

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

CAMBRIDGE INDUSTRIES USA INC.,

Petitioner

v.

APPLIED OPTOELECTRONICS, INC.,

Patent Owner

Case: IPR2025-00434

U.S. Patent No. 10,379,301

PETITION FOR *INTER PARTES* REVIEW

UNDER 35 U.S.C. §311-319 AND 37 C.F.R. §42.104

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Exhibit	Short Name	Description
Ex. 1001	'301 Patent	U.S. Patent No. 10,379,301
Ex. 1002	'301 File History	File History of U.S. Patent No. U.S. Patent No. 10,379,301
Ex. 1003	Kirk Declaration	Declaration of Dr. Andrew G. Kirk
Ex. 1004	Kirk CV	<i>Curriculum Vitae</i> of Dr. Kirk
Ex. 1005	Viswanadham	ESSENTIALS OF ELECTRONIC PACKAGING, P. Viswanadham, ASME (2011), pp. 7-9.
Ex. 1006	Pecht	HANDBOOK OF ELECTRONIC PACKAGE DESIGN, M. Pecht, Ed., Marcel Dekker, Inc. (1991), pp. 76-83, 173-178, 515-517.
Ex. 1007	Shen	U.S. Patent Pub. No. US 2016/0349451
Ex. 1008	Shen provisional	U.S. prov. patent appln SN 62/166015
Ex. 1009	Soldano	U.S. Patent No. 9,768,901
Ex. 1010	Scheduling Order	Scheduling Order dated August 7, 2024, in <i>Applied Optoelectronics, Inc. v. Cambridge Industries USA, Inc.</i> , No. 3:24-cv-01010-JD (N.D. Cal.)
Ex. 1011	Claim Terms	Joint Claim Construction and Pre-Hearing Statement in <i>Applied Optoelectronics, Inc. v. Cambridge Industries USA, Inc.</i> , No. 3:24-cv-01010-JD (N.D. Cal.)

Cambridge Industries USA, Inc. (“Petitioner” or “Cambridge”) petitions for *Inter Partes* Review (“IPR”) under 35 U.S.C. §§311-319 and 37 C.F.R. §42 of Claims 1-7 (“the Challenged Claims”) of U.S. Patent No. 10,379,301 (the “’301 Patent”). Petitioner requests cancellation of the Challenged Claims.

I. STANDING UNDER 37 C.F.R. §42.104(a)

Petitioner certifies that the ’301 Patent is available for IPR, and that Petitioner is not barred or estopped from requesting IPR.

II. PAYMENT OF FEES

Petitioner authorizes Account No. 19-5029 to be charged for any fees.

III. OVERVIEW OF CHALLENGES AND RELIEF REQUESTED

Pursuant to 37 CFR §42.22(a)(1) and 37 CFR §42.104(b)(1)-(2), Petitioner requests cancellation of the Challenged Claims pursuant to the grounds below.

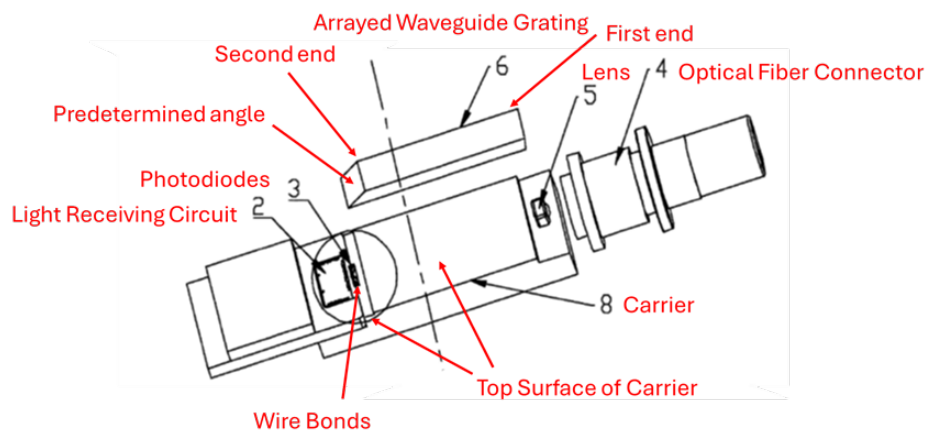
Ground 1: Claims 1-7 are Unpatentable Under 35 U.S.C. §102 as Anticipated by Shen

Ground 2: Claims 1-7 are Unpatentable Under 35 U.S.C. §102 as Anticipated by Soldano

IV. BACKGROUND

A. Overview of the '301 Patent

The '301 Patent describes and claims a multi-channel parallel optical receiving module including a carrier and a light receiving chip. Ex. 1001, Abstract. Specifically, the '301 Patent describes a plurality of optoelectronic diodes disposed in an array on a top surface of the carrier and electrically connected to the light receiving chip. *Id.*, 1:37-53. The '301 Patent further discloses an arrayed waveguide grating (“AWG”) disposed on the top surface of the carrier having an input end connected to an optical fiber connector to receive a multiwavelength input optical signal. The AWG separates the input optical signal into multiple channel wavelength signals that are transmitted in separate channel waveguides. The channel wavelengths are reflected by a top surface of an output end of the AWG onto the photosensitive surfaces of the optoelectronic diodes for conversion to electrical signals. *Id.*; Ex. 1003, ¶¶ 47-48.



Ex. 1001, FIG. 1 (partial, annotated)

The '301 Patent describes that the light receiving module processes the output of the photodiodes to generate electrical signals for further processing and may be a transimpedance amplifier. Ex. 1001, 3:5-9; Ex. 1003, ¶ 49.

As demonstrated in this Petition, the '301 Patent describes and claims photonics structures that were well-known to persons of skill in the art of optical fiber communications (“POSITAs”) before the application for the '301 Patent was filed. *See, e.g.*, Ex. 1007, ¶¶ [0006]-[0007]; Ex. 1003, ¶ 50. The architecture of such optical modules were aggressively developed in the optical communication with the aim of decreasing size and complexity and increasing signal capacity. Ex. 1001, 1:5-22. The '301 Patent only removes from the prior art that which was well known to POSITAs at the time the application for the '301 Patent was filed. Accordingly, the Board should institute review because there is a strong likelihood that Petitioner will prevail on at least one Challenged Claim.

B. Technical Background

1. Multi-Channel Optical Receiving Devices

Optical receiving modules receive an optical signal from an optical fiber and convert the received optical signal into an electrical signal. Ex. 1001, 1:12-15. Multi-channel optical receiving modules receive a multiwavelength optical signal and separate that signal into separate channel wavelengths, which channel wavelengths then are converted to electrical signals for further processing. *See* Ex.

1001, 1:37–54. The use of multiwavelength optical signals maximizes the system transmission rate over long distances, thereby allowing for a higher volume of data throughput. Ex. 1001, 1:12, see generally, Ex. 1003, ¶¶ 39-46.

C. '301 Patent Prosecution History, Ex. 1002.

Patent Owner filed Application No. 15/432,242 (the “’242 Application”), which issued as the ’301 Patent on August 13, 2019, on February 14, 2017, claiming priority to Chinese patent application CN 1 03460078, filed May 23, 2016. Ex. 1003, ¶ 52.

A non-final action was mailed August 29, 2017, rejecting application claims 1-7. Ex. 1002, pp. 239-252. Application claims 1-4 and 6 were rejected as anticipated by U.S. Patent Application Publication US 2017/0168252 to Pezeshki et al. (“Pezeshki”) and as obvious over U.S. Patent Application Publication US 2016/0349451 to Shen et al. (“Shen”) in view of Pezeshki. *Id.*, pp. 242-247. Application claims 5 and 7 were rejected as obvious over Pezeshki and in view of U.S. Patent Application Publication US 2003/0174964 to Gao et al. (“Gao”). *Id.*, pp. 247-250. At page 6 of the Office action the Examiner correctly noted that Shen discloses dividing a multi-channel optical signal into a plurality of channel wavelengths. Ex. 1002, p. 245. Inexplicitly, however, the Office action asserts that “Shen does not expressly teach that the [optoelectronic] diode receiver is a plurality of OE diodes that are split into separate receiving portions.” The Examiner instead

relied on Pezeshki for this feature. *Id.*, p. 246; Ex. 1003, ¶ 53.

