

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: IPR2023-01026

PATENT OWNER'S RESPONSE TO PETITION

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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	Intentionally left blank
2005	Intentionally left blank
2006	U.S. Published Patent Application US2003/0137849A1 to Alden, Prosecution History in the U.S. Patent and Trademark Office
2007-2039	Intentionally left blank
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	Intentionally left blank
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/)

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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.)

Exhibit No.	Description
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-ww&DCM=yes&distId=10) (Accessed September 12, 2023.)
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 1-36 (“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 (PO) 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

[illegible]

“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 illumination output to optimize illumination for the vehicle operator under a myriad of driving situations, whilst reducing glaring illumination for oncoming vehicles.

The Challenged Claims include independent claims 1, 20, and 26.

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, 8-9; Ex.2040, ¶¶8-22; 58-61.)

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

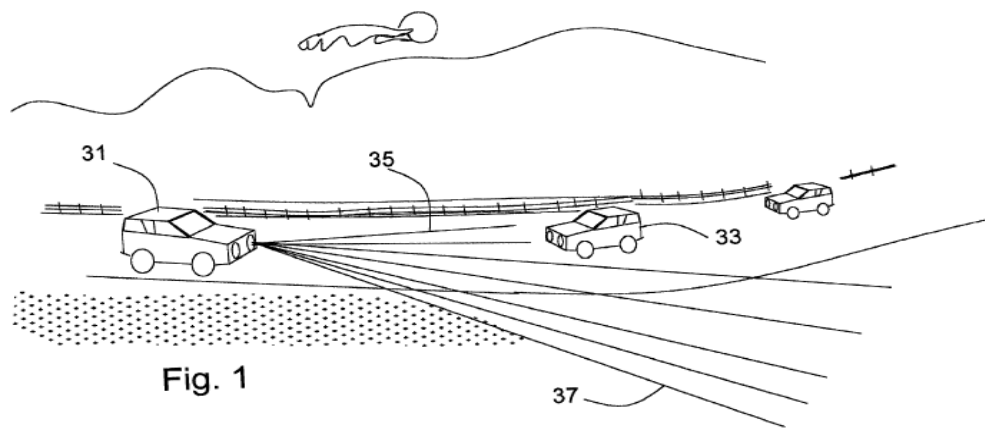
meaning,’ [which] . . . is the meaning that the [words] would have to a person of ordinary skill in the art in question at the time of the invention, *i.e.*, as of the effective filing date of the patent application.” *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312-13 (Fed. Cir. 2005) (*en banc*) (internal 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” and “curve” are provided below. (Ex.2040, ¶¶64-65.)

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.*)

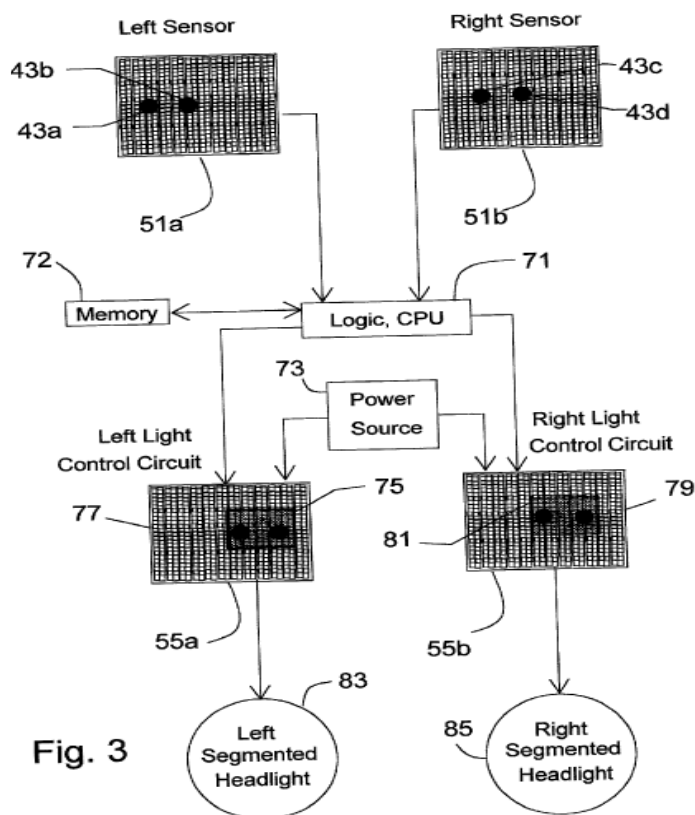
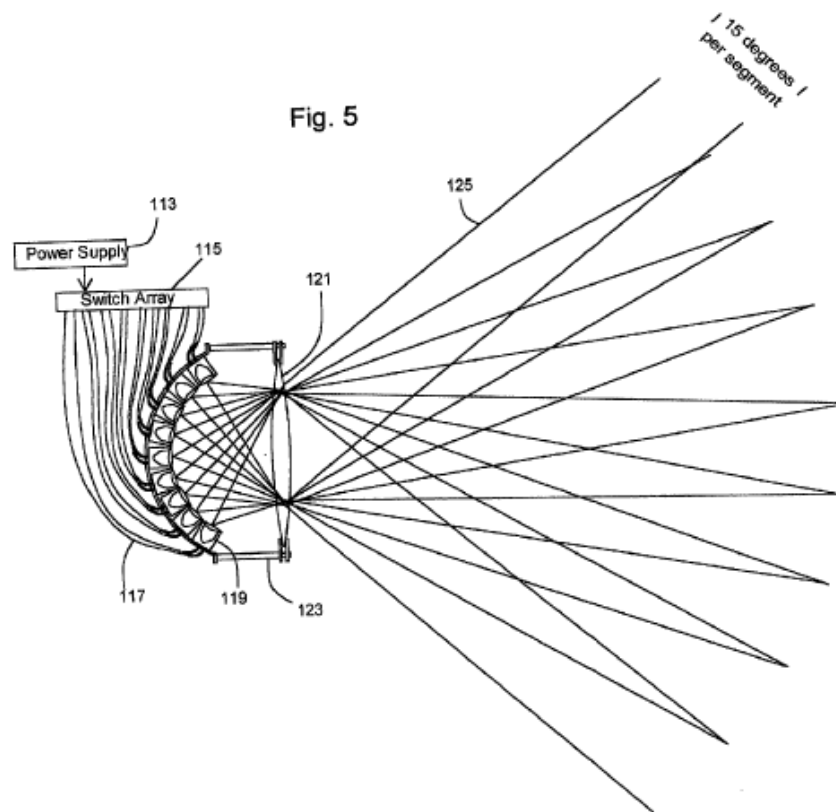


Fig. 3

(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.)

