PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To: KEVIN J. CARROLL
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PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43*bis*.1)

Date of mailing *(day/month/year)*	06 JUL 2017
Applicant's or agent's file reference PAT260018PCT	FOR FURTHER ACTION See paragraph 2 below

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US2017/029350	25 April 2017	25 April 2016

International Patent Classification (IPC) or both national classification and IPC
IPC(8) - G02B 6/12; H04J 14/02 (2017.01)
CPC - G02B 6/12016; G02B 6/12009; G02B 6/4214 (2017.02)

Applicant APPLIED OPTOELECTRONICS, INC.

1. This opinion contains indications relating to the following items:

- [x] Box No. I Basis of the opinion
- [ ] Box No. II Priority
- [ ] Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- [ ] Box No. IV Lack of unity of invention
- [x] Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement
- [ ] Box No. VI Certain documents cited
- [ ] Box No. VII Certain defects in the international application
- [ ] Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1*bis*(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

Name and mailing address of the ISA/US	Date of completion of this opinion	Authorized officer
Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450, Alexandria, VA 22313-1450 Facsimile No. 571-273-8300	15 June 2017	Blaine R. Copenheaver PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/237 (cover sheet) (January 2015)

AOI_NDCal 4-24cv09041_ 00002066

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US2017/029350

Box No. I Basis of this opinion

1. With regard to the **language**, this opinion has been established 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)).

2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(a)).

3. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing:

   a. ☐ forming part of the international application as filed:

      ☐ in the form of an Annex C/ST.25 text file.

      ☐ on paper or in the form of an image file.

   b. ☐ furnished together with the international application under PCT Rule 13*ter*.1(a) for the purposes of international search only in the form of an Annex C/ST.25 text file.

   c. ☐ furnished subsequent to the international filing date for the purposes of international search only:

      ☐ in the form of an Annex C/ST.25 text file (Rule 13*ter*.1(a)).

      ☐ on paper or in the form of an image file (Rule 13*ter*.1(b) and Administrative Instructions, Section 713).

4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that forming part of the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

5. Additional comments:

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US2017/029350

Box No. V **Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Claims	12-19	YES
	Claims	1-11, 20	NO
Inventive step (IS)	Claims	None	YES
	Claims	1-20	NO
Industrial applicability (IA)	Claims	1-20	YES
	Claims	None	NO

2. Citations and explanations:

Claims 1-11 and 20 lack novelty under PCT Article 33(2) as being anticipated by Bai.

Regarding Claim 1, Bai discloses an arrayed waveguide grating (AWG) chip (Hybrid receiver 100 also includes an optical demultiplexer in the silicon bench ... the optical demultiplexer includes an arrayed waveguide grating (AWG) 110 ... Col.5, Ln.37 - 55; Fig.1A) comprising: a first end for coupling to an optical coupling receptacle to receive an optical signal comprising a plurality of channel wavelengths (In an embodiment, the input port 112 is optically coupled to an optical fiber 119 for receiving a DWDM optical signal ... Col.5, Ln.56 - Col.6, Ln.6); a planar lightwave circuit (PLC) coupled to the first end configured to demultiplex each channel wavelength of the plurality of channel wavelengths (In a specific embodiment, the optical demultiplexer includes an arrayed waveguide grating (AWG) 110 made in a silica-on-silicon planar lightwave circuit (PLC) in the silicon bench. Col.5, Ln.37 - 55; Fig.1A); a plurality of output waveguides coupled to the PLC (... the AWG 110 includes ... multiple output ports 113 ... Col.5, Ln.56 - Col.6, Ln.6; Fig.1A), each of the output waveguides configured to receive light corresponding to an associated demultiplexed channel wavelength launched from the PLC (In a specific embodiment, each of the output ports outputs a demultiplexed optical signal. In some embodiments, each output port of the AWG has a center wavelength and pass band associated with light transmission. Col.5, Ln.56 - Col.6, Ln.6; Fig.1A) and provide the light along a first light path that extends towards a second end of the AWG chip (... at an end point of an output waveguide with a 45 degrees surface terminating the waveguide ... Col.7, Ln.48 -61; Fig.2B); 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 (For example, a gap is formed in the silica layer at an end point of an output waveguide with a 45 degrees surface terminating the waveguide to allow total internal reflection. Col.7, Ln.48 -61; Fig.2B).

Regarding Claim 2, Bai discloses the AWG chip of claim 1, wherein the 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 (In an embodiment, light coming out of each output waveguide is reflected to the surface of the PLC and collected by a corresponding photodetector, e.g., 214. Col.7, Ln.26 - 47; ... with a 45 degrees surface terminating the waveguide ... Col.7, Ln.48 -61; It is well known to all that such 45 degree structure will result in orthogonal reflected light path).

Regarding Claim 3, Bai discloses 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 (the upper and lower side of waveguide 121 in Fig.1B), 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 (... at an end point of an output waveguide with a 45 degrees surface terminating the waveguide ... Col.7, Ln.48 -61; Fig.2B).

Regarding Claim 4, Bai discloses the AWG chip of claim 3, wherein the angled surface has an interior angle of about 41 to 45 degrees relative to the output interface region (... with a 45 degrees surface terminating the waveguide ... Col.7, Ln.48 -61; Fig2B).

