

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

VOLKSWAGEN GROUP OF AMERICA, INC.,
Petitioner,

v.

YECHEZKAL EVAN SPERO,
Patent Owner.

U.S. Patent No. 10,894,503 to Spero

Case No.: IPR2023-00328

DECLARATION OF MATTHEW A. TURK PhD

TABLE OF CONTENTS

List of Exhibits.....	4
I. Qualifications and Professional Experience	6
II. Relevant Legal Standards	11
III. Overview of the ‘503 patent	12
A. Challenged Independent Claims.....	15
B. Qualifications of one of ordinary skill in the art	17
C. Proposed claim constructions.....	19
IV. Overview of the prior art	19
A. Beam: U.S. Patent No. 6,144,158	19
B. Thominet: U.S. Application Pub. No. 2001/0019486.....	26
C. Stam: WIPO Publication No. 2001/1070538	29
D. Harbers: WIPO Publication No. 2001/001038	30
E. Karlsson: WIPO Publication No. 1998/054030	33
V. Grounds for Challenge.....	39
A. All Grounds: Each Combination of References Fails to Teach the Determining Second Subsection Illumination Limitations and the Determining Control Strategy/Instruction Limitations in Claims 26 and 65.....	40
B. Grounds 1A and 2A: Beam Does Not Teach Directional Light Clusters/Sources	51
C. Grounds 1B-1C and 2B-2C: Even Combined, the Applied References Fail to Teach the Directional Clusters Limitations	54
D. Ground 8: Neither Karlsson Nor the Combination of Karlsson and Harbers Teach the Directional Light Clusters/Sources Limitations.....	55
E. All Grounds: A Person of Ordinary Skill in the Art Would Not Have Been Motivated to Combine Beam and Thominet or Karlsson and Harbers	59
1. Petitioner’s Rationale for Combining References Renders the Primary Reference Inoperable or Unsatisfactory for Its Intended Purpose.....	59
2. Grounds 1B-1C and 2B-2C: Beam’s Maximum Intensity Field-Of-View Teaches Away from Thominet’s	

	Illumination Functions Undermining Petitioner's Rationale for Combining.....	62
4.	Petitioner Fails to Explain <u>Why</u> the References Would Have Been Combined; the Rationale to Combine Suffers from Hindsight Bias	66
VI.	Conclusion	71

List of Exhibits

Exhibit No.	Description	Identifier
2001	Declaration of Matthew A. Turk, PhD	Turk Decl.
2002	Curriculum Vitae of Matthew A. Turk, PhD	Turk CV
2003	Best Practices and FAQs for Filing Requests for Reexamination Compliant with 37 CFR 1.510 and 1.915, PTAB, May 2010	Best Practices and FAQs
2004	Petition challenging U.S. Patent No. 10,894,503, Volkswagen Group of America, Inc. v. Yechezkal Evan Spero, IPR2023-00197, Paper 2, November 30, 2022	The '197 IPR Petition
2005	Petition challenging U.S. Patent No. 10,894,503, Volkswagen Group of America, Inc. v. Yechezkal Evan Spero, IPR2023-00335, Paper 2, December 23, 2022	The '335 IPR Petition

1. I, Matthew A. Turk, hereby declare as follows:
2. I am making this declaration at the request of Yechezkal Evan Spero in the matter of *Inter Partes* Review of U.S. Patent No. 10,894,503 (“the ‘503 Patent”) to Yechezkal Evan Spero.
3. I am being compensated for my work in this matter at a rate of \$490/hour for time spent reviewing materials and performing my analysis of the technical issues relevant to this matter. My compensation in no way depends on the outcome of this proceeding.
4. In preparation of this declaration, I have studied the exhibits as listed in the Exhibit List shown above in my report.
5. In forming the opinions expressed below, I have considered:
 - a. The documents listed above as well as additional patents and documents referenced herein;
 - b. The relevant legal standards, including the standard for obviousness provided in *KSR International Co. v. Teleflex, Inc.*, 550 U.S. 398 (2007), and any additional documents cited in the body of this declaration; and
 - c. My knowledge and experience based upon my work and study in this area as described below.

I. Qualifications and Professional Experience

6. I am a Professor and President of the Toyota Technological Institute at Chicago (TTIC) and an Emeritus Professor of the Department of Computer Science at the University of California, Santa Barbara. I have worked and studied in the field of computer vision since 1984, as well as related areas of image processing, pattern recognition, machine learning, and human-computer interaction. The field of computer vision is concerned with determining how computers can extract, analyze and understand information from images and video.

7. I received my doctorate degree in Media Arts and Sciences from the Massachusetts Institute of Technology (MIT) in 1991. My doctoral work was in the area of computer vision, specifically concerning automatic face recognition. I received my Master of Science degree in Electrical and Computer Engineering from Carnegie Mellon University in 1984. My Master's work was in the area of robot fine motion planning. I received my Bachelor of Science degree in Electrical Engineering from Virginia Tech (VPI&SU) in Blacksburg, Virginia in 1982, where my senior honors thesis was on image processing.

8. In 1991, I published the paper "Eigenfaces for Recognition," which I co-authored with my Ph.D. advisor, Dr. Alex Pentland. The research reported in this paper helped lead to practical automated face recognition systems that are used in today's security and surveillance systems, as well as in consumer applications.

My work on Eigenfaces has received several awards, including an IEEE Computer Society Outstanding Paper award at the IEEE Conference on Computer Vision and Pattern Recognition (CVPR) in 1991 and a “Most Influential Paper of the Decade” award from the International Association for Pattern Recognition (IAPR) Workshop on Machine Vision Applications (MVA 2000).

9. Along with my co-authors, I have received several other awards at professional conferences and workshops for my work in computer vision, image processing, and augmented reality, including several best paper awards and winning the ACM Multimedia Open Source Competition in 2015.

10. My industry experience includes working for Martin Marietta Denver Aerospace from 1984 to 1987, where I worked primarily on computer vision for autonomous vehicle navigation as part of the Defense Advanced Research Projects Agency’s Autonomous Land Vehicle program, the precursor to the later DARPA Grand Challenge events and subsequent advances in self-driving automobiles. In 1992, I was a visiting researcher at LIFIA/ENSIMAG in Grenoble, France and from 1993 to 1994, I worked for Teleos Research in Palo Alto, CA; in both of those positions, I worked on computer vision methods for recognizing human faces, gestures, and activity. From 1994 to 2000, I was a researcher for Microsoft Research, where I was a founding member of the Vision Technology Research Group and conducted research in vision-based human computer interaction and

other related areas.

11. In 2000, I joined the faculty of the University of California, Santa Barbara, as an Associate Professor. In 2005, I was promoted to Full Professor and served as the Chair of the Media Arts and Technology Graduate Program from 2005 to 2010. In 2017, I was appointed as Chair of the Department of Computer Science. At UCSB, I taught graduate and undergraduate courses related to computer vision, computer imaging, human computer interaction, probabilistic models and methods, artificial intelligence, computer graphics, machine learning, and other areas. My graduate Computer Imaging course covered the fundamentals of imaging systems, including the capture, storage, display, retrieval, and processing of images, as well as the nature of light, color, optics, human vision, non-visible (UV and IR) and multispectral imaging, sensors, cameras, and illumination.

12. I co-founded (in 2003) and co-directed the Four Eyes Lab at UCSB, where the research focus is on the “four I’s” of Imaging, Interaction, and Innovative Interfaces. The Four Eyes Lab researches a variety of topics, including computer vision, pattern recognition, virtual and augmented reality, and face processing technologies such as face recognition and facial expression analysis. I worked on and supervised many research projects in these areas, including (1) visual recognition of automobiles and (2) multi-flash imaging, which used multiple

image sources and special optics to infer 3D scene structure from images.

13. In 2014, I co-founded a startup company, Caugnate, to commercialize computer vision and augmented reality technology for remote collaboration. Caugnate was acquired by PTC Inc., in 2016, and now forms the core of the Vuforia Chalk augmented reality product.

14. In 2019, I became President of the Toyota Technological Institute at Chicago, an independent graduate research institute, where the research and education focus of the faculty and Ph.D. students is on computer science theory, machine learning, artificial intelligence, and related areas such as computer vision, speech and language processing, robotics, and computational biology.

15. As a result of my work and research, I am a named inventor of U.S. Patent Number 5,164,992 entitled “Face Recognition System,” U.S. Patent Number 6,674,877 entitled “System and Method for Visually Tracking Occluded Objects in Real-time,” and U.S. Patent Number 9,495,761 entitled “Environment mapping with automatic motion model selection.”

16. I was a founding member of the Advisory Board for the International Conference on Multimodal Interfaces (ICMI), which provides a venue for disseminating recent advances in multimodal interaction research, systems, and methods, which includes combining visual modalities with audio, haptic, or other modalities. I served as the Chair of the ICMI Advisory Board from 2006 to 2009. I

was also a founding member of the Advisory Board for the IEEE International Conference on Automatic Face and Gesture Recognition and served as the General Chair for the conference in 2011. I have been a primary organizer of several top research conferences, including serving as General Chair for the 2014 IEEE Conference on Computer Vision and Pattern Recognition, the primary annual conference in the field of computer vision, with over 2000 attendees, Program Chair for the 2017 IEEE Winter Conference on Applications of Computer Vision, and General Chair of the 2019 International Conference on Multimodal Interfaces (ICMI).

17. I am currently an Associate Editor of the *ACM Transactions on Intelligent and Interactive Systems* and the *International Journal of Computer Vision and Signal Processing*, and was formerly an Associate Editor of *Image and Vision Computing*. I have also served as a guest editor of several other journals related to computer vision, machine learning, and facial recognition.

18. In 2020, I was elected a Fellow of the Association for Computing Machinery (ACM), the main professional society in the field of computer science, for “contributions to face recognition, computer vision, and multimodal interaction.” In 2013, I was elected as a Fellow of the IEEE (the Institute of Electrical and Electronics Engineers), an award conferred by the Board of Directors of the IEEE upon a person with an extraordinary record of

accomplishments in any of the IEEE fields of interest. In 2014, I was elected as a Fellow of the International Association for Pattern Recognition (IAPR). In 2022, I was named as a Fellow of the Asia-Pacific Artificial Intelligence Association. I am also the recipient of the 2011-2012 Fulbright-Nokia Distinguished Chair in Information and Communications Technologies. I have given many keynote presentations at top conferences and workshops in my fields.

19. I have provided my full background in the curriculum vitae that is attached as Exhibit 2002.

II. Relevant Legal Standards

20. I have been asked to provide opinions on the claims of the '503 Patent in light of the prior art.

21. It is my understanding that a claimed invention is unpatentable under 35 USC § 102 if a prior art reference teaches every element of the claim. Further, it is my understanding that a claimed invention is unpatentable under 35 U.S.C. § 103 if the differences between the invention and the prior art are such that the subject matter as a whole would have been obvious at the time the alleged invention was made to a person having ordinary skill in the art to which the subject matter pertains. I also understand that an obviousness analysis takes into account factual inquiries including the level of ordinary skill in the art, the scope and content of the prior art, and the differences between the prior art and the claimed

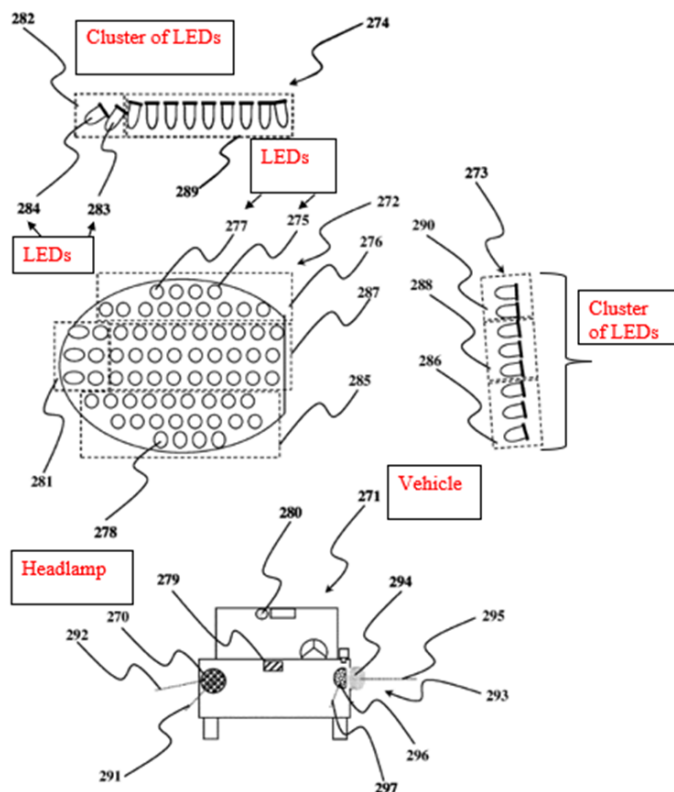
subject matter.

