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C08H 8/00 (2010.01)	***C08G 8/20*** (2006.01)
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(71) **Applicant**: **BATTELLE MEMORIAL INSTITUTE** [US/US]; 505 King Avenue, Columbus, OH 43201-2696 (US).

(72) **Inventors**: **GARBARK, Daniel**; 656 Cedar Run Drive, Blackick, OH 43004 (US). **BENECKE, Herman**; 920 Lansmere Lane, Columbus, OH 43220 (US). **MOORE, Megan**; 5311 Bonner Drive, Hilliard, OH 43026 (US). **PERRY, Mark, J.**; 2683 Westwind Court, Hilliard, OH 43026 (US). **CAFMEYER, Jeffrey, T.**; 492 Waring Way, Columbus, OH 43213 (US).

(74) **Agents**: **GEGENHEIMER, C., Michael** et al.; BATTELLE MEMORIAL INSTITUTE, 505 King Avenue, Columbus, OH 43201-2696 (US).

(81) **Designated States** *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, 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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[Continued on next page]

(54) **Title**: BIO-OIL POLYOLS, ALKOXYLATED BIO-OIL POLYOLS AND BIO-OIL PHENOLIC RESINS

(57) **Abstract**: Methods are provided for producing bio-oil polyols, alkoxylating bio-oil polyols to provide polyols, and for employing the alkoxylated bio-oil polyols for making polymers or copolymers of polyesters or polyurethanes. Compositions and methods are provided for incorporating bio-oils into phenolic resins such as phenol-formaldehyde resin and phenol-formaldehyde -urea resin, as well as hot melt adhesive compositions.

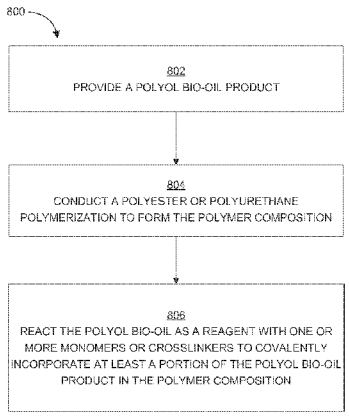

FIG. 8

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TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

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:
9 April 2015

INTERNATIONAL SEARCH REPORT

International application No
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A. CLASSIFICATION OF SUBJECT MATTER
INV. C08G65/26 C08G18/28 C08G18/32 C08H8/00 C08G16/02
C08L61/06 C09J161/06 C08L97/02 C08G8/20 C08G18/10
ADD.
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)
B27K C10L C10C C10B C08G C08H C08L C09J

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)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	LI YANG ET AL: "Kraft Lignin-Based Rigid Polyurethane Foam", JOURNAL OF WOOD CHEMISTRY AND TECHNOLOGY, vol. 32, no. 3, 3 April 2012 (2012-04-03), pages 210-224, XP009172057, ISSN: 0277-3813, DOI: 10.1080/02773813.2011.652795 [retrieved on 2012-04-03]	1-14, 19-34, 37-40, 45, 47-50, 55-58, 137-142, 145-151, 154-157
A	page 212 - page 214; table 2	17,130, 143

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[X] Further documents are listed in the continuation of Box C.

[X] 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 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

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
11 February 2015	17/02/2015

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Popescu, M

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2014/042016

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 017 474 A (GLASSER WOLFGANG GERHARD ET AL) 12 April 1977 (1977-04-12)	1-14, 19-62, 137-142, 144-151, 154-157
A	claims 1-10; examples I-IX example XII B	17,130, 143

X	CINELLI PATRIZIA ET AL: "Green synthesis of flexible polyurethane foams from liquefied lignin", EUROPEAN POLYMER JOURNAL, PERGAMON PRESS LTD. OXFORD, GB, vol. 49, no. 6, 13 April 2013 (2013-04-13), pages 1174-1184, XP028562685, ISSN: 0014-3057, DOI: 10.1016/J.EURPOLYMJ.2013.04.005 page 2584 - page 2585; figure 3; tables 1,2	1-14, 19-34, 37-40, 45, 47-50, 55-58

X	CAROLINA ANDREIA CATETO ET AL: "Optimization Study of Lignin Oxypropylation in View of the Preparation of Polyurethane Rigid Foams", INDUSTRIAL & ENGINEERING CHEMISTRY RESEARCH, vol. 48, no. 5, 4 March 2009 (2009-03-04), pages 2583-2589, XP055076453, ISSN: 0888-5885, DOI: 10.1021/ie801251r page 1175, column 2, paragraph 2.1 - page 1177, column 1, paragraph 3.1; tables 1-3	12-16, 18, 124-129, 131-136

X	GUO Z-X ET AL: "Polyesters from lignin-2. The copolyesterification of kraft lignin and polyethylene glycols with dicarboxylic acid chlorides", EUROPEAN POLYMER JOURNAL, PERGAMON PRESS LTD. OXFORD, GB, vol. 27, no. 11, 1 January 1991 (1991-01-01), pages 1177-1180, XP024055844, ISSN: 0014-3057, DOI: 10.1016/0014-3057(91)90053-Q [retrieved on 1991-01-01] Experimental Procedures; page 1177	137-141, 145-147, 149-153, 156,157

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INTERNATIONAL SEARCH REPORT

International application No
PCT/US2014/042016

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	MATJAZ KUNAVER, EDITA JASIUKAITYTE, NATASA CUK, JAMES T. GUTHRIE: "Liquefaction of wood, synthesis and characterization of liquefied wood polyester derivatives", JOURNAL OF APPLIED POLYMER SCIENCE, vol. 115, no. 3, 5 February 2010 (2010-02-05), pages 1265-1271, XP055167217, ISSN: 0021-8995, DOI: 10.1002/app.31277 page 1266, column 2 - page 1267, column 1 -----	137,140, 141, 145-147, 149-153, 156,157
X	FEI YU ET AL: "Liquefaction of Corn Stover and Preparation of Polyester From the Liquefied Polyol", APPLIED BIOCHEMISTRY AND BIOTECHNOLOGY, vol. 130, no. 1-3, 1 January 2006 (2006-01-01), pages 574-585, XP055167224, DOI: 10.1385/ABAB:130:1:574 page 575 - page 577 -----	137,140, 141, 145-147, 149-153, 156,157

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2014/042016

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4017474 A	12-04-1977	CA 1097617 A1	17-03-1981
		US 4017474 A	12-04-1977

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2014/042016

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.:
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:

see additional sheet

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 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.:

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.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-62, 124-136

   Method of production of alkoxylated bio-oil polyol, copolymer compositions based on said alkoxylated bio-oil polyol, said compositions and method of preparing a polyol bio-oil.

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2. claims: 63-107

   Method of production of phenolic resin copolymer compositions by reacting bio-oil polyol with aliphatic phenolic resin and said phenolic resin compositions.

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3. claims: 108-123

   Method for preparing a hot melt adhesive composition by curing the hot melt adhesive precursor mixture with a bio-oil polyol, the said hot melt adhesive composition and method for forming a hot melt adhesive bond

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4. claims: 137-157

   A polyol bio-oil polyol for use in forming a polyester or a polyurethane, method of production of said polyester or a polyurethane copolymer compositions and said copolymer compositions.
