

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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VOLKSWAGEN GROUP OF AMERICA, INC.,  
Petitioner

v.

YECHEZKAL EVAN SPERO,  
Patent Owner

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Case IPR2022-01586  
U.S. Patent No. 11,208,029

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

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**PETITIONER’S UPDATED EXHIBIT LIST**

| <b><i>Exhibit #</i></b> | <b><i>Description</i></b>                                                                                                                                                            |
|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1001</b>             | U.S. Patent No. 11,208,029 B2 to Spero (“the ’029 patent”)                                                                                                                           |
| <b>1002</b>             | Prosecution File History of U.S. Patent No. 11,208,029 B2 (“’029 File History”)                                                                                                      |
| <b>1003</b>             | Declaration of Dr. Jianzhong Jiao                                                                                                                                                    |
| <b>1004</b>             | Curriculum Vitae of Dr. Jianzhong Jiao                                                                                                                                               |
| <b>1005</b>             | U.S. Patent No. 6,144,158 to Beam                                                                                                                                                    |
| <b>1006</b>             | U.S. Patent Application Publication No. 2001/0019486 to Thominet <i>et al.</i>                                                                                                       |
| <b>1007</b>             | <i>Intentionally Left Blank</i>                                                                                                                                                      |
| <b>1008</b>             | U.S. Patent No. 6,049,749 to Kobayashi                                                                                                                                               |
| <b>1009</b>             | WIPO Patent Publication No. 2002/004247 to Braun <i>et al.</i>                                                                                                                       |
| <b>1010</b>             | WIPO Patent Publication No. 1998/054030 to Karlsson                                                                                                                                  |
| <b>1011</b>             | WIPO Patent Publication No. 2001/001038 to Harbers <i>et al.</i>                                                                                                                     |
| <b>1012</b>             | U.S. Patent No. 5,588,733 to Gotou                                                                                                                                                   |
| <b>1013</b>             | <i>Intentionally Left Blank</i>                                                                                                                                                      |
| <b>1014</b>             | <i>Intentionally Left Blank</i>                                                                                                                                                      |
| <b>1015</b>             | Westermann, “History and Scientific Back-up,” 48th Session of GRE, EUREKA Project 1403, Informal Document No. 30, April 30, 2002                                                     |
| <b>1016</b>             | “Adaptive Front Lighting Systems (AFS),” 48th Session of GRE, EUREKA Project 1403, Informal Document No. 28, April 12, 2002                                                          |
| <b>1017</b>             | Hogrefe <i>et al.</i> , “Adaptive Light Pattern – A New Way to Improve Light Quality,” SAE Transactions, Vol. 106, No. 6, February 27, 1997                                          |
| <b>1018</b>             | Löwenau <i>et al.</i> , “Adaptive Light Control – A New Light Concept Controlled by Vehicle Dynamics and Navigation, SAE Transactions, Vol. 107, No. 6, pp. 33-38, February 26, 1998 |
| <b>1019</b>             | Manassero <i>et al.</i> , “Adaptive Headlamp: A contribution for Design and Development of Motorway Light,” SAE Transactions, Vol. 107, No. 6, February 26, 1998                     |

| <b><i>Exhibit #</i></b> | <b><i>Description</i></b>                                                                                                                                                                        |
|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1020</b>             | Michael Hamm, “System Strategies for Adaptive Lighting Systems,” 2001 Symposium: Progress in Automobile Lighting (PAL), pp. 368-380, September 26, 2001                                          |
| <b>1021</b>             | <i>Intentionally Left Blank</i>                                                                                                                                                                  |
| <b>1022</b>             | U.S. Patent No. 5,975,734 to Müller                                                                                                                                                              |
| <b>1023</b>             | Manassero <i>et al.</i> , Adaptive Lighting Systems: Technical Solutions and Methodological Approach for Photometric Specifications, Progress in Automotive Lighting Vol. 6, pp. 514-525 (1999). |
| <b>1024</b>             | Hanno Westermann, Lighting Performance Requirements in Vehicle Lighting Exemplified by System Requirements for AFS, Progress in Automotive Lighting Vol. 6, pp. 807-820 (1999).                  |
| <b>1025</b>             | Diem <i>et al.</i> , Analysis of the Eye-Movement Behaviour During Use Moveable Headlamps, Progress in Automotive Lighting Vol. 5, pp. 185-207 (1999).                                           |
| <b>1026</b>             | Kobayashi & Sugimoto, Development of the Phase-I AFS Front Lighting System, Progress in Automotive Lighting Vol. 5, pp. 449-464 (1999).                                                          |
| <b>1027</b>             | Alejandro Vukotiich, Evaluation of the applicability of digital maps for the reconstruction of the real street shape, Progress in Automotive Lighting Vol. 6, pp. 774-790 (1999).                |
| <b>1028</b>             | Bernhard Wörner, Adaptive Frontlighting – Experimental System, Development and Functional Evaluation, Progress in Automotive Lighting Vol. 6, pp. 844-853 (1999).                                |
| <b>1029</b>             | Mark van den Berg, Development of high Brightness LED’s for Automotive Applications, Progress in Automotive Lighting Vol. 9, 987-993 (2001).                                                     |
| <b>1030</b>             | Assessment of Headlamp Glare and Potential Countermeasures, Survey of Advanced Front Lighting System (AFS) Research and Technology, National Highway Traffic Safety Administration (2005)        |
| <b>1031</b>             | Watanabe <i>et al.</i> , The Research on the Effectiveness of AFS Bending Lamp in Japanese Road Environment, Progress in Automotive Lighting Vol. 9, 1042-1053 (2001).                           |

| <b><i>Exhibit #</i></b> | <b><i>Description</i></b>                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1032</b>             | First Amended Complaint, <i>Torchlight Techs. LLC v. Daimler AG, et al.</i> , Civil Action No. 1:22-cv-00751 (D. Del.), filed August 26, 2022 (ECF No. 24)                                                                                                                                                                                                                                                                                              |
| <b>1033</b>             | File History of <i>Ex Parte</i> Reexamination of U.S. Patent No. 9,955,551, Control No. 90/014,815                                                                                                                                                                                                                                                                                                                                                      |
| <b>1034</b>             | U.S. Patent No. 6,127,947 to Uchida <i>et al.</i>                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>1035</b>             | United States District Courts – National Judicial Caseload Profile, June 2022                                                                                                                                                                                                                                                                                                                                                                           |
| <b>1036</b>             | Declaration of Jianzhong Jiao, Ph.D., in Support of Petitioner’s Reply                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>1037</b>             | Transcript of the Deposition of Matthew A. Turk, Ph.D.                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>1038</b>             | Leighty, <i>et al.</i> , “Developing Technologies for Army Autonomous Land Vehicles (U),” Leighty & Lane, available at Army Engineer Topographic Labs, Fort Belvoir, October 1985 (accessible online at <a href="https://apps.dtic.mil/sti/tr/pdf/ADA187972.pdf">https://apps.dtic.mil/sti/tr/pdf/ADA187972.pdf</a> , last accessed October 30, 2023)                                                                                                   |
| <b>1039</b>             | Lowrie, <i>et al.</i> , “The Autonomous Land Vehicle (ALV) Preliminary Road-Following Demonstration,” Lowrie, James, Thomas, Mark, Gremban, Keith, Turk, Matthew, Proceedings of SPIE, Vol. 579 Intelligent Robot and Computer Vision, (11 December 1985), (accessible at <a href="https://home.ttic.edu/~mturk/pubs/ALV-preliminary-SPIE1985.pdf">https://home.ttic.edu/~mturk/pubs/ALV-preliminary-SPIE1985.pdf</a> , last accessed October 30, 2023) |
| <b>1040</b>             | U.S. Patent. No. 5,426,294, to Kobayashi <i>et al.</i> , issued June 20, 1995                                                                                                                                                                                                                                                                                                                                                                           |
| <b>1041</b>             | “The International System of Units (SI),” Bureau International des Poids et Mesures, 7 <sup>th</sup> Edition (1998) (Excerpt)                                                                                                                                                                                                                                                                                                                           |
| <b>1042</b>             | Surface Vehicle Recommended Practice, Performance Requirement for Motor Vehicle Headlamps, J1383 (May 2018)                                                                                                                                                                                                                                                                                                                                             |
| <b>1043</b>             | “Turk Diagram,” (Exhibit A) From the Deposition of Matthew A. Turk PhD, October 17, 2023                                                                                                                                                                                                                                                                                                                                                                |
| <b>1044</b>             | 49 C.F.R. 571.108, Standard No. 108 (Up To date as of Nov. 3, 2023)                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>1045</b>             | Terminology – Motor Vehicle Lighting, SAE J387 Nov87, The Engineering Society For Advancing Mobility Land Sea Air and Space (Revised Nov. 1987)                                                                                                                                                                                                                                                                                                         |

