

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.: IPR2023-00197

DECLARATION OF MATTHEW A. TURK PhD

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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, IPR2023-00328, Paper 1, December 16, 2022	Petition 2
2005	Petition challenging U.S. Patent No. 10,894,503, Volkswagen Group of America, Inc. v. Yechezkal Evan Spero, IPR2023-00335, Paper 1, December 23, 2022	Petition 3

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

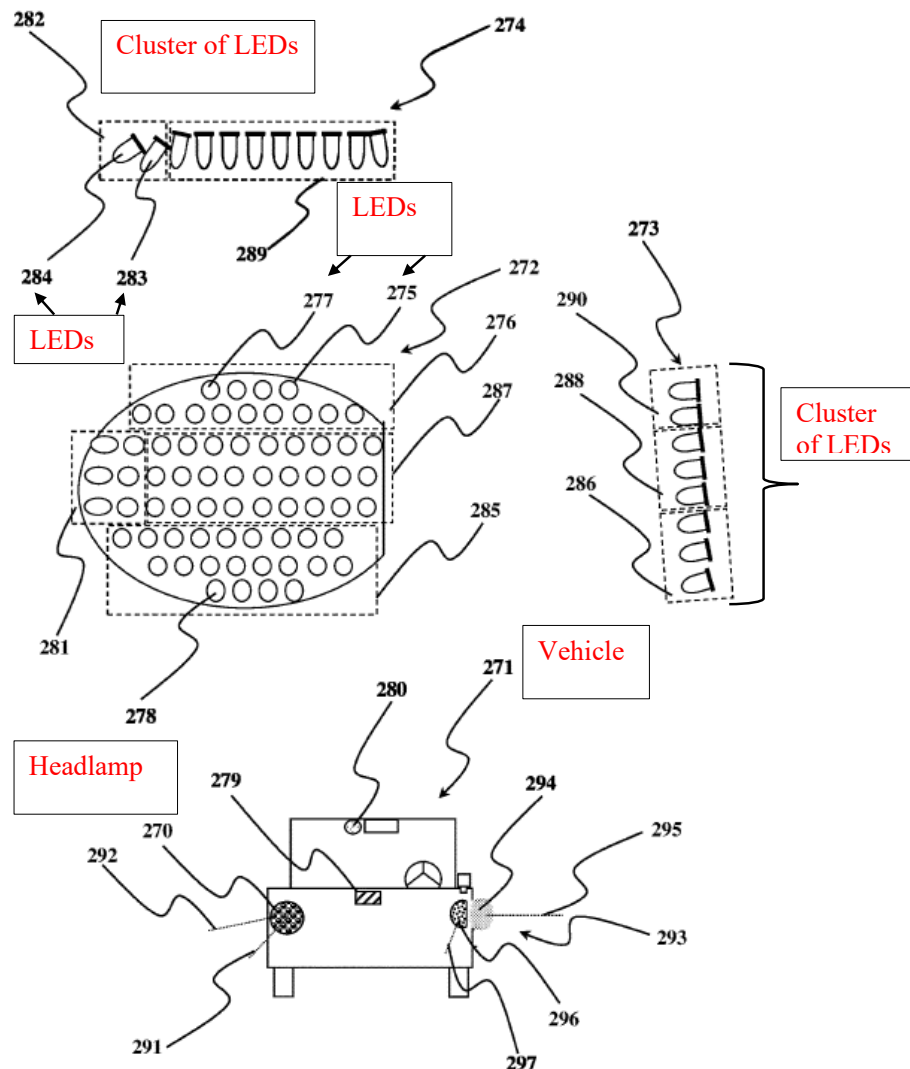
subject matter.

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 ‘503 Patent also describes the deficiencies of prior art lighting systems that replace conventional lights with solid-state LED light sources “with

some minor adjustments” but do not utilize the full “digital” control of the LEDs. (*Id.*, 9:63-66.) The ‘503 Patent describes “a different approach which is to provide the end user with the most correct lighting solution not a new technology lamp to replace the old one.” (*Id.*, 11:8-11.) “In contrast to a prior art, single large, lamp replacement like light source, the present invention provides multiple, small sized sources of differing characteristics such that the effect of the whole is greater than the sum of the individual parts.” (*Id.*, 11:50-54.) “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.) “The invention embraces LED-illuminating devices covering a wide scope of applications,” including transportation. (*Id.*, 11:18-21, 4:20-24, 50:40-41.)

A room lighting example describes how the invention uses the multi-LED light source “with finely controlled light delivery to assist people to better see objects or carry out visual tasks such as reading:”

The method comprises altering the intensity and/or color of the illumination delivered to the task versus other surfaces in the visual surround (that is they are in the viewer’s field of view) such that the luminance of the object, the luminance of the background, the contrast and the veiling reflections are controlled so as to produce optimal

vision conditions. To accomplish the spatially differentiated light delivery to the object of the visual task such as a book or computer screen the light sources to produce task lighting have multiple, narrow beams with minimal spill light. The limited coverage area of each beam and sharp cutoff is such that the lighting fixture controller can target a book while not substantially illuminating the desk.

(Ex. 1001, 65:2-16.)

Using machine vision technology known in the art such as neural networks training and other pattern recognition techniques the vision system has sensor, algorithmic and computational means for identifying devices or objects.

(Ex. 1001, 64:52-55.)

25. The claimed invention of the ‘503 Patent, titled “Detector Controlled Headlight System,” is 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, while reducing glaring illumination for oncoming vehicles. The ‘503 Patent achieves this non-glaring, optimized illumination by providing *at least three directional controlled light sources aimed at different angles relative to the operated vehicle*, sensors that process a field of view to define at least two different subsections, one with a detected vehicle and one without and determining the optimal illumination of the two different subsections to *maximize vehicle operator visibility* in the first subsection *while*

minimizing a disturbing effect, resulting from the illumination in the second subsection.¹ See, claim 20. (See e.g., Ex. 1001, Claim 20, 9758-98:21, emphasis added.)

26. The dependent claims provide various other innovative features that specify illumination strategies for various driving situations— for example, increasing illumination in a direction of the road curvature or a turn (claim 21 and claim 22), illuminating a subsection including a detected pedestrian (claim 26), providing bluish headlamp illumination along a side of a road to accommodate peripheral night vision of the driver (claim 28) and determining illumination of a subsection including a road sign (claim 67).

