芯片 2 还通过金线连接一柔性线路板 9，柔性线路板 9 用于和光站中的其它器件连接。所述阵列波导光栅有入射端和出射端光信号从入射端进入，由于本发明中光纤所用的为波分复用技术，即在光信号中包含有不同波长的信号，因此在阵列波导光栅中将不同波长的信号分成多路光信号在出射端输出。所述阵列波导光栅为现有技术，其采用多个可以过滤不同波长的光学滤波片使得每一路都仅通过所设定波长范围内的光信号，这样就可以将光纤中的光信号进行分波输出。本发明中由于端面 63 为斜面，因此光信号在端面 63 处会进行反射，通过设置特定的角度使得反射的光信号能够照射到载板 8 上的不同的多个光电二极管 3 的感光面上，一般情况下，阵列波导光栅 6 出射端的光路与多个光电二极管 3 一一对应，本实施例中设为 4 路，当然根据实际需求也可以设置其它数量的路数，如 6 路、8 路等等，均应在本申请保护范围之内，

采用上述结构后，本发明具有以下优点：本发明通过将阵列波导光栅的端面研磨出一个角度，使得阵列波导光栅中出射的光信号通过端面的反射可以反射到光电二极管的感光面上，这样在设计时在光电二极管的位置已经确定好之后，只需要在载板上做出阵列波导光栅的放置槽或导向结构来确定阵列波导光栅的位置即可，安装简单方便，省去了阵列波导光栅和光电二极管之间的耦合，而且光电二极管可以和光接收芯片设在同一平面上，节省了连接线的结构以及长度，稳定非常高，制造成本也较低。

所述多个光电二极管设置在同一线路板上。采用这种结构，可以确定不同光电二极管之间的位置，以及在制造时简单方便。在将光电二极管安装到载板上时，可以一次性安装，节省装配步骤。

所述光电二极管的数量与阵列波导光栅中分出的光路的数量相同。

所述阵列波导光栅的出射端的端面的研磨角度为 41~46 度。

所述阵列波导光栅的出射端的端面的研磨角度为 42 度。

图 4 位实施例之一：所述阵列波导光栅 6 的入射端 61 与光纤连接器 4 之间设有用于耦合光纤的第一透镜 5。本实施例中第一透镜 5 设置在载板 8 上，处于光纤连接器和阵列波导光栅的光路上，用于耦合光路，采用这种结构在光纤连接器和阵列波导光栅中设置第一透镜 5 来进行耦合。

图 5-图 6 为实施例之二：所述阵列波导光栅 6 的入射端 61 直接插接在光纤连接器 4 上，所述光纤连接器 4 与阵列波导光栅 6 连接的一端内置了一渐变折射率透镜 10。采用这种结构，不需要在载板上进行透镜的耦合，减少了一次耦合次数，能够提高产品的稳定性。



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# 说 明 书 附 图

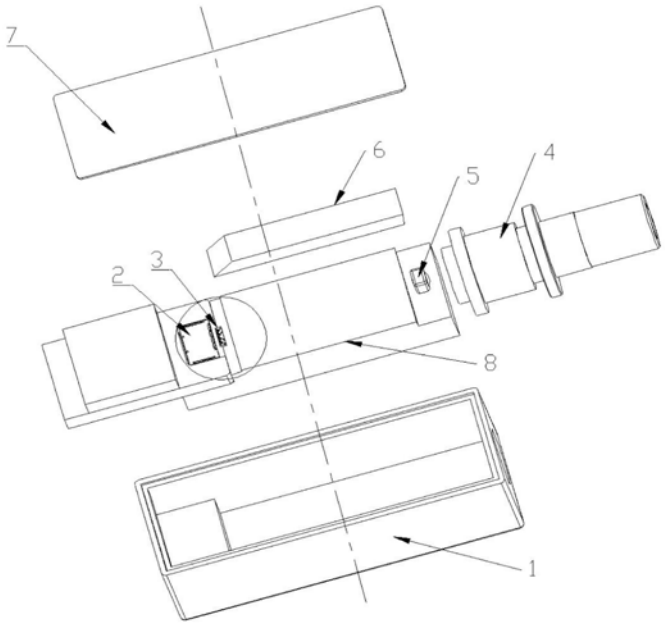



图 1

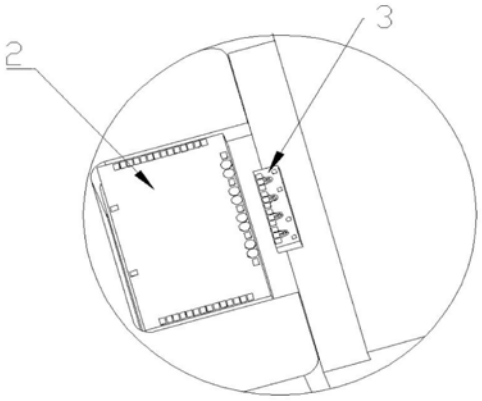



图 2

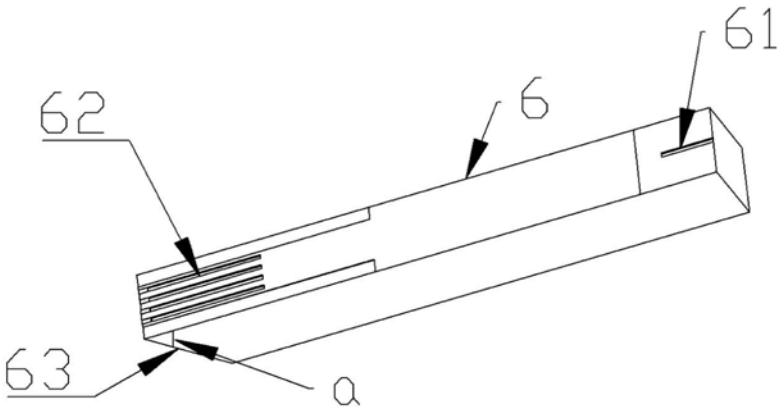



图 3

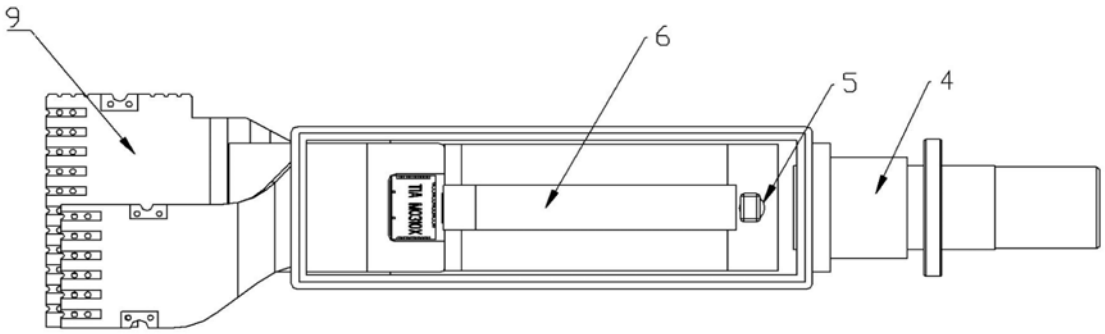



图 4

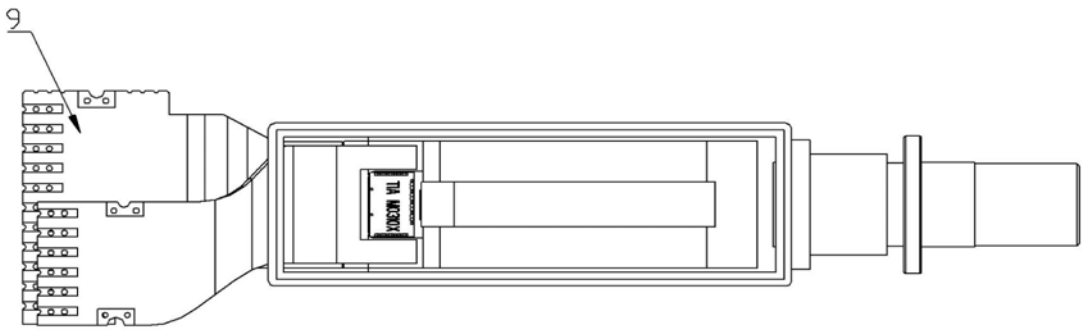



图 5

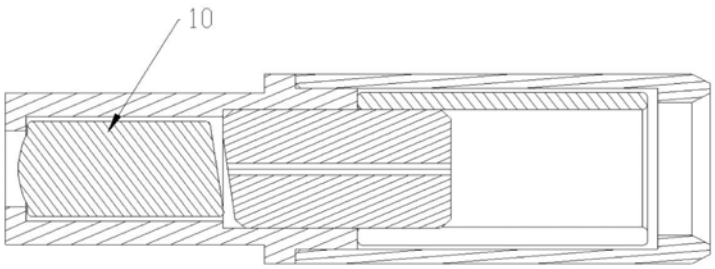



图 6

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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Alexandria, Virginia 22313-1450
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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 15/432,242 | 02/14/2017 | Jian-Hong LUO | AOIC006 | 2079 |

27543 7590 08/29/2017
APPLIED OPTOELECTRONICS, INC.
13115 JESS PIRTLE BLVD.
SUGAR LAND, TX 77478

| EXAMINER | |
|---|---|
| PETKOVSEK, DANIEL | |

| ART UNIT | PAPER NUMBER |
|---|---|
| 2874 | |

| NOTIFICATION DATE | DELIVERY MODE |
|---|---|
| 08/29/2017 | ELECTRONIC |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

kinsella@ao-inc.com
docketing@gtpp.com
kcarroll@gtpp.com

| Office Action Summary | Application No. 15/432,242 | Applicant(s) LUO ET AL. | |
|---|---|---|---|
| | Examiner Daniel Petkovsek | Art Unit 2874 | AIA (First Inventor to File) Status Yes |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *the application and claims filed February 14, 2017*.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims***

5)☒ Claim(s) *1-7* is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *1-7* is/are rejected.