## I. INTRODUCTION

Patent Owner's arguments all fail on the merits. Patent Owner (PO)—and their purported expert, Dr. Turk—make demonstrably incorrect characterizations about what the prior art discloses to a POSA. Compounding PO's erroneous arguments, this is a rare instance where PO fails to provide testimony from a declarant qualified to opine on what a POSA would have understood. PO's arguments are tainted by a declarant, Dr. Turk, who is neither an expert nor a POSA, as confirmed by Petitioner's undisputed expert Dr. Jiao. Regardless, PO's technical arguments are meritless.

Regarding Gotou-Karlsson, first, PO characterizes Karlsson's LEDs as defaulting to all "on," which is demonstrably false. Second, PO's own annotated figures establish Gotou-Karlsson meet the claims.

PO's unfounded attempt to question the motivations to combine references attacks the references individually and is decoupled from what a POSA would have understood about the state of the art.

For the Gotou-Karlsson combination, PO focuses on Karlsson (the secondary reference), ignoring what Gotou (the primary reference) discloses about lighting curves and what Karlsson *actually* discloses about how its beam is formed.

Finally, PO's fundamental misunderstanding of Beam's statements related to "maximum intensity" infect its entire argument for the Beam-Kobayashi

combination. PO fails to understand that, contrary to Dr. Turk's unsupported opinion, *intensity includes directionality*, and Beam discloses controlling its angular distribution (direction).

All of PO's arguments fail; thus, as the Petition showed, all claims are unpatentable.

## **II. DR. TURK IS NEITHER AN EXPERT NOR A POSA IN THE RELEVANT FIELD, AND NEVER HAS BEEN.**

Dr. Turk's declarations (EX2001, EX2006) should be excluded or accorded no weight because Dr. Turk is not a POSA. Petitioner and PO agree a POSA:

[W]ould have had a bachelor's degree (B.S.) in mechanical engineering, electrical engineering, optical engineering, applied physics, or an equivalent field, *as well as at least 2 years of industry experience in the area of automotive lighting and lighting-control systems*.

Pet. 10 (emphasis added throughout unless noted); POR 21. Dr. Turk accepts this level of skill (EX1037, 60:7-22), but does not meet it.

Only qualified experts can testify about issues of claim construction and validity. *HVLPO2, LLC v. Oxygen Frog, LLC*, 949 F.3d 685, 689 (Fed. Cir. 2020); *Sundance, Inc. v. DeMonte Fabricating Ltd.*, 550 F.3d 1356, 1361 & n.3 (Fed. Cir. 2008). This requirement extends to "ultimate conclusions" on those issues and to "underlying technical" determinations. *HVLOP2*, 949 F.3d, 689; *Sundance*, 550

F.3d, 1363 (“it is an abuse of discretion to permit a witness to testify as an expert on the issues” from the perspective of a POSA “unless that witness is qualified as an expert in the pertinent art”).

*“To offer expert testimony from the perspective of a skilled artisan in a patent case—like for claim construction, validity, or infringement—a witness must at least have ordinary skill in the art. Without that skill, the witness’ opinions are neither relevant nor reliable.” Kyocera Senco Indus. Tools v. Int’l Trade Comm’n, 22 F.4th 1369, 1375-77 (Fed. Cir. 2022). Testimony from a non-POSA on the issues of claim construction and validity “fails the standard of admissibility under [Federal Rule of Evidence] 702,” Sundance, 550 F.3d, 1363, “amount[ing] to nothing more than advocacy from the witness stand,” Kyocera, 1377 (quoting Sundance, 550 F.3d, 1364–65).*

Dr. Turk is not a POSA (EX1036, ¶¶1-49) and cannot testify on issues of claim construction or validity. There is no genuine dispute that Dr. Turk lacks “at least 2 years of industry experience in the area of automotive lighting and lighting-control systems.” Pet. 10. Dr. Turk’s industry experience relates to “computer vision methods for recognizing human faces, gestures, and activity.” EX2006, ¶12. The closest “bit” of relevant experience that Dr. Turk identified was at Martin Marietta (EX1037, 53:4–25), working on “computer vision for autonomous vehicle navigation,” not automotive lighting and lighting-control. EX2006, ¶12; EX1036,

¶¶41-49. The claims here concern *automotive lighting control*, not autonomous vehicle navigation, and PO has presented no evidence that Dr. Turk has any requisite “industry experience in the area of automotive lighting and lighting-control systems” required of a POSA. Pet. 10; EX1036, ¶¶10-49.

Petitioner’s expert, Dr. Jiao’s, industry experience stands in stark contrast to Dr. Turk’s. EX1036, ¶¶3, 6-8. Dr. Jiao worked for four years on “automotive lighting” for GM before working at North American Lighting, where he implemented “adaptive front-lighting system technologies” for 14 years. EX1003, ¶¶11–12. Dr. Jiao then worked at OSRAM on “automotive lighting” accruing an additional eight years of industry experience. *Id.*, ¶13.

As an unquestioned expert in the field—confirmed even by PO’s Dr. Turk, who had “no reasons to disagree.” (EX1037, 58:9-19, 59:16-19)—it is Dr. Jiao’s opinion that Dr. Turk lacks the requisite industry experience required of a POSA. EX1036, ¶¶10-49. For example, Dr. Jiao testified that a POSA would know that “intensity” includes direction and is not synonymous with “brightness,” which Dr. Turk does not understand. EX1036, ¶¶15-17, 25-26, 31, 79, 92, 111, 115, 116, 124. Dr. Jiao also confirms that Dr. Turk does not understand other concepts readily known to a POSA including: basic terms (“spatial distribution,” “beam pattern”), patterns for high and low-beam (among others), how those beams are optically combined, and other concepts. EX1036, ¶26. Further, Dr. Turk does not understand

how a POSA would measure, e.g., intensity (in development or under certain regulations), is not familiar with leading consortiums or conferences, or what a POSA would have found obvious to combine with respect to the applied references. EX1036, ¶¶48-49.

Notably, Dr. Turk has never worked for a vehicle headlamp company, never worked for an LED (or other light source) company, never worked for a general lighting company, never designed a vehicle forward lighting system, and has no patents, awards, or papers for vehicle forward lighting. EX1037, 52:18-53:1, 54:24-56:12; EX1036, ¶¶48-50.

PO will no doubt try to rehabilitate Dr. Turk’s qualifications, but the law dictates that he cannot meet the POSA requirement. Dr. Turk’s industry experience “in the area of automotive lighting and lighting-control systems,” Pet. 10, if any, amounts to nothing more than “vague reference[s]” that “fall[] short of establishing two years of...work experience” and should be “given no weight,” *Avail Medsystems, Inc. v. Teladoc Health, Inc.*, IPR2022-00444, Paper 10, 24, 26 (P.T.A.B. July 21, 2022); *id.*, 24–26 (citing *Kyocera*, 22 F.4th, 1375–78).

For these reasons, Dr. Turk’s opinions regarding claim construction and patentability should be excluded or receive no weight.