22. It is my understanding that the Supreme Court has recognized several rationales for combining references or modifying a reference to show obviousness of the claimed subject matter. Some of these rationales include the following: combining prior art elements according to known methods to yield predictable results; simple substitution of one known element for another to obtain predictable results; a predictable use of prior art elements according to their established functions; applying a known technique to a known device to yield predictable results; choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success; and some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention.

III. Overview of the ‘503 patent

23. 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 ‘503 Patent further explains that “[t]he terminology ‘digital’ as used herein refers to the discrete nature of the multiple

LED lamps provided in the luminaire, whereby, ‘digital’ control results from the individual control of the discrete, i.e., ‘digital’ lighting elements, the LEDs, in the luminaire.” (*Id.*, 2:67-3:5.)



(Ex. 1001, FIG 15, Annotated)

24. “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.” (*Id.*, 11:61-67.)

25. More specifically, the ‘503 Patent describes 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. (Id., 11:18-21, 4:20-24, 50:40-41.)

26. In the context of headlights,

[a]dditional features can include an optional very narrow flashlight type of beam. . . 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.

(Ex.1001, 52:58-53:2.)

27. Additionally, a spatially differentiated illumination pattern can be determined to differently illuminate segments of a field of view based on the detection of an object:

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, 53:3-8.)

28. The claimed invention of the '503 Patent is thus directed to multi-LED headlight systems that precisely determine anti-glaring illumination output to optimize illumination for the vehicle operator under a myriad of driving situations, whilst reducing glaring illumination for oncoming vehicles.

29. The dependent claims include additional innovative features that specify illumination strategies for a myriad of driving situations.

A. Challenged Independent Claims

30. The Challenged Claims include independent claims 26 and 65, which are reproduced below with claim identifiers with emphasis added to the Determining Second Subsections Illumination Limitations, the Directional Light Clusters/Sources Limitations and the Determining Control Strategy/Instructions Limitations:

[26.P] 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:

[26.1] 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;
<u>[26.2] 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;</u>
<u>[26.3] 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;</u>
[26.4] sending control signals implementing the control strategy to an electronic control circuitry configured to operate the light-clusters; and;
[26.5] controlling the light clusters via the electronic control circuitry to collectively emit the headlight beam meeting the determined illumination requirements.

[65.P] 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:

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

[65.2] 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 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;

[65.3] 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

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

B. Qualifications of one of ordinary skill in the art

31. I have been asked to provide my opinion as to the level of skill of a

person having ordinary skill in the art (“POSITA”) of the ’503 Patent at the time of the claimed invention. In determining the characteristics of a hypothetical person of ordinary skill in the art of the ’503 Patent at the time of the claimed invention, I was told to consider several factors, including the type of problems encountered in the art, the solutions to those problems, the rapidity with which innovations are made in the field, the sophistication of the technology, and the education level of active workers in the field. I also placed myself back in the time frame of the claimed invention and considered the skill level of colleagues with whom I had worked at that time.

32. In my opinion, a POSITA of the ’503 Patent at the time of its filing would have been a person having a Master of Science Degree (or a similar technical Master’s Degree, or higher degree) in an academic area emphasizing electrical engineering, computer engineering, or computer science with experience or education in optics and imaging systems or, alternatively, a Bachelor’s Degree (or higher degree) in an academic area emphasizing electrical, computer engineering or computer science and having two or more years of experience in the field of optical and imaging systems.

33. At the time of the filing of the ’503 Patent, a skilled artisan developing a lighting system utilizing LEDs and corresponding controls would have encountered new challenges with respect to both optics and LED controls.

Accordingly, it is my opinion that a POSITA would have had experience with both, i.e., engineering and optics.

C. Proposed claim constructions

34. To properly evaluate these claims, I understand that the terms of the claims must first be construed. In my opinion, the claims of the ‘503 Patent do not include any terms that require specific construction. Instead, each of the claims includes terms that an ordinary artisan would understand according to their plain and ordinary meaning.

IV. Overview of the prior art

A. Beam: U.S. Patent No. 6,144,158

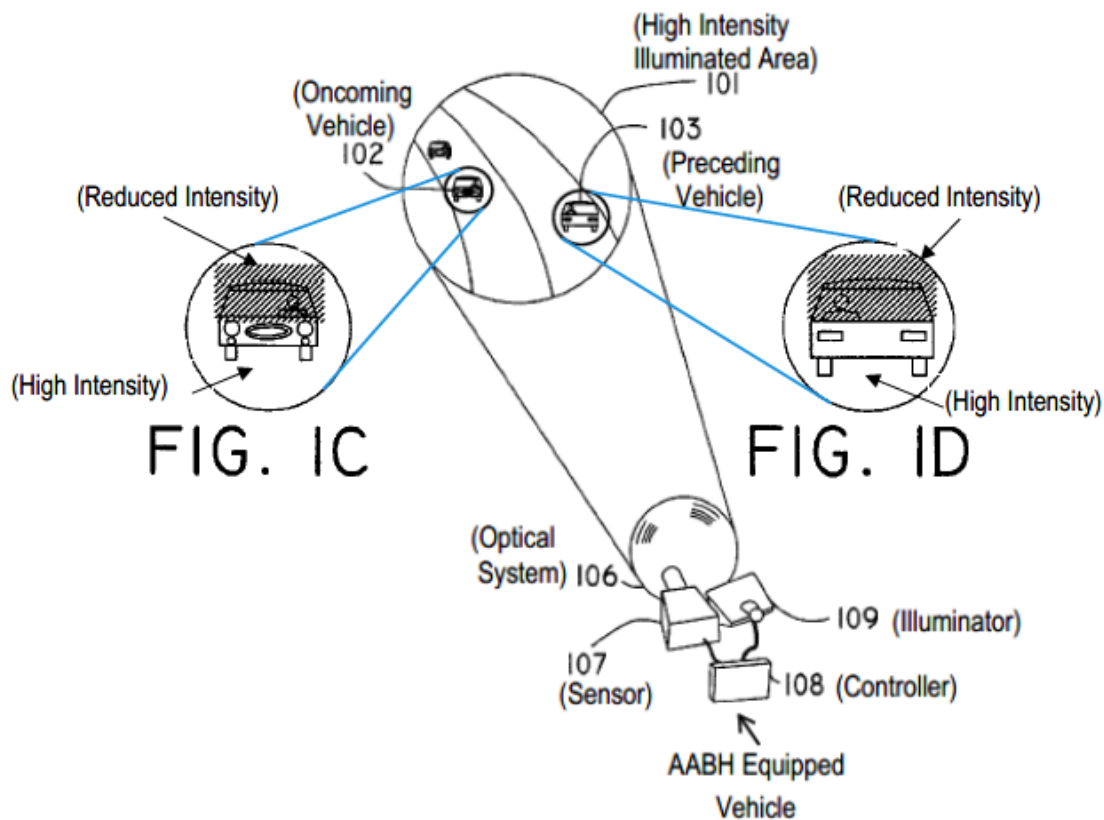
35. Beam discloses a complete, but generalized, Adaptive Anti-Blinding Headlight (“AABH”) system, where there is no need to differentiate among light sources, to aim the LEDs, or to provide any form of lateral illumination. The AABH system has a multiplicity of LED-produced microbeams that “operate at maximum intensity at all times” allowing “the driver to have the equivalent of high beam headlights or brighter on at all times, greatly enhancing the ability to see at night.” (Ex.1005, 6:11-12, 6:40-44.) Beam provides significantly reduced illumination only in those portions of the headlight beam that would otherwise dazzle or annoy other drivers. (Ex.1005, 6:40-44, 3:8-14.) This is accomplished by “darken[ing] those microbeams that would otherwise illuminate areas near to the

source of the impinging beam, thus eliminating the blinding of a driver in an oncoming vehicle, while continuing to provide intense forward illumination.” (Ex.1005, 1:14-18, Claims 4, 5, emphasis added.)

36. Beam’s AABH system is non-mechanical and non-moveable, i.e. a system with no moving parts or mechanisms to change the direction of the light beam (“non-moveable”). Beam recognized that existing headlight systems operated “either as a ‘high beam’ or as a ‘low beam,’” often under manual control, and various unsatisfactory attempts to solve this problem included “systems which attempt to control the intensity profile of the beam by using a reflector or lens shaped to control the output beam in some predetermined way; systems to move the headlamps in response to changes that occur to the automobile on which they are mounted; . . . movement of headlight beams in response to changes in the vehicle’s steering mechanism, etc.” (Ex.1005, 1:21-23, 1:63-2:5.) Beam also recognized the problem of headlamps being misaligned and illuminating unintended areas that could result in blinding of other drivers.

37. Beam solves the identified problems by providing a streamlined, non-moveable AABH system having a multiplicity of microbeams that “operate at maximum intensity at all times” thereby eliminating the complexity and potential failures of various prior art systems that attempt to change the beam direction or reduce overall intensity while still allowing “the driver to have the equivalent of

high beam headlights or brighter on at all times, greatly enhancing the ability to see at night.” (Ex.1005, 6:11-12, 6:40-44, 6:54-56, 3:8-14.) Other than controlling intensity of individual microbeams in response to detected incoming light, Beam does not disclose or suggest directional light sources, processing incoming light to differentiate a vehicle from other light sources, or changing direction of any microbeams, nor would the AABH system benefit from such increased control complexity, as its normal mode is to “operate at maximum intensity” to illuminate the field-of-view of the headlights, obviating a need to “add” or “increase” light anywhere. (Ex.1005, 1:15-19, 6:11-12.) Thus, Beam begins with a premise that a light, “operat[ing] at maximum intensity at all times,” is already maximally placing light everywhere it can, leaving nothing left to place, move, or add. (Ex.1005, 6:11-12.). Against such a fully and maximally illuminated field-of-view, Beam then concerns itself with determining where to remove light.

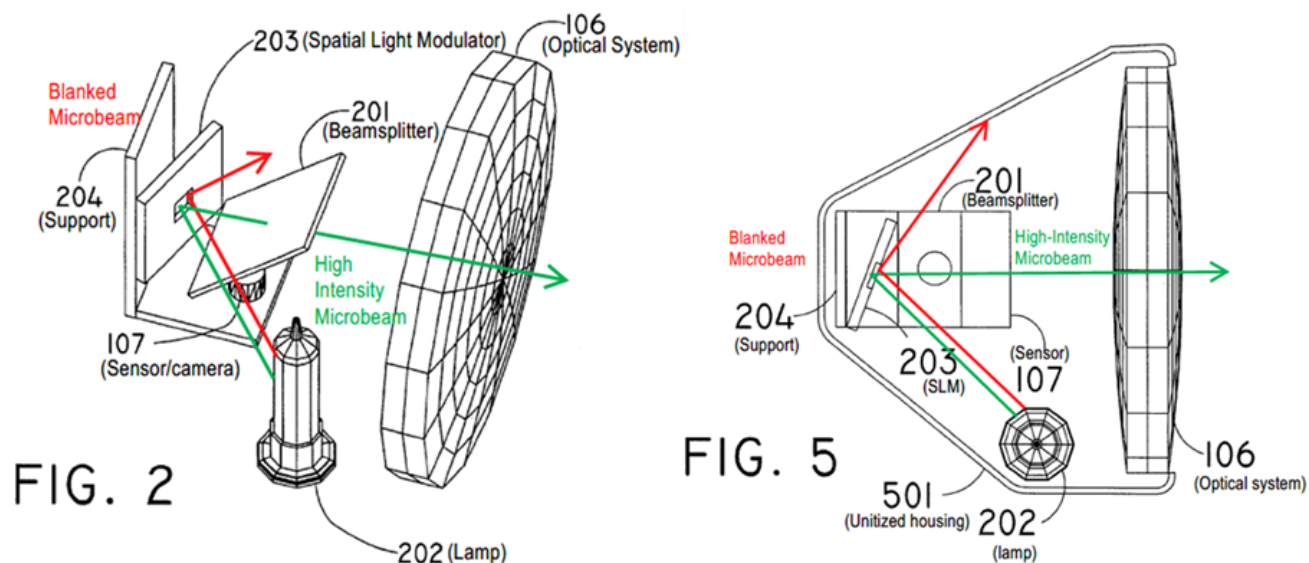


(Ex.1005, FIGs. 1, 1C, 1D, Annotated)

38. In the AABH system, illuminator 109 projects individually controlled narrow-angle microbeams to provide high-intensity illumination of illuminated area 101. Incoming light—which could be associated with headlights of an oncoming vehicle 102 and/or taillights of a preceding vehicle 103, streetlights, motorcycles or other light sources—is transmitted through optical system 106 and detected by a sensor (camera) 107. Sensor (camera) 107 is boresighted with the headlight so that the field-of-view (FOV) of the camera is coincident with the FOV of the headlight beam. 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 corresponding to the shaded areas shown in Figs. 1C, and 1D. (Ex.1005, 4:9-24, 53-59, 62-64.)

