

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. IPR2023-01026
Patent 10,894,503

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

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PETITIONER’S EXHIBIT LIST

Exhibit No.	Description
1001	U.S. Patent No. 10,894,503 (“ 503 ”)
1002	Original File History for the ’503 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	WIPO Patent Publication No. 2001/001038 (“ Harbers ”)
1007	U.S. Patent No. 4,970,628 (“ Bergkvist ”)
1008	U.S. Patent No. 6,144,158 (“ Beam ”)
1009	U.S. Patent No. 6,049,749 (“ Kobayashi ”)
1010	PTAB Trial Statistics April 2023 IPR, PGR
1011	Second Declaration of Dr. Nikolaos Papanikolopoulos
1012	First Deposition Transcript of Dr. Mathew A. Turk
1013	Second Deposition Transcript of Dr. Mathew A. Turk

I. Introduction

Patent Owner's Response ("POR") is a request for the Board to ignore the teachings of Alden (EX1005) in its entirety, take the Petition out of context, and improperly read limitations into the claims that are not there. As explained below and in the Petition, when Alden is considered in its entirety, it is clear it contains more than sufficient disclosure to invalidate the challenged claims. The POR's arguments are simply attempts to distract from Alden's clear, concise disclosure of the challenged claims and should be dismissed.

II. Alden Requires No Modification and Is Operative

First, Patent Owner ("PO") alleges Alden's Figure 5 is limited to a single row of LEDs and Petitioner's proofs relying on multiple rows of LEDs therefore require "modifying" Alden. (POR, 17-18.) As an initial matter, even under this improper assumption that Figure 5 can only be understood to have a single row of LEDs, the 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 provide dimmed low beam or high beam illumination in different areas renders the claims unpatentable.

Moreover, as the Board correctly found in its Institution Decision ("DI"), Alden is clear that Figure 5 is **not** limited to a single row of LEDs. (DI, 9-11; Second Declaration of Dr. Nikolaos Papanikolopoulos (EX1011), ¶¶5-15.) Nowhere does

Alden call the LEDs a “row” or indicate they are “one dimensional.” Instead, Alden discloses that 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 in this array. (Deposition Transcript of Dr. Nikolaos Papanikolopoulos (EX2041), 57:12-58:4, 106:22-107:10, 110:7-19; Second Deposition Transcript of Dr. Nikolaos Papanikolopoulos (EX2066), 32:10-36:22; *see also* DI, 9-11.)

Alden’s disclosures confirm 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. (Alden, Figs. 6-7.) Similarly, Figure 5 shows a sectional view of a row of LEDs to illustrate the segmented lighting, with it being understood that the full array in the front-on view (again, such as similarly shown in Figures 6-7) would be two-dimensional. (EX1011, ¶¶5-15; Alden, [0029]; EX2041, 57:12-16; EX2066, 32:20-33:10, 36:10-22, 45:14-46:8; Declaration of Dr. Nikolaos Papanikolopoulos (EX1003), ¶55.)

Additionally, Alden explains Figure 5’s LED “array” is controlled by corresponding switches from a switch array using the “CPU and logic *previously described*” in Figures 3 and 4. (Alden, [0029] (emphasis added); First Deposition Transcript of Dr. Matthew Turk (EX1012), 122:12-22.) Thus, Figure 5 must be read in connection with the descriptions of Figures 3-4, and not in the abstract. 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 likewise use multiple rows of LEDs. (Alden, Figs. 3-4, [0027]-[0028]; EX1011, ¶¶5-15.)

Further, Figure 4 discloses the CPU logic compiling two-dimensional (XY) sensor maps of the detected light and determining dimmed and high beam zones *within this XY space*. (Alden, Fig. 4, [0028]; EX1011, ¶¶5-15.) For this logic to apply to Figure 5, as Alden says it does, a POSITA would understand that a two-dimensional array would be used. (EX1011, ¶8; EX2041, 59:14-60:18; EX2066, 20:2-21:13, 34:4-15, 45:18-46:8.) Where Alden discloses that 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, making clear that Alden discloses rows of LEDs on a curved surface behind the lens to accomplish this. (*Id.*; *see also* Alden, [0029]; EX2041, 52:18-53:12, 106:22-107:10, 115:7-116:6.)