In an Amendment filed February 28, 2018, Patent Owner amended application claim 1 to recite that the optoelectric diodes and light receiving chip on disposed on the same surface of the carrier; a substantial portion of the arrayed waveguide grating is disposed on the top surface of the carrier; and that a predetermined angle at the output end of the arrayed waveguide grating is in a range of 41 to 46 degrees. Patent Owner argued that these limitations were not disclosed in either Pezeshki or Shen. Ex. 1002, pp. 223-231; Ex. 1003, ¶ 54.

A Final action was mailed on April 13, 2018, rejecting the claims as indefinite as to what constituted a “substantial portion” of the AWG. Ex. 1002, pp. 169-170. Application claims 1-3, 5 and 8 were rejected as anticipated by U.S. Patent Application Publication US 2017/0307819 to Ho et al. (“Ho”). *Id.*, pp. 171-173. In addition, application claims 1-3 and 6 were rejected as anticipated by U.S. Patent No. 9,341,786 to Gamache et al. (“Gamache”), application claims 5 and 8 as obvious over Gamache in view of U.S. Patent No. 7,162,124 to Gunn, III et al. (“Gunn”), and application claim 7 rejected further in view of Gao. *Id.*, pp. 173-181. The Final Action also repeated the rejection of claims 1-3 and 6 as obvious over Shen in view of Pezeshki, further rejected claims 5 and 8 further in view of Gunn and claim 7 further in view of Gao. *Id.*, pp. 181-186. The Final action also rejected Patent Owner’s arguments as set forth in the Remarks filed February 28, 2018. *Id.*, pp.

186-187; Ex. 1003, ¶ 55.

Patent Owner filed an Amendment and Reply on July 13, 2018, attempting to further amend and distinguish the claims, which was not entered until a Request for Continued Examination was filed on August 13, 2018. Ex. 1002, pp. 155-163, 140; Ex. 1003, ¶ 56.

On September 13, 2018, a non-final action was mailed, repeating the obviousness rejections set forth in the prior Final action based on Shen, Pezeshki, Gunn, Gamache, and Gao, and rejecting Patent Owner's arguments as not persuasive. Ex. 1002, pp. 113-131, Ex. 1003, ¶ 57.

Patent Owner filed a Reply on December 13, 2018, arguing that the claim amendments filed on August 13, 2018, adequately distinguished over the prior art. Patent Owner argued that in amended claim 1, the photodiodes and light receiving chip are disposed "directly" on the "same surface," whereas in Shen those components are located on different surfaces. Ex. 1002, pp. 93-111. Patent Owner disagreed with the Examiner's contention that a POSITA would have been motivated to place both components of "Chen" (sic, Shen) on the "same surface," arguing that the alleged invention simplified manufacture by reducing the length of wire bonds connecting the diodes to the light receiving chip. *Id.*, pp. 103-104. Patent Owner also argued that Gamache taught an integrated design, rather than separate wire-bonded components as described in its specification. *Id.*, pp. 106-108. While

Patent Owner disputed the Examiner's common-sense obviousness contentions, it submitted no expert evidence that the proposed combinations would not have been entirely obvious to a POSITA. Ex. 1003, ¶ 58.

A Non-final action was mailed January 28, 2019, rejecting all pending claims. Ex. 1002, pp. 77-84. The Examiner noted that “a/the ‘top surface of the carrier’ need[s] more specificity because this ‘top surface’ includes ‘three distinct surface sections/levels’” that are not in the “**same plane**,” rendering the claims indefinite. *Id.*, p. 80 (emphasis in original). Nonetheless, the Examiner credited as persuasive the Patent Owner's unsubstantiated arguments in the December 13, 2018, Reply and indicated the claims to contain allowable subject matter. *Id.*; Ex. 1003, ¶ 59.

Patent Owner filed an Amendment on April dated April 29, 2019, further amending the claims to clarify on which “top surface” the various components are disposed. Ex. 1002, pp. 71-76. While those amendments specified where on the top surfaces the components were located, they do not indicate whether those “top surfaces” all are on the same plane or different planes. Nonetheless, a Notice of Allowance was mailed May 13, 2019, including a Notice of Allowability stating that “Applicant has made specific corrections to clearly identify the three distinct “top surface” portions of the carrier element (reference #8 in Fig. 1)...” The Notice of Allowability further states: “The Examiner is unable to make a *prima facie* case for obviousness for such combination, most particularly in which the ‘light receiving

chip’ (2) and the ‘optoelectronic diodes’ (3) are disposed *directly* on the same surface of the end of the carrier (left end/side in Fig. 1 *same surface*).” *Id.*, p. 37 (emphasis in original). The ’301 patent issued on August 13, 2019. *Id.*, p. 25; Ex. 1003, ¶ 60.

D. Priority Date

The ’301 Patent claims the benefit of Chinese Patent CN103460078, with a filing date of May 23, 2016.

E. Prior Decisions by District Courts and the Board

The ’301 Patent is currently asserted in a pending district court case in the Northern District of California against Petitioner: *Applied Optoelectronics, Inc. v. Cambridge Industries USA, Inc.*, No. 3:24-cv-01010-JD. No dispositive judgments or claim construction orders have issued regarding the ’301 patent. A claim construction hearing is currently set for April 10, 2025. Ex. 1010, p. 2. The dispositive motion deadline is currently set for January 28, 2026. *Id.* Jury selection is scheduled for June 8, 2026. *Id.*

The ’301 Patent has not yet been the subject of prior decisions by the Board.

F. Claim Construction (37 C.F.R. §42.104(b)(3))

The claims are construed herein “using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. §282(b).”

37 C.F.R. §42.100(b) (Nov. 13, 2018). Unless otherwise specified, the terms should

receive their respective plain and ordinary meaning as understood by a person of ordinary skill in the art under *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005).

Petitioner submits that the following constructions appropriate for the claim terms “carrier” and “the same top surface.” Specifically, the term a “carrier” should be construed as “*a ceramic or silicon substrate*,” i.e., a ceramic or similar rigid substrate having high thermal conductivity and designed to carry an integrated chip, as that term is (and was) understood by POSITAs. *See, e.g.*, Ex. 1005, pp. 7-9; Ex. 1003, ¶ 62. A carrier is distinguished from a printed circuit board, which typically comprises fiberglass or plastic. *Id.*, pp. 8-9; *see also* Ex. 1006, pp. 76-83, 173-178, 515-517; Ex. 1003, ¶ 62.

The foregoing distinction is recognized in the ’301 Patent. *See, e.g.*, Ex. 1001, 4:6-11 (“The plurality of optoelectronic diodes may be disposed on the same circuit board. The position of the optoelectronic diodes may become definitive so as to simplify and streamline the manufacturing process. The optoelectronic diodes may be disposed onto the carrier 8 simultaneously, minimizing the iteration of disposing the optoelectronic diodes.”) Ex. 1003, ¶ 63.

Petitioner further submits that the phrase “the same top surface of the end of the carrier” (claims 1 and 7) should be construed to mean “*the topmost surface of the carrier*,” without respect to whether that surface has a single or multiple elevations *See* Ex. 1001, FIGS. 1-2, 2:66-3:5, 3:9-12, 4:6-11. Notably, as illustrated

in FIG. 1 of the '301 Patent, the carrier “top surface” spans multiple elevations. As discussed with respect to prosecution of the '301 Patent, the “same top surface” does not refer to a single plane, but rather the topmost surface of three distinct adjacent surfaces. Ex. 1003, ¶ 64.