39. Beam describes two distinct embodiments using alternative components that significantly reduce illumination intensity of individual microbeams in response to detecting incoming light. (Ex.1005, Figs. 3, 4.) However, neither embodiment discloses changing the direction of any of the microbeams. (*Id.*) Likewise, neither embodiment discloses processing signals from the incoming light sensor/camera to differentiate a vehicle from any other light sources. (*Id.*) Rather, Beam's AABH system significantly reduces intensity of microbeams associated with detected incoming light, regardless of whether the light source is a vehicle, streetlight, or any other source.

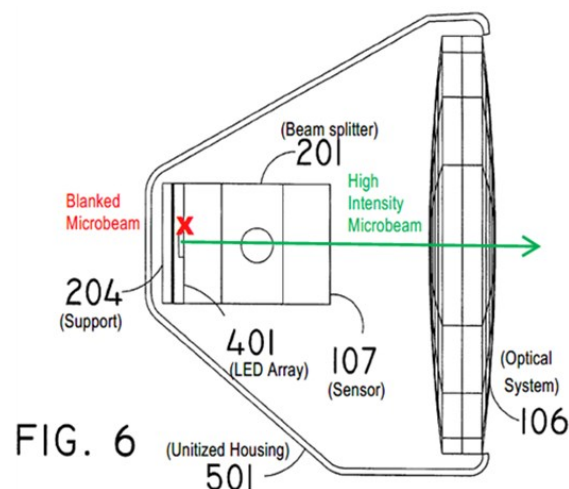
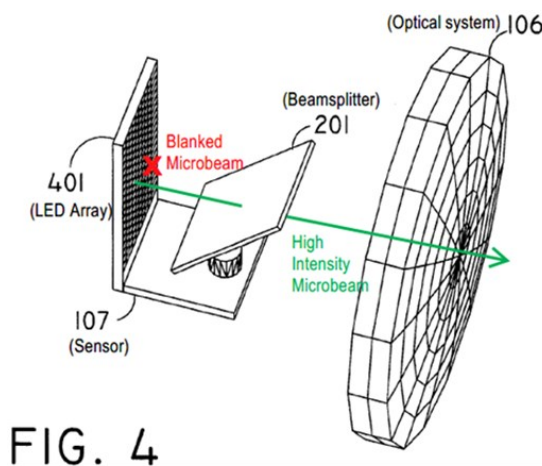


(Ex.1005, FIGs. 2, 5, Annotated)

40. In the first embodiment illustrated in Fig. 2 (perspective view) and

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

41. SLM 203 does not change the direction or angular position of the headlamp beam exiting optical system 106 because the blanked microbeams are “diverted or attenuated at the source” and never exit the headlamp optical system 106. (*Id.* at 5:66.) Furthermore, changing the direction of the microbeams exiting the headlamp optical system may result in misalignment of the FOV of the microbeams exiting the optical system 106 relative to the FOV of sensor 107 detecting incoming light. (*Id.*)



(Ex.1005, FIGs. 4, 6, Annotated)

42. The second embodiment is illustrated in Fig. 4 (perspective view) and Fig. 6 (top view). The second embodiment replaces both SLM 203 and lamp 202 used to generate and modulate (reduce) intensity of the microbeams of the first embodiment, with an X-Y array of light sources 401, such as an LED array, that generates the narrow-angle microbeams. (Ex.1005, 5:3-16, 5:28-31.) Microbeam blanking is accomplished by dimming selected LEDs, making the modulator of the first embodiment superfluous; it is thus omitted from the second embodiment. (*Id.*)

43. In operation, incoming light enters through optical system 106 and is reflected by beamsplitter 201 to sensor 107. (Ex.1005, 5:3-16.) The sensor signals corresponding to the angular position (azimuth/elevation) or the spatial location of the detected light are mapped by controller 108 to associated microbeams to determine the size (number) and location of the LEDs within LED array 401 to be blanked or dimmed to prevent blinding/dazzling other drivers. (Ex.1005, 5:10-16.) Beam does not disclose processing by controller 108 to differentiate among various types of light sources.

44. Beam's AABH system thus solves the various prior art problems identified without the associated complexity and is thus a complete but generalized system that eliminates moving components and potential misalignment of headlight beams, with no need to detect and differentiate between different types of light sources. (Ex.1005, 1:60-2:6.)

45. Intentionally left blank.

46. Notwithstanding Petitioner's assertions, a POSITA would clearly understand that Beam does not disclose 1) LEDs aimed at different angles or having controllable directionality; 2) an ability to process incoming light to detect a vehicle relative to any other light source or detect a pedestrian; 3) the ability, or even a reason, to point or steer the headlight beam for any purpose; 4) the ability to segment the field of view ("FOV") into subsections based on the detection of a vehicle; 5) processing incoming light to minimize beams directed at "objects," or "vehicles," (in contrast to reducing microbeams directed at locations of incoming light- or 6) processing the incoming light to control LEDs to optimally and differently illuminate at least two distinct field of view subsections, one including a detected vehicle, to mitigate glaring light illuminating the subsection including the detected vehicle.

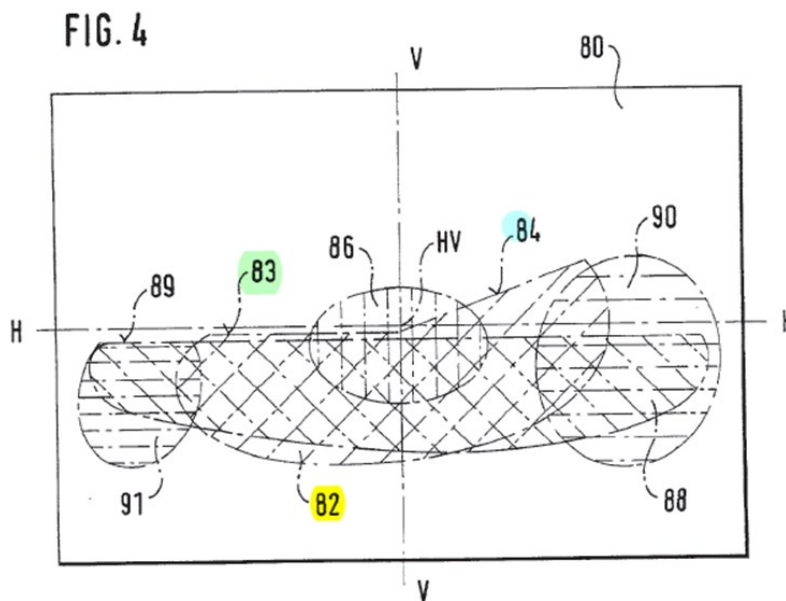
B. Thominet: U.S. Application Pub. No. 2001/0019486

47. Like Beam, Thominet discloses an array of LEDs with independently controllable intensity. However, unlike the simpler Beam AABH system that uses the entire LED array to provide high beam illumination across the field of view (other than in areas of detected incoming light), Thominet discloses the concept of assigning different LEDs within the LED array to provide "different illumination functions (low beam, high beam, low sight, large width)." (Petition at 15.) More

specifically, the different illumination functions in Thominet are provided by LEDs “arranged in partial quantities in different defined partial regions of the matrix” and these partial regions are “operatable independently from one another.” (Ex. 1006, claim 1; Abstract, ¶20.) As such, Thominet improves upon prior art implementations having an LED array that has only one function (such as the Stam reference described below) by assigning the LEDs within a single array different functions e.g. to produce light of different colors (for a signal function and a headlight), a concentric high beam, a horizontally dispersed light beam with wider front illumination or to provide “one side oriented light”. (Ex. 1006, ¶¶ 2, 4-9, 25.) All embodiments teach LEDs arranged in functionally predefined regions actuated as a group to achieve an associated illumination function.

48. While Thominet discloses that LEDs can be arranged in one plane or distributed “over a concavely curved surface or a stepped surface,” Thominet does not suggest any advantages, disadvantages, functional differences or other reasons to select any of the possible arrangements for any particular application. (Ex. 1006, claim 8, ¶0018.)

49. Thominet teaches using a screen 16 to create a bright-dark limit, which blocks a portion of light from light sources 10, creating illumination patterns similar to conventional high beam/low beam patterns. (Ex. 1006, ¶22.)



(Ex. 1006, Fig. 4, Annotated)

50. On review of Thominet, a POSITA would understand that the LEDs of the array are neither controlled as a single group (as in the recognized prior art) nor as individual light sources as in Beam's AABH system to create the different illumination patterns as shown in Fig. 4. Rather, predefined groups of LEDs are actuated depending on the associated desired functions to be operated. A POSITA would also understand that by segmenting the LED array into sections with different functions, the intensity of the resulting beam is necessarily reduced relative to a maximum attainable intensity associated with actuation of the entire array of LEDs.

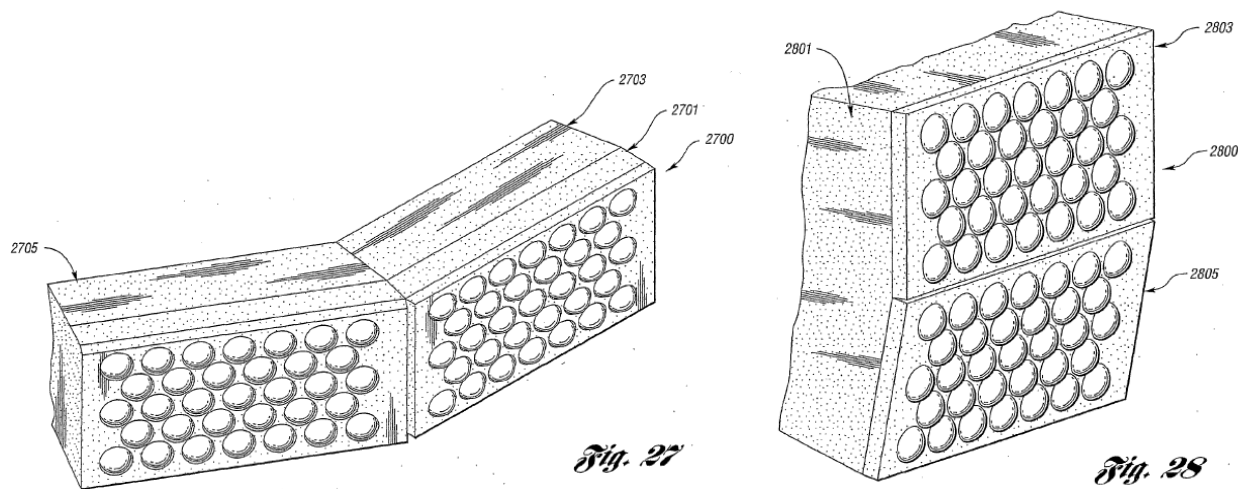
51. Separate from the lower attainable intensity and coarser control provided by the segmented groups, use of a screen to create a bright-dark limit

blocks light generated by the actuated group of LEDs, further reducing intensity of the beam exiting the headlamp above the bright-dark limit.

52. A POSITA would also understand that Thominet describes conceptual arrangements and generalized automatic switching between illumination functions based on parameters such as speed, steering wheel action, wiper system, or a sensor system for recognizing counter traffic without describing any processing strategies to actuate one or more of the predefined functional groups of LEDs in response to a particular parameter to implement the different functions.

C. Stam: WIPO Publication No. 2001/1070538

53. Unlike Thominet, but similar to the prior art disparaged by Thominet, Stam discloses a headlamp having single-function LED arrays with actuation of all LEDs within the array for a particular function, such as low beams or high beams. In the embodiment of Fig. 27, LED headlamp 2700 is controlled to actuate a first LED array in a first lamp section 2703 or a second LED array in a second lamp section 2705. Similarly, in the embodiment of Fig. 28, headlamp 2800 is controlled to actuate a first LED array in a first lamp section 2803 to provide a high beam function, or a second LED array in a second lamp section 2805 to provide a low beam function. (Ex.1007, 77:30-78:9, 84:21-85:2.)



