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APPLICATION NO./ CONTROL NO.	FILING DATE	FIRST NAMED INVENTOR / PATENT IN REEXAMINATION	ATTORNEY DOCKET NO.
15/137,823	25 April, 2016	HO ET AL.	PAT260-018US

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

EXAMINER	
RICHARD ELLIS	
ART UNIT	PAPER
OPIM	20171024-150116

DATE MAILED:

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Commissioner for Patents

The time period for reply set forth in the previous non-final action is being restarted to run from the mail date of the instant communication. Please refer to the non-final action for information on extensions of time if needed for the reply.

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PTO-90C (Rev.04-03)

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
15/137,823	04/25/2016	I-Lung HO	PAT260-018US

CONFIRMATION NO. 2275

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

PUBLICATION NOTICE

OC000000095036552

Title:TECHNIQUES FOR DIRECT OPTICAL COUPLING OF PHOTODETECTORS TO OPTICAL DEMULTIPLEXER OUTPUTS AND AN OPTICAL TRANSCEIVER USING THE SAME

Publication No.US-2017-0307819-A1
Publication Date:10/26/2017

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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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Office of Data Managment, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

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To: kinsella@ao-inc.com,docketing@gtpp.com,kcarroll@gtpp.com
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Oct 27, 2017 03:55:19 AM

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13115 JESS PIRTLE BLVD.
SUGAR LAND, TX 77478
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Application	Document	Mailroom Date	Attorney Docket No.
15137823	NRES	10/27/2017	PAT260-018US
	NTC.PUB	10/26/2017	PAT260-018US

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PATENT APPLICATION INFORMATION RETRIEVAL SYSTEM

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Named Inventor: I-Lung HO
Serial No.: 15/137,823
Filed: April 25, 2016
Examiner: Hanh, Phan
Group Art Unit: 2636 Conf. No.: 2275
Docket: PAT260-018US
Title: TECHNIQUES FOR DIRECT OPTICAL COUPLING OF PHOTODETECTORS TO OPTICAL DEMULTIPLEXER OUTPUTS AND AN OPTICAL TRANSCEIVER USING THE SAME

AMENDMENT AND RESPONSE UNDER 37 C.F.R. § 1.111

This is in response to the Official Action in this case mailed August 21, 2017. Applicant's reply period was reset by Official Correspondence dated October 27, 2017 which set the three-month shortened statutory period of reply to January 28, 2018. Therefore, as this response is being filed within the three-month shortened statutory period of reply, no extension of time is believed necessary. However, Applicant conditionally petitions for an extension of time to provide for the possibility that the need for an extension has inadvertently been overlooked. As provided below, please charge Deposit Account No. 50-1705 for any required fee, or for any deficiency in the enclosed fee.

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IN THE CLAIMS

1. (Currently Amended) An arrayed waveguide grating (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 substrate;

a planar lightwave circuit (PLC) disposed on the substrate, the PLC coupled to the first end and configured to de-multiplex 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 de-multiplexed 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 exposed output interface region of the AWG chip, wherein the exposed output interface region emits the received light from the AWG chip on the same side as the substrate without passing the received light through the substrate.

2. (Currently Amended) The AWG chip of claim 1, wherein the exposed output interface region 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.

3. (Original) The AWG chip of claim 1, 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.

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4. (Currently Amended) The AWG chip of claim 3, wherein the angled surface has an interior angle of about 41 to 45 degrees relative to the exposed output interface region.

5. (Original) The AWG chip of claim 3, 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.

6. (Original) The AWG chip of claim 5, wherein the core material of each of the plurality of output waveguides 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.

7. (Original) The AWG chip of claim 5, 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.

8. (Original) The AWG chip of claim 5, wherein the core material comprises doped silica (SiO_2) having an index of refraction of about 1.45 to 1.50.

9. (Original) The AWG chip of claim 6, wherein the external medium comprises a material having an index of refraction of about 1.0.

10. (Original) The AWG chip of claim 1, wherein the AWG chip is configured as a 1xN demultiplexer device whereby a single optical input signal is de-multiplexed into N different channel wavelengths.

11. (Original) The AWG chip of claim 1, wherein the AWG chip is implemented in an AWG device package.

