

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
16 August 2007 (16.08.2007)

PCT

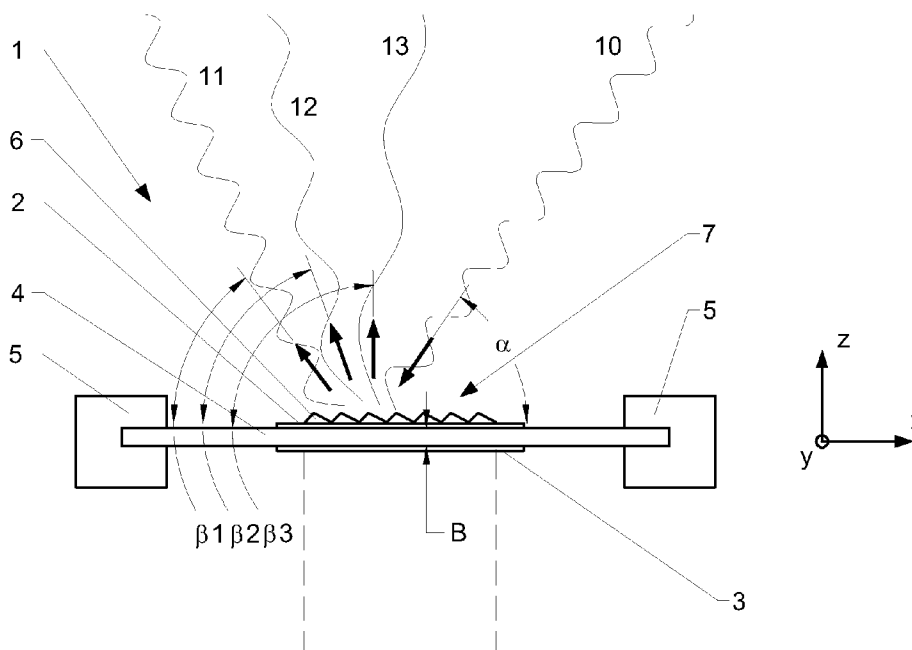
(10) International Publication Number
WO 2007/090842 A3

- (51) International Patent Classification:
G02B 5/18 (2006.01)
- (21) International Application Number:
PCT/EP2007/051137
- (22) International Filing Date: 6 February 2007 (06.02.2007)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
06002411.4 7 February 2006 (07.02.2006) EP
- (71) Applicant (for all designated States except US): **ETH Zürich, ETH transfer** [—/CH]; HG E 47-49, Rämistrasse 101, CH-8092 Zürich (CH).
- (72) Inventor; and
- (75) Inventor/Applicant (for US only): **ASCHWANDEN, Manuel** [CH/CH]; Studenbergli 10, CH-6469 Haldi (CH).
- (74) Agent: **Rentsch & Partner**; Postfach 2441, CH-8022 Zürich (CH).
- (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).
- 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
- (88) Date of publication of the international search report:
13 December 2007

[Continued on next page]

(54) Title: TUNABLE DIFFRACTION GRATING



(57) Abstract: The invention is directed to a tunable diffraction grating (1) with optically active elements (5) arranged at a distance (A) next to each other. The optically active elements (5) are displaceable relative to each other in a lateral direction (x, y) and mechanically interconnected to a layer (4), which is made out of a deformable material. A deformation of the layer (4) in a direction (z) in general perpendicular to the lateral direction (x, y) causes a change in the relative distance (A) of the optically active elements (5).

WO 2007/090842 A3



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/EP2007/051137A. CLASSIFICATION OF SUBJECT MATTER
INV. G02B5/18

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)
G02B

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3 942 048 A (LAUDE ET AL) 2 March 1976 (1976-03-02) cited in the application abstract column 2, line 21 - line 52 figures	1
A	-----	2,3,17
A	US 6 088 160 A (NOMURA YOSHIMITSU [JP] ET AL) 11 July 2000 (2000-07-11) abstract; figures	1-3
A	----- FR 2 517 436 A1 (BOSC DOMINIQUE [FR]) 3 June 1983 (1983-06-03) page 2, line 1 - page 3, line 10 figures 1a,1b,2 ----- -/--	1-3