Regarding Claim 5, Bai discloses 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 (As shown, a waveguide includes doped silica region 121 enclosed in an undoped silica layer 122 on a silicon substrate 124. Col.6, Ln.7 - 24; Fig.1B), the core material defining at least a portion of the plurality of sidewalls of the AWG chip (waveguide 121 in Fig.1B).

Regarding Claim 6, Bai discloses 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 (In a specific embodiment, the doped silica region 121 has a higher index of refraction than the undoped silica region. Col.6, Ln.7 - 24).

Regarding Claim 7, Bai discloses 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 (For example, a gap is formed in the silica layer at an end point of an output waveguide with a 45 degrees surface terminating the waveguide ... Col.7, Ln.48 -61; Fig.2B), and wherein the angled surface is configured to reflect incident light based on at least an interior angle of the angled surface (... with a 45 degrees surface terminating the waveguide to allow total internal reflection. Col.7, Ln.48 -61; Fig.2B).

Regarding Claim 8, Bai discloses the AWG chip of claim 5, wherein the core material comprises doped silica (SiO2) having an index of refraction of about 1.45 to 1.50 (In a specific example, the doped silica region 121 has a index of refraction of about 1.47, ... Col.6, Ln.7 - 24).

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
Continuation of:

Regarding Claim 9, Bai discloses the AWG chip of claim 6, wherein the external medium comprises a material having an index of refraction of about 1.0 (... in silica-air interface ... Col.7, Ln.48 -61; It is well known that the refrective index of air is about 1.0).

Regarding Claim 10, Bai discloses the AWG chip of claim 1, wherein the AWG chip is configured as a lxN demultiplexer device whereby a single optical input signal is de-multiplexed into N different channel wavelengths (These waveguides have varying lengths for performing wavelength division multiplexing and demultiplexing functions. In a specific embodiment, each of the output ports outputs a demultiplexed optical signal. Col.5, Ln.56 - Col.6, Ln.6).

Regarding Claim 11, Bai discloses the AWG chip of claim 1, wherein the AWG chip is implemented in an AWG device package (Fig. 1A is a simplified top view diagram of a hybrid integrated DWDM receiver according to an embodiment of the present invention. Col.5, Ln.37 - 55; Fig.1A).

Regarding Claim 20, Bai discloses a method of forming an arrayed waveguide grating (AWG) (Fig. 4 is a simplified flowchart of a method for making an integrated DWDM receiver according to an embodiment of the invention. Col.8, Ln.24 - 30) comprising: depositing sequential layers of cladding and core material onto a substrate to form a planar lightwave circuit (PLC) (... forming a first un-doped silica sub-layer on the silicon layer; forming a doped silica sub-layer on the first un-doped silica sub-layer; Col.8, Ln.49 - 52); removing a portion of the substrate to expose an output interface region of the PLC (The recess includes a first surface that terminates a corresponding one of the output waveguides. Col.8, Ln.58 - Col.9, Ln.9); and removing a portion of the PLC to provide a tapered region proximal to the output interface region of the PLC (... is formed by first forming a recess region in the first region of the silica layer. Col.8, Ln.58 - Col.9, Ln.9).

Claims 12 and 14-19 lack an inventive step under PCT Article 33(3) as being obvious over Bai in view of Ho et al. (hereinafter Ho).

Regarding Claim 12, Bai discloses a multi-channel receiver optical sub-assembly (ROSA) including an AWG chip (Hybrid receiver 100 also includes an optical demultiplexer in the silicon bench ... the optical demultiplexer includes an arrayed waveguide grating (AWG) 110 ... Col.5, Ln.37 - 55; Fig.1A) comprising: a first end for coupling to an optical coupling receptacle to receive an optical signal comprising a plurality of channel wavelengths (In an embodiment, the input port 112 is optically coupled to an optical fiber 119 for receiving a DWDM optical signal ... Col.5, Ln.56 - Col.6, Ln.6); a planar lightwave circuit (PLC) coupled to the first end configured to demultiplex each channel wavelength of the plurality of channel wavelengths (In a specific embodiment, the optical demultiplexer includes an arrayed waveguide grating (AWG) 110 made in a silica-on-silicon planar lightwave circuit (PLC) in the silicon bench. Col.5, Ln.37 - 55; Fig.1A); a plurality of output waveguides coupled to the PLC (... the AWG 110 includes ... multiple output ports 113 ... Col.5, Ln.56 - Col.6, Ln.6; Fig.1A), each of the output waveguides configured to receive light corresponding to an associated demultiplexed channel wavelength launched from the PLC (In a specific embodiment, each of the output ports outputs a demultiplexed optical signal. In some embodiments, each output port of the AWG has a center wavelength and pass band associated with light transmission. Col.5, Ln.56 - Col.6, Ln.6; Fig.1A) and provide the light along a first light path that extends towards a second end of the AWG chip (... at an end point of an output waveguide with a 45 degrees surface terminating the waveguide ... Col.7, Ln.48 -61; Fig.2B); 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 (For example, a gap is formed in the silica layer at an end point of an output waveguide with a 45 degrees surface terminating the waveguide to allow total internal reflection. Col.7, Ln.48 -61; Fig.2B); an array of detector devices disposed adjacent to the output interface region of the AWG chip (... and directed up toward a photodetector, which is mounted above the reflecting surface as described below. Col.8, Ln.58 - Col.9, Ln.9);
Bai fails to explicitly disclose a transceiver housing; a multi-channel receiver optical sub-assembly (ROSA) located in the transceiver housing and arrayed waveguide grating (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.
Ho teaches an optical transceiver module (The transceiver module 202 ... Col.5, Ln.32 - 48; Fig.2) comprising: a transceiver housing (... includes a transceiver housing 210 ... Col.5, Ln.32 - 48; Fig.2); a multi-channel receiver optical sub-assembly (ROSA) located in the transceiver housing and arrayed waveguide grating (AWG) chip (... a multi-channel ROSA 230, ... Col.5, Ln.32 - 48; Fig.2), ... and a multi-channel transmitter optical assembly (TOSA) (... containing the temperature controlled multi-channel TOSA 220, ... Col.5, Ln.32 - 48; Fig.2) including at least one laser package located in the transceiver housing (One embodiment of the multi-channel TOSA 120 includes an array of lasers 122, such as laser diodes, ... Col.4, Ln.18 - 30; Fig.1) for transmitting optical signals at different channel wavelengths (... the lasers 122 may be tunable lasers that generate the optical signals at the respective channel wavelengths. Col.4, Ln.31 - 49).
It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Bai with the teaching of Ho for the purpose of forming demultiplexer including AWG (see Bai; Col.5, Ln.37 - 55).