As a final example, Alden discloses additional functionalities its “segmented light distribution elements” can perform, including “directing light to look around corners,” “concentrate[ing] light to look uphill,” and “concentrate[ing] light to look downhill.” (Alden, Figs. 11-13, [0036]-[0038].) Here, Alden confirms the

“segmented light distribution elements described herein” (which include those of Figure 5) can perform these functions, not just the 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. (EX1011, ¶9.)

Second, PO claims Petitioner is “modifying” Alden because Dr. Papanikolopoulos allegedly “admitted” Alden does not describe certain details of its system and read things into Alden. (POR, 17-22.) But Dr. Papanikolopoulos has consistently testified that a POSITA would understand Figure 5 to illustrate one row of a two-dimensional LED array, with, as Alden explains, each LED having a corresponding switch in the control switch array. (EX1011, ¶¶5-15; Alden, [0029]; EX2041, 57:12-16; EX2066, 32:20-23, 33:5-10, 36:10-22, 45:14-46:8; EX2067, 58:11-59:4.) At deposition, Dr. Papanikolopoulos did not read anything into Alden or suggest a POSITA would not understand it. Rather, he explained how Alden’s figures are conceptual (not precise schematics) and gave examples as to what these figures and corresponding descriptions disclose to a POSITA. (*See e.g.*, EX2041, 57:12-21, 107:11-18; EX2066, 32:20-34:3, 44:12-22, 47:1-19, 99:21-100:11.)

Third, PO’s arguments that Alden is “inoperative” are easily dismissed. (POR 23-24.) PO argues that (1) the single row of LEDs in Figure 5 would provide insufficient lumen output and (2) Figures 3 and 5 are incompatible because “there

are 576 switches in the Figure 3 switch array and 9 LEDs in the Figure 5 LED array[.]” (*Id.*)

These arguments are predicated on Figure 5 being a single row of LEDs, which is incorrect for as explained above. As such, the lumen output of Figure 5 would be greater than that of a single row of LEDs. (EX2066, 99:21-100:5.) Moreover, the claims do not require a particular lumen output or compliance with any standard or regulation—whether for automobiles or otherwise. (EX1011, ¶13.) Indeed, the claims are directed toward a headlight system for a “vehicle,” *generally*, not a headlight system for a specific type of vehicle with a specific lumen output. (*See, e.g.*, ’503 Patent, Cl. 1; Second Deposition Transcript of Dr. Mathew Turk (EX1013), 25:7-15.)

Further, it is clear how Alden’s system would work to use a switch array like that in Figure 3 with the LEDs of Figure 5—the switch array would have one switch for each LED. (Alden, [0029]; EX1003, ¶76; EX1011, ¶¶5-15; EX1012, 121:3-18.) Figure 3 does not disclose Alden’s system as having 576 switches, and Figure 5 does not limit Alden’s system to 9 LEDs. (EX1011, ¶¶5-15.) These are conceptual figures in a patent application—not technical schematics intended to represent the precise number of switches and LEDs to be used in a particular real-world system. *See, e.g., Hockerson-Halberstadt, Inc. v. Avia Grp. Int’l, Inc.*, 222 F.3d 951, 956 (Fed. Cir.

2000) (“It is well established that patent drawings do not define the precise proportions of the elements.”).

In sum, when considering Alden in full, it is clear a POSITA would understand its teachings and how to implement them. PO’s arguments that Petitioner is “modifying” Alden and that Alden would be “inoperative” absent modification therefore fail.¹

III. Independent Claim 1

*Regarding Claim 1[D],*² PO argues “Petitioner has failed to address how power flows to each LED, specifically how the multiple switches of Figure 3 would be mapped to each LED of Figure 5—necessitating a modification to the combination[.]” (POR, 29-30.) However, no modification is required, as Alden

¹ PO also suggests a letter from Gentex to Alden proves Alden is “theoretical.” (POR, 14, n. 3.) This letter from Alden’s file history 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. (EX1012, 82:13-85:1.)

