

PATENT OWNER- SPERO'S DEMONSTRATIVES

*VOLKSWAGEN GROUP OF AMERICA, INC., & PORSCHE CARS
NORTH AMERICA, INC., V. YECHEZKAL EVAN SPERO*

IPR2023-00197 AND IPR2023-01231 (JOINED)

IPR2023-00328 AND IPR2023-01320 (JOINED)

IPR2023-00335 AND IPR2023-01321 (JOINED)

U.S. PATENT NO. 10,894,503

CONSOLIDATED ORAL HEARING APRIL 16, 2024

Overview

- 1) Lack of Particularity
- 2) Incomplete proofs - claims 60-62 and 64 (197 IPR)
- 3) Missing limitations
 - A) aimed light sources
 - B) determination limitations
- 4) Incompatible proofs
 - A) Beam segmentation
 - B) Curve Illumination - claims 21-23 and 60-62
- 5) Motivation to Combine Deficiencies
- 6) Dependent Claims
- 7) Petitioner's Motion to Exclude Lacks Merit

197 IPR

Lack of Particularity

Impact of "additionally, alternatively and either" styled arguments

1. 197 IPR presents six grounds to challenge 12 claims, but includes at least 41 sub-grounds
2. 328 IPR presents two grounds to challenge 17 claims, but includes at least 61 sub-grounds
3. 335 IPR presents two grounds to challenge 41 claims, but includes at least 47 sub-grounds
4. Petitioner's alternative arguments created at least 149 discrete sub-grounds for the '503 Patent

Petitioner has no explanation for the 40+ sub-grounds advanced in 197 IPR

Petition - Alternative, Interconnected Hardware and/or Software arguments

For a single claim element (“aimed sources” – 20.2), Petitioner advances multiple different positions— Beam’s LEDs+SLM are directional (a new position), Beam+Thominet is directional (citing both software and hardware arguments), Karlsson’s “sources” “and/or” those sources with SLMs are “independently aimed,” or Karlsson+Harbers is directional based on cited software and/or hardware arguments about Harbers. (Reply, 6-8.) Given the interconnected argument style, Petitioner’s lack of particularity creates the risk of inconsistent applications across different limitations.

197 Sur Reply, 6-7

Problems Exacerbated on Reply:

On Reply, Petitioner asserts that “there are only two sets of grounds in the Petition ... Beam-Thominet, and ... Karlsson-Harbers” (Reply, 5), ignoring “Beam alone” or “Karlsson alone,” as well as the myriad of individual “additional or alternative” combinations incorporated within the base “sets.” **197 Sur Reply, 6**

Petitioner’s generalized arguments fail to tie many of its reply arguments to a particular combination of hardware and software. Generic statements referencing “Beam-Thominet” thus continue to: 1) materially prejudice PO’s ability to respond effectively; and 2) impose a burden on PO and the Board to “figure out” how the generalized argument applies to *each* possible combination of “Beam-Thominet.” (See, Reply 12-13, where the Beam-Thominet conclusion that comes at the end of an argument about Beam alone.) **197 Sur Reply, 7**

Statute, CTPG and Caselaw

35 U.S.C. 312

A Petition filed under section 311 may be considered only if
(3) The petition identifies, in writing and with particularity, **the grounds on which the challenge to each claim** is based

CTPG, pg. 39

Although parties are given wide latitude in how they present their cases, the Board's experience is that **the presentation of an overwhelming number of issues tends to detract from the argument being presented, and can otherwise cause meritorious issues to be missed or discounted.** Thus, parties **should avoid submitting a repository of all the information that a judge could possibly consider**, and instead focus on concise, well-organized, easy-to-follow arguments supported by readily identifiable evidence of record.

Adaptics Ltd., IPR2018-10596, Paper 20, Designated Informative

challenges is unpatentable.” *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016) (emphasis added) (citing 35 U.S.C. § 312(a)(3)); *see also Intelligent Bio-Sys., Inc. v. Illumina Cambridge Ltd.*, 821 F.3d 1359, 1369 (Fed. Cir. 2016) (“**It is of the utmost importance that petitioners in the IPR proceedings adhere to the requirement that the initial petition identify ‘with particularity’ the ‘evidence that supports the grounds for the challenge to each claim.’**” (quoting 35 U.S.C. § 312(a)(3))).

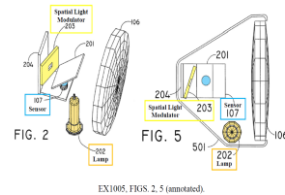
Adaptics, 16

The statutory requirement for particularity in a petition for IPR **takes on heightened importance when considered in conjunction with SAS’s “all-or-nothing” approach.** Because the Board’s practice, in light of *SAS*, is to institute on all grounds asserted in a petition, the Board may consider whether a lack of particularity as to one or more of the asserted grounds justifies denial of an entire petition. For example, where a petition contains voluminous or excessive grounds, Office guidance indicates “[t]he panel will evaluate the challenges and determine whether, in the interests of efficient administration of the Office and integrity of the patent system (*see* 35 USC § 316(b)), the entire petition should be denied under 35 USC *Adaptics*, 17

Beam-Thominet

Lamp + SLM 1A

2, 4, Abstract, 8:4-17. Each microbeam is a directional “source,” having its own independent *angular* position (angle/aiming), that combines to form the headlamp beam; so Beam’s lamp 202 and SLM 203 (see Figure 2) form at least three directional light sources having different angles/aimings. *Id.*, 4:26-59, 5:3-21, FIGS.

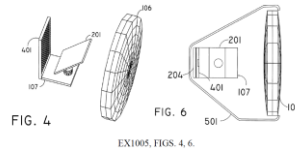


EX1005, FIGS. 2, 5 (annotated).

197 Petition, 23-24

LED 1B

Additionally, Beam discloses an array of individually controlled light sources 401 (e.g., LEDs, see Figure 4) having the same functionality as lamp 202 and SLM 203. EX1005, 3:61-64, 5:3-16, FIGS. 4, 6, 8:4-17. Each light source of the array has its own independent *angular* position (angle/aiming), that combines to form the headlamp beam; so Beam’s array of light sources 401 form at least three directional light sources having different angles/aimings. *Id.*, 3:61-64, 4:26-59, 5:3-16, FIGS. 2,

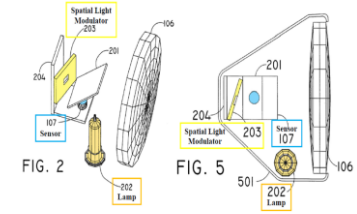


EX1005, FIGS. 4, 6.

197 Petition, 24

Lamp + SLM + Thominet Software 1C

First, including an additional control technique (software implementation) for Beam—Thominet’s *known technique* of using multiple directional beam regions for different functions—would have added more control methods for different functions to Beam’s visibility for different driving situations, thereby increasing safety. EX1003, ¶¶126, 155, 225. Beam discloses “[t]he *angular* position” of each microbeam can be set by controller 108, which commands SLM 203 in illuminator 109, to reduce glare. EX1005, 4:26-59, 5:3-21, FIGS. 1-2, 5, Abstract, 8:4-17;

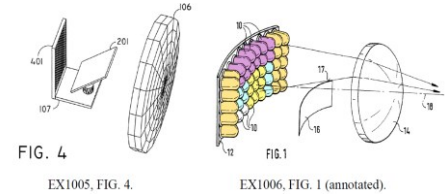


EX1005, FIGS. 2, 5 (annotated).

197 Petition, 26-27

Thominet LEDs 1D

Second, additionally or alternatively, a POSA would have sought to incorporate *known components* (hardware implementation) of Thominet’s semiconductor light sources 10 on curved surface 12 (with differently angled/aimed semiconductor light sources relative to the vehicle, see EX1006, ¶¶17-20, 23-26, FIGS. 1-2, 5-7) into Beam’s system (with flat array of light sources 401). EX1003,



EX1005, FIG. 4.

EX1006, FIG. 1 (annotated).

197 Petition, 30-31

Curving Beam LEDs 1E

Like the software implementation, this hardware combination—Beam’s array of light sources 401 and Thominet’s differently angled/aimed semiconductor sources 10 on curved surface 12—would have provided Beam’s system with different spatial distributions for different driving situations, as in Thominet, thereby improving driver safety. EX1003, ¶¶138, 167, 237. This would have been merely combining prior-art elements or a simple substitution of one known element for another (Beam’s array of light sources 401 on a flat surface and Thominet’s semiconductor sources 10 on a curved surface 12) according to known methods (disclosed in Beam and Thominet) to yield predictable results (improved visibility and safety). *Id.*; KSR, 550 U.S. at 415-418.

A POSA would have had a reasonable expectation of success combining Beam and Thominet, for example, by simply modifying the flat surface of Beam’s array of light sources 401 with Thominet’s curved surface 12 to provide multiple

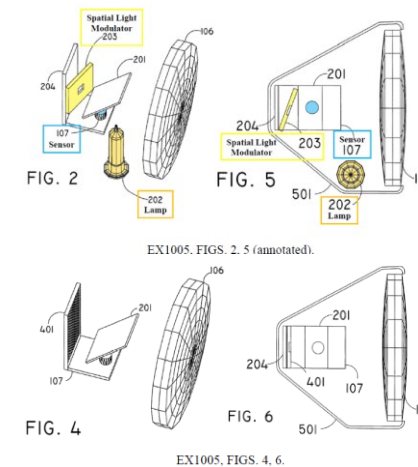
197 Petition, 32

Independent Claim 20.2

[20.2] each headlamp including at least three directional light sources aimed at different angles relative to the vehicle,
197 Petition, Appendix A

Absent Petitioner's contrived construction of *light source*, the fundamental flaw in Grounds 1A-1B is fully exposed: neither embodiment has the claimed *at least three directional light sources*, since the source in Fig. 2 is just a single directional lamp and the sources in Fig.4 are in a planar array. (Pet. at 14, 24; Ex.2006, ¶123.)
197 POR, 32
combination) (*Id.*, 26-27; Ex.2006, ¶132.) Thus, in Ground 1C as in Ground 1A because the Figure 2 SLM embodiment includes a single light source 202, it fails to satisfy the *three directional light source* limitation in all claims. (Ex.2006, ¶132.)
197 POR, 35-36

As discussed, Beam discloses [20.2]. *Supra* Section VI; EX1003, ¶¶146-149; EX1005, 4:26-59, 5:3-21, 5:61-63, 8:4-17, FIGS. 2, 4-6.



197 Petition, 34-35

been motivated to combine Thominet with Beam with a reasonable expectation of success. *Supra* Section VI.A; EX1003, ¶¶152-170.

Thominet's headlights include directional, independently controllable semiconductor light sources 10 (e.g., LEDs) arranged on curved surface 12 to provide beam regions 22, 24, 26, 28 with different angles/aimings for different functions. EX1006, ¶¶17-18, 21-26, FIGS. 1-2; EX1003, ¶151. For example,

197 Petition, 35

Independent Claim 59.2

3. [59.2]

[59.2]/[20.2] are patentably indistinct. *Supra* Section VI.B.3; EX1003, ¶215.

Thus, Beam, or combined with Thominet, discloses [59.2]. EX1003, ¶¶216-240.

197 Petition, 56

Dependent Claims 25/64

25. The system of claim 20, wherein at least one of the one or more headlamps further includes at least one of reflectors, refractors, or lenses usable to alter emitted light from at least one of the light sources.

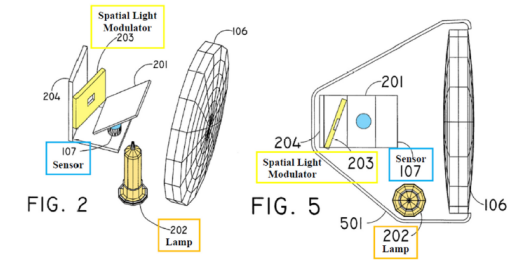
197 Petition, Appendix A

reasons: 1) as explained in Grounds 1A-1E of Section VI.A and contrary to Petitioner's assertions, none of the LED combinations include an SLM; and 2)

197 POR, 54

Beam discloses "a spatial light modulator...digital mirror devices" and "an optical system 106" (e.g., a bi-convex lens). EX1005, 8:4-12, FIGS. 2, 5, 1:63-65 ("a reflector or lens"), 4:10-59 ("reflected by a beamsplitter 201"), 5:17-21; EX1003, ¶¶199-201.

197 Petition, 50-51



EX1005, FIGS. 2, 5 (annotated).

64. The system of claim 59, wherein at least one of the one or more headlamps further includes at least one of reflectors, refractors, or lenses usable to alter the light emitted from at least one of the light sources as part of the instructed adjustment.

197 Petition, Appendix A

D. Claim 64

Requiring the reflector, refractor or lenses to be usable as part of the instructed adjustment, means there is some active utilization of at least one of those objects when an adjustment is instructed. The omitted element is material;

197 POR, 27

Claims 64 and 25 are patentably indistinct. *Supra* Section VI.D; EX1003,

¶¶293-295.

197 Petition, 64

Dependent Claims 21-23

3A	Beam_Lamp+SLM	Thominet Software		Map-Data	Means 2	
3B	Beam_Control		Thominet LEDs	Map-Data	Means 2	
3C	Beam_LEDs		Thominet Curve	Map-Data	Means 2	
3D	Beam_Lamp+SLM	Thominet Software		Map-Data		Means 3
3E	Beam_Control		Thominet LEDs	Map-Data		Means 3
3F	Beam_LEDs		Thominet Curve	Map-Data		Means 3
3G	Beam_Lamp+SLM	Thominet Software		Map-Data	Means 2	Means 3
3H	Beam_Control		Thominet LEDs	Map-Data	Means 2	Means 3
3I	Beam_LEDs		Thominet Curve	Map-Data	Means 2	Means 3

197 POR, 20

further motivated to modify Beam-Thominet to adjust light based on map data

197 Petition, 64

Combined with all grounds of Beam-Thominet

First, including an additional data source for Beam-Thominet's controller—

Kobayashi's *known technique* of using map data including road curvature—would

197 Petition, 65

"And/Or" Creates Three Possibilities

needed. *Second*, a POSA would have easily incorporated *known components* of

Kobayashi's road profile calculating means 2 and/or vehicle advancing direction

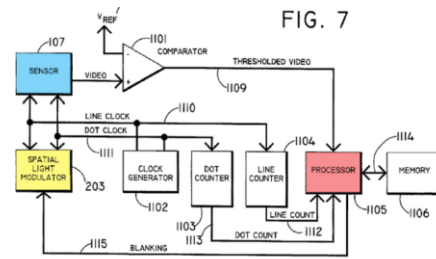
prediction means 3 (including GPS navigation device 29, *see* EX1008, Abstract,

197 Petition, 65

Claims 21-23/60-62

To summarize, Petitioner previously repeatedly contended that Beam provides maximum illumination (Section VIII, *supra*), fails to show a compelling reason to “break” Beam by segmenting that illumination (*Id.*), fails to demonstrate that SLMs are not binary devices used to control intensity only (Section VII.A.3, *supra*), fails to use SLMs in combination with LEDs (Section VII.B.2, *supra*), and

197 Sur-Reply, 22



EX1005, FIG. 7 (annotated).

197 Petition, 71, 74

6:24-27); *see also*; EX1003, ¶¶303-317; EX1051, ¶¶124-125. Thus, Beam’s headlights change direction of microbeams to form beam patterns. EX1051, ¶¶125-126. And a POSA would have been motivated to modify Beam-Thominet to adjust the directional light sources to increase illumination of a road curvature (e.g.,

197 Reply, 26

B. Claim 60

Claims 60 and 21 are patentably indistinct. *Supra* Section VII.B; EX1003, ¶¶326-327.

C. Claims 61/62⁹

Claims 61 and 22 are patentably indistinct. *Supra* Section VIII.C; EX1003, ¶¶328-331.

⁹ Claims 61-62 are identical. EX1003, ¶328.

197 Petition, 76 FN 9

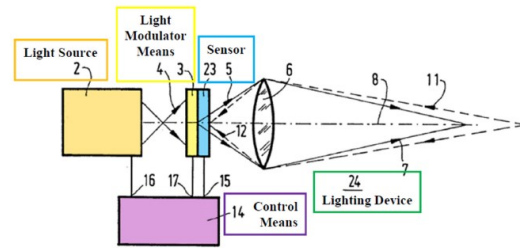
Karlsson-Harbers

LEDS 5A or LEDS + Mod 5B

1. “directional light sources” [20.2]/[59.2]

Karlsson discloses “spotlight beams 34 can be...a grid of separate light sources, such as LEDs...controlled either individually or in groups...[and] may also be made up of...light modulator means” and “light modulator means 3

197 Petition, 77



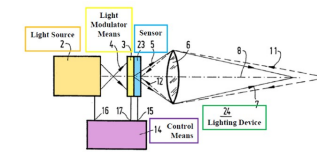
EX1010, FIG. 3 (annotated).

be made up of...light modulator means” and “light modulator means 3 advantageously can be switched to...given directions.” EX1010, 11:25-28, 14:1-9, FIGS. 3, 6, 14; EX1003, ¶333. Each spotlight beam is a directional “source,” having its own independent direction (angle/aiming), that combines to form the headlamp

197 Petition, 77

LEDS + Mod + Harbers SW 5C

First, including an additional control technique (software implementation) for Karlsson—Harbers’s known technique of using multiple directional beam segments for different functions—would have added control methods for different functions to Having multiple directional beam segments with different angles/aimings as in Harbers, implemented with Karlsson’s control means 14/spotlight beams 34 (including light modulator means 3), would have provided Karlsson’s system with



EX1010, FIG. 3 (annotated).

