

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 NOTICE OF APPEAL TO THE U.S. COURT OF
APPEALS FOR THE FEDERAL CIRCUIT**

Notice is hereby given, pursuant to 35 U.S.C. §§ 141, 142, 319 and 37 C.F.R. §§ 90.2(a), 90.3(a)(1), that Patent Owner Yechezkal Evan Spero (“Patent Owner”) hereby appeals to the United States Court of Appeals for the Federal Circuit from the Final Written Decision of the Patent Trial and Appeal Board (“PTAB”) entered on January 14, 2025 (Paper 35) in Case No. IPR2023-01034 regarding U.S. Patent No. 11,208,029 (the “’029 Patent”), attached as Exhibit A; and from all underlying findings, determinations, orders, decisions, rulings and opinions that are adverse to Patent Owner, including, without limitation, those within the Decision Granting Institution of *Inter Partes* Review, entered January 19, 2024 (Paper 17). This notice is being timely filed within 63 days of the issuance of the Final Written Decision.

In accordance with 37 C.F.R. § 90.2(a)(3)(ii) and Federal Rule of Appellate Procedure 15(a)(2)(C), without waiving and expressly reserving the right to raise other issues, the expected issues on appeal include, but are not limited to:

1. Whether the PTAB erred in finding that Petitioner has shown by a preponderance of the evidence that claims 1-8, 10-19, 21-30, 32, and 33 are unpatentable as obvious under 35 U.S.C. § 103 in view of U.S. Patent Publication No. 2003/0137849 (“Alden”) and U.S. Patent No. 6,049,749 (“Kobayashi”).
2. Whether the PTAB erred in finding that Petitioner has shown by a

preponderance of the evidence that claims 9, 20, and 31 are unpatentable as obvious under 35 U.S.C. § 103 in view of Alden, U.S. Patent No. 6,144,158 (“Beam”), and Kobayashi.

3. Whether the PTAB erred on all other issues decided adversely to Patent Owner in any findings, determinations, orders, decisions, rulings or opinions underlying or supporting the Final Written Decision.

Pursuant to 37 C.F.R. § 90.2(a)(1) and (a)(2), as well as Fed. Cir. R. 15(a)(1), and as reflected in the attached Certificate of Service and Filing, this Notice of Appeal is simultaneously being filed with the Director of the United States Patent and Trademark Office, the PTAB, and the Clerk’s Office for the United States Court of Appeals for the Federal Circuit, along with the requisite docketing fee.

Respectfully submitted,

Dated: February 20, 2025

/ Andrew B. Turner /
Andrew B. Turner (Reg. No. 63,121)
Sangeeta G. Shah (Reg. No. 38,614)
David S. Bir (Reg. No. 38,383)

Bernard P. Tomsa (Reg. No. 60,121)
Brooks Kushman P.C.
150 W. Second St.
Suite 400N
Royal Oak, MI 48067
(248) 358-4400
Attorneys for Patent Owner

CERTIFICATE OF FILING AND SERVICE

The undersigned hereby certifies that on February 20, 2025 a copy of **PATENT OWNER'S NOTICE OF APPEAL** was served by United States Postal Service Priority Express mail to counsel of record as follows:

Celine Crowson (Reg. No. 40,357) HOGAN LOVELLS US LLP 555 13 th Street, N.W. Washington, D.C. 20004 Telephone: (202) 637-5600 Facsimile: (202) 637-5910 celine.crowson@hoganlovells.com Counsel for Mercedes-Benz USA, LLC	Joseph Raffeto (Reg. No. 66,218) Scott Hughes (Reg. No. 68,385) Ryan Stephenson (Reg. No. 76,608) HOGAN LOVELLS US LLP 555 13 th Street, N.W. Washington, D.C. 20004 Telephone: (202) 637-5600 Facsimile: (202) 637-5910 joseph.raffeto@hoganlovells.com scott.hughes@hoganlovells.com ryan.stephenson@hoganlovells.com Counsel for Mercedes-Benz USA, LLC
--	--

In addition, I certify that **PATENT OWNER'S NOTICE OF APPEAL** is being filed on **February 20, 2025** as follows:

- by electronic mail with the Director of the United States Patent and Trademark Office c/o Office of the Solicitor to efileSO@uspto.gov, pursuant to 37 C.F.R. § 90.2(a)(1)(i);
- electronically with the PTAB through the P-TACTS system, pursuant to 37 C.F.R. § 90.2(a)(1)(ii); and
- electronically with the United States Court of Appeals for the Federal Circuit via the CM/ECF system, pursuant to Fed. R. App. Proc.

25(a)(2)(B)(i) and Fed. Cir. R. 25(a)(1)(A).

Respectfully submitted,

/ Andrew B. Turner /
Andrew B. Turner (Reg. No. 63,121)
Sangeeta G. Shah (Reg. No. 38,614)
David S. Bir (Reg. No. 38,383)

Bernard P. Tomsa (Reg. No. 60,121)
Brooks Kushman P.C.
150 W. Second St.
Suite 400N
Royal Oak, MI 48067
(248) 358-4400

Attorneys for Patent Owner

EXHIBIT A

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

MERCEDES-BENZ USA, LLC,
Petitioner,

v.

YECHEZKAL EVAN SPERO,
Patent Owner.

IPR2023-01034
Patent 11,208,029 B2

Before JON M. JURGOVAN, JASON W. MELVIN, and
AARON W. MOORE, *Administrative Patent Judges*.

MELVIN, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision
Determining All Challenged Claims Unpatentable
35 U.S.C. § 318(a)

I. INTRODUCTION

Mercedes-Benz USA, LLC (“Petitioner”) filed a Petition (Paper 2, “Pet.”) requesting *inter partes* review of claims 1–33 (“the challenged claims”) of U.S. Patent No. 11,208,029 B2 (Ex. 1001, “the ’029 patent”). Yechezkal Evan Spero (“Patent Owner”) filed a Preliminary Response. Paper 10. After additional authorized briefing, we instituted review. Paper 17 (“Institution Decision” or “Inst.”).

Patent Owner filed a Response (Paper 23, “PO Resp.”), Petitioner filed a Reply (Paper 26, “Pet. Reply”), and Patent Owner filed a Surreply (Paper 27, “PO Surreply”). We held an oral hearing on October 23, 2024. Paper 34 (“Tr.”).

For the reasons below, we conclude that Petitioner has proven the challenged claims unpatentable.

A. REAL PARTIES IN INTEREST

As real parties in interest, Petitioner identifies: Mercedes-Benz USA, LLC; Mercedes-Benz Group AG; Mercedes-Benz AG; and Mercedes-Benz Intellectual Property GmbH & Co. KG. Pet. 3. Patent Owner identifies Yechezkal Evan Spero and Torchlight Technologies LLC as the real parties in interest, noting that Torchlight is the exclusive licensee of the ’029 patent. Paper 3, 1 (Patent Owner’s Mandatory Notices).

B. RELATED MATTERS

The parties identify the following related federal district court litigations involving the ’029 patent: *Torchlight Techs. LLC v. Daimler AG et al.*, No. 1:22-cv-00751 (D. Del.); *Torchlight Technologies LLC v. General Motors LLC et al.*, No. 1:22-cv-00752 (D. Del). Pet. 3; Paper 3, 1.

The parties identify the following PTAB *inter partes* reviews of the '029 patent: IPR2022-01500; IPR2023-01586; IPR2023-01122; IPR2023-01226. Pet. 3; Paper 3, 1–2.¹

C. THE '029 PATENT

The '029 patent is titled “Adaptive Headlight System” and relates to motor vehicle headlamps with LED light sources and a processor to control the headlamp light pattern. Ex. 1001, codes (54), (57). The specification more generally describes a lighting device that “incorporates one or more discrete light sources and their ancillary optical and electrical control equipment in an integrated illuminating element.” *Id.* at 13:34–36.

The specification further describes transportation-vehicle applications. *Id.* at 50:49–57:35. In those applications, it refers to an “embodiment of a digital automotive headlamp” as depicted in Figure 15, reproduced below. *Id.* at 52:12–13.

¹ Patent Owner further lists reissue applications, reexaminations, and IPRs involving patents related to the '029 patent. Paper 3, 2–3.

