

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

MERCEDES-BENZ USA, LLC
Petitioner,

v.

YECHEZKAL EVAN SPERO
Patent Owner.

U.S. Patent No. 10,894,503 to Spero

Case No: IPR2023-01027

PATENT OWNER'S RESPONSE TO PETITION

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Table of Authorities

Cases

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List of Exhibits

Exhibit No.	Description
2001	Declaration of Matthew A. Turk, PhD
2002	Curriculum Vitae of Matthew A. Turk, PhD
2003	Best Practices and FAQs for Filing Requests for Reexamination Compliant with 37 CFR 1.510 and 1.915, PTAB, May 2010
2004	<i>Intentionally left blank</i>
2005	<i>Intentionally left blank</i>
2006	U.S. Published Patent Application US2003/0137849A1 to Alden, Prosecution History in the U.S. Patent and Trademark Office
2007-2039	<i>Intentionally left blank</i>
2040	Second Declaration of Matthew A. Turk, PhD
2041	Transcript of Deposition of Nikolaos Papanikolopoulos, Ph.D. <i>Mercedes Benz-USA, LLC v. Yechezkal Evan Spero</i> , taken on February 23, 2024 IPR2023-01039, IPR2023-01040
2042-2049	<i>Intentionally left blank</i>
2050	Jianzhong Jiao and Ben Wang, “Etendue Concern for Automotive Headlamp Using LEDs,” SPIE Proceedings Vol. 5187, (January 2004) (Available at https://www.spiedigitallibrary.org/conference-proceedings-of-spie/5187/0000/Etendue-concerns-for-automotive-headlamps-using-white-LEDs/10.1117/12.504363.short)
2051	Michael Bass, <i>Handbook of Optics</i> 3 RD Edition Volume II, (McGraw-Hill, 2010) (Available at https://www.worldcat.org/title/555545456)
2052	Ben Wang and Jianzhong Jiao “Studies for Headlamp Optical Design Using LEDs,” SAE Technical Paper Series 2004-01-0434, (March 2004) (Available at https://www.sae.org/publications/technical-papers/content/2004-01-0434/)

Exhibit No.	Description
2053	Ben Wang and Jianzhong Jiao “Optical Transform Limitations in Headlamp Photometric Performance,” SAE Technical Paper Series 2005-01-0861, (April 2005) (Available at https://www.sae.org/publications/technical-papers/content/2005-01-0861/)
2054	Intentionally left blank.
2055	Jianzhong Jiao and Ben Wang “High-Efficiency Reflector Optics for LED Forward Lighting,” SPIE Proceedings Vol. 6670, (September 2007) (Available at https://www.spiedigitallibrary.org/conference-proceedings-of-spie/6670/66700M/High-efficiency-reflector-optics-for-LED-automotive-forward-lighting/10.1117/12.730524.short)
2056	Navigant Consulting “Energy Saving Estimates of Light Emitting Diodes in Niche Lighting Applications” Building Technologies Program Office of Energy Efficiency and Renewable Energy U.S. Department of Energy (September 2008) (Available at Energy Savings Estimates of Light Emitting Diodes in Niche Lighting Applications (Technical Report) OSTI.GOV.)
2057	Intentionally left blank
2058	Intentionally left blank
2059	Intentionally left blank
2060	Michael Bass, <i>Handbook of Optics</i> 3 RD Edition Volume V, (McGraw-Hill, 2010) (Available at https://www.worldcat.org/title/557121959 .)
2061	Texas Instruments/Digikey “How DLP Technology Works,” (Available at https://www.digikey.com/en/product-highlight/t/texas-instruments/dlp-technology .) (Accessed September 12, 2023.)
2062	Texas Instruments “Introduction to +/- 12 Degree Orthogonal Digital Micromirror Devices (DMDs) (Available at https://www.ti.com/lit/an/dlpa008b/dlpa008b.pdf?HQS=dis-dk-null-digikeymode-dsf-pf-null-wwe&DCM=yes&distId=10) (Accessed September 12, 2023.)

Exhibit No.	Description
2063	Surendra Gupte, Osama Masoud, Robert F. K. Martin, and Nikolaos P. Papanikolopoulos “Detection and Classification of Vehicles” IEEE Transactions on Intelligent Transportation Systems, Vol. 3, No. 1 (March 2002) (Available at https://ieeexplore.ieee.org/document/994794) (Accessed February 20, 2024)
2064	Intentionally left blank.
2065	Webster’s New Universal Unabridged Dictionary Deluxe 2 nd Edition excerpts, Simon and Schuster (1983)
2066	Transcript of Deposition of Nikolaos Papanikolopoulos, Ph.D. <i>Mercedes Benz-USA, LLC v. Yechezkal Evan Spero</i> , taken on March 26, 2024, IPR2023-01026, IPR2023-01027
2067	Transcript of Deposition of Nikolaos Papanikolopoulos, Ph.D. <i>Mercedes Benz-USA, LLC v. Yechezkal Evan Spero</i> , taken on March 27, 2024, IPR2023-01034

I. Introduction

Pursuant to 37 C.F.R. § 42.107, Patent Owner, Yechezkal Evan Spero (“Patent Owner”), submits the following Response (“Response”) to the Petition for *Inter Partes* Review filed by Mercedes-Benz USA, LLC (“Petitioner”) that challenges Claims 37-70 (“Challenged Claims”) of U.S. Patent No. 10,894,503 (“the ’503 Patent”).

Between the limited teachings of Alden, the limited explanation in the Petition, and the deposition testimony of Petitioner’s expert, the proposed combination of teachings from Figures 3 and 5, results in an inoperative system, absent impermissible modification. As such, Petitioner’s anticipation grounds must fail. Moreover, as shown below, additional proof defects exist for each discrete claim, underscoring the multi-faceted issues with Petitioner’s anticipation and obviousness arguments.

Accordingly, Patent Owner respectfully requests that the Board find all claims patentable, for one or more of the reasons detailed below.

II. Overview of the ’503 Patent

The ’503 Patent is directed to “a novel multi-light source approach to the design and construction of solid-state lighting fixtures (vs. solid state lamps), which is termed a ‘Digital Lighting Fixture’, due to the control of individual lighting element ‘digits’ to provide the ‘correct’ lighting solution for the situation

The diagram illustrates a vehicle 271 equipped with multiple LED lighting systems. A headlamp 270 is shown on the front left, containing a cluster of LEDs 281. A rear light assembly 272 is located at the back, featuring a cluster of LEDs 285 and individual LEDs 286, 287, 288, and 289. A side light assembly 273 is positioned on the side, containing a cluster of LEDs 290 and individual LEDs 291, 292, 293, 294, 295, 296, and 297. A top light assembly 274 is located on the roof, containing a cluster of LEDs 282 and individual LEDs 283 and 284. The vehicle 271 is shown from a perspective view, with the lighting components labeled with reference numerals and their respective LED clusters or individual LEDs labeled in red text boxes.

“The added controllability offered by breaking the total light output up into discrete (‘digital’) specifically aimable and dimmable elements which can be addressed by control electronics to effect intensity, spectrum and spatial

distribution of intensity and spectrum, yields a lighting fixture (vs. lamp) of unparalleled performance.” (Ex.1001, 11:61-67.) The ’503 Patent describes using a digital light fixture (DLF) to provide multiple functions, for example “[i]n a DLF it is possible to combine a task light having a very narrow ‘spot’ beam at the correct aiming with a general area lighting ‘flood’ beam into one fixture.” (*Id.*, 22:18-20; Ex.2040, ¶51.)

More specifically, the ’503 Patent describes methods of using a multi-LED light source to segment a field of view and deliver varied, optimized illumination to the different segments within the field of view based on the presence of a detected object therein, “covering a wide scope of applications”, including transportation. (Ex.1001, 11:18-21, 4:20-24, 50:40-41; Ex.2040, ¶52.)

In the context of headlights,

[a]dditional features can include an optional very narrow flashlight type of beam. . . Such a beam at the correct narrow aiming can continue to illuminate far ahead (in high beam) without blinding oncoming traffic. Analysis by a detector or an imaging system of the oncoming vehicles position (using its headlights for example) can be used to determine which exact aiming is the maximum allowable for any given traffic situation and road layout.

(Ex.1001, 52:58-53:2; Ex.2040, ¶53.)

Additionally, a spatially differentiated illumination pattern can be

determined to differently illuminate segments of a field of view based on the detection of an object:

Using color and pattern recognition techniques it is possible to determine what is a sign. It is then possible to provide the equivalent of “task lighting” and use the controller and properly aimed SLS to follow and illuminate distant overhead and roadside signs for a longer time, yet not blind oncoming traffic due to the narrow beam.

(Ex.1001, 53:3-8; Ex.2040, ¶54.)

The claimed invention of the '503 Patent is thus directed to multi-LED headlight systems that precisely determine anti-glaring illumination output to optimize illumination for the vehicle operator under a myriad of driving situations, whilst reducing glaring illumination for oncoming vehicles. (Ex.2040, ¶55.)

The Challenged Claims include independent claims 37, 59 and 65.

The dependent claims include additional innovative features that specify illumination strategies for a myriad of driving situations — for example, increasing illumination in a direction of the road curvature or a turn (claims 54, 60, 55, 56), and, identifying vehicles or determining the position of vehicles (claim 50). (Ex.2040, ¶55.)

III. Level of Ordinary Skill

Patent Owner does not dispute Petitioner’s proposed skill level for a person of ordinary skill in the art (“POSA”) because Dr. Turk clearly satisfies it. (Petition

at 8-9; Ex.2040, ¶¶8-22; 56-61.) PO does expressly note that during deposition for a related proceeding, Dr. Papanikolopoulos noted that even having a Master's degree might offset entirely the need for industry experience – “let's suppose that you have a master's. Some of these two years which I mention here may become one year or zero.” (Ex.2041, 82:9-11.)

IV. Claim Construction

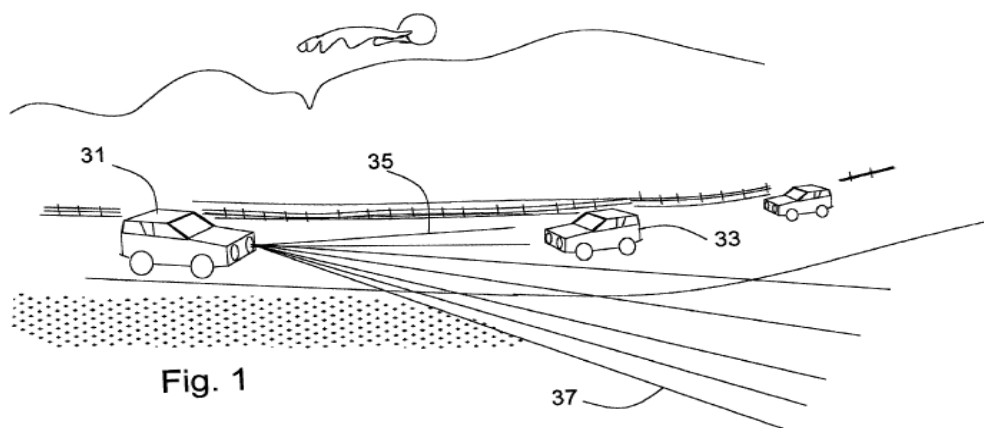
Claim terms are construed to the extent necessary to resolve the controversy. *See Wellman, Inc. v. Eastman Chem. Co.*, 642 F.3d 1355, 1361 (Fed. Cir. 2011). “[T]he words of a claim ‘are generally given their ordinary and customary meaning,’ [which] . . . is the meaning that the [words] would have to a person of ordinary skill in the art in question at the time of the invention, i.e., as of the effective filing date of the patent application.” *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312-13 (Fed. Cir. 2005) (en banc) (internal citations omitted). “The claims, of course, do not stand alone . . . [and] ‘must be read in view of the specification, of which they are a part.’” *Id.* at 1315 (quoting *Markman v. Westview Instruments, Inc.*, 52 F.3d 967, 978-979 (Fed. Cir. 1995)).

For purposes of this matter, the ordinary meaning, as supported by the specification of the '503 Patent, of the terms “identify,” “turn,” and “curve” are provided below.

