

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 [To be assigned]
Patent 9,955,551

**PETITION FOR *INTER PARTES* REVIEW OF
CLAIMS 48-87 OF U.S. PATENT NO. 9,955,551
UNDER 35 U.S.C. §§ 311-319 AND 37 C.F.R. §42.100 *et seq.***

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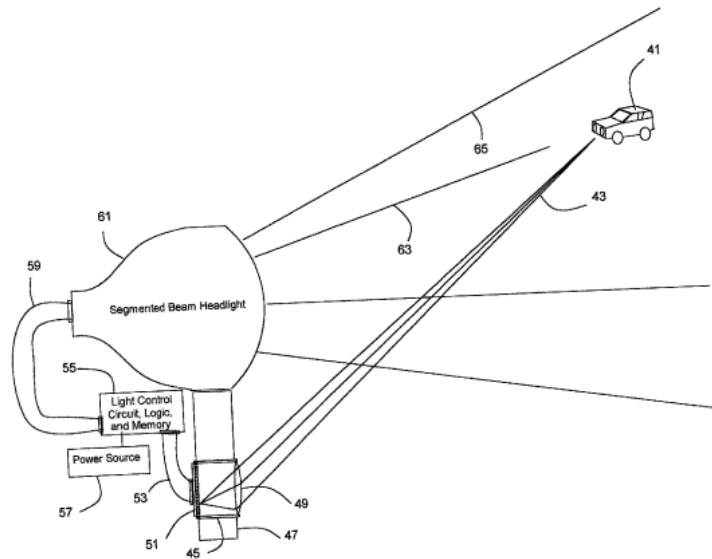
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I. INTRODUCTION

Petitioner Mercedes-Benz USA, LLC challenges Claims 48-87 of US9,955,551 (“**’551**”) (EX1001). The ’551 claims a headlight system for a vehicle that includes (1) a plurality of light clusters or sources in a headlight (*e.g.*, LEDs), (2) sensors to collect data, and (3) a processor and control circuitry to control the light clusters or sources based on the data. The ’551 recites that its sensors can obtain information about the field-of-view in front of the vehicle—for example, detect other vehicles—and that its processor and control circuitry can then use this to reduce illumination in portions of the field-of-view (*e.g.*, those LEDs pointing at the oncoming vehicle) while keeping LEDs in other areas (*e.g.*, in portions with no other vehicles) at full illumination.

But this was not new at the time of the ’551. Automated headlight systems, enabling selective illumination of lighting elements in response to sensor data, were well known before this. For example, the primary reference herein, US2003/0137849 (“**Alden**”) (EX1005), discloses a near-identical headlight system in which a controller can control individual lighting elements (*e.g.*, LEDs) based on received sensor data:



This enables the Alden system to, for example, reduce the light in certain areas where there is a detected vehicle (63) while switching other areas where there is no vehicle (65) to full illumination. Alden was not considered during prosecution of the '551, and alone and in combination with other prior art, renders Claims 48-87 of the '551 invalid.

II. MANDATORY NOTICES

A. Real Parties-in-Interest

The real parties-in-interest are Petitioner Mercedes-Benz USA, LLC; Mercedes-Benz Group AG; Mercedes-Benz AG; and Mercedes-Benz Intellectual Property GmbH & Co. KG.

B. Related Matters

An entity separate from the Patent Owner reflected in USPTO records, Torchlight Technologies, LLC (“**Torchlight**”), asserted the '551 in two lawsuits in

the District of Delaware on June 7, 2022:

- Case No. 1:21-CV-751 against Petitioner Mercedes-Benz USA, LLC, Daimler AG,¹ Volkswagen Group of America, Inc., Audi AG, Audi of America, LLC, Porsche AG, and Porsche North America, Inc.
- Case No. 1:22-CV-752 against General Motors LLC, General Motors Co., and General Motors Holdings, LLC.

These cases are in their infancy. Many defendants were only just served; responses to the operative complaint have not been filed; and no discovery has been exchanged. Further, the cases have been indefinitely stayed pending resolution of whether the complaint should be dismissed due to lack of standing and failure to join necessary parties.

The '551 is also the subject of IPR2023-00336 (challenging Claims 1-4, 7-8, 10-18), IPR202300615 (challenging Claims 24-55), and IPR2023-00318 (challenging Claims 56-87), filed by Volkswagen Group of America, Inc. (“**Volkswagen**”). These IPRs are pending, and are awaiting decisions on institution.

Petitioner is also filing contemporaneously herewith a petition for *inter partes* review of Claims 8, 10-18, and 24-47 of the '551.

C. Counsel and Service Information

¹ Daimler AG became Mercedes-Benz Group AG on February 1, 2022.

Lead counsel is Celine Crowson (Reg. No. 40,357). Backup counsel are Joe Raffetto (Reg. No. 66,218), Scott Hughes (Reg. No. 68,385), and Ryan Stephenson (Reg. No. 76,608). Service information is as follows:

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III. NOTICE OF FEES PAID

Fees are submitted herewith. If additional fees are due during the proceeding, the undersigned authorizes the Office to charge them to Deposit Account No. 50-1349.

IV. CERTIFICATION OF GROUNDS FOR STANDING

Petitioner certifies that the '551 is available for *inter partes* review, and that it is not barred or estopped from requesting this review.

V. PRECISE RELIEF REQUESTED

The relief requested is cancellation of the challenged claims, as follows:

Ground	References	Claims ²	Basis
1	Alden	48 , 50-51, 53-55, 56-59 , 61-63, 64-67 , 69-71, 72-75 , 77-79, 80-83 , 85-87	102/103
2	Alden / Beam	49	103
3	Alden / Kobayashi	52, 60, 68, 76, 84	103

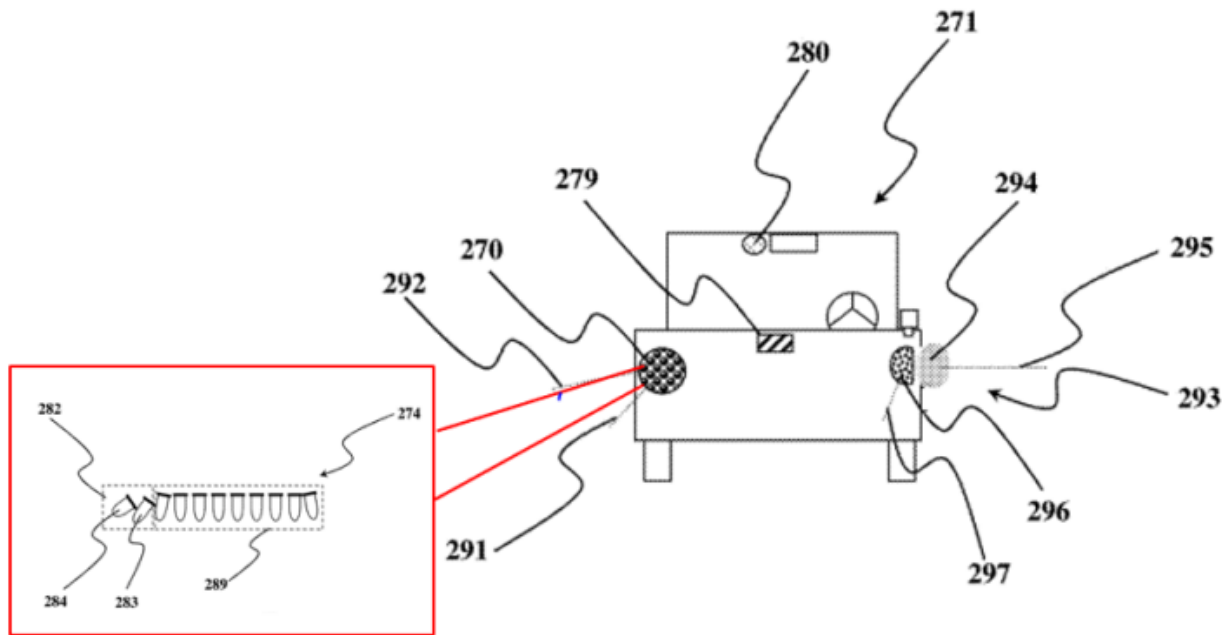
VI. OVERVIEW OF THE '551

A. Subject Matter of the '551

The '551 argues that in the “prior art,” lighting fixtures were often single, large lights that were “generic” and “universal.” ('551, 5:36-46, 11:1-5, 11:45-49.) These lights were allegedly not tailored to individual applications, produced light in more places than needed, and required reflectors and refractors to re-direct light. (*Id.*) The '551 claims it came up with a new approach it called a “Digital Lighting Fixture” that can “provide the ‘correct’ lighting solution for the situation at hand.” (*Id.*, 11:8-13.) The '551 purports to accomplish this through “controllability offered by breaking the total light output up into discrete (‘digital’) specifically aimable and dimmable elements which can be addressed by control electronics.” (*Id.*, 11:56-62.)

² Independent claims in bold.

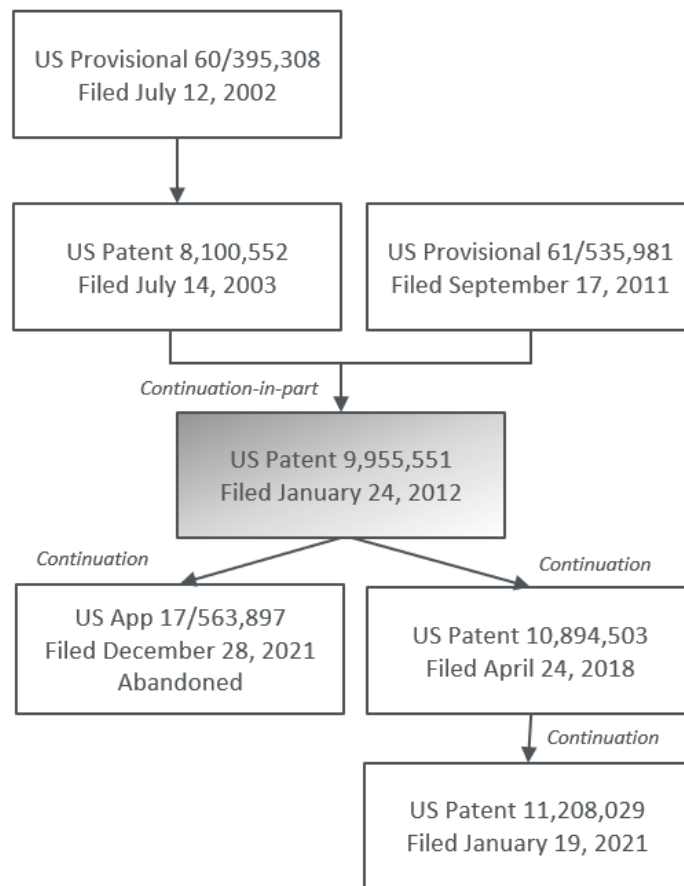
While the '551 gives various example applications, its claims are directed to the alleged invention as used in an “illuminating device” for a “motor vehicle.” (*Id.*, Claims 48, 56, 64, 72, 80; *see also* Abstract.) The claims recite how light clusters or sources (e.g., LEDs) can be included in a headlamp on a vehicle:



(*Id.*, Fig. 15 (annotated).) “Sensors” obtain relevant situational data, including detecting things like headlights of oncoming vehicles. (*See, e.g., id.*, Claim 48, 50:38-52:54; 53:13-55:42.) A “processor” can then determine, based on this, how to adjust the output from the individual lights (or LEDs), *e.g.*, “to reduce glare” in a particular area in the field-of-view. (*See, e.g., id.*)

B. Prosecution History of the '551

The '551 was filed on January 24, 2012, and issued on April 24, 2018. It is part of the following family:



Original prosecution of the application underlying the '551 did not address Claims 48-87; these claims were added during a recent *ex parte* reexamination. Specifically, on July 30, 2021, Patent Owner requested *ex parte* reexamination of independent Claim 6 of the '551, and with this request submitted new Claims 24-87. (EX1010, '551 Reexamination File History, Request for *Ex Parte* Reexamination.) After institution, the Examiner issued a single Office Action, rejecting independent Claim 6 over certain prior art and allowing new Claims 24-87. (*Id.*, Non-final Office Action mailed March 16, 2022.) Patent Owner canceled

Claim 6 in response, and an *Ex Parte* Reexamination Certificate issued cancelling such claim and issuing new Claims 24-87. (*Id.*, Reexamination Certificate.)

Subsequently, on April 10, 2023, Patent Owner filed a Disclaimer under 37 C.F.R. § 1.321(a), disclaiming Claims 1-4. (EX1011.) Thus, as of this Petition, the following claims remain in the '551: Claims 5 and 7-87.³

VII. CLAIM CONSTRUCTION AND POSITA DEFINITION

A. Claim Construction

Claims in an *inter partes* review “shall be construed using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. § 282(b), including construing the claim in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent.” 37 C.F.R. § 42.100(b). Unless indicated otherwise, all claim terms herein are given such ordinary and customary meaning.

B. Definition of a Person of Ordinary Skill in the Art

A person of ordinary skill in the art (“**POSITA**”) in the field of the '551

³ Patent Owner has also filed a broadening Reissue application, US16/858,342, to add 21 claims directed to a room illumination system. (EX1012.) That application was suspended pending the reexamination. (*Id.*) Patent Owner has requested that the suspension be lifted, but no action has been taken on this. (*Id.*)

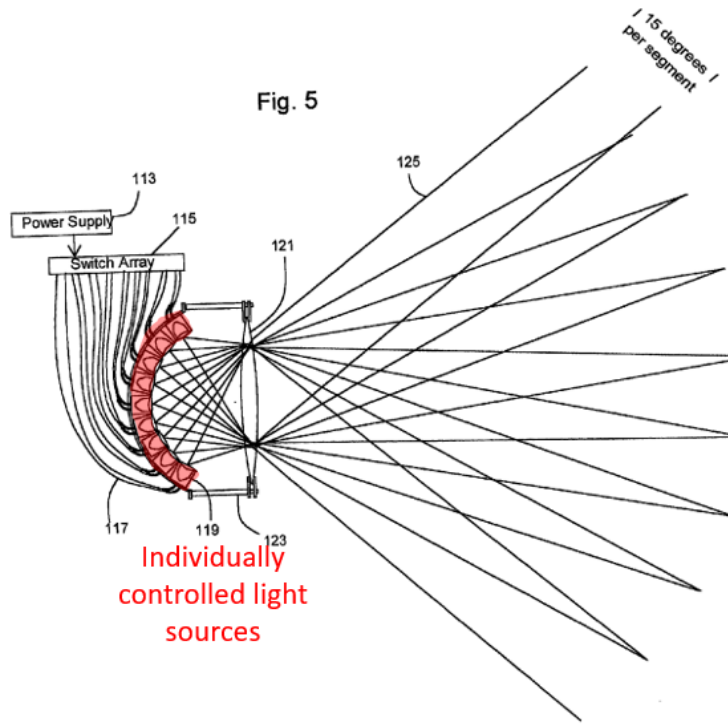
would have had an undergraduate degree in mechanical engineering, electrical engineering, automotive engineering, optical engineering, applied physics, computer science, or similar disciplines, along with two years of experience working with intelligent vehicle systems, automotive control systems, or lighting control systems. (Papanikolopoulos Decl., ¶33.)⁴ The more education one has, the less experience needed to attain an ordinary level of skill. (*Id.*) Similarly, more experience in the field may serve as a substitute for formal education. (*Id.*)

VIII. ANALYSIS OF GROUNDS FOR UNPATENTABILITY

Alden is US2003/0137849. Alden was filed January 22, 2002, and published July 24, 2003. Alden is prior art under at least pre-AIA § 102(e) because it was filed before the filing date, and any potential priority date, of the '551.

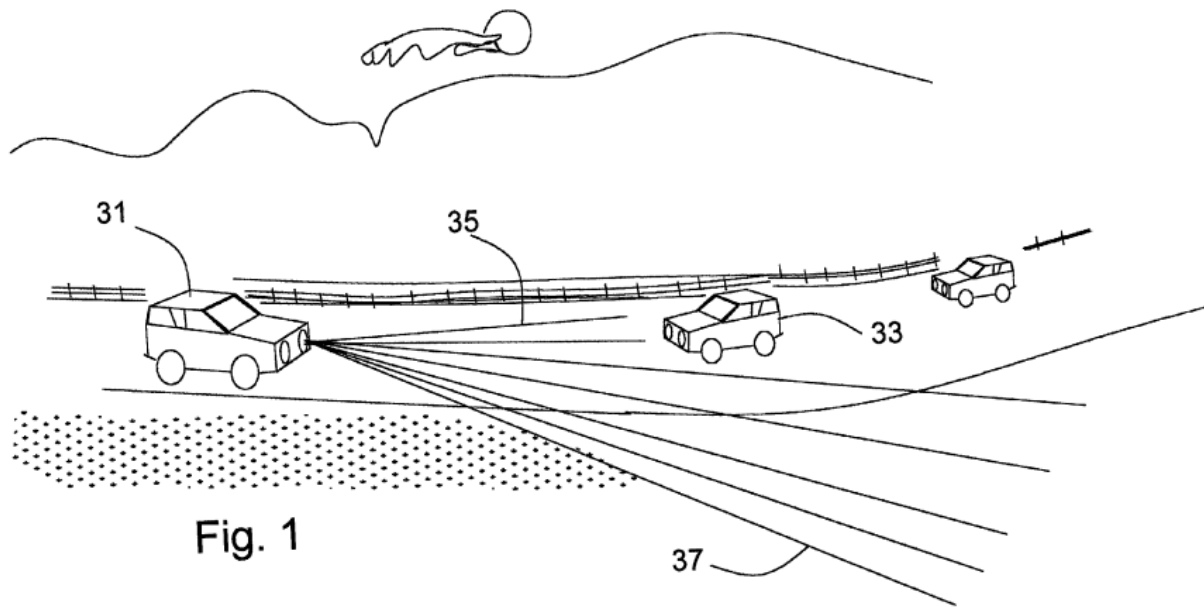
In Alden, individual lighting elements (119) such as LEDs are positioned in a curved manner inside of a headlight:

⁴ Dr. Nikolaos Papa Nikolopoulos is an expert in intelligent transportation systems, among other things. His Declaration is included as EX1003.



(Alden, Fig. 5, [0029].) Alongside this, the Alden system includes (a) a “sensor unit” to detect objects along the road and (b) a “light control circuit” with a “CPU” to adjust the individual LEDs based on sensor data. (*Id.*, Figs. 2-3, [0026]-[0027].)

Alden teaches that, with its individually-controllable LEDs, a vehicle can “emit[] 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,” with “[t]he low beam illumination being emitted in response to the detection of an oncoming vehicle 33” to reduce “glare”:



(*Id.*, Fig. 1, [0004], [0025].) Alden’s system can also be used to “concentrate light” to “look around corners,” “look up a hill,” and “look down a hill,” all “in response to road conditions.” (*Id.*, Figs. 11-13, [0036]-[0038].)

A. Ground 1 – Alden Anticipates and Renders Obvious Claims 48, 50-51, 53-59, 61-67, 69-75, 77-83, 85-87

1. Independent Claim 48

Alden anticipates and renders obvious Claim 48. (Papanikolopoulos Decl., ¶¶50-78.)

