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BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

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Published:

- with international search report (Art. 21(3))
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))

(88) Date of publication of the international search report:

5 March 2015

(54) Title: FLOATING PHOTOBIOREACTOR SYSTEM COMPRISING A FLOATING PHOTOBIOREACTOR AND AN INTEGRATED PADDLE WHEEL AND AN AIRLIFT AND METHODS OF USE

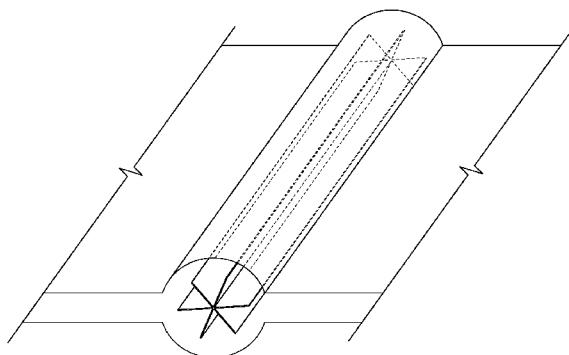


Fig. 1

(57) Abstract: This invention relates to a floating photobioreactor system comprising a floating photobioreactor and an integrated paddle wheel and an integrated airlift. This invention further relates to methods of using the floating photobioreactor system.



INTERNATIONAL SEARCH REPORT

International application No.

PCT/US14/43765

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - C12M 1/12, 1/09; C12N 1/12 (2014.01)

CPC - C12M 23/26, 23/56, 21/02

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(8): C12M 1/12, 1/09, 1/12, 3/00, 1/00, 1/02 (2014.01)

CPC: C12M 23/26, 23/56, 21/02, 23/34, 41/18, 23/06

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)

MicroPatent (US-G, US-A, EP-A, EP-B, WO, JP-bib, DE-C,B, DE-A, DE-T, DE-U, GB-A, FR-A); Google Scholar; ScienceDirect; Dialog ProQuest; photobioreactor, bioreactor, flex, rigid, shape, paddle, wheel, 'paddle wheel,' float, horizontal, system, mix

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 7980024 B2 (BERZIN, I et al.); July 19, 2011; abstract; column 3, lines 6-9; column 11, lines 37-40; column 17, lines 55-63; column 23, lines 28-30	1-4, 53
A	US 2011/0124087 A1 (MEISER, A et al.); May 26, 2011; abstract	1-4, 53
A	US 2011/0070632 A1 (KATOCH, AS et al.); March 24, 2011; abstract	1, 3, 4, 53

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


* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"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

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

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

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

"&" document member of the same patent family

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US14/43765

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☒ Claims Nos.: 5-26, 31-52
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

-Please See Supplemental Page-

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Group I: Claims 1-4, 53

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US14/43765

-***-Continued from Box No. III: Observations Where Unity of Invention Is Lacking:

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I: Claims 1-4 and 53 are directed toward a floating photobioreactor system to grow a photosynthetic or mixotrophic microorganism comprising: a floating photobioreactor; and an paddle wheel, wherein: the paddle wheel is integrated into the floating photobioreactor.

Group II: Claims 27-30 and 54 are directed toward a floating photobioreactor system to grow a photosynthetic or mixotrophic microorganism comprising: a floating photobioreactor; and an airlift, wherein: the airlift comprises an upper part and a lower part and the airlift is integrated into the floating photobioreactor.

The inventions listed as Groups I-II do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: the special technical features of Group I include a paddle wheel, which is not present in Group II, the special technical features of Group II including an airlift.

Groups I-II share the technical features including a floating photobioreactor system to grow a photosynthetic or mixotrophic microorganism comprising: a floating photobioreactor and a mechanism integrated into the floating photobioreactor.

However, these shared technical features are previously disclosed by US 2011/0124087 A1 to Meiser, et al. (hereinafter 'Meiser'). Meiser discloses a floating photobioreactor system (a floating photobioreactor system; paragraph [0012]) to grow a photosynthetic or mixotrophic microorganism (for cultivation of a phototrophic microorganism; paragraph [0016]) comprising: a floating photobioreactor (paragraph [0012]) and a mechanism (a pump (a mechanism); paragraph [0060]) integrated into the floating photobioreactor (integrated into the floating bioreactor; figure 1, paragraphs [0060], [0095]).

Since none of the special technical features of the Groups I-II inventions is found in more than one of the inventions, and since all of the shared technical features are previously disclosed by the Meiser reference, unity of invention is lacking.