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12. (Currently Amended) An optical transceiver module comprising:

a transceiver housing;

a multi-channel receiver optical sub-assembly (ROSA) located in the transceiver housing and including 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, wherein the first end for coupling to the optical coupling receptacle includes an angled surface to reduce back reflections of an optical signal launched into the AWG chip;

a planar lightwave circuit (PLC) coupled to the first end configured to de-multiplex 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 de-multiplexed 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; and

a multi-channel transmitter optical assembly (TOSA) including at least one laser package located in the transceiver housing for transmitting optical signals at different channel wavelengths.

13. (Currently Amended) The optical transceiver module of claim 12, wherein the output interface region of the AWG chip is an exposed region adjacent an air gap, and wherein [[an]] the air gap separates the output interface region of the AWG chip and the array of detector devices.

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14. (Original) The optical transceiver module of claim 12, wherein the output interface region of the AWG chip is separated from the array of detector devices by about 50 microns.

15. (Original) The optical transceiver module of claim 12, 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.

16. (Original) The optical transceiver module of claim 15, wherein the angled surface has an interior angle of about 41 to 45 degrees relative to the output interface region.

17. (Original) The optical transceiver module of claim 15, 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.

18. (Original) The optical transceiver module of claim 17, 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.

19. (Original) The optical transceiver of claim 12, 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.

20. (Withdrawn) A method of forming an arrayed waveguide grating (AWG) comprising:

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depositing sequential layers of cladding and core material onto a substrate to form a planar lightwave circuit (PLC);

removing a portion of the substrate to expose an output interface region of the PLC; and

removing a portion of the PLC to provide a tapered region proximal to the output interface region of the PLC.

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REMARKS

Please reconsider the application in view of the following remarks. Applicant submits that the claims, as presented, are in condition for allowance and respectfully requests the withdrawal of all pending rejections of the claims.

Status of Claims

Claims 1-19 were previously pending, with claim 20 having been previously withdrawn from consideration. Applicant herein amends independent claims 1, 12 and 13 herein, and claims 2 and 4 have been amended to be consistent with independent claim 1. Support for the amendments may be found at, for example, paras. 0021, 0041 and 0042 of Applicant's originally-filed disclosure. No claims are cancelled, and no new claims are added at this time. Accordingly, claims 1-19 remain pending for examination with claims 1 and 12 being independent claims.

Rejections Under 35 U.S.C. § 102

Claims 1-11 were rejected under 35 U.S.C. § 102 as being unpatentable over U.S. Patent No. 7,532,783 (Bai). Applicant respectfully requests reconsideration.

Without acceding as to the correctness of the rejection, Applicant herein amends claim 1 to recite an arrayed waveguide grating (AWG) chip including, *inter alia*, "*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 exposed output interface region of the AWG chip, wherein the exposed output interface region emits the received light from the AWG chip on the same side as the substrate without passing the received light through the substrate.*"

Bai discloses an AWG 110 that emits light from the side *opposite* the substrate 124 towards a photodetector 114 (see FIG. 1A and 1B of Bai reproduced below). Thus, Bai appears to disclose the opposite of Applicant's claimed invention. In contrast, claim 1 requires emitting light from the AWG chip "*on the same side as the substrate*."

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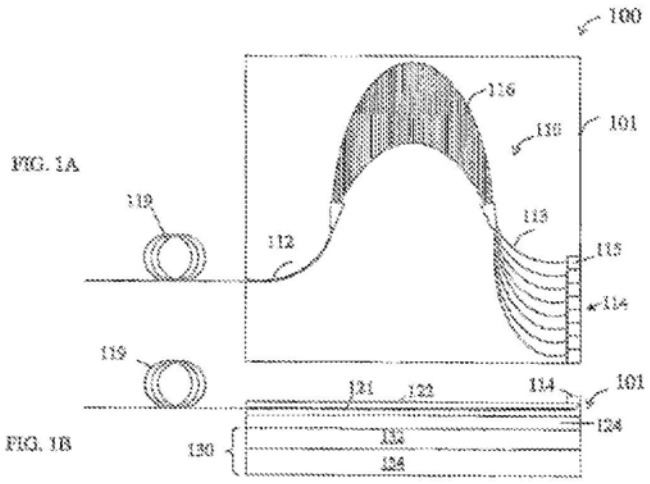


FIG. 1A

FIG. 1B

Applicant further submits that one of ordinary skill in the art would not be motivated to modify Bai to emit light on the same side as the substrate 124 as the result would prevent coupling with the photodetector 114. Applicant's claimed invention avoids this problem by including an *exposed* output interface region to allow light to emit from the AWG on the same side as the substrate. *See e.g., Applicant's Disclosure; FIG. 5A and accompanying description.*

For at least these reasons, Bai fails to anticipate independent claim 1 as Bai fails to disclose each and every element of claim 1. Claims 2-11 depend directly or indirectly from independent claim 1 and are allowable for at least the same reasons.

