

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

VOLKSWAGEN GROUP OF AMERICA, INC.,
Petitioner,

v.

YECHEZKAL EVAN SPERO
Patent Owner.

U.S. Patent No. 11,208,029 to Spero

Case No.: IPR2022-01586

PATENT OWNER'S RESPONSE TO PETITION

TABLE OF CONTENTS

Table of Authorities	iv
List of Exhibits	vi
I. Introduction	1
II. Overview of the '029 Patent — The Claimed Invention is Directed to an Adaptive Multi-LED Headlight System for Predictive Curve Illumination	3
III. Prior Art.....	9
A. Beam	9
B. Kobayashi	10
C. Gotou	11
D. Karlsson.....	12
1. Window 50 depicts illumination being reduced for situational glare.....	13
2. The Base Device That Karlsson Improves Takes A Similar Approach To Situationally Reducing Full Emission	20
IV. Level of Ordinary Skill	21
V. Claim Construction	21
VI. The Petition Lacks Particularity Under § 312.....	22
VII. The Challenged Claims are Patentable	24
A. Ground 2: Gotou and Karlsson.....	24
1. Independent Claims 1, 12, and 23: The Gotou-Karlsson Combination Does Not Teach All Claim Limitations	24
a. Both Parties Agree That Karlsson Teaches Controlling the LED Array to Provide “Full Intensity” Light in the “Remaining Areas” Outside of the Anti-Glare Region “To The Fullest Extent Possible” – Therefore the Gotou-Karlsson Combination Does Not Teach “ <i>Increasing Light in a Direction of the Road Curvature</i> ”	24

2.	Dependent Claims: 5-7, 9-10, 16-18, 20-21, 27-29, 31, 32 - The Gotou-Karlsson Combination Does Not Teach All Claim Limitations	31
a.	Claims 5, 16, and 27	31
i.	Claims 5 and 16	31
ii.	Claim 27	33
b.	Claims 6, 17, and 28	34
c.	Claims 7, 18, and 29	35
d.	Claims 9, 20, and 31	36
e.	Claims 21 and 32	37
B.	A POSA Would Not Have Been Motivated to Combine Gotou and Karlsson	37
1.	Petitioner Fails to Explain Why, Absent Hindsight, a POSA Would Have Combined Gotou and Karlsson.....	38
2.	Petitioner Does Not Explain <u>How</u> a POSA Would Have Combined Gotou and Karlsson	40
a.	White LED lumen output.....	42
b.	Optical System.....	43
c.	Heat Management.....	44
d.	Packaging	45
e.	Control.....	46
3.	Modifying Gotou, as Proposed by Petitioner, Would Render Gotou <u>Inoperable</u> For Its Intended Purpose of Adjusting Illumination Direction	47
a.	Input Controls	48
b.	Output Controls	50
C.	Ground 1: Beam and Kobayashi	51
1.	Independent Claims 1, 12, and 23: Both Parties Agree That Beam Teaches Providing “Full Intensity” Light in the Areas Outside of the Anti-Glare Region – Therefore The Beam-Kobayashi Combination Does Not Teach “ <i>increas[ing] light in a direction of the road curvature ahead of the motor vehicle</i> ”	51
2.	Dependent Claims: 5, 6, 9, 16, 20, 27, 31 - The Beam- Kobayashi Combination Does Not Teach All Claim Limitations.....	53
a.	Claims 5, 16 and 27	53
i.	Claims 5 and 16	53
ii.	Claim 27	55

b.	Claims 6, 17, and 28	55
c.	Claims 9, 20, and 31	56
3.	A POSA Would Not Have Been Motivated to Combine Beam and Kobayashi	56
a.	The Proposed Combination Renders Beam Inoperable and Defeats Beam’s High-Intensity Illumination “At All Times” Purpose	56
i.	Petitioner’s Contorted Rationale Undermines the Crux of Beam’s Illumination Strategy	58
ii.	Petitioner Reads Beam in a Manner that Results in a Non-functional Device.....	64
b.	Petitioner Does Not Explain How a POSA Would Use Kobayashi’s Map Data to Control the Direction of Beam’s Maximum Intensity Microbeams to Increase Light.....	67
c.	Petitioner Fails to Identify Why a POSA would Add Map Data to Beam’s AABH System That Already Illuminates Curves Absent <u>Hindsight Bias</u>	68
VIII.	Conclusion	70
	Certificate of Service	71
	Certificate of Compliance Pursuant to 37 C.F.R. § 42.24.....	72

Table of Authorities

Cases

<i>ATD Corp. v. Lydall, Inc.</i> , 159 F.3d 534 (Fed. Cir. 1998).....	68
<i>Facebook, Inc. et al v. Uniloc USA, Inc. et al</i> , IPR2017-01524 (December 4, 2017).....	66
<i>Gen. Plastic Indus., LTD. v. Canon Inc.</i> , IPR2015-01954, Paper 9 (PTAB Mar. 9, 2016)	47, 58
<i>In re Gordon</i> , 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984)	47, 48, 51, 58, 66
<i>In re Kahn</i> , 441 F.3d 977 (Fed. Cir. 2006).....	38
<i>In re Royka</i> , 490 F.2d 981, 180 USPQ 580 (CCPA 1974).....	24
<i>Intel Corp. v. PACT XPP Schwiez AG</i> , 61 F.4th 1373 (Fed. Cir. 2023).....	38
<i>Intel Corp. v. Qualcomm Inc.</i> , 21 F.4th 784 (Fed. Cir. 2021).....	38, 39, 68
<i>Kinetic Concepts, Inc. v. Smith & Nephew, Inc.</i> , 688 F.3d 1342 (Fed. Cir. 2012).....	24
<i>KSR Int'l Co. v. Teleflex Inc.</i> , 550 U.S. 398 (2006), 82 USPQ2d at 1396 (2007)	37, 38, 40, 41
<i>Personal Web Techs., LLC v. Apple, Inc.</i> , 848 F.3d 987 (Fed. Cir. 2017.).....	41, 47
<i>Stryker Corp. v. Karl Storz Endoscopy America, Inc.</i> , IPR2015-00764 (September 2, 2015).....	40, 69

<i>TRW Automotive U.S. LLC v. Magna Electronics, Inc.</i> , IPR2015-00972 (September 16, 2015)	40, 69
<i>Wellman, Inc. v. Eastman Chem. Co.</i> , 642 F.3d 1355 (Fed. Cir. 2011)	22
<i>Xerox Corp. v. Bytemark, Inc.</i> , IPR2022-00624 (August 24, 2022)	57

Other Authorities

PTAB Consolidated Trial Practice Guide	22
--	----

Rules

35 U.S.C. §312	2, 22
37 C.F.R. § 42.104	22, 36

List of Exhibits

Exhibit No.	Description
2001	Declaration of Matthew A. Turk, PhD
2002	Curriculum Vitae of Matthew A. Turk, PhD
2003	Petition challenging U.S. Patent No. 11,208,029, <i>Unified Patents, LLC v. Torchlight Technologies LLC</i> IPR2022-01500, Paper 1, September 22, 2022
2004	U.S. 6,406,172 to Harbers
2005	Comparison of Harbers (Ex. 1011) to Harbers '172 (Ex. 2004)
2006	Supplemental Declaration of Matthew A. Turk, PhD
2007	Transcript of Deposition of Jianzhong Jiao, Ph.D. taken on August 2, 2023
2008	Petition challenging U.S. Patent No. 9,995,551, <i>Volkswagen Group of America, Inc. v. Torchlight Technologies LLC</i> IPR2023-00318, Paper 2, December 22, 2022
2009	Declaration of Dr. Jiao, <i>Volkswagen Group of America, Inc. v. Torchlight Technologies LLC</i> IPR2023-00318, Exhibit 1003.
2010	Jianzhong Jiao and Ben Wang, "Etendue Concern for Automotive Headlamp Using LEDs," SPIE Proceedings Vol. 5187, (January 2004) (Available at https://www.spiedigitallibrary.org/conference-proceedings-of-spie/5187/0000/Etendue-concerns-for-automotive-headlamps-using-white-LEDs/10.1117/12.504363.short)
2011	Michael Bass, <i>Handbook of Optics</i> 3 RD Edition Volume II, (McGraw-Hill, 2010) (Available at https://www.worldcat.org/title/555545456)
2012	Ben Wang and Jianzhong Jiao "Studies for Headlamp Optical Design Using LEDs," SAE Technical Paper Series 2004-01-0434, (March 2004) (Available at https://www.sae.org/publications/technical-papers/content/2004-01-0434/)

Exhibit No.	Description
2013	Ben Wang and Jianzhong Jiao “Optical Transform Limitations in Headlamp Photometric Performance,” SAE Technical Paper Series 2005-01-0861, (April 2005) (Available at https://www.sae.org/publications/technical-papers/content/2005-01-0861/)
2014	LEDs Magazine “Major contributors in LED and lighting standards have led the SSL revolution,” Jianzhong Jiao February 2018. (Available at https://www.ledsmagazine.com/manufacturing-services-testing/standards/article/16695802/major-contributors-in-led-and-lighting-standards-have-led-the-ssl-revolution-magazine)
2015	Jianzhong Jiao and Ben Wang “High-Efficiency Reflector Optics for LED Forward Lighting,” SPIE Proceedings Vol. 6670, (September 2007) (Available at https://www.spiedigitallibrary.org/conference-proceedings-of-spie/6670/66700M/High-efficiency-reflector-optics-for-LED-automotive-forward-lighting/10.1117/12.730524.short)
2016	Navigant Consulting “Energy Saving Estimates of Light Emitting Diodes in Niche Lighting Applications” Building Technologies Program Office of Energy Efficiency and Renewable Energy U.S. Department of Energy (September 2008) (Available at Energy Savings Estimates of Light Emitting Diodes in Niche Lighting Applications (Technical Report) OSTI.GOV.)
2017	PCT Publication No. WO 86/05147 to Flaaten

Patent Owner submits the following Response (“Response”) to the Petition (Paper 1) for *Inter Partes* Review of claims 1-33 (“Challenged Claims”) of U.S. Patent No. 11,208,029 (“the ’029 Patent”) filed by Volkswagen Group of America, Inc., (“VW” or “Petitioner”), and the Board’s Decision of Institution (“DI,” Paper 7.)

I. Introduction

The ’029 Patent is directed to an Adaptive Multi-LED Headlight System that provides Predictive Curve Illumination. For example, independent claims 1, 12, and 23 require the system to “*increase light in a direction of the road curvature ahead of the motor vehicle ... prior to the motor vehicle reaching the road curvature*”¹—the Predictive Curve Limitations. Petitioner relies on Beam or Karlsson’s LED control functions for teaching these limitations, however as Petitioner admits in a follow-on Petition, both references disclose headlamps that provide **maximum intensity** forward illumination, leaving no light to be increased. Petitioner’s admissions of the teachings align with Patent Owner’s position. This, combined with the overwhelming weight of surrounding evidence, confirms that the Predictive Curve Limitations, as required by all claims, are missing from both Grounds.

¹ For ease of reference, claim language will be italicized.

Petitioner's motivation to combine arguments are also vague and conclusory with respect to both how and why a POSA would have combined the applied references. Without relying on the '029 patent itself, Petitioner identifies no rational reason to combine the references in the specific ways it alleges and completely glosses over the impact of the state of the art as of the critical date. Contemporaneous evidence years **after** the critical date, including numerous publications from Petitioner's own expert, make it clear that the technical challenges posed by the proffered combinations would have been well beyond the capability of a person of ordinary skill in the art ("POSA"). The proffered combinations require incompatible and excessive modifications to the prior art — which neither the Petition nor the expert declaration justify. Additionally, the proffered combinations render the primary references unsuitable for their stated purposes. As a result, all of Petitioner's asserted grounds lack sufficient evidence of obviousness.

Finally, the Petition presents multiple alternative grounds and referential arguments, requiring the reader to speculate as to 1) how the combination ultimately teaches the claim elements; 2) how the resulting combination would operate; and/or 3) which reference is being relied on for a particular claim element. Unsurprisingly, this approach leads to confusion and a lack of particularity under 35 U.S.C. §312(a)(3). With regards to certain claims (e.g. 7, 9, 18, 20, 29 and 31),

Petitioner's decision to merely reference the claims in an Appendix results in overlooked claim limitations never addressed by the arguments presented.

For these reasons, and others explained below, the Board should find that all Challenged Claims remain patentable.

II. Overview of the '029 Patent — The Claimed Invention is Directed to an Adaptive Multi-LED Headlight System for Predictive Curve Illumination

The '029 Patent is directed to “a novel multi-light source approach to the design and construction of solid-state lighting fixtures ... (vs. solid state lamps), which is termed a ‘Digital Lighting Fixture’, due to the control of individual lighting element ‘digits’ to provide the ‘correct’ lighting solution for the situation at hand.” (Ex. 1001, 11:5-13.) The '029 Patent further explains that “[t]he terminology ‘digital’ as used herein refers to the discrete nature of the multiple LED lamps provided in the luminaire, whereby, ‘digital’ control results from the individual control of the discrete, i.e., ‘digital’ lighting elements, the LEDs, in the luminaire.” (*Id.*, 2:67-3:5; Ex. 2006, ¶39.)

The '029 Patent also describes the deficiencies of prior art lighting systems that replace conventional lights with solid-state LED light sources “with some minor adjustments” but do not utilize the full “digital” control of the LEDs. (Ex. 1001, 9:60-63; Ex. 2006, ¶40.)



