

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. 11,208,029 to Spero

Case No: IPR2023-01034

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	Intentionally left blank
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)
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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 .)
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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-

Exhibit No.	Description
	wwe&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, Yechezkal Evan Spero (“Patent Owner”), submits the following Response to the Petition for *Inter Partes* Review filed by Mercedes-Benz USA, LLC (“Petitioner”) that challenges Claims 1-33 (“Challenged Claims”) of U.S. Patent No. 11,208,029 (“the ’029 Patent”).

Patent Owner respectfully requests that the Patent Trial and Appeal Board (“the Board”) determine that the Challenged Claims have not been shown, by a preponderance of evidence, to be unpatentable.

II. Overview of the ’029 Patent

The ’029 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 at hand.” (Ex.1001, 11:5-13.) The ’029 Patent explains that “[t]he terminology ‘digital’ as used herein refers to the discrete nature of the multiple LED lamps provided in the luminaire, whereby, ‘digital’ control results from the individual control of the discrete, i.e., ‘digital’ lighting elements, the LEDs, in the luminaire.” (*Id.*, 2:67-3:5; Ex.2040, ¶50.)

The ’029 Patent describes the deficiencies of prior art lighting systems that replace conventional lights with solid-state LED light sources “with some minor

adjustments” but do not utilize the full “digital” control of the LEDs. (Ex.1001, 9:60-63; Ex.2040, ¶51.)

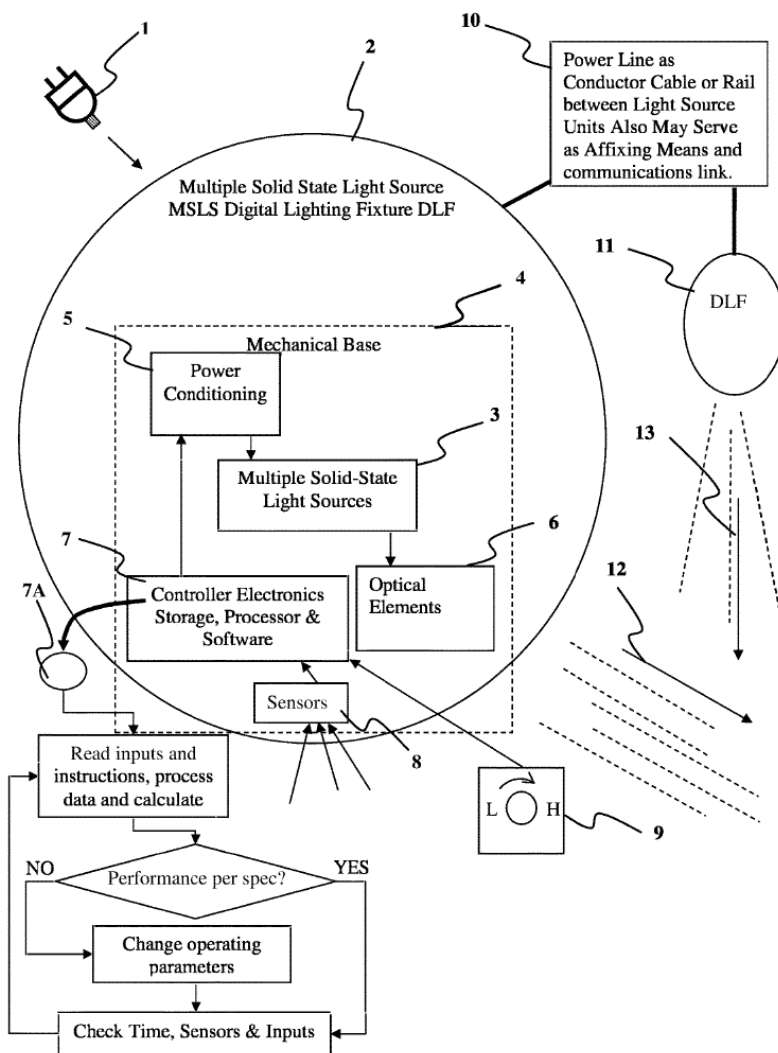


FIG. 1

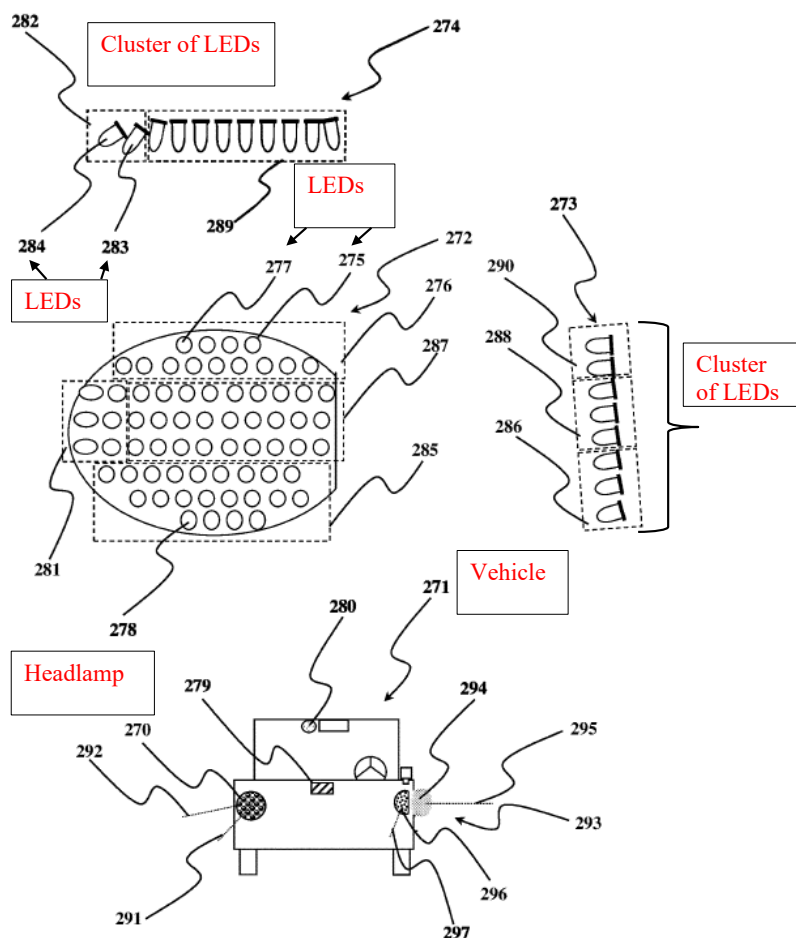
(Ex.1001, Fig. 1)

The digital lighting fixture (DLF) “includes more than one light source 3, which is preferably an electroluminescent solid-state light source” (SLS) and power conditioning circuitry 5 to condition the power supplied to the light sources 3.

(Ex.1001, 25:5-17.) “The direction of light exiting from the DLF as a whole or from each SLS individually is controllable by optical elements 6, such as reflective surfaces and or refractors, and may be electronically variable optical elements.” (*Id.*, 25:17-21; Ex.2040, ¶52.)

The '029 Patent describes: “The added controllability offered by breaking the total light output up into **discrete (‘digital’) specifically aimable and dimmable elements**¹ 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.” (*Id.*, 11:56-62.) “The invention embraces LED-illuminating devices covering a wide scope of applications,” including transportation. (*Id.*, 11:14-21, 4:18-20, 50:49-50; Ex.2040, ¶53.)

¹ Emphasis added by Patent Owner unless indicated otherwise.



(Ex.1001, FIG. 15, Annotated)

The claimed invention of the '029 Patent, titled “Adaptive Headlight System,” is directed to multi-LED headlight systems that provide predictive curve illumination with the receipt of map data indicating a road curvature upcoming along a road on which the motor vehicle is traveling. The '029 claimed invention solves the problem of how to provide a digital lighting solution that can “provide the optimal lighting solution in real-time” to predictively illuminate an upcoming road curvature. (Ex.1001, 57:43-49.) The '029 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.*, 22:26-28.) Similarly, an adaptive headlight system may utilize this dual functionality to aim a light beam at a curve ahead of the vehicle while maintaining forward lighting. (Ex.1001, 50:61-67; 51:54-67; Ex.2040, ¶54.)

The Challenged Claims include independent claims 1, 12, and 23. Independent claim 1 is representative and reproduced below with emphasis added. (Ex.2040, ¶55.)

1. A system for a motor vehicle, comprising:
a plurality of headlamps, each comprising a plurality of
LED light sources;
one or more processors; and
a memory storing instructions that, when executed by one or more of
the one or more processors, enable the one or more processors to:

receive first data, including at least map data, indicating
a road curvature upcoming along a road on which the
motor vehicle is traveling;

determine a light change, the change adapting
a light pattern of the headlamps in at least one of color,
intensity or spatial distribution **to increase light in a**
direction of the road curvature ahead of the motor
vehicle and shaping light based at least in part on the
road curvature; and

Predictive
Curve
Illumination
Limitation

control at least a first plurality of the LED light
sources to provide light **based at least in part on the**
determined light change and prior to the motor vehicle
reaching the road curvature.

Control
Limitation

(Ex.1001, claim 1.)

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 Patent Owner's expert, Dr. Matthew Turk, clearly satisfies it. (Petition, 8-9; Ex.2040, ¶58.)

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)).

Here, properly construed according to their ordinary meanings and as supported by the specification of the '029 Patent, the limitations “*the control*” or “*the controlling*” recited in dependent claims 9/20/31 are not taught by the Alden, Kobayashi, or Beam reference. The ordinary meaning of each of these claim terms is provided below.

V. The Applied References

A. Alden

Alden is directed to controlling the distribution of light by a vehicle headlight. Alden’s systems include headlights that produce multiple individually controllable beam segments of light, each illuminating a sector of an area (“distribution area”) ahead of the vehicle equipped therewith (“equipped vehicle”). (Ex.1005, ¶¶[0002], [0004-0006], [0008]; Ex.2040, ¶63.)

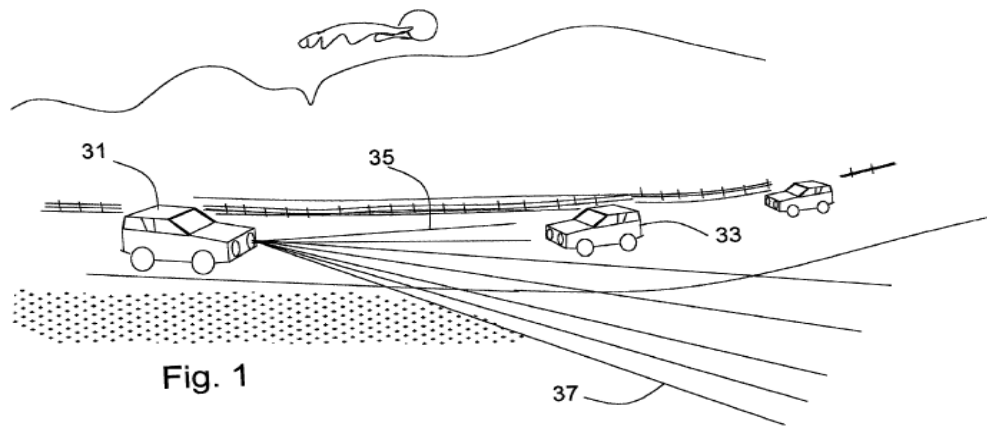
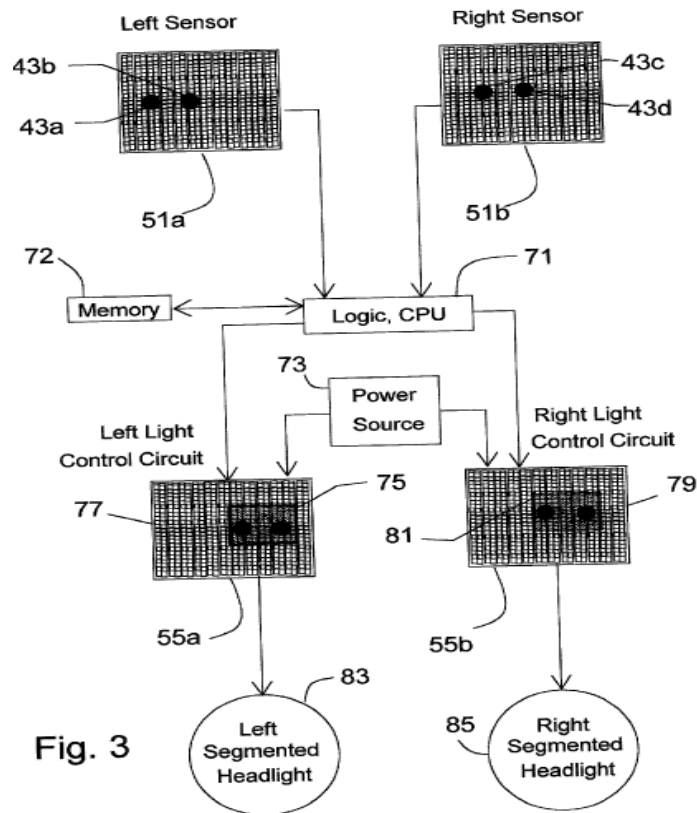


