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(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.

[Continued on next page]

(54) Title: QCL SPECTROSCOPY SYSTEM AND APPLICATIONS THEREFOR

(57) Abstract: A spectroscopy system comprising at least two laser modules, each of the laser modules including a laser cavity, a quantum cascade gain chip for amplifying light within the laser cavity, and a tuning element for controlling a wavelength of light generated by the modules. Combining optics are used to combine the light generated by the at least two laser modules into a single beam and a sample detector detects the single beam returning from a sample.

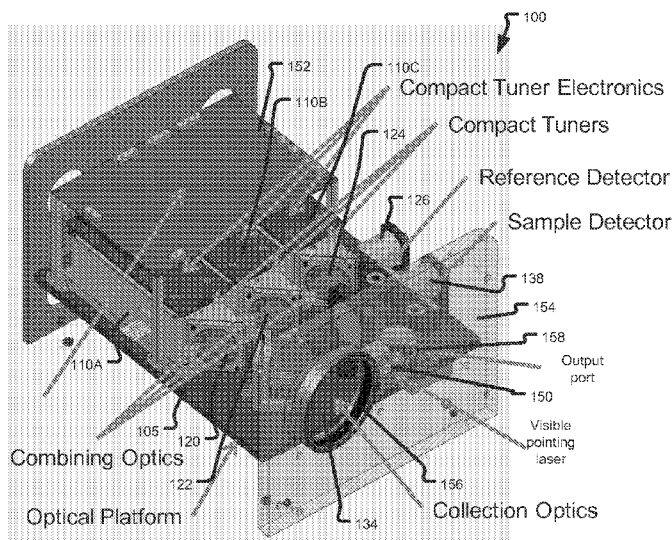


Fig. 2



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- *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:

22 March 2012

INTERNATIONAL SEARCH REPORT

International application No PCT/US2011/040217

A. CLASSIFICATION OF SUBJECT MATTER
 INV. G01J3/433 H01S5/14
 ADD.

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)
 G01J H01S

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, 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	DE 10 2007 062651 A1 (NEOPLAS CONTROL GMBH [DE]) 25 June 2009 (2009-06-25) paragraphs [0007], [0011] - [0017]; figure 2	1
A	----- US 2009/225802 A1 (DAY TIMOTHY [US] ET AL) 10 September 2009 (2009-09-10) paragraphs [0006], [0033], [0049] - [0058]; figures 1,4,5	1
Y	----- US 5 877 862 A (NELSON DAVID D [US] ET AL) 2 March 1999 (1999-03-02) column 2, line 65 - column 3, line 35; figure 1	1-5
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Further documents are listed in the continuation of Box C. See patent family annex.

* Special categories of cited documents :

<p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"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)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p>	<p>"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</p> <p>"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</p> <p>"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.</p> <p>"&" document member of the same patent family</p>
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Date of the actual completion of the international search 22 November 2011	Date of mailing of the international search report 07/02/2012
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Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer Hambach, Dirk
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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2011/040217

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.:

1-5

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/US2011/040217

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	<p>WYSOCKI G ET AL: "Widely tunable mode-hop free external cavity quantum cascade laser for high resolution spectroscopic applications", APPLIED PHYSICS B ; LASERS AND OPTICS, SPRINGER, BERLIN, DE, vol. 81, no. 6, 1 October 2005 (2005-10-01), pages 769-777, XP019337549, ISSN: 1432-0649, DOI: 10.1007/S00340-005-1965-4 section 2; page 306; figure 1a -----</p>	1-5

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2011/040217

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 102007062651 A1	25-06-2009	NONE	

US 2009225802 A1	10-09-2009	EP 2064782 A2	03-06-2009
		US 2008075133 A1	27-03-2008
		US 2009225802 A1	10-09-2009
		WO 2008036881 A2	27-03-2008

US 5877862 A	02-03-1999	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: 1-5

Spectral stitching

2. claims: 19-21

Spectral investigations with high magnification

3. claims: 6-13, 22-30, 33-36, 43-45

Applications of stand-off laser spectroscopy with QCL source

4. claims: 14-18, 31, 32, 37-42, 46

Near range observations, fiber-optical arrangements

5. claims: 47-50

Wavelength tuning with improved speed

6. claims: 51-61

Data processing
