

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
12 June 2008 (12.06.2008)

PCT

(10) International Publication Number
WO 2008/069847 A3

(51) International Patent Classification:
G01G 1/00 (2006.01)

(21) International Application Number:
PCT/US2007/016625

(22) International Filing Date: 25 July 2007 (25.07.2007)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/832,952 25 July 2006 (25.07.2006) US
11/782,229 24 July 2007 (24.07.2007) US

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(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, 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, 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, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, 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
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

(88) Date of publication of the international search report:
31 July 2008

(54) Title: ULTRASONIC MATERIAL MONITOR FOR DETERMINING A CHARACTERISTIC OF THE MATERIAL

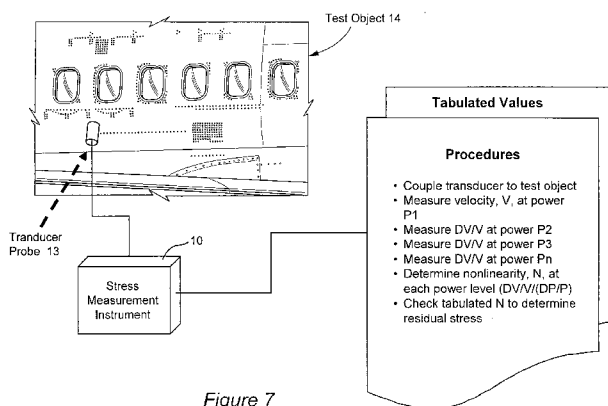


Figure 7

(57) Abstract: A material characteristic measurement approach measures an internal state of a material by measuring the nonlinear shift in velocity induced by different acoustic energies. The technology for implementing this measurement approach is relatively simple, robust, permits portable measurements, does not require that an unloaded initial condition of the material be measured or otherwise known in order to determine a characteristic of the material, can be applied using one or more transducers, and does not require physical contact with the material. Some example material characteristics include: a residual stress existing without any external mechanical force applied, applied stress, a fatigue state, age, an interference-fit fastener stress, bio-activity, a nanostructure mixture of the material, a heat treatment of the material, a cross-linking of polymers in the material, a bio-growth organization of the material, a clotting factor of blood or blood-like material, a cure of an adhesive or sealant material, or the microstructure of the material.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 07/16625

A. CLASSIFICATION OF SUBJECT MATTER
 IPC(8) - G01G 1/00 (2008.04)
 USPC - 73/646
 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)
 USPC - 73/646

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
 USPC - 73/629,630,640,643,645,646,760-763,786 (Text limited search, see terms below)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
 PubWEST(USPT,PGPB,EPAB,JPAB); DialogPRO(Engineering); Google Scholar; Google Patents; terms acoustic pumping wave energy nonlinear derivative material sample stress delay power difference resolution amplitude velocity acoustic signal amplitude velocity difference nonlinear OR slope OR divide age nanostructure blood clotting

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X -- Y	US 6,632,177 B1 (Phillips et al.) 14 October 2003 (14.10.2003) abstract, col. 3, ln. 54-55	21, 26, 48 -- 22-25, 27-31, 49-55
X -- Y	US 2005/0072236 A1 (Heyman et al.) 7 April 2005 (07.04.2005) para. [0005], [0009], [0011], [0012], [0033], [0042], [0047], [0050], [0075]	32-34, 56, 57 -- 1-20, 22, 23, 25, 27, 28, 35-47, 51, 52
Y	US 5,154,081 A (Thompson et al.) 13 October 1992 (13.10.1992) abstract, col. 1, ln. 12-14, col. 3, ln. 44-47, col. 6, ln. 63-col. 7, ln. 6, col. 8, ln. 56-59	1-20, 25, 29, 30, 35-47, 51, 54
Y	US 7,017,422 B2 (Heyman et al.) 28 March 2006 (28.03.2006) col. 7, ln. 26-27, 32-34, col. 8, ln. 8-11, col. 10, ln. 9-12, ln 33-38	8, 13, 14, 17, 23-25, 40, 42, 46, 49-51
Y	US 2006/0119402 A1 (Thomsen et al.) 08 June 2006 (08.06.2006) para. [0038], [0053]	30, 40-42, 53
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Y	US 2004/0177693 A1 (Tenoudji et al.) 16 September 2004 (16.09.2004) para. [0006]	10, 23, 46, 49
Y	US 2004/0182160 A9 (Madaras et al.) 23 September 2004 (24.09.2004) abstract	9, 23, 46, 49

Further documents are listed in the continuation of Box C.

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"A" document defining the general state of the art which is not considered to be of particular relevance	"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
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"O" document referring to an oral disclosure, use, exhibition or other means	
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Date of the actual completion of the international search 29 May 2008 (29.05.2008)	Date of mailing of the international search report 05 JUN 2008
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	Authorized officer: Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 07/16625

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 4,179,786 A (Eshghy) 25 December 1979 (25.12.1979) col. 4, ln. 23-24	11, 23, 46, 49
Y	US 7,052,854 B2 (Melker et al.) 30 May 2006 (30.05.2006) col. 4, ln 31-32, col. 6, ln 48-51, 53-54, 57-58,	12, 16, 23, 46, 49
Y	US 6,422,093 B1 (Feller) 23 Jul 2002 (23.07.2002) abstract, col. 15, ln. 4-8	15, 23, 46, 49