Fig. 1

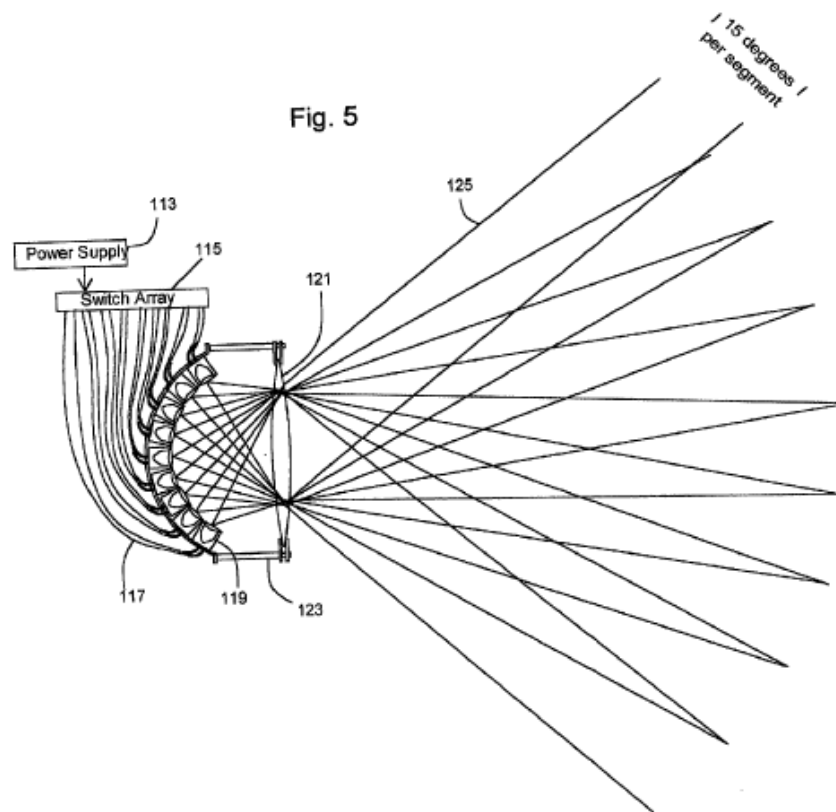
(Ex.1005, FIGURE 1)

The systems also include sensors 51a, 51b for detecting incoming light received from the distribution area, which sensors 51a, 51b are divided into multiple sectors associated with sectors of the distribution area illuminated by the beam segments of the headlight of the equipped vehicle. (Ex.1005, ¶¶[0027-0028], Figs. 3-4; Ex.2040, ¶64.) The systems further include a central processing unit (CPU) 71 that determines whether incoming light detected in each sector of the sensors 51a, 51b has an intensity that exceeds a threshold value. (*Id.*)



(Ex.1005, FIGURE 3)

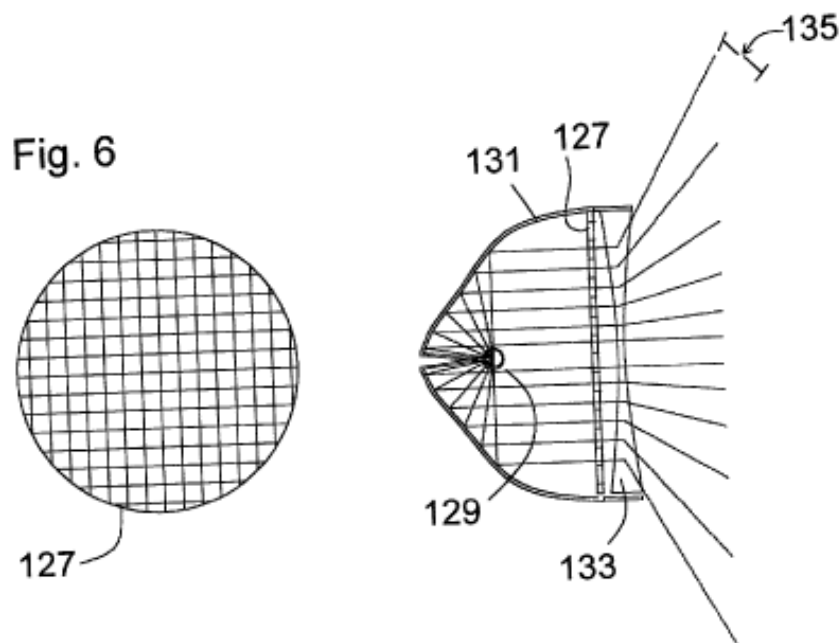
In one of the three distinct embodiments, the headlight system dims the intensity of selected beam segments produced by the headlight of an equipped vehicle that seemingly correspond with a sector or sectors in the distribution area. (Ex.1005, ¶¶[0025-0026], [0029], Figures 1, 2, 5; Ex.2040, ¶65.) A headlight 123 employs a single-row array of light emitting diode (LED) elements 119 and a double convex lens 121 for directing the beam segments produced by the LED elements 119 that illuminate different sectors of the distribution area. (Ex.1005, ¶[0029], Figure 5; Ex.2040, ¶65.)



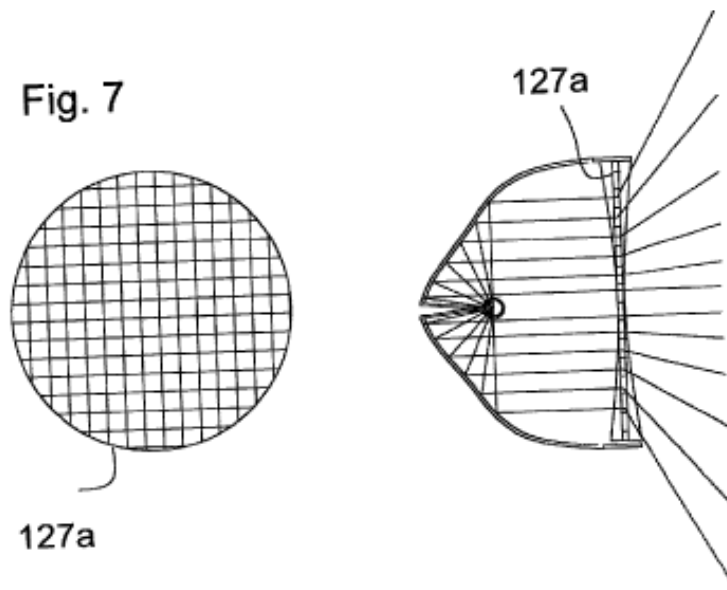
(Ex.1005, FIGURE 5)

The CPU 71 may determine the sector or sectors of the sensors 51a, 51b receiving incoming light from the distribution area that have a detected threshold intensity, which are used to create a region within which light is to be dimmed. (*Id.*, ¶¶[0026-0029]; Ex.2040, ¶66.) In response, the CPU 71 controls the headlight 123 to dim some number of beam segments produced by the individual LED elements 119. (Ex.1005, ¶¶[0026-0029].) Alden uses a convex lens with a curved LED array in this arrangement to create output where LED 119 is responsible for sector 125. (Ex.1005, ¶[0029]; Ex.2040, ¶66.)

Such operations may also be accomplished by another different headlight system embodiment of Alden shown in Figures 6 and 7. As seen therein, that embodiment 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, ¶67.) In Figure 7, the electro-chromatic elements 127a are within the double concave lens. (Ex.1005, ¶[0030-0031]; Ex.2040, ¶67.)

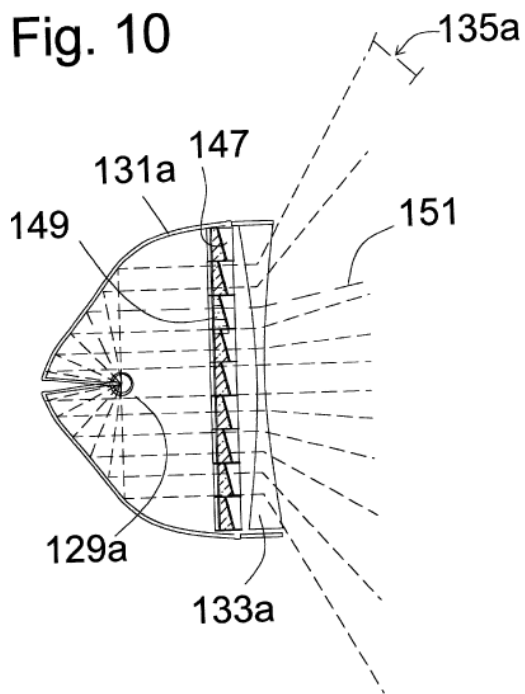


(Ex.1005, FIGURE 6)



(Ex.1005, FIGURE 7)

A third, further distinct embodiment is shown in Figure 10, in which the headlight system employs a single light source 129a, a collimating reflector 131, and electro-optic refractive material 147, 149 to produce multiple light beam segments. (*Id.*, ¶¶[0032-0035], Figure 10; Ex.2040, ¶68.) The CPU 71 can control the electro-optic refractive material 147, 149 to change the direction of the beam segments passing through that element. (Ex.1005, ¶¶[0032-0035], Figure 10; Ex.2040, ¶68.)



(Ex.1005, FIGURE 10)

In this embodiment, the electro-optic refractive material 147, 149 are birefringent liquid crystals, the principles of which Alden describes as well known in the prior art. (Ex.1005, ¶[0033]; Ex.2040, ¶69.)² Therefore, as seen in Figures 8 and 9, they can direct light in only two directions – straight and “bent” in one direction. (*Id.*, ¶¶[0050-0052]; Ex.2040, ¶69.)

²Birefringent: “having the quality of birefringence”; Birefringence: “the power of double refraction.” (Ex.2065, 186.)

Fig. 8

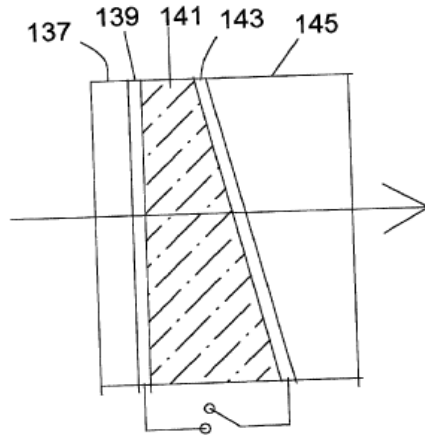
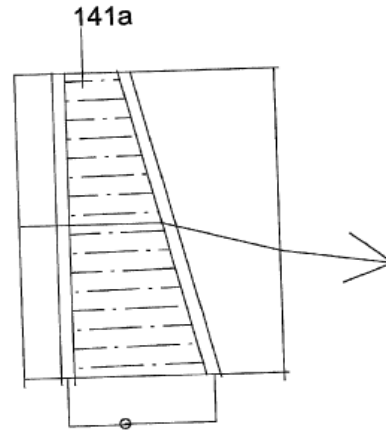


Fig. 9



(Ex.1005, FIGURES 8, 9)

In addition, all beam segments of Alden's various segmented beam headlight embodiments are always at high beam intensity/direction unless specifically dimmed. (Ex.1005, ¶¶[0006], [0026]; Ex.2040, ¶70.) Alden states in connection with Figure 3 that those portions of the segmented headlight not dimmed will be on high beam. (Ex.1005, ¶[0027]; Ex.2040, ¶70.) In connection with Figure 6, Alden states that distribution of light is dimmed for an oncoming vehicle but on high beam elsewhere. (Ex.1005, ¶[0030]; Ex.2040, ¶70.) In connection with Figure 10, Alden states that those beam segments not diverted for an oncoming vehicle are in high beam. (Ex.1005, ¶[0035]; Ex.2040, ¶70.) In general, Alden states in conjunction with Fig. 2 that "the driver of [vehicle] 47 can see everything illuminated to the maximum except the area where [vehicle] 41 is" located, providing a "highly

functional and reliable means for providing maximum light for an equipped vehicle's driver.” (Ex.1005, ¶¶[0026], [0060]; Ex.2040, ¶¶70-71.)