Regarding Claim 14, modified Bai discloses the optical transceiver module of claim 12, wherein the output interface region of the AWG chip is separated from the array of detector devices (...a gap is formed in the silica layer at an end point of an output waveguide...Col.7, Ln.48 -61; Fig.2B).
Bai fails to explicitly disclose the output interface region of the AWG chip is separated from the array of detector devices by about 50 microns.
However, determining the optimal distance between components that provides the transmission of the highest quality optical signals across the transmitted wavelengths in such an optical system is a matter of routine experimentation for one of ordinary skill in the art.
It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Bai by providing the output of the AWG chip separated from the array of detector devices by about 50 microns for the purpose of optimizing the transmitted signal across the utilized wavelengths, since discovering the optimum value of a result effective variable requires only routine skill in the art.

Supplemental Box

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Continuation of:

Regarding Claim 15, modified Bai discloses 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 (... at an end point of an output waveguide with a 45 degrees surface terminating the waveguide ... Col.7, Ln.48 -61; Fig.2B).

Regarding Claim 16, modified Bai discloses 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 (... with a 45 degrees surface terminating the waveguide ... Col.7, Ln.48 -61; Fig2B).

Regarding Claim 17, modified Bai discloses 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 (As shown, a waveguide includes doped silica region 121 enclosed in an undoped silica layer 122 on a silicon substrate 124. Col.6, Ln.7 - 24; Fig.1B), the core material defining at least a portion of the plurality of sidewalls of the AWG chip (waveguide 121 in Fig.1B).

Regarding Claim 18, modified Bai discloses 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 (For example, a gap is formed in the silica layer at an end point of an output waveguide with a 45 degrees surface terminating the waveguide ... Col.7, Ln.48 -61; Fig.2B), 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 (... with a 45 degrees surface terminating the waveguide to allow total internal reflection. Col.7, Ln.48 -61; Fig.2B).

Regarding Claim 19, modified Bai discloses the optical transceiver of claim 12, and further discloses a hybrid receiver 100 includes an optical demultiplexer in the silicon bench (Hybrid receiver 100 also includes ... the optical demultiplexer includes an arrayed waveguide grating (AWG) 110 ... Col.5, Ln.37 - 55; Fig.1A).
Bai fails to explicitly disclose the transceiver is a Small Formfactor 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.
Ho teaches the transceiver is a Small Formfactor Pluggable (SFP) transceiver module (The transceiver module 202 ... may thus be designed to have a relatively small form factor with minimal space. Col.5, Ln.32 - 48. The dual fiber type direct link adapter 250 is also configured to receive pluggable optical connectors ... Col.5, Ln.49 - 61) and the ROSA is configured to receive at least four different channel wavelengths at transmission rates of at least about 25 Gbps per channel (Other data rates and modulation schemes may also be used. Col.5, Ln.1 - 13).
It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Bai with the teaching of Ho for the purpose
of forming demultiplexer including AWG (see Bai; Col.5, Ln.37 - 55).

Claim 13 lacks an inventive step under PCT Article 33(3) as being obvious over Bai in view of Ho et al. (hereinafter Ho) and Cheben et al. (hereinafter Cheben).

Regarding Claim 13, modified Bai discloses the optical transceiver module of claim 12, and further discloses an array of detector devices (... and directed up toward a photodetector, which is mounted above the reflecting surface as described below. Col.8, Ln.58 - Col.9, Ln.9).
Bai fails to explicitly disclose an air gap separates the output interface region of the AWG chip and the array of detector devices.
Cheben teaches an air gap separates the output interface region of the AWG chip and the array of detector devices (The residual substrate 9 underneath the reflective element and the thinned aperture 8 are optional, the latter may be used to reduce distance between the reflection element and the second device that intercepts or emits the out-of-plane wave. Col.3, Ln.46 - 57; Fig.1a. The second device can be either an optical waveguide or an array of thereof, a photodetector or an array of thereof, ... Col.7, Ln.7 - 18).
It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Bai with the teaching of Cheben for the purpose of positioning photodetector to interecept reflected light from waveguide (see Cheben; Col.3, Ln.46 - 57).