A. Challenged Independent Claims

27. The Challenged Claims include independent claims 20 and 59, which are reproduced below with claim identifiers:

[20.P] A vehicle headlight system, comprising:
[20.1] one or more headlamps affixed to a vehicle,
[20.2] each headlamp including at least three directional light sources aimed at different angles relative to the vehicle,

¹ For ease of review, claim language is italicized.

[20.3] the light sources configured to have one or more controllable light characteristics

[20.4] 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;

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

[20.6] one or more sensors configured to sense information

[20.7] defined as pertinent to determining illumination output from the one or more headlamps and

[20.8] communicating the sensed information to a processor as sensor data;

[20.9] 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

[20.10] at least a second subsection not including the detected vehicle,

[20.11] determine optimal use of the differently aimed directional light sources to maximize vehicle operator visibility in at least the second subsection,

[20.12] while minimizing a disturbing effect, resulting from the illumination output, on the vision of other traffic in at least the first subsection, and

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

[59.P] A vehicle headlight system, comprising:

[59.1] one or more headlamps affixed to a first vehicle;

[59.2] each headlamp including at least three directional light sources having different aimings relative to the first vehicle,

[59.3] the light sources having one or more controllable illumination characteristics;

[59.4] one or more sensors configured to sense information,

[59.5] at least portion of the sensed information indicating a second vehicle, and

[59.6] communicate sensor data reflecting the sensed information to at least one processor,

[59.7] wherein the at least one processor is configured to: process the sensor data to identify a first subsection, of a field of view, that includes at least a portion of the second vehicle;

[59.8] determine light output for the headlight system that aims illumination at the first subsection;
[59.9] the illumination aimed at the first subsection substantially resulting in light below a first predefined illuminance in the first subsection, and
[59.10] that aims illumination at one or more subsections of the field of view to either side of the first subsection,
[59.11] the illumination aim at the one or more second subsections substantially resulting in light above the first predefined illuminance in the one or more second subsections; and
[59.12] instruct adjustment of one or more of the light sources to achieve the determined output.

B. Qualifications of one of ordinary skill in the art

28. 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.

29. 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.

30. 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

31. 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

32. 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, 6:54-55, 3:8-15.)

33. 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”).

34. 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.)

35. 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.) Beam solves the identified problems by providing a non-moveable AABH system having a multiplicity of microbeams that “will operate at maximum intensity at all times” allowing “the driver to have the equivalent of high beam headlights or brighter on at all times, greatly enhancing the ability to see at night.” (Ex. 1005, 6:11-12, 6:54-55, emphasis added.) Beam further discloses that:

From the viewpoint of the driver of an automobile equipped with AABH, it will be like having bright high beams on at all times but without concern that the other motorists within the extent of his headlight beam will be dazzled.

* * *

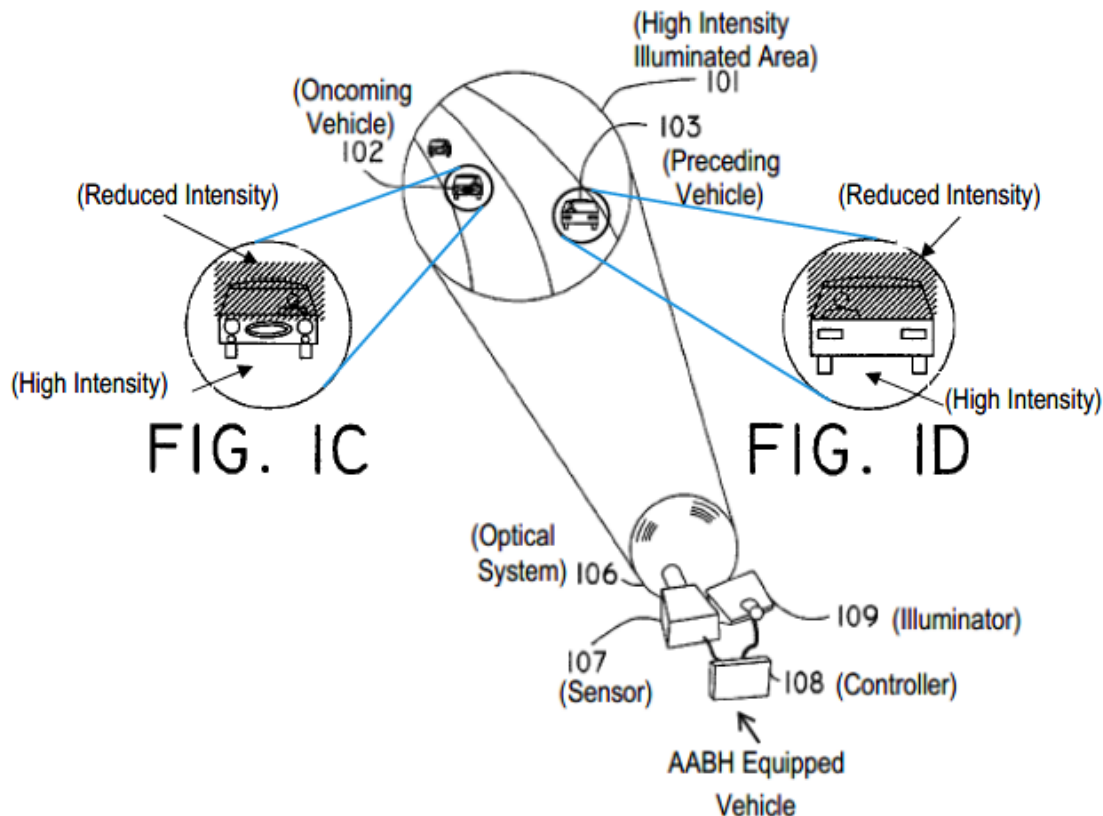
Accordingly, several objects and advantages of this invention are to provide greatly improved safety and comfort to the motoring public, in particular, and to others who may be affected by them by providing the driver of an automobile equipped with the instant invention with a far brighter headlight beam while simultaneously protecting the drivers of all vehicles ahead from being dazzled by the light.

(Ex. 1005, 6:40-44, 3:8-15.)

36. Other than controlling intensity of individual microbeams in response to detected incoming light, Beam does not disclose or suggest light sources aimed at different angles, 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.)