In these distinct embodiments, Alden's headlight systems with segmented light distribution elements are designed to provide a high beam to all sectors except sectors where light exceeding a threshold has been detected, in which sectors the systems either selectively change the intensity or lower the direction of beam segments. (Ex.1005, ¶¶[0029-0030], [0033-0035]; Ex.2040, ¶72.) As demonstrated above, Figure 5 illustrates a first headlight embodiment that is capable of selectively dimming beam segments produced by multiple LEDs 119. (Ex.1005, ¶[0029], Fig. 5; Ex.2040, ¶72.) Figures 6 and 7 illustrate a second headlight embodiment that is capable of selectively dimming beam segments having a single light source 129 and a collimating reflector 131. In this second embodiment, an electro-chromatic material is used that changes transmissivity depending on its state. (Ex.1005, ¶[0030-0031], Figs. 6-7; Ex.2040, ¶72.) In Alden's third embodiment described in connection with Figures 8-10, the electro-optic refractive material 147, 149 allows collimated light to be emitted either along a normal axis or an angled axis via refraction. (Ex.1005, ¶[0033], Figs. 8-9; Ex.2040, ¶72.)

These embodiments disclosed by Alden are also discrete and include features that are incompatible with each other. (Ex.2040, ¶73.) For example, the third headlight system embodiment of Figures 8-10 having electro-optic 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 129a and collimating reflector 131. (Ex.1005, ¶¶[0033-0035], Figs. 8-10; Ex.2040, ¶73.) However, in the first headlight system embodiment of Figure 5, the LED elements 119 of headlight 123 produce non-collimated light. (Ex.2040, ¶73.) Non-collimated light could not be directed in any meaningful fashion by electro-optic 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-optic refractive material 147, 149, thereby preventing the electro-optic refractive material 147, 149 from performing any meaningful control of beam segments, as well as redirecting much of the non-collimated input light away from the desired sectors of the distribution area. (*Id.*) Any headlight resulting from a combination of Alden's incompatible features would therefore be incapable of meeting the basic requirements of a headlight, *i.e.*, effectively illuminating the area ahead of the equipped vehicle, let alone directing its emitted light in any meaningful fashion. (*Id.*, Ex.2040, ¶73.)

Additionally, Alden's disclosure is theoretical in nature. It is ambiguous and fails to enable its disclosure in critical respects. (Ex.1005, ¶¶ [0027-0035]; Ex.2040,

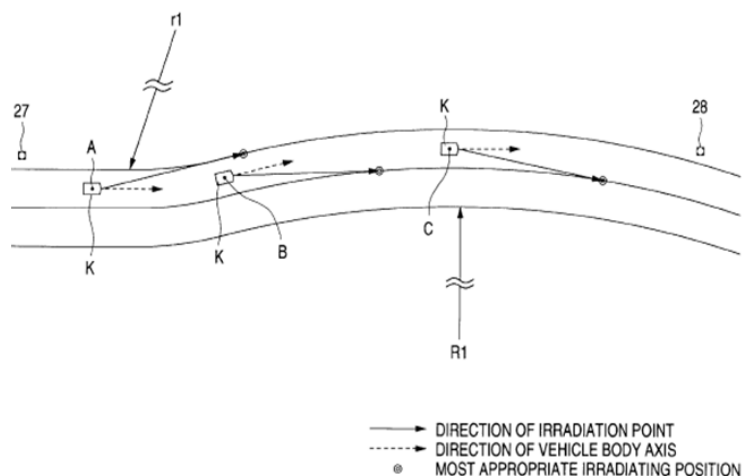
¶74.)³ The disclosure in Alden broadly describes certain features of headlight systems and the general functions such features and systems would desirably provide but lacks detailed explanations as to how those features and systems are practically implemented or how those functions are realized thereby. (*Id.*) Modifications would have to be made, if using Figures 3 and 5 together, to correlate switches from the switch array to the LEDs of Figure 9, since there are 576 switches in the array and 9 LEDs shown, and yet, each LED is operated by “a corresponding switch” that controls power to the LED. (Ex.1005, ¶[0029]; Ex.2040, ¶74.)

B. Kobayashi

Kobayashi uses map data to determine the shape of roads via its “profile calculating means”. Kobayashi also includes a separate and distinct “irradiation control means” to determine the direction light should be controlled. (Ex.2040, ¶¶76-81 160.)

³Notably, Alden was informed by Gentex Corporation, an automotive industry supplier, that Gentex’s technical staff had determined his segmented headlight system to be “futuristic” and likely “years away from any practical use.” (Ex.2006, 39; Ex.2040, ¶75.)

FIG. 10



(Ex.1006, FIG 10)

In Figure 10, the headlamp motors are operated according to road profile information and vehicle speed to change the irradiating direction toward a determined irradiating position for the driver's line of sight at each position of the vehicle. (Ex.1006, 14:53-15:28; Ex.2040, ¶81.) “As shown at point A in Fig. 10, **when the vehicle turns** to the left, the left shoulder is irradiated. **When the vehicle turns** to right, the right shoulder is irradiated,” etc. (Ex.1006, 15:20-26; Ex.2040, ¶81.) If the driver operates the steering wheel by an angle larger than necessary for the curve, irradiation control is conducted in accordance with the vehicle advancing direction predicted by the steering angle. (Ex.1006, 14:53-15:39; Ex.2040, ¶81.)

VI. The Challenged Claims are Patentable

As previously noted, the Petition challenges claims 1-33 (“Challenged Claims”) of the '029 Patent. (Petition at 5.) Claims 1, 12, and 23 are the only

independent claims among the Challenged Claims. (Ex.1001, 95:55-100:66.) All other Challenged Claims depend directly or indirectly from one of those independent claims. (*Id.*) For **Ground 1**, Petitioner combines Alden and Kobayashi's map data to satisfy the elements of claims 1-8, 10-19, 21-30, 32, and 33. For **Ground 2**, Petitioner combines Alden, Kobayashi, and Beam to satisfy the elements of dependent claims 9, 20, and 31. (Petition, 5.)

Petitioner has failed to meet the requisite burden of showing that the Challenged Claims are unpatentable based on either of those Grounds for at least the reasons that Petitioner relies on Alden, Kobayashi, and Beam to allegedly satisfy claim elements that those references fail to teach.

A. Obviousness proofs require clear evidence of all claim elements and how/why a POSA would have modified the combined art

Petitioner must show where each claim limitation is found in the applied references. *See, e.g., Kinetic Concepts, Inc. v. Smith & Nephew, Inc.*, 688 F.3d 1342, 1361 (Fed. Cir. 2012). Failure to do so defeats a claim of obviousness. *Id.* To establish a *prima facie* obviousness rejection, all the claimed elements must be taught or suggested by the prior art. *See In re Royka*, 490 F.2d 981, 984 (CCPA 1974).

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 (2007)

(requiring articulated reasoning with rationale underpinning as to why a person of ordinary skill in the art would have combined or modified the teachings of the prior art in the fashion claimed by the patent); *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). Further, the Federal Circuit has very 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.)

“[T]here must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.” *KSR*, 550 U.S. at 418 (*quoting In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)). If a proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon*, 733 F.2d 900, 902 (Fed. Cir. 1984). Moreover, if a proposed modification or combination of prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are insufficient to render a claim obvious. *In re Ratti*, 270 F.2d 810, 813 (CCPA 1959). Petitioner completely fails to address these issues.

B. Ground 1: Alden-Kobayashi

1. Independent Claim 1

a. Only the “map data” of Kobayashi is included in the combination

Importantly, only the map data of Kobayashi is included in Petitioner’s combination. While Petitioner explains that Kobayashi “uses [] inputs to automatically adjust the illumination of headlamp 5,” it never motivates or explains a combination for claim 1 using Kobayashi’s control strategy. Petitioner explains that it “would have been obvious to apply these teachings to Alden **to additionally use map data to identify road curvature** when adapting the LEDs of Alden...” and “Kobayashi **simply discloses an additional known means to detect road curvature: road map data.**” (Petition, 23-24.) Petitioner continues: “A POSITA would have understood the systems to be complimentary, **as both disclose sensor data fed to a controller**, which then controls lighting.” (*Id.*) Petitioner’s proffered expectation of success states “Alden’s controller can already synthesize multiple sources of data ... and **the map data of Kobayashi could be similarly synthesized.**” (*Id.*) Finally, Petitioner concludes: “A POSITA would have thus been motivated **to combine the techniques of detecting a road curvature** to maximize successful **detection** in different environments.” (*Id.*, 25.) Accordingly, for claim 1, Petitioner’s control and planning arguments rely exclusively on Alden alone. Kobayashi, at best, supplies map data to Alden’s control strategy. (Ex.2040, ¶160;

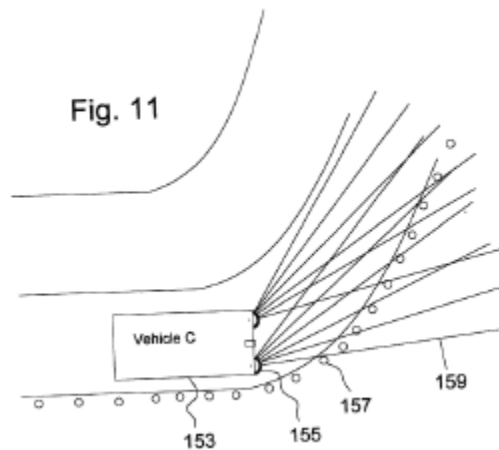
Ex.2067, 39-42.)

b. The Alden-Kobayashi Combination Does Not Teach the Predictive Curve Illumination Limitation

(1) Alden neither teaches nor enables the ability to increase light in the direction of the road curvature

Independent claim 1 includes the Predictive Curve Illumination Limitation, namely, determine a light change, the change *adapting a light pattern of the headlamps in at least one of color, intensity or spatial distribution to increase light in a direction of the road curvature* ahead of the motor vehicle.

According to Petitioner, Alden’s system “accommodates road curvature ahead of an equipped vehicle by adapting the light pattern to ‘concentrate light to look around corners’ in response to road conditions.” (Petition, 25.) First, Patent Owner notes that “accommodates road curvature **ahead of an equipped vehicle**” is not an express teaching of Alden. (*Id.*) While Figure 11, reproduced below, does show a vehicle traveling substantially straight, the vehicle is already within the curve. Though Figure 11 is probably a generalization, PO simply notes the discrepancy as Petitioner’s proofs rely heavily on “teachings” from Alden’s Figures. (Ex.2040, ¶161.)



(Petition, 26; Ex.1005, Figure 11)

Ultimately, Alden neither describes nor shows a system that “accommodates a road curvature **ahead of** the vehicle” as Petitioner contends. (Id.)

With regard to the vehicle’s ability to detect the curve based on reflectors, per Petitioner’s expert, Alden does not appear to enable that functionality. In his first deposition for related proceedings IPR2023-01039 and IPR2023-01040 (Ex.2041), 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.

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 ...

