

| Spero's Demonstratives

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

IPR2023-00315 and IPR2023-01225 (joined)

IPR2023-00318 and IPR2023-01296 (joined)

U.S. Patent No. 9,955,551 C2

Consolidated Oral Hearing March 20, 2024

Overview

- 1) Beam blanks light aimed at other vehicles
- 2) Karlsson Fig. 14 does not use a camera
- 3) Karlsson lacks a control function
- 4) Beam and Karlsson use their full arrays in their respective base operational state
- 5) Failure of proofs for claims 48/64 (and dependents) and 33/41/49/57/65/73/81
 - Neither proof shows the classifying element of claim 48
 - Neither proof shows the claimed "subsequent control for a single vehicle" in 64
 - "Image data" proof missing for 33/41/49/57/65/73/81
- 6) Petitioner's narrow interpretation and disregard of its own POSA language render its new POSA arguments unfounded by facts/law

The Claimed Invention is Directed to an Adaptive, Glare-Free LED Headlight System with Finely Controlled Light Delivery

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, 11:8-13

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.

Ex.1001, 11:56-62

Additional features can include an optional very narrow flashlight type of beam. Present day LEDs come in very narrow aimings such as two half angle 8 degrees which may not be narrow enough (a 10 meter spread for 150 meters down the road which may be sufficiently aimed to the right) but with need, smaller angles are also feasible. Such a beam at the correct narrow aiming can continue to illuminate far ahead (in high beam) without blinding oncoming traffic. Analysis by a detector or an imaging system of the oncoming vehicles position (using its headlights for example) can be used to determine which exact aiming is the maximum allowable for any given traffic situation and road layout.

Using color and pattern recognition techniques it is possible to determine what is a sign. It is then possible to provide the equivalent of “task lighting” and use the controller and properly aimed SLS to follow and illuminate distant overhead and roadside signs for a longer time, yet not blind oncoming traffic due to the narrow beam.

Ex.1001, 52:54-53:4

Independent claims 32, 56, 72 require positive illumination

Claim 32

create a beam of diminished illumination illuminating at least a portion of the at least one target with non-glaring illumination, ..., by one or more changes to characteristics of first light of a cluster of the LEDs providing the first light directed at the at least a portion and creating the beam, ...; and follow, ..., the at least one target with the diminished illumination

...

Claim 56

reduce intensity of illumination to non-glaring illumination of a first area ..., by control of emission from the first cluster..

Claim 72

vary illumination provided to the target by the selected cluster, relative to illumination provided to areas laterally adjacent to the target and provided by at least one LED different from LEDs in the selected cluster; and maintain a variance of illumination provided to the target...

Claims 32, 56, 72^{*}: Beam's blanking "prevents" illumination

Beam Field of the Invention

The present invention generally relates to a method and apparatus for automatically reformatting the pattern of a beam from a light source to prevent it from illuminating certain areas ... to darken those microbeams that would otherwise illuminate

Ex.1005, 1:1-15

By controlling an area determined by analyzing the position of the lights sensed ahead, the area of the beam that would dazzle the driver will be darkened, while maintaining f[u]ll intensity elsewhere.

Ex.1005, 2:60-62

Dr. Jiao's Admission:

Beam "*control[s] the intensity, and/or the angular position, of one or more*" LEDs via "controller 108 [including processor 1105] ... that uses appropriate algorithms on the incoming data to determine the locations to be blanked" (terminated/turned off). EX1005, Abstract, 5:33-54. This "blanking" means that the microbeams are "attenuated by being absorbed or deflected to an absorbing surface" by spatial light modulator 203. EX1005, 4:36-41. When LEDs are used as the microbeam source, this means that the LEDs would be turned off as the equivalent to being "absorbed" by the spatial light modulator.

Ex.1003, ¶193

Claim 32 Requires “Illumination Illuminating”

Claim 32 [32.8a]:

create a beam of diminished illumination illuminating at least a portion of the at least one target with non-glaring illumination... by one or more changes to characteristics of first light of a cluster of the LEDs providing the first light directed at the at least a portion...

The claimed *beam of diminished illumination* is “created” by “one or more changes to characteristics of first light of a cluster of the LEDs providing the first light.” Because Beam discloses *darkening/blanking* the cluster of the LEDs providing the first light, Beam does not teach a controller enabled to “create a *beam of diminished illumination illuminating*” as claimed. (Ex.2006, ¶108.)

315 POR, 18

Beam discloses that “[a]s the positions of both vehicles move, the blanked area tracks the location of the oncoming vehicle, dynamically varying in position

315 Petition, 42 [32.9]

Petitioner Ignores Plain Language (Claim 32)

The plain language does not mention any specific emission or illumination level. EX1052, ¶¶69-76, 80-85, 87-90; EX1003 ¶¶157, 171. Yet PO argues that “emission” and “illumination” implicitly requires some non-zero light level, which PO alleges Beam does not teach. POR, 15-20. Not so.

First, a POSA would not understand “emission” or “illumination” to prohibit zero light because of how these terms are used in the claims. EX1052, ¶¶69-76, 80-85, 87-90. Specifically, the claims only require a *relative* change in emission/illumination/intensity for glare reduction. *Id.*

315 Reply, 5

create a beam of diminished illumination illuminating at least a portion of the at least one target with non-glaring illumination... by one or more changes to characteristics of first light of a cluster of the LEDs providing the first light directed at the at least a portion...

Claim 32 [32.8a]

Despite Petitioner’s contrary argument (Reply, 5), the claims “prohibit” zero light as the result from the *full* “cluster” because they require the affirmative presence of light *from the “cluster.”* This does not preclude a given LED of the

315 Sur Reply, 11

Claim 56 Requires “Illumination of a first area”

Claim 56:

reduce intensity of illumination to non-glaring illumination of a first area associated with the at least one other vehicle, relative intensity of illumination on both sides of the first area at elevations common with the first area illuminated by a second cluster of the LEDs, by control of emission from the first cluster

Petitioner incorrectly relies on Beam’s disclosure that “the area of the beam that would dazzle the driver will be darkened” (Ex.1005, 2:56-3:3) for teaching reduc[ing] intensity of illumination ... by control of emission, as claimed. (Pet. at

318 POR, 15

“[b]y controlling an area determined by analyzing the position of the lights sensed ahead, the area of the beam that would dazzle the driver will be darkened.” *Id.*, 2:59-

318 Petition, 34

Spillover Illumination = Reduced illumination (Claim 56)

While Petitioner relies on Beam's "illumination being significantly reduced in intensity in the shaded areas" (*Id.*, 4:23-24), the reduced illumination results from blanking a cluster of LEDs such that the cluster is inactive and not emitting light. Thus, to the extent there is reduced illumination, it is **not** achieved by "control of emission from the first cluster," as claimed, but, at best, the result of residual spillover light from other LEDs. Because Beam teaches a binary system,

318 Reply, 7

318 POR, 16

"determin[ing] which microbeams [LEDs] must be *reduced* in intensity to protect the other drivers." *Id.*; EX1005, 4:16-19. Beam's "illumination in the shaded area [is] *reduced significantly* to protect the vision of the oncoming drivers." EX1005,

Petitioner Ignores Plain Language (Claim 56)

The plain language does not mention a specific emission or illumination level. EX1052, ¶¶66-73, 80-81; EX1003, ¶184. Yet PO argues that “emission” and “illumination” implicitly requires some non-zero light level, which PO alleges Beam does not teach. POR, 14-15, 17-18. Not so.

First, a POSA would not understand “emission” or “illumination” to prohibit zero light because of how these terms are used in the claims. EX1052, ¶¶66-73, 80-85. Specifically, the claims only require a *relative* change in emission/illumination/intensity for glare reduction. *Id.*

reduce intensity of illumination **to non-glaring illumination of** a first area associated with the at least one other vehicle, relative intensity of illumination on both sides of the first area at elevations common with the first area illuminated by a second cluster of the LEDs, **by control of emission from the first cluster**

Claim 56 (Emphasis added)

318 Reply, 5

Claim 72 Requires “illumination provided by the selected cluster...”

Claim 72

...vary illumination provided to the target by the selected cluster...

[72.9] is patentably indistinct from [56.8] and is taught by Beam for the reasons discussed above. Section VI.C.1; EX1003, ¶¶177-179.

[72.10] is patentably indistinct from [56.9] and is taught by Beam for the reasons discussed above. Section VI.C.2; EX1003, ¶¶180-183.

318 Petition, 43

As explained for claim 56, Beam generates a darkened area of reduced illumination by blanking or inactivating associated LEDs so they are not “active emitters.” (Ex.1005, 5:13-16.) Beam’s “reduced illumination” results from

318 POR, 17

light. Thus, to the extent there is reduced illumination, it is **not** achieved by “control of emission from the first cluster,” as claimed, but, at best, the result of residual spillover light from other LEDs. Because Beam teaches a binary system,

318 POR, 16

Petitioner Ignores Plain Language (Claim 72)

The plain language does not mention a specific emission or illumination level. EX1052, ¶¶66-73, 80-81; EX1003, ¶184. Yet PO argues that “emission” and “illumination” implicitly requires some non-zero light level, which PO alleges Beam does not teach. POR, 14-15, 17-18. Not so.

First, a POSA would not understand “emission” or “illumination” to prohibit zero light because of how these terms are used in the claims. EX1052, ¶¶66-73, 80-

...vary illumination provided to the target by the selected cluster...

Claim 72

318 Reply, 5

Thus, positive illumination as claimed cannot be met by Beam

Claim 32

create a beam of diminished illumination illuminating at least a portion of the at least one target with non-glaring illumination, ..., by one or more changes to characteristics of first light of a cluster of the LEDs providing the first light directed at the at least a portion and creating the beam, ...; and follow, ..., the at least one target with the diminished illumination ...

Claim 56

reduce intensity of illumination to non-glaring illumination of a first area ..., by control of emission from the first cluster..

Claim 72

vary illumination provided to the target by the selected cluster, relative to illumination provided to areas laterally adjacent to the target and provided by at least one LED different from LEDs in the selected cluster; and maintain a variance of illumination provided to the target...

All independent claims (representative claim 24)

Claim 24

one or more sensors, including one or more cameras, placed on the structure for detecting coordinate-specific information about the illuminated area...