8)☐ Claim(s) _____ is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

**Application Papers**

10)☐ The specification is objected to by the Examiner.

11)☒ The drawing(s) filed on *April 24, 2017* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

**Priority under 35 U.S.C. § 119**

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

**Certified copies:**

a)☒ All b)☐ Some** c)☐ None of the:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

4) ☐ Other: _____.

## DETAILED ACTION

This office action is in response to the application and claims filed February 14, 2017.

Claims 1-7 are pending. Claim 1 is the sole presented independent claim.

### *Notice of Pre-AIA or AIA Status*

1. The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

### *Priority*

2. Receipt is acknowledged of certified copies of papers required by 37 CFR 1.55.

### *Information Disclosure Statement*

3. It is noted that Applicant has *not* filed an Information Disclosure Statement. If Applicant becomes aware of any prior art that may be pertinent to the examination and analysis of the claimed subject matter, a PTO-1449 form should be filed.

### *Drawings*

4. The corrected / updated drawings were received on April 24, 2017. These drawings are acknowledged.


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***Claim Objections***

5. Claims 2 and 4 are objected to because of the following informalities: regarding claim 2, the phrase “on *a* same” should read “on *the* same.” Regarding claim 4, the phrase "grating is 41 to 46 degrees" should read "grating is (*between / from / in a range of*) 41 to 46 degrees." Appropriate correction is required.

***Claim Rejections - 35 USC § 102***

6. In the event the determination of the status of the application as subject to AIA 35 U.S.C. 102 and 103 (or as subject to pre-AIA 35 U.S.C. 102 and 103) is incorrect, any correction of the statutory basis for the rejection will not be considered a new ground of rejection if the prior art relied upon, and the rationale supporting the rejection, would be the same under either status.

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a)(2) the claimed invention was described in a patent issued under section 151, or in an application for patent published or deemed published under section 122(b), in which the patent or application, as the case may be, names another inventor and was effectively filed before the effective filing date of the claimed invention.

8. Claims 1-4 and 6 are rejected under 35 U.S.C. 102(a)(2) as being anticipated by Pezeshki et al. US 2017/0168252 A1 (effectively filed **December 10, 2015**).

Pezeshki et al. US 2017/0168252 A1 teaches (ABS; Figures 1-5, 10; corresponding text, in particular see paragraphs [0028] - [0061]; Claims, in particular see dependent

claims 5, 11, 12, 23) a multi-channel parallel optical receiving device (Fig. 1), comprising: a carrier 101 and a light receiving chip (chip-on-board; other "chips" defined by Pezeshki; use with circuit board 103); a plurality of optoelectronic diodes (photodiodes; E/O conversion elements cited) disposed on a top surface of an end of the carrier (at *left* in Fig. 1), and the plurality of optoelectronic diodes *electrically* connected to the light receiving chip (inherent to operate); an optical fiber (inputs provided by optical fiber(s)) connector disposed in another end (at *right* in Fig. 1) of the carrier; an arrayed waveguide grating (PLC uses AWG's) further disposed on the top surface of the carrier; and an input end of the arrayed waveguide grating connected to the optical fiber connector for receiving an optical signal from the optical fiber (fibers are coupled to PLC (AWGs); wherein the optical signals are divided (MUX / DEMUX) into multi-channel optical signals in parallel by the arrayed waveguide grating based on their wavelengths, the top surface of an output end of the arrayed waveguide grating is at a predetermined angle, causing the multi-channel optical signals reflected by the top surface to be reflected to an photosensitive surface of the plurality of optoelectronic diodes arranged in parallel (see Pezeshki '252 claim 23; and Fig. 7 paragraph [0045]), which clearly, fully meets Applicant's claimed **structural** limitations for sole pending independent claim 1.

Regarding claim 2, the OE diodes can be disposed on a / the *same* circuit board during optical and electrical integration.


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Regarding claim 3, when optical signals are split in the AWG, a corresponding number of light wave transmission signals can propagate to an equal amount of OE diodes by a path corresponding thereto.

Regarding claim 4, the angle of down reflection in the mirror of Pezeshki is between 41 and 46 angled degrees.

Regarding claim 6, the folded configuration for coupling optics in Pezeshki uses at least lens(es) between the optical fiber and the AWG.

***Claim Rejections - 35 USC § 103***

9. In the event the determination of the status of the application as subject to AIA 35 U.S.C. 102 and 103 (or as subject to pre-AIA 35 U.S.C. 102 and 103) is incorrect, any correction of the statutory basis for the rejection will not be considered a new ground of rejection if the prior art relied upon, and the rationale supporting the rejection, would be the same under either status.

10. The following is a quotation of 35 U.S.C. 103 which forms the basis for all obviousness rejections set forth in this Office action:

> A patent for a claimed invention may not be obtained, notwithstanding that the claimed invention is not identically disclosed as set forth in section 102, if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains. Patentability shall not be negated by the manner in which the invention was made.

11. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103 are summarized as follows:

1. Determining the scope and contents of the prior art.

2. Ascertaining the differences between the prior art and the claims at issue.

3. Resolving the level of ordinary skill in the pertinent art.

4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

12. Claim 1-4 and 6 are rejected under 35 U.S.C. 103 as being unpatentable over Shen et al. US 2016/0349451 A1, and further in view of Pezeshki et al. US 2017/0168252 A1.

Shen et al. US 2016/0349451 A1 teaches (ABS; Figures 1, 3, 5, 6; corresponding text, in particular paragraphs [0033] – [0045]; Claims) a multi-channel parallel optical receiving device (Fig. 1), comprising: a carrier 600 and a light receiving chip 700; an optoelectronic diode receiver 300 disposed on a top surface of an end of the carrier (at *left* in Fig. 1), and the optoelectronic diode *electrically* connected to the light receiving chip (by wire M); an optical fiber 500 (see [0044]; disclosing optical fiber(s) and/or lens(es)) connector disposed in another end (at *right* in Fig. 1) of the carrier; an arrayed waveguide grating 200 further disposed on the top surface of the carrier; and an input end of the arrayed waveguide grating connected to the optical fiber connector for receiving an optical signal from the optical fiber (500 coupled to 200), wherein the optical signals are divided (see Fig. 3 for division of optical signals) into multi-channel optical signals in parallel by the arrayed waveguide grating based on their wavelengths, the top surface of an output end of the arrayed waveguide grating is at a predetermined angle, causing the multi-channel optical signals reflected by the top surface to be


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reflected to an photosensitive surface of the optoelectronic diode arranged in parallel (down reflection at 400).

Regarding independent claim 1, Shen et al. '451 does not *expressly* teach that the OE diode receiver is a plurality of OE diodes that are split into separate receiving portions.

Pezeshki et al. US 2017/0168252 A1 teaches (ABS; Figures 1-5, 10; corresponding text, in particular see paragraphs [0028] - [0061]; Claims, in particular see dependent claims 5, 11, 12, 23) a multi-channel parallel optical receiving device (Fig. 1), comprising: a carrier 101 and an light receiving chip (chip-on-board; other "chips" defined by Pezeshki; use with circuit board 103); a ***plurality*** **of optoelectronic diodes** (photodiodes; E/O conversion elements cited) disposed on a top surface of an end of the carrier (at *left* in Fig. 1), and the plurality of optoelectronic diodes *electrically* connected to the light receiving chip (inherent to operate); an optical fiber (inputs provided by optical fiber(s)) connector disposed in another end (at *right* in Fig. 1) of the carrier; an arrayed waveguide grating (PLC uses AWG's) further disposed on the top surface of the carrier; and an input end of the arrayed waveguide grating connected to the optical fiber connector for receiving an optical signal from the optical fiber (fibers are coupled to PLC (AWGs); wherein the optical signals are divided (MUX / DEMUX) into multi-channel optical signals in parallel by the arrayed waveguide grating based on their wavelengths, the top surface of an output end of the arrayed waveguide grating is at a predetermined angle, causing the multi-channel optical signals reflected by the top

surface to be reflected to an photosensitive surface of the plurality of optoelectronic diodes arranged in parallel (see Pezeshki '252 claim 23; and Fig. 7 paragraph [0045]).

Since Shen et al. '451 and Pezeshki '252 are both from the same field of endeavor, the purpose disclosed by Pezeshki '252 would have been recognized in the pertinent art of Shen et al. '451.

A person having ordinary skill in the art at the time the invention was made would have recognized the teaching of Pezeshki '252, to use a ***plurality*** of configured photodiodes or photoreceivers that are distinct or separate components, on chip, in the device of Shen et al. '451 to improve optical coupling efficiency, by having separation and distinctness of components to allow 1 to 1 coupling. Both prior art references teach using AWGs. See *KSR v. Teleflex*, 127 S.Ct. 1727 (2007). Claim 1 does not impute any **patentable** distinction when considering Shen further in view of Pezeshki.

Regarding dependent claims 2-4 and 6, Shen (claims 4 and 6) and/or Pezeshki (claims 2-3) teach such limitations, in that the plural OE photodetectors are on the same circuit board (claim 2), in an equal amount based on optical paths (claim 3), or that the angled down reflection includes at least an angle of 41 to 46 down degrees (claim 4; Shen) and in that optical lenses are used (claim 6; in 500 element [0044] Shen).

13. Claims 5 and 7 (claim 5 being rejected standalone) are rejected under 35 U.S.C. 103 as being unpatentable over Pezeshki et al. US 2017/0168252 A1 as applied to claim 1 above, and further in view of Gao et al. US 2003/0174964 A1.

