

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
7 September 2007 (07.09.2007)

PCT

(10) International Publication Number
WO 2007/100823 A3

(51) International Patent Classification:

G01N 23/00 (2006.01) *G01N 23/20* (2006.01)
G03H 5/00 (2006.01) *G01T 1/36* (2006.01)
G01N 23/04 (2006.01) *G01N 23/201* (2006.01)

(74) Agents: GREENBAUM, Michael C. et al.; BLANK
ROME LLP, Suite 1100, 600 New Hampshire Avenue
NW, Washington, DC 20037 (US).

(21) International Application Number:

PCT/US2007/005081

(22) International Filing Date:

27 February 2007 (27.02.2007)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

60/776,684 27 February 2006 (27.02.2006) US

(71) Applicant (for all designated States except US): **UNIVERSITY OF ROCHESTER** [US/US]; 601 Elmwood Avenue, Box OTT, Rochester, NY 14642 (US).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, 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, LV, LY, MA, MD, 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, 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).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **NING, Ruola** [US/US]; 28 Chadwick Manor, Fairport, NY 14610 (US).
CAI, Weixing [CN/US]; 107 University Park, Rochester, NY 14620 (US).

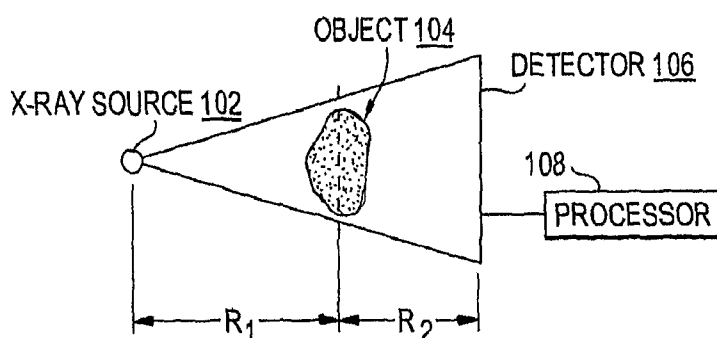
Published:

— with international search report

(88) Date of publication of the international search report:

26 June 2008

(54) Title: PHASE CONTRAST CONE-BEAM CT IMAGING



GENERAL SCHEME FOR PHASE-CONTRAST
IN-LINE HOLOGRAPHIC IMAGING

(57) Abstract: A cone beam CT imaging system incorporates the phase contrast in-line method, in which the phase coefficient rather than only the attenuation coefficient is used to reconstruct the image. Starting from the interference formula of in-line holography, the terms in the interference formula can be approximately expressed as a line integral that is the requirement for all CBCT algorithms. So, the CBCT reconstruction algorithms, such as the FDK algorithm, can be applied for the in-line holographic projections.



WO 2007/100823 A3

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US07/05081

A. CLASSIFICATION OF SUBJECT MATTER IPC: G01N 23/00(2006.01) G03H 5/00(2006.01);G01N 23/04(2006.01);G01N 23/20(2006.01);G01T 1/36(2006.01);G01N 23/201(2006.01) USPC: 378/36,62,70,82,86 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) U.S. : 378/36,62,70,82,86 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)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	Wu et al. X-ray cone-beam phase tomography formulas based on phase-attenuation duality Optics Express August 2005, Vol. 13, No. 16, pages 6000-6014	1, 2, 7, 9, 10, and 15 ----- 3-6, 8, and 11-14
Y --- P	US 6,047,042 (Khutoryansky et al.) 4 April 2000 (04.04.2000), column 10, lines 51-52	3 and 11
Y --- P	US 5,375,156 (Kuo-Petravic et al.) 20 December 1994 (20.12.1994), column 9 line 64 - column 10 line 10	4, 5, 12, and 13
☒ 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 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 6 November 2007 (06.11.2007)	Date of mailing of the international search report 02 APR 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 Ed Glick Telephone No. (571) 272-8048	

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US07/05081

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 6,018,564 (Wilkins) 25 Jan 2000 (25.01.2000), column 7, line 23-24	6 and 14
X --- P	US 2006/0039532 (Wu et al.) 23 Feb 2006, paragraph 0008	8
Y --- P	Momose Demonstration of phase-contrast X-ray computed tomography using an X-ray interferometer March 1994, Nuclear Instruments and Methods in Physics Research A 352, pages 622-628, especially page 625	1 and 9
Y --- P	Mayo et al. X-ray phase-contrast microscopy and microtomography Optics Express September 2003, Vol. 11, No. 19, pages2289-2302	1 and 9
Y --- P	US 5,802,137 (Wilkins) 1 Sept 1998 (01.09.1998)	1, 8, and 9
Y --- P	Chapman Diffraction enhanced x-ray imaging Phys Med Biol August 1997, Vol. 42, pages 2015-2025	1 and 9
Y --- P	Hwu et al. Coherence-enhanced synchrotron radiology: Refraction versus diffraction mechanisms Journal of Applied Physics October 1999, Vol. 86, No. 8 pages 4613-4618	1, 3, 9, and 11