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[Continued on next page]

(54) Title: OXIDATIVE COUPLING OF METHANE SYSTEMS AND METHODS

(57) Abstract: Systems and methods conducive to the formation of one or more alkene hydrocarbons using a methane source and an oxidant in an oxidative coupling of methane (OCM) reaction are provided. One or more vessels each containing one or more catalyst beds containing one or more catalysts each having similar or differing chemical composition or physical form may be used. The one or more catalyst beds may be operated under a variety of conditions. At least a portion of the catalyst beds may be operated under substantially adiabatic conditions. At least a portion of the catalyst beds may be operated under substantially isothermal conditions.

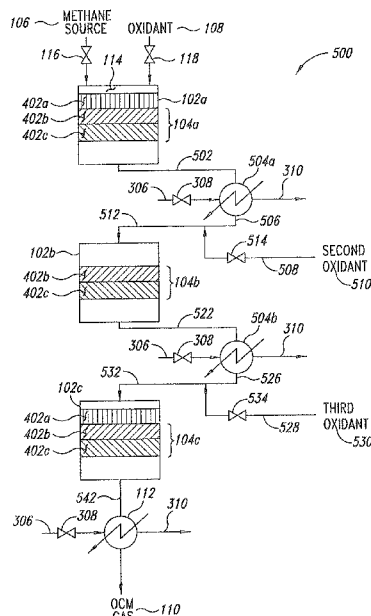


FIG. 5





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B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) C07C B01J C10G		
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	WANG J ET AL: "Low-temperature selective oxidation of methane to ethane and ethylene over BaCO ₃ /La ₂ O ₃ catalysts prepared by urea combustion method", CATALYSIS COMMUNICATIONS, ELSEVIER SCIENCE, AMSTERDAM, NL, vol. 7, no. 2, 1 February 2006 (2006-02-01), pages 59-63, XP024972921, ISSN: 1566-7367, DOI: 10.1016/J.CATCOM.2005.08.013 [retrieved on 2006-02-01]	1-32,34
A	paragraphs 1., 2.1, 2.3., 3.2. and 3.3 figures 2,3; table 2 ----- -/--	33,35
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> 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 "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 <p align="center">23 May 2014</p>		Date of mailing of the international search report <p align="center">03/06/2014</p>
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016		Authorized officer <p align="center">Baumlin, Sébastien</p>

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PCT/US2013/042480

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	US 2011/240926 A1 (SCHELLEN RALPH [DE] ET AL) 6 October 2011 (2011-10-06) paragraphs [0001], [0010], [0040], [0041], [0054], [0060], [0069] - [0073], [0076] - [0078], [0086], [0087] paragraphs [0091], [0096] - [0101], [0124], [0125], [0128], [0132] figures 1,2 -----	1-34 35
X A	US 2008/281136 A1 (BAGHERZADEH EBRAHIM [US] ET AL) 13 November 2008 (2008-11-13) paragraphs [0109] - [0125], [0171], [0186] figures 1B, 1C tables 5,9 -----	1-34 35
X A	DE 34 06 751 A1 (BAERNS MANFRED PROF DR [DE]) 29 August 1985 (1985-08-29) claims 1,3,5-11,13-15,26,27 page 16, line 12 - page 17, line 16 figures 1-5; table 1 -----	32,34 1-31,33, 35
X A	US 6 153 149 A (RABITZ HERSCHEL A [US] ET AL) 28 November 2000 (2000-11-28) column 1, lines 5-16 column 4, lines 45-65 column 5, line 62 - column 11, line 49 column 13, lines 26-53 claims 1,12 figures 2-5 -----	35 1-34
A	US 2012/041246 A1 (SCHER ERIK C [US] ET AL) 16 February 2012 (2012-02-16) claims 1-29,114-122 -----	1-35
A	D. SCHWEER ET AL: "OCM in a fixed-bed reactor: limits and perspectives", CATALYSIS TODAY, vol. 21, no. 2-3, 1 December 1994 (1994-12-01), pages 357-369, XP055119031, ISSN: 0920-5861, DOI: 10.1016/0920-5861(94)80157-6 the whole document -----	1-35
	----- -/--	

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2013/042480

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>MLECZKO L ET AL: "Catalytic oxidative coupling of methane - reaction engineering aspects and process schemes", FUEL PROCESSING TECHNOLOGY, ELSEVIER BV, NL, vol. 42, no. 2-3, 1 April 1995 (1995-04-01), pages 217-248, XP002576965, ISSN: 0378-3820, DOI: 10.1016/0378-3820(94)00121-9 [retrieved on 2000-03-13] the whole document</p> <p style="text-align: center;">-----</p>	1-35

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2013/042480

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2011240926 A1	06-10-2011	DE 102008064275 A1	01-07-2010
		US 2011240926 A1	06-10-2011
		WO 2010069488 A1	24-06-2010

US 2008281136 A1	13-11-2008	CA 2684896 A1	06-11-2008
		CN 101730586 A	09-06-2010
		EP 2152408 A2	17-02-2010
		JP 2010524684 A	22-07-2010
		JP 2013223864 A	31-10-2013
		MY 150199 A	13-12-2013
		RU 2009137208 A	27-05-2011
		US 2008281136 A1	13-11-2008
		WO 2008134484 A2	06-11-2008

DE 3406751 A1	29-08-1985	NONE	

US 6153149 A	28-11-2000	NONE	

US 2012041246 A1	16-02-2012	AU 2011258422 A1	10-01-2013
		CA 2800142 A1	01-12-2011
		CN 103118777 A	22-05-2013
		EA 201291333 A1	30-09-2013
		EP 2576046 A2	10-04-2013
		US 2012041246 A1	16-02-2012
		WO 2011149996 A2	01-12-2011