In the pending litigation, Patent Owner has argued the all claim terms in the '301 Patent should be accorded “plain and ordinary meanings.” Patent Owner has urged the District Court to adopt a definition of “carrier” as “one or more components for supporting ROSA components such as an AWG.” Ex. 1011, p. 6; Ex. 1003, ¶ 65. In its infringement claim charts exchanged in the pending district court litigation, Patent Owner has identified as the claimed “carrier” the printed circuit board employed in Petitioner’s products. Because the term “carrier” should be construed consistently for invalidity as for infringement, Petitioner and its expert has adopted for purposes of this Petition Patent Owner’s construction for carrier as “one or more components for supporting ROSA components such as an AWG.” Ex. 1003, ¶ 66.

V. PRIOR ART REFERENCES

A. U.S. Patent App. Pub. No. US 2016/0349451 (“Shen”), Ex. 1007 U.S. Provisional Patent App. 62/166,015, Ex. 1008

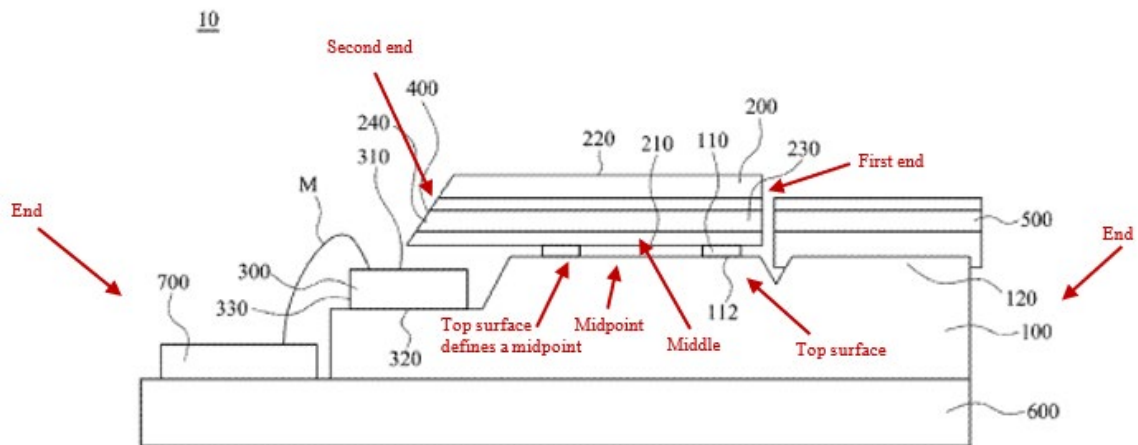
Shen was filed on May 24, 2016, and published on December 1, 2016. Shen claims priority to provisional application No. 62/166,015, filed May 25, 2015. With

respect to common disclosure in the provisional application, Shen qualifies as prior art under at least 35 U.S.C. §102(a). Shen was cited and considered during prosecution of the '301 patent, but only in combination with Pezeshski as discussed in Section IV.C, *supra*; Ex. 1008 was not cited or considered. Shen incorporates by reference the Shen Provisional Application. Ex. 1007, ¶ [0001]; Ex. 1003, ¶¶ 67-68.

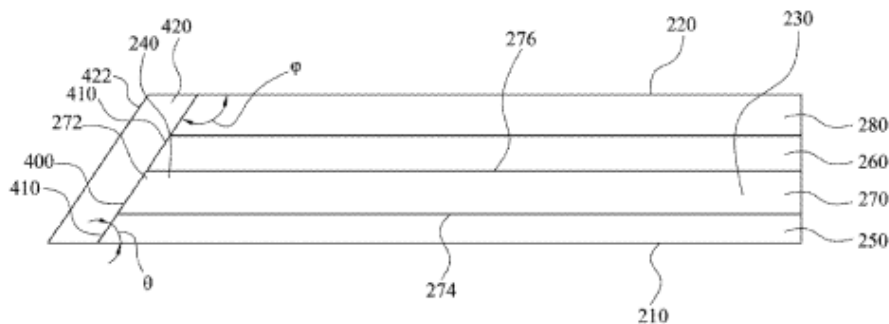
The Examiner erred in concluding that Shen does not teach “that the OE diode receiver is a plurality of OE diodes that are split into separate receiving portions.” Ex. 1002, p. 182. FIG. 3 of Shen plainly illustrates that AWG of Shen divides the multiwavelength incoming signal into multiple discrete channel wavelengths. Ex. 1007, FIG. 3, ¶¶ [0036], [0043]; Ex. 1008, p. 7; Ex. 1003, ¶¶ 69-70. The angled surface at the output end of the AWG of Shen directs the optical signal transmitted through the separate spaced-apart channel wavelength waveguides (278) to the detector 300. Ex. 1007, FIG. 3, ¶¶ [0036], [0043]; Ex. 1008, p. 7; Ex. 1003, ¶ 71.

A POSITA would have understood that detector 300 must necessarily include *discrete* photodiodes configured to receive the optical signals from spaced-apart waveguides (278) to convert the channel wavelength optical signals to electrical signals. Ex. 1003, ¶ 72. The detector simply could not work otherwise, as crosstalk between the adjacent wavelength channels as the optical signals reach the detector would render it useless. *Id.*

As demonstrated below, Shen discloses and anticipates the configuration described and claimed in the '301 Patent. Although the Patent Owner amended the claims during prosecution of the '301 Patent purportedly to address the prior art, those amendments do not patentably distinguish over Shen. Ex. 1002, pp. 71-76; Ex. 1007, FIGS. 1 and 4, ¶¶ [0038]-[0039], [0046]; Ex. 1003, ¶ 73.



Ex. 1007, Fig 1 (annotated)

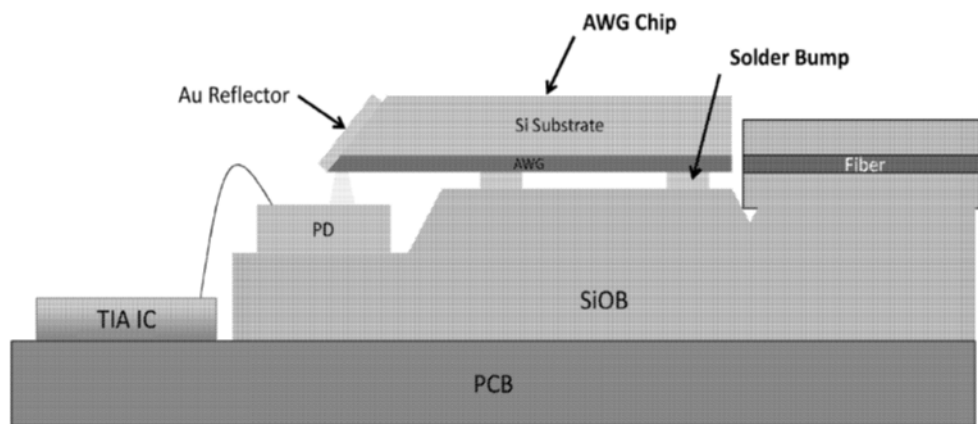


Ex. 1007, FIG. 4.

Shen teaches an optical connection module having a carrier, an arrayed wavelength grating (AWG) structure, an optical detector, and an angled surface at an output end of the AWG that redirects the transmitted light from the AWG to the

optical detector. Ex. 1007, Abstract.

Notably, even if the term “carrier” is construed as a POSITA would have understood it – as a specific type of heat-resistant rigid ceramic material, as opposed to a PCB, Shen explicitly discloses that structure. Specifically, Ex. 1008 at page 8 explicitly states that “TIA IC [the transimpedance amplifier integrated circuit, which is the equivalent to the “light receiving circuit” of the ’301 Patent] may be located on the same substrate (SiOB) with PD [photodetector], or located on the PCB [printed circuit board] and connected (sic) the PD on SiOB through wire bonding.” *Id.*, Ex. 1003, ¶ 74.