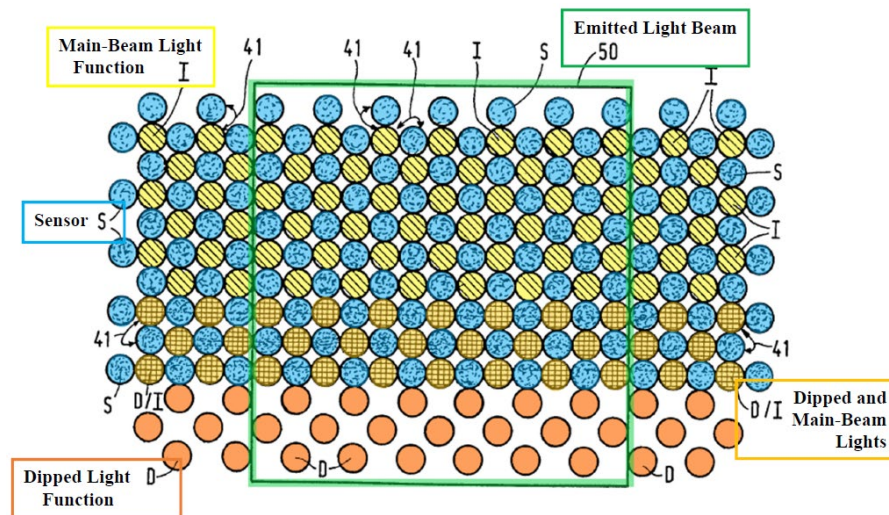
### III. PATENT OWNER'S SUBSTANTIVE ARGUMENTS AGAINST THE GOTOU-KARLSSON COMBINATION FAIL.

PO's arguments against the Gotou-Karlsson combination are rooted in Dr. Turk's lack of knowledge and, regardless, are incorrect.

#### A. Karlsson does not default to all LEDs on.

PO argues that Karlsson forms emitted beam 7 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.” POR, 13; EX2006, ¶76. This is an incorrect and gross misstatement. EX1036, ¶¶51-52.

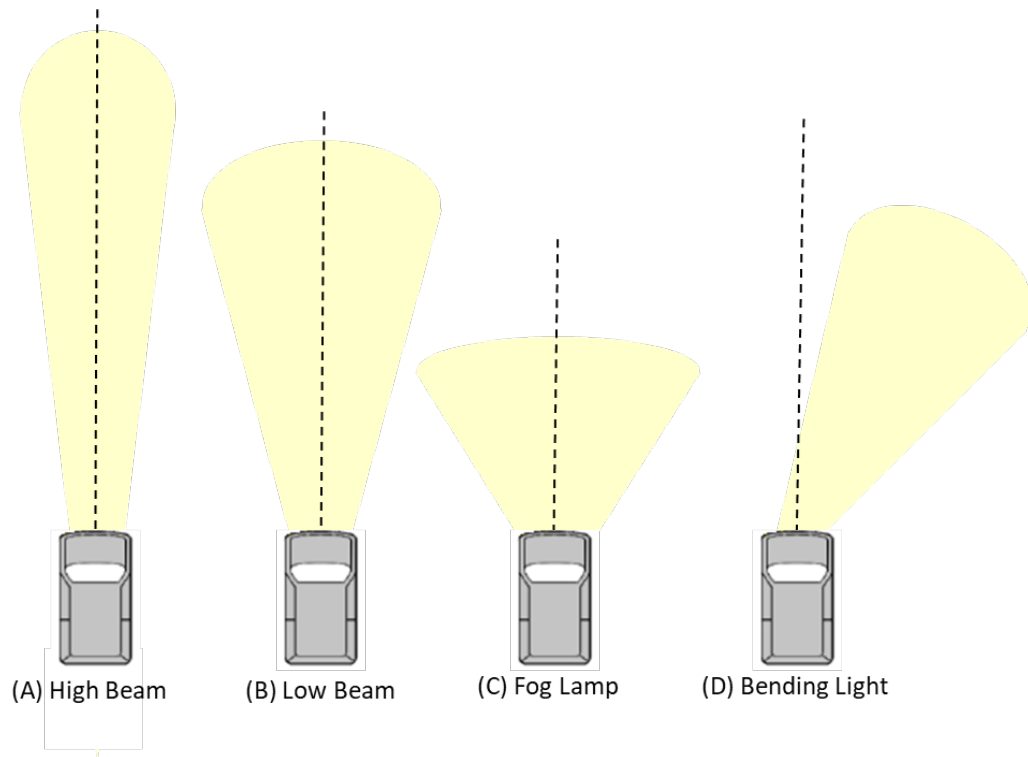
Karlsson's emitted light beam 50 shifts in the plane from left-to-right and from top-to-bottom, based on controller inputs. EX1010, 19:18-20:3; EX1003, ¶242; EX1036, ¶¶53-54:



EX1010, FIG. 14 (annotated).

Directly contradicting PO's/Dr. Turk's mischaracterization above and his misstatement that "[t]here is nothing in Karlsson to suggest that window 50 is the actual beam that would be used for driving" (EX2006, ¶134), Karlsson expressly states that "[t]he *emitted light beam 50 is represented as a window which can shift in the plane of the drawings from the left to the right and from the top to the bottom, if desired, and vice versa, and which may vary as regards its shape and dimension in dependence on the desired pattern and direction of the beam.*" EX1010, 19:29-34; Pet., 21-22; EX1003, ¶¶93, 242, 254, 296, 334; EX1036, ¶¶51-64. A POSA would have thus understood Karlsson discloses an adaptable beam. EX1036, ¶¶51-64.

Dr. Jiao illustrates "desired" beam pattern schematics that a POSA would have understood Karlsson creates:



EX1036, ¶54.

(A) shows a high-beam pattern which is long with a narrower angle of beam spread. EX1036, ¶55. (B) shows a low-beam pattern—still relatively long, with wider spread. *Id.* (C) illustrates a fog lamp beam pattern—low and wider still, to increase short-range visibility and safety. *Id.* Finally, (D) shows a beam aimed towards the right, for example, towards a right-handed curve when using Gotou’s control strategy to aim light in the direction towards a curve prior to entering the curve. *Id.*

Karlsson’s “spotlight beams 34 can be obtained... [with] a grid of separate light sources, such as LEDs, ...*controlled either individually or in groups,*”—i.e., *not* default to all LEDs “on,” as PO alleges. EX1010, 14:1-4; EX1036, ¶56. PO

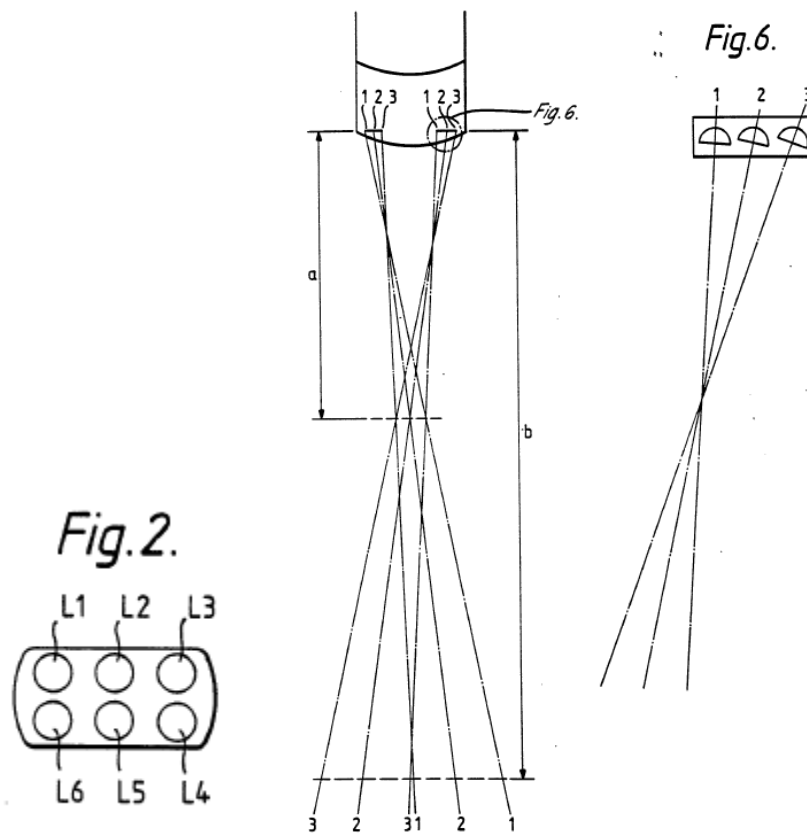
clouds the record by mischaracterizing Petitioner's position in a separate IPR related to a specific *surrounding area* of Karlsson's reduced illumination with respect to glare control. There, Petitioner explained illumination *around* the reduced illumination area can be maximized around a vehicle that Karlsson wishes to avoid providing glare to, while also allowing Karlsson's driver to fully see the area *around* the reduced illumination area. EX2008, 67. This does not suggest that Karlsson defaults to all LEDs on and does *not* suggest that Karlsson's maximized area *around the glare control region* means that all of Karlsson's LEDs are illuminated, much less illuminated to their highest degree. EX1036, ¶¶57-58.