Claims 1-20 meet the criteria set out in PCT Article 33(4), and thus have industrial applicability because the subject matter claimed can be made or used in industry.

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/Heather Woods
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_ 00002071

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

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Electronic Acknowledgement Receipt

EFS ID:	31934922
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/Heather Woods
Filer Authorized By:	Kevin J. Carroll
Attorney Docket Number:	AOIC006
Receipt Date:	01-MAR-2018
Filing Date:	14-FEB-2017
Time Stamp:	16:11:48
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	AOIC006_IDS.pdf	612772 5092a44f8035e0e6bba567da0a8623d54e688cfd	no	5

Warnings:

AOI_NDCal 4-24cv09041_ 00002073

Information:					
2	Non Patent Literature	OfficeAction_2017_08_21.pdf	445649 86299e4c2b2c4ccda5883a417f279549df84b1c1	no	13
Warnings:					
Information:					
3	Other Reference-Patent/App/Search documents	PCT_SearchReport_WrittenOpinion.pdf	636607 65bdfc49aa45d89e1984e0a52b3f18f009ef1b0c	no	9
Warnings:					
Information:					
4	Fee Worksheet (SB06)	fee-info.pdf	30706 553890390879684454585 25a78c951d42c2239b5	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	1725734		

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.

AOI_NDCal 4-24cv09041_ 00002074

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/Heather Woods
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:				
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Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

AOI_NDCal 4-24cv09041_ 00002075

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_ 00002076

Electronic Acknowledgement Receipt

EFS ID:	31935226
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/Heather Woods
Filer Authorized By:	Kevin J. Carroll
Attorney Docket Number:	AOIC006
Receipt Date:	01-MAR-2018
Filing Date:	14-FEB-2017
Time Stamp:	16:42:33
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$240
RAM confirmation Number	030218INTEFSW16443100
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)

AOI_NDCal 4-24cv09041_ 00002077

37 CFR 1.19 (Document supply 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	Fee Worksheet (SB06)	fee-info.pdf	30706 e3387830bece39de58681a6837173d685ba60fea	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	30706		

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.

AOI_NDCal 4-24cv09041_ 00002078

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 15/432,242	Filing Date 02/14/2017	☐ 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 $80 =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*		x $420 =	
☐ 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	02/28/2018	(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))	* 7	Minus	** 20	= 0		x $100 =	0
	Independent (37 CFR 1.16(h))	* 2	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 $0 =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=		x $0 =	
	☐ 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.	LIE
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".	/Dorian Evans/
*** 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.	

This collection of information is required by 37 CFR 1.16. 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 12 minutes 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.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

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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

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"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

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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 **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

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).

15. Claims 5 and 8 are rejected under 35 U.S.C. 103 as being unpatentable over Shen et al. US 2016/0349451 A1, further in view of Pezeshki et al. US 2017/0168252 A1, and further in view of Gunn, III et al. U.S.P. No. 7,162,124 B1.

Regarding independent claim 1, Shen et al. US 2016/0349451 A1, and further in view of Pezeshki et al. US 2017/0168252 A1 make obvious this claim. See the full rejection in section (14) above.

Regarding **further dependent claim 5**, and new independent **claim 8**, there is no exact teaching in Shen '451 and Pezeshki '252 to the predetermined angle of reflection to be "42 degrees." Shen '451 and Pezeshki '252 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 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 Shen '451, Pezeshki '252 and Gunn III '124 are all from the same field of endeavor, the purpose disclosed by Gunn III '124 would have been recognized in the pertinent art of Shen '451 and Pezeshki '252.

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 Shen '451 and Pezeshki '252 to improve optical coupling efficiency and results. The Examiner notes that Shen '451 and Pezeshki '252 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 Shen '451 and Pezeshki '252 further in view of Gunn III '124.

16. Claim 7 is rejected under 35 U.S.C. 103 as being unpatentable over Shen et al. US 2016/0349451 A1, further in view of Pezeshki et al. US 2017/0168252 A1, and further in view of Gao et al. US 2003/0174964 A1.

Regarding independent claim 1, Shen et al. US 2016/0349451 A1, and further in view of Pezeshki et al. US 2017/0168252 A1 make obvious this claim. See the full rejection in section (14) above.

Regarding **dependent claim 7**, there is no *express* teaching in Shen '451 and Pezeshki '252 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 Shen '451, Pezeshki '252, 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 Shen '451 and Pezeshki '252.

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 Shen '451 and Pezeshki '252 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 Shen '451 and Pezeshki '252, and further in view of Gao.