**48

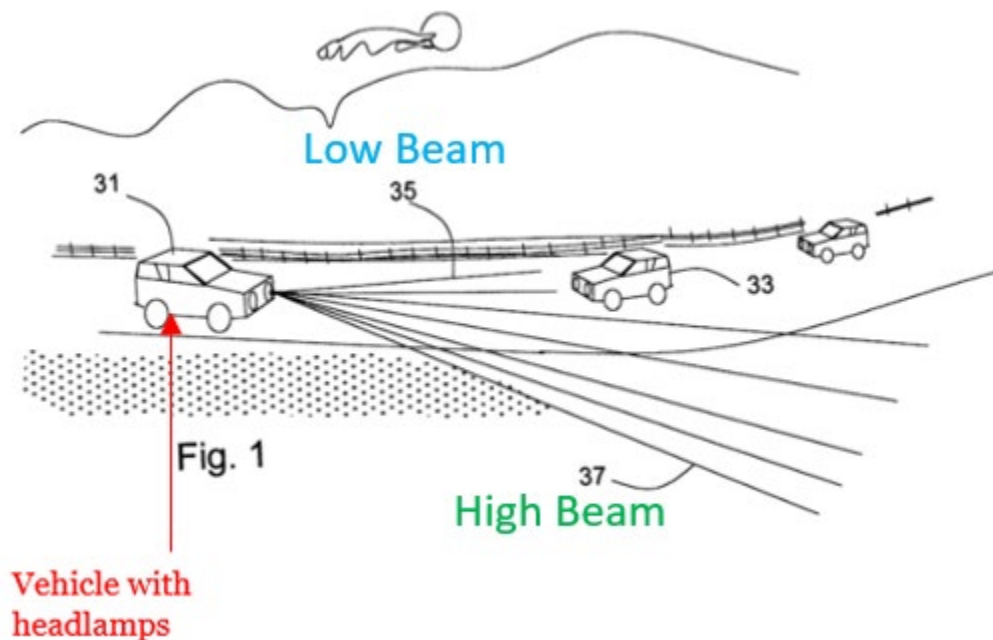
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[pre]
```**: *An illuminating device having automatic control of light provided to an illuminated area comprising:*

Alden discloses Claim 48

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[pre]
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 to the extent limiting. (*Id.*, ¶51.) Alden’s system is “for *automatically controlling* the distribution of *a headlight* in response

to environmental conditions.” (Alden, [0006]; *see also* Abstract.)⁵ In Alden, a “first vehicle 31” includes an “automatic segmented illumination” headlight system (“illuminating device”), allowing the vehicle to emit different illumination in different areas in its field-of-view, such as emitting “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”:



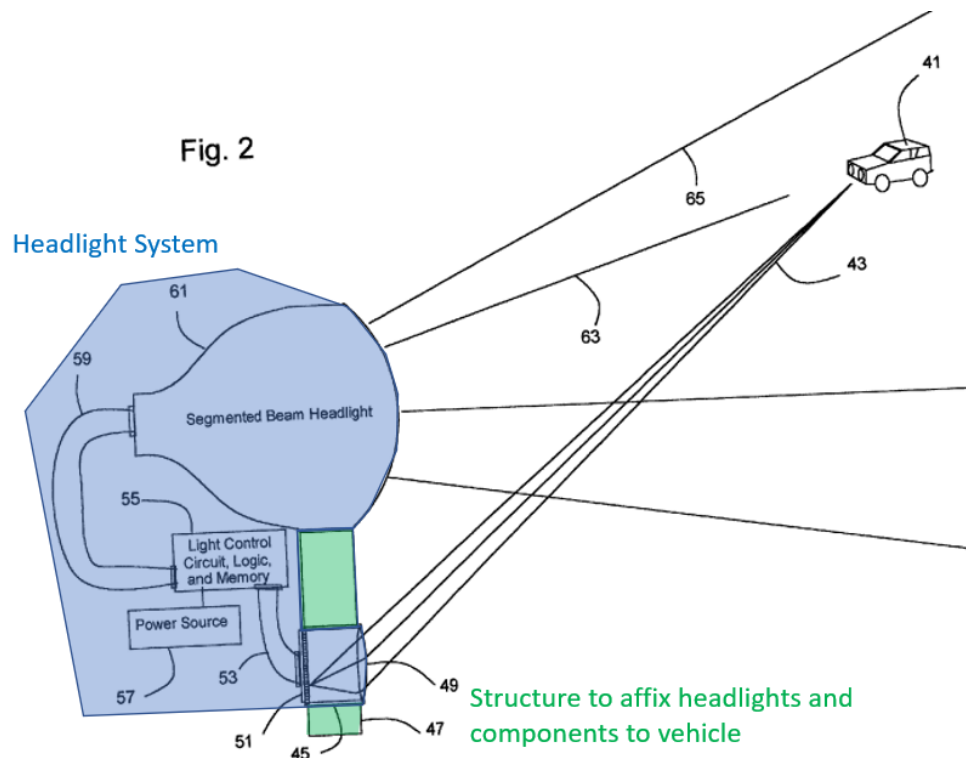
(*Id.*, [0025], Fig. 1 (annotated); *see also* [0026], [0029].)

48[a]: a structure for incorporating illuminating device elements, wherein the structure comprises a motor vehicle;

Alden discloses Claim 48[a]. (Papanikolopoulos Decl., ¶¶52-53.) Alden’s system is for headlights on a “structure compris[ing] a motor vehicle.” (Alden,

⁵ All emphasis added unless otherwise noted.

Figs. 1-2, Fig. 11, [0025].) *See also supra* Claim 48[pre]. Alden’s headlight system includes numerous components (“illuminating device elements”) to incorporate into the vehicle, including: “segmented beam headlight” (61); “sensor unit” (45); and “light control circuit, logic, and memory” (55):

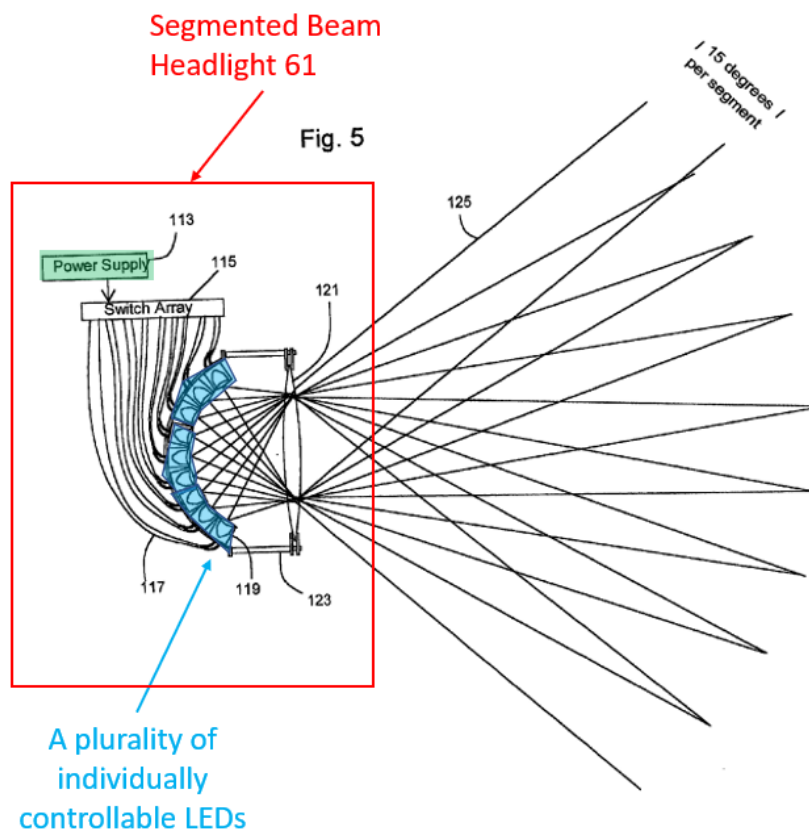


(*Id.*, [0026], Fig. 2 (annotated).) Alden explains these are “mounted on an equipped automobile 47 (47 being a part of the automobile—the [full] automobile is not shown).” (*Id.*, [0026].)

48[b]: *a plurality of individually controllable LEDs incorporated in the structure via at least one headlamp mounted to the structure, each headlamp including at least one of the LEDs, the LEDs in communication with a power source;*

Alden discloses Claim 48[b]. (Papanikolopoulos Decl., ¶¶54-55.) Alden’s “segmented beam” headlights 61 are incorporated into a vehicle 47. *See supra*

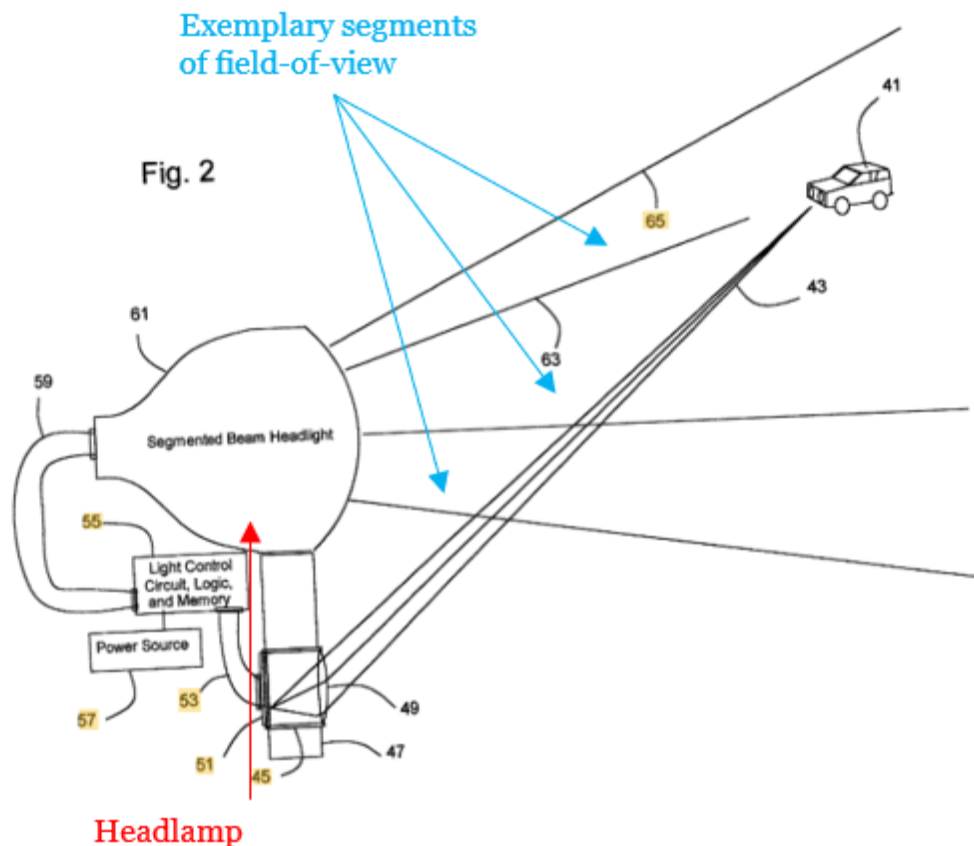
Claim 48[a]. (See also Alden, Figs. 1-2.) Each headlight can include an “array of individual lighting elements,” with each lighting element being a “white **LED** (or alternate lighting mechanism).” (*Id.*, [0029].) Further, this LED array (“lighting elements 119”) is in communication with a power source (“power supply 113”) via a “switch array 115” and “segment wire 117”:



(*Id.*, Fig. 5 (annotated), [0029]; see also Fig. 2.)

Each lighting element 119 (e.g., LED) is also “*independently controlled* by... an array of switches.” (*Id.*, [0029].) Alden discloses that each LED is at a different angle based on its position along a curve in the headlight, such that light from each LED “falls within a defined area of the light distribution area.” (*Id.*)

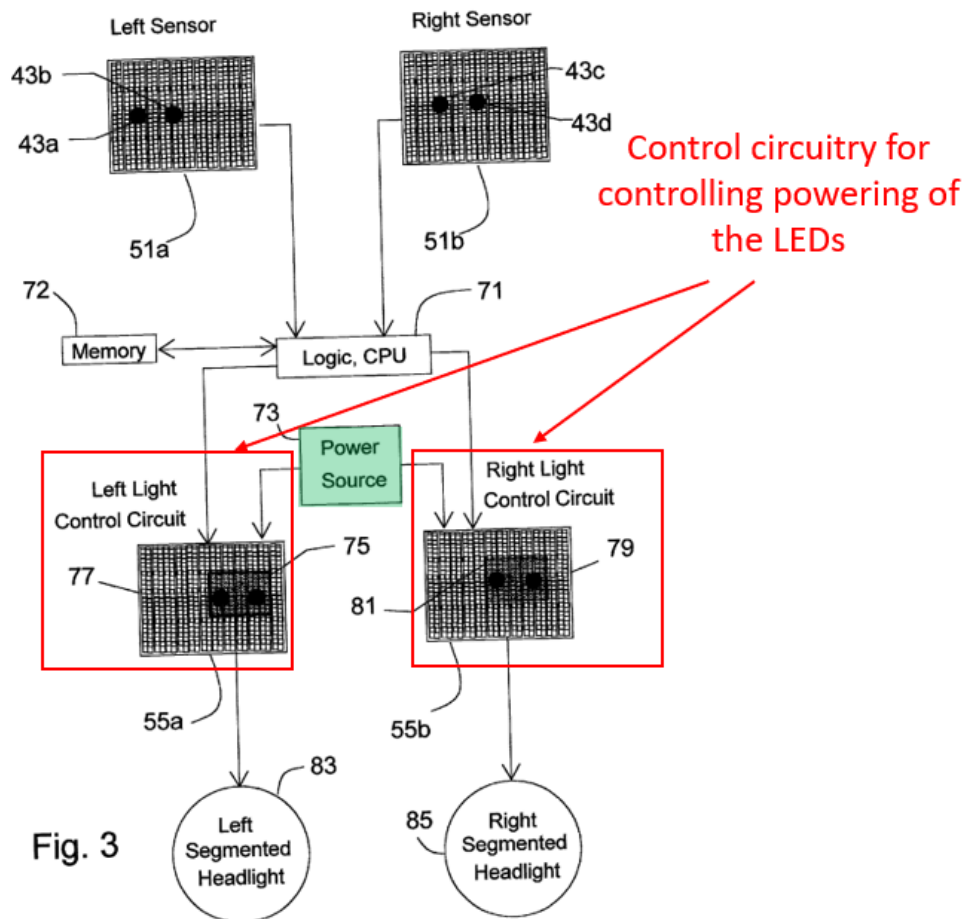
Alden further discloses that the power to each LED 119 “is controlled by the CPU which dictates its respective switch characteristics at [switch array] 115 such that the power from a power supply 113 carried via segment wire 117 is controlled in response to the sensed environmental conditions.” (*Id.*) This individual control over each LED enables Alden to produce different illuminations in different areas, such as “a high beam in a first sector 65 [where there is no other vehicle] while concurrently producing a low beam in a second respective sector 63 (or dim beam) where the 41 [other vehicle] is sensed”:



(*Id.*, Fig.2 (annotated), [0026]; see also [0027]-[0029], Figs. 11-13, [0036]-[0038].)

48[c]: electronic circuitry apparatus for the controlled powering of the LEDs and other of the illuminating device elements;

Alden discloses Claim 48[c]. (Papanikolopoulos Decl., ¶¶56-58.) Alden’s headlight system includes a “left light *control circuit*” (55a) and a “right light *control circuit*” (55b):

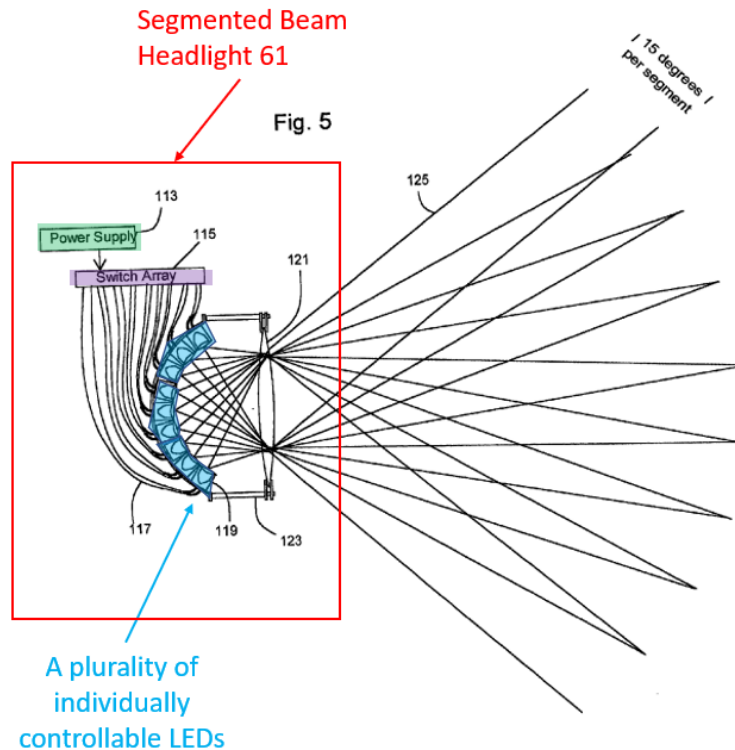


(Alden, Fig. 3 (annotated).)

These control circuits (e.g., “electronic circuitry apparatus”) control power to various “illuminating device elements,” including segmented power cables or wires which carry the power to the left and right segmented headlights and LEDs

in each headlight. (*Id.*, [0026], [0029], Figs. 2, 5; *see also* Papanikolopoulos Decl., ¶¶57-58.) Further, the control circuitry “controls the power flow” to the segmented headlights to independently control the LED lighting elements. (Alden, [0026]-[0027]; *see also* [0006], [0008], Fig. 4, [0028].) For example, where data from sensors 51a, 51b indicates the presence of another vehicle 41, the control circuitry “controls the power flow” so that the headlight “distributes high beams throughout its distribution areas except in a box in the direction of the 41.” (*Id.*, [0027].)

Additionally, Alden discloses that the control circuits include “segmented headlight control switch array switches,” which provide power to the different light elements in the segmented headlights, causing certain “portions” of the headlight to “dim” while other portions are switched “on high beam.” (*Id.*, [0027].) This switch array control circuitry is further illustrated in Figure 5, where the “switch array” controls power flow to each “segment wire 117” and corresponding “lighting element 119”:

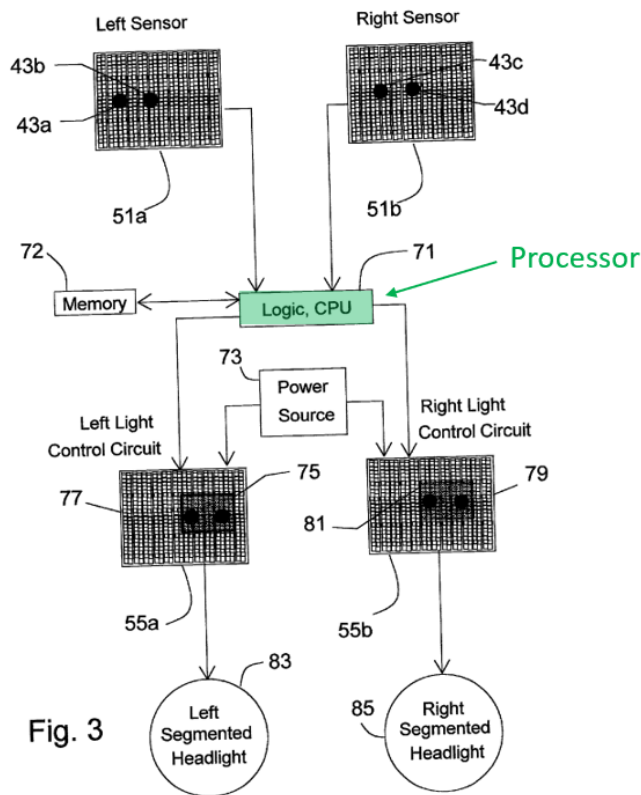


(*Id.*, Fig. 5 (annotated).) Alden discloses each switch being “controlled by the CPU and logic previously described. For example the power to 119 is controlled by the CPU which dictates its respective switch characteristics at 115 such that the power from a power supply 113 carried via segment wire 117 is controlled in response to the sensed environmental conditions.” (*Id.*, [0047], Fig. 5.)⁶

⁶ During reexamination, the Examiner interpreted “electronic circuitry apparatus...” as means-plus-function, in particular as “a controller described in a preferred embodiment as ‘logic control electronics unit 7’ of the ’551 patent disclosure.” (EX1010, Notice of Intent to Issue Reexam Certificate.) If the Board considers this

48[d]: one or more processors;

Alden discloses Claim 48[d]. (Papanikolopoulos Decl., ¶59.) Alden discloses “one or more processors”:

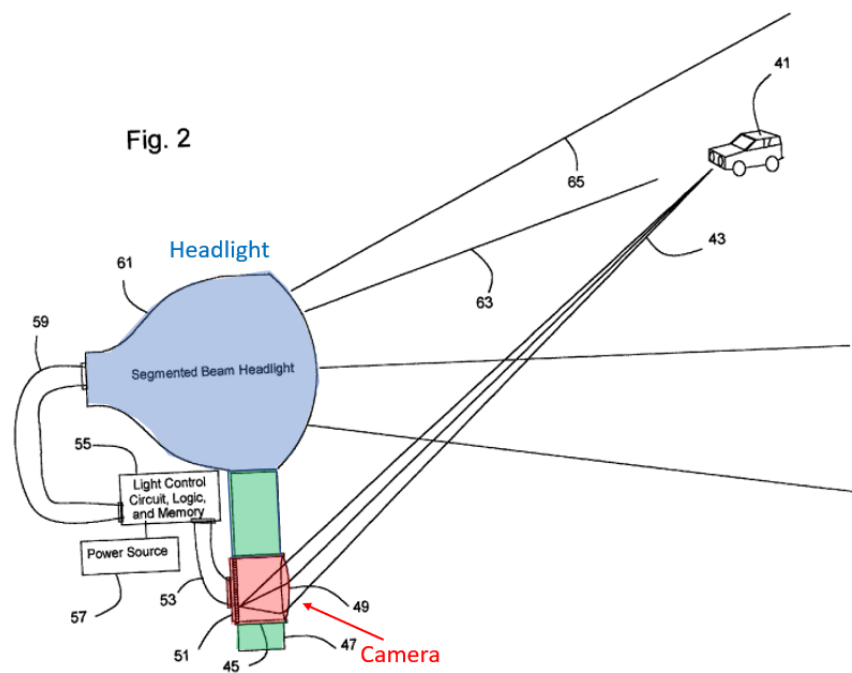


a means-plus-function limitation and similarly construes it as being “logic control electronics unit 7” and equivalents thereof, Alden discloses the same. As explained, Alden discloses a logic CPU that provides instructions to left and right control circuitry output electronics to control the power to each lighting element. (*See, e.g.*, Alden, Figs. 2-4, [0026]-[0028].)

(Alden, Fig. 3 (annotated); *see also* Fig. 2, [0026].) As shown in Figure 3, left and right sensors 51a-51b are connected to CPU 71 comprising logic. (*Id.*, [0027].) The CPU is connected to memory 72, and “[i]nformation from the [memory] 72 and [CPU] 71 is sent to control the power flow from a power source 73 via a left light control circuit 55a and a right light control circuit 55b.” (*Id.*)

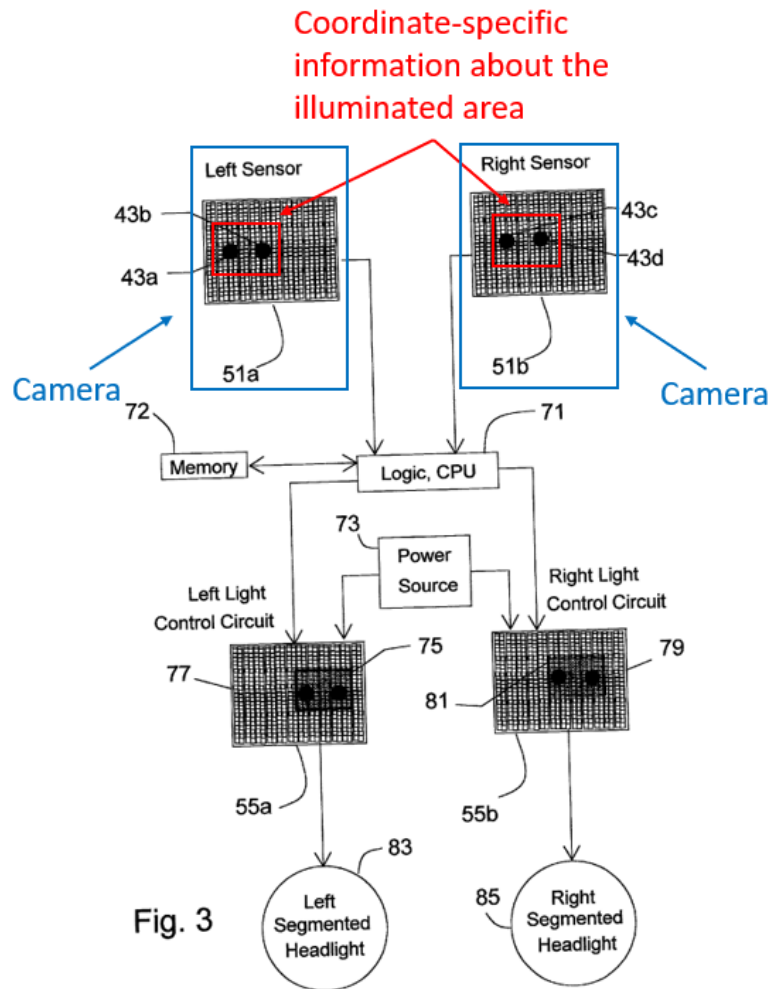
48[e]: [1] *one or more sensors, including one or more cameras, placed on the structure* [2] *for detecting coordinate-specific information about the illuminated area,* [3] *at least one of said cameras in communication with power, and in communication with at least one of the one or more processors;*

Alden discloses Claim 48[e]. (Papanikolopoulos Decl., ¶¶60-62.) First, Alden discloses one or more “sensors” including “cameras” that are placed on the “structure” (*i.e.*, vehicle). (*Id.*, ¶¶60.) Each headlight includes a “sensor unit 45” mounted on “vehicle 47” that can detect the presence of other vehicles:



(Alden, [0026], Fig. 2 (annotated).) Alden discloses that each “sensor unit 45” can include a primary *lens 49* and a *detector array 51*, and that the detector array can be a photodiode array or CCD (*i.e.*, camera sensors) that detects photon intensity (*i.e.*, light) and “convert[s] photons to electrons.” (*Id.*) The converted electrons “corresponding to the position and intensity of light” are sent into a light control circuit 55. (*Id.*, [0026]-[0027].)

Second, Alden’s sensors detect “coordinate-specific information about the illuminated area.” (Papanikolopoulos Decl., ¶61.) In Alden, the system includes a “left sensor 51a” and a “right sensor 51b” which are used concurrently. (*Id.*, [0027].) The left sensor 51a detects the “position and intensity” of two headlights of an oncoming vehicle “at a first illuminated spot 43a and a second illuminated spot 43b respectively,” *i.e.*, coordinate specific information about the illuminated area. (*Id.*) Similarly, the right sensor 51b detects position and intensity of the headlights of the oncoming vehicle as a first spot 43c and a second spot 43d respectively. (*Id.*)

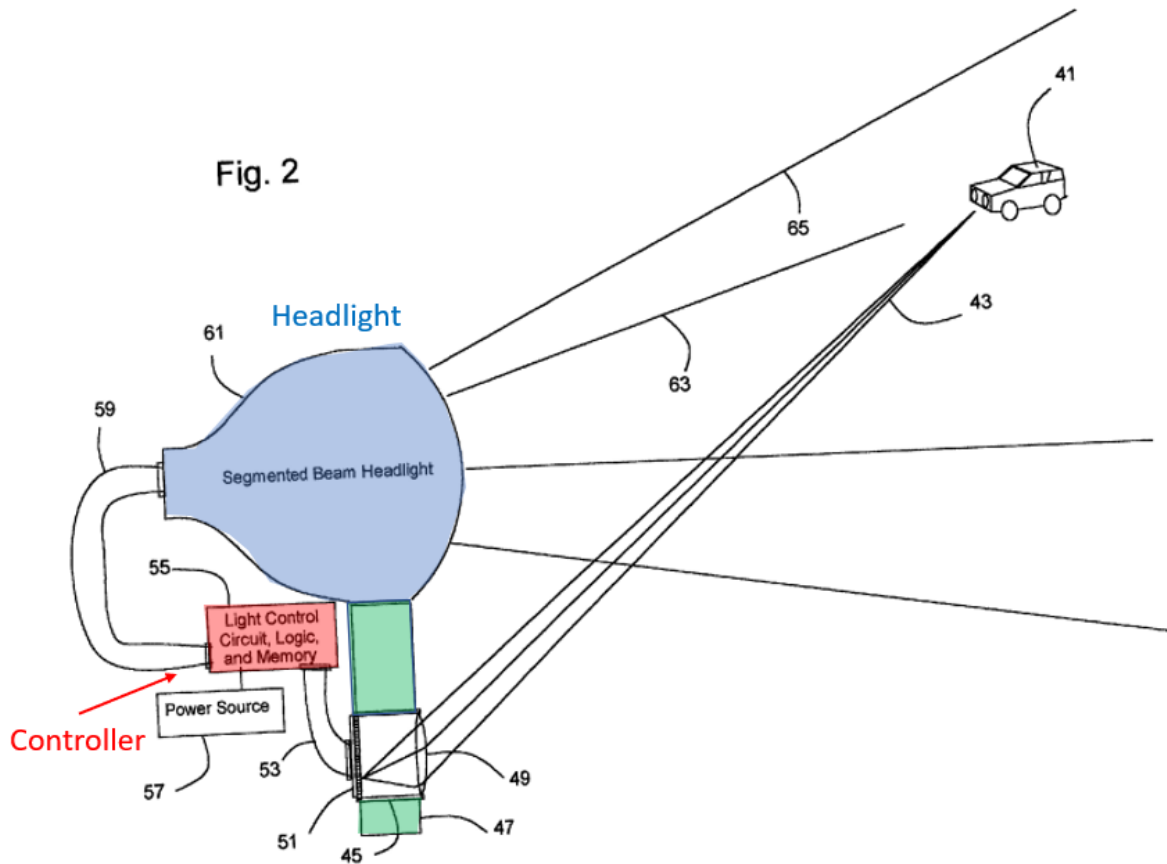


(*Id.*, Fig.3 (annotated).) Alden discloses that the position of each light spot (*i.e.*, “coordinate specific information”) is determined by checking the status of respective “sensor sectors” of each light sensor in an iterative process. (*Id.*, [0028], Fig. 4.)

Third, the left and right camera sensors 51a-51b are in “communication” with both the power supply (“power source 73”) and processor (“CPU 71”), as these components are connected to each other through cables or wires. (*Id.*, Fig. 3 (showing interconnection of components); *see also* Fig. 2, [0026] (discussing ribbon cable connection between power supply and sensors), [0027].)

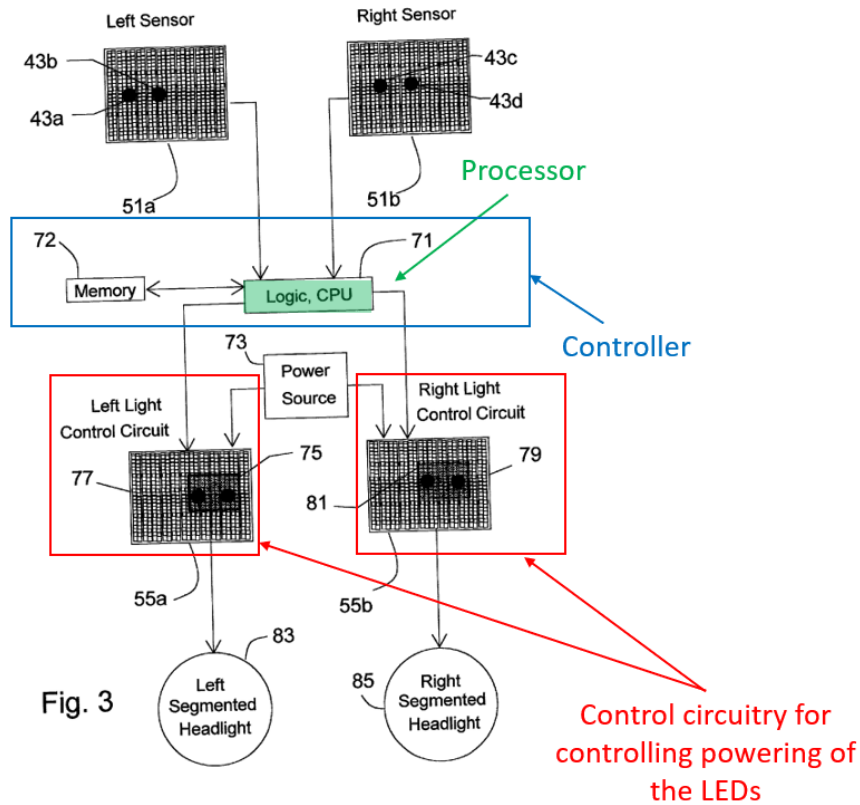
48[f]: a controller, including at least one of the one or more processors, integrated with the structure via mounting, in communication with the LED controlling power electronic circuitry apparatus,

Alden discloses Claim 48[f]. (Papanikolopoulos Decl., ¶¶63-64.) First, Alden discloses a light control circuit 55, which is integrated with the motor vehicle structure 47 via mounting:



(Alden, Fig. 2 (annotated), [0026].) *See also supra* Claim 48[a].

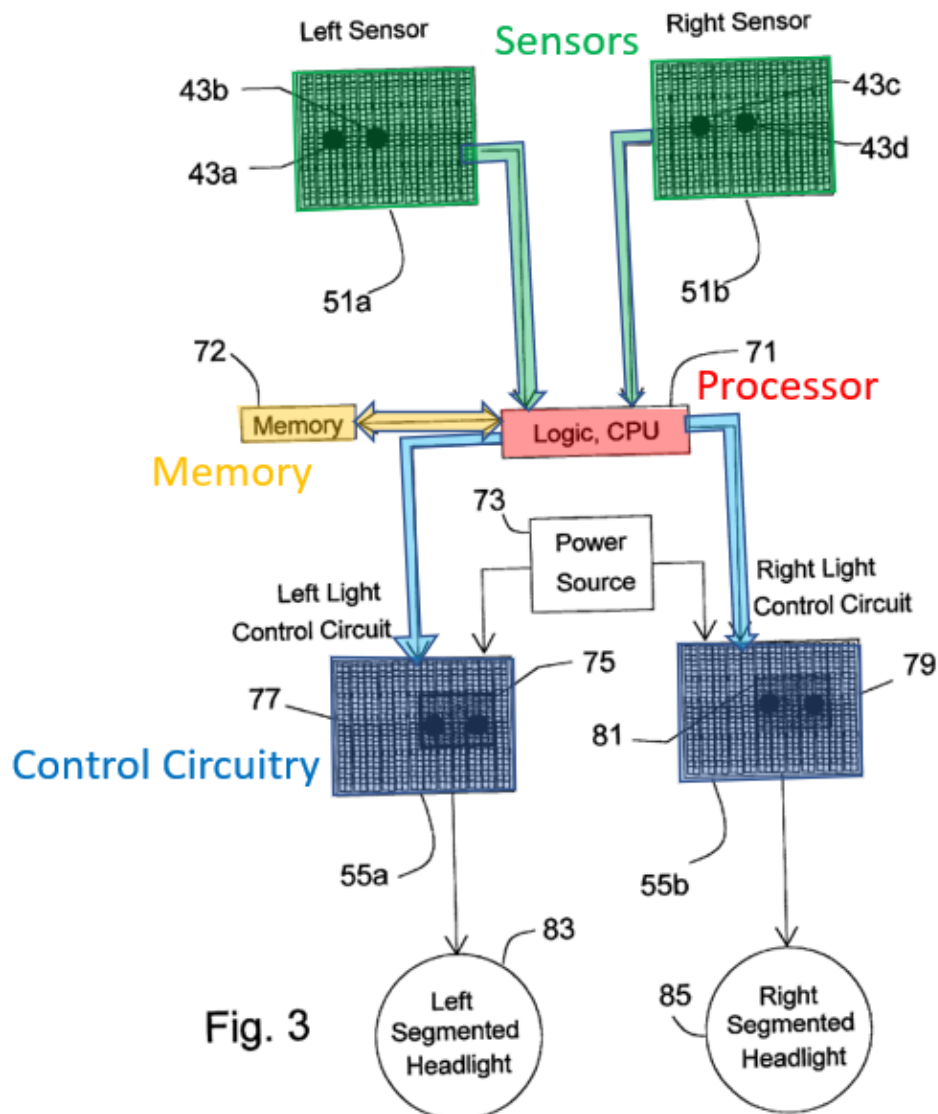
Second, Alden discloses that this includes “controller” with a logic and CPU 71 (*i.e.*, “processor”) and memory 72:



(Alden, Fig. 3 (annotated), [0027].) As shown, CPU 71 is connected to and in direct “communication” with the left and right control circuits 55a-55b which control power to the LEDs. (*Id.*, [0027], [0029]) Alden further discloses that the CPU and control circuits are in “communication” when “[i]nformation from the [memory] 72 and [CPU] 71 is sent to control the power flow from a power source via a left light control circuit 55a and a right light control circuit 55b.” (*Id.*, [0027].)

48[g]: said controller arranged to process the information communicated from the cameras and to automatically control the light provided to the illuminated area; and

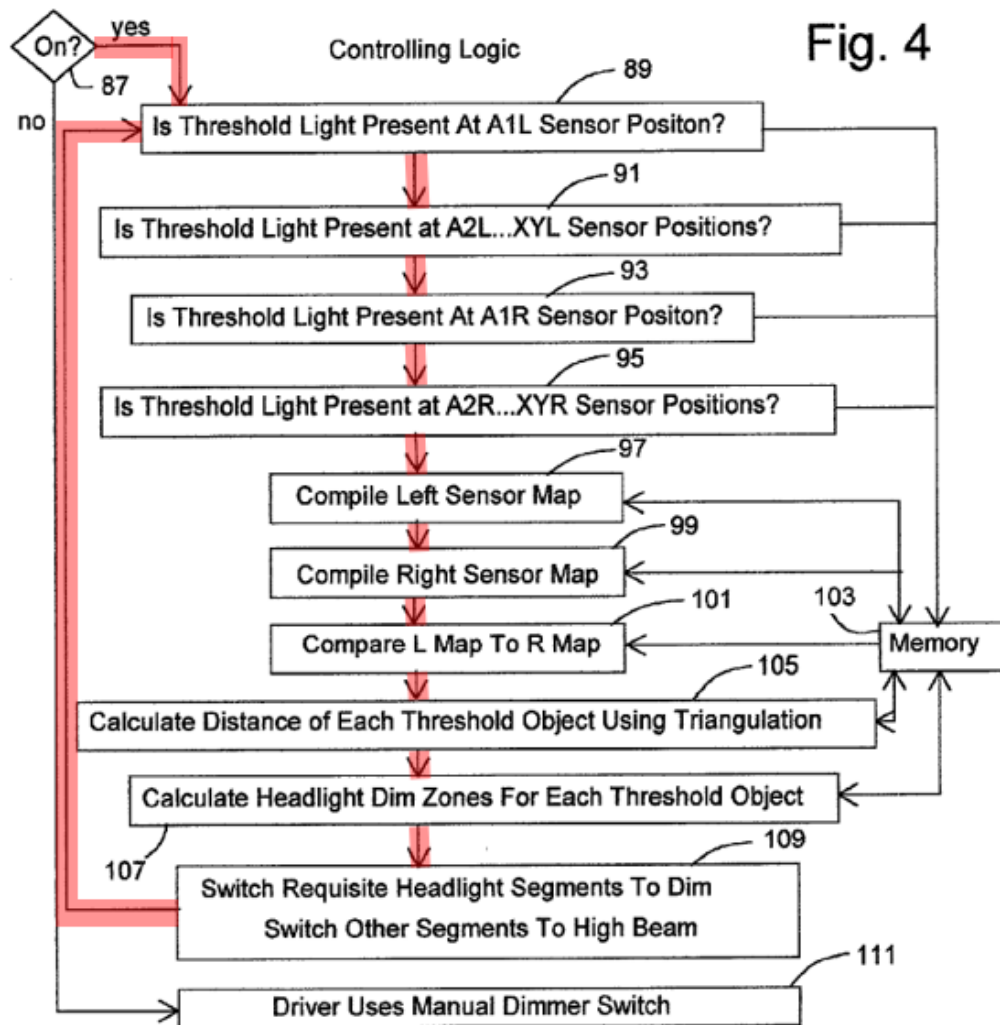
Alden discloses Claim 48[g]. (Papanikolopoulos Decl., ¶¶65-70.) Alden’s “controller” (e.g., logic CPU 71) receives sensor data from left and right camera sensors 51a-51b:



(Alden, Fig. 3 (annotated), [0027]; see also [0026].) As shown, logic CPU 71 is connected to sensors 51a-51b and receives information from the sensors regarding

sensed light. (*Id.*, [0027].) In particular, each sensor “detects the two headlights of 41 [other vehicle]” at first and second illuminated spots, and “[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.*) See also *supra* Claim 48[e].

CPU 71 “processes” this sensor data to: determine a location of the other vehicle; determine which sectors that vehicle is located in; and instruct the control circuitry to power the lighting elements in each headlight to switch to dimmed low beam light or to high beam light, depending on whether they direct light to the sectors where the other vehicle is located. (*Id.*, [0027]-[0029].) In particular, Alden discloses an “automatic segmented illumination” system. (*Id.*, [0006], [0008], [0025].) As part of this, its CPU continuously automatically determines illumination requirements for different sectors, or zones, in the area illuminated by the headlights using “controlling logic,” such as shown in Figure 4:



(*Id.*, Fig. 4 (annotated); *see also* Fig. 3, [0026]-[0028].)

As shown, the logic process can include: (a) processing sensor data to determine whether light above a threshold value is present at each sensor sector location (steps 89, 91, 93, 95), including categorizing the position and intensity of light sensed (*id.*, [0027]); (b) compiling sensor maps (steps 97, 99); (c) determining the “distance and intensity of each object sensed in a calculating process 101”; and (d) calculating distances to objects using a “triangulation process 105.” (*Id.*, Fig. 4,

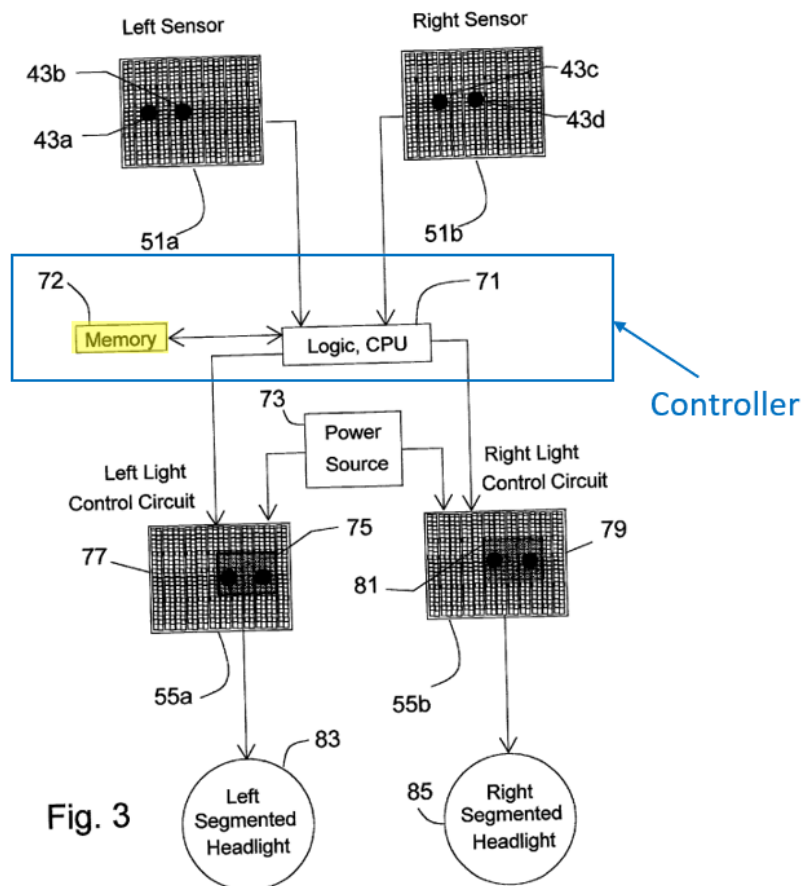
[0028]; *see also* Fig. 3, [0026]-[0027].) The CPU uses the distance data to “determine the intensity of light that will be produced by the 61 [headlight] in the corresponding headlight sectors,” as shown in step 107—*i.e.*, selecting which LEDs to dim and which to set to high beam. (*Id.*) It then sends signals to the control circuits to switch some sectors to dim, low beam light, and others to high beam, as shown in step 109. (*Id.*, Fig. 4, [0027]-[0028]; *see also* Fig. 3, [0025]-[0026].)

As an example, when the CPU detects an oncoming vehicle in a particular sector, it will select and cause the group of LEDs pointing in the direction of that sector to dim, while selecting and causing other LEDs (*e.g.*, those not pointing at that sector) to switch to high beam, such as shown in Figure 5 below (annotated). As a result, “the light sent to the sensed vehicle location is dimmer than the light sent to all other areas of the headlight distribution area.” Alden discloses that this reduces glare: “the driver of 41 [*i.e.*, the oncoming vehicle] has minimum glare while the driver of 47 [*i.e.*, the vehicle implementing the Alden system] has maximum light.” (*Id.*; *see also* Abstract, [0005].)

is no longer detected at those same sensor positions, then the system makes a determination to switch the corresponding sectors from dim, low beam to high beam. (*Id.*) In sum, as part of the real-time process, Alden is continuously determining whether each sector should be dimmed low beam or high beam. (Papanikolopoulos Decl., ¶70.)

48[h]: *memory storing instructions that, when executed by one or more processors of the controller, enable the controller to:*

Alden discloses Claim 48[h]. (Papanikolopoulos Decl., ¶71.) Alden discloses that CPU 71 (“processor[] of the controller”) is coupled to memory 72 and detects objects and determines whether to adjust lighting elements:



(*Id.*, Fig. 3 (annotated), [0027] (describing logic used and data being “stored in a memory 72”); *see also* Fig. 2, [0026].) Further, Figure 4 of Alden discloses the instructions (“logic process”) that the CPU 71 may execute, which would be stored in the memory, to process sensor data and control the power flow to each LED within the headlights. (*Id.*, [0028], Fig. 4; Papanikolopoulos Decl., ¶71.) *See also supra* Claim 48[g].