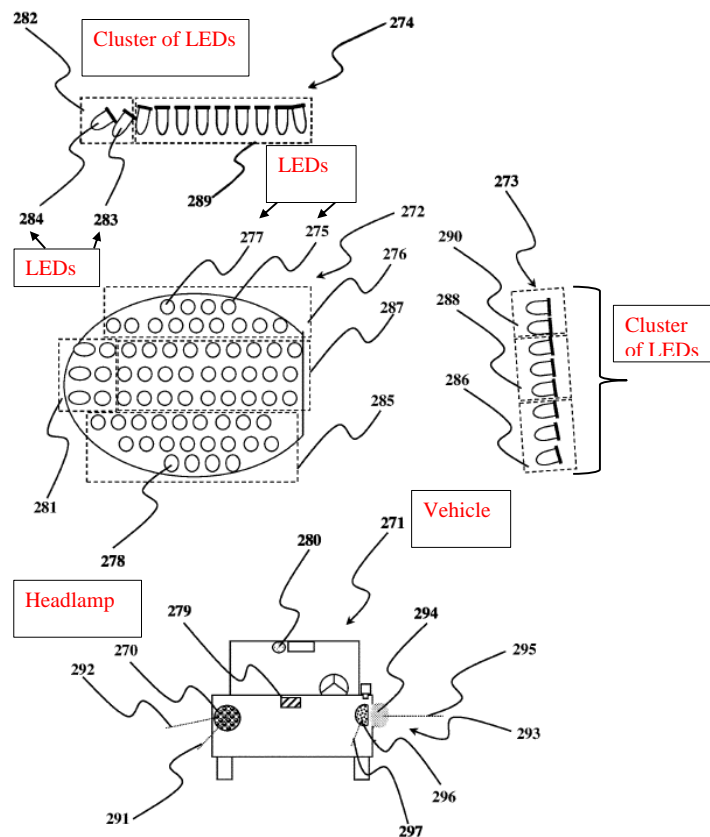
(Ex. 1001, Fig. 1.)

4

refractors, and may be electronically variable optical elements.” (*Id.*, 25:17-21; Ex. 2006, ¶41.)

The '029 Patent describes “a different approach which is to provide the end user with the most correct lighting solution not a new technology lamp to replace the old one.” (Ex. 1001, 11:5-8.) “In contrast to a prior art, single large, lamp replacement like light source, the present invention provides multiple, small sized sources of differing characteristics such that the effect of the whole is greater than the sum of the individual parts.” (*Id.*, 11:45-49.) “The added controllability offered by breaking the total light output up into **discrete (‘digital’) specifically aimable and dimmable elements**² which can be addressed by control electronics to effect intensity, spectrum and spatial distribution of intensity and spectrum, yields a lighting fixture (vs. lamp) of unparalleled performance.” (*Id.*, 11:56-62.) “The invention embraces LED-illuminating devices covering a wide scope of applications,” including transportation. (*Id.*, 11:14-21, 4:18-20, 50:49-50; Ex. 2006, ¶42.)

² Emphasis added by Patent Owner unless indicated otherwise.



(Ex. 1001, FIG. 15, Annotated)

The claimed invention of the '029 Patent, titled “Adaptive Headlight System,” is directed to multi-LED headlight systems that provide predictive curve illumination with the receipt of map data indicating a road curvature upcoming along a road on which the motor vehicle is traveling. The '029 claimed invention solves the problem of how to provide a digital lighting solution that can “provide the optimal lighting solution in real-time” to predictively illuminate an upcoming road curvature. (Ex. 1001, 57:43-49.) The '029 Patent describes using a digital light fixture (DLF) to provide multiple functions, for example “[i]n a DLF it is

possible to combine a task light having a very narrow ‘spot’ beam at the correct aiming with a general area lighting ‘flood’ beam into one fixture.” (*Id.*, 22:26-28.) Similarly, an adaptive headlight system may utilize this dual functionality to aim a light beam at a curve ahead of the vehicle while maintaining forward lighting. (Ex. 1001, 50:61-67; 51:54-67; Ex. 2006, ¶43.)

The Challenged Claims include independent claims 1, 12, and 23. Independent claim 1 is representative and reproduced below with emphasis added. (Ex. 2006, ¶44.) The Predictive Curve Limitations call for the processor to determine **changes** involved with *adapting a light pattern of the headlamps, in at least one of color, intensity or spatial distribution to increase light in the direction of the road curvature* and control 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*:

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

Predictive
Curve
Determination
Element

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.

Predictive Curve
Control
Element

(Ex. 1001, claim 1, emphasis added.)

The '029 Patent describes various techniques for predicting and illuminating an upcoming curve in the road. For example, Adaptive Frontal-lighting Systems are provided that “aid in seeing around curves and other features in the road.” (Ex. 1001, 51:54-56.) These systems predict upcoming curves in the road based on

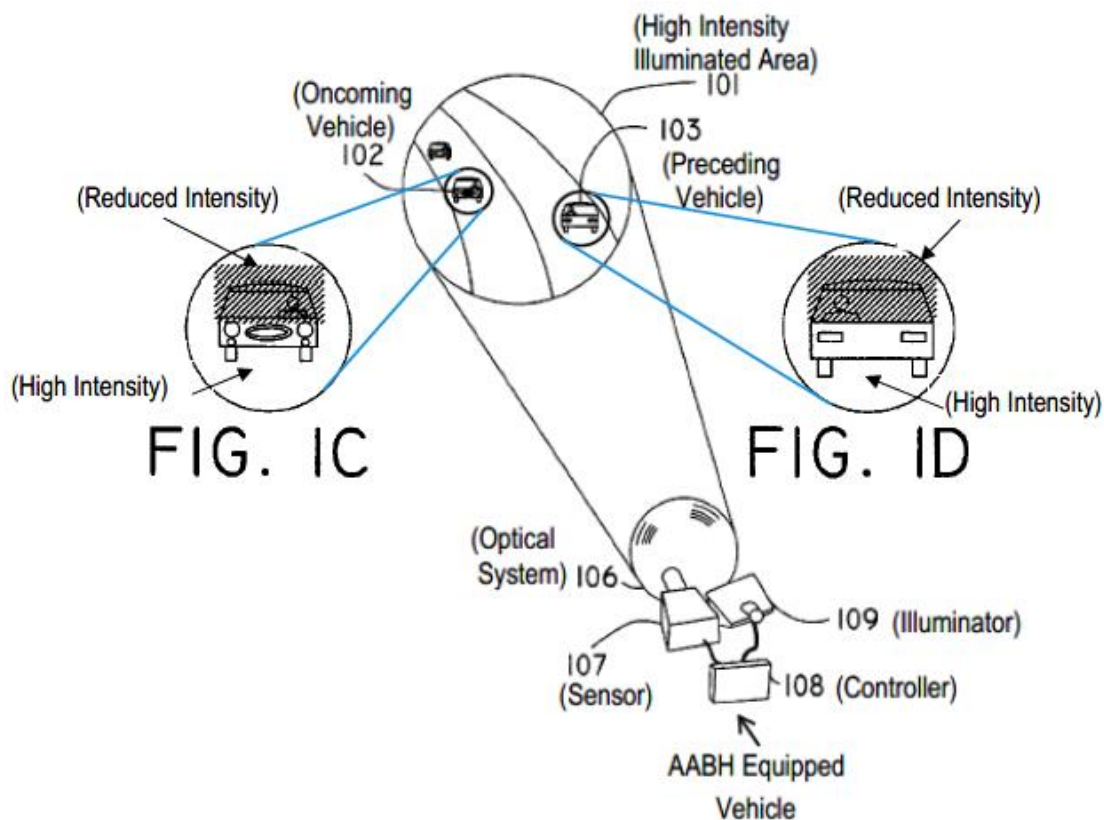
“instantaneous road conditions” and map data. (*Id.*, 51:56-67.) “A GPS system on the car may also let the headlamps system know of curves up ahead, one-way traffic and others factors such [that] the headlamp may be operated in the optimal mode at that instantaneous location.” (*Id.*) The ’029 Patent also describes adjusting “the intensity, spectrum and beam pattern of the headlamp” based on “instantaneous road conditions” and map data indicative of an upcoming curve. (*Id.*; Ex. 2006, ¶46.)

III. Prior Art

A. Beam

Beam discloses “Adaptive/Anti-Blinding Headlights” (AABH) and is directed to a system that provides a multiplicity of microbeams that “operate at maximum intensity at all times” allowing “the driver to have the equivalent of high beam headlights or brighter on at all times, greatly enhancing the ability to see at night.” (Ex. 1005, 3:8-15, 6:11-12, 6:40-44, 6:54-56; Ex. 2006, ¶51.) Beam provides significantly **reduced** illumination only in those portions of the headlight beam that would otherwise dazzle or annoy other drivers. (Ex. 1005, 3:8-15, 6:40-44.) This is accomplished by “darken[ing] those microbeams that would otherwise illuminate areas near to the source of the impinging beam, thus eliminating the blinding of a driver in an oncoming vehicle, while continuing to provide intense forward illumination.” (Ex. 1005, 1:14-19, Claims 4, 5, emphasis added; Ex. 2006,

¶¶51-61.)



(Ex. 1005, FIGs. 1, 1C, 1D, Annotated)

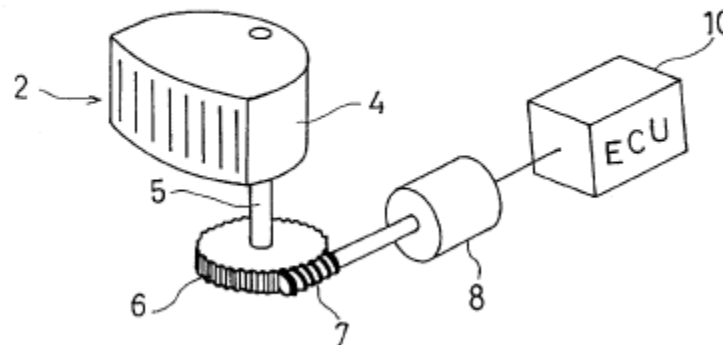
B. Kobayashi

Kobayashi discloses a “Lighting Device for a Vehicle” and is directed to a control system that employs motors to change direction or range of a non-LED headlight beam using map information, unless a predicted vehicle travel direction as indicated by a turn indicator, steering angle, vehicle speed/acceleration differs from the map data or scheduled course. (Ex. 1008, 3:10-27, 6:4-10, 17:59-67; Ex. 2006, ¶¶62-68.)

C. Gotou

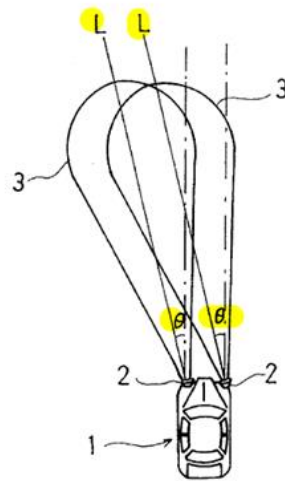
Gotou discloses a “Head Lamp Device for Vehicle” that is directed to a non-LED headlamp system that adjusts leftward/rightward illumination direction by deriving optical axis (theta) and operating a motor-driven “swinging mechanism” using map information and vehicle signals “in the case that a vehicle runs on a place having no road information in a navigation system.” (Ex. 1012, Abstract, Fig. 1, Fig. 5, Fig. 6, 1:42-2:18, 3:31-41; Ex. 2006, ¶¶69-74.)

FIG. 2



(Ex. 1012, FIG. 2)

FIG. 1



(Ex. 1012, FIG. 1, Annotated)

D. Karlsson

Karlsson discloses a “Lighting Device Having a Controllable Lighting Pattern,” wherein light sensors are interspersed with the LED “spotlight beams” to provide anti-blinding functionality, and the LEDs are dimmed during light sensor measurements so light from the LEDs doesn’t interfere with detecting light from oncoming traffic. (Ex. 1010, Abstract, 2:10-29; Ex. 2006, ¶75.)

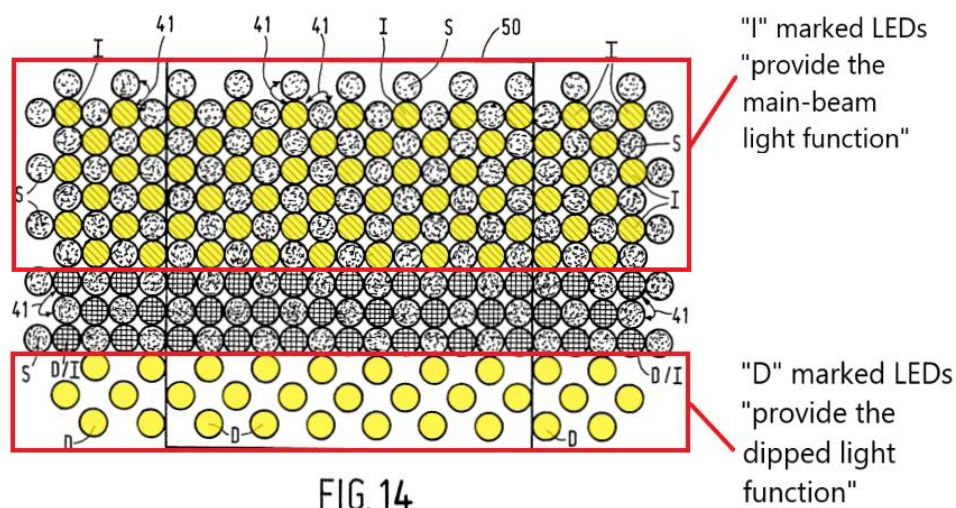
To address glare situations, Karlsson describes adaptation: 1) “in such a manner that no light at all or light having a low intensity is emitted in those directions from which light is detected by the light-sensitive sensor” (Ex. 1010, 9:19-23); and/or 2) responsive to “inclination” and “when the car is taking a bend”—situations when the light-sensitive sensors may not reliably detect light from oncoming vehicles to prevent glare based on vehicle movement may have

difficulty detecting due to relative positioning. (*Id.*, 20:24-32, Fig. 16; Ex. 2006, ¶83, 76.) Window 50 addresses the latter types of situational glare.