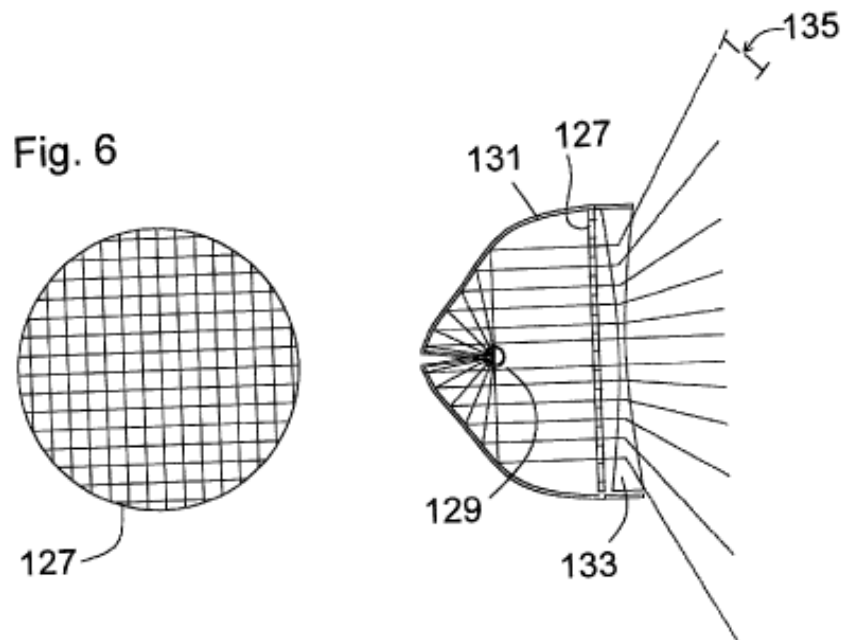


(Ex.1005, FIGURE 5)

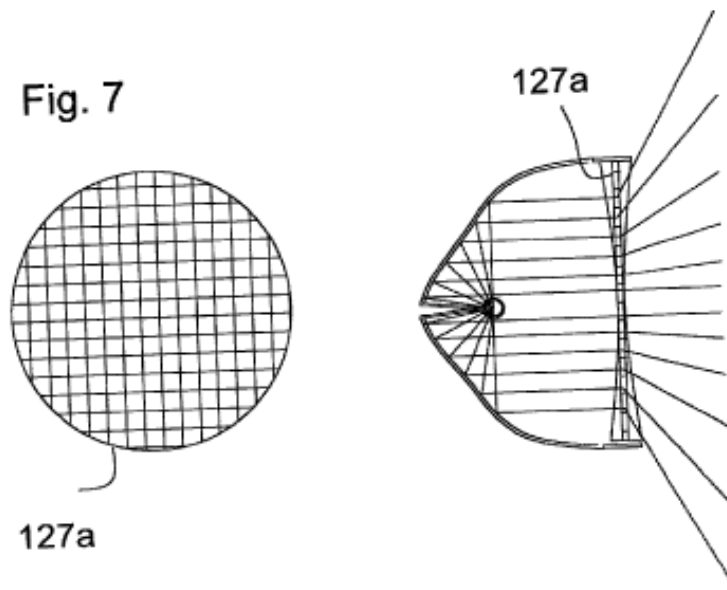
The CPU 71 determines sensor (51a, 51b) sectors receiving incoming threshold light, and then bounds a region encompassing the detected light. (Ex.1005, ¶¶[0026-0029]; Ex.2040, ¶70.) The bounding box for each sensor is sent to a corresponding control switch array and switches encompassed by the bounding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

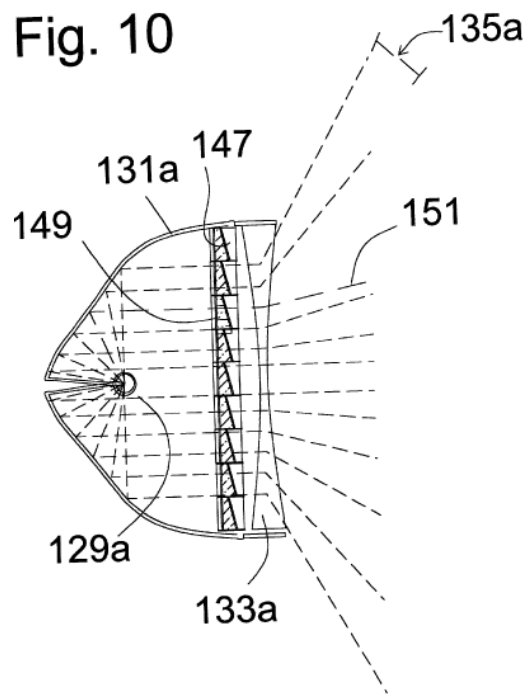


(Ex.1005, FIGURE 6)



(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.)

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

Fig. 8

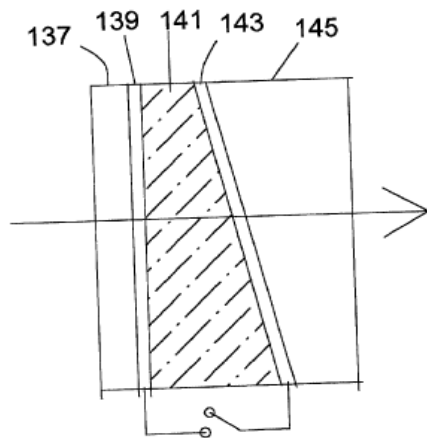
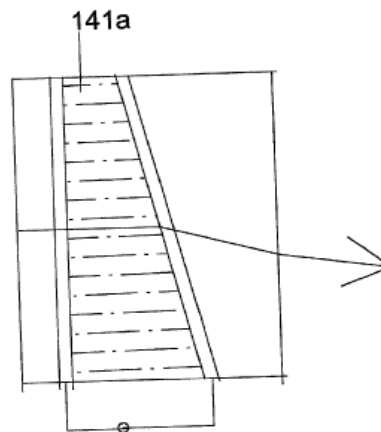


Fig. 9



(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 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 which 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.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 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

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.)

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.)³

VI. The Strict Contours of Anticipation

“A patent claim is invalid as anticipated only if each and every element of

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

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.” *Corephotonics*, 861 F. App’x 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 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. 20 L.Ed. 33 (1870) ("to support such a defen[s]e, must be an account of complete and operative invention capable of being put into practical operation.") *Id.* at 555.

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

Per the Institution Decision, except for claims 2-4, Petitioner’s Alden only proofs are limited to an anticipation challenge. (DI, 13-14.) Petitioner’s anticipation proofs must thus establish that the “four corners” of Alden “describe 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 rely exclusively on annotating the planar beam spread of Figure 5. While statements in the Institution Decision

regarding the general and broad functionality of the Figure 5 system assume two-dimensional control, Alden provides lacks express details needed to implement such functionality, absent modification, and Petitioner never makes such modifications or ever presents Figure 5 with an accompanying two-dimensional explanation. (Petition, 13-15; DI, 9-10; Ex.2040, ¶136.)

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, ¶137.) 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, ¶137.) 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, ¶138.) 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, ¶137.) 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 much 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, 56:25-57:17, 108:11-109:5, 112:19-113:3; Ex.2040, ¶138.) 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, ¶139.) 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, 115:25-116:6; Ex.2040, ¶140.)

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 the 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 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; Ex.2040, ¶141.)

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, ¶143.) “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.” *Apple Inc. v. Corephotonics, Ltd.*, 861 Fed. App’x 443, 450 (Fed. Cir. 2021) 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, 10-11.)

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, ¶143.) Thus, per Petitioner’s expert, to create an operative “segmented headlight system” and “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, 99:15-16.) As the Federal Circuit held in *Corephotonics*, 861 F. App’x. at 451 “inoperative embodiments cannot be anticipatory.” In *Corephotonics*, inoperability arose from an error in the reference such that two lenses occupied the same space; this holding is at least equally

⁴ Emphasis added by Patent Owner unless indicated otherwise.

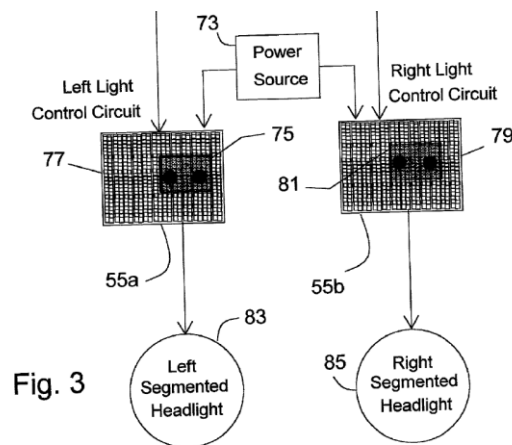
compelling here, where the reference simply fails to provide the requisite number of LEDs for an operative headlamp.

