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(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, IS, JP, KE, KG, KM, 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, 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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(54) Title: PROCESS FOR PROVIDING C2 HYDROCARBONS VIA OXIDATIVE COUPLING OF METHANE AND FOR SEPARATING HYDROCARBON COMPOUNDS

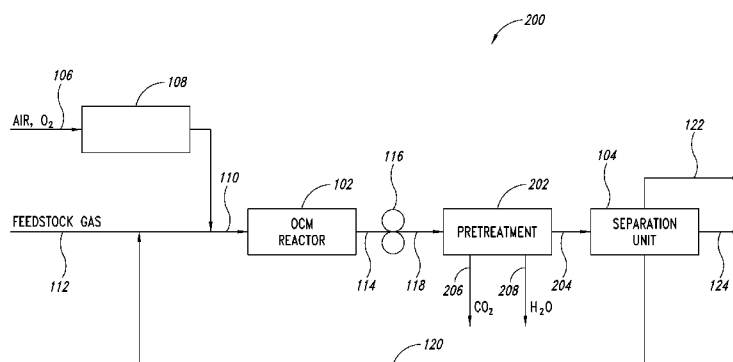


FIG. 2

(57) Abstract: Disclosed herein are processes for producing and separating ethane and ethylene. In some embodiments, an oxidative coupling of methane (OCM) product gas comprising ethane and ethylene is introduced to a separation unit comprising two separators. Within the separation unit, the OCM product gas is separated to provide a C2-rich effluent, a methane-rich effluent, and a nitrogen-rich effluent. Advantageously, in some embodiments the separation is achieved with little or no external refrigeration requirement.

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2013/021312

A. CLASSIFICATION OF SUBJECT MATTER

INV. C10G27/04 C10G29/20 C10G31/06 C07C2/82 B01D5/00
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)

C10G C07C B01D

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2011/149996 A2 (SILURIA TECHNOLOGIES INC [US]; SCHER ERIK C [US]; ZURCHER FABIO R [US]) 1 December 2011 (2011-12-01) page 136, line 1 - page 150, line 15; figures 6,21	1-27, 43-50,54
A	----- US 3 596 473 A (STREICH MARTIN) 3 August 1971 (1971-08-03) the whole document	1-27, 43-50,54
A	----- FR 649 429 A (IG FARBENINDUSTRIE AG) 21 December 1928 (1928-12-21) the whole document	1-27, 43-50,54



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 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

30 August 2013

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17/03/2014

Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2013/021312

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.:

1-27, 43-50, 54

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: 1-27, 43-50, 54

Independent claim 1 is directed towards a process to obtain C2 hydrocarbons via oxidative coupling of methane, the product of which is separated in a C2-rich effluent and a gas mixture including methane and nitrogen.

Independent claim 43 is directed to the use of the process of claim 1 to provide a mixture of hydrocarbons.

Independent claims 48 to 50 and 54 are directed to products by the process of claim 1 or of claim 25 (which is dependent on claim 1).

Claims 2 to 27 depend on claim 1, claims 44 to 47 depend on claim 43 and as such are also considered as belonging to the same invention.

2. claims: 28-42, 55

Independent claim 28 is directed to a system to provide C2 compounds via oxidative coupling of methane (OCM) wherein the OCM reactor includes a preheater and a first cryogenic separation system of the product of the OCM reaction.

Claim 55 is the use of the system of claim 28.

Claims 29 to 42 depend on claim 28 and as such belong to the same invention.

3. claims: 51-53

Independent claims 51 to 53 are directed to a process for separating C2 compounds from a OCM product including the step of compressing the OCM product before any step of separation, which does not include any cryogenic one.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2013/021312

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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