Despite the lack of detail, a consistent and reasoned interpretation emerges from the Karlsson reference when viewed in totality along with the referential prior art, contemporaneous evidence and Petitioner's own admissions (detailed in Section VII.A.1.a. below): Karlsson, like Beam, forms emitted beam 7 (Fig 1) by using the entire beam array at full intensity, except when avoiding glare, at which point, window 50, of reduced illumination (Fig. 14) is created to address glare situations. (Ex. 2006, ¶76.) Per Karlsson, this configuration creates a light beam that is "optimally adapted," where main beams are optimized for long range illumination (Ex. 1010, 1:19-20, 9:18-26) and "constant" main beam usage is "highly desirable" (*Id.*, 1:21-24, 9:18-26). Karlsson's removal of situational glare permits this. (Ex. 2006, ¶76.)

1. Window 50 depicts illumination being reduced for situational glare

Karlsson's lighting device includes a headlamp embodiment that provides a light beam 7 usable for driving, which includes dipped lights (low beams) and main beams (high beams) that span the full LED array. (Ex. 1010, 19:24-28, 20:24-29; Ex. 2006, ¶77.)

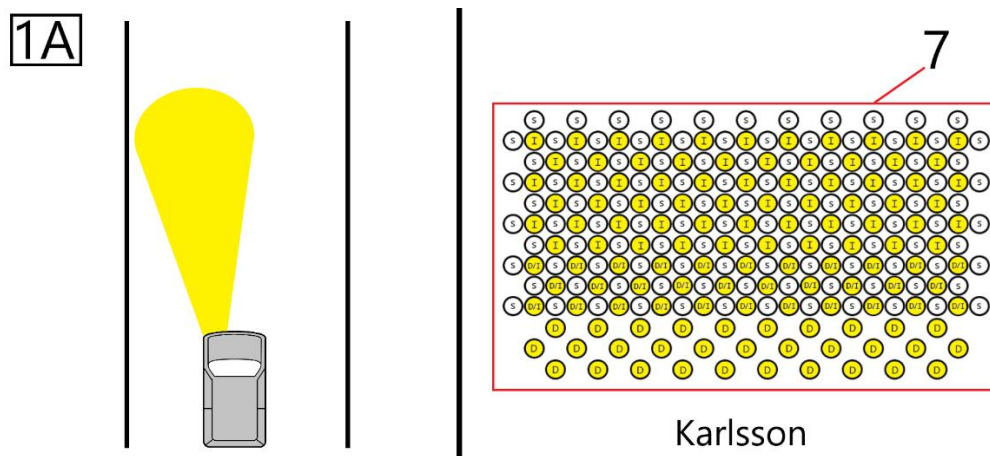


(Ex. 1010, Fig. 14, Annotated; Ex. 2006, ¶77)

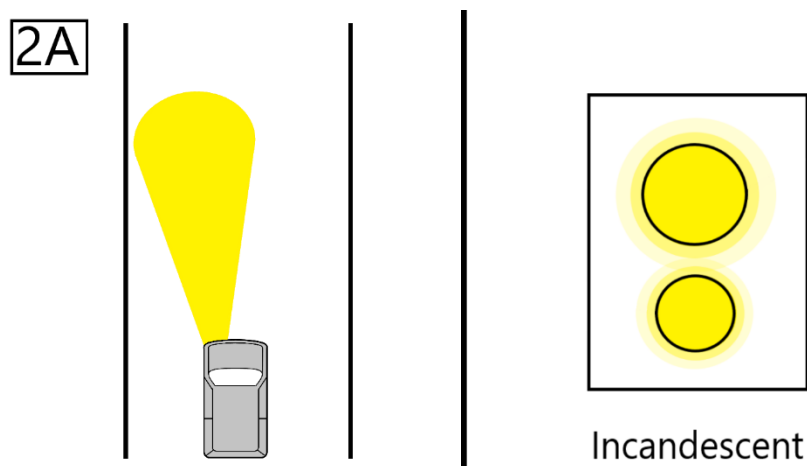
In reference to Fig. 14, Karlsson discloses that “spotlight sources indicated at D provide the dipped light [low-beam] function **in accordance with existing vehicle headlights**,” and “sources indicated at I provide the main-beam light function **of existing vehicle headlights**.” (Ex. 1010, 19:22-28, emphasis added.) Karlsson provides “a light beam, the intensity of which is **optimally adapted** to the road and to the ambient light”— i.e., the entire main/high beam is on full intensity except where dimmed for glaring. (Ex. 1010, 2:7-9, 4:17-21, 9:23-26, 19:22-28, Fig. 1; Ex. 2006, ¶¶78-82.)

For example, Figures 1B-1D depict glaring scenarios described in Karlsson, in reference to Figs. 14 and 16. Figure 1A below illustrates Karlsson’s Fig. 14 LED array with all spotlight sources performing the functions “of existing headlamps” to collectively emit a beam of light 7; and Figure 2A illustrates an “existing

headlight” with incandescent dipped (Low) and main (High) beam light sources activated to provide a comparable beam of light. (Ex. 2006, ¶80.)



(Ex. 2006, ¶80; Ex. 1010, Fig. 14, Annotated)



(Ex. 2006, ¶80)

Karlsson then uses Fig. 14 to illustrate a “reduction” control strategy to **reduce** emitted beam 7 in a manner that both provides anti-glare functionality for

specific situations whilst allowing for expanded usage of the main/high beam light (“Karlsson’s Reduction Control Strategy”). (Ex. 1010, 20:6-11.) The situationally adjustable beam 50 illustrates how glare reduction can be achieved. (Ex. 2006, ¶81.)

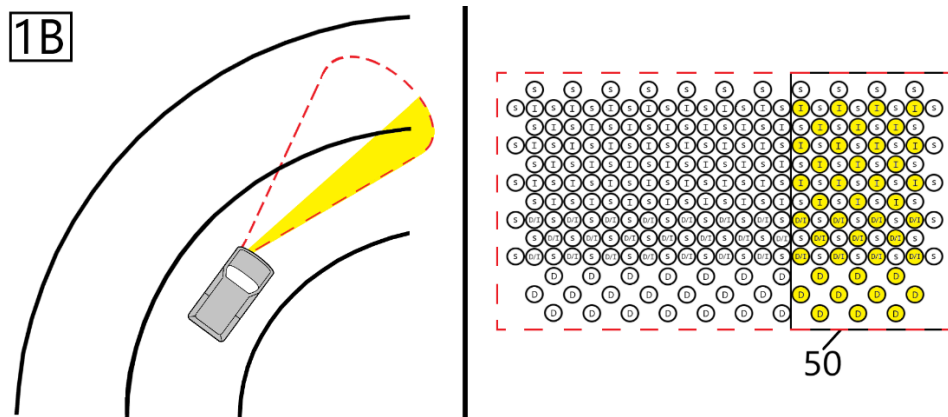
Karlsson teaches that glare occurs in multiple situations when using high beams (Ex. 1010., 1:19-26) -- when rapid velocity changes or overloading pitches the vehicle (*Id.*, 1:30-34), and when turning. (*Id.*, 1:35-2:1.) Absent glare situations, Karlsson provides “a light beam, the intensity of which is **optimally adapted** to the road and to the ambient light,” meaning all spotlight sources are on. (Ex. 1010, 2:7-9, 4:17-21, 9:23-26, Fig. 1; Ex. 2006, ¶82.)

To address glare situations, Karlsson describes adaptation: 1) “in such a manner that no light at all or light having a low intensity is emitted in those directions from which light is detected by the light-sensitive sensor” (Ex. 1010, 9:19-23); and/or 2) responsive to “inclination” and “when the car is taking a bend.” (*Id.*, 20:24-32; Ex. 2006, ¶83.)

Karlsson even explains, in the context of Fig. 14, that “an emitted light beam 50 is represented as a window which can shift” left-to-right and top-to-bottom “in dependence on the desired pattern and direction of the beam.” (Ex. 1010, 19:29-33.) The window 50 in Fig. 14 thus **illustrates the concept** of situational reduction of full beam 7. As shown below in Figures 1B – 1D, the shifting window 50 can be

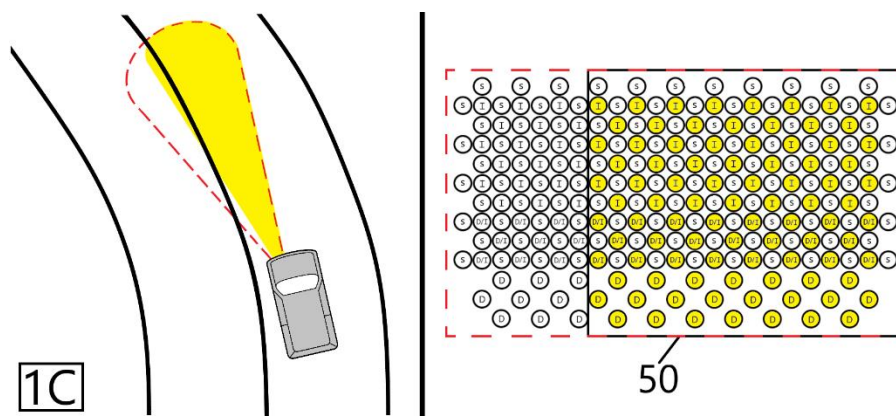
used to temporarily **reduce** the full beam 7 to adapt to the glaring situations Karlsson describes. Absent glare, beam 50 would expand its dimension to “optimally adapt” the light beam, where main beams are optimized for long range illumination (Ex. 1010, 1:19-20, 9:18-26) and “constant” main beam usage is “highly desirable.” (*Id.*, 1:21-24, 9:18-26; Ex. 2006, ¶76, 83-84.)

Karlsson addresses glare caused when a vehicle is taking a curve-- the beam may be “adapted” (shifted) away from the other lane, to avoid glaring oncoming traffic. (Ex. 1010, 1:34-2:1, 20:29-32.) This shift, however, is not a shift of the entire emitted beam 7, it is a temporary **reduction** of the beam aimed at the opposite lane, achieved by temporarily shutting off some of the array. Figures 1B and 1C below illustrate Karlsson’s Reduction Control Strategy during a turning maneuver, showing possible shifts in right and left turns, respectively. (Ex. 1010, Fig. 14; Ex. 2006, ¶84.)



(Ex. 2006, ¶80; Ex. 1010, Fig. 14, Annotated)

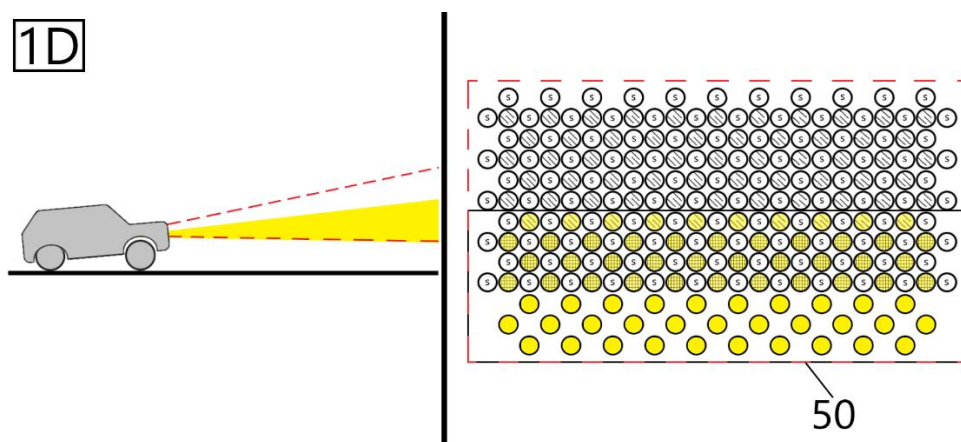
Figure 1B illustrates a full beam (dashed red-line) as the vehicle takes a sharp right turn and a reduced beam (yellow), according to Karlsson's Reduction Control Strategy to avoid glaring illumination. This beam reduction may be achieved by deactivating the LEDs on the left side of the array, "shifting" the window 50 to the right, as illustrated above, based on the inputs from the direction sensor 54, which is connected to the steering wheel to determine when the car is "taking a bend" to prevent "traffic on the other side of the road from being blinded as much as possible." (Ex. 1010, 20:23-32; Ex. 2006, ¶85.)



(Ex. 1010, Fig. 14, Annotated; Ex. 2006, ¶85)

Figure 1C illustrated above depicts a vehicle taking a gradual left turn. The beam may be reduced using Karlsson's Reduction Control Strategy to deactivate LEDs on the left side of the array, shifting the window 50 to the right again based on direction sensor 54, but less so. The remaining yellow beam is wider than the one illustrated in Figure 1B due to the gradual nature of the turn, since there would be less potential glaring light than with a sharp turn. (Ex. 1010, 20:23-29; Ex. 2006, ¶86.)

In reference to Figure 16, Karlsson also addresses glare caused when a vehicle pitches due to velocity changes or is overloaded—the inclination sensors detect “any deviation from the horizontal position,” allowing the pitched beam, possibly glaring other drivers, to be “shifted” down via deactivation of the upper rows of the array, as shown in Fig. 1D below. (Ex. 1010, 6:26-30; Ex. 2006, ¶87.)



(Ex. 2006, ¶87, Ex. 1010, Fig. 14, Annotated)

Thus, in reference to Figs 14 and 16, Karlsson addresses a variety of possible glare situations that cause light beam 7 to selectively reduce via window 50. When the sensors detect light, light beam 7 is selectively reduced. (Ex. 1010, 5:28-32.) If the vehicle is pitched, light beam 7 is adapted through a vertically shifted window 50 to account for pitch (*Id.*, 20:25-29). If the vehicle is taking a curve, light beam 7 is adapted through a horizontally shifted window 50 to prevent glare in the opposite lane. (*Id.*, 20:29-33; Ex. 2006, ¶88.)

2. The Base Device That Karlsson Improves Takes A Similar Approach To Situationally Reducing Full Emission

In lines 1-7, Karlsson establishes that it seeks to improve aspects of a prior art device of the “type known from” WIPO Patent Publication WO 86/05147 (“Flaaten,” Ex. 2017), which uses light sensitive detectors and a control unit to detect and control the light distribution pattern of a headlight “based on the distribution of detected light.” (Ex. 2017, Abstract; Ex. 1010, 1:1-7.) Flaaten,

Karlsson’s base device, states a clear objective: the light from a vehicle is dipped selectively so that **“only that portion of the light is removed that would otherwise inconvenience the driver of oncoming cars ... at the same time as the roadway, the edges of the road, curves, etc. are satisfactorily illuminated.”** (Ex. 2017 at 1-2.) Karlsson even explains that the Flaaten “prior art lighting device” “retain[ing] an **optimum lighting effect** for the driver of the vehicle ...” (Ex. 1010, 2:2-9; Ex. 2006, ¶89.)

