Mercedes's Hearing Demonstratives for *Mercedes vs. Spero*

IPR2023-01039 (U.S. Patent No. 9,955,551)

IPR2023-01040 (U.S. Patent No. 9,955,551)

IPR2023-01034 (U.S. Patent No. 11,208,029)

Mercedes EX1014
Mercedes-Benz USA LLC v. Spero
IPR2023-1039

Table of Contents

Overview of the Patents and the Petitions

Overview of Alden

Dispute 1 – Alden Is Enabled and No Modification is Needed

Dispute 2 – Alden Increases Light in the Direction of Road Curves

Other ’551 Patent Disputes

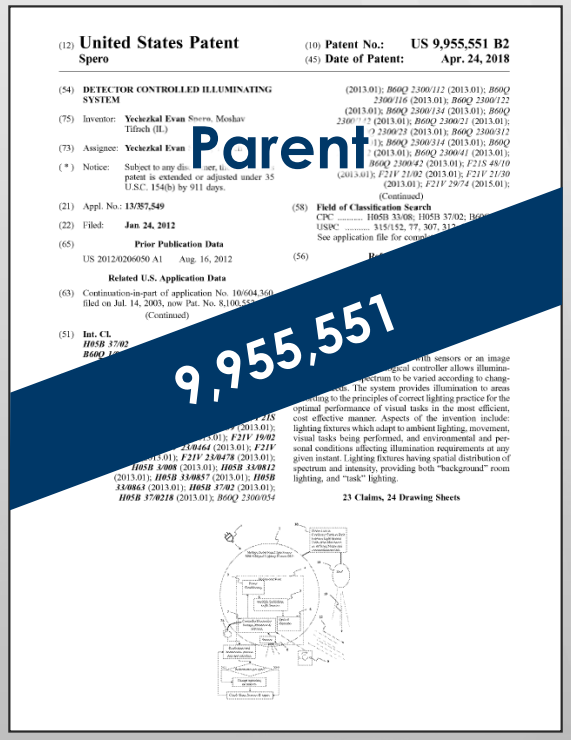
Other ’029 Patent Disputes

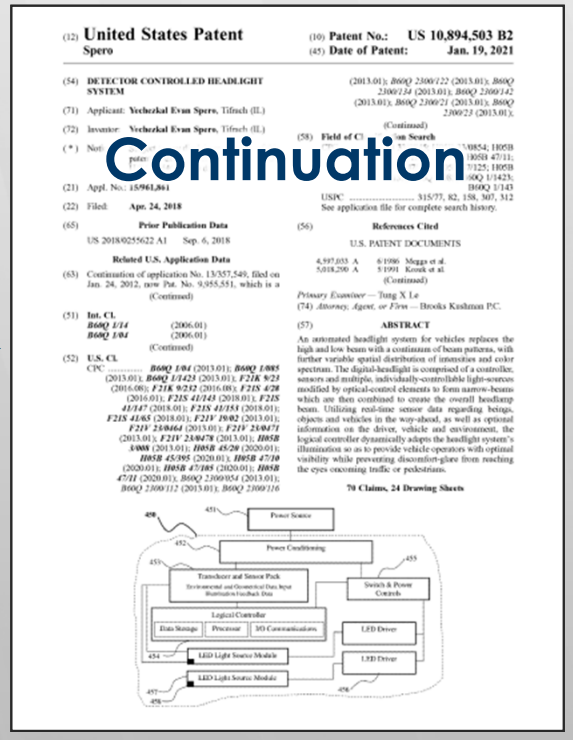
Mercedes EX1014
Mercedes-Benz USA LLC v. Spero
IPR2023-1039

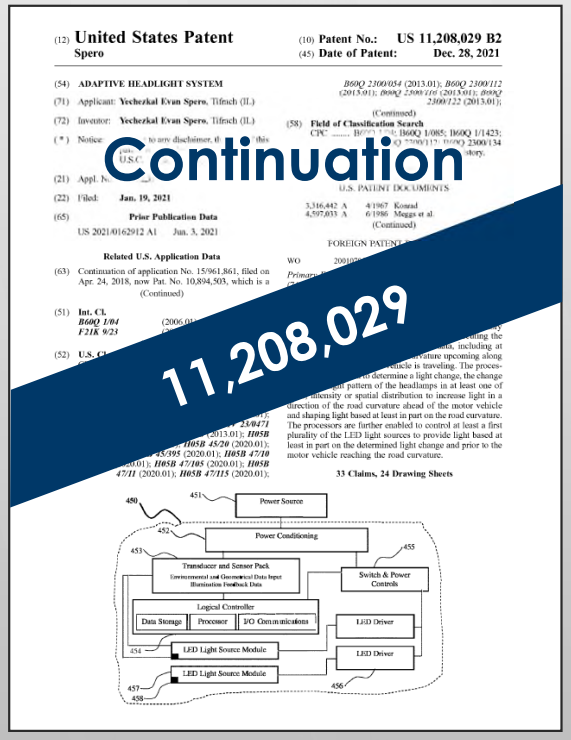
Overview of the Patents and the Petitions

Mercedes EX1014
Mercedes-Benz USA LLC v. Spero
IPR2023-1039

The Patents at Issue







Mercedes EX1014
Mercedes-Benz USA LLC v. Spero
IPR2023-1039

Overview of the Claimed Invention in the '551 Patent

The independent claims of the '551 Patent focus on systems that control headlights to diminish glare to the detected vehicles.

24. An illuminating device having automatic control of light provided to an illuminated area comprising:

a structure for incorporating illuminating device elements, wherein the structure comprises a motor vehicle;

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;

electronic circuitry apparatus for the controlled powering of the LEDs and other of the illuminating device elements;

one or more processors;

one or more sensors, including one or more cameras, placed on die 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 the one or more processors;

a controller, including at least one of the one or more processors, integrated with the structure via mounting, in communication with the controlling power electronic circuitry apparatus, said controller arranged to process the information communicated from the cameras and to automatically control the light provided to the illuminated area; and

memory storing instructions that, when executed by one or more processors of the controller, enable the controller to:

determine coordinates corresponding to an other vehicle, based on the coordinate-specific information;

select a cluster of the LEDs that emit light toward at portion of the other vehicle based on the LEDs having emission aimings associated with the first coordinates; and

change emission of the selected cluster of LEDs relative to emission of other LEDs not included in the cluster to create headlamp illumination that preserves a first level of illumination illuminating past the other vehicle while preventing glare to a driver of the other vehicle.

'551 Reexamination Certificate

Mercedes EX1014
Mercedes-Benz USA LLC v. Spero
IPR2023-1039

Overview of the Claimed Invention in the '029 Patent

The independent claims of the '029 Patent focus on systems that control headlights to increase light in the direction of road curvature.

1. A system, for a motor vehicle, comprising:
a plurality of headlamps, each comprising a plurality of LED light sources;
one or more processors; and
a memory storing instructions that, when executed by one or more of the one or more processors, enable the one or more processors to:
receive first data, including at least map data, indicating a road curvature upcoming along a road on which the motor vehicle is traveling;
determine a light change, the change adapting a light pattern of the headlamps in at least one of color, intensity or spatial distribution to increase light in a direction of the road curvature ahead of the motor vehicle and shaping light based at least in part on the road curvature; and
control at least a first plurality of the LED light sources to provide light based at least in part on the determined light change and prior to the motor vehicle reaching the road curvature.

'029 Patent at Cl. 1

Mercedes EX1014
Mercedes-Benz USA LLC v. Spero
IPR2023-1039

Overview of the Invalidity Grounds

’551 Patent (IPR2023-01039, IPR2023-01040)	’029 Patent (IPR2023-01034)
Alden anticipates and renders obvious claims 24-27, 29-35, 37-43, 45-48, 50-51, 53-59, 61-67, 69-75, 77-83, 85-87	
Alden in view of **Kobayashi** renders obvious claims 28, 36, 44, 52, 60, 68, 76, 84	**Alden** in view of **Kobayashi** renders obvious claims 1-8, 10-19, 21-30, 32-33
Alden (alone or as modified by **Stam**) in view of **Beam** renders obvious claim 49	**Alden** (alone or with **Beam**) in view of **Kobayashi** renders obvious claims 9, 20, 31
Alden in view of **Kondo** renders obvious claims 8, 10-14	
Alden (as modified by **Kondo**) in view of **Stam** renders obvious claims 15-18	

IPR2023-01039 Pet. at 5
IPR2023-01040 Pet. at 5
IPR2023-01034 Pet. at 5

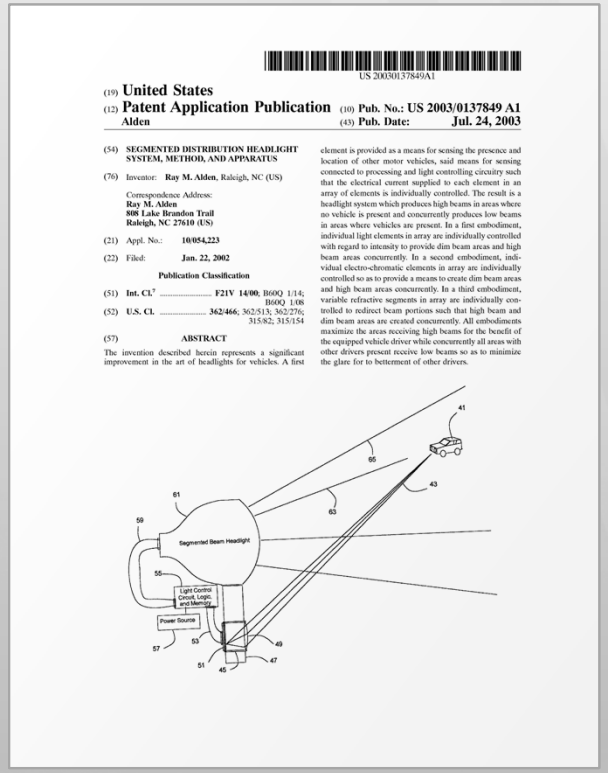
DEMONSTRATIVE EXHIBIT – NOT EVIDENCE

Mercedes EX1014
Mercedes-Benz USA LLC v. Spero
IPR2023-1039

Overview of Alden

Mercedes EX1014
Mercedes-Benz USA LLC v. Spero
IPR2023-1039

Alden Overview



US 2003/0137849A1

(19) United States
(12) Patent Application Publication
Alden
(10) Pub. No.: US 2003/0137849 A1
(43) Pub. Date: Jul. 24, 2003

(54) SEGMENTED DISTRIBUTION HEADLIGHT SYSTEM, METHOD, AND APPARATUS

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(21) Appl. No.: 10/054,223

(22) Filed: Jan. 22, 2002

Publication Classification

(51) Int. Cl.[7] F21V 14/00; B60Q 1/14; B60Q 1/08

(52) U.S. Cl. 362/466; 362/513; 362/276; 315/82; 315/154

(57) ABSTRACT

The invention described herein represents a significant improvement in the art of headlights for vehicles. A first element is provided as a means for sensing the presence and location of other motor vehicles, said means for sensing connected to processing and light controlling circuitry such that the electrical current supplied to each element in an array of elements is individually controlled. The result is a headlight system which produces high beams in areas where no vehicle is present and concurrently produces low beams in areas where vehicles are present. In a first embodiment, individual light elements in array are individually controlled with regard to intensity to provide dim beam areas and high beam areas concurrently. In a second embodiment, individual electro-chromatic elements in array are individually controlled so as to provide a means to create dim beam areas and high beam areas concurrently. In a third embodiment, variable refractive segments in array are individually controlled to redirect beam portions such that high beam and dim beam areas are created concurrently. All embodiments maximize the areas receiving high beams for the benefit of the equipped vehicle driver while concurrently all areas with other drivers present receive low beams so as to minimize the glare for to betterment of other drivers.

[0025] FIG. 1 depicts a vehicle employing an automatic segmented illumination means of the present invention. A first vehicle **31** emits a low beam illumination **35** in a first headlight distribution sector while concurrently emitting a high beam,illumination **37** in a second headlight distribution sector. The low beam illumination in **35** being emitted in response to the detection of an oncoming vehicle **33** (the **33** emitting light which has been omitted for drawing clarity). The **31** comprising a means to detect the sector in which **33** (or any other vehicle) is located, the **31** also comprising a means to provide a first intensity of illumination in the sector where the **33** is detected while concurrently providing a second intensity (or alternate direction) of illumination where no vehicle is detected. Specific means for sensing

Alden at [0025]

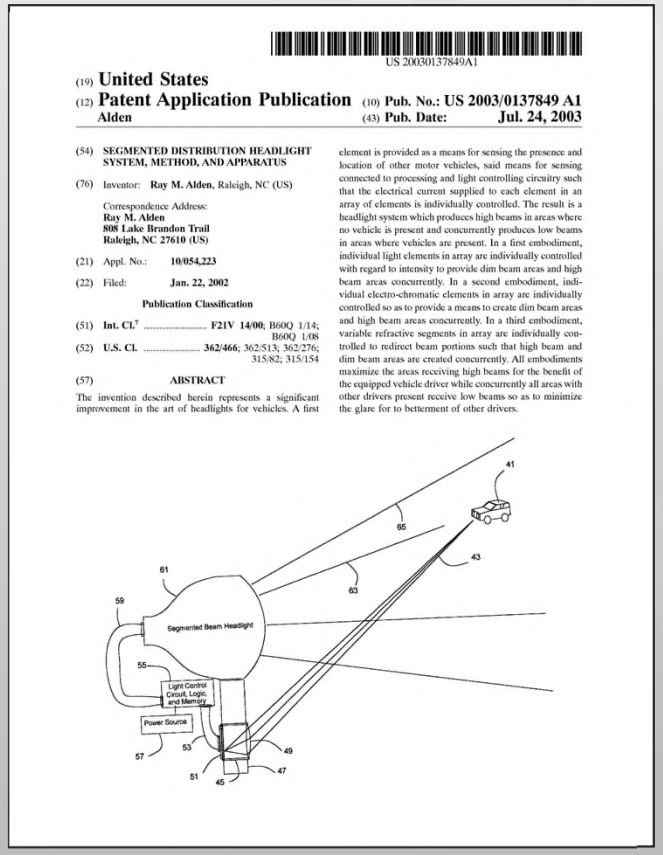
direction of the 41. Thus the driver of **41** has minimum glare while the driver of **47** has maximum light.

Alden at [0027]

IPR2023-01039 Pet. at 9-11
IPR2023-01040 Pet. at 9-11
IPR2023-01034 Pet. at 9-11

Mercedes EX1014
Mercedes-Benz USA LLC v. Spero
IPR2023-1039

Alden Discloses a Headlight of Individually Controllable LEDs



US 20030137849A1

(19) **United States**
(12) **Patent Application Publication** (10) **Pub. No.: US 2003/0137849 A1**
Alden (43) **Pub. Date: Jul. 24, 2003**

(54) **SEGMENTED DISTRIBUTION HEADLIGHT SYSTEM, METHOD, AND APPARATUS**

(76) Inventor: **Ray M. Alden**, Raleigh, NC (US)

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(57) **ABSTRACT**

The invention described herein represents a significant improvement in the art of headlights for vehicles. A first element is provided as a means for sensing the presence and location of other motor vehicles, said means for sensing connected to processing and light controlling circuitry such that the electrical current supplied to each element in an array of elements is individually controlled. The result is a headlight system which produces high beams in areas where no vehicle is present and concurrently produces low beams in areas where vehicles are present. In a first embodiment, individual light elements in array are individually controlled with regard to intensity to provide dim beam areas and high beam areas concurrently. In a second embodiment, individual electro-chromatic elements in array are individually controlled so as to provide a means to create dim beam areas and high beam areas concurrently. In a third embodiment, variable refractive segments in array are individually controlled to redirect beam portions such that high beam and dim beam areas are created concurrently. All embodiments maximize the areas receiving high beams for the benefit of the equipped vehicle driver while concurrently all areas with other drivers present receive low beams so as to minimize the glare for to betterment of other drivers.