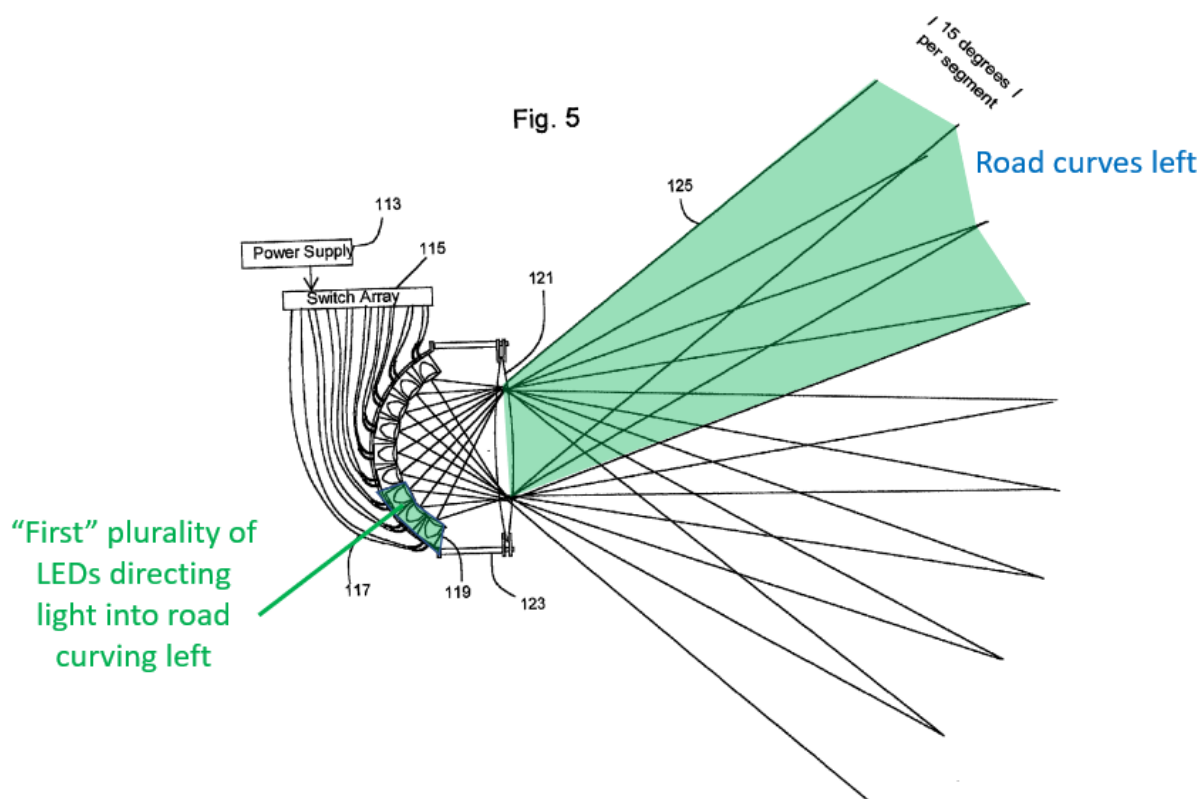
(Ex.2041, 79:18-80:12, Ex.2040, ¶162.)

Thus, 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; Ex.2040, ¶162.)

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 curve-accommodation per Figure 11, to form “concentrated” high-beam emission. (Ex.2040, ¶163.) Alden lacks 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.*) Given that Alden does not say anything else, or show anything else, conclusions about “other control,” such as accommodating a curve “ahead of” the equipped vehicle is mere speculation. (Petition, 25.)

**(2) The proposed combination defeats
Alden’s primary goal with no
reasonable explanation for why a
POSA would do so**

In its contention that Alden allegedly teaches claim 1, Petitioner cites its annotated version of Figure 5 thereof (Petition, 29; Ex.2040, ¶¶86-87, 121-122), reproduced immediately below:



(Ex.1005, FIGURE 5, Annotated by Petitioner)

Petitioner has annotated Figure 5 of Alden to show the purported operation of headlight 123 for a leftward road curve. According to Petitioner, in the event of a leftward road curve, only a selected first plurality of LED elements 119 configured to illuminate sectors on the left of the distribution area ahead of the equipped vehicle are activated. The remaining LED elements 119 configured to illuminate sectors in the center and on the right of that distribution area are deactivated. (Petition, 28-29.)

However, the operation of headlight 123 shown by Petitioner in its annotations is not disclosed in Alden. (Ex.2040, ¶88.) To the contrary, the headlight 123 of Figure 5 would never be operated in such a fashion. (*Id.*) Alden states

repeatedly that the primary object of its headlight systems is to maximize the amount of light that the driver of a vehicle equipped with such systems can use, selectively dimming only those sectors of the distribution area illuminated by such systems in which an oncoming vehicle is located to minimize glare for the driver of that oncoming vehicle. (Ex.1005, ¶¶[0006, 0008, 0026-0027, 0036-0038]; Ex.2040, ¶88.) In the headlight system of Figure 5 of Alden, the LED elements 119 of headlight 123 are individually controlled to provide such selective dimming. (Ex.1005, ¶¶[0025-0026, 0029]; Ex.2040, ¶88.)

That is, the default operating state of the LED elements 119 in headlight 123 is the emission of high intensity beam segments (*i.e.*, high beam) to provide maximum illumination of the distribution area ahead of the equipped vehicle. (Ex.1005, ¶¶[0025-0027, 0029]; Ex.2040, ¶89.) Indeed, in his deposition testimony, Petitioner's expert confirmed this fact and the fact that the headlamp in the Figure 5 embodiment is already capable of illuminating turns:

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.2066, 111:18-112:5; Ex.2040, ¶165.)

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, ¶166.)

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, ¶165.) 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, ¶¶165-167/165.)

Accordingly, the embodiment of Figure 5 has not been shown to “*increase*” illumination prior to the curve 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, ¶167.)

Only in the event of an oncoming vehicle are the high intensity beam segments emitted by selected LED elements 119 reduced so that those selected LED elements 119 emit low intensity beam segments (*e.g.*, low beam). Thus, contrary to Petitioner’s annotation of Figure 5, **none** of the LED elements 119 of headlight 123 is ever deactivated (different from reduced). (Ex.1005, ¶¶[0025-0027, 0029]; Ex.2040, ¶89.)

In the context of an equipped vehicle traversing a road curve, all the LED elements 119 of headlight 123 in Figure 5 would operate in their default state, emitting high intensity beam segments (*i.e.*, high beam) to maximize the amount of light that the driver of the equipped vehicle “can use.” (Ex.1005, ¶¶[0006, 0008, 0026, 0036-0038]; Ex.2040, ¶90.) Because all LED elements 119 would emit high intensity beam segments (*i.e.*, high beam), there would be no change in the intensity nor the spatial distribution (*e.g.*, depth, width, height) of light produced by the headlight 123. Here again, Petitioner’s expert confirmed such operation. (Ex.2067, 50:8-15; *see also*, 48:3-15.) As a result, there would be no adaptation of the light pattern produced by the headlight 123 **in intensity or spatial distribution to increase light** in a direction of the road curvature, as required by independent claim 1.

Even assuming *arguendo* that Petitioner’s annotation of Figure 5 is accurate, which Patent Owner does not concede, that annotation still fails to illustrate adapting

intensity to increase light in the direction of the road curvature, as required by independent claim 1. As previously demonstrated, the default operating state of the LED elements 119 of headlight 123 is emission of high intensity beam segments (*i.e.*, high beam) to maximize the amount of light that the driver of the equipped vehicle can use. (Ex.1005, ¶¶[0006, 0008, 0026, 0036-0038]; Ex.2040, ¶91.) In the leftward road curve scenario illustrated in Petitioner's annotated Figure 5, those LED elements 119 that were purportedly illuminating the distribution area in directions other than the direction of the curve are deactivated. Conversely, those LED elements 119 purportedly illuminating the distribution area in the direction of the curve continue to emit the same high intensity beam segments (*i.e.*, high beam) as before, thus having the same spatial distribution as before. As a result, there is no adaptation of the light pattern of the headlight 123 in intensity or spatial distribution to increase light in a direction of the road curvature, as required by independent claim 1.⁴

⁴This would be the case even if none of the LED elements 119 of headlight 123 were deactivated (*i.e.*, even if all the LED elements 119 remained activated), because the high intensity of the beam segments (*i.e.*, high beam) emitted by the subset of LED elements 119 illuminating the left distribution area sectors would still never increase nor would their spatial distribution ever change. (Ex.2040, ¶92.)

Again, according to Alden, “it is an object of the present invention to **maximize** the amount of light that the driver can use.” (Ex.1005, ¶[0008].) Selectively dimming only those sectors of the distribution area illuminated by such systems in which an oncoming vehicle is located, Petitioner’s proposed modification of the operation of headlight 123 including LED elements 119 would render the resulting headlight system inoperable or unsatisfactory for its intended purpose and change its principle of operation, making it an unsuitable option. *See In re Gordon* , 733 F.2d at 902. As a result, a POSA would not be motivated to modify operation of the LED headlight 123 of Figure 5 as proposed by Petitioner, and Alden is therefore insufficient to render the claimed invention obvious.⁵ *See Virtek*, 2024 WL 1292734 at *3; *In re Ratti*, 270 F.2d at 813.

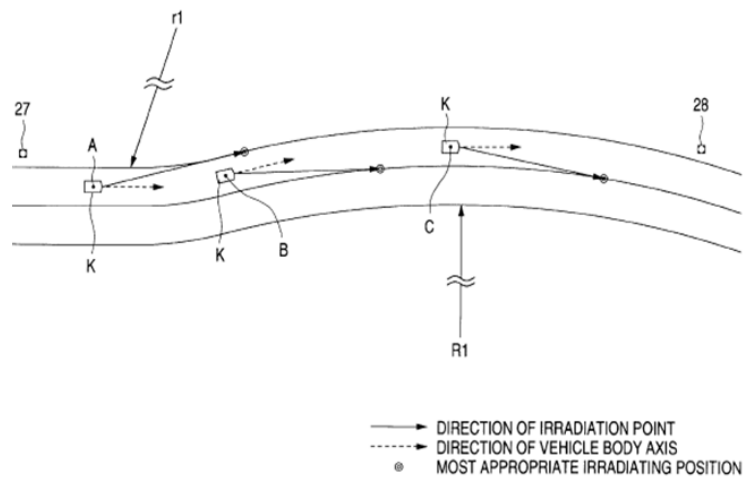
⁵Petitioner relies solely on Alden and does not cite or rely on Kobayashi in connection with the independent claim 1 limitation relating to increasing light. (Petition, 25-27.) Any attempt by Petitioner to now cite Kobayashi in connection with that claim 1 limitation would therefore be impermissible new argument. *Colas Sols., Inc. v. Blacklidge Emulsions, Inc.*, 759 Fed. App’x 986, 989 (Fed. Cir. 2019) *Henny Penny Corp. v. Frymaster LLC*, 938 F.3d 1324, 1330-31 (Fed. Cir. 2019).

**(3) Petitioner’s proposed combination
actually reduces forward illumination
of the roadway**

Also, through the placement of the vehicle shown in Figure 11 of Alden, where there is essentially no road ahead of the vehicle, at least the driver’s ability to see **the road** is not substantially impacted by the proposed change to Alden. (Alden, Figure 11.) That is, assuming *arguendo* that the proposed change was enacted using Figure 5, it would be done so at a point where the vehicle is in the curve, so that the loss of forward-aimed illumination and rightward (in this example) aimed illumination would have minimal impact on the driver’s view of the roadway. (Ex.2040, ¶168.)

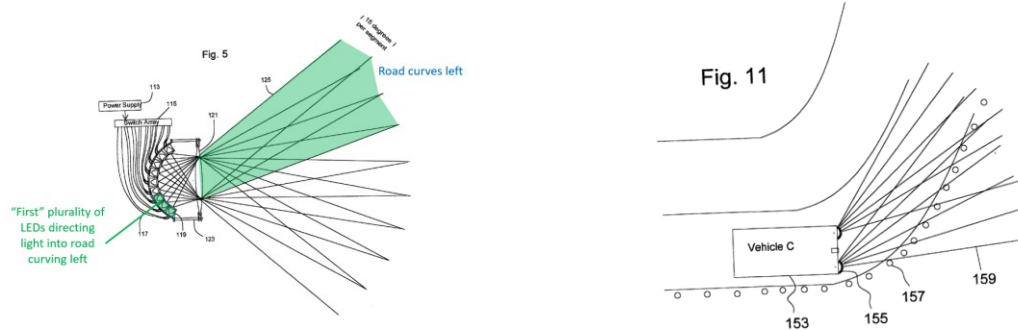
That is not the case when such changes are performed based on map data as shown in Figure 10 of Kobayashi. Modifying Figure 11 of Alden at the points indicated by Kobayashi’s Figure 10 would plainly defeat Alden’s goal of “maximum illumination” when there is still roadway ahead of the driver. (Ex.2040, ¶169.)