Dr. Turk states that the '029 patent's "*optimal* operating regime" is "how a device should be operating ideally." (EX1037, 73:5-16). Likewise, he acknowledges that Karlsson discloses that its average intensity of emitted light is controlled to provide a light beam with the intensity "*optimally* adapted to the road and to the ambient light, thereby increasing the driving comfort and road safety." EX1037, 130:7-131:7. Indeed, the '029 patent's disclosure of GPS systems used in AFS providing such an "optimal mode" (EX1001, 51:63-52:2) is similar to Karlsson's optimum lighting. EX1036, ¶¶58-60. And nothing suggests that Karlsson operates with all LEDs active as a default.

Next, PO raises Flaaten, but misses the point. Flaaten aims for an "*optimum* lighting effect." EX2006, ¶134 (citing EX2017, 1); *see also* EX2006, ¶89 (citing

EX1010, 2:2-9); EX1036, ¶¶60-61. Flaaten's maximum "*satisfactory* illumination" (EX2017, Abstract) does not mean all of Flaaten's sources are on at all times. Nor does Flaaten conclude that there should be "full illumination to the 'greatest extent possible,'" as Dr. Turk alleges. EX2006, ¶90. Rather, a POSA would understand that "*satisfactory* illumination is maintained of the roadway in front of the vehicle," e.g., including ahead in curves. EX1036, ¶¶60-61, citing EX2017, Abstract.

To the extent Karlsson is an evolution of Flaaten, as PO contends (POR, 20), this supports that changing from incandescent bulbs to LEDs was obvious:



EX2017, FIGS. 2, 5, 6.

Flaaten's sources are "dimmed gradually, one at a time." EX2017, 3:34-36.

And Flaaten's sources automatically adjust their angular settings. EX2017, 5:27-31; EX1036, ¶¶62-77. So PO's position actually supports Karlsson's directional aiming of its LEDs—Flaaten provides curves, etc. are satisfactorily illuminated (EX2017, 2:2-6; 2:22-26, claim 3). EX1036, ¶76.

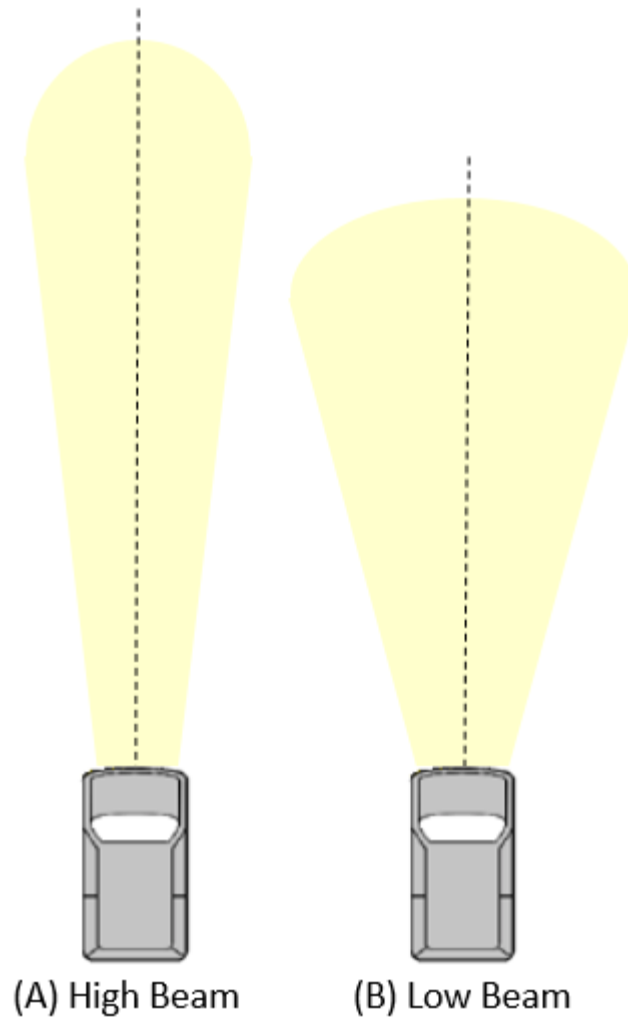
**B. PO's own annotated figures establish Gotou-Karlsson meets the claims of the '029 patent, even though their straight-line beam is incorrect.**

First, Dr. Turk creates new figures with Karlsson taking a curve. EX2006, Turk-created FIGS. 1A, 2A, 1B, 2B, 1C; POR, 14, 15, 18-20. While these are incorrect and self-serving, even they establish that Karlsson's beam shifts from left-to-right, as in the Preliminary Response at pages 41-42. And when applied to Gotou's system that controls for curvature via map data, it would do the same in the direction of the curve, meeting the claims, while still dealing with "a variety of possible glare situations." EX2006, ¶88. The Board appreciated this in its Institution Decision. Paper 7, 12-13 (noting Karlsson's beam shifts and "contemplates adjusting its LEDs 'when the car [] is taking a bend.'").

Second, during deposition, Dr. Turk was asked to annotate a version of his created Figure 1A, with a second red-dotted line for a potential beam pattern for the right-headlamp, as he drew for his left-headlamp, showing Dr. Turk's interpretation of Karlsson's beam *not* bending towards a curve. EX1037, 142:16-

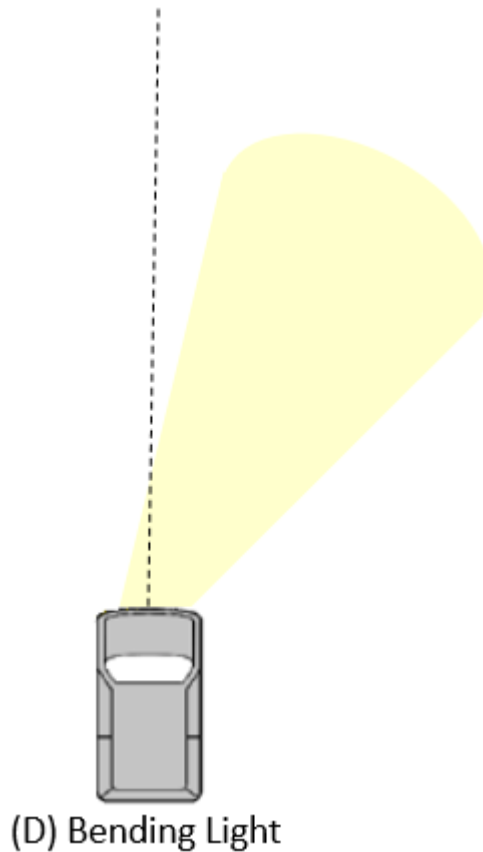
145:25; EX1043. Unsurprisingly, Dr. Turk stated that “I don’t know exactly what it would do, and again, it’s not meant to be technically precise[.]” EX1037, 144:13-15.