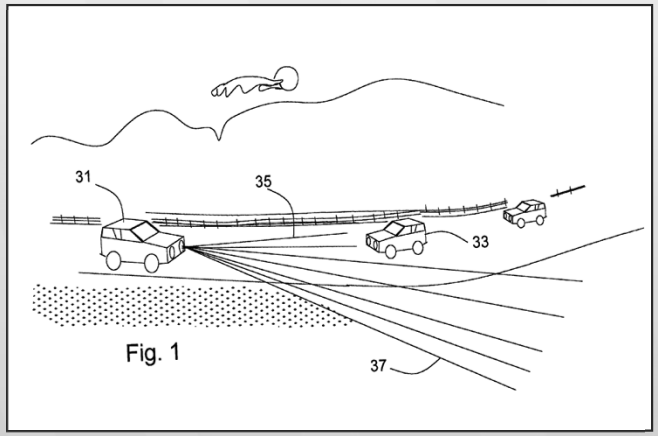


Fig. 1

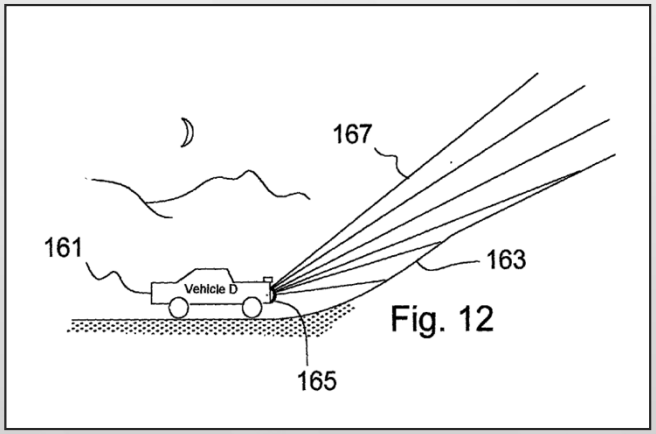


Fig. 12

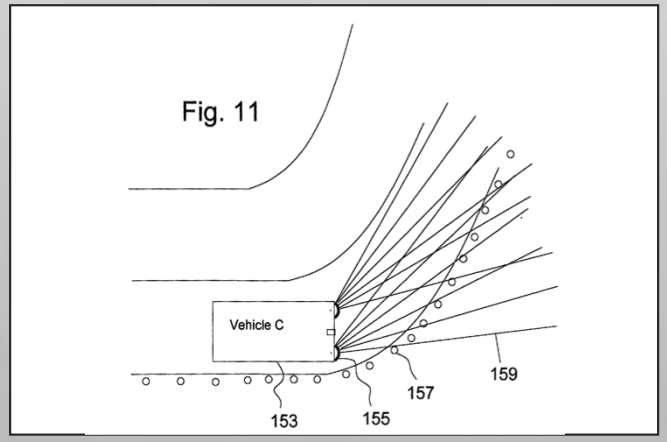


Fig. 11

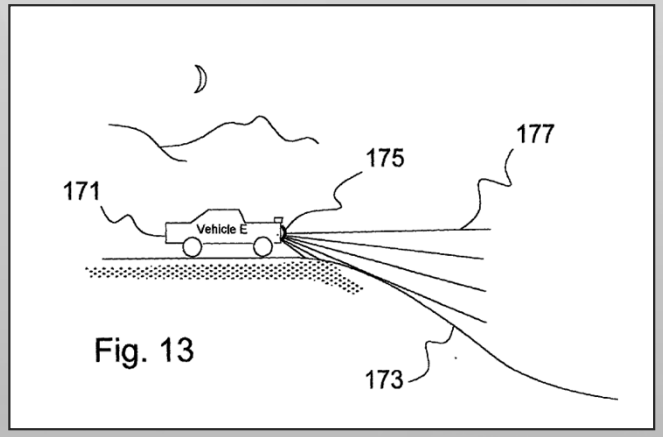
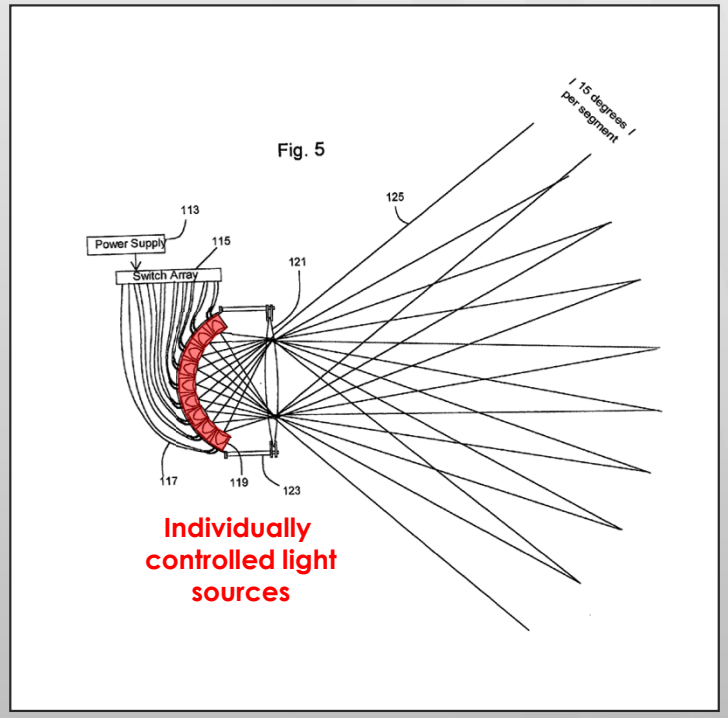


Fig. 13

IPR2023-01039 Pet. at 9-11
IPR2023-01040 Pet. at 9-11
IPR2023-01034 Pet. at 9-11

Mercedes EX1014
Mercedes-Benz USA LLC v. Spero
IPR2023-1039

Alden Discloses a Headlight of Individually Controllable LEDs

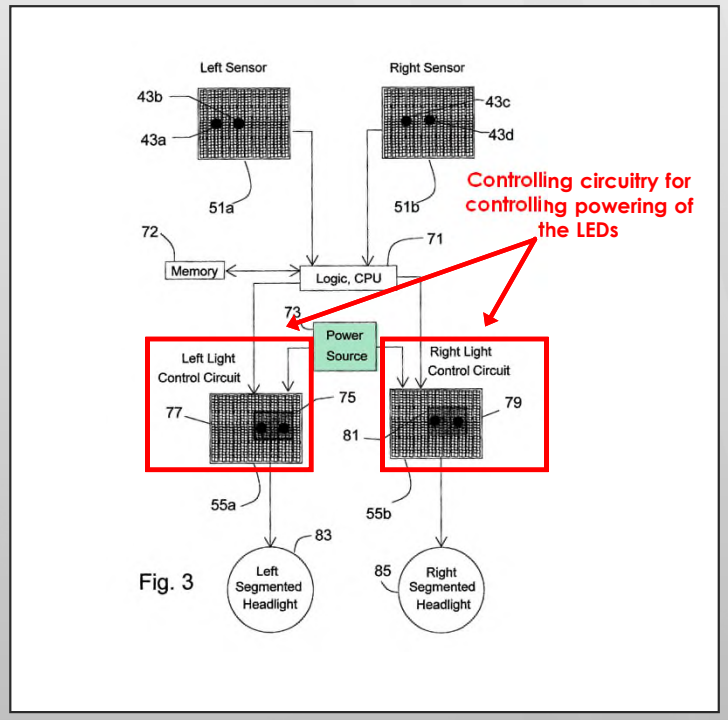


Alden at Fig. 5 (annotated)

and controlling switch array in a first embodiment. The head light is comprised of an array of individual lighting elements similar to light element **119**. The light elements being part of a segmented head light **123**. The **119** can be a white LED (or alternate lighting mechanism). Each lighting element being independently controlled by a corresponding switch in an array of switches **115**. Each switch is controlled by the CPU

Alden at [0029]

Alden Discloses Circuitry to Control Powering of the LEDs



Alden at Fig. 3 (annotated)

headlight sectors. Information from the **72** and **71** is sent to control the power flow from a power source **73** via a left light control circuit **55***a* and a right light control circuit **55***b*.

Alden at [0027]

array matrix and tell which areas are in which state.) The **55***a* controls the power flow from **73** to a left segmented headlight **83** which distributes high beams throughout its distribution areas except in a box in the direction of the **41**. Similarly, the **55***b* controls the power flow from **73** to a right segmented headlight **83** which distributes high beams throughout its distribution areas except in a box in the direction of the **41**. Thus the driver of **41** has minimum glare

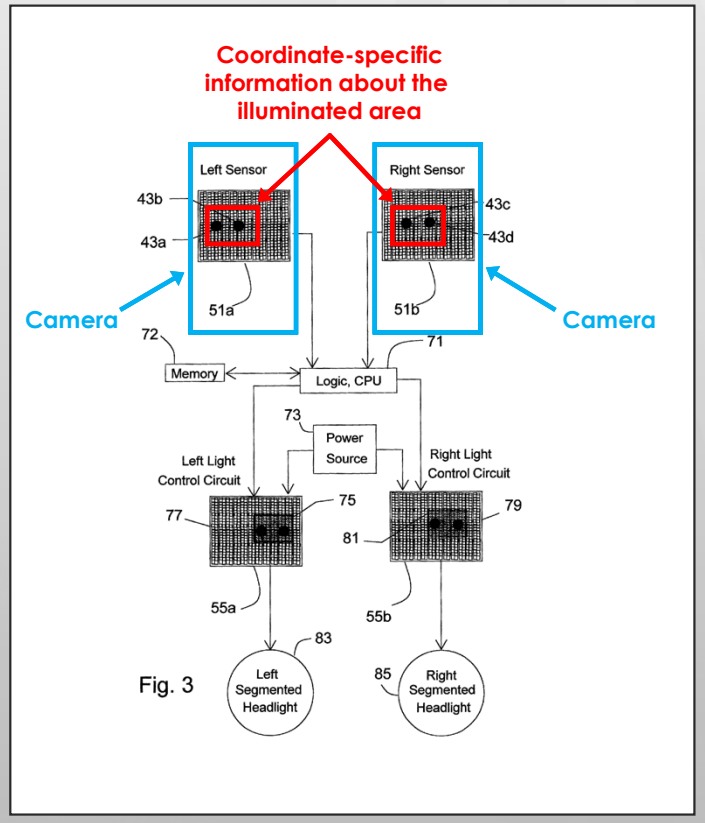
Alden at [0027]

IPR2023-01039 Pet. at 16-19, 23-25
IPR2023-01040 Pet. at 16-18, 23-24

DEMONSTRATIVE EXHIBIT – NOT EVIDENCE

Mercedes EX1014
Mercedes-Benz USA LLC v. Spero
IPR2023-1039

Alden Discloses Sensors for Detecting Information



Alden at Fig. 3 (annotated)

dently control each illumination sector. It is an advantage of the present invention to automatically control each illumination sector in response to sensed environmental conditions. In a first embodiment, it is an advantage of the present

Alden at [0008]

described in FIG. 2. In practice, a left sensor **51***a* and a right sensor **51***b* are used concurrently. The **51***a* detects the two headlights of **41** at a first illuminated spot **43***a* and a second illuminated spot **43***b* respectively. These spots of light fall

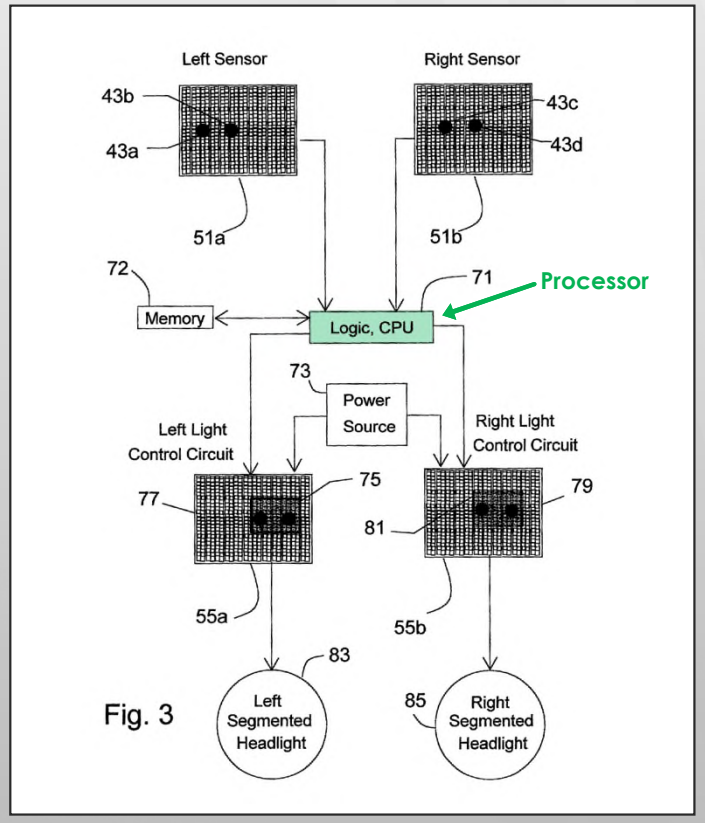
Meanwhile, **51***b* also detects the two headlights of **41** as a first spot **43***c* and a second spot **43***d* respectively. This

Alden at [0027]

IPR2023-01039 Pet. at 20-23, 27
IPR2023-01040 Pet. at 20-22, 26
IPR2023-01034 Pet. at 16, 53-55

Mercedes EX1014
Mercedes-Benz USA LLC v. Spero
IPR2023-1039

Alden Discloses a Controller (Processor) with Logic



Alden at Fig. 3 (annotated)

receive significant light (in this illustration). Electrons corresponding to the position and intensity of light are categorized by a logic and CPU **71** and stored in a memory **72**.

Alden at [0027]

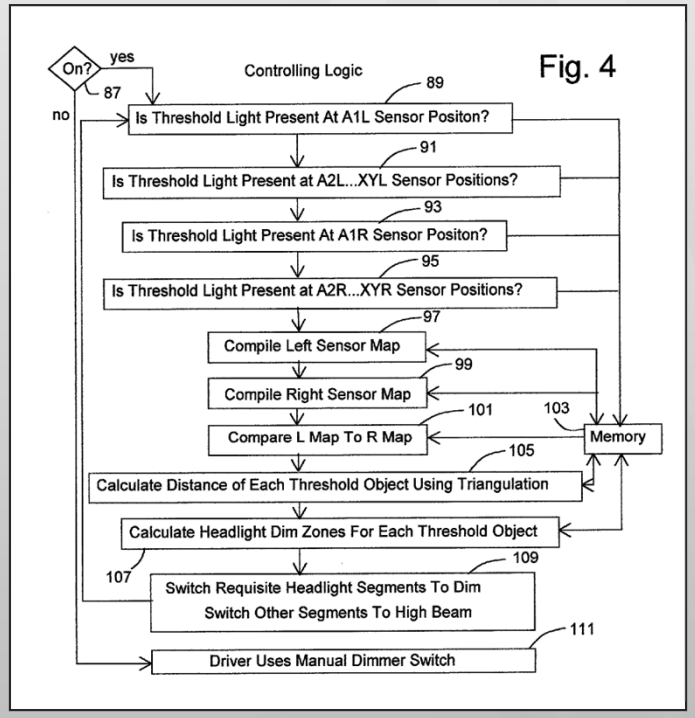
array of switches **115**. Each switch is controlled by the CPU and logic previously described. For example the power to **119** is controlled by the CPU which dictates its respective switch characteristics at **115** such that the power from a power supply **113** carried via segment wire **117** is controlled in response to the sensed environmental conditions. All of the other light elements are similarly individually controlled.