197 Petition, 81, 84

Karl Ctrl (Mod) + Harbers SW + Harbers LEDS 5D

Second, additionally or alternatively, a POSA would have sought to incorporate known components (hardware implementation) of Harbers’s opto-electronic elements 11-14 on a “curved substrate” (with differently angled/aimed opto-electronic elements 11-14 relative to the vehicle, see EX1011, 5:14-26, 6:1-7, 6:27-7:32, FIGS. 1B-2) into Karlsson’s system (with lighting means 2, 3). EX1003.

197 Petition, 85

Curving Karl LEDS+ Mod + Harb SW 5F

A POSA would have had a reasonable expectation of success combining Harbers with Karlsson, for example, by simply modifying the flat substrate of Karlsson’s lighting means 2, 3 with Harbers’s curved substrate to provide multiple light sources with different angles/aimings relative to the vehicle for different

197 Petition, 87

Karl Ctrl (Mod) + Harbers LEDS 5E

Second, additionally or alternatively, a POSA would have sought to incorporate known components (hardware implementation) of Harbers’s opto-electronic elements 11-14 on a “curved substrate” (with differently angled/aimed opto-electronic elements 11-14 relative to the vehicle, see EX1011, 5:14-26, 6:1-7, 6:27-7:32, FIGS. 1B-2) into Karlsson’s system (with lighting means 2, 3). EX1003.

197 Petition, 85

Curving Karl LEDS + Mod 5G

Second, additionally or alternatively, a POSA would have sought to incorporate known components (hardware implementation) of Harbers’s opto-

197 Petition, 85

Independent Claim 20.2

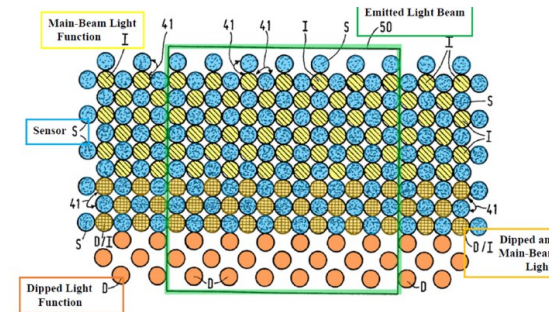
[20.2] each headlamp including at least three directional light sources aimed at different angles relative to the vehicle,
197 Petition, Appendix A

First, Petitioner deletes words to equate “beams 34” to “being” light sources: “Karlsson discloses ‘spotlight beams 34 can be...a grid of separate light sources, such as LEDs...controlled either individually or in groups.’” (Pet. at 77; Ex. 2006, ¶216.) What the section actually says is “beams 34 can be obtained, for example, by using a light source 2, which is a grid of separate light sources.” Karlsson clearly contemplates the plain meaning of the word “source”—i.e., the emitter that produces the light. (Ex. 2006, ¶216.) 197 POR, 66

Petitioner immediately omits essential context again, now to create new capabilities for the modulator: “light modulator means 3 advantageously can be switched to . . . given directions.” (Pet. at 77.) As the Board concluded, “Petitioner’s argument mischaracterizes the quoted language, using ellipses to flip the meaning.” (DI at 14.) Read in context, the quoted language is referring to the light modulator means *detecting* light *from* different directions to control intensity, not projecting light in different directions. (Ex.2006, ¶217.) Absent these disingenuous quotations, Petitioner fails to establish that Karlsson discloses [at least three] *different light sources aimed at different angles*” or *having different aimings* per claim 59. (*Id.*) 197 POR, 66

3. [20.2]/[59.2]

As discussed, Karlsson discloses [20.2]/[59.2]. *Supra* Section X; EX1003,



EX1010, FIG. 14 (annotated).

197 Petition, 88, 90

Independent Claim 20.2

[20.2] each headlamp including at least three directional light sources aimed at different angles relative to the vehicle,
197 Petition, Appendix A

alone--curved substrate and LEDs-- is lacking. ((Ex.2006, ¶206.) Further, the use of Harbers' colored array combined with Karlsson's controls creates a color-shifting problem because Karlsson will not know how or when to use colored LEDs, and will instead use them unpredictably in its own strategies, which are not designed to even generally accommodate color — all of which Petitioner fails to address. (*Id.*)

197 POR, 62-63

C. Petitioner ignores the color-shift issues by pretending that colored LEDs are not actually colored.

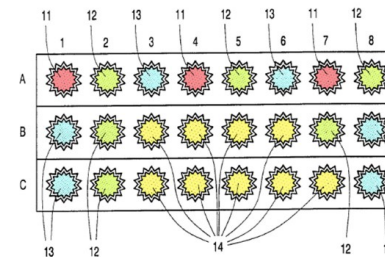
Petitioner glosses over the issues of color-shift that occur through their art combination, by maintaining an explanation about the *whole* lamp beam, that overlooks how that beam would be affected by termination of different color elements that make up that beam. Petitioner seems to not understand that Harbers

197 Sur Reply, 24

POSA would have been motivated to combine Harbers with Karlsson with a reasonable expectation of success. *Supra* Section X.A; EX1003, ¶¶370, 372-389.

Harbers discloses an array of opto-electronic elements 11-14 on a curved substrate that emits light beam segments 6-6'-6"-6"', 7-7'-7"-7"' with different angles/aimings relative to longitudinal direction 9 for different functions. EX1011.

197 Petition, 90



EX1011, FIG. 2 (annotated).

197 Petition, 90

In the example shown in Fig. 2, red LEDs are indicated by reference numeral 11, green LEDs by reference numeral 12, blue LEDs by reference numeral 13, and yellow or white LEDs by reference numeral 14. By ordering the LEDs in the manner indicated in Fig. 2,
30 Ex.1011, 8:28-30

Independent Claim 20.2

[20.2] each headlamp including at least three directional light sources aimed at different angles relative to the vehicle,
197 Petition, Appendix A

3. Grounds 5C-5D/5F Are Unmotivated Combinations Due to the Unaddressed Issues Arising From Conflicting Control Strategies

Petitioner never explains how Karlsson's selective dimming and Harbers particular automatic controls would contemporaneously function in situations where the two strategies required conflicting control. For example, Harbers' control under "different driving situations" may try to widen a beam (due to a slowing vehicle) that Karlsson is controlling as in Petitioner's annotated Fig. 14. (Pet., 81, 101.) (Ex.2006, ¶207.) At that moment, Harbers would be trying to place light where Karlsson is intentionally removing it, as well as possibly trying to dim forward illumination in the central segment of Fig. 14 that Karlsson is attempting to utilize at full output. (Pet. at 101.) Petitioner never recognizes these conflicts nor resolves them, and these indicate the unsuitability of combining Harbers and

197 POR, 63

POSA would have been motivated to combine Harbers with Karlsson with a reasonable expectation of success. *Supra* Section X.A; EX1003, ¶¶370, 372-389.

Harbers discloses an array of opto-electronic elements 11-14 on a curved substrate that emits light beam segments 6'-6"-6"', 7'-7"-7"' with different angles/aimings relative to longitudinal direction 9 for different functions. EX1011,

197 Petition, 90

- 5C - Karlsson_LEDs+Modulator + Harbers Control
- 5D - Karlsson_Control + Harbers Control + Harbers_Array
- 5E - Karlsson_Control+Harbers_Array
- 5F - Karlsson_LEDs+Modulator + Harbers Control + Harbers_Curve

197 POR, 62

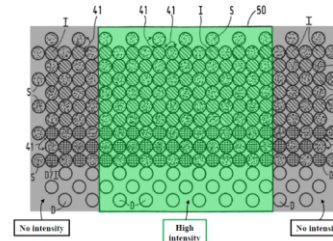
Independent Claim 20 v. Dependent Claims 21-23

Further, Petitioner's explanation of how Karlsson functions is thus: "the processor ... determines ... an area *to be suppressed* ..." (Petition, 99). For there to be suppression, there needs to be emission. (*Id.*) That comports with Petitioner's annotated Fig. 14. (*Id.*, 100.) Put another way – if the "suppressed" LEDs were not already providing illumination (i.e., the full array being in use), then there would be nothing to "suppress." (*Id.*)

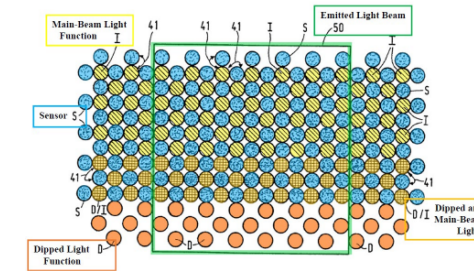
Moreover, Petitioner states — "Karlsson's processor determines where light will *not* be suppressed – a second subsection of the field of view (non-shaded area of *high intensity*)." (*Id.*, 101.) Thus, the "base" state of non-suppressed light is "high intensity" by Petitioner's own admission. Further, this proves that Petitioner originally contemplated Karlsson as utilizing all LEDs at high intensity for "normal" operation before glare control was applied.

197 Sur Reply, 23-24

As discussed, Karlsson discloses determining "a first subsection including a detected vehicle" (shaded area of *no intensity*). *Supra* Section X.B.10; EX1003, ¶¶407-409. Also, Karlsson's processor determines where light will *not* be suppressed—a second subsection of the field-of-view (non-shaded area of *high intensity*). EX1010, 5:16-23, 9:9-17, 12:19-24, FIGS. 14-15; EX1003, ¶408. Thus, Karlsson discloses determining "a second subsection not including the detected vehicle" (non-shaded area). EX1003, ¶411.



197 Petition, 101



EX1010, FIG. 14 (annotated).

Window 50 is a subset of the LEDs available. EX1052, ¶¶172-173; EX1051, ¶156; EX1010, 19:29-34; EX1003, ¶¶90-92; Pet., 13-14. And even Dr. Turk agreed that Karlsson's beam "can shift in the plane of the drawings from the left to the right and from the top to the bottom, if desired, and vice versa, and which may vary as regards its shape and dimension in dependence on the desired pattern and direction of the beam." EX1010, 19:29-34; EX1054, 132:15-25, 133:6-7, 134:2-7, 134:13-15.

Nothing suggests to a POSA that Karlsson operates with all of its LEDs active except to implement glare control. EX1010, 19:29-34; Pet., 18-20, 81; EX1003, ¶346; EX1051, ¶¶157-160. Rather, Karlsson's optimally adapted system with individually and group controllable LEDs produces beam patterns based on

197 Reply, 16

IX. KARLSSON-HARBERS-GOTOU RENDERS OBVIOUS THE ROAD CURVATURE DEPENDENT CLAIMS 21-23 AND 60-62.

A. Karlsson's spotlight beams are directional.

PO/Dr. Turk incorrectly allege that Karlsson's headlight "lack[s] directional control." POR, 73; EX2006, ¶237; EX1051, ¶¶170-172.

As explained in §VI.B.1, Karlsson's beam 50 "shift[s] in the plane of the drawings from the left to the right and from the top to the bottom, if desired, and vice versa, which may vary as regards its shape and dimension in dependence on the desired pattern and direction of the beam." EX1010, 19:29-34; EX1051, ¶¶173-

197 Reply, 26

335 Petition Beam-Thominet/Karlsson-Harbers

Ground	References
1A	Beam Lamp+SLM
1B	Beam LEDs
1C	Beam Lamp+SLM + Thominet Software (SW)
1D	Beam SW + Thominet LEDs (HW)
1E	Beam LEDs + Thominet Curved Substrate
7A	Karlsson LEDs + Mod
7B	Karlsson LEDs
7C	Karlsson LEDs+Mod+ Harbers SW
7D	Karlsson LEDs + Harbers SW
7E	Karlsson SW + Harbers HW
7F	Karlsson Mod+ Harbers Curved Substrate

335 POR, 22

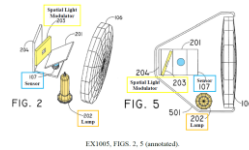
Beam

Lamp + SLM 1A

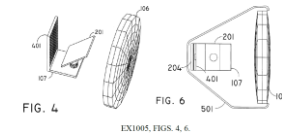
2, 4, Abstract, 7:25-29, 8:4-34. Each microbeam is a directional “cluster” or “source,” having its own independent *angular* position, that combines to form the headlamp beam; so Beam’s lamp 202 and SLM 203 (see Figure 2) form at least two light clusters/sources to provide illumination in desired subsections. *Id.*, 7:25-29,

LEDs

Beam’s LED array has the same functionality as lamp 202 and SLM 203. EX1005, 3:62-64, 5:3-16, FIGS. 4, 6, 8:4-17. So, Beam’s LED array also includes light clusters/sources. *Id.*, 3:62-64, 4:26-5:16, FIGS. 2, 4-6, 8:4-17; EX1003, ¶¶80, 117.



335 Petition, 8-9



335 Petition, 9-10

3. Beam’s lamp/LED/SLM controls the angular position of each microbeam according to achieve different headlight beam patterns.

Beam’s SLM adjusts the angular position of its microbeams, contrary to PO/Dr. Turk’s position. POR, 43-45, 47-50; EX2006, ¶¶65-66. Indeed, Beam’s SLM controls the microbeams’ angular positions/intensities via command signals. EX1051, ¶¶91-93; EX1005, 4:45-57. Dr. Jiao confirmed that a POSA would have

335 Reply 10

Petitioner argues “Beam’s lamp/LED/SLM” without explaining which elements it relies on. (Reply, 10.) There is no ground where Beam has an LED+SLM (§ VI.A, *supra*) and the organization of microbeams into regions as

335 Sur Reply, 13

Petitioner cites to either or both Beam embodiments throughout the Petition without explaining how or why a POSA would have combined these embodiments. The Petition never even contends that a POSA would have combined these embodiments. For example, for claim 1.5, Petitioner relies solely on Beam’s lamp-SLM embodiment for satisfying the ‘*electronic control circuitry*’ configured to ‘*independently operate the light clusters*’ claim limitation. (Petition, 22-23.) Beam’s controller/processor sends control signals (blanking/non-blanking) to illuminator (SLM 203) to control microbeams.’(Petition, 23.) However, for claim 18, Petitioner relies solely on Beam’s LED array embodiment for teaching a “*laser diode*.” (Petition, 52-53; Ex.2006, ¶160.) In a related proceeding, the Board

335 POR, 44

Unexpanded Combinations

Claim 5 - ... at least one of the light-clusters includes: a plurality of light sources, wherein one or more of the plurality of light sources comprises at least one of multiple light-emitting-diodes (LEDs) or organic light-emitting-diodes, each light source having a spectral power distribution characteristic and wherein the control circuitry is configured to alter the overall light-cluster spectral power distribution to illuminate at least one of the at least two sub-sections of the field-of-view with a different color of light from another of the at least two sub-sections.

b. Claim 5 – The Beam+Thominet Combinations do not teach “illuminat[ing] . . . with a different color of light”

Petitioner relies on Beam’s LEDs, Thominet’s semiconductor light sources and disclosure of mixing color in paragraphs 26-29 for satisfying this limitation, without specifying which reference/embodiment it is relying on for each sub-ground. (Petition, 43-44; Ex.2006, ¶142.) 335 POR, 36

(1) Grounds 1A-1B (Beam)

Beam does not disclose that its lamp or LEDs provide multi-color light.

(2) Ground 1C, 1E (Beam+ThominetSW-Substrate)

Since Beam does not teach different color lamps or LEDs, a POSA would have understood that Thominet’s software would not have been able to control Beam’s single color light source to provide “different color of light.” Curving Beam’s substrate would not have changed this. (Ex.2006, ¶144.) 335 POR, 36

(3) Grounds 1D (BeamSW+ThominetHW)

Since Beam does not teach the control of different color LEDs, Beam’s software (running the claimed “control circuitry”) would not be “configured to alter the overall spectral power distribution characteristic” using Thominet’s LEDs to provide “different color of light” between one sub-section and another. (Ex.2006, ¶145.) Even if colored LEDs were included, Beam would, at most, accidentally control them in some situations, but given that this would be entirely

335 POR, 37

F. Claim 5

Beam’s LEDs have the same functionality as lamp 202 and SLM 203.

EX1005, 3:62-64, 5:3-16, FIGS. 2, 4-6, 8:4-17. EX1003, ¶¶223-224.

Thominet’s semiconductor light sources 10 are arranged in different beam regions 22, 24, 26, 28 (clusters) for different situations. EX1006, ¶¶7-8, 17-18, 21-29, FIGS. 1-3; EX1003, ¶225. Thominet’s “different partial regions [22, 24, 26, 28]

Thus, Beam-Thominet’s LEDs each have “a spectral power distribution characteristic” (color) and that Beam-Thominet’s controller provides different colors to different subsections. EX1006, ¶¶2-5, 26-29, FIGS. 1B-2; EX1005, 3:62-64, 5:3-

Supra Section V.A; EX1003, ¶¶121-138, 228-238.

335 Petition, 43-44

2. Beam-Thominet’s headlight system illuminates two sub-sections with a different color (claims 5/45).

EX1003, ¶225. Dr. Jiao explained that a POSA would have sought to incorporate “Thominet’s colored semiconductor light sources 10” into Beam’s system “to automatically provide different colored spatial distributions for improved visibility in different driving situations.” EX1003, ¶¶229-231; Pet., 43-44. Beam-Thominet’s headlight system includes multi-colored LEDs selectively controlled to illuminate

335 Reply 13

Beam-Thominet / Karlsson-Harbers

There are only two sets of grounds here based on: (1) Beam-Thominet, and (2) Karlsson-Harbers, Pet., 3. The Board should confirm its finding of sufficient particularity. DI, 14-15.