(Ex.1007, Figs. 27, 28)

54. Intentionally left blank.

55. Intentionally left blank.

56. Intentionally left blank.

57. Intentionally left blank.

58. Intentionally left blank.

59. Intentionally left blank.

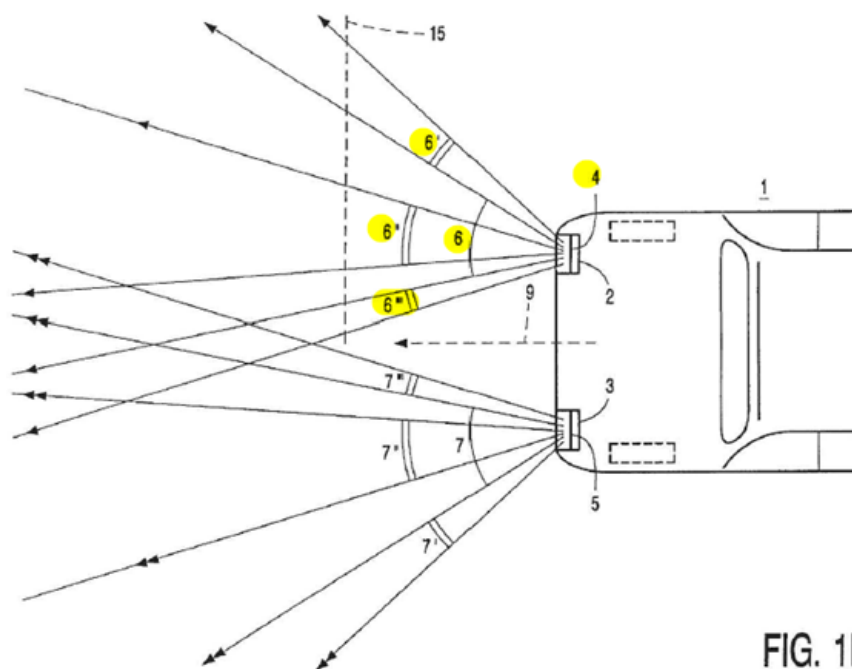
60. Intentionally left blank.

61. Intentionally left blank.

D. Harbers: WIPO Publication No. 2001/001038

62. Harbers discloses a headlamp system having fixed, planar LED arrays

with groups of LEDs associated with different illumination functions. As depicted in Figure 1B of Harbers, a “headlamp (2;3) of a vehicle (1) has a light source (4;5) comprising a plurality of opto-electronic elements (11;12;13;14), preferably light-emitting diodes (LEDs). . . The light beam generated by the light source comprises at least two light beam segments (6, 6'; 7,7') which define the spatial distribution of the light beam.” (Ex.1011, Abstract.)



(Ex. 1011, FIG 1B, Annotated)

63. As depicted in the asymmetric light distribution patterns of FIGS 3A and 3B, Harbers discloses a headlamp that provides light along multiple optical axes. (Ex.1011, FIGS 3A and 3B.) Spatial distribution of the light beam is achieved by selectively switching on and off individual LEDs and the

corresponding light beam segments. (*Id.*, 7:15-19, 8:21-25.)

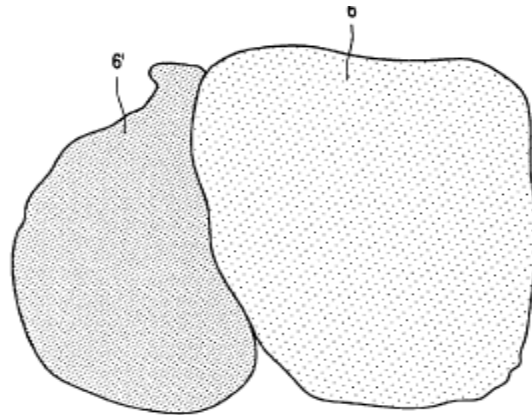


FIG. 3A

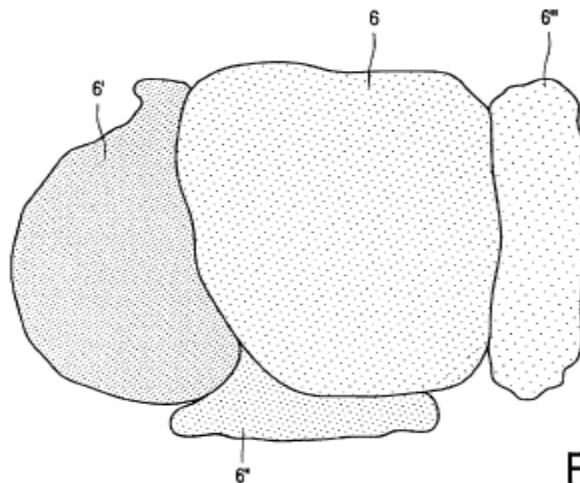


FIG. 3B

(Ex. 1011, FIGS 3A, 3B)

64. Harbers identifies specific parameters that can be used to define the desired spatial distribution of the light beam. Per Harbers, “the spatial distribution of the light beam can be influenced by the velocity of the vehicle...It may also be desirable for the width of the light beam to decrease and/or the intensity distribution between on-axis viewing and off-axis viewing to change.” (*Id.*, 3:28-

34.)

65. In another embodiment, Harbers discloses that:

the spatial distribution of the light beam can be influenced by the rotational position of the steering wheel of the vehicle. This enables the spatial distribution of the light beam of the vehicle headlamps to be adapted to the position of the steering wheel of the vehicle...By switching on or off one or more opto-electronic elements at specific-limiting values of the rotational position of the steering wheel of the vehicle, a continuously adjustable spatial distribution of the light emitted by the vehicle is obtained.

(*Id.*, 4:5-14.)

66. In yet another embodiment, “the spatial distribution of the light beam can be influenced by the weather conditions.” (*Id.*, 4:16-17.) In a final embodiment, “the spatial distribution, for example, the range and/or the width of the light beam, . . . [may] be adjusted by the driver” of the vehicle. (*Id.*, 4:24-25.) Apart from the above-identified inputs that could be used to define the spatial distribution of the light beam, Harbers provides no control teachings related to sensors or map data and thus no ability to control the LEDs to illuminate a desired region.

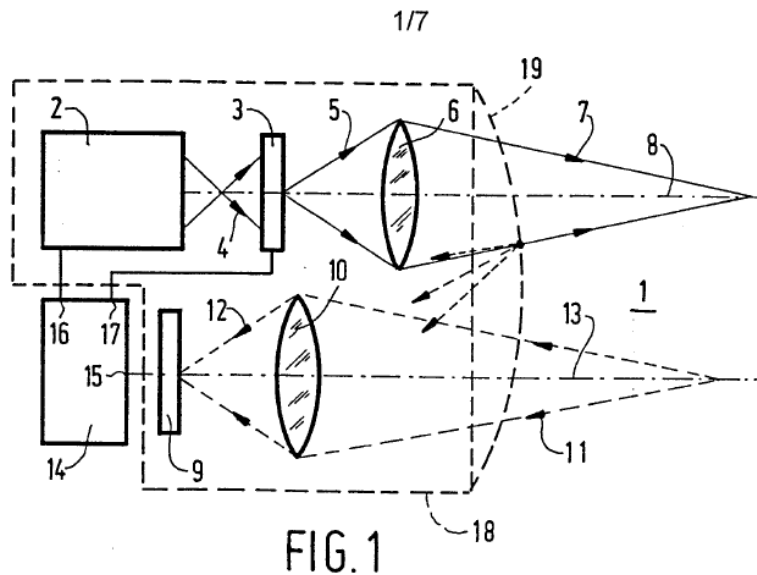
E. Karlsson: WIPO Publication No. 1998/054030

67. Karlsson discloses a headlight system using fixed LEDs, having

individually controllable intensities to create “spotlight beams” providing intense forward illumination brighter than low beams or conventional dipped headlights. Spotlight sensors interspersed with the LEDs provide anti-blinding functionality by turning off LEDs corresponding to detected light, “whereby the field of view of the light-sensitive sensors and the illumination field of the light beam to be emitted, will coincide.” (Ex. 1010, 3:29-31.)

68. Like Beam, Karlsson’s LED array is a fixed planar array that does not include LEDs aimed at different angles relative to the vehicle. Likewise, the only individually controllable characteristic of the fixed LEDs is their intensity. Unlike Beam but similar to Thominet, Karlsson assigns groups of LEDs within a single LED array to associated lighting functions, such as a dipped beam, main beam, etc.

69. In particular, Karlsson discloses “a lighting device 1 . . . [with] lighting means in the form of a light source 2 and light modulator means 3.” (Ex. 1010, 8:10-12.) “The light source 2, the light modulator means 3 and the lens 6 are arranged on an optical axis 8” to form light 5 “into a desired emitted light beam 7.” (*Id.* at 8:17-18.) The system includes “sensor means consisting of a light-sensitive sensor 9 and a further lens 10 disposed on the side of sensor 9 that is exposed to the incident light, such that incident light 11 on the lens 10 is formed into an incident light beam 12 on light-sensitive sensor 9.” (*Id.* at 8:19-23.)



(Ex. 1010, FIG 1)

70. Karlsson further discloses that “[t]he light modulator means 3 are controlled by the control means 14 in such a manner that the light 4 emitted by the light source 2 is processed into a light beam 7 having a desired pattern and intensity” that is “determined on the basis of the light 11 that is detected by the light-sensitive sensor 9 via the further lens 10.” (*Id.* at 9:3-8.) Controlling “the pattern and the intensity of the light beam 7” of a headlight “in such a manner that no light at all or light having a low intensity is emitted in those directions from which light is detected by the light-sensitive sensor 9” prevents “glaring or blinding of oncoming traffic.” (*Id.* at 9:19-23, emphasis added.)

71. “[C]ontrol means 14 are preferably arranged to switch the incident light 5 on the lens 6 periodically on and off” and detecting incident light with the sensor 9 “during the time that the light 5 is off” avoids “reflected light being

scattered by the cover glass 19 as indicated by dashed arrows.” (*Id.* at 9:27-33.)

72. With reference to Figure 6, Karlsson discloses “a light beam 33 which is composed of separate, spatially distributed . . . spotlight beams 34.” (*Id.* at 13:31-32.) The “spotlight beams 34 can be obtained, for example, by using a light source 2 which is composed of a grid of separate light sources, such as LEDs, which can preferably be controlled either individually or in groups.” (*Id.* at 14:1-4, emphasis added.)

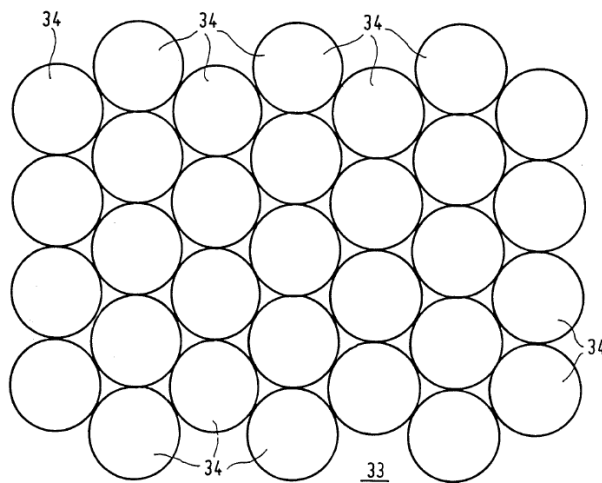


FIG. 6

(Ex. 1010, FIG 6)

73. 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.* at 19:22-27.) Further “[t]he double-shaded

spotlight sources indicated at D/I are both operative as dipped and main-beam [lights].” (*Id.*, 19:27-28.)

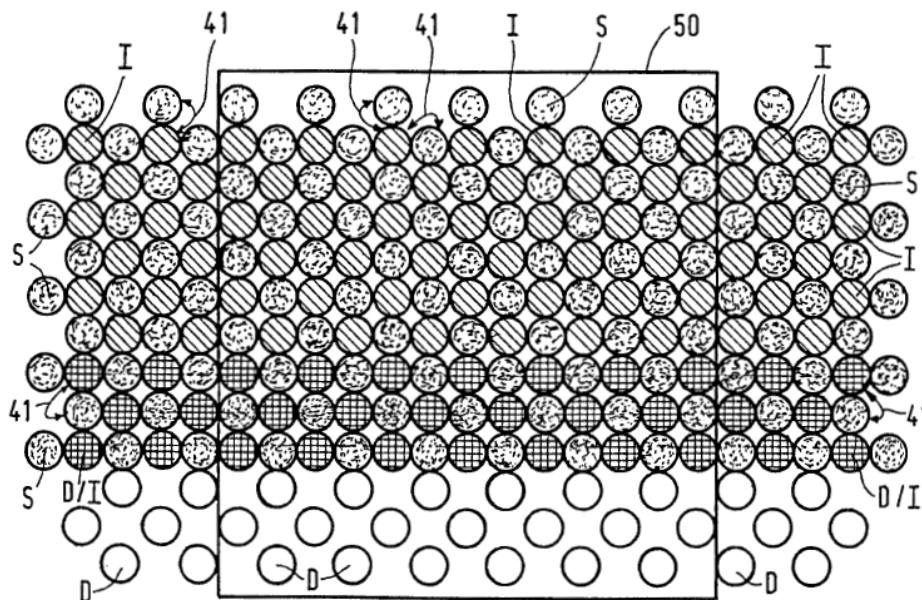


FIG. 14

(Ex.1010, FIG 14)

74. The “emitted light beam 50 is represented as a window which can shift in the plane of the drawings from the left to the right and from the top to the bottom, if desired, and vice versa, and which may vary as regards its shape and dimension in dependence on the desired pattern and direction of the beam” (*Id.* at 19:29-33.)

