

| Patent Owner Yechezkal Evan Spero's Demonstratives

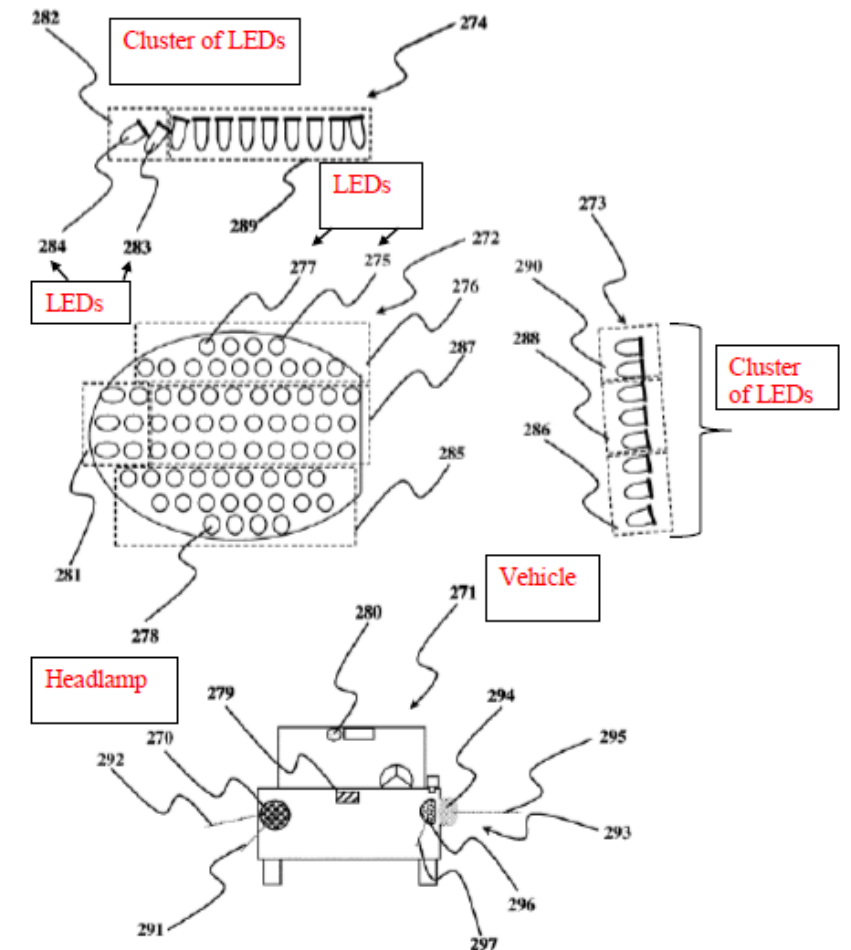
*Volkswagen Group of America, Inc., & Porsche Cars NA., Inc. v.
Yechezkal Evan Spero*

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

Oral Hearing February 22, 2024

Claim 1 of the '029 Patent

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



Ex. 1001 ('029 Patent), Fig. 15
POR, 5; Ex. 2006 (Turk Dec 2), ¶42

"The Claimed Invention is Directed to an Adaptive Multi-LED Headlight System for Predictive Curve Illumination"

Paper 13 (POR), 3-9

replace the old one. The present invention comprises 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 ('029 Patent), 11:5-13

over a wide range of currents and light output. The added controllability offered by breaking the total light output up into discrete ("digital") specifically aimable and dimmable elements 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. Unique to this patent is the approach.

Present advances in automobile lighting include Adaptive Frontal-lighting Systems which aid in seeing around curves and other features in the road. In these systems the light distribution pattern and color spectrum will be changed according to the instantaneous road conditions at hand. Thus, the headlamp now has much more flexibility than the high beam/low beam variation of today. At any instant in time the intensity, spectrum and beam pattern of the headlamp may be varied as a function of the driver's intent, lay of the road and environmental factors. A GPS system on the car may also let the headlamps system know of curves up ahead, one-way traffic and others factors such the headlamp may be operated in the optimal mode at that instantaneous location. With sensors sensitive to environmental surround-

Ex. 1001 ('029 Patent), 51:54-67

Grounds & Issues

| Ground | References | Basis | Claims |
|--------|-----------------|-------|--------|
| 1 | Beam, Kobayashi | §103 | 1-33 |
| 2 | Gotou, Karlsson | §103 | 1-33 |

Paper 1 (Petition), at 4

| Issue 1 –Dr. Turk Exceeds the Level of Skill Required for a POSA

“Petitioner Proposed a Broad Skill Level”

Paper 28 (Opp. to MTE), 2-5

Dr. Jiao:

41. In my opinion, a POSA in the context of the '029 patent as of July 12, 2002 (the earliest possible priority date of the '029 patent) would have had a bachelor of science (B.S.) degree 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. The POSA may work as part of a team, for example, with computer engineers to integrate, program, etc., controllers and various control inputs to affect control of a given light source. Ex. 1003 (Jiao Dec), ¶41

42. Experience could take the place of some formal training, as domain knowledge may be learned on the job. This description is approximate, and a higher level of education or skill might make up for less experience and vice versa.

Ex. 1003 (Jiao Dec), ¶42

Dr. Turk:

29. In my opinion, a POSITA of the '029 Patent at the time of its filing would have been a person having a Master of Science Degree (or a similar technical Master's Degree, or higher degree) in an academic area emphasizing electrical engineering, computer engineering, or computer science with experience or education in optics and imaging systems or, alternatively, a Bachelor's Degree (or higher degree) in an academic area emphasizing electrical, computer engineering or computer science and having two or more years of experience in the field of optical and imaging systems.

Ex. 2001 (Turk Dec), ¶29

Patent, a skilled artisan developing a lighting system utilizing LEDs and corresponding controls would have encountered new challenges with respect to both optics and LED controls. Accordingly, it is my opinion that a POSA would have had experience with both, i.e., engineering and optics.

Ex. 2006 (Turk Dec 2), ¶49

“‘Automotive Lighting’ is a broad term that includes optical and imaging systems.”

Paper 28 (Opp. to MTE), 2-5

SAE

Q Okay. Which courses have you taught through SAE as a facilitator?

A I have three. They're all called automotive lighting. And first class is called a

Paper 28 (Opp. to MTE), 3
Ex. 2007 (Jiao Tr), 113:19-22

A The class teaches the optical -- optics principles described what is optics. This branch of physics describes, primarily, in two categories, imaging optics and non-imaging optics, both under geometric optics category. Where

Paper 28 (Opp. to MTE), 3
Ex. 2007 (Jiao Tr), 119:9-13

Industry

Q So how many engineers did you have reporting to you at NAL?

* * *

Q Okay. How did you have the engineers organized into teams?

* * *

A First is optical design group; the second is electronic technology group; the third one is engineering analysis and testing group; the first [sic] one is standard regulation group.

Paper 28 (Opp.), at 3; Ex. 2007 (Jiao Tr), 14:1-16

Dr. Turk

Vehicle lighting is fundamentally about the physics and engineering aspects of optics and I'm an expert on those things.

"Petitioner's Current Narrow Interpretation Does Not Consider Precedent Governing the POSA Determination"

Paper 28 (Opp. to MTE), at 6-9

Petitioner's POSA interpretation and MTE fail to explain why their interpretation is correct, it just assumes that it governs. In *Daiichi*, the Federal Circuit listed a number of factors that may be considered in determining the POSA including: "(1) the educational level of the inventor; (2) type of problems encountered in the art; (3) prior art solutions to those problems; (4) rapidity with which innovations are made; (5) sophistication of the technology; and (6) educational level of active workers in the field." *Daiichi Sankyo Co. v. Apotex, Inc.*, 501 F.3d 1254, 1256 (Fed. Cir. 2007). The Federal Circuit also considers (7) the "patent's purpose" and (8) the "patent teachings as a whole" when determining the level of ordinary skill in the art. *Best Medical International, Inc. v. Elekta Inc.*, 46 F.4th 1346, 1354 (Fed. Cir. 2022), *see also DyStar Textilfarben GmbH & Co. Deutschland KG v. C.H. Patrick Co.*, 464 F.3d 1356, 1362–63 (Fed. Cir. 2006).

Paper 28 (Opp. to MTE), 6-7

1. Petitioner did not consider the educational level of the inventor.

Instead, they attempt to block such information by moving to exclude a hyperlink to the inventor's LinkedIn Profile, which shows that the inventor — a person that

Paper 28 (Opp. to MTE), 7

made; or sophistication of the technology. Rather, Petitioner's briefing glosses over the state of the art in the early 2000's. As LED headlamps were under development in the early 2000's, a myriad of complex, interrelated technical issues were being solved at the time. (POR, 39, 37-51, 67-70; Ex.2006, ¶¶25-38.)

Paper 28 (Opp. to MTE), 7

per the '029 Patent, the "purpose" is to use LED lighting to provide the "correct lighting solution" that "will radiate photons where needed, exactly in the correct amounts to accomplish the visual task application," "to not cause glare" in "real-time." (Ex.1001, 4:64-5:11, 11:5-13.)

Paper 20 (Sur Reply), 2

Petitioner Did Not Consider Workers' Educational Level

Q Are you saying that a microbeam includes a light source and a spatial light modulator?

A I said microbeam consists of an emitting device, light-emitting device, and spatial light modulator.

Paper 28 (Opp. to MTE), 7; Ex. 2018 (Jiao Tr.), 24:9-14

Q Dr. Jiao, in the automotive industry, do you use the term microbeam to refer to a system that includes light-emitting devices and spatial light modulators?

* * *

A We use the word "beam contributor."

Paper 28 (Opp. to MTE), 7-10

Q Okay. In your SAE classes, do you use the term "microbeam" to refer to lighting systems?

* * *

A I don't recall using the word microbeams.

Paper 28 (Opp. to MTE), 8; Ex. 2018 (Jiao Tr), 26:15-27:8

Dr. Jiao explains the importance of optics and sensing to “adaptive motor vehicle headlamps.”

Paper 28 (Opp. to MTE), at 8-9

Dr. Turk lacks “at least 2 years of industry experience in the area of automotive lighting and lighting-control systems.” Pet., 10; Institution Decision, 5-6; POR 21. This experience is critical to the POSA definition because the claims are directed to adaptive motor vehicle headlamps with LED light sources. Dr.