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 “in Figure 5, [] the lighting elements are ‘individually 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, 20.) 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, ¶144.) Since there are 576 switches in the Figure 3 switch array and 9 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], Figs. 3, 5; Ex.2040, ¶144.) 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, ¶145.)

“[T]he 55a [switch array] **controls the power flow from 73 [power source]**

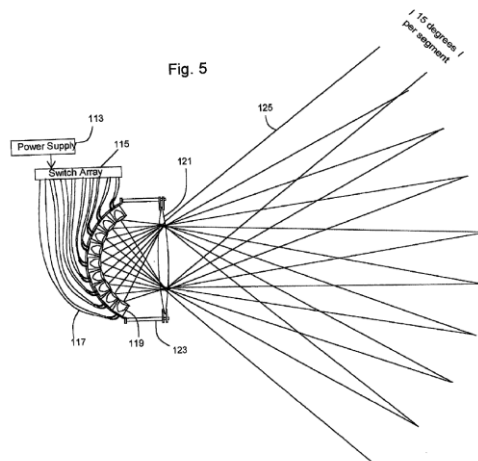
to a left segmented headlight ...". (Ex.1005, ¶[0027].) The overlap of the bounding box (dimmed area) with a switch, causes that switch to control power differently. Assuming a simple mapping, if a multitude of switches were mapped to a single LED, then unless the bounding box overlapped **all** those 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, ¶145.)

This would confound the purpose of both Alden and the claims. 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, ¶146.)



(Ex.1005, FIGURE 3)

Fig 3 depicting a switch array with enabled switches in each column.
(Ex.2040, ¶146.)



(Ex.1005, FIGURE 5)

Figure 5 depicting a linear array that would require columnar blanking.
(Ex.2040, ¶146.)

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, ¶147.) As in *Corephotonics*, the dimming issue must be fixed for the relied-upon embodiment to simply function, let alone to function as claimed. *Corephotonics* at 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**

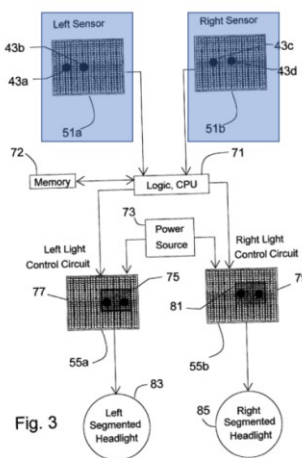
Petitioner bears the burden of supplying a *prima facie* case of unpatentability in the Petition. Any belated effort by Petitioner to modify their underlying anticipation theory post-institution is impermissible gap filling. Per the holding in *Colas Sols., Inc. v. Blacklidge Emulsions, Inc.*, 759 F. 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 *Cola 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 I – Alden fails to anticipate at least certain limitations of the claims 1-4, 7, 10-17, 19-23, 25-27 and 30-36

A. Independent Claim 1

1. Element 1[C]: *the subsections determined in response to sensor data*



(Petition, 17)

For this proof, Petitioner explains – “a left shaded circuit area 75 indicates the areas of a segmented headlight control switch array switches which will cause portions of the left headlight to be dim while a non-shaded left circuit area 77 represents the portions of the segmented headlight which will be on high beam.”

(Petition, 18.) Thus, in this example, the shaded areas represent a region bounding and extending beyond source locations (“bounding box”) to encompass one or more switches of the respective control circuits. (Ex.2040, ¶149.)

It appears, although never expressly stated, that Petitioner considers the shaded bounding boxes 75, 77, to be the determined subsections, as those are what Petitioner correlates to the “headlight distribution sectors.” (Petition, 17; Ex.2040, ¶150.)

2. Element 1[D]: *electronic control circuitry configured to independently operate the light clusters*

For its proofs for 1[D], Petitioner points to the respective control circuits. (Petition, 18-19.) According to Petitioner, “where data from sensors 51a, 51b .indicates the presence of another vehicle 41, the control circuitry ‘controls the power flow’ so the headlight ‘distributes high beams throughout its distribution areas except in a box in the direction of the 41.’” (Petition, 19-20.) There is no explanation as to any modification of the bounding box, the sensor array or the control circuitry. Petitioner is relying on the embodiments **as shown**, since any other modifications or changes remain unstated. (Ex.2040, ¶152.) This leaves Petitioner’s combination, as presented, impermissibly inoperative. *Corephotonics* at 451. As further detailed in VII.B., *supra*, Petitioner has failed to address how power flows to each LED, specifically how the multiple switches of Figure 3

would be mapped to each LED of Figure 5 — necessitating a modification to the combination, as presented, that Petitioner neither identifies nor explains. (Ex.2040, ¶153.)

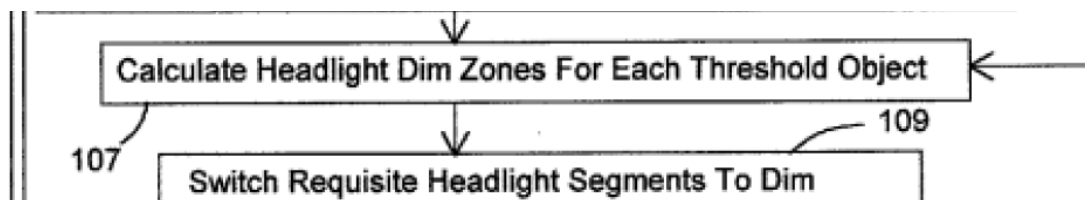
3. Element 1[E]: *one or more sensors configured to obtain and provide the sensor data predefined as pertinent to illumination requirements for the field-of-view*

As noted by Petitioner, 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, 20.) 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.*, 20-21.) 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, ¶157.)

4. Element 1[F]: Alden does not teach or disclose a processor . . . configured to . . . determine an illumination for at least two of the sub-sections, ... that reduces illumination to reduce glare in at least a first of the two subsections

According to Petitioner, the CPU in Alden can “determine[e] the ‘distance and intensity of each object sensed in a calculating process 101’[] and calculat[e] distances to objects using ‘a triangulation process 105.’” (Petition, 23-24.)

Petitioner further states “[t]he distance data is then used to ‘determine the intensity of light that will be produced by the 61 [headlight] in the corresponding sectors,’ as shown in step 107[.]” (Petition, 24.) That is a misstatement of what occurs in step 107. Step 107 shows the following:



(Ex.1005, Fig. 4)

What Alden discloses, with reference to step 107, is that “[t]he location of objects is used to calculate which zones of each headlight need to be dimmed in a calculate headlight dim zones process 107,” with no mention of the use of distance data. (Ex.1005, ¶[0028].) Separately, Alden discloses that “distance information is used to determine the intensity of light that will be produced by the [headlight] 61 in the corresponding headlight sectors” – neither Alden, nor Petitioner, explain how distance information is used in this manner. (Ex.2040, ¶¶160-161; Ex.1005, ¶[0027].)

Based on an alleged teaching of “distance data [being] used to ‘determine intensity of light that will be produced by the 61 [headlight] in the corresponding sectors,’ as shown in step 107,” Petitioner improperly and incorrectly concludes that Alden “determines illumination” for at least two subsections—inferring that

Alden **uses** the distance data to **determine illumination** for a subsection. (Petition, 24.) Alden includes no such teaching. (Ex.2040, ¶162.) The reference never explains how it uses the distance data or even how the triangulation process determines distance (i.e., what factors it uses, what the “object” is for which triangulation is performed, etc.) Dr. Papanikolopoulos states that the “object ... in this particular case is the vehicle” – but then that leaves an open question as to how the system of Alden is adjudging “the vehicle,” since all it has on its sensor arrays are two indications of sources. (Ex.2066, 22:19-21.) To the extent triangulation requires an angle, for example, Petitioner does not explain to what point in space the is angle drawn, if “the vehicle” is something supposedly indicated by **both** point sources. (Ex.2040, ¶162.) And, Petitioner sheds no additional light on how distance data would be “used to ‘determine the intensity of light[.]’” Even in his deposition, Petitioner’s expert did little more than read half of ¶[0028] aloud and conclude that triangulation is the outcome of “a pretty elaborate computer vision process[.]” (Ex.1005, ¶[0028]; Ex.2066, 20:8-21:22; Ex.2040, ¶162.) In the absence of any explained usage of “distance” to control “intensity,” Petitioner’s 1[F] proofs are unsupported by a functional or useful teaching about “determining” illumination.