Flaaten, like Karlsson, recognizes the desire for “optimum lighting” while also removing glare: “It is ... desirable to enable such control of the light that **only the portion of the light** that would inconvenience the driver of meeting cars **is removed, leaving as much as possible of the roadway and the surroundings illuminated.**” (Ex. 2017 at 1.) The reduced illumination provided by window 50 thus comports with Karlsson’s desire to retain “**an optimum lighting effect,**” even under glaring situations, per the base device in Flaaten. (Ex. 2006, ¶90.)

IV. Level of Ordinary Skill

Patent Owner does not dispute Petitioner’s proposed level of ordinary skill. (See Petition at 10.)

V. Claim Construction

No claim construction is necessary because Patent Owner’s arguments do not hinge on the outcome of an actual controversy about claim interpretation. See

Wellman, Inc. v. Eastman Chem. Co., 642 F.3d 1355, 1361 (Fed. Cir. 2011) (“[C]laim terms need only be construed to the extent necessary to resolve the controversy”).

VI. The Petition Lacks Particularity Under § 312

An IPR petition “may be considered only if ... the petition identifies, in writing and with particularity, each *claim* challenged, the *grounds* on which the challenge to each claim is based, and the *evidence* that supports the grounds for the challenge to each claim.” 35 U.S.C. § 312(a)(3). “In an IPR, the petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable.” *Harmonic Inc. v Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016.) citing 35 U.S.C. § 312(a)(3). The PTAB Consolidated Trial Practice Guide advises that “parties should avoid submitting a repository of all the information that a judge could possibly consider, and instead focus on concise, well-organized, easy-to-follow arguments supported by readily identifiable evidence of record.” (CTPG at 39.)

Further, “[t]he petition must specify where each element of the claim is found in the prior art patents or printed publications relied upon.” 37 C.F.R. § 42.104(b)(4). In at least certain instances, noted below, Petitioner fails to even address certain claim elements or, at other times, inaccurately paraphrases elements of the claims and then attempts to prove that the inaccurate paraphrasing,

not the element of the claim, as required, is present in the art.

The Petition lacks particularity regarding the evidence relied on and that lack of particularity has already created confusion and prejudiced Patent Owner. As noted by the Board, “Petitioner provides additional alternative arguments throughout the Petition.” (DI at 9 citing Petition at 69-70, 72, 75, and 77.) The ambiguity of the petition led the Board to excuse inconsistencies in the Ground 2 references, noted by Patent Owner in the Preliminary Response, and find that: “Petitioner does not include Karlsson’s direction sensor or control strategy as part of its combination.” (DI at 15.) The Board made that statement despite the fact that the direction sensor and curve-taking control strategy were expressly noted by Petitioner on pg. 77 as evidence of how Karlsson shapes light. (Petition at 77.) The fact that the Board **also** explicitly noted pg. 77 as an “alternative argument,” only six pages earlier, (DI at 9) reveals exactly how much prejudicial confusion the lack of particularity created.

In a myriad of other instances Petitioner makes arguments that are unsupported by any evidence and incredibly difficult to follow, given the self-referential nature of the entire Petition. This lack of particularity and tactical confusion results in a shell game, in which Patent Owner and Board must decipher arguments and pin down Petitioner’s positions – denying due process and making it impossible for Patent Owner to respond fully to all arguments.

VII. The Challenged Claims are Patentable

A. Ground 2: Gotou and Karlsson

1. Independent Claims 1, 12, and 23: The Gotou-Karlsson Combination Does Not Teach All Claim Limitations

Petitioner must show where each claim limitation is found in the prior art. *See e.g., Kinetic Concepts, Inc. v. Smith & Nephew, Inc.*, 688 F.3d 1342, 1361 (Fed. Cir. 2012). Failure to do so defeats a claim of obviousness. (*Id.*) To establish a prima facie obviousness rejection, all of the claimed features must be taught or suggested by the prior art. *See In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974).

a. Both Parties Agree That Karlsson Teaches Controlling the LED Array to Provide “Full Intensity” Light in the “Remaining Areas” Outside of the Anti-Glare Region “To The Fullest Extent Possible” – Therefore the Gotou-Karlsson Combination Does Not Teach “Increasing Light in a Direction of the Road Curvature”

Independent claim 1 is representative of claims 12 and 23 and requires: “*one or more processors to: ... determine a light **change** ... to increase light in a direction of the road curvature **ahead** of the motor vehicle.” Petitioner relies on Gotou’s headlamp device for satisfying the “headlamp” limitations, Karlsson’s LED arrays for satisfying the “LED” limitations, Gotou’s ECU 10 for satisfying the “processor” limitation and Karlsson’s control functions for the actual control of*

the LEDs (i.e., generation of the emitted beam). (Petition at 66-69, 79; Ex. 2006, ¶127.)

Karlsson discloses a headlight assembly having a controllable lighting pattern, that provides a high-beam or “main-beam” lighting pattern as a default setting. (Ex. 1010, 1:1-7, 1:18-23.) Karlsson further discloses reducing the high beam to a partial beam, (e.g., as depicted by a window 50 in Figure 14) under limited circumstances, in this case to avoid blinding oncoming drivers. For example, Karlsson discloses “retaining an optimum light for the driver of the vehicle” while automatically suppressing “that part of the light beam which might cause inconvenience to oncoming traffic.” (Ex. 1010, 2:7-9.) Karlsson also notes that “main-beams are designed and optimized for long-range illumination” (Ex. 1010, 1:19-20.) Karlsson seeks the **retention** of “optimum” light anywhere glare is not being accommodated. (Ex. 1010, 2:7-10, 9:23-26; Ex. 2006, ¶128.)

Karlsson discloses that the “light beam 7 ... [is] controlled in such a manner that **no light at all or light having a low intensity** is emitted in those directions from which light is detected ... [thus] **glaring or blinding of oncoming traffic is effectively prevented.**” (Ex. 1010, 9:18-26.) Petitioner admitted, in IPR2023-00315, that this disclosure teaches that the “remaining areas of light beam 7 are left at full intensity (‘main-beam’ or ‘high beam’ in Karlsson’s terms), ‘permitting a light intensity which is generally *higher than that of conventional dipped*

headlights.’) (Ex. 2008 at 66, emphasis in original, citing Ex. 2009, ¶280; Ex. 2006, ¶129.) Petitioner continues the explanation and interpretation of Karlsson by admitting that:

A POSA would also have understood that positioning the main beam **(full-intensity)** LEDs all around the **reduced illumination area** provides the **“optimum lighting effect”** for the driver because doing so maximizes the area that is fully illuminated. EX1003, ¶281; EX1010, 2:7-9. In the alternative, it would have been obvious to a POSA to configure Karlsson’s system to **surround** the reduced illumination area with **full illumination to the greatest extent possible** for the same reason. EX1003, ¶¶281-282.

(Ex. 2008 at 67.)

“The greatest extent possible” that “surrounds” a reduced illumination area, is, of course, use of the full LED array, to provide the driving beam 7. As Petitioner explains, this would also “maximize the area that is fully illuminated” to achieve “optimum lighting effect for the driver.” (Ex. 2006, ¶130.) Per Karlsson and Petitioner’s admissions, the only reasoned and consistent interpretation is that Karlsson uses full illumination “to the **greatest extent possible**” to achieve an “optimum lighting effect” by “maximizing the area that is fully illuminated”— i.e., use the **entire array** just as Beam does, except for portions dimmed to avoid glare under Karlsson’s specified circumstances. (Ex. 2006, ¶130.)

With reference to Figure 14, Karlsson states: “In this embodiment non-shaded spotlight sources indicated at D provide the dipped light function in accordance with existing vehicle headlights, whilst the single-shaded spotlight sources indicated at I provide the main-beam light function of existing vehicle headlights.” (Ex. 1010, 19:22-28.) As illustrated in Figure 14 below, the dipped light sources (D) and main-beam light sources (I) extend beyond window 50. Because the D and I “sources,” collectively, provide “existing vehicle” light beams, it follows that window 50 is created by blanking a subset of the overall beam “if desired,” i.e., to reduce potential glare. (Ex. 1010, 19:31-33; Ex. 2006, ¶131.)

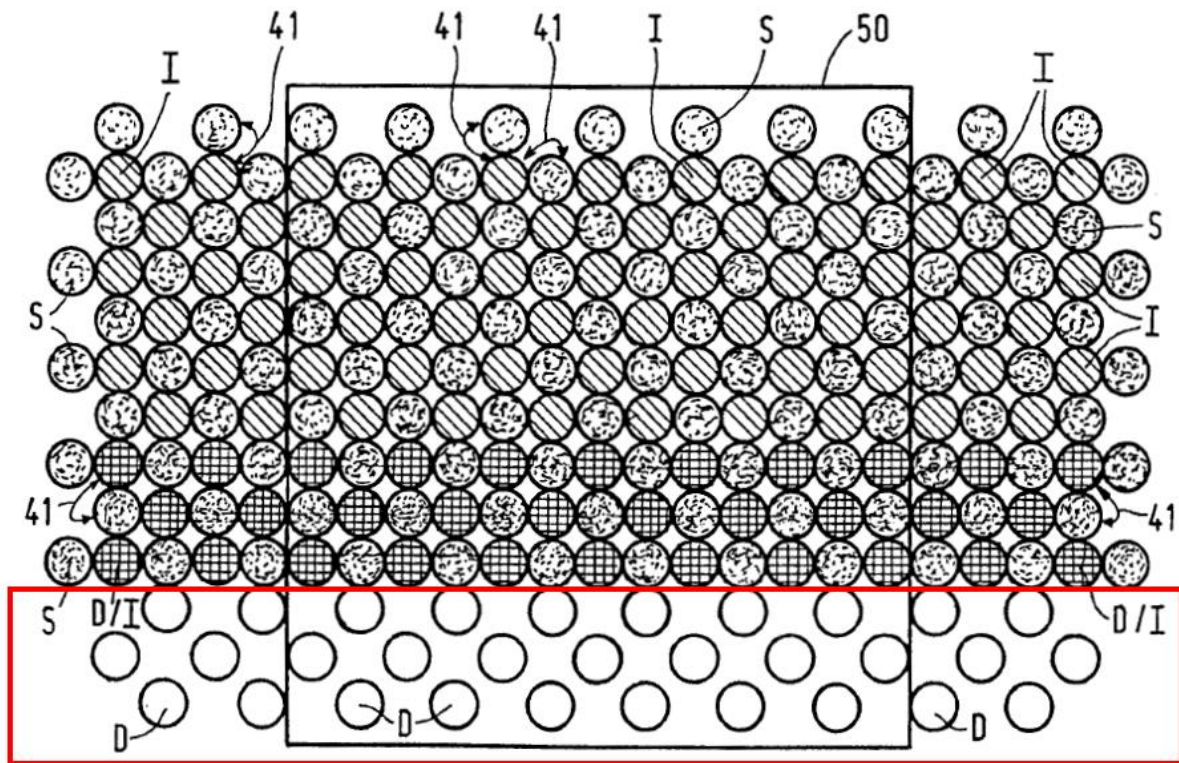


FIG. 14

(Ex. 1010, Fig. 14 Annotated; Ex. 2006, ¶131)

This interpretation further comports with Figure 16's description of sensors, used to prevent glare based on vehicle movement in situations, such as a curve, where another vehicle's lights may be difficult to detect due to relative positioning. If Karlsson's vehicle is pitched, e.g., during sharp velocity changes or "overloaded," the light beam 7 is adapted for pitch — i.e. certain LEDs are blanked causing the window 50 to vertically shift as described with reference to Fig. 14. (Ex. 1010, 20:25-29.) If the vehicle is taking a curve, the light beam 7 is adapted to prevent glaring the opposite lane — i.e., certain LEDs are blanked causing the

window 50 to horizontally shift as described with reference to Fig. 14. (Ex. 1010, 20:29-33; Ex. 2006, ¶132.)

Under any of these situations, the resulting beam would be less (for the duration of the event) than the full normal beam of an incandescent lamp (being diminished in some regard, vertically or horizontally), except that Karlsson makes these glare-reduction adaptations to allow the main (high) driving beam to continue to operate everywhere else to maintain “optimum illumination” of the road ahead of the driver. (Ex. 2006, ¶133.)

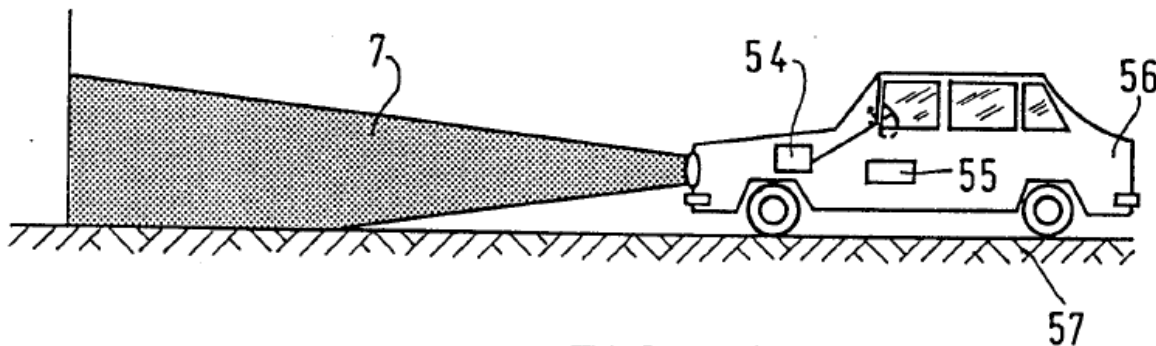


FIG. 16

(Ex. 1010, FIG. 16)

The reduced illumination provided by window 50 also comports with Karlsson’s desire to “retain an optimum lighting effect,” per Flaaten — the base device, which Karlsson seeks to improve. (Ex. 2017.) Karlsson explains that the Flaaten “prior art lighting device” “retain[s] an **optimum lighting** effect for the

driver of the vehicle,” by enabling “such control of the light that **only the portion of the light** that would inconvenience the driver of meeting cars **is removed, leaving as much as possible of the roadway and the surroundings illuminated.**” (Ex. 1010 at 1-2; Ex. 2017 at 1; Ex. 2006, ¶134.)