37. Beam provides significantly **reduced** illumination only in those portions of the headlight beam that would otherwise dazzle or annoy other drivers. 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.) While

Beam discloses blanking or darkening microbeams that would otherwise dazzle other drivers, it does not disclose or teach changing direction of any microbeams.

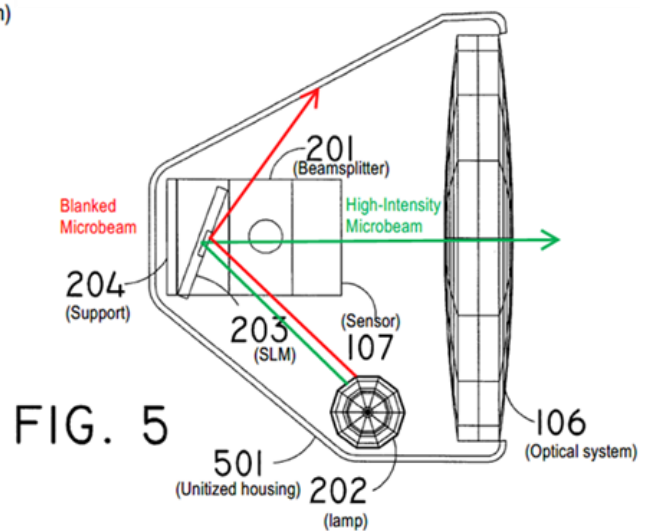
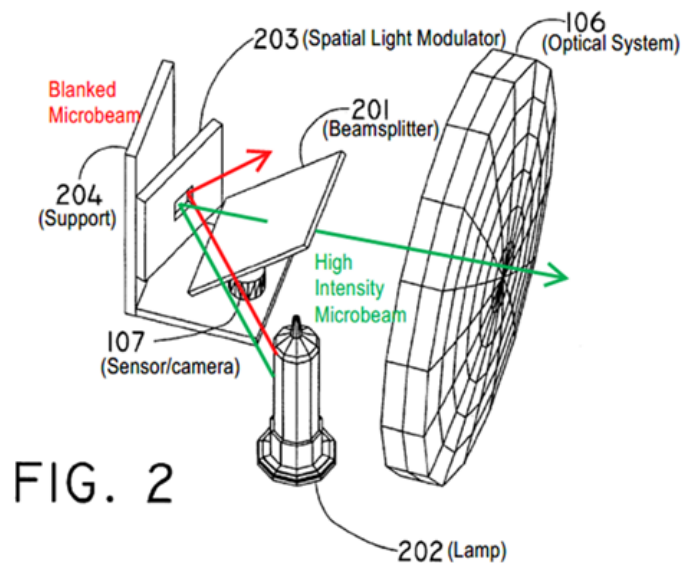


(Ex. 1005, FIGs. 1, 1C, 1D, Annotated)

38. In the AABH system, illuminator 109 projects individually controlled narrow-angle microbeams to provide high-intensity illumination of illuminated area 101. Headlights of an oncoming vehicle 102 and/or taillights of a preceding vehicle 103 are transmitted through optical system 106 and detected by a sensor (camera) 107. Data from sensor 107 is used by controller 108 to map the “angular position of the vehicles ahead” to a corresponding position/size of microbeams that must be significantly reduced in intensity corresponding to the shaded areas shown

for oncoming vehicle 102 in Fig. 1C, and preceding vehicle 103 in Fig. 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 headlights/taillights or other light sources. However, neither embodiment discloses increasing intensity beyond the maximum intensity for any microbeams, or changing direction of any of the microbeams.



(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, emphasis added.)

While SLM 203 blanks one or more microbeams by deflecting the blanked microbeams to an internal absorbing surface of the headlamp 501, it does not change 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.) The Beam SLM 203 appears to work in a similar fashion as a digital light processing (DLP) chip that was in existence on or before the time of filing of the Beam Patent and is used in DLP projectors. 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.

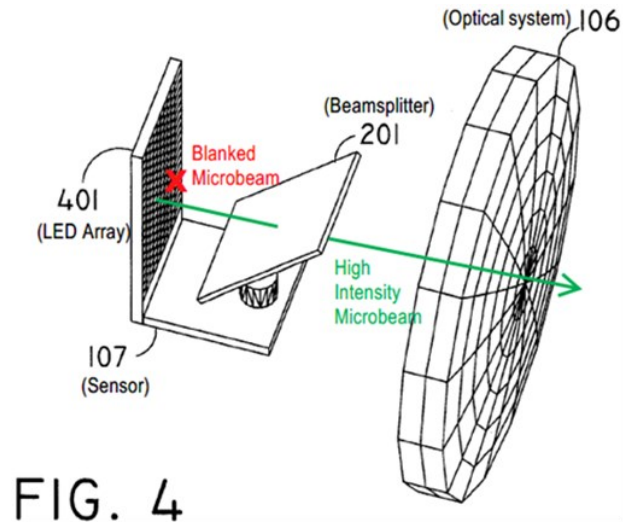


FIG. 4

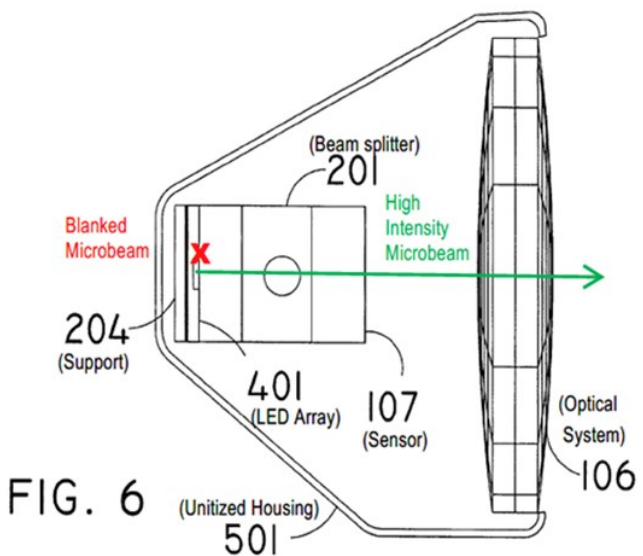


FIG. 6

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

41. The second embodiment is illustrated and described with respect to 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 array of light sources 401, such as an LED array, that generates the narrow-angle microbeams. Microbeam blanking is accomplished by dimming one or more of the LEDs making the modulator of the first embodiment superfluous and it is thus omitted from the second embodiment.