335 Reply, 5

First, including an additional control technique (software implementation) for Beam—Thominet's *known technique* of using multiple directional beam regions for different functions—would have added different functions to Beam's system for different situations. EX1003, ¶124. Beam's techniques and system of controlling

335 Petition, 11

Second, a POSA would have sought to incorporate *known components* (hardware implementation) of Thominet's semiconductor light sources 10 on curved surface 12 (arranged in different beam regions 22, 24, 26, 28, see EX1006, ¶¶17-20, 23-26, FIGS. 1-2, 5-7) into Beam (with flat array of light sources 401). EX1003,

335 Petition, 13

Like the software implementation, this hardware combination—Beam's LED array and Thominet's semiconductor sources 10 on curved surface 12 arranged in beam regions 22, 24, 26, 28—would have provided Beam with different spatial distributions for different situations, as in Thominet, thereby improving safety.

335 Petition, 14

Beam and Thominet, for example, by modifying the flat surface of Beam's LED array with Thominet's curved surface 12 to provide multiple light clusters/sources

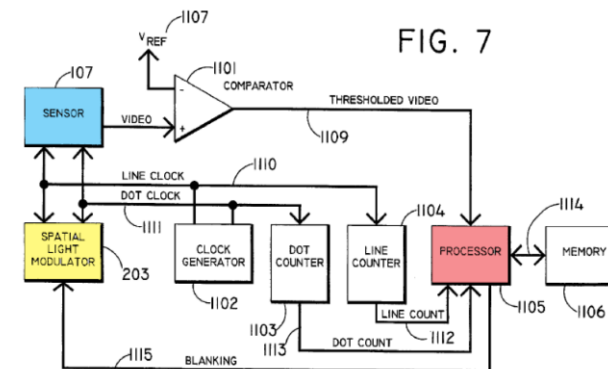
(e.g., beam regions 22, 24, 26, 28) for different functions. EX1003, ¶137. This

335 Petition, 14-15

3. Beam's lamp/LED/SLM controls the angular position of each microbeam according to achieve different headlight beam patterns.

Beam's SLM adjusts the angular position of its microbeams, contrary to PO/Dr. Turk's position. POR, 43-45, 47-50; EX2006, ¶¶65-66. Indeed, Beam's SLM controls the microbeams' angular positions/intensities via command signals. EX1051, ¶¶91-93; EX1005, 4:45-57. Dr. Jiao confirmed that a POSA would have understood to "simply modify[] software instructions in memory of Beam's controller/processor to organize Beam's array of microbeams into multiple beam regions (clusters)" taught by Thominet. EX1003, ¶131; Pet., 29-30.

335 Reply, 10



EX1005, FIG. 7 (annotated).

335 Petition, 32

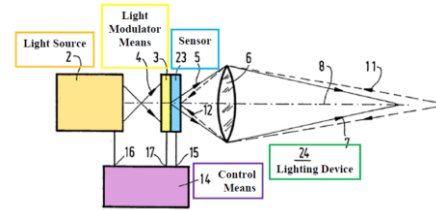
Beam-Thominet and Karlsson-Harbers

There are only two sets of grounds here based on: (1) Beam-Thominet, and (2) Karlsson-Harbers, Pet., 3. The Board should confirm its finding of sufficient particularity. DI, 14-15.

335 Reply, 5

335 Petition, 93

Karlsson's "spotlight beams 34 [are]...a grid of separate light sources, such as LEDs...controlled either *individually* or in *groups*." EX1010, 11:25-28, 14:1-9, FIGS. 3, 6, 14. Spotlight beams may also come from "light modulator means." *Id.*



EX1010, FIG. 3 (annotated).

335 Petition, 94

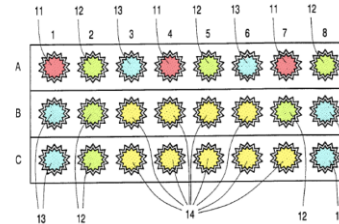
First, including an additional control technique (software implementation) for Karlsson—Harbers's *known technique* of using multiple directional beam segments

335 Petition, 96

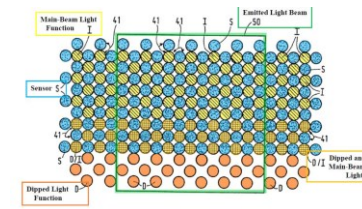
Harbers with Karlsson, for example, by modifying software instructions stored in Karlsson's controller/processor-memory to organize Karlsson's beams into multiple segments (clusters) for different functions. *Id.*, ¶557. This would have been routine

335 Petition, 98

Second, a POSA would have sought to incorporate *known components* (hardware implementation) of Harbers's opto-electronic elements 11-14 on a "curved substrate" (with differently aimed opto-electronic elements 11-14, *see* EX1011, 5:14-26, 6:1-7, 6:27-7:32, FIGS. 1B-2) into Karlsson. *Id.*, ¶559. This, too, would have provided different spatial distributions for different situations. *Id.*, ¶559.



335 Petition, 99-100



335 Petition, 104

Like the software implementation, this hardware combination including Harbers's differently aimed opto-electronic elements on a curved substrate, would have provided Karlsson with different spatial distributions for different situations. EX1003, ¶561. This would have been combining prior-art elements or a simple

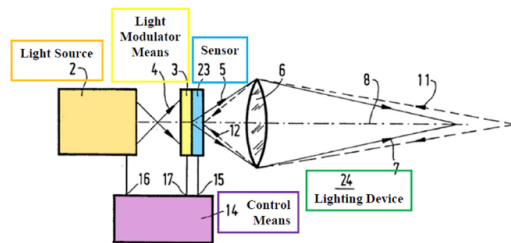
335 Petition, 100

Independent Claim 20 v. Dependent Claims 21-23

Reply². Based solely on the combinations seemingly described in the Petition, Patent Owner identifies at least **forty-one sub-grounds** to address **twelve claims**.

1. “directional light sources” [20.2]/[59.2] 197 POR, 16

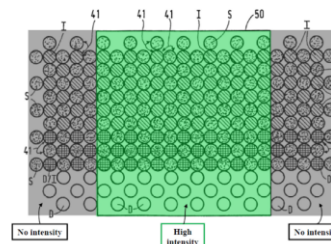
Karlsson discloses “spotlight beams 34 can be...a grid of separate light sources, such as LEDs...controlled either individually or in groups...[and] may also be made up of...light modulator means” and “light modulator means 3 advantageously can be switched to...given directions.” EX1010, 11:25-28, 14:1-9, FIGS. 3, 6, 14; EX1003, ¶333. Each spotlight beam is a directional “source,” having its own independent direction (angle/aiming), that combines to form the headlamp beam, so the combination of Karlsson’s spotlight beams form at least three directional light sources having different angles/aimings. EX1010, 4:25-31, 14:1-15, FIGS. 6, 14; EX1003, ¶333.



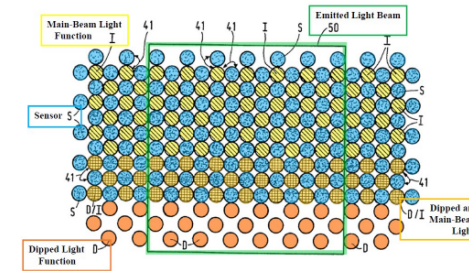
EX1010 FIG 3 (annotated)

197 Petition, 77

As discussed, Karlsson discloses determining “a first subsection including a detected vehicle” (shaded area of no intensity). *Supra* Section X.B.10; EX1003, ¶¶407-409. Also, Karlsson’s processor determines where light will *not* be suppressed—a second subsection of the field-of-view (non-shaded area of high intensity). EX1010, 5:16-23, 9:9-17, 12:19-24, FIGS. 14-15; EX1003, ¶408. Thus, Karlsson discloses determining “a second subsection not including the detected vehicle” (non-shaded area). EX1003, ¶411.



197 Petition, 101



EX1010, FIG. 14 (annotated).

Window 50 is a subset of the LEDs available. EX1052, ¶¶172-173; EX1051, ¶156; EX1010, 19:29-34; EX1003, ¶¶90-92; Pet., 13-14. And even Dr. Turk agreed that Karlsson’s beam “can shift in the plane of the drawings from the left to the right and from the top to the bottom, if desired, and vice versa, and which may vary as regards its shape and dimension in dependence on the desired pattern and direction of the beam.” EX1010, 19:29-34; EX1054, 132:15-25, 133:6-7, 134:2-7, 134:13-15.

Nothing suggests to a POSA that Karlsson operates with all of its LEDs active except to implement glare control. EX1010, 19:29-34; Pet., 18-20, 81; EX1003, ¶346; EX1051, ¶¶157-160. Rather, Karlsson’s optimally adapted system with individually and group controllable LEDs produces beam patterns based on

197 Reply, 16

IX. KARLSSON-HARBERS-GOTOU RENDERS OBVIOUS THE ROAD CURVATURE DEPENDENT CLAIMS 21-23 AND 60-62.

A. Karlsson’s spotlight beams are directional.

PO/Dr. Turk incorrectly allege that Karlsson’s headlight “lack[s] directional control.” POR, 73; EX2006, ¶237; EX1051, ¶¶170-172.

As explained in §VI.B.1, Karlsson’s beam 50 “shift[s] in the plane of the drawings from the left to the right and from the top to the bottom, if desired, and vice versa, which may vary as regards its shape and dimension in dependence on the desired pattern and direction of the beam.” EX1010, 19:29-34; EX1051, ¶¶173-

197 Reply, 26

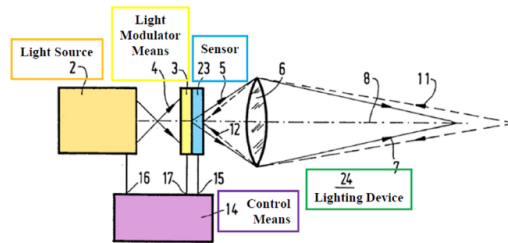
Independent Claim 20 v. Dependent Claims 21-23

Further, in 6A and 6D, there are two controllable systems, the array 2 and modulator 3, and Petitioner fails to explain, let alone with particularity, which

197 POR, 72

1. “directional light sources” [20.2]/[59.2]

Karlsson discloses “spotlight beams 34 can be...a grid of separate light sources, such as LEDs...controlled either individually or in groups...[and] may also be made up of...light modulator means” and “light modulator means 3 advantageously can be switched to...given directions.” EX1010, 11:25-28, 14:1-9, FIGS. 3, 6, 14; EX1003, ¶333. Each spotlight beam is a directional “source,” having its own independent direction (angle/aiming), that combines to form the headlamp beam, so the combination of Karlsson’s spotlight beams form at least three directional light sources having different angles/aimings. EX1010, 4:25-31, 14:1-15, FIGS. 6, 14; EX1003, ¶333.



EX1010 FIG 3 (annotated)

197 Petition, 77

Second, additionally or alternatively, a POSA would have sought to incorporate known components (hardware implementation) of Harbers’s opto-electronic elements 11-14 on a “curved substrate” (with differently angled/aimed opto-electronic elements 11-14 relative to the vehicle, see EX1011, 5:14-26, 6:1-7, 6:27-7:32, FIGS. 1B-2) into Karlsson’s system (with lighting means 2, 3). EX1003,

197 Petition, 85

Like the software implementation, this hardware combination of Karlsson’s lighting means 2, 3 and Harbers’s differently angled/aimed opto-electronic elements 11-14 on a curved substrate, would have provided Karlsson’s system with different spatial distributions for different driving situations, as in Harbers, thereby improving driver safety. EX1003, ¶356. This would have been merely combining prior-art elements or a simple substitution of one known element for another (Karlsson’s lighting means 2, 3 on a flat substrate and Harbers’s opto-electronic elements 11-14

197 Petition, 86

A POSA would have had a reasonable expectation of success combining Harbers with Karlsson, for example, by simply modifying the flat substrate of Karlsson’s lighting means 2, 3 with Harbers’s curved substrate to provide multiple light sources with different angles/aimings relative to the vehicle for different

197 Petition, 87

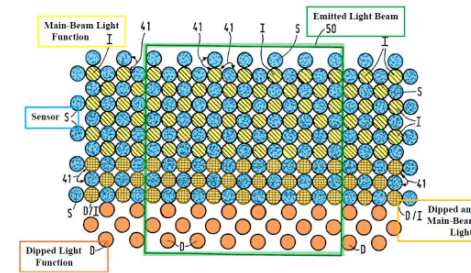
IX. KARLSSON-HARBERS-GOTOU RENDERS OBVIOUS THE ROAD CURVATURE DEPENDENT CLAIMS 21-23 AND 60-62.

A. Karlsson’s spotlight beams are directional.

PO/Dr. Turk incorrectly allege that Karlsson’s headlight “lack[s] directional control.” POR, 73; EX2006, ¶237; EX1051, ¶¶170-172.

As explained in §VI.B.1, Karlsson’s beam 50 “shift[s] in the plane of the drawings from the left to the right and from the top to the bottom, if desired, and vice versa, which may vary as regards its shape and dimension in dependence on the desired pattern and direction of the beam.” EX1010, 19:29-34; EX1051, ¶¶173-

197 Reply, 26



EX1010, FIG. 14 (annotated).

Window 50 is a subset of the LEDs available. EX1052, ¶¶172-173; EX1051, ¶156; EX1010, 19:29-34; EX1003, ¶¶90-92; Pet., 13-14. And even Dr. Turk agreed that Karlsson’s beam “can shift in the plane of the drawings from the left to the right and from the top to the bottom, if desired, and vice versa, and which may vary as regards its shape and dimension in dependence on the desired pattern and direction of the beam.” EX1010, 19:29-34; EX1054, 132:15-25, 133:6-7, 134:2-7, 134:13-15.

Nothing suggests to a POSA that Karlsson operates with all of its LEDs active except to implement glare control. EX1010, 19:29-34; Pet., 18-20, 81; EX1003, ¶346; EX1051, ¶¶157-160. Rather, Karlsson’s optimally adapted system with individually and group controllable LEDs produces beam patterns based on

197 Reply, 18

The Claimed Invention is Directed to an “Adaptive Multi-LED Headlight System” for Spatially Differentiated Light Distribution based on the Detection of a Vehicle in the Field of View

The '503 Patent is directed to “a novel multi-light source approach to the design and construction of solid-state lighting fixtures (vs. solid state lamps), which is termed a ‘Digital Lighting Fixture’, due to the control of individual lighting element ‘digits’ to provide the ‘correct’ lighting solution for the situation at hand.”

Ex.1001, 11:11-16

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, 11:61-67

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, 52:58-53:8

Independent Claim 20 – 197 IPR

one or more headlamps affixed to a vehicle, each headlamp including at least three directional light sources aimed at different angles relative to the vehicle, the light sources configured to have one or more controllable light characteristics, wherein a first light source of the more than one light sources at a first angle is less visually

Aiming
Limitation

process the sensor data to determine, within a field-of-view, at least a first subsection including a detected vehicle and at least a second subsection not including the detected vehicle,

Detected
Vehicle
Limitation

optimal use of the differently aimed directional light sources to maximize vehicle operator visibility in at least the second subsection, while minimizing a disturbing effect, resulting from the illumination output, on the vision of other traffic in at least the first subsection, and

Output
Limitation

direct the control circuitry to adjust the directional light sources to achieve the determined optimal use.

SLMs cannot aim emission(all IPRs)

All digital mirror SLMs in the art are binary control devices as proven by Petitioner's own secondary evidence

197 Sur Reply, 9

The micromirror 2 has one horizontal state and two tilt states. The **two tilt states are utilized for image formation**. In one of the two tilt states, spotlight travels from the micromirror 2 to form an image. For example, while the micromirror 2 takes $+\theta$, spotlight from the micromirror 2 is guided to an image **forming optical path**. While the micromirror 2 takes $-\theta$, spotlight is not needed so that it is guided to an **eliminating optical path**. While the micromirror 2 takes $+\theta$, a valid reflection state (ON state) maintains in which **reflection light is utilized for image formation**. While the micromirror 2 takes $-\theta$, an invalid reflection state (OFF state) maintains in which **reflection light is not utilized for image formation**

...

(Enomoto, Ex.1040, 5:12-26.)

197 Sur Reply, 10-11; *see also* 328 Sur Reply, 18-19;
see also 335 Sur Reply, 12-13

Dr. Jiao cites the Abstract of Ex.1040 as evidence of selectable angular control over emission, when the Abstract quite plainly describes the two-position "light utilized/not-utilized" operation of the SLM. (Ex.1051, ¶135; Ex.1040, Abstract.)

