

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Mercedes-Benz USA, LLC,
Petitioner,

v.

Yechezkal Evan Spero,
Patent Owner.

Case No. IPR2023-01034
Patent 11,208,029

**PETITIONER'S REPLY TO
PATENT OWNER'S RESPONSE**

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PETITIONER’S EXHIBIT LIST

Exhibit No.	Description
1001	U.S. Patent No. 11,208,029 (“’029”)
1002	Original File History for the ’029 Patent
1003	Declaration of Dr. Nikolaos Papanikolopoulos
1004	Curriculum Vitae of Dr. Nikolaos Papanikolopoulos
1005	U.S. Patent Publication No. 2003/0,137,849 (“ Alden ”)
1006	U.S. Patent No. 6,049,749 (“ Kobayashi ”)
1007	U.S. Patent No. 6,144,158 (“ Beam ”)
1008	PTAB Trial Statistics April 2023 IPR, PGR
1009	2/3/2023 - Dkt 97 - Second Amended Complaint (Torchlight v. MBUSA Case No. 22-751)
1010	Second Declaration of Dr. Nikolaos Papanikolopoulos
1011	First Deposition Transcript of Dr. Matthew Turk
1012	Second Deposition Transcript of Dr. Matthew Turk

I. Introduction

Patent Owner's Response ("POR") ignores disclosures in Alden (EX1005), takes the Petition and Petitioner's expert's testimony out of context, and mischaracterizes Petitioner's explanation for how references would be combined. But, as explained below and in the Petition, when the references are properly considered in their entirety, it is clear they contain more than sufficient disclosure to invalidate the challenged claims. The POR's arguments are nothing more than attempts to distract from the reference's concise and clear disclosure of the challenged claims and should be dismissed.

II. Independent Claim 1

A. The Alden-Kobayashi combination teaches increasing illumination in the direction of an upcoming road curvature.

Claim 1 recites "increas[ing] light in a direction of the road curvature ahead of the motor vehicle[.]" Patent Owner raises several arguments regarding this limitation.

First, Patent Owner ("PO") argues Alden does not enable detection of road curves based on sensing roadside reflectors because it allegedly cannot distinguish between reflectors and oncoming vehicles and, thus, is unable to determine whether

to dim or increase light. (POR, 23-25.)¹ This argument must fail. Disclosures in prior art publications are presumed enabled. *In re Antor Media Corp.*, 689 F.3d 1282, 1287-88 (Fed. Cir. 2012); *Amgen Inc. v. Hoechst Marion Roussel, Inc.*, 314 F.3d 1313, 1355 (Fed. Cir. 2003). PO, not Petitioner, bears the burden to show non-enablement and it has not done so.

Alden detects different objects of interest (including the roadside reflectors) by checking for light above a certain “threshold” intensity or distance at each location of the sensor array. (Alden, Figure 4, [0028]; Petition, 20-21; Declaration of Dr. Nikolaos Papanikolopoulos (EX1003), ¶¶60-65.) The logic of Figure 4 would apply to both detection of headlights and detection of roadside reflectors, with Alden’s Paragraph [0036] indicating that instead of dimming where objects (*i.e.*, reflectors) indicating the curve are detected, the system will now “direct light into the corner” by switching LEDs directed towards the reflectors to high beam and

¹ Patent Owner also suggests a letter from Gentex to Alden proves Alden’s disclosure is “theoretical.” (POR, 17, n. 2.) This letter from Alden’s file should be given no weight, as it is taken out of context, and there is no indication in the record regarding the circumstances surrounding the submission to Gentex, the type of review done, what Gentex was looking for, or why it responded as it did. (EX1011, 82:13-85:1.)

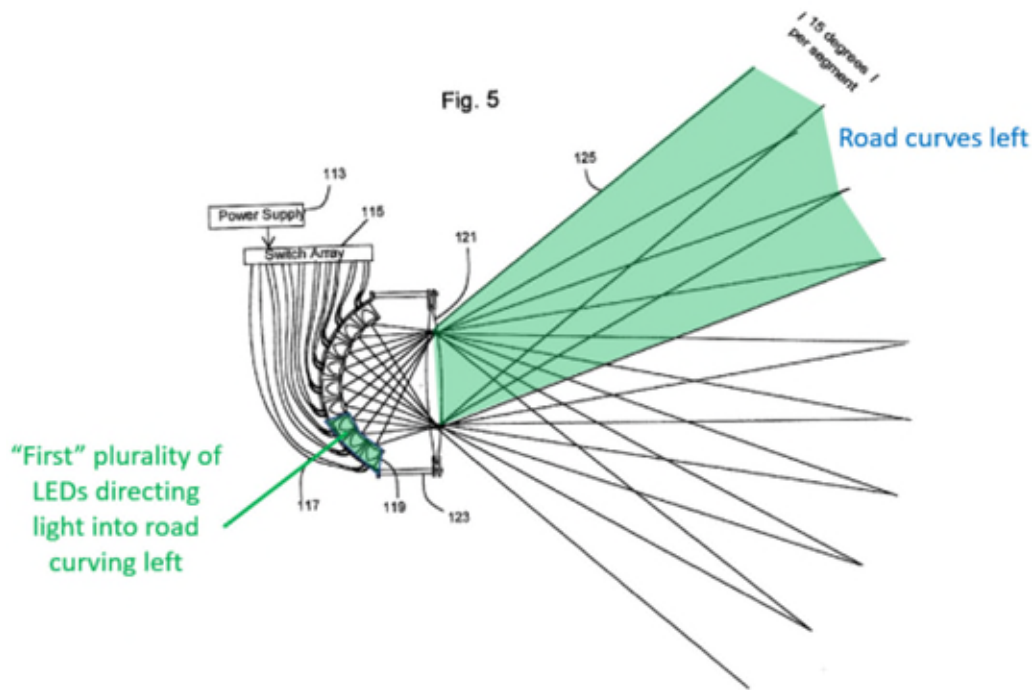
switching LEDs not directed at the curve to low beam or even off. (EX1003, ¶¶60, 65; Second Declaration of Dr. Nikolaos Papanikolopoulos (EX1010), ¶¶5-17; Second Deposition Transcript of Dr. Nikolaos Papanikolopoulos (EX2066), 114:20-115:14.)) To distinguish between different objects, such as roadside reflectors or oncoming vehicles, a POSITA would have understood the threshold intensity or distance of the process in Figures 3-4 may, for example, be adjusted based on the type of object. (EX1010, ¶¶5-17.) Moreover, as Alden also determines distance to each object above a threshold and uses this to determine the intensity of illumination of each sector, the determined distances to a series of roadside reflectors along a curve would distinguish from detection of just two dots at a different distance when there is another vehicle. (Alden, [0027]-[0028], [0036]; EX1003, ¶¶60-65; EX2041, 78:16-80:24; EX1010, ¶¶5-17.)

