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| <p>(72) Inventors; and</p> | |
| <p>(75) Inventors/Applicants (<i>for US only</i>): MULLEN, Brian D. [US/US]; 825 Amur Circle, Delano, Minnesota 55328 (US). SCHOLTEN, Marc D. [US/US]; 933 Montana Avenue West, Saint Paul, Minnesota 55117 (US). LOUWAGIE, Andrew J. [US/US]; 2408 Hillsboro Ave. N., Golden Valley, Minnesota 55427 (US). DONEN, Steven A. [US/US]; 7341 Frontier Trail, Chanhassen, Minnesota 55317 (US). JING, Feng [CN/US]; 1024 Ashley Lane, Al-</p> | <p>(84) Designated States (<i>unless otherwise indicated, for every kind of regional protection available</i>): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).</p> |

[Continued on next page]

(54) Title: METHODS FOR THE MANUFACTURE OF ACETALS AND KETALS, AND THE ACETALS AND KETALS PRODUCED THEREBY

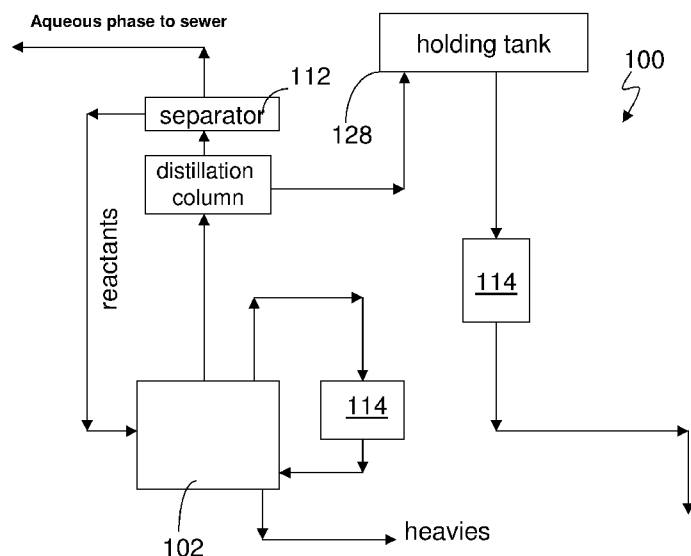


Figure 1

(57) Abstract: A method for producing a product that comprises glycerol ketal of ethyl levulinate or propylene glycol ketal of ethyl levulinate comprises reacting either glycerol or propylene glycol with ethyl levulinate in the presence of a homogeneous or heterogeneous catalyst system in a reactor or system. The ethyl levulinate and either glycerol or propylene glycol are heated to remove water, polyol, and excess ethyl levulinate. The excess ethyl levulinate and polyol is recycled back to the reactor. The product is distilled in a specific fashion and optionally treated by means of a stabilizing agent or acid species removal bed, to obtain a composition comprising glycerol ketal of ethyl levulinate or propylene glycol ketal of ethyl levulinate wherein the composition comprises less than or equal to about 2 wt% contaminants.

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A. CLASSIFICATION OF SUBJECT MATTER*C07D 317/24(2006.01)i, C07D 317/12(2006.01)i, C07D 317/18(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)

C07D 317/24; C07D 319/06; C08G 63/42; A61K 8/49; C07D 263/06; C07D 317/30; C07D 265/06; C08G 18/77

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)

eKOMPASS (KIPO internal), NCBI (PubMed, MeSH), Google

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	WO 2010-036884 A1 (SEGETIS, INC.) 01 April 2010 See examples 8-9; claim 24; abstract.	31-35 1-5
X A	US 2008-0242721 A1 (SERGEY SELIFONOV) 02 October 2008 See example 1; claims 42-47 and 67-69; abstract.	31-35 1-5
A	WO 2009-048874 A1 (SEGETIS, INC.) 16 April 2009 See the whole document.	1-5,31-35
A	WO 2009-032905 A1 (SEGETIS, INC.) 12 March 2009 See the whole document.	1-5,31-35

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

* 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 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

Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2011/046463**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.: 15-17, 24-26, 41
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:
Claims 15-17, 24-26 and 41 are unsearchable because they are worded in reference to multiple dependant claims.
3. ☒ Claims Nos.: 6-14, 18-23, 27-30, 36-40, 42
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:

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 an additional fee, this Authority did not invite payment of any additional fee.
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.:

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

Information on patent family members

International application No.

PCT/US2011/046463

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