V. Prior Art

A. Alden

Alden is directed to controlling the distribution of light by a vehicle headlight. Alden's various headlights produce individually controllable beam segments, each illuminating a sector of an area ("distribution area") ahead of the equipped vehicle. (Ex.1005, ¶¶[0002, 0004-0006, 0008]; Ex.2040, ¶67.)



(Ex.1005, FIGURE 1)

The systems also include sensors 51a, 51b divided into multiple sectors for detecting incoming light. (Ex.1005, ¶¶[0027-0028], Figs. 3-4.; Ex.2040, ¶68.) Central processing unit (CPU) 71 determines whether incoming light detected in each sensor sector has a threshold intensity. (*Id.*)

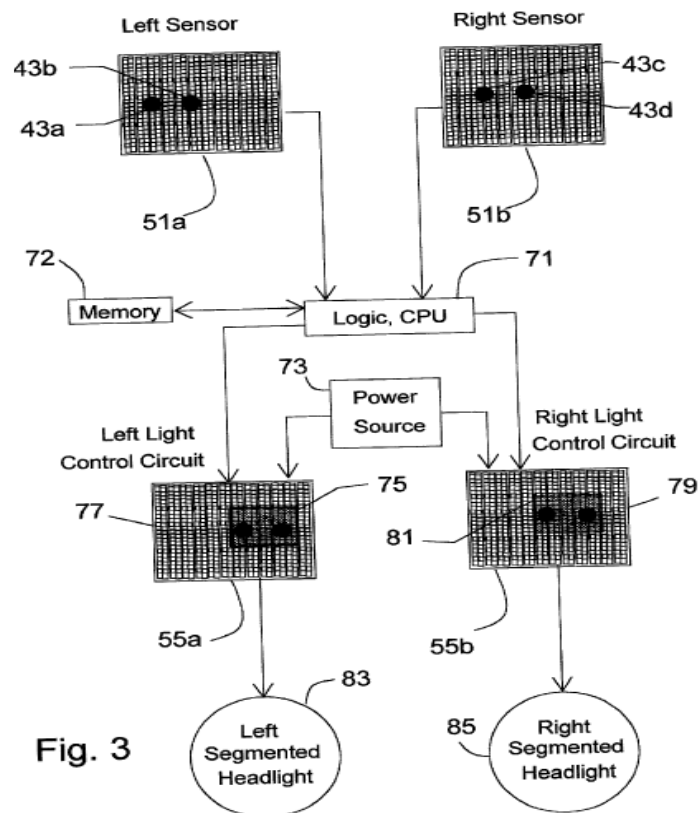
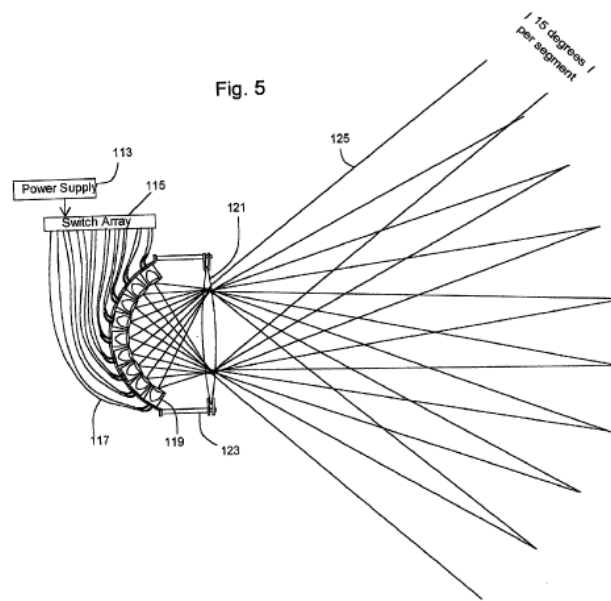


Fig. 3

(Ex.1005, FIGURE 3)

In the first of three distinct embodiments, the headlight system sets LEDs of the headlight that have a relationship to one or more distribution area sectors to a predefined low setting. (Ex.1005, ¶¶[0025-0026], [0029], Figures 1, 2, 5; Ex.2040, ¶69.) Per Figure 5, a headlight 123 employs a single-row array of light emitting diode (LED) elements 119 and a double convex lens 121. (Ex.1005, ¶[0029]; Ex.2040, ¶69.)



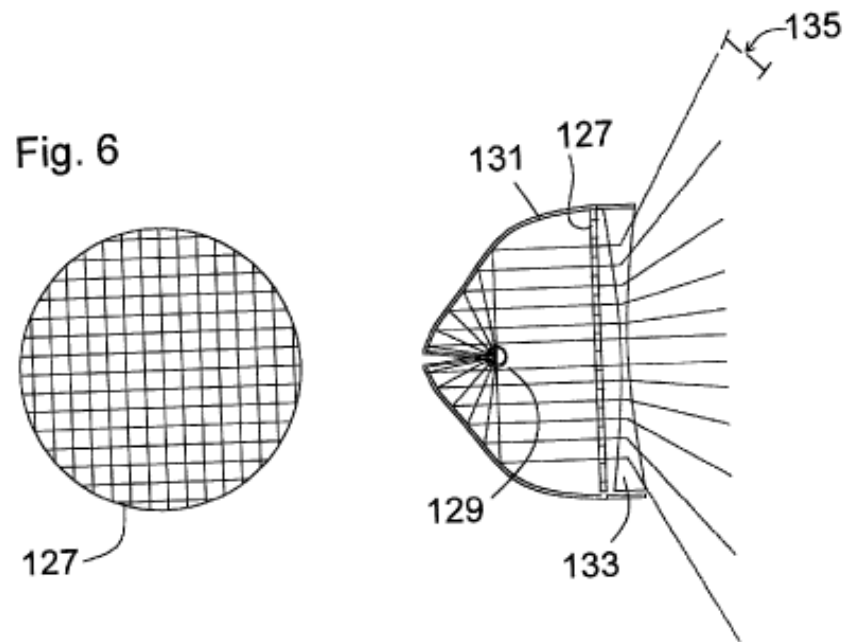
(Ex.1005, FIGURE 5)

The CPU 71 determines sensor (51a, 51b) sectors receiving incoming threshold light, and then bounds a region encompassing the detected light. (Ex.1005, ¶¶[0026-0029]; Ex.2040, ¶70.) The bounding box for each sensor is sent to a corresponding control switch array and switches encompassed by the bounding box limit power to headlamp elements (LEDs, in Figure 5) corresponding thereto. (Ex.1005, ¶[0029]; Ex.2040, ¶70.)

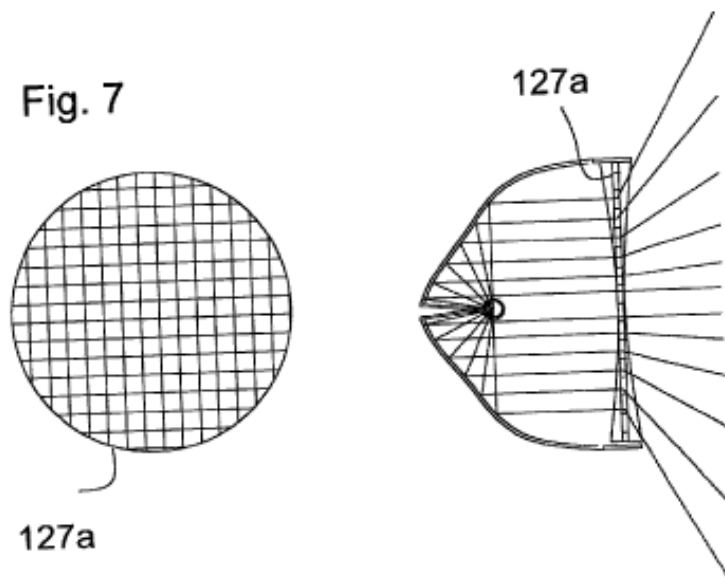
In the second embodiment, a different headlight system shown in Figures 6 and 7, employs a single light source 129 and a collimating reflector 131 to produce collimated light which may be segmented using electro-chromatic dimming elements 127 that, in conjunction with a double concave lens 133, can dim a given segment. (Ex.1005, ¶[0030-0031], Figures 6, 7; Ex.2040, ¶71.) In Fig. 7 the

electro-chromatic elements 127a are integrated within the double concave lens.

(Ex.1005, ¶[0031]; Ex.2040, ¶71 .)



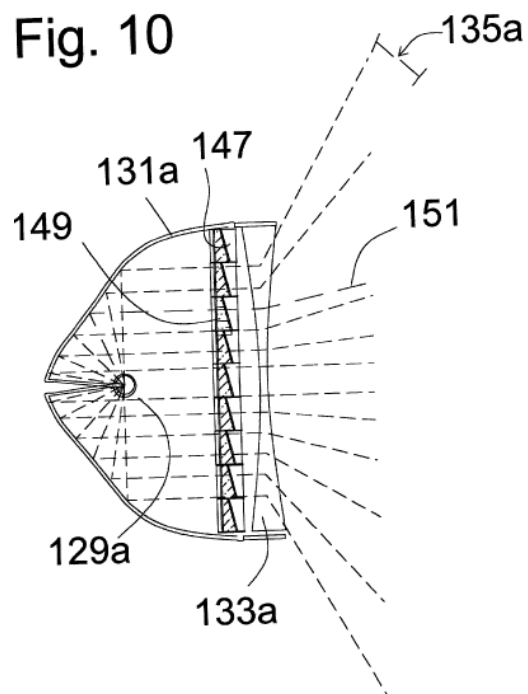
(Ex.1005, FIGURE 6)



(Ex.1005, FIGURE 7)

A third embodiment is shown in Figures 8-10, in which the headlight system

employs a single light source 129, a collimating reflector 131, and electro-optic refractive elements 147, 149 to produce multiple light beam segments. (Ex.1005, ¶¶[0032-0040]; Ex.2040, ¶72 .) The CPU 71 can control the electro-optic refractive elements 147, 149 to change the direction of beam portions passing through respective elements (*Id.*)



(Ex.1005, FIGURE 10)

In this third embodiment, the electro-optical refractive material 147, 149 comprises birefringent liquid crystals, the principles of which Alden describes as

“well known.” (Ex.1005, ¶[0033]; Ex.2040, ¶73.)¹ As seen in Figures 8 and 9, the birefringent liquid crystals can direct light in only two directions – straight and “bent” in one direction. (Ex.1005, ¶¶[0050-0052]; Ex.2040, ¶73.)

Fig. 8

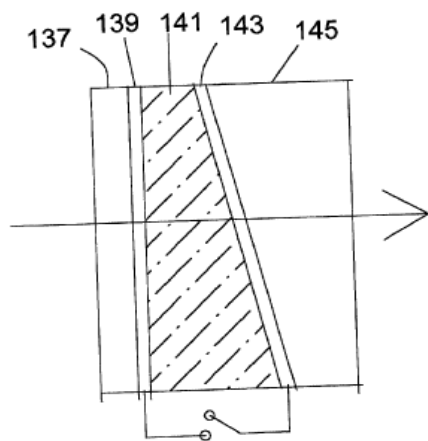
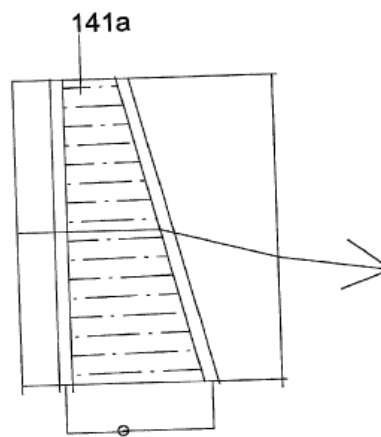


Fig. 9



(Ex.1005, FIGURES 8, 9)

Regardless of whether implemented using a multiple-LED light source as in the first embodiment or a single light source as in the second and third embodiments, all beam segments remain at high intensity unless specifically dimmed: “61 produces a high beam in a first sector 65 while concurrently producing a low beam in a second respective sector 63 (or dim beam) where the 41

¹Birefringent: “having the quality of birefringence”; Birefringence: “in optics, the power of double refraction.” (Ex.2065, 186).

is sensed. ... Thus the driver of 47 can see everything illuminated to the maximum[.]” (Ex.1005, ¶¶[0006], [0026]; Ex.2040, ¶74.) Alden further states in connection with Figure 3: “... segmented headlight 83 ... distributes high beams throughout its distribution areas except in a box in the direction of 41.”² (Ex.1005, ¶[0027]; Ex.2040, ¶74.)