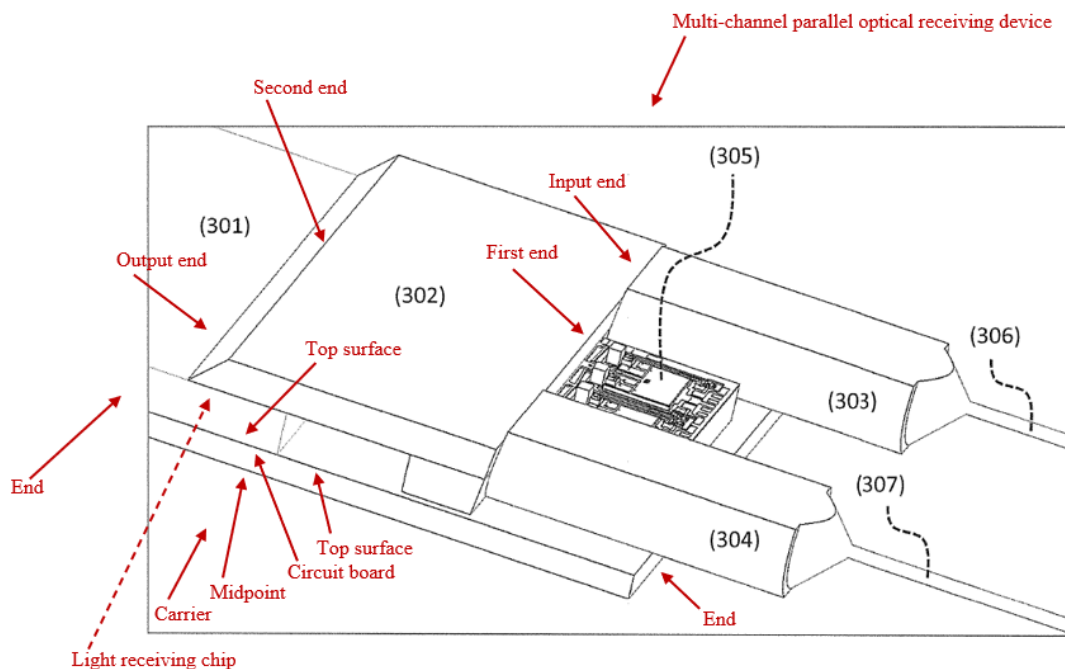
Ex. 1008, p. 6

B. U.S. Patent No. 9,768,901 (“Soldano”), Ex. 1009.

Soldano was filed on February 12, 2015, and issued on September 19, 2017. Soldano claims priority to U.S. Provisional Patent Application 62/082,529, filed November 20, 2014. Soldano qualifies as prior art under at least 35 U.S.C. §102(a).

Soldano was cited by the Examiner in a Notice of References included with the August 29, 2017, Office action, but was not applied in a rejection or otherwise considered during prosecution of the '301 Patent. Ex. 1003, ¶ 75.

Soldano teaches a photonic lightwave circuit (PLC, 302) that includes an arrayed waveguide grating, wherein an angled, polished end (409) of the PLC directs light from channel wavelength waveguides (406) to photodiodes (505) on a silicon photonics chip (301). Ex. 1009, FIGS. 3-4, 7:63-8:24, 10:10-19; Ex. 1003, ¶ 76.



Ex. 1009, FIG. 3 (annotated).

VI. LEVEL OF ORDINARY SKILL IN THE ART

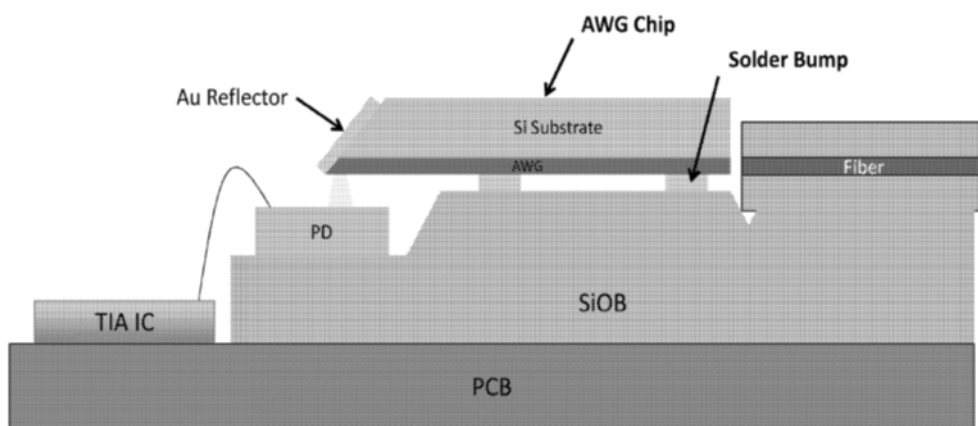
A person of ordinary skill in the art (“POSITA”) pertinent to the '301 Patent would have had at least (1) an undergraduate degree in electrical engineering, computer engineering, computer science, or a comparable field of study and (2) at

VII. THE CHALLENGED CLAIMS ARE UNPATENTABLE

Claim 1

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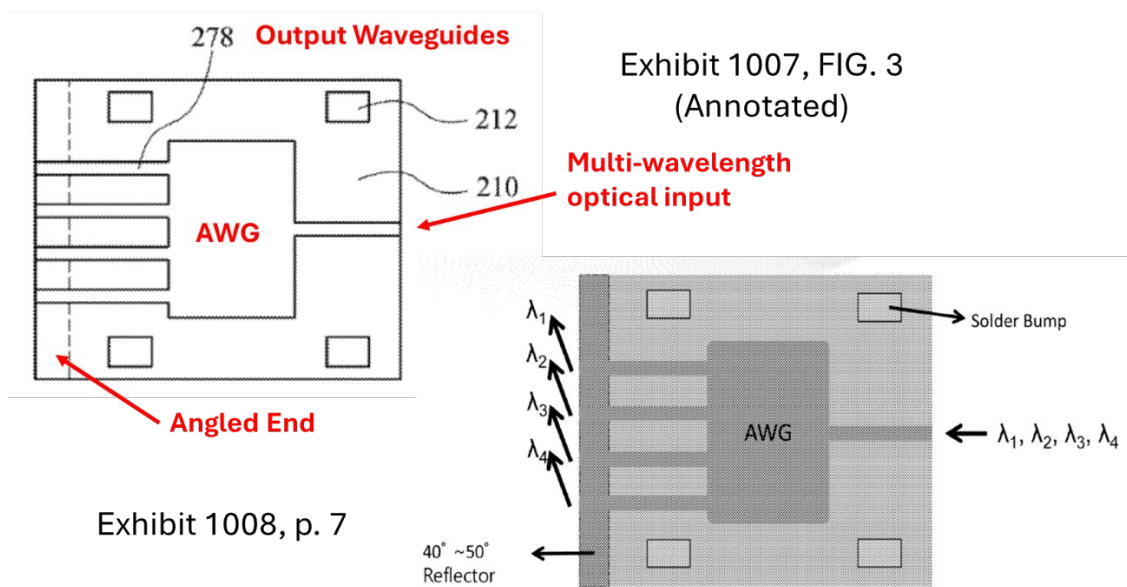
of design choice whether to use a multi-level substrate 100 in lieu of substrate 100 and PCB 600. *Id.* And indeed, as described, *supra*, the Shen provisional application explains that the photodiodes and TIA IC (corresponding to the claimed “light receiving circuit”) could both be located on the SiOB substrate (which is a carrier, not a PCB) to minimize wire bonds. *See* Ex. 1008, pp. 6-8; Ex. 1003, ¶ 81



[1c] Shen discloses a light receiving chip (700) located on a top surface of an end of the carrier (substrate 100 + PCB 600). *See* Ex. 1007, FIG. 1, ¶¶ [0033]–[0037], [0044]. As noted above, the Shen provisional application discloses that a POSITA would have understood that it was simply a matter of design choice whether to locate the light receiving chip on the carrier rather than a PCB. Ex. 1008, pp. 6-8; Ex. 1003, ¶ 82.