Accordingly, Applicant respectfully requests reconsideration and withdrawal of the rejections of claims 1-11 under 35 U.S.C. § 102.

Rejections Under 35 U.S.C. § 103

Claims 12-19 were rejected under 35 U.S.C. § 103 as being unpatentable over U.S. Patent No. 7,941,053 (Dallesasse) in view of Bai, or alternatively Dallesasse in view of U.S. Patent No. 7,058,263 (Welch). Applicant respectfully requests reconsideration.

Without any admission as to the merits of the rejection, independent claim 12 has been amended to recite, *inter alia*, "wherein the first end for coupling to the optical coupling

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receptacle includes an angled surface to reduce back reflections of an optical signal launched into the AWG chip."

The Office Action correctly notes that Dallesasse fails to disclose an AWG as claimed. *See Office Action; page 6*. In effort to remedy this deficiency the Office Action cited to Bai, or alternatively, to Welch.

Bai discloses an AWG 110 that couples to a fiber 119 via an optical input port 112. As shown in FIG. 1A and 1B of Bai reproduced above, the output input port 112 includes a surface that appears to extend upright at 90 degrees, and thus, without being *angled* to reduce back reflections as recited in independent claim 12. Thus, the proposed combination of Dallesasse and Bai fails to render claim 12 obvious. Claims 13-19 depend directly or indirectly from independent claim 12 and are allowable for at least the same reasons.

Turning to Welch, Applicant is unable to identify any language in Welch disclosing an input port with an angled surface to reduce back reflections. Indeed, Welch discloses only using an anti-reflective (AR) coating on the input surface of chip 10 to "eliminate spurious reflections." *See Welch; Col. 14; lines 38-42.* Thus, the proposed combination of Dallesasse and Welch fails to render claim 12 obvious. Claims 13-19 depend directly or indirectly from independent claim 12 and are allowable for at least the same reasons.

Accordingly, Applicant respectfully requests reconsideration and withdrawal of the rejection of claims 12-19 under 35 U.S.C. § 103.

Having dealt with all the objections raised by the Examiner, it is respectfully submitted that the present application, as amended, is in condition for allowance. Thus, early allowance is earnestly solicited.

If the Examiner desires personal contact for further disposition of this case, the Examiner is invited to call the undersigned Attorney at 603.668.6560.

In the event there are any fees due, please charge them to our Deposit Account No. 50-1705 (Ref:PAT260-022US).

Respectfully submitted,

By: /Kenneth M. Thompson/

Date: January 29, 2018

Kenneth M. Thompson
Reg. No. 72,001

AOI_NDCal 4-24cv09041_ 00001848

PTO/SB/08a (01-10)
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	15137823
Filing Date	2016-04-25
First Named Inventor	HO
Art Unit	2636
Examiner Name	PHAN, Hanh
Attorney Docket Number	PAT260-018US

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	3	20160149662	A1	2016-05-26	SOLDANO ET AL	
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	Application Number	15137823
	Filing Date	2016-04-25
	First Named Inventor	HO
	Art Unit	2636
	Examiner Name	PHAN, Hanh
	Attorney Docket Number	PAT260-018US

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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	1	US Office Action mailed August 29, 2017, received in US Application Serial No. 15/432,242, 15 pgs.	

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Examiner Signature		Date Considered	

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	15137823
	Filing Date	2016-04-25
	First Named Inventor	HO
	Art Unit	2636
	Examiner Name	PHAN, Hanh
	Attorney Docket Number	PAT260-018US

CERTIFICATION STATEMENT

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

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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.

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Signature	/Kenneth M. Thompson/	Date (YYYY-MM-DD)	2018-01-29
Name/Print	Kenneth M. Thompson	Registration Number	72001

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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.

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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

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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

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- 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

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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

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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

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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					
	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.