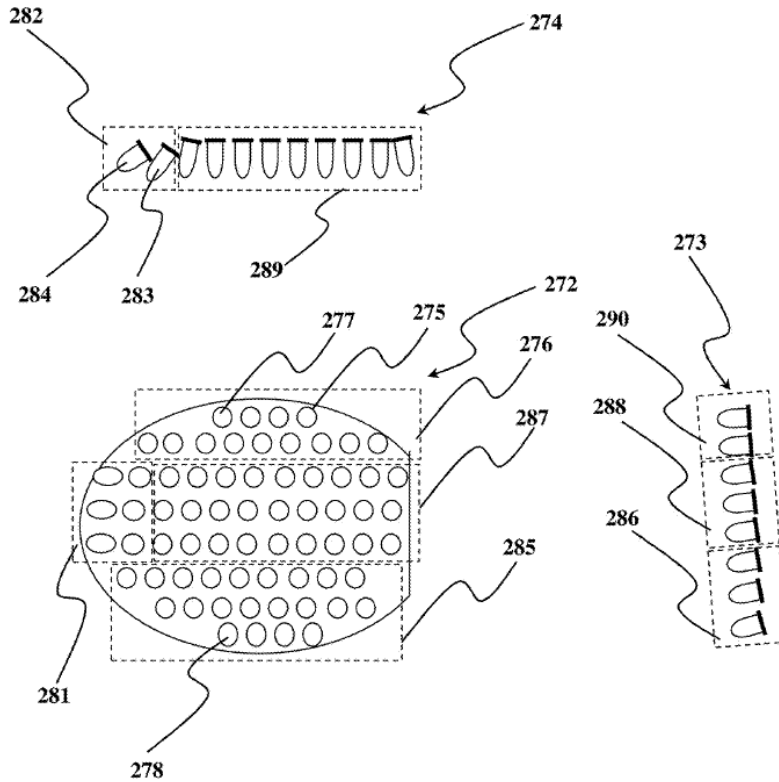


Figure 15 shows headlamp with multiple “discrete SLS light source[s]” such as LED 275, and logical clusters of light sources including cluster 282 containing light sources aimed away from the vehicle’s forward direction, such that sources in cluster 282 may illuminate around a corner. *Id.* at 53:24–30, 54:8–35.

With LEDs aimed in various directions, the headlamp's light distribution pattern may be controlled based on a number of factors, including location data from a GPS system, providing information about upcoming curves in the road. *See id.* at 51:54–67, 54:15–22.

D. CHALLENGED CLAIMS

Petitioner challenges all thirty-three claims of the '029 patent. Pet. 4. Claim 1 is independent and is reproduced below:

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;
 - [²] 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
 - [³] 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, 95:56–96:8. Claims 2–11 depend, directly or indirectly, from claim 1. *Id.* at 96:9–97:44. Claim 12 is independent and recites limitations similar to claim 1’s. *Id.* at 97:45–62. Claims 13–22 depend, directly or indirectly, from claim 12. *Id.* at 97:63–99:27. Claim 23 is independent and recites limitations similar to claim 1’s. *Id.* at 99:28–43. Claims 24–33 depend, directly or indirectly, from claim 23. *Id.* at 99:44–100:66.

² Patent Owner refers to these as the “predictive curve illumination limitations.” PO Resp. 6.

³ Patent Owner refers to these as the “control limitations.” PO Resp. 6.

E. PRIOR ART AND ASSERTED GROUNDS

This proceeding includes the following unpatentability grounds:

Claim(s) Challenged	35 U.S.C. §⁴	Reference(s)/Basis
1–8, 10–19, 21–30, 32, 33	103	Alden ⁵ , Kobayashi ⁶
9, 20, 31	103	Alden, Beam ⁷ , Kobayashi

Pet. 5. Petitioner also relies on the Declarations of Dr. Nikolaos Papanikolopoulos. Ex. 1003; Ex. 1010.

II. ANALYSIS

A. LEVEL OF ORDINARY SKILL IN THE ART

Petitioner asserts that an ordinarily skilled artisan “would have had an undergraduate degree in mechanical engineering, electrical engineering, automotive engineering, optical engineering, applied physics, computer science, or similar disciplines, along with two years of experience working with intelligent vehicle systems, automotive control systems, or lighting control systems.” Pet. 8–9 (citing Ex. 1003 ¶ 33). Patent Owner does not dispute that level of ordinary skill in the art. PO Resp. 6. We adopt the undisputed level of ordinary skill in the art for purposes of this decision and refer to people with that skill as skilled artisans.

⁴ The Leahy-Smith America Invents Act (“AIA”), Pub. L. No. 112-29, 125 Stat. 284 (2011), effective March 16, 2013, amended the applicable statutes. Because the application from which the ’029 patent issued was filed before this date, the pre-AIA version of § 103 applies.

⁵ US 2003/0137849 A1, filed Jan. 22, 2002 (Ex. 1005).

⁶ US 6,049,749, issued Apr. 11, 2000 (Ex. 1006).

⁷ US 6,144,158, issued Nov. 7, 2000 (Ex. 1007).

B. CLAIM CONSTRUCTION

The parties agree that no express claim construction is required at this stage. Pet. 8; PO Resp. 7. We agree with the parties and therefore do not further construe the claims for this decision. *Realtime Data, LLC v. Iancu*, 912 F.3d 1368, 1375 (Fed. Cir. 2019) (“The Board is required to construe ‘only those terms that . . . are in controversy, and only to the extent necessary to resolve the controversy.’”) (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999)).

C. OBVIOUSNESS OVER ALDEN AND KOBAYASHI

Petitioner asserts that claims 1–8, 10–19, 21–30, 32, and 33 are unpatentable as obvious over Alden and Kobayashi. Pet. 12–68. For most of claim 1’s limitations, Petitioner relies on Alden alone. *Id.* at 12–30.

Alden is a published U.S. Patent Application describing and claiming a segmented-distribution headlight system. Ex. 1005, code (54). Alden’s Figure 2 is reproduced below:

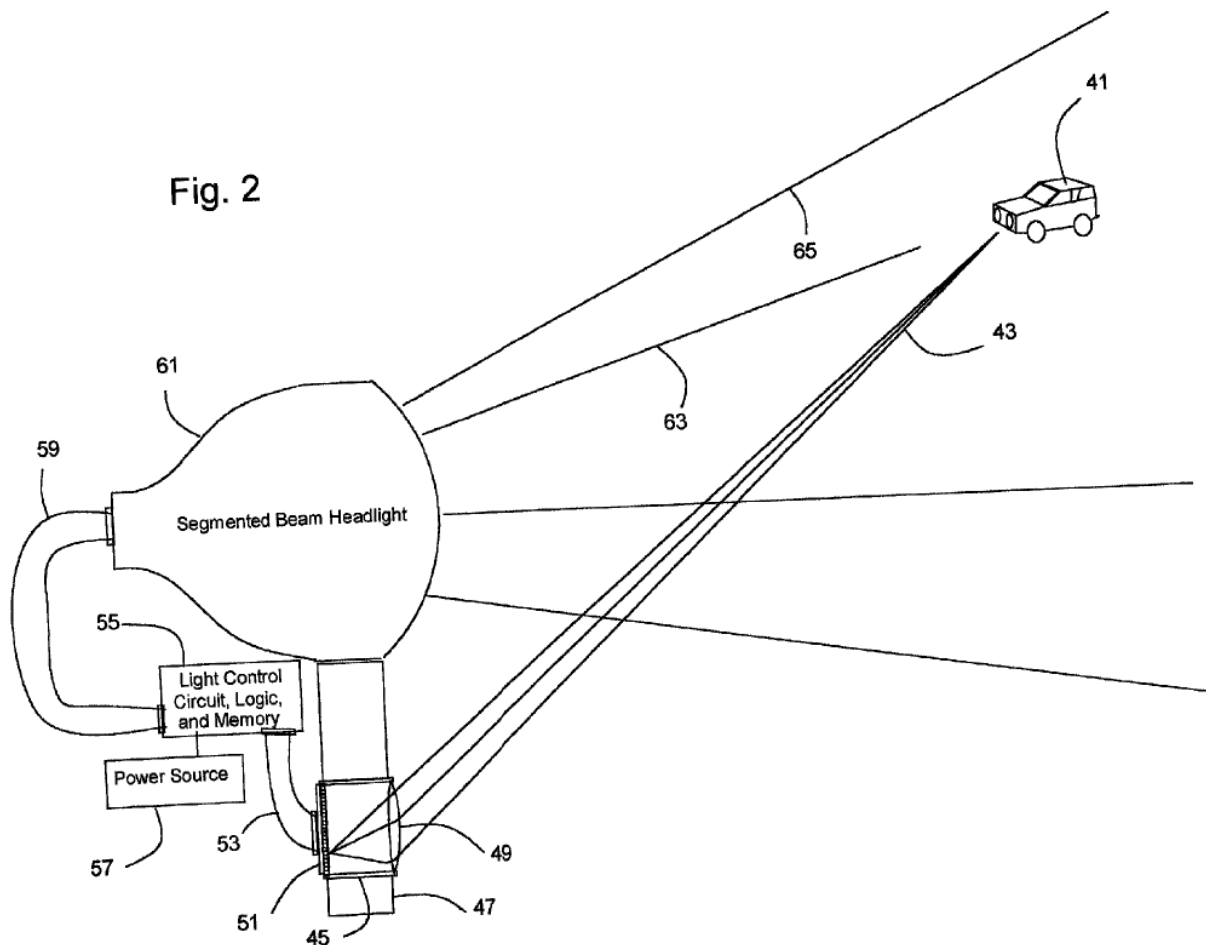


Figure 2 depicts the elements of Alden’s “segmented distribution illumination process,” in which vehicle 41 emits light towards a vehicle with Alden’s invention, and that light illuminates detector array 51 that is part of sensor unit 45; signals representing the received light are sent to light control circuit 55, which controls segmented beam headlight 61 to provide either low or high illumination in its various segments such that light directed toward the vehicle 41 is a low beam and light directed elsewhere is a high beam. *Id.* ¶ 26, Fig. 2.