² PO briefly discusses Claims 1[C] and 1[E], but does not contend Alden fails to disclose either. (POR, 28-30.) Alden discloses these elements. (Petition, 17-18, 20-21.)

discloses the switches of Figure 3 and the LEDs of Figure 5 would be mapped one-to-one. *See supra* Section II.

Regarding Claim 1[F], PO argues that (1) Alden’s processor does not “determine illumination” for two subsections (*e.g.*, it only determines the subsections, without separately determining their illumination requirements) (POR, 31-32, 34) and (2) the illumination to each subsection” is a preset low or high level of illumination and thus not “determined” (*id.*, 32-34). These arguments, as best as they can be understood, fail.

First, Claim 1[C], which PO refers to (*id.*, 33), recites “subsection determined in response to sensor data.” Alden discloses this. (Petition, 17-20.) Claim 1[F] then adds that a particular structure, *i.e.*, a processor, is used to process algorithms and “sensor data” to determine an illumination for at least two of the subsections. Alden discloses this too. (Petition, 21-26.) The claims do not require anything more, and the Petition addressed each element separately.

Second, Alden’s algorithm determines subsections based on sensor data *and* also determines their illumination requirements. In Alden, maps of sensed light are created (*e.g.*, determined) and stored in memory for both the left and right sensor. (Alden, [0028].) These maps, generated from the sensor data, represent areas (*e.g.*, the headlight distribution subsections) in front of the vehicle that may have different illumination requirements. (EX1011, ¶18; EX2041, 60:7-18, 108:19-6.) After these

maps are compiled, the CPU uses them to determine how different subsections should be illuminated, *e.g.*, by “compar[ing] the right map to the left map,” “calculat[ing] which zones... need to be dimmed,” and “switch[ing] requisite beam segments to dim” while “switch[ing] other segments to high beam.” (Alden, [0027]-[0028].) These are multiple, independent steps in Alden’s algorithm. (Petition, 21-26; EX1003, ¶¶64-65; EX1011, ¶18.)

PO argues it is unclear how distance information is used in this process. (POR, 31-32.) This is irrelevant to the claims, but in any case, Alden discloses its CPU “determines the distance which [oncoming vehicle] 41 is from [equipped vehicle] 47” (*i.e.*, its location) and this “distance information is used to *determine the intensity of light [e.g., determine the illumination requirements]* that will be produced by the [headlight] 61 in the corresponding headlight sectors.” (*Id.*, [0027] (emphasis added).)³ For example, if a vehicle is closer, then multiple sectors may need to be dimmed, while a vehicle further away may require only a single sector to be dimmed. (EX1011, ¶19.)

Third, PO’s argument that Alden does not “determine illumination” for a subsection because it provides a “predefined” high or low level intensity is a

³ Alden’s system is “operable within a range of intensities between the high beam and the low beam state.” (Alden, [0027], [0061]; *see also* Petition, 25 n. 6.)

misreading of the claims and art. The claims only require determining illumination, and not any particular way this must be done. (EX1011, ¶20.) Alden says its CPU “determine[s] the intensity of light that will be produced... in the corresponding headlight sectors,” and that information is “sent to control the power flow” to do so. (*Id.*; Alden [0027]; *see also* Petition, 23-26.) Moreover, this process happens in real time, such that subsections that were determined to be dim intensity at one time are switched to high beam (*e.g.*, when a vehicle is no longer sensed there), and vice versa. (EX1011, ¶20; *see also* Petition, 24-25.) Thus, the intensity of light from LEDs directed to each subsector is not predetermined; rather, the system repeatedly determines the level of light to be emitted. (EX1011, ¶20; Alden, [0027]-[0028]; Petition, 24-25.)