Karlsson provides **alternative** sensing options (all claims)

Karlsson discloses light-sensitive sensors 9, 23, that may be comprised of: a matrix of photo-diodes, like the spotlight sensors (S) described with reference to Figure 14, **or, alternatively,** a photo-sensitive plate as used in modern video cameras:

315 POR, 43

Karlsson discloses that the sensors may be provided by a “matrix of photo diodes or in the case of a light-sensitive sensor 23, a photo-sensitive plate as used in modern video cameras.” (Ex.1010, 12:22-24.) Karlsson discloses that the light-

318 POR, 55

In the preferred embodiment of the invention, the light-sensitive sensors 9 and 23 are preferably designed to be capable of precisely determining the direction and the intensity of the detected light 11. They may for example be comprised of a **matrix** of photo diodes **or** in the case of a light-sensitive sensor 23, a photo-sensitive plate as used in modern video cameras.

Karlsson Ex.1010, 12:22-24 (Emphasis added)

Petitioner chose Fig. 14 for its proofs (all claims)

With reference to Figure 14, Karlsson discloses spotlight sensors (S) that may be formed by “photosensitive transistors.” (Ex.1010, 19:34-35.) Karlsson further discloses that “a preferred embodiment of the invention comprises spotlight sensors in the form of, for example, photosensitive diodes, photo transistors or other light- sensitive semiconductor components, which are spatially distributed in a predetermined manner or at random so as to be capable of detecting light from desired directions or from all directions.” (*Id.*, 5:18-23.) Karlsson also discloses that “the term spotlight sensor used herein is understood to indicate a light-sensitive sensor of limited, physically light-sensitive dimensions, which generally detects light from a specific direction.” (*Id.*, 5:25-27; Ex.2006, ¶¶159.)

315 POR, 44-45

315 POR, 46

Petitioner relies on Karlsson’s matrix of photo diodes as illustrated in Figure 14 for satisfying various control limitations. (Pet. at 66, 68, 69, 73, 74, 75.) A

The sensors of Fig. 14 are not a “camera” (all claims)

The spotlight sources and the spotlight sensors, besides optical fibers, may also be formed by LEDs and photosensitive transistors, respectively. Arrow 41 schematically indicates an electric connection between the spotlight sensors S and spotlight sources D, I and D/I, which for example, may consist of transistors or the like.

Karlsson Ex.1010, 19:34 – 20:1

Figure 14 shows an embodiment of a spatial distribution of spotlight sources and spotlight sensors S

Karlsson Ex.1010, 19:18-19

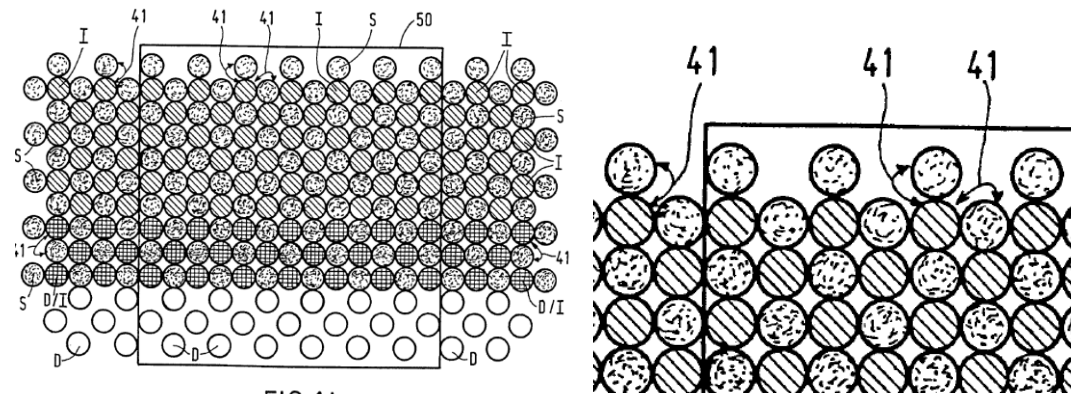


FIG. 14

Karlsson Ex.1010, Fig. 14

Spotlight Sensors in Fig. 14 are “switches” and do not need images

Further, a camera would not have included photosensors interspersed with emitters because this would have resulted in low resolution data that could not be formatted into an image. Further, the lack of sensors in the lower region of the array results in no data in this region and Karlsson does not disclose image processing, at all, so it is clear that the spotlight sensors are limited to sensing light. (Ex.2006, ¶162.)

315 POR, 46

Petitioner further states that:

A POSA would have therefore understood that images received by the camera, and the direction data associated with them, are “coordinate-specific information about the illuminated area” as claimed because the direction is stored in a format (as coordinates).

(Pet. at 63.)

Karlsson does not disclose storing the direction of the detected light 11 in a format as coordinates. (Ex.2006, ¶¶166-167.) On the contrary, with reference to Figure 14, Karlsson discloses an arrangement in which each sensor (S) of an array of spotlight sensors is electrically connected to an adjacent spotlight source to provide a switch to control the LEDs:

The spotlight sources and the spotlight sensors, ... may also be formed by LEDs and photosensitive transistors, respectively. Arrow 41 schematically indicates an electric connection between the spotlight sensors and spotlight sources D, I and D/I, which, for example, may consist of transistors or the like... Integration of LEDs and phototransistors on one carrier, for example, is also possible.

(Ex.1010, 19:34-20:5.)

315 POR, 48

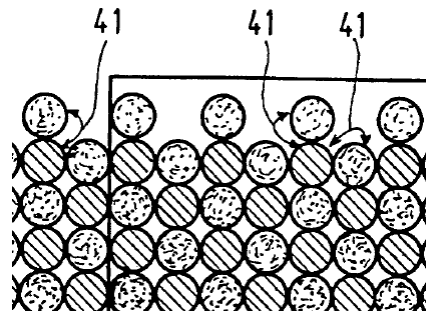
Petitioner co-mingles different embodiments without explaining why (all claims)

Petitioner simply points to a camera and LEDs in different Karlsson embodiments. (Reply, 19.) Petitioner fails to explain how or why a POSA would have modified Karlsson's Fig. 14 embodiment to include a camera/photo-plate instead of the disclosed photo-diodes. (POR, 43-51.)

315 Sur Reply, 16

The spotlight sources and the spotlight sensors, besides optical fibers, may also be formed by LEDs and photosensitive transistors, respectively. Arrow 41 schematically indicates an electric connection between the spotlight sensors S and spotlight sources D, I and D/I, which for example, may consist of transistors or the like.

Karlsson Ex.1010, 19:34 – 20:1



Karlsson Ex. 1010, Fig. 14

Karlsson's image data is used to control light emitted from its headlamp:

"control means 14 are arranged to selectively switch the individual small light sources, or a group of individual small light sources, on and off ... in response to a control signal from sensor means 23." EX1010, 14:22-30. Thus, Karlsson's control means 14, which includes a processor, is in communication with sensor 23 to receive the control signal.

Pet., 62-63 (citing EX1003, ¶256); EX1052, ¶¶150-161.

The Petition also explained that "the processor in control means 14 is processing the information from the cameras in Karlsson." Pet., 64. This information from the camera is image data transferred from Karlsson's camera to the controller to control the light emitted from Karlsson's headlamps. EX1052, ¶¶159-161.

315 Reply, 24

Claims 72 and 80 Karlsson's missing teachings

Claim 72

determine a target based on first data from one or more of the sensors;
determine a first target location based on the first data;
select a cluster of the LEDs having light associated therewith that is directed at the target, ...
maintain a variance of illumination provided to the target relative to the laterally adjacent areas, when subsequent data from one or more of the cameras indicates a change in position of the target relative to the motor vehicle, by repeating the determination of target location, selection of the cluster and variance to illumination provided to the target,

Claim 80

...sensors... to capture camera data indicating a target...
identify, based on data received from one or more of the sensors, a plurality of positions associated with the target as the target move relative to the motor vehicle; and
change, responsive to the positions associated with the target, first light associated with one or more LEDs aimed toward at least a portion of the target, ..., as the target moves relative to the motor vehicle.

Beam Explains How Its Region Is Created

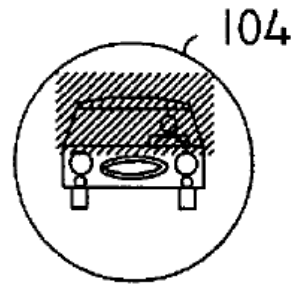


FIG. 1C

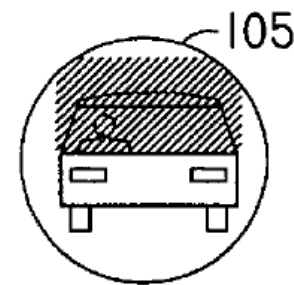


FIG. 1D

When an oncoming vehicle's headlights are detected ... an area slightly wider than the headlight spacing and approximately six feet high, and whose bottom edge is centered on the oncoming headlights ...

Beam Ex.1005, 6:19-23

Karlsson Does Not Explain Which LEDs to Control (72, 80)

detected light 11” for satisfying this limitation. (Pet. at 63.) Petitioner admits

“Karlsson does not expressly disclose how the direction of the target light sources is stored and processed to determine which LEDs to be dimmed to avoid glare.”

315 POR, 47; *See also* 318 POR, 45

Karlsson:

the lighting pattern and the lighting intensity are automatically adjusted, in such a manner that oncoming traffic will not be blinded

Karlsson Ex.1010, Abstract

The prior art lighting device... detects the distribution and the intensity of light ... The pattern of the light beam being emitted ... is ... adapted in dependence on the intensity and the direction of the light being detected ... that part of the light beam which might cause inconvenience to oncoming traffic is automatically suppressed ...

Karlsson Ex.1010, 2:2-8

When the lighting device 1 is used as a headlight ... 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.