Second, PO argues Alden does not increase illumination in the direction of a curve, because its headlamp beam is wide enough to encompass curves and its LEDs are always in high beam. (POR, 25-31.) PO argues Alden’s alleged primary purpose is to maximize light, selectively dimming only the sectors required to minimize glare for the driver of an oncoming vehicle, and Alden therefore has a “default operating state” of all LEDs emitting high beam illumination at all times. (POR, 26-31.)

Even if this is Alden’s primary purpose, it is not its *only* purpose and nothing suggests its system must *always* operate to achieve this purpose even when

performing other functionality. Alden’s system does not simply default all LEDs to maximum high beam intensity at all times unless otherwise dimmed as PO argues. (POR, 26-27.) Rather, Alden explains “[m]any other variations [of its system] are possible,” and regarding Figure 11, details the segmented headlight being “used to concentrate light to look around corners” when the vehicle senses road turns, by directing “light into the corner to maximize the driver’s ability to see there.” (Alden, [0036], [0061]; EX1003, ¶¶49, 55-56, 72-76; EX2041, 50:9-51:3, 76:8-80:24.)² Petitioner’s annotated Figure 5 accurately depicts, as the Board agreed, how Alden’s LED array would implement this functionality:

² Alden also discloses its system can “concentrate light to look up a hill,” “concentrate light to look down a hill” (Alden, [0037]-[0038]), and “can be used to shine light only where needed to conserve electricity[.]” (*Id.*, [0061].)



(Alden, Fig. 5 (annotated); Petition, 29; Institution Decision (DI), 14-15.) As shown, if the equipped vehicle approaches a leftward road curve, LEDs aimed towards the left side of the headlight distribution area can be controlled to direct light to illuminate the curve. (Petition, 25-29; EX1003, ¶¶71-75.)

Moreover, as shown in Figure 4 at element 109, Alden's system can "switch requisite headlight segments to dim" *and* "switch other segments to high beam." (Alden, Fig. 4, [0027]-[0029], [0036], [0061].) Thus, as a POSITA would have understood, in the context of Figure 11 where the system will "concentrate" and "direct" light into a corner, Alden does not default all sectors to high and then dim certain ones. (Alden, [0036], [0061]; EX1003, ¶¶49, 119-121.) Instead, it can selectively switch to high beam those LEDs positioned on the curve—for example

those at one of the extreme ends of the curve in Figure 5—such that they would direct high beam light into the area of the road curvature to “concentrate” light there. (Alden, [0036], [0061], [0027]-[0029]; EX1003, ¶75.) This switching on of LEDs directed at the curve to high beam light is increasing illumination in a direction of the road curvature. (EX1003, ¶113; *see also* Petition, 25-26.)

Further, PO takes Dr. Papanikolopoulos’s statements out of context. (POR, 27-29.) As Dr. Papanikolopoulos explained, Alden may illuminate the full pattern at high beam intensity “under the first application of Alden” (when no LEDs are dimmed if there is no detected oncoming vehicle), but it “depends.” (Third Deposition Transcript of Dr. Papanikolopoulos (EX2067), 17:9-20.) He elaborated that when Alden’s system is used for the second application, to concentrate light in the direction of a road curve, that is not how it would behave. (EX2067, 14:9-27:2; EX1010, ¶¶5-17.) Instead, Alden’s system would provide high beam illumination into the curve, and low or dim beam elsewhere. (*Id.*)

Third, as can best be understood, PO argues Kobayashi’s map data cannot be used with Alden because this would result in Alden no longer providing “maximum illumination” ahead of the driver. (POR, 32-36.) PO argues a vehicle at point A of Kobayashi’s Figure 10 producing an illumination pattern shown in annotated Figure 5 or Figure 11 of Alden would not be illuminating roadway ahead of the driver. (*Id.*)

But, the Petition does not suggest using the particular illumination patterns shown in annotated Figure 5 or Figure 11 of Alden when the vehicle is in Kobayashi's Figure 10 scenario, nor would the system attempt to do so. (Petition, 22-30.) Alden discloses its system "senses that the road turns" and "direct[s] light into the corner[.]" (Alden, [0036].) As explained in the Petition, Alden adapts the shape of the headlight distribution pattern to shift light "in the direction of the curve[.]" (Petition, 26-27; EX1003, ¶¶68-77.) That is, Alden produces a light pattern responsive to the particular shape of a given road curve. (EX1003, ¶¶68-77; EX1010, ¶¶5-18.) The Alden-Kobayashi system would simply determine upcoming road curves or changes in road shape based on Kobayashi's map data rather than data from Alden's sensors detecting light from roadside reflectors. (Petition 27, 30; EX1003, ¶¶72, 77.) Thus, an equipped vehicle at point A of Kobayashi's Figure 10 would have an illumination pattern particularized to the shape of that road. (EX1003, ¶¶68-77.)