Regarding sole pending independent claim 1, Pezeshki et al. US 2017/0168252 A1 teaches (ABS; Figures 1-5, 10; corresponding text, in particular see paragraphs [0028] - [0061]; Claims, in particular see dependent claims 5, 11, 12, 23) a multi-channel parallel optical receiving device (Fig. 1), comprising: a carrier 101 and an light receiving chip (chip-on-board; other "chips" defined by Pezeshki; use with circuit board 103); a plurality of optoelectronic diodes (photodiodes; E/O conversion elements cited) disposed on a top surface of an end of the carrier (at *left* in Fig. 1), and the plurality of optoelectronic diodes *electrically* connected to the light receiving chip (inherent to operate); an optical fiber (inputs provided by optical fiber(s)) connector disposed in another end (at *right* in Fig. 1) of the carrier; an arrayed waveguide grating (PLC uses AWG's) further disposed on the top surface of the carrier; and an input end of the arrayed waveguide grating connected to the optical fiber connector for receiving an optical signal from the optical fiber (fibers are coupled to PLC (AWGs); wherein the optical signals are divided (MUX / DEMUX) into multi-channel optical signals in parallel by the arrayed waveguide grating based on their wavelengths, the top surface of an output end of the arrayed waveguide grating is at a predetermined angle, causing the multi-channel optical signals reflected by the top surface to be reflected to an photosensitive surface of the plurality of optoelectronic diodes arranged in parallel (see Pezeshki '252 claim 23; and Fig. 7 paragraph [0045]).

Regarding intervening dependent claim 4, Pezeshki '252 teaches an angled mirror with a down reflection between 41 and 46 degrees.


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Regarding further **dependent claim 5**, there is no *express* teaching of Pezeshki of an exact angle of 42 degrees. However, one having ordinary skill in the art at the time of the effective filing of the current application would have recognized that using any particular reflection angle in the general range of down reflection (i.e. at or about 45 degrees) would have been an obvious design choice. Such an ordinarily skilled artisan would have recognized (and it would have been *obvious to try*) close angled range(s) of down reflection by using a mirror to allow for desired optical coupling effects. Although there is no express citation for 42 degrees down reflection, this value would have been recognized as an obvious workable range. See *KSR v. Teleflex*, 127 S.Ct. 1727 (2007). Claim 5 does not create any **patentable** distinction using common sense, and nominal skill in the optical fiber communication art.

Regarding **dependent claim 7**, there is no *express* teaching of Pezeshki of using a graded index (GRIN) lens to improve optical coupling of the optical input fiber to the optical components on the receiving device.

Gao et al. US 2003/0174964 A1 teaches (ABS; Figure, including Fig. 2; paragraph [0023]; Claims) a lens coupling system that couples optical fiber(s) to optical waveguides on chip, in that optical lenses are used to improve optical coupling between the fiber(s) and the waveguide(s). Gao (para [0023]) teaches that using GRIN lenses improves optical coupling functionality by directly inputting optical signals without loss from this coupling connection. GRIN lenses are also known and commonly used in the art.

Since Pezeshki and Gao '964 are both from the same field of endeavor, the purpose disclosed by Gao '964 would have been recognized in the pertinent art of Pezeshki.

A person having ordinary skill in the art at the time the invention was made would have recognized the teaching of Gao '964, to use GRIN lenses to improve optical coupling between an optical fiber(s) and an optical waveguide(s) on a chip or substrate type configuration, in the device of Pezeshki to improve optical coupling efficiency. See *KSR v. Teleflex*, 127 S.Ct. 1727 (2007). Dependent claim 7 cannot be said to impart any **patentable** distinction when reviewing the combined teachings of Pezeshki and Gao.

***Inventorship***

14. This application currently names joint inventors. In considering patentability of the claims the examiner presumes that the subject matter of the various claims was commonly owned as of the effective filing date of the claimed invention(s) absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and effective filing dates of each claim that was not commonly owned as of the effective filing date of the later invention in order for the examiner to consider the applicability of 35 U.S.C. 102(b)(2)(C) for any potential 35 U.S.C. 102(a)(2) prior art against the later invention.

***Conclusion***

15. The prior art made of record is considered pertinent to applicant's disclosure: PTO-892 form references A-E.

16. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Daniel Petkovsek whose telephone number is (571) 272-4174. The examiner can normally be reached on M-F 8:30-5:30PM.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Uyen Chau Le can be reached on (571) 272-2397. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.


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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Daniel Petkovsek/
Primary Examiner, Art Unit 2874
August 21, 2017


AOI_NDCal 4-24cv09041_ 00002021

| Notice of References Cited | Application/Control No. 15/432,242 | Applicant(s)/Patent Under Reexamination LUO ET AL. | |
|---|---|---|---|
| | Examiner Daniel Petkovsek | Art Unit 2874 | Page 1 of 1 |

**U.S. PATENT DOCUMENTS**

| * | | Document Number Country Code-Number-Kind Code | Date MM-YYYY | Name | CPC Classification | US Classification |
|---|---|---|---|---|---|---|
| * | A | US-2017/0168252 A1 | 06-2017 | Pezeshki; Bardia | G02B6/4246 | 1/1 |
| * | B | US-2016/0349451 A1 | 12-2016 | SHEN; Po-Kuan | G02B6/12019 | 1/1 |
| * | C | US-2016/0149662 A1 | 05-2016 | Soldano; Lucas | G02B6/30 | 398/51 |
| * | D | US-2003/0174964 A1 | 09-2003 | Gao, Renyuan | G02B6/1221 | 385/49 |
| * | E | US-2004/0161186 A1 | 08-2004 | Crafts, Douglas E. | G02B6/12004 | 385/14 |
| | F | US- | | | | |
| | G | US- | | | | |
| | H | US- | | | | |
| | I | US- | | | | |
| | J | US- | | | | |
| | K | US- | | | | |
| | L | US- | | | | |
| | M | US- | | | | |

**FOREIGN PATENT DOCUMENTS**

| * | | Document Number Country Code-Number-Kind Code | Date MM-YYYY | Country | Name | CPC Classification |
|---|---|---|---|---|---|---|
| | N | | | | | |
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| | P | | | | | |
| | Q | | | | | |
| | R | | | | | |
| | S | | | | | |
| | T | | | | | |

**NON-PATENT DOCUMENTS**

| * | | Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages) |
|---|---|---|
| | U | |
| | V | |
| | W | |
| | X | |

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

| Index of Claims | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 15432242 | LUO ET AL. |
| | Examiner | Art Unit |
| | DANIEL PETKOVSEK | 2874 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ✓ | Rejected | - | Cancelled | N | Non-Elected | A | Appeal |
| = | Allowed | ÷ | Restricted | I | Interference | O | Objected |

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

| CLAIM | | DATE | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Final | Original | 08/18/2017 | | | | | | | | |
| | 1 | ✓ | | | | | | | | |
| | 2 | ✓ | | | | | | | | |
| | 3 | ✓ | | | | | | | | |
| | 4 | ✓ | | | | | | | | |
| | 5 | ✓ | | | | | | | | |
| | 6 | ✓ | | | | | | | | |
| | 7 | ✓ | | | | | | | | |

**EAST Search History**

**EAST Search History (Prior Art)**

| Ref # | Hits | Search Query | DBs | Default Operator | Plurals | Time Stamp |
|---|---|---|---|---|---|---|
| L1 | 1 | ("20170168252").PN. | US-PGPUB; USPAT; USOCR; JPO | OR | OFF | 2017/08/21 10:05 |
| L2 | 0 | ("2017/0168252").URPN. | USPAT | OR | ON | 2017/08/21 10:08 |
| L3 | 4 | ("2004/0161186").URPN. | USPAT | OR | ON | 2017/08/21 10:09 |
| L4 | 1 | (10/368195).APP. | USPAT; USOCR | OR | ON | 2017/08/21 10:09 |
| L6 | 14603 | G02B6/32.cpc. or G02B6/12019.cpc. or G02B6/4214.cpc. or G02B6/4249.cpc. | US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT | OR | ON | 2017/08/21 10:15 |
| L7 | 96 | 6 and (("AWG" (array$3 near2 waveguid$3 near3 grating$4)) with (reflect$4 mirror$4) with (detect$4 diod$4 photo-detect$4 photodetect$4 photo-diod$4 photodiod$4 receiv$4)) | US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT | OR | ON | 2017/08/21 10:16 |
| L8 | 1 | (luo$2 jiang$2 nie$2 ding$2).in. and (parallel$4 with receiv$4 with optic$4) and ("AWG" (array$3 near2 waveguid$3 near3 grating$3)) | US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT | OR | ON | 2017/08/21 10:20 |
| L9 | 13 | (US-20010055444-$ or US-20150029572-$ or US-20160149662-$ or US-20040022490-$ or US-20020181890-$ or US-20170168252-$ or US-20160349451-$ or US-20150311669-$ or US-20040161186-$).did. or (US-6945708-$ or US-9341786-$).did. or (US-20170168252-$ or US-20160349451-$).did. | US-PGPUB; USPAT; DERWENT | OR | ON | 2017/08/21 10:20 |
| S1 | 1 | ("6715936").PN. | US-PGPUB; USPAT; USOCR; JPO | OR | OFF | 2017/08/18 15:19 |
| S2 | 88 | coupl$4 same ("AWG" (array$2 near2 waveguid$3 near2 grating$4)) same (optic$4 near9 fiber$4) same connector$4 | US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT | OR | ON | 2017/08/18 15:21 |
| S3 | 15 | petkovsek$2.xa,xp. and (fiber$4 with | US- | OR | ON | 2017/08/18 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | ("AWG" or (array$3 near3 grating$3))) | PGPUB; USPAT; USOCR; EPO; JPO; DERWENT | | | 15:21 |
| S4 | 12 | ("20010055444" \| "6490395").PN. OR ("6760521").URPN. | US-PGPUB; USPAT; USOCR | OR | ON | 2017/08/18 15:22 |
| S5 | 0 | (14/621273).APP. | USPAT; USOCR | OR | ON | 2017/08/18 15:44 |
| S6 | 1 | ("2016/0149662").URPN. | USPAT | OR | ON | 2017/08/18 15:44 |
| S7 | 42 | G02B6/4214.cpc. and G02B6/12019.cpc. | US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT | OR | ON | 2017/08/18 16:00 |
| S8 | 0 | ("2017/0168252").URPN. | USPAT | OR | ON | 2017/08/18 16:36 |
| S9 | 0 | (15/373991).APP. | USPAT; USOCR | OR | ON | 2017/08/18 16:36 |
| S10 | 0 | (15/162623).APP. | USPAT; USOCR | OR | ON | 2017/08/18 16:43 |
| S11 | 0 | ("2016/0349451").URPN. | USPAT | OR | ON | 2017/08/18 16:43 |
| S12 | 1 | ("20160149662").PN. | US-PGPUB; USPAT; USOCR; JPO | OR | OFF | 2017/08/18 20:09 |