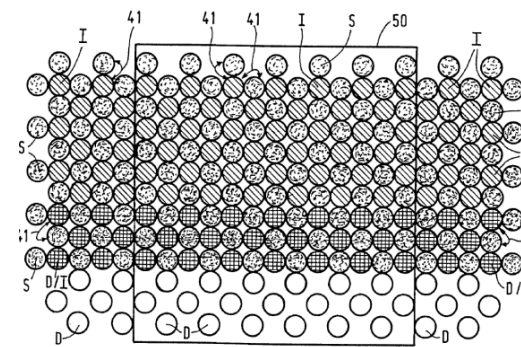
Karlsson Ex.1010, 9:18-22

Karlsson's Fig. 14 Control (Claims 72, 80)

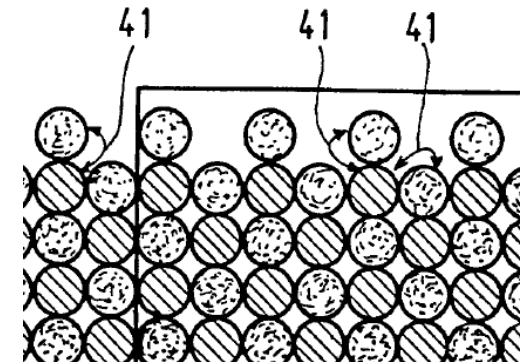
format as coordinates. (Ex.2006, ¶¶166-167.) On the contrary, with reference to Figure 14, Karlsson discloses an arrangement in which each sensor (S) of an array of spotlight sensors is electrically connected to an adjacent spotlight source to provide a switch to control the LEDs:

315 POR, 48; 318 POR, 45

Figure 14 shows an embodiment of a spatial distribution of spotlight sources and spotlight sensors S



Ex.1010, 19:18-19



The spotlight sources and the spotlight sensors, besides optical fibers, may also be formed by LEDs and photosensitive transistors, respectively. Arrow 41 schematically indicates an electric connection between the spotlight sensors S and spotlight sources D, I and D/I, which for example, may consist of transistors or the like.

Ex.1010, 19:34 – 20:1

Karlsson's General Control Issues (Claims 72, 80)

As illustrated in the above Figures 1-3, vehicle A having Karlsson's system will diminish some number of LEDs associated with light originating near the red box in response to detecting an illumination source producing that light. Which LEDs are blanked, how many LEDs are blanked, and specifically how those LEDs are chosen is beyond the teachings of Karlsson — which merely describes a preferred result. Adding Nakamura does not cure this deficiency, nor does it create

318 POR, 51

to control the headlights. However, Karlsson does not specify how the direction of the target light sources is stored and processed to determine which LEDs to be dimmed to avoid glare.

315 Ex.1003, ¶234

Karlsson does not specify how the detected target images are stored and processed to determine which LEDs to be dimmed to avoid glare.

318 Ex.1003, ¶242

A POSAs Search for Answers (Claims 72, 80)

It was the precise lack of a dimming process in Karlsson that motivated the combination with Nakamura – “search for known techniques detailing how sensor information... are stored and *processed to determine which portions of the headlight beam need to be dimmed for glare reduction.*” (Petition, 53.)

Compounding the problem, Nakamura is almost completely silent on the function for glare-reduction. “[W]hich portions of the headlight beam need to be dimmed”

318 Sur Reply, 22

It was the precise lack of a dimming process in Karlsson that motivated the combination with Nakamura – “search for known techniques detailing how sensor information ... is stored and *processed to determine which portions of the headlight beam need to be dimmed.*” (Petition, 55.) Compounding the problem, Nakamura is almost completely silent on the function for glare-reduction.

315 Sur Reply, 22

239. This would have led a POSA to search for known techniques detailing how sensor information, like the images recorded in Karlsson, are stored and processed to determine which portions of the headlight beam need to be dimmed for glare reduction. For example, Nakamura discloses an automatic headlight system detects vehicles by processing an “image 120 that is the image that was obtained by camera 22.” EX1013, ¶36. “Each pixel of the image that is formed by the image signal identifies a position based on the *coordinates* (X_n , Y_n).” EX1013, ¶25. Nakamura discloses a multi-step algorithm by which the pixels are processed to determine: (1) the boundaries of the roadway, and (2) the location of a vehicle in the roadway. EX1013, ¶¶36-47. Thus, Nakamura discloses that the pixels are each

315 Ex.1003, ¶239

The Wrong Control, At Best (Claims 72, 80)

control Petitioner admitted it was missing. At best, “no/low light ... in the directions from which light is detected” prevents glare *to the headlamps of the vehicle only* – leaving no explanation for how the teaching prevents glare to a driver’s eyes, which are not adjacent to the vehicle headlamps.

315 Sur Reply, 23
318 Sur Reply, 23

241. Karlsson teaches that “means for automatically adjusting the pattern of the light beam” use “sensors...[that] *precisely determin[e] the direction and intensity of the detected light* 11.” EX1010, 6:34-35, 12:19-22. That direction is a spatial location because the distance to the target is only important insofar as it affects the area to be dimmed. “[T]he pattern and the intensity of the light beam 7 are...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*.” EX1010; 9:18-22. Thus, Karlsson’s system relies on the location of the detected sources to determine the proper light sources to attenuate to prevent glare.

242. Nakamura’s algorithm uses coordinates to quantify the spatial locations of detected headlight targets in a system that is functionally similar to Karlsson’s. Like Karlsson, Nakamura’s camera detects headlights, and processes the resulting image to determine their location using X,Y pixel coordinates. EX1013, ¶¶36-47; EX1010, 2:30-35, 9:18-26, 13:24-14:4, FIG. 3. Thus, a POSA would have applied Nakamura’s teachings to implement what is implicit in Karlsson.

315 Ex.1003, ¶¶241-242

Karlsson thus cannot teach 72, 80

Claim 72

determine a target based on first data from one or more of the sensors;
determine a first target location based on the first data;
select a cluster of the LEDs having light associated therewith that is directed at the target, ...
maintain a variance of illumination provided to the target relative to the laterally adjacent areas, when subsequent data from one or more of the cameras indicates a change in position of the target relative to the motor vehicle, by repeating the determination of target location, selection of the cluster and variance to illumination provided to the target,

Claim 80

...sensors... to capture camera data indicating a target...
identify, based on data received from one or more of the sensors, a plurality of positions associated with the target as the target move relative to the motor vehicle; and
change, responsive to the positions associated with the target, first light associated with one or more LEDs aimed toward at least a portion of the target, ..., as the target moves relative to the motor vehicle.

Claim language 26 (26-29, 34-37, 42-45, 50-53, 58-61, 66-69, 74-77, 82-85)

Claim 26

accommodate the upcoming road curvature by adaptation of a light pattern of at least one of the at least one headlamps.

Beam maximally illuminates – leaving nothing to adapt

Beam:

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

Beam Ex.1005, 6:9-12

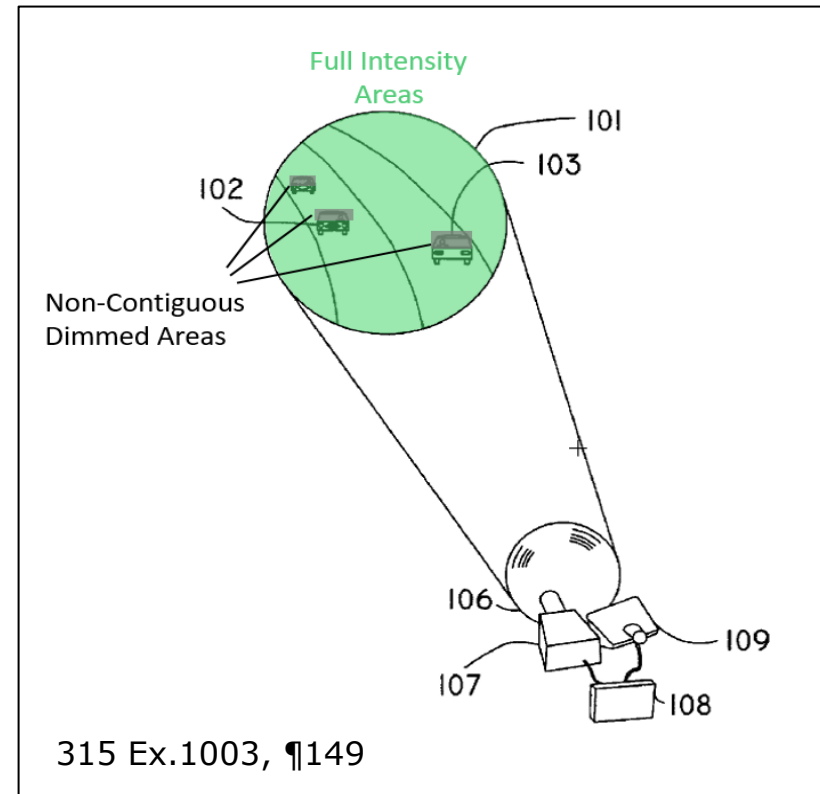
Dr. Turk:

51. Beam solves the identified problems by providing a non-moveable AABH system having a multiplicity of microbeams that “will 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, 6:11-12, 6:54-55, emphasis added.) Beam further discloses that:

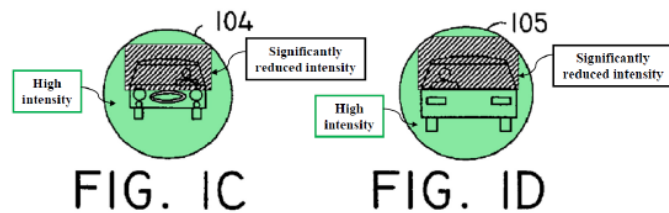
315 Ex.2006, ¶51

318 Ex.2024, ¶51



The Parties Agree – Beam teaches “Full Intensity”