FIG. 10



(Ex.1006, Figure 10)

As noted in the institution decision, Kobayashi **shows** a different irradiating direction (solid arrow) from the vehicle traveling direction (dashed arrow). (Ex.1006, Figure 10; 15:20-23; DI, 16.) Notably, however Kobayashi **teaches** that the vehicle is turning at point A: “As shown at point A in FIG. 10, when the vehicle turns to left, the left shoulder is irradiated,” (Ex.1006, 15:21-22) creating some confusion between Figure 10 and the related description. Nonetheless, assuming *arguendo* that what Figure 10 shows occurs, Petitioner’s proposal applies (to Figure 10’s situation) the pattern shown in Figure 11 of Alden, or, alternatively, the even more aggressively curved pattern shown in Petitioner’s annotated Figure 5. (Petition, 29; Ex.2040, ¶170.)



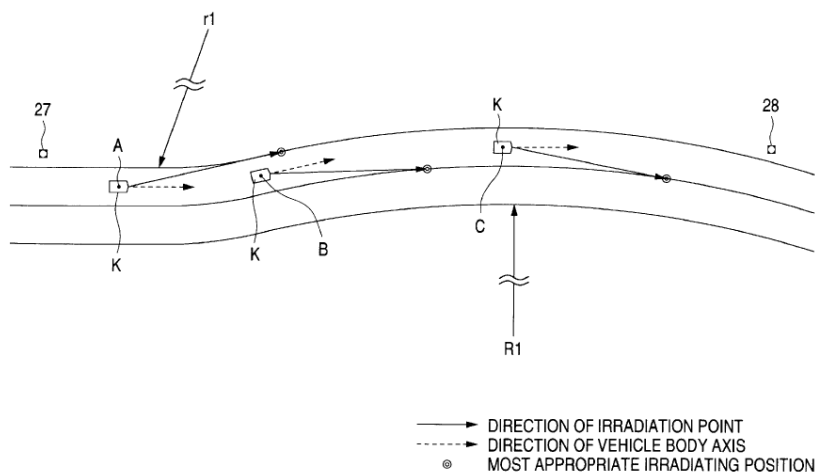
(Ex.1006, Figs 5, 11)

Under this combination, as only the “map data” of Kobayashi is being used, Alden’s processor must decide what to do with this additional map data. (Petition, 23-25.) According to Petitioner, “Alden would continue to **perform the same control of LEDs to shape the light pattern to direct light into the curve**, only now it would do so based on received map data indicating the road curve.” (*Id.*, 30.) However, if either pattern shown in annotated Figure 5 or Figure 11 was utilized, some amount of forward illumination would be lost. For Figure 5, Petitioner explains that the “controlled ‘first plurality’ of LEDs would be those shaded in green.” (*Id.*, 29.) There is no illumination shown for other LEDs, and rightward forward illumination is plainly missing in Figure 11. (Ex.2040, ¶171.)

Accordingly, the proposed combination does not comport with Alden’s goal of “maximizing the amount of light a driver can use.” As there is plainly road ahead of the driver (in Figure 10 at point A) that the driver needs to see, per Alden’s goals, Petitioner’s proposed use of map data results in an unsuitable modification, placing

Kobayashi's irradiation placement goals above Alden's maximum illumination goal; raising potential safety concerns. (Ex.2040, ¶172.)

FIG. 10



(Ex.1006, Fig 10)

Additionally, Petitioner never explains what Alden would do if rotation sensing were also included in the combination. Additionally, Petitioner never explains what Alden would do if steering rotation sensing were also included in the combination. For example, at point B of Kobayashi's Figure 10, if the vehicle is steering left and the "curve ahead" is rightwards, it is unclear how the combined system would function and which control goal would prevail. Petitioner proposes that where map data is **less reliable**, steering wheel sensors may be preferred, but there are many instances when steering would take precedence over map data and Petitioner does not address this in its combination. (Petition, 25.) Instead of

addressing the complexities associated with adding the map data input, Petitioner simply imports the map data and assumes that Alden will synthesize the data (Petition, 24; Ex.2040, ¶¶173.) Instead of addressing the complexities associated with adding the map data input, Petitioner simply imports the map data and assumes that Alden will synthesize the data (Petition, 24; Ex.2040, ¶¶173.)

The significantly different principle of operation and control among the embodiments disclosed by Alden would constrain available options for reconfiguring, combining, or otherwise modifying any particular embodiment(s), even if a POSA had a motivation to do so. (Ex.2040, ¶¶94-101.) As a result, it is only by mischaracterizing the operation of the headlight system of Figure 5 of Alden that Petitioner can pretend it “teaches” the independent claim 1 limitation **adapting a light pattern of the headlamps in . . . intensity or spatial distribution to increase light in a direction of the road curvature**. Because the headlight system of Figure 5 of Alden does not teach this limitation, Petitioner’s obviousness contention fails. *See, e.g., Kinetic Concepts*, 688 F.3d at 1361.⁶ (Ex.2040, ¶¶102-104.)

c. The Alden-Kobayashi Combination Does Not

⁶Once again, Petitioner relies solely on Alden and does not cite Kobayashi in connection with the independent claim 1 limitation relating to increasing light. (Petition, 25-28.)

Teach the Control Limitation

Independent claim 1 also includes the Control Limitation, namely, **control** at least a first plurality of the LED light sources to provide light based at least in part on the determined light change and **prior to** the motor vehicle reaching the road curvature. (Ex.1001, Claim 1; Ex.2040, ¶105.) However, contrary to Petitioner’s contentions, neither Alden nor Kobayashi teaches control of a first plurality of LED light sources to provide light based on a determined light change **prior to** an equipped vehicle reaching a road curvature, as required by independent claim 1.

Petitioner first contends that Alden teaches the Control Limitation of independent claim 1 because it allegedly discusses the detection of an upcoming road curve in connection with the headlight system of Figure 11 thereof. (Petition, 29-30.)⁷ This teaching is not enabled, as previously explained above. Even assuming

⁷In connection with Figure 11, Alden merely states that “an equipped vehicle 153 senses that the road turns by receiving light from reflectors, such as a reflector 157” and does not teach that such sensing occurs prior to the equipped vehicle entering the turn. (Ex.1005, ¶[0036]; Ex.2040, ¶106.) Similarly, Alden’s statement that “[t]he responding headlights 155 direct light into the corner to maximize the driver’s ability to see there” is also not a teaching that such re-direction of light occurs prior to the equipped vehicle entering the turn. (*Id.*)

arguendo that Alden discusses detection of an upcoming curve, which Patent Owner does not concede, the mere detection of an upcoming curve is obviously neither the same as nor a teaching of re-directing the light produced by the headlight of that embodiment, nor re-directing that light ***prior to*** the equipped vehicle entering that curve.

Indeed, Alden does not discuss the timing of the re-direction of the light emitted by headlights 155 in connection with Figure 11. (Ex.1005, ¶[0036]; Ex.2040, ¶108.) The only discussion of the timing of the re-direction of light occurs in connection with Figures 14 and 15, where Alden states “[a]s the steering wheel 191 rotates ‘x’ degrees, rotation sensor 193 detects the rotation” and “[t]he system calculates the new direction of the vehicle and changes the direction of the headlight output 197 a corresponding “f(x)” degrees.” (Ex.1005, ¶[0040].) Thus, in Alden’s Figure 11 headlight system, any re-direction of the light emitted by headlights 155 does not occur ***until the steering wheel is turned when the equipped vehicle enters the curve***. (Ex.2040, ¶108.) Alden therefore fails to teach the independent claim 1 Control Limitation of ***control at least a first plurality of the LED light sources to provide light based at least in part on the determined light change and prior to the motor vehicle reaching the road curvature***. Again, to the extent the Board considers Figure 11 of Alden to function as depicted, the Figure plainly shows vehicle 153 already within the curvature of the road.

As noted above, Kobayashi is only relied upon for map data. Petitioner contends that Kobayashi “includes a controller that controls a headlamp to provide a changed shape of light before a vehicle reaches a curve, when map data indicates an upcoming curve.” (Petition, 30.) Petitioner continues “it would have been obvious to modify Alden in view of Kobayashi to control the light sources to implement the changed shaping of light to accommodate upcoming road turns based on ‘map data’”. (*Id.*) While this may seem to implicate inclusion of a control strategy from Kobayashi, Petitioner ultimately concludes “Alden would **continue to perform the same control of LEDs to shape the light pattern to direct light into the curve,** only now **it would do so based on received map data** indicating the road curve.” (*Id.*) To the extent Petitioner is combining additional features from Kobayashi, such as a controller or even a strategy, such a combination is never explained under the *KSR* factors. Based on the evidence and explanation presented, the only allegedly motivated combination is still simply inclusion of map data of Kobayashi. (Ex.2040, ¶171.)

Moreover, Kobayashi also fails to teach the Control Limitation of independent claim 1. In connection with the discussion of Figure 10 depicting a vehicle K traversing a curved road, Kobayashi states: “**As shown at point A in FIG. 10, when the vehicle *turns* to the left, the left shoulder is illuminated.**” (Ex.1006, 15:21-22 , Figure 10.) Thus, for the road curve in Figure 10 having a radius of curvature r_1 , re-

direction of the light emitted by the headlights of Kobayashi's vehicle K does not occur until the vehicle enters that curve at point A. (Ex.2040, ¶109.) In that same discussion of Figure 10, Kobayashi subsequently states: "When the vehicle turns to [the] right, the right shoulder is irradiated." (Ex.1006, 15:22-23, Figure 10.) Thus, for the road curve in Figure 10 having a radius of curvature R1, re-direction of the light emitted by the headlights of Kobayashi's vehicle K does not occur until the vehicle enters that curve at point B.⁸ (Ex.2040, ¶109.)

Alden has no strategy for control prior to turning; at such locations, the steering "rotation sensor" would be at 0 degrees, and the lamp would be controlled forward in accordance with the vehicle's "calculated" "direction." (Ex.1005, ¶[0058]; Ex.2040, ¶174.) This aligns with Alden's goal of maximum illumination, because roadway in a straight direction would still be maximally illuminated. Since the curvature is already illuminated by the lamp, per Petitioner's expert as noted above, there is no need to illuminate the curve pre-emptively. When the vehicle

⁸Petitioner quotes this very language from Kobayashi (Petition, 23) but simply ignores its clear teaching, instead asserting that such language supports the exact opposite conclusion, *i.e.*, that Kobayashi teaches re-directing light emitted by the headlights of the vehicle K in advance of a road curve. (*Id.*, 30.) For the reasons set forth above, Petitioner's assertion is incorrect.

enters the turn, and the wheel turns (as Petitioner contends), Petitioner's control change may apply – but only then. Further, because Alden is unable to distinguish between reflectors and headlamps, Alden lacks an enabled teaching to support Petitioner's proposed combination. Since the control proposed is ultimately a reduction of overall illumination, and since the curve is already covered by forward illumination, the proposed combination lacks motivation to combine. (Ex.2040, ¶175.) Alden has no strategy for control prior to turning; , in fact, at such locations, the steering “rotation sensor” would be at 0 degrees, and so the lamp would be controlled accordingly forward in accordance with the vehicle's “calculated” “direction.” (Ex.1005, ¶[0058];Ex.2040, ¶174.) This aligns with Alden's goals of maximum illumination, because roadway in a straight direction would still be maximally illuminated. This would also not conflict with Alden's goals of maximum illumination, because if there is roadway still ahead, straight, it would be maximally illuminated, ahead, straight. And, since the curvature is already illuminated covered by the lamp in such a situation, per Petitioner's expert as noted above, there is no need, at that moment, to illuminate the curve pre-emptively. When the vehicle enters the turn, and the wheel turns (as Petitioner contends), then (for the sake of argument), Petitioner's control change may apply – but only then. Further,And, whilebecause Alden is unable's inability to distinguish between reflectors and headlamps, Alden lacks an enabled teaching to support Petitioner's proposed combination. Since the

control proposed is ultimately a reduction of overall illumination, and since the curve is already covered by forward illumination, the proposed combination lacks motivation to combine. (Ex.2040, ¶ 175.) There is no reason for Alden not to wait until the vehicle is within the curve to perform such control, to minimize the impact on maximum illumination of the roadway still ahead.