Alden’s three embodiments are discrete and include features that are incompatible with each other. (Ex.2040, ¶75.) For example, the second headlight system embodiment of Figures 8-10 having electro-optical refractive material 147, 149 for changing the direction of light passing therethrough is designed to work with collimated light produced by single point light source 129 and collimating reflector 131. (Ex.1005, ¶¶[0033-0035], Figs. 8-10; Ex.2040, ¶75.) However, in the first headlight system embodiment of Figure 5, the LED elements 119 of headlight 123 produce non-collimated light. (Ex.1005, ¶[0029]; Ex.2040, ¶75.) Non-collimated light could not be directed in any meaningful fashion by electro-optical refractive material 147, 149 as shown in Figure 10. (Ex.1005, ¶¶[0033-0035].) Rather, non-collimated light would blend and have different incident angles on the electro-optical refractive material 147, 149, thereby preventing the electro-optical

² Petitioner’s expert confirmed that this is one of the objectives of Alden’s system in a related IPR proceeding deposition. (Ex.2041, 50:9-12.)

refractive material 147, 149 from performing any meaningful control of beam segments, as well as redirecting much of the non-collimated light they receive away from the desired sectors of the distribution area. (Ex.2040, ¶75) Any headlight resulting from a combination of Alden's incompatible features would therefore be incapable of meeting the basic requirements of a headlight, *i.e.*, effectively illuminating the area ahead of the equipped vehicle, let alone directing its emitted light in any meaningful fashion. (*Id.*) Indeed, rather than suggesting combinations of various features of its different headlight system embodiments, Alden only states generally that each of its headlight system embodiments may employ the sensing elements 51a, 51b discussed in connection with Figures 3 and 4. (Ex.1005, ¶¶[0044-0046]; Ex.2040, ¶75.)

Additionally, Alden's disclosure is theoretical in nature. The disclosure broadly describes certain features of headlight systems and the general functions such features and systems would desirably provide but lacks detailed explanations as to how those features and systems are practically implemented or how those functions are realized. (Ex.2040, ¶77-94.)³ Further a POSA would not have been

³Notably, Alden contacted Gentex Corporation, an automotive industry supplier, regarding his segmented headlight system and was informed that Gentex's technical staff had determined the system to be "futuristic" and likely

motivated to combine different embodiments of Alden. (Ex.2040, ¶95-100.)

VI. The Strict Contours of Anticipation

“A patent claim is invalid as anticipated only if each and every element of the claim is expressly or inherently disclosed in a single prior art reference.” *Guangdong Alison Hi-Tech Co. v. Int’l Trade Comm’n*, 936 F.3d 1353, 1363–64 (Fed. Cir. 2019) (citing 35 U.S.C. § 102 (2006) and *SRI Int’l, Inc. v. Internet Sec. Sys., Inc.*, 511 F.3d 1186, 1192 (Fed. Cir. 2008)). In that regard, “[p]rior art that must be modified to meet the disputed claim limitation does not anticipate the claim ... Such modifications are permissible only in an obviousness analysis.” *Apple Inc. v. Corephotonics, Ltd.*, 861 F. App’x 443, 450 (Fed. Cir. 2021) . Similarly, “inoperative embodiments cannot be anticipatory.” *Id.* at 451.

Inherency requires a basis and/or technical reasoning to support a determination that an allegedly inherent characteristic necessarily flows from the applied reference's teaching. *See Ex parte Levy*, 17 USPQ.2d 1461, 1464 (Bd. Pat. App. & Inter. 1990). That a certain result or characteristic may occur or be present is insufficient to establish inherency. *See In re Rijckaert*, 9 F.3d 1531, 1534 (Fed. Cir. 1993).

To anticipate, the prior art disclosure must also be enabling. “A prior art

“years away from any practical use.” (Ex.2006, 39; Ex.2040, ¶78.)

reference anticipates a patent's claim ... 'when the four corners of [that] ... document describe every element of the claimed invention, either expressly or inherently, such that a [PHOSITA] could practice the invention without undue experimentation.'" *VirnetX Inc. v. Apple Inc.*, 665 Fed. App'x 880, 885 (Fed. Cir. 2016).

The interconnection between enablement and anticipation was further explained by the Supreme Court in *Seymour v. Osborne*: to "anticipate," the identical subject matter must not only be previously known, but the knowledge must be sufficient to "enable those skilled in the art or science to understand the nature and operation of the invention, and carry it into practice use." *Seymour v. Osborne*, 11 Wall. 516, 78 U.S. 516, 20 L.Ed. 33 (1870) ("to support such a defen[se], must be an account of complete and operative invention capable of being put into practical operation.") *Id.* at 555

In addition, "it is not enough that the prior art reference . . . includes multiple, distinct teachings that [an ordinary] artisan might somehow combine to achieve the claimed invention." *Net MoneyIN, Inc. v. VeriSign, Inc.*, 545 F.3d 1359, 1371 (Fed. Cir. 2008). Instead, the reference must "clearly and unequivocally disclose the claimed [invention] or direct those skilled in the art to the [invention] without any need for picking, choosing, and combining various disclosures not directly related to each other by the teachings of the cited

reference.” *Id.* (quoting *In re Arkley*, 455 F.2d 586, 587 (CCPA 1972) (emphasis in original)). Thus, anticipation cannot be proven merely by “multiple, distinct teachings in a single prior art document that the artisan might somehow combine to achieve the claimed invention.” *Microsoft Corp. v. Biscotti, Inc.*, 878 F.3d 1052, 1069 (Fed. Cir. 2017) (emphasis added). Instead, a reference may anticipate only if a POSA “reading the reference, would at once envisage the claimed arrangement or combination.” *Id.* at 1068 (emphasis added).

Because the Petition does not advance inherency arguments or supply the attendant proofs, Petitioner is limited to arguments related to the express teachings of Alden. Moreover, for any Petition arguments explained exclusively in the context of Figure 5, Petitioner’s arguments are equally limited to that embodiment. For such arguments, relied-upon teachings must be: 1) enabled within the four corners of Alden to function as taught, per *Corephotonics*; as well as 2) enable the claims to which they apply per *Seymour*, 78 U.S. at 555; and 3) not rely on inoperative embodiments that require modification to function per *Corephotonics*.

VII. Absent impermissible modification, the Petition proofs are deficient, by Petitioner’s own admission

A. Petitioner’s proofs fall outside the strict contours of an anticipation challenge

Petitioner’s anticipation proofs must thus establish that the “four corners” of Alden “describe[s] every element of the claimed invention either expressly or

inherently.” *VirnetX Inc. v. Apple Inc.*, 665 Fed. App'x 880, 885 (Fed. Cir. 2016) However, Petitioner’s application of Alden, specifically the seminal Figure 5 LED embodiment, strays beyond the “four corners” of that reference. Though the Petition takes definitive positions on how the Figure 5 embodiment operates — including color coding beam segments to explain their functionality and specifying the location of a vehicle in the beam pattern—the deposition of Dr. Papanikolopoulos establishes that Petitioner’s proofs are predicated on speculation and/or the need to modify Alden. (Ex.2040, ¶¶79-90, 135-142.)

As a starting point, Petitioner’s contentions and those statements in the Institution Decision (“DI”) regarding the general and broad functionality of the Figure 5 system, assume two-dimensional control, though Alden lacks express details needed to implement such functionality, absent modification. (Petition, 13-15; DI, 10-11; Ex.2040, ¶139.)

Regarding the Figure 5 LED first embodiment, Alden merely describes a row of LEDs positioned along the focal point of a lens. (Ex.1005, ¶[0029]; Ex.2040, ¶140.) Alden never mentions any additional rows/columns of LEDs above or below the single row of LEDs shown in Figure 5, let alone any positioning of such rows. (Ex.1005, ¶[0029]; Ex.2040, ¶140.) Alden’s depiction of the row of LEDs being positioned along the focal point of the lens undermines a conclusion that the Figure 5 LED embodiment expressly discloses a two-

dimensional array; at a minimum, a POSA would conclude that additional rows, above or below, would still be “positioned along the focal point.” (Ex.2040, ¶140.) When asked about this, Dr. Papanikolopoulos explained a variety of configurations and placements of LEDs, none of which are expressly taught in Alden. (Ex.2066, 35:10-13, 47:7-11; Ex.2040, ¶140.) That is in addition to his prior testimony, where he could only posit that there were “many variations” of possible placement of rows. (Ex.2041, 119:9-22.)

Indeed, in his first deposition in a related proceeding, Petitioner’s expert unequivocally and repeatedly made it clear that: 1) Alden’s Figure 5 embodiment is a “high-end schematic”; 2) Alden lacks specific details on how the sensing and control elements of Figure 3 inform the operation of the Figure 5 embodiment; 3) Figure 5 requires “speculation because . . .there are a lot of [missing] parameters which ... come into play: How many LEDs? What is the angle, the curvature”; and 4) these missing parameters constrain the expert’s ability to determine the Figure 5 beam shape, number of LED rows, placement of LED rows, etc. (Ex.2041, 56:25-57:3; 108:11-109:5, 112:19-113:3; Ex.2040, ¶141.) By way of example, Petitioner’s expert indicated that it is “*not clear*” and could not explain how the switch array shown in Figure 3 controls the LED array shown in Figure 5 to create the beam spread illustrated therein:

Q. Okay. So does the figure 3 description affect the total beam spread of the figure 5 embodiment?

A. The figure 3 can inform. But, again, this is a **concept**. So if you look at the number of rows on 77 and 79, it's not clear how many. Assuming that each element controls one LED, **it's not clear and I cannot count here.**

* * *

A. In figure 3. It's a reference as an array matrix. In other words, there are rows and columns. So here basically the disclosure is that each one of these controls one LED. And this is what the POSITA would understand at that time. So **it doesn't give me any information how many rows, how many columns we have. It's a concept diagram. There are no dimensions, no scale.**

(Ex.2041, 108:11-18; 108:23-109:1-5, emphasis added.)

Complicating the issue, in his first and second depositions, Petitioner's expert identified, for the first time, at least three modifications that would be required of the Figure 5 express teachings. (Ex.2040, ¶142.) A first modification involves the number of LEDs to "reach the lumen output required":

Q: [Y]ou're citing to the '503 patent, does this help explain the teachings in Alden?

A: No. So what I'm trying to say that **in order to reach the lumen output required, basically you need to have more than what basically we have here in this demonstrative or illustrative figure.**

So going back to your question, you may have in the next row below an LED or you may have an expanded row with more LEDs....

Q: Are you saying you might need more LEDs and more refractive elements just to provide sufficient lighting for this functionality that you're trying to achieve?

A: No, what I'm trying to say is actually this Figure 5 for a POSITA will have meant that **this is only one slice of the tons of LEDs that you need, number of LEDs that you need in order to have this – basically this segmented headlight system....**

(Ex.2066, 99:11-100:5.)

Second, Petitioner's expert modified the arrangement of LEDs, by stating that the Figure 5 embodiment "will be multiple -- so think of stacks of this section that are going to form the -- basically, the array of LED elements that corresponds to this control switch which is shown in Figure 3, the element 77 and 79." (Ex.2041, 115:21-116:6; Ex.2040, ¶143.)

Finally, Dr Papanikolopoulos, testified that, "slice to slice," the LED placement would be adjusted "closer to or further from the lens" to "capitalize on the focal point":

Q: [I]f it's a very clear teaching, can you explain what the shape of this lighting structure is that's described with reference to Figure 5, as a shape?

A: ... what is very clear here is that this is not – the LEDs **are not on a flat surface**.... as basically we move from slice to slice, the LEDs are placed closer to the lens or further away in order to capitalize on this focal point....

Q: [A]re you saying the slices of LEDs or rows of LEDs have different numbers of LEDs, different shapes?

A: ... the disclosure informs the POSITA, place the LEDs in a way that you maximize the collaboration, the cooperation between the LED elements and the lens, **which means that as you get different slices, you may want to place them closer to the lens or further away from the lens.**

(Ex.2066, 47:1-19.)