**EAST Search History (Interference)**

<This search history is empty>

**8/21/2017 10:20:49 AM**
**C:\Users\dpetkovsek\Documents\EAST\Workspaces\15432242.wsp**

| Search Notes | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 15432242 | LUO ET AL. |
| | Examiner | Art Unit |
| | DANIEL PETKOVSEK | 2874 |

| CPC- SEARCHED | | |
|---|---|---|
| Symbol | Date | Examiner |
| G02B 6/12019, 6/32, 6/4214, 6/4249 | 8/21/2017 | DJP |

| CPC COMBINATION SETS - SEARCHED | | |
|---|---|---|
| Symbol | Date | Examiner |
| | | |

| US CLASSIFICATION SEARCHED | | | |
|---|---|---|---|
| Class | Subclass | Date | Examiner |
| | | | |

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

| SEARCH NOTES | | |
|---|---|---|
| Search Notes | Date | Examiner |
| EAST searched, strategies attached | 8/21/2017 | DJP |
| Inventors and double patenting searched | 8/21/2017 | DJP |

| INTERFERENCE SEARCH | | | |
|---|---|---|---|
| US Class/ CPC Symbol | US Subclass / CPC Group | Date | Examiner |
| | | | |

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| 15432242 | CTNF | 08/29/2017 | AOIC006 |
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|---|---|---|---|
| 15/432,242 | 02/14/2017 | Jian-Hong LUO | AOIC006 |

**CONFIRMATION NO. 2079**

27543
APPLIED OPTOELECTRONICS, INC.
13115 JESS PIRTLE BLVD.
SUGAR LAND, TX 77478

**PUBLICATION NOTICE**

*OC000000095665340*

**Title:**MULTI-CHANNEL PARALLEL OPTICAL RECEIVING DEVICE

**Publication No.**US-2017-0336582-A1
**Publication Date:**11/23/2017

## NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

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| 15432242 | NTC.PUB | 11/24/2017 | AOIC006 |

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| | | | | |
|---|---|---|---|---|
| Application No. | : | 15/432,242 | Confirmation No. : | 2079 |
| Inventors | : | Jian-Hong Luo et al. | | |
| Filed | : | February 14, 2017 | | |
| TC/A.U. | : | 2874 | | |
| Examiner | : | Petkovsek | | |
| Docket No. | : | AOIC006 | | |
| Customer No. | : | 27,543 | | |

MS Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

**AMENDMENT AND REPLY UNDER 37 CFR § 1.111**

Sir/Madame:

In response to the Office Action dated August 29 2017, please amend the application as follows and consider the included remarks. Applicant is filing this amendment with a petition for a 3-month extension of time to extend the filing deadline from November 29, 2017 to February 28, 2018. The fee for such extension is being submitted concurrently herewith. Applicant believes that no additional extension of time is required. In the event that an additional extension is required, Applicant herewith petitions the Director of the United States Patent and Trademark Office for the necessary extension and authorizes the Director to charge Deposit Account 50-1705.


AOI_NDCal 4-24cv09041_ 00002030

## IN THE CLAIMS

1. (Currently Amended) A multi-channel parallel optical receiving device, comprising:

a carrier; ~~and an~~

a light receiving chip disposed on a top surface of the carrier;

a plurality of optoelectronic diodes disposed on ~~a~~ the top surface of an end of the carrier, and the plurality of optoelectronic diodes electrically connected to the light receiving chip, wherein the optoelectronic diodes and the light receiving chip are disposed on the same surface;

an optical fiber connector disposed in another end of the carrier;

an arrayed waveguide grating further disposed on the top surface of the carrier,[[;]] and an input end of the arrayed waveguide grating connected to the optical fiber connector for receiving an optical signal from the optical fiber, wherein a substantial portion of the arrayed waveguide grating is disposed on the top surface of the carrier; and

wherein the optical signals are divided into multi-channel optical signals in parallel by the arrayed waveguide grating based on their wavelengths, the top surface ~~of an~~ defined by an output end of the arrayed waveguide grating is at a predetermined angle, causing the multi-channel optical signals reflected by the top surface to be reflected to ~~an~~ a photosensitive surface of the plurality of optoelectronic diodes arranged in parallel, wherein the predetermined angle of the top surface defined by the output end of the arrayed waveguide grating is in a range of 41 to 46 degrees such that the top surface provides the reflection.

2. (Currently Amended) The multi-channel parallel optical receiving device according to claim 1, wherein the plurality of optoelectronic diodes are disposed on [[a]] the same circuit board.

3. (Original) The multi-channel parallel optical receiving device according to claim 1, wherein the amount of the optoelectronic diodes is equal to the amount of optical paths divided by the arrayed waveguide grating.



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4. (Cancelled)

5. (Currently amended) The multi-channel parallel optical receiving device according to claim 1 [[4]], wherein the predetermined angle of the top surface of the output end of the arrayed waveguide grating is 42 degrees.

6. (Original) The multi-channel parallel optical receiving device according to claim 1, wherein a first lens, for coupling the optical fiber, is disposed between the input end of the arrayed waveguide grating and the optical fiber connector.

7. (Original) The multi-channel parallel optical receiving device according to claim 1, wherein the input end of the arrayed waveguide grating is inserted directly into the optical fiber connector and a graded index lens is disposed in an end where the optical fiber connector and the arrayed waveguide grating connect.

8. (New) A multi-channel parallel optical receiving device, comprising:

a carrier;

a light receiving chip;

a plurality of optoelectronic diodes disposed on a top surface of an end of the carrier, and the plurality of optoelectronic diodes electrically connected to the light receiving chip;

an optical fiber connector disposed in another end of the carrier; and

an arrayed waveguide grating further disposed on the top surface of the carrier, and an input end of the arrayed waveguide grating connected to the optical fiber connector for receiving an optical signal from the optical fiber;



AOI_NDCal 4-24cv09041_ 00002032

wherein the optical signals are divided into multi-channel optical signals in parallel by the arrayed waveguide grating based on their wavelengths, the top surface defined by an output end of the arrayed waveguide grating is at a predetermined angle of 42 degrees, causing the multi-channel optical signals reflected by the top surface to be reflected to a photosensitive surface of the plurality of optoelectronic diodes arranged in parallel.



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## REMARKS

Please reconsider the application in view of the above amendments and the following remarks.

**Status of the Claims**

Claims 1-7 stand rejected. Claim 1 has been amended to include the subject matter of claim 4 and to provide clarification. Claim 4 has been cancelled, and claims 2 and 5 have been amended to correct antecedent basis and dependency. New claim 8 has been added. Claims 1-3 and 5-8 remain pending.

**Claim Objections**

Claim 2 and 4 were objected to because of minor informalities. Applicant has amended claim 2 to recite "on the same" as suggested in the Office Action. Applicant has canceled claim 4 and incorporated the subject matter into claim 1, reciting "grating is in a range of 41 to 46 degrees," as suggested in the Office Action. Accordingly, Applicant requests that the objections be withdrawn.

**Rejections under 35 U.S.C. § 102**

Claims 1-4 and 6 were rejected under 35 U.S.C. § 102(a)(2) as allegedly being anticipated by US Pat. Pub. No. 2017/0168252 (Pezeshki). Applicant respectfully traverses.

Claim 1 is directed to a multi-channel parallel optical receiving device comprising, *inter alia*, a carrier, a light receiving chip, a plurality of optoelectronic diodes, and an arrayed waveguide grating. The arrayed waveguide grating includes a top surface at a predetermined angle causing optical signals to be reflected by the top surface to a photosensitive surface of the optoelectronic diodes. Claim 1 has been amended to clarify that "the top surface defined by an output end of the arrayed waveguide grating is at a predetermined angled" causing the optical signals to be reflected.

Claim 1 is also amended to clarify that "a substantial portion of the arrayed waveguide grating is disposed on the top surface of the carrier." Support for this amendment may be found, for example, in FIG. 4, which shows an embodiment with the entire arrayed waveguide grating 6 disposed on the carrier 8. Disposing a substantial portion of the arrayed waveguide grating 6 on the top surface of the carrier 8 advantageously allows the carrier to provide a guiding structure to align the arrayed waveguide grating 6 with the optoelectronic devices, for example, as disclosed in paragraph 0022 of the published specification.



AOI_NDCal 4-24cv09041_ 00002034

Pezeshki discloses an optical transceiver including circuit board 611 with a substrate on a forward end, a PLC 615 mounted on a spacer on the substrate, and a plurality of photodetectors 717 positioned on the substrate. See Pezeshki, ¶¶0044-0046, FIGS. 6 and 7. Pezeshki discloses a folding optic structure 713 along part of a rear edge of the PLC 615 and an angled mirror of the folding optic structure 713 reflects light from the PLC 615 to the photodetectors 717, as shown in FIG. 7 reproduced below.