Because Alden does not teach the Control Limitation, because Kobayashi is conflicting on the point, and since the control of Kobayashi is not imported in any event, the proposed combination thereof fails to result in the claimed invention recited therein. (Ex.2040, ¶ 176.) Because Alden does not teach the Control Limitation, because Kobayashi is conflicting on this point, and since the control of Kobayashi is not imported in any event, the proposed combination fails to result in the claimed invention recited therein. Petitioner's obviousness contentions therefore fail. *See, e.g., Kinetic Concepts*, 688 F.3d at 1361; *In re Royka*, 490 F.2d at 984.

Moreover, Petitioner is "master of its complaint" (*SAS Institute, Inc v. Iancu*, 138 S. Ct. 1348, 1355 (2018)) and, as a result, any attempt by Petitioner to now address the failings of its obviousness contentions demonstrated by Patent Owner herein would be impermissible new argument and must be excluded. *Colas*, 759 Fed. App'x at 989; *Henny Penny*, 938 F.3d at 1331; *Google LLC v. Uniloc 2017 LLC*, IPR2020-00447, Paper 24 at 13–14 (PTAB May 11, 2021); *Haag-Streit AG v. Eidolon Optical, LLC*, IPR2018-01311, Paper 31 (PTAB September 5, 2019);

MModal LLC v. Nuance Commc'ns., Inc., 846 F. App'x 900, 906 (Fed. Cir. 2021); *Ariosa Diagnostics v. Verinata Health, Inc.*, 805 F.3d 1359, 1367-68 (Fed. Cir. 2015). In addition, the Board is constrained by the arguments and evidence presented and developed in the Petition and is not at liberty to “raise, address, and decide . . . theories never presented by [Petitioner] and not supported by record evidence.” *In re Magnum Oil Tools Int'l, Ltd.*, 829 F.3d 1364, 1381 (Fed. Cir. 2016).

2. Independent Claim 12

a. The Alden-Kobayashi Combination Does Not Teach the Predictive Curve Illumination Limitation

Like independent claim 1, independent claim 12 includes a Predictive Curve Illumination Limitation, namely, determine a light change, the change **adapting a light pattern of the headlamps in at least one of color, intensity or spatial distribution to increase light in a direction of the road curvature ahead of the motor vehicle.** (Ex.2040, ¶112.)

Petitioner's obviousness contentions relating to independent claim 12 are the same as those relating to independent claim 1, *i.e.*, that independent claim 12 is an obvious combination of Alden and Kobayashi. (Petition, 31-32; Ex.2040, ¶113.) For the same reasons set forth above in connection with independent claim 1, neither Alden nor Kobayashi teaches the Predictive Curve Illumination Limitation of independent claim 12 as it relates to adapting a light pattern to **increase light** in a

direction of the road curvature. For this and the other reasons stated with respect to claim 1, Petitioner's obviousness contentions relating to independent claim 12 likewise fail. *See Virtek*, 2024 WL 1292734 at *3; *In re Gordon*, 733 F.2d at 902; *In re Ratti*, 270 F.2d at 813. (See, § VI.A.2, *supra*.)

b. The Alden-Kobayashi Combination Does Not Teach the Control Limitation

Like independent claim 1, independent claim 12 also includes a Control Limitation, namely, *control at least a first plurality of the LED light sources to provide light based at least in part on the determined light change and prior to the motor vehicle reaching the road curvature.* (Ex.2040, ¶114.)

Petitioner's obviousness contentions relating to independent claim 12 are the same as those relating to independent claim 1. (Petition, 31-32; Ex.2040, ¶¶114-115.) For the same reasons set forth above in connection with independent claim 1, neither Alden nor Kobayashi teaches the Control Limitation of independent claim 12 as it relates to *control* of LED light sources based on the determined light change *prior to* the motor vehicle reaching the road curvature. For this and other reasons stated with respect to claim 1, Petitioner's obviousness contentions relating to independent claim 12 further fail. *See, e.g., Kinetic Concepts*, 688 F.3d at 1361; *In re Royka*, 490 F.2d at 984. (See, § VI.B.1, VI.B.2., *supra*.)

3. Independent Claim 23

a. The Alden-Kobayashi Combination Does Not Teach the Predictive Curve Illumination Limitation

Like independent claim 1, independent claim 23 includes a Predictive Curve Illumination Limitation, namely, determining a light output, the output adapting a light pattern of the headlamps in at least one of color, intensity or spatial distribution to increase light in a direction associated with the [road] shape change ahead of the motor vehicle. (Ex.2040, ¶116.)

Petitioner's obviousness contentions relating to independent claim 23 are the same as those relating to independent claim 1. (Petition, 32-33; Ex.2040, ¶¶116-119.) For the same reasons set forth above in connection with independent claim 1, neither Alden nor Kobayashi teaches the Predictive Curve Illumination Limitation of independent claim 12 as it relates to adapting a light pattern to increase light in a direction of the road shape change. For this and other reasons presented with respect to claim 1, Petitioner's obviousness contentions relating to independent claim 23 likewise fail. *See Virtek*, 2024 WL 1292734 at *3; *In re Gordon*, 733 F.2d at 902; *In re Ratti*, 270 F.2d at 813. (See, § VI.A.3, *supra*.)

b. The Alden-Kobayashi Combination Does Not Teach the Control Limitation

Like independent claim 1, independent claim 23 also includes a Control

Limitation, namely, *prior to reaching the road shape change, causing at least a first plurality of the LED light sources to provide light based at least in part on the determined light output.* (Ex.2040, ¶118.)

Here again, Petitioner's obviousness contentions relating to independent claim 23 are the same as those relating to independent claim 1. (Petition, 32-33; Ex.2040, ¶119.) For the same reasons set forth above in connection with independent claim 1, neither Alden nor Kobayashi teaches the Control Limitation of independent claim 23 as it relates to *causing* LED light sources to provide light based on the determined light change *prior to* reaching the road shape change. Because neither Alden nor Kobayashi teaches these independent claim 23 limitations, any combination thereof would fail to result in the claimed invention recited therein. For this and other reasons presented with respect to claim 1, Petitioner's obviousness contentions relating to independent claim 23 further fail. *See, e.g., Kinetic Concepts*, 688 F.3d at 1361; *In re Royka*, 490 F.2d at 984. (*See, § VI.B3, supra.*)

4. Dependent Claims 5/16/27: The Alden-Kobayashi Combination Does Not Teach the Claim Limitation *the increase of light in the direction of the road curvature includes at least an increase of light emitted at a level below high-beam light and directed in the direction of the road curvature*

Dependent claims 5/16/27 depend directly from independent claims 1/12/23, respectively and require, *inter alia*, that the increase of light in the direction of the

road curvature or road shape change required by those independent claims includes an increase of light emitted at an intensity below high-beam. Such limitations as set forth in dependent claim 5 are representative of similar limitations recited in dependent claims 16/27. In that regard, dependent claim 5 recites *wherein the increase of light in the direction of the road curvature includes at least an increase of light emitted at a level below high-beam light and directed in the direction of the road curvature*. (Ex.2040, ¶120.)

In its contention that Alden allegedly teaches these limitations, Petitioner cites the statement in Alden that its segmented light distribution system may provide illumination to independently controlled segments “each operable within a range of intensities between high-beam and low-beam”. (Petition, 42; Ex.1005, ¶[0061].) According to Petitioner, a POSA would therefore be motivated to modify the headlight system of Figure 5 of Alden on an equipped vehicle traversing a road curve to control the LED elements 119 of headlight 123 to emit increased light below high-beam in the direction of the curve that would allow the driver of the equipped vehicle to sufficiently see the curve while not blinding a potential oncoming vehicle not yet visible to that driver. (Petition, 42-43.) (Ex.2040, ¶121.)

However, Petitioner’s proposed operation of the headlight 123 of Figure 5 is contrary to Alden’s disclosure. The headlight 123 of Figure 5 would never be operated as proposed by Petitioner because such operation would be contrary to its

primary object.⁹ (Ex.2040, ¶122.) Alden states repeatedly that the primary object of its headlight systems is to maximize the amount of light that the driver of a vehicle equipped with such systems can use, selectively dimming only those sectors of the distribution area illuminated by such systems in which an oncoming vehicle is located to minimize glare for the driver of that oncoming vehicle. (Ex.1005, ¶¶[0006, 0008, 0026-0027, 0036-0038]; Ex.2040, ¶122.)

That is, the default operating state of the LED elements 119 in headlight 123 is the emission of *high intensity* beam segments (i.e., high beam) to provide maximum illumination of the distribution area ahead of the equipped vehicle. At a minimum, such a “full usage high beam” state would be present at the point just prior to proposed control, as Dr. Papanikolopoulos explains is the conventional base operational state of the lamp. (Ex.2040, ¶175; Ex.2041, 79:18-80:12.) Under such circumstances, all light directed to the curve already illuminates the curve and is all at high beam illumination. Given this state—a point at which illumination cannot be increased — any proposed control would simply decrease illumination in one way or another. (Ex.2040, ¶175.)

It is PO’s position that, in the context of an equipped vehicle traversing a road

⁹Hence, such operation is not disclosed in Alden, and is instead something Petitioner had to propose. (Ex.2040, ¶122.)

curve, all the LED elements 119 of headlight 123 in Figure 5 would operate in their default state, emitting high intensity beam segments (*i.e.*, high beam) to maximize the amount of light that the driver of the equipped vehicle can use. (Ex.1005, ¶¶[0006, 0008, 0026, 0036-0038]; Ex.2040, ¶124.) Because all LED elements 119 would emit high intensity beam segments (*i.e.*, high beam), there would never be an increase of light emitted at an intensity below high beam in the direction of the road curvature. As a result, there would never be *an increase of light emitted at a level below high-beam light and directed in the direction of the road curvature*, as required by dependent claim 5.

Moreover, because the primary object of Alden's headlight systems is to maximize the amount of light that the driver of a vehicle equipped with such systems can use, selectively dimming only those sectors of the distribution area illuminated by such systems in which an oncoming vehicle is located, Petitioner's proposed modification of the operation of headlight 123 including LED elements 119 would render the resulting headlight system inoperable or unsatisfactory for its intended purpose and change its principle of operation, making it an unsuitable option. (Ex.2040, ¶125-126.) As a result, a POSA would not be motivated to modify Alden as proposed by Petitioner, and Alden is therefore insufficient to render the claimed

invention obvious.¹⁰ *See Virtek*, 2024 WL 1292734 at *3 ; *In re Gordon*, 733 F.2d at 902; *In re Ratti*, 270 F.2d at 813.

Petitioner's obviousness contentions relating to dependent claims 5/16/27 therefore fails. *See, e.g., Kinetic Concepts*, 688 F.3d at 1361; *In re Royka*, 490 F.2d at 984.

¹⁰Petitioner relies solely on Alden and does not cite Kobayashi in connection with the dependent claim 5 limitation relating to increasing light. (Petition, 25-28.) Any attempt by Petition to now cite Kobayashi in connection with that claim 5 limitation would therefore be impermissible new argument. *Colas*, 759 Fed. App'x at 986; *Henny Penny*, 938 F.3d at 1331; *Google LLC*, IPR2020-00447, Paper 24 at 13–14; *Haag-Streit*, IPR2018-01311, Paper 31 (PTAB September 5, 2019), IPR2018-01311, Paper 31; *MModal*, 846 F. App'x at 906; *Ariosa*, 805 F.3d at 1367-1368.

5. Dependent Claims 6/17/28: The Alden-Kobayashi Combination Does Not Teach the Claim Limitations (i) the second change adapting the light pattern of the headlamps in at least one of color, intensity or spatial distribution to increase light in a direction of the second road curvature ahead of the motor vehicle, and (ii) control at least a second plurality of the LED light sources . . . to provide light based at least in part on the determined second light change and prior to the motor vehicle reaching the second road curvature

Dependent claims 6/17/28 depend directly from independent claims 1/12/23, respectively, and include further limitations related to the Predictive Curve Illumination Limitation and the Control Limitation of their respective independent claims and which are directed to features such as a second change, a second road curvature, or a second plurality of LED light sources. Such further limitations as set forth in dependent claim 6 are representative of similar limitations recited in dependent claims 17/28. In that regard, dependent claim 6 recites (i) the second change adapting the light pattern of the headlamps in at least one of color, intensity or spatial distribution to increase light in a direction of the second road curvature ahead of the motor vehicle and (ii) control at least a second plurality of the LED light sources . . . , to provide light based at least in part on the determined second light change and prior to the motor vehicle reaching the second road curvature. (Ex.2040, ¶127.)