Paper 27 (MTE), at 4

52. By 2000, adaptive headlamp systems with multiple directional light beams were developed with various means of sensors to detect surroundings while driving and resulted in glare reduction for oncoming and preceding vehicle drivers.

Ex. 1003 (Jiao Dec), ¶52

Q So when you refer to “different modes,” how do you design to accommodate different modes with one incandescent?

A The combination for the mode change, through the history of industry practice, and I conclude there is about three approaches. You

First, change the whole thing. Second is by addition. Third lighting, I also described you maybe change optics partially and meaning some part of optics is stationary. When adaptive features needed, you can change a portion of the optics to make a portion of the light left/right, or up and down. I think that's the three

Ex. 2007 (Jiao Tr), 125:13-126:12

“Dr. Turk Is Qualified in the Pertinent Art of Automotive Lighting and Lighting-Control Systems”

Dr. Turk has significant automotive lighting and lighting-control systems experience, including experience with optics, imaging systems, sensors and lighting controls—which govern how to adapt the headlight illumination.

Dr. Turk has “worked and studied in the field of computer vision since 1984, as well as related areas of image processing, pattern recognition, machine learning, and human-computer interaction.” (Ex.2001, ¶6.) The “field of computer vision is concerned with determining how computers can extract, analyze and understand information from images and video.” (*Id.*) Computer vision has further “been applied to a wide variety of applications including automotive lighting and controls such as those used in automotive adaptive forward lighting systems.” (*Id.*, ¶8.)

Paper 28 (Opp. to MTE), 9-10

Dr. Turk’s industry experience includes working for Martin Marietta Denver Aerospace from 1984 to 1987, where he worked primarily on computer vision for autonomous vehicle navigation as part of the Defense Advanced Research Projects Agency’s Autonomous Land Vehicle program and subsequent advances in self-driving automobiles. (Ex.2001, ¶10; Ex.2002, 3-4.) Dr. Turk explained during his deposition that this work involved “computer vision work” and “various aspects of sensing and imaging,” including vehicle lighting and lighting control systems. (Ex.1037, 21:10-12, 53:9-12.) As Dr. Turk confirmed in deposition: vehicle forward “illumination was an important part” of determining how the autonomous vehicle would drive at dusk and at night. (*Id.*, 54:7-8.)

Paper 28 (Opp. to MTE), 10

Dr. Turk opines on, *inter alia*, the State of the Art as of 2002 and adaptive headlamp systems including sensors, imaging systems, and optics, i.e., the technology described in the ‘029 Patent: “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.” (Ex.2006, ¶¶25-38, 39-43.) Dr. Turk’s opinions directly correlate with his expertise.

Paper 28 (Opp. to MTE), 12

“Petitioner’s MTE is replete with selective excerpts that blatantly mischaracterize Turk’s testimony”

Q. Let's go to Exhibit 2006, your second declaration, paragraph No. 52. And you're referring to the Beam reference. And do you see where you indicate that

* * *

Q. What does "maximum intensity" mean in the context of automotive lighting?

MS. SHAH: Objection. Vague. Calls for speculation.

THE WITNESS: In general, I don't know.
In this context, I think it means you can't make
it any brighter, any higher in terms of its
intensity.

BY MR. FITZSIMMONS:

Q. You said, though, that you don't know in general what "maximum intensity" means in the context of automotive lighting?

A. Not as a general term in all circumstances, no.

Q. Did you personally work on the illumination portion of that project?

A. I did at times.

Q. And what did you specifically work on with regards to the illumination?

A. It was a long time ago and I don't remember too much detail about it, but certainly an important question was how much and what kind of illumination was necessary to be able to do what we needed to do.

Q. And what was it that you would say you needed to do?

A. We needed to sense and understand the world around the vehicle so that it would know where to drive, among other things.

Ex. 1037 (Turk Tr.), 54:9-23

Ex. 1037 (Turk Tr.), 103:7-25

Hyperlink

Paper 28 (Opp. to MTE), 15

Petitioner argues that the hyperlink to the inventor's profile in PO's Sur-reply is inadmissible under 37 C.F.R. § 42.23(b)¹. In response to Petitioner's new POSA argument in its Reply, PO included a hyperlink to the inventor's LinkedIn Profile to illustrate that since Spero did not have experience working for a vehicle headlamp company prior to July 2002, the inventor himself would not meet Petitioner's new POSA criteria. (Sur-Reply, 2.) Since PO's argument was responding to Petitioner's new argument, it satisfies 37 C.F.R. § 42.23(b).

¹ Petitioner did not object to this hyperlink under the FRE, but should it raise new hearsay or authentication issues PO will seek leave to submit a declaration from Mr. Spero.

Turk Balanced Approach

Even

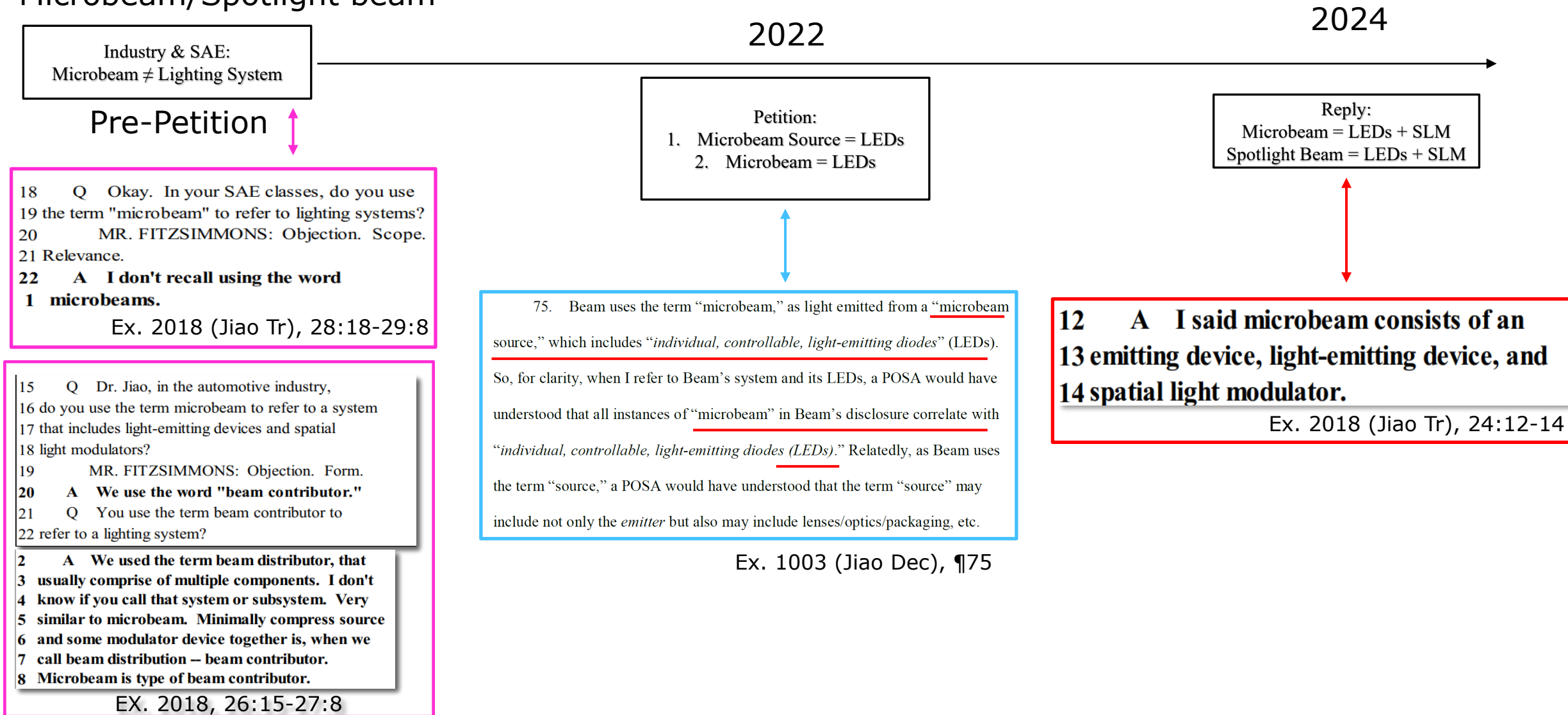
Beam's description of Fig. 7, the actual control function, supports Dr. Turk's contextual understanding of "intensity" – where blanking of pixels (e.g., a change of brightness to zero) is described as "reduced in intensity," again with no remote reference to control over directionality. (*Id.*, 5:52-54.)

Microbeam blanking

is accomplished by dimming one or more of the LEDs making the modulator of the first embodiment superfluous, and it is thus omitted from the second embodiment.

Ex. 2006 (Turk Dec 2), ¶58

Microbeam/Spotlight beam



Automotive Lighting

2023

Industry & SAE:
Automotive Lighting includes
optics and imaging

Pre-Petition

IPRs:
Automotive Lighting is very narrow
and only includes Dr. Jiao’s experience

Q Okay. Which courses have you taught through SAE as a facilitator?