Finally, there is nothing in Karlsson to suggest that window 50 is the actual beam that would be used for driving. On the contrary, as contemporaneous publications from Petitioner’s expert establish, given the state of the art and the numerous technical challenges with incorporating extra LEDs to the headlamp system, all LEDs in the Karlsson array would be used to achieve sufficient lumen output for driving. (Ex. 2006, ¶134.)

As both parties agree, Karlsson discloses providing full or maximum intensity light in the remaining areas outside of the anti-glare region to the greatest extent possible, i.e., everywhere it could be needed. Under such circumstances, there would be no reason to increase light in the direction of the curve, nor would there be remaining unlit LEDs with which to achieve the increase. Accordingly, the Gotou-Karlsson combination does not teach “*one or more processors to: ... determine a light change ... to increase light in a direction of the road curvature ahead of the motor vehicle*” as claimed, and claims 1, 12, and 23 are patentable over the combination. (Ex. 2006, ¶¶135-136.)

Accordingly, Petitioner’s proofs as to the Predictive Curve Limitations are

incomplete and constitute a fatal defect.

2. Dependent Claims: 5-7, 9-10, 16-18, 20-21, 27-29, 31, 32 - The Gotou-Karlsson Combination Does Not Teach All Claim Limitations

All dependent claims are non-obvious at least based on the novel claims from which they respectively depend. Claims 5-7, 9-10, 16-18, 20-21, 27-29, 31, 32 additionally remain patentable for at least the following reasons.

a. Claims 5, 16, and 27

Claim 5 is representative of claim 16 and further defines the “increase light” limitation of claims 1 and 12: “*wherein 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.*” Claim 27 uses different language and is directed to an increase to already-emitted light: “*output that increases light emitted at a level below high-beam light and directed in the direction associated with the shape change.*” (Ex. 2006, ¶137.)

i. Claims 5 and 16

Petitioner incorrectly contends that “Karlsson’s LEDs would implement the same type of light level [as Gotou] towards the curve,” without any explanation of why Karlsson would mimic Gotou’s incandescent light source output. (Petition at 84.) Assuming *arguendo* that Karlsson had additional LEDs usable to facilitate a “change,” there is no reason why Karlsson would not choose to “optimally”

illuminate the curve, for example, to provide high-beam illumination, instead of low-beam illumination, into a curve. (Ex. 2006, ¶138.)

Gotou has no choice in the matter. Gotou discloses turning a headlamp that emits the same light output after the turn that it was emitting before the turn. Gotou's controller does not control the lamp **output**, only the lamp **angle**. (Ex. 2006, ¶139.) Incidentally, Gotou does not even **specify** a light level, rendering Petitioner's statement about "the same type of light" unclear. (Ex. 2006, ¶139.)

Lacking any emission parameters or control from Gotou, it is only reasonable to conclude that under Petitioner's interpretation — which allows complete variance of the LEDs in use — Karlsson would illuminate the curve with the best light available, which is main/high beam emission. Again, Patent Owner contends that this is already being achieved without need for a change (i.e., because all the LEDs are already being used), but even in Petitioner's alternative interpretation, Petitioner provides literally no reasoning for recreating Gotou's emission, or where indication of such a "type of light" would even come from. (Ex. 2006, ¶140.)

Without any reason as to **why** or **how** Karlsson would replicate Gotou, and with good reason for Karlsson to choose optimal emission under Petitioner's logic, the obviousness conclusion is both unsupported and specious. (Ex. 2006, ¶141.)

ii. Claim 27

Claim 27 requires output that “increases” light that was “emitted at a level below high-beam light and directed in the direction associated with the shape change.” Hence the use of the active verb “increases.” (Ex. 2006, ¶142.) Petitioner, however, applies the same argument against claim 5 to claim 27. Regarding claim 1, from which claim 5 depends, Petitioner argues that Karlsson achieves the claimed increase by “shifting” the window 50 of Karlsson in the direction of the curve. (Petition at 77.) For claim 5, Petitioner also contends that this “shifting” light behaves as Gotou’s type of light – i.e., whether a light is high or low intensity is unchanged by horizontal movement. (Petition at 84; Ex. 2006, ¶¶143-144.)

To follow Petitioner’s claim 5 argument to its logical conclusion — if the window of light 50 shifted towards the curve, and intensity was “unaffected” by such horizontal movement, then any light previously emitted light below high-beam in the direction of the shape change would simply remain as it was — since the intensity of the respective LEDs responsible for such light would remain unchanged, and the unchanged light would be a part of both the alleged prior emission pattern and the alleged new pattern. There may be additional light elsewhere directed towards the shape change under Petitioner’s logic, but never an increase specifically to light “emitted at a level below high-beam light and directed in the direction associated with the shape change” as claim 27 requires. Again, this

is because, according to Petitioner, Karlsson would “implement the same type of light as Gotou” and “Gotou’s variation of high-beam and low-beam is ... not affected by horizontal movement.” (Petition at 84; Ex. 2006, ¶145.) *I.e.*, when horizontal movement occurs, the existing light remains as it is.

Accordingly, either the claims are patentably indistinct from claim 5 and the argument fails for the reasons presented with respect to claim 5, or the claims are distinct and the argument about claim 5 actually demonstrates why an already emitted light **would not** be “increased” as required by claim 27. In both scenarios, the Gotou-Karlsson combination does not teach claim 27. (Ex. 2006, ¶146.)

b. Claims 6, 17, and 28

Claim 6 is representative of claims 17 and 28 and further requires “*control[ling] at least a second plurality of the LED light sources, having at least one LED light source different from the first plurality of LED light sources, to provide light based at least in part on the determined second light change and prior to the motor vehicle reaching the second road curvature.*” Petitioner states that the Gotou-Karlsson combination teaches an iterative process, but does not ever explain how iteration would require the claimed use of “*at least one LED light source different from the first plurality of LED light sources.*” (Petition at 84-85.) The argument fails to even mention this limitation, let alone demonstrate its presence in the combination. As such, claims 6, 17 and 28 are patentable over the

combination. (Ex. 2006, ¶147.)

c. Claims 7, 18, and 29

Claim 7 is representative of claims 18 and 29 and requires “*wherein the increase of light in the direction of the road curvature includes at least one of **expansion** of the light pattern in the direction of the road curvature or an **increase to intensity** of light directed in the direction of the road curvature.*”

Notwithstanding Patent Owner’s contentions and Petitioner’s admissions that the Karlsson array is already fully utilized to the greatest extent possible, Petitioner also treats the language of 7.1 as though it is covered by 7.3 or 7.4, although they address different aspects of the concept. Petitioner genericizes the language of 7.1 in a manner that makes it indistinct from both claim 1 and the other elements of the claims, without any justification or explanation, simply a conclusion that it is so, treating the first two limitations of claim 7 as though they were an inconsequential preamble to the remainder. (Petition at 85.)

Petitioner never once establishes 7.1’s requirement, that the increase of claim 1 either result from an expanded beam *or an increase to intensity of light directed in the direction of the curve*. It is possible Petitioner’s reference to the 24 pages contained in Section VII.A includes some analysis, but that is hardly an argument made with particularity, and it is not the job of the Board or Patent Owner to go back to those 24 pages and decide what arguments might apply. This

is a prime example of incorrect paraphrasing, a failure to specify where each element of the claim is found in the prior art (as required by 37 C.F.R. § 42.104(b)(4)), and a general failure to address a limitation of the claim—Petitioner’s claim 7, 18 and 29 arguments fail. (Ex. 2006, ¶148-150.)

d. Claims 9, 20, and 31

Claims 9, 20, and 31 depend from claims 8, 19, and 30. Claim 9 is representative of claims 20 and 31 and requires “*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.*” Claims 8, 19, and 30 also require controlling the “*second plurality of LED light sources providing light directed towards an area including at least a portion of the other vehicle to diminish glare to a driver of the other vehicle.*” Thus, the “*control of the second plurality,*” in claim 9 refers to control “to diminish glare to” other detected vehicles. In claim 8, that control was based on vehicle detection using camera data. In claim 9, it is based, at least in part, on data from a non-camera sensor. (Ex. 2006, ¶151.)

Petitioner relies on Gotou’s map data to satisfy this limitation. (Petition at 88.) Petitioner fails to explain, how “map data” can be used to control the second plurality of LEDs to diminish glaring illumination of another vehicle. Petitioner fails to establish a *prima facie* case of obviousness for claims 9, 20 and 31. (Ex. 2006, ¶152.)

In another failure to even **address** a claim limitation, the Petition references [9.6]/[20.6]/[31.6] on page 90 but the accompanying argument references the elements of [9.4]/[20.4]/31.4]. By failing to address the [9.6]/[20.6]/[31.6] limitations, the claim 9, 20 and 31 arguments are fatally deficient. (Ex. 2006, ¶153.)

e. Claims 21 and 32

Petitioner overlooks the variances in language with respect to claims 21 and 32. Claim 21 recites “enable the one or more processors to *utilize* one or more optical control elements ... to control light” and claim 32 recites a method including “*utilizing* one or more optical control elements to control light.” These are active control elements either “utilized” by the processors or “utilized” in the method.

Petitioner relies on Gotou’s reflectors/sub-reflectors and Karlsson’s reflectors and lenses for satisfying these limitations but fails to identify which optics it relies on or how those optics would be “utilized” by processors and /or “utilized” in the combination. (Petition at 91.)

B. A POSA Would Not Have Been Motivated to Combine Gotou and Karlsson

“[T]here must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.” *KSR Int’l Co. v.*

Teleflex Inc., 550 U.S. 398, 418 (2006), 82 USPQ2d at 1396 (2007), *quoting In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006).

1. Petitioner Fails to Explain Why, Absent Hindsight, a POSA Would Have Combined Gotou and Karlsson

Under *KSR*, “if a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill.” *KSR*, 550 U.S. at 417. This is referred to as the “known-technique” rationale and the Federal Circuit has clarified that “if there’s a known technique to address a known problem using ‘prior art elements according to their established functions,’ then there is a motivation to combine.” *Intel Corp. v. PACT XPP Schwiez AG*, 61 F.4th 1373, 1381 (Fed. Cir. 2023) quoting *Intel Corp. v. Qualcomm Inc.*, 21 F.4th 784, 799-800 (Fed. Cir. 2021). In *Intel v. PACT*, when the prior art addressed the same, focused problem of cache coherency, the Federal Circuit expanded this “known technique” rationale, replacing the “improvement” requirement with a “suitable option” requirement, *i.e.*, “[i]t’s not necessary to show that a combination is the *best* option, only that it be a **suitable option**.” *Intel v. PACT*, 61 F.4th at 1381. Here, because the applied prior art is directed to different types of systems that function in different ways to address different problems, the *Intel* case is inapposite. Moreover, given the state

of the art, suitable versions of the proposed combinations would be beyond the skill of a POSA.

As LED headlamps were under development in the early 2000's, a myriad of complex, interrelated technical issues were being solved at the time; thus, there were no 'known techniques' to address known problems in the LED headlamp art using prior art elements "according to their established function." *Intel v. Qualcomm*, 21 F.4th at 799–800. LED headlamps are significantly different devices than conventional headlamps, and therefore in the early 2000's LED headlamp design posed a complex set of challenges and tradeoffs involving optics, heat management, white LED lumen output and packaging issues, all of which affected cost. (Ex. 2006, ¶¶25-38.) In the early 2000s, the efficiency of available white LEDs was a fraction of a conventional bulb, creating significant technical challenges for their use in headlight applications. For example, in 2004 and beyond, as Petitioner's expert points out, multiple LEDs (e.g., more than 30) were required to generate lumen output similar to a typical tungsten filament halogen bulb because "currently available white LED's lumen output [was] around 30 lm (maximum), which [was] about 3% of the typical tungsten halogen bulb's light flux output (1000 lm for 9006 bulb)." (Ex. 2012 at 3; Ex. 2006, ¶31.)

Petitioner however glosses over the state of the art and further fails to explain how a POSA would have combined Gotou and Karlsson, when the two

systems adapt light in significantly different ways and generate a combination that would render Gotou unsuitable for the purpose of adjusting illumination direction. By ignoring these issues, the Petition illustrates clear hindsight bias. (Ex. 2006, ¶155.)

Petitioner’s hindsight theory undermines the Petition’s alleged motivation for combining the applied references—to “improve driving safety.” (Petition at 65.) Except for identifying elements of the Challenged Claims to engage in hindsight reconstruction, Petitioner fails to explain why in Ground 2 it would have been obvious to add an LED array from Karlsson to Gotou. (Petition at 55.) Indeed, Petitioner fails to explain why a POSA would have been motivated to combine Gotou and Karlsson, when the combination results in an uncontrollable, and therefore unsuitable, form of curve illumination. The only *actual* motivation to add Karlsson’s LED array was to meet the claim limitations. (Ex. 2006, ¶156.) *TRW Automotive U.S. LLC v. Magna Electronics, Inc.*, IPR2015-00972, Paper 9, slip op. at 15, 17 (PTAB September 16, 2015). *See also Stryker Corp. v. Karl Storz Endoscopy America, Inc.*, IPR2015-00764, Paper 13, slip op. at 13 (PTAB September 2, 2015).