42. In operation, light from oncoming/preceding vehicles or other sources enters through optical system 106 and is reflected by beamsplitter 201 to sensor 107. The sensor signals corresponding to the angular position (azimuth/elevation) or 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. The output of the active LEDs creates the high-intensity microbeams projected out through optical system 106. (Ex. 1005, 3:62-64, 4:53-5:16.)

43. 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. The AABH system generates a high-intensity beam formed by non-moveable microbeams reliably and consistently aligned with the FOV of the camera/sensor with individual microbeams being blanked, attenuated, or otherwise dimmed in response to detected incoming light to darken portions of the high-intensity illumination and prevent blinding of other drivers. (Ex. 1005, 2:27-52.)

46. If that source of light happens to be a headlamp, this blanking or dimming has the effect of preventing blinding a driver of the vehicle that includes the headlamp. (Ex. 1005, 2:27-52.)

47. The Petition creates a new embodiment, in which the spatial light modulator, 203 in the embodiment of Figures 2 and 5, is inserted into the LED

array embodiment of Figures 4 and 6-- improperly conflating the functionality of the embodiments and ignoring Beam's express teaching that the lamp and modulator are replaced by the LED array in the second embodiment. A POSITA would never interpret the SLM as being included in the LED embodiment because the functionality of the two components is redundant, and thus unnecessary.

48. From reviewing the Beam reference, a POSITA would clearly understand that Beam does not disclose 1) LEDs with controllable directionality, 2) the ability to point or steer the headlight beam for any purpose or 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^[OBJ]); 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 maximize vehicle operator visibility whilst reducing disturbing illumination in the subsection including the detected vehicle.

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

49. Like the Beam reference, 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). 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.) Thus, 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.)

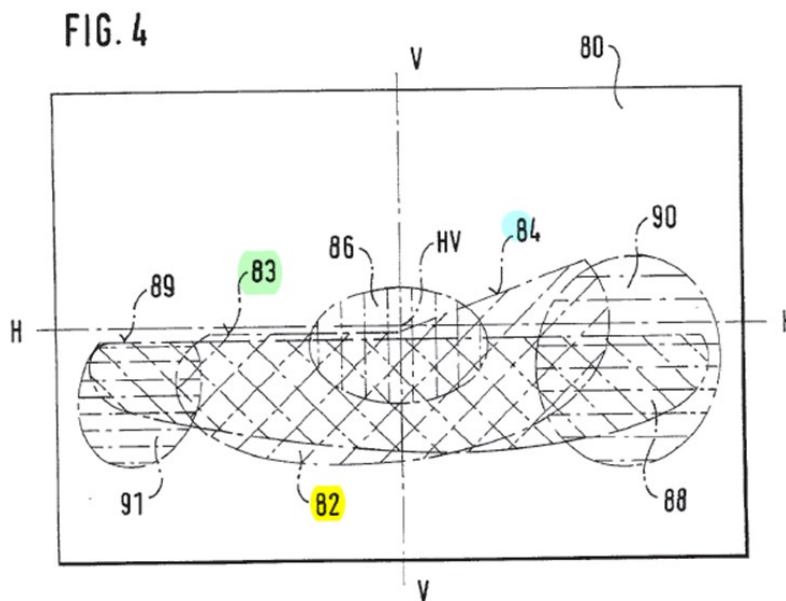
50. While Thominet discloses that LEDs can be arranged in one plane or distributed “over a concavely curved surface or a stepped surface,” Thominet does not suggest any advantages, disadvantages, functional differences or other reasons to select any of the possible arrangements for any particular application.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

51. Thominet teaches 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.

As illustrated and described by Thominet:

FIG. 4 shows a measuring screen **80** which is arranged at a distance from the illumination device. It represents a projection of a roadway located in front of the illumination device and correspondingly illuminated. The measuring screen **80** has a vertical central plane identified as **VV** and a horizontal central plane identified as **HH**. They intersect in a point **HV**. The light emitted by the semiconductor sources **10** and exiting the illumination device, illuminates the measuring screen **80** in a region **82** which is limited from above by an asymmetrical bright-dark limit **83, 84**. The bright-dark limit has for example at the counter traffic side which is a left side of the measuring screen **80** in the case of a right traffic, a horizontal portion **83**. At the traffic side itself which is a right side of the measuring screen **80** in the case of a right traffic, it has a portion **84** which raises starting from the portion **83**.

(Ex. 1006, ¶22.)



(Ex. 1006, FIG 4, Annotated)

52. 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.

53. 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.

54. A POSITA would 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

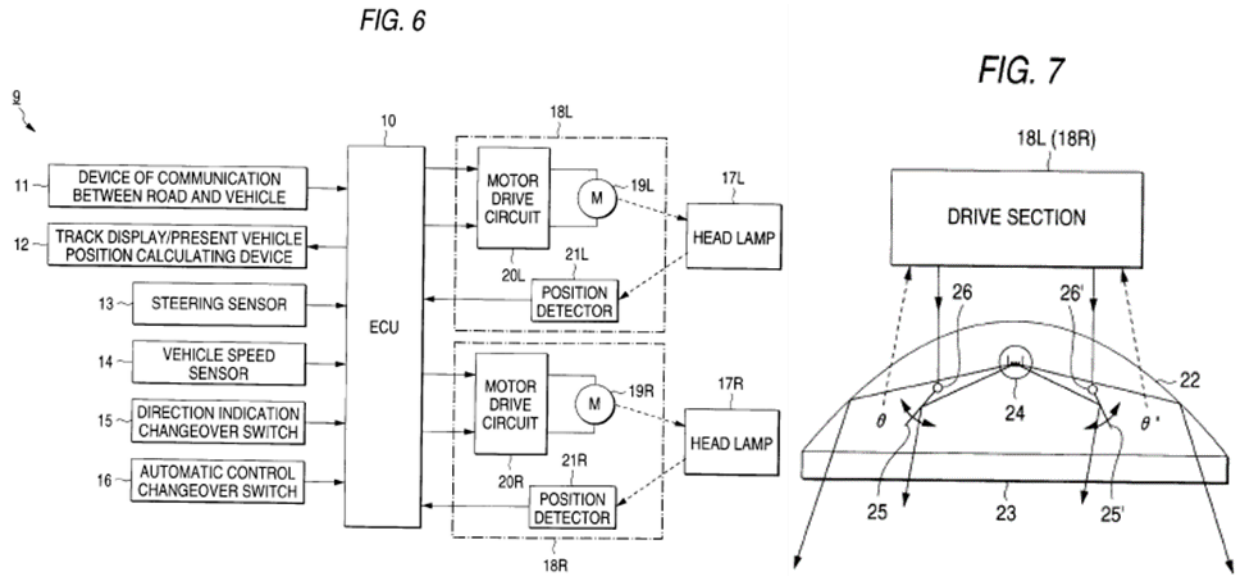
55. Stam discloses a headlamp having single-function LED arrays with actuation of all LEDs within the array for a particular function, such as low beams or high beams. In the embodiment of Fig. 27, LED headlamp 2700 is controlled to actuate a first LED array in a first lamp section 2703 or a second LED 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.)

