

(19) World Intellectual Property  
Organization  
International Bureau



(43) International Publication Date  
27 May 2004 (27.05.2004)

PCT

(10) International Publication Number  
**WO 2004/044624 A3**

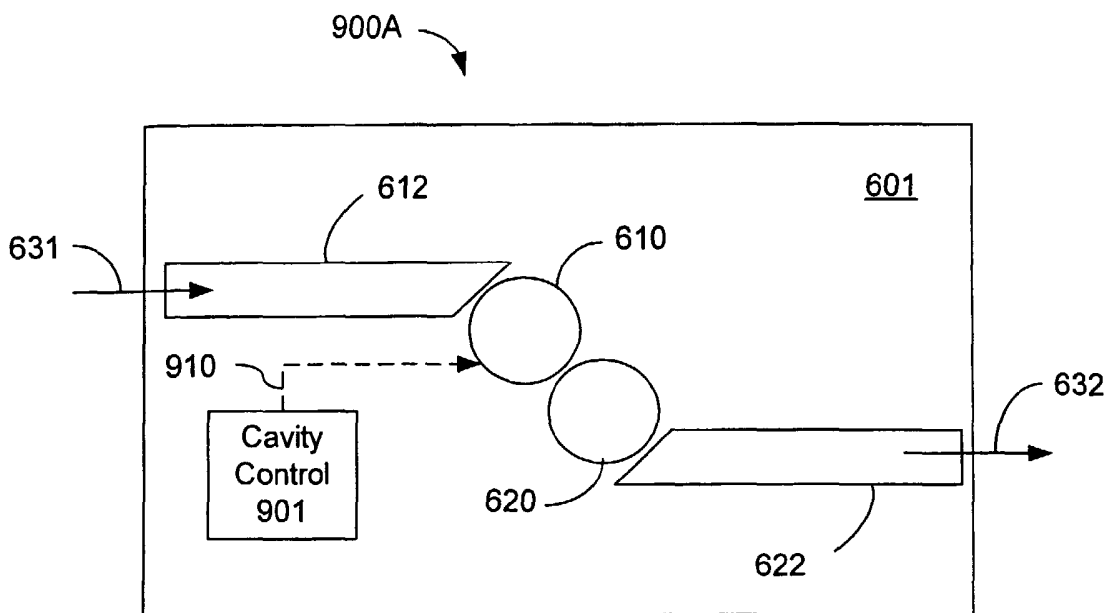
- (51) International Patent Classification<sup>7</sup>: **G02B 6/26**, 6/42
- (21) International Application Number: PCT/US2003/035131
- (22) International Filing Date: 4 November 2003 (04.11.2003)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
 

60/425,019	8 November 2002 (08.11.2002)	US
10/441,946	19 May 2003 (19.05.2003)	US
- (63) Related by continuation (CON) or continuation-in-part (CIP) to earlier applications:
 

US	10/441,946 (CIP)	
Filed on	19 May 2003 (19.05.2003)	
US	60/425,019 (CIP)	
Filed on	8 November 2002 (08.11.2002)	
- (71) Applicant (for all designated States except US): CALIFORNIA INSTITUTE OF TECHNOLOGY [US/US]; 1200 East California Boulevard, Mail Code 201-85, Pasadena, CA 91125 (US).
- (72) Inventors; and
- (75) Inventors/Applicants (for US only): SAVCHENKOV, Anatoliy [RU/US]; 4800 Oak Grove Drive, Building 298-105J, Pasadena, CA 91109-8099 (US). ILCHENKO, Vladimir [RU/US]; 4800 Oak Grove Drive, Mail Code 298, Pasadena, CA 91109 (US). MALEKI, Lutfolah [US/US]; Mail Code 298, 4800 Oak Grove Drive, Pasadena, CA 91109 (US). HANDLEY, Timothy, A. [US/US]; 3866 Center Avenue, Santa Barbara, CA 93110 (US).
- (74) Agent: HARRIS, Scott, C.; Fish & Richardson P.C., 12390 El Camino Real, San Diego, CA 92130 (US).
- (81) Designated States (national): 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, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.
- (84) Designated States (regional): ARIPO patent (BW, GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE,

[Continued on next page]

(54) Title: OPTICAL FILTER HAVING COUPLED WHISPERING-GALLERY-MODE RESONATORS



(57) Abstract: Optical filters (900A) having at least two coupled whispering-gallery-mode (WGM) optical resonators (610, 620) to produce a second order or higher order filter function with a desired spectral profile. At least one of the coupled WGM optical resonators (610, 620) may be tunable by a control signal to adjust the filtering function.

WO 2004/044624 A3



ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE,  
SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA,  
GN, GQ, GW, ML, MR, NE, SN, TD, TG).

**(88) Date of publication of the international search report:**  
23 September 2004

**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*

**(15) Information about Correction:**

**Previous Correction:**

see PCT Gazette No. 32/2004 of 5 August 2004, Section II

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

**INTERNATIONAL SEARCH REPORT**

International application No.  
PCT/US03/35131

**A. CLASSIFICATION OF SUBJECT MATTER**  
 IPC(7) : G02B 06/26, 06/42  
 US CL : 385/15  
 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. : 385/15,27,28; 372/32,92,96,108

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)  
 whispering gallery mode, (optic\$6 near4 resonat\$6), (alter\$6 or chang\$6) near3 (refract\$6 near3 (index or indices))

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2002/0044739 A1 (VAHALA et al) 18 April 2002 (18.04.2002), see ABS; figures 1A, 4, 9; [0121]-[0126], [0129]-[0132], [0147].	1-23
A, T	US 6,718,083 B2 (LOPES et al) 06 April 2004 (06.04.2004), see ABS; figure 2B; column 6, lines 38-65.	1-23
A, P	US 6,490,039 B2 (MALEKI et al) 03 December 2002 (03.12.2002), see ABS; figure 2; column 5, lines 20-33.	1-23
A	US 6,009,115 A (HO) 28 December 1999 (28.12.1999), see ABS, figures 1A, 9; column 3, line 66, through column 4, line 62; column 9, line 53, through column 10, line 46.	1-23

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: 02 May 2004 (02.05.2004)

Date of mailing of the international search report: 27 JUL 2004

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. (703) 305-3230

Authorized officer: *Meredith Guckler*  
 Rodney Bovernick  
 Telephone No. (571) 272-2800