Dr. Jiao, however, confirms that Karlsson’s beam would project light towards the right when taking a right-hand curve (bending towards the right, into the curve to the right of the vehicle’s centerline), e.g., as a result of Karlsson’s “direction sensor 54,” *and* how Gotou-Karlsson’s beam would project light towards the right taking a right-hand curve, using Gotou’s map data. EX1036, ¶¶67-72. This is based on the understanding of a POSA. A POSA would have understood that Karlsson’s spotlight beams are for at least *both* high-beam and low-beam functions, and that high-beam and low-beam are aimed in *different* directions. EX1036, ¶¶68-69; EX2010, 237; EX2012, 8, FIGS. 11A, 11B; EX2013, 7. Karlsson’s spotlight beam thus changes direction—and thus intensity—in order to achieve this, as shown below in Dr. Jiao’s schematic (high-beam left; low-beam right):



EX1036, ¶69.

Dr. Jiao also corrects Dr. Turk's illustrations showing the Gotou-Karlsson system taking a right-hand curve using map data to bend the light towards the right:



EX1036, ¶70.

And, a POSA would have understood that Gotou-Karlsson would provide a large set of known beam patterns. EX1036, ¶71. Dr. Jiao provides examples (EX1003, ¶¶48-52, among others; EX1036, ¶¶71-72) such as in Hogrefe, which explains that “the individual light *pattern* of multiple sub-units sum up to the total adaptive light pattern.” EX1017, FIG. 3 (emphasis original).

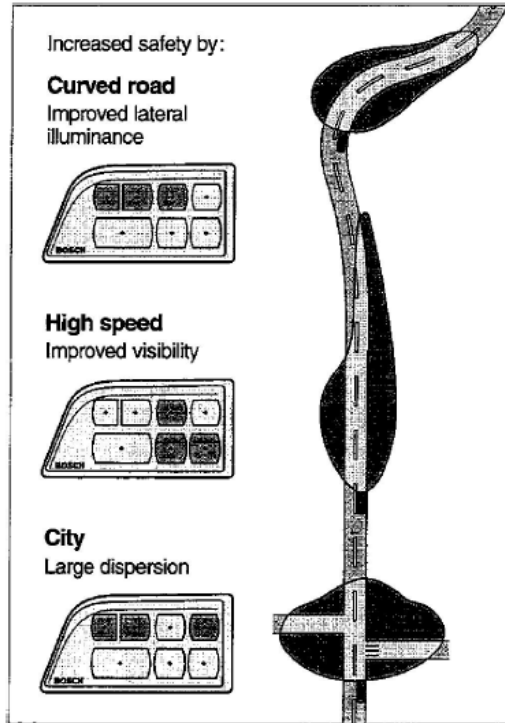


Fig.1: Three standard driving situations with adapted light pattern seen from the bird eye's view.

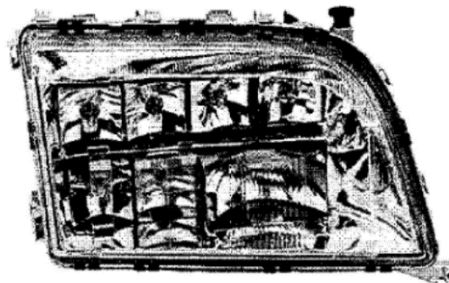
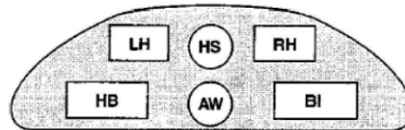


Fig 4: ALP headlamp sample



Single components:

LH Left hand bend  
RH Right hand bend  
HB High beam  
BI Basic illumination  
AW Adverse weather illumination  
HS Hot spot

Fig. 5: AdvancedALP sample layout

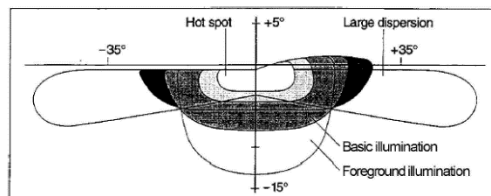


Fig. 3: Light pattern of multiple beam headlamp (Isolux curves in wall projection). The individual light pattern of multiple sub-units sum up to the total adaptive light pattern

EX1017, FIGS. 1 and 3-5.

This directly refutes Dr. Turk’s unsupported and misinformed arguments that Gotou-Karlsson does not teach “increasing light in a direction of the road curvature.” EX2006, ¶¶127-136. It would, as was already well-known in the art.

**C. PO’s arguments regarding motivation to combine Gotou-Karlsson fail.**

PO’s main criticism of Gotou is the factually incorrect statement that Gotou does not “contemplate turning lamp unit 4 on/off or otherwise changing its intensity.” EX2006, ¶71. This is wrong for at least two reasons.

First, because Gotou changes the direction of its beam pattern, it changes its intensity by its angular distribution change (change in direction reflects a change in intensity and an “increase of light in a direction,” as recited in the ’029 patent’s claims). EX1036, ¶¶69-80.

Second, Gotou expressly describes at 8:16-19 that its system contemplates plural bulbs. Pet., 59; EX1003, ¶239 (explaining that Gotou “*describe[s] that plural bulbs* may be installed in one head light” and the light distribution is changed by “separately using one bulb illumination and two-bulb illumination, respectively.” EX1012, 8:15-19.). Dr. Turk acknowledged Gotou’s disclosure and that with two bulbs where “one is lit and one is off and then you light the second one,...that would *increase light in a certain direction.*” EX1037, 127:9-128:20. So PO’s assertion that Gotou does not disclose “headlamps with multiple light sources with corresponding multiple optical axes” is categorically false. EX2006, ¶74;

EX1036, ¶¶81-82.

Separately, notwithstanding Dr. Turk’s misunderstanding of potential challenges in creating a commercial LED headlamp array (e.g., EX2006, ¶135), he acknowledged that the ’029 patent is not so limited by regulations, design tradeoffs, hardware, optical systems, heat management, packaging, or cost to suggest any of the claims of the ’029 patent be patentable. He also correctly acknowledged that the ’029 patent includes technologies that are either “feasible... or will become feasible in the future.” EX1037, 64:25-73:16; EX1001, 19:64-20-2. Dr. Turk alleges that substituting an LED array for a conventional light source to make a forward lighting system “that meets applicable regulations and standards would be beyond routine for a POSA and there would be no reasonable expectation of success for the resulting forward lighting system.” EX2006, ¶179. But, even Karlsson—the target of PO’s misplaced criticism—acknowledges that its light beam 7 to be emitted with LEDs “is *adapted to the respective regulations at all times*,” (EX1010, 20:26-27) and it improves upon a device that does not include LEDs (EX2017). EX1036, ¶¶83-85. Dr. Turk’s admissions and the express statements in the art confirm that PO’s lack of motivation arguments fail.

**D. PO's arguments against the dependent claims fail.**

**1. Claims 5, 16, and 27**

PO groups claims 5, 16, and 27 (POR, 31, 53; EX2006, ¶¶137-141), arguing that Gotou-Karlsson does not disclose these features. The Petition and First Jiao Declaration (e.g., EX1003, ¶299) explained these features recite increasing light (other than at high-beam intensity) in the direction of the road curvature. As Dr. Jiao explained, Gotou's variation of high-beam and low-beam is generally in a vertical direction and not affected by horizontal movement. EX1003, ¶300 (citing EX1012, 1:10-20); *see also* EX1012, 3:52-67, 4:1-29, FIG. 4, 4:36-40, 5:8-7:4, FIGS. 8-9; Pet., 84.

Contrary to Dr. Turk's misunderstanding, a POSA would have understood that Karlsson provides at least both low-beam and high-beam light. EX1036, ¶88. Dr. Jiao explained that the increase of lighting toward the curve with Gotou-Karlsson (using Karlsson's LEDs) would be emitted at a level below high-beam light. EX1003, ¶302; EX1012, 1:10-20; Pet., 84.

PO notes the patentably indistinct "road curvature" or "shape change" language in comparing claims 5 and 27. Yet Dr. Turk was unable to distinguish these terms (EX1037, 158:15-159:9)—"road curvature" is a type of "shape change." EX1003, ¶¶302, 175-176; Pet., 19, 31, FN8.

