

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
7 May 2009 (07.05.2009)

PCT

(10) International Publication Number
WO 2009/059124 A3

(51) International Patent Classification:
C10B 53/06 (2006.01)

(21) International Application Number:
PCT/US2008/081979

(22) International Filing Date:
31 October 2008 (31.10.2008)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/985,078 2 November 2007 (02.11.2007) US
61/049,056 30 April 2008 (30.04.2008) US

(71) Applicant (for all designated States except US): UNI-
VERSITY OF UTAH RESEARCH FOUNDATION
[US/US]; 615 Arapeen Drive, Suite 310, Salt Lake City,
UT 84108 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): HONG, Andy [US/
US]; 4465 Zarahemia Drive, Salt Lake City, UT 84124
(US). CHA, Zhixiong [CN/US]; 144 South 900 East,
Apt. 11, Salt Lake City, UT 84102 (US).

(74) Agents: STRINGHAM, John, C. et al.; Workman Ny-
degger, 60 East South Temple, Salt Lake City, UT 84111
(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, 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, ST, 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, HR, HU, IE, IS, IT, LT, LU, LV,
MC, MT, NL, NO, PL, PT, RO, SE, SI, SK, TR), OAPI
(BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, 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))

[Continued on next page]

(54) Title: CYCLIC GASEOUS COMPRESSION/EXPANSION FOR HEIGHTENED OIL SANDS EXTRACTION

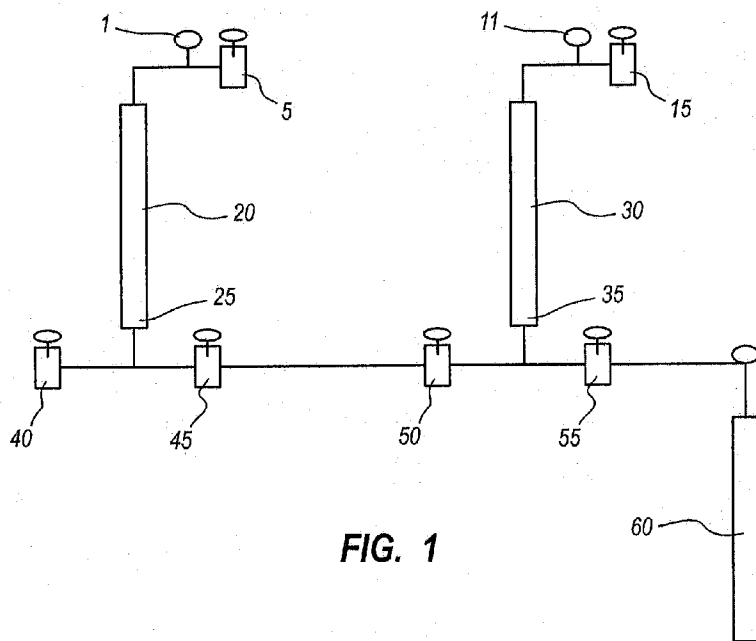


FIG. 1

(57) Abstract: A method for extracting hydrocarbons from sands can include: providing sands containing a hydrocarbon; mixing the hydrocarbon sands with water; heating the water before, during, or after being mixed with the hydrocarbon sands; increasing the pressure within a closed vessel containing the heated hydrocarbon and water mixture in the presence of gas or by injecting with gas; releasing the pressure of the heated hydrocarbon and water mixture in the vessel so as to create microbubbles from the dissolved gas in the water mixture; and collecting the hydrocarbon from the water. Optionally, the process is substantially devoid of adding caustic agents to the hydrocarbon and water mixture.

WO 2009/059124 A3

(88) Date of publication of the international search report:
13 August 2009

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2008/081979**A. CLASSIFICATION OF SUBJECT MATTER***C10B 53/06(2006.01)i*

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)

IPC 8 C10J 3, C10G 1

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)
e-KIPASS (KIPO internal) and keywords: oil sand, hydrocarbon, particle, water, pressure, gas, and similar terms**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4,400,125 (JENSEN, H. P.) 23 AUGUST 1983 See abstract, figures 1, 2, and claims 1-11	1-32
A	US 5,914,027 (ELLINGSEN, O.) 22 JUNE 1999 See abstract, figures 1, 5, 7, 9, detailed description of the invention, and claims 1-4	1-32
A	US 4,443,323 (HORIKOSHI, K. et al.) 17 APRIL 1984 See abstract, col. 5, ll. 51-65, col. 7, ll. 1-28, and claims 1-24	1-32
A	US 4,459,200 (DENTE, M. et al.) 10 JULY 1984 See abstract, figure 1, and claims 1-17	1-32

 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 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

29 JUNE 2009 (29.06.2009)

Date of mailing of the international search report

30 JUNE 2009 (30.06.2009)

Name and mailing address of the ISA/KR

Korean Intellectual Property Office
Government Complex-Daejeon, 139 Seonsa-ro, Seo-gu, Daejeon 302-701, Republic of Korea

Facsimile No. 82-42-472-7140

Authorized officer

PARK Jin

Telephone No. 82-42-481-8274



INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2008/081979

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4400125	23.08.1983	NONE	
US 5914027	22.06.1999	NONE	
US 4443323	17.04.1984	CA 1208149 A1 JP 59-033387 A	22.07.1986 23.02.1984
US 4459200	10.07.1984	CA 1198994 A1	07.01.1986