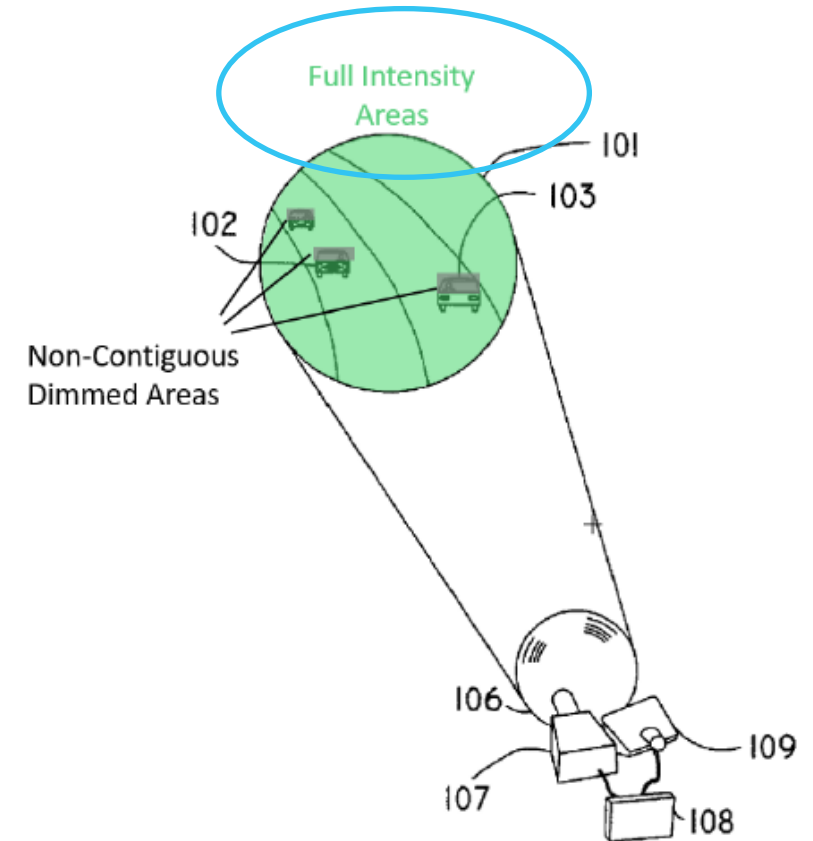
Beam maintains “a first level of illumination” in the areas around the traffic ahead, while preventing glare to the other driver. EX1003, ¶¶145-146. This high-intensity area is created by a “second cluster” of LEDs (microbeam sources) as claimed. *Id.* As shown below, the reduced-intensity area is in 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.*



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

315 Petition, 38; 318 Petition, 38

318 Petition, 36



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

315 Petition, 38; 318 Petition, 39
(Blue annotations added by PO)

Full illumination leaves nothing to modify

154. Since Beam discloses providing maximum intensity light everywhere
it could be needed, there is nothing to “adapt” or modify toward the upcoming road
curvature, rendering Kobayashi’s map data useless.

315 Ex.2006, ¶154; See also 318 Ex.2024, ¶¶158-159

Any Beam argument related to SLMs is new argument (Claims 26-29, 34-37, 42-45, 50-53)

4. [24.3]/[32.3]/[40.3]/[48.3] “electronic circuitry apparatus for the controlled powering of the LEDs and other of the illuminating device elements”

120. Unsurprisingly, given its limited focus on vehicle lighting, the '551

* * *

EX1005, 4:48-57. The LEDs in FIG. 4 are part of a “system similar to that of FIG. 2 except that lamp 202 and spatial light modulator 203 are replaced by an array of light sources 401.” EX1005, 5:3-9. This means that spatial light modulator 203 is replaced with the circuitry for “controlled powering of the LEDs,” as claimed, to selectively control “the energy of the microbeams” (LEDs). Because this circuitry takes the place of spatial light modulator 203, it would be part of controller 108 as shown in Figure 7, and therefore would meet the requirements of the means-plus-

315 Ex.1003, ¶120

Any Beam argument related to SLMs is new argument (Claims 58-61, 66-69, 74-77, 82-85)

Any attempt to *now* explain that illumination could be “directed” using SLMs is defeated by the fact that Petitioner expressly removed the SLMs in its combination – “spatial light modulator 203 is replaced with the circuitry for “controlled powering of the LEDs,” ... this circuitry takes the place of spatial light modulator 203” (Ex.1003, ¶120.) No SLM was ever referenced or re-added in the subsequent argument directed to claims 58-61, 66-69, 74-77, 82-85. In the first paragraph describing the combination of Beam, Satonaka and Kobayashi, Dr. Jiao states “modify Beam’s.... [headlamp]... *to further control Beam’s directional LEDs.*” (Ex.1003, ¶205; Petition, 46.)

Petitioner only used Beam’s LEDs in its Petition. (*See, e.g.,* discussing “altering ... intensity or distribution of LEDs” (Petition, 51) and “adjusting LEDs,”; or “control Beam’s directional LEDs.”) (Petition, 46.)).

4. [56.3]/[64.3]/[72.3]/[80.3] “electronic circuitry apparatus for the controlled powering of the LEDs and other of the illuminating device elements”

120. Unsurprisingly, given its limited focus on vehicle lighting, the ’551

* * *

attenuate them.” EX1005, 4:48-57. The LEDs in Figure 4 are part of a “system similar to that of FIG. 2 except that lamp 202 and spatial light modulator 203 are replaced by an array of light sources 401.” EX1005, 5:3-9. This means that spatial light modulator 203 is replaced with the circuitry for “controlled powering of the LEDs,” as claimed, to selectively control “the energy of the microbeams” (LEDs). Because this circuitry takes the place of spatial light modulator 203, it would be part of controller 108 as shown in Figure 7, and

318 Ex.1003, ¶120

The Parties Agree – Karlsson teaches “Full Intensity”

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.

315 Petition, 73;
See also 318 Petition, 67

281. 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. 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

318 Ex.1003, ¶281
See also 315 Ex.1003, ¶¶ 285, 324; 318 Ex.1003, ¶321

Karlsson uses Flaaten to explain “optimum”

Karlsson:

The invention relates to a lighting device, in particular a headlight of a motor vehicle, comprising lighting means arranged for generating and varying the pattern of a light beam to be emitted by the lighting device in response to at least one control signal delivered by light-sensitive sensor means during operation. A lighting device of this type is known from international patent application WO 86/05147.

Ex.1010, 1:3-9

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, 2:2-9 (Emphasis added)

Flaaten:

It is, thus, desirable to enable such control of the light that only the portion of the light that would inconvenience the driver of meeting cars is removed, leaving as much as possible of the roadway and the surroundings illuminated.

Ex.2017, 1

Flaaten's optimum lighting effect that already covers curves

Flaaten "prior art lighting device" "retain[s] an optimum lighting effect for the driver of the vehicle," by enabling "such control of the light that only the portion of the light that would inconvenience the driver of meeting cars is removed, leaving as much as possible of the roadway and the surroundings illuminated." (Ex.1010 at 1-2; Ex.2017 at 1; Ex.2006, ¶209.)

315 POR, 66;
See also 318 POR, 66-67

Dr. Jiao:

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.

315 Ex.1052, ¶178; 318 Ex.1052, ¶166

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)

315 Ex.1052, ¶182; 318 Ex.1052, ¶170

Dr. Jiao further cites to Flaaten

Dr. Jiao:

driver of the vehicle,” citing EX1010, 2:2-9). Indeed, Flaaten describes controlling “the light distribution pattern of the headlights,” with “intersecting directions of the axes of light beams,” to efficiently dim the light “selectively in the areas where there are other vehicles, persons, or sources of light, whereas a maximum *satisfactory* illumination is maintained of the roadway in front of the vehicle.”

318 Ex.1052, ¶166

Flaaten, I have explained above that Flaaten shows an array of bulbs in Figures 1 and 2, and gives an example of directional light sources in its arrays in Figures 5 and 6, also including intersecting, combined, optical axes, that together provide light sources “in each headlight [that] have directions of light that provide the *best possible illumination* in a *desired predetermined area* in front of the vehicle”

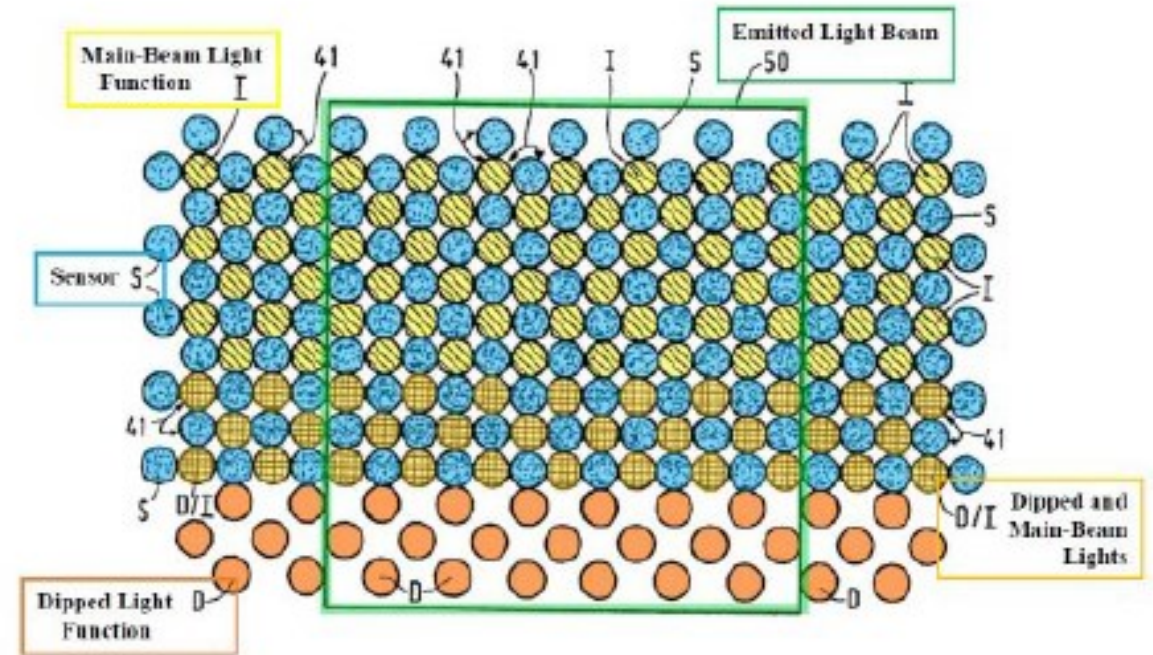
EX2017, 3:8-14. Flaaten’s Figures 2, 5, and 6 are shown for reference:

318 Ex.1052, ¶168

Karlsson Fig. 14

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.