Fourth, PO argues Kobayashi's map data cannot be used with Alden because this would be incompatible with Alden's steering wheel sensor. (POR, 35-36.) However, PO's argument is based on a misinterpretation of the combination as presented, and falsely assumes the combined system would have to make use of Kobayashi's map data and Alden's steering wheel sensor data simultaneously. (POR, 35-36.)

The Petition indicated it would have been obvious to use map data from Kobayashi as an information source regarding road curves in Alden's system, but not that such system would have to use the steering wheel sensor and map data at the same time. (Petition, 21-25, 29-30.) As explained, Alden's steering wheel rotation sensor data and Kobayashi's map data are both ways to determine a vehicle is approaching a road curve. (Alden, [0039]-[0040]; Petition, 21-25, 29-30; EX1003, ¶¶66-67.) And, from this, it would have been obvious to use Kobayashi's map data to determine when the road curves and adjust the lights accordingly in certain situations. (Petition, 25.) For example, map data may be preferable in environments where steering wheel sensor data is less reliable, and vice versa. (*Id.*; EX1003, ¶¶69-70, EX1010, ¶13.)

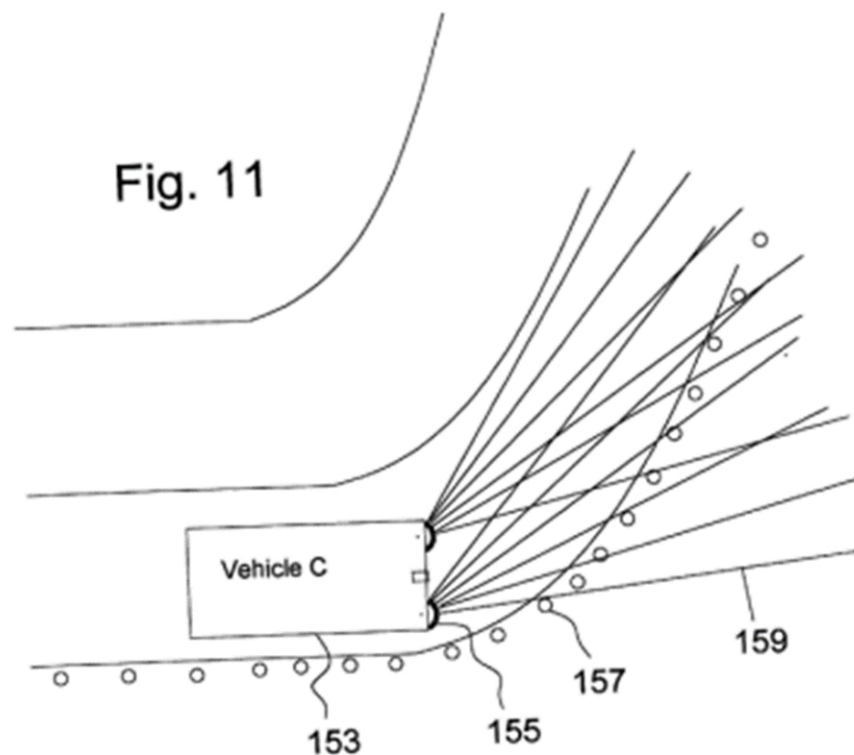
B. The Alden-Kobayashi combination teaches controlling LEDs prior to the vehicle reaching the road curvature.

Claim 1 requires controlling a plurality of LEDs *prior to* the vehicle reaching the road curvature. PO argues that, even if Alden-Kobayashi can *detect* an upcoming road curvature, neither Alden nor Kobayashi teaches redirecting light *prior to* the vehicle entering the curve. (POR, 37-42.)

However, Alden's "controlled light change takes effect prior to the vehicle reaching the road curvature." (Petition, 29-30; EX1003, ¶76.) Alden detects an upcoming road curve from sensor data detecting light from roadside reflectors.

(Alden, [0026]-[0029], [0036].) *See supra* Section II(A). Alden further discloses that once the road curve is detected, it will “concentrate light” in the direction of the road curve “to maximize the driver’s ability to see there.” (*Id.*, [0036].) This process is iteratively repeated “so as to be responsive to changing environmental conditions in real time.” (*Id.*, [0028].)

Alden’s light sensors would receive light from roadside reflectors 157 and detect the upcoming curve *before* the vehicle enters it. (EX1003, ¶76.) The headlight pattern is then changed to direct light into the curve *before* the vehicle reaches the curve as shown in Figure 11:



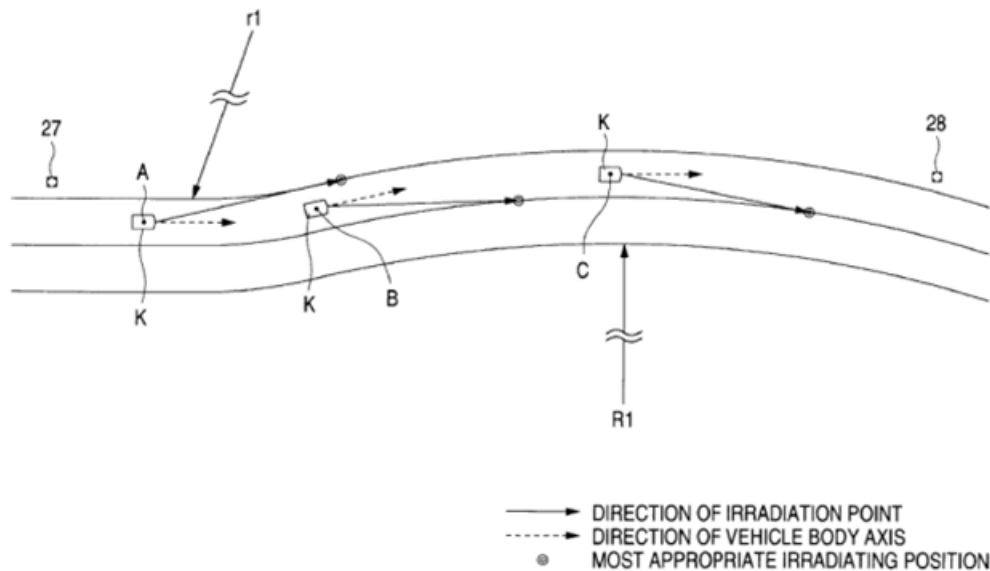
(Alden, Fig. 11; EX1003, ¶76.) PO admits Alden's Figure 11 shows the vehicle while it is still "traveling substantially straight," but appears to allege the light is only shifted left at the exact moment shown and that the vehicle is in the beginning of the curve at that time. (POR, 22.) However, Figure 11 shows the light was already shifted left prior to the vehicle entering the curve because, as Alden discloses, the reflectors along the curve were detected and the segmented headlights are directing "light into the corner." (Alden, [0036]; Petition, 27-30; EX1003, ¶76.) Thus, Alden concentrates light into the curve *prior to* reaching upcoming road curvature. (Alden, Fig. 11, [0036]-[0040]; EX1003, ¶76.)

PO's arguments regarding timing of re-direction of light in Alden with respect to the steering wheel sensor are also unavailing. (POR, 38-42.) PO argues Alden only mentions timing in the context of the steering wheel rotation sensor. (*Id.*) This is incorrect. First, as explained above, Alden would detect the reflectors on the curve in real time and adjust light prior to reaching the curve. (Alden, [0027-0028], [0036], Fig. 4; Petition, 16-20, 29-30; EX1003, ¶¶59-77; EX1010, ¶¶14-18.) Second, as explained, Alden's steering wheel sensor further provides for redirection of the light prior to a curve. PO's argument is premised on a misunderstanding of when a driver begins turning the steering wheel relative to when the vehicle enters the road curve. (Petition, 21, 29-30; Alden, [0039]-[0040]; EX1003, ¶¶66-67.) As a driver approaches a road curve, or is going to turn or enter a curve from a stopped position,

the driver begins to turn the steering wheel before the vehicle enters the curve. (EX1010, ¶¶14-18.) The driver keeps the steering wheel turned to follow the road's curvature ahead of the vehicle. (*Id.*) As the steering wheel rotates, the direction of headlight output rotates by corresponding degrees. (Petition 21; Alden, [0039]-[0040].) Because drivers must begin to turn the steering wheel prior to entering the curve, the LEDs would be controlled prior to reaching the road curvature. (EX1010, ¶¶14-18.)

PO also argues Kobayashi fails to teach Claim 1's control limitation because Kobayashi does not redirect light prior to entering the curve (POR, 39-40). However, as the Board found in its Institution Decision, Kobayashi teaches controlling lights with the claimed timing. (DI, 15-17.) Kobayashi discloses that "when the vehicle turns to [the] right, the right shoulder is irradiated." (Kobayashi, 15:22-23, Fig. 10.) Similarly, "when the vehicle turns to the left, the left shoulder is irradiated." (*Id.*, 15:21-22, Fig. 10.) That is, at the moment the vehicle turns, the respective shoulder of the road is *already* illuminated as shown in Kobayashi's Figure 10:

FIG. 10



(*Id.*, Fig. 10.) As seen above, when the vehicle is at point A, it is traveling straight and has not entered the curve while turning left. (*Id.*) Yet, at this point the irradiation is *already* directed left in the direction of the curve. (*Id.*; EX1010, ¶¶14-18.) Thus, the Alden-Kobayashi combination controls LEDs prior to the vehicle entering the curve.³ (*Id.*)

Moreover, when Kobayashi's map data is introduced, Alden's system would perform the same control. (Petition, 30.) The only difference being that rather than

³ To the extent PO argues Alden does not teach accommodating road curvature ahead of an equipped vehicle, PO's argument fails for these same reasons. (POR, 22.)

processing light sensor data to detect an upcoming road curve, map data as taught in Kobayashi would be used. (*Id.*)

III. Independent Claim 12

Claim 12, like claim 1, requires increasing light in the direction of road curvature and controlling a plurality of LEDs prior to the vehicle reaching the curve, and PO argues neither Alden nor Kobayashi teaches these limitations for the same reasons stated for claim 1. (POR, 43-44.) These arguments fail for the reasons explained above. *See supra* Section II.

IV. Independent Claim 23

Claim 23, like claim 1, requires increasing light in the direction of road curvature and controlling a plurality of LEDs prior to the vehicle reaching the curve, and PO argues neither Alden nor Kobayashi teaches this for the same reasons stated for claim 1. (POR, 43-44.) PO's arguments fail for the reasons explained above. *See supra* Section II.

V. Dependent Claims 5, 16, and 27

Dependent claims 5, 16, and 27 recite that the increase of light in the direction of the curve includes an "increase of light emitted at a level below high-beam light and directed in the direction of the road curvature." PO argues Alden does not teach this because allegedly its default operating state is all LEDs on high beam intensity, so "there would never be an increase of light emitted at an intensity below high

beam” directed at road curves. (POR, 47-50.) However, as explained, Alden does not default to emitting high beams everywhere there is not glare reduction, and instead Alden discloses a segmented headlight with multiple functionalities, including “concentrating” light in the direction of road curves. (Alden, [0036], [0061], Fig. 11; EX1003, ¶¶49, 64-67; EX2041, 50:9-51:3, 76:8-80:24; EX1010, ¶19.) *See supra* Section II. This switching on of LEDs directed at the curve to high beam is increasing illumination in a direction of the road curvature. (EX1003, ¶¶98-100; *see also* Petition, 41-43.) Moreover, a POSITA would have understood this increase of light in the direction of the curve would be a level less than high beam. (Petition, 41-43; EX1003, ¶¶98-100.)