2. Petitioner Does Not Explain How a POSA Would Have Combined Gotou and Karlsson

Petitioner must explain how a POSA would have modified or combined the

prior art. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 418 (2006) (requiring articulated reasoning with rationale underpinning as to how or why a person of ordinary skill in the art would have combined or modified the teachings of the prior art); *see also Personal Web Techs., LLC v. Apple, Inc.*, 848 F.3d 987, 994 (Fed. Cir. 2017) (holding obviousness determination to be improper where the record lacked a “clear, evidence-supported account” of “how the combination” would work).

Save the use of *KSR* terminology, Petitioner fails to provide specific teachings to support how a POSA would combine the disparate Gotou and Karlsson systems. Petitioner states that “[a] POSA would have understood how to combine the teachings of Gotou and Karlsson by simply substituting Gotou’s system with Karlsson’s LED array and control.” (Petition at 64; Ex. 2006, ¶158.) Petitioner further states that “[r]eplacing Gotou’s controllable non-LED light sources with Karlsson’s controllable LED light sources would have also merely been applying a known prior-art solution from a finite number of identified, predictable solutions, with a reasonable expectation of success.” (Petition at 67.) The state of the art refutes Petitioner’s contentions. (Ex. 2006, ¶¶25-38.)

LED headlamps were in their infancy in the early 2000’s, therefore there were no “predictable solutions,” nor was there a “reasonable expectation of success.” Designing an LED Headlamp for a vehicle application requires

consideration and tradeoffs involving complex and interrelated optics, heat management, white LED lumen output, packaging and cost issues. (Ex. 2006, ¶¶29-38, 160.) In 2004, Petitioner's expert lamented: "[w]ith desires of high performance and compact packaging size for both high and low beams, the issues of using LED light sources regarding light collection efficiency, beam pattern compression and optical accuracy, **are great concerns and challenges for the optical engineers.**" (Ex. 2012 at 3; see also Ex. 2006, ¶30.) Petitioner ignores these considerations and the challenges posed by the state of the art, resulting in a combination having no reasonable expectation of success. (Ex. 2006, ¶160.)

a. White LED lumen output

As Petitioner's expert details in his publications from 2004-2005, the efficiency of available white LEDs was a fraction of a conventional bulb, creating significant technical challenges for their use in headlight applications. For example, in a 2004 publication, Dr. Jiao noted that multiple LEDs (e.g., more than 30) were required to generate lumen output similar to a typical tungsten filament halogen bulb because "currently available white LED's lumen output [was] around 30 lm (maximum), which [was] about 3% of the typical tungsten halogen bulb's light flux output (1000 lm for 9006 bulb)." (Ex. 2012 at 3; Ex. 2006, ¶31.)

Nonetheless, Petitioner ignores the limitations of white LED efficiency as of the critical date, modifying Gotou to include Karlsson's light source 2, without

explaining how the combination would yield an operable headlight system with sufficient lumen output for low and high beams.

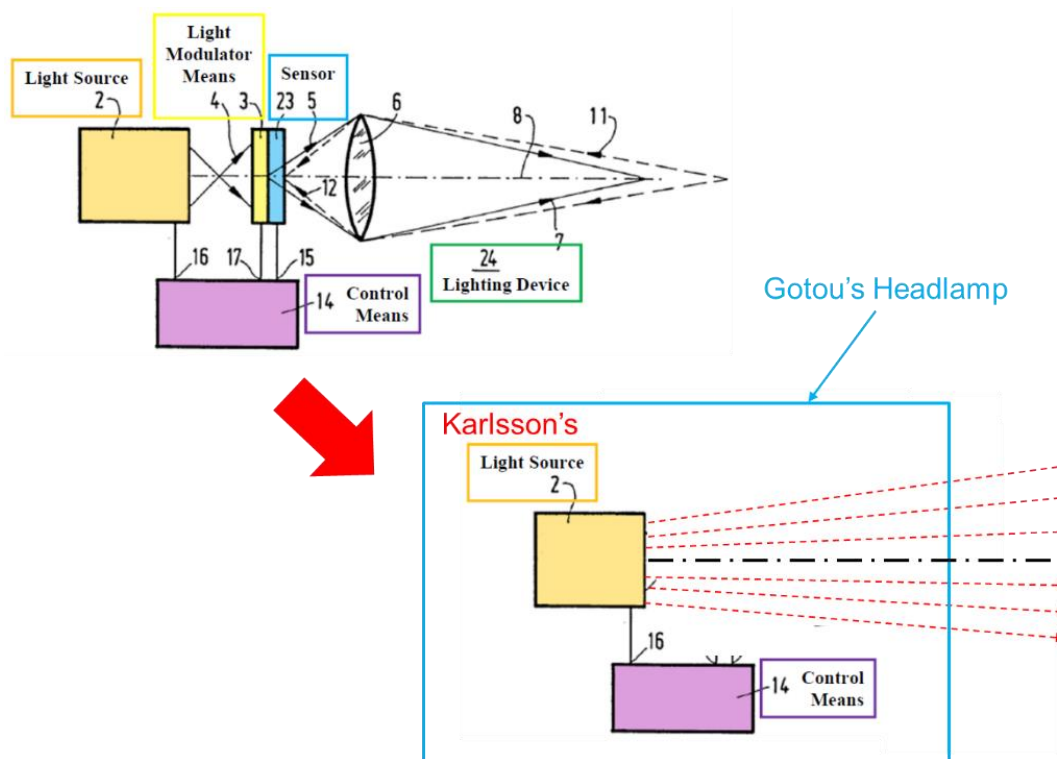
b. Optical System

An optical system for a lighting system is designed based on the light source and the application. The '029 Patent describes, with reference to Figure 1, that the “direction of light exiting from the DLF as a whole or from each SLS individually is controllable by optical elements 6, such as reflective surfaces and or refractors, and may be electronically variable optical elements.” (Ex. 1001, 25:17-21.) A light having an array of LED light sources may also include “a collimating lens for narrow beam generation.” (Ex. 1001, 78:60-62; Ex. 2006, ¶161.)

Petitioner’s expert, Dr. Jiao, explained that LEDs “use very unique optics” as compared to the optics for conventional light bulbs, and that “LED source-operated headlamps **always** use specific optics that's associated with that specific LED source.” (Ex. 2007 at 28, 85.) Dr. Jiao further agreed that “different optics are typically required for different beam patterns” and explained that “in almost all cases” LEDs use multiple optics, like, primary, secondary, tertiary, optics to provide specific functionality. (Ex. 2007 at 63, 85; Ex. 2006, ¶¶162-163.)

Petitioner however ignores optics considerations, modifying Gotou to include Karlsson’s light source 2, without explaining whether/how the combination includes Karlsson’s optics. (See Figure 1.) Karlsson’s LED array without the

associated optics would provide uncontrolled light along multiple axes, as illustrated in the figure below. (Ex. 2006, ¶164.)



(Ex. 1010, Fig. 3, Annotated)

In his deposition, Dr. Jiao explained that a headlamp assembly includes a single optical axis, and each light source includes an optical axis that is correlated to the headlamp assembly optical axis by “beam contributors” or optics. (Ex. 2007 at 92-93.) Thus, even if the Gotou-Karlsson combination included Karlsson’s optics, the optics would need to be redesigned to provide a different beam pattern, i.e., to illuminate an upcoming curve. (Ex. 2006, ¶165.)

c. Heat Management

LEDs are temperature-sensitive devices, requiring heat management controls

to maintain output performance. (Ex. 2006, ¶167.) As explained by Dr. Jiao:

[An] LED, in principle, is a **temperature-dependent light source**. In all cases, the higher the temperature, the lower the luminous flux output from LED is. As such, managing the heat generated in the LED, or heat from external environment of LED lamp, has been challenging because LED light output reduced when the temperature goes up.

(Ex. 2007 at 50.)

To ensure functionality, LED systems often include additional structure “to carry away heat from the electronic components,” such as “heat sinks,” “forced circulation cooling” systems that include “a fan or pump,” etc. (Ex. 1001, 35:58-60; Ex. 2007 at 47.) Petitioner however ignores heat management considerations—failing to describe how the Gotou-Karlsson combination would manage heat from the LEDs and incorporate heat management structure to provide light output. (Ex. 2006, ¶168-169, 36.)

d. Packaging

Relatedly, adding additional heat management structure creates packaging challenges because “it takes space.” (Ex. 2007 at 53.) Once again, Petitioner fails to describe how the LEDs and any related heat management structure would be packaged within the Gotou system. (Ex. 2006, ¶¶170, 37.)

e. Control

Petitioner does not explain how “[s]imply substituting Gotou’s system with Karlsson’s LED array and **control**” (Petition at 64) would reconcile the different control strategies of Gotou and Karlsson during a turning maneuver. Karlsson’s control includes reducing light during a turning maneuver: “direction sensor 54, which is for example connected to the steering wheel ... for determining when the car is taking a bend, so that the light beam 7 can be adapted to prevent the traffic on the other side of the road from being blinded.” (Ex. 1010, 20:23-32.) Gotou discloses swinging the headlamp along “the optical axis toward the planned running direction at an early stage before the steering wheel is actually turned” to increase light in a turn. (Ex. 1012, 6:40-44; Ex. 2006, ¶171.) The ambiguity and lack of particularity of the Petition led the Board to excuse the inconsistencies in the references and find that Petitioner was not relying on Karlsson’s control strategy despite Petitioner expressly stating that it was:

[A] POSA would have understood how to combine the teachings of Gotou and Karlsson by simply substituting Gotou’s system with Karlsson’s LED array and control, as shown, for example, in Karlsson’s Figures 14 (see also FIGs. 3 and 15).

(Petition at 64.)

As we understand the combination, Petitioner does not include Karlsson’s direction sensor or control strategy as part of its

combination. Pet. 73–75. Therefore, Petitioner did not have to explain any inconsistency between Karlsson’s control approach and Gotou’s.

(DI at 15, emphasis added.)

Because Petitioner failed to explain how the proposed Gotou-Karlsson combination would operate with respect to, *inter alia*: 1) exactly what elements of Karlsson’s “LED array and control” are being substituted into Gotou’s system; 2) controlling Karlsson’s LED array along multiple optical axes to achieve Gotou’s optical angle determination; and 3) controlling Karlsson’s LED array using Karlsson’s direction sensor while the steering wheel is being turned, Petitioner has failed to meet their burden of explaining how and why a POSA would have modified or combined Gotou and Karlsson. (Ex. 2006, ¶172.) *Personal Web Techs.*, 848 F.3d at 994.

3. Modifying Gotou, as Proposed by Petitioner, Would Render Gotou Inoperable For Its Intended Purpose of Adjusting Illumination Direction

If a proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984). *See Gen. Plastic Indus., LTD. v. Canon Inc.*, IPR2015-01954, Paper 9, at 25-26 (PTAB Mar. 9, 2016) (denying institution where “it appears that the proposed modification [] would render [the prior art] unsuitable

for its intended purposes” (citing *In re Gordon*, 733 F.2d at 902)).

Petitioner states that a “POSA would have been motivated to combine Gotou’s adaptive vehicle headlamp that uses map data as a control input to predict and adjust illumination direction with Karlsson’s controllable LEDs as a light source.” (Petition at 55.) Petitioner further states that “Karlsson’s controllable LEDs would have simplified controlling the illumination direction and beam shape by removing Gotou’s moving parts (e.g., motors), while also providing expanded beam shaping abilities.” (*Id.*) The applied references contradict Petitioner’s assertions as Karlsson’s “controllable LEDs” are not controllable by Gotou’s ECU and the illumination direction and beam shaping abilities are not readily available without redesigning the optical system, thereby rendering Petitioner’s combination and modification inoperable for its intended purpose of adjusting illumination. (Ex. 2006, ¶173.)

a. Input Controls

Although LEDs are controllable, they are controlled differently than conventional light bulbs with respect to the input voltage and waveform. LEDs are typically controlled, individually or in groups, using pulsed power to provide digital control. (Ex. 2006, ¶174.) The ’029 Patent describes that the DLF includes power conditioning circuitry 5 to condition the power supplied to the light sources 3. (Ex. 1001, 25:14-16.) For example, the LEDs may be “operated on DC as well

as pulse power and current as well as timing in terms of duty cycle, pulse width and other signal modulations are useable by the controller to effect intensity changes.” (Ex. 1001, 23:22-25.) The power conditioning circuitry for an LED circuit is commonly referred to as an LED driver. (Ex. 2006, ¶174.) An LED driver is typically designed to provide between three to twelve volts to an LED circuit of a headlamp assembly, depending on number of LEDs and electrical circuit configuration. (Ex. 2006, ¶174; Ex. 2007 at 20-21, 33-35, 174-176.)

Gotou discloses a “light distributing control ECU 10” that controls the motor 8 of a “swinging mechanism” to adjust the lamp unit 4 based on an optical axis angle θ . (Ex. 1010, 3:24–67.) Gotou’s lamp unit includes a conventional light source that receives 12-Volt DC power for a vehicle battery. Such conventional light sources are typically supplied with constant voltage, not pulsed power, because the time constants associated with such sources do not switch rapidly. As explained by Dr. Jiao “incandescent filament take time to cool down or heat up ... [y]ou cannot turn off immediately, like LED does.” If the combination excludes Karlsson’s “control means,” per the Institution Decision, a POSA would not have been motivated to combine Gotou and Karlsson as proposed, because Gotou’s ECU, with its limited control capability, would not have been capable of providing digital control of Karlsson’s LED array at the correct input voltage. (Ex. 2006, ¶175.)

Petitioner includes Karlsson's control means in one of its many alternative grounds. (Petition at 69; DI at 9 FN 8.) However, such a combination would still fail because a POSA would not have included two controllers for the headlamp in view of the cost restrictions in the automotive industry. As explained by Dr. Jiao, cost is a significant consideration in the auto-industry and the additional components for LED headlamps, such as the driver, pose a significant additional cost. (Ex. 2007, 31-33.) Accordingly, a POSA would not have included Karlsson's LED driver, in addition to Gotou's ECU, because the redundant controller would make the Gotou-Karlsson combination cost-prohibitive for an automotive application.

b. Output Controls

Petitioner did not argue that the Gotou-Karlsson combination includes Karlsson's optics. Even if the Gotou-Karlsson combination did include Karlsson's optics, the optics would need to be redesigned to accommodate the Gotou beam pattern toward an upcoming curve. (*See* Section VII.B.3.b, *supra*.) Without these additional optics changes, Petitioner's proposed modification to Gotou would render Gotou unsatisfactory for its intended purpose of "varying the optical axis ... before the steering wheel is actually turned." (Ex. 1012, 6:40-44.) Furthermore, there would be no adjustment to the optical axis by an angle θ as required by Gotou.