Alden’s system detects spots of light, performs triangulation to calculate the distance to each, then uses the spots’ intensity, size, and location information to represent “objects.” *Id.* ¶ 27 (“Triangulation is thus used by the CPU to determine

the distance” when detecting “spots of nearly identical intensity and size representative of the [oncoming vehicle’s] headlights.”), 28 (“The CPU compares the right map to the left map to determine the distance and intensity of each object sensed . . .”).

Once objects have been identified, Alden’s system uses them to determine which headlight zones to dim. *Id.* ¶ 28 (“The location of objects is used to calculate which zones of each headlight need to be dimmed . . .”; “assuming the sensed light is above a threshold intensity or distance”). In that decision, the CPU identifies a corresponding pair of headlights as a vehicle, and accommodates the vehicle by defining a dimming area larger than just the headlights. *Id.* ¶ 27 (“The [dimmed] area is significantly larger than the headlight dots that were initially received by [the light-detector arrays] because, the CPU has made assumptions about the space that may potentially be occupied by the driver of the sensed vehicle.”). Finally, “[s]ignals are sent to each of the headlight control circuit zones that need to be dimmed,” whereas other zones “remain on high beam.” *Id.* ¶ 28.

With signals from the CPU, Alden’s “segmented beam headlight” projects light in the desired pattern. *E.g., id.* ¶¶ 26, 29. Alden discloses a number of embodiments for the headlight, including one with an array of LEDs (*id.* ¶ 29, Fig. 5) and others with electro-chromatic, liquid-crystal, or variable-refraction elements (*id.* ¶¶ 30–35, Figs. 6–10).

Alden further discloses other applications for its controllable headlights, including one directed to curves in the road. Alden’s Figure 11 is reproduced below:

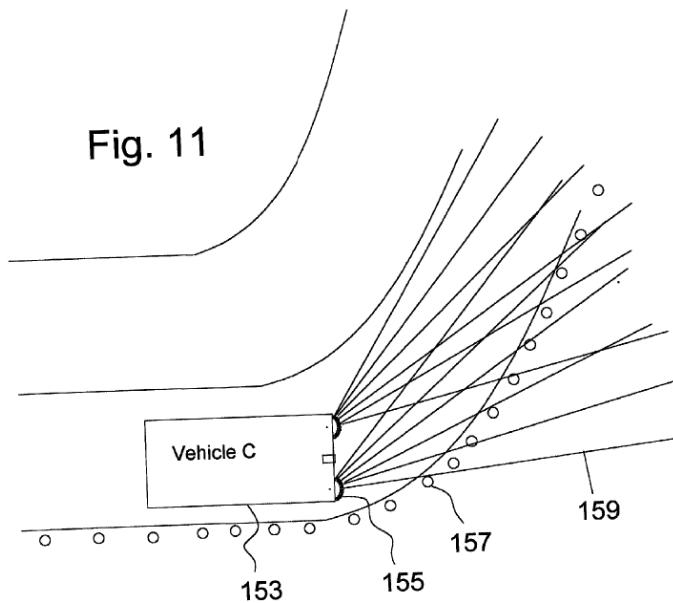


Figure 11 depicts equipped vehicle 153 sensing that the road turns using roadside reflectors 157, causing headlights 155 to “direct light into the corner to maximize the driver’s ability to see there.” Ex. 1005 ¶ 36, Fig. 11. Alden states that the same device already disclosed may direct light as illustrated in Figure 11. *Id.* ¶ 36.

Petitioner additionally relies on Alden’s steering-wheel rotation sensor, which Alden uses to calculate its vehicle’s direction changes and adjust the light projection. Pet. 21 (citing Ex. 1005 ¶¶ 39–40).

For receiving map data indicating an upcoming road curvature, Petitioner relies on Kobayashi, submitting that it would have been obvious to “use map data to identify road curvature when adapting the LEDs of Alden to ‘direct light into the corner.’” Pet. 23–24 (quoting Ex. 1005 ¶ 36). Petitioner reasons that Alden discloses detecting road curvature through roadside reflectors and steering-wheel sensors, and Kobayashi discloses an additional way to detect road curvature. *Id.* at 24. Petitioner continues that, because Kobayashi discloses using map data to control vehicle headlights, skilled artisans would have had reason to adopt its teachings in Alden’s system “to maximize successful detection in different

environments.” *Id.* at 24–25 (citing Ex. 1003 ¶ 70). Petitioner relies on Kobayashi also for determining a light change to increase light in the direction of road curvature and shaping light based on the road curvature. *Id.* at 27. Finally, Petitioner relies on Kobayashi for the requirement to control the light sources both based on the determined light change and also prior to the vehicle reaching the road curvature. *Id.* at 30.

1. Alden’s ability to increase light in the direction of road curvature

Petitioner relies on Alden’s disclosure of detecting road curvature using roadside reflectors and altering light distribution in response, which is summarized above. Pet. 20–21 (citing Ex. 1005 ¶ 36, Fig. 11).

As noted above, Petitioner relies further on Kobayashi’s use of map data to identify road curvature and adapt the light distribution in response. Pet. 22–25. Petitioner submits that skilled artisans would understand Kobayashi to disclose “an additional known means to detect road curvature: road map data.” *Id.* at 24. Using Kobayashi’s map data to detect road curvature would “maximize successful detection in different environments” such as where a road lacks reflectors. *Id.* at 25.

Patent Owner argues that Alden does not enable a system that detects road curvature. PO Resp. 23–25 (“Alden does not teach any logic for determining the difference between headlights and reflectors . . .”). We do not agree.

We agree with Petitioner that Patent Owner has not demonstrated lack of enablement for Alden’s system detecting road curves. Pet. Reply 1–3. As Petitioner points out, Alden uses both intensity and a detected object’s location (including distance) to inform its response. Ex. 1005 ¶¶ 27–28. Petitioner’s expert testifies that the same physical system used to accommodate oncoming vehicles

could be used to detect roadside reflectors and direct light into road curves. Ex. 2041, 78:16–80:24. Further, Petitioner’s expert testifies that skilled artisans would adjust the intensity and distance thresholds to distinguish roadside reflectors from oncoming vehicles. Ex. 1010 ¶¶ 5–7. Based on Alden’s disclosures, we credit Petitioner’s expert’s testimony that Alden’s system could detect and accommodate road curvatures. *Id.*; Ex. 1003 ¶¶ 64–65.

Thus, we do not agree with Patent Owner’s position that Alden’s system has no way of determining whether to dim light for an oncoming vehicle or accommodate a road curvature by increasing light. *See* PO Resp. 25. We agree with Petitioner’s expert that Alden’s system can distinguish the two, as discussed.

Patent Owner argues additionally that Alden’s Figure 5 embodiment does not allow for certain LEDs to be used to illuminate around curves, because the LEDs provide high-beam illumination unless dimmed for an oncoming vehicle. *Id.* at 25–31. That position does not account for Alden’s teachings regarding road curvature.

