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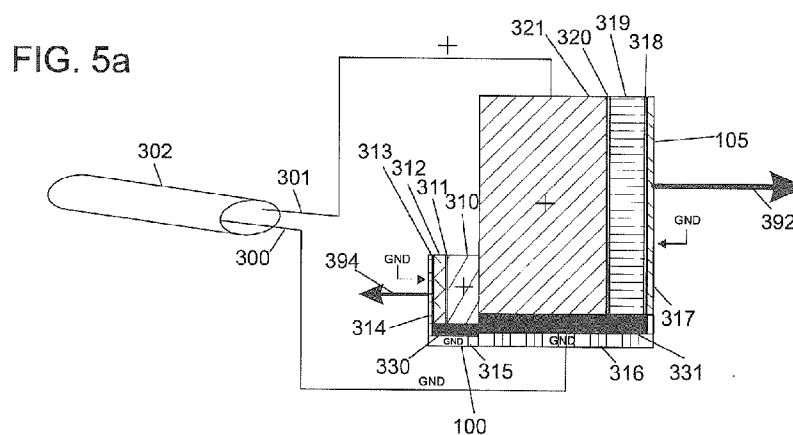
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Published:

- 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))

[Continued on next page]

(54) Title: ULTRASONIC PROBE WITH ULTRASONIC TRANSDUCERS ADDRESSABLE ON COMMON ELECTRICAL CHANNEL



(57) Abstract: Methods and apparatus are provided for electrically addressing multiple ultrasonic transducers that are connected to a common electrical channel and housed within an imaging probe. An imaging probe may comprise an imaging ultrasonic transducer and a moveable element for controlling the direction of an emitted imaging beam, and an angle sensing ultrasonic transducer, where the angle sensing ultrasonic transducer is configured for determining the direction of an ultrasonic imaging beam. The angle-sensing transducer may be configured to direct an angle sensing ultrasonic beam towards an acoustically reflective substrate and provide a signal by detecting a reflected ultrasonic beam reflected from the acoustically reflective substrate, where the acoustically reflective substrate is positioned relative to the movable element such that motion of the movable element produces a change in the signal.



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report:**

20 September 2012

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see Notice of 20 September 2012

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INTERNATIONAL SEARCH REPORT

International application No.
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A. CLASSIFICATION OF SUBJECT MATTER IPC: <i>G01S 15/89</i> (2006.01) , <i>A61B 8/00</i> (2006.01) , <i>F16F 1/14</i> (2006.01) , <i>G01D 5/48</i> (2006.01) , <i>G01S 7/52</i> (2006.01) , <i>G01S 7/527</i> (2006.01), <i>G01N 21/64</i> (2006.01) , <i>G01N 21/65</i> (2006.01) , <i>G01N 29/14</i> (2006.01) 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) <i>G01S 15/89</i> (2006.01) , <i>A61B 8/00</i> (2006.01) , <i>F16F 1/14</i> (2006.01) , <i>G01D 5/48</i> (2006.01) , <i>G01S 7/52</i> (2006.01) , <i>G01S 7/527</i> (2006.01), <i>G01N 21/64</i> (2006.01) , <i>G01N 21/65</i> (2006.01) , <i>G01N 29/14</i> (2006.01)		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic database(s) consulted during the international search (name of database(s) and, where practicable, search terms used) Databases: EPOQUE (Epodoc, English Full Text); IEEEExplore, Google Scholar/ patent Keywords: Ultrasonic / ultrasound / acoustic transducer/ imaging, intravascular / intracardiac imaging, tiltable/rotatable member/ transducer/ mirror, centripetal force, frequency multiplexing, central frequency, (conductive) torsion spring, angle detect(ion), acoustically		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	WO2006/121851A2 (HOSSACK et al.) 16 November 2006 (16-11-2006) * p. 1, line 25 - p. 2, line 18; p. 8, line 6 - p. 13, line 29; p. 16, lines 5-20; p. 18, lines 8-24; figs. 1-19 *	1-5, 7, 13-22, 88 6, 8-12, 23-35, 40-41, 43-58, 61-62, 89-91
X Y	US2009/0264768A1 (COURTNEY et al.) 22 October 2009 (22-10-2009) * paras [26, 124, 140-142, 161-165, 170-175, 205, 211, 249-254, 260-261]; figs. 1-27; cited by applicant *	78-79 6, 8-12, 23-35, 40-41, 43-58, 61-62, 80-87, 89-91
Y	US6985271B2 (YAZDI et al.) 10 January 2006 (10-01-2006) * col. 1, lines 17-40; figs. 1, 3 *	10-11, 80-87
Y	US2007/0197917A1 (BAGGE) 23 August 2007 (23-08-2007) * figs. 1, 3; abstract; paras [1, 5] *	23-24
A	US5651366 (LIANG et al.) 29 July 1997 (29-07-1997) * whole document *	1-95
☐ 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 20 July 2012 (20-07-2012)		Date of mailing of the international search report 25 July 2012 (25-07-2012)
Name and mailing address of the ISA/CA Canadian Intellectual Property Office Place du Portage I, C114 - 1st Floor, Box PCT 50 Victoria Street Gatineau, Quebec K1A 0C9 Facsimile No.: 001-819-953-2476		Authorized officer Michal Bordovsky (819) 994-7533