Alden at [0029]

IPR2023-01039 Pet. at 23-32
IPR2023-01040 Pet. at 23-31
IPR2023-01034 Pet. at 16-20

Mercedes EX1014
Mercedes-Benz USA LLC v. Spero
IPR2023-1039

Alden's Controller Controls the LEDs Based on Sensor Information



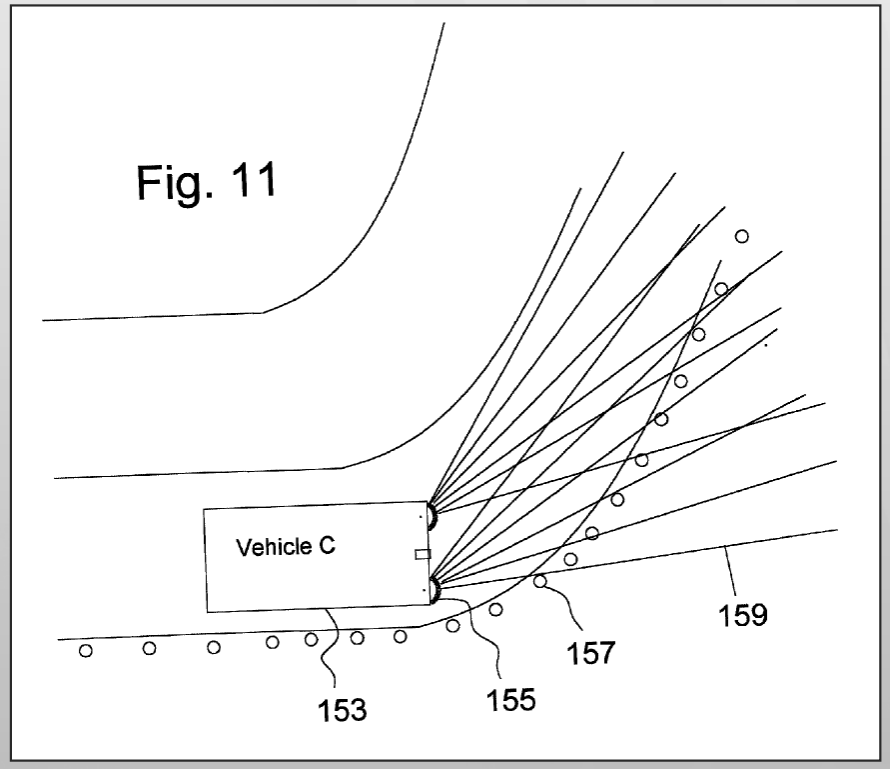
Alden at Fig. 4

- When Alden's system is on, the CPU checks each sector of the left and right light sensor.
- Using the light sensor data, the CPU compiles a left and right sensor map.
- The left and right sensor maps are used to determine which zones need dimmed illumination and which zones need high beam illumination.
- The LEDs in the headlights are then switched to high beam or dimmed to create the desired illumination pattern.

IPR2023-01039 Pet. at 31-36
IPR2023-01040 Pet. at 30-36
IPR2023-01034 Pet. at 55-63

Mercedes EX1014
Mercedes-Benz USA LLC v. Spero
IPR2023-1039

Alden's Controller Controls the LEDs Based on Sensor Information



Alden at Fig. 11

- Alden also identifies an upcoming road curve, including by detecting light from reflectors positioned along the road.
- Based on the data indicating that the road ahead curves, Alden "adapts the shape of the light pattern from the headlights to shift light … in the direction of the curve, so that the curve is illuminated with greater intensity and distribution of light," as shown in Fig. 11.

IPR2023-01034 Pet. at 27

IPR2023-01039 Pet. at 54-58
IPR2023-01040 Pet. at 62-67
IPR2023-01034 Pet. at 25-30

Mercedes EX1014
Mercedes-Benz USA LLC v. Spero
IPR2023-1039

Dispute 1 – Alden Is Enabled and Does Not Require Modification

All claims of the ’551 Patent

Claims 8/19/30 of the ’029 Patent

Mercedes EX1014
Mercedes-Benz USA LLC v. Spero
IPR2023-1039

Legal Standard for Enablement

- Disclosures in prior art publications are ***presumed*** enabled, and ***Patent Owner bears the burden*** to show non-enablement. *See Amgen Inc. v. Hoechst Marion Roussel, Inc.*, 314 F.3d 1313, 1355 (Fed. Cir. 2003).

- ***Patent Owner*** must show "***undue experimentation*** would be required [for a POSITA] to perform the claimed invention based on the teachings in [Alden]." *In re Antor Media Corp.*, 689 F.3d 1282, 1289 (Fed. Cir. 2012)

- ***Factors to be considered*** in determining whether undue experimentation is required include: (1) quantity of experimentation necessary, (2) amount of direction or guidance presented, (3) presence or absence of working examples, (4) nature of the invention, (5) state of the prior art, (6) relative skill of those in the art, (7) predictability or unpredictability of the art, and (8) breadth of the claims. *In re Wands,* 858 F.2d 731, 737 (Fed. Cir. 1988).

IPR2023-01039 Pet. Reply at 2-3
IPR2023-01040 Pet. Reply at 2-3

Mercedes EX1014
Mercedes-Benz USA LLC v. Spero
IPR2023-1039

Patent Owner Fails to Show Alden is not Enabled

- Patent Owner claims that Alden is "ambiguous" and does not provide "sufficient precision and detail."

  See, e.g., IPR2023-01039 POR at 33-34.

- However, Patent Owner does not discuss undue experimentation or any of the *Wands* factors.

- Additionally, Patent Owner's expert was unfamiliar with the standard for enablement and did not offer opinions on whether undue experimentation would be required.

Q. So your understanding is that for prior art to have an enabling disclosure, it has to describe something with sufficient precision, is that fair?

A. That's how I'm describing it here, yes.

Turk Depo. (EX1013) at 46:8-11

Q. Your Declarations don't discuss any particular experiments that you attempted with the systems disclosed in Alden, is that fair?

A. That's correct. My Declarations don't describe any experiments of mine.

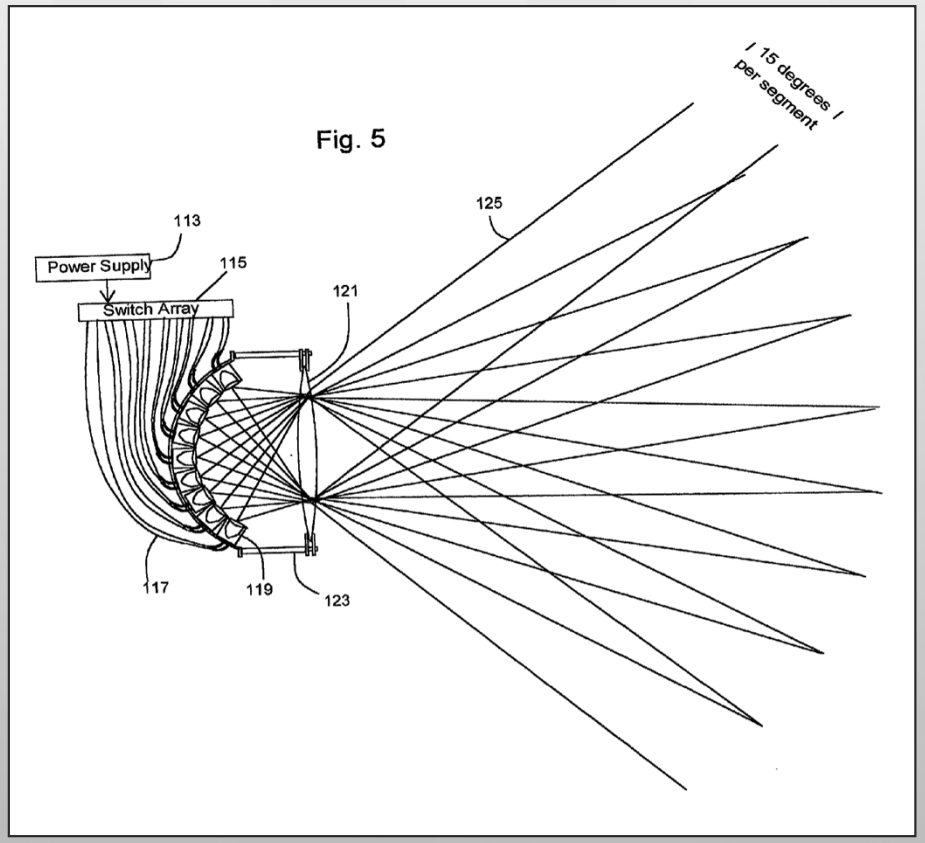
Id. at 33:4-8

IPR2023-01039 POR at 30-34, 39-43, 48-51, 55; PO Sur-reply at 6-13; Pet. Reply at 1-4
IPR2023-01040 POR at 24-29; PO Sur-reply at 1-7; Pet. Reply at 1-4
IPR2023-01034 POR at 16-17, 57-60; PO Sur-reply at 13-18; Pet. Reply at 17-20

Patent Owner's "Single-Row" Argument Fails

Patent Owner argues:

Alden's disclosure is not enabled because Fig. 5 of Alden is limited to a headlight with a ***single row*** of LEDs.



Alden at Fig. 5

IPR2023-01039 POR at 30-33, 39-43; Pet. Reply at 5-9
IPR2023-01040 POR at 24-29; Pet. Reply at 5-8
IPR2023-01034 POR at 57-60; PO Sur-reply at 13-18; Pet. Reply at 17-20

Alden's Fig. 5 is not Limited to a Single Row of LEDs

Fig. 5 is ***not*** limited to a single row of LEDs, as the Board correctly found at institution.

Institution Decisions

circuits. Ex. 1005, Fig. 3. While Alden's Figure 5 shows a sectional view of one segmented-headlight embodiment, that does not restrict the embodiment as a whole to a one-dimensional array. Indeed, Alden's disclosures contradict such a view.

IPR2023-01039 DI at 15; IPR20023-01040 DI at 17

herein." *Id.* ¶ 30. Considering Alden's description of its sensing-and-control circuit in connection with Figure 3, which illustrates a two-dimensional array, and its description of Figure 5's segmented headlight as working with that approach, we find that Alden's LED-based segmented headlight is capable of selective illumination in two dimensions.

IPR2023-01039 DI at 15-16; IPR20023-01040 DI at 17

IPR2023-01039 Pet. at 14-19, 26-31, 41-42; Pet. Reply at 5-9
IPR2023-01040 Pet. at 13-18, 25-30; Pet. Reply at 4-8
IPR2023-01034 Pet. at 14-16, 53-60; Pet. Reply at 17-20

Mercedes EX1014
Mercedes-Benz USA LLC v. Spero
IPR2023-1039

Patent Owner is Reading Fig. 5 in Isolation

- In discussing Fig. 5, Alden explains each LED is controlled by a corresponding switch in a switch array, and "[e]ach switch is controlled by the CPU and logic previously described." (Alden at [0029].)
- This "CPU and logic previously described" refers to Figs. 3-4 and their corresponding descriptions.
- Thus, Alden's Fig. 5 cannot be viewed in isolation; it must be read in connection with the descriptions of Figs. 3-4.

Patent Owner's expert agrees:

Q. So you would agree that in paragraph 29, it's referencing CPU and logic previously described, correct?

A. Yes, it does say that.

Q. And it's true, isn't it, that the only CPU and logic previously described is in paragraph 28 and 27, correct?

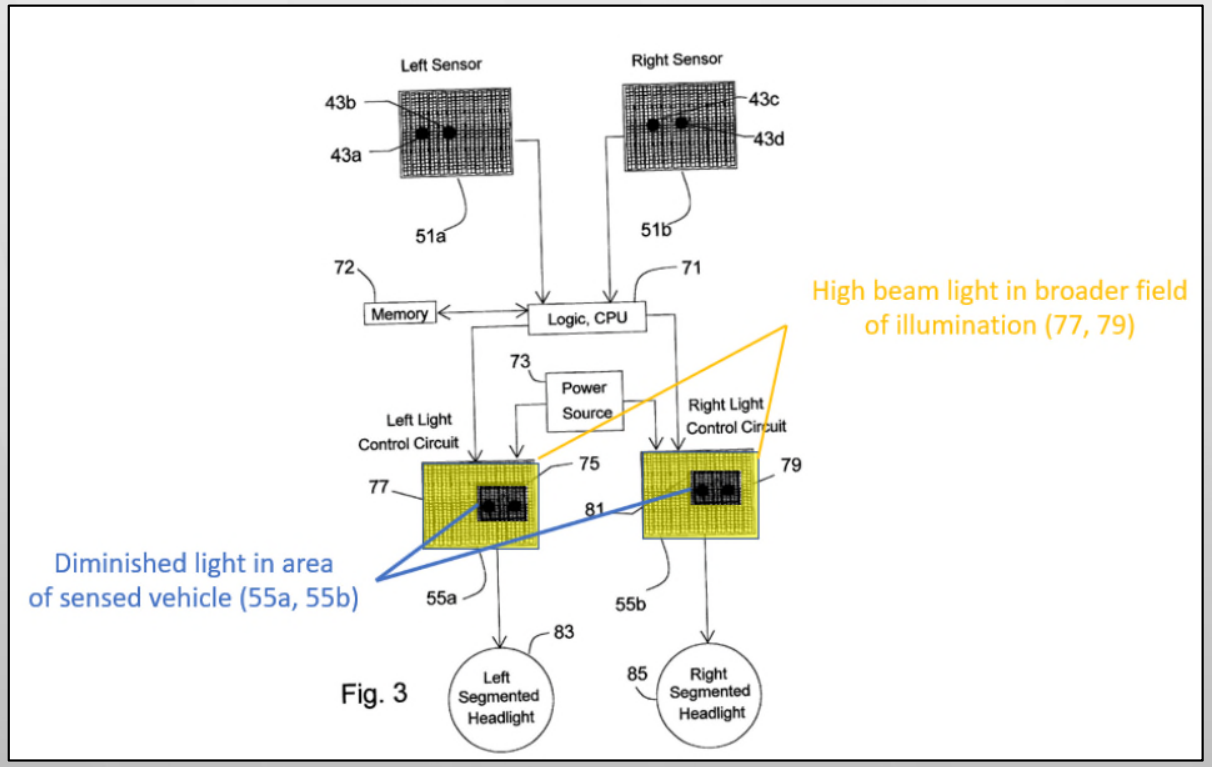
A. I believe that's the only previously described CPU and logic.