IV. Independent Claim 20

PO’s sole argument is that Alden determines “where a portion of a vehicle is,” but this “does not prove that [Alden] can determine where the vehicle is not.” (POR, 36-38.) This cannot be squared with Claim 20[E] (which does not require affirmatively determining where vehicles are not) or Alden.⁴ Alden’s system

⁴ PO briefly discusses Claims 20[A][3] and 20[C], but does not contend Alden fails to disclose either. (POR, 35-36.) Alden discloses both elements. (Petition, 26-28, 30.) Moreover, the “direction” of light from each LED is “controllable,” including

provides dimmed intensity where other vehicles are detected and “a second intensity (or alternate direction) of illumination *where no vehicle is detected.*” (Alden, [0025].) This is done using a process that detects where light from vehicle headlights is above a threshold and accounts for the area around the headlights where the vehicle’s driver may be to determine where the other vehicle is present. (*Id.*, [0027]-[0028]; *see also* EX1011, ¶21) Alden similarly determines where other vehicles are not present—areas where threshold light is not detected and which do not fall within the area around sensed headlights where a driver may be present. (*Id.*)

V. Independent Claim 26

Regarding Claim 26[B], PO reiterates the same arguments made for Claims 1 and 20.

First, it argues Alden does not “determine illumination” for a first or second subsection because it uses predefined illumination levels. (POR, 38-39.) This is wrong for the reasons provided above. *See supra* Section III.

For example, Alden’s CPU iteratively “checks the status of *each* respective sector 89 of the light sensors” for the presence of a vehicle. (Alden, [0028] (emphasis added).) Using this data, Alden determines subsections including a vehicle

through use of a lens or other optical element in Alden which directs the light from the LED to a particular sector. (*Id.*; *see also* Alden, [0029], Fig. 5.)

corresponding to shaded circuit area 75, 81 and subsections not including a vehicle corresponding to non-shaded circuit area 77, 79. (*Id.*, [0027]-[0028].) Further, the system does not merely preserve high beam illumination in subsections not within the shaded circuit area (*e.g.*, with no sensed vehicle); rather, the CPU sends signals to actively “switch the requisite headlight segments [corresponding to the shaded circuit area] to dim” and “switch other segments [corresponding to the non-shaded circuit area] to high beam.” (*Id.*, Fig. 4, [0027]-[0028].) If the system merely preserved the illumination level of LEDs within the shaded circuit area, LEDs that had been set to dim during operation of the system would never again be set to high beam intensity, contrary to Alden disclosure. (EX1011, ¶22-23.)

Second, PO argues Alden does not “determine” whether the second subsection lacks another vehicle (POR, 39), but this is again wrong for the reasons above. *See supra* Section IV.

Regarding Claim 26[C], PO argues that Claim 26[C] (“determining a control strategy for controlling” the directional light clusters) must be performed *after* Claim 26[B] (“determining illumination requirements” for different subsections, *e.g.*, with and without a vehicle) and that Petitioner failed to show this. (POR, 40-42.) It is unclear how the claim could be read as PO suggests. A control strategy for controlling the light clusters is simply the logic for controlling the light clusters *generally*. (Petition, 33-34; EX1011, ¶¶24-26.) And as the claim requires, Alden’s

logic “create[s] an output headlight beam meeting the determined illumination requirements” of the different headlight distribution sectors in real time so some are low and others high beam. (Alden, [0027]-[0028]; EX1011, ¶¶24-26.)

Alden’s “controlling logic” (illustrated in Figure 4) includes detecting light at different sensor positions, compiling and comparing sensor maps, calculating distances to detected objects, and determining which zones to dim and which to set to high beam in real time. (Alden, Fig. 4, [0028].) Further, after it determines which zones to dim and which to set to high beam, Alden’s “control strategy” uses different control signals for the light(s) in each zone to “switch” the segments to the appropriate illumination level, as information is sent to “control the power flow from a power source” to create the headlight beam. (Alden, [0027]-[0028], Figs. 3-4; Petition, 23-24.) Thus, Alden determines a control strategy for controlling the light clusters to “create a headlight beam meeting the determined illumination requirements” as claimed.