VI. Dependent Claims 6, 17, and 28

Dependent claims 6, 17, and 28 merely add increasing light in the direction of a second road curvature and control of a second plurality of LEDs prior to the vehicle reaching the second road curvature. PO argues Alden and Kobayashi cannot meet this for the same reasons given above with respect to the first road curve recited in Claims 1/12/23. (POR, 51-53.) PO’s arguments regarding increasing light in the direction of a curve and controlling LEDs prior to the curve fail for the reasons given above. *See supra* Section II. And, as explained, Alden as modified by Kobayashi would perform this increase of illumination into “second” detected curves and even additional curves. (Petition, 44-50; EX1003, ¶¶103-108.)

PO further argues the control limitation is not met because Kobayashi's "road profile calculating means" does not actually decide where to illuminate, but rather Kobayashi's irradiation control means" does so. (POR, 52-53.) This is incorrect, and ignores the combination set forth in the Petition.

"A proper obviousness analysis considers whether the claimed subject matter would have been obvious in light of the teachings of the prior art, not whether the particular embodiments disclosed in the prior art could actually be combined." *Volkswagen Group of America, Inc. v. Spero*, IPR2023-00197, Paper 39 at 20-21 (PTAB June 20, 2024) (citing *Allied Erecting and Dismantling Co., Inc. v. Genesis Attachments, LLC*, 825 F.3d 1373, 1381 (Fed. Cir. 2016)). Kobayashi teaches continuously "reshaping" the headlight beam pattern as a vehicle proceeds along multiple road curves using map data. (Kobayashi, Abstract; Petition, 37-38, 44-47.) It would have been obvious to implement this teaching of continuous control using map data from Kobayashi in Alden's system. (Petition, 44, 38.) The combined system would perform the same control of LEDs as disclosed by Alden and described above, only now it would do so based on map data indicating road curves as taught by Kobayashi. (Petition, 49-50.) *See supra* Section II.

VII. Dependent Claims 7, 18, and 29

With respect to claims 7, 18, and 29, PO argues that neither Alden nor Kobayashi teaches increasing light in a direction of the road curve and controlling a

plurality of LEDs prior to the vehicle reaching the road curve on the same bases provided in connection with claims 1, 12, and 23. (POR, 54-56.) Accordingly, PO's arguments fail for the reasons set forth above. *See supra* Sections II-IV.

Claims 7, 18, and 29, additionally recite providing light in the direction of the road curve from an LED not providing light in the direction of the road curve prior to the change, with this being one of several "or" options in Claims 7 and 18 and thus not expressly required by either. PO appears to argue Alden cannot do so because all of Alden's LEDs always produce high intensity light unless otherwise dimmed and Alden cannot otherwise change the direction an LED is aimed to a direction aimed at the curve. (POR, 55.)

PO is wrong. First, Alden does not default to all LEDs at high intensity unless otherwise dimmed. (EX2041, 50:9-51:3, 73:25-74:24.) *See supra* Section II. Second, as explained, Alden's system will "concentrate light to look around corners" when a curve is detected by "direct[ing] light into the corner to maximize the driver's ability to see there." (Petition 51-52; Alden, [0036].) It does this by emitting light from LEDs directed towards the curve which may not have previously been illuminated (as they do not direct light generally ahead), and thus it changes the shape of the overall illumination by emitting light from LEDs not providing light directed towards the curve prior to the change. (Petition, 48-52; EX1003, ¶¶107, 112; EX1010, ¶¶20-22)

Moreover, Alden as modified by Kobayashi discloses continuously “reshaping” light output as a vehicle proceeds along a road with multiple curves. As a vehicle goes from a left-hand curve to a right-hand curve, Alden’s system would select a second set of LEDs to “concentrate” light into the right-hand curve that were not previously focusing light into the curve. (Petition, 52.) This reshaping of light thus includes providing light from an LED not providing light directed in the road curve prior to the change. (*Id.*; EX1003, ¶112.)

VIII. Dependent Claims 8, 19, and 30

Given how closely Alden tracks these challenged claims, PO takes a scattershot approach to argue Alden cannot be an invalidating reference. PO argues that Alden is ambiguous and requires Petitioner to assume details about the reference, that Petitioner’s proofs require modification of Alden, and that Petitioner mischaracterized Alden’s disclosure. (POR, 56-60.) These arguments fail for several reasons.

First, PO is misreading Alden to create alleged ambiguities where there are none. PO argues Alden’s Figure 5 is limited to a single row of LEDs, and Petitioner’s proofs relying on a two-dimensional array of LEDs is either an assumption about or modification of the reference. (*Id.*) Alden, however, is clear Figure 5 is *not* limited

to a single row of LEDs.⁴ Nowhere does Alden call the LEDs a “row” or indicate they are “one dimensional.” Instead, Alden discloses Figure 5 illustrates “the segmented headlight” comprised of an “array” of lighting elements. (Alden, [0029], Fig. 5.) Figure 5 is simply a sectional view of one row of LEDs in this array. (EX2041, 57:12-58:4, 106:22-107:10, 110:7-19; EX2066, 32:10-36:22; EX2067, 59:22-60:2.)

Alden’s disclosure confirms a POSITA would understand Figure 5’s array includes multiple rows. For example, Figures 6-7 show (a) a “sectional” view of one row of lighting elements and (b) a “front-on” view depicting the full two-dimensional array of elements within the headlight. (Alden, Figs. 6-7.) Similarly, Figure 5 shows a sectional view of a row of LEDs to illustrate the segmented lighting, it being understood the full array in front-on view (such as similarly shown in Figures 6-7) would be two-dimensional. (*See e.g.*, Petition, 16-21; Alden, [0029]; EX2041, 57:12-16; EX2066, 32:20-34:15, 36:10-22, 45:14-46:8; EX1003, ¶¶55-67.)

