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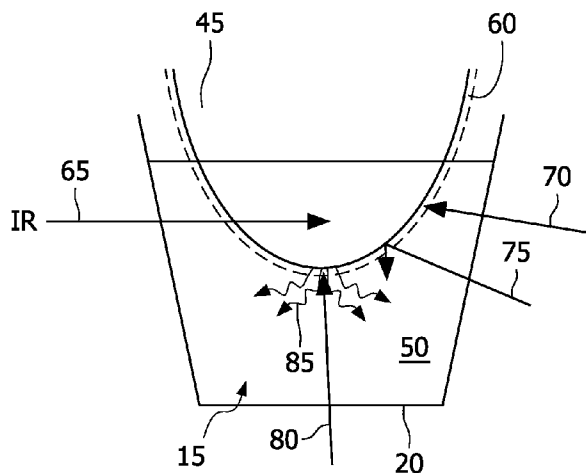
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[Continued on next page]

(54) Title: A METHOD OF, SYSTEM FOR, AND MEDICAL IMAGE ACQUISITION SYSTEM FOR IMAGING AN INTERIOR OF A TURBID MEDIUM TAKING INTO ACCOUNT THE GEOMETRY OF THE TURBID MEDIUM



(57) Abstract: The invention relates to a method of imaging an interior of a turbid medium (45) comprising the following steps: accommodation of the turbid medium (45) inside a receiving volume (20); coupling transmission input light (65) from a transmission light source into the receiving volume (12), with said transmission input light (65) being chosen such that it is capable of propagating through the turbid medium (45) and with at least a part of said transmission input light (65) passing through a matching medium (50) in the receiving volume (12), said matching medium (50) being chosen to reduce optical boundary effects at an interface between the turbid medium (45) and its surroundings; detection of transmission output light emanating from the receiving volume as a result of coupling transmission input light (65) from the transmission light source into the receiving volume (12) through use of a transmission photodetector unit. The invention also relates to a system for imaging an interior of a turbid medium (45) and a medical image acquisition system both using the method. Accord-

ing to the invention, the method, system for imaging an interior of a turbid medium (45), and medical image acquisition system are adapted such that data relating to the exterior of the turbid medium (45) can be obtained. This object is realized in that the method further comprises the following additional steps: coupling geometry input light (70, 75, 80) from a geometry light source into the receiving volume (12), with the receiving volume comprising the turbid medium (45), with the receiving volume (12) further comprising a geometry medium (60) for surrounding the turbid medium (45) during coupling of geometry input light (70, 75, 80) into the receiving volume (12), and with the combination of the geometry input light (70, 75, 80), the geometry medium (60), and the interface being chosen for creating a contrast between the turbid medium and its surroundings; - detection of the contrast between the turbid medium (45) and its surroundings; reconstructing an image of an interior of the turbid medium (45) using the detected contrast.

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A. CLASSIFICATION OF SUBJECT MATTER
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B. FIELDS SEARCHED

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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 practical, search terms used)

EPO-Internal, WPI Data, INSPEC, BIOSIS, COMPENDEX

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 023 341 A (COLAK SEL B [NL]) 8 February 2000 (2000-02-08)	1-3, 6-9, 11-16
Y	column 4, line 29 - line 58; figure 2 column 4, line 66 - column 6, line 65; figure 4 column 8, line 66 - column 9, line 14	4, 5, 10
X	US 2002/099287 A1 (OHMAE ETSUKO [JP] ET AL) 25 July 2002 (2002-07-25)	1-3, 6-9, 11-16
Y	paragraphs [0032] - [0040], [0056], [0057], [0069], [0082], [0085] - [0088]; figure 2	4, 5, 10
Y	US 2002/045833 A1 (WAKE ROBERT H [US] ET AL) 18 April 2002 (2002-04-18)	4, 5, 10
	paragraphs [0015], [0037]; figure 7	
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Further documents are listed in the continuation of Box C.

See patent family annex.

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	<p>US 6 216 540 B1 (NELSON ROBERT S [US] ET AL) 17 April 2001 (2001-04-17) column 5, line 37 - line 51 column 8, line 5 - line 13 column 8, line 64 - column 9, line 15 column 12, line 1 - line 63 column 25, line 44 - column 26, line 19 column 27, line 53 - column 28, line 40 claims 1,2,4</p> <p>-----</p>	1,6,7, 11-16
X	<p>WO 01/53802 A (MEDICAL OPTICAL IMAGING INC [US]; ZEYLIKOVICH IOSIF SEMEN [US]; KLIBAN) 26 July 2001 (2001-07-26) page 10, line 23 - page 14, line 34; figures 1,2</p> <p>-----</p>	1,6,7, 11-16
A	<p>COLAK S B ET AL: "Clinical Optical Tomography and NIR Spectroscopy for Breast Cancer Detection" IEEE JOURNAL OF SELECTED TOPICS IN QUANTUM ELECTRONICS, IEEE SERVICE CENTER, PISCATAWAY, NJ, US, vol. 5, no. 4, August 1999 (1999-08), XP011062582 ISSN: 1077-260X the whole document</p> <p>-----</p>	1,11,14
A	<p>VAN DER MARK M B ET AL: "BREAST IMAGING USING OPTICAL TOMOGRAPHY" CONFERENCE ON LASERS AND ELECTRO-OPTICS. CLEO '98. TECHNICAL DIGEST. CONFERENCE EDITION. SAN FRANCISCO, CA, MAY 3 - 8, 1998, OSA TECHNICAL DIGEST SERIES, VOL 6, NEW YORK, NY : IEEE, US, vol. CONF. 18, 3 May 1998 (1998-05-03), pages 85-86, XP009083645 ISBN: 0-7803-4417-0 the whole document</p> <p>-----</p>	1,11,14

INTERNATIONAL SEARCH REPORT

Information on patent family members

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6023341	A	WO 9807021 A1 JP 11514096 T	19-02-1998 30-11-1999
US 2002099287	A1	WO 0075633 A1	14-12-2000
US 2002045833	A1	US 2003195417 A1	16-10-2003
US 6216540	B1	NONE	
WO 0153802	A	AU 2959001 A EP 1254360 A2 JP 2003520637 T US 7006676 B1	31-07-2001 06-11-2002 08-07-2003 28-02-2006