75. Any shifting of the emitted light beam is constrained by the number and arrangement of LEDs within the LED array and is not capable of swinging the emitted beam optical axis in the direction of a curve. (Ex.1010, 20:24-32.)

76. However, any shifting of the emitted light beam is constrained by the number and arrangement of LEDs within the LED array and is not capable of changing direction of the light emitted by the LED array.

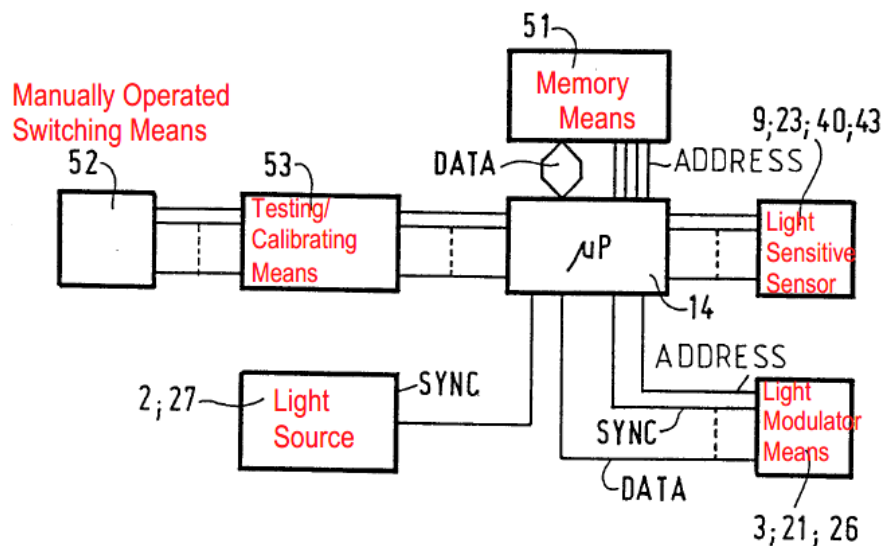


FIG. 15

(Ex.1010, FIG 15, Annotated)

77. As shown in Figure 15, “testing and/or calibrating means 53 are provided, which enable automatic adjustment of the lighting device according to the invention at a calibration station and storage in the memory means 51, in such a manner that a light beam [50, Fig. 14] is emitted which is adapted to the respective national and/or international regulations, as is schematically shown in Figure 16.” (Ex.1010, 20:16-21.)

78. In addition to the interspersed spotlight sensors, an inclination sensor may sense the angle of inclination of the car with respect to the road surface so that the emitted light beam is adapted to respective regulations at all times. However,

Karlsson is silent with respect to how the control means 14 coordinates control of the LEDs based on signals from both the spotlight sensors and the inclination sensor. Similarly, a direction sensor connected to the steering wheel may be provided “for determining when the car 56 is taking a bend, so that the light beam 7 can be adapted to prevent the traffic on the other side of the road from being blinded as much as possible.” (Ex.1010, 20:30-32.) However, Karlsson is also silent with respect to how the control means changes intensity of LEDs based on the direction sensor as opposed to the spotlight sensors detecting light from traffic on the other side of the road.

79. On review of Karlsson in its entirety, a POSITA would understand that Karlsson does not disclose: 1) LEDs aimed at different angles relative to the vehicle; 2) processing detected light to identify subsections within the field of view including a detected vehicle; or 3) controlling the emitted beam to aim illumination below a predefined illuminance to the subsection including the vehicle while providing illumination above the predefined illumination to another subsection.

80. Intentionally left blank.

81. Intentionally left blank.

V. Grounds for Challenge

82. For purposes of simplicity, the [20.2]/[59.2] claim limitations will be

referred to as the Aiming Limitation, the [20.9] and [59.7] claim limitations will be referred to as the Detected Vehicle Limitations and the [20.11-20.13] and [59.8-59.12] limitations will be referred to as the Output Limitations. I understand that Petitioner uses and/or terminology to combine each primary reference with one or more teachings of a secondary reference. For example, regarding Ground 1, Petitioner proposes combining Beam with Thominet's software and/or hardware. (Petition at 11.) Similarly, regarding Ground 8, Petitioner proposes combining Karlsson with Harber's software and/or hardware. (Petition at 81.) Accordingly, as shown in the following table, Grounds 1 and 8 expand into at least 3 grounds each:

Grounds			Challenged Claims	References
Lumped Ground #1	1A	102	26-27, 30-31	Beam
	1B	103	26-27, 30-31	Beam + Thominet's <i>Software</i>
	1C	103	26-27, 30-31	Beam + Thominet's <i>Hardware</i>
Lumped Ground #8	8A	102	26-31, 65, 68-69	Karlsson
	8B	103	26-31, 65, 68-69	Karlsson + Harber's <i>Software</i>
	8C	103	26-31, 65, 68-69	Karlsson + Harber's <i>Hardware</i>

A. All Grounds: Each Combination of References Fails to Teach the Determining Second Subsection Illumination Limitations and the Determining Control Strategy/Instruction Limitations in Claims 26 and 65

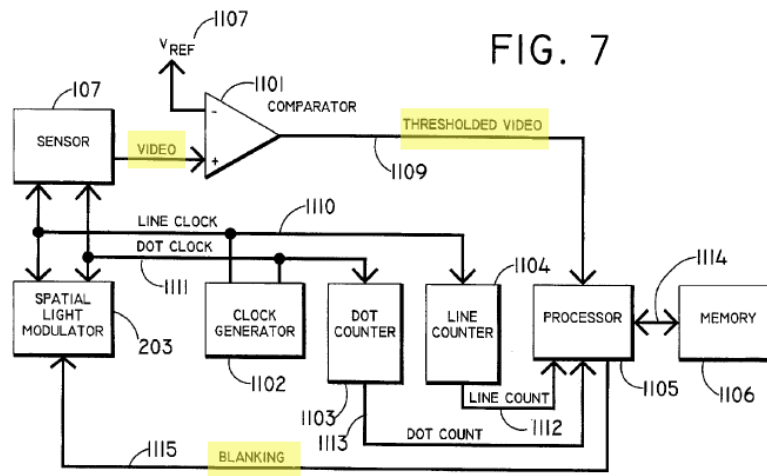
83. In all Grounds, the combinations lack disclosure of systems that

employ methods of determining illumination requirements: 1) *for at least a second subsection of the field-of-view not including the other vehicle or pedestrian*, per [26.5] and 2) *for at least one or more second subsections, to either side of the first subsection*, per [65.4]. Rather than providing evidence that the applied references determine illumination requirements for the sections that *don't include* a vehicle and/or pedestrian, Petitioner simply points to operating illumination states. Providing light is however not the same as *determining illumination requirements*. By conflating the **provision** of illumination—which is addressed in [26.10] and [65.10]-- with the **determination of illumination requirements** for the second subsection, Petitioner impermissibly removes the Determining Second Subsection Illumination Limitations in [26.5] and [65.4] and the corresponding Determining Control Strategy/Instruction Limitations in [26.8 and 65.9] and Determining Illumination Level Limitation in [65.7].

84. Petitioner's Grounds 1 and 2 argument for the [26.5] and [65.4] limitations is restricted to a single sentence and disconnected from the claim language: "Beam discloses determining illumination for a second subsection (without the vehicle) by **providing** '*higher brightness beam in the areas which do not dazzle the drivers ahead*' and '*the area...that would dazzle the driver will be darkened, while maintaining full intensity elsewhere.*' EX1005, 3:19-24, 2:59-3:3, FIGS. 1, 1C-1D, 7, 6:40-44, 6:11-12, 1:5-18; EX1003, ¶¶154-156." (Petition

at 25, 43, emphasis added.) The mere provision of high intensity beams in the areas that “do not dazzle drivers ahead” does not, without more, equate to a method for determining the illumination requirements for the second subsections that don’t include a vehicle/pedestrian.

85. Reading between the lines, Petitioner seems to incorrectly assume that by illuminating all areas where light is not detected, the Beam system must have engaged in the step of determining illumination requirements for the second subsections. Petitioner’s assumptions lack support; Beam neither defines second subsections based on the absence of vehicles/pedestrians nor determines illumination requirements for the second subsections. Indeed, Petitioner’s own citations undermine their position. Figure 7 of Beam illustrates how the system detects light and utilizes a pixel-by-pixel approach through its dot and line counters to determine “the locations to be blanked” and “the appropriate pixels to be reduced in intensity.” (Ex.1005, 5:46-54.) Everywhere else, even according to Petitioner’s own argument, illumination is merely **maintained** at the base “maximum” state at which it always operates when not intentionally dimmed.



(Ex.1005, FIG 7, Annotated)

86. Because Beam determines which pixels to block based on the detection of light (as opposed to the detection of a vehicle), it has no ability or reason to 1) collect data on detected vehicles or pedestrians in the field of view, per [26.2 and 65.2]; 2) define second subsections based on the absence of vehicles/pedestrians and determine illumination requirements/illumination for second subsections that exclude vehicles or pedestrians, per [26.5 and 65.4]; and 3) determine control strategies/instructions for subsections that exclude vehicles or pedestrians, per [26.8 and 65.9].

87. In sum, Beam makes no determination about sections that do not correspond to detected light. In reference to claims 26 and 65, Beam fails in both its inability to determine illumination requirements for a second subsection not including the detected vehicle or pedestrian as well as its inability to differentiate between a subsection that does or does not include a vehicle or pedestrian. Yet

Petitioner never addresses these shortcomings – it never explains how Beam would distinguish between a section that include a vehicle or pedestrian compared to those that do not, given that Beam merely detects light (which can come from any source and itself has no direct correlation to either a vehicle or pedestrian). Petitioner also never explains what portion of Beam **determines the illumination requirements** for the second subsection -- or what those requirements would be, how they would be determined, etc.

88. Petitioner’s Ground 8 argument similarly misses the mark. For the [26.5 and 65.4] limitations—directed to determining illumination for second subsections **excluding** vehicles—Petitioner’s argument is yet again disconnected from the claim language:

Karlsson discloses “pattern and...intensity are automatically adjusted...permitting a light intensity...generally higher than that of conventional dipped headlights.” EX1010, Abstract, FIGS. 3, 14-15, 19:26-33, 2:7-9, 14:26-30, 5:16-32, 9:9-17; EX1003, ¶486. Karlsson thus determines illumination for a different subsection outside of the detected vehicle (e.g., high intensity area to either side of first subsection). EX1010, 5:16-23, 9:9-17, 12:19-24, FIGS. 14-15; EX1003, ¶¶486-487

(Petition at 95.)

89. When the above quoted sections are reviewed in their entirety and not modified through ellipses, they establish that Karlsson adjusts the illumination

pattern and intensity responsive to light detection, in a manner very similar to Beam, but, by contrast, with even fewer operational details. As before, Petitioner's citations are devoid of any teachings for **determining illumination for any sections that do not include a vehicle.** The Petition fails to explain how Karlsson determines whether or not detected light corresponds to a vehicle and, relatedly, how to determine a section that does not include a vehicle.

90. Once again, Petitioner improperly points to the mere provision of light to satisfy the [26.5 and 65.4] limitations requiring *determining illumination* for second subsections that exclude a vehicle and the related step of *determining an illumination level* for the second subsections in [65.7-65.8]. (Petition at 95, 113.) In so doing, Petitioner impermissibly reads out the [26.5 and 65.4] Determining Second Subsections Illumination Limitations and [65.8] Determining Second Subsections Illumination Level Limitations, conflating these determining steps with the [26.10 and 65.10] limitations directed to controlling the light clusters/sources to emit the headlight beam in accordance with the illumination requirements/control instructions.