Electronic Patent Application Fee Transmittal	
Application Number:	15137823
Filing Date:	25-Apr-2016
Title of Invention:	TECHNIQUES FOR DIRECT OPTICAL COUPLING OF PHOTODETECTORS TO OPTICAL DEMULTIPLEXER OUTPUTS AND AN OPTICAL TRANSCEIVER USING THE SAME
First Named Inventor/Applicant Name:	I-Lung HO
Filer:	Kenneth M. Thompson/April Davis
Attorney Docket Number:	PAT260-018US
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:				

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Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Submission- Information Disclosure Stmt	1806	1	240	240
		Total in USD ($)		**240**

AOI_NDCal 4-24cv09041_ 00001869

Electronic Acknowledgement Receipt

EFS ID:	31636619
Application Number:	15137823
International Application Number:	
Confirmation Number:	2275
Title of Invention:	TECHNIQUES FOR DIRECT OPTICAL COUPLING OF PHOTODETECTORS TO OPTICAL DEMULTIPLEXER OUTPUTS AND AN OPTICAL TRANSCEIVER USING THE SAME
First Named Inventor/Applicant Name:	I-Lung HO
Customer Number:	27543
Filer:	Kenneth M. Thompson/April Davis
Filer Authorized By:	Kenneth M. Thompson
Attorney Docket Number:	PAT260-018US
Receipt Date:	29-JAN-2018
Filing Date:	25-APR-2016
Time Stamp:	17:22:15
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$240
RAM confirmation Number	013018INTEFSW00005113501705
Deposit Account	501705
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)

AOI_NDCal 4-24cv09041_ 00001870

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		PAT260_018US_Amendment_asfiled_012918.pdf	123812 f19a2f2cb70260b1b44d4320be3e665e7bd6edb2	yes	10
	Multipart Description/PDF files in .zip description				
	Document Description		**Start**	**End**	
	Amendment/Req. Reconsideration-After Non-Final Reject		1	1	
	Claims		2	6	
	Applicant Arguments/Remarks Made in an Amendment		7	10	
Warnings:					
Information:					
2	Information Disclosure Statement (IDS) Form (SB08)	PAT260_018US_SUPP_IDS_012918.pdf	612437 3d36d73ce70e95d9594451d18e7985fb20669e30	no	4
Warnings:					
Information:					
3	Other Reference-Patent/App/Search documents	Office_Action_082917.pdf	583320 c4c94c60c0cbed6c3c71a645fed086e17865bd52	no	15
Warnings:					
Information:					
4	Fee Worksheet (SB06)	fee-info.pdf	30897 e8781fb6f669b13307055018bcb703edea1d0683	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	1350466		

AOI_NDCal 4-24cv09041_ 00001871

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

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.

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 15/137,823	Filing Date 04/25/2016	☐ To be Mailed

ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT 01/29/2018

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 20	Minus	** 20	= 0	X $100 =	0
Independent (37 CFR 1.16(h))	* 3	Minus	***3	= 0	X $460 =	0
☐ Application Size Fee (37 CFR 1.16(s))						
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
					TOTAL ADD'L FEE	0

AMENDMENT

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =	
☐ Application Size Fee (37 CFR 1.16(s))						
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
					TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

LIE
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	15137823
Filing Date	2016-04-25
First Named Inventor	HO
Art Unit	2636
Examiner Name	PHAN, Hanh
Attorney Docket Number	PAT260-018US

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	7162124	B1	2007-01-09	GUNN, III ET AL	
	2	9341786	B1	2016-05-17	GAMACHE ET AL	

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	15137823
	Filing Date	2016-04-25
	First Named Inventor	HO
	Art Unit	2636
	Examiner Name	PHAN, Hanh
	Attorney Docket Number	PAT260-018US

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	US Office Action mailed April 13, 2018, received in US Application Serial No. 15/432,242, 28 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	15137823
	Filing Date	2016-04-25
	First Named Inventor	HO
	Art Unit	2636
	Examiner Name	PHAN, Hanh
	Attorney Docket Number	PAT260-018US

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)	2018-04-16
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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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.
15/432,242	02/14/2017	Jian-Hong LUO	AOIC006	2079

27543 7590 04/13/2018
APPLIED OPTOELECTRONICS, INC.
13115 JESS PIRTLE BLVD.
SUGAR LAND, TX 77478

EXAMINER	
PETKOVSEK, DANIEL	

ART UNIT	PAPER NUMBER
2874	

NOTIFICATION DATE	DELIVERY MODE
04/13/2018	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 amendment filed February 28, 2018*.

☐ 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) *1-3 and 5-8* 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) *1-3 and 5-8* 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 *3/1/18*.

