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 lectual Property Department, SP-Ti-03-01, Corning, New
 York 14831 (US).

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 MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM,
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(54) Title: OPTICAL COUPLING SYSTEMS FOR OPTICALLY COUPLING LASER DIODES TO OPTICAL FIBERS

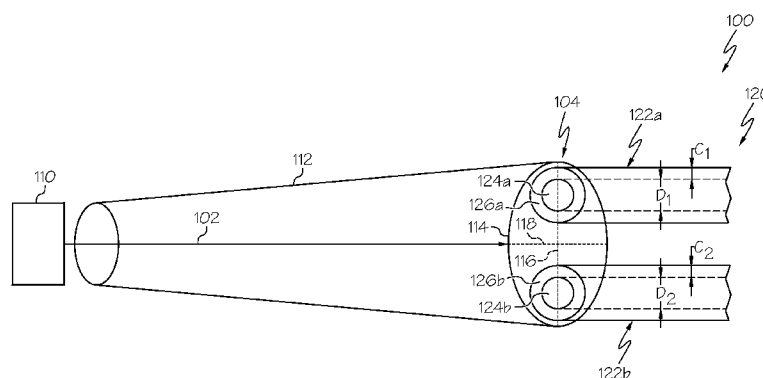


FIG. 1

(57) Abstract: Optical coupling systems are provided. An optical coupling system includes a first optical fiber end (122a) having a first core (124a), a second optical fiber end (122b) having a second core (124b), and a laser diode (110) optically coupled to the first core and the second core at an optical coupling location. The laser diode emits a light beam having an asymmetrical cross-sectional light beam profile comprising a fast axis diameter and a slow axis diameter. The fast axis diameter is longer than the slow axis diameter. Further, the first optical fiber end and the second optical fiber end are adjacently positioned along the fast axis diameter of the asymmetrical cross-sectional light beam profile of the laser diode at the optical coupling location such that the first core and the second core are within the asymmetrical cross-sectional light beam profile at the optical coupling location.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2016/037539

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.:

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
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A. CLASSIFICATION OF SUBJECT MATTER

INV. G02B6/00 G02B6/42 F21V8/00 H01S5/40 G02B6/36
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)

G02B 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 practicable, search terms used)

EP0-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.
A	US 8 761 222 B2 (STOPPEL KLAUS [DE] ET AL) 24 June 2014 (2014-06-24) column 15, line 57 - column 24, line 59; figures 3-15	1-8
A	----- WO 2014/049145 A1 (AIRBUS OPERATIONS GMBH [DE]) 3 April 2014 (2014-04-03) page 12, line 16 - page 14, line 29; figure 1	1,4,5,7
A	----- US 2008/259633 A1 (WANG WAN-CHU [TW]) 23 October 2008 (2008-10-23) the whole document	1,4,5,7
A	----- DE 196 52 159 A1 (BOSCH GMBH ROBERT [DE]) 18 June 1998 (1998-06-18) the whole document	1,4,5
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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

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"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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Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

International application No
PCT/US2016/037539

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	FR 2 890 455 A1 (MICRO MODULE SARL [FR]) 9 March 2007 (2007-03-09)	9,10, 13-15
A	page 8, line 19 - page 14, line 4; figures 1-7	11,12,16
A	----- JP 5 191771 B2 (PANASONIC CORP) 8 May 2013 (2013-05-08) the whole document	17-20
A	----- US 2013/148966 A1 (KUROKAWA MUNETAKA [JP] ET AL) 13 June 2013 (2013-06-13) paragraphs [0025] - [0033]; figures 1, 2 -----	17-20

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2016/037539

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			US 2013148966 A1 13-06-2013
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FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

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

1. claims: 1-8

Optical coupling system having a laser diode and two optical fibers, the fibers positioned adjacently along the fast axis of the laser beam

2. claims: 9-16

Optical coupling system having a laser diode and a fiber housing ferrule having two hole for housing fibers

3. claims: 17-20

Optical coupling system having a laser diode first and second diffusing optical fibers, and a birefringent crystal splitting the beam from the laser diode into two beams each one of the two beams for coupling into one of the fibers
