



- (51) International Patent Classification:
G01V 1/40 (2006.01) G06F 19/00 (2011.01)
G01V 1/28 (2006.01)
- (21) International Application Number:
PCT/US2012/048213
- (22) International Filing Date:
26 July 2012 (26.07.2012)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
61/512,380 27 July 2011 (27.07.2011) US
- (71) Applicant (for AL, AM, AU, AZ, BF, BG, BJ, BN, BY, CF, CG, CI, CM, CO, CZ, DE, DK, GA, GN, GQ, GR, GW, HU, ID, IE, IL, IT, KG, KP, KR, KZ, LT, MD, ML, MR, MX, MY, NE, NO, NZ, OM, PL, QA, RO, RU, SI, SK, SN, TD, TG, TH, TJ, TM, TN, TR, TT, UZ, ZA only):
SCHLUMBERGER TECHNOLOGY B.V. [NL/NL]; Parkstraat 83-89m, NL-2514 JG The Hague (NL).
- (71) Applicant (for CA only): **SCHLUMBERGER CANADA LIMITED** [CA/CA]; 525-3rd Avenue Southwest, Calgary, Alberta T2P-0G4 (CA).
- (71) Applicant (for GB, JP, NL only): **SCHLUMBERGER HOLDINGS LIMITED**; P.O. Box 71, Craigmuir Chambers, Road Town, Tortola, Virgin Islands, British, 1110 (VG).
- (71) Applicant (for all designated States except AU, BN, CA, CO, CZ, DE, DK, FR, GB, GR, HU, ID, IE, IL, IT, KR, LT, MX, MY, NL, NO, NZ, OM, PL, QA, RO, SI, TN, TR, TT, US, UZ, ZA): **PRAD RESEARCH AND DEVELOPMENT LIMITED**; P.O. Box 71, Craigmuir Chambers, Road Town, Tortola, Virgin Island, British, 1110 (VG).
- (72) Inventors; and
- (75) Inventors/Applicants (for US only): **HORNE, Steve Alan** [GB/AU]; 158 Cobb Street, Double View, Perth, Western Australia 6018 (AU). **WALSH, John** [US/US]; 1100 Bering Drive #313, Houston, Texas 77057 (US).
- (74) Agents: **DU, Jianguang** et al.; 10001 Richmond Avenue, IP Administration Center of Excellence, Room 4720, Houston, Texas 77042 (US).
- (81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM,

[Continued on next page]

(54) Title: MULTI-WELL ANISOTROPY INVERSION

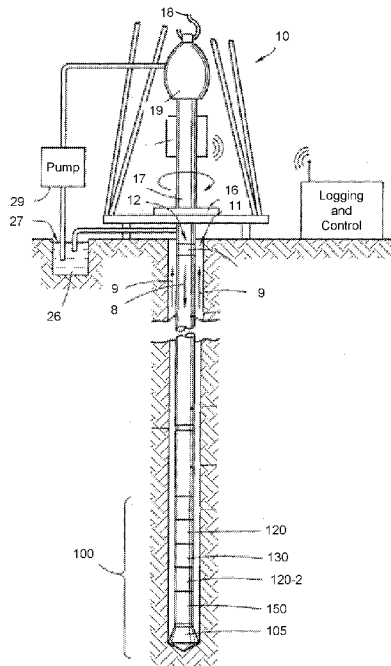


Fig. 1

(57) Abstract: A method can include providing compressional and shear-wave slowness data for a homogeneous, anisotropic formation at deviated borehole angles greater than 40 degrees and less than 90 degrees as defined by a vertical transverse isotropy (VTI) symmetry axis; providing a relationship for normal and tangential compliances (e.g., B_N and B_T); and, based on the data and the relationship, outputting a model for calculating anisotropy parameter values (e.g., $\alpha_0, \epsilon, \delta$) that characterize the homogeneous, anisotropic formation (e.g., along a borehole angle of 90 degrees). Various other apparatuses, systems, methods, etc., are also disclosed.





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, 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).

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:

4 April 2013

A. CLASSIFICATION OF SUBJECT MATTER*G01V 1/40(2006.01)i, G01V 1/28(2006.01)i, G06F 19/00(2011.01)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; G01V 1/30; G01V 1/32; G01V 1/28; G01V 1/50

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: homogeneous, anisotropic, model

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 7508735 B2 (GRECHKA VLADIMIR et al.) 24 March 2009 See column 6, line 27-column 7, line 20; claim 1 and fig. 2.	1-20
A	US 2009-0225628 A1 (SAYERS COLIN MICHAEL) 10 September 2009 See paragraphs 0053-0058, claim 1, and fig. 3.	1-20
A	US 7679993 B2 (SAYERS COLIN M.) 16 March 2010 See column 3, line 41-column 4, line 33; claim 1 and fig. 3A.	1-20
A	US 6714480 B2 (SINHA; BIKASH K. et al.) 30 March 2004 See abstract and claim 1.	1-20

 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 JANUARY 2013 (29.01.2013)

Date of mailing of the international search report

30 JANUARY 2013 (30.01.2013)

Name and mailing address of the ISA/KR

Korean Intellectual Property Office
189 Cheongsu-ro, Seo-gu, Daejeon Metropolitan
City, 302-701, Republic of Korea

Facsimile No. 82-42-472-7140

Authorized officer

HA, Jeong Kyun

Telephone No. 82-42-481-8361



INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2012/048213

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 7508735 B2	24.03.2009	US 2007-115755 A1	24.05.2007
US 2009-0225628 A1	10.09.2009	BR P10900766 A2	03.11.2009
		MX 2009002405 A	22.09.2009
		US 8243549 B2	14.08.2012
US 7679993 B2	16.03.2010	GB 0610459 D0	05.07.2006
		GB 2427274 A	20.12.2006
		GB 2427274 B	16.04.2008
		NO 20062690 A	18.12.2006
		US 2006-0283589 A1	21.12.2006
US 6714480 B2	30.03.2004	AU 2003-224664 A1	22.09.2003
		GB 0418184 D0	15.09.2004
		GB 2403012 A	22.12.2004
		GB 2403012 B	04.01.2006
		US 2003-0167835 A1	11.09.2003
		WO 03-076967 A2	18.09.2003
		WO 03-076967 A3	15.04.2004