Problematically, because Petitioner never identified any of these modifications in their Petition and further never explained why a POSITA would “at once envisage” these modifications to achieve the claimed segmented headlight system, Petitioner’s proofs are fatally defective. *See Microsoft Corp. v. Biscotti, Inc.*, 878 F.3d at 1069, quoting *Kennametal, Inc. v. Ingersoll Cutting Tool Co.*, 780 F.3d 1376, 1381 (Fed. Cir. 2015). (Ex.2040, ¶145.) “‘Prior art that must be modified to meet the disputed claim limitation does not anticipate the claim.’ ... Such modifications are permissible only in an obviousness analysis.” *Corephotonics*, 861 F. App’x at 450 quoting *Enplas Display Device Corp. v. Seoul Semiconductor Co.*, 909 F.3d 398, 405 (Fed. Cir. 2008). To the extent Petitioner

understood such modifications to be “inherent” or relied on such modifications for any proofs, Petitioner’s failure to identify any such positions, leaves Petitioner’s proofs limited to that which Alden expressly says or shows. For example, even if the Board is correct that Alden is enabled because a “skilled artisan would recognize that a headlamp intended to produce a pattern similar to that reflected in the control circuits of Figure 3 would include additional rows of LEDs passing through the center of the lens” or that the POSA would “understand that the sensor and/or control circuitry would need to be tailored to such an arrangement,” Petitioner never presented either position and thus cannot rely on an unstated argument for its proofs. (DI, 11-12.)

B. Per Petitioner’s expert testimony, absent modification, Petitioner’s Figure 5 proofs result in an inoperative headlamp

Compounding the defects, Petitioner’s proofs rely on a Figure 5 embodiment (as part of its combination of Figures 3 and 5) that, by their own admission, is inoperative absent modification: “in order to reach **the lumen output required**, basically you need to have more than what basically we have here in this demonstrative or illustrative figure.” (Ex.2066, 99:11-16⁴; Ex.2040, ¶148.) Thus, per Petitioner’s expert, to create an operative “segmented headlight system” and

⁴ Emphasis added by Patent Owner unless indicated otherwise.

“to reach the lumen output required,” the Figure 5 embodiment **requires** modification to have more LEDs “than what basically we have here in this demonstrative figure.”. (Ex.2066, 99:13-100:5.) As the Federal Circuit held in *Corephotonics*, “inoperative embodiments cannot be anticipatory.” *Corephotonics*, 861 Fed. App’x at 451, citing *In re Dowty*, 118 F.2d 363, 366 (CCPA 1941) (“an inoperative prior art device may not be relied upon as an anticipation.”), quoting *In Re Kehl*, 101 F.2d 193, 195 (CCPA 1939). In *Corephotonics*, inoperability arose from an error in the reference such that two lenses occupied the same space; this holding is at least equally compelling here, where the reference simply fails to provide the requisite number of LEDs for an operative headlamp. *Id.*, at 450.

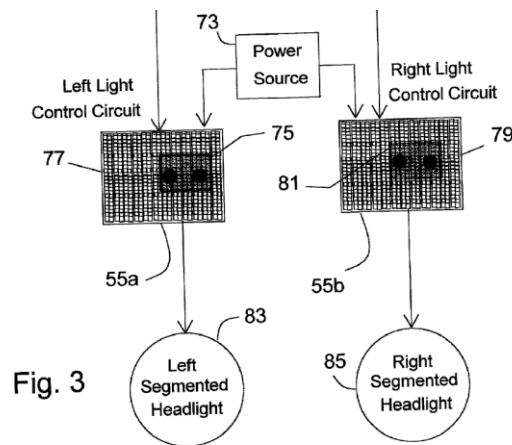
A similar functional defect arises with how each of the nine LEDs shown in the Figure 5 embodiment are powered by the switch arrays disclosed in Figure 3. Petitioner explains, that “the individual lighting elements ... in Figure 5 ... are controlled by a ‘switch array,’ with each switch being ‘controlled by the CPU and logic previously described. For example the power to 119 is controlled by the CPU which dictates its respective switch characteristics at 115” (Petition, 41, citing Ex.1005, ¶[0029].) Given Alden’s requirement that each LED be controlled by “**a corresponding switch**” — which Dr Papanikolopoulos repeatedly confirmed in his deposition — Petitioner’s proofs necessarily require modification to ensure that each LED is correctly powered per Alden’s teachings. (Ex.1005, ¶[0029]; Ex.2040,

¶149.) Since there are 576 switches in the Figure 3 switch array and nine LEDs in the Figure 5 LED array as shown, absent some unspecified modification, it is unclear what switch or switches would be “a corresponding switch” to each LED as required by Alden. (Ex.1005, ¶[0029].) If each switch independently provided power to the LED, and the array was evenly mapped, for example, then each LED would receive power from 64 switches and have control attempted, via power provision, by 64 different switches. (Ex.2040, ¶149.)

“The 55a [switch array] **controls the power flow from 73 [power source] to a left segmented headlight ...**”. (Ex.1005, ¶[0027].) The overlap of the bounding box (dimmed area) with a switch, causes that switch to control power differently. Assuming a simple mapping, if a multitude of switches were mapped to a single LED, then unless the bounding box overlapped **all** those switches, at least one switch would still permit high-beam power to the LED — which means the LED would not be powered to the low state dictated by the low power switch(es). (Ex.2040, ¶150.)

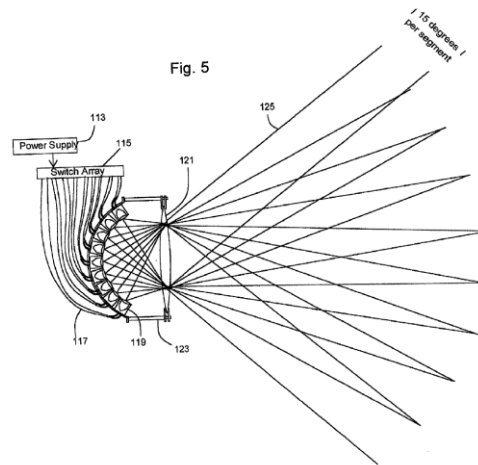
This would confound the purpose of both Alden and the claims. (Ex.2040, ¶149.) That is, if the array shown in Fig. 3 were used to control the switches shown in Fig. 5, wherein “columns” of the array were mapped to LEDs of Fig. 5, then the pattern shown in Fig. 3 would not actually turn a single LED to the “low beam” state because each column has numerous switches that would still instruct “high

beam” power to the LED. (Ex.2040, ¶151.)



(Ex.1005, FIGURE 3)

Fig 3 depicting a switch array with enabled switches in each column.
(Ex.2040, ¶151.)



(Ex.1005, FIGURE 5)

Figure 5 depicting a linear array that would require columnar blanking. (Ex.2040, ¶151.)

Thus, while there may be operative versions of the combination that could

have been proposed, the specific combination of the Figure 3 switch array **as shown** and the Figure 5 LEDs **as shown — and relied on by Petitioner —** would not result in the dimming of light from any LEDs. (Ex.2040, ¶152.) As in *Corephotonics*, the dimming issue must be fixed for the relied-upon embodiment to simply function, let alone to function as claimed. *Corephotonics*, 861 F. App’x at 451. Because Petitioner’s proofs all rely on an embodiment (a combination of Figures 3 and 5 as shown), that necessarily needs modification to be operative, the proofs impermissibly and fatally rely on an inoperative embodiment and, under *Corephotonics*, all such proofs must fail. (“Although Apple is correct that the EX2-LN2 embodiment meets the numerical requirements of the claims absent modification, the problem is that the relied upon embodiment is inoperative unless the overlap between lenses L4 and L5 is fixed. Under our precedent, such inoperative embodiments cannot be anticipatory.”) (*Id.*, citations omitted).

1. All belated attempts to revise Petitioner’s anticipation proofs should be declined consideration

Petitioner bears the burden of supplying a *prima facie* case of unpatentability in the Petition. Any belated effort by Petitioner to modify their underlying anticipation theory post-institution is impermissible gap filling. Per the holding in *Colas Sols., Inc. v. Blacklidge Emulsions, Inc.*, 759 F. App’x 986, 989 (Fed. Cir. 2019), Petitioner is not permitted an opportunity to modify their unpatentability

theory, after Patent Owner identifies flaws with the original presentation. In *Colas Sols*, the Board found petitioner’s overlapping ranges theory to be new and untimely because the petitioner could not identify “a single line of its original Petition articulating this theory.” The Federal Circuit agreed, explaining that “[the petitioner’s] belated attempt to stretch [the] evidence to fit its alternative ‘overlapping ranges’ theory only underscores that this theory was an afterthought raised for the first time in its Reply,” making it untimely. *Id.* See also *Henny Penny Corp. v. Frymaster LLC*, 938 F.3d 1324 (Fed. Cir. 2019) and *Intelligent Bio-Sys., Inc. v. Illumina Cambridge Ltd.*, 821 F.3d 1359, 1369-70 (Fed. Cir. 2016), where the Board and Federal Circuit found a new reply argument modifying the underlying unpatentability theory to be belated and declined to consider it. Accordingly, any attempt by Petitioner to belatedly gap fill its original anticipation theory is impermissible.

VIII. Ground 1: Alden Fails to anticipate at least certain limitations of claims 37-44, 47, 50-56, 58-59, 60-62, 64-65 and 70

A. Independent Claim 37

- 1. 37[C]: one or more sensors configured to obtain and provide sensor data, at least a portion of the sensor data indicating a second vehicle within the field-of-view;**

Regarding 37[C], Petitioner states: Alden discloses... [that] the sensor data comprises detection of ‘illuminated spot[s]’ ‘fall[ing] upon a photon detector array

which otherwise doesn't receive significant light.” (Petition, 17.) Then, per Petitioner, “[t]he logic of Alden’s system interprets this data as headlights of an oncoming vehicle, and Alden’s CPU selects portions of the segmented headlight system to dim based on this data.” (*Id.*, 17-18.) Thus, Petitioner contends that Alden: 1) detects light (“illuminated spots”); and 2) determines that detected light corresponds to the headlights of an oncoming vehicle. (Ex.2040, ¶153.)

2. **37[E]: *such that a headlight beam . . . illuminates a first subsection of the field-of-view including at least a portion of the second vehicle with an illuminance below a predefined threshold value, while the beam substantially illuminates at least the one or more second subsections of the field-of-view to either side of the first subsection with an illuminance above the predefined threshold value***

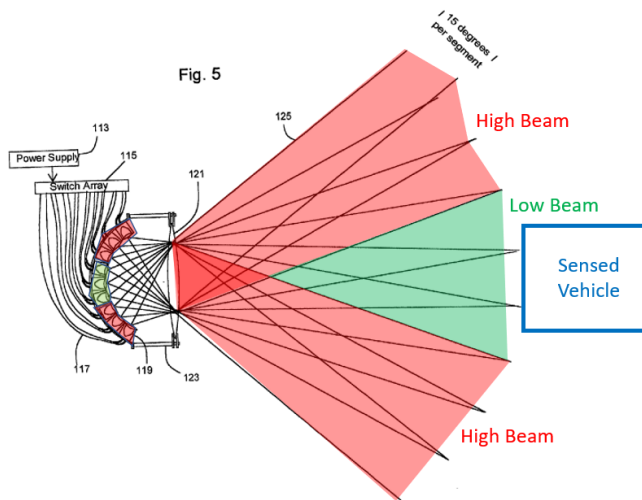
- a. **Alden alone (anticipation)**

For 37[E], Petitioner expressly relies on only two levels of predefined output – i.e., low or high. “[I]ntensities in between high beam and low beam (e.g., medium) are a ‘predefined threshold value’ **which the low beam would be below and the high beam would be above.**” (Petition, 24-25, FN8.) That is, the full range of intervening intensities possible constitute the “predefined threshold value” with the low serving as the lower threshold boundary and the high as the higher threshold boundary; but only low and high are **actually used** for 37[E]. (Ex.2040, ¶155.)

Petitioner then states “the low beam’s intensity would need to be below a particular threshold – e.g., below a level such that the ‘driver of 41 sees only a dim or low beam light from 47.’” (Petition, 25.) Accordingly, if this is true, then there must be virtually no overlap between Alden’s beams, otherwise at certain locations, for example, where beams of “low beam” light overlapped, there would be increased (above low beam) light in those locations, because of the additive nature of light. (Ex.2040, ¶156.) These overlapping light locations would also be above the low beam level, and thus definitionally no longer below the proffered “threshold,” which was, as noted above, all ranges of illumination between low and high.