A I have three. They're all called automotive lighting. And first class is called a

Paper 28 (Opp. to MTE), 3;
Ex. 2007 (Jiao Tr), 113:19-22

A The class teaches the optical -- optics principles described what is optics. This branch of physics describes, primarily, in two categories, imaging optics and non-imaging optics, both under geometric optics category. Where

Paper 28 (Opp. to MTE), 3;
Ex. 2007 (Jiao Tr), 119:9-13

compliance. EX1037, 52:18-53:1. He never worked for a vehicle headlamp company, never worked for an LED (or any other light source) company or for a general lighting company, never designed a vehicle forward lighting system, and has no patents, awards, or papers for any vehicle forward lighting. *Id.*, 54:24-56:12. The record demonstrates that Dr. Turk lacks the knowledge that a POSA

Paper 27 (MTE), 8

It was not until Petitioner’s Reply, which revealed a new interpretation of its proposed POSA skill level, one that requires specific industry experience, with a “vehicle headlamp company,” “an LED (or any other light source) company,” and design experience and awards/patents on a “vehicle forward lighting system.” (MTE, 8.) Petitioner seems to fault Dr. Turk for not having the same exact CV as Dr. Jiao. There is no such requirement. As the ’029 Patent involves multiple technical fields—namely optics, sensing/imaging, and the control of LED lighting, each field is relevant. To testify as an expert, under Fed. R. Evid. 702, a person

Paper 28 (Opp. to MTE), 4

Complexity of Adaptive Headlamps

Industry & SAE:
Complex decades to develop

2004

Petition:
Simple Conclusory Rationales to
Combine

With 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 (SAE Studies Jiao), 3

FMVSS requirements. However, the currently available white LED's lumen output is around 30 lm (maximum), which is about 3% of the typical tungsten halogen bulb's light flux output (1000 lm for 9006 bulb). If the LED's

Ex. 2012 (SAE Studies Jiao), 3
optical accuracy. Although total lumen flux produced by the LEDs may be comparable to the exiting light sources, e.g., incandescent bulbs, the optical and mechanical characteristics of LEDs may limit the headlamp applications. The paper identifies the etendue

Ex. 2012 (SAE Studies Jiao), 3

A POSA would have had a reasonable expectation of success combining Gotou and Karlsson. EX1003, ¶246. Indeed, 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). *Id.*, ¶246. This would have been routine and

Petition, 64

needed areas), improving driver safety. EX1003, ¶108. Doing so would have merely been applying Kobayashi's known technique (using map data from Kobayashi's GPS to shape and reshape light and/or adjust intensity) to Beam's similar, known device (dynamic AABH system based on light sensing inputs that directs light to needed areas and away from undesired areas), in the same way. EX1003, ¶108; *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 417 (2007).

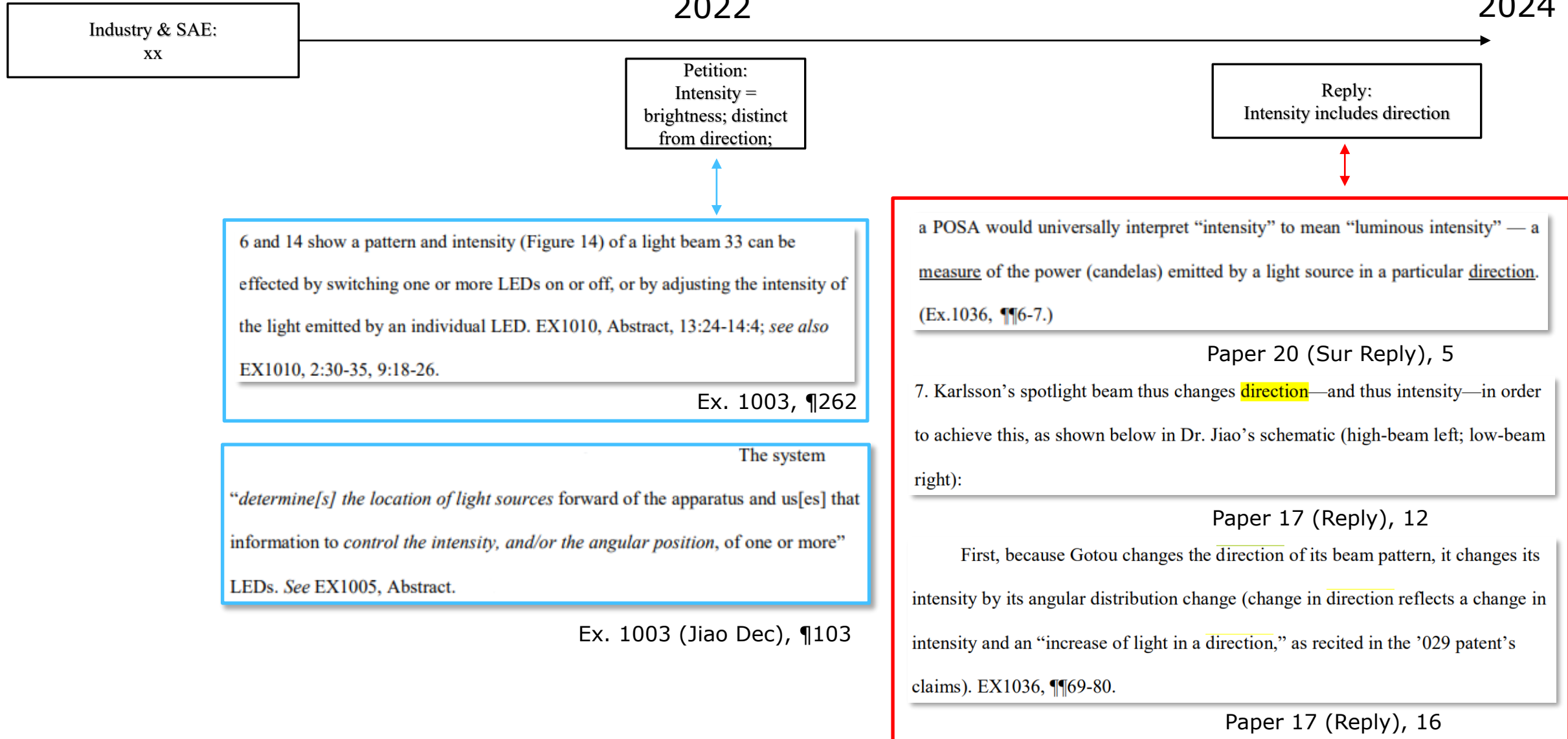
Petition, 28

A POSA would have had a reasonable expectation of success in combining a controllable LED array headlamp, as disclosed by Karlsson, in the context of the Gotou's adaptive vehicle headlamp, at least because it was well-known in the field to use LEDs to control headlight illumination (e.g., intensity, shape, and/or angular position) to improve driving safety, in an efficient manner and with automatic sensitivity. EX1010, 14:1-15, 14:26-30, 2:30-35; 6:1-5; EX1003, ¶¶247-52.

Petition, 65

Issue 2 – Dr. Jiao’s Inconsistent Positions – Beam/Karlsson

Intensity



Jiao's original explanation:

Beam's processor 1105 (*see* EX1005, 5:34-36) as used in controller 108 uses appropriate algorithms on the incoming data to determine the LEDs to be controlled, e.g., blanked, thus making it clear that a specific LED is used in one situation (e.g., Figure 1C) but not in another situation (e.g., Figure 1D, having an enlarged blanked area). EX1005, 5:33-54, FIG. 7. Such control is “*dynamically varying in position and in size,*” in response to the control input. EX1005, 5:46-54.

Ex. 1003 (Jiao Dec), ¶166

Jiao Dec:

Further, Beam's control is “*dynamically varying in position and in size,*” in response to the control input. EX1005, 5:46-54, 6:24-27. So, what Beam discloses to a POSA is that Beam “determines a light change,” and adapts the headlamps' light pattern in both intensity *and* spatial (angular) distribution as in the '029 patent's claims.

Ex. 1036 (Jiao Dec 2), ¶113;
Paper 20 (Sur Reply), 10

Jiao's Original Explanation in IPR2023-00318:

280. Karlsson's "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." EX1010, 9:18-26, FIGS. 3, 14, 15. 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*." EX1010, 1:21-24, Abstract, FIGS. 3, 14, 15, 2:7-9 ("*part of the light beam...is automatically suppressed, whilst retaining an optimum lighting effect for the driver*").

Ex. 2009 (Jiao Dec 318IPR), ¶280

that is fully illuminated. 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. This would result in the high intensity and low intensity light being at a common elevation, as claimed.

Jiao Dec:

52. In paragraph 76 of the Second Turk Declaration (EX2006), Dr. Turk states that "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." This is a gross misstatement of Karlsson. Karlsson does not disclose full or maximum intensity.

Ex. 1036 (Jiao Dec 2), ¶52

Karlsson-Petitioner’s position in the ‘318 Petition

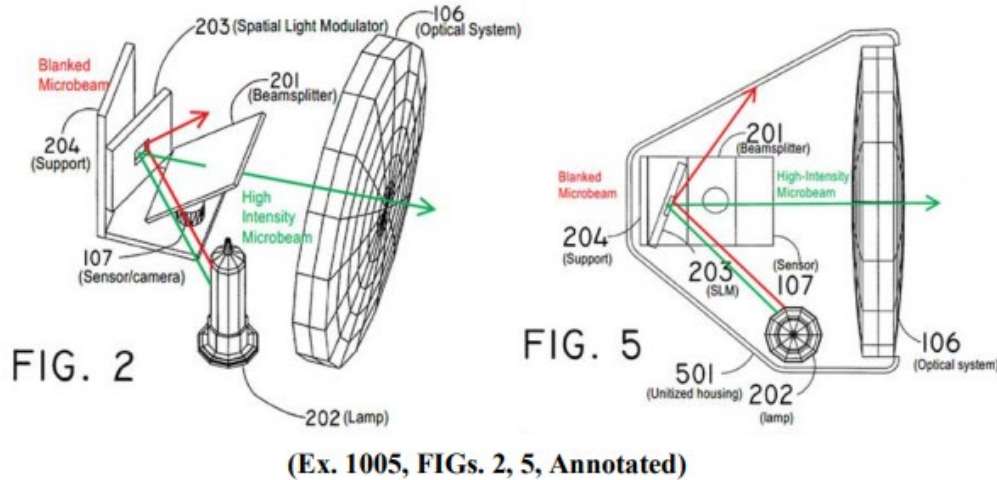
In the ‘318 Petition, Petitioner/Dr. Jiao stated: “Karlsson’s light ... [is] ‘controlled in such a manner that no light at all or light having a low intensity is emitted ... directions from which light is detected ... The remaining areas of light beam 7 are left at full intensity ...” (Ex.2008, 66.) Then, Dr. Jiao explained what this means: “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.” (*Id.*, 67.)

Dr. Jiao further clarified that the “maximized area that is fully illuminated” is achieved by “surrounding the reduced illumination area with full illumination to the greatest extent possible.” (*Id.*)

Petitioner stated: “[P]ositioning 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.” (Ex.2008, 67.)