197 Sur Reply, 11

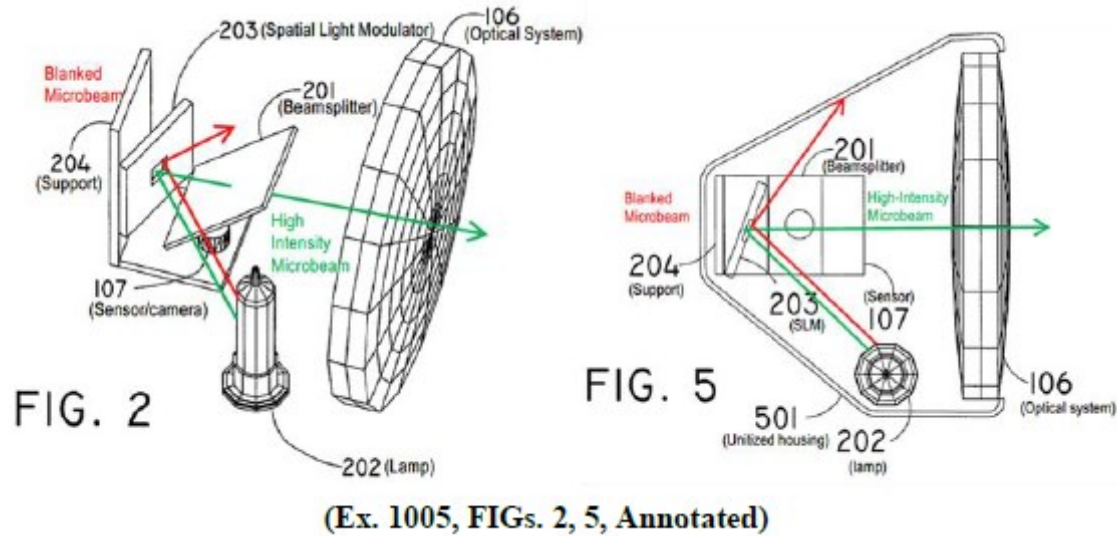
... consistent with Dr. Turk's explanation and cited extrinsic evidence (Ex.2006, ¶¶35, 65-66), these documents support Dr. Turk's testimony and, actually prove the binary function of a DMD — "[T]he mirrors are rotated . . . to one of two stable positions" (Ex.1056, 19) (on/off) and that the binary states are the result of "angular control" to either block or permit light from exiting the system. (Ex.2006, ¶35; *see also* Ex.1040, 5:12-26.)

197 Sur Reply, 10

Petitioner's SLM admissions + New LED + SLM argument

- Even Dr. Jiao's Reply Declaration admits: "these two positions [of the micromirror] determine the direction that light is deflected." (Ex.1051, ¶53 citing to Ex.2022, 2.) Dr. Jiao casts this as "controlling angle[s] [sic]," but Ex.2022 is describing only that one angle is blocking, one angle is emitting, and only two angles exist. (*Id.*, 2.) "[T]he positive (+) state is ... the 'on state' ... the negative (-) state is ... the 'off' state, ... These are the **only** operational states of the micromirror." (*Id.*) **328 Sur Reply, 19; see also 335 Sur Reply, 12-13**
- Dr. Jiao explains that the SLM described in Beam 4:26-59 is a DMD. (Ex.1003, ¶51.) Dr. Jiao provided Enomoto's Figs. 2A-2C as examples of how "angular position" can be controlled by DMDs. (*Id.*, ¶¶51, 162.) **328 Sur Reply, 18; see also 335 Sur Reply, 12-13**
- **Further, Petitioner** even admitted that "the LED array has the same functionality as the Lamp 202 and SLM 203" and further that "a headlamp only formed from LEDs ... could not control the directionality ..." (Petition, 9, 14; Ex.1051, ¶53.) **328 Sur Reply, 19; see also 335 Sur Reply, 15-16**
- On Reply, Petitioner actually argues that LEDs alone are not directional: "In order to be 'directional,' a POSA would have understood that the emitter of the light source is combined with an optical element" e.g., SLM. (Reply, 6; Ex.1051, ¶66.) **197 Sur Reply, 12; see also 335 Sur Reply, 12-13**

Beam's 2 Embodiments

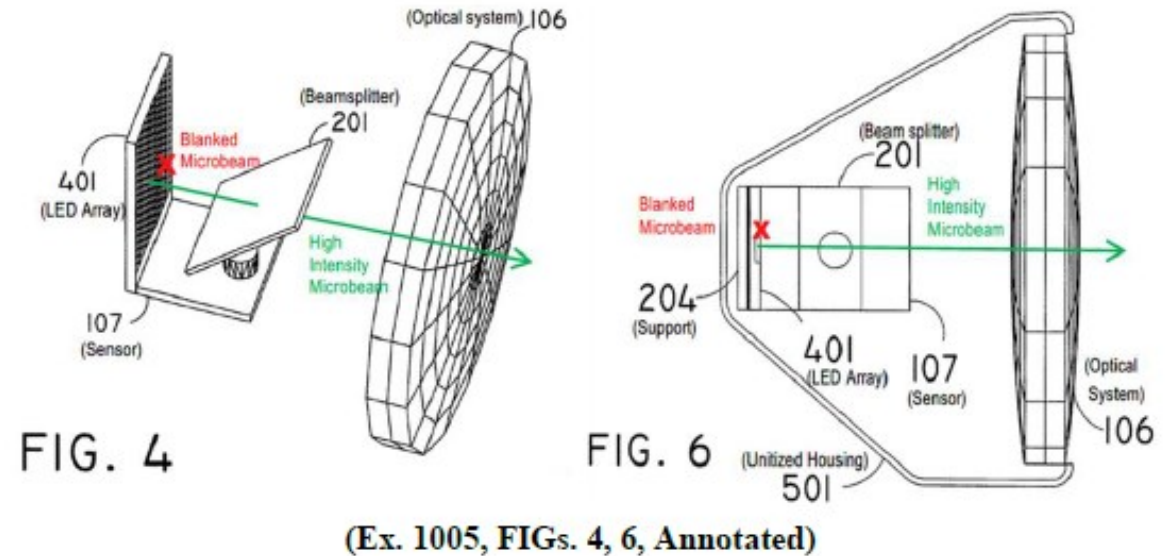


197 POR, 37; Ex.2006, ¶133; see also 335 POR, 49; Ex.2006, ¶176

As the Board correctly concluded, and as Beam literally states, the lamp 202 and SLM 203 in the Figure 2 embodiment is **replaced** in the Figure 4 embodiment with an LED array 401 having LEDs fixed in place — with no ability to provide independent angular positioning. (Ex.2006, ¶124; DI, 11-12.)

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

197 Ex.1005, 5:3-6



Karlsson - *Sensor data* (claim 20 - 197 IPR)

Claim 20

one or more sensors configured to sense information defined as pertinent to determining illumination output from the one or more headlamps and communicating the sensed information to a processor as sensor data;

the processor, in communication with at least the sensors and the control circuitry, configured to:

process the sensor data to determine, within a field-of-view, at least a first subsection including a detected vehicle and at least a second subsection not including the detected vehicle,

determine optimal use of the differently aimed directional light sources to maximize vehicle operator visibility in at least the second subsection, while minimizing a disturbing effect, resulting from the illumination output, on the vision of other traffic in at least the first subsection, and

direct the control circuitry to adjust the directional light sources to achieve the determined optimal use.

Ex.1001, Claim 20

Petition: Karlsson discloses "lighting means 2, 3...controlled by control means 14, such that the incident light 11 on the light-sensitive sensor 9...is processed into an electric control signal...[and] processed by the control means 14 into output signals...to control...light beam 7 having a desired pattern and a desired intensity." EX1010, 9:11-17, FIGS. 3, 14-15, 20:1-3 ("control electronics 41"), 2:7-10, 19:29-33, 20:12-32, 21:36-22:4; EX1003, ¶¶395-398. **197 Petition, 94**

Jiao Decl, Ex.1003:

378. Karlsson's system "selectively adjust[s]...spotlight beam[s] 34, in response to a control signal from sensor means 23...to provide a desired lighting pattern" in "given directions." EX1010, 14:26-30, 11:25-28, FIGS. 3, 6, 14. **197 Ex.1003, ¶378**

400. Karlsson discloses "light-sensitive sensors 9 and 23...determin[e] the direction and the intensity of the detected light 11." EX1010, 12:19-24, FIGS. 3, 14; EX1010, 19:18-21 ("spotlight sensors S"), 5:16-23 ("sensor means...comprises spotlight sensors"), 2:2-4, 9:6-8, 5:28-32. **197 Ex.1003, ¶400**

Jiao Reply Decl, 197 Ex.1051

139. I agree with the Board's finding that Karlsson's headlight includes a processor that processes sensor data to determine, within a field-of-view, a first subsection including a detected vehicle. DI, 20. My First Declaration explained that controller 14 of Karlsson's headlight system receives an input 15 from light sensitive sensor 9 corresponding to detection of incident light 11. EX1010, 9:9-18. Karlsson's sensor 9 detects "light from oncoming traffic as a parameter to which the pattern of the emitted light beam is to be adjusted." EX1010, 5:16-19.

Karlsson's Figure 14 window

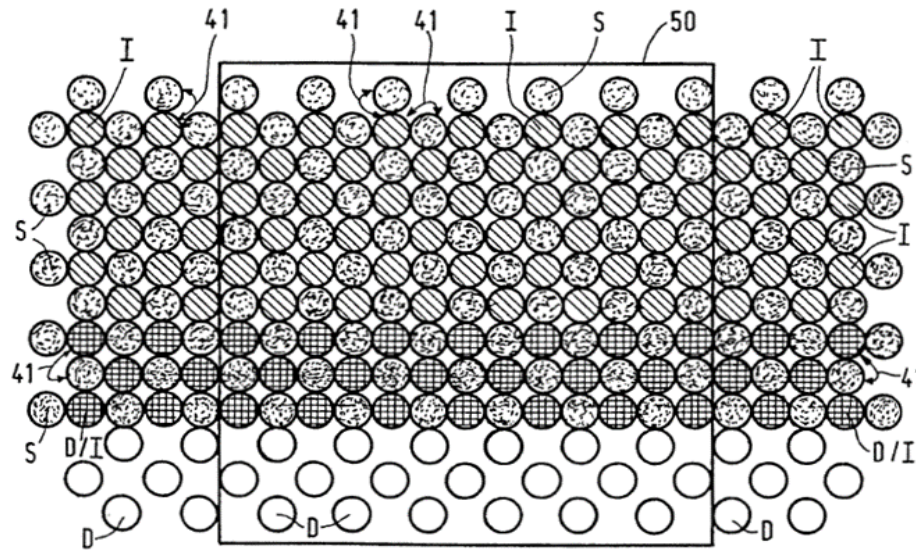


FIG. 14

(Ex.1010, FIG 14)

Referring to Figure 14, "a number of the spotlight sources are grouped in specified levels" where "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." (*Id.*, 19:22-27.) Furthermore, "[t]he double-shaded spotlight sources indicated at D/I are both operative as dipped and main-beam lights." (*Id.*, 19:27-28; Ex. 2001, ¶65.)

197 IPR: POPR, 27-28

Karlsson also fails to satisfy the Detected Vehicle Limitations (all claims/IPRs)

Karlsson similarly only determines the presence of lights and has no way of knowing if those lights relate to a vehicle or any other light source. (Ex.2006, ¶1227.)

197 Sur Reply, 19

Petitioner cites Karlsson's disclosure at 5:16-18 for teaching "distinguishing vehicle lights from ambient lights," however Karlsson is merely teaching that both ambient light and light from traffic can be sensed, not "distinguishing" between them. (Reply, 25.)

197 Sur Reply, 19

And, while vehicle lights may be an example of light to which the system reacts, Karlsson could not distinguish a vehicle light from any other comparably bright detected light source in the scene—a person with a flashlight, highly reflective signs, a bright road sight light, etc. (Ex.2006, ¶1227.)

197 POR, 70

Indeed, Dr. Jiao admits that a simple photodiode—such as the one disclosed in Karlsson — will "have difficulty to detect" pedestrians wear[ing] dark clothes at night, without any reflection of visible light." (Ex.2026, 28:8-13.)

197 Sur Reply, 20

Petitioner's admissions= Karlsson operates at full intensity as a base state

Petitioner presents Fig. 14 as an example of glare reduction and the noted function of Karlsson is to have "high" illumination everywhere in the figure that glare control is not occurring. (Petition, 109.)

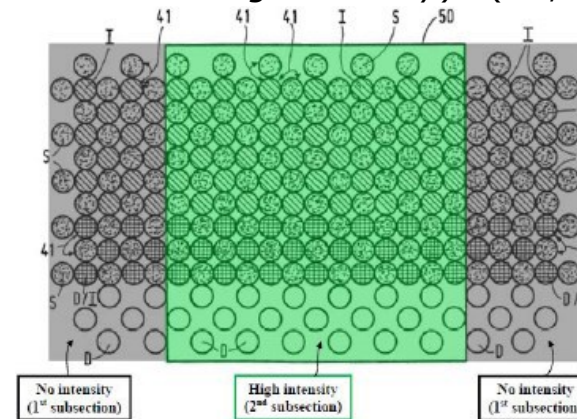
197 Sur Reply, 23

Further, Petitioner's explanation of how Karlsson functions is thus: "the processor ... determines ... an area *to be suppressed* ..." (Petition, 99). For there to be suppression, there needs to be emission. (*Id.*) That comports with Petitioner's annotated Fig. 14. (*Id.*, 100.)

197 Sur Reply, 23-24

Moreover, Petitioner states — "Karlsson's processor determines where light will *not* be suppressed — a second subsection of the field of view (non-shaded area of *high intensity*)."
(*Id.*, 101.)

197 Sur Reply, 24



EX1010, FIG. 14 (annotated).

A Vehicle is Not a Species of the Light Genus

We find these arguments unpersuasive because the claims do not require that the system detect **only vehicles**. We find it sufficient to meet the claim language that Beam and Karlsson would identify oncoming **headlights** and dim the light being projected in that area, even if they would also reduce **light being projected towards other types of light sources**.

197 POR, 50

(DI, 20.)

Moreover, per the claim language, the detection of light is *per se* insufficient, the processor must be able to **detect a vehicle**, which inherently requires the processor to use the sensor data to determine whether the sensor inputs confirm **vehicle detection**.

197 POR, 50

Here, as the genus is light, which includes for example, landscape lights, residential lights, house lights, interior lights, motorcycle lights, streetlights, bicycle lights and vehicle lights, a POSA would not immediately recognize vehicle headlights as falling within the light genus. Accordingly, even if genus/species law applied, the disclosure of light detection in the primary Beam and Karlsson references fails to anticipate the species claim to vehicle detection. (Ex.2006, ¶171.)

197 POR, 51-52

Combination Issues

Thominet's hardware alone defeats Beam's motivation to combine

Petitioner's "motivation" to add Thominet/Harbers curved substrate included "different spatial distributions for different driving situations." (POR, 41.) **197 Sur Reply, 14**

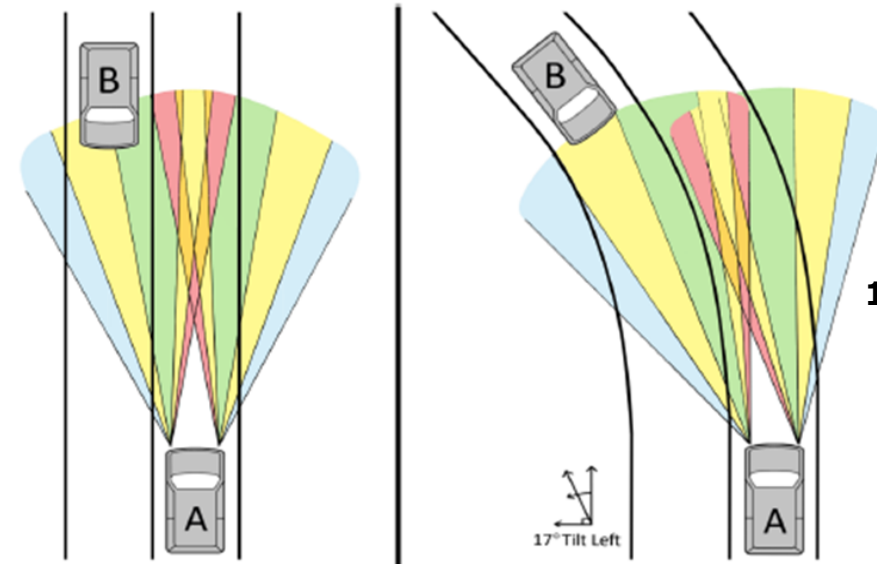
Petitioner next asserts that "dynamically varying in position and size" is evidence of "angular control." (Reply, 13.) This ignores the fact that Beam achieves the "dynamic variance" by simply re-selecting and re-signaling different LEDs as the vehicle moves without any need to ever "aim" a single LED. (Ex.1005, 6:24-28.) **197 Sur Reply, 14**

Segmenting Beam's output to create lesser-illuminating "functional" beam segments defeats what Petitioner termed the "optimal use" of the light sources, because there is no longer going to be "maximum intensity" everywhere outside the glare-reduction region. (Ex.1003, ¶188.) **197 Sur Reply, 15**

Harbers' segmentation is incompatible with Karlsson

- "By ordering the LEDs in the manner indicated in Fig. 2 ..." (Ex.1011, 8:30.)
- Citing Harbers (*Id.*, 5:27-29), Petitioner states that the light beams "generated from each colored light source have a more or less 'white' appearance."

197 Sur Reply, 17 citing Reply, 18



197 Sur Reply, 18

(Ex.2006, ¶238.)

Curve illumination (197 IPR - claims 21-23 and 60-62)

Petitioner has failed to adequately explain how Beam would use less than the expressly taught “maximum intensity” in the full scene, rendering “increases” impossible. (Reply, 25.)

197 Sur Reply, 22

To summarize, Petitioner previously repeatedly contended that Beam provides maximum illumination (Section VIII, *supra*), fails to show a compelling reason to “break” Beam by segmenting that illumination (*Id.*), fails to demonstrate that SLMs are not binary devices used to control intensity only (Section VII.A.3, *supra*), fails to use SLMs in combination with LEDs (Section VII.B.2, *supra*), and fails to prove that “dynamic variance” isn’t just a reference to iterations of discrete choices and controls that do not require aiming (Section VIII, *supra*).