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

4) ☐ Other: _____.

DETAILED ACTION

This office action is in response to the amendment filed February 28, 2018. In accordance with this amendment, claims 1, 2, and 5 have been amended, claim 4 has been canceled, while new independent claim 8 has been added.

Claims 1-3 and 5-8 are pending. Claims 1 and 8 are in independent form.

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.

Information Disclosure Statement

2. The prior art documents submitted by Applicant in the Information Disclosure Statements filed on March 1, 2018, have been considered and made of record (note attached copy of forms PTO-1449). The Examiner notes that the *incorrect* U.S. Application number was cited and has been corrected to 15/137,823.

Claim Rejections - 35 USC § 112

3. The following is a quotation of 35 U.S.C. 112(b):
(b) CONCLUSION.—The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the inventor or a joint inventor regards as the invention.

The following is a quotation of 35 U.S.C. 112 (pre-AIA), second paragraph:
The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

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4. Claims 1-3 and 5-7 are rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being ***indefinite*** for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor, or for pre-AIA the applicant regards as the invention. Regarding amended independent claim 1, the term "a ***substantial*** **portion** of the arrayed waveguide grating (AWG)" does not meet the requirements for definiteness under 35 U.S.C. 112(b). The original disclosure filed February 14, 2017 does not define such term, and there is no clear meaning for the *metes-and-bounds* in the claim language. In particular, it is unclear from this claim language when a prior art AWG would have a *nonsubstantial* portion thereof on a surface. Additionally, Applicant's original disclosure does not use or define this language added. As such, the clear claiming required by 35 U.S.C. 112(b) is not met. Claims 2-3 and 5-7 are rejected at least as being dependent from claim 1.

Claim Rejections - 35 USC § 102

5. 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.

6. 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.

7. Claims 1-3, 5, and 8 are rejected under 35 U.S.C. 102(a)(2) as being anticipated by Ho et al. US 2017/0307819 A1. The effectively filed date of Ho et al. '819 is April 25, 2016.

The applied reference may have a common Assignee with the instant application. Based upon the earlier effectively filed date of the reference, it constitutes prior art under 35 U.S.C. 102(a)(2). This rejection under 35 U.S.C. 102(a)(2) might be overcome by: (1) a showing under 37 CFR 1.130(a) that the subject matter disclosed in the reference was obtained directly or indirectly from the inventor or a joint inventor of this application and is thus not prior art in accordance with 35 U.S.C. 102(b)(2)(A); (2) a showing under 37 CFR 1.130(b) of a prior public disclosure under 35 U.S.C. 102(b)(2)(B) if the same invention is not being claimed; or (3) a statement pursuant to 35 U.S.C.102(b)(2)(C) establishing that, not later than the effective filing date of the claimed invention, the subject matter disclosed in the copending application and the claimed invention were either owned by the same person or subject to an obligation of assignment to the same person or subject to a joint research agreement.

Ho et al. US 2017/0307819 A1 teaches (ABS; Figures 1, 3, 4, 5A, 8, 9; corresponding text, in particular paragraphs [0016] - [0046]; Claims) a multi-channel parallel optical receiving device (Figs. 4 and 9), comprising: a carrier 302 and a light receiving chip (at least TIA); a plurality of optoelectronic diodes 804 disposed on a top

surface (at 502 substrate) of an end of the carrier (Fig. 8), and the plurality of optoelectronic diodes *electrically* connected to the light receiving chip (by 901; Fig. 8), wherein the optoelectronic diode and the light receiving chip are disposed on the same surface (at 502); an optical fiber connector 314/315 disposed in another end of the carrier (*left* in Fig. 4); an arrayed waveguide grating 402 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 a "substantial portion" of the AWG 402 is disposed on the top surface of the carrier; and 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 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 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 AWG is in a range of 41 to 46 degrees such that the top surface provides the reflection (paragraph [0041]), which clearly, fully meets Applicant's claimed **structural** limitations for sole pending independent claims 1 and *8* (about 41 to 45 degrees meets "*42*").

Regarding claim 2, the OE diodes can be disposed on a / the *same* circuit board during optical and electrical integration in Ho et al. '819.

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 5, see Ho et al. '819 paragraph [0041]).

8. Claims 1-3 and 6 are rejected under 35 U.S.C. 102(a)(2) as being anticipated by Gamache et al. U.S.P. No. 9,341,786 B1. The effectively filed date of Gamache et al. '789 is July 28, 2015.