Petitioner’s 1[F] proofs also fail to establish that Alden **determines illumination** **for** a subsection. For element 1[F], Petitioner points to “zones where

an oncoming vehicle is present that need to be dimmed (first subsection) and zones where there is no other vehicle that should be high beam (second subsection).” (Petition, 24.) This demonstrates that what Alden determines is which zones need to be dimmed, which is the same proof offered for 1[C]. Petitioner provides no separate proof to establish that Alden determines illumination **for** a subsection-- because no such proof exists. (Ex.2040, ¶163.) Once Alden determines the subsections that require control – i.e., element 1[C], those sections are automatically set to the single, predetermined low level, while the subsections that are not dimmed “remain on high beam. . . such that the light sent to the sensed vehicle location is dimmer than the light sent to all other areas of the headlight distribution area.” (Ex.1005, ¶¶[0026]-[0028]; Ex.2040, ¶¶161-163.)

Based on the Petition, Petitioner argues that Alden only discloses two fixed levels of illumination control – low and high, which can be seen, for example, from the footnote on page 25: “Where Alden wants a sector of the headlight beam to be low or high, a determination is made to power the lighting elements for those sectors to produce low or high beam intensity light, **as opposed to light at an intensity in the range between** low and high.” (Petition, 25, *see also* 24; Ex.2040, ¶165.)

Even that statement is inaccurate. The system determines which zones (LEDs) should be controlled to the predetermined low intensity. It does not

determine what low intensity illumination level should be applied “for” those zones, or even choose from optional alternative illumination levels. Per the Petition, “Alden explains that **if threshold light is detected at certain sensor positions such that another vehicle is present**, a determination is made that **the intensity of light for the headlight sectors corresponding to those sensor positions should be switched to dim, or low beam.**” (Petition, 24.) Thus, the presence of threshold light triggers application of the low beam level, and distance plays no demonstrated role. (Ex.2040, ¶166.)

Accordingly, Petitioner improperly relies on a singular determination, that of 1[C], to satisfy two discrete claim determinations. For Alden to anticipate claim 1, Petitioner needs to identify a distinct teaching to satisfy element 1[F] and no such showing has been made. Alden determines where detected light is located (“determined” sectors) and then provides a default low illumination level to the determined sectors. (Ex.2040, ¶168.) Regardless of the result of performing Alden’s techniques, Alden’s singular determination step does not satisfy both determination elements in claim 1. Petitioner has thus not proven claim 1 is anticipated by Alden.

B. Independent Claim 20

1. Claim 20[A][3]: *the light sources configured to have one or more controllable light characteristics*

Petitioner contends that “Alden discloses that its lighting elements have ‘one or more controllable light characteristics,’ as its lighting elements are ‘independently controllable as to intensity and[/or] direction.’” (Petition, 28, quoting Ex.1005, ¶[0008], Abstract, ¶¶[0026]-[0029].) Dr. Papanikolopoulos explained that Alden controls direction by “the placement of the LEDS with respect to the lens plus the individually controlled [LEDs].” (Ex.2066, 71:2-7.) There is no “controllability” of the direction of lighting elements in Figure 5, however. (Ex.2040, ¶171.) There may be a fixed output angle that is affected by the lens 121, but that is not a “controllable” characteristic of “direction” because it cannot be “controlled.” (Ex.2040, ¶171.) Nor does the remainder of the explanation, focused solely on how to control intensity, explain how direction is a “controllable” characteristic. While intensity may be sufficient for this element, later references in the Petition, citing this element, rely on other allegedly “controllable” characteristics such as direction. Subsequent proofs related to controllability of such characteristics and directed to claims dependent from claim 20 should be limited to reliance on intensity control, the only “controllable” characteristic shown for the LEDs of Figure 5.

2. 20[C]: control circuitry configured to adjust the at least one light characteristic of at least one of the directional light sources;

The preceding notion, that controllable characteristics are limited to proofs related to control of intensity, is reinforced by the proffer for this element – which relates exclusively to control of intensity via the “switch arrays.” (Petition, 30.) It is also worth noting that the Petition again agrees that each “lighting element 119 [is] ‘individually controlled’ by a corresponding switch in the array.” (*Id.*, Ex.2040, ¶174.)

3. Element 20[E]: The Petition fails to prove: [1] the processor, in communication with at least the sensors and the control circuitry, configured to: [2] process the sensor data to determine, within a field-of-view, at least a first subsection including a detected vehicle and at least a second subsection not including the detected vehicle ...

For element 20[E], Petitioner analogously references claim elements 1[E]-1[F], contending “Alden’s processor uses ‘sensor data’ to determine which subsections in the field-of-view include ‘a detected vehicle’ and which do not.” (Petition, 31.) That is the entirety of the proof for 20[E][2], with no expert declaration support. The referenced element 1[F] (*see* § VIII.B.3, *supra*) is about detecting light and creating an area to be blanked. Claim element 1[E] is about sensor data predefined as pertinent to the field of view, and the proof related to detection of “illuminated spots.” (Petition, 20.)

Thus, Petitioner has failed to explain how the system of Alden would determine “a second subsection not including the detected vehicle,” per element 20[E]. While the referential proof for 1[E] alleges interpretation of data “as headlights of a vehicle,” it offers no explanation for determining that a sector does not include a vehicle. (Petition, 20; Ex.2040, ¶170.) To complete this proof, Petitioner must show that Alden “determines” at least one sector “not including the detected vehicle.” Citing a previous proof that lacks such a requirement does not satisfy 37 C.F.R. § 42.104(b)(4)’s requirement for an explanation of where “**each claim element** is found in the prior art.”

Similarly, for referential element 1[F], there is no mention in claim 1[F] related to determining where a vehicle is, and where a vehicle is not. There is just a determination to reduce glare in a first subsection. Since the language of element 20[E] does not appear in either referential element 1[E] or 1[F], the Petition fails to provide evidence for what constitutes “*determination... of a second subsection not including the vehicle*.” Determining where a portion of a vehicle is, based on the position of detected headlights, does not prove that the system can determine where the vehicle is not, given that vehicles are larger than their headlights and can, per Petitioner’s proofs, approach at angles where the “sectors” not including the headlights may include substantial portions of the vehicle. (Ex.2040, ¶178; *see* IPR2023-01039, 49.)

Petitioner's argument that Alden anticipates 20[E] element thus amounts to an assumption that if the processor can determine where a portion of the vehicle is, the processor must also be able to determine where the vehicle is not. Petitioner's burden was, however, to prove, using substantial evidence, how the limitation was met. By choosing to use referential arguments that exclusively rely on two claims elements devoid of the relevant claim language, Petitioner has failed to demonstrate or explain how Alden "*determines*" a section "*not including the second vehicle.*" Petitioner's proofs thus fail to show that Alden anticipates claim element 20[E] with the specificity required by 37 C.F.R. § 42.104(b)(4).

C. Independent Claim 26

1. **Element 26[B]: *determining illumination requirements for the field-of-view based on the data sensed by the sensors, including determining illumination for at least a first subsection of the field-of-view including the other vehicle or pedestrian, as indicated by the sensor data, and for at least a second subsection of the field-of-view not including the other vehicle or pedestrian;***

Petitioner's proffer has three issues when it comes to this claim limitation. First, as noted previously, Petitioner's proof fails to establish that Alden includes a determination of illumination for the subsection including the other vehicle. (Ex.2040, ¶¶183-185, *see* § VIII.A.4, *supra*.) While there is a predefined low illumination level, the setting is automatically applied to the subsections that are determined to include detected headlights. (Ex.2040, ¶185.) That is, as previously

explained with respect to claim 1, there is a predefined low beam level (*see*, Petition, 25 fn) and the adjudged portions of the sensor array corresponding to detected illumination are automatically set to that fixed low beam level. (Ex.2040, ¶183.)