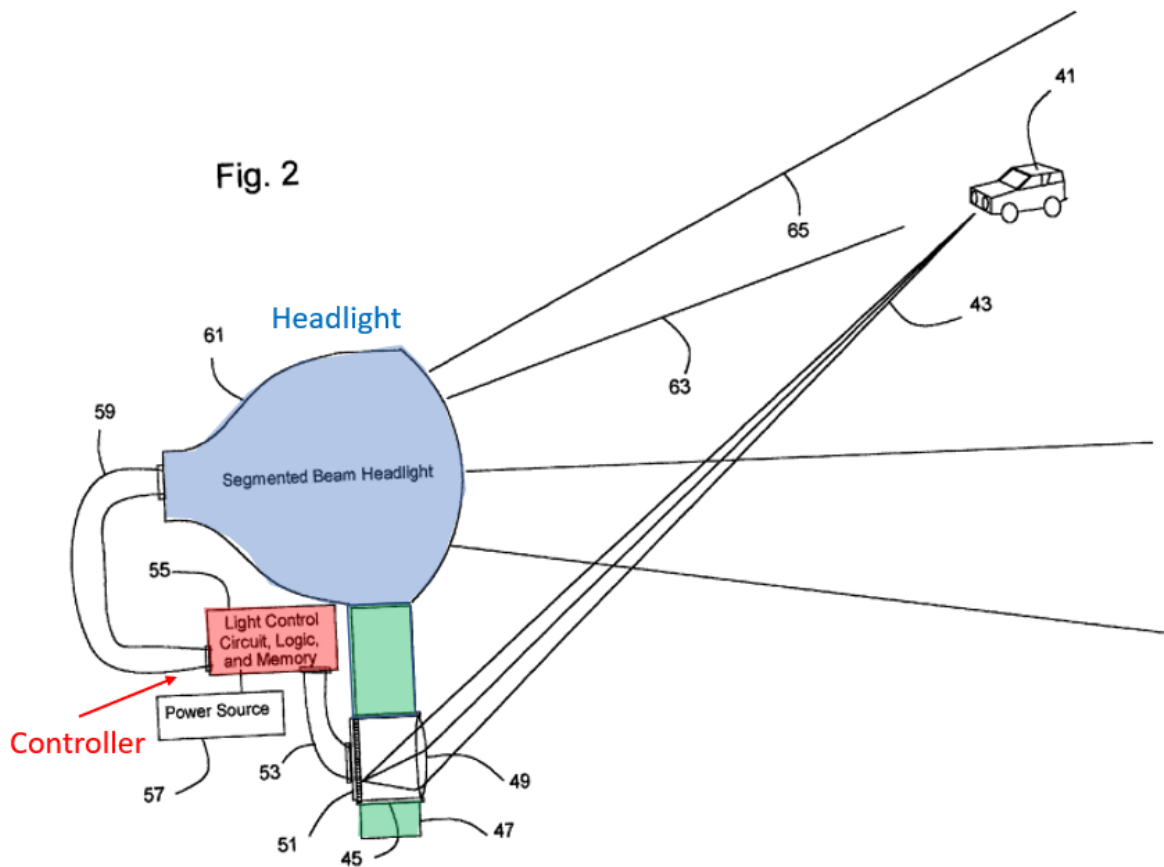
48[i]: [1] illuminate a portion of at least one object, indicated by data from at least one of the one or more sensors, [2] by selecting a first cluster of the LEDs to emit first light directed towards a first area including the at least the portion of at least one object, [3] the first area determined based at least in part on the data, [4] the first cluster selected based at least in part on known aimings of light associated with the first cluster determined to correspond to the first area, and [5] the first light determined based at least in part on classifying the object based at least in part on the data; and

Alden discloses Claim 48[i]. (Papanikolopoulos Decl., ¶¶72-76.)

First, Alden discloses illuminating a portion of an object indicated by sensor data. As discussed, Alden’s system has sensors that detect objects in the field-of-view, like oncoming vehicles, and can illuminate those objects with light, such as low beam light to “reduce glare.” *See supra* 48[g].

Second, in Alden this illumination is done by selecting a cluster of LEDs to emit a “first light” (*e.g.*, low beam) in an area that includes the object. As discussed, CPU 71 “processes” the sensor data to determine which LEDs direct light to the area of an oncoming vehicle and causes those LEDs to emit a “first

light” (e.g., low beam) in the area (63) of the detected vehicle (41), while other LED groups, such as in other areas (65), are switched to different light:

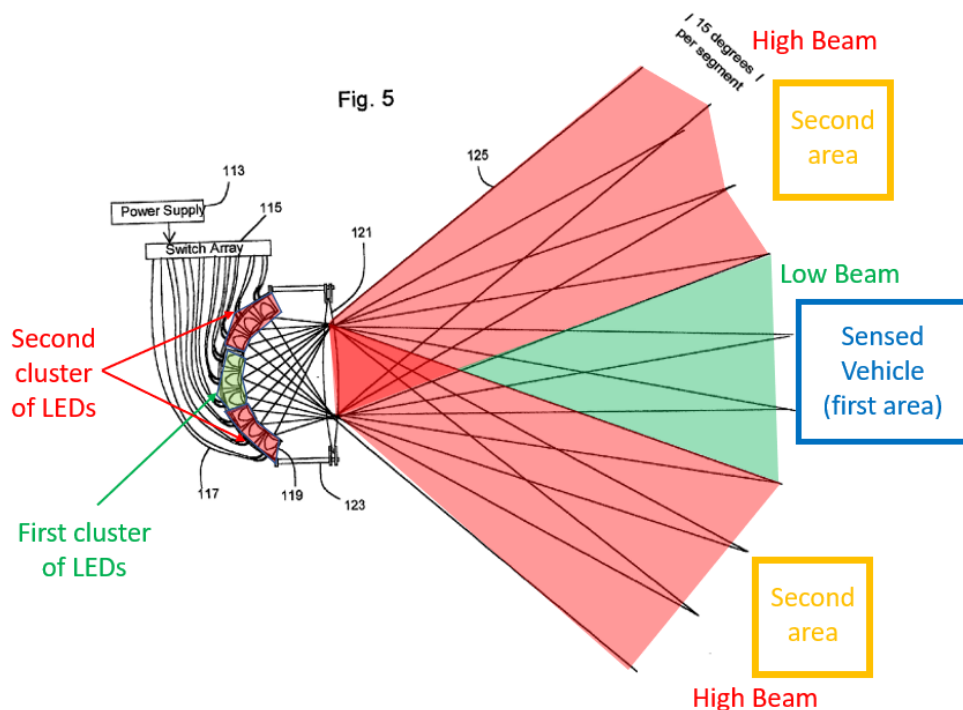


(Alden, Fig. 2 (annotated), [0026].) *See also supra* Claim 48[g].

Third, the “first area” is determined based on sensor data. As discussed, Alden uses the sensor data to determine the coordinates, or area, of the detected vehicle and adjusts the LEDs in that area accordingly. *See supra* Claim 48[g].

Fourth, the “first cluster” of LEDs selected to illuminate the area is based on the “known aimings of light” associated with those LEDs. In particular, Alden’s lighting elements 119 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” ahead of the vehicle:



(Alden, [0029], Fig. 5 (annotated).) Thus, each lighting element is directed to a “specified” area, and when Alden illuminates an area (such as one with an oncoming vehicle) with low beam light, it will select and adjust those LEDs that are directing light into that corresponding area where the vehicle is.

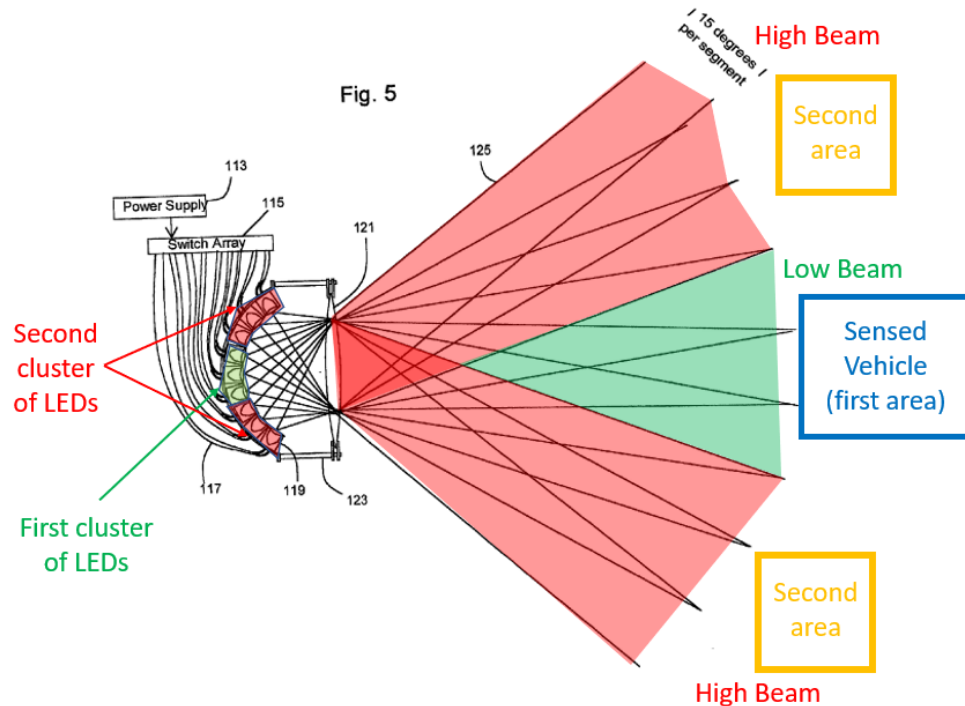
(Papanikolopoulos Decl., ¶75.) *See also supra* 48[g].

Fifth, the “first light” (e.g., low beam) is determined based on “classifying the object.” As discussed, Alden determines whether the object is an oncoming vehicle, based on sensed light above a threshold, and if it is determined to be an oncoming vehicle (such as based on light emitted from its headlights), Alden

project a dim, low beam light in the area of the oncoming vehicle. *See supra* Claim 48[g].

48[i]: [1] *control light emitted from the first cluster directed towards the first area to be different in at least one emission characteristic, based on the first light determination, from second light emitted from a second, different cluster of the LEDs, [2] directed towards one or more illuminated second areas at a common elevation with the first area and laterally adjacent to the area.*

Alden discloses Claim 48[j]. (Papanikolopoulos Decl., ¶¶77-78.) First, in Alden the light emitted from the “first cluster” is different in “at least one emission characteristic” (e.g., intensity) from light emitted from a second cluster. (*Id.*, ¶77.) As discussed, Alden discloses (a) reducing light emitted from selected LEDs, which direct light to sectors determined to contain another vehicle (*i.e.*, “first cluster” of LEDs directing light to the “first area”), to dimmed, “low beam” intensity light, and (b) setting the light emitted from the LEDs, which direct light to sectors where no other vehicle is detected (*i.e.*, “second clusters” of LEDs directing light to “second areas”), on “high beam” intensity light:



(*Id.*, Fig. 5 (annotated), [0026]-[0029].) See also *supra* Claims 48[g]-[i].⁷

Second, Alden further discloses that the determined sectors where another vehicle is present (“first area”) and sectors where no other vehicles are present (“second area”) are at a “common elevation” and “laterally adjacent.” (Papanikolopoulos Decl., ¶78.) For example, as shown in Figure 5 above, Alden’s lighting elements each direct light into a “15 degree section of the headlight distribution area” on the same plane (“common elevation”) and next to one another

⁷ The “second light” can be additional intensities as well. Alden discloses that LEDs can be “a range of intensities between the high beam and the low beam state.” (Alden, [0061].)

(“laterally adjacent”). (Alden, Fig. 5, [0029].) As can also be seen above, where another vehicle is detected in, for example, a middle sector, that sector will be dimmed while light directed to the sectors at the same elevation and laterally adjacent to the middle zone will be switched to high beam intensity. (*Id.*, Fig. 5, [0027]-[0029]; *see also* [0025]-[0026], Figs. 1-2 (depicting common elevation, laterally-adjacent sectors of light with differing illumination based on whether another vehicle is present).)

2. Independent Claim 56

Claim 56 is anticipated and rendered obvious by Alden. (Papanikolopoulos Decl., ¶¶79-88.)

56[pre]-56[h]

Claims 56[pre]-56[h] are nearly identical to claims 48[pre]-48[h]. *See* Appendix A. Therefore, Claims 56[pre]-56[h] are disclosed by Alden for the reasons above. *See supra* Claims 48[pre]-48[h].

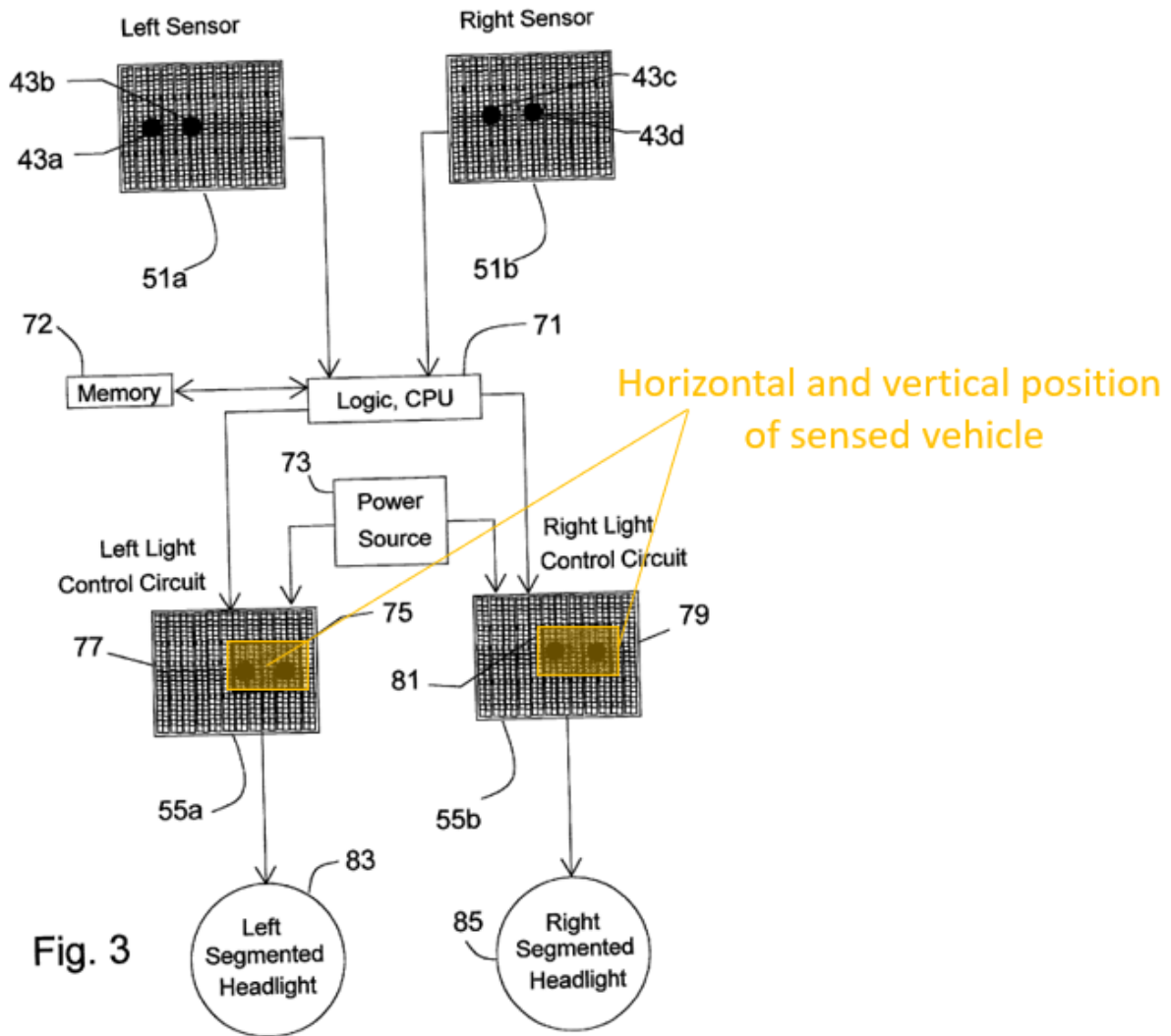
Claim 56[e] additionally recites one or more cameras “positioned to capture an image of at least one other vehicle ahead of the motor vehicle.” *See* Appendix A. This is disclosed by Alden. (Papanikolopoulos Decl., ¶81.) Alden includes a lens 49 that directs light to photodiode arrays or CCD detectors 51 (*i.e.*, “camera sensors”), which image lights of oncoming vehicles. (Alden, [0026]-[0028], Figs. 2-3.) This image data, collected from the photodiode arrays or CCD detectors 51,

is provided to the CPU 71 and stored in memory 72. (*Id.*) *See also supra* Claim 48[e].

For example, Alden discloses that when there is an oncoming vehicle in the area of the “equipped” vehicle, light from the oncoming vehicle “passes through [the] primary lens 49” in the sensor unit 45, converges, and “fall[s] upon one or more sectors [] within the detector array 51 where it is detected.” (Alden, [0026].) In particular, the sensors capture an image of the “two headlights” of an oncoming vehicle as “illuminated light spots,” which are stored as a “map of sensed light.” (*Id.*, [0027]-[0028], Figs. 3-4.)

56[i]:determine, based on data from one or more of the sensors, a vertical and horizontal position associated with the at least one other vehicle;

Alden discloses Claim 56[i]. (Papanikolopoulos Decl., ¶¶83-84.) Alden discloses determining a location and position of an oncoming vehicle based on data from sensors. *See supra* Claim 48[g]. Alden’s sensor unit 45 includes a photon detector array that detects photon intensity of objects in the area illuminated by the headlights. (Alden, [0026]-[0027], Fig. 3.) The photon detector array has both vertical and horizontal dimensions, as shown in Figure 3:



(*Id.*, Fig. 3 (annotated).)

With respect to Figure 4, Alden further discloses that CPU 71 “checks the status of each respective sector [] of the light sensors,” which each represent a vertical and horizontal position in the sensor array. (*Id.*, [0028].) The amount of light received by each sector of the left sensor is stored in the memory as a left map, while the amount of light received by each sector of the right sensor is stored as a right map. (*Id.*) These “maps” include vertical and horizontal positions of the

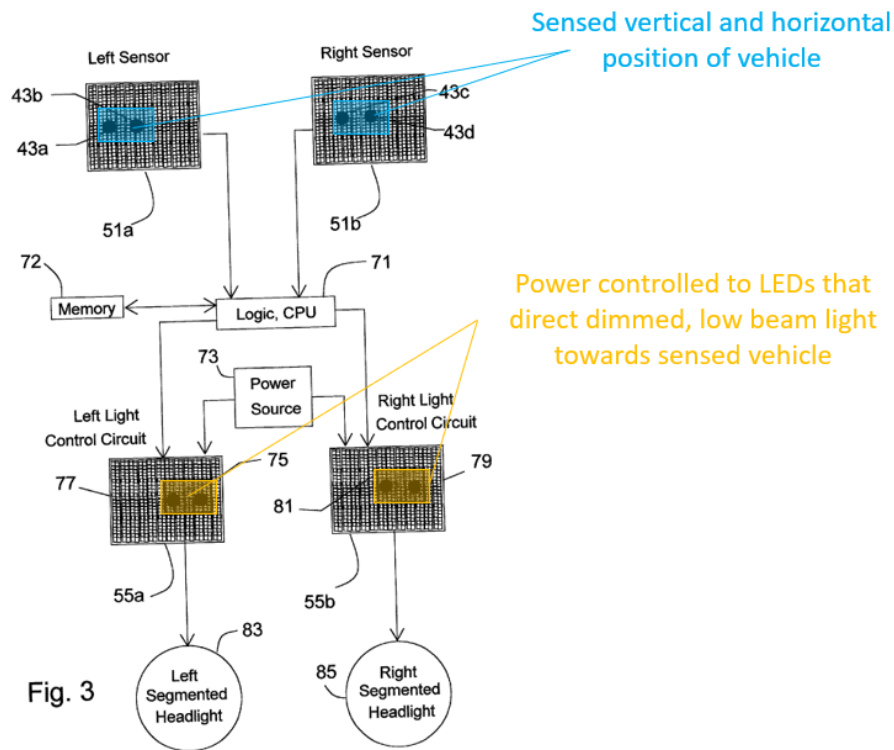
sensed light from the other vehicle, corresponding to the sensor sectors where light was detected. (*Id.*; *see also* Papanikolopoulos Decl., ¶84.) Alden’s CPU then compares the left map and right map to determine the position information of the sensed object, which again includes vertical and horizontal position. (Alden, [0027]-[0028].) Alden also discloses that the CPU further uses the position information in a triangulation process to determine distance of the sensed object. (*Id.*)

56[j]: select a first cluster of the LEDs based at least in part on at least one of the vertical and horizontal position compared to known aimings of light associated with the first cluster; and

Alden discloses Claim 56[j]. (Papanikolopoulos Decl., ¶¶85-86.) As discussed, Alden discloses determining the vertical and horizontal position of an oncoming vehicle, and using the determined vertical and horizontal position to determine a location and distance of the detected vehicle. (Alden, [0027]-[0028].) *See also supra* Claim 48[i], 56[i]. Alden further discloses that the location of the oncoming vehicle “is used to calculate which zones of each headlight” are to be switched to dim, low beam light and which are to be switched to high beam light. (Alden, [0028]; *see also* [0026]-0027], [0029].)

Additionally, Alden discloses that the “first cluster” of LEDs is selected based on the “known aimings” of the LEDs—that is, those LEDs that are aimed to direct light into the sector containing the sensed other vehicle are selected and set

to low, dim beam light. (Alden, [0029].) *See also supra* Claim 48[i]. As shown in, for example, Figure 3, the LEDs that direct light to the area of the sensed vehicle (“first cluster”) are selected based on the sensed vertical and horizontal position of the sensed vehicle, as the lighting elements that correspond to the location of the sensed vehicle are selected to produce dimmed, low beam light:



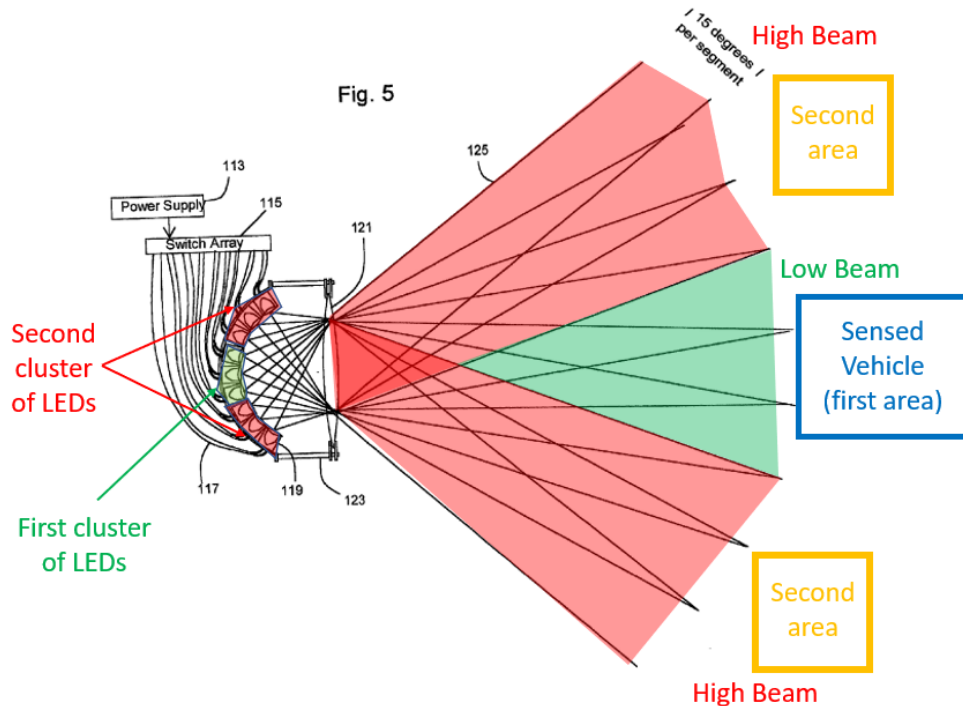
(*Id.*, Fig. 3 (annotated), [0027]-[[028].) Thus, in sum, lighting elements 119 are selected for the first cluster based on their known aimings directing light into sectors or zones that contain the sensed vertical and horizontal position of another vehicle. (Papanikolopoulos Decl., ¶86.)

56[k]: *reduce intensity of illumination to non-glaring illumination of a first area associated with the at least one other vehicle, relative to intensity of illumination*

on both sides of the first area at elevations common with the first area illuminated by a second cluster of the LEDs, by control of emission from the first cluster.

Alden discloses Claim 56[k]. (Papanikolopoulos Decl., ¶¶87-88.) As discussed, Alden discloses (a) reducing light emitted from the selected LEDs, which direct light to sectors containing an oncoming vehicle (*i.e.*, the “first cluster” of LEDs illuminating a “first area”), to be dim, “low beam” light, and (b) setting the light emitted from the LEDs directed towards sectors not containing another vehicle (*i.e.*, “second cluster” of LEDs) on “high beam.” *See supra* Claim 48[i]. In particular, Alden discloses that light directed towards sectors containing another vehicle is “dimmed in a dimming process,” so that “the light sent to the sensed vehicle location is dimmer than the light sent to all other areas of the headlight distribution area.” (*Id.*, [0028].) Alden discloses that, as a result, the “driver of 41 [oncoming vehicle] has ***minimum glare*** while the driver of 47 [equipped vehicle] has maximum light.” (Alden, [0027]; *see also* [0025]-[0026], [0029].)

Moreover, as discussed, the area illuminated in low beam is reduced in intensity relative to areas to either side, at a common elevation, that are illuminated in high beam light by a “second cluster” of LEDs controlled to be on high beam. *See supra* Claim 48[j].



(*Id.*, Fig. 5 (annotated).)

3. Dependent Claim 57

Alden anticipates and renders obvious Claim 57. (Papanikolopoulos Decl., ¶¶89-94.)

57[a]: *The illuminating device of claim 56, wherein: the data includes image data;*

Alden discloses Claim 57[a]. (Papanikolopoulos Decl., ¶90.) Alden’s “camera sensors” include a lens 49 that directs light to photodiode arrays or CCD detectors 51, which image lights of oncoming vehicles. (Alden, [0026]-[0028], Figs. 2-3.) The image data, collected from the photodiode arrays or CCD detectors 51 is provided to the CPU 71 and stored in memory 72. (*Id.*) Alden further discloses that “maps” of sensed light from the sensors are determined from the sensor data and stored in

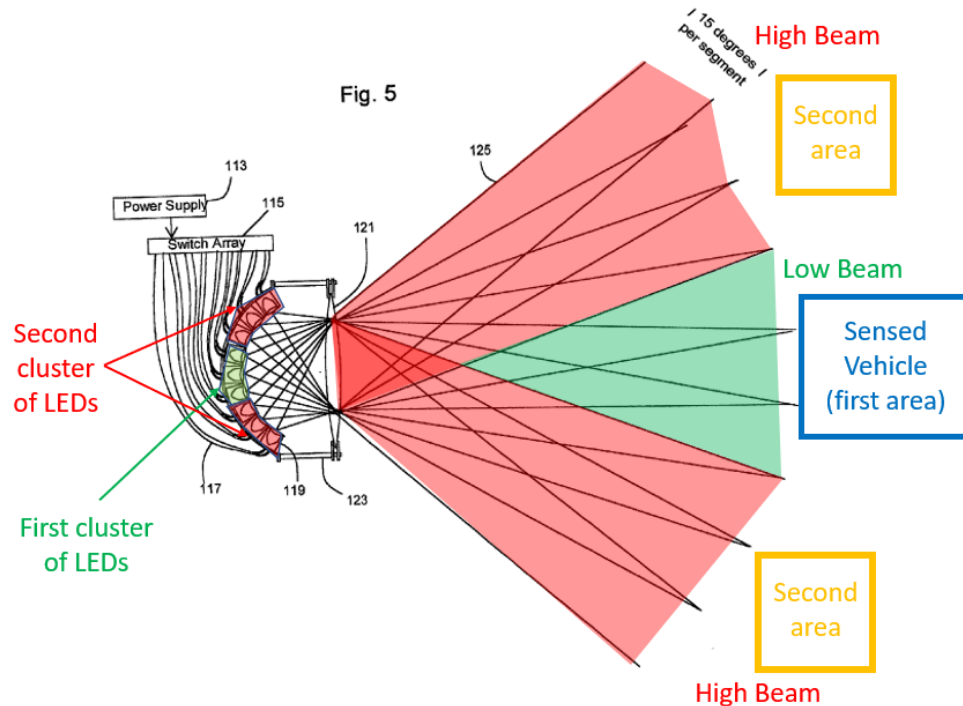
memory. (*Id.*, [0029], Fig. 4.) These “maps” are images of the detected light, including headlights of oncoming vehicles. *See also supra* Claim 48[e].

57[b]: *the control of emission of the first cluster includes a change of at least one of color or intensity or control of at least one LED of the first cluster into a non-emitting state;*

Alden discloses Claim 57[b]. (Papanikolopoulos Decl., ¶¶91.) Alden discloses that control of emission of the LEDs that direct light into sectors containing a detected other vehicle includes a change in “intensity” of illumination to a dimmed, low beam light. *See supra* Claim 56[k].

57[c]: *at least one of the first cluster or the second cluster includes a plurality of the LEDs and at least one of the first cluster or the second cluster includes non-contiguous LEDs;*

Alden discloses Claim 57[c]. (Papanikolopoulos Decl., ¶¶92-93.) Alden discloses that both the first cluster and the second cluster include a plurality of the LEDs. (Alden, [0029], Fig. 5.) *See supra* Claim 48[i]; *see also supra* 48[b]. Moreover, Alden discloses that at least the second cluster includes non-contiguous LEDs, as the “second cluster” of LEDs that direct high beam light to areas where there is no sensed vehicle are separated by the “first cluster” of LEDs that direct dimmed, low beam light towards the sensed vehicle:



(Alden, [0029], Fig. 5 (annotated); *see also* Papanikolopoulos Decl., ¶93.)

Additionally, Alden discloses that the overall headlight beam distribution is from both the left headlight and the right headlight. (*Id.*, [0027], Fig. 3.) Thus, a “first cluster” of low beam LEDs in both the left and right headlights would be “non-contiguous,” as the LEDs in each headlight are separated from each other. (*Id.*) The same is true for the “second cluster” of LEDs in both headlights that emit high beam light. (*Id.*) *See also* Papanikolopoulos Decl., ¶92.

57[d]: *the known light aimings associated with the first cluster is based at least in part on known directionality of light emitted by LEDs of the first cluster exiting from the at least one headlamp.*

Alden discloses Claim 57[d]. (Papanikolopoulos Decl., ¶94.) Alden discloses that the dimmed, low beam LEDs in the “first cluster” have known aimings based in