Karlsson Ex.1010, 19:22-28



315 Petition, 14, 68, 69, 73, 74, 75 citing Karlsson Ex.1010, Fig. 14;
See also 318 Petition, 14, 65, 66, 68, 71, 72, 75

Karlsson provides Fig. 14 for movement-related improvements

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

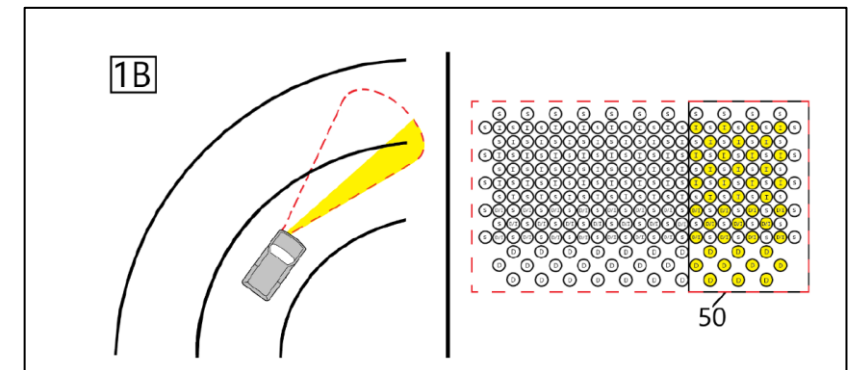
used to prevent glare based on vehicle movement in situations, such as a curve, where another vehicle's lights may be difficult to detect due to relative positioning.

If Karlsson's vehicle is pitched, *e.g.*, during sharp velocity changes or "overloaded," the light beam 7 is adapted for pitch — *i.e.*, certain LEDs are blanked causing the window 50 to vertically shift as described with reference to Fig. 14. (Ex.1010, 20:25-29.) If the vehicle is taking a curve, the light beam 7 is adapted to prevent glaring the opposite lane — *i.e.*, certain LEDs are blanked causing the window 50 to horizontally shift as described with reference to Fig. 14. (Ex.1010, 20:29-33; Ex.2006, ¶207.)

315 POR, 64-65;
See also 318 POR, 65-66

90. Karlsson addresses glare caused when a vehicle is taking a curve, the beam may be "adapted" (shifted) away from the other lane. (Ex. 1010, 1:34-2:1; 20:29-32.) This shift, however, is not a shift of the entire main driving beam 7, it is a temporary reduction of the beam aimed at the opposite lane, achieved by temporarily shutting off some portion of the array. Figures 1B and 1C below

315 Ex.2006, ¶90



Karlsson's base full illumination already covers curves

As both parties agree, Karlsson discloses providing full or maximum intensity light in the remaining areas outside of the anti-glare region to the greatest extent possible, *i.e.*, everywhere it could be needed. Under such circumstances, there would be no reason to adapt the light pattern to accommodate road curvature, nor would there be remaining unlit LEDs with which to achieve the adaptation.

Accordingly, the Gotou-Karlsson combination does not teach a controller enabled to “*accommodate the upcoming road curvature by adaptation of a light pattern of at least one of the at least one headlamps,*” as claimed, and claims 26-29, 34-37, 42-45, 50-53 are non-obvious over the combination. (Ex.2006, ¶211.)

315 POR, 67

Dr. Jiao:

to the ‘greatest extent possible,’” (EX2024, ¶96). 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.

318 Ex.1052, ¶166

“Light Determined Based on Classifying an Object” (CI 48)

Claim 48 [48.a]:

illuminate a portion of at least one object, indicated by data from at least one of the one or more sensors by selecting a first cluster of the LEDs to emit first light directed towards a first area including the at least the portion of at least one object, ... the first light determined based at least in part on classifying the object based at least in part on the data

Emphasis added

[48.8a] is patentably indistinct from elements [24.8] and [24.9], and claim 33.

Sections VI.C.1-2, VI.H; EX1003, ¶185. The coordinates in [24.8] used to determine the cluster in [24.9] are based on the coordinate-specific information detected by the camera in [24.5], which is “data” as claimed here. Sections VI.C.1-2, VI.B.6; EX1003, ¶185. A POSA would have understood that the vehicle recited in [24.8], [24.9], and 33 is “an object” as claimed. EX1003, ¶¶185-189.

315 Petition, 45

[48.8a] is patentably indistinct from elements [24.8] and [24.9], and claim 33,

and is disclosed or rendered obvious by Karlsson for the same reasons. Sections VIII.C.1-2; VIII.H; EX1003, ¶316. The coordinates in [24.8] used to determine the cluster in [24.9] are based on the coordinate-specific information detected by the camera in [24.5], which is “data” as claimed here. Sections VIII.C.1-2, VIII.B.6; EX1003, ¶316. A POSA would have understood that the vehicle recited in [24.8], [24.9], and 33 is “an object.” EX1003, ¶¶318-321.

315 Petition, 77-78

Never Addressed by Argument (Cl 48)

Finally, claim 48 requires enabling the controller to “*illuminate a portion of at least one object . . . by selecting a first cluster of the LEDs to emit first light directed towards a first area . . . the first light determined based at least in part on classifying the object based at least in part on the data.*” (Ex.1002, 0995.)

Petitioner identifies this limitation as claim [48.9a] at page 128 of the Petition. However, Petitioner’s analysis of claim 48 ends with claim limitation [48.8]. The

Petition thus fails to include any argument as to how the combinations satisfy claim limitation [48.9a] or why the language difference between representative claim 24 and claim 48 is immaterial. (Pet. at 45-46; 78; Ex.2006, ¶102.)

315 POR, 12-13

Failing of Karlsson Combination (CI 48)

As noted in the POR at pages 12 and 13, Petitioner did not address the “*the first light determined based at least in part on classifying the object...*” limitation of claim 48. Petitioner attempts to pass off this deficiency as a “typographical

error,” stating: “Petition addresses this element, referring to it as part of element [48.8].” (Reply, 25.) Petitioner does not specifically identify its prior *analysis* of the “classifying” limitation because there is none. Petitioner tries several tactics to

315 Sur Reply, 8-9

PO argues that there is no analysis of [48.9a]. POR, 12-13. The Petition addresses this element, referring to it as part of element [48.8], a typographical error. Pet., 45-46, 77-78. But clearly the substantive discussion addresses the relevant claim elements, supported by Dr. Jiao’s declaration cites, which includes the correct claim language. EX1003, ¶¶185-192, 318-325. 315 Reply, 25

[48.8a] is patentably indistinct from elements [24.8] and [24.9], and claim 33, and is disclosed or rendered obvious by Karlsson for the same reasons. Sections VIII.C.1-2; VIII.H; EX1003, ¶316. The coordinates in [24.8] used to determine the cluster in [24.9] are based on the coordinate-specific information detected by the camera in [24.5], which is “data” as claimed here. Sections VIII.C.1-2, VIII.B.6; EX1003, ¶316. A POSA would have understood that the vehicle recited in [24.8], [24.9], and 33 is “an object.” EX1003, ¶¶318-321. 315 Petition, 77-78

Improper Burden Shifting (Cl 48)

Finally, Petitioner states in its secondary-considerations argument: “PO does not dispute that Karlsson discloses this element.” (Reply, 26; Ex.1052, ¶103.) This implies the absolute fiction that it was PO’s burden to address an unrepresented argument. Since Petitioner never mentioned “classifying,” never mapped any evidence to “classifying,” and never explained why the recitation of “classifying” was immaterial, there was nothing for PO to “dispute.”

315 Sur Reply, 10-11

Finally, for the “classifying” feature (claim 48), PO does not dispute that Karlsson discloses this element, and PO’s argument against Beam is wrong.

315 Reply, 26 (Secondary Considerations)

Failing of Beam Combination (CI 48)

As detailed in Section V *supra*, because the Petition omits any analysis as to how the proffered combination teaches the “*classifying the object*” limitation in claim 48 or why the limitation is immaterial, the claim 48 proof is fatally deficient.

(Ex.2006, ¶102.)

315 POR, 21

315 Petition, 45

[48.8a] is patentably indistinct from elements [24.8] and [24.9], and claim 33.

Sections VI.C.1-2, VI.H; EX1003, ¶185. The coordinates in [24.8] used to determine the cluster in [24.9] are based on the coordinate-specific information detected by the camera in [24.5], which is “data” as claimed here. Sections VI.C.1-2, VI.B.6; EX1003, ¶185. A POSA would have understood that the vehicle recited in [24.8], [24.9], and 33 is “an object” as claimed. EX1003, ¶¶185-189.

Reply is All New Argument (CI 48)

First, Petitioner casts this argument as rooted in the interpretation of “classifying” so that it might present new evidence. (Reply, 8-10.) PO’s primary argument was that there was *no* argument at all, a position for which the meaning of “classifying” is irrelevant. (POR, 12-13.)

Petitioner also now contends Beam’s “algorithm differentiates between illuminated objects that are above and below a threshold.” (Reply, 9-10.) Beam makes no mention of “illuminated objects.” Petitioner’s citations to the Petition and Declaration do not even reference “thresholding,” making this plainly new argument. (*Id.*)

315 Sur Reply, 9

require specific objects be classified. EX1052, ¶¶92-98. A POSA would understand the plain language merely requires “placing the detected objects into categories or classes.” *Id.*, ¶96.

* * *

Beam discloses the plain and ordinary meaning of “classifying” because its algorithm differentiates between illuminated objects that are above and below a threshold. EX1052, ¶¶97-98; Pet., 45; EX1003, ¶186. “The spatial scene data from sensor 107 is *thresholded* to eliminate weak signals and becomes the input to a processor 1105.” EX1005, 5:34-36. As Dr. Jiao explains, this means that objects

* * *

¶99. Beam’s thresholding function separates objects into different classes: those below the threshold and those above it. *Id.*; Pet., 34, 45; EX1005, 5:34-36. Thus, 315 Reply, 8-9

[48.8a] is patentably indistinct from elements [24.8] and [24.9], and claim 33.