Gamache et al. U.S.P. No. 9,341,786 B1 teaches (ABS; Figures 1A, 1B, 2A, 2C, 6A, 6B, 7A, 7C; corresponding text, in particular column 4, line 50 through column 8, line 49; Claims) a multi-channel parallel optical receiving device (Figs. 1A, 1B, and 2C; specifics of AWG attachment in Figs. 6A and 6B), comprising: a carrier 102 (also 104 on top of 102) and a light receiving "chip" disposed on a top surface of the carrier (column 6, lines 18-25 discussed many "electrical" and "chip" functions in/on the carrier 102); a plurality of optoelectronic diodes (within 104; see column 4, lines 50-67) disposed on a top surface of an end of the carrier, and the plurality of optoelectronic diodes *electrically* connected to the light receiving chip (column 6, lines 18-25), wherein the optoelectronic diode and the light receiving chip are disposed on the same surface (at 102/104); an optical fiber connector 116 disposed in another end of the carrier (*left* in Fig. 1A); an arrayed waveguide grating 610A/610B (Figs. 6A and 6B interchangeable optical sub-elements) 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

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optical signal from the optical fiber (fibers are coupled to PLC (AWGs) at *left*); wherein a "substantial portion" of the AWG 402 is disposed on the top surface of the carrier; and 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 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 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 AWG is in a range of 41 to 46 degrees such that the top surface provides the reflection (the "top surface" of the AWG in Figs. 6A and 6B causes light to be reflected toward the photo-diodes), which clearly, fully meets Applicant's claimed **structural** limitations for independent claim 1.

The Examiner notes that the claim term "*light receiving* chip" may be confusing because no "light" appears to be "received" by this chip. However, Applicant's may be their own lexicographer and this "chip" is most closely associated with TIA components.

Regarding claim 2, the OE diodes can be disposed on a / the *same* circuit board during optical and electrical integration in Gamache (as shown in Figs. 1A and 1B).

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 in Gamache Figs. 6A and 6B.

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Regarding claim 6, lenses (microlens array(s)) are shown in operation of some embodiments of Gamache to couple between optical fiber(s) and the corresponding element during optical operation, and would have been recognized in operation of the AWG to improve optical coupling performance as needed.

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. Claims 5 and 8 are rejected under 35 U.S.C. 103 as being unpatentable over Gamache et al. U.S.P. No. 9,341,786 B1, relating to base independent claim 1, and further in view of Gunn, III et al. U.S.P. No. 7,162,124 B1.

Regarding independent claim 1, Gamache et al. U.S.P. No. 9,341,786 B1 teaches (ABS; Figures 1A, 1B, 2A, 2C, 6A, 6B, 7A, 7C; corresponding text, in particular column 4, line 50 through column 8, line 49; Claims) a multi-channel parallel optical receiving device (Figs. 1A, 1B, and 2C; specifics of AWG attachment in Figs. 6A and 6B), comprising: a carrier 102 (also 104 on top of 102) and a light receiving "chip" disposed on a top surface of the carrier (column 6, lines 18-25 discussed many "electrical" and "chip" functions in/on the carrier 102); a plurality of optoelectronic diodes (within 104; see column 4, lines 50-67) disposed on a top surface of an end of the carrier, and the plurality of optoelectronic diodes *electrically* connected to the light receiving chip (column 6, lines 18-25), wherein the optoelectronic diode and the light receiving chip are disposed on the same surface (at 102/104); an optical fiber connector 116 disposed in another end of the carrier (*left* in Fig. 1A); an arrayed waveguide grating 610A/610B (Figs. 6A and 6B interchangeable optical sub-elements) 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) at *left*); wherein a

"substantial portion" of the AWG 402 is disposed on the top surface of the carrier; and 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 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 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 AWG is in a range of 41 to 46 degrees such that the top surface provides the reflection (the "top surface" of the AWG in Figs. 6A and 6B causes light to be reflected toward the photo-diodes). The Examiner notes that the claim term "*light receiving* chip" may be confusing because no "light" appears to be "received" by this chip. However, Applicant's may be their own lexicographer and this "chip" is most closely associated with TIA components.

Regarding further dependent claim 5, and new independent claim 8, there is no exact teaching in Gamache et al. '786 to the predetermined angle of reflection to be "42 degrees." Gamache is *silent to* this 42 degree amount.