part on known directionality of light emitted by those LEDs exiting from the headlamp. (Alden, Fig. 5, [0029].) *See supra* Claim 48[i]. As explained, each LED is positioned along a curve in the headlamp and emits light from the headlamp into to a “specified” direction, and when Alden illuminates an area (such as one with an oncoming vehicle) with low beam light, it will select and adjust those LEDs that are aimed to direct light into that corresponding area where the vehicle is. *Id.*

4. Independent Claim 64

Alden anticipates and renders obvious Claim 64. (Papanikolopoulos Decl., ¶¶95-102.)

64[pre]-64[h]

Claims 64[pre]-64[h] are nearly identical to claims 48[pre]-48[h]. *See* Appendix A. Therefore, Claims 64[pre]-64[h] are disclosed by Alden for the reasons above. *See supra* Claims 48[pre]-48[h].

Claim 64[e] additionally requires one or more cameras “positioned to capture an image of another vehicle.” This is also disclosed by Alden, which discloses using camera sensors to image the lights of oncoming vehicles. *See supra* Claim 56[e].

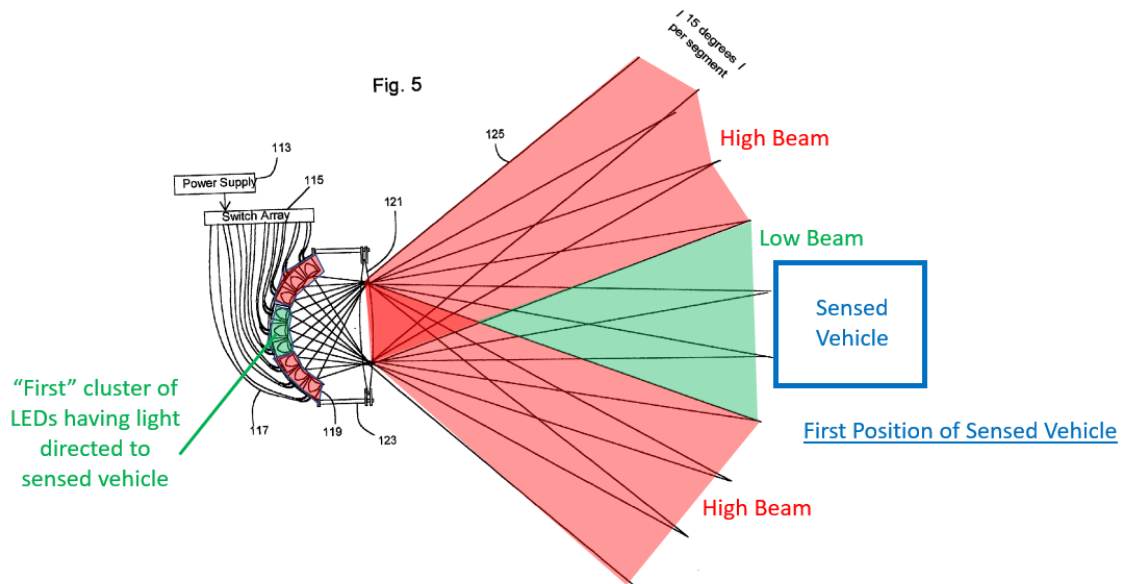
64[i]: select a first cluster of the LEDs having light associated therewith that is directed towards the other vehicle based at least in part on first data from one or more of the sensors indicating a first position associated with the other vehicle;

Alden discloses Claim 64[i]. (Papanikolopoulos Decl., ¶98.) Alden discloses selecting a “first cluster” of LEDs that direct dimmed, low beam light towards a

detected oncoming vehicle, based on data from the sensors that indicates the position of the detected vehicle. *See supra* Claims 48[g], 48[i]. In particular, the Alden system processes data from left and right light sensors indicating a first position (current location) of another vehicle using a “triangulation process” to calculate the distance to the detected other vehicle. (Alden, Fig. 4, [0027]-[0028].) The “location” of the sensed vehicle “is used to calculate which zones of each headlight need to be dimmed in a calculate headlight dim zones process 107,” and Alden’s system then selects a “first cluster” of LEDs that are “switched” to emit dimmed, low beam light towards the detected vehicle. (*Id.*)

64[j]: control a first change to one or more characteristics of the light associated with the first cluster of the LEDs that is directed towards the other vehicle, that diminishes glare to a driver of the other vehicle when the other vehicle is at the first position;

Alden discloses Claim 64[j]. (Papanikolopoulos Decl., ¶99.) Alden discloses reducing the intensity of the light emitted from the selected LEDs in a “dimming process” so that the driver of the oncoming vehicle has “minimum glare” when the sensed vehicle is at the first position. (Alden, [0027], *see also* [0026], [0028]-[0029].) As discussed, when Alden’s system detects an oncoming vehicle at a first position, it controls a “characteristic” of the light emitted from the first cluster of LEDs (*i.e.*, those directing light to sectors where the oncoming vehicle is located) by dimming the output of those LEDs to a “low beam” intensity, in order to diminish glare to the driver of the other vehicle:



(*Id.*, Fig. 5 (annotated), [0027] (noting that the lighting elements directing light to sectors with the oncoming vehicle are dimmed to low beam so “the driver of 41 [oncoming vehicle] has minimum glare.”); *see also* [0026], [0028]-[0029], Figs. 1-3.) *See also supra* Claims 48[g], 48[i]-48[j].

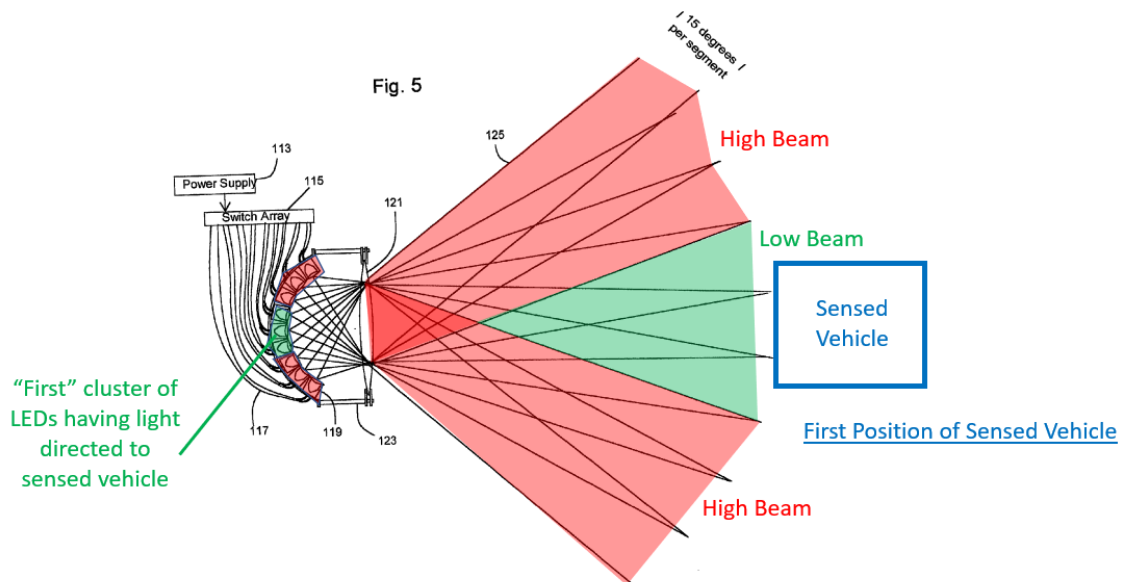
64[k]: *select a second, different cluster of the LEDs having light associated therewith that is directed towards the other vehicle based at least in part on second, subsequent data from one or more of the sensors indicating a second, subsequent position associated with the other vehicle; and*

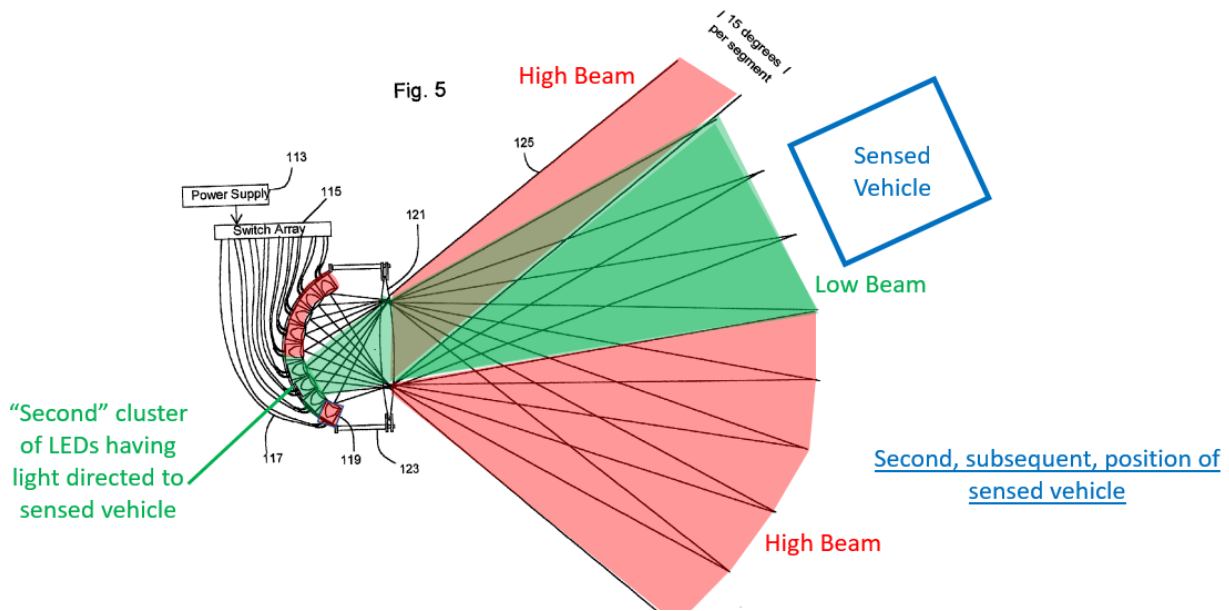
Alden discloses Claim 64[k]. (Papanikolopoulos Decl., ¶¶100-101.) Alden discloses continuously: collecting sensor data from left and right light sensors 51a-51b; calculating the position of a detected oncoming vehicle based on the sensor data; determining which portions or zones of the headlight distribution area are directed towards the detected vehicle; and determining control of the lighting

elements, so that lighting elements corresponding to the portions or zones where the detected vehicle is located are switched to dim, low beam light, while lighting elements corresponding to portions or zones with no detected vehicle are switched to high beam light. (Alden, [0027]-[0028] (noting that the result of the process is that “the light sent to the sensed vehicle location is dimmer than the light sent to all other areas of the headlight distribution area” and that the process “then *begins again* so as to be responsive to changing environmental conditions in *real time*.”).) *See supra* Claim 48[g]. That is, the determination of vehicle location and which lighting elements need to be switched to dim, low beam light and which need to be switched to high beam light is done continuously “in real time.” (Papanikolopoulos Decl., ¶100.)

Thus, Alden’s system will select a second, different cluster of LEDs having light associated therewith that is directed towards the other vehicle based on second, subsequent data from the sensors as the vehicles are moving, with the subsequent data indicating a second, subsequent position associated with the oncoming vehicle. (*Id.*, ¶101.) For example, if the detected other vehicle changes position over time, then the continuous, real-time process of Alden will continuously determine which sector of the headlight distribution area the vehicle is in. (Alden, [0028]; Papanikolopoulos Decl., ¶101.) As the vehicle changes position, the “cluster” of LEDs that distribute light to sectors of the headlight

distribution area where the vehicle is located will also change. (*Id.*, [0028]; *see also* [0026]-[0027], [0029].) Stated differently, if the detected vehicle position changes such that it moves from left to right in front of the equipped vehicle over time, then the group of LEDs selected as the “cluster” to provide dimmed, low beam light in the sector containing the detected vehicle will also change accordingly:





(*Id.*, Fig. 5 (annotated), [0027]-[0029]; *see also* Figs. 1-3.)

64[l]: *control a second, subsequent change, to one or more characteristics of the light that is subsequently directed towards the other vehicle, that diminishes glare to the driver of the other vehicle when the other vehicle is at the second position.*

Alden discloses Claim 64[l]. (Papanikolopoulos Decl., ¶102.) Alden discloses continuously adjusting the a characteristic of the light directed toward the sensed other vehicle, namely intensity, headlights in response to changing environmental conditions, such that the light directed towards the detected other vehicle is al. *See supra* Claim 48[g]. Thus, when a second cluster of LEDs are selected in response to the oncoming vehicle subsequently moving to a second position, Alden’s system will similarly control the intensity of the light emitted from the second cluster of LEDs to diminishes glare to the driver of the other vehicle. (Papanikolopoulos Decl., ¶102.) *See also supra* Claim 64[k].

5. Dependent Claim 65

Alden anticipates and renders obvious Claim 65. (Papanikolopoulos Decl., ¶¶103-107.)

65[a]: *The illuminating device of claim 64, wherein: the first data or second data includes image data;*

Claim 65[a] is substantially identical to Claim 57[a], which likewise recites “wherein: the data includes image data.” Claim 65[a] is thus disclosed by Alden for the reasons above. *See supra* Claim 57[a].

65[b]: *at least one of the first or second change to characteristics of light associated with at least one of the first or second cluster of LEDs includes at least one of a change to color, to intensity, or a change of at least one LED respective cluster to a non-emitting state;*

Alden discloses Claim 65[b]. (Papanikolopoulos Decl., ¶¶105.) Alden discloses that the changes to “characteristics” of the light associated with the LEDs directing light to the sensed other vehicle at the first position (“first cluster”) and subsequent second position (“second cluster”) include a change to intensity, as the LEDs are dimmed to low beam light. *See supra* Claims 57[b], 64[l].

65[c]: *at least one of the first cluster or the second cluster includes a plurality of the LEDs and at least one of the first cluster or the second cluster includes non-contiguous LEDs;*

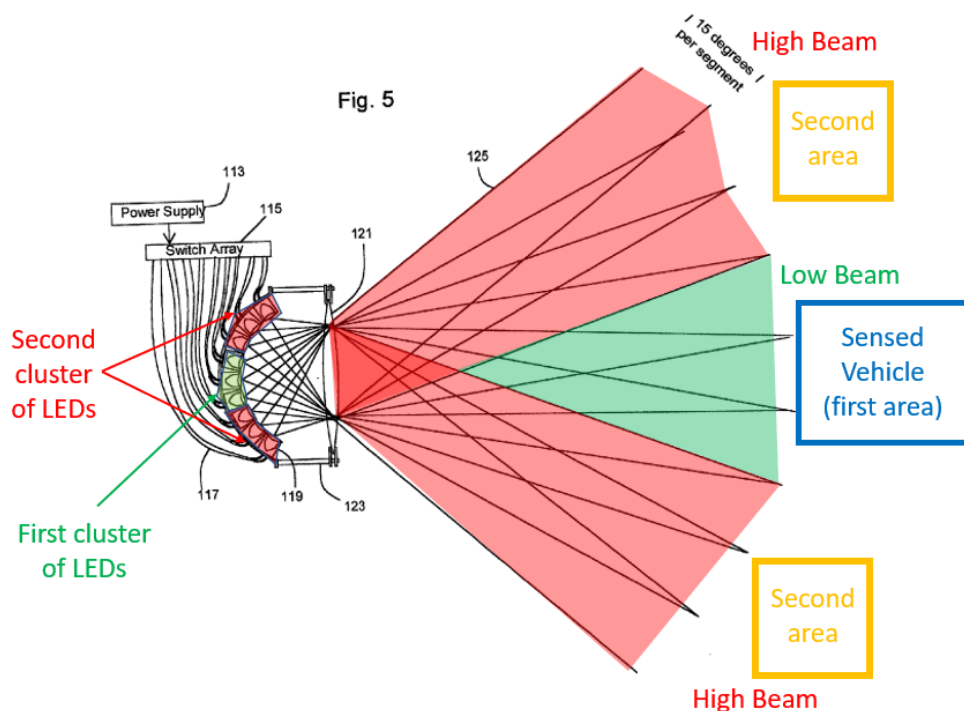
Claim 65[d] is substantially identical to Claim 57[c], which likewise recites “at least one of the first cluster or the second cluster includes a plurality of the LEDs and at least one of the first cluster or the second cluster includes non-

contiguous LEDs.” Claim 65[c] is thus disclosed by Alden for the reasons above.

See supra Claim 57[c].

65[d]: *the light that is directed or subsequently directed towards the other vehicle is determined based at least in part on known directionality of light emitted by the respective first or second cluster exiting the at least one headlamp.*

Claim 65[d] is substantially identical to Claim 57[d], and is disclosed by Alden. *See supra* Claim 57[d]. Again, Alden discloses that LEDs selected to illuminate the other vehicle are based on the “known directionality” of light emitted from those LEDs. In particular, Alden’s lighting elements 119 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” ahead of the vehicle:



(Alden, [0029], Fig. 5 (annotated).) Thus, each lighting element is directed to a “specified” area, and when Alden illuminates an area (such as one with an oncoming vehicle) with low beam light, it will individually select and adjust those LEDs that are directing light into that corresponding area where the vehicle is. (Papanikolopoulos Decl., ¶107.)

6. Independent Claim 72

Alden anticipates and renders obvious Claim 72. (Papanikolopoulos Decl., ¶¶108-115.)

72[pre]-72[h]

Claims 72[pre]-72[h] are identical to Claims 48[pre]-48[h]. *See* Appendix A. Therefore, Claims 72[pre]-72[h] are disclosed by Alden for the reasons above. *See supra* Claims 48[pre]-48[h].

72[i]: determine a target based on first data from one or more of the sensors;

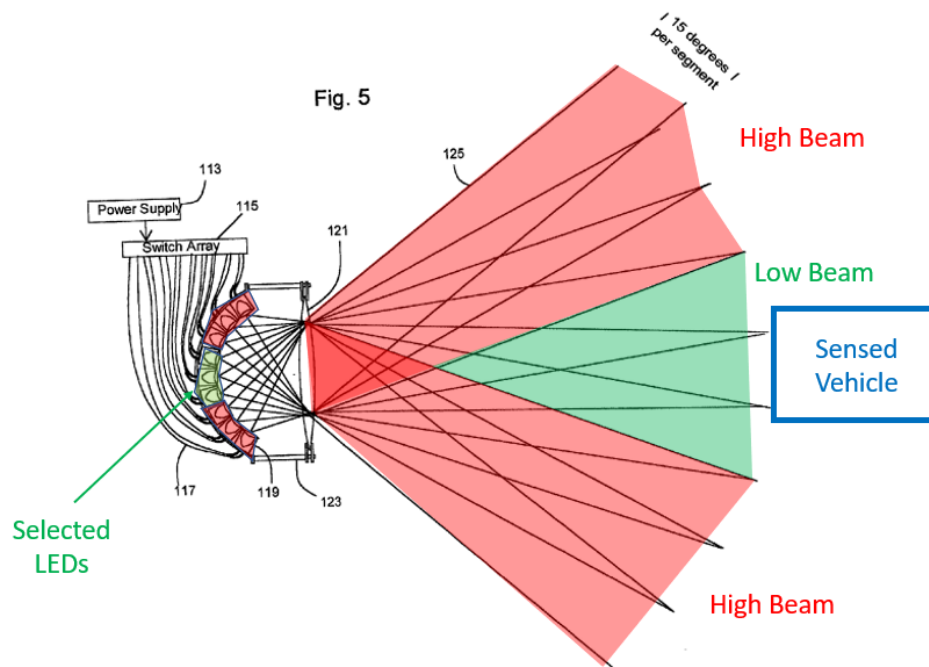
Alden discloses Claim 72[i]. (Papanikolopoulos Decl., ¶110.) Alden discloses determining a target, such as an oncoming vehicle, based on data from sensors. *See supra* Claims 48[g], 64[i].

72[j]: determine a first target location based on the first data;

Alden discloses Claim 72[j]. (Papanikolopoulos Decl., ¶111.) Alden discloses determining a first location of the sensed object based on first sensor data from the left and right light sensors. *See supra* Claim 64[i].

72[k]: *select a cluster of the LEDs having light associated therewith that is directed at the target, determined based on the first target location; and*

Alden discloses Claim 72[k]. (Papanikolopoulos Decl., ¶112.) Alden discloses selecting a cluster of LEDs that direct light towards the sensed other vehicle (“target”) based on its location:



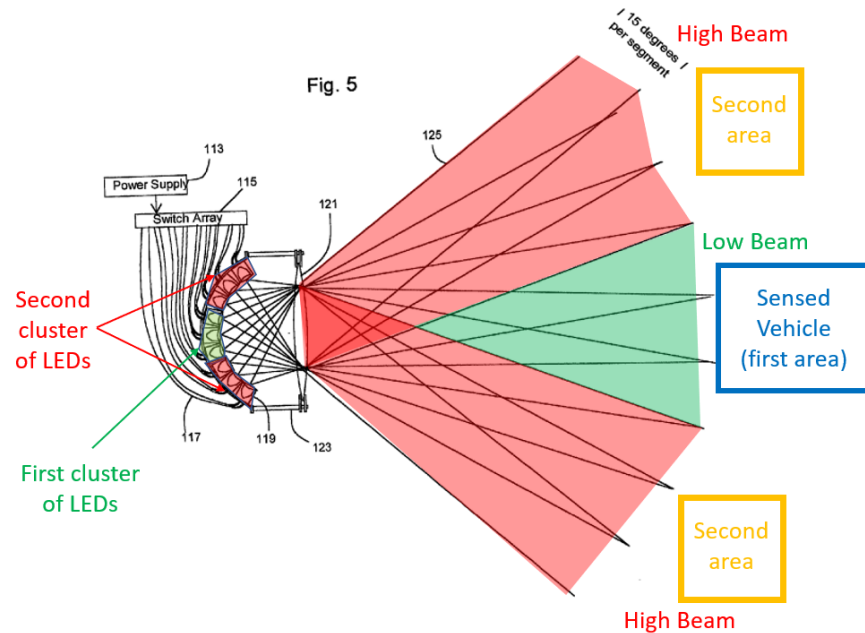
(*Id.*, Fig. 5 (annotated).) See also *supra* Claim 64[i].

72[l]: *vary illumination provided to the target by the selected cluster, relative to illumination provided to areas laterally adjacent to the target and provided by at least one LED different from LEDs in the selected cluster; and*

Alden discloses Claim 72[l]. (Papanikolopoulos Decl., ¶¶113-114.) Alden discloses varying the illumination provided to the sensed other vehicle (“target”) by reducing light emitted from the selected LEDs to dimmed “low beam” light and

switching the light emitted from LEDs directed to areas with no other vehicle present to “high beam.” (Alden, [0026]-[0029].) *See also supra* Claims 48[j], 64[j].

As also discussed above, when the sensed object is an oncoming vehicle, the illumination in sectors of the headlight distribution area directed towards the oncoming vehicle is varied, or dimmed, relative to light illumination in laterally adjacent sectors, which are illuminated with other LEDs switched to “high” beam intensity light. *See supra* Claim 48[j].



(Alden., Fig. 5 (annotated).)

72[m]: *maintain a variance of illumination provided to the target relative to the laterally adjacent areas, when subsequent data from one or more of the cameras indicates a change in position of the target relative to the motor vehicle, by repeating the determination of target location, selection of the cluster and*

variance to illumination provided to the target, relative to the laterally adjacent areas, based on the subsequent data.

Alden discloses Claim 72[m]. (Papanikolopoulos Decl., ¶115.) As discussed, Alden discloses continuously collecting sensed data, calculating the position of the oncoming vehicle based on new data and determining which portions of the headlights need to be dimmed or switched based on the new calculations, and adjusting the headlights accordingly, so that the headlight system is responsive to changing environmental conditions in real time. *See supra* Claims 64[k]-[l]. As also discussed, this includes continuously selecting “clusters” of LEDs that direct light to the sectors (or zones) where the target, or oncoming vehicle, is present, and dimming the light directed to these sectors relative to laterally adjacent sectors that are switched to high beam. *See supra* Claims 48[j], 56[k], 72[l]. As a result, a variance of illumination provided to the target relative to laterally-adjacent areas is maintained, such that the illumination from the LEDs in the headlamp vary in illumination as the oncoming vehicle moves across the field-of-view.

(Papanikolopoulos Decl., ¶115.)

7. Dependent Claim 73

Alden anticipates and renders obvious Claim 73. (Papanikolopoulos Decl., ¶¶116-120.)

73[a]: *The illuminating device of claim 72, wherein the variation of illumination provided to the target includes variation in at least one of color or intensity or at least a change of at least one LED of the selected cluster to a non-emitting state;*

Claim 73[a] is substantially identical to Claim 57[b] and is thus disclosed by Alden. *See supra* Claim 57[b]. Again, Alden discloses varying (or changing) intensity of illumination provided to areas where there is a detected other vehicle by dimming light directed to those areas to a “low beam” intensity light. *Id.*

73[b]: *the cluster includes a plurality of the LEDs and the cluster includes non-contiguous LEDs;*

Claim 73[b] is substantially identical to Claim 57[c], which similarly recites “at least one of the first cluster or the second cluster includes a plurality of the LEDs and at least one of the first cluster or the second cluster includes non-contiguous LEDs.” Claim 73[b] is thus disclosed by Alden for the reasons above. *See supra* Claim 57[c].

73[c]: *the light directed at the target is determined based at least in part on known directionality of light emitted by the first cluster exiting from the at least one headlamp; and*

Claim 73[c] is substantially identical to Claim 65[d] and is thus disclosed by Alden for the reasons above. *See supra* Claim 65[d].