VI. Dependent Claims 2 and 4

Regarding Claims 2[C] and 4 (anticipation), PO argues these require that the “light modifying elements” control light source characteristics dependent on power and Alden’s lens only controls light direction (not power-dependent intensity). (POR, 43-44, 51.) This argument fails for at least two reasons.

First, the plural “light source characteristics” of Claim 2[C] are not limited to the characteristic dependent on power. PO argues Claim 2[B] confirms the light-source characteristics in Claim 2[C] must be power-dependent, but Claim 2[B] simply recites that each light source has “a *variable* light-source characteristic dependent on power.” This is a reference to a light-source characteristic that is singular (not plural) and variable and, thus, does not provide antecedent basis for Claim 2[C].

Thus, while each light source has at least one characteristic dependent on power, it may have other characteristics not dependent on power. Claim 2[C] is directed to adding a light modifying element that controls “the light source characteristics” *generally*, not the particular power-dependent characteristic. Reading claim 2 in context with claim 4 confirms this, as claim 4 recites light modifying elements that can control characteristics not dependent on power. For example, a static light guide may change the direction of light regardless of any power provided to the light source or light guide. (’503, Claim 4; EX1011, ¶¶27-30; EX1013, 62:14-63:18.)

Second, even assuming Claims 2 and 4 require that the light modifying element control a light-source characteristic dependent on power (they do not), Alden still discloses this. The intensity of each light source is a variable-light source characteristic, as it can be either a high or low beam, depending on the power

supplied. (Petition, 38-39.) The lens further controls intensity of these light sources in particular areas of the headlight distribution area. For example, if intensity of the light emitted from light element 119 in Figure 5 of Alden was measured at sector 125 with no lens present, this would be different than the intensity measured at sector 125 with the lens present and focusing light from 119 into sector 125. (EX1013, 78:7-16.) Thus, the intensity is controlled by the lens. (EX1011, ¶30.)

Regarding Claims 2[C] and 4 (obviousness), PO argues that Petitioner fails to explain how and why a POSITA would include a liquid crystal variable refractive element in Alden's Figure 5. (POR, 44-48)

Alden describes that a liquid crystal element allows light to pass straight through when a circuit is open, and has a second refractive state causing light to bend when the circuit is closed. (Petition, 40-43; EX1003, ¶¶95-96.) Alden further explains that “[o]ne or more methods employed herein may be used in combination to vary illumination in a segmented system.” (Alden, [0061].) A POSITA would have readily understood how to implement variable refractive elements in the Figure 5 system. (Petition, 42; EX1003, ¶95.) Regarding why a POSITA would implement such a variable refractor, as the Petition explains, the variable refractor would provide an additional means of modifying the direction or intensity of individual light sectors, allowing more variable control of lighting subsections of the headlight beam. (*Id.*) For example, as Dr. Papanikolopoulos explained, Alden is concerned not

only with dimming light when other vehicles are detected, but also illuminating curves in the road. (EX2041, 79:18-80:24.) To achieve this additional control of intensity and direction of light at a curve, Alden's Figure 5 headlight could include a light source with a variable refractive element at either end, so as to be able to bend the light directed towards the sides of the road, and thus any upcoming curves. (*Id.*)

VII. Dependent Claim 3

Regarding Claim 3 (anticipation), PO again argues that the controlled light characteristic must be the variable light-source characteristic dependent on power. (POR, 49.) This is incorrect. Claim 3 depends from Claim 2 and recites “[t]he headlight system of claim 2... wherein [the] light modifying element [comprises] at least one of reflectors or refractors[.]” As explained, the power-dependent light-source characteristic is not the antecedent basis for the light source characteristics (plural) controlled by the light modifying element of Claim 2, and regardless, the lens would control intensity (a characteristic dependent on power). *See supra* Section VI (Claims 2[C], 4).