197 Sur Reply, 22

Moreover, Petitioner states “Karlsson’s processor determines where light will *not* be suppressed – a second subsection of the field of view (non-shaded area *of high intensity*).” (*Id.*, 101.) Thus, the “base” state of non-suppressed light is “high intensity” by Petitioner’s own admission. Further, this proves that Petitioner originally contemplated Karlsson as utilizing all LEDs at high intensity for “normal” operation before glare control was applied. **197 Sur Reply, 24 citing Petition, 101**

Curve illumination vs Turn illumination

As compared to a bend in the road (curve), turns signify sharper directional changes, where lateral and parked cross-traffic may be present; requiring different illumination considerations. (POR, 49.)

Moreover, the contention that “increasing illumination of an ‘upcoming turn’ would in the same way increase illumination of an ‘upcoming curve’” impermissibly conflates claims 34 and 70 as though they were the same. (Reply, 21; POR, 49.)

Failed Proofs – 35 U.S.C. § 312 (a)(3) and 37 C.F.R. § 42.22 (a) (2) (dependent claims 60-62 and 64)

Claim	Language	Claim	Language
25	... reflectors, refractors, or lenses usable to alter emitted light from at least one of the light sources.	64	... reflectors, refractors, or lenses usable to alter the light emitted from at least one of the light sources as part of the instructed adjustment.
21	... processor is further configured to ... direct the control circuitry to adjust the directional light sources to increase illumination in a direction of the road curvature.	60	... processors is further configured to ... determine light output that aims illumination in a direction of the road curvature.
22	... processor is further configured to ... to direct the control circuitry to increase illumination illuminating the turn.	61	... processors is further configured to ... determine light output that illuminates the turn.
23	Same as 22	62	Same as 61

Dependent Claims 21-23 (197 IPR)

21. The system of claim 20, wherein the processor is further configured to determine at least a road curvature, indicated by the sensor data, ahead of the vehicle and to direct the control circuitry to adjust the directional light sources to increase illumination in a direction of the road curvature.

22. The system of claim 21, wherein the processor is further configured to determine at least a planned upcoming turn, indicated by the sensor data, and to direct the control circuitry to increase illumination illuminating the turn.

23. The system of claim 20, wherein the processor is further configured to determine at least a planned upcoming turn, indicated by the sensor data, and to direct the control circuitry to increase illumination illuminating the turn.

Ground 3 – Claims 21 – 23 – Beam, Thominet, Kobayashi

First, including an additional data source for Beam-Thominet's controller—

Kobayashi's *known technique* of using map data including road curvature—would have enhanced Beam-Thominet by increasing/adjusting illumination based on road curvature or a planned turn, improving driver safety by providing light to where it is needed. *Second*, a POSA would have easily incorporated *known components* of

197 Petition, 65

Dependent Claims 60-62 (197 IPR Only)

60. The system of claim 59, wherein at least one of the at least one processors is further configured to determine at least a road curvature, indicated by the sensor data, ahead of the first vehicle and to determine light output that aims illumination in a direction of the road curvature.

61. The system of claim 60, wherein at least one of the at least one processors is further configured to determine at least a planned upcoming turn, indicated by the sensor data, and to determine light output that illuminates the turn.

62. The system of claim 59, wherein at least one of the at least one processors is further configured to determine at least a planned upcoming turn, indicated by the sensor data, and to determine light output that illuminates the turn.

<i>The system of claim 20, wherein at least one of the one or more headlamps further includes at least one of reflectors, refractors, or lenses usable to alter emitted light from at least one of the light sources.</i>	<i>The system of claim 59, wherein at least one of the one or more headlamps further includes at least one of reflectors, refractors, or lenses usable to alter the light emitted from at least one of the light sources as part of the instructed adjustment.</i>
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For claim 64, as the **entire** argument, Petitioner merely state s– “Claims 64 and 25 are patentably indistinct. *Supra* Section VI.D; EX1003, ¶¶293-295 The Petition not only fails to present proofs for the omitted element and fails to establish that the omitted element is immaterial.

Requiring the *reflector, refractor or lenses to be usable as part of the instructed adjustment*, means there is some active utilization of at least one of those objects when an adjustment is instructed. The omitted element is material;
197 POR, 27

D. Claim 64

Claims 64 and 25 are patentably indistinct. *Supra* Section VI.D; EX1003, ¶¶293-295. 197 Petition, 64

Claim 64 only differs by adding “as part of the instructed adjustment.” EX1001, 98:39-42 (claim 25), 102:57-61 (claim 64). As the Petition demonstrated, Beam’s SLM includes “digital mirror devices” controlled by Beam’s controller to alter light “as part of the instructed adjustment” by Beam’s controller. Pet., 50-51; EX1003, ¶¶199-201, 293-295, 433-34; EX1051, ¶¶118-119, 169. 197 Reply, 29

21	... processor is further configured to ... direct the control circuitry to adjust the directional light sources to increase illumination in a direction of the road curvature.	60	... processors is further configured to ... determine light output that aims illumination in a direction of the road curvature.
22	... processor is further configured to ... to direct the control circuitry to increase illumination illuminating the turn.	61	... processors is further configured to ... determine light output that illuminates the turn.

197 POR, 29

The Board did not abuse its discretion in concluding that Microsoft's complete failure to address the language differences and explain why they do not matter [and thus how the claim limitations were met] was a failure to meet the particularity requirements for what must be in the petition and cannot be left to be filled in on reply.

Microsoft Corp., 2022 WL 989403, at *6(citing 35 U.S.C. § 312 (a)(3), 37 C.F.R.

§ 42.22(a)(2)).

197 POR, 27-28

197 POR 27

B. Claim 60

Claims 60 and 21 are patentably indistinct. *Supra* Section VII.B; EX1003, ¶¶326-327.

C. Claims 61/62⁹

Claims 61 and 22 are patentably indistinct. *Supra* Section VIII.C; EX1003, ¶¶328-331. 197 Petition, 76

Karlsson-Gotou combinations disclose the “increase illumination in a direction of the road curvature” of claims 21-23. Pet., 64-76, 113-126. Likewise, the Petition showed the patentably indistinct “light output that aims illumination in a direction of the road curvature” of claims 60-62. Pet., 64-76, 113-126. A POSA would have also understood that directing control circuitry to increase illumination, as recited in claims 21-23, would include determining a light output to illuminate the road curvature or turn. EX1051, ¶¶128-129, 182; Pet. 76, 123. Thus, Petitioner

197 Reply, 30

Claim 34 recites “determining illumination the increases illumination of an upcoming turn...” This expressly requires an **increase** of illumination. Claim 32 includes no such recitation. Petitioner fatally fails to note or explain the difference, rendering its proof deficient for claims 34/36. (See *Microsoft Corp.*, 13-14; Ex.2006, ¶201).

328 POR, 46

Claim 70 also requires that the determination “increases illumination.” For the reasons noted in Ground 3 with respect to claim 34, the Petition fails to prove this point for claim 70 as well – a failing extending to all nine sub-grounds of Ground 4. (§VII.D.3, *supra*; Ex.2006, ¶216).

328 POR, 49

The language of claim 70 is patentably indistinct from claim 34. Claim 70 is therefore disclosed as discussed above. *Supra* Section VII.B; EX1003, ¶¶352-354.

328 Petition, 59

the headlight output to illuminate the curve/turn. EX1003, ¶325. The language of claims 33 and 34 is patentably indistinct from the language of claim 32. *Id.*, ¶¶326-327; Appendix B. The language of claims 33 and 35 is identical, and the language of claims 34 and 36 is identical. *Id.*, ¶¶328-329.

328 Petition, 59

Claim 32	-	The method of claim 26, wherein the determining illumination requirements further includes determining illumination for an upcoming curve indicated by the sensor data, wherein the determining the control strategy further comprises determining the control strategy for controlling the directional light clusters to create an output headlight beam that illuminates around the curve.
Claim 34	-	The method of claim 32, wherein the determining illumination further includes determining illumination the increases illumination of an upcoming turn indicated by the sensor data, wherein the determining the control instructions further comprises determining the control instructions for controlling one or more of the directional light sources to achieve illumination of the turn.
Claim 70	-	The method of claim 65, wherein the determining illumination further includes determining illumination that increases illumination of an upcoming curve indicated by the data, wherein the determining the control instructions further comprises determining the control instructions for controlling one or more of the directional light sources to achieve illumination around the curve.

328 Petition, Appendix B

328 Petition, Appendix B

328 Petition, Appendix B

4. Petitioner Fails to show “[sensor] data includes data indicating fog or snow” as in claim 69

Just as Petitioner failed to show that there was “sensed fog or snow” in claim 29, here Petitioner, in rejecting by analogy, also fails to even note or show the specific requirement that the “data” (sensor data of claim 65) “includes data indicating fog or snow.” This element is simply missing from the analysis, because Petitioner never explained how this element was inconsequentially different from the elements of claim 29. This fatal defect renders the argument for claim 69 insufficient, in addition to the failures in proof. (*See Microsoft Corp.*, 13-14;Ex.2006, ¶241.)

328 POR, 56

C. Claim 69

The language of claim 69 is patentably indistinct from claim 29. Therefore, as discussed above claim 69 is rendered obvious. *Supra* Section X.C; EX1003, ¶¶430-432. 328 Petition, 78

Claim 29	-	The method of claim 26, wherein the illumination requirements accommodate sensed fog or snow environmental conditions by defining a shift of at least a portion of the headlight beam towards yellow.	328 Petition, Appendix B
Claim 69	-	The method of claim 65, wherein the data includes data indicating fog or snow environmental conditions and the determining illumination includes determining a shift of at least a portion of the light output from the headlight system towards yellow.	328 Petition, Appendix B
	[65.1]	utilizing one or more sensors of a first vehicle to obtain and provide data,	328 Petition, Appendix B

Independent Claim 20 (197 IPR Only)

Claim 20

20. A vehicle headlight system, comprising:

one or more headlamps affixed to a vehicle, each headlamp including at least three directional light sources aimed at different angles relative to the vehicle, the light sources configured to have one or more controllable light characteristics, wherein a first light source of the more than one light sources at a first angle is less visually disturbing to traffic than a second light source of the more than one light sources aimed at a second angle, different from the first angle;

control circuitry configured to adjust the at least one light characteristic of at least one of the directional light sources;

one or more sensors configured to sense information defined as pertinent to determining illumination output from the one or more headlamps and communicating the sensed information to a processor as sensor data;

the processor, in communication with at least the sensors and the control circuitry, configured to: process the sensor data to determine, within a field-of-view, at least a first subsection including a detected vehicle and at least a second subsection not including the detected vehicle,

determine optimal use of the differently aimed directional light sources to maximize vehicle operator visibility in at least the second subsection, while minimizing a disturbing effect, resulting from the illumination output, on the vision of other traffic in at least the first subsection, and

direct the control circuitry to adjust the directional light sources to achieve the determined optimal use

Ex.1001, Claim 20

328 IPR

The Claimed Invention is Directed to an “Adaptive Multi-LED Headlight System” for Spatially Differentiated Light Distribution based on the Detection of a Vehicle in the Field of View

The '503 Patent is directed to “a novel multi-light source approach to the design and construction of solid-state lighting fixtures (vs. solid state lamps), which is termed a ‘Digital Lighting Fixture’, due to the control of individual lighting element ‘digits’ to provide the ‘correct’ lighting solution for the situation at hand.”

Ex.1001, 11:11-16

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, 11:61-67

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, 52:58-53:8

328 IPR – Independent Claim 26

26. A method for generating a headlight beam in an adaptive headlight system that provides illumination to at least a portion of a field-of-view, comprising:

utilizing one or more sensors of a vehicle including the adaptive headlight system to obtain and provide data predefined as relevant to a determination of illumination requirements for the field-of-view, the data including data indicative of at least one of one or more other vehicles or a pedestrian;

determining illumination requirements for the field-of-view based on the data sensed by the sensors, including **determining illumination for** at least a first subsection of the field-of-view including the other vehicle or pedestrian, as indicated by the sensor data, and for at least a second subsection of the field-of-view not including the other vehicle or pedestrian;

determining a control strategy for controlling one or more directional light clusters in a headlight assembly to create an output headlight beam meeting the determined illumination requirements, the headlight beam spatial light distribution shaped to provide high beam illumination for a driver of the vehicle, in at least the second subsection, while **mitigating glaring light illuminating** at least the first subsection including detected other vehicles or pedestrians;

sending control signals implementing the control strategy to an electronic control circuitry configured to operate the light clusters; and

controlling the light clusters via the electronic control circuitry to collectively emit the headlight beam meeting the determined illumination requirements.

Ex.1001, Claim 26

328 IPR – Independent Claim 65

65. A method for generating a headlight beam in an adaptive headlight system that provides illumination to at least a portion of a field-of-view, comprising:

utilizing one or more sensors of a first vehicle to obtain and provide data, the data including data indicating at least a second vehicle;

determining illumination for at least a first subsection including the second vehicle and at least one or more second subsections, to either side of the first subsection, including determining an illumination level for the first subsection that substantially illuminates the first subsection below a predefined illuminance, and determining an illumination level for the one or more second subsections that substantially illuminates the one or more second subsections above the predefined illuminance;

determining control instructions for controlling one or more directional light sources included in the adaptive headlight system to achieve the determined illumination levels for at least the first and one or more second subsections; and

controlling the light sources to emit the headlight beam in accordance with the control instructions.

Ex.1001, Claim 65

Lack of Particularity

Impact of "additionally, alternatively and either" styled arguments

1. 197 IPR presents six grounds to challenge 12 claims, but includes at least 41 sub-grounds
2. 328 IPR presents two grounds to challenge 17 claims, but includes at least 61 sub-grounds
3. 335 IPR presents two grounds to challenge 41 claims, but includes at least 47 sub-grounds
4. Petitioner's alternative arguments created at least 149 discrete sub-grounds for the '503 Patent

Petitioner has no explanation for the 60+ arguments advanced in 328 IPR

Petition - Alternative, Interconnected Hardware and/or Software arguments

"Lamp/LED/SLM" is confusing because the three terms are not interchangeable and no combination included both an SLM and LED array. Instead, Petitioner argued "Beam's LED array has the same functionality as lamp 202 and SLM 203." (Petition, 9, 14.) Further, "organiz[ation] ... into multiple direction regions as taught by Thominet" requires Thominet's software — which is only combined with the lamp+SLM embodiment and not the LED embodiment. (*Id.*, 11-13, Reply, 14; Ex.1003, ¶124.) This imprecise argument style compounds the underlying lack of particularity, sowing confusion.

328 Sur Reply, 8

Problems Exacerbated on Reply:

In order to rely the combinations that include Thominet/Thominet-Stam, the combinations must include use of Thominet or Thominet-Stam. Petitioner originally relied on a software function of Thominet and then switched to a hardware argument, ignoring that there is not a combination that has both from Thominet. (Petition, 55, 59.) Now, on Reply, Petitioner argues that Beam alone has the necessary elements. (Reply, 20.) If that is true, there is no need for Thominet.

328 Sur Reply, 9

The above exemplifies Petitioner's strategy — presenting a mishmash of parts and hoping the Board will divine a tenable unpatentability combination. (DI, 19 FN9.) But "Judges are not like pigs, hunting for truffles buried in briefs ..." *See, Apple Inc. v. Qualcomm Inc.*, IPR2018-01276, Paper 32, 6 (PTAB Feb. 3, 2020).

328 Sur Reply, 9

Petitioner's SLM admissions + NEW LED + SLM argument

- Even Dr. Jiao's Reply Declaration admits: "these two positions [of the micromirror] determine the direction that light is deflected." (Ex.1051, ¶53 citing to Ex.2022, 2.) Dr. Jiao casts this as "controlling angle[s] [sic]," but Ex.2022 is describing only that one angle is blocking, one angle is emitting, and only two angles exist. (*Id.*, 2.) "[T]he positive (+) state is ... the 'on state' ... the negative (-) state is ... the 'off' state, ... These are the **only** operational states of the micromirror." (*Id.*) **328 Sur Reply, 19; see also 335 Sur Reply, 12-13**
- Dr. Jiao explains that the SLM described in Beam 4:26-59 is a DMD. (Ex.1003, ¶51.) Dr. Jiao provided Enomoto's Figs. 2A-2C as examples of how "angular position" can be controlled by DMDs. (*Id.*, ¶¶51, 162.) **328 Sur Reply, 18; see also 335 Sur Reply, 12-13**
- **Further, Petitioner** even admitted that "the LED array has the same functionality as the Lamp 202 and SLM 203" and further that "a headlamp only formed from LEDs ... could not control the directionality ..." (Petition, 9, 14; Ex.1051, ¶53.) **328 Sur Reply, 19; see also 335 Sur Reply, 15-16**
- On Reply, Petitioner actually argues that LEDs alone are not directional: "In order to be 'directional,' a POSA would have understood that the emitter of the light source is combined with an optical element" e.g., SLM. (Reply, 6; Ex.1051, ¶66.) **197 Sur Reply, 12; see also 335 Sur Reply, 12-13**

SLMs cannot aim emission (all IPRs/claims)

The micromirror 2 has one horizontal state and two tilt states. The **two tilt states are utilized for image formation**. In one of the two tilt states, spotlight travels from the micromirror 2 to form an image. For example, while the micromirror 2 takes $+\theta$, spotlight from the micromirror 2 is guided to an image **forming optical path**. While the micromirror 2 takes $-\theta$, spotlight is not needed so that it is guided to an **eliminating optical path**. While the micromirror 2 takes $+\theta$, a valid reflection state (ON state) maintains in which **reflection light is utilized for image formation**. While the micromirror 2 takes $-\theta$, an invalid reflection state (OFF state) maintains in which **reflection light is not utilized for image formation**

...