Paper 20 (Sur Reply), 16

Issue 2 – Dr. Jiao’s Inconsistent Positions – Beam/Karlsson SLMs



“microbeams that would blind the oncoming driver are diverted [] at the source.” (Ex. 1005, 5:65-66, emphasis added.) The SLM is thus not capable of pointing or otherwise changing direction of microbeams exiting the headlamp.

57. In the first embodiment illustrated in Fig. 2 (perspective view) and Fig. 5 (top view), light from lamp 202 falls on spatial light modulator (SLM) 203, which is controlled so that the associated individual microbeams are either 1) reflected by SLM 203 at full intensity through beam splitter 201 and out through headlamp optical system 106, or 2) “blanked (attenuated by being either absorbed or deflected [by SLM 203] to an absorbing surface” so that they do not exit the headlamp optical system 106. (Ex. 1005, 4:36-40, 5:65-66, emphasis added.)

Ex. 2006 (Turk Dec 2), ¶57

| Issue 3 – Beam/Kobayashi does not teach “*increasing light*”

Paper 13 (POR) 51-53

Paper 20 (Sur Reply), 14-21

Such as Beam stating his invention “produces a beam of high intensity light that enables the driver to see more clearly,” explaining the purpose of his invention as “providing a brighter headlight beam...” and noting the invention “needs no intervention to... restore the bright light mode...” (Ex.1005, 3:12-14, 3:30-31, 3:38-40.)

Paper 20 (Sur Reply), 5

173. And Kobayashi also discloses this feature, and describes increasing light emitted at a *level below high-beam light and directed in the direction of the road curvature*, for example, with reference to Figure 8.

135. As explained in my First Declaration (EX1003, ¶¶171-177), in the Beam-Kobayashi combination, Kobayashi explains increasing light emitted at a *level below high-beam light and directed in the direction of the road curvature*, for example, with reference to Figure 8.

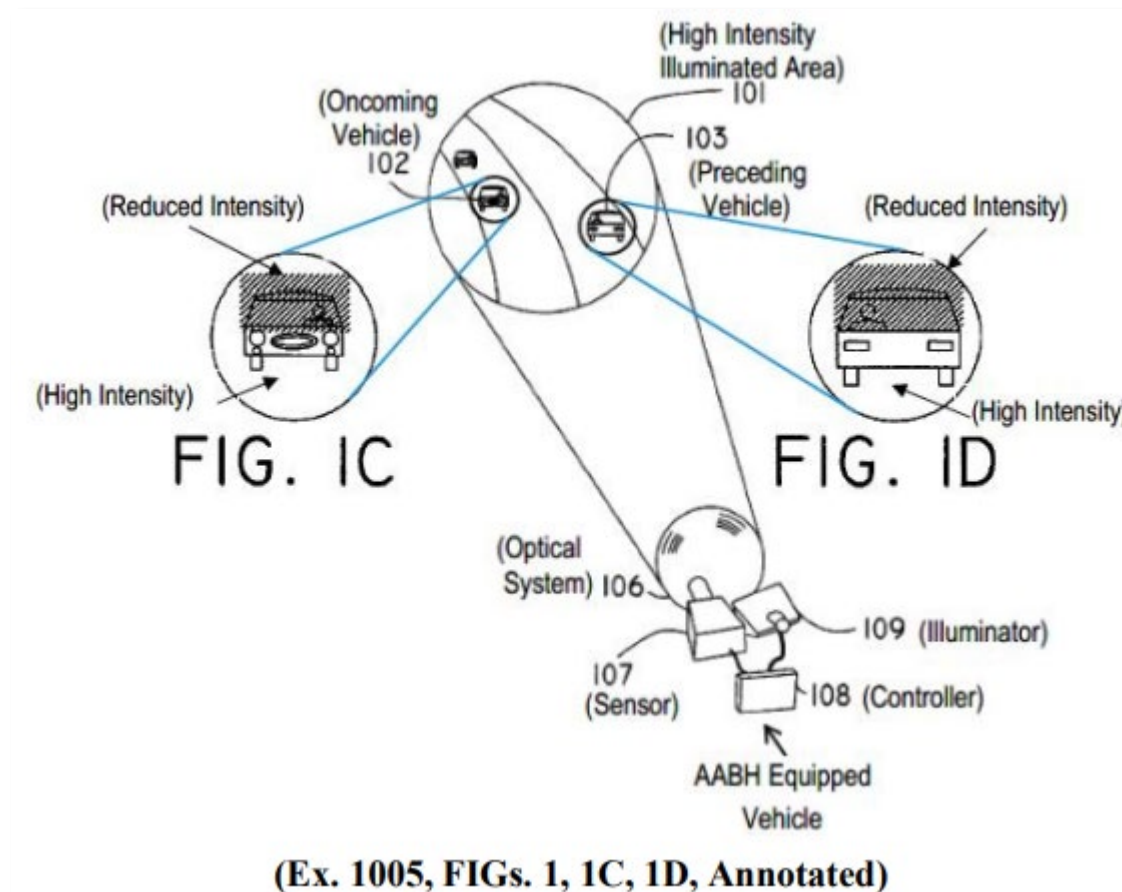
Ex. 1036 (Jiao Dec 2), ¶135

Ground 1: Beam and Kobayashi

Paper 13 (POR), 9-10

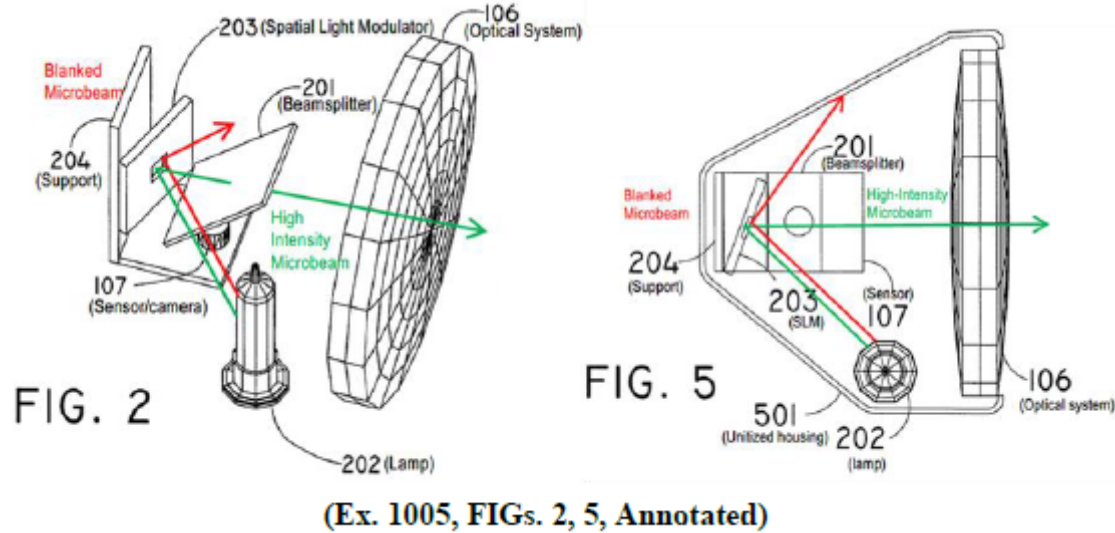
Kobayashi discloses a “Lighting Device for a Vehicle” and is directed to a control system that employs motors to change direction or range of a non-LED headlight beam using map information, unless a predicted vehicle travel direction as indicated by a turn indicator, steering angle, vehicle speed/acceleration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

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-



Paper 13 (POR), 9-10; Ex. 2006 (Turk Dec 2), ¶54

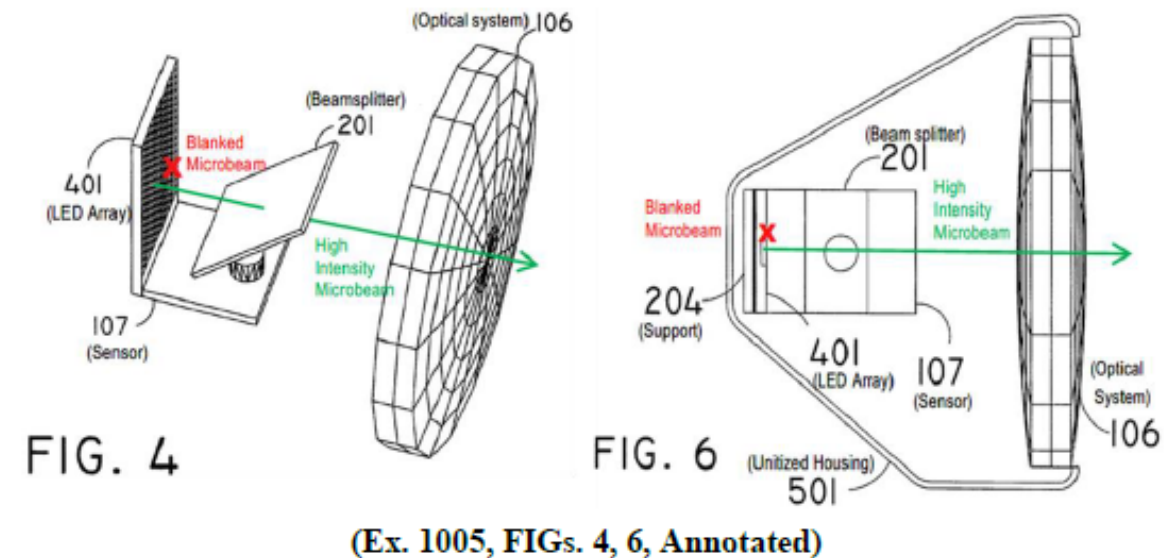
Beam Discloses 2 Embodiments



Ex. 2006 (Turk Dec 2), ¶56

FIG. 4 depicts a system similar to that of FIG. 2 except that the lamp 202 and spatial light modulator 203 are replaced by an array of light sources 401 which are individually controlled. This array could be implemented a

Ex. 1005 (Beam), 5:3-6
Ex. 2006 (Turk Dec 2), ¶59



Ex. 2006 (Turk Dec 2), ¶57 25

Beam discloses Max Intensity Everywhere

implementation of spatial light modulator **203** chosen. The resulting beam is at full intensity except in areas that would dazzle a driver ahead.