Response to Arguments

17. Applicant's arguments (pages 5-8) filed February 28, 2018 have been fully considered but they are *not* persuasive.

18. Applicant argues for language of "disposed *on* the same surface" to overcome Shen et al. '451. See pages 7-8 filed February 28, 2018. However, the prior art of Shen gives multiple embodiments (location(s) of the AWG), and further that intervening elements (such as 100) still allows a *reasonable* interpretation of Shen element 300 in Fig. 1 to be "disposed on" element 600. As a comparison, a book stacked on *another*

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book stacked on a table is still "on the surface of table", even though the "another book" is intervening. Even though element 300 of Shen may be located with an intervening element 100 in Figure 1 of Shen, the element 300 is still “disposed on" the same surface of element 600 as element 300.

19. Applicant argues for language of “*substantial* portion of the AWG" disposed on the same surface to overcome Shen. See pages 7-8 filed February 28, 2018. However, this language is both vague and indefinite (see above rejections under 35 U.S.C. 112(b)) as well as *reasonably* met by the prior art to Shen. Shen also shows different embodiments in which the AWG may be located as claimed. It is unclear how having "substantial portion" of the AWG to be located on a surface creates any **patentable** distinction over the prior art.

20. Applicant argues for language of a “top surface” of the AWG to reflect optical signals to the photodiode(s) in Shen. See pages 7-8 filed February 28, 2018. Applicant cites Figure 4 of Shen and the reflective layer added to the end surface for coupling. While the Examiner does not concede that Figure 4 of Shen is overcome by the amendment to independent claim 1, the Examiner notes that Figure 4 is simply *one* embodiment of the AWG out coupling surface. See ***Figure 2*** of Shen, which does not include this added reflective layer. At least Shen's Figure 2 clearly meets each claimed limitation of amended independent claim 1 in the final paragraph starting "wherein the optical signals are divided" in an obviousness analysis under 35 U.S.C. 103 above.

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21. Also, based on the amendments filed February 28, 2018, the Examiner has conducted further searches and prior art analysis. Accordingly, additional prior art rejections (Ho et al. '819 and Gamache et al. '786 as the primary references) are made herein. This action is made **FINAL**.

Inventorship

22. 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

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

24. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP

§ 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

25. 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.

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
March 30, 2018

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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-9,341,786 B1	05-2016	Gamache; Claude	G02B6/30	1/1
*	B	US-7,162,124 B1	01-2007	Gunn, III; Lawrence C.	G02B6/30	385/27
	C	US-				
	D	US-				
	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					
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NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
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*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	03/29/2018							
	1	✓	✓							
	2	✓	✓							
	3	✓	✓							
	4	✓	-							
	5	✓	✓							
	6	✓	✓							
	7	✓	✓							
	8		✓							

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	3/29/2018	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
Refreshed pertinent EAST searches	3/29/2018	DJP
Analyzed amendment and remarks filed February 28, 2018	3/30/2018	DJP
Conducted further EAST searches	3/30/2018	DJP

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

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
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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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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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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~~ 15/137,823, 13 pgs. ~~15 pgs.~~	

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EXAMINER SIGNATURE

Examiner Signature	/DANIEL PETKOVSEK/	Date Considered	03/29/2018

*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.

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EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L9	15	8 and (angl$3 degree$4)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2018/03/30 11:47
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L6	1	("7162124").PN.	US-PGPUB; USPAT; USOCR; JPO	OR	OFF	2018/03/30 10:37
L5	3	4 and (degree$3 near2 ("41" "42" "43"))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2018/03/30 10:34
L4	59	("20020106156" | "20020146054" | "20030010904" | "20030081902" | "20040202428" | "20040240788" | "5488681" | "5657407" | "5724463" | "6136611" | "6289144" | "6697411").PN. OR ("7162124").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2018/03/30 10:34
L3	14	("20030067676" | "20080138013" | "20110142395" | "20150087092" | "7162124" | "7366380" | "7900836" | "8064745" | "8213751" | "8317411" | "8615149" | "8639073" | "9054489").PN. OR ("9341786").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2018/03/30 10:29
L2	1	("20160349451").PN.	US-PGPUB; USPAT; USOCR;	OR	OFF	2018/03/30 10:20