91. Because Karlsson, like Beam, determines which LEDs to switch off based on the detection of light by sensors, it has no ability or reason to 1) obtain sensor data on detected vehicles or pedestrians, per [26.2 and 65.2] and determine *illumination requirements for the field-of-view* based on the obtained data per

[26.3]; 2) define and determine illumination *for second subsections that exclude a vehicle* in [26.5], which are located on either side of the first subsection that includes a detected vehicle per [65.3-65.4]; and 3) determine an illumination level for the second subsections, per [65.7-65.8]. Rather than engaging in the step of determining illumination requirements for second subsections, Karlsson simply relies on nearby interspersed sensors to determine which LEDs to shut off. Since Karlsson is directed to the limited “purpose of accurately measuring ambient light and light on oncoming traffic” to improve detection capability and reliability, it lacks any details regarding whether/how a controller forms the desired light patterns. (Ex.1010, [7-21].)

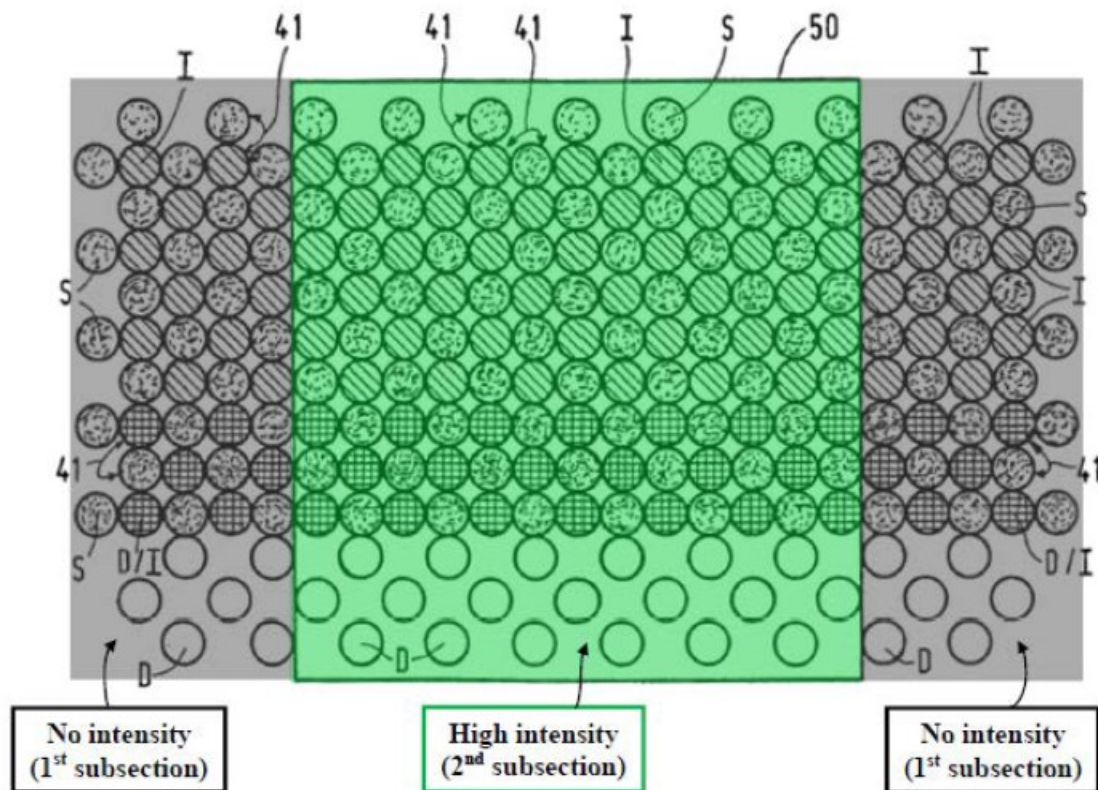
92. Petitioner takes great liberty in assigning specific functions to the controller, despite the utter absence of such teachings. By way of example, Petitioner states: “Karlsson discloses ‘incident light 11 on the light-sensitive sensor 9 . . . is processed into an electrical control signal on input 15 of the control means 14.’ [citations omitted] Thus, incident light data from the sensor determines ‘illumination requirements for the field of view.’” (Petition at 95.)

93. Since the sensor can’t determine “illumination requirements for the field of view,” but can only provide inputs, Petitioner seems to be arguing that control means 14 provides this functionality. It does not. However, in Karlsson, control means 14 is only ascribed two functions: 1) “to switch the incident light 5

on the lens periodically on and off . . . [so] the light detected by the sensor 9 is measured and processed without the measurement by the sensor being affected” (Ex. 1010, 9:27-33.); and 2) “the electric signal fed to the input 15 of the control means 14 by the light-sensitive sensor 9 is processed by the control means 14 into output signals at outputs 16,17 thereof, so as to 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.” (Ex. 1010, 9:9-17.)

94. Apart from identifying the two controller functions, and specifying that the pattern and the intension of the light beam 7 can be “controlled in such a manner that no light at all or light having a low intensity is emitted in those directions from which light is detected,” Karlsson offers no other details regarding how the controller generates the desired pattern and intensity. (Ex. 1010, 9:19-22.) Thus, contrary to Petitioner’s arguments for [26.3], Karlsson fails to teach a system that determines ‘illumination requirements for the field of view.’ (Petition at 21.) The same evidentiary gap exists in the Petition for **all** of the claimed determining steps, *inter alia*, in [26.2 and 65.2], [26.3], [26.5], [65.3-65.4]; and [65.7-65.8].

95. As part of its unsupported and confusing argument, Petitioner relies heavily on its own annotated version of Figure 14—referring to it 17 times—to demarcate two “No Intensity” first subsections and a “High Intensity” second subsection:



(Petition at e.g., 80, 91.)

96. Notably, Petitioner’s version of Figure 14—specifically regarding Petitioner’s added annotations for the claimed first and second subsections—is not taught by Karlsson. As detailed below, Petitioner neither offers support for its “no-intensity” first subsection demarcations nor the conclusions that it draws therefrom.

97. When the maze of citations are unpacked, the Petition provides no support for its conclusion that “Karlsson determines illumination for a different subsection outside of the detected vehicle (e.g., high intensity area to either side of first subsection).” (Petition at 95.) Indeed, Petitioner’s own conclusions are not

even supported by Petitioner's homemade version of Figure 14, which actually shows something different from what Petitioner argues. Petitioner argues that there is a high intensity second subsection to either side of the first subsection, but the modified Figure 14 shows first subsections to either side of the high intensity second subsection. Petitioner never explains that an additional high intensity subsection would exist, let alone why or how it would exist.

98. Addressing each failing individually, Karlsson fails to support Petitioner's Figure 14 "no-intensity" first subsection demarcations; at best, Karlsson teaches that certain LEDs within the first subsections would be switched off. In Karlsson, each LED functions independently based on indication of detected light from a nearby sensor. Specifically, spotlight sensors (S) interspersed with the LEDs (I) provide anti-blinding functionality by turning off LEDs corresponding to detected light. (Ex.1010, 3:29-31.)

99. Karlsson is unclear as to which or how many LEDs are turned off, and there are certainly no teachings of a "section" including a vehicle and/or other "sections" not including a vehicle. Karlsson's teachings are further muddled, as it assigns groups of LEDs within a single array to associated lighting functions and doesn't explain when/how those associated lighting functions are integrated with the anti-blinding functionality. (Ex.1010, 19:22-27.)

100. Finally, Petitioner's own Fig. 14 version contradicts Petitioner's

argument that “Karlsson determines illumination for a different subsection outside of the detected vehicle (e.g., high intensity area to either side of first subsection).” (Petition at 95.) In the Petitioner-created version, Fig. 14 includes two no-intensity first subsections to either side of a high intensity “second subsection.” This is neither congruent with what Petitioner argues Karlsson teaches, nor claim 65, the latter claiming that the first subsection that includes the lower illumination is *between* the second subsections of higher illumination. Petitioner’s modified Fig. 14 places the first and second sections in positions neither claimed by Patent Owner nor otherwise argued by Petitioner.

101. Even assuming Petitioner’s version of Fig. 14 was supported by Karlsson, the “no-intensity” first subsections on either side of a “high intensity” second subsection, are the opposite configuration from the one required by limitation [65.4]. Limitation 65.4 requires *determining illumination for second subsections to either side of the first subsection*, but where the first subsection of diminished illumination is bounded on either side by second subsections that are *more brightly* illuminated than the area between them (not unlit, as shown).

102. Thus, Petitioner’s arguments fail to establish how Karlsson teaches the Determining Second Subsections Illumination Limitations in [26.5 and 65.4] and by extension, the interrelated Determining Second Subsections Illumination Level Limitation in [65.7] and Determining Control Strategy/Instructions in [26.6

and 65.9].

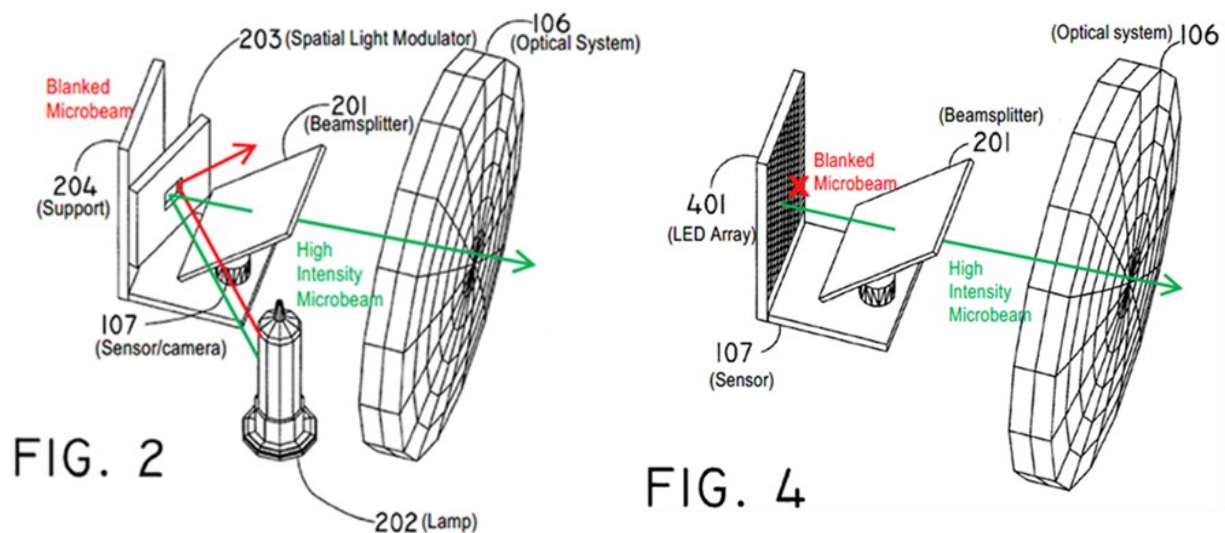
103. When reviewed in context, the applied references lack any teachings to support Petitioner's positions on interrelated limitations [26.3-26.8] of claim 26 and likewise the [65.4], [65.7] and [65.9] limitations of claim 65.

B. Grounds 1A and 2A: Beam Does Not Teach Directional Light Clusters/Sources

104. In Grounds 1A and 2A, to satisfy limitations [26.6]/[65.9], Petitioner asserts that “[e]ach 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.” (Petition at 8-9 and 29) Tellingly, Petitioner takes two distinctly contradictory positions to satisfy the Directional Light Clusters/Sources Limitations — arguing on the one hand for purposes of claim construction that the light source “includes any headlamp light source” and then undermining its own construction to assert that “each microbeam is a directional ‘cluster’ or source” Petition at 7-8. A reflected **beam** of light is not “*a light source*.”

105. The foundation of Petitioner's position, is the fictional narrative that Beam's LED array embodiment in Figure 4 has “the same functionality as lamp 202 and SLM 203,” in the Figure 2 embodiment—essential to Petitioner's

argument that “Beam’s LED array also includes directional light clusters/sources. . . . “--independently controllable angular microbeam clusters/sources—that ‘create an output headlight beam meeting the determined illumination requirements’/‘achieve the determined illumination levels’ as recited in [26.6]/[65.9].” (Petition at 9-10.)



(Ex.1005, FIGs. 2, 4, Annotated)

106. Beam teaches that 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 — i.e., with no ability to provide independent angular positioning. Beam’s AABH system is thus incapable of operating as Petitioner contends.