Even under PO's/Dr. Turk's suggestion that an "emitting LED has its

illumination increased” is required (EX2006, ¶142) (it is not), Gotou’s plural bulb control provides light in the direction of the shape change including at least light output that increases light emitted at a level below high-beam light and directed in the direction associated with shape change. EX1012, 8:15-19; EX1003, ¶239; Pet., 27; EX1036, ¶¶86-92.

Karlsson, too, controls illumination of its LEDs individually and in groups, such that the Gotou-Karlsson combination renders the claims obvious. By Dr. Turk’s own admission, Karlsson’s LEDs may be “freshly lit, having never been previously illuminated.” EX2006, ¶145. This would include at least light output that increases light emitted at a level below high-beam light and directed in the direction of the curvature or associated with shape change. EX1036, ¶92.

## **2. Claims 6, 17, and 28**

PO groups claims 6, 17, and 28 (POR, 34, 55; EX2006, ¶147), and feigns confusion that Gotou-Karlsson would not have “at least one LED light source different from the first plurality of LED light sources.” Dr. Jiao explained (EX1003, ¶¶304-315) that Gotou-Karlsson is iterative, determining any number of successive light changes. The elements verbosely recite that the system (including instructions [6.1]/[17.1]/[28.1]): (1) determines a second light change for a second (next) road curvature [6.2]/[17.2]/[28.2], and (2) controls the LEDs to provide light toward the second road curvature (i.e., “shaping light”) based on map data

[6.3]/[17.3]/[28.3]. Pet., 45, 84.

The Gotou-Karlsson combination discloses this function for the same reasons as in Pet., 84-85. *See, e.g.*, EX1003, Sections XI.A.1, XI.A.7, XI.A.8, XI.B.2, XI.B.3; EX1008, 13:67-14:13, 14:26-30, 2:30-35, 6:1-5; EX1012, Abstract, 1:35-40, 2:8-26, 3:24-62, 4:45-49, 6:4-61, 7:32-43, 8:28-35, FIGS. 1-3 and 8-10. This is merely a subsequent, repeated step in the iterative processes of the '029 patent and Gotou-Karlsson systems. Pet., 45, 85; EX1036, ¶¶93-98.

There are many instances where at least one LED light source would be different from the first plurality of LED light sources. EX1036, ¶¶94, 137. Dr. Turk's own annotations showing shifting LEDs towards a right-hand curve in his FIG. 1B (EX2006, ¶84) and the addition of LEDs to the left when taking a left-hand curve in his FIG. 1C (EX2006, ¶85) show these claims are obvious. It confirms Karlsson uses "at least one LED light source different from the first plurality of LED light sources," for a second road curvature or shape change, contradicting Dr. Turk's argument in EX2006, ¶147. EX1036, ¶¶93, 97, 137.

PO does not separately argue claims 4, 15, and 26 (EX1003, ¶¶295-298), which are similar to claims 6, 17, and 28 and recite selecting one of the first plurality of LED's or some second plurality of LEDs with a different LED to provide *reshaped* light. EX1003, ¶295. Like claims 6, 17, and 28, a POSA would have understood this was obvious, at least because *reshaping* the Gotou-Karlsson

system's light would have included taking action with *at least one* of Gotou's modified headlamps utilizing Karlsson's LEDs. EX1003, ¶295; EX1036, ¶98.

### 3. Claims 7, 18, and 29

PO groups claims 7, 18, and 29 (POR, 35-36; EX2006, ¶¶148-150), ignoring the Petition's explanation of Gotou-Karlsson. Gotou-Karlsson increases light by increasing intensity of light directed toward the road curvature, as previously explained, *and* an expansion of the light pattern (only one is required). Pet., 85-86; EX1003, ¶¶316-320.

These were well-known alternatives for increasing light toward the road curvature [7.1]/[18.1]/[29.1], [7.2]/[18.2]/[29.2]. EX1003, ¶¶316-317. Light can be increased by increasing (1) intensity of the lights [7.3]/[18.3], or (2) the number of lights that are “on” that provide light toward the road curvature [7.4]/[18.4]/[29.2]. These basic alternatives are disclosed by the Gotou-Karlsson combination and shown by the same disclosures as the independent claims. EX1003, ¶317 (citing EX1003, Section XI.A); Pet., 85; EX1036, ¶¶99-102.

Karlsson expressly states that “[t]he *emitted light beam 50 is represented as a window* which can *shift* in the plane of the drawings *from the left to the right* and *from the top to the bottom*, if desired, and vice versa, and which may *vary as regards its shape and dimension* in dependence on the *desired pattern* and *direction of the beam*.” EX1010, 19:29-34. Gotou also suggests this. EX1036,

¶102. This discloses an expansion of the light pattern by increasing the number of lights providing light toward the road curvature (and controlling intensity, which includes direction) as shown in Dr. Jiao’s annotated figures and other known art such as Hogrefe. EX1036, ¶102.

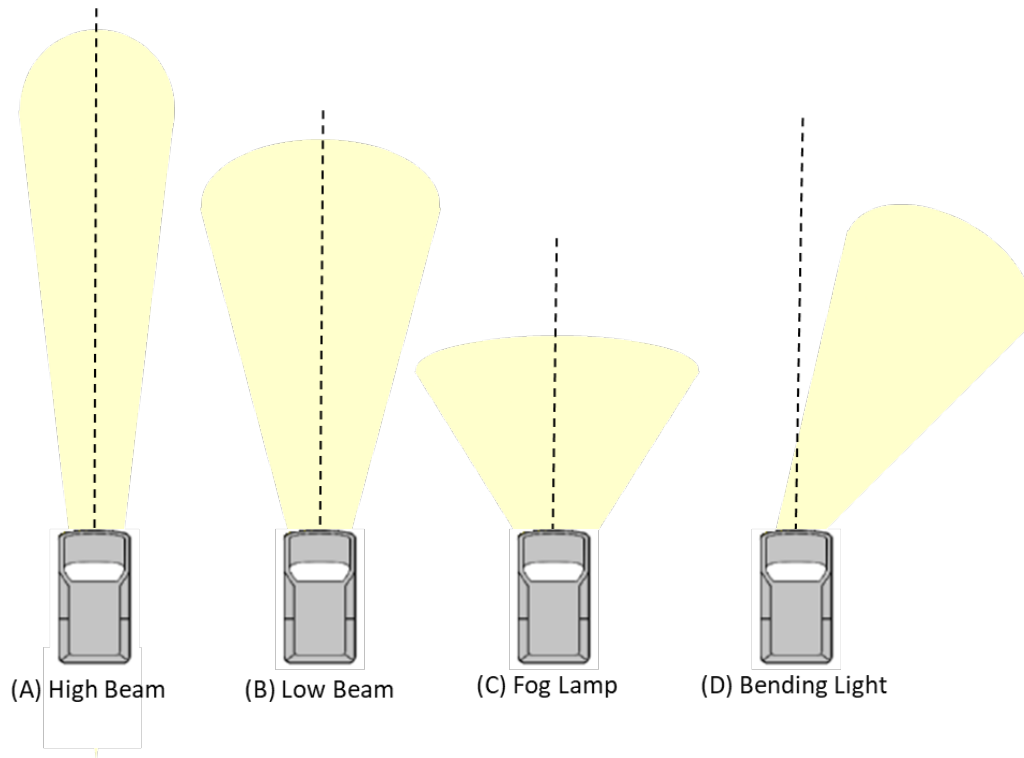
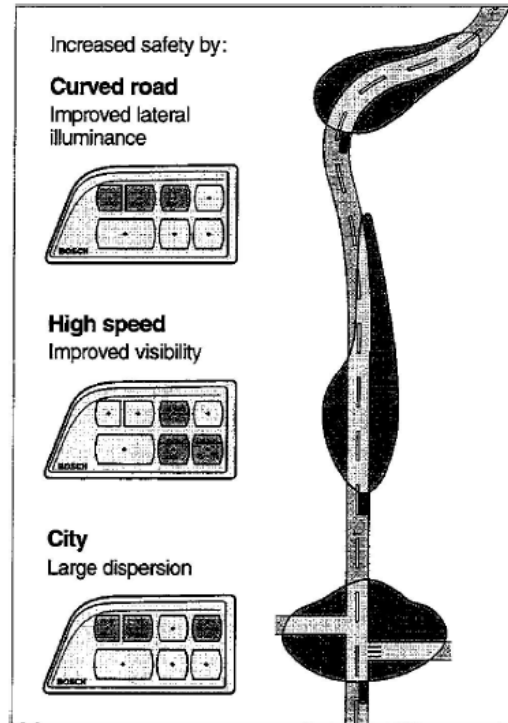


FIG. 1: Examples of Karlsson’s “Desired Beam Pattern”



*Fig.1: Three standard driving situations with adapted light pattern seen from the bird eye's view.*

EX1017, FIG. 1.

