(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
27 December 2012 (27.12.2012)

WIPO | PCT

(10) International Publication Number
WO 2012/178013 A3

(51) International Patent Classification:
G01V 1/40 (2006.01) *G01V 1/44* (2006.01)

(21) International Application Number:
PCT/US2012/043755

(22) International Filing Date:
22 June 2012 (22.06.2012)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
61/499,809 22 June 2011 (22.06.2011) US

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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, 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, 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.

(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, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— *of inventorship (Rule 4.17(iv))*

Published:

— *with international search report (Art. 21(3))*

[Continued on next page]

(54) **Title**: SYSTEM AND DEVICE FOR ACOUSTIC MEASURING IN A MEDIUM

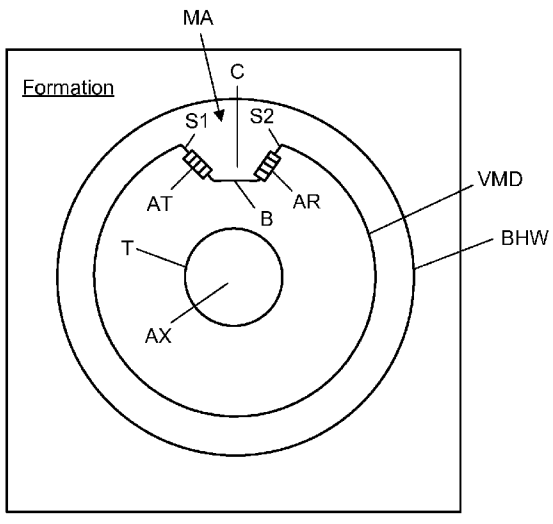

FIG. 2

(57) **Abstract**: A device for acoustic measuring in a medium in a borehole such as velocity of sound in the medium or velocity of the medium, includes at least a first acoustic array situated in a first, slanted sidewall of a measuring area and operating to emit a series of acoustic waveforms across a measuring area. In one form, the device includes a second acoustic array situated in a second, slanted sidewall of the measuring area and operating to receive an acoustic signal resulting from the emitted series of acoustic waveforms or to receive said acoustic signal and emit a second series of acoustic waveforms. A the processor measures a time between when a predefined portion of one of the series of acoustic waveforms was emitted and when a predefined portion of the received acoustic signal corresponding to the predefined portion of one of the series of acoustic waveforms is received by the acoustic receiver, and correlates the measured time to a reference time, then outputs a correlation factor for determining the velocity of sound in the medium in the measuring area. The processor may also calculate transit time for the two emitted acoustic signals or echoes from the first emitted acoustic signals to determine medium flow velocity.

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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 (Rule 48.2(h))*

(88) Date of publication of the international search report:
14 February 2013

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2012/043755

A. CLASSIFICATION OF SUBJECT MATTER

G01V 1/40(2006.01)i, G01V 1/44(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)

G01V 1/40; E21B 47/00; G01F 120; A61B 8/14; G01F 1/66

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models
Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) & Keywords: acoustic, receiver, transmitter, correlation factor

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6829947 B2 (HAN WEI et al.) 14 December 2004 See column 5, lines 22-38; claim 1 and fig. 3.	1-26
A	US 05031155 A (HSU; KAI) 09 July 1991 See column 1, lines 26-36; column 7, line 3-column 8, line 35; fig. 1.	1-26
A	US 04532812 A (BIRCHAK; JAMES R.) 06 August 1985 See colum 7, lines 14-28; claim 1 and fig. 2.	1-26
A	US 2010-0010351 A1 (JOVANOVIC IVANA et al.) 14 January 2010 See paragraphs 0063-0065, claim 1.	1-26

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:

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"O" document referring to an oral disclosure, use, exhibition or other means

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"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	Date of mailing of the international search report
28 DECEMBER 2012 (28.12.2012)	**02 JANUARY 2013 (02.01.2013)**

Name and mailing address of the ISA/KR

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Facsimile No. 82-42-472-7140

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2012/043755

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6829947 B2	14.12.2004	US 2004-0003658 A1	08.01.2004
		US 2005-0034530 A1	17.02.2005
		US 6938458 B2	06.09.2005
US 05031155 A	09.07.1991	EP 0395500 A2	31.10.1990
		EP 0395500 A3	26.08.1992
		EP 0395500 B1	14.06.1995
		US 04951266 A	21.08.1990
		US 05031155 A	09.07.1991
		US 05047991 A	10.09.1991
US 04532812 A	06.08.1985	None	
US 2010-0010351 A1	14.01.2010	EP 2148216 A2	27.01.2010
		EP 2148216 A3	03.08.2011