D. Kobayashi: U.S. Patent No. 6,049,749

56. Kobayashi is directed to a mechanical headlight control system that

changes direction or range of a headlight beam using map information unless a predicted vehicle travel direction as indicated by a turn indicator, steering angle, and vehicle speed/acceleration differs from the map data, i.e., “[w]hen the vehicle advancing direction at which the driver aims does not coincide with the profile of the road.” (Ex. 1008, 2:34-36, 4:39.) More specifically, Kobayashi discloses a headlamp system with moveable components to control irradiation (illumination) direction and range in accordance with a road profile when the vehicle travels along a scheduled course, or in accordance with a steering angle and vehicle speed when the predicted advancing direction of the vehicle deviates from the scheduled course (Ex. 1008, 6:4-9; 17:59-67.)

57. Kobayashi changes irradiation direction using a motor to either rotate the entire lighting device about its axis, or to change relative position among internal lighting device components, such as a reflecting mirror, lens, light source, or shielding member. (Ex. 1008, 6:10-38.) Irradiation range is controlled by either combining different lighting devices with each other (such as a fog lamp, head lamp, and cornering lamp), or by controlling a motor to change position of the internal components (such as reflecting mirrors lenses, or shades) relative to one another. (Ex. 1008, 6:40-7:14.) Irradiation range may be changed responsive to a branch (intersection) ahead on a road by moving the internal lighting device components to change a horizontal irradiating angle α . (Ex. 1008, 8:1-32.)



(Ex. 1008, FIGs. 6, 7)

58. Kobayashi's ECU 10 receives signals from: communication device 11 (conducting communication between a road and vehicle), track display/present vehicle position calculating device 12, steering sensor 13, vehicle speed sensor 14, direction indicating switch 15 and automatic control change-over switch 16. ECU 10 generates signals for drive sections 18L, 18R of head lamps 17L, 17R arranged on the left and right front portion of a vehicle. (Ex. 1008, 10:1-17.) Drive sections 18L, 18R include associated motor drive circuits 20L, 20R to drive associated motors 19L, 19R with position detectors 21L, 21R to detect the posture of the head lamps 17L, 17R or their composing members (internal components). (Ex. 1008, 10:66-11:14.)

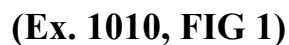
E. Karlsson: WIPO Publication No. 1998/054030

59. 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.)

60. 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.

61. 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.)



63. “[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.)

64. 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.)

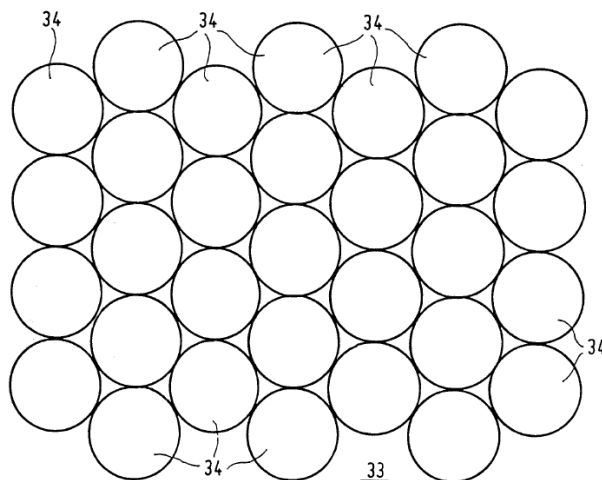


FIG. 6

(Ex. 1010, FIG 6)

65. 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.) Further “[t]he double-shaded

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

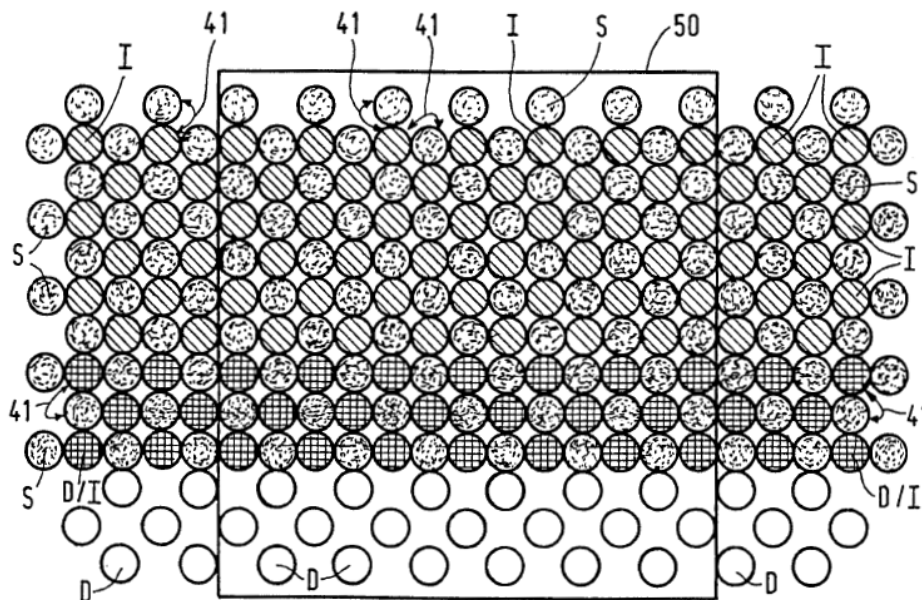


FIG. 14

(Ex. 1010, FIG 14)

66. 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.)