There is also no determination of illumination for the second subsection – i.e., the subsections that remain on high beam. (Ex.2040, ¶184.) The control function of Alden is as follows: “[s]ignals are sent to each of the headlight control circuit zones that need to be dimmed to restrict the amount of current to the corresponding headlight zones such that they are dimmed in a dimming process 109. Zones which are not dimmed remain on high beam.” (Ex.1005, ¶[0028]; Ex.2040, ¶184.)

Per Petitioner’s own explanation, the Alden illumination system employs a binary high beam/low beam system. The first set of zones are determined, and those are switched to a predefined low beam setting. (Ex.2040, ¶185.) The remaining zones “remain on high beam.” (*Id.*) The system is designed to parse the scene and correlate zones to either a high beam or low beam level, without the determination steps that are part of the claimed process. Petitioner offers no proof of such determination. And, beyond a reference to claims 1[F] and/or 20[E], Petitioner offers no proof of the “determining” steps claimed in element 26[B]. (Petition, 33.)

Third, there is no possible way for the Alden system to “know” whether a subsection does “not include” the other vehicle. In Alden, to the extent any control of light outside the detected headlamp zone covers a section not including the vehicle, it happens incidentally. (Ex.2040, ¶186.) The system cannot “*determine illumination ... for at least a second subsection ... not including the other vehicle*” because it does not know what that subsection is. (*Id.*) At best, it preserves illumination for all subsections outside the bounding box that it draws around detected light, and, as noted above, to the extent one of those subsections “does not include” a vehicle, that is simply incidental.

2. **Element 26[C]: *determining a control strategy for controlling one or more directional light clusters in a headlight assembly to create an output headlight beam meeting the determined illumination requirements, the headlight beam spatial light distribution shaped to provide high beam illumination for a driver of the vehicle, in at least the second subsection, while mitigating glaring light illuminating at least the first subsection including detected other vehicles or pedestrians;***

The preceding issues with Petitioner’s proof become more pronounced when 26[B] and 26[C] are considered in concert. (Ex.2040, ¶189.) The “illumination requirements” – i.e., illumination for the first and second subsections – are supposed to be “determined” prior to the control strategy, as the control strategy is based on such determinations. (Ex.2040, ¶189.) While claims are not necessarily

temporally organized, here the control strategy **utilizes** the determined illumination, so illumination for the two subsections must be “determined” prior to the control strategy. (Ex.2040, ¶189.)

What happens in Alden, at best, is as follows: 1) the system detects threshold illumination across a plurality of sensor elements (Ex.1005, Fig. 4); 2) based on regions where threshold illumination is present, the system compiles maps 51a, 51b. (Ex.2040, ¶190; Ex.1005, Fig. 4.) At this point, the system has two sensor maps, each indicating corresponding detected illumination. (Ex.2040, ¶¶190-191.)

The system then compares the maps, calculates distance to the threshold objects, and determines the “dim zones.” (Ex.1005, Fig. 4; Ex.2040, ¶191.) Again, this “determination” of “dim zones” is **not** determining zones where there is illumination and **then** determining illumination **for** those zones, this is simply determining zones where a predefined, fixed level of dimming should be applied. (Ex.2040, ¶190-191.)

Now, having such zones, the system “switches requisite headlight segments to dim—” to a predefined, fixed level. (Ex.2040, ¶192.) That is the “control strategy” for achieving dimming. This “strategy,” however, is also predefined – i.e., once the zones are known, the zones are mapped to a switch array. Thus, the “control strategy”--the decision that zones should be mapped to switches that have predefined binary control-- is already part of the predefined algorithm in Fig. 4.

(Ex.2040, ¶193.)

Alternatively, if one considers determination of the bounding box to be the determination of the control strategy – although this is not clear from Petitioner’s proof –that box is determined *before* the application of the predefined, dim and high illumination levels. Thus, given the temporal restrictions of the “control strategy” element, the determination of the bounding box *cannot* satisfy the claimed “control strategy” determination. (*Id.*) According to the claim, the control strategy is supposed to “meet the determined illumination requirements,” but if the proof of “illumination requirements” does not occur in Alden until *after* the bounding box is determined, then determination of the bounding box cannot “meet” such “determined illumination requirements.” (*Id.*) Accordingly, given their temporal interrelationship, Petitioner’s proofs fail to meet either or both element 26[B] and 26[C].

In sum, Petitioner’s proof fails to show anticipation of elements 26[B]-[C]. Petitioner has not shown either how the illumination requirements for the subsections are “determined,” or how a control strategy that “meets determined illumination requirements” can be determined for illumination requirements that are, per the proof and Alden, at best determined *after* the alleged control strategy. (Ex.2040, ¶195.)

Thus, the proof fails to meet the statutory requirements of 37 C.F.R.

§ 42.104(b)(4) .

D. Dependent claim 2

1. **Element 2[B]: *one or more light emitting sources, each having a variable light-source characteristic dependent on power, and wherein the control circuitry is arranged to alter said light-source characteristic via power control;***

Petitioner relies on Alden’s lighting elements 119, as disclosed with reference to Figure 5, for satisfying “*light emitting sources*” in element 2[B]. (Petition, 38.) For the “*light source characteristic*” of each light source (collectively, “the characteristics”) “dependent on power”, Petitioner relies on Alden’s disclosure in ¶¶[0026]-[0029], and states that “the intensity of each light element is alterable, as it can be either a ‘high’ or ‘low’ beam.” (Petition, 38.) Thus, the proof relies on the “*characteristic*” being intensity. (Ex.2040, ¶201.)

2. **Element 2[C]: *one or more light modifying elements provided in the path of light emitted from at least one of the sources, further controlling the light-source characteristics***

a. Anticipation

Petitioner relies on Alden’s lens 121 as described in ¶[0029] and Figure 5 for satisfying the “*light modifying elements*” limitation. (Petition, 39.) Alden discloses that the light element “119 and other lighting elements are on a curve along the focal point of a headlight lens 121 such that the light from each lighting

element goes into a specified portion (or portions) of the headlight distribution area.” (Ex.1005, ¶[0029].) Thus, at best Alden discloses that the lens 121 “adjusts” the direction of light emitted by the light element 119, not its intensity. (Ex.2040, ¶204.) Petitioner’s proof fails to appreciate the prior proof for claim 2[B] that relies on Alden’s disclosure regarding intensity for satisfying the “*characteristic*” limitation. Given the interrelationship between claim elements 2[B] and 2[C], the identification of headlight lens 121 for element 2[C] fails, as lens 121 is not shown to “control” the intensity characteristic, as required by the claim. Accordingly, Petitioner’s 2[B] and 2[C] anticipation proofs fail to establish that Alden discloses “*wherein the control circuitry is arranged to alter said light-source characteristic via power control; [and] one or more light modifying elements . . . further controlling the light-source characteristics*” as claimed.

b. Obviousness

Petitioner further states that “[i]n addition, Alden’s system can include other ‘light modifying elements,’ including a ‘variable refractive element’ in the form of a liquid crystal. (Alden, [0033]-[0035], [0061], Figs. 8-10.)” (Petition, 40.) Petitioner proposes modifying Alden’s Figure 5 embodiment to include Alden’s refractive elements of its Figure 8-10 embodiments: “Alden discloses that its use of refractive elements to ‘bend’ light can be included in its headlight system, such as that of Figure 5, and a POSITA would have readily understood how to implement

the variable refractive elements in such system. (*Id.*, ¶97.)” (Petition, 42.) Notwithstanding Petitioner’s argument, Alden does not disclose combining the Figure 5 LED, “first embodiment” with the “third embodiment” depicted in Figures 8-10. (Ex.2040, ¶205.) Rather, Alden discloses three distinct embodiments, having a different principle of operation to control either intensity or the direction of light exiting the headlights. (Ex.2040, ¶¶75, 205.) Further, Alden’s boilerplate language in ¶61 (e.g., “Many other variations are possible”) does not expressly support Petitioner’s proposed combination. (Ex.2040, ¶205.) Therefore, Petitioner’s 2[C] anticipation argument fails.