This is relevant because Petitioner relies on Figure 5 to prove illumination “*to either side of the first subsection*,” but portions of the beams created by the lamp create substantial overlap in the portions shown. (Petition, 32.) Even if the “first subsection” is the green region, it is unclear where that subsection is *only* illuminated with low beam light, and not additive overlap. The light from each of those three beams shown expands as it travels further from the vehicle, and so, for example, the outer two green beams would experience at least some additive overlap from both the adjacent high beam illumination “above” or “below” the green triangle, as well as additive overlap from the central beam. Because Petitioner describes the “threshold” as the “**range of intensities between** the high

beam and low beam state,” any illumination above low beam is not “below” the threshold offered by Petitioner. (Petition, 24-25.)



(Petition, 24 citing Ex.1005, Fig. 5 (annotated))

Given the additive light overlap that would result, it is not possible to conclude, for example, that the region shown for the proof is “substantially illuminated ... **below** a ... threshold value” over the entire region colored in green. If there is a lesser, more central portion that meets the limitation, then the sections “to either side” of that portion would not be “**above** the ... threshold value,” they would simply be above the low beam state and **within** the “range” that Petitioner defined as “the threshold.” (Petition, 22, 25.)

Because Petitioner chose to use Figure 5 without regard to light overlapping, because Petitioner chose two discrete levels of emission for its proof, and because Petitioner chose to define **everything** between those two discrete levels as the

“threshold value,” the proof lacks a definitive showing of “*a headlight beam adapted to the pattern [that] substantially illuminates a first subsection of the field-of-view including at least a portion of the second vehicle with an illuminance below a predefined threshold value, while the beam substantially illuminates at least the one or more second subsections of the field-of-view to either side of the first subsection with an illuminance above the predefined threshold value[.]*”

Patent Owner asked Dr. Papanikolopoulos in depositions in other proceedings, IPR2023-01039 and IPR2023-01040, about the figure and the beams and could not obtain a suitable explanation usable for an anticipation argument:

Q: [B]ack to the figure 5 embodiment. Do these beams overlap? Do each segment overlap?

A: From this diagram – I will only **speculate** from this diagram.

(Ex.2041, 110:20-25, emphasis added.)

Q: Okay. So in your opinion, do the beams overlap?

A: Again, I don’t want to speculate on this one because I don’t have the exact distance between the LEDs, the placement of the LEDs, the angle, the curvature associated with the curve that we see here.

Q: So in the scenario when there's not any vehicles present – so this is not a dim condition – would the beams – the output beams in the figure 5 embodiment overlap?

A: I think my answer, again, would be speculation because the issue there is not so much as I mentioned earlier, there are a lot of parameters which – there are several parameters that come into play: How many LEDs? What is the angle, the curvature of the – and then the existence or nonexistence of a vehicle or vehicles.”

(*Id.*, 111:2-8, 112:19-113:4, emphasis added.)

In short, Petitioner's expert could never satisfactorily answer what the beam pattern looked like, whether the beams overlapped, or generally provide any useful information beyond what was stated in the Petition. It is unclear from this testimony how Petitioner can rely on Figure 5 as showing anything about how its beams form the illumination claimed in 37[E], when its own expert raises fundamental questions. Because Petitioner has chosen to rely on Figure 5 as shown, and either cannot or will not describe things like beam overlap, that proof suffers from the noted defects.

Patent Owner also notes that Petitioner appears to choose a range of values for the “predefined threshold value,” contending “[t]hese intensities in between high beam and low beam (*e.g.*, medium) are a “predefined threshold value” which the low beam would be below and the high beam would be above.” (Petition, 25.)

That also fails to map to the claims, which recite a singular “predefined threshold value.” (*Id.*, 22.)

b. Alden+Stam

Petitioner also attempts to incorporate Stam in its combination, contending that Stam’s alleged teaching of 0.1 foot candles (fc) of incident illuminance would have required nothing more than “setting a predetermined illuminance level” to control the amount of glare experienced. (Petition, 26.) Stam discusses a few dimming options under specific circumstances that avoid creating illuminance of 0.1 fc incident on vehicles at the respective angles noted in Stam. (Ex.1010, 1:20-2:5; Ex.2040, ¶164.) Contrary to its assertions, Petitioner’s Stam citations fail to support the notion of “setting” a “predefined *threshold value*,” and using that as a benchmark to “set[] the illuminance of low and high beams[.]” (Petition, 26.) Rather, Stam says that “in order to avoid an illuminance of 0.1 foot candles (fc) incident on another vehicle.... the vehicle headlamps should be dimmed” at certain prespecified ranges based on relative positioning of the other vehicle. (Ex.1010, 1:25-26.) At no point in the cited portions does Stam ever mention “setting” the “0.1 fc” as an illuminance *threshold value* or using a *predefined threshold value* “in setting the illuminance of low and high beam.” (Petition, 26; Ex.2040, ¶164.) At best, Stam appears to be discussing a few parameters of a specific control strategy dictating *when* dimming control should occur to avoid creating incident

illuminance of “0.1” fc on another vehicle. (Ex.2040, ¶164.) Thus, the relied-on Stam disclosure fails to establish the creation of a predefined illuminance threshold value, which is then used to set different illuminance levels for different sections of a field-of-view. (Ex.2040, ¶164.)

Petitioner simply says “[i]t would have been obvious to use such a predefined illuminance threshold value, such as 0.1 foot candles, in the system of Alden. (Nikos Decl., ¶71.)” (Petition, 26.) Per Petitioner, “[i]ncluding such a threshold level would have required nothing more than setting a predetermined illuminance level to ‘control the amount of glare experienced by drivers’ as taught by Stam.” (Petition, 26, emphasis added.) There is no cited teaching of Stam about “setting a predetermined illuminance level,” so this proposed combination is combining a teaching that simply has not been shown to exist in Stam. (Ex.2040, ¶165.)

Petitioner also says: “[i]n particular, the controllers in Stam would be able to apply appropriate power to the lighting elements for sectors of the headlight distribution area.” (Petition, 27.) That appears to be a physical modification importing a literal controller of Stam, but that combination is never explained and the assertion is entirely unsupported. The prior statements were “including such a threshold would have required nothing more than setting a predetermined illuminance level” and “using a predefined threshold as taught by Stam would be

an easy, known way.” (Petition, 26-27.) None of these statements motivate use or explain use of one of Stam’s “controllers.” Further, the statement itself does not specifically reference a teaching of Stam about “controllers,” so it is unclear what Petitioner even considered to be the “controllers” of Stam, in this context.

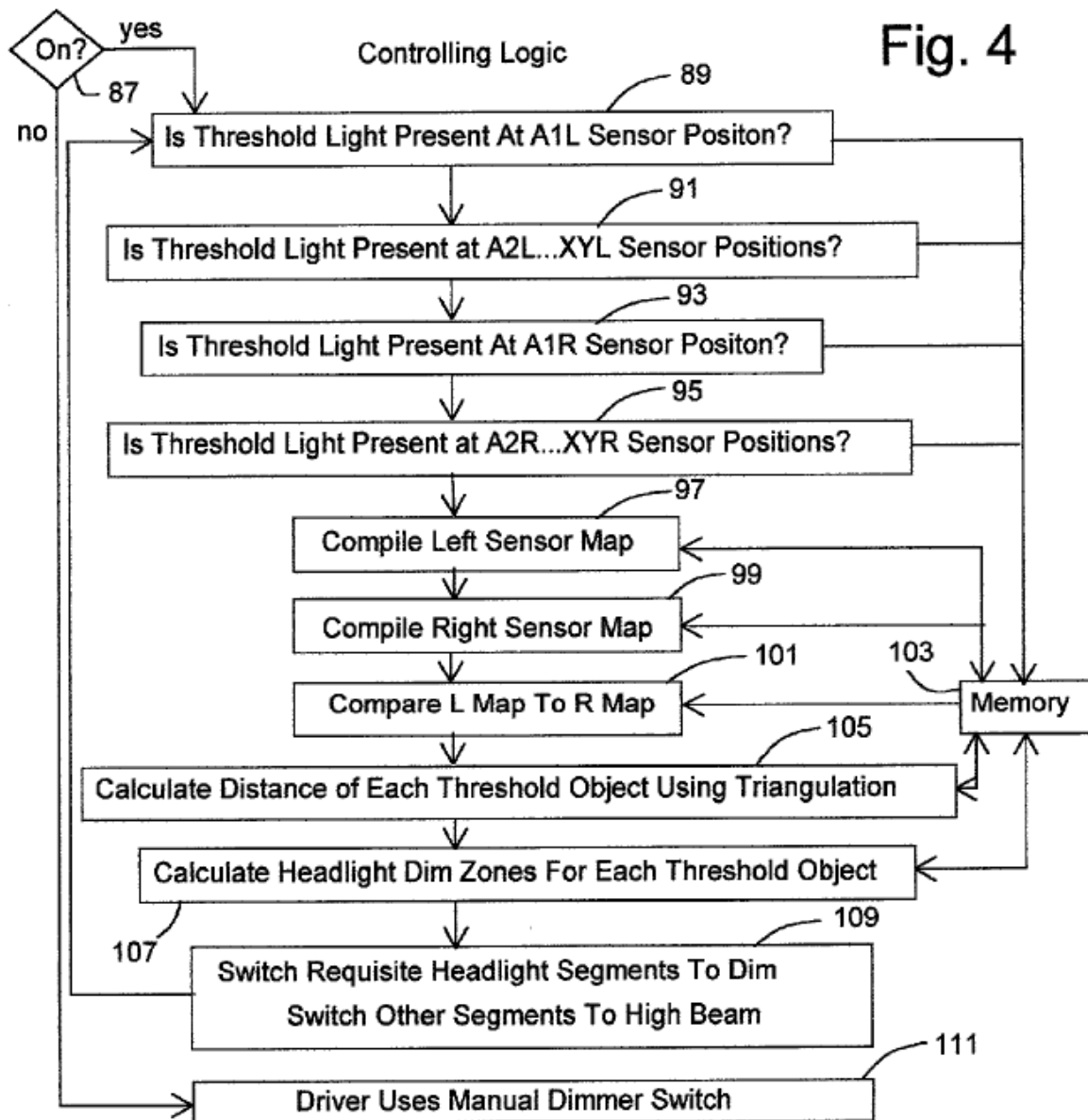
Accordingly, Petitioner’s Alden/Stam combination for the “predefined threshold value” element fails, as it fails to rely on an actual teaching of Stam that uses a predefined threshold value in the manner claimed (or ~~use~~ the noted 0.1 fc value in any manner at all), and it fails to motivate any combination of Stam using Stam’s controllers.

B. Independent Claim 59

1. ***59[D]: wherein the at least one processor is configured to: determine light output . . . the illumination aimed at the first subsection substantially resulting in light below a first predefined illuminance in the first subsection, and that aims illumination at one or more second subsections of the field of view to either side of the first subsection, the illumination aimed at the one or more second subsections substantially resulting in light above the first predefined illuminance in the one or more second subsections;***

This claim calls for the processor to “determine light output for the headlight,” among other things. (Petition, 32.) According to Petitioner, “Alden’s CPU determines light output for the lighting elements of its system . . .” (*Id.*) This is not a function of Alden’s processor.

Figure 4 of Alden shows Alden's control logic.



(Ex.1005, Figure 4)

Once the processor has “calculate[d] [the] dim zones” (Step 107) – i.e., determined the subsections as per Petitioner’s proof for limitation 59[C], the only

step remaining is to “switch requisite headlight segments to dim/switch other segments to high beam.” (Ex.1005, Fig. 4, ¶[0028].) That is an automatic step of applying predefined light output and does not involve the processor determining any light output. (Ex.2040, ¶172.) Nothing in Alden establishes how or where “Alden’s CPU **determines light output** for the lighting elements of its system...” (Petition, 32.) The system quite literally just “switches” the determined sector to the single, predefined low value. Moreover, the next step of claim 59 calls for the processor to “*instruct adjustment of one or more of the light sources to achieve the determined output*” (Petition, 33 59[E]), so to the extent that Petitioner is considering relying on the application of Alden’s predefined levels to demonstrate element 59[E], the argument fails, as the *determined output* is something that must have been determined, by the processor, **before** step 59[E]. (Ex.2040, ¶172.) Because Alden lacks any “determination” of “light output,” the proof for claim 59 fails.