107. Because Beam’s **blanking** of selected microbeams from the LED

array forming the output beam is controlled in response to incoming light, and specifically the location of incoming light relative to the corresponding microbeams generated by the LED array, Beam maps the angular position of incoming light with each LED in the X-Y matrix to facilitate selective darkening, not to control or change the angular position of each LED, as Petitioner contends. “The output and reflected wavefronts are used to determine range and angular position of the vehicles ahead in the usual manner. The output drives controller 108, of FIG. 1, which uses range data to determine size and azimuth/elevation data to determine the position of the area of the microbeams to be dimmed.” (Ex.1005, 4:62-5:1.) Indeed, Beam is incapable of controlling the angular position of each LED—the LEDs are fixed in place within the X-Y matrix. (Ex.1005, 5:3-16.)

108. Petitioner relies on two separate embodiments of Beam to meet the Challenged Claims, without explaining how a POSITA would have thought that these embodiments and teachings are the same or interchangeable.

109. Intentionally left blank.

110. Petitioner also repeatedly notes, and even relies on, the fact that when an LED array is present, it actually **replaces** the spatial light modulator that would exercise any degree of control over the microbeams. (*See e.g.*, Ex.2005 at 43. “Beam’s LEDs have the same functionality as lamp 202 and SLM 203.”) Thus, to the extent that Petitioner is relying on the presence of the LED array to satisfy

claim limitations, which is the case in every argument presented, Beam expressly has replaced the SLM in every such instance, and therefore any argument predicated on the presence of the SLM is not supported by Beam.

111. Intentionally left blank.

C. Grounds 1B-1C and 2B-2C: Even Combined, the Applied References Fail to Teach the Directional Clusters Limitations

112. Petitioner's primary references fail to disclose the Directional Light Clusters/Sources Limitations in [26.6] and [65.6]. The addition of Thominet in Grounds 1B-2B and 1C-2C is of little use; the combination still fails to disclose the Directional Light Clusters/Sources Limitations.

113. In a convoluted Ground 1B-2B argument, Petitioner seems to combine Beam with the "control technique (software implementation)" in Thominet: "using multiple beam regions (clusters) for different functions." (Petition at 11, 12.) More specifically, Petitioner proposes modifying Beam's software: "A POSA would have had a reasonable expectation of success combining Beam and Thominet, for example, by simply modifying software instructions in memory of Beam's controller/processor to organize Beam's array of microbeams into multiple directional beam regions for different functions." (Petition at 14.) However, because microbeams do not constitute a light source, per Petitioner's own admission, angularly positioned microbeams do not constitute directionally

controlled light sources, as required by the Directional Light Clusters/Sources Limitations in all Challenged Claims.

114. Finally, for its third and also futile effort, Petitioner attempts a hardware combination— “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).” (Petition at 14.) “Beam’s array of light sources 401 and Harbers’s differently colored opto-electronic elements 11-14 on a curved substrate—would have provided Beam-Thominet’s system with different colored spatial distributions for different driving situations, as in Harbers.-Thominet’s differently angled/aimed semiconductor sources 10 on curved surface 12.” (Petition at 32.) As Petitioner correctly points out, “in Thominet “semiconductor light sources 10 arranged on curved surface 12 provide beam regions 22, 24, 26, 28 for different driving situations.” (Petition at 15.) What Petitioner fails to mention, however, is that each of the beam regions are predefined for specific functions and controlled as a unit—rendering Thominet fundamentally incompatible with Beam. Petitioner also fails to present a plausible rationale to combine.

D. Ground 8: Neither Karlsson Nor the Combination of Karlsson and Harbers Teach the Directional Light Clusters/Sources Limitations

115. Petitioner can’t decide whether or how various limitations of the

Challenged Claims are found in Karlsson or Harbers or some combination thereof left to the imagination of the reader. To satisfy the Directional Light Clusters/Sources Limitations [26.6]/[65.9], Petitioner asserts that Karlsson discloses every feature of claims 26-31, 65, and 68-69, but if not, then Harbers discloses [26.6]/[65.9] and a POSITA would have been motivated to extract them from Harbers and insert them into Karlsson (Petition at 78.)

116. Although Petitioner has repeatedly asserted that LEDs are individually controllable light sources, recognizing that Karlsson's LED array does not include LEDs that are aimed at different angles or have aimings, Petitioner undermines its construction of light source to improperly conflate the emitted beam and the light source-- arguing that each of Karlsson's spotlight beams is a directional 'cluster' or 'source'. (Petition at 78-79, emphasis added.) As this is still insufficient to meet [26.6]/[65.9], Petitioner creates new capabilities for Karlsson's "light modulator means 3" by omitting essential context on p. 78 stating that "light modulator means 3 advantageously can be switched to . . . given directions." (Petition at 78, 116-117.) Contrary to this misrepresentation of Karlsson as teaching a "directional light source", this quote is related to detecting incoming light when the light sensor is positioned behind the light modulator means 3: **"If the light modulator means 3 are arranged to receive incident light in front of the sensor 23, the light modulator means 3 advantageously can be switched to detect light by the sensor**

23 from a given direction or given directions.” (Ex.1010, 11:25-28.)

117. The Petition is also unclear as to how **“the combination of Karlsson’s spotlight beams** form *at least one directional light cluster/source* to provide illumination in desired subsections” to satisfy either explicitly or implicitly [26.6]/[65.9]. (Petition at 78.)

118. Perhaps recognizing the untenable contortions of Karlsson to meet [26.6]/[65.9], Petitioner provides a conclusory assertion that if Karlsson doesn’t disclose these limitations “to avoid doubt, Karlsson is combined with Harbers, for [26.6] and [65.9] rendering the claims obvious” relying solely on Dr. Jiao’s declaration ¶433 that parrots the same. (Petition at 78.) Dr. Jiao then states that the “array of opto-electronic elements 11; 12;13; 14| . . .” disclosed by Harbers is now the directional light sources that satisfy [26.6] and [65.9], rather than some combination of beams emitted by the opto-electronic elements as required for Petitioner’s interpretation of Karlsson. However, neither Petitioner nor Dr. Jiao describe how Harbers’ “array of opto-electronic elements” a.k.a. “directional light sources” of Fig. 2 that may alternatively be provided on a curved substrate are combined or substituted into the planar LED array of Karlsson’s Fig. 14 that includes interspersed light-sensitive sensors.

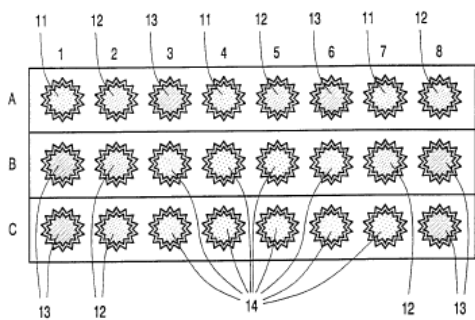


FIG. 2

Harbers Array/Light Pattern

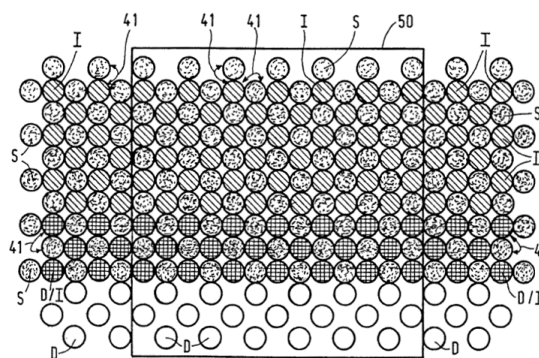


FIG. 14

Karlsson Array/Light Pattern

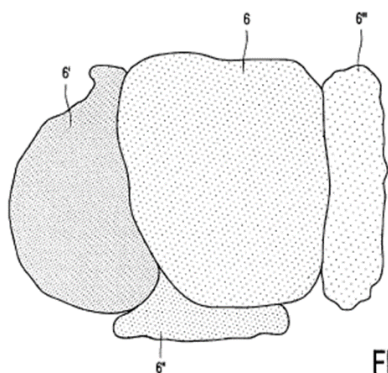


FIG. 3B

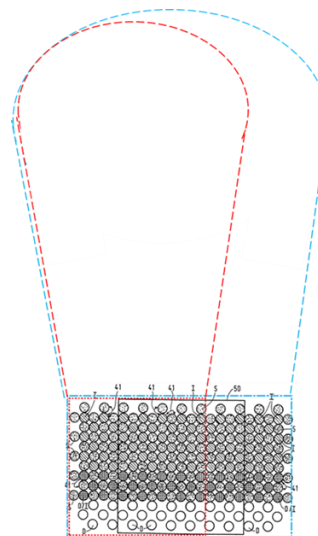


FIG. 14



(Ex.1011, Figs 2, 3B, Annotated)

(Ex.1010, Fig. 14, Annotated)

119. Furthermore, Petitioner does not explain how the combined Karlsson/Harbers system having a curved substrate to satisfy [26.6]/[65.9] controls intensity of the individual spotlight beams in response to light detected by the interspersed light-sensitive sensors of Karlsson, or how parameters such as vehicle velocity, steering wheel position, or weather as disclosed by Harbers are provided

by the dipped/main beam groupings of LEDs disclosed by Karlsson. Petitioner further fails to describe how the four beam segments and resulting light pattern of Harbers is provided by the groupings of D, I, and D/I LEDs in Karlsson that correspond to the dipped beam and main beam functions. In short, Petitioner simply selectively combines the two teachings out of convenience and completely omits any and all addressing of the myriad of additional issues this would create.

E. All Grounds: A Person of Ordinary Skill in the Art Would Not Have Been Motivated to Combine Beam and Thominet or Karlsson and Harbers

1. Petitioner’s Rationale for Combining References Renders the Primary Reference Inoperable or Unsatisfactory for Its Intended Purpose

a. Grounds 1B-1C and 2B-2C: The Proposed Combination Renders Beam Inoperable and Defeats Beam’s High-Intensity Illumination “At All Times” Purpose

120. In Grounds 1B-1C and 2B-2C, Petitioner’s proposed modification of Beam by adding “an additional control technique (software implementation) . . . -- Thominet’s *known technique* of using multiple directional beam regions for different functions”—would 1) render Beam’s AABH system inoperative or unsatisfactory for its stated purpose of providing “high-intensity illumination all the time” but for selective darkening associated with the location of incoming light, 2) interfere with Thominet’s stated purpose of providing partial predefined regions that are controllable as a unit to deliver multi-functional capability with an LED

array and 3) as a result, would not accomplish Petitioner's proffered purpose of "improving driver safety."

b. Petitioner's Contorted Rationale Undermines the Crux of Beam's Maximum Intensity "At All Times" Strategy

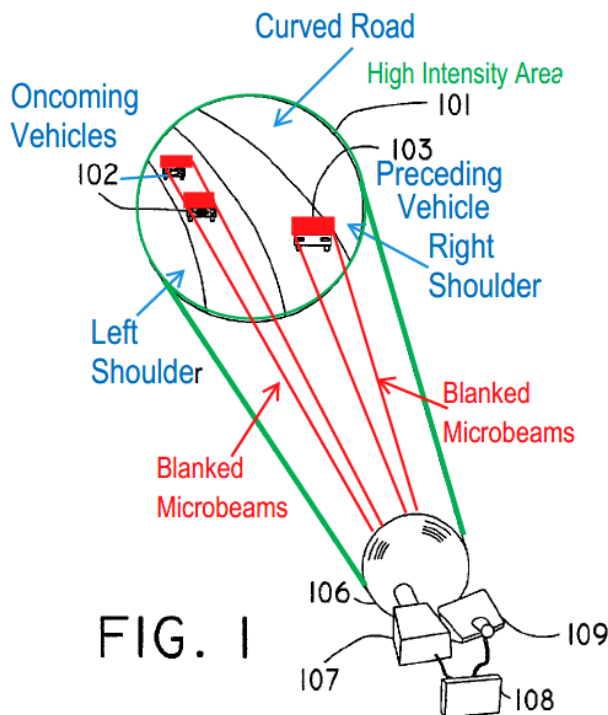
121. The specification details the central tenet of the Beam reference—to darken the area of the beam that would dazzle the driver, **"while maintaining [full] intensity elsewhere"**:

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

(Ex.1005, 6:11-19, emphasis added.)

122. Beam specifically recognizes and disparages prior art attempts to control the direction of the headlight beams. (Ex.1005, 1:60-2:6.) According to

Beam, prior art systems that had to choose where to put light and that changed the direction of the headlamp beam, were prone to errors and/or subject to misalignment. (Ex.1005, 2:15-26.) In response to these prior art problems, Beam's solution is to provide "the equivalent of high beam headlights or brighter on at all times, greatly enhancing the ability to see at night" (*Id.*, 6:53-56.) except for areas where incoming light is detected. Since Beam is already putting maximum intensity light everywhere it could be needed, there would be no reason to provide the ability to change the direction of microbeams in the AABH system or on point or direct light in any particular direction.