Regarding obviousness, Petitioner must explain how and why a POSA would have modified or combined the prior art. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 418 (2006) (requiring articulated reasoning with rationale underpinning as to how or why a person of ordinary skill in the art would have combined or modified the teachings of the prior art); *Personal Web Techs., LLC v. Apple, Inc.*, 848 F.3d 987, 994 (Fed. Cir. 2017) (holding obviousness determination to be improper where the record lacked a “clear, evidence-supported account” of “how the combination” would work); *Adidas AG v. Nike, Inc.*, IPR2016-00922, Paper 21, 36 (October 19, 2017) (holding that challenged claims are patentable when the “Petitioner fails to explain why and how a person of ordinary skill in the art would combine” two references.)

Notably, Petitioner’s 2[C] obviousness argument is couched in the form of what Alden could include, which doesn’t address the relevant inquiry of whether a POSA would combine “other light modifying elements,’ including a ‘variable refractive element’ in the form of a liquid crystal” from the third embodiment of Alden with the Figure 5 LED embodiment. *See In re Giannelli*, 739 F.3d 1375, 1379 (Fed. Cir. 2014) (“physical capability alone does not render obvious that which is contraindicated.”) On this point, the Federal Circuit has recently clarified that the “mere fact that these possible arrangements existed in the prior art does not provide a reason that a skilled artisan” would have made the substitution. *See Virtek Vision Int’l ULC v. Assembly Guidance Sys., Inc.*, No. 2022-1998, 2024 WL 1292734 at *3 (Fed. Cir. Mar. 27, 2024) (emphasis added).

The Petition fails to not only explain why a POSA would have made the proposed substitution, it also fails to explain how a POSA would have combined Alden’s Figure 5 and Figures 8-10 embodiments. In his deposition, Dr. Papanikolopoulos proffered an explanation, for the first time, regarding how a combination might be made—proposing the insertion of a **single** refractor close to the first LED element of the Figure 5 embodiment between the LED array and the lens 121:

Q. Okay, so how would a POSITA have added this refractor element to the Figure 5 embodiment?

A. So, for example, let me go to figure -- so let's suppose, for example, if you go to Figure 5, . . . So the element -- the first element from the top, the first LED element, we can put a refractor, which is basically it's quite small, we can put it as close to the LED as possible, among other options.

(Ex.2066, 79:3-16.)

Q. Okay, so you're inserting this [one refractor element] . . . to the Figure 5 embodiment between the LEDs and the lens 121 or are you removing lens 121?

A. A POSITA will have the option depending on the particular task but in this case in this scenario that I mention in the context I mention before, we can keep the lens.

(Ex.2066, 80:11-17.)

According to Petitioner, “a POSITA would have had a reasonable expectation of success, as the refractor would perform its same function of allowing light to pass straight through when a circuit is open and bending light when the circuit is closed.” (Petition, 42.) This statement, however, ignores the express teachings in Alden regarding the third embodiment, depicted in Figures 8-10, which shows collimated light entering the optical control at the same perpendicular (to the control) angle and the fact that the liquid crystal is described as “birefringent.” (Ex.1005, ¶¶[0033], [0051].) By contrast, the LEDs in the Figure 5 embodiment, do not provide collimated light. (Ex.2040, ¶75.)

Deploying a refractor into the lamp of Figure 5 would result in most light striking the refractor at non-perpendicular angles. (Ex.2040, ¶208.) The birefringent crystals of the third embodiment would simply scatter the non-collimated light generated by the LEDs; leading to an inoperative combination. (*Id.*) Accordingly, the proposal to add the elements of Figures 8-10 to the system of Figure 5 is not explained sufficiently to ensure a reasonable expectation of success – as the proposed combination would instead almost certainly fail to yield an operative headlamp beam. (Ex.2040, ¶¶208, ¶75.) Thus, Petitioner’s proposed combination or modification of Alden fails because it does not provide an articulated reasoning with rationale underpinning as to how or why a person of ordinary skill in the art would have combined or modified Alden. *See KSR*, 550 U.S. at 418. Per the Federal Circuit’s recent guidance in *Virtek*, “*KSR* did not do away with the requirement that there must exist a motivation to combine various prior art references in order for a skilled artisan to make the claimed invention.” *See Virtek*, 2024 WL 1292734, at *3 (emphasis added).

E. Dependent claim 3

1. **Element 3: wherein the one or more light modifying elements is at least one of a static light modifier or a variable light modifier, said light modifying element comprising at least one of reflectors or refractors, and wherein variable light modifier** control circuitry is configured to control the light-cluster light characteristic by altering the light modifying elements in the path of the light emitted from the at least one of the light sources

a. Anticipation

Claim 3 depends from claim 2. Petitioner relies on lens 121 as described in ¶[0029] and Figure 5 for satisfying the “*light modifying elements*” of claim 3. Here again, Petitioner’s proofs fail to appreciate the interrelationship between element 3 of claim 3 and claim 2, from which it depends. Because lens 121 is a static light modifier, it is not capable of controlling intensity, the proffered “characteristic” for the claim 2 proof. Per claim 2, the “*light-source characteristic*” — which Petitioner identifies as “intensity” — must be “*dependent on power*” and capable of being altered “*via power control*” and further the “*light modifying element*” must control “*the light source characteristics.*” (Petition, 38; Ex.2040, ¶211.) While intensity is capable of being altered via power control, static lens 121 is incapable of controlling Petitioner’s proffered intensity characteristic. (*Id.*)

To the extent Petitioner contends that other characteristics are also present and controllable by lens 121, Petitioner has never shown how those characteristics meet the requirement that they are “dependent on power.” (Ex.2040, ¶212.) Thus,

Petitioner cannot rely on “direction” as the applicable characteristic for claim 3 unless Petitioner additionally established (here or in claim 2) that “direction” is a characteristic “dependent on power” per the claim 2 requirements for *the light source characteristic*.

While a *light source characteristic* that is “dependent on power” could have been shown, for example, in the form of “directionality/aiming,” Petitioner made no such proffer for “characteristic” in the Petition and is thus not entitled to altering its argument post-institution. (Ex.2040, ¶¶211-212.)

b. Obviousness

In addition to the defects identified with the claim 2 proof, specifically the combination failure for element 2[C] *supra*, Petitioner’s claim 3 proof includes another defect. (See § VIII.D.2., *supra*.) More specifically, because Petitioner’s proof is now combining a controllable optic with a controllable array, it is unclear what the control circuitry is controlling.

In the Alden embodiment of Fig. 10, the control circuitry controls the optic and the light source is a static single-point emitter. (Ex.1005, Fig. 10.) But, in Figure 5, the control circuitry controls the LED array. (Ex.1005, Fig. 5.) Thus, when Petitioner attempts to combine the embodiments of Figure 5 and 10, it is unclear if the combination includes dual control circuitry, or if one control circuit controls power to the LED array and the second controls the variable light modifier

circuitry. (Ex.2040, ¶215.) It is similarly unclear how the two control systems would function when light is detected – for example, whether the system could and/or would dim an LED or steer light from the LED away from a sector. (*Id.*)

In light of the above deficiencies, Petitioner’s claim 3 obviousness combination fails. The obviousness combination also fails at least for the issues noted with respect to element 2[C] – namely the lack of an explanation regarding how the non-collimated light of Fig. 5 could be used with the bi-refractive optics of Fig 10.