Turk Depo. at 122:12-22
(EX1013 in IPR2023-01039, -01040, EX1011 in IPR2023-01034)

IPR2023-01039 Pet. at 14-19, 26-31, 41-42; Pet. Reply at 5-9
IPR2023-01040 Pet. at 13-18, 25-30; Pet. Reply at 4-8
IPR2023-01034 Pet. at 14-16; Pet. Reply at 17-20

Fig. 3 Shows Differing Illumination Across a 2D Plane

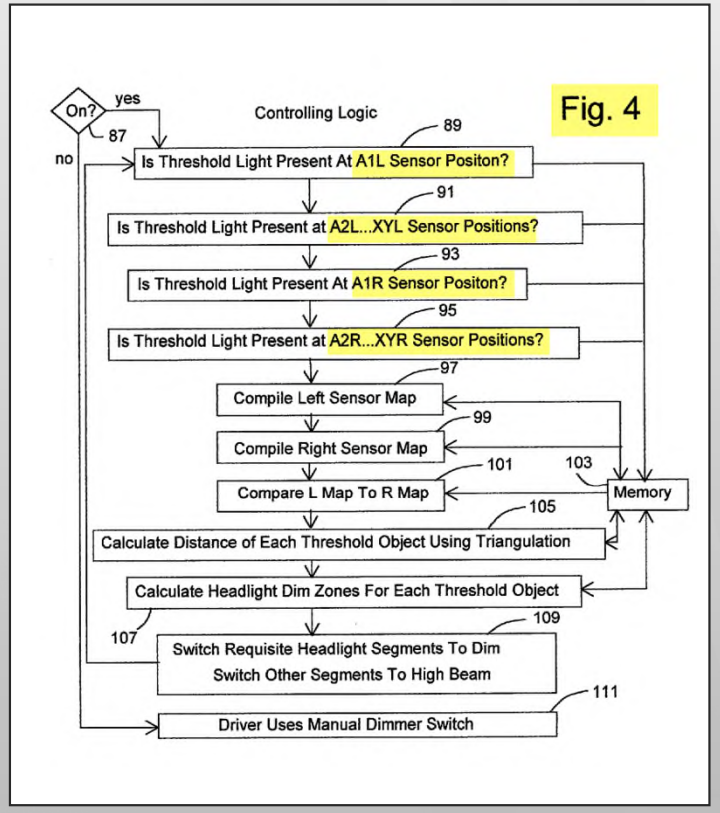
- As shown in Fig. 3, the "shaded circuit area … indicates … portions of the … headlight to be dim while a non-shaded … circuit area … represents the portions ... which will be on high beam." Alden at [0027].
- Thus, Alden "distributes high beams throughout its distribution areas except in a box in the direction" of the detected vehicle. *Id.*



Alden at Fig. 3 (annotated)

IPR2023-01039 Pet. at 39-43; Pet. Reply at 6-8; IPR2023-01040 Pet. at 25-29; Pet. Reply at 6-8
IPR2023-01034 Pet. at 55-63; Pet. Reply at 17-20; Second Papanikolopoulos Decl. (EX1010) at ¶¶25-26
Papanikolopoulos Depo. (EX2041) at 57:12-58:4, 60:1-10, 106:22-107:10, 110:7-19

Fig. 4 Discloses CPU Logic Compiling 2D Sensor Maps



Alden at Fig. 4 (annotated)

26. As a further example, Figure 4 discloses the CPU logic compiling two-dimensional (XY) sensor maps of the detected light and determining dimmed and high beam zones within this XY space. (*Id.*, Fig. 4, [0028].) Particularly, Alden discloses the system checks each sector of the left sensor 89, from A1L, A2L through XYL, and similarly checks each sector of the right sensor, from A1R, A2R through XYR. (*Id.*) This is a clear indication that the sensor sectors are distributed in two dimensions, X and Y. For this logic to apply to Figure 5, as Alden expressly says it does, a POSITA would understand that a two-dimensional array of LEDs would be used corresponding to the two-dimensional sensor sectors. In particular, where

Second Papanikolopoulos Decl. at ¶26
EX1010 in IPR2023-01034

IPR2023-01039 Pet. at 26-31; Pet. Reply at 6-8; IPR2023-01040 Pet. at 25-30; Pet. Reply at 6-8
IPR2023-01034 Pet. at 55-63; Pet. Reply at 17-20; Second Papanikolopoulos Decl. (EX1010) at ¶26
Papanikolopoulos Depo. (EX2041) at 57:12-58:4, 60:1-10, 106:22-107:10, 110:7-19

Additional Evidence That Fig. 5 is not Limited to Single Row

- Figure 5 shows ***a sectional view of a row of LEDs*** to illustrate the segmented lighting, with it being understood that ***the full array in the front-on view would be two-dimensional***, as similarly shown in Figures 6-7.

Alden at Figs. 5-7, [0029]-[0031]; Papanikolopoulos Depo. (EX2041) at 57:12-58:4, 106:22-107:10, 110:7-19
Second Papanikolopoulos Decl. (EX1010 in IPR2023-01034) at ¶24

- Alden discloses that Figure 5 illustrates "the segmented headlight" comprised of an "***array***" of lighting elements, not a "row" of lighting elements.

Alden at [0029], Fig. 5; IPR2023-01039 EX1003 at ¶¶56-59; IPR2023-01040 EX1003 at ¶¶65-70; IPR2023-01034 EX1003 at ¶¶117-120

- For Alden's Figure 5 LEDs to direct light uphill and downhill, for example, there must be multiple rows of LEDs with some angled and positioned on the curved surface to direct light upwards and others angled and positioned to direct light downwards.

Alden at Figs. 11-13, [0037]-[0038]; IPR2023-01039 EX1003 at ¶¶49, 137; IPR2023-01040 EX1003 at ¶49
Second Papanikolopoulos Decl. (EX1010 in IPR2023-01034) at ¶27

IPR2023-01039 Pet. at 15-16, 34-35; Pet. Reply at 5-9
IPR2023-01040 Pet. at 15-16, 34-35; Pet. Reply at 5-8
IPR2023-01034 Pet. at 14-16; Pet. Reply at 17-20

Mercedes EX1014
Mercedes-Benz USA LLC v. Spero
IPR2023-1039

Alden Does not Need to be Modified

Patent Owner argues:

No presumption of enablement attaches because "Petitioner does not rely on express disclosure, but rather modifies Figure 5 using Figure 3 and piecemeal descriptors."

But a POSITA would know:

- Alden discloses "[e]ach lighting element being independently controlled by a corresponding switch." Alden at [0029].
- Even Patent Owner's expert admits this is how Alden would work:

Q. So, Alden is saying here that there is one switch for each LED, correct?

A. I believe so, yes.

Q. So if there were nine LEDs, you would have nine switches, right?

A. I believe so.

Q. And if there were 27 LEDs, there would be 27 switches, right?

A. There should be, yes.

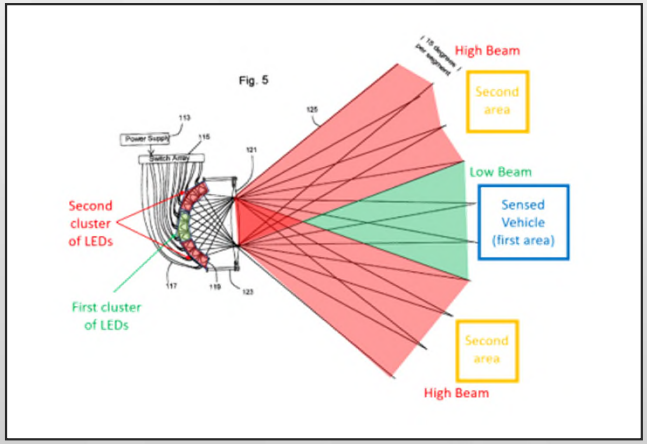
IPR2023-01039 Turk Depo. (EX1013) at 121:8-18

IPR2023-01039 POR at 32-34; PO Sur-Reply at 6-13; Pet. Reply at 5-8
IPR2023-01040 POR at 26-29; PO Sur-Reply at 1-7; Pet. Reply at 5-8
IPR2023-01034 PO Sur-reply at 16-17; Pet. Reply at 17-20; Second Papanikolopoulos Decl. (EX1010) at ¶¶28-29

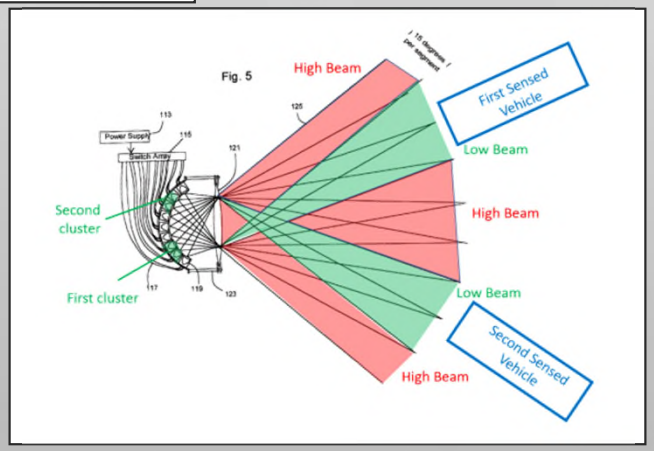
Petitioner's Annotations Accurately Depict Alden

Patent owner argues:

The Petition mischaracterizes Alden's disclosure by relying on annotated figures with an inaccurate scale.



IPR2023-01039 Pet. at 30



IPR2023-01039 Pet. at 49

IPR2023-01039 POR at 34-39, 44-48; PO Sur-reply at 13-16
IPR2023-01040 POR at 37; PO Sur-reply at 14-18
IPR2023-01034 POR at 60

Petitioner's Annotations Accurately Depict Alden

- Petitioner and Dr. Papanikolopoulos made clear the annotated figures demonstrate the concepts disclosed in Alden and are not intended to be to-scale technical drawings.
- This is consistent with case law, as it is well established patent drawings are not to scale.

vehicle (the annotated figure below, and other similar annotated figures herein, should be considered only as high-level representations to illustrate the different low beam and high beam light that characterizes the different sectors):

IPR2023-01040 Papanikolopoulos Decl. (EX1003) at ¶75

fins. Under our precedent, however, it is well established that patent drawings do not define the precise proportions of the elements and may not be relied on to show particular sizes if

Hockerson-Halberstadt, Inc. v. Avia Grp. Int'l, Inc., 222 F.3d 951, 956 (Fed. Cir. 2000)

IPR2023-01039 DI at 13; Pet. Reply at 13-17
IPR2023-01040 DI at 13; Pet. Reply at 11-17
IPR2023-01034 Pet. Reply at 20-23

Mercedes EX1014
Mercedes-Benz USA LLC v. Spero
IPR2023-1039

Dispute 2 – Alden Increases Light in the Direction of Road Curves

Claims 1/12/23 of the ’029 Patent

Claims 26/34/42/50/58/66/74/82 of the ’551 Patent

Mercedes EX1014
Mercedes-Benz USA LLC v. Spero
IPR2023-1039

Alden Increases Light in the Direction of Road Curves

Claims 1/12 of the '029 Patent	Claim 23 of the '029 Patent	Claim 26 of the '551 Patent	Claims 34/42/50/58/66/74/82 of the '551 Patent
determine a light change, the change adapting a light pattern of the headlamps in at least one of color, intensity or spatial distribution to ***increase light in a direction of the road curvature*** ahead of the motor vehicle	determining a light output, the output adapting a light pattern of the headlamps in at least one of color, intensity or spatial distribution to ***increase light in a direction associated with the shape change [of a road]*** ahead of the motor vehicle and shaping light based on the shape change	***accommodate the upcoming road curvature by adaptation of a light pattern*** of at least one of the at least one headlamps	***accommodate the road curvature by changing illumination in at least a direction of the road curvature*** by adaptation of the light pattern in at least one of color, intensity, or spatial distribution

DEMONSTRATIVE EXHIBIT – NOT EVIDENCE

Mercedes EX1014
Mercedes-Benz USA LLC v. Spero
IPR2023-1039

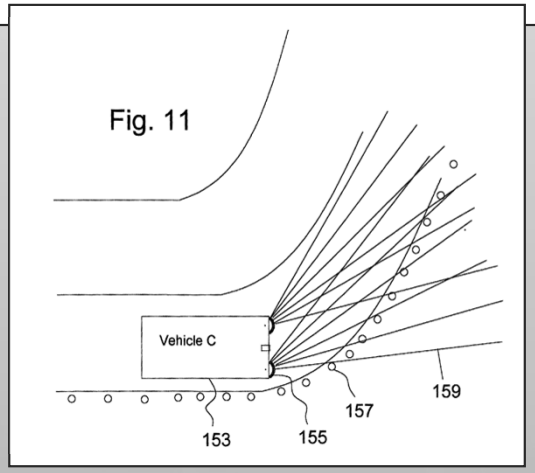
Alden Increases Light in the Direction of Road Curves

- Alden accommodates road curvature by adapting the light pattern to "***concentrate light to look around corners*** in response to road conditions," thereby increasing the amount of light in the area of the curve, as shown in Fig. 11.
- As can be seen in Fig. 11, "Alden's systems adapts the shape of the light pattern from the headlights to shift light to the left, in the direction of the curve, so that the curve is illuminated with greater intensity and distribution of light."

IPR2023-01034 Pet. at 27

[0036] **FIG. 11** illustrates the art of the present invention being used to concentrate light to look around corners in response to road conditions. An equipped vehicle **153** senses that the road turns by receiving light from reflectors such as a reflector **157**. The responding headlights **155** direct light into the corner to maximize the driver's ability to see there. The directing of light can be achieved with the segmented sensing elements and segmented light distribution elements described herein.

Alden at [0036]



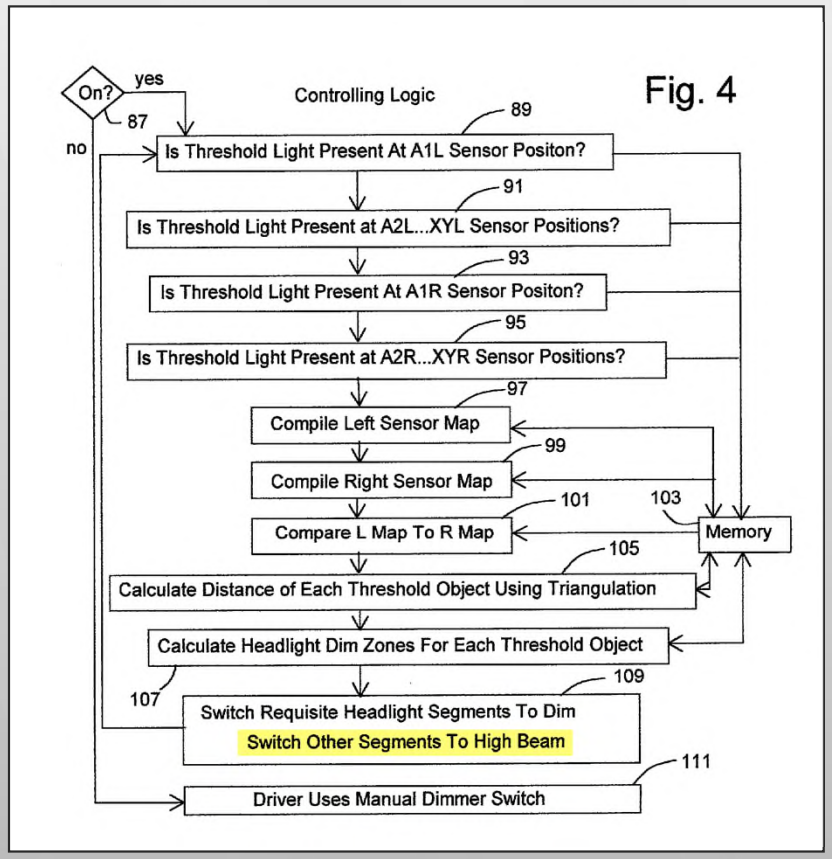
Alden at Fig. 11

IPR2023-01039 Pet. at 57-58; Pet. Reply at 17-19; EX1003 at ¶111
IPR2023-01040 Pet. at 62-64; Pet. Reply at 22-24; EX1003 at ¶134
IPR2023-01034 Pet. at 25-27; Pet. Reply at 1-8; EX1003 at ¶¶71-72; EX1010 at ¶¶5-13

Mercedes EX1014
Mercedes-Benz USA LLC v. Spero
IPR2023-1039

Alden Increases Light in the Direction of Road Curves

As Dr. Papanikolopoulos explained (EX2041 at 78:16-80:8), the road curve accommodation functionality is achieved using "the same logic" described in Fig. 4, with the system now configured to detect light from roadside reflectors and switch LEDs aimed at segments including the reflectors to high beam.