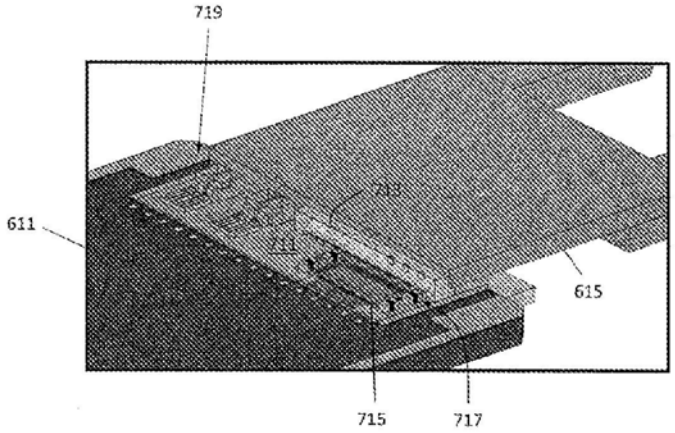



FIG. 7

In contrast to the claimed invention, therefor, Pezeshki discloses a structure that is separate and distinct from an arrayed waveguide grating for reflecting optical signals to the photodetectors. Thus, Pezeshki fails to disclose an arrayed waveguide grating with a top surface defined by an output end of the arrayed waveguide grating at a predetermined angle, causing the multi-channel optical signals reflected by the top surface to be reflected to a photosensitive surface of the plurality of optoelectronic diodes, as recited in amended claim 1.

Moreover, Pezeshki discloses the PLC 615 mounted only at an end portion to the substrate on the circuit board 611. As such, Pezeshki fails to disclose "a substantial portion of the arrayed waveguide grating is disposed on the top surface of the carrier," as recited in amended claim 1.

Because Pezeshki fails to disclose each and every element recited in amended claim 1, Pezeshki fails to anticipate claim 1 or the claims dependent therefrom. Accordingly, Applicant respectfully requests that the rejection under 35 U.S.C. § 102 be withdrawn.



AOI_NDCal 4-24cv09041_ 00002035

**Rejections Under 35 U.S.C. § 103**

Claims 1-4 and 6 were rejected under 35 U.S.C. § 103 as being unpatentable over U.S. Patent Pub. No. 2016/0349451 (Shen) in view of Pezeshki. Claims 5 and 7 were rejected under 35 U.S.C. § 103 as being unpatentable over Shen in view of Pezeshki and further in view of U.S. Patent Pub. No. 2003/0174964 (Gao). Applicant respectfully requests reconsideration in light of the above amendments.

As mentioned above, claim 1 is directed to a multi-channel parallel optical receiving device comprising, *inter alia*, a carrier, a light receiving chip, a plurality of optoelectronic diodes, and an arrayed waveguide grating. The arrayed waveguide grating includes a top surface at a predetermined angle causing optical signals to be reflected by the top surface to a photosensitive surface of the optoelectronic devices. Claim 1 has been amended to clarify further that the light receiving chip is disposed on a top surface of the carrier and that the optoelectronic diodes and the light receiving chip are disposed on the same surface. Support for this amendment may be found in the original application, for example, in paragraph 0022 of the published specification. The present application states that disposing the optoelectronic devices and the light receiving chip on the same surface reduces the length of the bonding wire to improve integrity. See published specification, ¶0022.

Claim 1 is further amended to incorporate the subject matter of dependent claim 4 and further recites "wherein the predetermined angle of the top surface of the output end of the arrayed waveguide grating is in a range of 41 to 46 degrees such that the top surface provides the reflection." The angle thus allows the top surface of the output end of the arrayed waveguide grating to reflect optical signals without requiring a separate mirror.

Applicant respectfully submits that the proposed combination of Shen and Pezeshki fails to result in the claimed multi-channel parallel optical receiving device with the claimed combination of the optoelectronic devices and light receiving chip on the same surface, a substantial portion of the arrayed waveguide grating disposed on the top surface of the carrier, and the predetermined angle of the top surface of the output end of the arrayed waveguide grating in a range of 41 to 46 degrees such that the top surface provides the reflection.


AOI_NDCal 4-24cv09041_ 00002036

The primary reference Shen discloses the driver 700 and the optical detector 300 disposed on different surfaces. See Shen, FIG. 1. In particular, the driver 700 is disposed on a surface of the circuit 600 and the optical detector 300 is disposed on a surface of the substrate 100. Shen also states that "the AWG structure 200 and the optical detector 300 are disposed on the same substrate 100, and the substrate 100 is integrally formed so it may reduce the optical path length between the arrayed-wavelength structure 200 and the optical detector 300." See Shen, ¶0037. As such, one skilled in the art would not have moved the optical detector 300 from the substrate 100 to the circuit 600 to be on the same surface as the driver 700 because it would increase the path length between the arrayed-wavelength structure 200 and the optical detector 300.

Moreover, both Shen and Pezeshki disclose the use of mirrors or reflective layers to reflect light to the photodetectors. In particular, Shen discloses the use of the reflective layer 420 in FIG. 4 and paragraphs 0045 and 0046 and Pezeshki discloses an angled mirror of the folding optical structure 713 in paragraph 0045. Thus, a combination of Shen and Pezeshki would likely use a mirror or reflective layer to reflect light instead of using only the top surface to provide the reflection.

Because the proposed combination of Shen and Pezeshki (and also Gao) fails to result in the claimed multi-channel parallel optical receiving device recited in amended independent claim 1, as discussed above, claim 1 and the claims dependent therefrom would not have been obvious over this proposed combination. Accordingly, Applicant respectfully requests that the rejections under 35 U.S.C. § 103 be withdrawn.

**New claim**

New claim 8 is added and combines original claim 1 with original claim 5. Applicant submits that the prior art of record does not disclose or make obvious an arrayed waveguide grating including a top surface of an output end of the arrayed waveguide grating at a predetermined angle of 42 degrees to provide reflection to a photosensitive surface of a plurality of optoelectronic diodes.

**Conclusion**

The claims have been shown to be allowable over the prior art. Applicant believes that this paper is responsive to each and every ground of rejection cited by the Examiner in the Action dated August 29, 2017, and respectfully requests favorable action in this application. The


AOI_NDCal 4-24cv09041_ 00002037

examiner is invited to telephone the undersigned, Applicant's attorney of record, to facilitate advancement of the present application. Please apply any charges not covered, or any credits, to Deposit Account 50-1705 (Reference Number AOIC006).

Respectfully submitted,

GROSSMAN, TUCKER, PERREAULT & PFLEGER PLLC

Date: February 28, 2018

By: /Kevin J. Carroll/
Kevin J. Carroll, Reg. No. 36,384

55 S. Commercial Street
Manchester, NH 03101
Telephone: (603) 668-6560
Facsimile: (603) 668-2970



AOI_NDCal 4-24cv09041_ 00002038

# Electronic Patent Application Fee Transmittal

| | |
|---|---|
| **Application Number:** | 15432242 |
| **Filing Date:** | 14-Feb-2017 |
| **Title of Invention:** | MULTI-CHANNEL PARALLEL OPTICAL RECEIVING DEVICE |
| **First Named Inventor/Applicant Name:** | Jian-Hong LUO |
| **Filer:** | Kevin J. Carroll/April Davis |
| **Attorney Docket Number:** | AOIC006 |

Filed as Large Entity

**Filing Fees for Utility under 35 USC 111(a)**

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Basic Filing:** | | | | |
| **Pages:** | | | | |
| **Claims:** | | | | |
| **Miscellaneous-Filing:** | | | | |
| **Petition:** | | | | |
| **Patent-Appeals-and-Interference:** | | | | |
| **Post-Allowance-and-Post-Issuance:** | | | | |
| **Extension-of-Time:** | | | | |



AOI_NDCal 4-24cv09041_ 00002039

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| Extension - 3 months with $0 paid | 1253 | 1 | 1400 | 1400 |
| **Miscellaneous:** | | | | |
| | | | **Total in USD ($)** | **1400** |

# Electronic Acknowledgement Receipt

| | |
|---|---|
| **EFS ID:** | 31924414 |
| **Application Number:** | 15432242 |
| **International Application Number:** | |
| **Confirmation Number:** | 2079 |
| **Title of Invention:** | MULTI-CHANNEL PARALLEL OPTICAL RECEIVING DEVICE |
| **First Named Inventor/Applicant Name:** | Jian-Hong LUO |
| **Customer Number:** | 27543 |
| **Filer:** | Kevin J. Carroll/April Davis |
| **Filer Authorized By:** | Kevin J. Carroll |
| **Attorney Docket Number:** | AOIC006 |
| **Receipt Date:** | 28-FEB-2018 |
| **Filing Date:** | 14-FEB-2017 |
| **Time Stamp:** | 18:29:24 |
| **Application Type:** | Utility under 35 USC 111(a) |

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| Submitted with Payment | yes |
| Payment Type | CARD |
| Payment was successfully received in RAM | $1400 |
| RAM confirmation Number | 030118INTEFSW18301900 |
| Deposit Account | 502121 |
| Authorized User | April Davis |

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

37 CFR 1.16 (National application filing, search, and examination fees)

37 CFR 1.17 (Patent application and reexamination processing fees)



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37 CFR 1.19 (Document supply fees)

37 CFR 1.20 (Post Issuance fees)

37 CFR 1.21 (Miscellaneous fees and charges)

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes)/ Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
| 1 | | AOIC006_Amendment_asfiled_022818.pdf | 110597<br>52bee056ee91cd5f300adad6d65fd8ccec216b17 | yes | 9 |

| | Multipart Description/PDF files in .zip description | | |
|---|---|---|---|
| | **Document Description** | **Start** | **End** |
| | Amendment/Req. Reconsideration-After Non-Final Reject | 1 | 1 |
| | Claims | 2 | 4 |
| | Applicant Arguments/Remarks Made in an Amendment | 5 | 9 |

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|---|---|---|---|---|---|
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 2 | Fee Worksheet (SB06) | fee-info.pdf | 30564<br>95310bc782b19895c236b0b47167665b9d45e674 | no | 2 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| | | **Total Files Size (in bytes):** | 141161 | | |



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**New Applications Under 35 U.S.C. 111**