Sections VI.C.1-2, VI.H; EX1003, ¶185. The coordinates in [24.8] used to 315 Petition, 45

PO only ever relied on plain meaning (CI 48)

First, Petitioner casts this argument as rooted in the interpretation of “classifying” so that it might present new evidence. (Reply, 8-10.) PO’s primary

315 Sur Reply, 9

96. Indeed, a POSA would have understood the plain and ordinary meaning of “classifying” in claim 48 as simply placing the detected objects into categories or classes. While in my opinion this term does not require a specific definition, I note that the verb “classify” is defined as “arrange in or assign to classes.” EX1055. In the context of the technology here and claim 48, a POSA

315 Ex.1052, ¶96

explain what he believes this portion of claim 48 requires. EX2006, ¶113. When asked about his understanding of “classifying” in claim 48 during his deposition, for the first time Dr. Turk stated that it means “to perform multi-class classification or recognition or determining the identity of an object.” EX1053, 82:15-19. He

315 Ex.1052, ¶94

New Argument Also Does Not Prove Classifying (CI 48)

Petitioner's statement that "Beam's algorithm differentiates between illuminated objects that are above and below a threshold," is also a technical misstatement suggesting that Beam detects and sorts objects, despite Beam's whole teaching being limited to: "the spatial scene data is thresholded to eliminate weak signals." (Ex.1005, 5:34-36.) This sort of misleading characterization demonstrates

315 Sur Reply, 9-10

require specific objects be classified. EX1052, ¶¶92-98. A POSA would understand the plain language merely requires "placing the detected objects into categories or classes." *Id.*, ¶96.

* * *

Beam discloses the plain and ordinary meaning of "classifying" because its algorithm differentiates between illuminated objects that are above and below a threshold. EX1052, ¶¶97-98; Pet., 45; EX1003, ¶186. "The spatial scene data from sensor 107 is *thresholded* to eliminate weak signals and becomes the input to a processor 1105." EX1005, 5:34-36. As Dr. Jiao explains, this means that objects

* * *

¶99. Beam's thresholding function separates objects into different classes: those below the threshold and those above it. *Id.*; Pet., 34, 45; EX1005, 5:34-36. Thus,

315 Reply, 8-9

More New Argument (48)

Petitioner also impermissibly tries to introduce Satonaka to satisfy this limitation. (Reply, 10.) Satonaka is not referenced once with respect to claim 48 in the Petition. (Petition, 45-46.) Further, Satonaka's alleged "classification into oncoming or preceding" has no relevance to Beam, which would treat "oncoming or preceding" vehicles equally. Claim 48 requires "light is *determined based on* classifying the object," so if the classification were "oncoming" vs. "preceding" then *that* classification would have to be shown to affect light-determination. Also, Petitioner elsewhere reiterates *exactly* what is taken from Satonaka – "Beam is modified with Satonaka's teachings for the "coordinates of the pixels" in the image." (Reply, 16-17.) Dr. Jiao confirms this is "only" what is taken. (Ex.1052, ¶130.)

315 Sur Reply, 10

Third, further confirmation is in Satonaka (combined with Beam here), which classifies vehicle targets into oncoming vehicles or preceding vehicles. Pet.,

315 Reply, 10

[48.8a] is patentably indistinct from elements [24.8] and [24.9], and claim 33. Sections VI.C.1-2, VI.H; EX1003, ¶185. The coordinates in [24.8] used to

315 Petition, 45

Per Dr. Jiao, Satonaka is used for ONE thing only (CI 48)

Petitioner elsewhere reiterates *exactly* what is taken from Satonaka – “Beam is modified with Satonaka’s teachings for the “coordinates of the pixels” in the image.” (Reply, 16-17.) Dr. Jiao confirms this is “only” what is taken. (Ex.1052, ¶130.)

315 Sur Reply, 10

the modification. Beam is being modified only to include the known concept of coordinate mapping to the extent Beam does not disclose that concept. EX1003, ¶¶104-106. Dr. Turk’s analysis assumes, incorrectly, that every detail of Satonaka’s algorithm would be incorporated in Beam and that incorporating those details would worsen the performance of Beam. As I explained, Beam is only being modified with the algorithmic details related to the “coordinates of the pixels as taught by Satonaka.” EX1003, ¶106. Dr. Turk bases his analysis in part on

318 Ex. 1052, ¶115; See also 315 Ex.1052, ¶130

Claim 64 – The Proof is about two vehicles simultaneously, the claim is not

For independent claim 64, the Petition fails to address a “*second, subsequent change of the other vehicle*” and fails to provide any explanation for why that language is immaterial. Claim 64 requires a controller enabled to “*select a second, different cluster of the LEDs having light . . . directed towards the other vehicle . . .*” and “*control a second, subsequent change . . . of the light that is subsequently directed towards the other vehicle.*” Both of these limitations are directed to the same “*other vehicle*” at a second, subsequent time. (Ex.2024, ¶¶110-112.)

Petitioner relies on Beam’s disclosure regarding glare reduction for multiple vehicles at 2:62-63 and Figure 1 for satisfying this limitation. For example, Petitioner states that “[a] second vehicle at a different position uses a different cluster of LEDs than the first vehicle, and thus Beam’s system would ‘select a second, different cluster’ of LEDs to accommodate the second vehicle.” (Pet. at 42; Ex.2024, ¶111.)

Beam discloses that “[m]ultiple vehicles . . . are accommodated simultaneously by the system” and that the glare-reduction process “can be done for any number of vehicles that fall in the headlight beam [area].” EX1005, 2:62-63, 6:27-28; EX1003, ¶163. A second vehicle at a different position uses a different cluster of LEDs than the first vehicle, and thus Beam’s system would “select a second, different cluster” of LEDs to accommodate the second vehicle as claimed. EX1003, ¶163. The remainder of [64.10] is a patentably indistinct duplication of [64.8]. *Id.*, ¶¶163-165; Section VI.G.1; EX1005, 2:56-3:3.

318 Petition, 42 [64.10]
control a first change to ... the light associated with the first cluster of the LEDs that is directed towards the other vehicle, ... select a second, different cluster of the LEDs having light associated therewith that is directed towards the other vehicle based at least in part on second, subsequent data ... indicating a second, subsequent position associated with the other vehicle; and control a second, subsequent change, to one or more characteristics of the light that is subsequently directed towards the other vehicle, ...

318 POR, 11

Claim 64

Petitioner ignores the language of the claims (Cl 64)

Claim 64 requires “select a second, different cluster of the LEDs having light ... that is directed towards **the** other vehicle... based . . . on . . . subsequent data... indicating a second, subsequent position associated with **the** other vehicle.”

Petitioner never **showed** that the second cluster was illuminating the **same** vehicle as the first cluster at a later point in time. (POR, 11-13.) Whether the second

cluster could *also* be illuminating some *other* vehicle is irrelevant. Petitioner had to show that the second cluster was illuminating the *same* vehicle, which it never did. (*Id.*)

318 Sur Reply, 9-10

control a first change to ... the light associated with the first cluster of the LEDs that is directed towards the other vehicle, ...; select a second, different cluster of the LEDs having light ...that is directed towards the other vehicle based ...on second, subsequent data ...indicating a second, subsequent position associated with the other vehicle; and control a second, subsequent change, ...of the light that is subsequently directed towards the other vehicle, ...

Claim 64 (Emphasis added)

The Petition’s explanation that Beam selects additional, different clusters to address multiple vehicles is correct because the claim language does not restrict the second cluster to a single vehicle. Pet., 42; EX1003, ¶¶163-164; EX1035, 10:24-29. The second vehicle would have a different spatial position than the first vehicle, thus requiring a second, *different* cluster of LEDs, as claimed. EX1003, ¶¶163-164; EX1052, ¶77.

318 Reply, 8

Petitioner introduces new argument (64)

Petitioner alternatively seeks to introduce a new argument – that Beam also discloses selecting a new, second cluster to track the same vehicle. (Reply, 8.) This argument was however never presented for claim 64. (Petition, 22-32, 41-43.)

318 Sur Reply, 10

Beam discloses that “[m]ultiple vehicles ... are accommodated simultaneously by the system” and that the glare-reduction process “can be done for any number of vehicles that fall in the headlight beam [area].” EX1005, 2:62-63, 6:27-28; EX1003, ¶163. A second vehicle at a different position uses a different cluster of LEDs than the first vehicle, and thus Beam’s system would “select a second, different cluster” of LEDs to accommodate the second vehicle as claimed. EX1003, ¶163. The remainder of [64.10] is a patentably indistinct duplication of [64.8]. *Id.*, ¶¶163-165; Section VI.G.1; EX1005, 2:56-3:3.

318 Petition, 42 [64.10]

Beam also discloses selecting new, second clusters to track the same vehicle for the same reasons as discussed with elements [72.12] and [80.9]. EX1052, ¶¶76-77; Pet., 44-45; EX1003, ¶¶187, 197-198. For example, element [72.12] recites

318 Reply, 8

Proof is about multiple vehicles (CI 64)

other vehicle.” Both of these limitations are directed to the **same “other_vehicle”** addressed in limitations 64.8 and 64.9. (Ex.2024, ¶179.)

Petitioner relies on Karlsson’s disclosure regarding glare reduction for **traffic** as satisfying this limitation, alleging that this demonstrates utility of Karlsson for “any number of vehicles.” (Pet. at 71.) Notwithstanding that Karlsson doesn’t teach how to handle multiple vehicles, **the challenged claim is not about multiple vehicles.** According to Petitioner “A second vehicle would require a second cluster, as claimed ...” -- a fatal misstatement of the claim, which actually requires use of a second, different cluster for the **same vehicle at a different point in time.** Offering evidence of contemporaneous usage of a second cluster for a **different vehicle** (even were the proof not flawed) fails to meet the claim. (Ex.2024, ¶180.)

318 POR, 48-49

control a first change to ... the light associated with the first cluster of the LEDs that is **directed towards the other vehicle,** ...;
select a second, different cluster of the LEDs having light associated therewith that is **directed towards the other vehicle** based at least in part on second, subsequent data ...indicating a second, **subsequent position associated with the other vehicle;** and
control a second, subsequent change, to one or more characteristics of the light that is **subsequently directed towards the other vehicle,** ...

Claim 64 (Emphasis added)

Karlsson’s system automatically functions to detect and reduce illumination on **any number** of target vehicles because Karlsson references protecting “traffic” from glare. EX1003, ¶298; EX1010, 9:18-26. **A second** vehicle would require a second cluster, as claimed, to execute Karlsson’s glare-reduction process. EX1003,

Alternatively, Nakamura discloses that it was known to detect **multiple “vehicles** (preceding vehicles and oncoming vehicles)” and adjust the headlights to “not expose other *vehicles* to glare.” EX1013, ¶¶35, 45; EX1003, ¶299-300. To the extent Patent Owner argues that Karlsson does not disclose detecting and adjusting light based on **multiple vehicles,** it would have been obvious to modify Karlsson’s programming in view of Nakamura because this would improve safety and system performance when **multiple other vehicles** are present. EX1003, ¶¶299-301.

