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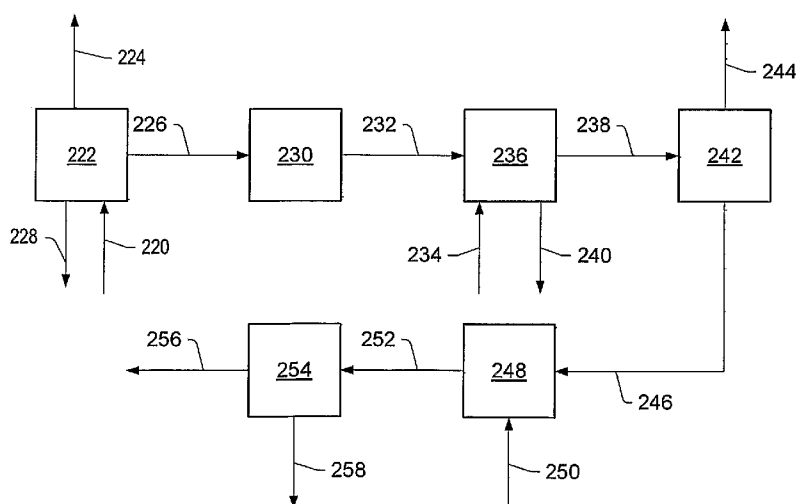
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[Continued on next page]

(54) Title: TREATMENT OF GAS FROM AN IN SITU CONVERSION PROCESS



(57) Abstract: The invention provides methods of producing methane that include: producing formation fluid from a subsurface in situ conversion process and separating the formation fluid to produce a liquid stream and a first gas stream. The first gas stream includes olefins. The first gas stream is contacted with a hydrogen source in the presence of one or more catalysts to produce a second gas stream. Steam, carbon monoxide, and/or hydrogen may be present or added to in the first stream during contacting. The second gas stream is contacted with a hydrogen source in the presence of one or more additional catalysts to produce a third gas stream that includes methane.

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— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

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

14 June 2007

# INTERNATIONAL SEARCH REPORT

International application No  
PCT/US2006/015286

**A. CLASSIFICATION OF SUBJECT MATTER**  
INV. C10L3/08

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)  
C10L C10K C07C

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 practical, search terms used)

EPO-Internal, WPI Data, COMPENDEX

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2002/050357 A1 (WELLINGTON SCOTT LEE [US] ET AL WELLINGTON SCOTT LEE [US] ET AL) 2 May 2002 (2002-05-02) paragraphs [0039], [0067], [0071], [0079], [0270], [0285], [0313], [0575] - [0584], [0589]	1-4, 16-19
Y X	GB 2 110 231 A (JGC CORP; TSUKISHIMA KIKAI CO) 15 June 1983 (1983-06-15) page 3, line 8 - line 9 page 5, line 2 - line 3 claims 1,4,10; example 10; tables 17,23-25	1-4, 16-19 21
A	GB 774 283 A (RUHRCHEMIE AG) 8 May 1957 (1957-05-08) page 1, line 12 - line 44	1-4, 16-19,21

☐ 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 document 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.

\*S\* document member of the same patent family

Date of the actual completion of the international search

2 November 2006

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24/04/2007

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## FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Continuation of Box II.2

Claims Nos.: 20

In claim 20 of the present application, contacting one or more of the gas streams is to be done "using one or more of the methods as claimed in any of claims 1-19". However, claims 1-19 define methods of producing methane rather than methods of contacting a gas stream. This renders claim 20 unclear in that its scope cannot be determined. Claim 20 is thus not in compliance with the provisions of clarity and conciseness of Article 6 PCT to such an extent that a meaningful search into the prior art cannot be carried out (PCT Guidelines 9.01).

The applicant's attention is drawn to the fact that claims relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure. If the application proceeds into the regional phase before the EPO, the applicant is reminded that a search may be carried out during examination before the EPO (see EPO Guideline C-VI, 8.5), should the problems which led to the Article 17(2) declaration be overcome.

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US2006/015286

### Box 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.: 20  
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:  
see FURTHER INFORMATION sheet PCT/ISA/210
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 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 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.:  
see annex

#### Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.  
☐ 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: 1-4, 16-19(part), 21(part)

A method of producing methane, comprising: providing formation fluid from a subsurface in situ conversion process; separating the formation fluid to produce a liquid stream and a first gas stream, wherein the first gas stream comprises olefins; contacting at least a portion of the olefins in the first gas stream with a hydrogen source in the presence of one or more catalysts and steam to produce a second gas stream; and contacting the second gas stream with a hydrogen source in the presence of one or more additional catalysts to produce a third gas stream, wherein the third gas stream comprises methane. A composition produced by this method.

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2. claims: 5-8, 16-19(part), 21(part)

A method of producing methane, comprising: providing formation fluid from a subsurface in situ conversion process; separating the formation fluid to produce a liquid stream and a first gas stream; wherein the first gas stream comprises carbon monoxide, olefins, and hydrogen; and contacting the first gas stream with a hydrogen source in the presence of one or more catalysts to produce a second gas mixture, wherein the second gas mixture comprises methane, and wherein the hydrogen source comprises hydrogen present in the first gas stream. A composition produced by this method.

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3. claims: 9-15, 16-19(part), 21(part)

A method of producing methane, comprising: providing formation fluid from a subsurface in situ conversion process; separating the formation fluid to produce a liquid stream and a first gas stream, wherein the first gas stream comprises carbon monoxide, hydrogen, and hydrocarbons having a carbon number of at least 2, wherein the hydrocarbons having a carbon number of at least 2 comprise paraffins and olefins; and contacting the first gas stream with hydrogen in the presence of one or more catalysts and carbon dioxide to produce a second gas stream, the second gas stream comprising methane and paraffins, and wherein the hydrogen source comprises hydrogen present in the first gas stream. A composition produced by this method.

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2006/015286

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 2002050357	A1	02-05-2002	NONE	
GB 2110231	A	15-06-1983	NONE	
GB 774283	A	08-05-1957	NONE	