73[d]: *at least one of the first data or the subsequent data includes image data.*

Claim 73[d] is substantially identical to Claim 57[a], which similarly recites “wherein: the data includes image data.” Claim 73[d] is thus disclosed by Alden for the reasons above. *See supra* Claim 57[a].

8. Independent Claim 80

Alden anticipates and renders obvious Claim 80. (Papanikolopoulos Decl., ¶¶121-125.)

80[pre]-80[h]

Claims 80[pre]-80[h] are nearly identical to claims 48[pre]-48[h]. *See* Appendix A. Therefore, Claims 80[pre]-80[h] are disclosed by Alden for the reasons above. *See supra* Claims 48[pre]-48[h].

Claim 80[e] additionally requires one or more cameras “positioned to capture camera data indicating a target ahead of the motor vehicle.” This is disclosed in Alden, which teaches that the camera-sensors capture data indicating a target, such as an oncoming vehicle, ahead of the equipped vehicle. *See supra* Claim 56[e].

80[i]: identify, based on data received from one or more of the sensors, a plurality of positions associated with the target as the target moves relative to the motor vehicle; and

Alden discloses Claim 80[i]. (Papanikolopoulos Decl., ¶124.) As discussed, Alden discloses *continuously* collecting sensed data, calculating positions of the target, such as an oncoming vehicle, based on sensor data, and determining which portions of the headlights need to be dimmed based on the calculated positions, and adjusting the headlights accordingly, so that the headlight system is responsive to changing environmental conditions in real-time. *See supra* Claims 48[g], 64[k]-

[l]. That is, as an oncoming vehicle changes position relative to a vehicle equipped with Alden’s system, the equipped vehicle identifies a plurality of positions associated with the oncoming vehicle over time as the relative positions of the equipped and oncoming vehicle change. (*Id.*; *see also* Papanikolopoulos Decl., ¶124.)

80[j]: *change, responsive to the positions associated with the target, first light associated with one or more LEDs aimed toward at least a portion of the target, relative to second light associated with other one or more of the LEDs aimed laterally adjacent the target on either side, as the target moves relative to the motor vehicle.*

Alden discloses Claim 80[j]. (Papanikolopoulos Decl., ¶125.) As discussed, Alden discloses when the sensed object is an oncoming vehicle, selecting LEDs that are directed towards the space occupied by the sensed vehicle, and reducing light emitted from the selected LEDs (*i.e.*, “first light”) to “low beam.” *See supra* Claims 48[g], 64[l], 72[m].

9. Dependent Claim 81

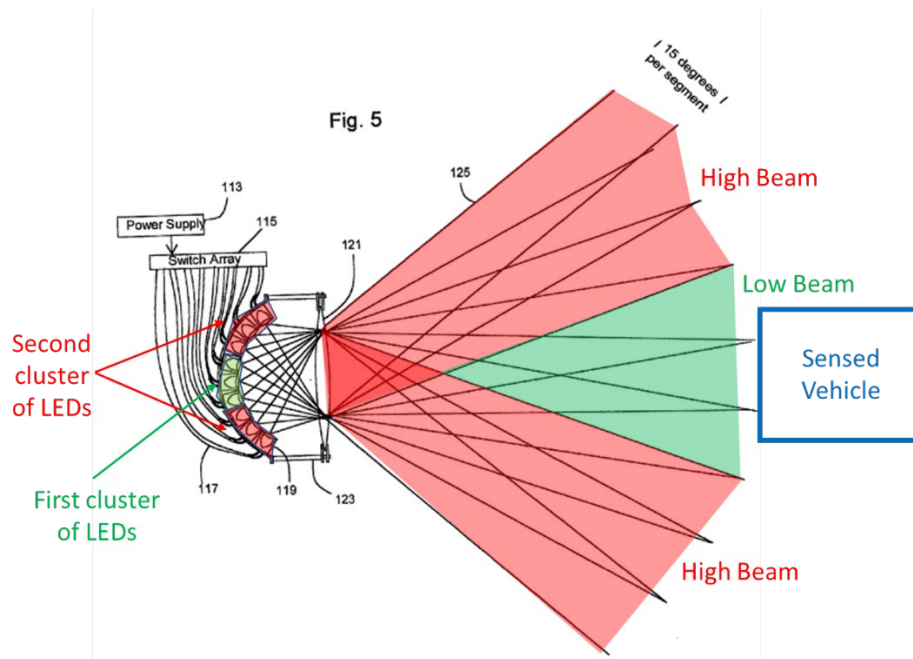
Alden anticipates and renders obvious Claim 81. (Papanikolopoulos Decl., ¶¶126-129.)

81[a]: *The illuminating device of claim 80, wherein the data includes image data;*

Claim 81[a] is substantially identical to Claim 57[a], which likewise recites “wherein: the data includes image data.” Claim 81[a] is thus disclosed by Alden for the reasons above. *See supra* Claim 57[a].

81[b]: the memory further stores instructions that, when executed by one or more processors of the controller, enable the controller to select a first cluster of LEDs, associated with the first light, for the change, based at least in part on known aimings of the first light associated with the first cluster having a correlation to the at least the portion, the known aimings based at least in part on at least one of known directionality of light emitted by the first cluster or known directionality of light emitted by the first cluster exiting the headlamp; and

Alden discloses Claim 81[b]. (Papanikolopoulos Decl., ¶128.) As discussed, Alden discloses a CPU that executes logic instructions stored in memory for selecting the LEDs to be dimmed. (Alden, [0029] (“Each lighting element being independently controlled by a corresponding switch in an array of switches 115. Each switch is controlled by the CPU and logic previously described.”); *see also* [0027]-[0028].) In particular, the controller uses this to select the LEDs to dim based on the known aimings of each LED, and the known aimings of each LED is based on the known directionality of light emitted from the LED, as shown below in Figure 5:



(*Id.*, Fig. 5 (annotated), [0029] (stating that the “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.”).) *See also supra* Claim 57[d].

81[c]: *the change to emission of one or more LEDs aimed towards the at least the portion includes a change to intensity or color or a change of at least one of the LEDs to a non-emitting state.*

Claim 81[c] is substantially identical to Claim 57[b], which similarly recites “the control of emission of the first cluster includes a change of at least one of color or intensity or control of at least one LED of the first cluster into a non-emitting state.” Claim 81[c] is thus disclosed by Alden for the reasons above. *See supra* Claim 57[b].

10. Dependent Claims 50/58/66/74/82

Alden anticipates or renders obvious Claims 50/58/66/74/82.

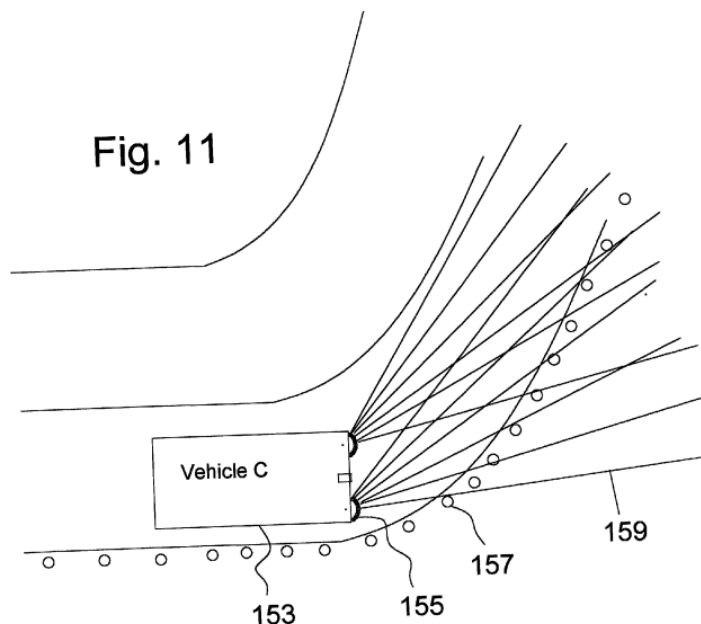
(Papanikolopoulos Decl., ¶¶130-134.)

[50/58/66/74/82]a: *The illuminating device of claim [48/56/64/72/80], wherein the memory further stores instructions that when executed by one or more processors of the controller, enable the controller to:*

Alden discloses Claim [50/58/66/74/82]a. *See supra* Claims 48[g]-[h].

[50/58/66/74/82]b: *identify an upcoming road curvature along a road on which the motor vehicle is traveling; and*

Alden discloses Claim [50/58/66/74/82]b. (Papanikolopoulos Decl., ¶¶132-133.) Alden discloses that “the present invention,” namely its segmented headlight system, can be used to “concentrate light to look around corners in response to road conditions”:



(Alden, [0036], Fig. 11.) As shown, Alden discloses that a vehicle with the “segmented sensing elements and segmented light distribution elements described herein” can “*sense[] that the road turns* by receiving light from reflectors such as a reflector 157.” (*Id.*, [0036].) That is, Alden identifies an upcoming road curve by sensing the location and position of reflectors positioned along the curve. (*Id.*) Alden’s “sensing elements” include left and right sensors to detect such light and a CPU to process this data and instruct the control circuitry and LEDs accordingly. (Alden, Figs. 3-5, [0027]-[0029].) This data is, in particular, used by the CPU and control circuitry to adjust the LEDs “responding headlights 155” (such as, for example, those shown in Figure 5 pointed in the direction of the reflectors) so that they “direct light into the corner to maximize the driver’s ability to see there.” (*Id.*, [0036], [0026]-[0029]; Papanikolopoulos Decl., ¶132.) *See also supra* Claim 48[c], 48[g].

Additionally, Alden discloses that its system can include a “rotation sensor” in the steering wheel that can further detect when a vehicle is planning to turn. (Alden, [0039]-[0040], Figs. 14-15.) As the steering wheel “rotates ‘x’ degrees,” the system calculates the new planned direction of the vehicle and “changes the direction of the headlight output 197 a corresponding ‘f(x)’ degrees.” (*Id.*) Thus, when a driver turns her steering wheel before moving, in anticipation of an

upcoming turn, Alden’s system “increases illumination illuminating the turn.”

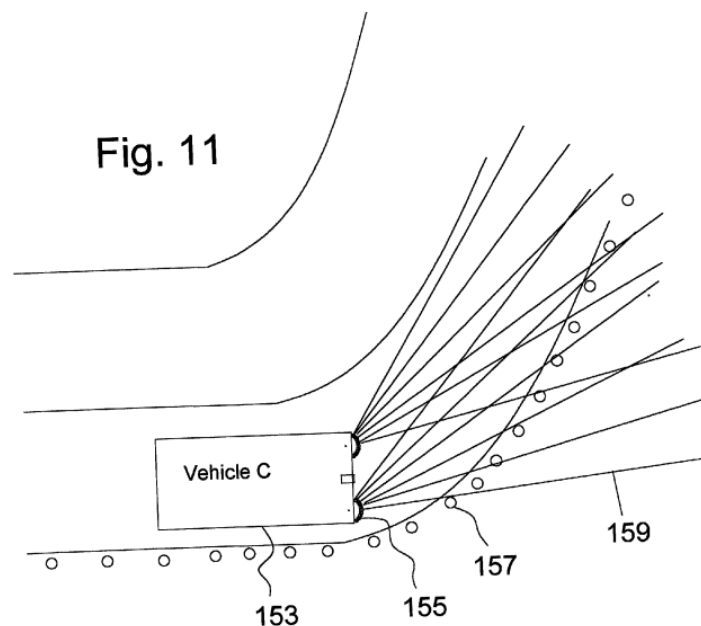
(Papanikolopoulos Decl., ¶133.)

[50/58/66/74/82]c: accommodate the upcoming road curvature by adaptation of a light pattern of at least one of the at least one headlamps.

Alden discloses Claim [50/58/66/74/82]c. (Papanikolopoulos Decl., ¶134.)

Again, Alden discloses that its segmented headlight system can be used to

“concentrate light to look around corners in response to road conditions”:



(Alden, [0036], Fig. 11.) Alden does this by adapting the light pattern of the headlights to “direct light into the corner to maximize the driver’s ability to see there.” (*Id.*, [0036], [0026]-[0029]; Papanikolopoulos Decl., ¶134.) *See also supra* Claim 48[g]. Alden further discloses that “the directing of light can be achieved with the segmented sensing elements and segmented light distribution elements described therein.” (*Id.*, [0036], [0026]-[0029].) As discussed, this includes

determining a control strategy to adapt the light output of the lighting elements, such that high intensity light is directed to segments intended to illuminate the turn. (*Id.*, [0027]-[0029], [0036]; *see also* [0039]-[0040] (discussing controlling direction of the headlight beam based on senses steering wheel angle.) *See also supra* 48[g]. By directing light into the corner, or curve of the road, to maximize the driver's ability to see there, the system is increasing illumination in the direction of the curve. (Papanikolopoulos Decl., ¶134.) This directing of light into the corner, as shown in Figure 11 above, is an adaption of the light pattern of the headlamps. (*Id.*)

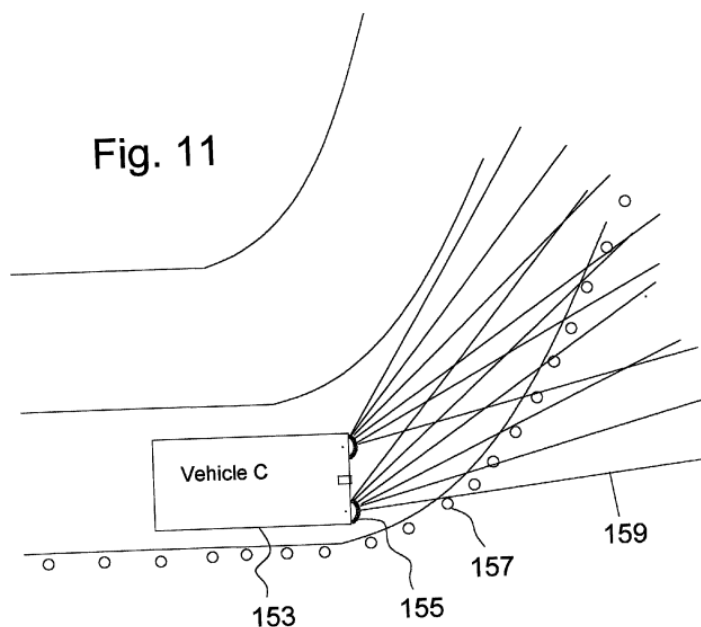
11. Dependent Claims 51/59/67/75/83

Alden anticipates and renders obvious Claims 51/59/67/75/83. (Papanikolopoulos Decl., ¶135.) Claims 51, 59, 67, 75, and 83 are substantially identical to Claims 49, 57, 65, 73, and 81, respectively, except that each additionally recites that “the memory further stores instructions that, when executed by one or more processors of the controller, enable the controller to accommodate the road curvature by changing illumination in at least a direction of the road curvature by adaptation of light pattern in at least one of color, intensity or spatial distribution by modification of light associated with one or more of the LEDs.” *See* Appendix B. Thus, the claims are anticipated and rendered obvious by Alden for the reasons given above for the common elements. *See supra* Claims 49,

57, 65, 73 and 81. Moreover, Alden discloses the additional limitation, as detailed below:

51g/59d/67d/75d/83c: The illuminating device of claim [50/58/66/74/82] wherein... the memory further stores instructions that, when executed by one or more processors of the controller, enable the controller to accommodate the road curvature by changing illumination in at least a direction of the road curvature by adaptation of light pattern in at least one of color, intensity or spatial distribution by modification of light associated with one or more of the LEDs.

Alden discloses Claim 51g/59d/67d/75d/83c. (Papanikolopoulos Decl., ¶136.) Alden discloses that its system, including the processor executing stored instructions, accommodate road curvature by adapting the light pattern in intensity to “concentrate light to look around corners in response to road conditions”:



(Alden, [0036], Fig. 11.) Alden does this by adapting the light pattern of the headlights to “direct light into the corner to maximize the driver’s ability to see there.” (*Id.*, [0036], [0026]-[0029], Fig. 11 *see also* [0039]-[0040] (discussing

controlling direction of the headlight beam based on senses steering wheel angle).

See also supra Claims 50/58/66/74/82.

12. Dependent Claims 53/61/69/77/85

The illuminating device of claim [50/58/66/74/82], wherein the identification of the upcoming road curvature is based at least in part on sensor data provided by one or more of the sensors of the vehicle and wherein the adaptation of the light pattern is based at least in part on the sensor data.

Alden anticipates and renders obvious Claim [53/61/69/77/85].

(Papanikolopoulos Decl., ¶¶137-138.) *See supra* Claims 50/58/66/74/82. As

discussed, Alden's system can sense when a road curves in front of a vehicle based on sensor data detecting reflectors 157 along the road. (Alden, [0036], Fig. 11.)

Alden further discloses adapting the emitted light pattern from the headlights based on the sensor data to increase the illumination illuminating the turn, by directing light "into the corner to maximize the driver's ability to see there." (*Id.*)

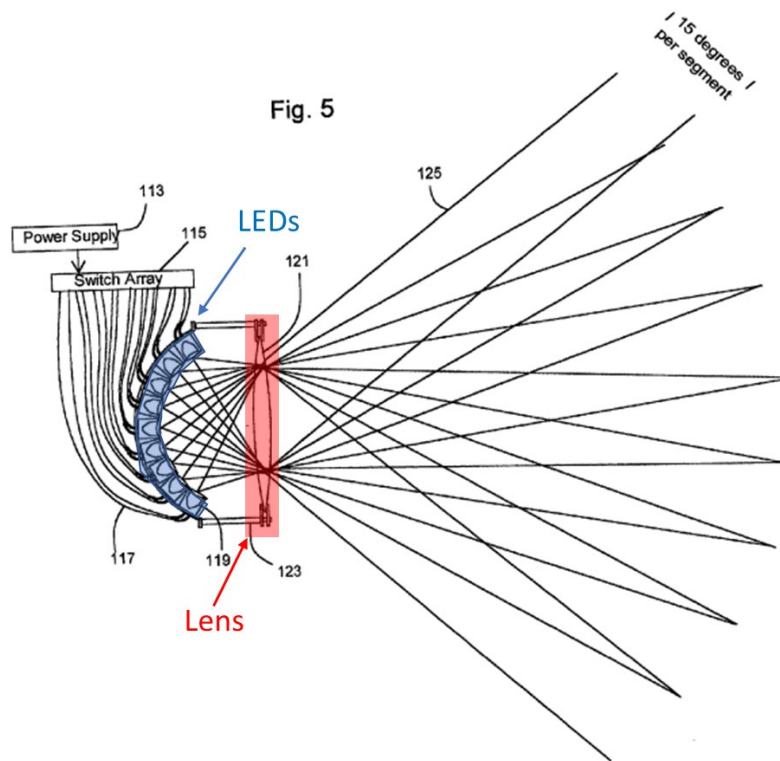
Additionally, Alden discloses that its system can include a "rotation sensor" in the steering wheel that can further detect when a vehicle is approaching an upcoming road curve. (Alden, [0039]-[0040], Figs. 14-15.) As the steering wheel "rotates 'x' degrees," the system calculates the new planned direction of the vehicle and "changes the direction of the headlight output 197 a corresponding 'f(x)' degrees." (*Id.*) Thus, when a driver turns her steering wheel before moving, in anticipation of an upcoming curve, Alden's system adapts the light pattern to illuminate the curve. (Papanikolopoulos Decl., ¶138.)

**13. Dependent Claims 54/62/70/78/86 and
Dependent Claims 55/63/71/79/87**

[54/62/70/78/86]: *The illuminating device of claim [48/56/64/72/80], further including one or more optical control elements to control light emitted from one or more of the LEDs.*

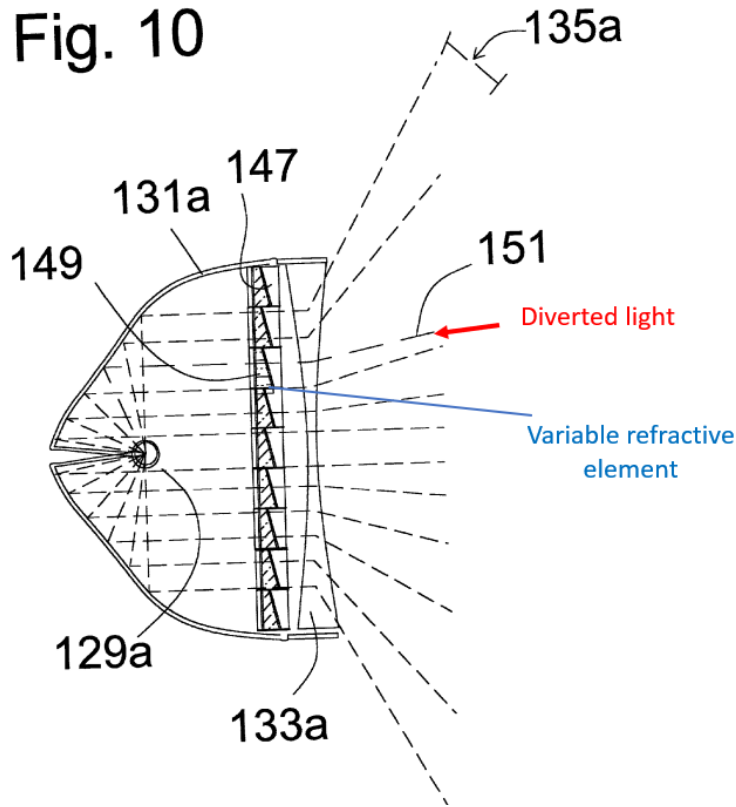
[55/63/71/79/87]: *The illuminating device of claim [54/62/70/78/86], wherein the optical control elements include at least one of one or more reflectors, refractors or lenses.*

Alden anticipates and renders obvious Claim [54/62/70/78/86] and Claim [55/63/71/79/87]. (Papanikolopoulos Decl., ¶¶139-142.) As shown in Figure 5 of Alden (below), each headlamp comprises of an array of lighting elements, *e.g.*, LEDs. (Alden, [0029], Fig. 5.) Alden further discloses that these 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.*, [0029].) Thus, Alden discloses the illuminating device further includes an “optical control element” to control light emitted from one or more of the LEDs, such as the headlight “lens 121.”



(*Id.*, Fig. 5 (annotated).)

In addition, Alden’s system can include other “optical control elements,” including a “variable refractive element” in the form of a liquid crystal. (*Id.*, [0033]-[0035], [0061], Figs. 8-10.) This refractor “enables light from an individual headlight distribution sector to be redirected in response to sensed environmental conditions when used in conjunction with the elements and processes previously discussed herein.” (*Id.*)



(*Id.*, Fig. 10 (annotated).) The liquid crystal has a first refractive state when a circuit is open, such that light passes straight through, without bending. (*Id.*, Fig. 8, [0033].) The liquid crystal then has a second refractive state when the circuit is closed, causing the “light to bend due to refraction after passing through.” (*Id.*, Fig. 9, [0033].) By selectively closing the circuit, light for a particular sector can be “bent” to redirect the light to a different area.

Alden discloses that its use of refractive elements to “bend” light can be included in its headlight system, such as that of Figure 5, and a POSITA would have readily understood how to implement the variable refractive elements in such system. (Papanikolopoulos Decl., ¶142.) In fact, Alden expressly discloses that