**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

**National Stage of an International Application under 35 U.S.C. 371**

**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

**New International Application Filed with the USPTO as a Receiving Office**

**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**



AOI_NDCal 4-24cv09041_ 00002043

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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**INFORMATION DISCLOSURE STATEMENT BY APPLICANT**
**( Not for submission under 37 CFR 1.99)**

| | |
|---|---|
| Application Number | 15432242 |
| Filing Date | 2017-02-14 |
| First Named Inventor | LUO, Jian Hong |
| Art Unit | 2874 |
| Examiner Name | Petkovsek, Daniel |
| Attorney Docket Number | AOIC006 |

**U.S.PATENTS** Remove

| Examiner Initial* | Cite No | Patent Number | Kind Code[1] | Issue Date | Name of Patentee or Applicant of cited Document | Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear |
|---|---|---|---|---|---|---|
| | 1 | 5617234 | | 1997-04-01 | KOGA ET AL | |
| | 2 | 7376308 | B2 | 2008-05-20 | CHEBEN ET AL | |
| | 3 | 8831433 | B2 | 2014-09-09 | HO ET AL | |
| | 4 | 7058263 | B2 | 2006-06-06 | WELCH ET AL | |
| | 5 | 7532783 | B2 | 2009-05-12 | BAI | |
| | 6 | 7941053 | B2 | 2011-05-10 | DALLESASSE | |

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| Examiner Initial* | Cite No | Publication Number | Kind Code[1] | Publication Date | Name of Patentee or Applicant of cited Document | Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear |
|---|---|---|---|---|---|---|

| INFORMATION DISCLOSURE STATEMENT BY APPLICANT ( Not for submission under 37 CFR 1.99) | | |
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| | Application Number | 15432242 |
| | Filing Date | 2017-02-14 |
| | First Named Inventor | LUO, Jian Hong |
| | Art Unit | 2874 |
| | Examiner Name | Petkovsek, Daniel |
| | Attorney Docket Number | AOIC006 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 20030174964 | A1 | 2003-09-18 | GAO ET AL | |
| | 2 | 20040161186 | A1 | 2004-08-19 | CRAFTS ET AL | |
| | 3 | 20160149662 | A1 | 2016-05-26 | SOLDANO ET AL | |
| | 4 | 20160349451 | A1 | 2016-12-01 | SHEN ET AL | |
| | 5 | 20170168252 | A1 | 2017-06-15 | PEZESHKI ET AL | |
| | 6 | 20150249501 | A1 | 2015-09-03 | NAGARAJAN | |
| | 7 | 20170307819 | A1 | 2017-10-26 | HO ET AL | |

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| Examiner Initial* | Cite No | Foreign Document Number[3] | Country Code[2] i | Kind Code[4] | Publication Date | Name of Patentee or Applicant of cited Document | Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear | T[5] |
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| INFORMATION DISCLOSURE STATEMENT BY APPLICANT ( Not for submission under 37 CFR 1.99) | | |
|---|---|---|
| | Application Number | 15432242 |
| | Filing Date | 2017-02-14 |
| | First Named Inventor | LUO, Jian Hong |
| | Art Unit | 2874 |
| | Examiner Name | Petkovsek, Daniel |
| | Attorney Docket Number | AOIC006 |

| Examiner Initials* | Cite No | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published. | T[5] |
|---|---|---|---|
| | 1 | PCT Search Report and Written Opinion mailed July 6, 2017, received in corresponding PCT Application No. PCT/US17/29350, 9 pgs. | |
| | 2 | US Office Action mailed August 21, 2017, received in US Application Serial No. 15/432,242, 15 pgs. | |

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**EXAMINER SIGNATURE**

| Examiner Signature | | Date Considered | |
|---|---|---|---|

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

| INFORMATION DISCLOSURE STATEMENT BY APPLICANT ( Not for submission under 37 CFR 1.99) | | |
|---|---|---|
| | Application Number | 15432242 |
| | Filing Date | 2017-02-14 |
| | First Named Inventor | LUO, Jian Hong |
| | Art Unit | 2874 |
| | Examiner Name | Petkovsek, Daniel |
| | Attorney Docket Number | AOIC006 |

**CERTIFICATION STATEMENT**

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

**OR**

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

A certification statement is not submitted herewith.

**SIGNATURE**

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

| Signature | /Kevin J. Carroll/ | Date (YYYY-MM-DD) | 2018-03-01 |
|---|---|---|---|
| Name/Print | Kevin J. Carroll | Registration Number | 36384 |

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 15/137,823 | 04/25/2016 | I-Lung HO | PAT260-018US | 2275 |

27543 7590 08/21/2017
APPLIED OPTOELECTRONICS, INC.
13115 JESS PIRTLE BLVD.
SUGAR LAND, TX 77478

| EXAMINER | |
|---|---|
| PHAN, HANH | |

| ART UNIT | PAPER NUMBER |
|---|---|
| 2636 | |

| NOTIFICATION DATE | DELIVERY MODE |
|---|---|
| 08/21/2017 | ELECTRONIC |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

kinsella@ao-inc.com
docketing@gtpp.com
kcarroll@gtpp.com

| Office Action Summary | Application No. 15/137,823 | Applicant(s) HO ET AL. | |
|---|---|---|---|
| | Examiner HANH PHAN | Art Unit 2636 | AIA (First Inventor to File) Status Yes |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *04/25/2016*.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims***

5)☒ Claim(s) *1-19* is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *1-19* is/are rejected.

8)☐ Claim(s) _____ is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

**Application Papers**

10)☐ The specification is objected to by the Examiner.

11)☒ The drawing(s) filed on *04/25/2016* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

**Certified copies:**

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

4) ☐ Other: _____.

1. The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

## DETAILED ACTION

### *Election/Restrictions*

2. Applicant's election without traverse of Group I, Claims 1-19 in the reply filed on 08/07/2017 is acknowledged.

### *Claim Rejections - 35 USC § 102*

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a)(1) the claimed invention was patented, described in a printed publication, or in public use, on sale or otherwise available to the public before the effective filing date of the claimed invention.

4. Claims 1-11 are rejected under 35 U.S.C. 102(a)(1) as being anticipated by Bai (US Patent No. 7,532,783).

Regarding claim 1, referring to Figures 1A, 1B, 2A and 2B, Bai teaches an arrayed waveguide grating (AWG) chip (i.e., AWG chip 110, Figs. 1A, 1B, 2A and 2B) comprising:

a first end (i.e., input port 112, Figs. 1A, 1B, 2A and 2B) for coupling to an optical coupling receptacle to receive an optical signal comprising a plurality of channel wavelengths;

a planar lightwave circuit (PLC) (i.e., grating waveguides 116, Figs. 1A, 1B, 2A and 2B) coupled to the first end configured to demultiplex each channel wavelength of the plurality of channel wavelengths;

a plurality of output waveguides (i.e., output ports 113, Figs. 1A, 1B, 2A and 2B) coupled to the PLC, each of the output waveguides configured to receive light corresponding to an associated demultiplexed channel wavelength launched from the PLC and provide the light along a first light path that extends towards a second end of the AWG chip; and

a tapered region (i.e., mirror 225, and photodetector array chips 114, Figs. 1A, 1B, 2A and 2B) disposed at the second end of the AWG chip configured to receive light via the plurality of output waveguides and reflect the same towards an output interface region of the AWG chip (i.e., Figures 1A, 1B, 2A and 2B, col. 5, lines 17-67, col. 6, lines 1-67, col. 7, lines 1-61, and col. 10, lines 4-9).

Regarding claim 2, Bai further teaches wherein the output interface region (i.e., mirror 225, and photodetector array chips 114, Figs. 1A, 1B, 2A and 2B) is configured to pass the reflected light received via the plurality of output waveguides out of the AWG chip along a second light path that is substantially orthogonal to the first light path.

Regarding claim 3, Bai further teaches wherein the AWG chip (i.e., AWG chip 110, Figs. 1A, 1B, 2A and 2B) defines a plurality of sidewalls extending longitudinally from the first end to the second end, and wherein the tapered region of the second end defines an angled surface that extends from a first sidewall of the plurality of sidewalls to a second sidewall of the plurality of sidewalls.


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Regarding claim 4, Bai further teaches wherein the angled surface (i.e., mirror 225, Fig. 2B) has an interior angle of about 41 to 45 degrees relative to the output interface region (i.e., Figs. 1A, 1B, 2A and 2B, col. 7, lines 25-61).

Regarding claim 5, Bai further teaches wherein each of the output waveguides (i.e., output port 113, Figs. 1A, 1B, 2A and 2B) comprise a core material, and wherein a cladding material is disposed on the core material, the core material defining at least a portion of the plurality of sidewalls of the AWG chip (i.e., Figures 1A, 1B, 2A and 2B, col. 5, lines 17-67, col. 6, lines 1-67, and col. 7, lines 1-61).

Regarding claim 6, Bai further teaches wherein the core material of each of the plurality of output waveguides (i.e., output ports 113, Figs. 1A, 1B, 2A and 2B) has a first index of refraction, and a medium external to and adjacent the tapered region has a second index of refraction, the first index of refraction being greater than the second index of refraction (i.e., Figures 1A, 1B, 2A and 2B, col. 5, lines 17-67, col. 6, lines 1-67, and col. 7, lines 1-61).

Regarding claim 7, Bai further teaches wherein the core material of each of the plurality of output waveguides provide a portion of the angled surface, and wherein the angled surface (i.e., mirror 225, Fig. 1B) is configured to reflect incident light based on at least an interior angle of the angled surface.

Regarding claim 8, Bai further teaches wherein the core material comprises doped silica (SiOi) having an index of refraction of about 1.45 to 1.50 (i.e., Figures 1A, 1B, 2A and 2B, col. 5, lines 17-67, col. 6, lines 1-67, and col. 7, lines 1-61).

Regarding claim 9, Bai further teaches wherein the external medium comprises a material having an index of refraction of about 1.0 (i.e., Figures 1A, 1B, 2A and 2B, col. 5, lines 17-67, col. 6, lines 1-67, and col. 7, lines 1-61).