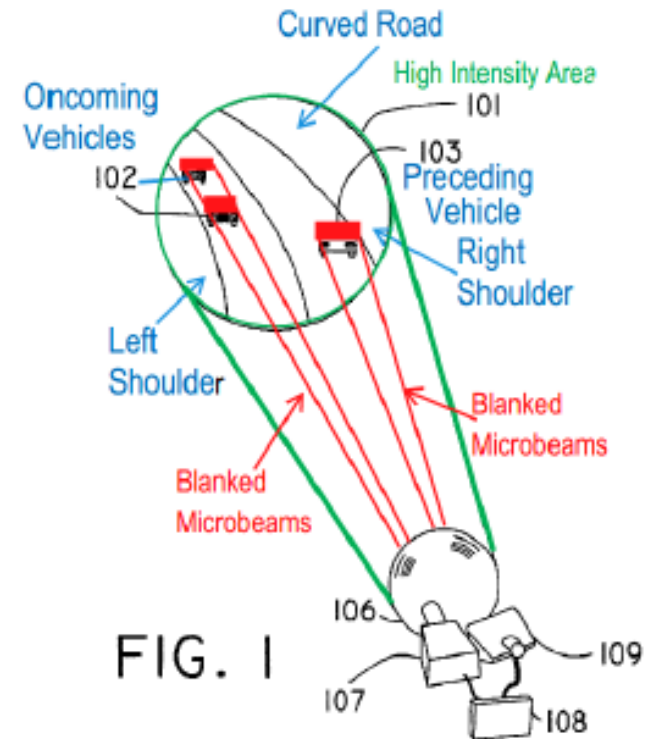
Ex. 1005 (Beam), 4:57-59
Paper 13 (POR), 52; Ex. 2006 (Turk Dec 2), ¶95

Thus, the reader will see that the AABH system enables the driver to have the equivalent of high beam headlights or brighter on at all times, greatly enhancing the ability to see at night. It protects oncoming drivers and drivers being

Ex. 1005 (Beam), 6:53-56
Paper 13 (POR), 52; Ex. 2006 (Turk Dec 2), ¶95

In a typical automotive installation, two AABH units will be mounted on a vehicle, facing forward, just as are conventional headlights. These AABH headlights will operate at maximum intensity at all times. An imaging sensor (such as

Ex. 1005 (Beam), 6:9-11



Ex 1005, Fig. 1 (Annotated)

Ex. 1005 (Beam), Fig. 1 (Annotated)
Paper 13 (POR), 60-61; Ex. 2006 (Turk Dec 2), ¶115

Beam discloses Max Intensity Everywhere - no reason to increase light

Paper 13 (POR), 52

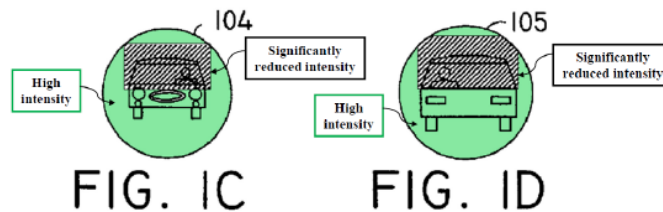
96. Similar to the European approach to adaptive driving beam (ADB) technology, Beam operates the high-beam at all times and includes anti-glare strategies, to avoid blinding oncoming traffic when needed. (Ex. 2007, 69:6-12, 69:22-71:4.) Since Beam discloses providing maximum intensity light everywhere 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.

Paper 13 (POR), 52; Ex. 2006 (Turk Dec 2), ¶96

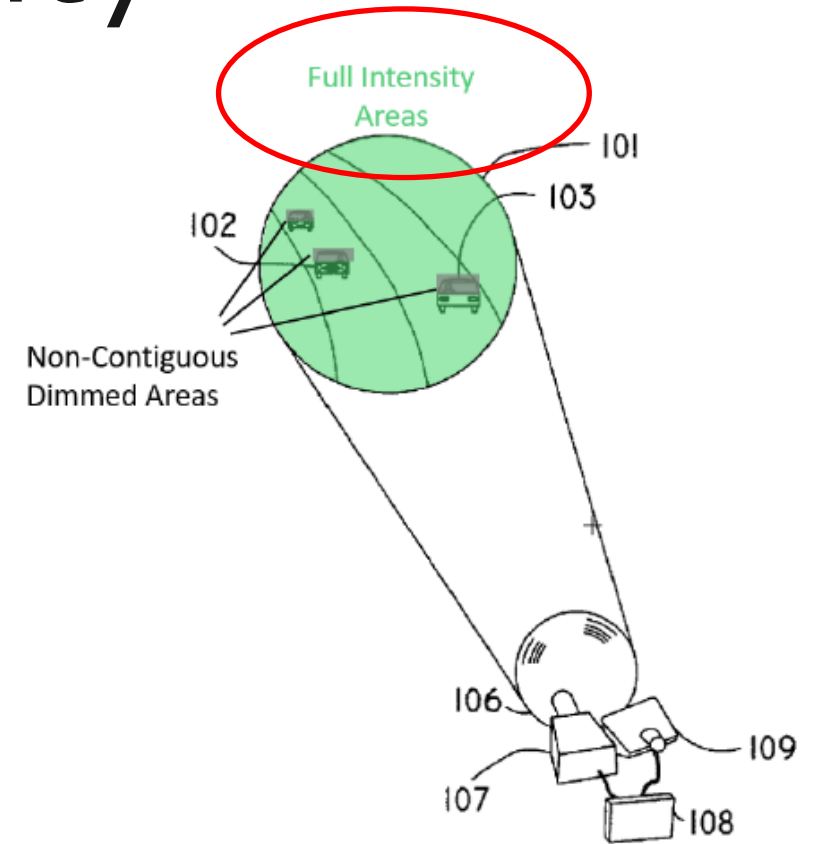
The Parties Agree – Beam teaches “Full Intensity”

Beam maintains “a first level of illumination” in the areas around the traffic ahead, while preventing glare to the other driver. EX1003, ¶¶145-146. This high-intensity area is created by a “second cluster” of LEDs (microbeam sources) as claimed. *Id.* As shown below, the reduced-intensity area is in a field of higher intensity that extends on both sides, above, and below, the reduced-intensity area. *Id.* The reduced-intensity (grey) and higher-intensity (green) areas are at a common elevation, as shown below. *Id.*

Ex. 2008 (318 IPR Petition), 36
Paper 13 (POR), 52
Ex. 2006 (Turk Dec 2), ¶95



EX1005, FIGS. 1C-1D (annotated).



EX1005, FIG. 1 (annotated); EX1003, ¶.

Petitioner's rewrite of Beam is demonstrably incorrect, Beam does not disclose controlling its angular distribution

Paper 20 (Sur-Reply), 10-13

Beam:

4. The anti-blinding illumination system as set forth in claim 1 wherein said light source includes an array of individual, independently controllable microbeam sources selected from the group consisting of light-emitting diodes, lasers, incandescent lamps, arc lamps and electroluminescent lamps, and a spatial light modulator selected from the group consisting of digital mirror devices, liquid crystal devices, and grating light valves for selectively controlling the intensity of individual microbeam sources in said array.

"Combined" Ex. 1005 (Beam), 8:3-12

FIG. 4 depicts a system similar to that of FIG. 2 except that the ~~lamp 202~~ and spatial light modulator 203 are ~~replaced~~ by an array of light sources 401 which are individually controlled. This array could be implemented a number of ways: it could be an addressable matrix of lasers; it could be an array of incandescent filaments; or it could be some other similar arrangement of emitters. The rays from

Dr. Jiao:

Q Okay. So what does Beam mean by replacing the lamp and spatial light modulator with an array of light sources?

MR. FITZSIMMONS: Objection. Form.

A I read it as combined.

* * *

Q So you're interpreting the word "replaced" as combined; is that correct?

A I interpret the entire specification associated with the claims, without spatial modulator, you cannot create narrow-beam micro -- narrow-angle microbeams. It's stated very clearly in the claim 4.

"LEDs (emitters/microbeam sources) and microbeams (emission) are different."

Paper 20 (Sur-Reply), 10-13

This invention relates to the production of a beam of light comprised of many microbeams, controlled by incoming radiation, employing a sensor to determine the location of light sources forward of the apparatus and using that information to control the intensity, and/or the angular position, of one or more narrow-angle microbeams, which are part of a large number of beams comprising the overall output beam.

Ex. 1005 (Beam), Abstract

Beam's controller 108 uses input data from sensor 107 to determine which LEDs to adjust to protect other drivers, while maintaining appropriate forward lighting. EX1005, 4:16-19. The system "*determine[s] the location of light sources forward of the apparatus and us[es] that information to control the intensity, and/or the angular position, of one or more*" LEDs. See *id.*, Abstract. Control is "*dynamically varying in position and in size,*" in response to the input. EX1005, 6:24-27, 5:46-54; EX1003, ¶103.

Paper 1 (Petition), 26

75. Beam uses the term "microbeam," as light emitted from a "microbeam source," which includes "*individual, controllable, light-emitting diodes*" (LEDs). So, for clarity, when I refer to Beam's system and its LEDs, a POSA would have understood that all instances of "microbeam" in Beam's disclosure correlate with "individual, controllable, light-emitting diodes (LEDs)." Relatedly, as Beam uses

Beam's "maximum intensity" mantra is unchanged by Petitioner's fresh insertion of low and high beam teachings

Dr. Jiao:

different directions. Beam's microbeams must be able to change direction in order to achieve at least the high beam and low beam functions that a POSA would have understood. Beam does not, however, disclose to a POSA that it is unable to

Ex. 1036 (Jiao Dec 2), ¶111

Patent Owner:

Petitioner advances another new argument, that a POSA would necessarily read Beam to include low and high beam teachings and that Beam's microbeams "*must be able to change direction in order to achieve high and low beam functions.*" (Ex.1036, ¶111.) Assuming *arguendo* that the Board permits this new argument, these high and low beams (if differently aimed) could be achieved by fixed positioning of LEDs or fixed optics, certainly not "requiring" "changing" direction. (Reply, 26.) This is all notwithstanding the fact that Beam does not even discuss: 1) high and low beams; 2) portions of the beam creating such distinct patterns; and 3) changing the direction of emitted microbeams.