 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 document 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.
- *Z* document member of the same patent family

Date of the actual completion of the international search

4 May 2007

Date of mailing of the international search report

31/10/2007

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Seibert, Joachim

INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2007/051137

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2004/017619 A1 (KANG CHIH-CHUNG [TW]) 29 January 2004 (2004-01-29) figures -----	1-3
A	US 4 850 682 A (GERRITSEN ET AL) 25 July 1989 (1989-07-25) cited in the application abstract column 8, line 22 - line 38 -----	1-3,17
A	WO 99/48197 A (TREX COMMUNICATIONS CORPORATION) 23 September 1999 (1999-09-23) cited in the application page 5 - page 7 figures 3a,3b,4 -----	1-3,17
A	EP 1 471 373 A (XEROX CORPORATION) 27 October 2004 (2004-10-27) cited in the application abstract; figures -----	1-3,17
A	WO 2005/085930 A (SIEMENS AKTIENGESELLSCHAFT; ARNDT, FRANK; STECKENBORN, ARNO; STOESSEL,) 15 September 2005 (2005-09-15) cited in the application abstract; figures -----	1-3,17
A	US 4 494 826 A (SMITH ET AL) 22 January 1985 (1985-01-22) abstract; figures -----	1-3,17

INTERNATIONAL SEARCH REPORT

International application No.
PCT/EP2007/051137

Box II Observations where certain claims were found unsearchable (Continuation of item 2 of 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. Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

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

Box 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 additional 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 an additional fee, this Authority did not invite payment of any additional fee.

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 claims 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 claims Nos.:

1-3, 5, 7-9, 15, 17

Remark on Protest

- The additional search fees were accompanied by the applicant's protest.
- No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-3,5,7-9,15,17

A tunable diffraction grating having a deformable intermediate layer between an upper electrode and a lower electrode, and a optically active element, in which the intermediate layer is encompassed, at least partially, by a support.

2. claims: 4 (when dependent on claim 1 only), 19

A tunable diffraction grating having a deformable intermediate layer between an upper electrode and a lower electrode, and a optically active element, in which the upper electrode is arranged between the optically active element and the intermediate layer.

3. claims: 6 (when dependent on claims 1 and 5 only), 18

A tunable diffraction grating having a deformable intermediate layer between an upper electrode and a lower electrode, and a optically active element, the optically active element is located between the electrode and the intermediate layer, in which the optically active element is integrated into the surface of the intermediate layer.

4. claims: 10,11 (when dependent on claim 1 only)

A tunable diffraction grating having a deformable intermediate layer between an upper electrode and a lower electrode, and a optically active element, in which the optically active element consists out of thin stripes of material.

5. claim: 12 (when dependent on claim 1 only)

A tunable diffraction grating having a deformable intermediate layer between an upper electrode and a lower electrode, and a optically active element, in which the optically active elements comprise pyramidal or spherical shaped elements.

6. claims: 13, 14 (when dependent on claim 1 only)

A tunable diffraction grating having a deformable intermediate layer between an upper electrode and a lower electrode, and a optically active element, in which the intermediate layer is made out of an elastomeric material.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

7. claim: 16 (when dependent on claim 1 only)

A device comprising an array of tunable diffraction gratings.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2007/051137

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 3942048	A	02-03-1976	DE 2456560 A1	05-06-1975
			FR 2271586 A1	12-12-1975
			GB 1481528 A	03-08-1977
			JP 1238289 C	31-10-1984
			JP 50090350 A	19-07-1975
			JP 59009884 B	06-03-1984
US 6088160	A	11-07-2000	JP 11109109 A	23-04-1999
FR 2517436	A1	03-06-1983	NONE	
US 2004017619	A1	29-01-2004	TW 525793 Y	21-03-2003
US 4850682	A	25-07-1989	NONE	
WO 9948197	A	23-09-1999	AU 3451499 A	11-10-1999
			EP 1086529 A2	28-03-2001
EP 1471373	A	27-10-2004	JP 2004326114 A	18-11-2004
			US 2004212869 A1	28-10-2004
WO 2005085930	A	15-09-2005	DE 102004011026 A1	29-09-2005
US 4494826	A	22-01-1985	NONE	