Regarding claim 10, Bai further wherein the AWG chip (i.e., AWG chip 110, Figs. 1A, 1B, 2A and 2B) is configured as a 1xN demultiplexer device whereby a single optical input signal is de-multiplexed into N different channel wavelengths.

Regarding claim 11, Bai further teaches wherein the AWG chip (i.e., AWG chip 110, Figs. 1A and 3A) is implemented in an AWG device package.

***Claim Rejections - 35 USC § 103***

5. The following is a quotation of 35 U.S.C. 103 which forms the basis for all obviousness rejections set forth in this Office action:

> A patent for a claimed invention may not be obtained, notwithstanding that the claimed invention is not identically disclosed as set forth in section 102, if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 12-19 are rejected under 35 U.S.C. 103 as being unpatentable over Dallesasse (US Patent No. 7,941,053) in view of Bai (US Patent No. 7,532,783) **OR** Welch et al (US Patent No. 7,058,263).

Regarding claim 12, referring to Figures 1A, 1B, 2 and 3, Dallesasse teaches an optical transceiver module (i.e., optical transceiver module 100, Figs. 1A, 1B, 2 and 3) comprising:

a transceiver housing (i.e., transceiver housing 102, Fig. 2);

a multi-channel receiver optical sub-assembly (ROSA)(i.e., receiver subassembly 503, Fig. 3) located in the transceiver housing;

an array of detector devices (i.e., photodetectors 513, Fig. 3) disposed adjacent to the output of the optical demultiplexer (i.e., optical demultiplexer 512, Fig. 3); and

a multi-channel transmitter optical assembly (TOSA) (i.e., transmitter subassembly 502, Fig. 3) including at least one laser package located in the transceiver housing for transmitting optical signals at different channel wavelengths (i.e., Figures 1A, 1B, 2 and 3, col. 7, lines 6-67, col. 8, lines 1-67, col. 9, lines 1-67, and 10, lines 1-15).

Dallesasse differs from claim 12 in that he fails to specifically teach an arrayed waveguide grating (AWG) chip, the AWG chip comprising: a first end for coupling to an optical coupling receptacle to receive an optical signal comprising a plurality of channel wavelengths; a planar lightwave circuit (PLC) coupled to the first end configured to demultiplex each channel wavelength of the plurality of channel wavelengths; a plurality of output waveguides coupled to the PLC, each of the output waveguides configured to receive light corresponding to an associated demultiplexed channel wavelength launched from the PLC and provide the light along a first light path that extends towards a second end of the AWG chip; and a tapered region disposed at the second end of the AWG chip configured to receive light via the plurality of output waveguides and reflect the same towards an output interface region of the AWG chip; an array of detector devices disposed adjacent to the output interface region of the AWG chip. However, Bai in US Patent No. 7,532,783 teaches an arrayed waveguide grating (AWG) chip (i.e.,

AWG chip 110, Figs. 1A, 1B, 2A and 2B) comprising: a first end (i.e., input port 112, Figs. 1A, 1B, 2A and 2B) for coupling to an optical coupling receptacle to receive an optical signal comprising a plurality of channel wavelengths; a planar lightwave circuit (PLC) (i.e., grating waveguides 116, Figs. 1A, 1B, 2A and 2B) coupled to the first end configured to demultiplex each channel wavelength of the plurality of channel wavelengths; a plurality of output waveguides (i.e., output ports 113, Figs. 1A, 1B, 2A and 2B) coupled to the PLC, each of the output waveguides configured to receive light corresponding to an associated demultiplexed channel wavelength launched from the PLC and provide the light along a first light path that extends towards a second end of the AWG chip; and a tapered region (i.e., mirror 225, and photodetector array chips 114, Figs. 1A, 1B, 2A and 2B) disposed at the second end of the AWG chip configured to receive light via the plurality of output waveguides and reflect the same towards an output interface region of the AWG chip (i.e., Figures 1A, 1B, 2A and 2B, col. 5, lines 17-67, col. 6, lines 1-67, col. 7, lines 1-61, and col. 10, lines 4-9). **OR**, Welch et al in US Patent No. 7,058,263 teaches an arrayed waveguide grating (AWG) chip (i.e., AWG chip 30, Figs. 28A, 28B, and 64) comprising: a first end for coupling to an optical coupling receptacle to receive an optical signal comprising a plurality of channel wavelengths; a planar lightwave circuit (PLC) coupled to the first end configured to demultiplex each channel wavelength of the plurality of channel wavelengths; a plurality of output waveguides coupled to the PLC, each of the output waveguides configured to receive light corresponding to an associated demultiplexed channel wavelength launched from the PLC and provide the light along a first light path that extends towards

a second end of the AWG chip; and a tapered region disposed at the second end of the AWG chip configured to receive light via the plurality of output waveguides and reflect the same towards an output interface region of the AWG chip (i.e., Figures 28A, 28B, and 64, col. 31, lines 15-54). Based on this teaching, it would have been obvious to one having skill in the art at the time the invention was made to incorporate the arrayed waveguide grating (AWG) chip, the AWG chip comprising: a first end for coupling to an optical coupling receptacle to receive an optical signal comprising a plurality of channel wavelengths; a planar lightwave circuit (PLC) coupled to the first end configured to demultiplex each channel wavelength of the plurality of channel wavelengths; a plurality of output waveguides coupled to the PLC, each of the output waveguides configured to receive light corresponding to an associated demultiplexed channel wavelength launched from the PLC and provide the light along a first light path that extends towards a second end of the AWG chip; and a tapered region disposed at the second end of the AWG chip configured to receive light via the plurality of output waveguides and reflect the same towards an output interface region of the AWG chip; an array of detector devices disposed adjacent to the output interface region of the AWG chip as taught by Bai **OR** Welch et al in the system of Dallesasse. One of ordinary skill in the art would have been motivated to do this sine allowing improving the performance of the system.

Regarding claim 13, the combination of Dallesasse and Bai **OR** Welch et al teaches wherein an air gap separates the output interface region of the AWG chip and the array of detector devices (i.e., Fig. 2B of Bai, OR Figs. 28A and 28B of Welch et al).


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Regarding claim 14, the combination of Dallesasse and Bai **OR** Welch et al teaches wherein the output interface region of the AWG chip is separated from the array of detector devices by about 50 microns (i.e., Fig. 2B of Bai, OR Figs. 28A and 28B of Welch et al).

Regarding claim 15, the combination of Dallesasse and Bai **OR** Welch et al teaches wherein the AWG chip defines a plurality of sidewalls extending longitudinally from the first end to the second end, and wherein the tapered region of the second end defines an angled surface that extends from a first sidewall of the plurality of sidewalls to a second sidewall of the plurality of sidewalls (i.e., Fig. 2B of Bai, OR Figs. 28A and 28B of Welch et al).

Regarding claim 16, the combination of Dallesasse and Bai **OR** Welch et al teaches wherein the angled surface has an interior angle of about 41 to 45 degrees relative to the output interface region (i.e., Fig. 2B of Bai, OR Figs. 28A and 28B of Welch et al).

Regarding claim 17, the combination of Dallesasse and Bai **OR** Welch et al teaches wherein each of the output waveguides comprise a core material, and wherein a cladding material is disposed on the core material, the core material defining at least a portion of the plurality of sidewalls of the AWG chip (i.e., Fig. 2B of Bai, OR Figs. 28A and 28B of Welch et al).

Regarding claim 18, the combination of Dallesasse and Bai **OR** Welch et al teaches wherein the core material of each of the plurality of output waveguides provide a portion of the angled surface, and wherein the angled surface is configured to reflect

incident light based on at least an interior angle of the angled surface relative to the output interface of the AWG chip (i.e., Fig. 2B of Bai, OR Figs. 28A and 28B of Welch et al).

Regarding claim 19, the combination of Dallesasse and Bai **OR** Welch et al teaches wherein the transceiver is a Small Form-factor Pluggable (SFP) transceiver module and the ROSA is configured to receive at least four different channel wavelengths at transmission rates of at least about 25 Gbps per channel (i.e., Figs. 2 and 3 of Dallesasse).

***Conclusion***

7. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Nagarajan (Pub. No.: US 2015/0249501) discloses optical module.

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Hanh Phan whose telephone number is (571)272-3035.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kenneth Vanderpuye, can be reached on (571)272-3078. The fax phone number for the organization where this application or proceeding is assigned is (571)273-8300.


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Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703)305-4700.

/HANH PHAN/

Primary Examiner, Art Unit 2636


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| Notice of References Cited | Application/Control No. 15/137,823 | Applicant(s)/Patent Under Reexamination HO ET AL. | |
|---|---|---|---|
| | Examiner HANH PHAN | Art Unit 2636 | Page 1 of 1 |

**U.S. PATENT DOCUMENTS**

| * | | Document Number Country Code-Number-Kind Code | Date MM-YYYY | Name | CPC Classification | US Classification |
|---|---|---|---|---|---|---|
| * | A | US-7,532,783 B2 | 05-2009 | Bai; Yu Sheng | G02B6/12019 | 385/14 |
| * | B | US-7,058,263 B2 | 06-2006 | Welch; David F. | B82Y20/00 | 385/24 |
| * | C | US-7,941,053 B2 | 05-2011 | Dallesasse; John | H04B10/40 | 398/135 |
| * | D | US-2015/0249501 A1 | 09-2015 | NAGARAJAN; Radhakrishnan L. | H04B10/40 | 398/79 |
| | E | US- | | | | |
| | F | US- | | | | |
| | G | US- | | | | |
| | H | US- | | | | |
| | I | US- | | | | |
| | J | US- | | | | |
| | K | US- | | | | |
| | L | US- | | | | |
| | M | US- | | | | |

**FOREIGN PATENT DOCUMENTS**

| * | | Document Number Country Code-Number-Kind Code | Date MM-YYYY | Country | Name | CPC Classification |
|---|---|---|---|---|---|---|
| | N | | | | | |
| | O | | | | | |
| | P | | | | | |
| | Q | | | | | |
| | R | | | | | |
| | S | | | | | |
| | T | | | | | |

**NON-PATENT DOCUMENTS**

| * | | Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages) |
|---|---|---|
| | U | |
| | V | |
| | W | |
| | X | |

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

# PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

To: KEVIN J. CARROLL
GROSSMAN TUCKER PERREAULT & PFLEGER, PLLC
55 SOUTH COMMERCIAL STREET
MANCHESTER, NH 03101

# PCT

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL SEARCH REPORT AND THE WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY, OR THE DECLARATION

(PCT Rule 44.1)

RECEIVED
JUL 10 2017
GROSSMAN, TUCKER
PERREAULT & PFLEGER, PLLC

| | |
|---|---|
| Applicant's or agent's file reference PAT260018PCT | Date of mailing *(day/month/year)* FOR FURTHER ACTION See paragraphs 1 and 4 below |
| International application No. PCT/US2017/029350 | International filing date *(day/month/year)* 25 April 2017 |
| Applicant APPLIED OPTOELECTRONICS, INC. | |

1. ☒ The applicant is hereby notified that the international search report and the written opinion of the International Searching Authority have been established and are transmitted herewith.