Alden at Fig. 4

IPR2023-01039 Pet. at 57-58; Pet. Reply at 17-19; EX1003 at ¶111
IPR2023-01040 Pet. at 62-64; Pet. Reply at 22-24; EX1003 at ¶134
IPR2023-01034 Pet. at 25-27; Pet. Reply at 1-8; EX1003 at ¶¶71-72; EX1010 at ¶¶5-13

Mercedes EX1014
Mercedes-Benz USA LLC v. Spero
IPR2023-1039

Alden Can Distinguish Roadside Reflectors from Headlights

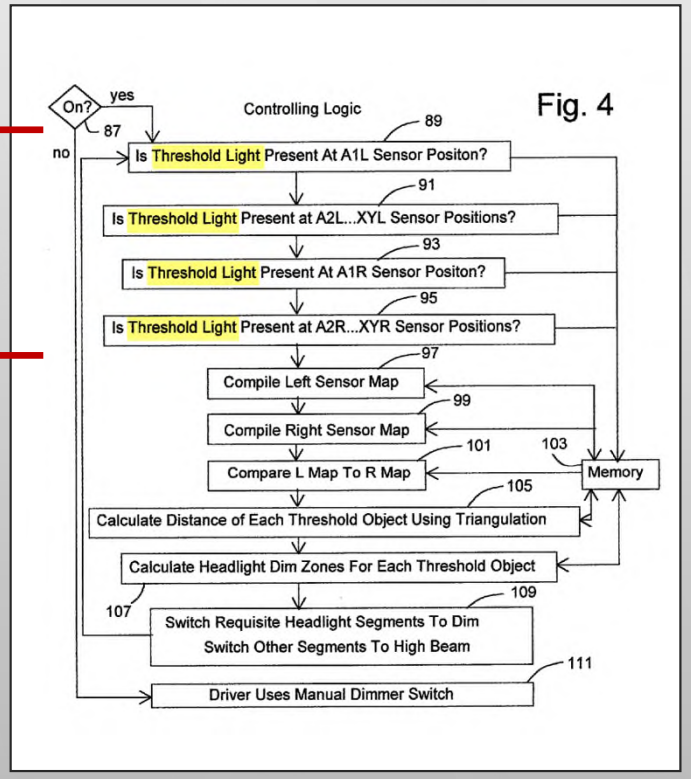
Patent Owner argues:

"Alden lacks any ability to determine whether detected light is a reflector indicative of a curve, which warrants curve-emission, or detected light indicative of a vehicle, which warrants glare reduction."

See IPR2023-01034 POR at 25

But a POSITA would understand:

Alden teaches checking for light above a certain "threshold" at each location of the sensor array.



Alden at Fig. 4 (annotated)

IPR2023-01039 POR at 48-49, PO Sur-reply at 19-21; Pet. at 54-57; Pet. Reply at 9-11; EX1003 at ¶111
IPR2023-01040 POR at 51-52, PO Sur-reply at 21-23; Pet. at 62-64; Pet. Reply at 20-22; EX1003 at ¶134
IPR2023-01034 POR at 22-25; Pet. at 25-27; Pet. Reply at 1-8; EX1003 at ¶¶71-72; EX1010 at ¶¶5-13

Alden Can Distinguish Reflectors from Headlights

- The logic of Figure 4 would apply to detecting roadside reflectors.
- To distinguish between different objects, such as roadside reflectors and oncoming vehicles, the threshold would simply be adjusted based on the type of object.

off. (EX1003, ¶59-65; EX2066, 114:20-115:14; Alden, [0027]-[0028], Fig. 4.) To distinguish between different objects, such as roadside reflectors or oncoming vehicles, a POSITA would have understood from Alden that the threshold intensity or distance of the process described in Figures 3 and 4 may, for example, simply be adjusted based on the type of an object. (*Id.*; *see also* EX2066, 114:20-115:14.) Additionally, Alden's system also evaluates the location/distance of detected lights in determining the headlight distribution pattern, which could also be used to differentiate between different objects. (*Id.*) A POSITA would understand that by looking at the spatial-temporal data representing light received from a reflector, Alden's system could distinguish the reflector from other objects. (*Id.*)

IPR2023-01034 Second Papanikolopoulos Decl. (EX1010) at ¶6

IPR2023-01039 Pet. at 57-58; Pet. Reply at 17-19; EX1003 at ¶111
IPR2023-01040 Pet. at 62-64; Pet. Reply at 22-24; EX1003 at ¶134
IPR2023-01034 Pet. at 25-27; Pet. Reply at 1-8; EX1003 at ¶¶71-72; EX1010 at ¶¶5-13

Alden Does Not Default All LEDs to Maximum High Beam

Patent Owner argues:

Alden cannot adapt the intensity or spatial distribution of the light pattern and cannot increase in the direction of the road curve because Alden's primary objective is to maximize light, and therefore, all LEDs must be on high beam unless specifically dimmed.

But a POSITA would understand:

Alden can be used for different applications including dimming where other vehicles are sensed and directing light into the area of road curves.

> 10. As a preliminary matter, even if maximizing light and selectively dimming only the sectors required to minimize glare for oncoming drivers was considered Alden's primary purpose, nothing in Alden suggests that its system must *always* operate to achieve this purpose, especially when performing other functionality expressly disclosed in Alden.

IPR2023-01034 Second Papanikolopoulos Decl. (EX1010) at ¶10

IPR2023-01039 POR at 50-54; PO Sur-reply at 21-23; Pet. at 57-58; Pet. Reply at 17-19; EX1003 at ¶¶111-13
IPR2023-01040 POR at 53-57; PO Sur-reply at 23-25; Pet. at 62-64; Pet. Reply at 23-24; EX1003 at ¶¶132-36
IPR2023-01034 POR at 22-36; PO Sur-reply at 1-8; Pet. at 25-27; Pet. Reply at 1-8; EX1003 at ¶¶71-72; EX1010 at ¶¶5-13
Papanikolopoulos Depo. (EX2041) at 50:9-51:3, 73:25-74:24, 78:22-80:24

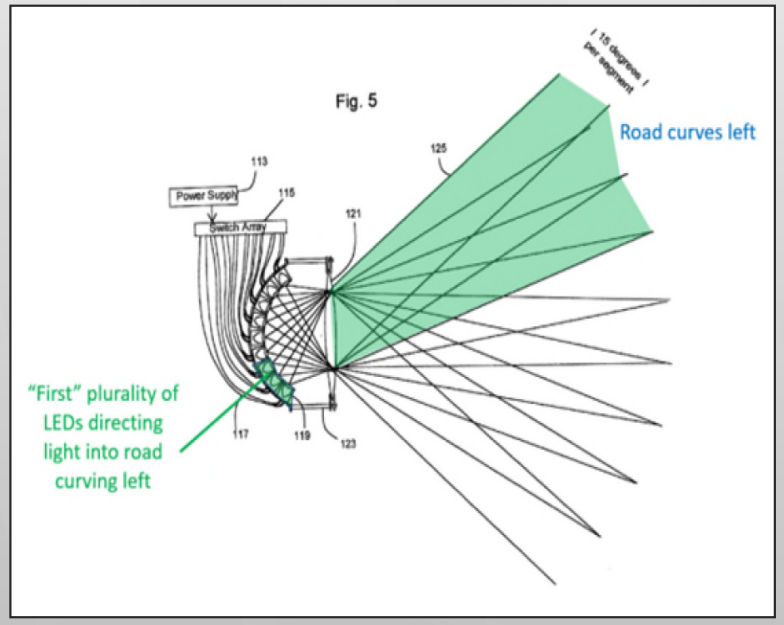
Alden Does Not Default All LEDs to Maximum High Beam

(*Id.*, Fig. 11.) As shown above, when preforming this functionality Alden's system does not simply operate all LEDs at high beam, only dimming sectors required to minimize glare. Rather, Alden discloses its LEDs are "operable within a range of intensities" and shows its system could control its LEDs to produce an illumination pattern like the one shown in the annotated Figure 5 included in my first declaration: (*Id.*, Fig. 5 (annotated), [0027]-[0029], [0036], [0061]; EX1003, ¶75.) That is, when the equipped vehicle approaches a left-hand curve, the LEDs aimed towards the left side of the headlight distribution area can be controlled to direct light to illuminate the curve while those aimed elsewhere could be terminated or dimmed.

IPR2023-01034 Second Papanikolopoulos Decl. (EX1010) at ¶11

(Alden, Fig. 5 (annotated), [0029].) As can be seen from the annotated figure, the three LEDs at the bottom of the array direct light in the sectors towards the left hand side of the headlight distribution area and thus can be controlled to produce the illumination pattern illuminating the curve.

IPR2023-01039 Papanikolopoulos Decl. (EX1003) at ¶111

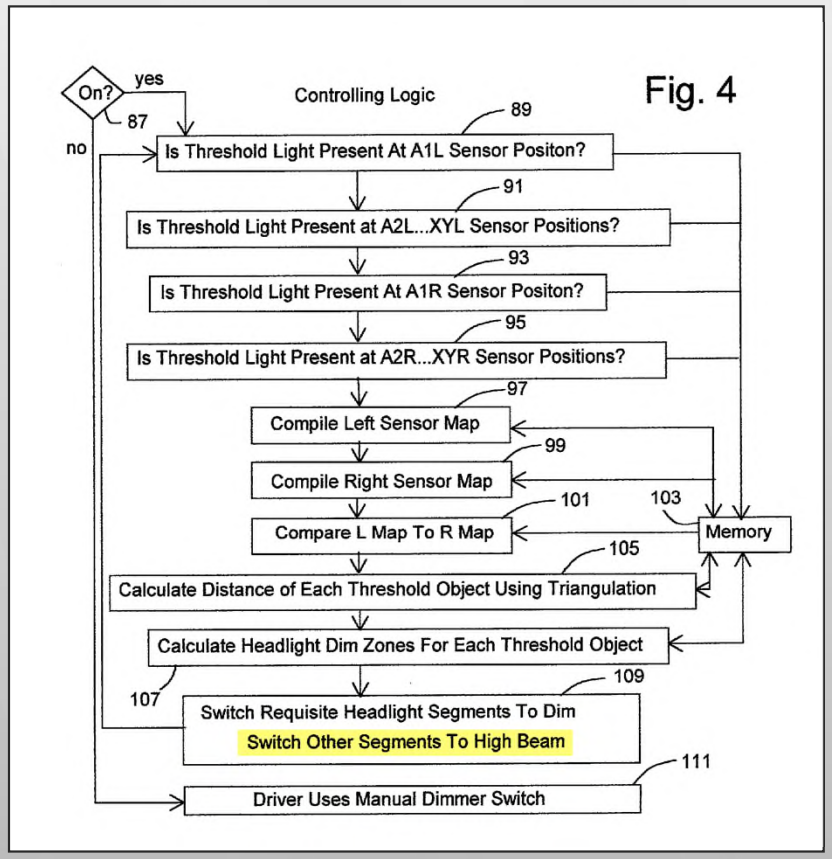


Alden at Fig. 5 (annotated)

IPR2023-01039 POR at 50-54; PO Sur-reply at 21-23; Pet. at 57-58; Pet. Reply at 17-19; EX1003 at ¶¶111-13
IPR2023-01040 POR at 53-57; PO Sur-reply at 23-25; Pet. at 62-64; Pet. Reply at 23-24; EX1003 at ¶¶132-36
IPR2023-01034 POR at 22-36; PO Sur-reply at 1-8; Pet. at 25-27; Pet. Reply at 1-8; EX1003 at ¶¶71-72; EX1010 at ¶¶5-13
Papanikolopoulos Depo. (EX2041) at 50:9-51:3, 73:25-74:24, 78:22-80:24

Alden Does Not Default All LEDs to Maximum High Beam

Fig. 4 shows the LEDs are not high beam by default, but rather Alden must "switch other segments to high beam."



Alden at Fig. 4

IPR2023-01039 POR at 50-54; PO Sur-reply at 21-23; Pet. at 57-58; Pet. Reply at 17-19; EX1003 at ¶¶111-13
IPR2023-01040 POR at 53-57; PO Sur-reply at 23-25; Pet. at 62-64; Pet. Reply at 23-24; EX1003 at ¶¶132-36
IPR2023-01034 POR at 22-36; PO Sur-reply at 1-8; Pet. at 25-27; Pet. Reply at 1-8; EX1003 at ¶¶71-72; EX1010 at ¶¶5-13
Papanikolopoulos Depo. (EX2041) at 50:9-51:3, 73:25-74:24, 78:22-80:24

Other ’551 Patent Disputes

IPR2023-01039
IPR2023-01040

Mercedes EX1014
Mercedes-Benz USA LLC v. Spero
IPR2023-1039

Claim 8 – Alden Discloses Identifying Vehicles

Claim 8 recites:

"identifying at least one of . . . (vi) road objects, people and/or vehicles . . ."

Alden discloses:

[0006] The present invention is a system for automatically controlling the distribution of a headlight in response to environmental conditions wherein, a means for sensing the locations of other vehicles is provided, said means dividing the exterior space into sectors and determining if an automobile is present in each respective sector. Additionally a

Alden at [0006]

The **31** comprising a means to detect the sector in which **33** (or any other vehicle) is located, the **31** also comprising a means to provide a first intensity of illumination in the sector where the **33** is detected while concurrently providing a second intensity (or alternate direction) of illumination where no vehicle is detected. Specific means for sensing locations of vehicles and independent sector illumination control within the light distribution area will be discussed later.

Alden at [0025]

IPR2023-01039 Pet. at 26-31, 76-78; Pet. Reply at 11-12

Claim 8 - Particular Steps for Identification are not Required

Patent Owner argues:

- Alden never "recognizes anything as a vehicle"; it assumes "light above a threshold" indicates an oncoming vehicle.
- Alden's system would "respond in the same fashion regardless of the actual source of such light."

But a POSITA would understand:

- The claims merely require identifying an oncoming vehicle without specifying particular steps for the identification.
- They do not require the system to operate with a specific level of accuracy.

IPR2023-01039 POR at 21-26, PO Sur-reply at 1-6
IPR2023-01039 Pet. at 76-78; Pet. Reply at 11-12; Papanikolopoulos Decl. (EX1003) at ¶51

Claim 8 - Perfect Accuracy is not Legally Required

IPR2016-00714
Patent 8,446,275 B2

activity points. Additionally, the reward item can be selected as a goal based on a user's interest in athletics. Pet. 13–14 (citing Ex. 1003 ¶¶ 114, 123). Additionally, the activity point price of the reward, which is the claimed "target score," is established based on the activity, for example athletics. Thus, we are not persuaded by Patent Owner's argument.

Patent Owner asserts that "Hoffman's activity points do not represent a user's health or wellness since "activity points are earned through non-athletic activity such as shopping," such as "award[ing] activity points for each dollar spent shopping at sponsoring companies." PO Resp. 14–15 (citing Ex. 1003 ¶¶ 6, 26, 77, 81). We disagree. As explained above in Section II.B.8., the dependent claims specifically include non-athletic activity within the scope of the claims. Under our claim construction, the claims do not require the point earned toward a "target score" be converted directly from athletic activity, rather the points need to be "based on" data representing "health-related activities." Additionally, Patent Owner admits that points in Hoffman "can be earned via athletic activity." PO Resp. 14. This is sufficient to meet the claim even if the points sometimes are earned from non-athletic activity. Prior art that sometimes explicitly[4] meets the claim elements is sufficient to show unpatentability. Just as a device or process that sometimes infringes nonetheless infringes (*Bell Commc'n Research, Inc. v. Vitalink Commc'n Corp.*, 55 F.3d 615, 622–23 (Fed. Cir. 1995)), a description of a device that in some embodiments anticipates nonetheless anticipates. *See Lewmar Marine, Inc. v. Barient, Inc.*, 827 F.2d 744, 747 (Fed. Cir. 1987) (that which would literally infringe if later anticipates if earlier).

from non-athletic activity. Prior art that sometimes explicitly[4] meets the claim elements is sufficient to show unpatentability. Just as a device or process that sometimes infringes nonetheless infringes (*Bell Commc'n Research, Inc. v. Vitalink Commc'n Corp.*, 55 F.3d 615, 622–23 (Fed. Cir. 1995)), a description of a device that in some embodiments anticipates nonetheless anticipates. *See Lewmar Marine, Inc. v. Barient, Inc.*, 827 F.2d 744, 747 (Fed. Cir. 1987) (that which would literally infringe if later anticipates if earlier).