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S51	7	(("20030174964") or ("20040161186") or ("20160149662") or ("20160349451") or ("20170168252") or ("20150249501") or ("20170307819")).PN.	US-PGPUB; USPAT; USOCR; JPO	OR	OFF	2018/03/29 13:31
S50	6	(("5617234") or ("7376308") or ("8831433") or ("7058263") or ("7532783") or ("7941053")).PN.	US-PGPUB; USPAT; USOCR; JPO	OR	OFF	2018/03/29 13:28
S49	1	("20160349451").PN.	US-PGPUB; USPAT; USOCR; JPO	OR	OFF	2018/03/29 13:21
S48	0	(15/162623).APP.	USPAT; USOCR	OR	ON	2018/03/29 13:19
S47	0	("2016/0349451").URPN.	USPAT	OR	ON	2018/03/29 13:19
S46	0	("2017/0336582").URPN.	USPAT	OR	ON	2018/03/29 13:05
S45	1	("20170336582").PN.	US-PGPUB; USPAT; USOCR; JPO	OR	OFF	2018/03/29 13:04
S44	1	("20170336852").PN.	US-PGPUB; USPAT; USOCR; JPO	OR	OFF	2018/03/29 13:04
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S41	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	2018/03/28 15:37
S40	2	(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	2018/03/28 15:37
S39	102	S38 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	2018/03/28 15:37
S38	15510	G02B6/32.cpc. or G02B6/12019.cpc. or G02B6/4214.cpc. or G02B6/4249.cpc.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2018/03/28 15:37
S37	1	(10/368195).APP.	USPAT; USOCR	OR	ON	2018/03/28 15:37
S36	4	("2004/0161186").URPN.	USPAT	OR	ON	2018/03/28 15:37
S35	0	("2017/0168252").URPN.	USPAT	OR	ON	2018/03/28 15:37
S34	1	("20170168252").PN.	US-PGPUB; USPAT; USOCR; JPO	OR	OFF	2018/03/28 15:37
S33	1	("20160149662").PN.	US-PGPUB; USPAT; USOCR; JPO	OR	OFF	2018/03/28 15:37
S32	0	("2016/0349451").URPN.	USPAT	OR	ON	2018/03/28 15:37
S31	0	(15/162623).APP.	USPAT; USOCR	OR	ON	2018/03/28 15:37
S30	0	(15/373991).APP.	USPAT; USOCR	OR	ON	2018/03/28 15:37
S29	0	("2017/0168252").URPN.	USPAT	OR	ON	2018/03/28 15:37
S28	46	G02B6/4214.cpc. and G02B6/12019.cpc.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2018/03/28 15:37
S27	2	("2016/0149662").URPN.	USPAT	OR	ON	2018/03/28 15:37

S26	1	(14/621273).APP.	USPAT; USOCR	OR	ON	2018/03/28 15:37
S25	12	("20010055444" | "6490395").PN. OR ("6760521").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2018/03/28 15:37
S24	15	petkovsek$2.xa,xp. and (fiber$4 with ("AWG" or (array$3 near3 grating$3)))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT	OR	ON	2018/03/28 15:37
S23	107	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	2018/03/28 15:37
S22	1	("6715936").PN.	US-PGPUB; USPAT; USOCR; JPO	OR	OFF	2018/03/28 15:37

EAST Search History (Interference)

<This search history is empty>

3/30/2018 11:55:17 AM
C:\Users\dpetkovsek\Documents\EAST\Workspaces\15432242.wsp

To: kinsella@ao-inc.com,docketing@gtpp.com,kcarroll@gtpp.com
From: PAIR_eOfficeAction@uspto.gov
Cc: PAIR_eOfficeAction@uspto.gov
Subject: Private PAIR Correspondence Notification for Customer Number 27543

Apr 13, 2018 03:32:20 AM

Dear PAIR Customer:

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

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Application	Document	Mailroom Date	Attorney Docket No.
15432242	CTFR	04/13/2018	AOIC006
	892	04/13/2018	AOIC006
	1449	04/13/2018	AOIC006

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Thank you for prompt attention to this notice,

UNITED STATES PATENT AND TRADEMARK OFFICE

PATENT APPLICATION INFORMATION RETRIEVAL SYSTEM

Doc Code: A.NE.AFCP
Document Description: After Final Consideration Pilot Program Request

PTO/SB/434 (05-13)

CERTIFICATION AND REQUEST FOR CONSIDERATION UNDER THE AFTER FINAL CONSIDERATION PILOT PROGRAM 2.0

Practitioner Docket No.:	Application No.:	Filing Date:
AOIC006	15/432,242	February 14, 2017
First Named Inventor:	**Title:**	
LUO	MULTI-CHANNEL PARALLEL OPTICAL RECEIVING DEVICE	

APPLICANT HEREBY CERTIFIES THE FOLLOWING AND REQUESTS CONSIDERATION UNDER THE AFTER FINAL CONSIDERATION PILOT PROGRAM 2.0 (AFCP 2.0) OF THE ACCOMPANYING RESPONSE UNDER 37 CFR 1.116.

1. The above-identified application is (i) an original utility, plant, or design nonprovisional application filed under 35 U.S.C. 111(a) [a continuing application (*e.g.*, a continuation or divisional application) is filed under 35 U.S.C. 111(a) and is eligible under (i)], or (ii) an international application that has entered the national stage in compliance with 35 U.S.C. 371(c).
2. The above-identified application contains an outstanding final rejection.
3. Submitted herewith is a response under 37 CFR 1.116 to the outstanding final rejection. The response includes an amendment to at least one independent claim, and the amendment does not broaden the scope of the independent claim in any aspect.
4. This certification and request for consideration under AFCP 2.0 is the only AFCP 2.0 certification and request filed in response to the outstanding final rejection.
5. Applicant is willing and available to participate in any interview requested by the examiner concerning the present response.
6. This certification and request is being filed electronically using the Office's electronic filing system (EFS-Web).
7. Any fees that would be necessary consistent with current practice concerning responses after final rejection under 37 CFR 1.116, *e.g.*, extension of time fees, are being concurrently filed herewith. [There is no additional fee required to request consideration under AFCP 2.0.]
8. By filing this certification and request, applicant acknowledges the following:
    - Reissue applications and reexamination proceedings are not eligible to participate in AFCP 2.0.
    - The examiner will verify that the AFCP 2.0 submission is compliant, *i.e.*, that the requirements of the program have been met (see items 1 to 7 above). For compliant submissions:
        - The examiner will review the response under 37 CFR 1.116 to determine if additional search and/or consideration (i) is necessitated by the amendment and (ii) could be completed within the time allotted under AFCP 2.0. If additional search and/or consideration is required but cannot be completed within the allotted time, the examiner will process the submission consistent with current practice concerning responses after final rejection under 37 CFR 1.116, *e.g.*, by mailing an advisory action.
        - If the examiner determines that the amendment does not necessitate additional search and/or consideration, or if the examiner determines that additional search and/or consideration is required and could be completed within the allotted time, then the examiner will consider whether the amendment places the application in condition for allowance (after completing the additional search and/or consideration, if required). If the examiner determines that the amendment does not place the application in condition for allowance, then the examiner will contact the applicant and request an interview.
            - The interview will be conducted by the examiner, and if the examiner does not have negotiation authority, a primary examiner and/or supervisory patent examiner will also participate.
            - If the applicant declines the interview, or if the interview cannot be scheduled within ten (10) calendar days from the date that the examiner first contacts the applicant, then the examiner will proceed consistent with current practice concerning responses after final rejection under 37 CFR 1.116.