F. Dependent claim 4: *headlight system of claim 2, wherein the light modifying element further comprises at least one of lenses, diffractors, optical devices, a light guide, filters, phosphors, optical coatings, prisms, controllable piezoelectric light guides, MEMS devices, light valves or optical switches*

1. Anticipation

Here again, Petitioner proffers lens 121 for its anticipation proof for claim 4. Because claim 4 inherits all of the claim limitations of claim 2, the proof deficiencies of claim 2 apply with equal measure. As noted with respect to claim 2, because the “*light modifying element*” needs to control a “*light source characteristic*” that is “*dependent on power*” and Petitioner has never shown how direction, controlled by the lens 121, is a characteristic *dependent on power*, Petitioner’s claim 4 proof also fails. (Petition, 45; Ex.2040, ¶220; see VIII.F., *supra.*)

2. Obviousness

The variable refractive element combination discussed with respect to claim 2[C] includes the deficiencies noted with respect to the claim 2[C] combination. Thus, this proof also fails for the reasons presented with respect to claim 2[C]. (Petition, 45; Ex.2040, ¶221.)

- G. Dependent claim 11: *headlight system of claim 1, further including a computer vision processing unit configured to use the sensor data and one or more of the algorithms to identify entities including at least one of beings, vehicles, roadway, or street signs and wherein the logical controller/processor is further configured to modify 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, ¶224.) Per the claim construction principles laid out in *Phillips v. AWH Corp*, the ordinary meaning of “identify” is to “show to be a certain person or thing; to fix the identity of”. (Ex.2065, 902.) The notion that Alden can “identify” a vehicle is a misstatement of the reference’s teachings. (Petition, 49.) In relevant part, Alden determines an area in which light should be diminished, based on the detection of light within that area. (Ex.2040, ¶224.) 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. (*Id.*)

H. Dependent claims 15, 21, 32-33

1. **Claim 15: *system of claim 1, wherein the logical controller is further configured to determine at least a road curvature, indicated by the sensor data, ahead of the vehicle and wherein the required illumination includes increasing illumination in a direction of the road curvature***

Though Petitioner combines the proofs for claims 15 and 21, given the differences in the claim language and possible confusion, PO presents the problems with each claim proof separately. (Petition, 52.)

- a. ***wherein the logical controller is further configured to determine at least a road curvature, indicated by the sensor data, ahead of the vehicle***

There are several requirements for this portion of claim 15: 1) that the logical controller determines the road curvature; 2) that the road curvature is indicated by “the” sensor data; and 3) that the road curvature is “ahead” of the vehicle. In claim 1, the independent claim from which claim 15 depends, “*sensor data*” is defined as “*data predefined as pertinent to illumination requirements of the field of view.*” Petitioner’s proffer for “*sensor data*” in claim 1 was “detected light.” (See VIII.A.1., *supra.*) Thus, in claim 15, the road curvature “*indicated by the sensor data*” must be also based on detected light – or, alternatively, different sensor data must be shown to meet the “*predefined as pertinent to illumination requirements*” limitation of 1[E]. (Ex.2040, ¶228.)

Petitioner's 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, 53 citing Ex.1005, ¶[0036].) 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, 79:18-80:12, 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, ¶231.) 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. (*Id.*)

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 contention “this data” (detected light) is used to “adjust the LEDs ‘responding headlights 155’ so that they ‘direct light into the corner ...’” is entirely unsupported. (Petition, 53; Ex.2040, ¶232.)

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, ¶233.)

The reference to the “rotation sensor” is of no help. (Petition, 53.) First,

Petitioner did not establish that data from the steering wheel satisfies the requirements for “*the sensor data*” limitation of claim 1, which is “*data predefined as pertinent to illumination requirements of the field of view.*” (Ex.2040, ¶234.) Even assuming that this is met, steering data is not indicative of a road curvature “*ahead of*” the vehicle, as required by claim 15. (*Id.*)

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]; Ex.2040, ¶235.) 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 a calculation involving “**the new direction** of the vehicle;” Alden lacks any mention of a “planned” direction. (Contrast Petition, 53, with Ex.1005, ¶[0058].)

*b. wherein the required illumination includes
increasing illumination in a direction of the road
curvature*

Finally, it is not clear that the headlight of Figure 5 can “change direction.” (Petition, 53.) The lamp already emits high beams everywhere there is not glare reduction and it lacks optical steering capability. (Ex.1005, Fig. 5, ¶¶[0006],

[0026]-[0027]; Ex.2040, ¶239.)

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 are you saying that’s what is shown in Figure 5?

A: I say such as shown in Figure 5.

(Ex.2067, 111:18-112:5.)

And, in another deposition, Dr. Papanikolopoulos admitted that when there are no other vehicles present, all LEDs are 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; Ex.2040, ¶240.)

While the second deposition questions 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.2067, 111:18-112:5; Ex.2040, ¶242.) 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; Ex.2040, ¶241.)

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, ¶242.)

Petitioner’s claim 15 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 21 below, apply equally to claim 15-- as Petitioner proffered combined proofs for both claims.

2. ***Claim 21: system of claim 20, wherein the processor is further configured to determine at least a road curvature, indicated by the sensor data, ahead of the vehicle and to direct the control circuitry to adjust the directional light sources to increase illumination in a direction of the road curvature***
- a. ***wherein the processor is further configured to determine at least a road curvature, indicated by the sensor data, ahead of the vehicle***

As claim 21 was proven in reference to claim 15, the claim 21 anticipation proof fails for at least the same reasons as claim 15. (See VIII(H), *supra*). Here again, Petitioner proffered no obviousness-type proof for claim 21.

- b. ***to direct the control circuitry to adjust the directional light sources to increase illumination in a direction of the road curvature***

This limitation varies slightly from that of claim 15, as it requires a showing that the processor directs control circuitry to adjust directional light sources. (Ex.2040, ¶246.) In addition to the claim 21 proof failing for the reasons noted with respect to claim 15, the claim 21 proofs also fail to show what control adjustment achieves the claimed increase of illumination in a direction of the road curvature. While the steering allegedly causes a change of “f(x)” degrees, the proof does not show how the processor of the claim 20 proof directs the control circuitry to increase illumination f(x) degrees, as required by claim 21. (Ex.2040, ¶246.)

The blended argument contends, for example: “This data [sensed turns from

reflectors is] used by the CPU and control circuitry to adjust the LEDs ‘responding headlights 155’ (such as, for example, those show in Figure 5 pointed in the direction of the reflectors) so that they ‘direct light into the corner...’” (Petition, 53.) However, with regard to Figure 5, Alden clearly states that all LEDs “remain on high beam.” And, Dr. Papanikolopoulos has further explained that the Figure 5’s LEDs are positioned “to ensure that the beam created by the headlamp is sufficiently wide to illuminate turns.” (Ex.2067, 111:18-112:5.) Thus, Petitioner’s claim 21 proofs fail to show how the control circuitry is “directed” to adjust directional light sources and fail for this additional reason. (Ex.2040, ¶¶247-248.)

3. Claims 32/33

Petitioner’s proof for method claims 32 and 33 conflates *curves* and *turns*, even though both claim terms have different plain meanings and the doctrine of claim differentiation militates against such a conflated construction. The plain meaning of a “turn” is a “change of direction when moving” (www.google.com/turn) while the plain meaning of a “curve” is a “continuously bending line, without angles.” (<https://www.dictionary.com/browse/curve>). Thus, by their plain meanings alone, a “curve” lacks the “angle” that facilitates the change of direction required for a “turn.” (Ex.2040, ¶¶65, 256.) Unsurprisingly, the “illumination requirements” that need to be determined in claim 33 for a “turn” are different from the “illumination requirements” for a “curve.” (Ex.2040, ¶251.)

