



(51) International Patent Classification:

E21B 47/00 (2012.01) B06B 1/06 (2006.01)
E21B 47/08 (2012.01) G01V 1/40 (2006.01)
E21B 47/10 (2012.01)

(21) International Application Number:

PCT/US2012/071127

(22) International Filing Date:

21 December 2012 (21.12.2012)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

11290616.9 26 December 2011 (26.12.2011) EP

(71) Applicant (for FR only): **SERVICES PETROLIERS SCHLUMBERGER** [FR/FR]; 42 rue Saint Dominique, F-75007 Paris (FR).

(71) Applicant (for AL, AM, AT, AU, AZ, BF, BG, BJ, BN, BY, CF, CG, CH, CI, CL, CM, CO, CY, CZ, DE, DK, EG, GA, GE, GN, GQ, GR, GW, HR, HU, ID, IE, IL, IT, KE, KG, KP, KR, KZ, LT, MD, MG, ML, MR, MX, MY, NE, NO, NZ, OM, PL, QA, RO, RU, SI, SK, SN, TD, TG, TH, TJ,

TM, TN, TR, TT, TZ, UA, UG, UZ, ZA only): **SCHLUMBERGER TECHNOLOGY B.V.** [NL/NL]; Parkstraat 83-89m, NL-2514 JG The Hague (NL).

(71) Applicant (for GB, JP, NL only): **SCHLUMBERGER HOLDINGS LIMITED**; P.O. Box 71, Craigmuir Chambers, Tortola, Road Town, 1110 (VG).

(71) Applicant (for CA only): **SCHLUMBERGER CANADA LIMITED** [CA/CA]; 525-3rd Avenue Southwest, Calgary, Alberta T2P-0G4 (CA).

(71) Applicant (for all designated States except AL, AM, AT, AU, AZ, BG, BN, BY, CA, CH, CL, CO, CY, CZ, DE, DK, EG, FR, GB, GE, GR, HR, HU, ID, IE, IL, IT, JP, KE, KG, KP, KR, KZ, LT, MG, MX, MY, NL, NO, NZ, OM, PL, QA, RO, RU, SI, SK, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, ZA): **PRAD RESEARCH AND DEVELOPMENT LIMITED**; P.O. Box 71, Craigmuir Chambers, Tortola, Road Town, 1110 (VG).

(71) Applicant (for US only): **SCHLUMBERGER TECHNOLOGY CORPORATION** [US/US]; 300 Schlumberger Drive, Sugar Land, Texas 77478 (US).

[Continued on next page]

(54) Title: DOWNHOLE ULTRASONIC TRANSDUCER AND METHOD OF MAKING SAME

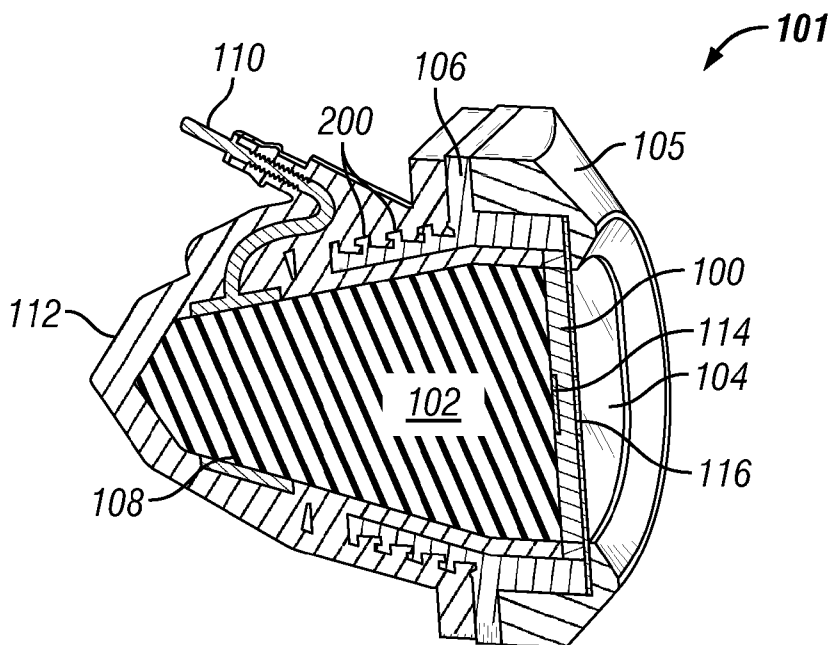


FIG. 2-1

(57) Abstract: An ultrasonic transducer (101) for use in a downhole measurement tool (58) is provided. The ultrasonic transducer includes a piezoelectric element (100) coupled to a backing (102), and enclosed within a compliant material housing (112). The compliant material housing may be flexible for withstanding extreme temperatures, pressures, and mechanical shocks that may be present in downhole environments. A method for fabricating the ultrasonic sensor is also provided.