Signature	Date
/Kenneth M. Thompson/	July 13, 2018
Name (Print/Typed) Kenneth M. Thompson	Practitioner Registration No. 72,001

***Note**: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. Submit multiple forms if more than one signature is required, see below*.*

☐ * Total of _____ forms are submitted.

AOI_NDCal 4-24cv09041_ 00002115

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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 disclosure of these records is required by the Freedom of Information Act.
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 inspection 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.

AOI_NDCal 4-24cv09041_ 00002116

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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 § 1.113

Sir/Madame:

In response to the Office Action dated April 13, 2018, please amend the application as follows and consider the included remarks. A request for consideration under the After Final Consideration Pilot (AFCP) is also included herewith. Applicant is filing this amendment within the three-month statutory period for reply on or before July 13, 2018. Thus, Applicant believes that no 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_ 00002117

IN THE CLAIMS

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

a carrier;

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

a plurality of optoelectronic diodes disposed on the top surface of an end of the carrier, and the plurality of optoelectronic diodes electrically connected to the light receiving chip via bonding wire, wherein the optoelectronic diodes and the light receiving chip are disposed directly 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, the arrayed waveguide grating having a first end, a middle, and a second end disposed opposite the first end, 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 the top surface of the carrier underlies the middle of the arrayed waveguide grating ~~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 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 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. (Previously Presented) The multi-channel parallel optical receiving device according to claim 1, wherein the plurality of optoelectronic diodes are disposed on the same circuit board.

3. (Original) The multi-channel parallel optical receiving device according to claim 1,

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wherein the amount of the optoelectronic diodes is equal to the amount of optical paths divided by the arrayed waveguide grating.

4. (Cancelled)

5. (Previously Presented) The multi-channel parallel optical receiving device according to claim 1, 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. (Currently Amended) 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 <u>via wire bonding, wherein the plurality of optoelectronic diodes and the light receiving chip are directly disposed on the same surface</u>;

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

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an arrayed waveguide grating further disposed on the top surface of the carrier, the arrayed waveguide grating having a first end, a middle, and a second end disposed opposite the first end, 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 the top surface of the carrier underlies the middle of the arrayed waveguide grating; 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 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 1-3 and 5-8 stand rejected. Claims 1 and 8 are sought to be amended herein. Support for the amendments may be found at, for example, page 4 lines 16-18 and FIGs. 1 and 4 of Applicant's originally filed disclosure. No claims are cancelled and no new claims are added herein. Claims 1-3 and 5-8 remain pending.

Rejections under 35 U.S.C. § 112

Claims 1-3 and 5-7 were rejected under 35 U.S.C. 112 as allegedly being indefinite for reciting the term "a substantial portion of the arrayed waveguide grating." Without conceding as to the correctness of this rejection, Applicant herein amends the claims to clarify that the top surface of the carrier underlies the middle of the arrayed waveguide grating. See FIG. 4 of Applicant's originally filed specification. Accordingly, Applicant respectfully requests reconsideration and withdrawal of the rejections under 35 U.S.C. § 112.

Rejections under 35 U.S.C. § 102

Claims 1-3, 5, and 8 were rejected under 35 U.S.C. § 102(a)(2) as being anticipated by U.S. Patent Pub. No. 2017/0307819 (Ho). Applicant respectfully requests reconsideration.

The instant application was assigned to Global Technology Inc., and the assignment was recorded on Feb. 14, 2017. *See Reel/frame 041252/0582*. Global technology Inc. is a wholly owned subsidiary of Applied Optoelectronics, Inc. who is the assignee of the Ho reference. *See Reel/frame 038379/0560 recorded on April 26, 2016*. Thus, Applicant respectfully establishes that as of the filing date of the instant application, February 14, 2017, the subject matter disclosed in the copending application and the claimed invention were owned by the same entity (Applied Optoelectronics, Inc.) and subject to the exception pursuant to 35 U.S.C. 102(b)(2)(C).