Further, the “variable light modifier circuitry” language of Claim 3 is only limiting with respect to the use of a “variable light modifier.” (EX1003, ¶99.) When the light modifying element is a static modifier like a lens, variable light modifier circuitry is neither required nor of use. By definition, a static light modifier is a light modifying element that is not alterable during operation. (EX1011, ¶¶34-35.) As

such, there cannot be control circuitry that alters the light modifying element. (*Id.*) If there were, the light modifying element would be variable, not static. (*Id.*)

Regarding Claim 3 (obviousness), PO additionally argues that it is unclear how the system would function if the variable refractor light modifier of Alden’s Figure 10 was implemented in the Figure 5 system. (POR, 50-51.) As the Petition explains, however, this variable refractive element includes a circuit (*i.e.*, variable light modifier control circuitry) configured to be open or closed to control the direction and distribution of light passing through the elements. (Petition, 44.) *See also supra*, Section VI (Claims 2[C], 4).

VIII. Dependent Claim 11

PO’s sole argument is that Alden does not disclose “identifying” other vehicles, but rather “determines an area in which light should be diminished, based on the detection of light within that area.” (POR, 21-25.) This is wrong. A key purpose of Alden is to “sense the locations of *other vehicles*” and control the headlights in response to the “sensed vehicle[s].” (Alden, [0006]; *see also* [0008], [0003]-[0005], [0025]-[0029]; EX1003, ¶109.) Alden’s CPU “checks the status of each respective sector 89 of the light sensors,” assesses whether the detected light is “above a *threshold* intensity or distance” such that it indicates “two headlights of [an

oncoming vehicle] 41,” and correspondingly determines “which zones need to be dimmed.”⁵ (Alden, [0027]-[0028]; *see also* Petition, 49.)

IX. Dependent Claims 15 and 21

Claims 15 and 21 recite a “logical controller... configured to determine at least a road curvature, indicated by the sensor data, ahead of the vehicle[.]” PO argues Alden allegedly has no way of “knowing the difference between vehicles and reflectors” and, therefore, cannot determine whether it should dim in response to a detected vehicle or concentrate light in response to an upcoming road curvature. (POR, 53-56, 60.)⁶

But, Alden’s system detects different objects by checking for light above a “threshold” intensity or distance at each location of the sensor array. (*Id.*, Fig. 4, [0028]; EX1003, ¶¶66.) To distinguish between different objects, such as roadside reflectors or oncoming vehicles, a POSITA would have understood that the threshold intensity or distance of the process in Figures 3-4 may, for example, simply be adjusted based on the object type. (EX1011, ¶¶37-38.)

⁵ That Alden dims the area *above* oncoming vehicle “headlight dots” because it may be “occupied by the driver” reinforces Alden is “identifying” vehicles. (Alden, [0027], Fig. 3.)

⁶ PO argues Petitioner’s proofs for Claims 32-33 are similarly flawed. (POR, 62.)

As Dr. Papanikolopoulos explained, Figure 4's logic would apply to detecting roadside reflectors, with Alden's Paragraph [0036] now 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 switching LEDs not directed at the curve to low beam or even off. (EX1003, ¶113; EX1011, ¶¶37-38; EX2066, 114:20-115:14.) Thus, Alden would not simply "dim" all lights directed to the road curve in Figure 11, but rather would control the LEDs using the process described in Figure 4 to "switch [] segments to high beam" that direct light into the curve. (Petition 54-57; Alden, Fig. 4, [0028], [0036]; EX1003, ¶113; EX1011, ¶¶37-38.)

For Claim 15, PO additionally argues Alden's system does not "*increase[e]* illumination in a direction of a road curvature" because it "emits high beams everywhere there is not glare reduction and [] lacks optical steering capability." (POR, 57-59.) This is a misstatement of how Alden functions.