[1d] Shen discloses an optical detector (300) located on the top surface of the end of the carrier. The optical detector (300) includes a plurality of optoelectronic diodes, one for each channel wavelength output by the arrayed wavelength grating

(AWG). *See* Ex. 1007, FIG. 3, ¶ [0043]; Ex. 1008, p. 7. A POSITA would have understood that because the output waveguides (278) are spaced apart, the optical detector (300) necessarily includes a plurality of photodetectors to receive the multiple channel wavelength optical signals output by the AWG. Ex. 1003, ¶¶ 83-84.

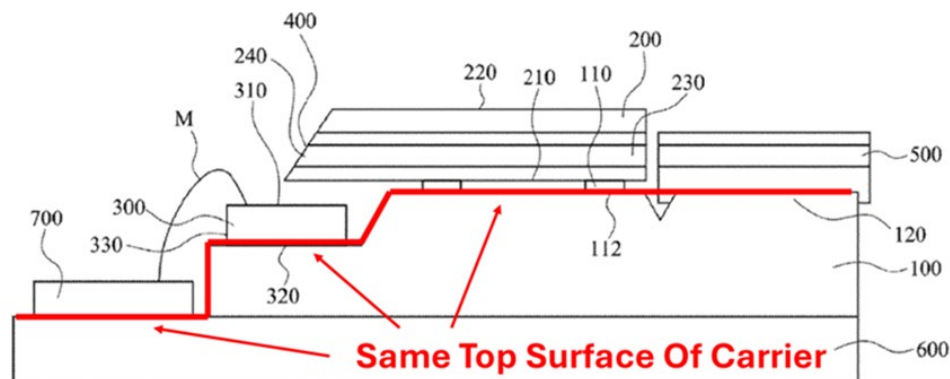


The optical detector (e.g., photodiodes) (300) and the light receiving chip (700) are located directly on the same top surface of the end of the carrier. *See* Ex. 1007, FIG. 1, ¶¶ [0033]-[0037], [0044]; Ex. 1003, ¶ 84; *see also*, Ex. 1008, the Shen provisional application, which states at page 8 that “TIA IC [transimpedance amplifier integrated chip] may be located on the same substrate (SIOB) with PD [photodetector] or located on the PCB and connected to the PD on the SIOB through wire bonding.”

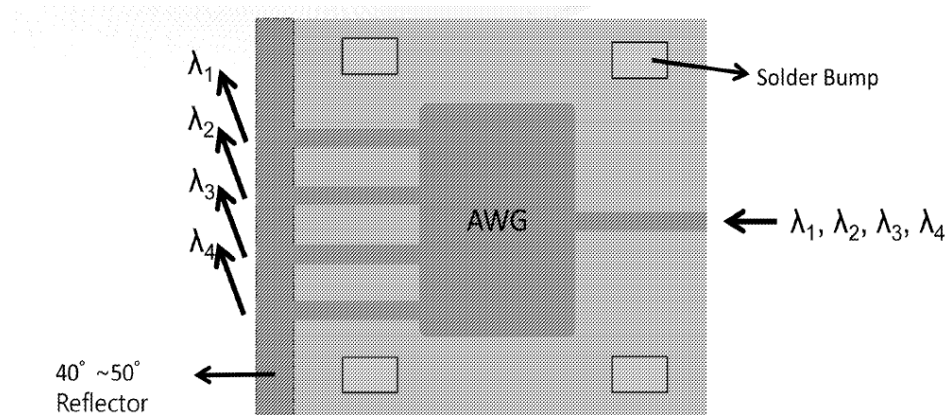
[1e] Shen discloses an optical fiber connector (500) located in an end of the carrier (100). *See* Ex. 1007, FIG. 1, ¶ [0044]; Ex. 1008, pp. 6-8; Ex. 1003, ¶ 86.

[1f] Shen discloses an arrayed waveguide grating (200) located on a top surface of the carrier that defines a midpoint of the carrier. While the '301 Patent does not define the term “midpoint,” as indicated in the annotated version of FIG. 1 of Shen below, the AWG is located at about the midpoint of the top surface of the carrier. Notably, no criticality is ascribed to this location of the AWG in the '301 Patent. A POSITA would not have understood this positioning as having any effect on the functionality of the AWG but instead would have viewed it as a simple design choice. Ex. 1003, ¶ 87.

The AWG (200) of Shen has a first end, a middle, a second end located opposed the first end, and an input end (230) connected to the optical fiber connector (500) for receiving an input optical signal from the optical fiber. *See* Ex. 1007, FIGS. 1, 4, ¶ [0044] The top surface of the carrier underlies the middle of the AWG (200) as illustrated in the annotated version of FIG. 1 of Shen below. *Id.*, Ex. 1003, ¶ 88.



[1g] Shen discloses that the input optical signal is divided into multiple channel optical signals in parallel by the AWG (200) based on their wavelengths. *See* Ex. 1007, FIG. 3; Ex. 1008, p. 7 (disclosing a multiwavelength input signal and separate channel wavelengths exiting the AWG). Shen discloses that “the [AWG] structure may include a plurality of optical channels. The optical channels are separated from each other... [and] may transmit the light within different wavelength ranges.” *See* Ex. 1007, FIGS. 1, 4, ¶ [0043]; Ex. 1008, p. 7; Ex. 1003, ¶ 89.



Ex. 1008, p. 7

A top surface (220) defined by an output end (240) of the AWG (200) is at a predetermined angle (θ), causing the multi-channel optical signals reflected by the top surface (220) defined by the output end (240) to be reflected to a photosensitive surface of the optical detector (e.g., optoelectronic diodes) (300) arranged in parallel. The predetermined angle (θ) of the top surface (220) defined by the output end (240) of the AWG (200) is in a range of 41 to 46 degrees. *See* Ex. 1007, FIGS. 1, 2, 4, ¶¶ [0038]-[0039], [0046]; Ex. 1008, p. 7 (“40° ~ 50° reflector”); Ex. 1003, ¶ 90.

Accordingly, Shen Exs. 1007 and 1008 anticipate Claim 1 of the '301 Patent. Ex. 1003, ¶ 91.

Claim 2

Remarkably, Claim 2 of the '301 Patent redefines the “carrier” of Claim 1 to also include a portion of the PCB, such that the “end of the carrier” need not actually be the “carrier” at all, but only an adjacent PCB surface. Claim 2 further recites that neither the light receiving circuit nor the photodetectors need be located on the “carrier”, but instead could both be “directly disposed on the circuit board,” thereby demonstrating that the location of these components really is a matter of design choice, as would have been understood by a POSITA. Ex. 1003, ¶¶ 92-94.

As construed by Patent Owner in the pending district court litigation, Shen discloses the top surface of the end of the carrier (100) may be defined at least in part by a circuit board (600). *See* Ex. 1007, FIG. 1. A POSITA would have understood that it would have been a simple design choice to locate both the light receiving chip (700) and photodiodes (300) directly located on the circuit board (600), instead of the SIOB substrate as suggested in the Shen provisional application. *See* Ex. 1007, FIG. 1, ¶¶ [0037], [0044]; Ex. 1008, p. 7; Ex. 1003, ¶ 95.

Accordingly, Shen anticipates Claim 2. Ex. 1003, ¶ 96.

Claim 3

Shen discloses that the optical detector (300) includes a plurality of

optoelectronic diodes equal to the number of optical paths (278), i.e., channel wavelengths, into which the input multi-wavelength signal is divided by the AWG structure (200). *See* Ex. 1007, FIGS. 1, 3, ¶¶ [0033], [0035], [0037], [0040], [0043]; Ex. 1008, p. 6; Ex. 1003, ¶ 97.

