

(19) World Intellectual Property Organization
International Bureau



(10) International Publication Number
WO 2011/106324 A3

(43) International Publication Date
1 September 2011 (01.09.2011)

(51) International Patent Classification:
G01B 11/24 (2006.01) **G02B 27/22** (2006.01)

(21) International Application Number:
PCT/US2011/025751

(22) International Filing Date:
22 February 2011 (22.02.2011)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
61/307,328 23 February 2010 (23.02.2010) US
61/307,324 23 February 2010 (23.02.2010) US

(71) Applicant (for all designated States except US): **CALIFORNIA INSTITUTE OF TECHNOLOGY** [US/US];
1200 East California Blvd., Pasadena, CA 91125 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **PAVANI, Sri Rama Prasanna** [IN/US]; 1539 Vista Club Circle Apt. 102, Santa Clara, CA 95054 (US). **YANG, Changhuei** [SG/US]; 1269 E. Elizabeth Street, Pasadena, CA 91104 (US).

(74) Agent: **MARTINEZ-LEMKE, Sheila**; 110 Pacific Avenue, Suite 240, San Francisco, CA 94111 (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, 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, PE, PG, PH, PL, PT, RO, RS, RU, 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, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, 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).

[Continued on next page]

(54) Title: NONDIFFRACTING BEAM DETECTION DEVICES FOR THREE-DIMENSIONAL IMAGING

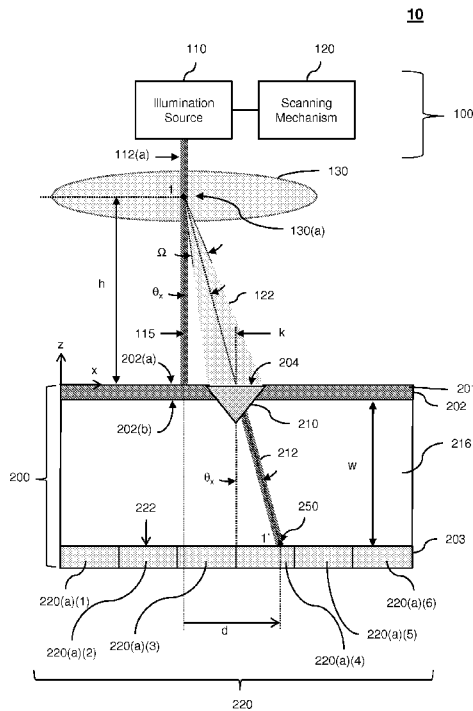


FIG. 4

(57) Abstract: Embodiments of the present invention relate a nondiffracting beam detection module for generating three-dimensional image data that has a surface layer having a first surface and a light transmissive region, a microaxicon, and a light detector. The microaxicon receives light through the light transmissive region from outside the first surface and generates one or more detection nondiffracting beams based on the received light. The light detector receives the nondiffracting beams and generates three-dimensional image data associated with an object located outside the first surface based on the one or more detection nondiffracting beams received. In some cases, the light detector can localize a three-dimensional position on the object associated with each detection nondiffracting beam received. In other cases, the light detector can determine perspective projections based on the detection nondiffracting beams received and generates the three-dimensional image data, using tomography, based on the determined perspective projections.

WO 2011/106324 A3



Published:

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

5 January 2012

- *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))*

A. CLASSIFICATION OF SUBJECT MATTER**G01B 11/24(2006.01)i, G02B 27/22(2006.01)i**

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)

G01B 11/24; G01B 11/02; G01N 21/64; G01B 9/02

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) & Keywords: nondiffracting beam, three dimensional data and microaxicon.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	Thierry Grosjean et al. `Fiber microxicons fabricated by a polishing technique for the generation of Bessel-like beams` Vol.46, No. 33 APPLIED OPTICS, 19 November 2007 See page 8061-8063 and figure 3.	1-25
A	Carlos J et al. `Three-dimensional field distribution in the focal region of low-Fresnel-number axicons`. F.Opt. Soc. Am.A/Vol.23, No.12, 6 July 2006 See page 3016-3017, figure 1.	1-25
A	US 2003-0218756 A1 (ZHONGPING CHEN et al.) 27 November 2003 See paragraphs 24-38 and figures 1,2,7.	1-25
A	US 05583342 A (ICHIE er al.) 10 December 1996 See column 8, line 39 - column 10, line 24 and figures 1,4.	1-25
A	US 7310150 B2 (Guillermo, Tearney J. et al.) 18 December 2007 See Column 4, line 43 - column 5, line4 and figures 3-4B.	1-25

 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 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

25 OCTOBER 2011 (25.10.2011)

Date of mailing of the international search report

25 OCTOBER 2011 (25.10.2011)

Name and mailing address of the ISA/KR

Korean Intellectual Property Office
Government Complex-Daejeon, 189 Cheongsa-ro,
Seo-gu, Daejeon 302-701, Republic of Korea

Facsimile No. 82-42-472-7140

Authorized officer

AHN, Young Woong

Telephone No. 82-42-481-8720



INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2011/025751

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2003-0218756 A1	27.11.2003	US 7072045 B2	04.07.2006
US 05583342 A	10.12.1996	EP 0627643 A2	07.12.1994
		EP 0627643 A3	12.04.1995
		EP 0627643 B1	06.05.1999
		JP 02-931268 B2	21.05.1999
		JP 08-015156 A	19.01.1996
		JP 10-062694 A	06.03.1998
		JP 2017-931268 B	09.08.1999
		US 05796112A A	18.08.1998
US 7310150 B2	18.12.2007	AU 2003-207507 A1	30.07.2003
		AU 2003-207507 A2	30.07.2003
		CA 2473465 A1	24.07.2003
		CA 2473465 C	05.04.2011
		CN 101598685 A	09.12.2009
		CN 1639539 C0	13.07.2005
		EP 1468245 A2	20.10.2004
		EP 1468245 B1	30.03.2011
		EP 2290318 A1	02.03.2011
		EP 2290319 A1	02.03.2011
		EP 2327954 A1	01.06.2011
		JP 2005-530128 A	06.10.2005
		US 2005-0018200 A1	27.01.2005
		WO 03-060423 A2	24.07.2003
		WO 03-060423 A3	24.07.2003