Accordingly, Applicant respectfully requests reconsideration and withdrawal of the rejection of claims 1-3, 5 and 8 under 35 U.S.C. § 102(a)(2) over Ho.

Claims 1-3, and 6 were also rejected under 35 U.S.C. § 102(a)(2) as being anticipated by U.S. Patent No. 9,341,786 (Gamache). Applicant respectfully requests reconsideration.

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Claim 1 has been amended to clarify that "the plurality of optoelectronic diodes electrically connected to the light receiving chip via bonding wire." Claim 1 also recites "wherein the optoelectronic diodes and the light receiving chip are disposed directly on the same surface." As discussed on page 6 lines 3-5 of Applicant's originally filed disclosure ".. the optoelectronic diodes and the light receiving chip 2 may be disposed on the same surface, *reducing length of the bonding wire to improve the integrity and lower the manufacturing cost*." (Emphasis added).

Gamache discloses an optomechanical assembly for a *photonic chip*. *Gamache Abstract*. In Gamache the photonic chip 104 "*may include an electro-optical chip, such as, for example, a laser diode chip, a transmitter chip, etc.; an optoelectronic chip such as, for example, a photodiode chip, a receiver chip; or a purely passive chip, such as, for example, an optical filter or demultiplexor chip; and so on*." *See FIG. 1A of Gamache reproduced below and Col. 4 lines 50-67.* Simply stated, Gamache discloses a photonic chip 104 that *integrates* both light detecting and light converting elements into a *single chip*.

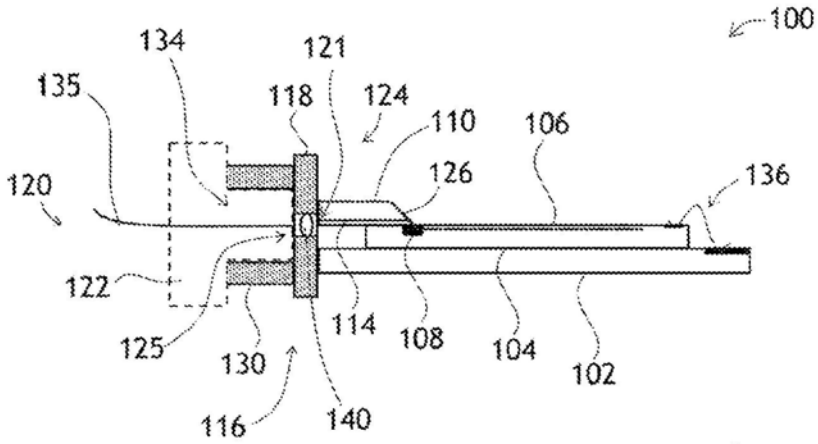


FIG. 1A

Applicant has clarified independent claim 1 to require a multi-channel parallel optical receiving device with bonding wire to electrically couple the plurality of optoelectronic diodes electrically and the light receiving chip. In contrast, Gamache discloses *integrating* light detecting and converting elements into a *single chip* rather than having *separate and distinct* optoelectronic diodes and a light receiving chip that electrically couple *via wire bonding*, as claimed. For at least

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these reasons, Gamache fails to anticipate independent claim 1, and the claims dependent therefrom, as Gamache fails to disclose each and every element of the claims.

Accordingly, Applicant respectfully requests reconsideration and withdrawal of the rejection of claims 1-3 and 6 under 35 U.S.C. § 102(a)(2) over Gamache.

Rejections under 35 U.S.C. § 103

Claims 5 and 8 were rejected under 35 U.S.C. § 103 as being unpatentable over Gamache and further in view of U.S. Patent No. 7,162,141 (Gunn). Applicant respectfully requests reconsideration.

Claim 8 has been amended similarly to independent claim 1 to require bonding wire to electrically couple the plurality of optoelectronic diodes electrically and the light receiving chip. Nothing in Gunn remedies the deficiencies of Gamache discussed above with regard to independent claim 1. Accordingly, Applicant respectfully submits that the proposed combination of Gamache and Gunn fails to render claim 8 obvious as the proposed combination fails to disclose or suggest each and every element.

Claim 5 depends from independent claim 1 and is allowable by virtue of its dependency.

Accordingly, Applicant respectfully requests reconsideration and withdrawal of the rejection of claims 5 and 8 under 35 U.S.C. § 103.

Claim 7 was rejected under 35 U.S.C. § 103 as being unpatentable over Gamache and further in view of U.S. Patent Pub. No. 2003/0174964 (Gao). Applicant respectfully requests reconsideration.

Claim 7 depends from independent claim 1 and is allowable by virtue of its dependency. Accordingly, Applicant respectfully requests reconsideration and withdrawal of the rejection of claim 7 under 35 U.S.C. § 103.

Claims 1-3 and 6 were also rejected under 35 U.S.C. § 103 as being unpatentable over U.S. 2016/0349451 (Shen) and U.S. Patent Pub. No. 2017/0168252 (Pezeshki). Applicant respectfully requests reconsideration.

Independent claim 1 has been amended to clarify that "the optoelectronic diodes and the light receiving chip are disposed directly on the same surface."

In contrast, the primary reference Shen includes an optical detector 300 and a driver 700 disposed on *different* surfaces (See FIG. 1 of Shen reproduced below).

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