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— of inventorship (Rule 4.17(iv))

Published:

— with international search report (Art. 21(3))

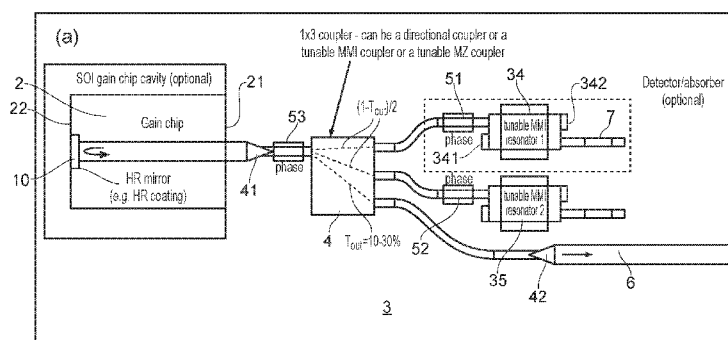
— before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))

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

11 September 2015

(54) Title: TUNABLE SOI LASER

FIG. 1



(57) Abstract: A wavelength tunable silicon-on-insulator (SOI) laser (1) comprising: a laser cavity including: a semiconductor gain medium (2) having a front end (21) and a back end (22), wherein a mirror (10) of the laser cavity is located at the back end (22) of the semiconductor gain medium; and a phase-tunable waveguide platform (3) coupled to the front end of the semiconductor gain medium, the phase-tunable waveguide platform comprising: a first resonator (34) and a second resonator (35); at least one resonator being a phase-tunable resonator; wherein the first resonator is any one of: an MMI device (34) including a pair of reflective surfaces defining a resonator cavity therebetween such that the device is configured to act as a Fabry-Perot filter; a ring resonator; or a waveguide Fabry-Perot filter; and wherein the second resonator is any one of: an MMI device including a pair of reflective surfaces defining a resonator cavity therebetween such that the device is configured to act as a Fabry-Perot filter; a ring resonator; or a waveguide Fabry-Perot filter. Output coupling from the resonator may be realized by a 1x3 coupler (4) and the resonator may comprise an additional phase tuning element (53) for wavelength fine adjustment.

INTERNATIONAL SEARCH REPORT

International application No

PCT/GB2015/050105

A. CLASSIFICATION OF SUBJECT MATTER

INV. H01S5/14

ADD. H01S5/028 H01S5/12 H01S3/1055 H01S3/106 H01S3/105
G02B6/12

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)

H01S 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 practicable, search terms used)

EPO-Internal, COMPENDEX, INSPEC, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CHERCHI M ET AL: "Deeply etched MMI-based components on 4 mum thick SOI for SOA-based optical RAM cell circuits", PROCEEDINGS OF SPIE, S P I E - INTERNATIONAL SOCIETY FOR OPTICAL ENGINEERING, US, vol. 8629, 1 January 2013 (2013-01-01), pages 86290C-1, XP009183773, ISSN: 0277-786X	22-26
Y	pages 86290C-1, paragraph 1 - pages 86290C-6, paragraph 2; figures 9-13	1-21,74
Y	US 2008/166134 A1 (MCCALLION KEVIN JOHN [US] ET AL) 10 July 2008 (2008-07-10) paragraphs [0024] - [0037]; figures 2-6 ----- -/--	1-21,74

☒ 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 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

"&" document member of the same patent family

Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/GB2015/050105

Box No. 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 No. 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 fees, this Authority did not invite payment of additional fees.
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.:

1-26, 74

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No

PCT/GB2015/050105

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EP 2 544 319 A1 (ALCATEL LUCENT [FR]; THALES S A [FR]; IMEC [BE]; UNIV GENT [BE]) 9 January 2013 (2013-01-09) paragraphs [0018] - [0030]; figures 1-5 -----	16-21

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/GB2015/050105

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2008166134 A1	10-07-2008	US 2008166134 A1	10-07-2008
		WO 2008080171 A1	03-07-2008

EP 2544319 A1	09-01-2013	NONE	

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

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

1. claims: 1-26, 74

Claims 1-21,74 comprise in common a wavelength tunable SOI laser as defined in claim 1, i.e. a SOI laser having a semiconductor gain medium coupled to a phase tunable waveguide platform comprising two MMI, the device acting as a tunable Fabry-Perot filter.

1.1. claims: 22-26

Claims 22-26 comprise in common a phase tunable MMI comprising two reflective surfaces with a phase tuning region therebetween, the MMI acting as a tunable Fabry-Perot filter.

2. claims: 27-52

Claim 27-52 comprise in common a wavelength tunable SOI laser as defined in claim 27, i.e. a SOI laser having a semiconductor gain medium coupled to a phase tunable waveguide platform comprising a MMI and two ring resonators with different FSR, one ring resonator is phase tunable.

3. claims: 53-73

Claims 53-73 comprise in common a wavelength tunable SOI laser as defined in claim 53, i.e. a SOI laser having a semiconductor gain medium with a HR coating on one facet and coupled to a phase tunable waveguide platform comprising two waveguide Fabry-Perot filters, one filter being a phase tunable Fabry-Perot filter.