Fitbit, Inc. v. Aliphcom, Inc., IPR2016-00714, Paper No. 27 at 22-3 (PTAB Sept. 13, 2017)

IPR2023-01039 Pet. Reply at 12

Mercedes EX1014
Mercedes-Benz USA LLC v. Spero
IPR2023-1039

Claim 48 - Alden Discloses Classifying Objects

Patent Owner argues:

Alden does not disclose the "classifying" element in claim 48 because it never "assign[s] an object a classification from among multiple classes or types of objects."

48. An illuminating device having automatic control of light provided to an illuminated area comprising:

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 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

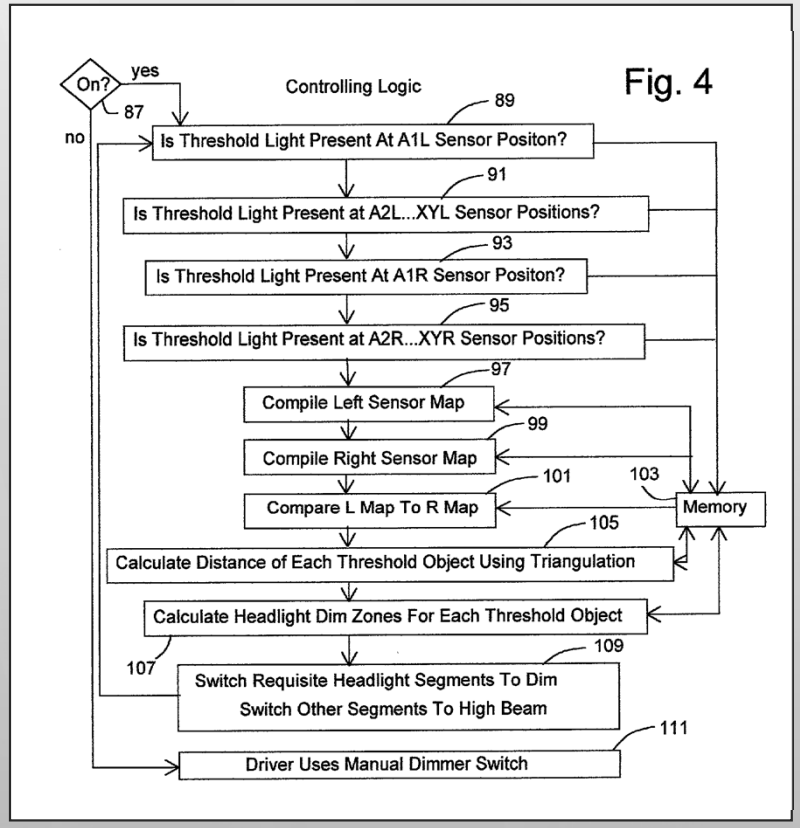
'551 Reexamination Certificate

IPR2023-01040 POR at 29-33; PO Sur-reply at 7-12

Mercedes EX1014
Mercedes-Benz USA LLC v. Spero
IPR2023-1039

Claim 48 - Alden Discloses Classifying Objects

- Alden senses light from objects, including other vehicles.
- After it senses light, Alden uses a "threshold" to classify the object.
- If Alden classifies an object as a vehicle, it provides dimmed illumination where that vehicle is present.
- High beam illumination is provided in sectors where no vehicles are detected.
- Accordingly, detected objects will be classified as a "vehicle" (if above threshold) or "not a vehicle" (if below threshold).



Alden at Fig. 4

IPR2023-01040 Pet. at 25-34; Pet. Reply at 8-10; Papanikolopoulos Decl. (EX1003) at ¶¶ 72-76

DEMONSTRATIVE EXHIBIT – NOT EVIDENCE

Mercedes EX1014
Mercedes-Benz USA LLC v. Spero
IPR2023-1039

Claim 48 - Alden Discloses Classifying Objects

Patent Owner argues:

Alden's system "responds in the same fashion regardless of the actual source of such light."

But, again, the law is clear:

"Prior art that sometimes explicitly meets the claim elements is sufficient to show unpatentability."

Fitbit, Inc. v. Aliphcom, Inc., IPR2016-00714, Paper No. 27 at 22-3 (PTAB Sept. 13, 2017)

IPR2023-01040 POR at 29-33; PO Sur-reply at 7-12
IPR2023-01040 Pet. at 31-34; Pet. Reply at 8-10; Papanikolopoulos Decl. (EX1003) at ¶51

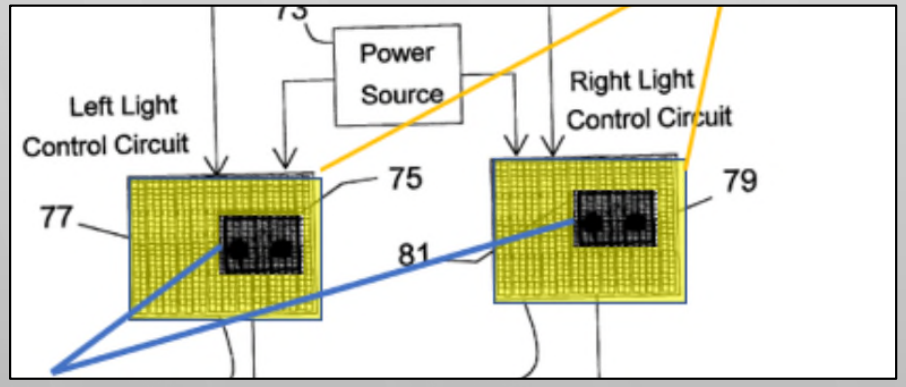
Claim 32 - Alden Disclose Illumination "Above" the Dimmed Beam

Patent Owner argues:

The headlight "in Figure 5 of Alden illustrates a single-row of LED elements," and therefore is "incapable of satisfying" the claim limitations of "*creat[ing] a beam . . . diminished in intensity relative to the broader field of illumination illuminating at least* ***above*** *… the beam.*"

A POSITA would understand:

- Alden is not limited to a single row of LEDs.
- Additionally, as the Board found at institution (IPR2023-01039 DI at 16), Alden expressly discloses that it provides non-dimmed illumination ***above*** an oncoming vehicle, as can be seen in Fig. 3:



Alden at Fig. 3 (annotated)

IPR2023-01039 POR at 39-41; PO Sur-Reply at 13
IPR2023-01039 Pet. at 39-43; Pet. Reply at 8-9; EX1003 at ¶¶82-86

Mercedes EX1014
Mercedes-Benz USA LLC v. Spero
IPR2023-1039

Claim 40 - Alden Discloses Concurrently Detecting Multiple Vehicles

Patent Owner argues:

Alden "fails to enable … control over light directed to multiple vehicles," because it does not describe "concurrent detection of multiple vehicles" and instead simply references "vehicles encountered in the distribution area serially over time."

Alden clearly discloses:

Its system can detect the location of multiple vehicles and dim the light to all detected vehicles at the same time.

> dim beam areas are created concurrently. All embodiments maximize the areas receiving high beams for the benefit of the equipped vehicle driver while concurrently all areas with other drivers present receive low beams so as to minimize the glare for to betterment of other drivers.

Alden at Abstract

> 1. A vehicular headlight system producing a light distribution area, comprising
>
> a means for sensing the location of other vehicles,
>
> a means for diminishing the amount of light directed to said other vehicles, wherein

Alden at Claim 1

IPR2023-01039 POR at 43-48; PO Sur-reply at 16-18
IPR2023-01039 Pet. at 47-51; Pet. Reply at 16-17

Claims 72 and 80 - Alden Discloses the "Laterally Adjacent" Limitation

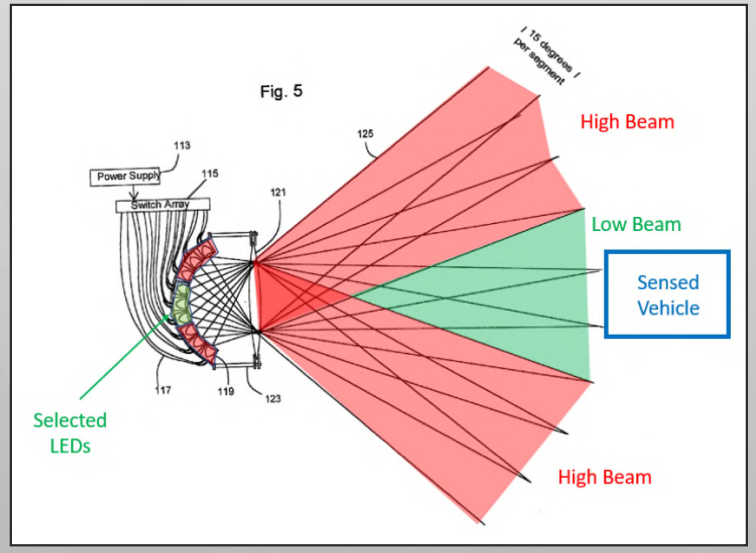
Patent Owner argues:

Alden does not disclose the "laterally adjacent" limitation in claims 72 and 80 because annotated Figure 5 illustrates areas immediately adjacent to the sensed vehicle, or target, illuminated with the same low beam light as the sensed vehicle.

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

maintain a variance of illumination provided to the target relative to the laterally adjacent areas, when subse-

'551 Reexamination Certificate at 11:63-12:12



Alden at Fig. 5 (annotated)

IPR2023-01040 POR at 46-48; PO Sur-reply at 18-20
IPR2023-01040 Pet. at 10-12, 35-36, 54-56, 58-59; Pet. Reply at 17-20

Claims 72 and 80 - Alden Discloses the "Laterally Adjacent" Limitation

But a POSITA would understand:

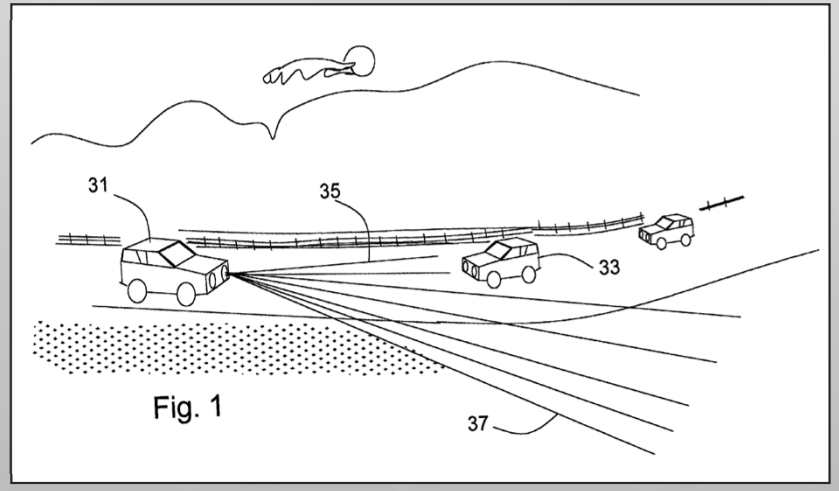
- All the claims require is that illumination towards the target is varied relative to areas laterally adjacent to the target.
- Alden clearly discloses its high beams illuminate sectors laterally adjacent to the sectors in which low beam is emitted.
- "[V]ariance of illumination between the target vehicle and laterally adjacent areas is maintained, as the target vehicle sectors are dimmed and laterally adjacent areas with no other vehicle are switched to high beam in real time."

IPR2023-01040 Pet. Reply at 20

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

maintain a variance of illumination provided to the target relative to the laterally adjacent areas, when subse-

'551 Reexamination Certificate at 11:63-12:12



Alden at Fig. 1; *see also* Fig. 2, [0025]-[0029]

IPR2023-01040 POR at 46-48; PO Sur-reply at 18-20
IPR2023-01040 Pet. at 10-12, 35-36, 54-56, 58-59; Pet. Reply at 17-20

Alden Can Both Diminish Glare and Accommodate a Curve (Claims 26-27, 34-35, 42-43, 50, 53, 58, 61, 66, 69, 74, 77, 82, 85)

Patent Owner argues:

Because Alden cannot tell the difference between headlights and reflective signs, its system cannot both diminish glare and accommodate a curve.

But as discussed in "Dispute 2":

Alden's system can detect both reflectors and oncoming vehicles with the light sensors.

(Alden, Fig. 11, [0036].) Alden can also 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." (*Id.*) 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.) If anything, the threshold level and distance of the detected light would simply be adjusted to consider something a road sign or reflector as opposed to headlights of an oncoming vehicle (which Alden discloses appear as two dots of light). 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. *See also supra* ¶¶106-111 (Claims 26/34/42).

IPR2023-01039 Papanikolopoulos Decl. (EX1003) at ¶150

IPR2023-01039 POR at 48-49, PO Sur-reply at 19-21; IPR2023-01040 POR at 51-52, PO Sur-reply at 21-23
IPR2023-01039 Pet. at 54-57; Pet. Reply at 9-11
IPR2023-01040 Pet. at 62-64; Pet. Reply at 20-22

Alden Can Both Diminish Glare and Accommodate a Curve (Claims 26-27, 34-35, 42-43, 50, 53, 58, 61, 66, 69, 74, 77, 82, 85)

- Alden clearly discloses that it can ***both*** diminish glare and accommodate a curve.
- In describing Fig. 11 where the system is "used to concentrate light to look around corners," Alden discloses this "can be achieved with the segmented sensing elements and segmented light distribution elements described herein." Alden at [0036].
- Alden further discloses "one or more methods employed herein may be used in combination to vary illumination in a segmented system." Alden at [0061].

A. So basically here what is happening, when there is a detection like this, Alden, by using the LEDs described in figure 5 and the corresponding paragraph, makes this dim while the other has full light in order to increase the visibility for the driver.

In figure 11, I believe, the same structural figure 5 can do the dual (phonetic). In other words, I can have dots of the reflectors -- instead of having the dots that correspond to the headlights, I have dots that correspond to the reflectors on the side of the road.

So I want to -- as we drive, we want to be able to see this better. So it's going to send as much light as possible to this one by using the same structure.

Papanikolopoulos Depo. (EX2041) at 78:16-79:6

IPR2023-01039 Pet. at 54-57; Pet. Reply at 9-11
IPR2023-01040 Pet. at 62-64; Pet. Reply at 20-22

Alden Discloses Identifying Road Curves Based on Sensor Data (Claims 29/37/45, 53/61/69/77/85)

- Dependent claims 29/37/45 and 53/61/69/77/85 recite "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***."
- The independent claims from which these depend recite sensors "for detecting coordinate-specific information about the illuminated area."

IPR2023-01039 Pet. at 20, 39-40, 46, 58-59
IPR2023-01040 Pet. at 20-22, 67

Mercedes EX1014
Mercedes-Benz USA LLC v. Spero
IPR2023-1039

Alden Discloses Identifying Road Curves Based on Sensor Data (Claims 29/37/45, 53/61/69/77/85)

In its Response, Patent Owner argued:

- "the sensor data" must refer to data from the sensors in the independent claims.
- Petitioner cites Alden's "steering wheel rotation sensor as providing *the sensor data*," but the rotation sensor does not detect "coordinate specific information" as recited in the independent claims.