While Alden describes operation where non-dimmed areas are illuminated with high beam (Ex. 1005 ¶ 27), that relates to preventing glare to oncoming vehicles. Skilled artisans would understand that it is a different use with different requirements where Alden describes directing light into corners. Ex. 2041, 50:9–51:1. Petitioner’s expert explains that the segmented headlight shown in Alden’s Figure 5 can function in both uses by identifying both oncoming vehicles and roadside reflectors. *Id.* at 78:22–80:24. Even when preventing glare to oncoming vehicles, Alden teaches switching certain headlight segments to dim and switching other segments to high beam. Ex. 1005, Fig. 4; *accord id.* ¶ 28. By including a decision about each headlight segment, Alden’s system is thus configured to implement the road-curvature use. And Alden teaches that its invention may be

used such that each segment is “within a range of intensities between the high beam and the low beam state.” *Id.* ¶ 61. That supports that Alden’s invention is not limited to a binary choice between dimming for oncoming vehicles or providing high-beam illumination.

Petitioner’s expert testifies that the lateral LEDs in Alden’s Figure 5 embodiment may be controlled to illuminate curves. Ex. 1003 ¶ 75; Ex. 1010 ¶ 11. That is consistent with his testimony that, in the road-curvature use, skilled artisans would position the device’s LEDs “to ensure that the beam created by the headlamp is sufficiently wide to illuminate turns.” (*see* PO Resp. 27–28 (quoting Ex. 2066, 111:18–112:5)), because how Figure 5’s LEDs would be operated depends on how they are positioned. Patent Owner submits that Petitioner’s expert agreed that, in Alden’s Figure 5 embodiment, the full pattern would be used for a road with no curves. PO Resp. 28. The expert, however, clarified that using the full pattern “would have been the first application described in Alden,” rather than a general description of Figure 5’s hardware. Ex. 2067, 17:9–18:4. Indeed, as Petitioner’s expert testifies, “Alden discloses a segmented distribution headlight with individually controlled segments with broad functionality.” Ex. 1010 ¶ 12. We see nothing inconsistent about the testimony.

Alden’s Figure 11 also contradicts Patent Owner’s view that all segments would be illuminated, as Figure 11 depicts an asymmetric beam projection. Ex. 1005, Fig. 11. That projection pattern is consistent with Petitioner’s expert’s testimony (Ex. 1010 ¶ 11) that the outermost LEDs would be used for wide illumination, only activated when the system desires to “concentrate light to look around corners in response to road conditions” (Ex. 1005 ¶ 36, Fig. 11).

Patent Owner draws a parallel between Alden’s statement that its invention can “concentrate light to look around corners” when its headlights “direct light into

the corner” (Ex. 1005 ¶ 36) and Figure 10’s embodiment, which uses variable refraction elements to redirect light from a single illumination source (*id.* ¶ 35). PO Surreply 5–8. We do not agree that Alden’s use of “direct” and “redirect” do not refer to the same process. Alden’s description of the variable refraction elements indicates that they have two states (Ex. 1005 ¶¶ 33–35), and therefore would not be able to flexibly direct light as required by the road-curvature application. We agree with Petitioner that Alden’s general invention works in the Figure 11 application to “concentrate light” towards road curvature. Certain areas of lighting—LEDs in the Figure 5 embodiment—are used for wide illumination, only activated when the system directs light into a curvature.

Patent Owner argues that configuring Alden’s headlight such that it could direct light into a curve, “some amount of forward illumination would be lost.” PO Resp. 34. Thus, Patent Owner argues, such a configuration would not comport with Alden’s goal of maximizing light for the driver. *Id.* We do not agree that Alden requires maximizing light at all times. Rather, to the extent Alden seeks to maximize light for the driver, it’s within the context of using “a high beam to see further ahead” (Ex. 1005 ¶ 5). That is, Alden’s goal is for a driver “to see optimally” (*id.* ¶ 2), not to illuminate as much area as possible. In our view, it is consistent with Alden’s goals for it to reserve some lighting capacity for directing into road curvature, because doing so would better illuminate the road ahead for the driver.

2. Adapting light prior to a road curvature

Claim 1 requires controlling light to enact the determined light change “prior to the motor vehicle reaching the road curvature.” Petitioner relies on Alden’s use of roadside reflectors to identify road curvature and argues that Alden’s system

would adapt light before the curvature because the reflectors are ahead of a vehicle and the system would react “once it detects light from such reflectors.” Pet. 29–30 (citing Ex. 1003 ¶ 76). Petitioner also points to Kobayashi’s controller, which changes light shaping before a vehicle reaches a curve. *Id.* at 23–24, 30.

Patent Owner argues that Alden’s Figure 11 teaching to direct light into a corner does not include doing so prior to the vehicle entering the turn. PO Resp. 37–38. Patent Owner’s position relies on Alden not discussing the timing of the lighting change depicted in Figure 11. *Id.* at 38. We agree with Petitioner and credit the testimony of Petitioner’s expert that because Alden senses road curvature from roadside reflectors, it would detect road curvature in advance of entering that curvature, adapting the light when the curvature is sensed. Ex. 1010 ¶ 15; Ex. 1003 ¶ 76. Further, Petitioner’s expert testifies that drivers turn the steering wheel before the vehicle enters a curve. *Id.* ¶ 17. Thus, using Alden’s steering-wheel sensor additionally supports a system that adapts light for a road curvature prior to the vehicle entering the curvature.

Considering Kobayashi’s teachings, Patent Owner argues that the asserted combination includes only Kobayashi’s map data, not any aspect of Kobayashi’s control strategy. PO Resp. 39, 21. Even accepting that a combination would use Kobayashi’s map data alone, because Alden’s system already uses information about road curvature before the vehicle enters the curvature, the record supports that adding Kobayashi’s map data, at a minimum, would not change that behavior.

Moreover, we agree with Petitioner that skilled artisans reading Kobayashi would understand that it teaches adapting light for road curvatures before a vehicle reaches a curvature, and would follow that teaching when implementing the combined system. Ex. 1003 ¶ 77. Patent Owner argues further that Kobayashi teaches changing the light direction only once a vehicle has entered a curve.

PO Resp. 39–40. That position is not consistent with Kobayashi’s disclosures, which show a vehicle at point A, before a road curvature, with the light emitted in the direction of curvature. Ex. 1006, Fig. 10. Petitioner’s expert confirms those relationships. Ex. 1010 ¶ 18. We agree with Petitioner’s expert because the testimony is consistent with Kobayashi’s Figure 10.

Accordingly, we find that the asserted combination would adapt light prior to the vehicle reaching a road curvature.

3. Conclusion on independent claims

As discussed above, Patent Owner challenges whether the asserted combination teaches claim 1’s Predictive Curve Illumination Limitation and Control Limitation. PO Resp. 6, 21–43. Patent Owner does not dispute other aspects of Petitioner’s showing for claim 1.

Independent claims 12 and 23 recite limitations similar to those of claim 1, and Patent Owner challenges Petitioner’s contentions for the same reasons already discussed. PO Resp. 43–44 (claim 12), 45–46 (claim 23).

We have considered the full record, including evidence and arguments presented by Petitioner and Patent Owner on whether the combination of Alden and Kobayashi discloses each limitation of claims 1, 12, and 23, and whether skilled artisans would have had reason to combine the references’ teachings as asserted. Based on the full record, we conclude that Petitioner has proven that claims 1, 12, and 23 would have been obvious over Alden and Kobayashi.

4. Dependent claims 5, 16, 27: *increasing light emitted at a level below high-beam light*

Claim 5 depends from claim 1 and recites that “the increase of light in the direction of 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. 1001, 96:24–27. Claims 16 and 27 recite parallel limitations.

Petitioner submits that skilled artisans would have configured the combined system to direct light below high-beam level into curves because it “would allow the driver to sufficiently see the road curvature, while not blinding potential oncoming vehicles that are not yet visible.” Pet. 42–43 (citing Ex. 1003 ¶ 100). In that regard, Petitioner relies on Alden’s emphasis of reducing glare to other drivers. *Id.* at 43 (citing Ex. 1005 ¶¶ 5–6, 26–29).

Patent Owner argues that configuring a system in that way would be contrary to Alden’s primary object of maximizing light for the driver. PO Resp. 46–50. Patent Owner’s argument relies on its position that Alden operates with a default state of high-beam intensity. *Id.* at 48–49.

As we note above, Alden states that its goal is for a driver “to see optimally” (*id.* ¶ 2), not to illuminate as much area as possible. What a skilled artisan would consider optimal illumination could include either high-beam illumination, as Patent Owner contends, or a lower level, as Petitioner contends. Petitioner’s expert explains that because “an oncoming vehicle may be present or approaching,” skilled artisans had reason to select illumination below high-beam level to avoid blinding such oncoming vehicles that are not yet visible. Ex. 1003 ¶ 99–100. We agree with that testimony that configuring the system as claimed would have “minimize[ed] the risk of blinding another driver that could be coming around the curve.” *Id.* ¶ 100.