In sum, the Petition lacks a suggestion or motivation to make Petitioner's proposed modification. Rather, there are ample good reasons not to make the proposed modification. (*Id.*) See *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984). (Ex. 2006, ¶177.)

C. Ground 1: Beam and Kobayashi

1. Independent Claims 1, 12, and 23: Both Parties Agree That Beam Teaches Providing “Full Intensity” Light in the Areas Outside of the Anti-Glare Region – Therefore The Beam-Kobayashi Combination Does Not Teach “*increas[ing] light in a direction of the road curvature ahead of the motor vehicle*”

Independent claim 1 is representative of claims 12 and 23 and requires: “*one or more processors to: ... determine a light change ... to increase light in a direction of the road curvature ahead of the motor vehicle ... 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.”*

Petitioner relies on, *inter alia*, Beam's processor 1105 for satisfying the “processors” limitation, Beam's disclosure in claims 4 and 5, 2:53-3:3, 4:10-59 for satisfying the “LED” limitations, and Beam's disclosure, at 17:8-15, 1:21-29, 4:6-21, 15:15-28 for satisfying the “*determine a light change ... to increase light in a*

direction of the road curvature ahead of the motor vehicle” limitation. (Petition at 31-32, 37; Ex. 2006, ¶94.)

Beam discloses a headlamp that provides “the equivalent of high beam headlights or brighter on **at all times**, greatly enhancing the ability to see at night” except for areas where incoming light is detected. (Ex. 1005, 6:53-56.) Beam further discloses that “[t]he resulting beam is at full intensity except in areas that would dazzle a driver ahead.” (Ex. 1005, 4:57-59.) Petitioner admitted, in a related proceeding, that this disclosure teaches providing a “Full Intensity” beam outside of the anti-glare region. (Ex. 2008 at 36; Ex. 2009, ¶¶145-146; Ex. 2006, ¶95.) Similar to the European approach to adaptive driving beam (ADB) technology, Beam uses the high-beam at all times and includes anti-glare strategies, to avoid blinding oncoming traffic when needed. (Ex. 2006, ¶96; Ex. 2007 at 69, 71.)

Since Beam discloses providing maximum intensity light everywhere it could be needed, there would be no reason to increase light or provide the ability to change the direction of microbeams in the AABH system. (Ex. 2006, ¶96.)

Accordingly, the combination of Beam and Kobayashi does not teach “*one or more processors to: ... determine a light change ... to **increase light in a direction of the road curvature **ahead** of the motor vehicle**” as claimed, and claims 1, 12, and 23 are patentable over the combination. (Ex. 2006, ¶97.)*

2. Dependent Claims: 5, 6, 9, 16, 20, 27, 31 - The Beam-Kobayashi Combination Does Not Teach All Claim Limitations

a. Claims 5, 16 and 27

The same general flaws noted with reference to Ground 2 apply to Petitioner's interpretation of claims 5 and 27 as being patentably indistinct.

Should Petitioner incorrectly argue, however, that somehow Beam does not utilize the full array prior to the curve, despite Beam's express requirements for full illumination, Patent Owner will further explain the distinction between claims 5 and 27 and how Petitioner's analysis, in both grounds, is also deficient for claims 5 and 16 and absent and/or incorrect in the case of claim 27. (Ex. 2006, ¶¶98-99.)

i. Claims 5 and 16

Again, the paraphrasing of the claims includes the same inaccuracies as with respect to Karlsson in Ground 2, possibly even worse. Here, Petitioner states that the claims "amount to merely directing any light (other than high-beam) in the direction of the road curvature." (Petition at 43.) In addition to being an incorrect statement for comparable reasons to the Ground 2 paraphrasing, this paraphrase does not even discuss the claimed increase. (Ex. 2006, ¶100.)

Petitioner's first argument is based on a misquoting of Beam achieved by using a portion of the quoted sentence completely out of context with the rest of the sentence — "Beam's AABH provide 'a default illumination level will be the

equivalent of today's *low beams*" (Petition at 44 quoting Ex. 1005, 6:30-33; Ex. 2006, ¶101.) Contrary to the quote, the full sentence makes it clear that the situation described relates to a **failing** controller of Beam. The whole sentence reads "The system will be designed to be fail-safe; *if there is a control system failure*, the default illumination level will be the equivalent of today's low beams." (Ex. 1005, 6:30-33; Ex. 2006, ¶102.) The low-beam is used when the control system of Beam fails. This is a fail-safe condition, it is not the default condition of Beam with a functioning controller. (Ex. 2006, ¶102.)

Petitioner's other argument that Beam's "illumination in the 'darkened' or 'shaded areas' is 'significantly less than with current low beams'" (Petition at 44) relates to anti-glare portions and is also irrelevant — unless Petitioner is suggesting that Beam is going to dynamically and intentionally **re-aim** the shaded portion into a curve, **moving it off of the anti-glare target** for which it was initially established. In the absence of another vehicle, Beam never establishes such a region. (Ex. 2006, ¶103.)

Kobayashi's Fig. 8, also noted by Petitioner, shows a shift in luminous intensity **achieved using the mirror system of Fig. 7**. (Ex. 1008, 11:5-19.) Since Petitioner's combinations eschew such moving parts, it is unclear how any of this is applicable to the proposed combination. The remainder of Kobayashi's discussion about Fig. 8 presents an alternative embodiment where the whole

optical system is rotated as in Gotou. (*Id.*, 11:25-33.) Petitioner never explains how the shift in luminous intensity shown in Fig. 8 would be comparably achieved through usage of Beam’s LEDs. (Ex. 2006, ¶104.)

Petitioner never explains how the combination would achieve the claimed “*includes at least an increase of light emitted at a level below high-beam light and directed in the direction of the road curvature*” **using LEDs** – Beam never contemplates such a shift and Kobayashi achieves the shift cited by Petitioner by relying on using movable mirrors and/or a movable entire optical system, both of which would utilize the motors for which Petitioner has presented motivation to remove. (Ex. 2006, ¶104.)

ii. Claim 27

As with Ground 2, either the Board agrees with Petitioner about the meaning of claim 27, in which case the above analysis about claim 5 applies, or the Petitioner simply fails to address the alternative language of claim 27. Nothing in the prior analysis of claim 5 deals with an output that increases light having the claimed characteristics. (*See* Section VII.A.2.a.ii.) Nor did Petitioner ever try to make this argument. (Ex. 2006, ¶105.)

b. Claims 6, 17, and 28

Similar to Ground 2, Petitioner’s whole argument never once makes a statement that any control would involve the claimed “*at least one LED light*

source different from the first plurality of LED light sources.” Merely discussing control of various LEDs is insufficient to meet Petitioner’s burden of proof. (Ex. 2006, ¶106.)

c. Claims 9, 20, and 31

As before, Petitioner contends that the *control of the second plurality of LED light sources*, which is done for purposes of non-glaring illumination (*See* Section VII.A.2.d), can be based on “map data” as the claimed non-camera data. Again, Petitioner never explains is how “map data” can be used to *control the second plurality of LEDs light sources to diminish glare to a driver of the other vehicle* in any manner, once again failing to establish a *prima facie* case for claims 9, 20 and 31. (Ex. 2006, ¶107.)

3. A POSA Would Not Have Been Motivated to Combine Beam and Kobayashi

a. The Proposed Combination Renders Beam Inoperable and Defeats Beam’s High-Intensity Illumination “At All Times” Purpose

Petitioner admits that “Beam does not disclose using map data, such as from GPS or navigation beacons, as an input to control the intensity, shape, and/or angular position of the LEDs (or their resultant beam)” but Petitioner asserts that “it would have been obvious to a POSA to do so” to make “Beam’s system even more active than prior systems, as Beam seeks to do” – parroting unsupported

expert opinion devoid of any actual evidence. (Petition at 26-27; Ex. 2006, ¶109.) Expert declarations that merely repeat, “verbatim, the conclusory assertion for which it is offered to support” are entitled to little weight. *See, Xerox Corp. v. Bytemark, Inc.*, IPR2022-00624, Paper 9, at 15 (PTAB August 24, 2022).

However, Beam contravenes Petitioner’s unsupported arguments. More specifically, Beam expressly disparages prior art devices that control “the shape and direction of the headlight beam” “in a predetermined profile that is expected to cause the fewest problems to the oncoming drivers under a variety of circumstances” — referring to them as a “compromise, at best between reducing glare and providing enough light to the driver for adequate visibility.” (Ex. 1005, 2:15-22.) Contrary to Petitioner’s assertions, Beam has no need for map data to provide curve illumination, nor any other purpose for beam shaping, and would not benefit in any way from having the map data or control strategies as disclosed by Kobayashi. (Ex. 2006, ¶110.) Indeed, Beam sought to solve the problems associated with systems such as the one provided in Kobayashi “which attempt to control the intensity profile of the beam by using a reflector or lens shaped to control the output beam in some predetermined way” and systems that control “movement of headlight beams in response to changes in the vehicle's steering mechanism, etc.” (Ex. 1005, 1:60-2:5; Ex. 2006, ¶111.)

Petitioner’s proposed modification of Beam by adding map data and

associated control complexity from Kobayashi would render Beam's AABH system inoperative or unsatisfactory for its stated purpose. In particular, Petitioner's proposed combination would: 1) defeat Beam's stated purpose of providing high-intensity illumination all the time but for selective darkening relative to other vehicles, 2) be inoperative in that Beam's AABH system is incapable of changing the direction of light from the headlamps, or of increasing light beyond maximum intensity of the light source(s), and 3) as a result, would not accomplish Petitioner's proffered purpose of "improving driver safety." (Ex. 2001, ¶70; Ex. 2006, ¶112.) *See Gen. Plastic Indus., LTD. v. Canon Inc.*, IPR2015-01954, Paper 9, at 25-26 (PTAB Mar. 9, 2016) (denying institution where "it appears that the proposed modification [] would render [the prior art] unsuitable for its intended purposes" (citing *In re Gordon*, 733 F.2d at 902)).

**i. Petitioner's Contorted Rationale
Undermines the Crux of Beam's
Illumination Strategy**

Petitioner contorts the description of Beam's AABH system by using partial quotes taken out of context and mischaracterized to conclude that the AABH system somehow controls the direction or steering of one or more of the microbeams to **increase** light in the direction of a curve, apparently based solely on the limitations of the Challenged Claims. (Petition at 38; Ex. 2006, ¶113.) However, Beam is clear, beginning with the title and extending throughout the

detailed description and claims, that it is an anti-blinding system that darkens or blanks individual microbeams to **reduce** illumination based on direction of an incoming beam of light, e.g., from an oncoming vehicle, preceding vehicle and/or any other light source. (Ex. 2006, ¶113.)

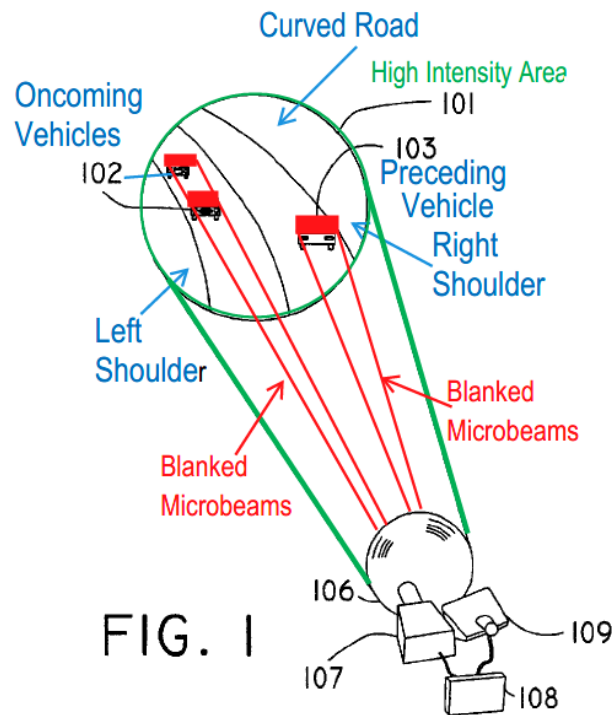
Beam specifically recognizes and disparages prior art attempts to control the direction of the headlight beams, whether in response to vehicle loading, steering wheel, etc. (Ex. 1005, 1:60-2:6.) In contrast to the prior art systems, Beam states:

The instant invention solves all of the enumerated problems by automatically sensing the presence and location of headlights and taillights ahead of the car on which it is mounted. It will then control the light output of a group selected from a multiplicity of narrow angle beams (microbeams) which comprise the overall headlight beam pattern. By controlling an area determined by analyzing the position of the lights sensed ahead, the area of the beam that would dazzle the driver will be darkened, while maintaining [full] intensity elsewhere.”

(*Id.*, 2:52-64; Ex. 2006, ¶114.)

According to Beam, prior art systems that had to choose where to put light and that changed the direction of the headlamp beam, were prone to errors and/or subject to misalignment. (Ex. 1005, 2:15-26.) In response to these prior art problems, Beam’s solution was to provide “the equivalent of high beam headlights or brighter on at all times, greatly enhancing the ability to see at night” (*Id.*, 6:53-

56) except for areas where incoming light is detected. Since Beam is already providing maximum intensity light everywhere it could be needed, there would be no reason to provide the ability to change the direction of microbeams in the AABH system. As illustrated in Beam's Figure 1 as annotated below, the high intensity illumination area 101 is sufficient to illuminate oncoming vehicles 102 and preceding vehicle 103, as well as both lanes of the curved road including the left shoulder and right shoulder. (Ex. 1005, Fig. 1.) The AABH system prevents blinding drivers of oncoming vehicles 102 or preceding vehicles 103 by blanking associated microbeams at corresponding angular positions of the X-Y matrix/array of LEDs. As such, there is no need for the AABH system to point or direct light in any particular direction. (Ex. 2006, ¶115.)



