

**(19) World Intellectual Property Organization**  
International Bureau



**(43) International Publication Date**  
**2 May 2008 (02.05.2008)**

**(10) International Publication Number**  
**WO 2008/051837 A3**

**(51) International Patent Classification:**  
*E21B 43/24 (2006.01)*

**(21) International Application Number:**

PCT/US2007/081920

**(22) International Filing Date:** 19 October 2007 (19.10.2007)

(25) Filing Language: English

(26) **Publication Language:** English

**(30) Priority Data:**

60/853,096	20 October 2006 (20.10.2006)	US
60/925,685	20 April 2007 (20.04.2007)	US

**(71) Applicant (for SM only): SHELL OIL COMPANY**  
[US/US]; One Shell Plaza, P.O. Box 2463, Houston, TX  
77252-2463 (US).

(71) **Applicant** (for all designated States except US): **SHELL INTERNATIONALE RESEARCH MAATSCHAPPIJ B.V.** [NL/NL]; Carel van Bylandtlaan 30, NL-2596 HR The Hague (NL).

(72) Inventors: and

(75) **Inventors/Applicants (for US only):** **ABBASI, Faraz** [US/US]; 16410 Leedswell Lane, Houston, TX 77084 (US). **ANDERSON, Karl, Gregory** [US/US]; 7218 Shadyside Circle, Missouri City, TX 77459 (US). **BRIGNAC, Joseph, Phillip** [US/US]; 2714 Kittansett Circle, Katy, TX 77450 (US). **CLOMBURG, Lloyd, Anthony** [US/US]; 18207 Widcombe Drive, Houston, TX

77084 (US). **FARMAYAN, Walter, Farman** [US/US]; 8940 Turrif, Houston, TX 77055 (US). **GILES, Steven, Paul** [US/US]; 21937 Rycade School Road, Damon, TX 77430 (US). **MUNSHI, Abdul, Wahid** [US/US]; 12635 S. Dairy Ashford, Houston, TX 77099 (US). **SIDDOWAY, Mark, Alan** [US/US]; 2215 Monona Drive, Katy, TX 77494 (US). **TSAL, Kuochen** [US/US]; 6410 Dylan Springs Lane, Katy, Texas 77450 (US).

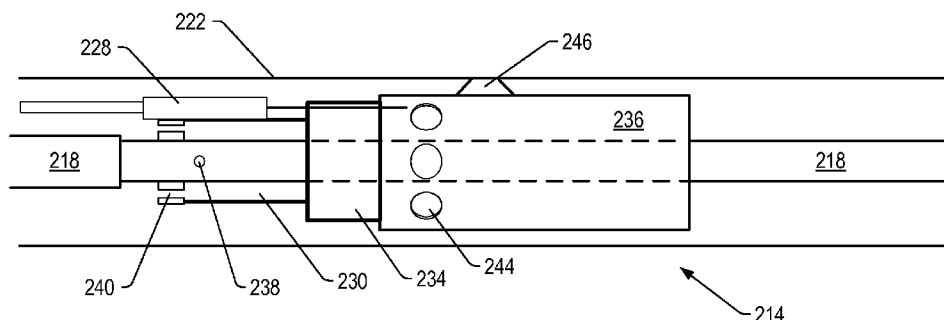
(74) **Agent: CHRISTENSEN, Del, S.;** Shell Oil Company,  
One Shell Plaza, P.O. Box 2463, Houston, TX 77252-2463  
(US).

**(81) Designated States** (*unless otherwise indicated, for every kind of national protection available*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, 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, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

**(84) Designated States** (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GO, GW, ML, MR, NE, SN, TD, TG).

[Continued on next page]

**(54) Title:** IN SITU HEAT TREATMENT PROCESS UTILIZING OXIDIZERS TO HEAT A SUBSURFACE FORMATION



**(57) Abstract:** Systems for heating a subsurface formation are described. The systems include a plurality of oxidizers positioned in a wellbore to form an oxidizer assembly. One or more of the oxidizers may include a shield with flame stabilizers. The flame stabilizers may stabilize the flame zone of the oxidizer by controlling fluid flow entering the shield and by controlling fluid flowing in the oxidizer. One or more of the oxidizers may be a catalytic oxidizer. Catalytic oxidizers may facilitate ignition of the oxidizers of the oxidizer assembly.



**Published:**

- *with international search report*
- *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

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

13 November 2008

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/US07/81920

<b>A. CLASSIFICATION OF SUBJECT MATTER</b> IPC: <b>E21B 43/24( 2006.01)</b>  USPC: 166/256,257 According to International Patent Classification (IPC) or to both national classification and IPC		
<b>B. FIELDS SEARCHED</b> Minimum documentation searched (classification system followed by classification symbols) U.S. : 166/256,257  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)		
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US Patent Application Publication 2005/0051327 A1 (Vinegar et al.) 10 March 2005, paragraphs 0977-1013, figures 186, 192-193	1, 3, 6, 9, 11, 16, 18 ----- 2, 4-5, 7, 10, 17
Y	US Patent 4,161,103 (Horgan et al.) 17 July 1979 (17.07.1979), figure 3	8
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input 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	"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	
"E" earlier application or patent published on or after the international filing date	"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	
"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)	"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	
"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family	
"P" document published prior to the international filing date but later than the priority date claimed		
Date of the actual completion of the international search 20 August 2008 (20.08.2008)		Date of mailing of the international search report <b>12 SEP 2008</b>
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No. (571) 273-3201		Authorized officer Steve McAllister <i>SB</i> Telephone No. 571-272-3700

Form PCT/ISA/210 (second sheet) (April 2007)

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/US07/81920

### 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.: 12-15, and 19-21  
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 additional fees, this Authority did not invite payment of any 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.