⁴ The Board has correctly found Alden’s Figure 5 is not limited to a single row of LEDs. *Mercedes-Benz USA, LLC, v. Spero*, IPR2023-01039 Paper 10 at 15 (PTAB Dec. 12, 2023).

Additionally, Alden explains Figure 5's "array" of LEDs is controlled by corresponding switches from a switch array using the "CPU and logic *previously described.*" (Alden, [0025].) Because Figures 3-4 disclose the CPU and logic selectively providing high beam and dimmed low beam light in different sectors across a two-dimensional plane, a POSITA would understand Figure 5 to use multiple rows of LEDs. (Alden, Figs. 3-4, [0027]-[0028]; EX1003, ¶¶65-72.)

Further, Figure 4 discloses the CPU logic compiling two-dimensional (XY) sensor maps of detected light and determining dimmed and high beam zones *within this XY space.* (Alden, Fig. 4, [0027]-[0028].) For this logic to apply to Figure 5, as Alden says it does, a POSITA would understand a two-dimensional array would be used. (EX1010, ¶¶23-29; EX2041, 59:14-60:18; EX2066, 20:2-21:13, 34:4-15, 45:18-46:8.) Where Alden discloses the LEDs "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," it is describing directing light into different sectors of a two-dimensional plane in front of the vehicle, and as such Alden discloses rows of LEDs along the focal point of a curved surface behind the lens to accomplish this. (Alden, [0029]; EX2041, 53:2-12, 57:7-61:5, 106:22-107:10, 110:7-19, 115:7-116:6.) If the LED array were one-dimensional as PO alleges, then it could only correspond to X locations, and not the

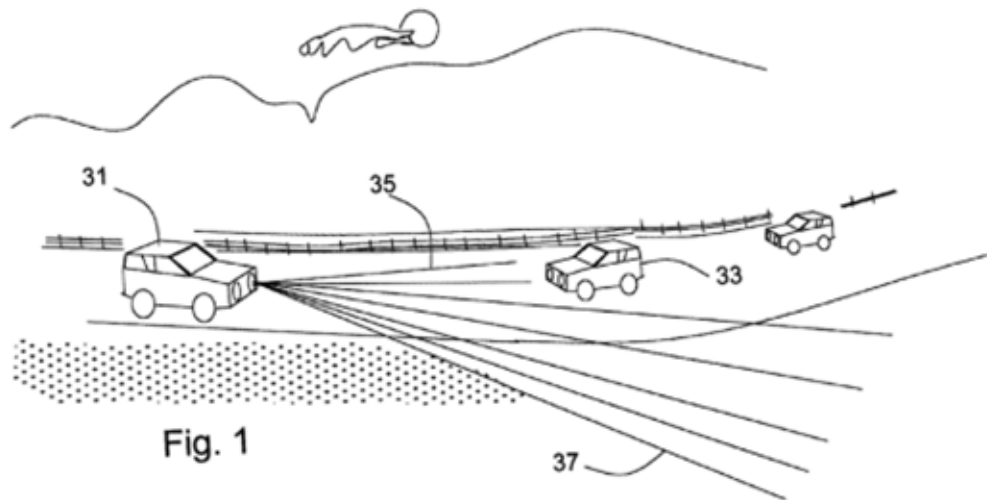
plurality of XY locations that Figure 4 and Paragraph [0028] indicate must be accounted for. (Alden, Fig. 4, [0028]; EX2041, 52:18-53:1; 57:12-60:18.)

Finally, Alden discloses additional functionalities its “segmented light distribution elements” can perform, including “directing light to look around corners,” “concentrat[ing] light to look uphill,” and “concentrat[ing] light to look downhill.” (Alden, Figs. 11-13, [0036]-[0038].) Alden confirms the “segmented light distribution elements described herein” (which includes Figure 5) can perform these functions, not just lighting elements of any particular embodiment. (*Id.*) For Alden’s Figure 5 to direct light uphill and downhill, there are multiple rows of LEDs, some positioned on the curved surface to direct light upwards and others positioned to direct light downwards. (EX1010, ¶27.)

And, in any event, even under PO’s erroneous assumption Figure 5 is limited to a single row of LEDs, *all* challenged claims would still be unpatentable. The claims do not require a two-dimensional array of LEDs, and Alden’s disclosure of LEDs, each having a corresponding switch, being controlled to selectively provide dimmed low or high beam illumination in different areas renders the claims unpatentable.

Second, PO argues Petitioner’s annotated Figure 5 mischaracterizes Alden because the sensed vehicle is not properly scaled relative to the headlight. (POR, 60.) However, Alden expressly discloses its headlights can select LEDs directing