“[o]ne or more methods employed herein *may be used in combination* to vary illumination *in a segmented system*.” (Alden, [0061].) Thus, this would be the use of a known optical element (liquid crystal) in a system having different light distribution sectors that Alden describes the liquid crystal as acting upon. (Papanikolopoulos Decl., ¶142.) Moreover, a POSITA would have a reasonable expectation of success, as the refractor would perform its same function of allowing light to pass straight through when a circuit is open and bending light when the circuit is closed. And a POSITA would have been motivated to add this refractor, such as to the system in Figure 5, so as to provide an additional means of modifying the direction or intensity of individual lighting sectors, including bending the light output in certain desired portions, allowing more variable control of lighting of subsections of a headlight beam. (*Id.*) For example, as disclosed in Alden, the inclusion of variable refractor elements in the path of different beam segments allows for greater control of the light, including allowing a user to “divert” light from one section to become low beam light in areas where a vehicle is sensed. (Alden, [0035].) In addition, including the refractor would allow for more controlled bending or directing of certain light segments into road curves, as shown in Figure 11. (*Id.*, Fig. 11; *see also* Figs. 14-15, [0039]-[0040].)

B. Ground 2 – Alden (Alone or as Modified by Stam) in View of Beam Renders Obvious Claim 49

1. Dependent Claim 49

Alden, alone or in combination with WO2001070538 (“**Stam**”)⁸ (EX1008), in view of US6144158 (“**Beam**”) (EX1007)⁹ renders obvious Claim 49. (Papanikolopoulos Decl., ¶¶143-157.)

49[a]: *The illuminating device of claim 48, wherein: the data includes image data;*

Alden discloses Claim 49[a]. (Papanikolopoulos Decl., ¶144.) Alden discloses that its “camera sensors” include a lens 49 that directs light to photodiode arrays or CCD detectors 51, which image lights of oncoming vehicles. (Alden, [0026]-[0028], Figs. 2-3.) *See also supra* Claim 57[a].

49[b]: *the memory further stores instructions that, when executed by one or more processors of the controller, enable the controller to illuminate the at least the portion with light below at least a predefined glare level;*

Alden discloses Claim 49[b]. (Papanikolopoulos Decl., ¶¶145-149.) Alden discloses that memory stores instructions which are executed by logic CPU 71, and that CPU 71 causes the LEDs to be controlled, so as to illuminate the portions of the headlight distribution area containing a detected vehicle in dimmed, low beam light. *See supra* Claims 48[i]-[j]. Alden’s adaptive headlight beam provides different illumination levels in different sectors to reduce glare where another

⁸ Stam published September 27, 2001, and is prior art under at least § 102(a).

⁹ Beam was issued November 7, 2000, and is prior art under at least § 102(b).

vehicle is present, while switching other sectors to “high beam.”

(Papanikolopoulos Decl., ¶145.) Alden describes that “[t]he location of objects is used to calculate which zones of each headlight need to be dimmed in a calculate headlight dim zones process 107. Signals are sent to each of the headlight control circuit zones that need to be dimmed to restrict the amount of current to the corresponding headlight zones such that they are dimmed in a dimming process 109. Zones which are not dimmed remain on high beam. Thus the light sent to the sensed vehicle location is dimmer than the light sent to all other areas of the headlight distribution area.” (*Id.*, [0028], Fig. 4; *see also* [0026]-[0027], [0029], Fig. 5.) Alden discloses that this reduces glare: “the driver of [oncoming vehicle] 41 has minimum glare while the driver of [vehicle] 47 has maximum light.” (Alden, [0027]; *see also* Abstract, [0005], [0026].)

With respect to illuminance being below a “predefined glare level,”¹⁰ a POSITA would have understood that for low beam to have “minimum glare” as disclosed in Alden, the low beam’s intensity would need to be below a particular threshold—*e.g.*, below a level such that the “driver of 41 sees only a dim or low beam light from 47.” (Alden, [0026]-[0027], Figs. 1-2; Papanikolopoulos Decl., ¶146.) High beam light would be above this threshold, so that, as Alden teaches, visibility in high beam areas is maximized. (Papanikolopoulos Decl., ¶146; Alden

¹⁰ The ’551 does not use this phrase outside of the claims.

[0026]-[0027].) Further, Alden’s system can “provide illumination to independently controlled segments each operable within a range of intensities between the high and the low beam state.” (Alden, [0061].) That is, Alden’s system can operate not only at high beam and low beam but also at intensities in between, *e.g.*, medium low, medium, medium high. (Papanikolopoulos Decl., ¶146.) The “dimmed, low beam state” is a selected intensity at the low end of this range and thus below a predefined glare level that Alden characterizes as “minimizing glare” to other drivers. (Alden, [0026]-[0027]; Papanikolopoulos Decl., ¶146.)

Moreover, Alden in view of Stam renders Claim 49[b] obvious with respect to the “predefined glare level” element. (Papanikolopoulos Decl., ¶147.) Stam similarly discloses vehicles with headlamps that can be controlled to change brightness and beam patterns based on objects, so as to “maximize the illuminated area in front of the vehicle without causing excessive glare in the eyes of other drivers.” (Stam, Abstract, 2:28-5:23, 9:8-10:19, 10:20-25.) Stam further discloses that predefined threshold values can be considered in setting the illuminance of low and high beams, and that governments have laws limiting the intensity of vehicle headlamps, including to control the amount of glare experienced by drivers of other vehicles. (*Id.*, 1:16-2:5) Stam gives an example of limiting headlight illuminance to below a threshold of “0.1 foot candles (fc)” incident on other vehicles, to avoid causing glare and to comply with regulations, and notes that

when no other vehicles are present, the lights can be on high beam above this predefined threshold. (*Id.*)

It would have been obvious to use such a predefined glare level, such as 0.1 foot candles, in the system of Alden. (Papanikolopoulos Decl., ¶148.) This would have required nothing more than setting a predetermined illuminance level to “control the amount of glare experienced by drivers” as taught by Stam. (*Id.*) A POSITA would have also had a reasonable expectation of success and been motivated to use such a predetermined value as taught by Stam, since Alden and Stam are in the same field, Alden already contemplates using a range of intensities and desires to minimize glare, and using a predefined level as taught by Stam would be an easy, known way to ensure the appropriate light levels are being used at all times. (*Id.*) In particular, the controllers would be able to apply appropriate power to the lighting elements for sectors of the headlight distribution area where other vehicles are present with “low beam” light that would not cause glare, while powering lighting elements illuminating sectors with no other vehicles so as to emit light with an intensity higher than the threshold to maximize visibility. (*Id.*)

49[c]: the at least one object includes at least one of a pedestrian, a sign, or another vehicle;

Alden discloses Claim 49[c]. (Papanikolopoulos Decl., ¶150.) As discussed, Alden discloses the “at least one object” could be an oncoming vehicle (“another vehicle”). *See supra* Claim 48[h]. Alden also discloses that its system can detect

road “signs,” as it can sense “that the road turns by receiving light from reflectors such as a reflector 157,” and, accordingly, light emitted from the headlights is “directed into the corner to maximize the driver’s ability to see there.” (Alden, [0036], Fig. 11.) The roadside reflectors 157 would be detected using the same process described with respect to Figures 3-4, where “objects” are sensed based on detected received light above threshold limits at a plurality of sensor positions. (*Id.*, [0027]-[0028], Figs. 3-4; *see also* Papanikolopoulos Decl., ¶150.) A POSITA would understand that a roadside reflector is a type of traffic sign, as it signals to the driver that the road is curving. (*Id.*, ¶150.)

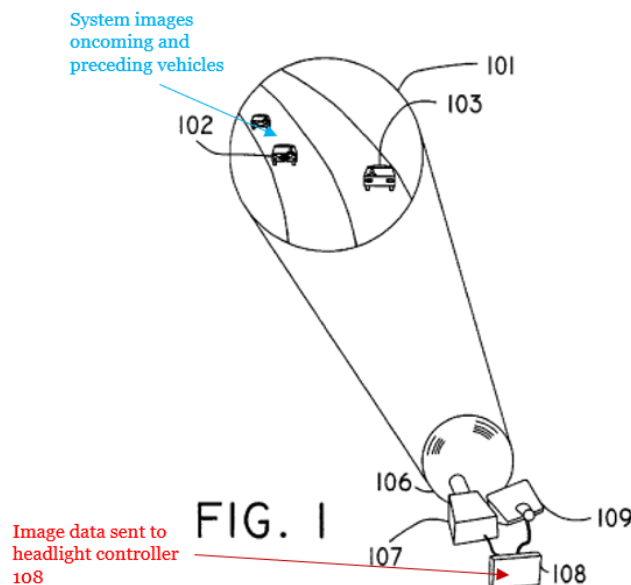
49[d]: at least one of the first cluster or the second cluster includes a plurality of the LEDs and at least one of the first cluster or the second cluster includes non-contiguous LEDs;

Claim 49[d] is substantially identical to Claim 57[c], which recites “at least one of the first cluster or the second cluster includes a plurality of the LEDs and at least one of the first cluster or the second cluster includes non-contiguous LEDs.” Claim 49[d] is thus disclosed by Alden for the reasons above. *See supra* Claim 57[c].

49[e]: the control of the light emitted from the first cluster includes a change of at least one LED of the cluster to a non-emitting state;

Alden (alone or in combination with Stam) in view of Beam renders obvious Claim 49[e]. (Papanikolopoulos Decl., ¶151.) Like Alden, Beam discloses a system controlling headlight output patterns in particular areas to eliminate “the blinding of a driver in an oncoming vehicle, while continuing to provide intense forward

illumination.” (Beam, Abstract, 1:5-19.) Beam describes a vehicle headlamp system that uses a “sensor 107” to detect light from other vehicles. (Beam, 4:9-59, 5:3-16, Claims 1-6, Figs. 1-2, 4.) The sensor data is used by a controller 108 to adjust the output of a plurality of individually controlled light sources, or “microbeams,” making up the headlight beam in order to attenuate beams directed to detected vehicles. (*Id.*)



(*Id.*, Fig.1 (annotated).)

Beam recognizes that headlights can cause glare, or “dazzle,” that impacts not only drivers of oncoming vehicles, but also drivers of preceding vehicles “when reflected by a rear-view mirror.” (*Id.*, 4:9-25, 4:45-59, 6:61-7:8.) Thus, Beam discloses that lights from both the headlights of oncoming vehicles and light from the taillights of preceding vehicles can be detected, and the output of the

headlight controlled to **darken** light directed to the areas of the sensed oncoming and preceding vehicles. (*Id.*, 4:9-25, 4:45-59, 5:61-6:8, 6:61-7:8.) Beam further discloses that the light can be darkened, as lighting elements can be “blanked (attenuated by being either absorbed or deflected to an absorbing surface.)” (*Id.*, 4:26-52, 5:33-54.) That is, those lighting elements can be switched to a non-emitted state, where the light is attenuated. (Papanikolopoulos Decl., ¶153.)

For example, Beam’s system “automatically sens[es] the presence and location of headlights and taillights ahead of the car on which it is mounted,” and then controls “the light output” of an overall headlight beam so that “the area of the beam that would dazzle the driver will be **darkened**, while maintaining full intensity elsewhere.” (*Id.*, 2:54-65.) Like Alden, Beam’s system “provid[es] the driver of an automobile equipped with the instant invention with a far brighter headlight beam while simultaneously protecting the drivers of all vehicles ahead from being dazzled by the light.” (*Id.*, 3:11-15.)

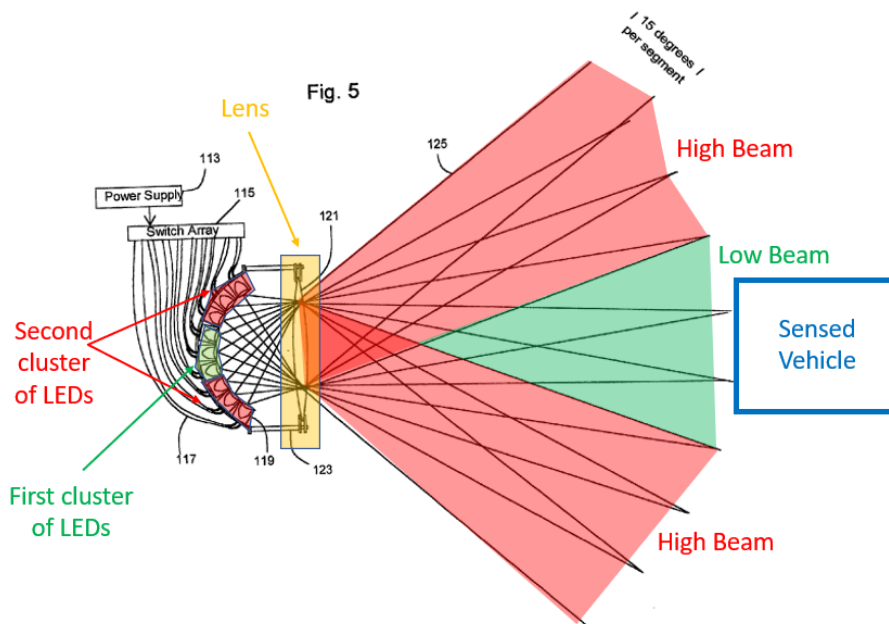
It would have been obvious to a POSITA to modify Alden to change at least one of the selected LEDs to a non-emitting state to dim headlight beam output directed to areas of the oncoming vehicles as taught by Beam. (Papanikolopoulos Decl., ¶155.) Both Alden and Beam are directed to controlling headlight beams so as to reduce glare for other drivers by dimming the headlights in areas occupied by detected vehicles. (*Id.*) And both accomplish this by detecting lights from other

vehicles using a sensor, determining the locations of the other vehicles based on the detected lights, and controlling the output of an array of light sources so that beams directed to the other vehicles are dimmed. Thus, modifying Alden to dim headlight beams by changing at least one of the selected LEDs to a non-emitting state would have merely required the continued use of Alden's existing system components for their intended purpose. (*Id.*) A POSITA would have recognized that LEDs could be changed into non-emitting state in the same way the Alden system dims the LEDs—by using the left and right light control circuit 55a-55b to control the power supply to the selected LEDs such that no power or current is provided. (Alden, [0027]-[0029].) That is, modifying Alden to change certain LEDs to non-emitting state would require no additional equipment or changes in the processing steps. (Papanikolopoulos Decl., ¶155.) Moreover, a POSITA would have a reasonable expectation of success, as the system of Alden would continue to perform the same function, using the same components, and would produce the same result—namely, using the control circuits in concert with headlamps to increase illumination for a driver while reducing glare for the drivers of other vehicles nearby that driver. (*Id.*) And a POSITA would have been motivated to change the selected LEDs to non-emitting state under certain circumstances to minimize glare to the driver of oncoming vehicles, as taught by Beam, as this is

exactly the same purpose of Alden (Alden, Abstract; *see also* Papanikolopoulos Decl., ¶155.)

49[f]: the at least one emission characteristic is different following modification by an optical control element; and

Alden discloses Claim 49[f]. (Papanikolopoulos Decl., ¶156.) For example, as shown in Figure 5 below (annotated), each headlamp comprises of an array of LEDs. (Alden, [0029].) Alden further discloses that the LEDs “are on a curve along the focal point of *a headlight lens 121* such that the light from each [LED] goes into a specified portion (or portions) of the headlight distribution area.” (*Id.*, [0029].) As discussed, the first cluster of LEDs are selected to illuminate a different area from the second cluster of LEDs, with the direction of light emitted from the first cluster of LEDs being different than the direction of light emitted from the second cluster of LEDs. *See supra* Claim 48[i]. The difference in light directionality is following modification by lens 121. (Papanikolopoulos Decl., ¶156.)



(*Id.*, Fig. 5 (annotated).)

49[g]: *the known aimings of light associated with the first cluster is based at least in part on known directionality of light emitted by LEDs of the first cluster exiting from the at least one headlamp.*

Alden discloses Claim 49[g]. (Papanikolopoulos Decl., ¶157.) As discussed, each LED in Alden’s headlights is directed to a specific sector of the light distribution area, and thus the aimings of the light associated with each LED is based, at least in part, on known directionality of light emitted by the LED. *See supra* Claim 48[g].

C. Ground 3 – Alden in View of Kobayashi Renders Obvious Claims 52, 60, 68, 76, 84

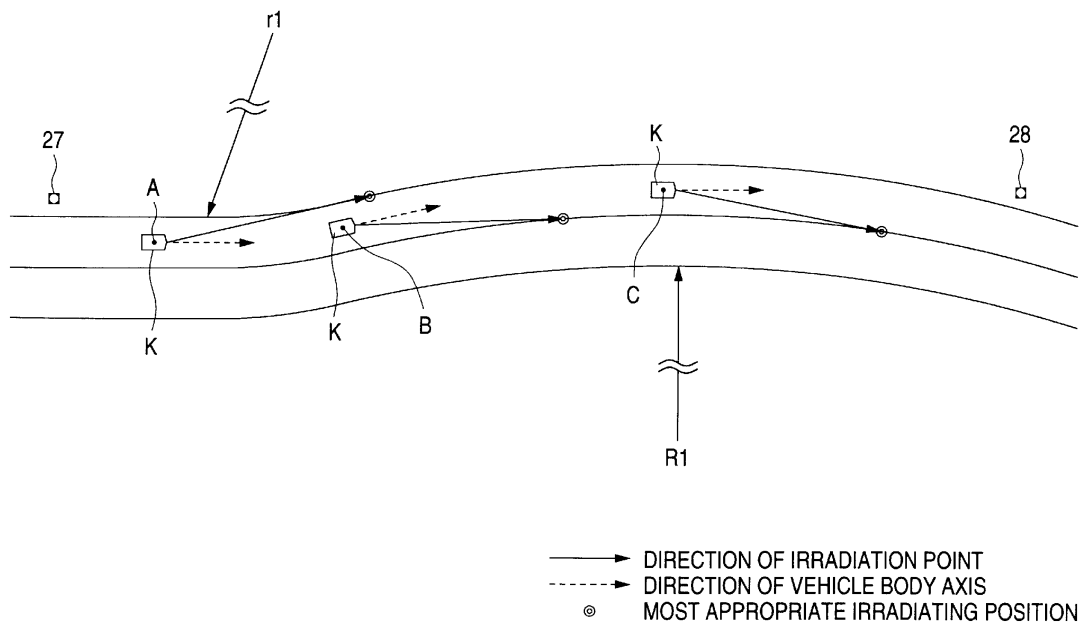
The illuminating device of claim [50/58/66/74/82], wherein the identification of the upcoming road curvature is based at least in part on map data and wherein the adaptation of the light pattern is based at least in part on the map data.