(72) **Inventors:** **TEIXEIRA, Jose**; Etudes et Productions Schlumberger, 1 rue Henri Becquerel, BP 202, F-92142 Clamart Cedex (FR). **CANTIN, Gilles**; Etudes et Productions Schlumberger, 1 rue Henri Becquerel, BP 202, F-92142 Clamart Cedex (FR). **CORREA, Gloria**; Etudes et Productions Schlumberger, 1 rue Henri Becquerel, BP 202, F-92142 Clamart Cedex (FR).

(74) **Agents:** **CHI, Stephanie** et al.; Schlumberger, IP Administration, 10001 Richmond Avenue, Room 4720, Houston, Texas 77042 (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, 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, PA, 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:**

27 March 2014

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2012/071127

A. CLASSIFICATION OF SUBJECT MATTER
INV. E21B47/00 E21B47/08 E21B47/10 B06B1/06 G01V1/40
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 B06B G01V

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	GB 2 328 746 A (DRESSER IND [US]) 3 March 1999 (1999-03-03) page 14, line 3 - page 16, line 12; claim 5; figure 4 -----	1,2,4,5, 8-10
X	US 6 466 513 B1 (PABON MIGUEL F [US] ET AL) 15 October 2002 (2002-10-15) column 1, line 66 - column 2, line 44; figures 1,3 -----	1,2,4-6, 8-10
X	US 4 011 473 A (MASSA FRANK) 8 March 1977 (1977-03-08) column 5, line 24 - line 42; figure 2 -----	1,2,4-8, 16 11-18
Y	EP 0 477 575 A1 (SIEMENS AG [DE]) 1 April 1992 (1992-04-01) abstract; figures 1,2,4,5 -----	11-18
	-/--	

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	"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 but 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 January 2014	Date of mailing of the international search report 29/01/2014
--	--

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 Dantine, Patrick
--	--

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2012/071127

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 02/065446 A1 (FRAUNHOFER GES FORSCHUNG [DE]; HEINZ MARTIN [DE]; TRAUTMANN THOMAS [DE]) 22 August 2002 (2002-08-22) claim 1; figure 1 -----	3,12
A	US 2008/072675 A1 (OKUDA YASUYUKI [JP] ET AL) 27 March 2008 (2008-03-27) paragraph [0150]; figures 15A,15B -----	3,12
A	EP 1 986 465 A1 (MURATA MANUFACTURING CO [JP]) 29 October 2008 (2008-10-29) abstract; figure 5 -----	1-18
A	US 2005/000279 A1 (YOGESWAREN ELAN [US]) 6 January 2005 (2005-01-06) paragraph [0044] - paragraph [0045]; figures 1,3,7,10 paragraph [0057] paragraph [0060] - paragraph [0061] -----	1-18

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No PCT/US2012/071127

Patent document cited in search report	Publication date	Patent family member(s)	Publication date	
GB 2328746	A	03-03-1999	GB 2328746 A NO 983985 A	03-03-1999 01-03-1999
US 6466513	B1	15-10-2002	CN 1298093 A DZ 3095 A1 GB 2355528 A US 6466513 B1	06-06-2001 20-06-2004 25-04-2001 15-10-2002
US 4011473	A	08-03-1977	NONE	
EP 0477575	A1	01-04-1992	CA 2052034 A1 EP 0477575 A1 JP H04258100 A	26-03-1992 01-04-1992 14-09-1992
WO 02065446	A1	22-08-2002	DE 10106477 A1 WO 02065446 A1	29-08-2002 22-08-2002
US 2008072675	A1	27-03-2008	DE 102007045494 A1 US 2008072675 A1	30-04-2008 27-03-2008
EP 1986465	A1	29-10-2008	CN 101371616 A EP 1986465 A1 KR 20080083209 A US 2008289428 A1 WO 2007094104 A1	18-02-2009 29-10-2008 16-09-2008 27-11-2008 23-08-2007
US 2005000279	A1	06-01-2005	NONE	