Accordingly, we conclude that Petitioner has shown that claims 5, 16, and 27 would have been obvious over Alden and Kobayashi.

5. Dependent claims 6, 17, 28:
a second road curvature

Claim 6 depends from claim 1 and recites that the processor may determine a second change adapting the light pattern, “to increase light in a direction of a second road curvature” determined based at least on second map data, and control a second plurality of the LED light sources to accommodate the second change “prior to the motor vehicle reaching the second road curvature.” Ex. 1001, 96:28–45. Claims 17 and 28 recite parallel limitations.

Petitioner asserts that because Alden’s system is responsive to detected curvature, “when the received data indicates the upcoming road changes curve direction or shape, such as going from a first left-hand curve to a second right-hand curve,” it would control a different plurality of LEDs to illuminate the second curve. Pet. 44, 48–49. Similarly, Petitioner reasons that Kobayashi’s map data would provide different information for Alden’s system to accommodate road turns as the vehicle travels. *Id.* at 44–47, 49.

Patent Owner argues that iterative control does not necessarily mean control prior to reaching a curve. PO Resp. 52–53. While that is true, we find that the combined Alden–Kobayashi system would adapt its light pattern prior to the vehicle reaching a curvature for the reasons discussed above. *See supra* at 14 (§ II.C.2). For those same reasons, we find that it would do so also for subsequent, different, road curvatures.

Accordingly, we conclude that Petitioner has shown that claims 6, 17, and 28 would have been obvious over Alden and Kobayashi.

6. Dependent claims 7, 18, 29:
illuminating road curvature with an LED that did not do so prior to the change

Claim 7 depends from claim 1 and recites that the light increase in the direction of road curvature “includes at least one of expansion of the light pattern . . . or an increase to intensity” and that the determination of light change includes changes to individual LEDs include at least one of “variation to at least one of intensity or color” or “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. 1001, 96:46–61.

Petitioner reasons that Alden’s change to accommodate road curvatures expands light in the area of the curve or increases intensity of light in the curve, because Alden describes controlling LED’s to “concentrate” or “direct light” into the curve. Pet. 50 (citing Ex. 1005 ¶ 36). Petitioner further submits that Alden’s Figure 11 shows that light is “directed into the curve” by expanding the beam laterally beyond its normal range. *Id.* at 51–52.

Patent Owner argues that Alden’s Figure 5 embodiment “does not slant or otherwise change the direction of any beam segments emitted by any LED elements 119 of headlight 123.” PO Resp. 55. That is inapposite, as the claims do not require an individual LED element change its emission direction, but rather that the headlight as a whole illuminate an LED with an emission direction that the headlight had not illuminated before the curvature. We understand Patent Owner’s position to rely on the idea that Alden would have illuminated all of its LEDs prior to detecting a road curvature, but we do not agree with that view of how Alden operates. Rather, we agree with Petitioner that Alden would have used LEDs on the sides of its illumination pattern to project light into detected road curvatures. Pet. Reply 16; Ex. 1003 ¶¶ 107, 112; Ex. 1010 ¶¶ 20–22.

Accordingly, we conclude that Petitioner has shown that claims 7, 18, and 29 would have been obvious over Alden and Kobayashi.

*7. Dependent claims 8, 19, 30:
diminishing glare to another vehicle*

Claim 8 depends from claim 1 and further recites “one or more cameras positioned to capture data indicating at least one other vehicle ahead of the motor vehicle” and require the processor have capability to determine a position of the other vehicle using data from the camera

control, based at least in part on the position, a second plurality of LED light sources providing light directed towards 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, the light that is directed towards and illuminating the area having lower intensity compared to light directed towards points laterally adjacent the area to either side.

Ex. 1001, 96:62–97:14. Claims 19 and 30 recite parallel limitations.

Petitioner relies on Alden’s teachings that its system “detects other vehicles and controls LEDs to direct dimmed, low beam light into areas where those other vehicles are located.” Pet. 52–63. Those teachings are summarized above. *See supra* at 7–9.

a. Alden’s Figure 5 embodiment

Patent Owner argues that Alden does not sufficiently disclose its Figure 5 embodiment to support Petitioner’s contentions. PO Resp. 56–60.

First, we do not agree with Patent Owner that Alden’s Figure 5 depicts a device with only a single row of lighting elements. *See id.* at 57; PO Surreply 13–14. Although Figure 5 shows one embodiment of Alden’s “segmented headlight means and controlling switch array” (Ex. 1005 ¶ 29), the segmented headlight is

merely one aspect of Alden's invention. The segmented headlight receives signals from a "light control circuit"—logic executing on a CPU that controls the switch array. *Id.* ¶¶ 26, 27, Figs. 2, 3. Thus, it is important to view Figure 5 and the corresponding description with an eye to the broader context in which it operates.

Alden discusses "elements of a segmented distribution illumination process" in connection with Figure 2. Ex. 1005 ¶ 26. The described process uses "a segmented beam headlight 61" to differentially illuminate sectors of the light distribution based on light sensed by a detector array and logic in a light-control circuit. *Id.* ¶ 26, Fig. 2. Alden's description is generic to the specific headlight embodiment, and states that "[s]ome methods employed within [segmented beam headlight] 61 to segment light into independently controlled sectors are discussed later." *Id.* Similarly, Figure 3 and its associated discussion provides "a more detailed illustration of the information flow, processes and architecture of the elements described in FIG. 2." *Id.* ¶ 27, Fig. 3. Figure 3 is reproduced below:

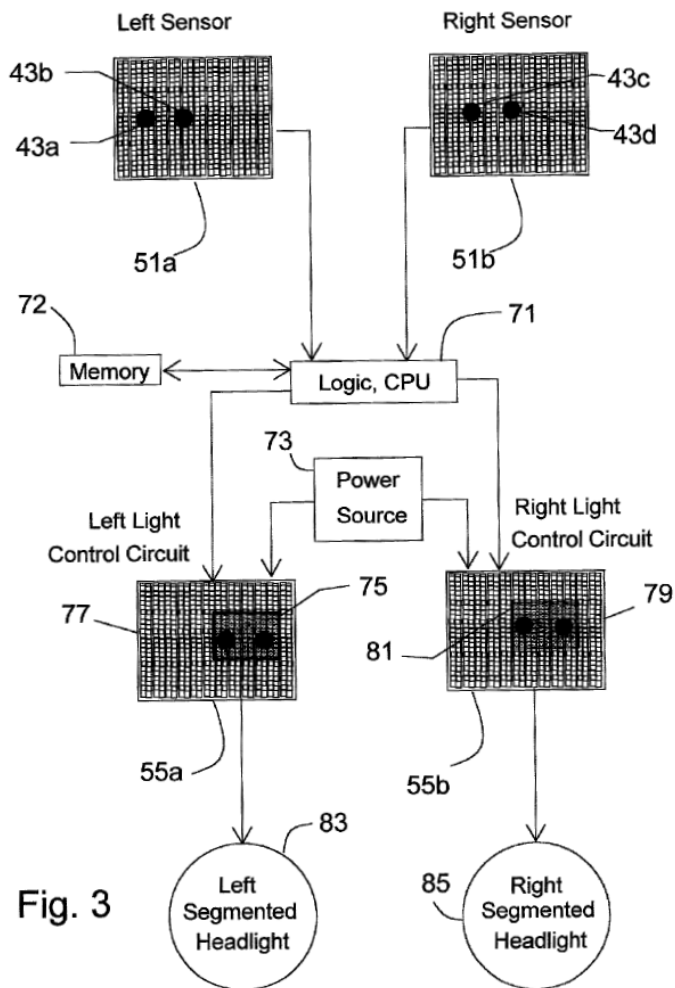


Figure 3 depicts “the information flow, processes and architecture of the elements described in FIG. 2” including sensors 51a/b with illuminated spots 43a/b/c/d, logic and CPU 71, light control circuits 55a/b, and segmented headlights 83/85. *Id.* ¶ 27, Fig. 3.

Figure 3 depicts segmented headlights 83 and 85 generically, and the description refers to them without limiting the particular form of those headlights. *Id.* Thus, when Alden describes that Figure 5 “illustrates the segmented headlight means and controlling switch array in a first embodiment,” that does not describe an aspect disconnected from the components and operation depicted in Figures 2 or

3, but rather provides details regarding one embodiment of the segmented headlights included in Figures 2 and 3. *See id.* ¶ 29.