Alden in view of US6,049,749 (“Kobayashi”)¹¹ (EX1006) renders obvious Claim [52/60/68/76/84]. (Papanikolopoulos Decl., ¶¶158-161.)

Like Alden, Kobayashi is titled “Lighting device for a vehicle,” and is directed to improvements in vehicle headlamp systems. (Kobayashi, Abstract). Kobayashi discloses a lighting device that identifies road curvatures and adapts the light direction of headlamps based at least in part on map data. (Kobayashi, 1:5-8, 2:4-14, 3:9-14, 5:2-13, 15:6-28.) Particularly, Kobayashi teaches that the “irradiation control means 4” (e.g., controller) of the device may control the light direction of headlights based on input from a “road profile calculating means 2,” which finds the “advancing direction of the vehicle” at least in part based on “map information including the road profile.” (*Id.*, 2:9-28.) Kobayashi further teaches that for driving safety, when the vehicle is running on a curved road, the lighting device 5 can be controlled to irradiate the left shoulder when the vehicle turns to left and to irradiate the right shoulder when the vehicle turns to right for purpose of driving safety:

¹¹ Kobayashi issued on April 11, 2000, and is prior art under § 102(b).

FIG. 10



It would have been obvious to a POSITA to combine Alden and Kobayashi. (Papanikolopoulos Decl., ¶160.) Both are directed to the same function and result—Alden discloses directing light based on detecting an oncoming road turn or curve (Alden, Fig. 11, [0036], Fig. 14, [0039]), and Kobayashi similarly discloses controlling vehicle headlights in a predicted vehicle advancing direction. (Kobayashi, 18:1-14.) A POSITA would have been motivated to combine the teachings of Alden and Kobayashi. (Papanikolopoulos Decl., ¶160.) Alden details how an LED lighting system may be configured to alter a light beam based on detection of a road curvature using various approaches, including light sensors and reflectors and steering wheel sensors. (Alden, Fig. 11, [0036], Fig. 14, [0039].) Kobayashi makes clear that map data can be included as an additional approach in

controlling direction of vehicle headlights. (Kobayashi, 1:5-8, 2:4-14, 3:9-14, 5:2-13, 15:6-28.)

A POSITA would have been motivated to combine the techniques of detecting a road curvature to maximize successful detection in different environments. (Papanikolopoulos Decl., ¶161.) Where, for example, a road lacks the reflectors contemplated in Alden, relying on map data would be preferred. (*Id.*, ¶161.) Where in, for example, an urban environment where map data may be inaccurate, light or steering wheel sensors may be preferred. (*Id.*, ¶161.) A POSITA would understand that the systems would be complementary, as both Alden and Kobayashi disclose sensor data fed to a controller, which then controls lighting. (*Id.*, ¶161.) A POSITA would have also had a reasonable expectation of success, as a POSITA would understand that a controller could synthesize multiple sources of information, such as the Alden system detecting both roadside light reflectors and oncoming vehicles (Alden, [0025]-[0026], [0036]), when controlling vehicle lighting. It would have thus been obvious to include map data from Kobayashi into the system of Alden to further control lighting around road curvatures. (Papanikolopoulos Decl., ¶161.)

IX. TRIAL SHOULD BE INSTITUTED

A. *Fintiv* Factors

The Board should institute review because Petitioner has been diligent in filing its Petitions and the circumstances surrounding the parallel district court cases do not warrant discretionary denial under § 314(a). *Sotera Wireless, Inc. v. Masimo Corp.*, IPR2020-01019, Paper 12 at 11-21 (Dec. 1, 2020) (precedential) (citing *Apple, Inc. v. Fintiv, Inc.*, IPR2020-00019, Paper 11 (Mar 20, 2020) (precedential)). These cases are in the early stages: there is no case schedule; fact discovery has not taken place; no *Markman* or substantive proceedings have taken place; and no trial date is set. Further, the cases have been indefinitely stayed **by agreement of the parties** pending investigation into whether the plaintiff, Torchlight Technologies, has standing. *See, e.g., Torchlight Technologies, LLC v. Daimler AG, et al.*, No. 1:21-CV-751, D.I. 124-125. Given the foregoing, it is speculative that any court will address the distinct invalidity challenges raised in this Petition.

B. 35 U.S.C. § 325(d)

The Board should decline to exercise discretion under § 325(d).

First, Claims 48-80 are each subject to only one other IPR challenge. Those challenges were brought by an entity unrelated to and that competes with Petitioner: Volkswagen. Torchlight Technologies has accused different products of

Petitioner and Volkswagen of infringement, such that there are distinct issues in the (alleged) infringement proceedings between Petitioner and Volkswagen. *Id.*, D.I. 97 at ¶¶ 49-57 (accusing Mercedes' 84 LED multi-row headlamp system), 74-82 (accusing Audi's Matrix system). It is also speculative to assume, at the institution deadline of this Petition, that Volkswagen's IPR challenges against the '551 will ultimately reach a Final Written Decision. Over a quarter of all IPRs settle before Final Written Decision. EX1009 at 9.

Second, significantly, the prior art herein, including Alden in particular, was never considered by the Examiner, let alone applied in a rejection. Further, none of the other pending IPR proceedings against the '551 include Alden or the combinations of Alden with other references as presented herein. *See Oticon Med. AB v. Cochlear Ltd.*, IPR2019-00975, Paper 15 at 20 (Oct. 16, 2019) (precedential) (noting "[t]here is new, noncumulative prior art asserted in the Petition"). Petitioner's grounds thus present art that is not the same or substantially the same as art previously considered by the Office. *Advanced Bionics v. MED-EL Elektromedizinische Geräte GmbH*, IPR2019-01469, Paper 6 at 7-9 (Feb. 13, 2020).¹²

¹² Should Patent Owner raise a *Fintiv* or § 325(d) challenge to the Petition, Petitioner intends to respond to any counter-arguments Patent Owner may raise.

X. CONCLUSION

Petitioner respectfully requests that a Trial be instituted. Claims 48-87 of the '551 should be cancelled as anticipated or obvious over the prior art.

Dated: June 7, 2023

Respectfully submitted,

/s/ Celine J. Crowson

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Table of Exhibits

| Exhibit No. | Description |
|-------------|---|
| 1001 | U.S. Patent No. 9,955,951 (“ 551 ”) |
| 1002 | Original File History for the ’551 Patent |
| 1003 | Declaration of Dr. Nikolaos Papanikolopoulos |
| 1004 | Curriculum Vitae of Dr. Nikolaos Papanikolopoulos |
| 1005 | U.S. Patent Publication No. 2003/0137849 (“ Alden ”) |
| 1006 | U.S. Patent No. 6,049,749 to Kobayashi (“ Kobayashi ”) |
| 1007 | U.S. Patent No. 6,144,158 to Beam (“ Beam ”) |
| 1008 | WIPO Patent Publication No. 2001/070538 (“ Stam ”) |
| 1009 | PTAB Trial Statistics April 2023 IPR, PGR |
| 1010 | Reexamination File History for the ’551 Patent |
| 1011 | Patent Owner Disclaimer under 37 CFR 1.321(a) |
| 1012 | Reissue File History for the ’551 Patent |

Certificate of Word Count

I certify that, in accordance with 37 C.F.R. § 42.24(d), the word count for the foregoing Petition totals 13,935. This is less than the permitted total under the 37 C.F.R. 42.24(a)(1)(i).

/s/ Celine J. Crowson

Celine J. Crowson (Reg. No. 40,357)

*One of the attorneys for Petitioner Mercedes-Benz
USA, LLC*

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 Petition for Inter Partes Review, and Exhibits 1001 through 1012 were served on June 7, 2023, by Overnight Courier at the following address of record and addresses known to Petitioner as likely to effect service and the address of record for the '551 patent:

Brooks Cushman
1000 Town Center
22nd Floor
Southfield, MI 48075

/s/ Nicole Lynch

Nicole Lynch
Hogan Lovells US LLP
555 Thirteenth Street NW
Washington, DC 20004

Appendix A: Independent Claims Comparison Table

| | Claim 48 | Claim 56 | Claim 64 | Claim 72 | Claim 80 |
|-------|---|---|---|---|---|
| [pre] | An illuminating device having automatic control of light provided to an illuminated area comprising: | An illuminating device having automatic control of light provided to an illuminated area comprising: | An illuminating device having automatic control of light provided to an illuminated area comprising: | An illuminating device having automatic control of light provided to an illuminated area comprising: | An illuminating device having automatic control of light provided to an illuminated area comprising: |
| [a] | a structure for incorporating illuminating device elements, wherein the structure comprises a motor vehicle; | a structure for incorporating illuminating device elements, wherein the structure comprises a motor vehicle; | a structure for incorporating illuminating device elements, wherein the structure comprises a motor vehicle; | a structure for incorporating illuminating device elements, wherein the structure comprises a motor vehicle; | a structure for incorporating illuminating device elements, wherein the structure comprises a motor vehicle; |
| [b] | a plurality of individually controllable LEDs incorporated in the structure via at least one headlamp mounted to the structure, each headlamp including at least one of the LEDs, the LEDs in communication | a plurality of individually controllable LEDs incorporated in the structure via at least one headlamp mounted to the structure, each headlamp including at least one of the LEDs, the LEDs in communication | a plurality of individually controllable LEDs incorporated in the structure via at least one headlamp mounted to the structure, each headlamp including at least one of the LEDs, the LEDs in communication | a plurality of individually controllable LEDs incorporated in the structure via at least one headlamp mounted to the structure, each headlamp including at least one of the LEDs, the LEDs in communication | a plurality of individually controllable LEDs incorporated in the structure via at least one headlamp mounted to the structure, each headlamp including at least one of the LEDs, the LEDs in communication |

| | Claim 48 | Claim 56 | Claim 64 | Claim 72 | Claim 80 |
|-----|---|--|---|---|--|
| | with a power source; | with a power source; | with a power source; | with a power source; | with a power source; |
| [c] | electronic circuitry apparatus for the controlled powering of the LEDs and other of the illuminating device elements; | electronic circuitry apparatus for the controlled powering of the LEDs and other of the illuminating device elements; | electronic circuitry apparatus for the controlled powering of the LEDs and other of the illuminating device elements; | electronic circuitry apparatus for the controlled powering of the LEDs and other of the illuminating device elements; | electronic circuitry apparatus for the controlled powering of the LEDs and other of the illuminating device elements; |
| [d] | one or more processors; | one or more processors; | one or more processors; | one or more processors; | one or more processors; |
| [e] | one or more sensors, including one or more cameras, placed on the structure for detecting coordinate-specific information about the illuminated area, at least one of said cameras in communication with power, and in communication with at least one of | one or more sensors, including one or more cameras, placed on the structure for detecting coordinate-specific information about the illuminated area and positioned to capture an image of at least one other vehicle ahead of the motor vehicle , at least one of said | one or more sensors, including one or more cameras, placed on the structure for detecting coordinate-specific information about the illuminated area and positioned to capture an image of another vehicle , at least one of said cameras in communication | one or more sensors, including one or more cameras, placed on the structure for detecting coordinate-specific information about the illuminated area, at least one of said cameras in communication with power, and in communication with at least one of | one or more sensors, including one or more cameras, placed on the structure for detecting coordinate-specific information about the illuminated area and positioned to capture camera data indicating a target ahead of the motor vehicle , at least one of said cameras in |

| | Claim 48 | Claim 56 | Claim 64 | Claim 72 | Claim 80 |
|-----|---|---|---|---|---|
| | the one or more processors; | cameras in communication with power, and in communication with at least one of the one or more processors; | with power, and in communication with at least one of the one or more processors; | the one or more processors; | communication with power, and in communication with at least one of the one or more processors; |
| [f] | a controller, including at least one of the one or more processors, integrated with the structure via mounting, in communication with the LED controlling power electronic circuitry apparatus, | a controller, including at least one of the one or more processors, integrated with the structure via mounting, in communication with the LED controlling power electronic circuitry apparatus, | a controller, including at least one of the one or more processors, integrated with the structure via mounting, in communication with the LED controlling power electronic circuitry apparatus, | a controller, including at least one of the one or more processors, integrated with the structure via mounting, in communication with the LED controlling power electronic circuitry apparatus, | a controller, including at least one of the one or more processors, integrated with the structure via mounting, in communication with the LED controlling power electronic circuitry apparatus, |
| [g] | said controller arranged to process the information communicated from the cameras and to automatically control the light provided to the | said controller arranged to process the information communicated from the cameras and to automatically control the light provided to the | said controller arranged to process the information communicated from the cameras and to automatically control the light provided to the | said controller arranged to process the information communicated from the cameras and to automatically control the light provided to the | said controller arranged to process the information communicated from the cameras and to automatically control the light provided to the |

| | Claim 48 | Claim 56 | Claim 64 | Claim 72 | Claim 80 |
|-----|---|--|---|--|---|
| | illuminated area;
and | illuminated area;
and | illuminated area;
and | illuminated area;
and | illuminated area;
and |
| [h] | memory storing instructions that, when executed by one or more processors of the controller, enable the controller to: | memory storing instructions that, when executed by one or more processors of the controller, enable the controller to: | memory storing instructions that, when executed by one or more processors of the controller, enable the controller to: | memory storing instructions that, when executed by one or more processors of the controller, enable the controller to: | memory storing instructions that, when executed by one or more processors of the controller, enable the controller to: |