4. [64.11]

[64.11] is a patentably indistinct duplication of [64.9] for **a second vehicle,** which Karlsson discloses for the reasons discussed in [64.10]. Sections VIII.G.2-3;

Petitioner ignores the language of the claim (Cl 64)

Claim 64 requires “select a second, different cluster of the LEDs having light ... that is directed towards **the** other vehicle... based . . . on . . . subsequent data... indicating a second, subsequent position associated with **the** other vehicle.”

Petitioner never **showed** that the second cluster was illuminating the **same** vehicle as the first cluster at a later point in time. (POR, 11-13.) Whether the second

cluster could *also* be illuminating some *other* vehicle is irrelevant. Petitioner had to show that the second cluster was illuminating the *same* vehicle, which it never did. (*Id.*)

318 Sur Reply, 9-10

control a first change to ... the light associated with the first cluster of the LEDs that is directed towards the other vehicle, ...;
select a second, different cluster of the LEDs having light ...that is directed towards the other vehicle based ...on second, subsequent data ...indicating a second, subsequent position associated with the other vehicle; and
control a second, subsequent change, ...of the light that is subsequently directed towards the other vehicle, ...

Claim 64 (Emphasis added)

The Petition applied Karlsson’s multiple-vehicle tracking (similar to Beam’s multiple-vehicle tracking) for this element, which as explained above meets the claim language. Pet., 42; Section IV; EX1052, ¶138.

318 Reply, 19

Petitioner introduces new argument (Cl 64)

Karlsson's system automatically functions to detect and reduce illumination on **any number** of target vehicles because Karlsson references protecting "traffic" from glare. EX1003, ¶298; EX1010, 9:18-26. **A second** vehicle would require a second cluster, as claimed, to execute Karlsson's glare-reduction process. EX1003,

Alternatively, Nakamura discloses that it was known to detect **multiple** "**vehicles** (preceding vehicles and oncoming vehicles)" and adjust the headlights to "not expose other **vehicles** to glare." EX1013, ¶¶35, 45; EX1003, ¶299-300. To the extent Patent Owner argues that Karlsson does not disclose detecting and adjusting light based on **multiple vehicles**, it would have been obvious to modify Karlsson's programming in view of Nakamura because this would improve safety and system performance when **multiple** **other vehicles** are present. EX1003, ¶¶299-301.

4. [64.11]

[64.11] is a patentably indistinct duplication of [64.9] for **a second vehicle**, which Karlsson discloses for the reasons discussed in [64.10]. Sections VIII.G.2-3;

318 Petition, 71-72

Karlsson also discloses selecting new, second clusters to track the same vehicle for the same reasons as discussed for elements [72.12] and [80.9]. EX1052, ¶¶139-141; Pet., 74-75; Section V. Thus, these elements recite single-vehicle tracking, as PO understands this element of claim 64 to recite. EX1052, ¶138; POR, 48.

Karlsson discloses [72.12] and [80.9], which are directed at singular vehicle targets. Pet., 74-75; EX1003, ¶¶335-336. Karlsson discloses the plain language understanding of the relevant part of claim 64 for the same reasons. EX1052, ¶139. Specifically, as explained in element [72.12], "Karlsson discloses 'repeatedly

318 Reply, 19-20

Failure to address “image data” (representative claim 33)

Claim 33
the data includes image data;

"Image data" language unaddressed (claims 33, 57*)

For claim 33, save one new argument, the Petition refers back to arguments made in reference to claim 25: “The remaining elements of claim 33 are patentably indistinct from the elements of claim 25, and are disclosed or rendered obvious by Karlsson for the same reasons.” (Pet. at 42-43; 74-75.) In so doing, the Petition however omits any mention of the *wherein the data includes image data* language of claim 33 — which is not part of claim 25 — and fails to provide any explanation for why that language is immaterial. (Pet. at 69-71, 74-75; Ex.2006, ¶100.) Claims 41 and 49 include the same claim language and suffer from the same defect.

315 POR, 10

For claim 57, the Petition omits any mention of the “*wherein the data includes image data*” language and fails to provide any explanation for why that language is immaterial. (Pet. at 36-39, 67-69.) By analogy to claim 57, claims 65, 73 and 81 include the same claim language and suffer from the same defect. Though all four claims include the *wherein the data includes image data* language, the Petition omits any analysis for that language, providing no explanation for why that language is immaterial. (*Id.*, 43-44, 46, 73-74, 76; Ex.2024, ¶¶98-101.)

318 POR, 11

Petitioner's argument is all new argument (claims 33, 57*)

As the “wherein the data includes image data” limitation of claims 33, 41 and 49 is absent from the Petition mapping, the Reply impermissibly cites disconnected portions of the Petition to rectify the shortfall. (Reply, 23-24.) Under 37 C.F.R. § 42.104(b)(4), Petitioner’s new arguments should not be considered.

315 Sur Reply, 8

As the “wherein the data includes image data” limitation of claims 57, 65, 73, and 81 is absent from the Petition mapping, the Reply impermissibly cites disconnected portions of the Petition to rectify the shortfall. (Reply, 24.) Under 37 C.F.R. § 42.104(b)(4), Petitioner’s new arguments should not be considered.

318 Sur Reply, 8

Karlsson’s image data is used to control light emitted from its headlamp:

“control means 14 are arranged to selectively switch the individual small light sources, or a group of individual small light sources, on and off ... in response to a control signal from sensor means 23.” EX1010, 14:22-30. Thus, Karlsson’s control means 14, which includes a processor, is in communication with sensor 23 to receive the control signal.

Pet., 62-63 (citing EX1003, ¶256); EX1052, ¶¶150-161.

The Petition also explained that “the processor in control means 14 is processing the information from the cameras in Karlsson.” Pet., 64. This information from the camera is image data transferred from Karlsson’s camera to the controller to control the light emitted from Karlsson’s headlamps. EX1052, ¶¶159-161.

315 Reply, 24;
See also 318 Reply, 25

Secondary considerations - unaddressed

PO:

Cir. 2019). As explained in section II above, the '551 Patent claims include multiple unique characteristics that are novel and nonobvious over the asserted art, such as “Predictive Curve Illumination” the subject of claims 26-29, 34-37, 42-45 and 50-53, “*adapting light emission based on the classification of objects*”, the subject of claim 48, and adapting light emission to provide at least two dark zones with “light in-between,” the subject of claim 40. Objective evidence in the form of industry praise and long felt unmet need were correlated with all three claimed characteristics in the Stam Declaration. (Ex.2023 at 70-77, 728-734; Ex.2006,

315 POR, 70-71

Petitioner:

Second, the features PO identifies fail to show nexus because they are not unique. EX1052, ¶¶186-195. PO never disputes that Kobayashi and Gotou teach the “Predictive Curve Illumination” feature. *Id.*, ¶189. PO’s argument against the relevant claims addresses elements unrelated to the “Predictive Curve Illumination” feature. *Id.*; Sections VIII, XII.

For the “light in-between” feature, PO also fails to show nexus. Claim 40 was known in the art. Indeed, PO never challenges the corresponding feature of claim 40, and as Dr. Jiao explains, this feature is taught at least by Beam and Karlsson. EX1052, ¶192; EX1005, FIG. 1.

Finally, for the “classifying” feature (claim 48), PO does not dispute that Karlsson discloses this element, and PO’s argument against Beam is wrong.

315 Reply, 26

Karlsson Can't Distinguish Reflected Light

In the case of a motor vehicle equipped with two switched lighting devices according to the invention, it may be desirable to synchronize the two lighting devices, i.e. headlight units, and thus performing measurements of ambient light from road signs etc. at the same time. This, to prevent reflections from road signs to be falsely detected as oncoming traffic.

Karlsson Ex.1010, 12:30-35

Like Beam, Karlsson does not identify the targets and therefore cannot distinguish between light associated with vehicle B in Fig. 2, from reflection of light from a roadside sign (such as a mile marker) in Fig. 3, for example. Karlsson's system would presumably then alter illumination directed at the boxed areas by undesirably reducing illumination of something meant to be illuminated in Fig. 3 (although it is unclear how Karlsson would choose LEDs as previously noted.) (Ex.2024, ¶187.)

318 POR, 52

Claim 33 requires “*image data*”

Claim 32:

follow, based at least in part on data from one or more of the cameras, the at least one target with the diminished illumination as the at least one target changes location relative to the motor vehicle

Claim 33:

the data includes image data

As part of its automatic glare-reduction system, Beam’s controller “automatically sens[es] the presence and location of headlights and taillights ahead,” and “will then control the light output of a *group selected from a multiplicity of narrow angle beams.*” EX1005, 2:53-59. Thus, Beam selects a cluster of LEDs (the microbeam sources) that correspond to the known location of the target vehicle. EX1003, ¶161. This teaches the claimed “known aimings of the first light” because the known aiming is the direction of the dimmed area that corresponds to the target vehicle. *Id.*, ¶161. Indeed, Beam states “the spatial locations of the sources [the LEDs] are mapped into controller 108,” allowing the controller to select the correct LEDs based on their known positioning. *Id.*; EX1005, 4:53-57.

The remaining elements of claim 33 (changed characteristics and non-contiguous LEDs) are patentably indistinct from the elements of claim 25, and are disclosed or rendered obvious by Beam for the same reasons. Section VI.D; EX1003, ¶¶162-165.

Claim 33 – Petition References Claim 25 Analysis

Claim 25

The illuminating device of claim 24, wherein: the changed emission includes a change to at least one of intensity Or color or a change of at least one LED of the cluster to a non-emitting state; and the cluster includes a plurality of the LEDs and the cluster non-contiguous LEDs.

For the changed emission/characteristic element, Beam discloses reducing the intensity of the LEDs. Section VI.C.3 (citing EX1005, 4:21-25); EX1003, ¶148. Further, Beam discloses determining “which *microbeams* must be reduced in intensity to protect the other drivers,” which confirms that multiple microbeams (LEDs) would be part of a group. EX1005, 4:15-18; EX1003, ¶148. Thus, a POSA would have understood, or found obvious, that a plurality of LEDs would have been selected as part of Beam’s selected “group” because a single LED is unlikely to cover sufficient area to fully shade a target vehicle as shown in FIGs. 1C-1D. EX1005, 2:53-56; EX1003, ¶148. This is especially the case as the target vehicle gets closer and takes up more of the illuminated area. EX1003, ¶148.