Accordingly, Shen anticipates Claim 3. Ex. 1003, ¶ 98.

Claim 4

Shen discloses that the predetermined angle (θ) of the top surface (220) of the output end (240) of the arrayed waveguide grating (200) may be an acute angle, whereas the Shen provisional application specifies an angle of $40^\circ \sim 50^\circ$, which encompasses the claimed angle of 42 degrees. *See* Ex. 1007, FIGS. 1, 2, 4, ¶¶ [0039], [0046]; Ex. 1008, p. 6. No criticality is ascribed in the '301 Patent for requiring an angle of precisely 42 degrees. However, recognizing the need to reduce back reflection, a POSITA would have chosen the angle for the end of the AWG as less than an 8-degree tilt, e.g., reducing the angle to about 41 to 42-degrees, and also as a matter of design choice, depending upon the material characteristics of the AWG and the alignment of the output end of the AWG with the diodes. Ex. 1003, ¶ 99.

Accordingly, Shen anticipates Claim 4. Ex. 1003, ¶ 100.

Claim 5

Shen discloses a multi-channel parallel optical receiving device according to claim 1, wherein an input end of the AWG may be coupled to the optical fiber

connector via a lens. Ex. 1007, ¶ [0044]. A POSITA would have understood that such as lens would be a graded lens to assist propagation of the light delivered by the optical fiber connector (500) into the AWG (200) to increase optical coupling efficiency and reduce dispersion and signal loss. Ex. 1003, ¶ 101.

Shen therefore anticipates Claim 5. Ex. 1003, ¶ 102.

Claim 6

Shen discloses an embodiment of the optical receiving device where an optical passive device “may assist the light to propagate into the AWG structure ... to increase the optical coupling efficiency ... [and] may be, but is not limited to be, an optical fiber or a lens.” Ex. 1007, ¶ [0044]. Additionally, the use of graded index lenses was known and commonly used in optical communications at the time the ’301 patent was filed. Accordingly, a POSITA would have understood that it would have been a simple design choice to use a graded index lens to “improve optical coupling between an optical fiber and an optical waveguide on a chip or substrate type configuration in the device of Shen ‘451 ... to improve optical coupling efficiency.” Ex. 1003, ¶¶ 103-104.

Shen therefore anticipates Claim 6. Ex. 1003, ¶ 105.

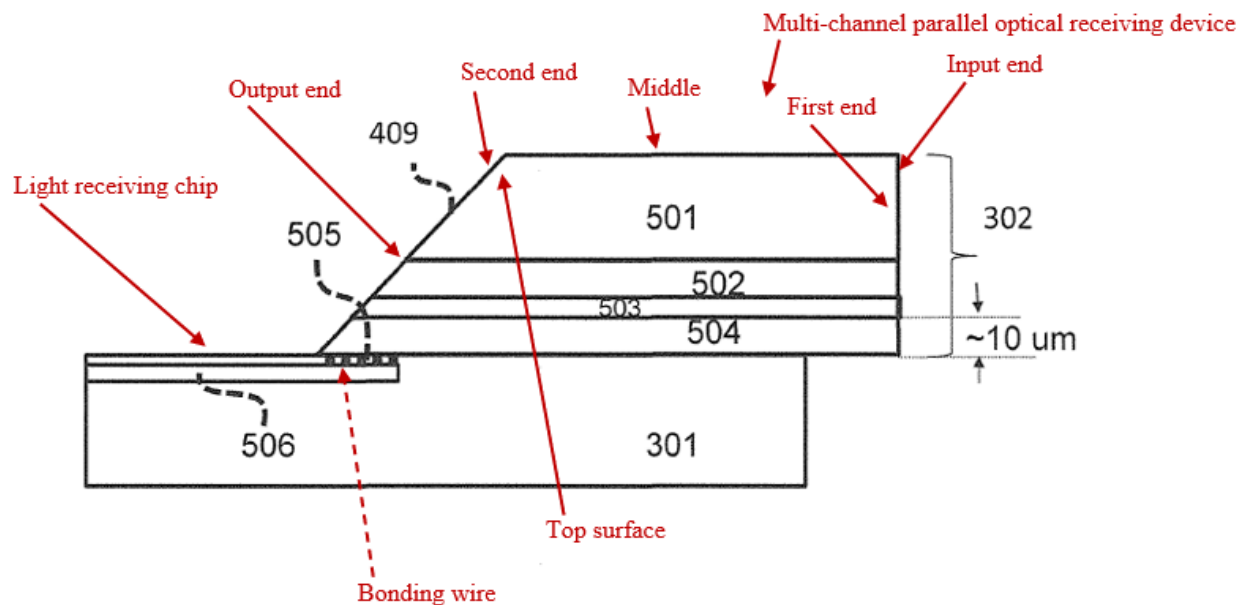
Claim 7

Claim 7 combines the elements of claims 1 and 4 and is anticipated by Shen for the same reasons as described above for claims 1 and 4. Ex. 1003, ¶¶ 106-107.

B. Ground 2: Claims 1-7 Are Anticipated Under 35 U.S.C. §102 By Soldano.

Claim 1

[1a] Soldano discloses a multi-channel parallel optical receiving device. *See* Ex. 1009, FIGS. 3, 5, 7:29, 8:28; Ex. 1003, ¶ 108.



Ex. 1009, FIG. 5 (annotated).

[1b] Soldano discloses a carrier. *See* Ex. 1009, FIGS. 3, 5, 7:29, 8:28. More particularly, Soldano discloses a silicon photonics chip coupled to an arrayed waveguide grating (“AWG”) that includes a demultiplexer for an incoming multiwavelength optical signal and a multiplexer for outgoing optical signals. *Id.*, 9:5-12 The AWG may be coupled to detectors via grating couplers 505 and waveguides 506 of the silicon photonics chip. *Id.*, 9:52-64. In an alternative embodiment, Soldano describes that grating couplers could be replaced by

photodetectors that receive light directly from the channel wavelength waveguides of the AWG. *See* Ex. 1009, 10:10-19. The silicon photonics chip of Soldano corresponds to the claimed “carrier” of the ’301 patent. Ex. 1003, ¶ 109.

[1c] Soldano discloses a light receiving chip located on a top surface of an end of the carrier. *See* Ex. 1009, FIGS. 3, 5, 8:8-10, 8:14-20, 9:15-20; Ex. 1003, ¶ 110.

[1d] Soldano discloses in an alternative embodiment a plurality of optoelectronic diodes (505) located on the top surface of the end of the carrier. *See* Ex. 1009, FIGS. 3, 5, 8:14–20. The plurality of optoelectronic diodes (505) are electrically connected to the light receiving chip, which a POSITA would have understood could be accomplished via wire bonds. *See* Ex. 1009, 10:10-19; Ex. 1003, ¶ 111. The optoelectronic diodes (505) and the light receiving chip are located directly on the same top surface of the end of the carrier. *See* Ex. 1009, FIGS. 3, 5, 8:4-8, 8:14-28, 10:10-25; Ex. 1003, ¶ 111.

[1e] Soldano discloses an optical fiber connector (303) located in an end of the carrier. *See* Ex. 1009, FIG. 3, 7:24–32, 7:52–65; Ex. 1003, ¶ 112.

[1f] Soldano discloses an arrayed waveguide grating (302) located on a top surface of the carrier that defines a midpoint of the carrier. *See* Ex. 1009, FIG. 3, 7:65–8:1. The arrayed waveguide grating has a first end, a middle, and a second end located opposite the first end. *See* Ex. 1009, FIG. 5, 7:65. An input end of the arrayed

waveguide grating (302) is connected to the optical fiber connector (303) for receiving an optical signal from the optical fiber (306). *See* Ex. 1009, FIG. 3, 7:24–8:10. The top surface of the carrier underlies the middle of the arrayed waveguide grating (302). *See* Ex. 1009, FIGS. 3, 5, 7:24-8:10; Ex. 1003, ¶ 113.