However, this range, starting with 40 to 45 degrees, and being in the exact degree of 42 degrees, is known in the optical coupling art. Gunn, III et al. U.S.P. No. 7,162,124 B1 teaches (ABS; Figs.; column 3, line 34 through column 4, line 14) an optical element coupling signals down into another optical device, and in particular in that these signals are coupled at 42 degrees (less than 43 degrees, to 41 degrees; see

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column 3, line 34 through column 4, line 14). This angled degree of reflection / coupling is known in the art, at the time of the effective filing of the current application.

Since Gamache et al. '786 and Gunn III '124 are both from the same field of endeavor, the purpose disclosed by Gunn III '124 would have been recognized in the pertinent art of Gamache et al. '786.

A person having ordinary skill in the art at the time the invention was made would have recognized the teaching of Gunn III '124, to use optical coupling at a degree of reflection of 42 degrees (and between generally 40 and 45 degrees), in the device of Gamache et al. '786 to improve optical coupling efficiency and results. The Examiner notes that Gamache et al. '786 is *silent* to the exact degree of "42", as being somewhere between 40 and 45 degrees in operation. See *KSR v. Teleflex*, 127 S.Ct. 1727 (2007). Dependent claim 5, and new independent claim 8, cannot be said to impart any **patentable** distinction when reviewing the combined teachings of Gamache and Gunn III '124.

13. Claim 7 is rejected under 35 U.S.C. 103 as being unpatentable over Gamache et al. U.S.P. No. 9,341,786 B1, relating to base independent claim 1, and further in view of Gao et al. US 2003/0174964 A1.

Regarding independent claim 1, Gamache et al. U.S.P. No. 9,341,786 B1 teaches (ABS; Figures 1A, 1B, 2A, 2C, 6A, 6B, 7A, 7C; corresponding text, in particular column 4, line 50 through column 8, line 49; Claims) a multi-channel parallel optical receiving device (Figs. 1A, 1B, and 2C; specifics of AWG attachment in Figs. 6A and

6B), comprising: a carrier 102 (also 104 on top of 102) and a light receiving "chip" disposed on a top surface of the carrier (column 6, lines 18-25 discussed many "electrical" and "chip" functions in/on the carrier 102); a plurality of optoelectronic diodes (within 104; see column 4, lines 50-67) disposed on a top surface of an end of the carrier, and the plurality of optoelectronic diodes *electrically* connected to the light receiving chip (column 6, lines 18-25), wherein the optoelectronic diode and the light receiving chip are disposed on the same surface (at 102/104); an optical fiber connector 116 disposed in another end of the carrier (*left* in Fig. 1A); an arrayed waveguide grating 610A/610B (Figs. 6A and 6B interchangeable optical sub-elements) 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) at *left*); wherein a "substantial portion" of the AWG 402 is disposed on the top surface of the carrier; and 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 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 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 AWG is in a range of 41 to 46 degrees such that the top surface provides the reflection (the "top surface" of the AWG in Figs. 6A and 6B causes light to be reflected toward the photo-diodes). The Examiner notes that the claim term

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"*light receiving* chip" may be confusing because no "light" appears to be "received" by this chip. However, Applicant's may be their own lexicographer and this "chip" is most closely associated with TIA components.

Regarding **dependent claim 7**, there is no *express* teaching in Gamache et al. '786 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 Gamache et al. '786 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 Gamache et al. '786.

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 Gamache et al. '786 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 Gamache and Gao.

14. Claims 1-3 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 disposed on the top surface of the carrier (*through* 100, still "on the top surface of 600"; 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), wherein the optoelectronic diode an the light receiving chip are "disposed on" the same surface (300 through 100, but still meets "on" a surface); 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 a "*substantial* portion" of the AWG is disposed on the top surface of the carrier (note vagueness of substantial portion, but also other embodiments in Shen show positioning changes for placement of the AWG) wherein the optical signals are divided (see Fig. 3

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for division of optical signals) 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, causing the multi-channel optical signals reflected by the top surface to be reflected to an photosensitive surface of the optoelectronic diode arranged in parallel (down reflection at 400), wherein the predetermined angle of the top surface by the output end of the AWG is in a range of 41 to 46 degrees such that the top surface provides reflection (Figs. 1-2).

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

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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 2-3 and 6, Shen (claim 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 in that optical lenses are used (claim 6; in 500 element [0044] Shen).