67. 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.)

68. 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.

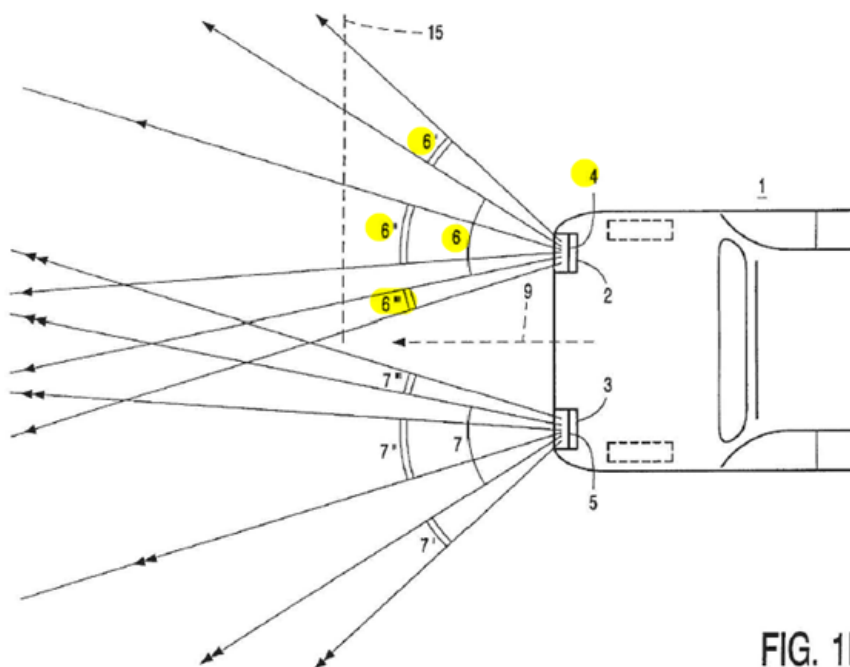
69. In addition to the interspersed spotlight sensors, an inclination sensor may sense the angle of inclination of the car with respect to the road surface so that the emitted light beam is adapted to respective regulations at all times. However, Karlsson is silent with respect to how the control means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

70. 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

aiming illumination above the predefined illumination to another subsection.

F. Harbers: WIPO Publication No. 2001/001038

71. Harbers discloses 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)

72. 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. 1004, 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.)

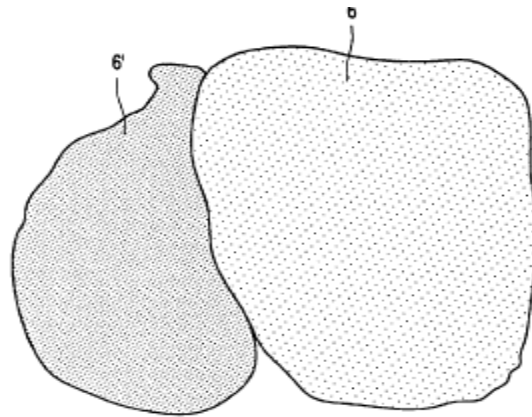


FIG. 3A

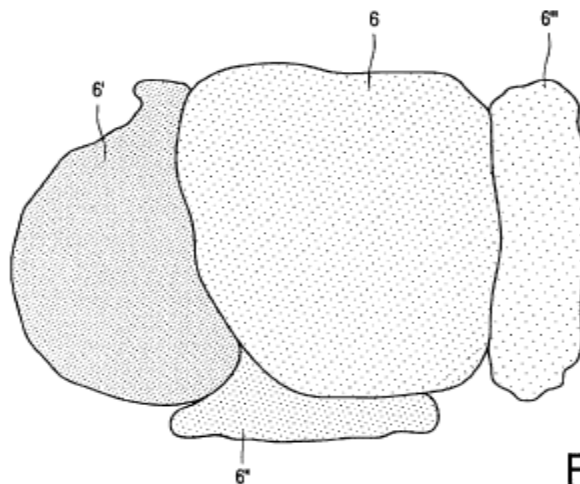


FIG. 3B

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

73. 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.)

74. 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.)

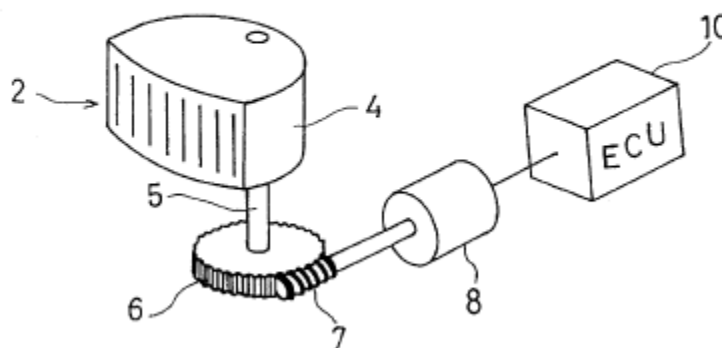
75. In yet another embodiment, “the spatial distribution of the light beam can be influenced by the weather conditions.” (*Id.*, 4:16-17.) In a final embodiment, “the spatial distribution, for example, the range and/or the width of the light beam, . . . [may] be adjusted by the driver” of the vehicle. (*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.

G. Gotou: U.S. Patent No. 5,588,733

76. Gotou discloses a headlamp system with moveable headlamps rotated by a motor to change the leftward/rightward illumination direction using map information indicative of forward road shape, or in accordance with vehicle signals such as a direction indicating signal, a steering angle signal, and a vehicle speed signal “in the case that a vehicle runs on a place having no road information in a navigation system or the vehicle turns out of the planned course.” (Ex. 1012, 1:52-2:18, Abstract, Fig. 4.)

77. Gotou discloses a “swinging mechanism,” shown in Figure 2, wherein “a lamp unit 4 of the head light 2 is fixed to a rotary shaft 5, and a worm gear 7 formed at a driving shaft of a motor 8 is engaged with a worm wheel 6 fitted to the rotary shaft 5.” (*Id.*, 3:36-41.)

FIG. 2



(Ex. 1012, FIG 2)

V. Grounds for Challenge

78. 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.