[1g] Soldano discloses the optical signal is divided into multiple channel wavelength optical signals in parallel by the arrayed waveguide grating (302). *See* Ex. 1009, FIGS. 3-5, 7:29-8:28, 9:5-12; Ex. 1003, ¶ 114. A top surface defined by an output end of the arrayed waveguide grating (302) is at a predetermined angle (409), causing the multiple channel wavelength optical signals reflected by the top surface to a photosensitive surface of the plurality of optoelectronic diodes (505) arranged in parallel. Ex. 1009, 9:31-37, 10:10-19. The predetermined angle (409) of the top surface defined by the output end of the arrayed waveguide grating (302) redirects the optical signals from horizontal to vertical beams, which a POSITA would have understood to require an angle for the top surface in range of 41 to 46 degrees. *See* Ex. 1009, FIGS. 3, 5, 7:62-8:10, 9:31-10:25; Ex. 1003, ¶ 115.

Accordingly, a POSITA would have understood that Soldano anticipates Claim 1. Ex. 1003, ¶ 116.

Claim 2

Soldano further discloses the top surface of the end of the carrier may be defined at least in part by a circuit board. The plurality of optoelectronic diodes (505)

and the light receiving chip may be directly located on the circuit board. *See* Ex. 1009, FIGS. 3, 5, 7:24-8:28, 9:52-10:25; Ex. 1003, ¶ 117.

A POSITA therefore would have understood that Soldano anticipates Claim 2. Ex. 1003, ¶ 118.

Claim 3

Soldano discloses that the number of optoelectronic diodes (505) is equal to the number of optical paths output by the arrayed waveguide grating (302). *See* Ex. 1009, FIGS. 3, 5, 8:1–20, 8:61–9:45; Ex. 1003, ¶¶ 119-120.

Claim 4

Soldano discloses that the predetermined angle (409) of the top surface defined by the output end of the arrayed waveguide grating (302) redirects the optical signals from horizontal to vertical beams. *See* Ex. 1009, FIGS. 3, 5, 7:62-8:10, 9:31-10:25. A POSITA therefore would have Soldano understood to require an angle for the top surface of about 45 degrees. *Id.*, Ex. 1003, ¶ 121.

The '301 Patent does not ascribe criticality to having the predetermined angle (409) of the top surface of the output end of the arrayed waveguide grating (302) at 42 degrees. However, as discussed *supra*, and a POSITA would have understood selection of a 42-degree angle as preferable to reduce back reflection and also as a design choice, depending upon the optical characteristics of the material selected for the PLC and alignment of the AWG with the photodetectors. *See* Ex. 1009, FIGS. 3,

5, 7:35-37, 8:8-14; Ex. 1003, ¶ 122. A POSITA would have understood Soldano to anticipate Claim 4. Ex. 1003, ¶ 123.

Claim 5

Soldano discloses a prior art method wherein a lens is used to couple light to the AWG input by positioning a lens between the optical fiber and an input end of the AWG. *See* Ex. 1009, 7:1-5, 7:62-67. A POSITA would have understood that lenses were routinely used in optical fiber connectors to couple optical signals from optical fibers to waveguides, such as an AWG, to reduce signal loss at the time the application for the '301 patent was filed. Ex. 1003, ¶ 124.

Accordingly, a POSITA would have understood that use of a lens with the structure disclosed in Soldano would have been a simple design choice, and thus Soldano anticipates Claim 5. Ex. 1003, ¶ 125.

Claim 6

Soldano discloses the use of a lens to couple an optical signal with the input end of a waveguide. *See* Ex. 1009, 7:1-5, 7:62-67. The use of graded index lenses was known and commonly used in optical communications at the time the '301 Patent was filed, and a POSITA would have understood that using of a graded index lens to improve optical coupling between an optical fiber and the AWG was a matter of design choice. Ex. 1002, p. 126; Ex. 1003, ¶ 126.

Accordingly, a POSITA would have understood that using a graded lens in the

optical connector of Soldano would have been a simple design choice, and thus Soldano anticipates Claim 6. Ex. 1003, ¶ 127.

Claim 7

Soldano discloses all of the elements of Claim 7, and therefore anticipates Claim 7, for the same reasons as described above with respect to Claims 1 and 4. Ex. 1003, ¶¶ 128-129.

VIII. DISCRETIONARY ISSUES

A. The Petition Does Not Present the Same References Addressed during Prosecution of the '301 Patent

The Board should not deny institution under §325(d). The Board uses a two-part framework in determining whether to exercise its discretion under §325(d). *Advanced Bionics, LLC v. MED-EL Elektromedizinische*, No. IPR2019-01469, Paper 6 at 8 (P.T.A.B. Feb. 13, 2020).

The Board has held that the first prong of *Advanced Bionics* is not met where “neither [the combination references] nor similar prior art was before the examiner... the prosecution history does not include any overlapping arguments directed to this prior art.” *Godbersen-Smith Constr. Co. v. Guntert & Zimmerman Const. Div., Inc.* No. IPR2021-00050, Paper 24 at 19–21 (P.T.A.B. May 7, 2021). And in such a case, the Board “need not address part two of the analysis.” *Id.* at 21.

This Petition does not include any prior art references that were cited during the prosecution of the '301 Patent on the cases set forth herein. Shen was cited only in combination with Pezeshki, Ex.1002, pp. 242-247; the Shen provisional application was not cited or considered. Ex. 1003, ¶ 68. Soldano was cited by the Examiner but not applied in a rejection or otherwise considered. *Id.*, ¶ 75. The prior art cited herein is not cumulative of the art considered by the Examiner during prosecution.

Thus, the combination of references used in this petition cannot be cumulative of the art and/or arguments raised during prosecution as there are material differences between the grounds herein and what was previously presented. *Tianma Microelectronics Co., v. Japan Display Inc.*, IPR2021-01058, Paper 16 at 31 (P.T.A.B. Jan. 5, 2022). Because the first prong is not met, the Board need not move to the second prong. *Id.* at 21; *Oticon Med. AB v. Cochlear Ltd.*, IPR2019-00975, Paper 15 at 20 (P.T.A.B. Oct. 16, 2019).

B. The Board Should Not Deny Institution Under *Fintiv*

The claims of the '301 Patent have never been tested in view of the most relevant prior art. In view of these strong challenges and the nascent nature of the current district court proceedings, institution should not be discretionarily denied under §314(a). See *NHK Spring Co. v. Intrix-Plex Techs., Inc.*, IPR2018-00752, Paper 8 at 19-20 (P.T.A.B. Sept. 12, 2018) (precedential); *Apple v. Fintiv, Inc.*, IPR2020-

00019, Paper 11 at 13-14 (P.T.A.B. Mar. 20, 2020) (precedential).

Factor 1—potential stay of the district court litigation—is neutral because no party has requested a stay. *VMWare, Inc. v. Intellectual Ventures I LLC*, IPR2020-00470, Paper 13 at 17 (P.T.A.B. Aug. 18, 2020), (finding in the absence of a stay motion that this factor “does not weigh for or against discretionary denial”).

Factor 2—district court trial date and the Board’s statutory deadline—should be considered neutral. The trial date set for this case according to the Court’s Scheduling Order is June 8, 2026. *See* Ex. 1010, p. 2. The current trial date does not support denial. *See Dish Network v. Broadband iTV*, IPR2020- 01280, Paper 17 at 17-18 (P.T.A.B. Feb. 4, 2021).

Further, Petitions for *inter partes* review are being filed simultaneously against at least three other patents asserted in the pending District Court litigation. An institution decision is expected no later than mid-June 2025. Should the Board institute review on these patents, the likelihood that a stay is granted in the District Court proceeding will increase dramatically. Thus, this factor does not support discretionary denial.