Paper 20 (Sur-Reply), 13

| Issue 4 – A POSA would not
have combined Beam &
Kobayashi

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

Paper 13 (POR), 56-58

Petition:

EX1003, ¶104. 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 it would have been obvious to a POSA to do so. EX1003, ¶105. This would have made Beam’s system even more active than prior systems, as Beam seeks to do (*see* EX1005, 2:15-22), and further achieves Beam’s purpose of improving driver safety. EX1003, ¶105; EX1005, 3:8-45, 6:53-7:13. Kobayashi provides additional active techniques, specifically map data-based control.

POR:

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.)

Paper 13 (POR), 57;
Ex. 2006 (Turk Dec 2), ¶1110

Petitioner's Rationale Undermines Beam's Illumination Strategy

Paper 13 (POR), 58-63

Dr. Turk:

116. 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

118. 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, emphasis added.) 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 (Turk Dec 2), ¶118; Paper 13 (POR), 63

Petitioner Does Not Explain How a POSA Would Use Kobayashi's Map Data to Control Beam

Paper 13 (POR), 67

Dr. Turk:

123. Petitioner does not explain how the AABH system of Beam could 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 significantly reducing illumination. Petitioner does not explain how a POSA would convert

Ex. 2006 (Turk Dec 2), ¶123; Paper 13 (POR), 67

LED array to increase illumination based on the map data. Petitioner also does not:

1) explain how the combined Beam-Kobayashi system would determine which microbeams to blank as compared to which microbeams to change direction; 2) explain how Beam's AABH system would control the direction of the microbeams of Beam's LED array using Kobayashi's motor control signals; 3) explain how the system would change direction of some microbeams based on Kobayashi's road profile data "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.

Ground 1: “Why”/“How” Is Deficient

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.

Paper 17 (Reply), 30

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.

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.

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.)

Petitioners Proposed Rationale to Combine Renders Beam's System Unsatisfactory

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.*

Paper 13 (POR), 65; Ex. 2006 (Turk Dec 2), ¶120
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.)

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. (Ex. 2006, ¶116.)

Paper 13 (POR), 64; Ex. 2006 (Turk Dec 2), ¶119
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.)

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.)

Paper 13 (POR), 61-62; Ex. 2006 (Turk Dec 2), ¶116

Paper 13 (POR), 65; Ex. 2006 (Turk Dec 2), ¶119

| Issue 5 – Beam/Kobayashi does not teach dependent claims 5, 6, 9, 16, 20, 27, 31

Claims 5, 16, and 27

5. The system of claim 1, 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.

16. The storage medium of claim 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.

27. The method of claim 23, wherein the increase of light in the direction associated with the shape change includes at least light output that increases light emitted at a level below high-beam light and directed in the direction associated with shape change.

Ex. 1001 ('029 Patent), Claim 27

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.)

Paper 13 (POR), 53-54;
Ex. 2006 (Turk Dec 2), ¶¶135-136

Claim 9

8. The system of claim 1, further comprising one or more cameras positioned to capture data indicating at least one other vehicle ahead of the motor vehicle;

wherein the instructions include instructions that, when executed by the one or more processors, enable the one or more processors to:

* * *

control, based at least in part on the position, a 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 by a decrease to intensity of light directed towards and illuminating the area, the light that is directed towards and illuminating the area having lower intensity compared to light directed towards points laterally adjacent the area to either side.

9. The system of claim 8, wherein:
the first plurality and second plurality of LED light sources include at least one common LED light source;
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;

* * * *

Petitioner:

8. Claims 9/20/31, elements [9.1]-[9.8], [20.1]-[20.8], [31.1]-[31.8]

Gotou's map data is not from a camera sensor (among other examples in both

Gotou and Karlsson), and thus in combination with Karlsson meets the features

related to both 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; EX1003,

¶¶329-30.

Patent Owner:

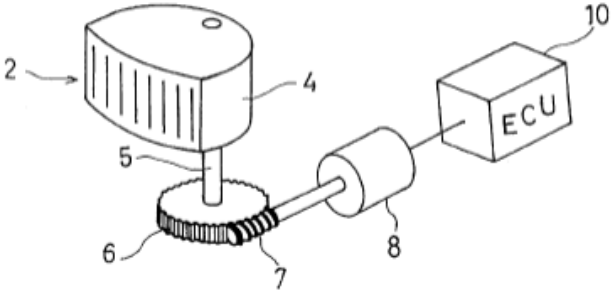
Petitioner's reply still ignores and obfuscates how antecedent basis functions in a claim. Under the basic principle of antecedent basis, "the control" in claim 9 (which depends from claim 8) is "the control... to diminish glare to a driver of the other vehicle [indicated by camera data]." Petitioner has never explained how map data would be usable in this regard, as map data (especially in the art) is ignorant of the locations of other vehicles.

| Issue 6 – Gotou/Karlsson does not teach “increasing light”

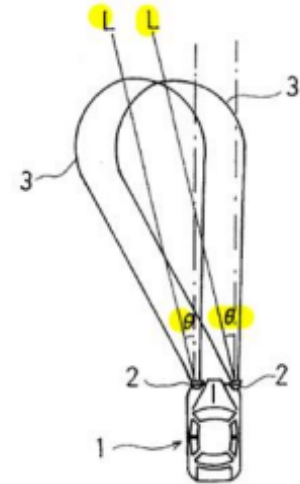
Ground 2: Gotou and Karlsson

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)



(Ex. 1012, FIG. 1, Annotated)

Paper 13 (POR), 12; Ex. 2006 (Turk Dec 2), ¶75

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.)

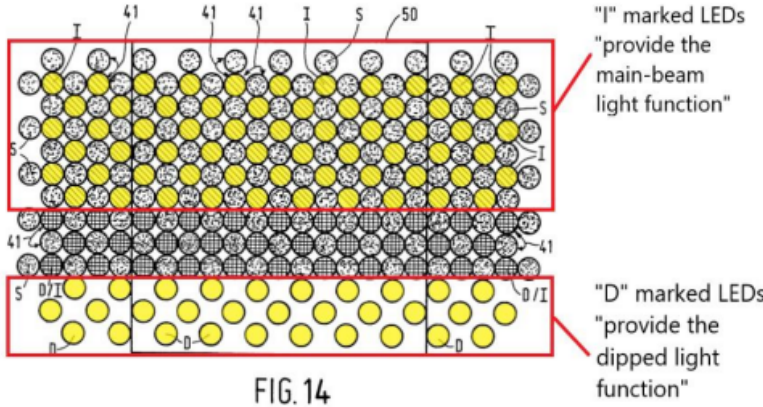


FIG. 14

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

Karlsson's Window 50 Depicts Reduced Illumination

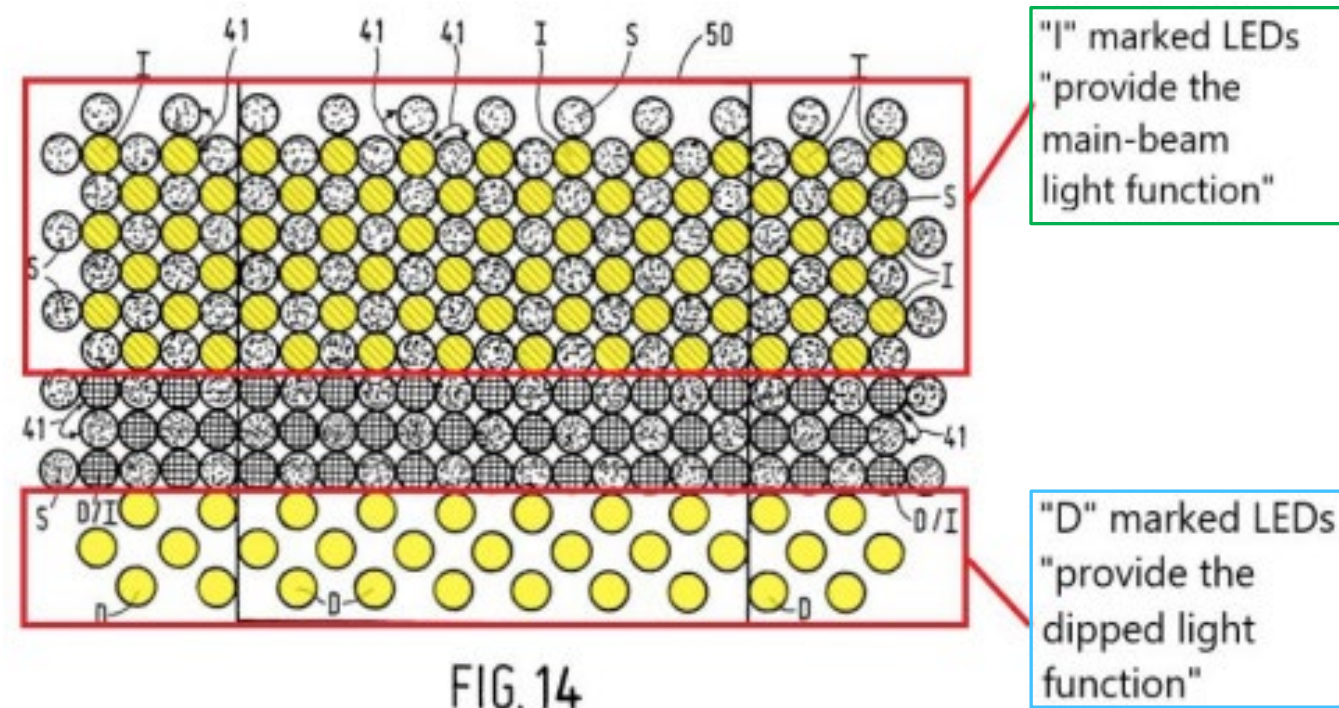
Paper 13 (POR), 13

In addition to the arrangement of Figure 13, a number of the spotlight sources are grouped in specified levels. 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. The double-shaded spotlight sources indicated at D/I are both operative as dipped and main-beam lights.