**Filing of amendments and statement under Article 19:**
The applicant is entitled, if he so wishes, to amend the claims of the international application (see Rule 46):

**When?** The time limit for filing such amendments is normally two months from the date of transmittal of the international search report.

**How?** Directly to the International Bureau of WIPO preferably through ePCT or on paper to, 34 chemin des Colombettes 1211 Geneva 20, Switzerland, Facsimile No.: +41 22 338 82 70

**For more detailed instructions,** see *PCT Applicant's Guide*, International Phase, paragraphs 9.004 – 9.011.

2. ☐ The applicant is hereby notified that no international search report will be established and that the declaration under Article 17(2)(a) to that effect and the written opinion of the International Searching Authority are transmitted herewith.

3. ☐ With regard to any protest against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:
   - ☐ the protest together with the decision thereon has been transmitted to the International Bureau together with any request to forward the texts of both the protest and the decision thereon to the designated Offices.
   - ☐ no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. **Reminders**

The applicant may **submit comments on an informal basis on the written opinion of the International Searching Authority** to the International Bureau. These comments will be made available to the public after international publication. The International Bureau will send a copy of such comments to all designated Offices unless an international preliminary examination report has been or is to be established.

Shortly after the expiration of **18 months from the priority date, the international application will be published** by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau before the completion of the technical preparations for international publication (Rules 90*bis*.1 and 90*bis*.3).

Within **19 months** from the priority date, but only in respect of some designated Offices, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase **until 30 months** from the priority date (in some Offices even later); otherwise, the applicant must, **within 20 months** from the priority date, perform the prescribed acts for **entry into the national phase** before those designated Offices. In respect of other designated Offices, the time limit of **30 months** (or later) will apply even if no demand is filed within 19 months. For details about the applicable time limits, Office by Office, see www.wipo.int/pct/en/texts/time_limits.html and the *PCT Applicant's Guide*, National Chapters.

Within **19 months from the priority date, the applicant may request that a supplementary international search be carried out** by a different International Searching Authority that offers this service (Rule 45*bis*.1). The procedure for requesting supplementary international search is described in the *PCT Applicant's Guide*, International Phase, paragraphs 8.006-8.032.

| | |
|---|---|
| Name and mailing address of the ISA/US<br>Mail Stop PCT, Attn: ISA/US<br>Commissioner for Patents<br>P.O. Box 1450, Alexandria, VA 22313-1450<br>Facsimile No. 571-273-8300 | Authorized officer<br>Blaine R. Copenheaver<br>PCT Helpdesk: 571-272-4300<br>Telephone No. PCT OSP: 571-272-7774 |

Form PCT/ISA/220 (July 2014)



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# PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

To: KEVIN J. CARROLL
GROSSMAN TUCKER PERREAULT & PFLEGER, PLLC
55 SOUTH COMMERCIAL STREET
MANCHESTER, NH 03101

# PCT

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL SEARCH REPORT AND THE WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY, OR THE DECLARATION

(PCT Rule 44.1)

| | |
|---|---|
| Date of mailing *(day/month/year)* | 06 JUL 2017 |
| Applicant's or agent's file reference: PAT260018PCT | **FOR FURTHER ACTION** See paragraphs 1 and 4 below |
| International application No.: PCT/US2017/029350 | International filing date *(day/month/year)*: 25 April 2017 |
| Applicant: APPLIED OPTOELECTRONICS, INC. | |

1. ☒ The applicant is hereby notified that the international search report and the written opinion of the International Searching Authority have been established and are transmitted herewith.

   **Filing of amendments and statement under Article 19:**
   The applicant is entitled, if he so wishes, to amend the claims of the international application (see Rule 46):

   **When?** The time limit for filing such amendments is normally two months from the date of transmittal of the international search report.

   **How?** Directly to the International Bureau of WIPO preferably through ePCT or on paper to, 34 chemin des Colombettes 1211 Geneva 20, Switzerland, Facsimile No.: +41 22 338 82 70

   **For more detailed instructions**, see *PCT Applicant's Guide*, International Phase, paragraphs 9.004 – 9.011.

2. ☐ The applicant is hereby notified that no international search report will be established and that the declaration under Article 17(2)(a) to that effect and the written opinion of the International Searching Authority are transmitted herewith.

3. ☐ **With regard to any protest** against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:
   - ☐ the protest together with the decision thereon has been transmitted to the International Bureau together with any request to forward the texts of both the protest and the decision thereon to the designated Offices.
   - ☐ no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. **Reminders**

   The applicant may **submit comments on an informal basis on the written opinion of the International Searching Authority** to the International Bureau. These comments will be made available to the public after international publication. The International Bureau will send a copy of such comments to all designated Offices unless an international preliminary examination report has been or is to be established.

   Shortly after the expiration of **18 months from the priority date, the international application will be published** by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau before the completion of the technical preparations for international publication (Rules 90*bis*.1 and 90*bis*.3).

   Within **19 months** from the priority date, but only in respect of some designated Offices, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase **until 30 months** from the priority date (in some Offices even later); otherwise, the applicant must, **within 20 months** from the priority date, perform the prescribed acts for **entry into the national phase** before those designated Offices. In respect of other designated Offices, the time limit of **30 months** (or later) will apply even if no demand is filed within 19 months. For details about the applicable time limits, Office by Office, see www.wipo.int/pct/en/texts/time_limits.html and the *PCT Applicant's Guide*, National Chapters.

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| | |
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| Name and mailing address of the ISA/US<br>Mail Stop PCT, Attn: ISA/US<br>Commissioner for Patents<br>P.O. Box 1450, Alexandria, VA 22313-1450<br>Facsimile No. 571-273-8300 | Authorized officer<br>Blaine R. Copenheaver<br>PCT Helpdesk: 571-272-4300<br>Telephone No. PCT OSP: 571-272-7774 |

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# PATENT COOPERATION TREATY

# PCT

## INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

| Applicant's or agent's file reference PAT260018PCT | FOR FURTHER ACTION | see Form PCT/ISA/220 as well as, where applicable, item 5 below. |
|---|---|---|
| International application No. PCT/US2017/029350 | International filing date *(day/month/year)* 25 April 2017 | (Earliest) Priority Date *(day/month/year)* 25 April 2016 |
| Applicant APPLIED OPTOELECTRONICS, INC. | | |

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 2 sheets.

☐ It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**

   a. With regard to the **language**, the international search was carried out on the basis of:

   ☒ the international application in the language in which it was filed.

   ☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

   b. ☐ This international search report has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43.6*bis*(a)).

   c. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.

2. ☐ **Certain claims were found unsearchable** (see Box No. II).

3. ☐ **Unity of invention is lacking** (see Box No. III).

4. With regard to the **title**,

   ☒ the text is approved as submitted by the applicant.

   ☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

   ☒ the text is approved as submitted by the applicant.

   ☐ the text has been established, according to Rule 38.2, by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. With regard to the **drawings**,

   a. the figure of the **drawings** to be published with the abstract is Figure No. 2

   ☒ as suggested by the applicant.

   ☐ as selected by this Authority, because the applicant failed to suggest a figure.

   ☐ as selected by this Authority, because this figure better characterizes the invention.

   b. ☐ none of the figures is to be published with the abstract.

Form PCT/ISA/210 (first sheet) (January 2015)



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# INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2017/029350

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - G02B 6/12; H04J 14/02 (2017.01)
CPC - G02B 6/12016; G02B 6/12009; G02B 6/4214 (2017.02)

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)
See Search History document

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
USPC - 385/14; 385/31; 398/79 (keyword delimited)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
See Search History document

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X<br>---<br>Y | US 7,532,783 B2 (BAI) 12 May 2009 (12.05.2009) entire document | 1-11, 20<br>---<br>12-19 |
| Y | US 8,831,433 B2 (HO et al) 09 September 2014 (09.09.2014) entire document | 12-19 |
| Y | US 7,376,308 B2 (CHEBEN et al) 20 May 2008 (20.05.2008) entire document | 13 |
| A | US 5,617,234 A (KOGA et al) 01 April 1997 (01.04.1997) entire document | 1-20 |

☐ 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 | Date of mailing of the international search report |
|---|---|
| 15 June 2017 | 06 JUL 2017 |
| Name and mailing address of the ISA/US<br>Mail Stop PCT, Attn: ISA/US, Commissioner for Patents<br>P.O. Box 1450, Alexandria, VA 22313-1450<br>Facsimile No. 571-273-8300 | Authorized officer<br>Blaine R. Copenheaver<br>PCT Helpdesk: 571-272-4300<br>PCT OSP: 571-272-7774 |

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