Alden's system does not default to emitting high beams everywhere there is not glare reduction. Rather, Alden's system can be used for "many applications," and Figure 11 details an additional functionality of its 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, ¶113; EX1011, ¶¶39-41) Further, 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’s system does not by default have all sectors on high and then dim certain ones. (Alden, [0036], [0061]; EX1011, ¶¶39-41.) Instead, it can selectively switch to high beam certain LEDs—for example those at one of the extreme ends of the headlight curve in Figure 5—such that they would then direct high beam light into the area of the road curvature to “concentrate” light there. (Alden, [0036], [0061], [0027]-[0029]; EX1003, ¶113.) 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, 52-54.) PO’s attempts to confuse the issue by assuming all lights must be on high beam at all times under all circumstances *other than* for a detected other vehicle are incorrect, and contrary to Alden’s disclosure of its headlights performing multiple functions. (POR, 57-59.) When the system recognizes a curve, it can perform additional functionality to illuminate the curve while also dimming where needed if other vehicles are present. (EX2041, 50:9-51:3, 76:8-80:24.)

PO makes similar arguments regarding Claim 21, arguing. Petitioner fails to show what adjustment achieves the increase of illumination. (POR, 60.) Again, the

logic of Figure 4 would apply to detecting roadside reflectors, with Paragraph [0036] of Alden indicating that instead of the CPU sending signals to restrict the amount of current to the headlight zones corresponding to where an oncoming vehicle is detected, the system will now “direct light into the corner” by sending signals to increase the amount of current to the headlight zones corresponding to where an upcoming road curvature is detected. (EX1003, ¶113, EX2041, 76:8-80:24.)

X. Dependent Claims 16-17, 22-23, and 32-36

Claims 16-17, 22-23, and 32-36 all relate to detecting and/or illuminating an upcoming road curve or turn. (Petition, 54-64.) PO argues that Petitioner’s “proofs” are flawed because Petitioner conflates “curves” and “turns.” (POR, 61-64.) This argument is baseless, and there is little explanation for it. For example, for Claims 32-33, PO simply points to two different arbitrarily-selected dictionary definitions and argues that “curves” and “turns” are defined differently and have different illumination requirements. (*Id.*, 61-62.) PO offers no explanation as to how this relates to Alden or invalidity.

Moreover, there is no basis to limit the claim terms “curves” and “turns” to two dictionary definitions identified by PO. Nor do these definitions even make sense. For example, PO defines turn as a “change of direction when moving,” but its expert admitted at deposition a curve also results in a change of direction when moving. (EX1013, 100:4-8.) Similarly, while PO asserts a curve does have a change

in angle required for a turn, its expert admitted the definition of “turn” makes no mention of any angle. (*Id.*, 102:4-7.) In any event, even under these definitions, Alden still discloses the challenged claims—it senses an upcoming curve or turn in the road and controls its headlights accordingly. (Petition, 54-56.)

XI. Dependent Claims 5 and 28-29

PO does not dispute Harbers discloses LEDs that can be controlled such that different beam segments have different colors. (POR, 64-68.) Instead, it argues a POSITA would not combine Alden and Harbers because this would result in colored light being output from Alden’s headlights, which could result in, for example, the driver of an oncoming vehicle seeing colored beams.⁷ (*Id.*)

First, this ignores the claims, which contemplate projecting different colors of light forward. Claim 28, for example, recites projecting bluish illumination on the side of the road and yellowish illumination along the road. Second, PO is misreading

⁷ PO also makes a passing argument that the Petition includes only proofs about “light clusters” being LEDs, not “light sources.” (POR, 64.) This makes no sense. The Petition explains how light clusters can be comprised of different sources, or groups of LEDs (such as groupings that project light into different general areas, *e.g.*, left, center, right, in front of the vehicle), with each group having multiple LEDs. (Petition, 60-61, 13-14.)

the art and combination. PO claims Alden’s array is limited to one row of nine LEDs and that Harbers requires the LEDs to be in a “strict ordering.” (*Id.*, 65, 67.) PO does not explain the relevance of these assumptions, but they are incorrect, and Harbers and Alden are not incompatible.