Ex. 1010 (Karlsson), 19:22-28
Paper 13 (POR), 14; Ex. 2006 (Turk Dec 2), ¶77

In a preferred embodiment of the invention, the average intensity of the light emitted by the lighting means is controlled such to provide a light beam, the intensity of which is optimally adapted to the road and to the ambient light, thereby increasing the driving comfort and road safety. An advantage, in the long run, of motor vehicles equipped

Ex. 1010 (Karlsson), 4:17-21
Paper 13 (POR), 14; Ex. 2006 (Turk Dec 2), ¶82



Ex. 1010 (Karlsson) Fig. 14, Annotated
Paper 13 (POR), 13-14; Ex. 2006 (Turk Dec 2), ¶77

Karlsson's window 50 depicts reduced illumination

Paper 13 (POR), 13

78. In Fig. 14, for example, 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 also discloses that the “spotlight sources indicated at D/I are both operative as dipped and main beam lights.” (*Id.*)

Ex. 2006 (Turk Dec 2), ¶78

Absent glare situations, Karlsson prefers providing “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 (Turk Dec 2), ¶82

132. This interpretation further comports with Figure 16's description of sensors, 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

Ex. 2006 (Turk Dec 2), ¶132

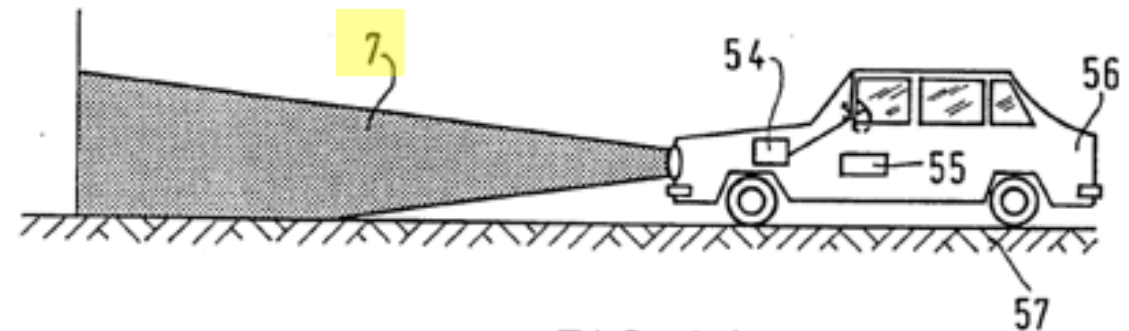


FIG. 16

(Ex. 1010, FIG. 16)

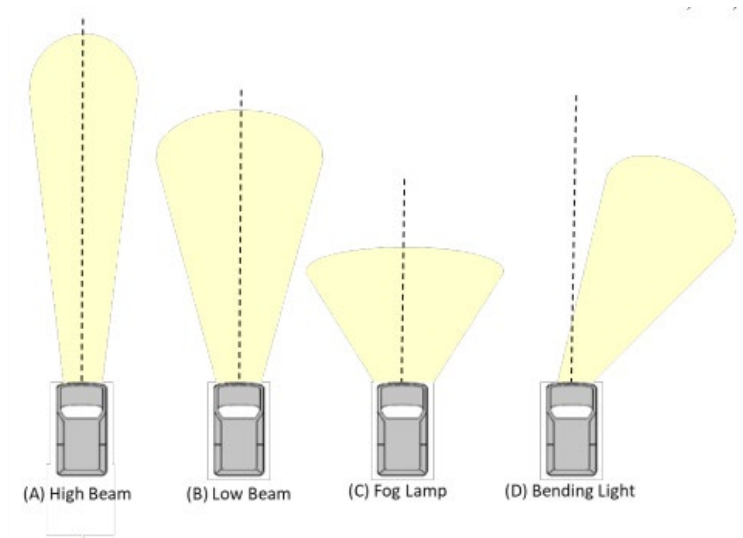
Karlsson

intensity are automatically adjusted, in such a manner that oncoming traffic will not be blinded, thus permitting a light intensity which is generally higher than that of conventional dipped headlights, for example. More in particular, a lighting device which is built up of spotlight beams and spotlight sensors is provided.

Ex. 1010 (Karlsson), Abstract

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

(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.*



EX1036, ¶54.

Ex. 1036 (Jiao Dec 2), ¶54

Karlsson is just like Beam

Beam recognizes that controllable headlamps “provide greatly improved safety and comfort to the motoring public,” and a “brighter headlight beam while simultaneously protecting the drivers of all vehicles ahead” increases safety. *Id.*, 3:8-45. Beam’s AABH enables “the driver to see more clearly at night,” while protecting other drivers from glare. *Id.*; *see also* EX1003, ¶102.

Beam recognizes prior systems that control headlamps in response to changes in the vehicle’s position (e.g., tilt on a hill) and steering mechanism (e.g., along a curve) and acknowledges those systems’ safety benefits—noting that more active systems decrease the compromise between “reducing glare and providing enough light to the driver for adequate visibility.” *See* EX1005, 2:1-6, 2:15-22; *see also* EX1003, ¶104.

Paper 1 (Petition), 26

Ex. 1010
(Karlsson),
1-2

30 In the latter case, the position of
the vehicle, as well as that of the headlights, with respect to the road
surface, will deviate from the normal horizontal position and,
consequently, also the inclination of the light beam being emitted with
respect to the road surface will be different. This phenomenon also occurs
35 when vehicles are overloaded or when headlights are badly adjusted. When
taking a bend there is also the problem that the road ahead of the vehicle
is insufficiently lit, because the light beam is generally optimized for
straight movement (rather than turning movement) of the vehicle.
The prior art lighting device comprises a light-
sensitive sensor, which detects the distribution and the intensity of light
in the area ahead of a vehicle. The pattern of the light beam being emitted
5 by the lighting device is automatically and dynamically adapted in
dependence on the intensity and the direction of the light being detected.
That is, that part of the light beam which might cause inconvenience to
oncoming traffic is automatically suppressed, whilst retaining an optimum
lighting effect for the driver of the vehicle himself.

Since Petitioner has already agreed, and actually advanced the argument that Karlsson would use the full array, at “full intensity” to “surround” any “area of reduced illumination,” “to the greatest extent possible” and in order to “maximize the area that is fully illuminated,” there is not actually any dispute on this point. (Ex.2008, 66-67.) In turn, this operational state of Karlsson that is already using all of its LEDs leaves nothing left to “increase” in the direction of the curve, similar to the problems with Beam.

Paper 20 (Sur Reply), 19

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.)

Paper 13 (POR), 13; Ex. 2006
(Turk Dec 2), ¶76

| Flaaten – optimum lighting effect

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.

Ex. 2008 (318 IPR Petition), 67

The prior art lighting device comprises a light-sensitive sensor, which detects the distribution and the intensity of light in the area ahead of a vehicle. The pattern of the light beam being emitted by the lighting device is automatically and dynamically adapted in dependence on the intensity and the direction of the light being detected. That is, that part of the light beam which might cause inconvenience to oncoming traffic is automatically suppressed, whilst retaining an optimum lighting effect for the driver of the vehicle himself.

Ex. 1010 (Karlsson), 1-2; Ex. 2017 (Flaaten), 1; Ex. 2006 (Turk Dec 2), ¶134

Rather, a POSA would

understand that Flaaten expressly acknowledges that “satisfactory illumination is maintained of the roadway in front of the vehicle,” for example, including ahead in curves. EX2017, Abstract.

device,” he appears to acknowledge Karlsson’s directionality and aiming of its spotlight beams from its LEDs—indeed Flaaten itself provides that the roadway, the edges of the road, *curves*, etc. are *satisfactorily* illuminated (EX2017, 2:2-6)

Ex. 1036 (Jiao Dec 2), ¶76

| The Parties agree that Karlsson teaches full intensity illumination

Paper 13 (POR), 25-26

When the lighting device 1 is used as a headlight in a car, the pattern and the intensity of the light beam 7 are, for example, 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 by the light-sensitive sensor 9. In this manner glaring or blinding of oncoming traffic is effectively prevented, for example, whereby the lighting means 2, 3 can operate with a light intensity and with a light beam which are optimally adapted to the road and to the ambient light, which will significantly increase the driving comfort and the road safety.

Ex. 1010 (Karlsson), 9:18-26
Paper 13 (POR), 25-26; Ex. 2006 (Turk Dec 2), ¶129

EX1010, 9:18-26, FIGs. 3, 14, 15. 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.”

EX1010, 1:21-24, 2:7-9, Abstract, FIGs. 3, 14, 15; EX1003, ¶280. This high-

Ex. 2008 (318 IPR Petition), 66;
Paper 13 (POR), 25-26; Ex. 2006 (Turk Dec 2), ¶129

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. This would result in the high-intensity and low-

Ex. 2008 (318 IPR Petition), 67
Paper 13 (POR), 25-26; Ex. 2006 (Turk Dec 2), ¶129 48

“Petitioner newly introduces a variety of annotated beam patterns it alleges Karlsson would produce — without any explanation of why a POSA would read these patterns into Karlsson”

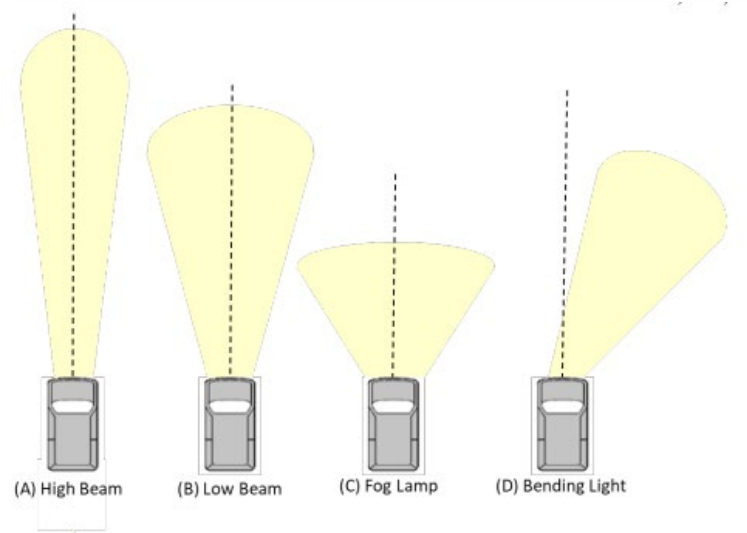
Paper 20 (Sur-Reply) 20

Karlsson:

The 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.

