



- (51) International Patent Classification:
E21B 43/24 (2006.01)
- (21) International Application Number:
PCT/US2014/049111
- (22) International Filing Date:
31 July 2014 (31.07.2014)
- (25) Filing Language:
English
- (26) Publication Language:
English
- (30) Priority Data:
14/021,119 9 September 2013 (09.09.2013) US
- (71) Applicant: HARRIS CORPORATION [US/US]; 1025 W. Nasa Blvd., M/S A-11I, Melbourne, Florida 32901 (US).
- (72) Inventors: HANN, Murray; 1365 Corey Road, Malabar, Florida 32950 (US). TRAUTMAN, Mark Alan; 1001 Worthington Spring Drive, Melbourne, Florida 32940 (US). WHITE, John E.; 2700 Filly Lane, Melbourne, Florida 32934 (US). WRIGHT, Brian N.; 104 Ormond Drive, Indialantic, Florida 32903 (US).
- (74) Agents: EVANDER, G. Mitchell et al.; Harris Corporation, 1025 W. Nasa Blvd., M/S A-11I, Melbourne, Florida 32919 (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, 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, IR, IS, JP, KE, KG, 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, SA, 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.

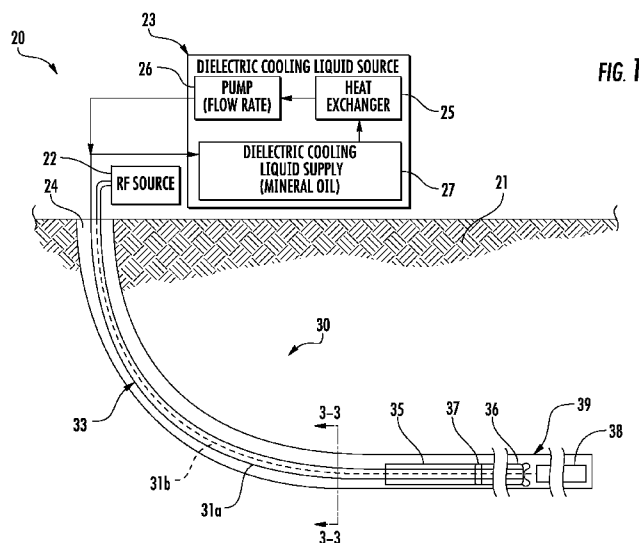
- (84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, 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))

- (88) Date of publication of the international search report:
21 May 2015

(54) Title: HYDROCARBON RESOURCE PROCESSING APPARATUS FOR GENERATING A TURBULENT FLOW OF COOLING LIQUID AND RELATED METHODS



(57) Abstract: A device for processing hydrocarbon resources in a subterranean formation may include a radio frequency (RF) source (22), a dielectric cooling liquid source (27), and an RF applicator (30) in the subterranean formation and coupled to the RF source (22) to supply RF power to the hydrocarbon resources. The RF applicator (30) may include concentric tubular conductors (35, 36) defining cooling passageways therebetween coupled to the dielectric cooling fluid source (27). At least one property of the dielectric cooling liquid, a flow rate of the dielectric cooling liquid, and a configuration of the cooling passageways may be operable together to generate a turbulent flow of the dielectric cooling liquid adjacent surfaces of the plurality of concentric tubular conductors to enhance thermal transfer.



INTERNATIONAL SEARCH REPORT

International application No
PCT/US2014/049111

A. CLASSIFICATION OF SUBJECT MATTER
INV. E21B43/24
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)
E21B

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	US 5 829 519 A (UTHE MICHAEL [US]) 3 November 1998 (1998-11-03) column 3, line 66 - column 4, line 17 column 5, line 39 - line 50 column 7, line 46 - line 64 figure 1	1-10
A	----- CA 2 790 618 A1 (SIEMENS AG [DE]) 25 August 2011 (2011-08-25) page 10, line 2 - line 5 page 22, line 1 - line 9 page 23, line 5 - line 18	1-10
A	----- US 2012/061383 A1 (PARSCHE FRANCIS EUGENE [US]) 15 March 2012 (2012-03-15) paragraph [0058] ----- -/--	1-10

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 25 March 2015	Date of mailing of the international search report 08/04/2015
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 Schneiderbauer, K

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2014/049111

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2008/265654 A1 (KEARL PETER M [US] ET AL) 30 October 2008 (2008-10-30) paragraphs [0033], [0039] -----	1-10

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No PCT/US2014/049111

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5829519	A	03-11-1998	NONE

CA 2790618	A1	25-08-2011	CA 2790618 A1 25-08-2011
			DE 102010008776 A1 25-08-2011
			EP 2507471 A2 10-10-2012
			WO 2011101228 A2 25-08-2011

US 2012061383	A1	15-03-2012	AU 2011302351 A1 28-03-2013
			CA 2812079 A1 22-03-2012
			US 2012061383 A1 15-03-2012
			WO 2012036984 A1 22-03-2012

US 2008265654	A1	30-10-2008	NONE