For the non-contiguous element, Beam also discloses that the glare-reduction process “can be done for any number of vehicles that fall in the headlight beam [area].” EX1005, 2:62-63. This means that when there are two or more separated

vehicle targets, as would be the case in most situations with multiple other vehicles present, Beam’s system would select a cluster of LEDs that are non-contiguous to cover all of the vehicle targets. EX1003, ¶¶149-150. This is illustrated in the combination of the multi-vehicle situation in Beam’s Figure 1 and the disclosed dimmed areas in Beam’s Figures 1C-1D. *Id.*

Claim 41 requires “*image data*”

Claim 40:

determine a list cluster of the LEDs illuminating at least a first portion of a first other vehicle based at least in part on data from one or more of the sensors indicating a first position associated with the first other vehicle...

determine a second, different cluster of the LEDs illuminating at least a second portion of a second other vehicle based at least in part on the data indicating a second position associated with the second other vehicle;

Claim 41:

the data includes
image data

Claim 41 is patentably indistinct from claims 25 and 33, and is disclosed or rendered obvious by Beam for the same reasons. Sections VI.D, VI.H; EX1003, ¶¶180-184. The addition of a second LED cluster and second direction corresponding to a second vehicle (the second claimed “known aimings”) is a simple repetition of claim 33 that is disclosed by Beam. EX1005, 6:27-28; EX1003, ¶¶180-184.

315 Petition, 45

Claim 49 requires “*image data*”

Claim 48:

illuminate a portion of at least one object, indicated by data from at least one of the one or more sensors...

the first area determined based at least in part on the data...

and the first light determined based at least in part on classifying the object based at least in part on the data

Claim 49:

the data includes image data

The majority of claim 49’s elements are patentably indistinct from claims 25, 30, and 33, and are taught or rendered obvious for the same reasons. Sections VI.D, VI.E, VI.H; EX1003, ¶193. Claim 49 differs in two non-patentable ways. EX1003,

¶193. First, it further specifies that the light control “includes a change of at least

one LED of the cluster to a non-emitting state.” Beam discloses selective LED control—including turning the LEDs on and off. *Id.*, ¶193; *see, e.g.*, EX1005, Abstract, 5:33-54, 4:46-48, FIG. 14. Beam “uses appropriate algorithms on the incoming data to determine the locations to be *blanked*” (terminated/turned off). EX1005, Abstract, 5:33-54. This “blanking” means that the microbeams are “attenuated by being either *absorbed* or deflected to an absorbing surface” by spatial light modulator 203. *Id.*, 4:36-41. When LEDs are used as the microbeam source, this means that the LEDs would be turned off as the equivalent to being “absorbed” by the spatial light modulator. EX1003, ¶193.

315 Petition, 46-47

Motion to Exclude: Petitioner's Broad Skill Level

Petitioner:

44. In my opinion, a POSA in the context of the '551 patent as of July 12, 2002 (the earliest possible priority date of the '551 patent)¹ 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.

45. 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.

315 IPR: Ex.1003, ¶¶44-45;

See also 318 IPR: Ex.1003, ¶¶44-45

Kyocera:

I. Dr. Pratt's Testimony

During claim construction, the ALJ adopted Koki's definition of a skilled artisan:

A person of ordinary skill in the art relevant to the Asserted Patents would have either (i) a Master's Degree in mechanical engineering with at least two years of *experience in power nailer design*; (ii) a Bachelor's Degree in mechanical engineering with at least five years of *experience in powered nailer design*; or, (iii) ten or more years of *experience in powered nailer design*. This experience in powered nailer design would include mechanical design, tool design, manufacturing, mechanics of materials, stress analysis, ergonomics, and human factors.

J.A. 1476 (emphases added). That definition requires, at minimum, two years' experience designing power nailers.

Kyocera, 22 F.4th at 1376

See also 315 IPR: MTE, 12 , 318 IPR: MTE, 12

Petitioner's Broad Skill Level

Dr. Jiao's Reply Declaration:

6. I incorporate by reference my opinion of the person of ordinary skill in the art ("POSA") as set forth in paragraphs 44-46 of my First Declaration

Ex.1052, ¶6 incorporating 315 Ex.1003, ¶¶44-46;
See also Ex.1052, ¶6 incorporating 318 Ex.1003, ¶¶44-46

Dr. Jiao's Declaration:

44. In my opinion, a POSA in the context of the '551 patent as of July 12, 2002 (the earliest possible priority date of the '551 patent)¹ 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.

45. 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.

315 Ex.1003, ¶44-45; See also 318 Ex.1003, ¶44-45

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

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).

315 Opp. to MTE, 6-7
318 Opp. to MTE, 6-7

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, 27-28; Ex.2006, ¶¶25-38.)

315 Opp. to MTE, 7
318 Opp. To MTE, 7

Per the '551 Patent, the purpose is to use LED lighting "to effect the provision of lighting that is in concert with the actual illumination needs at a given time... a camera serves as a sensor, and the device uses computer vision technology to recognize... the surroundings... to provide the lighting requirements needed." (Ex.1001, 14:59:66.)

315 Sur Reply, 3
318 Sur Reply, 3

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

Opp. To MTE, 9

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.2006, ¶12; 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.1054, 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.)

Opp. To MTE, 11

Opp. To MTE, 8-9

as well as related areas of image processing, pattern recognition, machine learning, and human-computer interaction.” (Ex.2006, ¶8.) 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.*)

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 ’551 Patent: “a multitude of sensor-based techniques for observing a scene, analyzing a scene, determining varied illumination for a scene, etc. This can include determining what objects are within the scene and what illumination should correlate to those objects.” (Ex.2006, ¶¶25-38, 42.) Dr. Turk’s opinions directly correlate with his expertise.

Dr. Jiao's Contradictory Positions

Dr. Jiao — then (Ex.1003)	Dr. Jiao now — Reply Declaration (Ex.1052) and Deposition Transcript (Ex. 2025)
“lamp 202 and spatial light modulator 203 are replaced by an array of light sources 401... This means that [SLM] 203 is replaced with the circuitry for ‘controlled powering of the LEDs,’ ... this circuitry takes the place of spatial light modulator 203 ...” (§120.)	“A replacement is a combination of a light-emitting element and optical-control elements ... The replacement is combining the two ...” (Ex.2025, 94:21-95:9.)
“control Beam’s directional LEDs ...” (§205 - using a combination where the SLM was intentionally removed.) “Beam’s LEDs are therefore	“an SLM ... provides the benefit of having directional control over the light emitted from the LEDs, instead of only having control of the brightness of that light.” (§53.)
controllable in direction, pattern, intensity, etc.” (§72.)	“A POSA would have understood the emitter element, without optical elements, cannot be directional ...” (Ex.2025, 100:5-7.)
“Beam uses the term ‘microbeam,’ as light emitted from a ‘microbeam source,’ which includes ... LEDs.” (§71.)	“A microbeam and microbeam source, a POSA would understand ... these are two things ... either one is hardware, another one's result of hardware or you can alternatively say that's the same thing.” (Ex.2025, 96:21-97:9.)

Dr. Jiao's testimony – reduced weight

Moreover, Dr. Jiao was repeatedly unable to explain how the theoretical POSA perspective differed from his own; impermissibly commingling the two and calling into question whether expert knowledge formed the basis for his obviousness analyses. (Ex.2025, 13:19-23:18.) Dr. Jiao continually referred to himself as “a POSA” (*Id.*, 14:6, 14:19, 16:4) and was unable to explain any distinction he made between POSA and expert. (*Id.*, 14:11-15, 15:21-16:14, 17:1-8.)

The law clearly contrasts a POSA with one of “expert skill” and establishes that it improper to “determine the challenged claims’ patentability from an expert’s perspective rather than the POSA’s perspective.” *McCoy v. Heal Systems, LLC*, 850 Fed. Appx. 785, 788 (Fed. Cir. 2021).

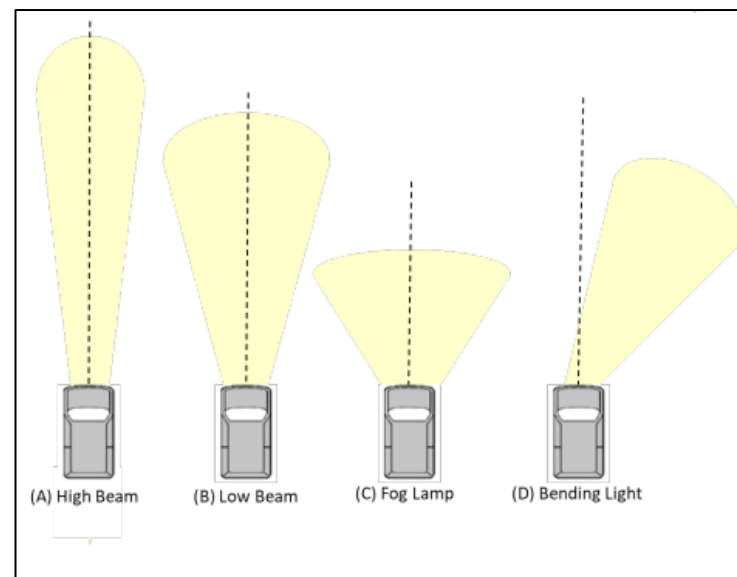
Karlsson

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.

Karlsson Ex.1010, Abstract

174. The left-most figure shows a schematic of a high-beam pattern, which is long with a narrower angle of beam spread. The figure next to that shows a low beam pattern—still relatively long and wider spread. The third-from-left figure illustrates a fog lamp beam pattern—low and wider still, ideal to increase short-range visibility and safety. Finally, the right-most figure 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. EX1003, ¶¶335, 337; EX1012, 6:40-44, 3:24-47, 3:52-62. I note that Dr.

315 Ex.1052, ¶¶173-174; See also 318 Ex.1052, ¶¶161-162



315 Ex.1052, ¶157