Harbers teaches using colored LEDs to project colors of light in certain areas, like bluish light along the side of the road and yellowish light along the road—*near-identical to Claim 28*. (Petition, 61-63.) And, Alden says that alternate lighting mechanisms can be used in its system. (*Id.*, 60-61.) Dr. Papanikolopoulos provides more than sufficient explanation for how and why a POSITA would apply Harbers to Alden. (*Id.*, 63-68.)

XII. Dependent Claim 6

PO does not dispute Bergkvist discloses a headlight beam further comprising UV light, but rather argues a POSITA would not apply this teaching to Alden. (POR, 64-68.) First, whether Bergkvist discloses LEDs is irrelevant. What matters is whether it discloses emitting UV light from a headlight, which it does. (Petition, 68-69.) Second, PO alleges the Petition provides no explanation of how Bergkvist’s UV light alone (without the filter) could be applied to Alden without also introducing unwanted visible light in certain sectors. (POR, 67-68.) PO misconstrues the combination set forth in the Petition—Alden is modified to include UV light output “outside the visible range, such that it is not distracting to other drivers or pedestrians

but can still illuminate reflective materials such as road signs or markings.” As taught by Berkgvist, such light source would include a filter to remove all the visible light and allow only UV light outside the visible range to be emitted. (Petition, 68-69; EX1011, ¶42.)

XIII. Dependent Claim 8

PO does not dispute Beam discloses detecting the taillights of a preceding vehicle. (POR, 68-69.) Instead, it argues applying Beam to Alden would not work because (1) the threshold(s) used in Alden to detect vehicles would need to be reduced, which in turn would cause Alden to no longer be able to appropriately adjust the light to oncoming vehicles, and (2) Alden would be unable to “match” taillights across its sensors. (*Id.*)

First, PO ignores that *Beam*’s teachings are being applied to Alden, and Beam discloses detecting both headlights and taillights. (Petition, 69-73; EX1003, ¶141; Beam, 2:54-65.) PO has not argued or shown Beam is not enabled. (POR, 68-69.)

Second, there is no evidence in the record that the difference in intensities between headlights and taillights is markedly different. PO cites none. (POR, 68-69.) Thus, there is no reason to assume significant adjustments would need to be made to Alden when applying Beam’s teachings.

Third, even assuming there is an appreciable difference in intensities between headlights and taillights, it is clear from Alden and the record that a POSITA would

be able to take this into account. (POR, 68-69.) PO urges, in essence, that Alden, as modified, would detect and dim light to an overly large area for oncoming vehicles, without saying why the threshold for both would need to be the same. (POR, 69.) Instead, Alden as modified by Beam can detect, and separately account for, both oncoming and preceding vehicles. In fact, a POSITA would have readily understood how to account for intensity differences and use two different intensity thresholds, with a lower one being indicative of taillights of a preceding vehicle and a higher one being indicative of headlights of an oncoming vehicle. (EX1003, ¶143.)

Finally, PO's argument that Alden does not explain how it "pairs lights" detected between the sensors fails to understand the art. (POR, 68-69.) Alden explains that for a given light source, the right and left sensors "will receive spots of nearly identical intensity and size[.]" (Alden, [0027].) Accordingly, Alden could readily match the data across the sensors without the need for additional modification or experimentation. (EX1011, ¶¶43-46.)

XIV. Dependent Claim 9

PO does not dispute Kobayashi discloses a GPS sensor. (POR, 70.) Instead, it argues that if a GPS sensor is added to Alden, there would be no need for Alden's other sensors. (*Id.*) This is irrelevant, and misses that the Petition explains that a POSITA would have *added* Kobayashi's GPS sensor to Alden's system and that

using *multiple sensors* would help “maximize successful detection of road curvature in different environments.” (Petition, 76-78.)⁸

XV. Conclusion

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

⁸ Nor does Alden emit high beam all the time into corners. *See supra* Section IX.

Dated: July 3, 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 5546 words, excluding the parts exempted by § 42.24(c).

Dated: July 3, 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 3, 2024, electronically via e-mail upon the following parties:

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