CORRECTED VERSION
INTERNATIONAL SEARCH REPORT

International application No.
PCT/CA2012/050057

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US2003/0171674A1 (JAGO et al.) 11 September 2003 (11-09-2003) * whole document *	1-95
A	WO00/16123 (ZLOTTER et al.) 23 March 2000 (23-03-2000) * whole document *	1-95
A	US4916675 (HOERING) 10 April 1990 (10-04-1990) * whole document *	1-95

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Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of the first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons :

1. ☐ Claim Nos. :
 because they relate to subject matter not required to be searched by this Authority, namely :

2. ☐ Claim Nos. :
 because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically :

3. ☐ Claim Nos. :
 because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows :

see extra sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claim Nos. :
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim Nos. :

Remark on Protest ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

The claims are directed to a plurality of inventive concepts as follows:

Group A - Claims 1-77, 88-91 are directed to an imaging probe (and corresponding methods of electrical addressing and beam direction detection) comprising: a longitudinal body, a first ultrasonic transducer, a second ultrasonic transducer, electrically conductive paths extending through the longitudinal body and defining a common electrical channel, wherein said first ultrasonic transducer and said second ultrasonic transducer are connected to said common electrical channel, and wherein said common electrical channel is electrically connectable to an external processing system.

Group B - Claims 78-87 are directed to a pivotable ultrasonic apparatus with restricted pivotal motion comprising: a solid support, an ultrasonic transducer; a pair of pivot elements supporting said transducer and a spring connecting said ultrasonic transducer to said solid support, such that said spring provides a restoring force in response to pivotal motion of said ultrasonic transducer.

Group C - Claims 92-95 are directed to an ultrasonic angle detection device for determining an angle of a pivotable member, wherein the pivotable member is pivotally coupled to a solid support, the device comprising: an electrically addressable ultrasonic transducer attached to the pivotable member, and an acoustically reflective substrate fixed relative to the solid support and having a surface curvature selected to substantially retroreflect the ultrasonic pulses back to said ultrasonic transducer over a defined angular range of the pivotable member.

Common features of groups A-C, such as ultrasonic imaging probe having a longitudinal body, an ultrasonic transducer, and a pivotable member, are well known from the prior art (e.g. US2009/0264768A1 cited by the applicant). The groups A-C, therefore, lack unity of invention.

The claims must be limited to one inventive concept as set out in Rule 13 of the PCT.

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CA2012/050057

Patent Document Cited in Search Report	Publication Date	Patent Family Member(s)	Publication Date
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