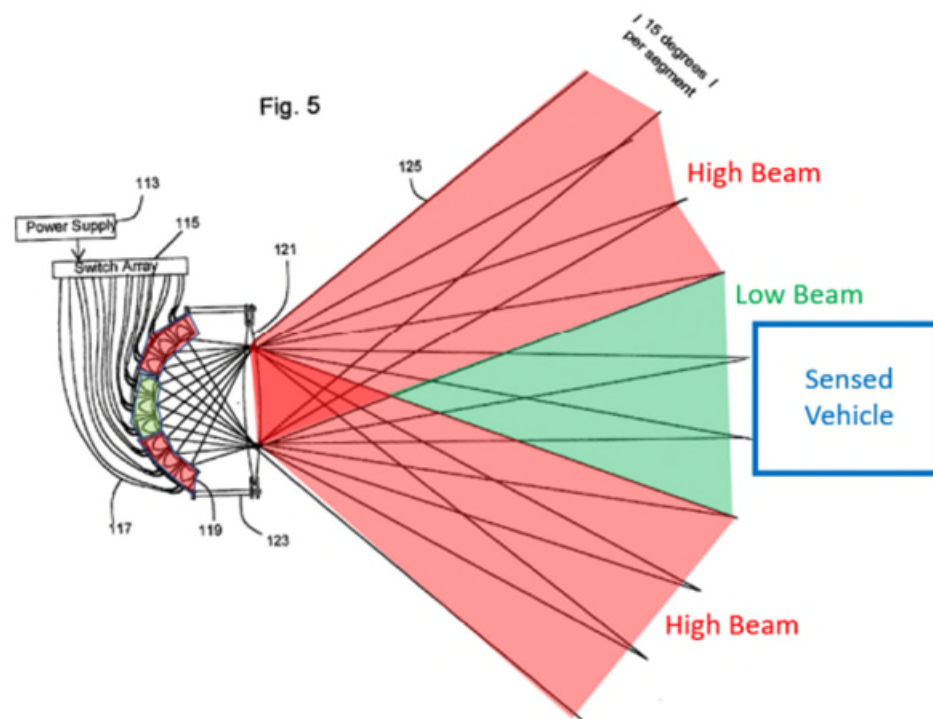
light to sectors containing other vehicles (first area) and control them so that they emit low beam light, while LEDs directing light to sectors with no vehicle present (other areas) can be switched to high beam. (Alden, [0027]-[0029], Petition, 55-63.) For example, when another vehicle is detected in the middle of the headlight distribution area (first area), Alden controls light from LEDs directed at the sectors containing that vehicle to be dimmed, while controlling LEDs directing light to other areas laterally adjacent to that first area (*e.g.*, to areas on each side of the oncoming vehicle) to have different, high beam illumination. (Alden, Figure 5, [0027]-[0029]; *see also* [0025]-[0026].) As another example, Alden's Figure 1 depicts a vehicle 31 equipped with a segmented headlight, which "emits a low beam illumination 35 in a first headlight distribution sector while concurrently emitting a high beam illumination 37 in a second headlight distribution sector." (Alden, [0025].) As Alden explains, "[t]he low beam illumination in 35 [is] emitted in response to the detection of an oncoming vehicle 33," and the high beam illumination 37 illuminates areas where no vehicle is detected. (*Id.*) It can be seen from Figure 1 that the high beam 37 illuminates is emitted in sectors laterally adjacent to the sector in which low beam is emitted:



(Alden, Fig. 1; *see also* [0026], Fig. 2 (disclosing high beam and low beam light in different sectors.)

Petitioner’s annotations to Figure 5 are clearly demonstrative of what is described in Alden, and are not the creation of a scaled technical drawing. (EX1003, ¶126.) “It is well established that patent drawings do not define the precise proportions of the elements.” *See Hockerson-Halberstadt, Inc. v. Avia Grp. Int’l, Inc.*, 222 F.3d 951, 956 (Fed. Cir. 2000). Thus, it would make no sense to provide scaled annotations on top of the non-scaled patent drawings in Alden. Further, the annotations to Alden’s figure accurately illustrate the *concept* as disclosed in Alden, *i.e.*, “the light sent to the sensed vehicle location [shown in green below] is dimmer than the light sent to all other areas of the headlight distribution area [shown in red].” (Alden, [0027]-[0029], Figs. 3-5.) The annotations are also consistent with illustrations in other figures such as Figures 1-2, as discussed above. Accordingly,

annotated Figure 5 does not mischaracterize Alden, and accurately shows how Alden's disclosures meet the claims, with certain LEDs directing dimmed light towards areas containing another vehicle, and other LEDs directing high beam light to laterally adjacent areas as illustrated below:



(Alden, Fig. 5 (annotated), [0026]-[0029]; *see also* EX1003, ¶126.)

Dependent claims 8, 19, and 30 additionally recite determining a position associated with an other vehicle based on data captured by one or more cameras. PO confusingly argues Alden does not teach this because data from Alden's photodiode array or CCD (Alden's camera) is allegedly not "used to generate a bounding box around the contours of the vehicle." (POR, 60-63.) This is irrelevant to the claim

language, and in any event, Alden is unambiguous that its system determines a position of another vehicle using its camera data. (Petition, 54-60.) For example, Alden's camera sensors detect data representing "two headlight of [an oncoming vehicle] 41," (Alden, Figs. 2-4, [0026]-[0028]), and this data is then used to "determine the distance" of the oncoming vehicle, and a determined "location" of the oncoming vehicle is used to "calculate[] which zones of each headlight need to be dimmed." (*Id.*, Figs. 3-4, [0027]-[0028].)

IX. Dependent Claims 9, 20, and 31

Claims 9, 20, and 31 recite that the control of the second plurality of LEDs to direct decreased intensity light at another vehicle is based at least in part on data received from a non-camera sensor. Both Alden and Kobayashi disclose such non-camera sensors—Alden discloses, for example, using a steering wheel rotation sensor and Kobayashi discloses using a GPS sensor. (Petition, 69-71.) PO argues that neither Alden's steering wheel rotation sensor nor Kobayashi's GPS sensor is used as sensor input to control light output to diminish glare. (POR, 63-65.) This is incorrect.

Alden explains that when a driver rotates the steering wheel "x" degrees, "[t]he system calculates the new direction of the vehicle and changes the direction of the headlamp output 197 a corresponding 'f(x)' degrees." (Alden [0040]; Petition, 69-71.) Thus, Alden expressly discloses that the light emitted from its headlights

must be shifted a corresponding number of degrees when the vehicle is turned, based on data from the steering wheel sensor. (*Id.*) This includes shifting the light to account for turning of the steering wheel when certain LEDs are emitting diminished, low beam light in the area of another vehicle to reduce glare. (EX1003, ¶¶138-143; Alden, Figs. 14-15, [0057]-[0058].) In other words, data from the steering wheel rotation sensor is used to further control the second plurality of LEDs such that 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. (*Id.*; Petition 70-71.) If it were not, then there would be the possibility that as the vehicle is turned, high beam light instead of the diminished low beam light would be directed at an oncoming vehicle. (EX1010, ¶¶30-33) Notably, PO's own expert named only the same steering wheel rotation sensor when asked for an example of a non-camera sensor in the '029 patent. (Second Deposition Transcript of Dr. Matthew Turk (EX1012), 132:16-21.)