#### 4. Claims 9, 20, and 31

PO groups claims 9, 20, and 31 (POR, 36-37, 56; EX2006, ¶¶151–153), and suggests that “map data” cannot be used to “control the second plurality of LED light sources” to diminish glare to a driver of another vehicle. This is incorrect and irrelevant.

Claim 8 for example, from which claim 9 depends, clarifies that there is “control, *based at least in part* on the position [of a vehicle determined with a camera]” as in Karlsson, of “a second plurality of LED light sources...to diminish glare.” EX1003, ¶¶321-328. But [9.3] only recites that “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;” it does *not* require the control is “to diminish glare,” as the partial control of the second plurality of LEDs is based at least in part on the position of a vehicle. Rather, the *additional* control in [9.3] is not limited in its purpose; it is just based “at least in part on third data received from a non-camera sensor of the motor vehicle.” EX1036, ¶¶103-106, 145.

Gotou’s map data is not from a camera sensor; thus, in combination with Karlsson it meets the elements related to first and third data not from a camera sensor [9.3]/[20.3]/[31.3], [9.5]/[20.5]/[31.5]. EX1012, 3:52-67, 4:1-29, 5:8-6:3, 6:18-7:4, FIGS. 4, 7; Pet., 88; EX1003, ¶330.

## **5. Claims 10, 21, and 32**

Dr. Turk groups claims 10, 21, and 32 (EX2006, ¶154), alleging that “Petitioner does not identify which optics it is relying on for this combination.” While not argued in the POR, a POSA would have understood that Karlsson’s optical control elements would have been used in the Gotou-Karlsson system, as they provide the correct illumination and control for Karlsson’s LEDs. Pet., 91; EX1003, ¶¶341-349; EX1036, ¶¶107-108.

Gotou also discloses optical control elements—reflectors/sub-reflectors to change light distribution (EX1012, 8:20-22)—while Karlsson discloses optical control elements such as reflectors and lenses (EX1010, 14:1-15, 5:4-10, 10:26-

31). EX1003, ¶¶341-342. Dr. Turk acknowledged that Karlsson’s lenses and reflectors are “optical control elements.” EX1037, 164:12-165:2; EX1036, ¶¶107-108.

#### **IV. PATENT OWNER’S SUBSTANTIVE ARGUMENTS AGAINST THE BEAM-KOBAYASHI COMBINATION FAIL.**

PO’s arguments against the Beam-Kobayashi combination are also rooted in Dr. Turk’s lack of knowledge and, regardless, are incorrect.

##### **A. PO is wrong about Beam’s “maximum intensity” statements.**

When Dr. Turk was asked “What does ‘maximum intensity’ mean in the context of automotive lighting?” he answered “In general, *I don’t know...I think it means you can’t make it any brighter, any higher in terms of its intensity.*”

EX1037, 103:13-20. Dr. Turk was asked as a direct follow up: “You said, though, that you don’t know in general what ‘maximum intensity’ means in the context of automotive lighting?” and he answered “Not as a general term in all circumstances, no.” EX1037, 103:22-25.

“Intensity” is not synonymous with “brightness,” as Dr. Turk proposes (EX1037, 62:18-25, 84:3-6)—“brightness” is a human perception measurement, whereas “intensity” refers to luminous intensity measured in the unit candela (cd) in the International System of Units. EX1036, ¶15, EX1041, 18. Dr. Turk also incorrectly states that “beam pattern” is “related to brightness and darkness of illumination within the shape.” EX1037, 43:2-4. This conflicts with the Second

Turk Declaration's paragraph 26, quoting *from an article that Dr. Jiao co-authored*, explaining that “[a]ny automotive headlamp beam pattern, either high-beam or low-beam, is a light luminous intensity (candela) angular distribution.” EX2010, 237; EX1036, ¶116.

Dr. Turk's misunderstanding contradicts what Beam discloses to a POSA: a system that includes at least *both* low and high-beams achieved by its microbeams, as Dr. Jiao confirmed. EX1036, ¶¶109-111. Beam's microbeams *must* be able to change direction to achieve at least the high-beams and low-beams, which by definition are aimed in *different* directions. *Id.* That is, high and low-beams have different “maximum intensities,” and such “maximum intensities” would be understood by a POSA with regard to the change in beam pattern and direction. EX1036, ¶¶18, 111; EX2010, 237; EX2012, 8, FIGS. 11A, 11B; EX2013, 7. Beam does not, as PO contends, suggest to a POSA that it is unable to *increase light in a direction* by virtue of its “maximum intensity.” EX1036, ¶111. A POSA would thus understand that Beam *controls intensity including angular position* to a maximum desired in a given direction, and does not default (using a colloquialism) “full blast” everywhere at all times. EX1036, ¶¶111-113.

Beam's headlamps each comprise a plurality of LED light sources that may be configured as “an array of individual, independently controllable microbeam sources.” EX1005, 8:4-17, 2:53-3:3, 4:9-59, claims 4 and 5; EX1003, ¶119. Beam

“control[s] the intensity, and/or the angular position, of one or more” LEDs.

EX1005, Abstract. This control is “*dynamically varying* in position and in size,” in response to the control input. EX1005, 6:24-27, 5:46-54. So, Beam “determines a light change,” and adapts the headlamps’ light pattern in both intensity *and* spatial distribution, as in the ’029 patent’s claims. Pet., 36-37; EX1003, ¶129; EX1036, ¶¶113-116.

Thus, Beam’s beam pattern includes directionality (e.g., angular distribution), and a change in beam pattern includes a change in direction of the light. Dr. Jiao is convinced that Dr. Turk does not understand Beam’s disclosure in this regard given Dr. Turk’s lack of understanding of “intensity.” EX1036, ¶¶109-118; EX2010, 237; EX1017, FIGS. 1 and 3-5. Dr. Turk opines that Beam does not “disclose or teach changing direction of any microbeams,” (EX2006, ¶¶54, 56), but this is demonstrably false. Beam expressly states that the *angular position* or *attenuation* (e.g., decrease as understood by Dr. Turk, EX1037, 95:12-23) “of each of these microbeams is independently set by controller 108,” which is controlled in a dynamic environment of moving vehicles. EX1005, 4:46-54; EX1036, ¶117. Thus, Beam does not, contrary to Dr. Turk’s opinion, suggest to a POSA that it is unable to *increase light in a direction* by virtue of its use of the phrase “maximum intensity.” EX1036, ¶118.

**B. Beam discloses a system that includes both an LED array and a spatial light modulator.**

Dr. Turk opines that Beam’s LED array renders its “spatial light modulator...superfluous.” EX2006, ¶58. But Dr. Turk’s assertion that “[a] POSA would never interpret the SLM as being included in the LED embodiment because the functionality of the two components is redundant, and thus unnecessary,” *id.*, ¶61, is not credible. Indeed, it is demonstrably false, exemplified by Beam’s claim 4, which includes both. When confronted with this, Dr. Turk had to acknowledge that claim 4 specifically provides a system with “both an array of LEDs and a spatial light modulator.” EX1037, 90:17-91:8; EX1036, ¶¶119-120; Pet., 11-12, 31-32.