Petitioner's obviousness contentions relating to dependent claims 6/17/28 are

similar to those relating to independent claims 1/12/23, *i.e.*, that those dependent claims are obvious combinations of Alden and Kobayashi. (Petition, 43-50; Ex.2040, ¶128.) However, as previously demonstrated, neither Alden nor Kobayashi teaches the Predictive Curve Illumination Limitation and the Control Limitation of independent claims 1/12/23 as they relate to a light change adapting a light pattern to **increase light** in a direction of the road curvature and **control** of a plurality of LED light sources based on the determined light change **prior to** the motor vehicle reaching the road curvature. (*See*, § VI.A.1-3., *supra*.) As a result, for the same reasons set forth above in connection with independent claims 1/12/23, Alden and Kobayashi each also fails to teach the further limitations of dependent claims 6/17/28 as they relate to a **second** light change adapting a light pattern to **increase light** in a direction of a **second** road curvature and **control** a **second** plurality of LED light sources based on the **second** light change **prior to** the motor vehicle reaching the **second** road curvature. (*Id.*)

Also, while these claims appear to incorporate a general iterative “technique” of Kobayashi, introduced for the first time in claim 3, iterative control does not automatically implicate control **prior to reaching the curve**. “Road profile calculating means” is different from “irradiation control means” and it is the latter that actually decides where to place illumination (Ex.1006, 4:60-5:12; Ex.2040, ¶177.) At no point is Kobayashi’s “irradiation control means” ever combined with Alden, here or

elsewhere. Accordingly, even if Alden did iteratively control two different turns, there is simply no portion of Alden's strategy that would cause such control to occur prior to the vehicle reaching the turn. For example, considering the control shown in the annotated figures, in virtually every location shown in Figure 10 of Kobayashi, were such control implemented prior to the vehicle reaching a curve, the driver would lose illumination of some portion of the road ahead. And, as previously noted, this would directly conflict with the control attempted in the actual steering direction. (Ex.2040, ¶178.)

Because neither Alden nor Kobayashi teaches the further limitations of dependent claims 6/17/28 noted, any combination thereof would fail to result in the claimed invention as recited therein. Petitioner's obviousness contentions relating to dependent claims 6/17/28 therefore also fail. *See, e.g., Kinetic Concepts*, 688 F.3d at 1361; *In re Royka*, 490 F.2d at 984.

- 6. Dependent Claims 7/18/29: The Alden-Kobayashi Combination Does Not Teach the Claim Limitations**
(i) the increase of light in the direction of the road curvature includes at least one of expansion of the light pattern ... or an increase to intensity of light directed in the direction of the road curvature, or (ii) a variation to at least one of intensity or color of individual LEDs of the first plurality of LED light sources, and (iii) providing light directed in the direction of the road curvature from an LED not providing light directed in the direction of the road curvature prior to the change

Dependent claims 7/18/29 depend directly from independent claims 1/12/23,

respectively, and include further limitations related to the Predictive Curve Illumination Limitation of their respective independent claims and which are directed to features such as providing light in the direction of the road curve from an LED that was not providing such light prior to a determined light change. Such further limitations as set forth in dependent claim 7 are representative of similar limitations recited in dependent claims 18/29. In that regard, dependent claim 7 recites (i) the **increase of light in the direction of the road curvature includes at least one of expansion of the light pattern** in the direction of the road curvature **or an increase to intensity of light** directed in the direction of the road curvature, (ii) a variation to at least one of **intensity** or color of individual LEDs of the first plurality of LED light sources, and (iii) **providing light** directed in the direction of the road curvature **from an LED not providing light** directed in the direction of the road curvature **prior to the change**. (Ex.2040, ¶130.)

Petitioner's obviousness contentions relating to dependent claims 7/18/29 are similar to those relating to independent claims 1/12/23, *i.e.*, that those dependent claims are obvious combinations of Alden and Kobayashi. (Petition, 50-52; Ex.2040, ¶131.) However, as previously demonstrated, neither Alden nor Kobayashi teaches the Predictive Curve Illumination Limitation and the Control Limitation of independent claims 1/12/23 as they relate to a light change adapting a light pattern to **increase light** in a direction of the road curvature and **control** of a plurality of

LED light sources based on the determined light change prior to the motor vehicle reaching the road curvature. (*See*, §VI.A.1-3, *supra*.) As a result, for the same reasons set forth above in connection with independent claims 1/12/23, Alden and Kobayashi each also fails to teach the further limitations of dependent claims 7/18/29. (*Id.*)

Moreover, the operation of the LED headlight 123 of Figure 5 illustrated in Figure 11 of Alden does not slant or otherwise change the direction of any beam segments emitted by any LED elements 119 of headlight 123. (Petition, 52; Ex.2040, ¶132.) Instead, the light produced by headlight 123 is permanently directed toward the distribution area ahead of the equipped vehicle, *i.e.*, in a fixed direction and never re-directed. (Ex.1005, ¶¶[0025-0026, 0029]; Ex.2040, ¶94.) The headlight system of Figure 5 merely reduces the intensity of beam segments emitted by selected LED elements 119 of headlight 123 from high intensity (*i.e.*, high beam) to low intensity (*e.g.*, low beam) in the event of an oncoming vehicle. While the headlight system of Figures 8-10 of Alden changes the direction of light emitted by a headlight having a single point light source 129 (Ex.1005, ¶¶[0029-0040]; Ex.2040, ¶95), as previously demonstrated, each of the embodiments disclosed by Alden is distinct and includes features that are incompatible with the others. Any combination of Alden's incompatible embodiments would thus impermissibly render the resulting headlight system inoperable or unsatisfactory for its intended purpose and changes its principle

of operation, making it an unsuitable option. *See Virtek*, 2024 WL 1292734 at *3 ; *In re Gordon*, 733 F.2d at 902; *In re Ratti*, 270 F.2d at 813. (*See*, §VI.A.1-3, *supra*.)

Because neither Alden nor Kobayashi teaches the further limitations of dependent claims 7/18/29 noted, any combination thereof would fail to result in the claimed invention as recited therein. (Ex.2040, ¶133.) Petitioner's obviousness contentions relating to dependent claims 7/18/29 therefore also fail. *See, e.g., Kinetic Concepts*, 688 F.3d at 1361; *In re Royka*, 490 F.2d 981.

7. Dependent Claims 8/19/30

- a. **The Alden-Kobayashi Combination Does Not Teach the Claim Limitations *control . . . a second plurality of LED light sources providing light directed toward an area including at least a portion of the other vehicle to diminish glare to a driver of the other vehicle by a decrease to intensity of light directed towards and illuminating the area, that light having lower intensity compared to light directed towards points laterally adjacent the area to either side***

Dependent claims 8/19/30 depend directly from independent claims 1/12/23 and require, *inter alia*, diminishing glare to a driver of another vehicle by a decrease to the intensity of light directed toward the area including the other vehicle compared to light directed laterally adjacent the area. Dependent claims 8/19/30 recite the limitation *control [or controlling] . . . a second plurality of LED light sources providing light directed toward an area including at least a portion of the other*

vehicle to diminish glare to a driver of the other vehicle by a decrease to intensity of light directed towards and illuminating the area, that light having lower intensity compared to light directed towards points laterally adjacent the area to either side.

Petitioner's obviousness contentions relating to dependent claims 8/19/30 are similar to those relating to independent claims 1/12/23, *i.e.*, that those dependent claims are obvious combinations of Alden and Kobayashi. However, in its obviousness contentions, Petitioner does not cite Kobayashi but relies only on Alden in connection with the limitations of claims 8/19/30. (Petition, 52-63; Ex.2040, ¶¶134-135.)

Petitioner's contentions regarding the general and broad functionality of the systems described by Alden at best **assume** specific details needed to implement such functionality and to meet the above-noted limitations of claims 8/19/30. (Petition, 12-33, 52-63.) Indeed, it is the absence of specific details from Alden's disclosure which demonstrates that Alden fails to teach such claim limitations. The ambiguity of Alden's disclosure also establishes that it fails to provide an enabling disclosure of such claim limitations. (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 any additional rows, above or below, would still be “positioned along the focal point.” (*Id.*) When asked about this, Petitioner’s expert, 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, 56:25-57:3, 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

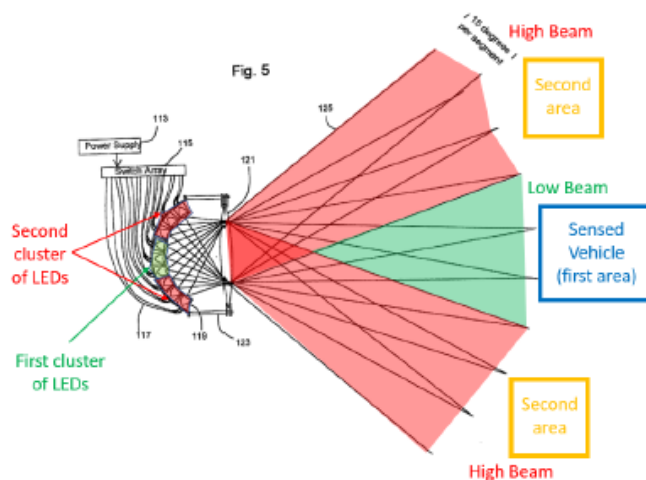
shown in Figure 3 controls the LED array shown in Figure 5 to create the beam spread illustrated therein. (Ex.2041, 108:11-18; 108:23-109:1-5.)

Complicating the issue, in deposition testimony from a related proceeding, 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 increasing the number of LEDs to "reach the lumen output required." (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, ¶139.) Finally, Petitioner's expert testified that, "slice to slice," the LED placement would be adjusted "closer to or further from the lens" to "capitalize on the focal point". (Ex.2066, 47:1-19; Ex.2040, ¶138.)

In view of the foregoing, the operation of Alden's LED headlight embodiment shown in Figure 5 is unclear. (Ex.2040, ¶140.) 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,

¶138.)

Petitioner has also mischaracterized Alden’s disclosure. (Ex.2040, ¶141.) It is only by rendering the annotated sensed vehicle with a completely inaccurate scale relative to headlight 123 that Petitioner can contend that Alden “teaches” these claim 8/19/30 elements. (*Id.*) Petitioner’s annotated Figure 5 is shown below.



(Petition, 63)

Petitioner’s annotations are clearly inaccurate and, consequently, a mischaracterization of Alden’s disclosure. (Ex.2040, ¶142.)

- b. **The Alden-Kobayashi Combination Does Not Teach the Claim Limitations one or more cameras positioned to capture data indicating at least one other vehicle ahead of the motor vehicle and determine a position associated with the at least one other vehicle based at least in part on second data captured by at least one of the one or more cameras**

Dependent claims 8/19/30 also require, *inter alia*, data from one or more

cameras to determine a position of another vehicle. Such limitations as set forth in dependent claim 8 are representative of similar limitations recited in dependent claims 19/30. In that regard, dependent claim 8 recites *one or more cameras positioned to capture data indicating at least one other vehicle ahead of the motor vehicle and determine a position associated with the at least one other vehicle based at least in part on second data captured by at least one of the one or more cameras.*

Once again, Petitioner's obviousness contentions relating to dependent claims 8/19/30 are similar to those relating to independent claims 1/12/23, *i.e.*, that those dependent claims are obvious combinations of Alden and Kobayashi. (Petition, 52-63; Ex.2040, ¶143-144.) Petitioner again does not cite Kobayashi but relies only on Alden in connection with the limitations of claims 8/19/30. (Petition, 52-63; Ex.2040, ¶144.)

Alden uses a photodiode array (or CCD) to detect photon intensity of headlights ("spots of nearly identical intensity and size representative of the [] headlights"). (Ex.1005, ¶¶[0026-0027].) As Figure 4 of Alden shows, this data is simply used for light thresholding purposes, once a light threshold is reached that data is discarded: "Thus (assuming the sensed light is above a threshold intensity or distance) the light sent to the sensed vehicle location is dimmer than the light sent to all other areas of the headlight distribution area. The process then begins again so as to be responsive to changing environmental conditions in real time." (*Id.*, ¶[0027].)

As described with respect to Figure 4, the only processing is of the “amount of light received” above a threshold where “[t]he CPU compares the right map [of amount of light received by each sector] to the left map to determine the distance and intensity of each object sensed in a calculating process 101.” (*Id.*, ¶[0028]; Ex.2040, ¶145.)