A. Grounds 1 and 5 – The Applied References Do Not Teach Directional Light Sources Aimed at Different Angles / Aimings

79. I understand that if a proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification.

80. In Ground 1A, Petitioner asserts “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.” (Petition at 24.) The Petition improperly states that Beam’s LED array embodiment in Figure 4 has “the same functionality as lamp 202 and SLM 203,” in the Figure 2 embodiment—such that “each light source of the array has its own independent angular position (angle/aiming) that combines to form the headlamp beam.” (Petition at 14, 24.) However, a reflected beam of light cannot constitute *a light source*.

81. To clarify, 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. Beam’s AABH system is thus incapable of operating as Petitioner contends.

82. Because Beam’s blanking of selected microbeams 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.

83. “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.)

84. Ground 1B seems to combine Beam with the “control technique (software implementation)” in Thominet: “using multiple directional beam regions for different functions.” (Petition at 26, 29.) 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 with different angles/aimings for different functions." (Petition at 29-30.) However, because microbeams do not constitute a light source, angularly positioned microbeams do not constitute *directionally controlled light sources*.

85. In Ground 1C, Petitioner combines "Beam's array of light sources 401 and Thominet's differently angled/aimed semiconductor sources 10 on curved surface 12." (Petition at 32.) The Petition further states: "in Thominet semiconductor light sources 10 arranged on curved surface 12 provide beam regions 22, 24, 26, 28 for different driving situations." (Petition at 31.) However, because each of the beam regions in Thominet are predefined for specific functions and controlled as a unit—Thominet is fundamentally incompatible with Beam.

86. In Ground 5, Petitioner argues that the Karlsson and/or the combination of Karlsson and Harbers discloses the Aiming Limitation [20.2]/[59.2] by arguing that Karlsson's spotlight beams constitute a directional light source. The emitted spotlight beam however cannot constitute the light source.

87. The Petition combines Harbers' "array of opto-electronic elements" a.k.a. "directional light sources" of Fig. 2 that may alternatively be provided on a curved substrate into the planar LED array of Karlsson's Fig. 14 that includes

interspersed light-sensitive sensors. The combination raises several issue namely:

1) how the combined Karlsson/Harbers system having a curved substrate to satisfy [20.2]/[59.2] controls intensity of the individual spotlight beams in response to light detected by the interspersed light-sensitive sensors of Karlsson; 2) 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; or 3) 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.

B. The Combinations Fail to Teach the Detected Vehicle Limitations in [20.9] and [59.7]

1. Beam Fails to Teach the Detected Vehicle Limitations and Output Limitations

88. For Grounds 1A-1C, the Petition relies on the Beam references to meet the [20.9] limitation—which requires *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 sub-section including a detected vehicle* and the [59.7] limitation which requires that the processor is *configured to: process the sensor data to identify a first subsection, of a field of view, that includes at least a portion of the second vehicle.*

89. Notably, Beam lacks the ability to detect or identify a vehicle and then segment the field of view based on the location of the detected vehicle. In Beam, incoming light—which may 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. 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.)

90. For Beam's AABH system, it is irrelevant whether the incoming radiation is from a vehicle, a streetlight or another light source; it simply blanks all LEDs correlated with the position of incoming light, regardless of the classification of the light source. Beam lacks any specific way to differentiate between different sources of incoming light.

91. Beam's generalized, more simplistic solution lacks any machine vision system or pattern recognition system for detecting or identifying a vehicle. As a result, it is incapable of detecting or identifying a vehicle and segmenting the field of view based on the location of the detected vehicle, as required by the [20.9]/[59.7] limitations. Likewise, because Beam is incapable of detecting a vehicle it is also incapable of differently illuminating at least two distinct subsections to minimize light output at a subsection including the detected vehicle.

2. Karlsson Fails to Teach the Detected Vehicle and Output Limitations

92. In Ground 5, the Petition relies on Karlsson to satisfy the Detected Vehicle Limitations. However, as with the Beam reference, Karlsson lacks the ability to detect or identify a vehicle and then segment the field of view based on the location of the detected vehicle as required by [20.9]/[59.7]. Likewise, because Karlsson is incapable of detecting a vehicle it is also incapable of differently illuminating at least two distinct subsections to minimize light output at a subsection including the detected vehicle.

93. Unlike Beam's sensor (camera) 107 used to detect incoming light within the entire field-of-view, Karlsson relies on multiple spatially distributed "spotlight sensors" interspersed with the LEDs that generate "spotlight beams" to detect incoming 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, 19:6-20:5, Figs. 13, 14.) One or more spotlight sensors are associated with each LED "for adjusting the light intensity of the spotlight beams . . . so as to provide a compound light beam having a desired pattern." (Ex. 1010, 4:25-31.)

94. Thus, Karlsson, like Beam, is agnostic to the source of the incoming light and does not disclose any processing of the spotlight sensor signals to determine whether the source is a vehicle, streetlight, or another light source.

Instead, Karlsson simply adjusts intensity of one or more spotlight beams associated with the spotlight sensors that detect incoming light.

95. Because Karlsson fails to disclose processing of the spotlight sensor signals for any purpose other than reducing intensity of associated spotlight beams, Karlsson does not parse or analyze the field-of-view to determine a first subsection within the field-of-view including a detected vehicle and a second subsection within the field-of-view not including the detected vehicle.

**C. A POSITA Would Not Have Been Motivated to
Combine the Applied References**

**1. Grounds 1B-1C - Combinations Render Beam
Inoperable and Defeat Its Primary Purpose**

96. In Ground 1B, the Petition proposes modifying Beam by adding “an additional control technique (software implementation) . . . --- Thominet’s *known technique* of using multiple directional beam regions for different functions”.