Further, as with “predefined threshold value,” from claim 37, presentation of a “range of intensities” as a “predefined illuminance” does not show anticipation when giving the term its ordinary meaning. (*Supra* XIV.A.2.a. and b.) The proposal to modify Alden with Stam also similarly fails for at least the reasons noted above with respect to the combination. (*Supra* XIV.A.2.b.)

C. Independent Claim 65

1. ***65[B]: determining illumination . . . including determining an illumination level for the first subsection that substantially illuminates the first subsection below a predefined illuminance, and determining an illumination level for the one or more second subsections that substantially illuminates the one or more second subsections above the predefined illuminance;***

Petitioner’s analogous proofs fail to address a claim requiring “determining an illumination level,” and neither proffer for 37[D]-[E] or 59[D] demonstrate “determining illumination level[s]” for any subsection, so the analogous proofs necessarily fail. Any other arguments related to corresponding claim language that does co-exist in both claims also fail for reasons already noted. (Petition, 35; *Supra* XIV.A.2, XIV.B.1.)

While the language of claim 59[D] is similar, as shown for that argument, the Petition fails to show how light output is “determined” by the processor, instead relying on a conflation of aspects of elements 59[C] (determining the subsections) or 59[E] (instructing control). The intervening step of actually “determining output” never occurs. (*Supra*, XIV.B.1.)

The 65[B] proof is exclusively by analogy to arguments regarding claim language that is fundamentally different; Petitioner’s twelve pages of referential proofs thus lack particularity. Nothing in the twelve pages of referential arguments is directed to anything about “determining illumination levels.” (Ex.2040, ¶177.) It

is neither the Board's nor Patent Owner's job to dig through that argument and attempt to guess at what portions Petitioner is correlating to the preceding noted elements. (But "Judges are not like pigs, hunting for truffles buried in briefs ...") *See Apple Inc. v. Qualcomm Inc.*, IPR2018-01276, Paper 32, 6 (PTAB Feb. 3, 2020). The Petition fails this proof for particularity under 35 U.S.C. § 312(a) and for failure to show where each element of the claims is present under 37 C.F.R. § 42.104(b)(4).

- a. **Claim 38: The headlight system of Claim 37, wherein at least one of the at least one processors is further configured to process the sensor data to determine illumination for at least one first subsection of the field-of-view, determined to include at least a portion of the second vehicle, based on the sensor data, and for at least one second subsection determined not to include the second vehicle, based on the sensor data**
 - (1) ***determine illumination for at least one first subsection of the field-of-view... and for at least one second subsection***

Petitioner relies on its proof for claims 37[D]-37[E] for this element, which fails for at least the reasons noted for claim 65[B] related to "determining illumination" for any subsection. (Petition, 36; *Supra* XIV.C.1.) The Petition also offers an explanation related to resultant emitted illumination, and it explains that such emission is in response to detection of an oncoming vehicle. (Petition, 36.) None of this explains, however, whether or how the system actually "determines

illumination” **for** any subsection – it merely determines the subsection and then applies predefined illumination to those subsections. (Ex.2040, ¶180.)

Petitioner also states that “Data from [] sensors is used to ‘determine the intensity of light that will be produced by the 61 [vehicle] in the corresponding headlight sectors.” (Petition, 37.) This is not a precise quote of Alden, and, moreover, there is no teaching or suggestion in Alden as to *how* such data would be used to “determine intensity.” (Ex.2040, ¶181.) Instead, what is shown is that Alden determines a bounding box and then applies predefined low-beam illumination to that region. (Ex.2040, ¶181.)

**(2) *at least one second subsection
determined not to include the second
vehicle***

Alden is not capable of “determining” whether a section “does not” include a vehicle. (Ex.2040, ¶184.) Because a vehicle can overlap multiple sections and the system of Alden has no way of knowing whether non-emitting portions of that vehicle exist, or where they exist, Alden lacks this second determination. (Ex.2040, ¶184.) Also, Petitioner relies exclusively on analogy to arguments for 37[D] and 37[E] to prove “*determined not to include the second vehicle*,” but those claim elements do not recite this limitation. (Petition, 36.) That leaves Petitioner’s proof deficient under 37 C.F.R. § 42.104(b)(4), as there is no mention, in the claim

language of 37[D] or 37[E] of a second subsection “*determined not to include a second vehicle.*”

- b. Claim 39: The headlight system of Claim 37, wherein the plurality of light clusters are further capable of illuminating at least two of the sub-sections with different illumination characteristics based on the at least one processor determining specific, different illumination characteristics for each of the at least two sub-sections**

The entirety of the claim 39 proof is directed at the fact that Alden “can” illuminate different sectors with different illumination. (Petition, 38; Ex.2040, ¶187.) While the explanation about what Alden “can” do may cover the “*capable of*” language generally, it fails to offer any explanation for the claimed “*specific, different illumination characteristics for each of the at least two sub-sections*” element other than providing an argument-by-analogy to claims 37[B] and 37[D]-37[E]. (Ex.2040, ¶187) Because neither claim element 37[B], 37[D] or 37[E] call for *determining specific, different illumination characteristics* for a sector per claim 39, Petitioner’s proof-by-analogy fails under 37 C.F.R. § 42.104(b)(4). (Petition, 38.)

- c. Claim 40: The headlight system of Claim 37, wherein the light distribution pattern defines illumination for at least the first and the one or more second sub-sections of the field of view**

For claim 40, Petitioner argues that the “‘light distribution pattern’ is

differing illumination levels **output** from the lighting elements.” (Petition, 38-39.) “**That** pattern[,]” according to Petitioner, “defines the light to be produced in ‘the first and one or more second subsections[.]’” (*Id.*, 39.) The pattern, per the claims, however, is something determined **before** emission occurs – *see* claim 37: “*process the sensor data to determine a light distribution pattern for an adaptive headlight beam.*” (*Id.*, 18; Ex.2040, ¶190.)

Accordingly, any **output**– i.e. “differing illumination levels **output** from the lighting elements” cannot be the pattern of the claims that is a “*determined*” pattern that precedes such output. (Ex.2040, ¶191.) The proof therefore fails to map to the language of the claims and thus ultimately fails. Any logical leaps that must occur to get from the “output pattern” to the “*determined pattern*” per claim 37 are never explained by Petitioner. (Ex.2040, ¶191.)

- d. **Claim 41: wherein the light distribution patterns defines illumination for the first subsection designed to result in an illuminance below the predefined threshold value, and defines illumination for the one or more second subsections designed to result in an illuminance above the predefined threshold value**

Petitioner’s proof for claim 41 is simply an analogy to claims 37[D] and 37[E]. (Petition, 39.) It is insufficiently particular as it fails to explain why the different additional language of this claim, such as the pattern “*defining illumination*” is covered by the prior proof, or why the language is inconsequential.

(Ex.2040, ¶194.) Lacking particularity and failing 37 C.F.R. § 42.104(b)(4) – this proof must fail.

e. Claim 42

- (1) **42[B]: *one or more light modifying elements provided in a path of light emitted from at least one of the light sources, further controlling at least one light characteristic of the at least one of the light source***

Petitioner’s claim 41 proof is either a lens 121 or “refractors.” (Petition, 41.) There is however no refractor in figure 5, the figure upon which Petitioner relies for the proof of claim 37, from which claim 41 depends. (*Id.*, 41-42.) Per the Petition, the lens modifies a “characteristic” of the emitted light, wherein the characteristic is direction. (*Id.*, 42.)

Petitioner additionally contends that the “‘variable refractive element’ in the form of liquid crystal” enables light to be redirected, showing an example of Fig. 10 of Alden. (Petition, 42-43.) Petitioner then proposes to add this element to Figure 5. (*Id.*, 44.) Petitioner fails to explain, however, why such disparate embodiments are interchangeable beyond a citation to boilerplate language about “methods ... be[ing] used in combination.” (*Id.*) Notably, Figure 10 shows collimated light entering a bi-refracting refractor. (Ex.1005, Fig. 10; Ex.2040, ¶197.)

The light from Fig. 5 is not collimated, and such light, entering the bi-refracting refractors shown in Figure 10, would simply be scattered as it is not entering at an angle suitable for clean refraction or pass-through. (Ex.1005, ¶¶[0029], [0033]-[0035], [0053]; Ex.2040, ¶198.) Petitioner never explains or addresses this issue, but merely appears to assume that this would simply work. Thus, the two elements are not combinable as proposed, and so the Petitioner is left with lens 121 for this portion of the claim 42 proof.

- (2) **42[C]: *wherein control of the light sources and light modifying elements results in a specified emitted light-source light characteristic, where said emitted light-source light characteristic includes at least one of direction, intensity, beam spread, spatial light distribution or spectral light distribution.***

Limitation 42[C] requires, among other things, “*control of the... light modifying elements.*” (Ex.2040, ¶199.) The Petition does not show how the lens 121 is controlled in any manner, perhaps because lens 121 is not controllable in any manner. (Ex.2040, ¶199.) Petitioner states that “control of light elements 119, in conjunction with lens 121, results in emitted light with particular intensity, direction, beam spread, and spatial distribution.” (Petition, 45.) That sentence, however, expressly notes the problem – the “control” is only control of the

elements 119, not control of the light modifying elements. (Ex.2040, ¶199.) The phrase “control of the light sources and light modifying elements results in” correlates “control of the” to both “light sources” and “light modifying elements.” Petitioner has never shown the latter.

As noted above, Petitioner can only reasonably rely on the lens 121 for the proof of 42[B] because of the incompatibility of its alternative combination using refractive elements from Figure 10. (*Supra* XIV.C.1.e.(1)) Petitioner must thus show that the lens is an element subject to control. (Ex.2040, ¶200.) Since it did not, the 42[C] proof fails.

f. Claim 43: The headlight system of Claim 42, wherein the one or more light modifying elements comprises at least one of reflectors or refractors, and wherein at least one of the at least one processors is configured to instruct control of at least one light modifying element resulting in a change to the light-source light characteristic

Again, for at least the reasons why Petitioner cannot rely on the refractive elements for its proof of 42[B], this argument fails for claim 43 as well. (*Supra* XIV.C.1.e.(1); Ex.2040, ¶203.)

Petitioner does not cure the issues noted with respect to 42[B] upon which it relies for proof of “refractor.” (Petition, 45.) Additionally, Petitioner does not explain, for example, how the processor is going to decide whether to control the LED array or the controllable optic. (Ex.2040, ¶204.) Both systems require control,

and Petitioner does not explain if there is a second separate control circuit for the optic or what controllable system would be controlled when, in the combination.

(Ex.2040, ¶204.))

- g. Claim 50: system of Claim 37, further including a computer vision processing unit configured to use the sensor data to identify entities including at least one of beings, vehicles, roadway, or street signs, and wherein the processor is further configured to determine modification of the headlight beam to change illumination of the identified entity**

The light sensors of claim 1 are at best, a very rudimentary “computer vision processing unit” that is incapable of “identifying” a vehicle (or anything else). (Ex.2040, ¶207.) Per the claim construction principles laid out in *Phillips v. AWH Corp*, 415 F.3d at 1313-14, the ordinary meaning of “identify” is to “show to be a certain person or thing; to fix the identity of”. (Ex.2065, 7; Ex.2040, ¶207.) The notion that Alden can “identify” a vehicle is a misstatement of the reference’s teachings. (Petition, 49; Ex.2040, ¶207.) In relevant part, Alden determines an area in which light should be diminished, based on the detection of light within that area. (Ex.2040, ¶207.) At no point does Alden provide an algorithm or any other teaching that allows Alden to “show or fix the identity of” the detected light as a vehicle, as compared to a myriad of other potential light sources. (Ex.2040, ¶207.)

- h. Claim 54: headlight system of claim 37, wherein at least one of the at least one processors is**

further configured to determine at least a road curvature, indicated by the sensor data, ahead of the first vehicle and to determine a second illumination pattern defining increased illumination in a direction of the road curvature

Petitioner combines the proofs for claims 54 and 60, but given some variances in language, PO presents the problems with the proofs separately.

(1) *processors is further configured to determine at least a road curvature, indicated by the sensor data, ahead of the first vehicle*

There are several requirements for this portion of claim 54: a) that the processor determines the road curvature; b) that the road curvature is indicated by “the” sensor data; c) that the road curvature is “ahead” of the vehicle.