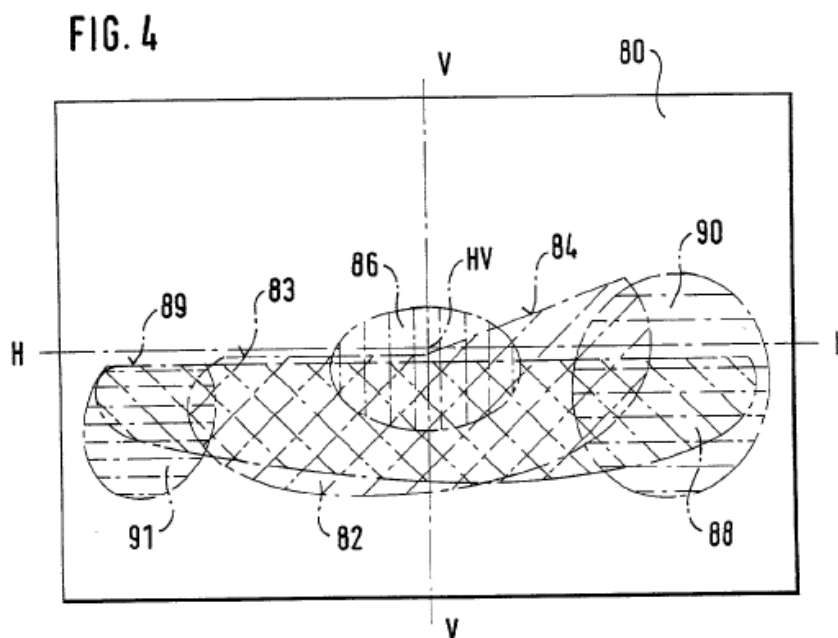
(Ex.1005, FIG 1, Annotated)

123. Even if changing the direction of microbeams in Thominet's software was possible, it would reduce the maximum intensity of illumination of regions within the road ahead, contrary to Beam's stated purpose. For example, changing direction of microbeams in the direction of an upcoming left-hand curve in response to map data would reduce illumination below the maximum possible in regions to the right of oncoming vehicles 102 and would defeat anti-blinding operability for any vehicles outside of the intersection of the illumination and sensor fields of view.

2. Grounds 1B-1C and 2B-2C: Beam's Maximum Intensity Field-Of-View Teaches Away from Thominet's Illumination Functions Undermining Petitioner's Rationale for Combining

124. Petitioner's rationale for combining Thominet with Beam is the generalized goal of improving/increasing safety through improved visibility. (Petition at 26-32.) However, Beam disparages and teaches away from "devices which shape the beam(s) in a predetermined profile that is expected to cause the fewest problems to the oncoming drivers under a variety of circumstances" noting that "This is a compromise, at best, between reducing glare and providing enough light to the driver for adequate visibility." (Ex.1005, 2:16-21.) Beam's microbeams "operate at maximum intensity at all times" allowing "the driver to have the equivalent of high beam headlights or brighter on at all times, greatly enhancing

the ability to see at night.” In contrast, Thominet assigns different partial regions of semiconductor sources, “which shape the beam(s) in a predetermined profile” to provide “different illumination functions (low beam, high, beam, low sight, large width)” as shown in Fig. 4, each necessarily providing less than the maximum intensity illumination to the field-of-view directly contrary to the teachings of Beam.



(Ex.1006, Fig. 4)

125. As such, the proposed combination would not provide increased visibility and increased/improved safety as alleged and there would therefore be no motivation for a POSITA to combine Thominet’s predefined beam profiles with Beam’s AABH system.

3. Petitioner Does Not Explain How the Combination Would Operate for its Intended Purpose

a. Grounds 1B-1C and 2B-2C: Petitioner Does Not Explain How a POSITA Would Use Thominet's Software or Hardware to Control Direction of Beam's Maximum Intensity Microbeams

126. Petitioner's obviousness arguments gloss over how a POSITA would combine the disparate teachings in Beam and Thominet. The Petition asserts that because the references include the same building block components and share a common goal, the software/hardware functionality is effectively interchangeable. (Petition at 25-26.) By taking such a superficial approach to addressing how the references would be combined, the Petition does not: 1) explain how the combined Beam-Thominet system would determine which LEDs to blank in view of the predefined functionality of the LED regions; 2) how the Beam-Thominet combined hardware or software system would provide spatially differentiated illumination to different subsections based on the detection or identification of a vehicle in a given subsection; or 3) provide Beam's anti-blinding feature for microbeams that change direction based on Thominet's curved hardware.

127. By way of example, Thominet identifies that low beams are advantageous when you go around a curve but doesn't explain whether the operation of the low beam is achieved by the driver manually doing something or some form of automatic control; similarly, it identifies different functions without

explaining how those regions can be used at different times and provides no details on how the “different functions” would be controlled. Because Thominet discloses high-level concepts, it was incumbent on the Petitioner to explain how a POSITA would integrate the teachings of Thominet and Beam, Petitioner offers no details on how the references would be combined.

b. Ground 8: Petitioner Does Not Explain How a POSITA Would Use Harber’s Curved LEDs with Karlsson’s Spotlight Beams and Spotlight Sensors

128. Petitioner does not explain how the combined Karlsson/Harbers system, which “implements Harber’s multiple directional beam segments, through either hardware or software,” controls intensity of the individual spotlight beams of Karlsson in response to light detected by the interspersed light-sensitive sensors of Karlsson, or how parameters such as vehicle velocity, steering wheel position, or weather as disclosed by Harbers are provided by the dipped/main beam groupings of LEDs disclosed by Karlsson. Petitioner further fails to describe how the four beam segments and resulting light pattern of Harbers is provided by the groupings of D, I, and D/I LEDs in Karlsson that correspond to the dipped beam and main beam functions.

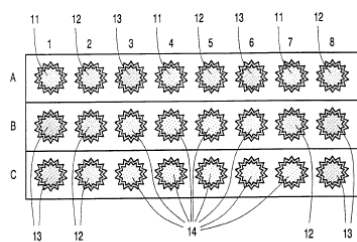


FIG. 2

Harbers Array/Light Pattern

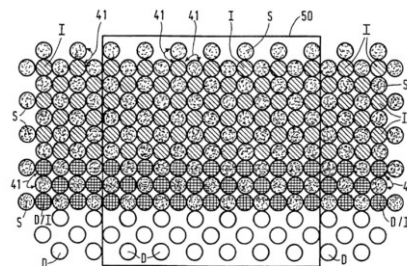


FIG. 14

Karlsson Array/Light Pattern

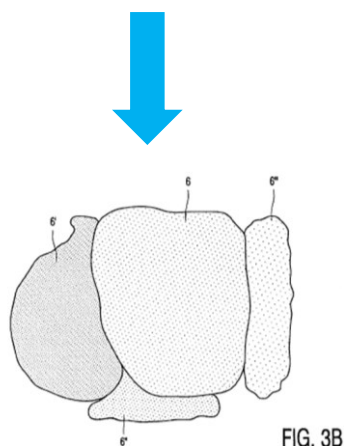


FIG. 3B

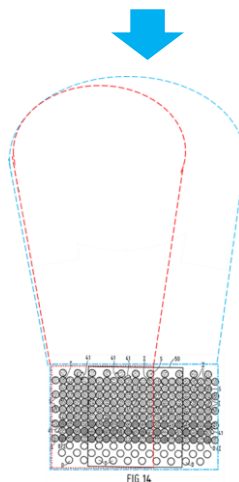


FIG. 14

(Ex.1011, Figs 2, 3B, Annotated)

(Ex.1010, Fig. 14, Annotated)

129. Petitioner fails to explain *how* the proposed combination would function to establish Petitioner's stated rationale.

4. Petitioner Fails to Explain Why the References Would Have Been Combined; the Rationale to Combine Suffers from Hindsight Bias

130. Petitioner fails to explain why a POSITA would add features from the secondary references to modify the primary references when, according to their own argument, the primary reference already “improves safety” by “reducing glare towards other drivers.” (Petition at 25-26.) In both Grounds, the reason for

combining the references is not to achieve the overly broad and amorphous goal of “improving driver safety” as stated by Petitioner. (Petition at 26-29.) Rather, the only plausible, but impermissible, reason for combining the references as proposed is to meet the ‘503 Patent claims.

c. Grounds 1B-1C and 2B-2C: The Addition of Features Already Present in Beam Constitutes Impermissible Hindsight

131. The Petition fails to explain why a POSITA would have been motivated to make the proposed modifications. Petitioner states that “Thominet’s express control of having multiple directional beam regions (clusters), implemented with Beam’s controller 108/illuminator 109 (including SLM 203), would have provided Beam’s system with different spatial distributions for different driving situations beyond reducing glare for drivers, thereby improving safety.” (Petition at 13.) But Petitioner fails to explain why the prior art would have prompted a POSITA to improve Beam’s LED array solution with Thominet’s software or hardware techniques to have “multiple directional beam regions for different functions,” when Petitioner repeatedly argues that Beam discloses “directional light cluster/sources.” (Petition at 10, 28-29, 37.)

132. Petitioner has not cited any disclosure in Thominet regarding recognizing a problem with Beam’s ability to provide spatial distributions to improve driver safety. Moreover, Petitioner fails to explain why a POSITA would

be motivated to combine Beam and Thominet, when the combination results in a worse, materially deficient form of anti-glare illumination—one with conflicting control strategies and reduced intensity—than Beam provides alone.

133. Beam and Thominet are directed to different purposes, Beam teaches a simple, general approach to delivering anti-glaring illumination, whereas Thominet provides an LED array with multi-functional capability. Petitioner fails to explain why a POSITA would have chosen to add the system complexity of Thominet, especially where, by Petitioner’s own admission, it offers no teachings to enhance anti-glaring illumination. On the contrary, Thominet introduces significant operational complexity by predefining groups of LEDs in different defined partial regions that work in concert for different functions--contrary to Beam’s overarching purpose of providing maximum intensity at all times. (Ex.1006, [0004-0009].)

d. Ground 8: The Addition of Features Already Present in Karlsson Constitutes Impermissible Hindsight

134. Petitioner has not only failed to identify *how* Harbers would be combined with Karlsson to achieve the proffered purpose but has also failed to provide articulated reasoning *why* a POSITA would look to Harbers to implement Harber’s multiple directional beam segments to either replace Karlsson’s LED array or integrate with Karlsson’s LED array – as the petition leaves it to the reader

to decide – other than solely to meet the Challenged Claim limitations using impermissible hindsight. Petitioner’s rationale for combining is based on the flawed premise that “Karlsson discloses ‘directional light [clusters/sources]’ independently controllable directional spotlight beam clusters/sources—that ‘create an output headlight meeting the determined illumination requirements’/‘achieve the determined illumination levels’ as in [26.6]/[65.9].” (Ex.1003, ¶435; Petition at 79.) This premise is based on a gross misrepresentation of Karlsson with omitted language from a citation directed to detecting incoming light, rather than operation of Karlsson’s LEDs.

135. Notably, Karlsson discloses a headlight having spotlight beams and sensors to automatically control a lighting pattern to reduce blinding of oncoming traffic and different illumination patterns/functions produced by spotlight sources D (dipped light), I (main-beam light), and D/I (dipped and main-beam lights). (Ex.1010, 19:22-30.) Karlsson also discloses “further sensor means, such as inclination sensors, and direction sensors for controlling the light beams . . . dependent on the inclination of a vehicle and/or its change of direction.” (Ex.1010, 15:7-10.) As such, Karlsson already provides “different spatial distributions for improved visibility in different driving situations” such that there would be no increased/improved driver safety or visibility, and therefore no motivation for a POSITA to look to Harbers to provide these features as advanced by Petitioner.

(Petition at 81.)

136. Rather than providing articulated reasoning with rational underpinnings for culling “building blocks” from Harbers and combining them with Karlsson, Petitioner relies on the catch-all goals of “improved visibility” and “increasing safety.” The Petition fails to articulate why the inclusion of multiple directional beam segments “software or hardware” from Harbers provides “different functions” when combined with Karlsson, resulting in “increased safety.” (Petition at 81 and 82.) A POSITA would understand that Karlsson and Harbers disclose fundamentally different approaches that do not benefit from the combinations Petitioner proffers.

VI. Conclusion

137. In my opinion, the prior art references discussed above taken alone or in any permissible combination do not disclose or suggest each and every element of the challenged claims.

138. I reserve the right to supplement my opinions to address any information obtained, or positions taken, based on any new information that comes to light throughout this proceeding.

I declare under penalty of perjury that the foregoing is true and accurate to the best of my ability.

Executed on: 4/19/2023



Matthew A. Turk PhD