| [i] | illuminate a portion of at least one object, indicated by data from at least one of the one or more sensors, by selecting a first cluster of the LEDs to emit first light directed towards a first area including the at least the portion of at least one object, the first area determined based at least in part on the data, the first cluster selected | determine, based on data from one or more of the sensors, a vertical and horizontal position associated with the at least one other vehicle; | select a first cluster of the LEDs having light associated there that is directed towards the other vehicle based at least in part on first data from one or more of the sensors indicating a first position associated with the other vehicle; | determine a target based on first data from one or more of the sensors; | identify, based on data received from one or more of the sensors, a plurality of positions associated with the target as the target move relative to the motor vehicle; and |

| | Claim 48 | Claim 56 | Claim 64 | Claim 72 | Claim 80 |
|-----|--|---|---|--|--|
| | based at least in part on known aimings of light associated with the first cluster determined to correspond to the first area, and the first light determined based at least in part on classifying the object based at least in part on the data; and | | | | |
| [j] | control light emitted from the first cluster directed towards the first area to be different in at least one emission characteristic, based on the first light determination, from second light emitted from a | select a first cluster of the LEDs based at least in part on at least one of the vertical and horizontal position compared to known aimings of light associated with the first cluster; and | control a first change to one or more characteristics of the light associated with the first cluster of the LEDs that is directed towards the other vehicle, that diminishes glare to a driver of the other vehicle | determine a first target location based on the first data; | change, responsive to the positions associated with the target, first light associated with one or more LEDs aimed toward at least a portion of the target, relative to second light associated with other one or more |

| | Claim 48 | Claim 56 | Claim 64 | Claim 72 | Claim 80 |
|-----|--|---|---|---|--|
| | second, different cluster of the LEDs, directed towards one or more illuminated second areas at a common elevation with the first area and laterally adjacent to the area. | | when the other vehicle is at the first position; | | of the LEDs aimed laterally adjacent the target on either side, as the target moves relative to the motor vehicle. |
| [k] | | reduce intensity of illumination to non-glaring illumination of a first area associated with the at least one other vehicle, relative to intensity of illumination on both sides of the first area at elevations common with the first area illuminated by a second cluster of the LEDs, by control of emission | select a second, different cluster of the LEDs having light associated therewith that is directed towards the other vehicle based at least in part on second, subsequent data from one or more of the sensors indicating a second, subsequent position associated with the other vehicle; and | select a cluster of the LEDs having light associated therewith that is directed at the target, determined based on the first target location; and | |

| | Claim 48 | Claim 56 | Claim 64 | Claim 72 | Claim 80 |
|-----|----------|-------------------------|--|---|----------|
| | | from the first cluster. | | | |
| [l] | | | control a second, subsequent change, to one or more characteristics of the light that is subsequently directed towards the other vehicle, that diminishes glare to the driver of the other vehicle when the other vehicle is at the second position. | vary illumination provided to the target by the selected cluster, relative to illumination provided to areas laterally adjacent to the target and provided by at least one LED different from LEDs in the selected cluster; and | |
| [m] | | | | maintain a variance of illumination provided to the target relative to the laterally adjacent areas, when subsequent data from one or more of the cameras indicates a change in position of the | |

| | Claim 48 | Claim 56 | Claim 64 | Claim 72 | Claim 80 |
|--|----------|----------|----------|--|----------|
| | | | | target relative to the motor vehicle, by repeating the determination of target location, selection of the cluster and variance to illumination provided to the target, relative to the laterally adjacent areas, based on the subsequent data. | |

Appendix B: Dependent Claims Comparison Tables

| Claim 51 | Claim 49 |
|---|---|
| [51pre] The illuminating device of claim 50, wherein: | [49pre] The illuminating device of claim 48, wherein: |
| | [49a] the data includes image data; |
| [51a] the memory further stores instructions that, when executed by one or more processors of the controller, enable the controller to illuminate the at least the portion with light below at least a predefined glare level; | [49b] the memory further stores instructions that, when executed by one or more processors of the controller, enable the controller to illuminate the at least the portion with light below at least a predefined glare level; |
| [51b] the at least one object includes at least one of a pedestrian, a sign, or another vehicle; | [49c] the at least one object includes at least one of a pedestrian, a sign, or another vehicle; |

| | |
|--|---|
| [51c] at least one of the first cluster or the second cluster includes a plurality of the LEDs and at least one of the first cluster or the second cluster includes non-contiguous LEDs; | [49d] at least one of the first cluster or the second cluster includes a plurality of the LEDs and at least one of the first cluster or the second cluster includes non-contiguous LEDs; |
| the control of the light emitted from the first cluster includes a change of at least one LED of the cluster to a non-emitting state; | [49e] the control of the light emitted from the first cluster includes a change of at least one LED of the cluster to a non-emitting state; |
| [51d] the at least one emission characteristic is different following modification by an optical control element; and | [49f] the at least one emission characteristic is different following modification by an optical control element; and |
| [51e] the known aimings of light associated with the first cluster is based at least in part on known directionality of light emitted by LEDs of the first cluster exiting from the at least one headlamp; and | [49g] the known aimings of light associated with the first cluster is based at least in part on known directionality of light emitted by LEDs of the first cluster exiting from the at least one headlamp. |
| [51f] the memory further stores instructions that, when executed by one or more processors of the controller, enable the controller to accommodate the road curvature by changing illumination in at least a direction of the road curvature by adaptation of light pattern in at least one of color, intensity or spatial distribution by modification of light associated with one or more of the LEDs. | |
| Claim 59 | Claim 57 |
| [59pre] The illuminating device of claim 58, wherein: | [57pre] The illuminating device of claim 56, wherein: |
| | [57a] the data includes image data; |
| [59a] the control of emission of the first cluster includes | [57b] the control of emission of the first cluster includes |

| | |
|---|--|
| a change of at least one of color or intensity or control of at least one LED of the first cluster into a non-emitting state; | a change of at least one of color or intensity or control of at least one LED of the first cluster into a non-emitting state; |
| [59b] at least one of the first cluster or the second cluster includes a plurality of the LEDs and at least one of the first cluster or the second cluster includes non-contiguous LEDs; | [57c] at least one of the first cluster or the second cluster includes a plurality of the LEDs and at least one of the first cluster or the second cluster includes non-contiguous LEDs; |
| [59c] the known light aimings associated with the first cluster is based at least in part on known directionality of light emitted by LEDs of the first cluster exiting from the at least one headlamp; and | [57d] the known light aimings associated with the first cluster is based at least in part on known directionality of light emitted by LEDs of the first cluster exiting from the at least one headlamp. |
| [59d] the memory further stores instructions that, when executed by one or more processors of the controller, enable the controller to accommodate the road curvature by changing illumination in at least a direction of the road curvature by adaptation of light pattern in at least one of color, intensity or spatial distribution by modification of light associated with one or more of the LEDs. | |
| Claim 67 | Claim 65 |
| [67pre] The illuminating device of claim 66, wherein: | [65pre] The illuminating device of claim 56, wherein: |
| | [65a] the first data or second data includes image data; |
| [67a] at least one of the first or second change to characteristics of light associated with at least one of the first or second cluster of LEDs includes at least one of a change to color, to intensity, or a change of at least one | [65b] at least one of the first or second change to characteristics of light associated with at least one of the first or second cluster of LEDs includes at least one of a change to color, to intensity, or a change of at least one |

| | |
|---|--|
| LED respective cluster to a non-emitting state; | LED respective cluster to a non-emitting state; |
| [67b] at least one of the first cluster or the second cluster includes a plurality of the LEDs and at least one of the first cluster or the second cluster includes non-contiguous LEDs; | [65c] at least one of the first cluster or the second cluster includes a plurality of the LEDs and at least one of the first cluster or the second cluster includes non-contiguous LEDs; |
| [67c] the light that is directed or subsequently directed towards the other vehicle is determined based at least in part on known directionality of light emitted by the respective first or second cluster exiting the at least one headlamp; and | [65d] the light that is directed or subsequently directed towards the other vehicle is determined based at least in part on known directionality of light emitted by the respective first or second cluster exiting the at least one headlamp. |
| [67d] the memory further stores instructions that, when executed by one or more processors of the controller, enable the controller to accommodate the road curvature by changing illumination in at least a direction of the road curvature by adaptation of light pattern in at least one of color, intensity or spatial distribution by modification of light associated with one or more of the LEDs. | |
| Claim 75 | Claim 73 |
| [75pre] The illuminating device of claim 74, | [73pre] The illuminating device of claim 72, |
| [75a] wherein the variation of illumination provided to the target includes variation in at least one of color or intensity or at least a change of at least one LED of the selected cluster to a non-emitting state; | [73a] wherein the variation of illumination provided to the target includes variation in at least one of color or intensity or at least a change of at least one LED of the selected cluster to a non-emitting state; |
| [75b] the selected cluster includes a plurality of the LEDs and the selected cluster includes non-contiguous | [73b] the cluster includes a plurality of the LEDs and the cluster includes non-contiguous LEDs; |

| | |
|---|---|
| LEDs; | |
| [75c] the light directed at the target is determined based at least in part on known directionality of light emitted by the first cluster exiting from the at least one headlamp; and | [73c] the light directed at the target is determined based at least in part on known directionality of light emitted by the first cluster exiting from the at least one headlamp; and |
| [75d] the memory further stores instructions that, when executed by one or more processors of the controller, enable the controller to accommodate the road curvature by changing illumination in at least a direction of the road curvature by adaptation of light pattern in at least one of color, intensity or spatial distribution by modification of light associated with one or more of the LEDs. | [73d] at least one of the first data or the subsequent data includes image data. |
| Claim 83 | Claim 81 |
| [83pre] The illuminating device of claim 74, wherein: | [81pre] The illuminating device of claim 80, wherein: |
| [83a] the change to emission of one or more LEDs aimed towards the at least the portion includes a change to intensity or color or a change of at least one of the LEDs to a non-emitting state; | [81a] the data includes image data; |
| [83b] the memory further stores instructions that, when executed by one or more processors of the controller, enable the controller to select a first cluster of LEDs, associated with the first light, for the change, based at least in part on known aimings of the first light associated with the first cluster having a correlation to the at least the portion, the known aimings based at least in part on at least one of known directionality of light | [81b] the memory further stores instructions that, when executed by one or more processors of the controller, enable the controller to select a first cluster of LEDs, associated with the first light, for the change, based at least in part on known aimings of the first light associated with the first cluster having a correlation to the at least the portion, the known aimings based at least in part on at least one of known directionality of light |

| | |
|--|---|
| emitted by the first cluster or known directionality of light emitted by the first cluster exiting the headlamp; and | emitted by the first cluster or known directionality of light emitted by the first cluster exiting the headlamp; and |
| [83c] the memory further stores instructions that, when executed by one or more processors of the controller, enable the controller to accommodate the road curvature by changing illumination in at least a direction of the road curvature by adaptation of light pattern in at least one of color, intensity or spatial distribution by modification of light associated with one or more of the LEDs. | [81c] the change to emission of one or more LEDs aimed towards the at least the portion includes a change to intensity or color or a change of at least one of the LEDs to a non-emitting state. |