Importantly, Figure 3 unambiguously depicts two-dimensional sensor arrays 51a/b and two-dimensional control circuits 55a/b. *Id.*, Fig. 3. That figure and the corresponding text indicate that Alden’s process for dimming illumination sectors involves aspects in the vertical direction—the shaded boxes 75/77 representing dimmed illumination extend beyond the sensed lights 43a/b/c/d more in the vertical direction than in the horizontal direction, and “[t]he 75 area is significantly larger than the headlight dots that were initially received by 51a and 51b because, the CPU has made assumptions about the space that may potentially be occupied by the driver of the sensed vehicle.” *Id.* ¶ 27, Fig. 3.

Moreover, Alden’s description of Figure 3’s logic—though Figure 4’s flow chart and corresponding text—leaves no doubt that Alden’s process uses two-dimensional analysis. As Alden describes, the CPU checks each sector of the light sensor, for the left sensor beginning with sector A1L, proceeding to A2L and continuing through XYL. *Id.* ¶ 28, Fig. 4. The same process occurs for the right sensor, checking sectors A1R through XYR. *Id.*

Finally, Alden describes additional applications for its invention, beyond those used to dim light sectors for oncoming vehicles. Those applications include where the invention is “used to concentrate light to look up a hill in response to road conditions” and “look down a hill in response to road conditions.” *Id.* ¶¶ 55, 56, Figs. 12, 13. From that description and the corresponding figures, it is apparent that those applications use Alden’s ability to control sectors along the vertical axis within the segmented headlight that effects illumination.

While Alden’s Figure 5 shows a sectional view of a segmented-headlight embodiment, thus depicting a single line of LEDs, that does not restrict the

embodiment to a one-dimensional array. Indeed, Alden's disclosures discussed above contradict such a view, as do the disclosures regarding Figure 5 and other segmented-headlight embodiments. We credit Petitioner's expert's testimony in this regard. Ex. 2041, 59:10–12 (“[I]t’s very clear we’re talking about a two-dimensional structure that is map of this set of slices in figure 5.”); *accord id.* at 56:25–60:18. The Figure 5 embodiment includes a switch array to control the individual lighting elements, with “[e]ach lighting element being independently controlled by a corresponding switch in an array of switches 115.” Ex. 1005 ¶ 29. The Figure 6 embodiment includes a face-on view of the segmented headlight plainly showing a two-dimensional array, in addition to a sectional view similar to Figure 5’s. *Id.* at Fig. 6. And Alden describes that the Figure 6 embodiment uses “switch array similar to 115 and the process previously described herein.” *Id.* ¶ 30. The Figure 6 description expressly refers to the same reference numeral as the Figure 5 description, making a plain connection.

Considering Alden's description of its sensing-and-control circuit in connection with Figure 3, which illustrates a two-dimensional array, and its description of Figure 5's segmented headlight as working with that approach, we find that Alden's LED-based segmented headlight is capable of selective illumination in two dimensions. Ex. 1005 ¶¶ 27, 29, Figs. 3, 5.

Patent Owner relies heavily on Alden's statement that “[t]he [light element] 119 and other lighting elements are on a curve along the focal point of a headlight lens 121 such that the light from each lighting element goes into a specified portion (or portions) of the headlight distribution area.” *Id.* ¶ 29; PO Resp. 57 (“Alden merely describes a row of LEDs positioned along the focal point of a lens.”). It is uncontroversial that the lens has a single focal point, though there are many curves passing through that focal point, and thus many curves on which lighting elements

may be arranged. While Figure 5 shows elements along one such curve, that does not preclude the existence of other elements that fall on other curves. Thus, we do not agree that Alden's statement regarding the focal point restricts Figure 5 to depicting an embodiment with one row of lights.

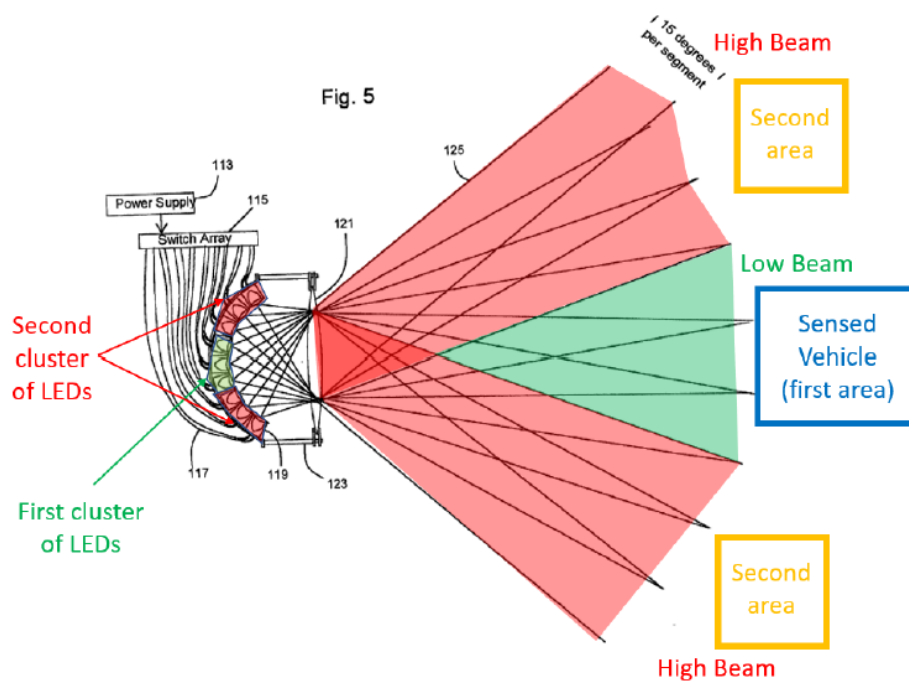
Patent Owner also faults Petitioner's expert for characterizing the figures as conceptual. PO Resp. 58; PO Surreply 14, 17–18. But there is nothing problematic with conceptual figures, particularly where the corresponding description makes clear how the invention operates. For example, Patent Owner complains that Petitioner's expert "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." PO Resp. 58–59 (emphasis omitted). We would not expect Dr. Papanikolopoulos to explain that—the beam spread of any optical system will depend on the lens used and the relative position of the light sources to the lens, so it is unclear why Patent Owner expects the particular switch array to determine beam spread. When asked about beam spread (Ex. 2041, 107:11–12), Dr. Papanikolopoulos stated that it would depend on the specifics of an overall system and could not be determined by Alden's figures (*id.* at 108, 4–10).

Because Alden describes its segmented headlights as implementing a process using two-dimensional signals for two-dimensional dimming functionality, we find that Figure 5 depicts a section of an embodiment that contains more than a single row of lighting elements. Stated otherwise, Alden's disclosures are consistent with each other and are directed to a two-dimensional approach to sensing, control, and illumination. Based on our review of the record, we credit the testimony of Petitioner's expert that Alden's Figure 5 embodiment includes multiple rows of LEDs. Ex. 1010 ¶¶ 23–28.

Finally, we agree with Petitioner that the challenged claims do not require a two-dimensional approach. Pet. Reply 20. Although Patent Owner asserts that Alden fails to provide an enabling disclosure (PO Resp. 57), Patent Owner has not addressed the legal standard for lack of enablement. In particular, to overcome the presumption that prior-art disclosures are enabled, Patent Owner must show ordinarily skilled artisans would require undue experimentation to practice the disclosed invention. *See Amgen Inc. v. Hoechst Marion Roussel, Inc.*, 314 F.3d 1313, 1354–55 (Fed. Cir. 2003); *In re Antor Media Corp.*, 689 F.3d 1282, 1287–88 (Fed. Cir. 2012). Other than arguing that Figure 5 discloses a single-row embodiment that is unusable with Alden’s other disclosures, Patent Owner has made no attempt to show Alden lacks enablement. Patent Owner has not addressed what experimentation skilled artisans would require to practice an invention using Alden’s Figure 5 segmented headlight with the remainder of Alden’s system as disclosed in Figures 2, 3, and 4, and Alden’s corresponding textual description. Thus, even viewing Alden’s Figure 5 as a single row of LEDs would not undermine Petitioner’s positions here or change our conclusions, because it would still disclose the claimed elements, and we conclude that Alden teaches both accommodating detected road curvatures and oncoming vehicles using Figure 5’s headlight.

b. Petitioner’s annotations

Patent Owner argues also that Petitioner’s annotations mischaracterize Alden’s disclosures by using an inaccurate scale for the sensed vehicle as compared to the headlight. PO Resp. 60. Petitioner’s annotated version of Alden’s Figure 5 is reproduced below:



Pet. 63 (quoting and annotating Ex. 1005, Fig. 5). Petitioner’s annotations designate and highlight red a central cluster of lighting elements within Figure 5’s array as a “First cluster of LEDs” and designate and highlight green the remainder of the array (to both sides of the first cluster) as a “Second cluster of LEDs.” *Id.* The annotations further highlight the light beams emitted from the segmented headlight by the two clusters as green and red, respectively, and show a “Sensed Vehicle (first area)” within the “Low Beam,” green portion emitted by the first cluster and a “Second area” as the “High Beam,” red portion emitted by the second cluster. *Id.*

As Petitioner points out, its annotations are “demonstrative of what is described in Alden, and are not the creation of a scaled technical drawing.” Pet. Reply 22. Petitioner’s expert testifies that Alden’s figures are conceptual in nature (Ex. 1010 ¶ 29) and we view Petitioner’s annotations as consistent with that conceptual nature. There would be no use in a drawing that accurately represented the scale of both Alden’s segmented headlight and an oncoming vehicle, because

the headlight would be too small to resolve any detail. That reality is reflected in Alden's Figure 2, reproduced above, which uses different scales to depict the segmented distribution system versus an oncoming vehicle. *See* Ex. 1005, Fig. 2. Thus, we do not fault Petitioner's annotations for representing an oncoming vehicle as falling within a small portion of the projected beam. Indeed, Alden indicates Figure 5 depicts an embodiment in which each lighting element provides 15 degrees of the overall illumination. *Id.* ¶ 39, Fig. 5. Using that example, each element's illumination would spread about 39 feet at a distance of 150 feet.⁸ The challenged claims do not restrict the distance at which an "other vehicle" is accommodated. Alden's Figure 5 example depicts a system that would provide segments to isolate the vehicle at some reasonable distance from Alden's system.

We do not rely on Petitioner's annotations to reach our conclusions that Alden discloses the '029 patent's claimed invention, for any challenged claim. That said, we conclude that Petitioner's annotations accurately represent Alden's disclosures, without purporting to depict the scale of oncoming vehicles relative to Alden's segmented headlight.

c. Determining the position of other vehicles

Claim 8 requires the controller be able to "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." Ex. 1001, 97:1–3. Patent Owner argues that Alden's system does not detect oncoming vehicles, as opposed to simply detecting spots of light from such vehicles. PO Resp. 61–62. In that regard, Patent Owner faults Alden for not using camera data "to generate a bounding box around the contours of the vehicle." *Id.* at 62 (emphasis omitted).

⁸ $150 \cdot \sin(15^\circ) = 38.8$

We agree with Petitioner that Alden discloses the claimed capability. Alden's system does not simply dim its headlights where it detects spots of light. Rather, it performs a multistep process in which those spots are detected, analyzed with triangulation to determine distance, and then used to determine dimming zones. Ex. 1005 ¶¶ 27–28. Alden discloses that its sensor “detects the two headlights” of an oncoming vehicle when “[e]lectrons corresponding to the position and intensity of light are categorized by a logic and CPU 71 and stored in a memory 72.” *Id.* ¶ 27. Petitioner's expert noted that Alden's description “move[s] from lights – thresholding lights to objects, and then calculate[s] distance of each thresholding object using triangulation.” Ex. 2041, 109:23–110:2. That testimony supports our view that Alden first detects lights, uses those detected lights to identify and classify an oncoming car, then dims the headlight output to prevent glare.

Alden's dimming decision particularly indicates that it classifies pairs of detected headlights as oncoming vehicles. The CPU makes “assumptions about the space that may potentially be occupied by the driver of the sensed vehicle” and identifies an area of the segmented headlight to dim that is “significantly larger than the headlight dots that were initially received.” Ex. 1005 ¶ 27. The way Alden's system selects sectors surrounding detected light indicates that it identifies vehicles, not just spots of light. It does not simply expand an area around each detected light; it dims an area to encompass the driver of the identified vehicle. Ex. 1005 ¶ 27, Fig. 3. By treating a pair of corresponding detected lights collectively for dimming, Alden indicates that it classifies pairs of detected lights as vehicles. We find that Alden determines a position associated with another vehicle as claimed.

Accordingly, we conclude that Petitioner has shown that claims 8, 19, and 30 would have been obvious over Alden and Kobayashi.

8. Dependent claims 21, 32:
utilizing control elements

Claim 21 depends from claim 19 (and thus indirectly from claim 12) and further recites that the processor can “utilize one or more optical control elements included in the motor vehicle to control light” from one of the LED pluralities. Ex. 1001, 99:19–24. Claim 32 recites a parallel limitation in a method claim.

Petitioner addresses claims 21 and 32 together with dependent claims 10, 11, 22, and 23. Pet. 64–68. Claim 10 depends from claim 1 and further recites “one or more optical elements for controlling light from one or more of the LED light sources.” Ex. 1001, 97:39–41. Claim 11 depends from claim 10 and further recites that “the optical control elements include at least one of one or more reflectors, refractors or lenses.” *Id.* at 97:42–44. Claims 22 and 33 depend from claims 21 and 32, respectively, and recite limitations parallel to those of claim 11. Petitioner asserts that claims 10, 21, and 32 are substantially similar in requiring “optical control elements” and that claims 11, 22, and 33 are identical to each other in restricting the optical control elements to “reflectors, refractors or lenses.” Pet. 64.

Petitioner relies on Alden’s disclosure of using lens element 121 in the Figure 5 embodiment. *Id.* at 64–65. Petitioner submits that Alden’s processor “utilizes the lens element 121 to direct light into the desired sectors or segments of the headlight distribution area based on their position on the curve relative to the focal point of the lens.” *Id.* at 65 (citing Ex. 1005 ¶ 29).

Patent Owner argues that “a simple lens, such as 121 [in Alden’s Figure 5], will not suffice for the proof.” PO Resp. 67. Petitioner, on the other hand, submits that the claims do not require an “active” element and therefore read on Alden’s

lens, which Alden's processor uses because it must consider how the lens affects where light from each LED will illuminate in the target space. Pet. Reply 27–28.

We agree with Petitioner. By simply using “utilize” to reference the optical control elements, the claim language does not impose an active-control requirement. Patent Owner does not explain its position in the Response, but elaborates in the Surreply, where Patent Owner submits that the specification discloses both passive and active optical control elements, and claim language directed to a processor executing instructions must be directed to active optics. PO Surreply 19.

Patent Owner's position is belied by dependent claims 22 and 33, which recite that the optical control elements are “reflectors, refractors or lenses.” As Petitioner points out, those claims indicate that passive elements are within the scope of claims 21 and 32. Tr. 43:3–25. Patent Owner takes the position that claim 22's further recitation regarding the optical control elements has no bearing on how to read claim 21 (Tr. 84:20–85:2), but we do not agree. Rather, Petitioner's reading is more consistent with the claim language as a whole.

As to claim 21's language that the processor executes instructions to utilize the optical control elements, logically, that language may be satisfied by instructions causing the processor to consider the effect a lens has on the light distribution and controlling the LEDs to account for that effect. Claim 21's language requires the processor control light from the LEDs, not control the optical control elements. *See* Tr. 96:6–13.

For the foregoing reasons, we conclude that Alden's system utilizes its lens to control light from the LEDs, satisfying claim 21 and 32's additional limitations. Accordingly, Petitioner has shown that claims 21 and 32 would have been obvious over Alden and Kobayashi.

9. Uncontested claims

For dependent claims 2–4, 10, 11, 13–15, 22, 24–26, and 33, Petitioner provides unpatentability contentions showing where Alden or Kobayashi discloses the additional limitations of each claim. Pet. 33–41, 64–68. Other than as discussed above, Patent Owner does not challenge those contentions. We have considered the full record, including evidence and arguments presented by Petitioner and Patent Owner on whether the combination of Alden and Kobayashi discloses each limitation of claims 2–4, 10, 11, 13–15, 22, 24–26, and 33, and whether skilled artisans would have had reason to combine the references’ teachings as asserted. Based on the full record, we conclude that Petitioner has proven that claims 2–4, 10, 11, 13–15, 22, 24–26, and 33 would have been obvious over Alden and Kobayashi.

D. OBVIOUSNESS OVER ALDEN, BEAM, AND KOBAYASHI

Claim 9 depends from claim 8, and thus indirectly from claim 1. Ex. 1001, 97:15–38. Claims 20 and 31 depend from claims 19 and 30, respectively, and recite limitations parallel to claim 9’s.