(Enomoto, Ex.1040, 5:12-26.)

328 Sur Reply, 18

By Dr. Jiao's own evidence, the "angular control" achieved by an SLM is binary. A first angle for "forming an optical path" and a second angle for "eliminating an optical path." This is further supported by "angle modulation" as the result of mirrors being rotated **"to one of two stable positions."** (Ex.1056, 19.)

328 Sur Reply, 19

Even Dr. Jiao's Reply Declaration admits: "these two positions [of the micromirror] determine the direction that light is deflected." (Ex.1051, ¶53 citing to Ex.2022, 2.) Dr. Jiao casts this as "controlling angle[s] [sic]," but Ex.2022 is describing only that one angle is blocking, one angle is emitting, and only two angles exist. (*Id.*, 2.) "[T]he positive (+) state is ... the 'on state' ... the negative (-) state is ... the 'off' state. ... These are the **only** operational states of the micromirror." (*Id.*)

328 Sur Reply, 19

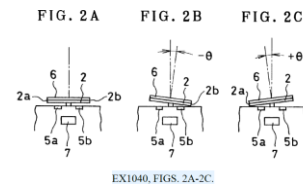
SLMs cannot aim emission (328 IPR)

Petitioner is simply wrong about how an SLM functions and their own evidence proves it. (Reply, 14.) Dr. Jiao explains that the SLM described in Beam 4:26-59 is a DMD. (Ex.1003, ¶51.) Dr. Jiao provided Enomoto's Figs. 2A-2C as examples of how "angular position" can be controlled by DMDs. (*Id.*, ¶¶51, 162.)

328 Sur Reply, 18

FIGS. 1-3; EX1039, 9:16-11:11, FIGS. 1-6; EX1040, 1:16-30, FIGS. 1, 2A-2C; EX1036, 3:52-4:32, FIGS. 2-6.

328 Ex.1003, ¶162



EX1040, FIGS. 2A-2C.

The micromirror 2 has one horizontal state and two tilt states. The **two tilt states are utilized for image formation**. ... while the micromirror 2 takes +θ, spotlight from the micromirror 2 is guided to an **image forming optical path**. While the micromirror 2 takes -θ, spotlight is not needed so that it is guided to an **eliminating optical path**. While the micromirror 2 takes +θ ... (ON state) ... **reflection light is utilized for image formation**. While the micromirror 2 takes -θ, ... (OFF state) ... **reflection light is not utilized for image formation** ...

328 Sur Reply 18, citing Ex. 1040, 5:12-26

"eliminating an optical path." This is further supported by "angle modulation" as the result of mirrors being rotated "to one of two stable positions." (Ex.1056, 19.)

328 Sur Reply, 19

DMDs are fabricated by micromachining a silicon wafer.⁷ Tiny ($16\ \mu\text{m} \times 16\ \mu\text{m}$) suspended mirrors are micromachined on cantilevers. The mirrors are rotated by an electrostatic field to one of two stable positions. The **reflection angle modulation** is converted into an intensity modulation after spatial filtering through an aperture. DMDs, with 400×600 pixels, can be fabricat-

Optics & Photonics News / March 1997 **19**

328 Ex. 1056, 19

SLMs cannot aim emission (328 IPR)

Even Dr. Jiao's Reply Declaration admits: "these two positions [of the micromirror] determine the direction that light is deflected." (Ex.1051, ¶53 citing to Ex.2022, 2.) Dr. Jiao casts this as "controlling angle[s] [sic]," but Ex.2022 is describing only that one angle is blocking, one angle is emitting, and only two angles exist. (*Id.*, 2.) "[T]he positive (+) state is ... the 'on state' ... the negative (–) state is ... the 'off' state. ... These are the only operational states of the micromirror." (*Id.*)

328 Sur Reply, 19

2.1 Bi-stable Operation (±12 Degrees)

The DMD pixel is an electro-mechanical element in that there are two stable micromirror states (+12° and –12° for most current DMDs) that are determined by geometry and electrostatics of the pixel during operation.

The DMD pixel is an opto-mechanical element in that these two positions determine the direction that light is deflected. In particular, the DMD is a spatial light modulator. By convention, the positive (+) state is tilted toward the illumination and is referred to as the "on" state. Similarly, the negative (–) state is tilted away from the illumination and is referred to as the "off" state. Figure 2-1 shows two pixels, one in the on and one in the off state. These are the only operational states of the micromirror.

328 Ex.2022, 2

All Grounds--*Process the sensor data to **determine...** at least a first subsection including a detected vehicle and at least a second subsection not including the detected vehicle* ([20.9-20.10], [26.4-26.5, 65.3-65.6 (328 IPR)])

Specifically, to satisfy [20.9], Petitioner points to Beam's ability to provide a "shaded area based on blanking signals" and Beam's statement that the "blanked area tracks the location of the oncoming vehicle." (*Id.*) Beam however lacks the ability to **detect a vehicle** and then segment the field of view based on the location of the detected/identified vehicle. (Ex.2006, ¶¶159-160.)

197 POR, 48

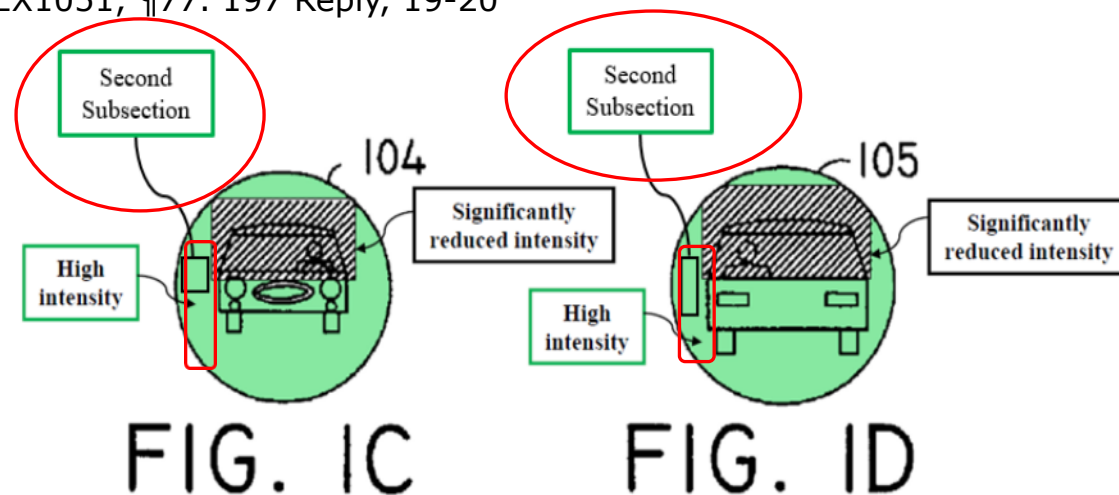
162. In Beam, incoming light — which may be associated with any light source, e.g., house lights, streetlights, motorcycles, interior vehicle lights, headlights of an oncoming vehicle and/or taillights of a preceding vehicle-- is transmitted through optical system 106 and detected by a sensor (camera) 107. (*Id.*) Data from sensor 107 is used by controller 108 to map the angular position of incoming light to a corresponding position/size of microbeams that must be significantly reduced in intensity. (Ex.1005, 4:9-24, 53-59, 62-64.)

Ex.2006, ¶162

Petitioner newly argues that "Beam's controller does distinguish between light sources, filtering weak signals." **197 Sur Reply** citing Reply, 19

Also, Petitioner miscasts "ambient" light as "dim" detected light. (Reply, 20; Ex.1051, ¶77.) **197 Sur Reply, 19**

Beam's controller thus distinguishes between stronger light sources (headlights) and ambient light sources (street sign reflections). EX1051, ¶77. 197 Reply, 19-20



(Reply, 21, red annotations added by Patent Owner)

Karlsson - *Sensor data* (328 IPR)

Claim 1- **328 IPR**

one or more sensors configured to obtain and provide the sensor data predefined as pertinent to illumination requirements for the field-of-view; and
a logical controller including a processor, the processor in communication with a memory storing one or more algorithms, with the sensors, and with the control circuitry, wherein the processor is configured to process the one or more algorithms and the sensor data to determine an illumination for at least two of the sub-sections, that reduces illumination to reduce glare in at least a first of the at least two subsections and adapt the light emitted from one or more of the light-clusters so as to create the headlight beam that provides the determined illumination.

Petition:

Karlsson discloses "lighting means 2, 3...controlled by control means 14, such that the incident light 11 on the light-sensitive sensor 9...is processed into an electric control signal...[and] processed by the control means 14 into output signals...to control...light beam 7 having a desired pattern and a desired intensity." EX1010, 9:11-17, FIGS. 3, 14-15, 20:1-3 ("control electronics 41"), 2:7-10, 19:29-33, 20:12-32, 21:36-22:4; EX1003, ¶¶395-398. **197 Petition, 94**

Jiao Declaration:

378. Karlsson's system "selectively adjust[s]...spotlight beam[s] 34, in response to a control signal from sensor means 23...to provide a desired lighting pattern" in "given directions." EX1010, 14:26-30, 11:25-28, FIGS. 3, 6, 14. **197 Ex.1003, ¶378**

400. Karlsson discloses "light-sensitive sensors 9 and 23...determin[e] the direction and the intensity of the detected light 11." EX1010, 12:19-24, FIGS. 3, 14; EX1010, 19:18-21 ("spotlight sensors S"), 5:16-23 ("sensor means...comprises spotlight sensors"), 2:2-4, 9:6-8, 5:28-32. **197 Ex.1003, ¶400**

Jiao Reply Decl, 197 Ex.1051

139. I agree with the Board's finding that Karlsson's headlight includes a processor that processes sensor data to determine, within a field-of-view, a first subsection including a detected vehicle. DI, 20. My First Declaration explained that controller 14 of Karlsson's headlight system receives an input 15 from light sensitive sensor 9 corresponding to detection of incident light 11. EX1010, 9:9-18. Karlsson's sensor 9 detects "light from oncoming traffic as a parameter to which the pattern of the emitted light beam is to be adjusted." EX1010, 5:16-19.

All Grounds--*Process the sensor data to **determine...** at least a first subsection including a detected vehicle and at least a second subsection not including the detected vehicle* ([20.9-20.10], [26.4-26.5, 65.3-65.6 (328IPR)])

Specifically, to satisfy [20.9], Petitioner points to Beam's ability to provide a "shaded area based on blanking signals" and Beam's statement that the "blanked area tracks the location of the oncoming vehicle." (*Id.*) Beam however lacks the ability to **detect a vehicle** and then segment the field of view based on the location of the detected/identified vehicle. (Ex.2006, ¶¶159-160.)

197 POR, 48

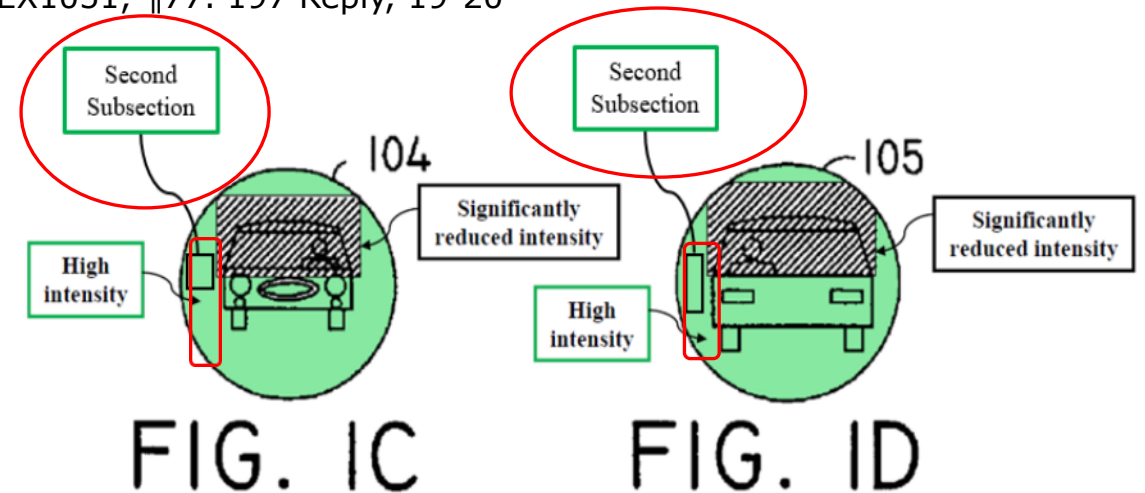
162. In Beam, incoming light — which may be associated with any light source, e.g., house lights, streetlights, motorcycles, interior vehicle lights, headlights of an oncoming vehicle and/or taillights of a preceding vehicle-- is transmitted through optical system 106 and detected by a sensor (camera) 107. (*Id.*) Data from sensor 107 is used by controller 108 to map the angular position of incoming light to a corresponding position/size of microbeams that must be significantly reduced in intensity. (Ex.1005, 4:9-24, 53-59, 62-64.)

Ex.2006, ¶162

Petitioner newly argues that "Beam's controller does distinguish between light sources, filtering weak signals." **197 Sur Reply** citing Reply, 19

Also, Petitioner miscasts "ambient" light as "dim" detected light. (Reply, 20; Ex.1051, ¶77.) **197 Sur Reply, 19**

Beam's controller thus distinguishes between stronger light sources (headlights) and ambient light sources (street sign reflections). EX1051, ¶77. 197 Reply, 19-20



(Reply, 21, red annotations added by Patent Owner)

Beam and Karlsson SLMs don't achieve emission aiming

Karlsson

Karlsson posits two types of SLMs, both binary. A first fully-transmissive/fully-blocking SLM, which is either full-on or full-off – i.e., all light or none. (Ex.1010, 14:10-15.) A second SLM that transmits light to a “specified degree” so that intensity can be adjusted. (*Id.*)

197 Sur Reply, 11

The Petition improperly used sentence fragments to apply the phrase “given directions” (related to light *detection*) to the modulator 3. (Petition, 77, 93; DI, 14)

197 Sur Reply, 13

“[T]he Board overlooked that Karlsson’s modulators are ‘controlled to transmit light to a specified degree, so that a desired light intensity can be adjusted’...” (Reply, 8 *citing* Ex.1003, ¶333; DI, 14.)

197 Sur Reply, 11-12

Beam

... claim 4 uses the claimed SLMs for “selectively controlling intensity”, not angular emission. (Ex.1005, 8:10-12.)

197 Sur Reply, 12

On Reply, Petitioner actually argues that LEDs alone are not directional: “In order to be ‘directional,’ a POSA would have understood that the emitter of the light source is combined with an optical element” e.g., SLM. (Reply, 6; Ex.1051, ¶66.)

197 Sur Reply, 12

328 IPR -- Petitioner's results-based proofs for "how" Beam *determines illumination* for a first and second subsection-- glare reduction-- is both new and incomplete

Claim 26.4

In its original "proof," "Beam determines "which ...rays of light must be extinguished" to "prevent[]" illuminating certain areas." (Petition, 21, 23.) **328 Sur Reply, 10**

For its reply "proof," Petitioner merely points to an end-result — Beam having "less than low-beam" illumination in the shaded section. (Reply, 6-7.) **328 Sur Reply, 10**

Petitioner argues that claim 26 does not specify the boundary of the second subsection relative to the first. (Reply, 7.)

328 Sur Reply, 12

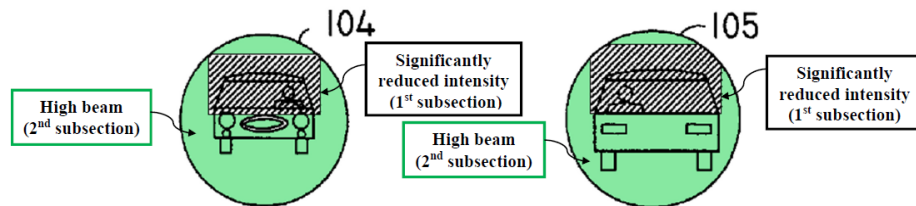


FIG. IC

FIG. ID

328 Sur Reply, 5

(Ex.1003, ¶¶84, 88, 108, 101, 124, 125, 126, 130, 140, 145.)

Claim 26.4

including determining illumination for at least a first subsection of the field-of-view including the other vehicle or pedestrian, as indicated by the sensor data,

328 IPR -- Petitioner's results-based proofs for "how" Beam *determines illumination* for a first and second subsection-- glare reduction-- is both new and incomplete

Claim 65.3-65.6

determining illumination for at least a first subsection including the second vehicle and at least one or more second subsections, to either side of the first subsection, including determining an illumination level for the first subsection that substantially illuminates the first subsection below a predefined illuminance, and determining an illumination level for the one or more second subsections that substantially illuminates the one or more second subsections above the predefined illuminance;

Claim 65.3/65.5/65.6

For claim 65, Petitioner presents a similarly specious "result-oriented" argument, contending that "Beam illuminates the first subsection below a predefined illuminance" (Reply, 9.)

328 Sur Reply, 10

The limitation is "determining illumination for the first subsection that illuminates the first subsection below the predefined illuminance".

328 Sur Reply, 10

Claim 65.4

The new reply argument that the 2nd subsection is not "coextensive" is also unpersuasive. (Reply, 7.) Petitioner uses the same 2nd subsection and explanation for its proof of [65.4], which recites "at least one or more second subsections, to either side of the first vehicle," simply stating "the features of [65.4] are included in [26.5]." (Petition, 43.)