The proof contends that “Alden discloses that a vehicle with the ‘segmented sensing elements and segmented light distribution elements described herein’ can ‘sense[] that the road turns by receiving light from reflectors such as reflector 157.’” (Petition, 51.)

In his first deposition for related proceedings IPR2023-01039 and IPR2023-01040 (Ex.2041), however, Dr. Papanikolopoulos expressly stated that the “reflectors” in Alden would “have the same appearance on the image like the headlights” and that the system would use the “same logic.”

A. So basically here what is happening, when there is a detection like this, Alden, by using the LEDs described in figure 5 and the corresponding paragraph, makes this dim while the other has full light in order to increase the visibility for the driver.

In figure 11, I believe, the same structural figure 5 can do the dual (phonetic). In other words, I can have dots of the reflectors -- instead of having the dots that correspond to the headlights, I have dots that correspond to the reflectors on the side of the road.

So I want to -- as we drive, we want to be able to see this better. So it's going to send as much light as possible to this one by using the same structure.

Q. Okay.

A. So it's the dual problem. Again, one is actually high beam so I don't create glare for the oncoming driver, or **if I'm on a turn the system can use these refractors (sic) by using the same logic of detecting lights** -- using the same reflectors in order basically to just have direct LED light in order for the driver to make inferences about the curvature.

(Ex.2041, 78:16-79:15, emphasis added.)

When pressed further, Dr. Papanikolopoulos explained:

Q. So using the figure 5 embodiment you're saying that light reflects off these reflectors on the side of the road and the headlamp detects these and then dims those corresponding lights?

A. No. What I'm saying is the following: **There are two main use cases in Alden. One is basically headlights maximizing visibility for the driver and minimizing – we discussed this. The second one is actually using the same logic, which is described in figures 3, 4, and 5. I detect that, so my dots here in the figure 3 are going to be the reflectors. The reflectors are going to be something that corresponds -- it will have the same appearance on the image like the headlights. So I will have a rectangle like -- but instead of having dim light I'm going to have high beam[.] ...**

(Ex.2041, 79:18-80:11, emphasis added.)

Alden does not teach any logic for determining the difference between headlights and reflectors, and as Dr. Papanikolopoulos notes, he understands the reflectors to “have the same appearance on the image like the headlights.” (Ex.2041, 80:7-8.)

Without knowing the difference between vehicles and reflectors, and absent a teaching to help differentiate between the two, Alden has no way of determining whether it should dim in response to detected light per the Figure 5 embodiment or perform some curve-accommodation per Figure 11, to form “concentrated” high-beam emission. (Ex.2040, ¶214.) Alden lacks teachings in Figure 11 or elsewhere regarding any ability to determine whether detected light is a reflector indicative of a curve, which warrants curve-emission, or detected light indicative of a vehicle, which warrants glare reduction. (Ex.2040, ¶214.)

Furthermore, even if it is assumed that Alden can somehow distinguish between detected light in the form of road reflectors versus oncoming vehicle headlights, Petitioner's contention that "this data" (detected light) is used to "adjust the LEDs 'responding headlights 155' ... so hat they 'direct light into the corner ...'" is entirely unsupported. (Petition, 51; Ex.2040, ¶215.)

Since the system never distinguishes between the two varied light-sources, and, as Petitioner's expert has explained, the system handles reflectors "by using the same logic of detecting lights" such that reflectors "appear[] ... like ... headlights," it would be impossible for Alden, without modification, to even determine the presence of a curve based on detected reflection. (Ex.2040, ¶216.)

The reference to the "rotation sensor" is of no help. (Petition, 51.) Steering data is not indicative of a road curvature "*ahead of*" the vehicle, as required by claim 54. (Ex.2040, ¶217.)

Further, allegations about "pre-steering" into a turn do not solve the problem, because if slight movements of the wheel caused the system to believe a turn was present, then lane changing (when no turn is present), would constantly elicit false positives. That is, slight changes to steering are not indicative of an upcoming curve, which is probably why Alden "calculates the new direction of the vehicle" before doing anything (Ex.1005, ¶[0040].) On this last point, Alden's very brief teaching is **not** based on calculation of "the new planned direction of the

vehicle” as Petitioner contends, but rather based on a calculation involving “**the new direction** of the vehicle.” (Ex.1005, ¶[0058].) Alden lacks any mention of a “planned” direction. (Contrast Petition, 51, with Ex.1005, ¶[0058].)

(2) *processors configured... to determine a second illumination pattern defining increased illumination in a direction of the road curvature*

This claim calls for determining an illumination pattern “defining increased illumination in a direction of the road curvature.” The argument presented is a near-verbatim recreation of the proof for claim 15 in counterpart Petition 2023-01026, and makes no mention of, for example, a pattern. Thus, the argument fails to map the proof to the language of the claims as required per 37 C.F.R. § 42.104(b)(4).

Further, there is no evidence the emission of Fig. 5 can be increased in the direction of a curve, or that a pattern, eliciting such an increase, could be determined. The lamp already emits high beams everywhere there is not glare reduction and it lacks any optical steering. (Ex.1005, ¶[0029]; Ex.2040, ¶222.)

Further, in his deposition for related proceeding IPR2023-01034, Dr. Papanikolopoulos opined that the array already includes LEDs positioned to cover curves:

Q: So farther down below in that paragraph, you have a sentence here,

“Further a POSITA would have understood from Alden that when positioning LEDs along the curve structure in the headlamp, such as shown in Figure 5, LEDs could be positioned to ensure that the beam created by the headlamp is sufficiently wide to illuminate turns.” Do you see that?

A: Yes.

Q: Are you proposing adding additional LEDs to what’s shown in Figure 5 or you’re saying that’s what is shown in Figure 5?

A: I say such as shown in Figure 5.

(Ex.2066, 111:18-112:5)

And, in another deposition, Dr. Papanikolopoulos admitted that when there are no other vehicles present, all LEDs emitting:

Q: Okay, but in normal driving conditions when there’s no oncoming traffic and no curves, the Figure 5 embodiment would illuminate the full pattern shown in Figure 5, is that correct?

A: Yes.

(Ex.2067, 17:21-25).

While the second deposition question involved a driving condition with “no curves,” the answer to the first deposition question clearly establishes that, LEDs could be positioned “to ensure that the beam created by the headlamp is sufficiently wide to illuminate turns.” (Ex.2066, 111:20-24.) Thus, a POSA would

understand that if a curve were to appear ahead of the vehicle, it would have already been illuminated by the sufficiently wide pattern achieved by illumination of the “full pattern shown in Figure 5.” (Ex.2067, 17:21-25; Ex.2040, ¶225.)

Accordingly, the embodiment of Figure 5 has not been shown to “*increase*” illumination as claimed, rather, it already includes sufficient LEDs to “ensure that the beam created by the headlamp is sufficiently wide to illuminate turns.” (Ex.2067, 111:18-112:5; Ex.2040, ¶226.) Petitioner’s claim 54 anticipation proof thus fails for the reasons identified above. Patent Owner notes that there is no proffer of any obviousness-type proof for claim 15 and further that the arguments regarding claim 60 below, apply equally to claim 15 — as Petitioner proffered combined proofs for both claims.

i. Claim 60: *processors is further configured to determine at least a road curvature, indicated by the sensor data, ahead of the first vehicle and to determine light output that aims illumination in a direction of the road curvature*

This claim calls for the processor to determine the curve in the same manner as claim 54, and this argument fails for the same reasons presented with respect to the comparable element of claim 54. (cite *above, supra*).

Further, the claim calls for “determin[ing] light output that aims illumination in a direction of the road curvature.” (Petition, 50.) In addition to being unable to distinguish between road signs and headlights, as noted for claim 54, it is unclear

how the output of Fig. 5 would “aim” illumination anywhere . (Ex.2040, ¶230.)

The proof contends that sensor data is used by the CPU to “adjust” the LEDs “so that they ‘direct light into the corner ...’” (Petition, 51.) There is no suitable explanation as to how such adjustment would occur – the LEDs are emitting at high/maximum illumination, and further, they are not controllable in Figure 5 with regards to anything other than intensity. (Ex.2040, ¶231.) Thus, the proof ascribes a capability to the embodiment of Figure 5 that simply does not exist, and fails for this additional reason. (Ex.2040, ¶231.)

j. Claims 55 / 56: The headlight system of claim [54 / 37], wherein at least one of the at least one processors is further configured to determine at least a planned upcoming turn, indicated by the sensor data, and to determine a third illumination pattern defining increased illumination illuminating the turn

This claim requires knowledge of a “*planned*” turn, as well as definition of a third pattern defining increased illumination illuminating the turn. (Ex.2040, ¶234.) Instead of choosing a different proof for turn vs. curve, since the claim uses different language and clearly requires a different pattern, Petitioner simply reargues curve illumination. (Petition, 52.)

Petitioner never explains how there is a third pattern (different from the second pattern of claim 54, for example) or how the system of Figure 5 can be controlled, pursuant to such a pattern or otherwise, to provide increased

illumination illuminating a turn. (Ex.2040, ¶235.)

Per the ordinary meaning of both terms, turns are different from curves, as they typically involve the possibility of cross-traffic and would thus be illuminated differently. (Ex.2040, ¶236.) Moreover, despite having the burden to do so, Petitioner has never provided a reason why turns and curves are the same. Petitioner seems to try to present a turn as something that happens in a curve, but this is not evidence of a “planned turn,” nor does this explain why a third, different pattern is required. (*Id.*)

Finally, Petitioner contends that “[a]s the steering wheel ‘rotates ‘x’ degrees’ the system calculates the new **planned** direction of the vehicle.” (Petition, 52.) What Alden actually says, however, is that the system calculates the new direction of the vehicle (i.e., where it is now heading, not where it is planning to head) and bases the adjustment on that present heading. (Ex.2040, ¶237.) Further, and again, there is no mention of how the array of Figure 5 could be adapted in any manner to accommodate this information regardless. (Ex.2040, ¶237.)

- k. ***Claims 61 / 62: The system of claim [60 / 59], wherein at least one of the at least one processors is further configured to determine at least a planned upcoming turn, indicated by the sensor data, and to determine light output that illuminates the turn***

Petitioner relies on its proof for claim 60 and/or claims 54-56. (Petition, 53.)

Thus, the issues with the failings related to noting differences between turns and curves persist. If Petitioner considers the language of this claim sufficiently different to warrant a different proof, no such proof was made. Moreover, the system still cannot at least determine a “planned” turn, and so regardless of the variance in language, the rejection fails. (Ex.2040, ¶240.)

- I. ***Claim 70: The method of claim 65, wherein the determining illumination further includes determining illumination that increases illumination of an upcoming curve indicated by the data, wherein the determining the control instructions further comprises determining the control instructions for controlling one or more of the directional light sources to achieve illumination around the curve***

Here, Petitioner relies on a variety of analogous proofs – referencing 54-56 and 60-62. (Petition, 53.) Again, variances in language are unaddressed. (Ex.2040, ¶243.) This claim requires, among other things: a) determining illumination that increases illumination of the upcoming curve; and b) determining control instructions for controlling directional light sources to achieve illumination around the curve. (Ex.2040, ¶243.)

The argument suffers from all the shortcomings of the referenced portions of the Petition, including, for example, failure to show how the system of Figure 5 can increase illumination, failure to show how the system determines that there is an upcoming curve, and failure to show derivation of control instructions for

controlling Figure 5 elements in the manner claimed. (Ex.2040, ¶244.)

- m. **Claims 58 / 64: The [headlight] system of claim [37 / 59], wherein at least one of the one or more headlamps further includes at least one of reflectors, refractors, or lenses usable to alter emitted light from at least one of the light [clusters/sources] as part of the instructed operation**

The proof for these claim elements rely on the proof for claims 42[B]-42[C]. (Petition, 53.) As noted for that proof, there is insufficient explanation of how bi-refractive elements requiring collimated light input could be used with the non-collimated system of Figure 5. (Ex.2040, ¶247.)