But the Petition:

Cited to the light sensors for the independent claims *and* in the dependent claims clearly relied upon the same light sensor data being used to identify when a road curves.

> 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.)

IPR2023-01040 Pet. at 67

IPR2023-01039 POR at 55-57; IPR2023-01040 POR at 29-33
IPR2023-01039 Pet. at 20, 39-40, 46, 58-59
IPR2023-01040 Pet. at 20-22, 67

Other '551 Patent Disputes – Dependent Claims 29/37/45, 53/61/69/77/85

Patent Owner Argues in its Sur-reply:

Petitioner cannot rely on the light sensors detecting reflectors because the light sensors cannot distinguish between headlights and road-signs.

But again, as discussed in "Dispute 2":

Alden's system can detect both reflectors and oncoming vehicles with the light sensors.

(Alden, Fig. 11, [0036].) Alden can also 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." (*Id.*) 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.) If anything, the threshold level and distance of the detected light would simply be adjusted to consider something a road sign or reflector as opposed to headlights of an oncoming vehicle (which Alden discloses appear as two dots of light). 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. *See also supra* ¶¶106-111 (Claims 26/34/42).

IPR2023-01039 Papanikolopoulos Decl. (EX1003) at ¶150

IPR2023-01039 PO Sur-reply at 23; IPR2023-01040 PO Sur-reply at 25
IPR2023-01039 Pet. at 20, 39-40, 46, 58-59; Pet. Reply at 9-11
IPR2023-01040 Pet. at 20-22, 67; Pet. Reply at 24-25

The Claim 51 Grounds Incorporate Alden in View of Beam

Patent Owner argues:

Petitioner only argued claim 51 is unpatentable over Alden alone.

But the Petition clearly explains:

Claim 51 is the same as Claim 49, except for an additional limitation. And Claim 51 is rendered obvious by Alden for the same reasons as Claim 49 for common elements.

(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:

IPR2023-01040 Pet. at 65

IPR2023-01040 POR at 58-59; IPR2023-01040 Sur-Reply at 26
IPR2023-01040 Pet. at 65-66, 72-81; Pet. Reply at 25-27

Mercedes EX1014
Mercedes-Benz USA LLC v. Spero
IPR2023-1039

The Claim 51 Grounds Incorporate Alden in View of Beam

- The "non-emitting state" limitation of Claim 51 is a common element with Claim 49.
- Thus, this element is rendered obvious by Alden (alone or in combination with Stam) in view of Beam, as set forth in the Petition addressing claim 49.

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.)

IPR2023-01040 Petition at 72

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

IPR2023-01040 Petition at 76

IPR2023-01040 Pet. at 65-66, 72-81; Pet. Reply at 25-27

Mercedes EX1014
Mercedes-Benz USA LLC v. Spero
IPR2023-1039

Other ’029 Patent Disputes

IPR2023-01034

Mercedes EX1014
Mercedes-Benz USA LLC v. Spero
IPR2023-1039

Independent Claims 1/12/23

Issue: Can Kobayashi's map data be used with Alden?

Answer: Yes.

right. *Id.* Again, it would have been obvious to modify Alden in view of Kobayashi to determine the required changed shaping of light to accommodate upcoming road turns based on "map data." *Id.* (Papanikolopoulos Decl., ¶72.) Alden would continue to perform the same determination of changed light patterns to accommodate upcoming curves or changes in road shape, only now it would make the determination based on received map data indicating the road curve. (*Id.*)

IPR2023-01034 Pet. at 27

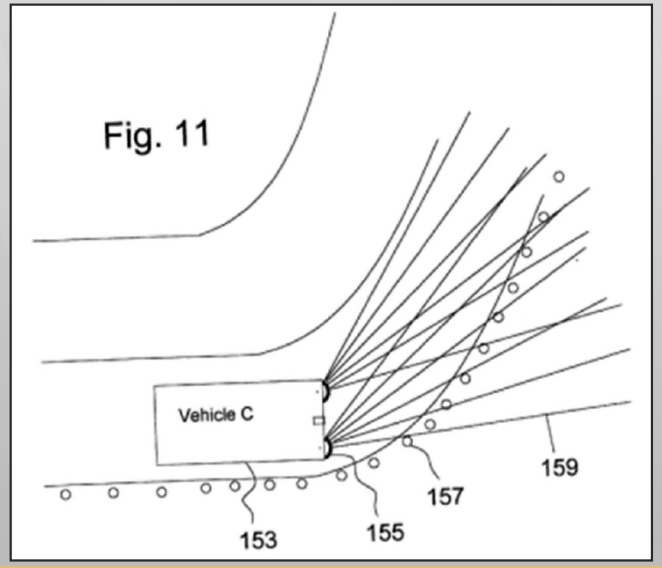
IPR2023-01039 POR at 50-54; PO Sur-reply at 21-23; Pet. at 57-58; Pet. Reply at 17-19; EX1003 at ¶¶111-13
IPR2023-01040 POR at 53-57; PO Sur-reply at 23-25; Pet. at 62-64; Pet. Reply at 23-24; EX1003 at ¶¶132-36
IPR2023-01034 POR at 22-36; PO Sur-reply at 1-8; Pet. at 25-27; Pet. Reply at 1-8; EX1003 at ¶¶71-72; EX1010 at ¶¶5-13
Papanikolopoulos Depo. (EX2041) at 50:9-51:3, 73:25-74:24, 78:22-80:24

Independent Claims 1/12/23

Issue: Does Alden in view of Kobayashi disclose "control at least a first plurality of the LED light sources to provide light … ***prior to*** the motor vehicle reaching the road curvature" as recited in dependent claims 1/12/23?

Answer: Yes.

- Alden directs light into the corner in response to detection of reflectors along the curve, which would be ahead of a vehicle.
- Figure 11 of Alden shows the light was already shifted left prior to the vehicle entering the curve



Alden at Fig. 11

IPR2023-01034 POR at 36-46; PO Sur-reply at 9-12
IPR2023-01034 Pet. at 27-30; Pet. Reply at 8-13; EX1003 at ¶¶73-77; EX1010 at ¶¶14-18

Mercedes EX1014
Mercedes-Benz USA LLC v. Spero
IPR2023-1039

Independent Claims 1/12/23

Patent Owner argues:

Alden only discloses the timing of the re-direction of light in connection with steering wheel rotation sensor in Figures 14 and 15, not Figure 11.

- But Figure 11 clearly shows the light is adjusted before the vehicle is turning.
- Alden discloses that its system is "***responsive to changing environmental conditions in real time***" (Alden at [0028]), and thus it adjusts light once detecting the reflectors on the curve, which is prior to reaching the curve.
- A POSITA would understand:

> 17. A driver begins to turn the steering wheel prior to entering the curve in order to align the vehicle with the direction of the beginning of the curve. The driver then continues to keep the steering wheel turned in order to follow the curvature of the road as the vehicle advances along the road. Thus, because a driver of a vehicle begins to turn the steering wheel prior to the vehicle entering the road curve, the system would control the LEDs prior to the vehicle entering the curve.

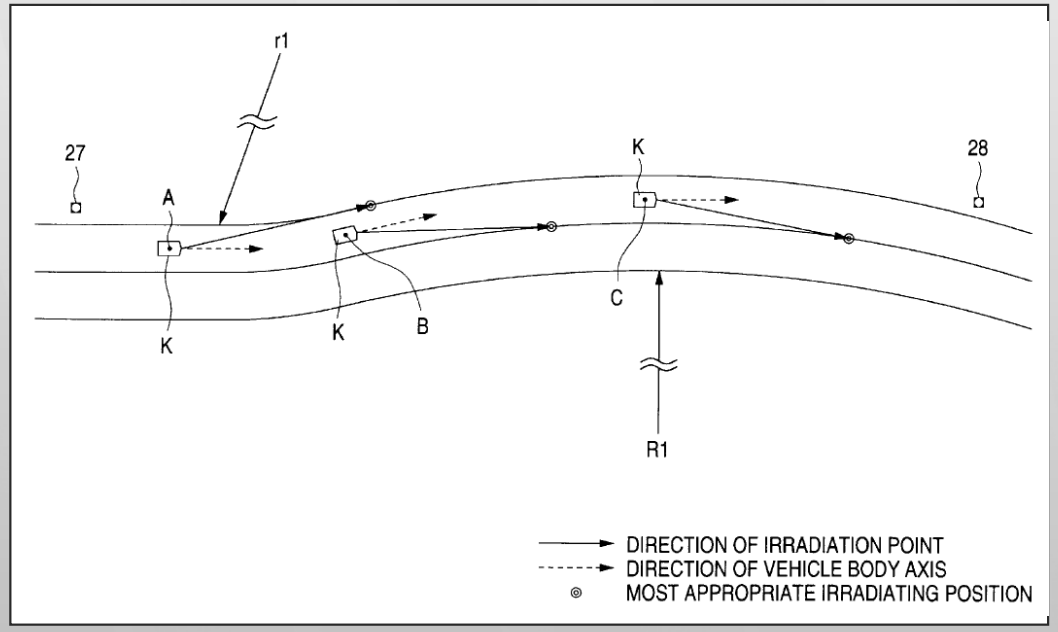
Second Papanikolopoulos Decl. (EX1010) at ¶17

IPR2023-01034 POR at 38-39; PO Sur-reply at 10-12
IPR2023-01034 Pet. at 27-30; Pet. Reply at 8-13; EX1003 at ¶¶73-77; EX1010 at ¶¶14-18

Mercedes EX1014
Mercedes-Benz USA LLC v. Spero
IPR2023-1039

Independent Claims 1/12/23

- Kobayashi also discloses controlling lights ***prior to*** the vehicle reaching a road curvature, as shown in Figure 10.
- Figure 10 depicts vehicle K approaching a road curvature and shows that the "direction of irradiation point" has been altered in the direction of road curvature before the vehicle reaches the curvature.



Kobayashi at Fig. 10

IPR2023-01034 Pet. at 27-30; Pet. Reply at 8-13; EX1003 at ¶¶73-77; EX1010 at ¶¶14-18; DI at 15-17

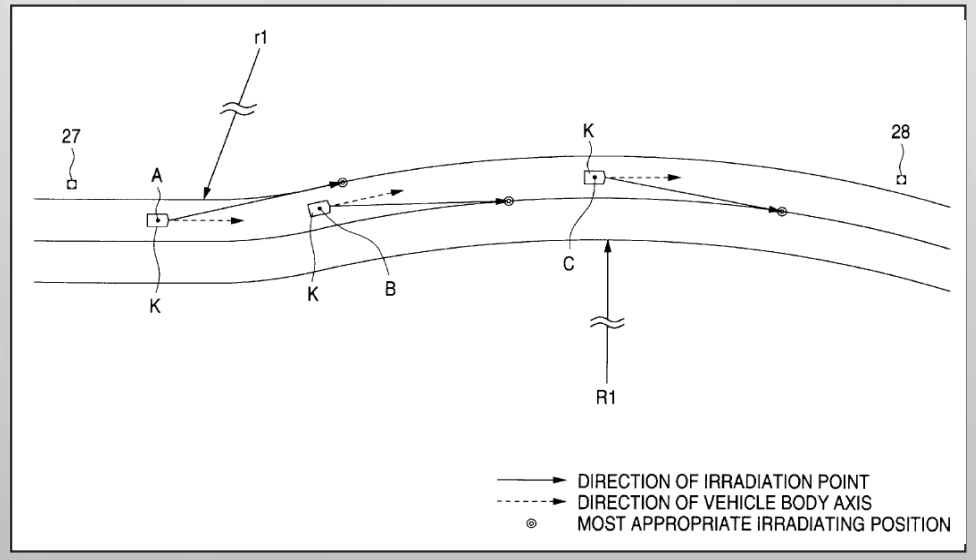
Mercedes EX1014
Mercedes-Benz USA LLC v. Spero
IPR2023-1039

Independent Claims 1/12/23

Patent Owner argues:

Kobayashi does not redirect light prior to the motor vehicle reaching the road curvature, pointing to the disclosure in Kobayashi that "[a]s shown at point A in Fig. 10, when the vehicle turns to the left, the left shoulder is irradiated. When the vehicle turns to the right, the right shoulder is irradiated."

- But Figure 10 of Kobayashi shows that when the vehicle turns, the shoulder of the road is ***already*** illuminated.



Kobayashi at Fig. 10

IPR2023-01034 POR at 39-40; PO Sur-reply at 12
IPR2023-01034 Pet. at 27-30; Pet. Reply at 8-13; EX1003 at ¶¶73-77; EX1010 at ¶¶14-18

Mercedes EX1014
Mercedes-Benz USA LLC v. Spero
IPR2023-1039

Dependent Claims 5/16/27

Issue: Does Alden in view of Kobayashi disclose "the increase of light in the direction of the road curvature includes at least ***an increase of light emitted at a level below high-beam light*** and directed in the direction of the road curvature" as recited in dependent claims 5/16/27?

Answer: Yes.

Alden discloses:

- Alden discloses its system is "operable within a range of intensities between the high beam and the low beam state." Alden at [0061]
- As Dr. Papanikolopoulos testified, "[c]ontrolling the LEDs directed to sectors including the road curvature to emit increased light below high-beam light, such as a 'medium' intensity light, would allow the driver to sufficiently see the road curvature, but would not blind potential oncoming vehicles that are not yet visible."

Papanikolopoulos Decl. (EX1003) at ¶100

IPR2023-01034 POR at 46-50; PO Sur-reply at 13
IPR2023-01034 Pet. at 41-43; Pet. Reply at 13-14; EX1003 at ¶¶98-100; EX1010 at ¶19

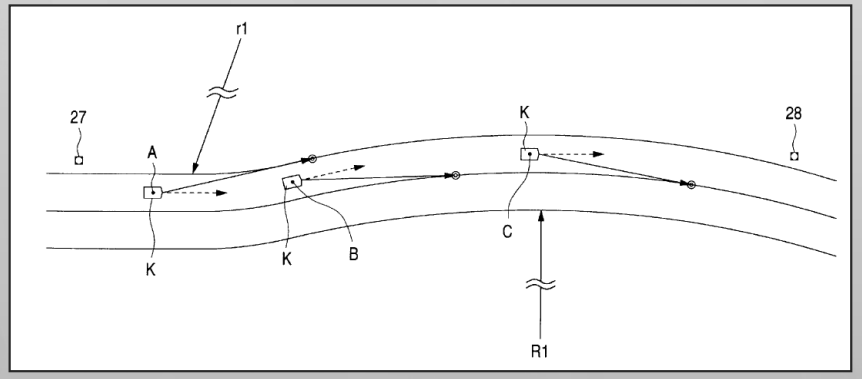
Mercedes EX1014
Mercedes-Benz USA LLC v. Spero
IPR2023-1039

Dependent Claims 6/17/28

Issue: Does Alden in view of Kobayashi disclose a "***second change*** adapting the light pattern of the headlamps" in a direction of a "***second road curvature***" and "control at least a second plurality of the LED light resources" as recited in dependent claims 6/12/23?

Answer: Yes.

- Alden discloses an iterative process that repeats in real-time, continuously determining the light output for each LED in the array, which includes determining a second light change that adapts the light pattern in the direction of a new, different curve.
- Kobayashi also teaches continuously "reshaping" the headlight beam pattern as a vehicle proceeds along multiple road curves using map data.