328 Sur Reply, 13

Petitioner's results-based proofs for "how" Beam *determines illumination* for a first subsection – glare reduction-- is both new and incomplete

Claim 26.4

In its original "proof," "Beam determines "which ...rays of light must be extinguished" to "prevent[]" illuminating certain areas." (Petition, 21, 23.) **328 Sur Reply, 10**

For its reply "proof," Petitioner merely points to an end-result — Beam having "less than low-beam" illumination in the shaded section. (Reply, 6-7.)

328 Sur Reply, 10

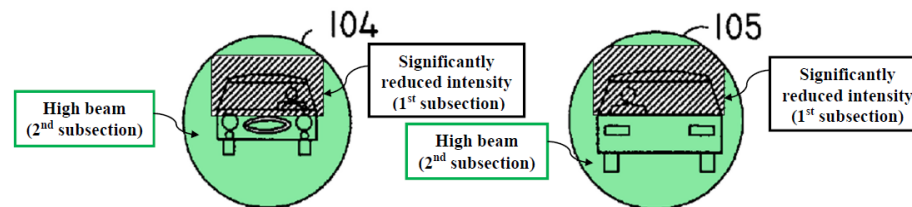


FIG. IC

FIG. ID

(Ex.1003, ¶¶84, 88, 108, 101, 124, 125, 126, 130, 140, 145.)

328 POR, 5

Claim 65.3/65.5/65.6

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328 Sur Reply, 10

Beam – Thominet – Motivation to Combine

Many reply arguments reference elements only present in a particular sub-combination, though the underlying explanation addresses a general combination (e.g., “Beam-Thominet”). This is problematic when the general combination (e.g., “Beam-Thominet”) also includes alternative combinations lacking such elements. *See*, Reply, 14, where Petitioner is arguing “Beam-Thominet’s lamp/LED/SLM” can “organize Beam’s array of microbeams into multiple directional regions” as taught by Thominet.”

“Lamp/LED/SLM” is confusing because the three terms are not interchangeable and no combination included both an SLM and LED array. Instead, Petitioner argued “Beam’s LED array has the same functionality as lamp 202 and SLM 203.” (Petition, 9, 14.) Further, “organiz[ation] ... into multiple direction regions as taught by Thominet” requires Thominet’s software — which is only combined with the lamp+SLM embodiment and not the LED embodiment. (*Id.*, 11-13, Reply, 14; Ex.1003, ¶124.) This imprecise argument style compounds the underlying lack of particularity, sowing confusion.

V. A POSA WOULD HAVE BEEN MOTIVATED TO COMBINE THOMINET’S/HARBERS’S MULTI-FUNCTION BEAM SEGMENTS WITH BEAM’S/KARLSSON’S ADAPTIVE HEADLIGHTS.

328 Reply, 12

3. Beam-Thominet’s lamp/LED/SLM controls the angular position of each microbeam to achieve different light beam patterns.

Beam’s SLM adjusts the angular position of its microbeams, contrary to PO/Dr. Turk’s position. POR, 25, 39; EX2006, ¶¶65-66; EX1051, ¶¶93-95. Beam’s SLM controls the microbeams’ angular positions/intensities via command signals. EX1051, ¶94; EX1005, 4:45-57. Dr. Jiao confirmed that a POSA would have understood to “simply modify[] software instructions in memory of Beam’s controller/processor to organize Beam’s array of microbeams into multiple direction regions” taught by Thominet. EX1003, ¶131; Pet., 12-14; EX1051, ¶¶93-95.

328 Reply, 14

Karlsson - Harbers

For the software variant, Petitioner argues Harbers’ use of “multiple beam segments for different functions” would be implemented with Karlsson’s spotlight beams 34 (including modulator 3.) (*Id.*, 84.) This limits the software combination to the LEDs+Modulator combination 8B.

Petitioner argues it would alternatively have been known to incorporate Harbers’ opto-electronic elements 11-14 into Karlsson’s system “with lighting means 2, 3.” (*Id.*, 84-85.) Petitioner asserts it would have been possible to “substitute” Karlsson’s lighting means 2, 3 and Harbers’ opto-electronic elements on a curved substrate, setting up a first hardware combination where **both** the LEDS 2 **and** modulator 3 of Karlsson are replaced by Harbers’ LEDs. (*Id.*, 86.) Petitioner alternatively argues that it would have been reasonable to “simply modify flat substrate of Karlsson’s lighting means 2, 3 with Harbers’ curved substrate...” (*Id.*)

This results in **five** sub-grounds for Ground 8, bringing the total to **fifty-five**.

8A	Karlsson_LEDs		
8B	Karlsson_LEDs+Mod		
8C	Karlsson_LEDs+Mod	Harbers_Software	
8D	Karlsson_Control		Harbers_Array
8E	Karlsson_LEDs+Mod		Harbers_Curve

328 POR, 16

5A	Karlsson_LEDs		
5B	Karlsson_LEDs+Modulator		
5C	Karlsson_LEDs+Modulator	Harbers_ControlSW	

5D	Karlsson_Control	Harbers_ControlSW	Harbers_Array (replacement for both 2 and 3 of Karlsson)	
5E	Karlsson_Control		Harbers_Array (replacement for both 2 and 3 of Karlsson)	
5F	Karlsson_LEDs+Modulator	Harbers_ControlSW		Harbers Curve
5G	Karlsson_LEDs+Modulator			Harbers

197 POR, 21-22

32-36/70 Karlsson-Harbers

Initially, none of the shortcomings of the various imported sub-grounds 8C-8E from Karlsson-Harbers are cured by including Gotou, and some are amplified as noted below. So, for at least the reasons already presented, all sub-grounds would not be combinations a POSA would have made. (§VII.I.1-4, *supra*; Ex.2006, ¶296.)

328 POR, 67-68

C. Karlsson-Harbers-Gotou (with or without Stam)

Here again, Petitioner presents arguments reliant on hardware only present in some combinations but applies it across all combinations.

328 Sur Reply, 25

B. Claims 32/33/34/35/36/70

See supra Section VII.B; EX1003, ¶¶623-628. Karlsson's "light-sensitive sensor, ...detects...the area *ahead of a vehicle*" and "*direction sensor* 54...determin[es] when the car 56 is *taking a bend*, so that the light beam 7 can be *adapted*." EX1010, 1:35-2:4, 20:29-32, FIGS. 3, 14-16, 6:26-33, 9:11-17; EX1003, ¶629. Karlsson/Karlsson-Harbers discloses "directional light [clusters/sources]." *Supra* Sections XII.A/XII.B.7; EX1003, ¶629.

328 Petition, 131

Should Patent Owner allege, incorrectly, that Karlsson does not disclose [26.6], it would have been obvious in view of Harbers. EX1003, ¶¶494, 496-513. *Supra* Section XII.A; EX1003, ¶¶445-459, 494.

Harbers discloses an array of opto-electronic elements 11-14 on a curved substrate that emits light beam segments 6'-6"-6'", 7'-7"-7'" (directional light clusters) for different functions. EX1011, 5:14-26, 6:1-7, 6:27-7:19, FIGS. 1B-2, 7:27-32; EX1003, ¶495. For example, Harbers's beam segment 6, 7 is a "wide...passing beam" (first cluster), beam segment 6', 7' illuminates "the shoulder of the road" (second cluster), and beam segment 6", 7" illuminates "the center of the road" (third cluster). EX1011, 7:1-17, FIG. 1B; EX1003, ¶495.

328 Petition, 100 (XII.B.7)

XIII. GROUND 9: THE COMBINATION OF KARLSSON, HARBERS, AND GOTOU RENDERS OBVIOUS CLAIMS 32-36 AND 70.

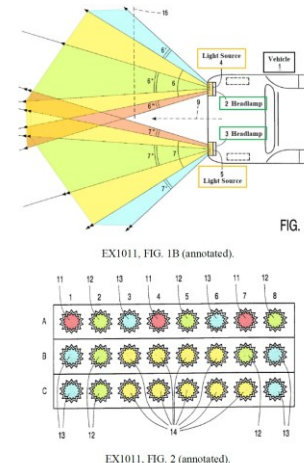
A. A POSA would have been motivated to combine Gotou with Karlsson-Harbers with a reasonable expectation of success.

A POSA would have been further motivated to modify Karlsson-Harbers to adjust light based on map data including road curvature, as in Gotou, to further

328 Petition, 125

[26.6]		determining a control strategy for controlling one or more directional light clusters in a headlight assembly to create an output headlight beam meeting the determined illumination requirements,
Claim 32	-	The method of claim 26, wherein the determining illumination requirements further includes determining illumination for an upcoming curve indicated by the sensor data, wherein the determining the control strategy further comprises determining the control strategy for controlling the directional light clusters to create an output headlight beam that illuminates around the curve.

328 Petition, Appendix A



328 Petition, 101 (XII.B.7)

Combination Issues

Thominet's hardware alone defeats Beam's motivation to combine

Petitioner cannot refute the problems Thominet's software would create with Beam. Creating "beam regions" (i.e., less than the full beam) necessarily defeats Beam's goal of maximum illumination. (POR, 24.) **328 Sur Reply, 17**

Were that not the case, the subset of lights used to address weather conditions, would be blanked in response to detected headlights—which further frustrates the addition of Thominet's software to Beam. (POR, 26-29.)

328 Sur Reply, 17-18

Harbers' segmentation is incompatible with Karlsson

- "By ordering the LEDs in the manner indicated in Fig. 2 ..." (Ex.1011, 8:30.)

Karlsson suppresses illumination responsive to light detection anywhere in the scene. If, as Petitioner proposes, a Harbers' segmented beam were used in Karlsson, there are no assurances that some or all of the subset of the beam utilized for a given "driving situation" would not be suppressed if a headlight were detected in that section. (Reply, 15.)

Harbers' proposed beam segmentation, which uses select LEDs for a specific purpose, doesn't account for the possibility of random blanking. (POR, 33.) And, Petitioner never explained how Harbers would accommodate the blanking of some or all of those LEDs. (*Id.*) Were Harbers' segmentation software included with Karlsson, use of either program's primary function would conflict with the other's. (*Id.*)

328 Sur Reply, 20

The Petition explained that combining Harbers's multiple directional beam segments with Karlsson provides "different spatial/angular distributions for different driving situations, thereby improving driver safety." EX1003, ¶¶297, 497-

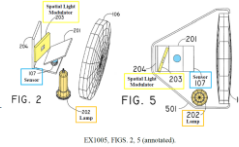
513; Pet., 81-86; EX1051, ¶¶135-137, 150-152. **328 Reply, 15**

Claim 26 Beam – Thominet – 328 IPR

Beam discloses every feature in claims 26-27 and 30-31. The specific 328 Petition, 8

Lamp + SLM 1A

2, 4, Abstract, 7:25-29, 8:4-17, 8:23-34. Each microbeam is a directional “cluster” or “source,” having its own independent *angular* position, that combines to form the headlamp beam; so Beam’s lamp 202 and SLM 203 (see Figure 2) form at least one directional light cluster/source to provide illumination in desired subsections. *Id.*,

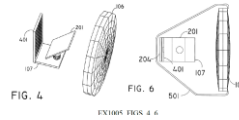


328 Petition, 8-9

LEDs 1B

Beam’s LED array has the same functionality as lamp 202 and SLM 203.

EX1005, 3:61-64, 5:3-16, FIGS. 4, 6, 8:4-17. So, Beam’s LED array also includes directional light clusters/sources. *Id.*; *id.*, 4:26-59, FIGS. 2, 4-6; EX1003, ¶¶80, 117.



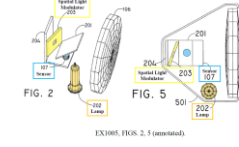
328 Petition, 9-10

been obvious to a POSA to implement Thominet’s multiple directional beam regions—through either software or hardware—for different functions in Beam’s

328 Petition, 10

Lamp + SLM + Thom SW 1C

First, including an additional control technique (software implementation) for Beam—Thominet’s *known technique* of using multiple directional beam regions for different functions—would have added different functions to Beam’s visibility for different driving situations, thereby increasing safety. EX1003, ¶124. Beam discloses “[t]he *angular position*” of each microbeam can be set by controller 108, which commands SLM 203 in illuminator 109, to reduce glare. EX1005, 4:26-59,

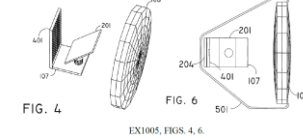


328 Petition, 11

Beam SW + Thom LEDs 1D

Second, a POSA would have sought to incorporate *known components* (hardware implementation) of Thominet’s semiconductor light sources 10 on curved surface 12 (arranged in different beam regions 22, 24, 26, 28, see EX1006, ¶¶17-20, 23-26, FIGS. 1-2, 5-7) into Beam’s system (with flat array of light sources 401). EX1003, ¶133. Again, this would have provided different spatial distributions for different driving situations, improving visibility and thereby safety. EX1006, ¶¶17-20, 23-26, FIGS. 1-2, 5-7; EX1003, ¶133.

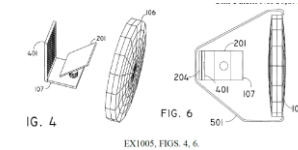
Beam’s LED array has the same functionality as lamp 202 and SLM 203, and



328 Petition, 14-15

Beam LEDs + Thom Curve 1E

Beam and Thominet, for example, by simply modifying the flat surface of Beam’s array of light sources 401 with Thominet’s curved surface 12 to provide multiple light clusters/sources (e.g., directional beam regions 22, 24, 26, 28) for different functions. EX1003, ¶137. This would have been routine and well within a POSA’s



328 Petition, 15-16

Beam – Thominet – Motivation to Combine

Many reply arguments reference elements only present in a particular sub-combination, though the underlying explanation addresses a general combination (e.g., “Beam-Thominet”). This is problematic when the general combination (e.g., “Beam-Thominet”) also includes alternative combinations lacking such elements. *See*, Reply, 14, where Petitioner is arguing “Beam-Thominet’s lamp/LED/SLM” can “organize Beam’s array of microbeams into multiple directional regions” as taught by Thominet.”

“Lamp/LED/SLM” is confusing because the three terms are not interchangeable and no combination included both an SLM and LED array. Instead, Petitioner argued “Beam’s LED array has the same functionality as lamp 202 and SLM 203.” (Petition, 9, 14.) Further, “organiz[ation] ... into multiple direction regions as taught by Thominet” requires Thominet’s software — which is only combined with the lamp+SLM embodiment and not the LED embodiment. (*Id.*, 11-13, Reply, 14; Ex.1003, ¶124.) This imprecise argument style compounds the underlying lack of particularity, sowing confusion.

328 Sur Reply, 8

V. A POSA WOULD HAVE BEEN MOTIVATED TO COMBINE THOMINET’S/HARBERS’S MULTI-FUNCTION BEAM SEGMENTS WITH BEAM’S/KARLSSON’S ADAPTIVE HEADLIGHTS.

328 Reply, 12

3. Beam-Thominet’s lamp/LED/SLM controls the angular position of each microbeam to achieve different light beam patterns.

Beam’s SLM adjusts the angular position of its microbeams, contrary to PO/Dr. Turk’s position. POR, 25, 39; EX2006, ¶¶65-66; EX1051, ¶¶93-95. Beam’s SLM controls the microbeams’ angular positions/intensities via command signals. EX1051, ¶94; EX1005, 4:45-57. Dr. Jiao confirmed that a POSA would have understood to “simply modify[] software instructions in memory of Beam’s controller/processor to organize Beam’s array of microbeams into multiple direction regions” taught by Thominet. EX1003, ¶131; Pet., 12-14; EX1051, ¶¶93-95.

328 Reply, 14

Karlsson - Harbers

For the software variant, Petitioner argues Harbers’ use of “multiple beam segments for different functions” would be implemented with Karlsson’s spotlight beams 34 (including modulator 3.) (*Id.*, 84.) This limits the software combination to the LEDs+Modulator combination 8B.

Petitioner argues it would alternatively have been known to incorporate Harbers’ opto-electronic elements 11-14 into Karlsson’s system “with lighting means 2, 3.” (*Id.*, 84-85.) Petitioner asserts it would have been possible to “substitute” Karlsson’s lighting means 2, 3 and Harbers’ opto-electronic elements on a curved substrate, setting up a first hardware combination where **both** the LEDS 2 **and** modulator 3 of Karlsson are replaced by Harbers’ LEDs. (*Id.*, 86.) Petitioner alternatively argues that it would have been reasonable to “simply modify flat substrate of Karlsson’s lighting means 2, 3 with Harbers’ curved substrate...” (*Id.*)

This results in **five** sub-grounds for Ground 8, bringing the total to **fifty-five**.

8A	Karlsson_LEDs		
8B	Karlsson_LEDs+Mod		
8C	Karlsson_LEDs+Mod	Harbers_Software	
8D	Karlsson_Control		Harbers_Array
8E	Karlsson_LEDs+Mod		Harbers_Curve

328 POR, 16

5A	Karlsson_LEDs		
5B	Karlsson_LEDs+Modulator		
5C	Karlsson_LEDs+Modulator	Harbers_ControlSW	

5D	Karlsson_Control	Harbers_ControlSW	Harbers_Array (replacement for both 2 and 3 of Karlsson)	
5E	Karlsson_Control		Harbers_Array (replacement for both 2 and 3 of Karlsson)	
5F	Karlsson_LEDs+Modulator	Harbers_ControlSW		Harbers Curve
5G	Karlsson_LEDs+Modulator			Harbers

197 POR, 21-22

335 IPR

The Claimed Invention is Directed to an “Adaptive Multi-LED Headlight System” for Spatially Differentiated Light Distribution based on the Detection of a Vehicle in the Field of View

The '503 Patent is directed to “a novel multi-light source approach to the design and construction of solid-state lighting fixtures (vs. solid state lamps), which is termed a ‘Digital Lighting Fixture’, due to the control of individual lighting element ‘digits’ to provide the ‘correct’ lighting solution for the situation at hand.”