Dr. Jiao:

Ex. 1010 (Karlsson), 19:29-33



EX1036, ¶54.

Sur-Reply:

What Petitioner fails to explain, however, is why Karlsson would not simply utilize all lights of the array to create, for example, illumination of the width of B or D (D on both sides) combined with the length of A or even B. Especially given that Dr. Jiao admits that these are all possibilities. (Ex.2018, 54.)

* * *

Nor did Petitioner explain, for any of its new annotated figures, what LEDs Dr. Jiao thinks that Karlsson is using to create each of these patterns. (Ex.2018, 50:5-57:6.).

Paper 20 (Sur-Reply), 20

| Issue 7 – A POSA would not
have combined Gotou & Karlsson

Ground 2: “Why” Is Deficient

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.)

Paper 13 (POR), 11; Ex. 2006 (Turk Dec 2), ¶¶69-74

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.)

Paper 13 (POR), 12; Ex. 2006 (Turk Dec 2), ¶75

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.)

Paper 13 (POR), 41

Paper 20 (Sur-Reply), 24

However, the currently available white LED’s lumen output is around 30 lm (maximum), which is about 3% of the typical tungsten halogen bulb’s light flux output (1000 lm for 9006 bulb).

Petitioner does not explain “How” a POSA would have combined Gotou and Karlsson

Paper 13 (POR), 40-47

Petitioner:

A POSA would have had a reasonable expectation of success combining Gotou and Karlsson. EX1003, ¶246. Indeed, 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). *Id.*, ¶246. This would have been routine and

Karlsson:

car is for example overloaded. The direction sensor 54 is in particular intended for determining when the car 56 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 as much as possible.

Ex. 1010 (Karlsson), 20:22-32
Paper 13 (POR), 46

Dr. Turk re Control:

171. 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, 20:22-32.) 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.) The ambiguity and lack of

Ex. 2006 (Turk Dec 2), ¶171; Paper 13 (POR), 46

Not a simple substitution

Dr. Jiao in 2004:

Paper 13 (POR) 40-45

With 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 (SAE Studies Jiao), 3;
Paper 13 (POR) 42; Ex. 2006 (Turk Dec 2), ¶30

White Lumen Output:

However, the currently available white LED's lumen output is around 30 lm (maximum), which is about 3% of the typical tungsten halogen bulb's light flux output (1000 lm for 9006 bulb).

Ex. 2012 (SAE Studies Jiao), 3;
Paper 13 (POR) 42; Ex. 2006 (Turk Dec 2), ¶31

Optics:

A LED source-operated headlamps always use specific optics that's associated with that specific LED source.

Heat Management:

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 (Jiao Tr), 50:2-9;
Paper 13 (POR), 45; Ex. 2006 (Turk Dec 2), ¶167

Packaging:

Q Did these additional heat structures create any challenges with your packaging requirements?

A It does. It takes space.

Ex. 2007 (Jiao Tr), 53:5-8;
Paper 13 (POR), 45; Ex. 2006 (Turk Dec 2), ¶167

Petitioners Proposed Modifications Would Render Gotou Inoperable

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. EX1003, ¶229-30.

* * *

EX1011, 3:18-26, 10:21-22. *Second*, 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. EX1003, ¶234.

Input Control

Petition, 55

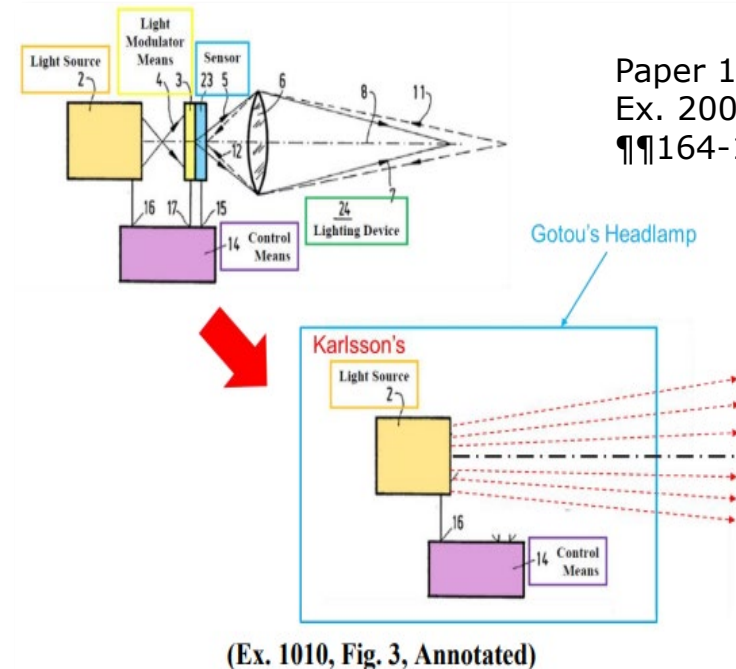
As explained by Dr. Jiao, cost is a significant consideration in the auto-industry and the additional components for LED headlamps, such as the driver, pose a significant additional cost. (Ex. 2007, 31-33.)

DEMONSTRATIVE EXHIBIT – NOT EVIDENCE
SPERO EX. 2029

Output Control

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.)

Paper 13 (POR), 50; Ex. 2006 (Turk Dec 2), ¶177



Paper 13 (POR), 44;
Ex. 2006 (Turk Dec 2),
¶¶164-165

Paper 13 (POR), 50;
Ex. 2007 (Jiao Tr), 31-33

Issue 7 – Gotou/Karlsson does not teach dependent claims

Claims 6, 17, 28

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.

Paper 17 (Reply), 18

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.

Paper 17 (Reply), 19

Not one LED would be *increased* in intensity 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 (Turk Dec 2), ¶145;
Paper 20 (Sur Reply), 21

As above, the combined system is iterative, and determines any number of future light changes. EX1003, ¶304. These claims are a verbose way of reciting that the system (1) determines a second light change for a second (i.e., next) road curvature, and (2) controls the LEDs to provide light toward the second road curvature (i.e., "shaping light") based on map data. *Id.*

Petition, 84

This is merely a subsequent, repeated step in the continuous, iterative processes of the '029 patent and Gotou-Karlsson systems. EX1003, ¶¶305-15.

Petition, 85

To backfill their missing argument, Petitioner incorrectly points to the annotated figures provided by Dr. Turk — which show how Karlsson functions while in a curve, not how Karlsson functions prior to a curve, nor how Gotou-Karlsson would function. (Reply, 20.)

Paper 20 (Sur Reply), 22

Claims 9, 20, 31

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.

Paper 17 (Reply), 24

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.

Paper 17 (Reply), 24

152. Petitioner relies on Gotou's map data for satisfying this limitation. (Petition at 88.) Petitioner fails to explain how "map data" can be used in any manner regarding controlling the second plurality of LEDs to diminish glaring illumination of another vehicle.

Paper 13 (POR), 36; Ex. 2006 (Turk Dec 2), ¶152

Claims 5, 16, and 27

5. The system of claim 1, 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.

Ex. 1001 ('029 Patent), Claim 5

27. The method of claim 23, wherein the increase of light in the direction associated with the shape change includes at least light output that increases light emitted at a level below high-beam light and directed in the direction associated with shape change.

Gotou discloses turning a headlamp that emits the same light output after the turn that it was emitting before the turn.

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

Paper 13 (POR), 32; Ex. 2006 (Turk Dec 2), ¶139

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

Paper 13 (POR), 33; Ex. 2006 (Turk Dec 2), ¶145

Claims 9, 20, and 31

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;

Petitioner confusedly contends that the “additional control is not limited in its purpose,” i.e., not limited to the control of claim 8. (Reply, 24.)

Paper 20 (Sur Reply), 24

Petition relies on Gotou’s map data to satisfy this limitation.

No explanation how map data would “control” a grouping of LEDs, as map data is ignorant of other vehicle position.

Paper 1 (Petition), 88-91

Claims 21, and 32

21. The storage medium of claim 19, wherein the instructions include instructions that, when executed by the one or more processors, enable the one or more processors to utilize one or more optical control elements included in the motor vehicle to control light from at least the first plurality or second plurality of the LED light sources.

32. The method of claim 30, further comprising utilizing one or more optical control elements included in the motor vehicle to control light from at least the first plurality or second plurality of the LED light sources.

Ex. 1001 ('029 Patent), Claim 32

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.)

Paper 13 (POR), 37

Petitioner's rewrite of Beam is demonstrably incorrect, Beam does not disclose controlling its angular distribution

Paper 20 (Sur Reply), 10

"The system 'us[es] that information to control the intensity, and/or the angular position, of one or more' LEDs." (Petition, 26, 27, 36, 38, 40, 41, 43, 45-46, 49, 50; Ex.1036, ¶113.) The actual quote is "to control the intensity, and/or the angular position, of one or more narrow-angle microbeams." (not "LEDs.") (Ex.1005, Abstract.)

The system "us[es] that information to *control the intensity, and/or the angular position, of one or more*" LEDs. *See id.*, Abstract.

Paper 1 (Petition), 36

to control the intensity, and/or the angular position, of one or more **narrow-angle microbeams**.

Ex. 1005 (Beam), Abstract

| New impermissible arguments

1. POSA construction of microbeam

Beam's microbeams *must* be able to change direction in order to achieve at least the high beam and low beam functions that a POSA would have understood.

Paper 20 (Sur Reply), 13; Ex. 1036 (Jiao Dec 2), ¶111.

Thus, the microbeams must be able to constantly change directions in order to follow the moving targets.

2. Construction of intensity

4 So what is your understanding of the
5 term "intensity," as used in claim 1 of the '029
6 patent?

7 **A Intensity's always clearly defined as**
8 **luminous intensity. It means luminous flux per**
9 **solid angle.**

Ex. 2018 (Jiao Tr 2), 21:4-9

| New impermissible arguments

3. Karlsson creates “desired” beam patterns

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