Thus, Petitioner cannot prove that both claims are anticipated with the exact same proof, unless it first establishes a genus/species relationship between the two claims or explains why the language differences are immaterial. Petitioner proffered no such proofs.

Additionally, the proofs for claims 32/33 suffer from the enablement-related issues presented with respect to claim 15, wherein the vehicle is incapable of distinguishing between headlights and road reflectors. (Ex.2040, ¶252; *see* § X.A.8, *supra*.)

I. Dependent claims 16-17, 22-23, 34-36

1. Claims 16/17

Petitioner's claim 16 and 17 "turn" proofs once again conflate the claim terms "turn" and "curve," by providing referential proofs to claim 15, which is expressly directed to "curves," though the terms have different ordinary meanings and reside in different claims. (Petition, 55.) As with claims 32/33, Petitioner fails to explain why the language difference between claims 15 and 16-17 is immaterial, and so in addition to failing for the enablement-related issues corresponding to claim 15, the claim 16-17 proofs also fail because Petitioner never justifies why a single proof is sufficient for claims of different scope. (*See* § X.A.8,11, *supra*.)

And again, because Alden discusses determining the "new direction" of the vehicle with respect to the steering function $f(x)$ and not the "planned new

direction” as Petitioner contends, turning a steering wheel while the vehicle is not moving will have no apparent effect, as there is no “new direction” of the vehicle at that moment. (Petition, 55; Ex.2040, ¶¶256-257.)

2. Claims 22/23

Here again, claims 22/23 relate to a *planned upcoming turn*, not an upcoming *curve*, but Petitioner ultimately relies on referential proofs detailed for claims 15/21, directed to a curve. (Petition, 55; Ex.2040, ¶260.) These proofs are deficient for the reasons cited with respect to claims 15/21 and with respect to claims 16/17 and 33 (*See* §VIII.H.1, §VIII.H.2, §VIII.I.1 and §VIII.I.2, *supra*).

3. Claims 34/36

In addition to the shortcomings related to the claim terms “*turn*” vs. “*curve*” noted above with respect to claims 15/21 (enablement) and claims 16/17/33 (the plain meaning of “turn” versus “curve”), the proofs for claims 34/36 also require “*determining control instructions for controlling one or more directional light sources to achieve illumination of the turn*” – another distinction never shown or explained by the mere analogy to claims 16-17 and 32-33. (Petition, 56; Ex.2040, ¶263.)

4. Claim 35

Here again, claim 35 is directed to a “turn,” and the referential proof suffers from all the issues of claims 15/21 and 16/17/33. (Petition, 56.) Further, claim 35

also calls for “creating an output headlight beam” that illuminates the turn, a feature never explained in the referenced arguments for claims 15/21 and 16/17/33. (Petition, 56; Ex.2040, ¶265.)

IX. Ground II – Alden in view of Harbers - dependent claims 5//28/29

For Ground 2, Petitioner asserts that dependent claims 5 and 28-29 are obvious based on the combination of Alden in view of Harbers. Claim 5 recites in relevant part: **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 and wherein the control circuitry is configured to alter the overall light-cluster spectral power distribution to illuminate at least one of the at least two sub-sections of the field-of-view with a different color of light from another of the at least two sub-sections.**

1. **5[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, 60; Ex.2040, ¶268.) Instead, the proof is about light clusters, not light sources. (Petition, 60; Ex.2040, ¶268.) The proof thus fails.

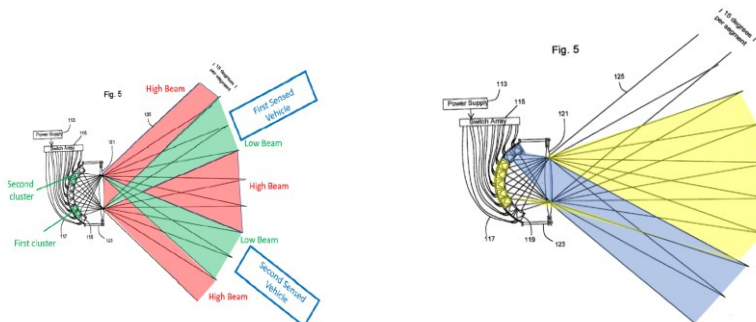
2. 5[b]: Reliance on single colored LEDs would cause colored emission from the combination

Petitioner relies on the colored LEDs of Harbers for the 5[b] claim limitation. (Petition, 61.) 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, ¶271.) Figure 5 of the Alden reference is a nine element LED array that is not otherwise modified by Petitioner for this combination. (*Id.*) Thus, each replacement of a colored LED from Harbers into the Alden array, replaces 1/9 of the emission output with a different color.

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, ¶273.) As Petitioner has shown, in some of its examples, oncoming vehicles may also be traveling towards the emitting vehicle at angles. (*See* IPR2023-01039, Petition, 49.) 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, ¶271.) In the example shown below from Petitioner’s annotated figure from the

Petition in IPR2023-01039, the driver's face would be squarely in the "blue" beam.

(Ex.2040, ¶272.)



(IPR2023-01039, Petition, 49; IPR2023-01039, 65)

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. (Ex.2040, ¶274.)

B. Claim 28

Claim 28 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, ¶277.) Again, Petitioner relies on inclusion of “color” LEDs from Harbers. (Petition, 65-66.) 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 "substantially reduce 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. (Ex.2040, ¶277.)

C. Claim 29

Again, Petitioner relies on usages of colored LEDs from Harbers. (Petition, 67). But, as detailed above, changing output levels of LEDs and "activating different LEDs," to deal with the creation of function-specific beams per Harbers, is not compatible with Alden's system. (Ex.2040, ¶280.) Moreover, in a one-dimensional array, it is not even clear how such changing would occur – as Harbers appears to require more than one row of LEDs to create its functional segments. (*Id.*) 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 Harbers' functions, or how such a configuration would look. Accordingly, this claim 29 argument suffers from all the deficiencies of the combinations proposed for claims 5 and 28. (*Id.*)

X. Ground III – Alden in view of Bergkvist—(Claim 6)

For this combination, Petitioner relies on the inclusion of "a UV light

source” “in the array of Alden” based on Bergkvist. (Petition, 69.) 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, 2:63-28; 3:17-26.) Bergkvist has no LEDs, nor does it mention UV LEDs. (Ex.2040, ¶282.) 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, 69; Ex.2040, ¶282.)

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, ¶283.)

XI. Ground IV – Alden in view of Beam (Claims 8)

Claim 8 relates to detecting a preceding vehicle (i.e., taillights). (Ex.2040, ¶XX.) Petitioner largely seems to be arguing that if one can detect headlights, one can also detect taillights. (Petition, 72; Ex.2040, ¶286.) Based on deposition testimony, Petitioner’s expert seems to believe that the requisite capability is present in Alden, and that one would simply “tune” the sensor of Alden to detect

taillights. (Ex.20XX, XX.)

Beam however provides no such tuning, it simply relies on detecting light that is indicative of both headlights and taillights. (Ex.1008, XX; Ex.2040, ¶286-7.) Presumably, the modified system would have its threshold tuned downward to include the data of taillights, as they are dimmer than headlights. (*Id.*) 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. (*Id.*)

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, ¶288.) 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, ¶288-290.)

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, ¶290.)

XII. Ground V – Alden in view of Kobayashi (Claim 9)

For claim 9, Petitioner imports the GPS of Kobayashi. (Petition, 75.) 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, ¶293.) That is, even if GPS coordinates are present, the combined system seems to only use them when reflectors are not present. (Petition, 77.) 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. (Ex.2040, ¶294.) 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. (Ex.2040, ¶293-294.)

XIII. 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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