IX. Grounds II-V: All Obviousness Combinations

A. Ground II: Alden in view of Harbers

- 1. **Claim 45: wherein at least one of the light-clusters includes: [a] a plurality of light sources, wherein one or more of the plurality of light sources comprises at least one of multiple light-emitting-diodes (LEDs) or organic light-emitting-diodes, [b] each light source having a spectral power distribution characteristic alterable, at least responsive to instructions from at least one of the at least one processors, by modifying power to the one or more light sources of the plurality of light sources, resulting in a color change to projected light from the at least one light-cluster illuminating at least one sub-section of the field-of-view.**
 - a. **45[a]: wherein one or more of the plurality of light sources comprises at least one of multiple light-emitting-diodes (LEDs) or organic light-**

emitting-diodes

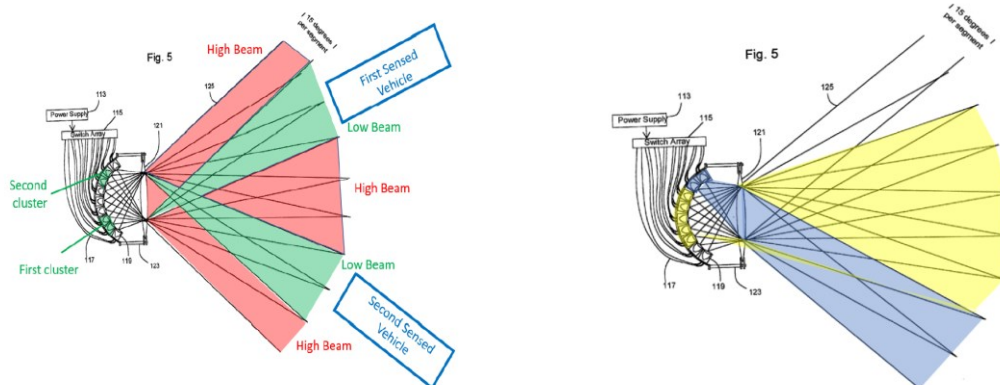
Petitioner's 5[a] proof shows neither a single light source that comprises multiple LEDs, nor a single light source that comprises an organic LED. (Petition, 54; Ex.2040, ¶250.) Instead, the proof is about light clusters, not light sources. (Petition, 54; Ex.2040, ¶250.) The proof thus fails. PO notes that the remainder of the explanation for this section does not cure this issue, as it is directed to element 45[b].

- b. 45[b]: *each light source having a spectral power distribution characteristic alterable, at least responsive to instructions from at least one of the at least one processors, by modifying power to the one or more light sources of the plurality of light sources, resulting in a color change to projected light from the at least one light-cluster illuminating at least one sub-section of the field-of-view***

Petitioner relies on the colored LEDs of Harbers for the 5[b] claim limitation. (Petition, 55.) Specifically, Petitioner notes that the LED array may include red, green, blue and yellow LEDs. (*Id.*) But, what Petitioner has not explained is, how including such colored LEDs into the system of, for example, the Fig. 5 embodiment will not create color changing issues with emission. (Ex.2040, ¶253.) Figure 5 of the Alden reference is a nine element LED array that is not otherwise modified by Petitioner for this combination. (Ex.2040, ¶253.) Thus, each replacement of a colored LED from Harbers into the Alden array, replaces 1/9 of

the emission output with a different color. (Ex.2040, ¶253.)

Also, in Alden, each beam segment has defined responsibility for a portion of the field of view — a factor Petitioner’s proofs fail to address. Thus, any vehicle, or driver’s face, within that area of responsibility, would see the color of light aimed at that portion. (Ex.2040, ¶254.) As Petitioner has shown, in some of its examples, oncoming vehicles may also be traveling towards the emitting vehicle at angles. (Petition, 29-30.) In such examples, the whole beam of a single, or maybe two LEDs encompasses the oncoming vehicle; thus, the driver of the oncoming vehicle would see red, or yellow, or blue emission beams. (Ex.2040, ¶254.) In the example shown below (Petitioner’s annotated figure from the Petition in IPR01039), the driver’s face would be squarely in the “blue” beam. (Ex.2040, ¶254.)



(IPR2023-01039, 50; IPR2023-01027, 58)

Moreover, Harbers notes expressly that its specific color ordering is

important: **“By ordering the LEDs in the manner indicated in Fig. 2, a substantial reduction of possible color effects is achieved ...”** (Ex.1006, 8:30-34.) Yet, Petitioner has never explained, for example, what color effect would be achieved by dimming a single (or group of) color LEDs, or replacing white LEDs, having exclusive responsibility for a sector, with colored ones, rendering the combination unpredictable at best and unsafe at worst.

2. Claim 68: *wherein the determining illumination further includes determining a yellowish illumination color for illumination illuminating a road within the field-of-view and a blueish illumination color for illumination illuminating areas off-road within the field-of-view*

Claim 68 also requires colored light output for certain regions, this time bluish illumination along a roadside and yellowish illumination in the center of the road. (Ex.2040, ¶258.) Again, Petitioner relies on inclusion of “color” LEDs from Harbers. (Petition, 59-60.) But Petitioner never addresses any of the unpredictability selective dimming would have on such a combined Alden-Harbers system, and/or the issues occurring from not following Harbers’s strict LED ordering to “substantial[ly] reduc[e] ... possible color effects.” (Ex.1006, 8:30-34.) Petitioner’s proposed combination fails to establish how a POSA would address these issues and relatedly, whether these complications would impact a POSA’s decision to combine the references in the first instance. All arguments for claim 45[b] also apply to the combination here. (*Supra* IX.A.1.b.)

3. Claim 69: *wherein the data includes data indicating fog or snow environmental conditions and the determining illumination includes determining a shift of at least a portion of the light output from the headlight system towards yellow*

Again, Petitioner relies on usages of colored LEDs from Harbers. (Petition, 60-61). In a one-dimensional array, it is not even clear how such output changing would occur – where each element is singularly responsible for a given segment of the scene. (Ex.2040, ¶260.) Because Petitioner never expands the array, beyond the single row, Patent Owner is left to guess at how many rows would be required to perform any function of Harbers, or how such a configuration would look. Thus, the proof provides inadequate explanation of the proposed combination. Also, being reliant on colored LEDs, this claim 69 argument suffers from all the deficiencies of the combinations proposed for claims 45 and 68. (*Supra* IX.A.1. and 2.; Ex.2040, ¶260.).

B. Ground III: Alden in view of Bergkvist

1. Claim 46: *wherein the light output from at least one headlamp further comprises at least one of infrared or ultraviolet wavelengths*

For this combination, Petitioner relies on the inclusion of “a UV light source” “in the array of Alden” based on Bergkvist. (Petition, 61-62.) Bergkvist uses a single light source that emits in both visible and UV spectrums and relies on a filter to block visible light. (Ex.1007, 2:63-68; 3:17-26.) Bergkvist has no LEDs,

nor does it mention UV LEDs. (Petition, 62; Ex.2040, ¶263.) The suggestion to “include at least one UV light **source** in the array of Alden” has no motivation in Bergkvist, as there is no filter element imported – i.e., incorporating the source of Bergkvist will simply also produce visible light. (Petition, 62; Ex.2040, ¶263.)

Petitioner also provides no explanation as to how any UV light will be in a sector without visible light, which is the stated motivation to combine. The Bergkvist light source produces both visible and UV light and without the filter of Bergkvist, anywhere there is UV light, there would be visible light. Since the motivation to combine was “in order to have light outside the visible range, such that it is not distracting to other drivers or pedestrians” it is unclear how such distraction would not occur when visible light is not filtered. (Ex.2040, ¶264.)

C. Ground IV: Alden in view of Beam

3. Claim 48: *wherein at least one of the sensors is a camera-sensor configured to image at least lights indicative of a preceding vehicle*

Claim 48 relates to detecting a preceding vehicle (i.e., taillights). (Ex.2040, ¶267.) Petitioner largely seems to be arguing that if one can detect headlights, one can also detect taillights. (Petition, 63; Ex.2040, ¶267.)

Beam however provides no such tuning, it simply relies on detecting light that is indicative of both headlights and taillights. (Ex.1008, 4:11-16; Ex.2040, ¶268.) Presumably, the modified system would have its threshold tuned downward

to include the data of taillights, as they are dimmer than headlights. (Ex.2040, ¶268.) Problematically, however, this would increase the level of illumination detected for an oncoming headlight — by decreasing the threshold of detection, more light from an oncoming headlight would be detected, so the illumination “spots” would be bigger. Since Alden never explains how it pairs lights, the impact on the overall control system is unclear. (Ex.2040, ¶268.)

To further illustrate the issues, a traveling vehicle on a crowded highway would see countless preceding taillights, yet Petitioner’s combination provides no explanation of how Alden would “match” such taillights across two sensors, especially as the taillights would appear much dimmer than headlights. (Ex.2040, ¶269.) Beam is of no assistance, as it does not attempt sensor-to-sensor matching and Alden never explains such matching for anything more than a single vehicle scenario. (Ex.2040, ¶269.)

As Alden requires that data is matched across two sensors, a great deal of additional modification and/or experimentation would be needed for the proposed combination to accommodate headlights and preceding taillights. (Ex.2040, ¶270.)

D. Ground V: Alden in view of Kobayashi

1. Claim 49: wherein the one or more sensors further includes a GPS sensor

For claim 49, Petitioner imports the GPS of Kobayashi. (Petition, 68.) The

combination, however, seems to be an either/or type of combination, without explanation as to which system controls when both signals are useful. (Ex.2040, ¶273.) That is, even if GPS coordinates are present, the combined system seems to only use them when reflectors are not present. (Petition, 69.) Moreover, this ignores the larger issue, which is that Alden’s system is already inclusive of a significant beam-spread, more than sufficient to accommodate curves. And, Alden lacks any control over its LEDs for curve purposes – they emit, per Alden, at high-beam all the time. Thus, there is no way to “control” them alternatively to deal with curves. (*Id.*) In light of the preceding issues, a POSA would have no reason to include such a GPS sensor from Kobayashi; Alden’s Fig. 5 system can do nothing useful with the GPS data. (*Id.*)

E. Ground VI: Alden in view of Braun

1. ***Claim 66: wherein the data includes data indicating a pedestrian and wherein the determining illumination includes determining an illumination level, for at least a third subsection including the pedestrian***

For this limitation, Petitioner proposes to replace Alden’s lens and photodiode array with Braun’s camera and pattern recognition system (Petition, 72-73.) There are several issues with this proposed combination.

First, the photodiodes in the array of Alden are mapped to corresponding sensor elements, so it is unclear how that mapping would be converted from

Braun's camera to Alden's control circuitry. (Ex.1005, ¶[0043].) Petitioner has not shown that Braun uses a similar mapping or similar logic, and so whether or not Braun can image a scene and detect a vehicle, pedestrian or sign, it is unclear how the processor of Braun, now the operational processor of the system, would map to the array of Alden.

Second, Braun does not “make assumptions” about where the oncoming driver is located, and so, losing the processor of Alden, the system loses this capability. (Ex.2040, ¶278.) A POSA, understanding that decreasing illumination aimed towards headlights is insufficient, would not be motivated to lose the capability to accommodate the oncoming driver. Nor has Braun's processor been modified to account for this aspect of Alden's now-removed processor.

Third, the array of Alden is still being used. (Petition, 73.) In addition to the issues with mapping the camera to the sensors, it is unclear how the array of Alden could be used to “spotlight” anything. While the processor of Alden is removed, the “maximum illumination” **goal** of Alden is not, and so, presumably, the array would be operated at full intensity by the processor of Braun. This issue is never addressed by Petitioner. Additionally, there is nothing to use to “spotlight” pedestrians or signs, since the LEDs are not aimable and further, they are already maximally emitting. If the proposed combination involves *not* applying the maximum emission principles of Alden, which are there for safety, then the

combination involves “breaking” the safety goals of Alden in order to create temporary situational safety – something no POSA would be motivated to do.

2. ***Claim 67: wherein the data includes data indicating a road-sign wherein the determining illumination includes determining an illumination level, for at least a third subsection including the road-sign.***

The problems noted for claim 66 apply to the analysis of claim 67 as well, as Petitioner does not bifurcate the analysis between claims 66 and 67. (Petition, 71-74.)

X. Conclusion

In light of the remarks herein, Patent Owner respectfully requests that the Board find the claims not unpatentable.

Respectfully submitted,

Dated: April 10, 2024

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Certificate of Service

The undersigned hereby certifies that the foregoing **PATENT OWNER'S RESPONSE TO PETITION**, including any attachments and exhibits, was served in its entirety on **April 10, 2024** upon the following parties by electronic mail:

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