97. As detailed below, this Ground 1B proposed combination 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.”

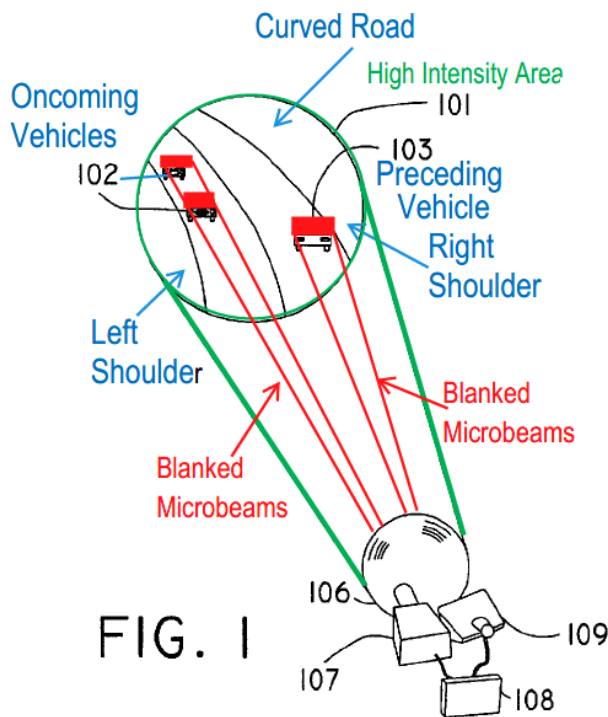
98. The specification details the central principle of the Beam reference - to darken the area of the beam that would dazzle the driver, “**while maintaining [full] intensity elsewhere**”:

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.)

99. 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. at 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)

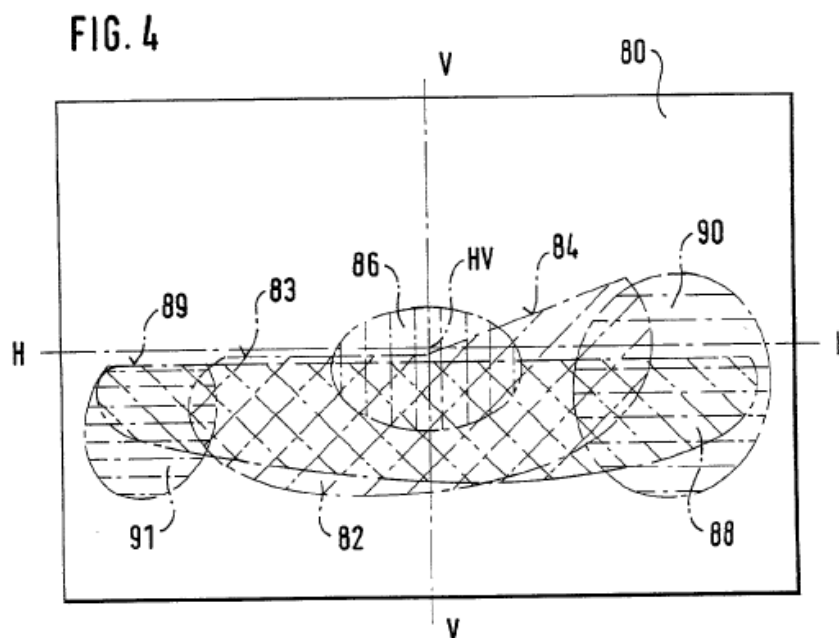
100. Even if changing the direction of microbeams in Thominet's software was possible, it would reduce the maximum intensity of illumination of regions within the road ahead, contrary to Beam's stated purpose. For example, changing direction of microbeams in the direction of an upcoming left-hand curve 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 - Beams Maximum Intensity Field-Of-View Teaches Away from Thominet's Illumination Functions

101. 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.)

102. Notably, 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.



103. 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.

D. Grounds 1B-1C and Ground 5: The Petition Does Not Explain How The Combinations Would Operate for Their Intended Purpose

104. The Petition suggests that because the applied references include the same building block components and share a common goal, shared by all headlights, the software/hardware functionality is interchangeable. That is however incorrect.

105. Perhaps because of this assumption, the Petition doesn't answer key

questions as to how the combination would operate, namely:: 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.

106. 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.

107. Similarly, the Petition, does not explain several question regarding how the Karlsson/Harbers combination would function, e.g. how the combined Karlsson/Harbers system having a curved substrate from Harbers to satisfy [20.2]/[59.2] 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.

108. The Petition also 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.

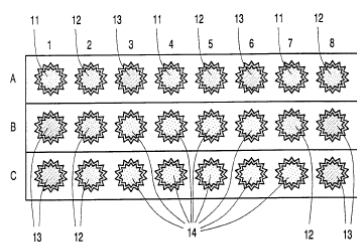


FIG. 2

Harbers Array/Light Pattern

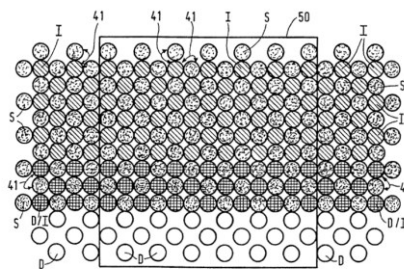


FIG. 14

Karlsson Array/Light Pattern

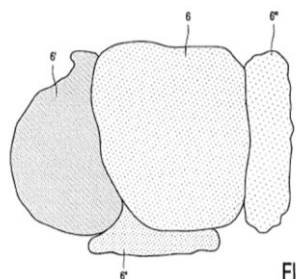


FIG. 3B

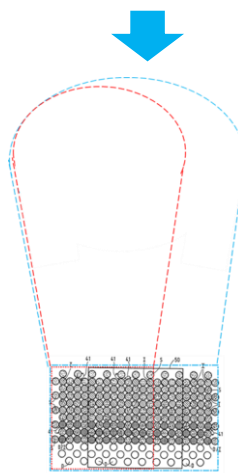


FIG. 14

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

(Ex. 1010, Fig. 14, Annotated)

E. Grounds 1B-1C and Ground 5: The Petition Doesn't Explain Why the References Would Have Been Combinedd

109. A POSITA would not have been motivated to combine Beam and Thominet, when the combination results in a worse, materially deficient form of anti-glaring illumination—one with conflicting control strategies and reduced

intensity—than Beam provides alone.

110. 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.

111. A POSITA would not have chosen to add the system complexity of Thominet, especially where, 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].)

112. Similarly, with the Ground 5 combination, because 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, a POSITA would have no motivation to look to Harbers to provide feature that already exist in Karlsson. A POSITA would understand that Karlsson and Harbers disclose fundamentally different approaches that do not benefit from the combinations Petitioner proffers.

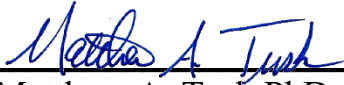
VI. Conclusion

113. 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.

114. 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: 3/22/2023



Matthew A. Turk PhD