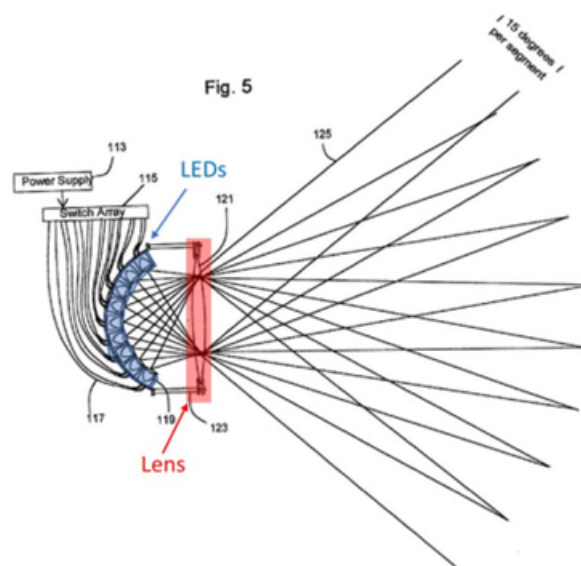
Moreover, using data from Kobayashi's GPS sensor control of the second plurality of LEDs to diminish glare by decreasing light intensity based at least in part on data from a non-camera sensor could be achieved to again maintain dimmer light at the oncoming vehicle as the equipped vehicle travels around a curve. (Petition, 68-79; EX1010, ¶¶30-33.)

Claims 9, 20, and 31 additionally require that the control of the second plurality of LEDs includes termination of light from at least one LED. PO argues a POSITA would not have understood Alden to include operating LEDs at zero intensity, and Petitioner's proposed modification to incorporate Beam's teaching to operate certain LEDs at zero intensity would be contrary to Alden's primary goal. (POR, 66-67.) However, as explained in the Petition, Alden's system alone could operate LEDs at zero intensity, and additionally it would have been obvious to combine Beam's teaching to operate LEDs at zero intensity with Alden's system. (Petition, 75-78; EX1003, ¶¶148-151.) Alden's system has broad functionality capable of multiple applications, and does not simply default to high beam in every circumstance. *See supra*, II. Beam, like Alden, discloses a system that controls headlight output patterns to eliminate "the blinding of a driver in an oncoming vehicle, while continuing to provide intense forward illumination." (Beam, Abstract, 1:5-19.) Beam teaches controlling the output of the headlight to darken light directed toward a detected vehicle to avoid causing glare, or "dazzling," other drivers, and that this can be done with lighting elements being "blanked (attenuated by being either absorbed or deflected to an absorbing surface.)" (*Id.*, 4:9-59, 5:33-6:8, 6:61-7:8; EX1003, ¶¶149-150.) Accordingly, to the extent that Alden alone does not disclose operating LEDs at zero intensity, it would have been obvious to a POSITA to do so as taught by Beam. (Petition, 75-78.)

X. Dependent Claims 21 and 32:

Claims 21 and 32 are substantially similar, requiring the processor to "utilize" one or more optical control elements to control light emitted from the LEDs. PO argues that a lens like Alden's cannot be used or utilized by the processor. (POR, 67-71.) PO further argues Petitioner's alternative use of a variable refractive element will not suffice because a variable refractive element is not suitable for combination with Alden's Figure 5 embodiment. (*Id.*)

First, Alden's lens is an optical control element utilized by the processor to control light. Alden's processor is programmed to utilize lens element 121 to direct light into the desired sectors of the headlight distribution area based on their petition on the curve relative to the focal point of the lens:



(Alden, Fig. 5 (annotated), [0029].) That is, the processor utilizes the lens to direct light into a desired sector, as it is programmed to understand which LEDs will emit into which sectors based on the presence of the lens to direct light accordingly, whereas the light would be directed into a different sector if the lens were absent. (EX1010, ¶34.)

Second, Alden discloses a liquid crystal variable refractive element can be used to enable “light from an individual headlight distribution sector to be redirected in response to sensed environmental conditions[.]” (Alden, [0033]-[0035], [0061], Figs. 8-10.) Alden further expressly discloses that “[o]ne or more methods employed herein may be used in combination to vary illumination in a segmented system.” (*Id.*, [0061].) Thus, at the very least, it would have been obvious to a POSITA to use a variable refractive element to the system in Alden’s Figure 5 such that the processor utilizes the variable refractive element to control the LEDs. (Petition, 66-68; EX1003, ¶¶131-132.)

XI. Conclusion

For the reasons above and in the Petition, the Board should cancel the challenged claims as unpatentable.

Dated: July 8, 2024

Respectfully submitted,

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Certificate of Word Count

The undersigned certifies, in accordance with 37 C.F.R. § 42.24(d), that the foregoing **PETITIONER'S REPLY TO PATENT OWNER'S RESPONSE** complies with the type-volume limitation of 5,600 words, comprising 5,572 words, excluding the parts exempted by § 42.24(c).

Dated: July 8, 2024

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Certificate of Service

The undersigned certifies that, in accordance with 37 C.F.R. § 42.6(e) and 37 C.F.R. § 42.105, the foregoing **PETITIONER'S REPLY TO PATENT OWNER'S RESPONSE** was served on July 8, 2024, electronically via e-mail upon the following parties:

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