Kobayashi at Fig. 10

IPR2023-01034 POR at 51-53
IPR2023-01034 Pet. at 43-50; Pet. Reply at 14-15; EX1003 at ¶¶101-108

Dependent Claims 7/18/29

Issue: Does Alden in view of Kobayashi disclose "providing light directed in the direction of the road curvature ***from an LED not providing light directed in the direction of the road curvature prior to the change***" as recited in dependent claims 7/18/29?

Answer: **Yes, Alden alone or in view of Kobayashi renders this element unpatentable.**

IPR2023-01034 POR at 53-56
IPR2023-01034 Pet. at 50-52; Pet. Reply at 15-17; EX1003 at ¶¶109-112; EX1010 at ¶¶20-22

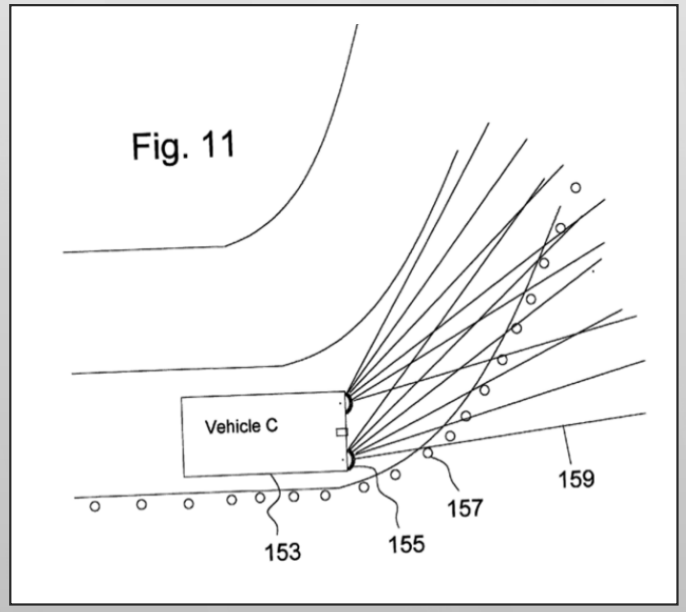
Mercedes EX1014
Mercedes-Benz USA LLC v. Spero
IPR2023-1039

Dependent Claims 7/18/29

As explained in the Petition, this can be seen in Figure 11 of Alden.

otherwise dimmed. *See supra* ¶¶5-18. Second, as explained in the Petition, Alden's system will "concentrate light to look around corners" when a curve is detected by "direct[ing] light into the corner to maximize the driver's ability to see there." (Petition 51-52; Alden, [0036].) It does this by emitting light from LEDs directed towards the curve which may not have previously been illuminated (as they do not direct light generally ahead), and thus it changes shape of the overall illumination by emitting light from LEDs not providing light directed towards the curve prior to the change. (EX1003, ¶¶107, 112.) Consider, for example, Alden's Figure 11:

Second Papanikolopoulos Decl. (EX1010) at ¶21



Alden at Fig. 11

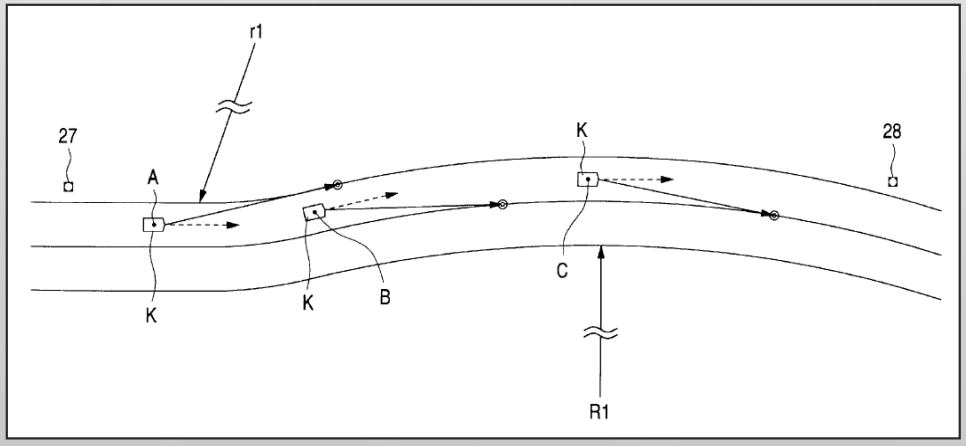
IPR2023-01034 Pet. at 27-30; Pet. Reply at 8-13; EX1003 at ¶¶73-77; EX1010 at ¶¶14-18; DI at 15-17

Mercedes EX1014
Mercedes-Benz USA LLC v. Spero
IPR2023-1039

Dependent Claims 7/18/29

- Additionally, Alden as modified by Kobayashi discloses continuously "reshaping" light output as a vehicle proceeds along a road with multiple curves.

- A POSITA would understand, if the road has a left-hand curve followed by a right-hand curve, the combined system will select a second set of LEDs to direct light into the right-hand curve that were not previously focusing light into the left-hand curve as the vehicle approaches the right-hand curve.



Kobayashi at Fig. 10

IPR2023-01034 Pet. at 27-30; Pet. Reply at 8-13; EX1003 at ¶¶73-77; EX1010 at ¶¶14-18; DI at 15-17

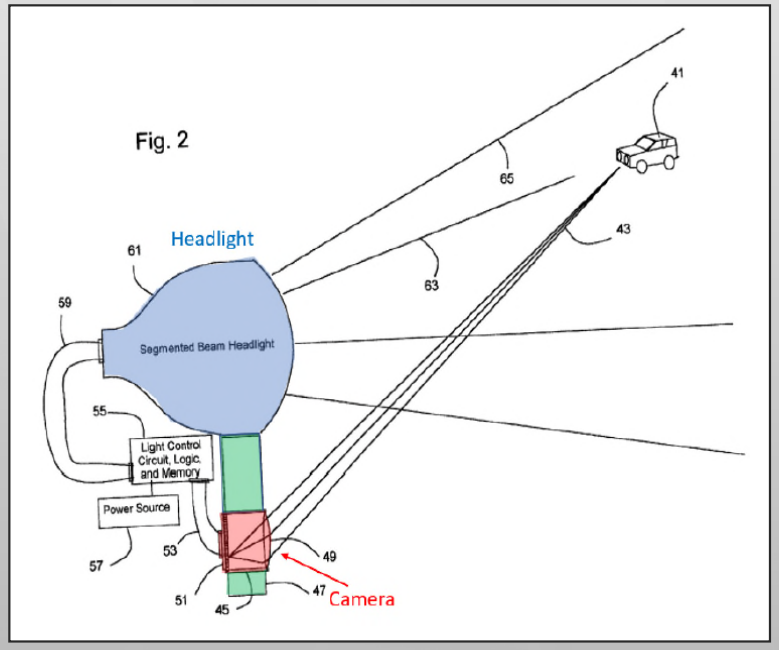
Mercedes EX1014
Mercedes-Benz USA LLC v. Spero
IPR2023-1039

Dependent Claims 8/19/30

Issue: Does Alden in combination with Kobayashi disclose the claim limitation of using data captured by ***one or more cameras*** to determine a position of another vehicle as recited in dependent claims 8/19/30?

Answer: Yes.

Alden discloses each segmented headlight includes a "sensor unit 45" ("camera") that can detect the presence of other vehicles within the headlight distribution area:

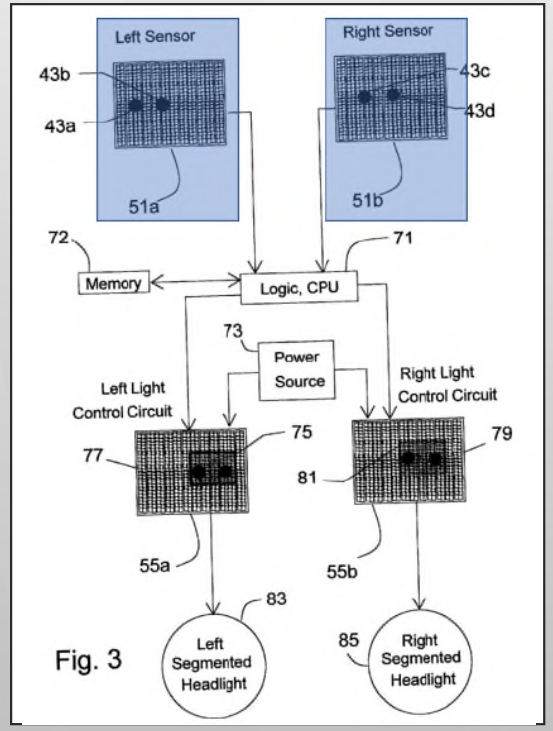


Alden at Fig. 2

IPR2023-01034 POR at 60-62
IPR2023-01034 Pet. at 53-55; Pet. Reply at 23-24; EX1003 at ¶¶114-116

Dependent Claims 8/19/30

- Alden discloses each "sensor unit 45" can include "a primary lens 49" and "a detector array 51" which is "a photodiode array (or an alternative means of detecting photon intensity such as a CCD)." Alden at [0026].
- Alden also discloses the detector array 51 is "converting photons to electrons which are sent … into a light control circuit including logic and memory 55." *Id*.
- Alden further discloses that its system includes a "left sensor 51a and a right sensor 51b" ("camera-sensors") that detect light from headlights of another vehicle at multiple positions 43a-d as shown in Fig. 3.



Alden at Fig. 3 (annotated)

IPR2023-01034 POR at 60-62
IPR2023-01034 Pet. at 53-55; Pet. Reply at 23-24; EX1003 at ¶¶114-116

Dependent Claims 9/20/31

Issue: Does Alden in combination with Kobayashi disclose "the control of the second plurality of LED light sources is based at least in part on ***third data received from a non-camera sensor*** of the motor vehicle" as recited in dependent claims 9/20/31?

Answer: Yes.

- Both Alden and Kobayashi disclose such non-camera sensors—Alden discloses, for example, using a steering wheel rotation sensor and Kobayashi discloses using a GPS sensor.
- As the petition explains, a POSITA would understand that control of the second plurality of LED light sources to reduce glare can be based on (1) Alden's steering wheel rotation sensor data or (2) Kobayashi's GPS sensor data.

IPR2023-01034 POR at 63-65; PO Sur-reply at 21-25
IPR2023-01034 Pet. at 69-71; Pet. Reply at 24-25; EX1003 at ¶¶138-143; EX1010 at ¶¶30-33

Mercedes EX1014
Mercedes-Benz USA LLC v. Spero
IPR2023-1039

Dependent Claims 9/20/31

- Alden discloses the method of controlling the headlight output based on the steering wheel rotation sensors. (Alden, [0039]-[0040].)
- Alden also discloses that "[o]ne or more" of these "method employed herein may be used in combination to vary illumination in a segmented system." (Alden, [0061].)
- Thus, a POSITA would have understood that controlling the headlight output based on the steering wheel rotation sensor could be used in combination with dimming sectors in which an oncoming vehicle is detected.

32. For example, the equipped vehicle may be traveling along a road that is initially straight with an oncoming vehicle ahead of the equipped vehicle. When the system detects the oncoming vehicle by sensing the vehicles headlights, the system will dim a group of LEDs aimed at the vehicle to diminish glare. (Alden, [0026]-[0028].) If equipped vehicle then approaches a right-hand curve, the driver of the equipped vehicle will begin to turn the steering wheel to the right. The steering wheel rotation sensor will detect that the steering wheel has been rotated "x" degrees. (*Id.*, [0058].) In response, the system will change the headlight output direction a corresponding "f(x)" degrees to maximize visibility. This change of the headlight output direction will include further controlling the plurality of LEDs aimed at the oncoming vehicle to diminish glare. By doing so, the area dimmed to diminish glare will be maintained around the oncoming vehicle.

Second Papanikolopoulos Decl. (EX1010) at ¶32

IPR2023-01034 Pet. at 69-71; Pet. Reply at 24-25; EX1003 at ¶¶138-143; EX1010 at ¶¶30-33

Dependent Claims 9/20/31

33. This control could similarly be achieved using data from Kobayashi's GPS sensor. Like before, Alden's light sensors could detect an oncoming vehicle and dim a plurality of LEDs aimed at the oncoming vehicle to diminish glare. Only now, rather than the headlight output direction being changed based on the steering wheel rotation sensor data indicating that the equipped vehicle is turning to follow a road curve, the headlight output direction would be changed based on Kobayashi's GPS sensor data indicating that the equipped vehicle is following a road curve. Thus, control of the plurality of LEDs dimmed to dimmish glare could be based at least in part on data from a non-camera sensor.

Second Papanikolopoulos Decl. (EX1010) at ¶33

IPR2023-01034 Pet. at 69-71; Pet. Reply at 24-25; EX1003 at ¶¶138-143; EX1010 at ¶¶30-33

Dependent Claims 9/20/31

Issue: Does Alden in combination with Kobayashi and Beam disclose "the control of the second plurality of LED light sources additionally includes ***termination of light from at least one LED*** providing light directed to the area prior to the termination" as recited in dependent claims 9/20/31?

Answer: Yes.

- Alden's system alone could operate LEDs at zero intensity as it discloses that the LEDs can be operated in a range of intensities. (Alden at [0061])
- Additionally, it would have been obvious to combine Beam's teaching of operating LEDs at zero intensity with Alden's system.

> camera could be used independently as shown in FIG. **1**. The incoming rays are imaged by the sensor **107** and are converted to video or other electrical signals used to drive controller **108**, which uses the data to determine the particular area of microbeams to be blanked. Rays from a lamp **202** fall on the surface of a spatial light modulator **203**, mounted on a support **204**, where they are either reflected through or blanked (attenuated by being either absorbed or deflected to an absorbing surface.) If reflected, they pass through beamsplitter **201** and out optical system **106**. Thus

Beam at 4:32-41

IPR2023-01034 POR at 66-67
IPR2023-01034 Pet. at 75-78; Pet. Reply at 26; EX1003 at ¶¶147-151

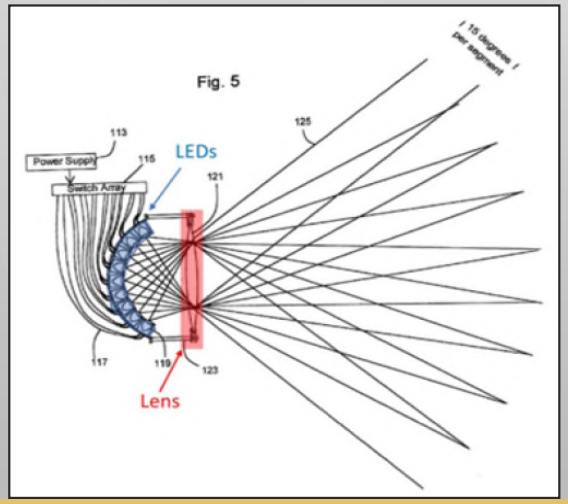
Mercedes EX1014
Mercedes-Benz USA LLC v. Spero
IPR2023-1039

Dependent Claims 21/32

Issue: Does Alden in combination with Kobayashi disclose "utilize/utilizing one or more ***optical control elements*** included in the motor vehicle to control light from at least the first plurality or second plurality of the LED light sources" as recited in dependent claims 21/32?

Answer: Yes.

- Alden discloses that its LEDs "are on a curve along the focal point of a headlight lens 121 such that the light from each lighting element goes into a specified portion (or portions) of the headlight distribution area." (Alden at [0029])
- Thus, a POSITA would understand Alden's lens is an optical control element utilized by the processor to produce the desired headlight distribution pattern:



Alden at Fig. 5

IPR2023-01034 POR at 67-71; PO Sur-reply at 18-21
IPR2023-01034 Pet. at 64-68; Pet. Reply at 27-28; EX1003 at ¶¶127-132; EX1010 at ¶34

Mercedes EX1014
Mercedes-Benz USA LLC v. Spero
IPR2023-1039