At no point does Alden use or suggest that data from the photodiode array (or CCD) should be used to generate a bounding box around the contours of the vehicle. Moreover, Alden fails to include any teachings associated with detecting the location of the vehicle in the distribution area or providing segmented light distribution based on the location of the vehicle or other objects in the distribution area. (*Id.*, ¶146.)

Thus, contrary to Petitioner’s contentions, Alden lacks a camera that can capture data that can be used by the processor to *determine a position associated with the at least one other vehicle* and then satisfy the claimed lighting controls. (*Id.*, ¶147.) Petitioner’s obviousness contentions relating to dependent claims 8/19/30 therefore again fail.¹¹ *See, e.g., Kinetic Concepts*, 688 F.3d at 1361; *In re Royka*, 490 F.2d 981.

¹¹Once again, Petitioner does not cite Kobayashi but relies only on Alden in connection with the limitations of claims 8/19/30. (Petition, 52-63.)

C. Ground 2: Alden-Kobayashi-Beam

1. Dependent Claims 9/20/31: The Alden-Kobayashi-Beam Combination Does Not Teach the Claim Limitations the control of the second plurality of LED light sources is based at least in part on third data received from a non-camera sensor of the motor vehicle

Dependent claims 9/20/31 require the control or controlling of LED light sources based on data from a non-camera sensor. Dependent claims 9/20/31 recite that *the control [or the controlling] of the second plurality of LED light sources is based at least in part on third data received from a non-camera sensor of the motor vehicle.*

Petitioner contends that dependent claims 9/20/31 are an obvious combination of Alden, Kobayashi, and Beam. (Petition, 68-79.) However, in its obviousness contentions, Petitioner does not cite Beam but relies only on Alden and Kobayashi in connection with the limitations of claims 9/20/31 relating to the control or the controlling of LED light sources based on data from a non-camera sensor. (*Id.*, 69-71.) More specifically, Petitioner cites Alden's equipped vehicle steering wheel rotation sensor or alternatively Kobayashi's GPS sensor as the *non-camera sensor* providing the data required by dependent claims 9/20/31. (*Id.*, 70-71.)

Dependent claims 9/20/31 depend directly from dependent claims 8/19/30. Dependent claims 8/19 each recites the limitation *control . . . a second plurality of LED light sources providing light directed toward an area including at least a*

*portion of the other vehicle to diminish glare to a driver of the other vehicle by a decrease to intensity of light directed towards and illuminating the area. Dependent claim 30 similarly recites the limitation *controlling . . . a second plurality of LED light sources providing light directed toward an area including at least a portion of the other vehicle to diminish glare to a driver of the other vehicle by decreasing intensity of light directed towards and illuminating the area.* (Ex.2040, ¶150)*

It is thus apparent that the antecedent basis for the limitations the control and the controlling relating to the second plurality of LED light sources recited in dependent claims 9/20/31 are the limitations of control and controlling of a second plurality of LED light sources recited in dependent claims 8/19/29. Moreover, as further recited in dependent claims 8/19/29, such control and controlling must diminish glare to the driver of another vehicle by decreasing intensity of light. (*Id.*, ¶151.)

As a result, the control and the controlling recited in dependent claims 9/20/31 that must be based on data from a non-camera sensor is control and controlling of the second plurality of LED light sources to diminish glare to the driver of another vehicle by decreasing intensity of light. Significantly, however, neither the steering wheel rotation sensor of Alden, nor the GPS sensor of Kobayashi provides data that is used to diminish glare to the driver of another vehicle by decreasing intensity of light. Instead, the data provided by Alden's steering wheel

rotation sensor and Kobayashi's GPS sensor are used to re-direct light beams produced by vehicle headlights. (Ex.1005, ¶[0040]; Ex.1006, 17:3-50; Ex.2040, ¶152.) Indeed, Petitioner admits that data provided by Alden's steering wheel rotation sensor and Kobayashi's GPS sensor is used for changing or adjusting the direction of vehicle headlight beams. (Petition 70-71.); Ex.2040, ¶152.)

Thus, contrary to Petitioner's contentions, neither Alden nor Kobayashi teaches the dependent claim 9 and 20 limitation *the control of the second plurality of LED light sources is based at least in part on third data received from a non-camera sensor of the motor vehicle*. Similarly, neither Alden nor Kobayashi teaches the claim 31 limitation *the controlling of the second plurality of LED light sources is based at least in part on third data received from a non-camera sensor of the motor vehicle*. Because neither teaches such limitations, Alden alone or in any combination with Kobayashi would fail to result in the claimed invention recited in dependent claims 9/20/31.¹² Petitioner's obviousness contentions relating to those dependent claims therefore fail. *See, e.g., Kinetic Concepts*, 688 F.3d at 1361; *In re*

¹²Once again, Petitioner does not cite Beam but relies only on Alden and Kobayashi in connection with the limitations of claims 9/20/31 relating to the control or the controlling of LED light sources based on data from a non-camera sensor. (Petition, 68-71.)

Royka, 490 F.2d 981.

2. Dependent Claims 9/20/31: The Alden-Kobayashi-Beam Combination Does Not Teach the Claim Limitations *the control of the second plurality of LED light sources additionally includes termination of light from at least one LED providing light directed to the area prior to the termination*

Dependent claims 9/20/31 also require that the control or controlling of LED light sources includes termination of light from at least one LED. Once again, Petitioner contends that dependent claims 9/20/31 are an obvious combination of Alden, Kobayashi, and Beam. (Petition, 68-79.)

Petitioner first argues that because the LEDs 119 of Figure 5 can be operated in a range of intensities between high beam and low beam states, a POSA would have understood such a range to include operating at an intensity of zero. (Petition, 75.) Contrary to Petitioner's contention, a range of intensities between high beam and low beam obviously does not include zero. (Ex.2040, ¶156.)

Petitioner next argues that Beam discloses terminating selected individually controlled light sources of a headlight. (Petition, 76-77.) Once again, however, the primary object of Alden's headlight systems is to "maximize the amount of light that the driver **can use**." (Ex.1005, ¶[0008].) Petitioner's proposed modification to the headlight 123 of Alden according to the teaching of Beam to operate certain LED elements 119 at zero intensity (i.e., deactivate) decreases the amount "of light the

driver **can use.**” (Ex.2040, ¶158.) It has no additional explained benefit, and thus is simply making the combined system less effective at meeting Alden’s primary goal, than Alden alone. As a result, a POSA would not be motivated to combine Alden and Beam as proposed by Petitioner. *See Virtek*, 2024 WL 1292734 at *3 *In re Gordon*, 733 F.2d at 902; *In re Ratti*, 270 F.2d at 813. (See, § VI.C.1-2, *supra*.) Petitioner’s obviousness contentions therefore again fail.¹³ *See, e.g., Kinetic Concepts*, 688 F.3d at 1361; *In re Royka*, 490 F.2d at 984.

3. Dependent Claims 21/32

Claims 21 and 32, while treated equally by Petitioner, require use of the control elements to control light in some manner. Claim 21 requires that the processor be able to use the control elements and claim 32 includes “utilizing” the control elements as part of a method. (Ex.2040, ¶179.) Therefore, a simple lens, such as 121, will not suffice for the proof. Petitioner offers, as an alternative explanation, a use of a “variable refractive element.” (Petition, 66.) This refractive element is not suitable for combination with the Figure 5 LED embodiment. (Ex.2040, ¶179.) The unsuitability of the combination, and the failure of “lens 121” to meet the

¹³Once again, Petitioner does not cite Kobayashi but relies only on Alden and Beam in connection with the limitations of claims 9/20/31 relating to the termination of light. (Petition, 75-78.)

requirements of the claim, render Petitioner's argument against claims 21 and 32 insufficient.

While the headlight system of Figures 8-10 of Alden changes the direction of light emitted by a headlight having a single point light source 129 (Ex.1005, ¶¶0029-0040]; Ex.2040, ¶95, 132), as previously demonstrated, each of the embodiments disclosed by Alden is distinct and includes features that are incompatible with the others. (*Id.*, ¶132.)

The light generated by the LEDs in the first embodiment is non-collimated light directed forward toward the lens without being reflected from any internal reflectors or passing through any other optical components. (*Id.*, ¶97.) The direction and spread of light exiting the headlight is fixed based on the fixed position and distance of each LED 119 relative to the double convex lens 121. (*Id.*)

Like the second embodiment, the third embodiment (Figures 8-10) does not control intensity of the light source and uses a single light source 129a that directs light rearward to a reflector that collimates the light before passing through a planar 2D array of electro-optic (more specifically liquid crystal) elements. (Ex.1005, ¶¶[0032-0035]; Ex.2040, ¶99.) Furthermore, in contrast to both the first and second embodiments, the third embodiment controls the individual electro-optic elements to redirect collimated input light passing through them to "become diverted light 151 (in low beam where a vehicle (not shown) has been sensed) while the light from

other segments [is] not diverted (are in high beam) where no vehicle is sensed.”
(Ex.1005, ¶[0035]; Ex.2040, ¶99.)

Because the first embodiment uses a significantly different principle of operation and control relative to the second and third embodiments, Alden does not disclose or suggest combining or otherwise modifying these embodiments. (*Id.*, ¶100.) Similarly, even if a POSA could rearrange components disclosed by Alden, there is no reason that a POSA would be motivated to do so due to the different principles of operation and corresponding different optical components and control strategies that are not interchangeable or combinable. (*Id.*) For example, use of multiple light sources vs. single light source; use of forward facing light sources vs. rearward facing light sources; use of extended, curved light source vs. point light source; use of collimated light and collimating reflector vs. non-collimated light; use of converging double convex lens vs. diverging double concave lens; controlling power supplied to light source(s) vs. controlling power supplied to electro-optic elements, controlling intensity by controlling power to the light source(s) vs. controlling intensity by filtering or redirecting light from the light sources, *etc.*, would limit the modifications or substitutions of components, particularly those of the first embodiment with either the second or third embodiments disclosed by Alden. (*Id.*) As a result, a POSA would not be motivated to combine the distinct embodiments of Alden. (*Id.*) See *KSR*, 550 U.S. at 418.

As previously noted, the electro-optical refractive elements 147, 149 and double concave lens 133 of the headlight of Figures 8-10 are designed to work with the collimated light produced by single light source 129a and collimating reflector 131 and would be inoperable with the non-collimated light produced by the LED elements 119 of the headlight of Figure 5. (Ex.2040, ¶102.) Non-collimated light cannot be directed in any meaningful fashion by the electro-optical refractive elements 147, 149 of the headlight of Figures 8-10 of Alden. (*Id.*) Rather, non-collimated light would blend and have different incident angles on those electro-optical refractive elements 147, 149 thereby preventing any meaningful control of individual sectors as well as redirecting much of the non-collimated light they receive away from the desired sectors of the distribution area. (*Id.*) The result of any combination thereof 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.*) (*See*, § V.A., *supra.*) Any combination of Alden's incompatible embodiments would thus impermissibly render the resulting headlight system inoperable or unsatisfactory for its intended purpose and changes its principle of operation, making it an unsuitable option and thus a combination lacking motivation to combine. *See Virtek*, 2024 WL 1292734 at *3 ; *In re Gordon*, 733 F.2d at 902; *In re Ratti*, 270 F.2d at 813. In that regard, the incompatibility of Alden's different embodiments is applicable to all

Challenged Claims, *e.g.*, independent claims 1/12/23 and dependent claims 10/11/21/22/32/33, where Petitioner's obviousness contentions rely on any combination or combinations thereof, such as a combination of the headlight system of Figure 5 with that of Figures 8-10. (Ex.2040, ¶102.)

The various features of Alden's embodiments thus cannot simply be treated as interchangeable. Instead, Alden's disclosure must support any contention of interchangeability. There must also be a sufficient rationale to combine Alden's different embodiments. *KSR*, 550 U.S. at 418.

VII. Conclusion

In light of the remarks herein, Patent Owner respectfully requests that the Board find the Challenged Claims of the '029 Patent not unpatentable.

Respectfully submitted,

Dated: April 11, 2024

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Certificate of Service

The undersigned hereby certifies that the foregoing **PATENT OWNER'S RESPONSE**, including any attachments and exhibits, was served in its entirety on **April 11, 2024** upon the following parties by electronic mail:

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