Factor 3—investment in the district court proceedings—weighs heavily against discretionary denial. The associated district court case is still in the very early stages of litigation: discovery is still in the preliminary stages, the Defendants only recently filed their invalidity contentions, and Claim Construction is not scheduled

until April 10, 2025. Ex. 1010, p. 2. Moreover, it is unlikely that a claim construction order will issue prior to the P.T.A.B.’s projected institution decision date. Accordingly, the district court will not invest significant resources or issue substantive orders related to the challenged patent prior to the issuance of an institution decision. *See Fintiv*, IPR2020-00019, Paper 11 at 9-12. Regardless, Petitioner diligently prepared this Petition and filed well in advance of the statutory deadline, which weighs against denying institution.

Factor 4—overlap in the parallel proceedings—favors institution. Instituting trial will allow issues to be narrowed in the district court because, if instituted, Petitioner stipulates that it will not pursue invalidity against the asserted claims in the district court using the specific combination of prior art references set forth in the grounds presented in this Petition. *See Sand Revolution II LLC v. Continental Intermodal Group-Trucking LLC*, IPR2019-01393, Paper 24 at 11-12 (P.T.A.B. June 16, 2020) (holding a similar stipulation weighs against discretionary denial). Given the lack of overlap between the proceedings, this factor weighs against the Board exercising discretion to deny.

Factor 5—overlapping parties—is neutral as it is “far from an unusual circumstance that a petitioner in *inter partes* review and a defendant in a parallel district court proceeding are the same.” *Sand*, No. IPR2019-01393, Paper 24 at 12-

Factor 6—other considerations—weighs against discretionary denial. As explained, the merits of the Petition are strong, and the Challenged Claims are invalid. For example, none of the specific grounds asserted herein were previously considered by either the Office or the district courts. *Cf. Comcast Cable Commn’s, LLC v. Rovi Guides, Inc.*, IPR2019-00231, Paper 14 at 11 (P.T.A.B. May 20, 2019) (obviousness challenges not “previously considered by the Office or any court” weigh in favor of not denying institution). Accordingly, the Board should decline to exercise its discretion under *Fintiv* and institute trial.

C. The Board Should Not Deny Institution Under *General Plastic*.

The *General Plastic* factors, set forth in *Gen. Plastic Indus. Co., Ltd. v. Canon Kabushiki Kaisha*, Case IPR2016-01360 (P.T.A.B. Nov. 14, 2016) (Paper 12) do not apply because this is the first and only *inter partes* review (“IPR”) petition filed by Petitioner with respect to the ’301 Patent.

IX. CONCLUSION

Petitioner respectfully requests cancellation of the Challenged Claims.

X. MANDATORY NOTICES UNDER 37 C.F.R. §42.8

A. Real Party in Interest (37 C.F.R. §42.8(b)(1))

The real parties-in-interest are Cambridge Industries USA, Inc, which is a named defendant in the associated district court proceeding, and its parent corporation, CIG Shanghai, Co. Ltd.

B. Related Matters (37 C.F.R. §42.8(b)(2))

Pursuant to 37 C.F.R. §42.8(b)(2), Petitioner is aware of the following pending lawsuits or related matters involving the '301 Patent:

- *Applied Optoelectronics, Inc. v. Cambridge Industries USA, Inc.*
5:24-cv-01010 (N.D. Cal. filed Feb. 20, 2024)
- *Applied Optoelectronics, Inc. v. Accelight Technologies, Inc.*,
4:24-cv-09041 (N.D. Cal. filed Nov. 19, 2024)

C. Designation of Counsel (37 C.F.R. §42.8(b)(3))

Petitioner provides the following designation of counsel.

Lead Counsel	Backup Counsel
Nicola A. Pisano Reg. No. 34,408 EVERSHEDS SUTHERLAND (US) LLP 12255 Camino Real, Suite 100 San Diego, California 92130-2071 Phone: (858)252-2952 Fax: (858)794-4091 Email: nicolapisano@eversheds-sutherland.com	Regis Worley Reg. No. 58,430 EVERSHEDS SUTHERLAND (US) LLP 12255 Camino Real, Suite 100 San Diego, California 92130-2071 Phone: (858)252-2952 Fax: (858)794-4091 Email: regisworley@eversheds-sutherland.com

Pursuant to 37 C.F.R. §42.8(b)(4), counsel agrees to service by mail as detailed above, and to electronic service by email at the following addresses:

nicolapisano@eversheds-sutherland.com and regisworley@eversheds-sutherland.com.

Pursuant to 37 C.F.R. §42.10(b), a Power of Attorney executed by Petitioner accompanies this Petition.

D. Service Information (37 C.F.R. §42.8(b)(4))

Please address all correspondence and service to the addresses listed above. Petitioner consents to electronic service directed to nicolapisano@eversheds-sutherland.com, and regisworley@eversheds-sutherland.com.

Date: January 17, 2025

By: /Nicola A. Pisano/

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CLAIMS APPENDIX

Claim	Recitation
[1a]	A multi-channel parallel optical receiving device, comprising:
[1b]	a carrier;
[1c]	a light receiving chip disposed on a top surface of an end of the carrier;
[1d]	a plurality of optoelectronic diodes disposed on the top surface of the 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 top surface of the end of the carrier;
[1e]	an optical fiber connector disposed in an end of the carrier;
[1f]	an arrayed waveguide grating further disposed on a top surface of the carrier that defines a midpoint 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
[1g]	wherein the optical signal is divided into multi-channel optical signals in parallel by the arrayed waveguide grating based on their wavelengths, a 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 defined by the output end of the arrayed waveguide grating 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.

CLAIMS APPENDIX

Claim	Recitation
[2]	The multi-channel parallel optical receiving device according to claim 1, wherein the top surface of the end of the carrier is defined at least in part by a circuit board and wherein the plurality of optoelectronic diodes and the light receiving chip are directly disposed on the circuit board.
[3]	The multi-channel parallel optical receiving device according to claim 1, wherein the amount of the optoelectronic diodes is equal to the amount of optical paths divided by the arrayed waveguide grating.
[4]	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.
[5]	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.
[6]	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.
[7a]	A multi-channel parallel optical receiving device, comprising:
[7b]	a carrier;
[7c]	a light receiving chip disposed on a top surface of an end of the carrier;
[7d]	a plurality of optoelectronic diodes disposed on the top surface of the end of the carrier, and the plurality of optoelectronic diodes electrically connected to the light receiving chip via wire bonding, wherein the plurality of optoelectronic diodes and the light receiving chip are directly disposed on the same top surface of the end of the carrier;
[7e]	an optical fiber connector disposed in an end of the carrier;

[7f]	an arrayed waveguide grating further disposed on a top surface of the carrier that defines a midpoint 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;
[7g]	wherein the top surface of the carrier that defines the midpoint of the carrier underlies the middle of the arrayed waveguide grating; and
[7h]	wherein the optical signal is divided into multi-channel optical signals in parallel by the arrayed waveguide grating based on their wavelengths, a 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 defined by the output end of the arrayed waveguide grating to be reflected to a photosensitive surface of the plurality of optoelectronic diodes arranged in parallel.

CERTIFICATION UNDER 37 C.F.R. §42.24

Petitioner certifies that the word count in this Petition is 6587 words, as counted by the word-processing program (Microsoft Word for Office 365) used to generate this Petition, where such word count excludes the table of contents, table of authorities, mandatory notices, certificate of service, appendix of exhibits, and this certificate of word count. This Petition is in compliance with the 14,000-word limit set in 37 C.F.R. §42.24(a)(1)(i).

Date: January 17, 2025

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CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. §§42.6(e), 42.105, the undersigned hereby certifies that true and correct copies of the above-captioned PETITION FOR INTER PARTES REVIEW OF U.S. PATENT NO. 10,379,301, all associated exhibits, and Petitioner's Power of Attorney were served in their entireties on January 17, 2025, upon the Patent Owner at the correspondence address of record for the subject patent as listed on the USPTO's Patent Center via Priority Mail Express[®]:

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Date: January 17, 2025

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