Ex.1001, 11:11-16

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, 11:61-67

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, 52:58-53:8

Lack of Particularity

Impact of "additionally, alternatively and either" styled arguments

1. 197 IPR presents six grounds to challenge 12 claims, but includes at least 41 sub-grounds
2. 328 IPR presents two grounds to challenge 17 claims, but includes at least 61 sub-grounds
3. 335 IPR presents two grounds to challenge 41 claims, but includes at least 47 sub-grounds
4. Petitioner's alternative arguments created at least 149 discrete sub-grounds for the '503 Patent

Petitioner has no explanation for the 45+ arguments advanced in 335 IPR

Petition - Alternative, Interconnected Hardware and/or Software arguments

The prior art combinations presented in the Petition are far from “clear.” On Reply, Petitioner states: “there are only two sets of grounds here ... Beam-Thominet, and ... Karlsson-Harbers” (Reply, 5) – ignoring “Beam alone,” “Karlsson alone,” and the myriad “additional/alternative” combinations (e.g., Thominet Software (“Software Implementation”) (Petition, 10-13); Thominet Hardware I & II (“Hardware Implementation[s]”) (*Id.*, 13-14; *See* POR, 20-26).

335 Sur Reply, 6

Problems Exacerbated on Reply:

Many reply arguments reference elements only present in a particular sub-combination, though the underlying explanation addresses a general combination (e.g., “Beam-Thominet”) and the general combination includes alternative sub-combinations lacking such elements.

335 Sur Reply, 6-7

A prime example of this is found in the Reply argument relating to “Beam-Thominet’s” usage of color. (Reply, 13.) Petitioner’s Ground 1 includes the following five sub-grounds:

- 1) Ground 1A – Beam Lamp+SLM (no Thominet/no color)
- 2) Ground 1B – Beam LEDs (no Thominet/no color)
- 3) Ground 1C – Beam’s lamp+SLM+Thominet’s software, (no color, no LEDs)
- 4) Ground 1D – Beam SW +Thominet’s LEDs (possibly color)
- 5) Ground 1E – Beam’s LEDs+Thomient’s curved substrate, (no color)

(POR, 22.)

335 Sur Reply, 7

Dependent claim arguments

1. Petitioner relies on new combinations of Beam (2- 4/42-44)
2. Petitioner impermissibly tries to include an element from one combination into all combinations (5/45)
3. Beam cannot **identify** vehicles
4. Petitioner again conflates results with claimed steps (39-41)
5. Petitioner's fatal flaw in the claim 58 analysis
 - Any proof for claim 58 needs to address controllability of claim 58 elements "as part of the instructed operation." The explanation for claim 19 is one sentence, without correlation of the argued elements to claim 19, let alone claim 58's. (Petition, 54.)
6. Claims 9, 15-17, 49, and 54-56
 - No combination of Beam and Kobayashi alone
 - SLM is a binary control device
 - Petitioner repeatedly relied on the single "maximum intensity" in the non-shaded areas

335 IPR – Claim 1

1. A vehicle headlight system comprising:

one or more headlamps and a vehicle structure, arranged for affixing components of the system to the vehicle;

a plurality of light clusters, arranged in each of the one or more of the one or more headlamps, the headlamps capable of projecting light so as to illuminate a plurality of sub-sections of a field-of-view with different illumination characteristics, the subsections determined in response to sensor data, wherein the light clusters operate to create a headlight beam;

electronic control circuitry configured to independently operate the light clusters;

one or more sensors configured to obtain and provide the sensor data predefined as pertinent to illumination requirements for the field-of-view; and

a logical controller including a processor, the processor in communication with a memory storing one or more algorithms, with the sensors, and with the control circuitry, wherein the processor is configured to process the one or more algorithms and the sensor data to determine an illumination for at least two of the sub-sections, that reduces illumination to reduce glare in at least a first of the at least two subsections and adapt the light emitted from one or more of the light-clusters so as to create the headlight beam that provides the determined illumination.

335 IPR – Claim 1

one or more sensors configured to obtain and provide the sensor data predefined as pertinent to illumination requirements for the field-of-view; and

Ex.1001, 95:52-54

335 IPR - Claim 37

Claim 37 requires “one or more subsections... to either side.” That is one or more subsections on one side, and one or more subsection on the other side. Petitioner’s proof did not show this. (POR, 68.) Petitioner’s new contention that “a POSA would have understood that beam 50 is adaptable to being on both sides” is a new argument and unsupported by annotated Fig. 14, (Petitioner’s chosen evidence), which is never taught to be separable into two windows. (Reply, 21-22.)

37. A vehicle headlight system comprising:

one or more headlamps affixable to a first vehicle;

a plurality of light clusters arranged in each of the one or more of the headlamps and capable of illuminating sub-sections of a field-of-view with different illumination characteristics, wherein at least two of the light clusters operate to create a headlight beam;

one or more sensors configured to obtain and provide sensor data, at least a portion of the sensor data indicating a second vehicle within the field-of-view; and

at least one processor configured to:

receive the sensor data;

process the sensor data to determine a light distribution pattern for an adaptive headlight beam, such that a headlight beam adapted to the pattern substantially illuminates a first subsection of the field-of-view including at least a portion of the second vehicle with an illuminance below a predefined threshold value, while the beam substantially illuminates at least the one or more second subsections of the field-of-view to either side of the first subsection with an illuminance above the predefined threshold value; and

instruct operation of at least two of the light clusters to create the adapted headlight beam.

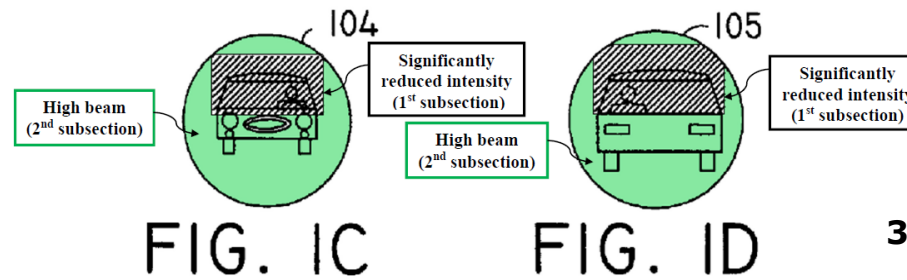
335 IPR -- Petitioner's results-based proofs for "how" Beam **determines "illumination"** for at least two subsections is not the function of Beam, per Petitioner's admissions [1.8]- [1.10]/[37.8]

Claim 1

Claim 1 requires: determining illumination "for" the first subsection. Beam provides no illumination from LEDs aimed at the first subsection – any "remaining" illumination is from off-center rays of light aimed elsewhere. (Ex.1005, 2:59-3:3, 6:45-48.) Beam does not determine this spillover illumination.

Petitioner uses this "resulting intensity that the ... oncoming driver would see" (*Id.*, 2:65-3) (i.e., the "illumination in the shaded areas") to undermine its own prior statements about Beam "extinguishing" light and "preventing" illumination. (*Id.*, 1:5-8, 8:33-34; Reply, 7.) Beam's control is "extinguishing." (POR, 51-52.) Beam's result may include "illumination" in the glare-zone, but that illumination is from LEDs aimed outside that zone – per Petitioner, LEDs aimed at that zone are "extinguished." (Ex.1003, ¶¶193, 252, 374, 407.)

335 Sur Reply, 9



(Ex.1003, ¶173.)

New Lamp + SLM arguments:

Statements about Beam's "lamp/LED+SLM" are decoupled from the original combinations where Petitioner clearly presented Lamp+SLM and LEDs as alternatives: "Beam's LEDs have the same functionality as lamp 202 and SLM 203." (Reply, 7; Petition, 43.)

335 Sur Reply, 9

335 Sur Reply, 4

Karlsson - *Sensor data* (claim 1 - 335 IPR)

Claim 1

A vehicle headlight system comprising:
one or more headlamps and a vehicle structure, arranged for affixing components of the system to the vehicle;
a plurality of light clusters, arranged in each of the one or more of the one or more headlamps, the headlamps capable of projecting light so as to illuminate a plurality of sub-sections of a field-of-view with different illumination characteristics, the subsections determined in response to **sensor data**, wherein the light clusters operate to create a headlight beam;
electronic control circuitry configured to independently operate the light clusters;
one or more sensors configured to obtain and provide the sensor data predefined as pertinent to illumination requirements for the field-of-view; and
a logical controller including a processor, the processor in communication with a memory storing one or more algorithms, with the sensors, and with the control circuitry, wherein the processor is configured to process the one or more algorithms and the sensor data to determine an illumination for at least two of the sub-sections, that reduces illumination to reduce glare in at least a first of the at least two subsections and adapt the light emitted from one or more of the light-clusters so as to create the headlight beam that provides the determined illumination.

Ex.1001, Claim 1

Petition:

Karlsson's "**light-sensitive sensor**...*detects* the distribution and the intensity of light in the *area ahead of a vehicle*" and "**control means 14...control the lighting means 2, 3...[so] light beam 7 having a desired pattern and a desired intensity is emitted.**" EX1010, 2:2-4, Abstract, 9:9-17, FIGS. 3, 14-15, 3:17-21, 12:19-24, 5:16-32, 3:27-31; EX1003, ¶¶605-608. **335 Petition, 120**

Karlsson's "**light-sensitive sensors 9 and 23**...*determin[e]* the *direction* and the *intensity* of the *detected light 11*." EX1010, 12:19-24, 2:2-4, Abstract, FIGS. 3, 14-15, 3:27-31, 19:18-21, 5:16-23, 3:17-20, 9:6-8, 5:28-32; EX1003, ¶¶616-619. **335 Petition, 112**

Jiao Decl, Ex.1003:

608. Karlsson's "**light-sensitive sensor**...*detects* the distribution and the intensity of light in the *area ahead of a vehicle*" for "*detecting* light from *oncoming traffic*" and "**control means 14...control the lighting means 2, 3** in such a manner that a **light beam 7 having a desired pattern and a desired intensity is emitted.**" EX1010, 2:2-4, Abstract, 9:9-17, FIGS. 3, 14-15; EX1010, 3:17-21 ("*light of oncoming traffic*"), 12:19-24 ("*precisely determining the direction and the intensity of the detected light 11*"), 5:16-32, 3:27-31.

Jiao Reply Decl, 335 Ex.1051

62. I agree with the Board's finding that "Beam describes a headlight system with a headlamp including a plurality of light clusters capable of projecting light to illuminate sub-sections of a field-of-view with different illumination characteristics as determined from sensor data." DI, 11. I agree with the Board's finding that Beam's headlight system includes a processor that processes sensor data to determine illumination for at least two of the sub-sections of a field-of-view and adapting the light emitted from the one or more of the light clusters. DI, 9-12.

Petitioner's SLM admissions / New LED + SLM argument

- Even Dr. Jiao's Reply Declaration admits: "these two positions [of the micromirror] determine the direction that light is deflected." (Ex.1051, ¶53 citing to Ex.2022, 2.) Dr. Jiao casts this as "controlling angle[s] [sic]," but Ex.2022 states ::[T]he positive (+) state is ... the 'on state' ... the negative (-) state is ... the 'off' state. ... These are the **only** operational states of the micromirror." (*Id.*) **335 Sur Reply, 14**
- Dr. Jiao opines that Beam's SLM (4:26-59) is a digital micromirror device (DMD), providing Enomoto (Ex.1040) as another DMD example and citing Figs. 2A-2C as how DMDs control "angular position." (Ex.1003, ¶¶148, 51.) **335 Sur Reply, 13**
- On reply, Petitioner points to a Beam citation (Ex.1005, 8:4-12), including recitation of an LED and an SLM, as though it were dispositive. (Reply, 12.) But the same cite includes recitation of an "incandescent lamp" (i.e., source 202) with an SLM. (Ex.1005, 8:4-12.) Per Petitioner: "LED array has the same functionality as the Lamp 202 and SLM 203." (Petition, 9.) Thus, absent any explanation to the contrary, the cite to Beam (Ex.1005, 8:4-12) appears to be a string-cite to evidence of an incandescent lamp and SLM. Petitioner never explained a combination using the LEDs and SLM, or a reason for such a combination, but did expressly explain the redundancy of such a combination. **335 Sur Reply, 15-16**

SLMs cannot aim emission (all IPRs)

The micromirror 2 has one horizontal state and two tilt states. The **two tilt states are utilized for image formation**. In one of the two tilt states, spotlight travels from the micromirror 2 to form an image. For example, while the micromirror 2 takes $+\theta$, spotlight from the micromirror 2 is guided to an image **forming optical path**. While the micromirror 2 takes $-\theta$, spotlight is not needed so that it is guided to an **eliminating optical path**. While the micromirror 2 takes $+\theta$, a valid reflection state (ON state) maintains in which **reflection light is utilized for image formation**. While the micromirror 2 takes $-\theta$, an invalid reflection state (OFF state) maintains in which **reflection light is not utilized for image formation** ... (Enomoto, Ex.1040, 5:12-26.)

335 Sur Reply, 13-14

With regards to 1A/1C, Petitioner's own extrinsic evidence proves Petitioner is wrong about how an SLM functions. (Reply, 10.)

335 Sur Reply, 13

By Dr. Jiao's own testimony, the "angular control" achieved by an SLM is binary. A first angle "forming an optical path" and a second angle for "eliminating an optical path." This is further supported by "angle modulation" as the result of mirrors being rotated "to one of two stable positions." (Ex.1056, 19). Even Dr. Jiao's Reply Declaration admits: "these two positions [of the micromirror] determine the direction that light is deflected." (Ex.1051, ¶53 citing to Ex.2022, 2.) Dr. Jiao casts this as "controlling angle[s] [sic]," but Ex.2022 states: "[T]he positive (+) state is ... the 'on state' ... the negative (-) state is ... the 'off' state. ... These are the only operational states of the micromirror." (*Id.*)

335 Sur Reply, 14

Petitioner's Motion to
Exclude Dr. Turk's
Declaration Evidence

1. *Kyocera doesn't apply*
2. *Governing precedent doesn't support Petitioner's new, narrow POSA interpretation*
3. *As an expert in optics, imaging and sensing — relevant to all disputed issues — Dr. Turk is qualified as a POSA in the pertinent art of "automotive light and lighting-control systems"*

Motion to Exclude: Petitioner's Broad Skill Level

Petitioner:

42. In my opinion, a POSA in the context of the '503 patent as of July 12, 2002 (the earliest possible priority date of the '503 patent)² 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.

43. 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.

0197 Ex.1003, ¶¶42-43;
See also 328 Ex.1003, ¶¶42-43;
See also 335 Ex.1003, ¶¶42-43

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 197 MTE, 12; 328 MTE, 12; 335 MTE, 12

“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).

197 Opp., 7-10; *see also*
328 Opp., 8-10
335 Opp., 8-10

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. (Ex.2006, ¶¶25-39.)

197 Opp., 8 *see also*
328 Opp., 9
335 Opp., 9

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

197 Opp., 10-11; *see also*
328 Opp., 10-11
335 Opp., 10-11

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.)

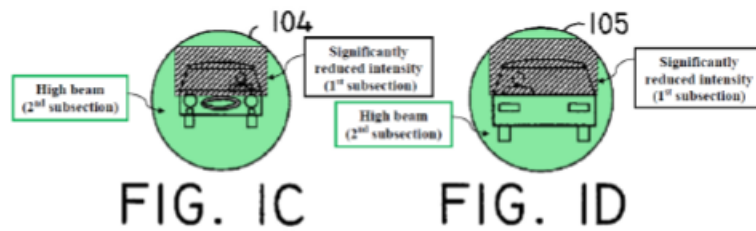
197 Opp., 10 *see also*
328 Opp., 10
335 Opp., 10

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.*)

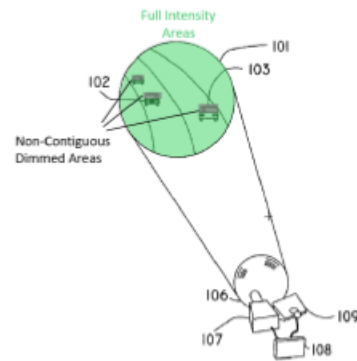
197 Opp., 12-13 *see also*
328 Opp., 12-13
335 Opp., 12-13

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 ’503 Patent: “methods of using a multi-LED light source to segment a field of view and deliver varied, optimized illumination to the different segments within the field of view based on the presence of a detected object therein, ‘covering a wide scope of applications’, including transportation.” (Ex.2006, ¶¶49, 47-54.) Dr. Turk’s opinions directly correlate with his expertise.

Dr. Jiao's contradictory positions



(Ex.1003, ¶¶84, 88, 108, 101, 124, 125, 126, 130, 140, 145.)



(Ex.2009, ¶149.)

328 Sur Reply, 5; *see also* 335 Sur Reply, 4

In another example, Dr. Jiao now contends “Beam discloses a system that includes at least *both* low beam and high beam ...” (Ex.1051, ¶¶79, 103.)

328 Sur Reply, 4; *see also* 335 Sur Reply, 3