This embodiment is not superfluous. Beam discloses a beam pattern comprising many—on the order of 300,000—individual, narrow angle microbeams, e.g., from LED sources. EX1005, 4:41-45. Of course, Dr. Turk acknowledged that Beam would not include 300,000 LEDs (EX1037, 101:4-102:15); rather, an SLM would be included. EX1036, ¶120. Beam’s microbeams are “diverted or attenuated” (EX1005, 5:65-66) which a POSA would understand means, for example, changed direction or dimmed. EX1036, ¶120. A POSA would not conflate these concepts, as Dr. Turk did. When asked whether the term “angular position” is the same thing as “attenuation” in Beam, he responded (wrongly) that “...the angular position of each microbeam is equated to the

attenuation of each microbeam.” EX1037, 94:21-96:12; EX1036, ¶¶120-121.

Simply, Beam’s LED array does not render its “spatial light modulator...superfluous” (EX2006, ¶58), and Beam specifically discloses a system with both an array of LEDs and a spatial light modulator.

**C. PO’s arguments regarding motivation to combine Beam-Kobayashi fail.**

PO argues that adding Kobayashi’s map data to Beam would render Beam inoperative or unsatisfactory for its stated purpose. POR, 58. But Dr. Turk fails to understand that Beam’s system *does* change the direction of light from headlamps and the Beam-Kobayashi combination *would* improve driver safety. EX2006, ¶112; EX1036, ¶¶122-123.

Dr. Turk repeatedly truncates the ’029 patent claim language “increase light” from the full phrase “increase light in a direction,” e.g., through an intensity change that includes spatial distribution. EX1036, ¶¶122-125. Dr. Turk thinks that Beam’s “maximum intensity” does not include direction, which a POSA would understand is incorrect. *Id.*

From this perspective, Dr. Turk alleges that Beam does not “disclose or teach changing direction of any microbeams” (EX2006, ¶¶54, 56, 119)—this is fundamentally wrong. EX1036, ¶¶126-131. Beam expressly states that the *angular position* or *attenuation* (e.g., decrease as understood by Dr. Turk, EX1037, 95:12-23) “of each of these microbeams is independently set by controller 108,” which is

controlled in a dynamic environment of moving vehicles. EX1005, 4:46-54; EX1036, ¶126; EX1003, ¶208; Pet., 49, 53. “Such control is ‘*dynamically varying* in position and in size,’ in response to the control input. EX1005, 5:46-54.” EX1003, ¶103; EX1036, ¶¶127-128; Pet., 13, 24-30. Thus, Beam *does* disclose changing direction of its microbeams.

Additionally, PO’s/Dr. Turk’s observation that Kobayashi (EX1008) does not disclose LEDs, specific light sensors, or glare prevention is irrelevant (EX2006, ¶68)—Beam does, and is relied upon for these elements in the Beam-Kobayashi combination. Moreover, Kobayashi clearly understood glare sensors for vehicles and automatic headlamp control (*see* U.S. Pat. No. 5,426,294, EX1040, cited on the face of EX1008). EX1036, ¶129.

PO’s individual attack on Beam’s lack of map data to control intensity and/or angular position of its LEDs (or their resultant beam) falls flat—it would have been obvious to a POSA as the Petition explains. Pet. 24-30; EX1003, ¶105; EX1036, ¶130. This would have made Beam’s system even more active and sophisticated, as Beam seeks to do (*see* EX1005, 2:15-22), and further achieves Beam’s purpose of improving driver safety. EX1005, 3:8-44; 6:53-7:13. Kobayashi similarly explains that controlling the shape of the light, e.g., ahead of a curve, enhances safety. Pet., 27; citing EX1008, 15:6-28; EX1003, ¶¶96-115; EX1036, ¶131.

**D. PO's arguments against the dependent claims fail.**

**1. Claims 5, 16, and 27**

PO groups claims 5, 16, and 27 (POR, 31-33; EX2006, ¶¶98-105), arguing that these claims do not “amount to merely directing any light (other than high-beam) in the direction of the road curvature.” EX2006, ¶100. Dr. Turk points to Beam's default of low-beam illumination (EX1005, 6:30-33), but as Dr. Jiao explains, a POSA would have understood that Beam relates to *at least both low-beam and high-beam light*. EX1036, ¶¶132-136. Dr. Turk's issue with the “road curvature” or “shape change” language difference in comparing claims 5 and 27 was addressed in the Petition. Pet., 24; EX1003, ¶95. Accounting for “road curvature” is a type of “shape change.” Pet., 24; EX1003, ¶95.

**2. Claims 6, 17, and 28**

PO groups claims 6, 17, and 28 (POR, 34-35; EX2006, ¶106), arguing that control would not have included “at least one LED light source different from the first plurality of LED light sources.” That is incorrect, as the Petition and Dr. Jiao explained. Pet., 34-35; EX1003, ¶185; EX1036, ¶¶137-142.

**3. Claims 9, 20, and 31**

PO groups claims 9, 20, and 31 (POR, 56; EX2006, ¶107), alleging “map data” cannot be used to “control the second plurality of LED light sources” to diminish glare to a driver of another vehicle.

As above, the *additional* control in [9.3] is not limited in its purpose; it is

just based “at least in part on third data received from a non-camera sensor of the motor vehicle.” EX1036, ¶¶143-149. In the Beam-Kobayashi combination, control of the LEDs would include both the glare control inputs *and* map data inputs. Pet., 52-54; EX1003, ¶¶96-115.

Finally, for completeness, PO reiterates its “lack of particularity” challenge under § 312 (POR, 22-23) that was rejected in the Institution Decision (Paper 7, 20-21, noting that the Board “understand[s] Petitioner’s asserted combinations.”). The Petition meets the requirements under § 312.

## **V. CONCLUSION**

The Board should find all challenged claims unpatentable.

Respectfully submitted,

STERNE, KESSLER, GOLDSTEIN & FOX PLLC

/Jason A. Fitzsimmons/

Jason A. Fitzsimmons  
Registration No. 65,367  
Attorney for Petitioner

Date: November 8, 2023

1101 K Street, NW, 10th Floor  
Washington, DC 20005  
(202) 371-2600

**CERTIFICATE OF WORD COUNT (37 C.F.R. § 42.24(d))**

1. This Petitioner's Reply complies with the type-volume limitation of 5,600 words, comprising 5,570 words, excluding the parts exempted by 37 C.F.R. § 42.24(c).

2. This Petitioner's Reply complies with the general format requirements of 37 C.F.R. § 42.6(a) and has been prepared using Microsoft® Word 2016 in 14-point Times New Roman font.

Respectfully submitted,

STERNE, KESSLER, GOLDSTEIN & FOX PLLC

/Jason A. Fitzsimmons/

Jason A. Fitzsimmons  
Registration No. 65,367  
Attorney for Petitioner

Date: November 8, 2023

1101 K Street, NW, 10th Floor  
Washington, DC 20005  
(202) 371-2600

**CERTIFICATE OF SERVICE (37 C.F.R. § 42.6(e))**

I certify that the above-captioned **PETITIONER'S REPLY TO PATENT OWNER RESPONSE** and associated **Exhibits 1036-1045** were served in their entireties upon the Patent Owner on November 8, 2023, upon the following parties via email:

Sangeeta G. Shah (Lead Counsel)  
David S. Bir (First Back-up Counsel)  
Andrew B. Turner (Back-up Counsel)  
BROOKS KUSHMAN P.C.  
[TRCH0110IPR@brookskushman.com](mailto:TRCH0110IPR@brookskushman.com)

Respectfully submitted,

STERNE, KESSLER, GOLDSTEIN & FOX PLLC

/Jason A. Fitzsimmons/

Jason A. Fitzsimmons  
Registration No. 65,367  
Attorney for Petitioner

Date: November 8, 2023

1101 K Street, NW, 10th Floor  
Washington, DC 20005  
(202) 371-2600

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