(Ex. 1005, FIG. 1, Annotated)

Even if changing the direction of microbeams in response to map data as proposed by Petitioner was possible, it would allow the microbeams to illuminate areas outside the field-of-view (FOV) of sensor 107 and thus defeat the anti-blinding operability in at least part of the illuminated area 101. It would also reduce the maximum intensity of illumination of regions within the road ahead, contrary to Beam's stated purpose. For example, changing the direction of microbeams in the direction of an upcoming left-hand curve in response to map data would reduce illumination below the maximum possible in regions to the right of oncoming vehicles 102 and would defeat anti-blinding operability for any

vehicles outside of the intersection of the illumination and sensor fields of view.
(Ex. 2006, ¶116.)

The specification details the central tenet of the Beam reference—to darken the area of the beam that would dazzle the driver, “**while maintaining [full] intensity elsewhere**”:

These AABH headlights will operate at maximum intensity at all times. An imaging sensor (such as a video camera) faces forward, boresighted with the headlight. The output of the sensor is connected to the controller. The controller module uses the sensor spatial data (video) to determine whether there are illumination sources (headlights or tail lights) present in the headlight's field-of-view, determines their location relative to the Adaptive Anti-Blinding Headlights beam, and uses these data to control the Illuminator. When an oncoming vehicle's headlights are detected (whether or not it is equipped with the AABH system), an area slightly wider than the headlight spacing and approximately six feet high, and whose bottom edge is centered on the oncoming headlights, is dimmed in the beam-bundle of the vehicle equipped with the AABH system.

(Ex. 1005, 6:11-24.)

In operation, the AABH produces a multiplicity of individually directed narrow-angle beams which are herein referred to as microbeams, each being controlled by a processor responsive to incoming data from an imaging sensor. Any microbeams that would

blind the oncoming driver **are diverted or attenuated at the source.** **Selection of the particular microbeams that form the dimmed area is performed continuously and dynamically (they would be adjusted based on input to the sensor,** as opposed to older systems which shape the intensity profile of the beam following a presupposed distribution requirement.) The AABH system will also sense taillights of a vehicle being followed and control those microbeams that would otherwise dazzle or annoy its driver when reflected by a rear-view mirror.

(Ex. 1005, 5:61-6:8; Ex. 2006, ¶117.)

The Beam specification further underscores that “[t]he primary advantage of the present invention over the prior art is that it produces a beam of high intensity light that enables the driver to see more clearly at night, while simultaneously protecting drivers in front from dangerous glare.” (Ex. 1005, 3:37-41.) Accordingly, the fixed direction of the microbeams operating at maximum intensity would obviate the need to change the direction or angle of illumination to accommodate a curve or any other road feature as alleged by Petitioner to increase illumination, because Beam’s AABH system already operates at maximum intensity and already illuminates such road features while detecting incoming light from forward headlights/taillights. Additionally, Beam’s AABH system processes sensor inputs to significantly reduce, not increase, illumination based on sensor data. (Ex. 2006, ¶118.)

**ii. Petitioner Reads Beam in a Manner that
Results in a Non-functional Device**

Moreover, Beam's AABH system is incapable of operating as Petitioner contends. (Ex. 2006, ¶119.) Petitioner's Ground 1 arguments are predicated on two false premises, namely that 1) Beams' AABH embodiments "control the angular position of each LED" (*see* Petition at 13); and 2) the spatial light modulator (SLM) is used for controlling light exiting the headlamp. Both premises rely on misinterpretation of Beam's teachings with respect to "controlling angular position" of the LEDs. (Ex. 2006, ¶119.) On the first point, because Beam's blanking of selected microbeams forming the output beam is controlled in response to incoming light, and specifically the location of incoming light relative to the corresponding microbeams generated by the LED array, Beam maps the angular position of incoming light with each LED in the X-Y matrix to facilitate selective darkening, not to control or change the angular position of each LED, as Petitioner contends. (*Id.*, ¶119.) "The output and reflected wavefronts are used to determine range and angular position of the vehicles ahead in the usual manner. The output drives controller 108, of FIG. 1, which uses range data to determine size and azimuth/elevation data to determine the position of the area of the microbeams to be dimmed." (Ex. 1005, 4:62-5:1.) Indeed, Beam is incapable of controlling the angular position of each LED — the LEDs are fixed in place within the X-Y

matrix. (Ex. 1005, 3:16-27, 4:45-48; Ex. 2006, ¶¶115, 119.)

On the second false premise, Beam's AABH embodiments provide alternative fixed, non-movable components controllable to blank, darken or reduce illumination of individual microbeams in response to detecting incoming light sources such as headlights/taillights. In the first embodiment illustrated in Figures 2 and 5, the spatial light modulator (SLM) is controlled so that the individual microbeams are either 1) reflected at full intensity out through the headlamp, or 2) any microbeams that would blind the oncoming driver are blanked by being absorbed or deflected to an absorbing surface so that they do not exit the headlamp, i.e. "microbeams that would blind the oncoming driver are diverted [] at the source." (Ex. 1005, 5:65-66.) The SLM is thus not capable of pointing or otherwise changing direction of microbeams exiting the headlamp. (Ex. 2006, ¶119.) Similarly, the second embodiment illustrated and described with respect to Figures 4 and 6 replaces the SLM 203 and lamp 202 with individually controllable light sources, such as an array of LEDs, that generate the narrow-angle LED beams, and are selectively attenuated or blanked to prevent blinding/dazzling other drivers. As a POSA would understand from reviewing Beam the disclosed LED array has no controllable elements capable of changing the position or otherwise pointing or steering the associated microbeams illuminating the road. (Ex. 2006, ¶120.)

Petitioner improperly relies on two separate embodiments of Beam to meet the

Challenged Claims, without showing how a POSA would have thought that these embodiments and teachings are the same or interchangeable. *Facebook, Inc. et al v. Uniloc USA, Inc. et al*, IPR2017-01524, Paper 7 at 19-20 (PTAB December 4, 2017) (denying institution stating that Petitioner “inconsistently maps the recited [claim element] to different elements of [the prior art] within its proffered analysis of [the claims].”).

As such, Petitioner’s proposed combination renders Beam’s AABH system unsatisfactory for its intended purpose of providing maximum intensity illumination everywhere (other than regions surrounding detected light sources) all the time without the use of moving components. Furthermore, the proposed combination is inoperable in that, unlike Kobayashi’s system that changes position of components (such as reflecting mirrors lenses, or shades) relative to one another to change a horizontal irradiating angle α . (Ex. 1008, 8:1-32.) Beam’s LED embodiment of Figures 4 and 6 has no way of controlling the direction of output light in response to Kobayashi’s map data. And, it has no need to control the direction of emitted light, as it already illuminates the field-of view (FOV) of the headlights (and FOV of the aligned, bore-sighted sensor) at “maximum intensity.” (Ex. 2006, ¶121.) Accordingly, there is no suggestion or motivation to make Petitioner’s proposed modification. *See In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984).

b. Petitioner Does Not Explain How a POSA Would Use Kobayashi's Map Data to Control the Direction of Beam's Maximum Intensity Microbeams to Increase Light

Petitioner does not explain how the AABH system of Beam would use the map data of Kobayashi to determine a light change to **increase** light as Beam's embodiments operate at maximum intensity and only disclose **reducing** illumination. Petitioner does not explain how a POSA would convert Kobayashi's headlamp motor control signals for "rotating the entire lighting device about its axis" or "controlling the posture of a member composing the lighting device such as a reflecting mirror, lens, light source and shielding member" in response to map data to control Beam's LED array. Petitioner also does not: 1) explain how the combined Beam-Kobayashi system would determine which microbeams to blank as compared to which microbeams to maintain in a particular direction; 2) explain how Beam's AABH system would control the direction of the microbeams using Beam's LED array; 3) how the system would **increase** light "while continuing to provide intense forward illumination" as the AABH system already operates at maximum intensity to provide "bright high beams on at all times"; or 4) provide Beam's anti-blinding feature for microbeams that change direction based on a road profile and are therefore no longer aligned with the field-of-view of Beam's sensor/camera. (Ex. 2006, ¶123.)

c. Petitioner Fails to Identify Why a POSA would Add Map Data to Beam’s AABH System That Already Illuminates Curves Absent Hindsight Bias

As LED headlamps were under development in the early 2000’s, a myriad of complex, interrelated technical issues were being solved at the time; thus, there were no ‘known techniques’ to address known problems in the LED headlamp art using prior art elements “according to their established function.” *Intel v. Qualcomm*, 21 F.4th at 799–800. LED headlamps are significantly different devices than conventional headlamps, and therefore in the early 2000’s LED headlamp design posed a complex set of challenges and tradeoffs involving optics, heat management, white LED lumen output and packaging issues, all of which affected cost. (Ex. 2006, ¶¶25-38.) Petitioner’s impermissible reliance on hindsight rather than any teachings from the disparate references, or addressing the state of the art, undermines the alleged combination of references as proposed. A “[d]etermination of obviousness cannot be based on the hindsight combination of components selectively culled from the prior art to fit the parameters of the patented invention.” *ATD Corp. v. Lydall, Inc.*, 159 F.3d 534, 546 (Fed. Cir. 1998) (emphasis added). Instead, “[t]here must be a teaching or suggestion within the prior art, or within the field of the invention, to look to particular sources of

information, to select particular elements, and to combine them in the way they are combined by the inventor.” (*Id.*)

Petitioner fails to identify such rational underpinnings in the references to explain why a POSA would add features from a non-LEDsecondary reference to modify the primary reference when, according to their own argument, the primary reference already provides curve illumination. The reason for combining the references is not to achieve the overly broad and amorphous goal of “improving driver safety” as stated by Petitioner. Rather, the only plausible, but impermissible reason for combining the references as proposed is to meet the ’029 Patent claims. *TRW Automotive U.S. LLC v. Magna Electronics, Inc.*, IPR2015-00972, Paper 9, slip op. at 15, 17 (PTAB September 16, 2015). *See also Stryker Corp. v. Karl Storz Endoscopy America, Inc.*, IPR2015-00764, Paper 13, slip op. at 13 (PTAB September 2, 2015).

As clearly shown in Figure 1 of Beam and acknowledged by Petitioner, Beam’s AABH system provides higher than high-beam intensity that illuminates both lanes of the roadway including oncoming vehicles, a preceding vehicle, left shoulder, right shoulder, and the upcoming curve (and would also illuminate upcoming intersections and any other road feature). (Ex. 2006, ¶126.) As such, Beam’s AABH system is agnostic to the road profile and effectively includes some built-in curve illumination. Accordingly, there is simply no plausible reason to add

superfluous map data and related control complexity of Kobayashi's moveable mechanical system to Beam's AABH LED system that provides high intensity illumination of the driver's entire field of view, other than using hindsight bias in a failed attempt to meet the limitations of the Challenged Claims of the '029 patent.

(Id.)

VIII. Conclusion

In light of the remarks herein, Patent Owner respectfully requests that the Board finds all challenged claims not unpatentable.

Respectfully submitted,

Dated: August 16, 2023

/Sangeeta G. Shah/
Sangeeta G. Shah (Reg. No. 38,614)
David S. Bir (Reg. No. 38,383)
Andrew B. Turner (Reg. No. 63,121)
Brooks Kushman P.C.
1000 Town Center, 22nd Floor
Southfield, MI 48075
(248) 358-4400

Attorneys for Yechezkal Evan Spero

Certificate of Service

The undersigned hereby certifies that on August 16, 2023, a complete and entire copy of **PATENT OWNER'S RESPONSE TO PETITION** and any Exhibits was served via electronic mail by serving the correspondence email addresses of the following lead and back-up counsel as shown below:

Michael D. Specht (Reg. No. 54,463) Sterne, Kessler, Goldstein & Fox P.L.L.C. 1101 K Street, N.W., Washington D.C., 20005 Telephone: (202) 371-2600 Facsimile: (202) 371-2540 E-mail: mspecht- PTAB@sternekessler.com	Jason A. Fitzsimmons (Reg. No. 65,367) Daniel E. Yonan (Reg. No. 53,812) Ian Soule (Reg. No. 74,290) Sterne, Kessler, Goldstein & Fox P.L.L.C. 1101 K Street, N.W., Washington D.C., 20005 Telephone: (202) 371-2600 Facsimile: (202) 371-2540 E-mail: jfitzsimmons- PTAB@sternekessler.com, dyonan- PTAB@sternekessler.com, isoule- PTAB@sternekessler.com, PTAB@sternekessler.com
---	---

Respectfully submitted,

Dated: August 16, 2023

/Sangeeta G. Shah/
Sangeeta G. Shah (Reg. No. 38,614)
David S. Bir (Reg. No. 38,383)
Andrew B. Turner (Reg. No. 63,121)
Brooks Kushman P.C.
1000 Town Center, 22nd Floor
Southfield, MI 48075
(248) 358-4400

Attorneys for Yechezkal Evan Spero

Certificate of Compliance Pursuant to 37 C.F.R. § 42.24

This paper complies with the type-volume limitation of 37 C.F.R. § 42.24. The paper contains 13,649 words, excluding the parts of the paper exempted by § 42.24(a).

This paper also complies with the typeface requirements of 37 C.F.R. § 42.6(a)(ii) and the type style requirements of § 42.6(a)(iii)&(iv).

Respectfully submitted,

Dated: August 16, 2023

/Sangeeta G. Shah/
Sangeeta G. Shah (Reg. No. 38,614)
David S. Bir (Reg. No. 38,383)
Andrew B. Turner (Reg. No. 63,121)
Brooks Kushman P.C.
1000 Town Center, 22nd Floor
Southfield, MI 48075
(248) 358-4400

Attorneys for Yechezkal Evan Spero