1. Controlling light sources based in part on data from a non-camera sensor

Claim 9 requires “third data received from a non-camera sensor,” in addition to claim 8’s “second data captured by at least one of the one or more cameras” and claim 1’s “first data, including at least map data.” *Id.* at 97:19–20, 97:1–3, 95:63–65. As discussed above, claim 8 requires “control, based at least in part on the position [of another vehicle determined from camera data]” of a second LED plurality directed towards the other vehicle “to diminish glare to a driver of the other vehicle.” *Id.* at 97:5–14. Claim 9 further requires that “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.” *Id.* at 97:18–20.

Petitioner points to Alden’s steering-wheel (non-camera) sensor and that it may be used to accommodate road curvature “in combination” with Alden’s camera sensor, which is used to accommodate oncoming vehicles. Pet. 70. Thus, reasons Petitioner, when a vehicle with Alden’s system “is traveling straight and there is an oncoming vehicle, light emitted from the ‘second plurality’ of LEDs in the area of the oncoming vehicle is dimmed” but “if the steering wheel sensor detects that the wheel is turned ‘x degrees,’ indicating that the driver will be turning the vehicle, then the ‘second plurality’ of LEDs would be further controlled to ‘change[] the direction of the headlight output a corresponding $f(x)$ degrees.” *Id.* at 70–71 (citing Ex. 1005 ¶ 57–58, Figs. 14–15; Ex. 1003 ¶ 141). Petitioner points additionally to Kobayashi’s GPS sensor, asserting that the combined system would use data from that non-camera sensor to control the second LED plurality, “adjusting their direction in view of the map data indicating an upcoming road curve.” *Id.* at 71.

Patent Owner challenges that approach to the claim language and submits that controlling light as required by claim 9 requires control “to diminish glare” to oncoming vehicles, as recited in claim 8. PO Resp. 63–64. Patent Owner argues that neither Alden’s steering-wheel sensor nor Kobayashi’s GPS sensor satisfies that role. *Id.* at 65.

Petitioner responds Patent Owner’s view of the claim language by arguing that, in Alden, “dimming to reduce glare is maintained in the direction of an oncoming vehicle as the equipped vehicle turns, by shifting the dimmed light by an amount equal to the turning of the steering wheel.” Pet. Reply 25. Patent Owner asserts that Petitioner’s view of the claim has changed in response to Patent

Owner's construction of claim 9's "the control" language. PO Surreply 24. We consider any change in Petitioner's position appropriate in light of Patent Owner's claim-construction position, raised in the Response. *See Axonics, Inc. v. Medtronic, Inc.*, 75 F.4th 1374, 1383 (Fed. Cir. 2023).⁹

Patent Owner argues that, if Alden's beam shifts in response to detected road curvature,¹⁰ and a detected vehicle falls within the shifted beam, the system would dim a portion of light within the shifted beam to address glare to the vehicle. PO Surreply 23. We agree, and conclude that shows that Alden's system satisfies claim 9's language. When Alden's system shifts its beam to accommodate road curvature (using a non-camera sensor), the shifted beam may illuminate an oncoming vehicle. And Alden's system would operate as detailed above to dim a portion of the beam corresponding to the detected oncoming vehicle. Thus, the LED plurality directed towards that vehicle would be controlled to reduce glare to the vehicle as a result of both the non-camera sensor and the camera sensor, as claimed.

This view of the claim language comports with testimony from Patent Owner's expert. When asked about what non-camera sensors the '029 patent describes to control headlights, he named only a steering sensor, specifically stating that it is used "in controlling a second plurality of the light sensors." Ex. 1012, 132:16–21. This additionally supports Petitioner's view that Alden's steering sensor satisfies the claim language.

⁹ In the Preliminary Response, Patent Owner did not contest unpatentability based on claim 9's "the control" language. *See* Paper 10, 41–42.

¹⁰ We conclude above that Alden's beam does shift in that manner. *See supra* at 11 (§ II.C.1).

Accordingly, we conclude that Alden's disclosures support that Alden's system satisfies claim 9, 20, and 31's "the control" language.

2. Terminating light from an LED

Claim 9 further recites that controlling a second plurality of LEDs "includes termination of light from at least one LED providing light directed to the area prior to the termination." Ex. 1001, 97:33–36.

Petitioner asserts first that skilled artisans would have understood that Alden's approach of dimming an LED "could include operating at zero" and that "turning off LEDs that emit light directly at the driver of the other vehicle would accomplish Alden's purpose of reducing glare to other drivers." Pet. 75 (citing Ex. 1003 ¶ 147). Petitioner asserts additionally that claims 9, 20, and 31 would have been obvious over Alden, Beam, and Kobayashi. Pet. 68–79.

Beam discloses an adaptive-headlight system that uses a sensor to detect other vehicles and dim its headlights to prevent light that "would dazzle the driver" of another vehicle. Ex. 1007, codes (54), (57), 1:5–18, 2:53–3:3. Beam discloses that portions of its light may be "blanked (attenuated by being either absorbed or deflected to an absorbing surface.)" *Id.* at 4:26–52; *accord id.* at 2:59–65 ("[T]he area of the beam that would dazzle the driver will be darkened, while maintaining f[u]ll intensity elsewhere.").

Petitioner relies on Beam's headlight system using individually controlled microbeams to eliminate glare for other vehicles, "controlled to darken light directed to the areas of the sensed oncoming and preceding vehicles." *Id.* at 76 (emphasis omitted) (citing Ex. 1007, 4:9–25, 4:45–59. 5:61–6:8, 6:61–7:8). Petitioner points also to Beam's disclosure that its lighting elements can be

“blanked” (*id.* at 77 (quoting Ex. 1007, 4:26–52, 5:33–54)), which skilled artisans would understand as terminating light output (*id.* (citing Ex. 1003 ¶¶ 149–150)).

Petitioner submits that skilled artisans would have had reason to incorporate Beam’s blanking approach in Alden’s system by changing one of Alden’s LEDs to a non-emitting state “to further dim headlight beam output directed to areas of the oncoming vehicles as taught by Beam.” Pet. 77 (citing Ex. 1003 ¶ 151). In Petitioner’s view, skilled artisans had reason to make the combination “to minimize glare to the driver of oncoming vehicles.” Pet. 78.

Patent Owner argues that using Beam’s method of terminating light from an LED (blanking) would contravene Alden’s “primary object” of maximizing light for the driver. PO Resp. 66–67. We do not agree, because Alden unambiguously seeks to diminish glare to oncoming vehicles, as discussed above. We agree with Petitioner that using Beam’s blanking method would facilitate diminishing glare to oncoming vehicles. *See* Pet. Reply 26.

Accordingly, we conclude that Petitioner has shown that claims 9, 20, and 31 would have been obvious over Alden, Beam, and Kobayashi.

III. CONCLUSION¹¹

For the reasons discussed above, we conclude Petitioner has proven the challenged claims unpatentable. In summary:

¹¹ Should Patent Owner wish to pursue amendment of the challenged claims in a reissue or reexamination proceeding subsequent to the issuance of this decision, we draw Patent Owner’s attention to the April 2019 *Notice Regarding Options for Amendments by Patent Owner Through Reissue or Reexamination During a Pending AIA Trial Proceeding*. *See* 84 Fed. Reg. 16,654 (Apr. 22, 2019). If Patent Owner chooses to file a reissue application or a request for reexamination of the challenged patent, we remind Patent Owner of its continuing obligation to

Claim(s)	35 U.S.C. §	Reference(s)/Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
1–8, 10–19, 21–30, 32, 33	103	Alden, Kobayashi	1–8, 10–19, 21– 30, 32, 33	
9, 20, 31	103	Alden, Beam, Kobayashi	9, 20, 31	
Overall Outcome			1–33	

IV. ORDER

Accordingly, it is

ORDERED that Petitioner has shown by a preponderance of the evidence that claims 1–33 of the '029 patent are unpatentable; and

FURTHER ORDERED that, because this is a Final Written Decision, parties to the proceeding seeking judicial review of the decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

notify the Board of any such related matters in updated mandatory notices. *See* 37 C.F.R. § 42.8(a)(3), (b)(2).

IPR2023-01034
Patent 11,208,029 B2

For PETITIONER:

Celine Crowson
Joe Raffetto
Scott Hughes
Ryan Stephenson
HOGAN LOVELLS US LLP
celine.crowson@hoganlovells.com
joseph.raffetto@hoganlovells.com
scott.hughes@hoganlovells.com
ryan.stephenson@hoganlovells.com

For PATENT OWNER:

Sangeeta G. Shah
David Bir
Andrew Turner
BROOKS KUSHMAN P.C.
sshah@brookskushman.com
aturner@brookskushman.com
btomsa@brookskushman.com