UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

PORSCHE CARS NORTH AMERICA, INC.,
Petitioner

v.

YECHEZKAL EVAN SPERO,
Patent Owner

Case IPR2023-01231
U.S. Patent No. 10,894,503 B2

DECLARATION OF SCOTT ANDREWS, IN SUPPORT OF PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 10,894,503

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X. GROUND 1: THE COMBINATION OF BEAM AND THOMINET RENDERS OBVIOUS CLAIMS 20, 24, AND 25. 62

A. A POSA would have been motivated to combine Beam and Thominet with a reasonable expectation of success. 65

B. Independent Claim 20 75

1. [20.P]: "A vehicle headlight system, comprising:" 75

2. [20.1]: "one or more headlamps affixed to a vehicle,.....76

3. [20.2]: "each headlamp including at least three directional light sources aimed at different angles relative to the vehicle," 76

(a) Beam discloses this element. 76

(b) Thominet also discloses this element. 80

(c) A POSA would have been motivated to combine Beam and Thominet with a reasonable expectation of success. 81

4. [20.3]: "the light sources configured to have one or more controllable light characteristics," 90

5. [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;" 91

6. [20.5]: "control circuitry configured to adjust the at least one light characteristic of at least one of the directional light sources;" 93

7. [20.6]: "one or more sensors configured to sense information" 95

8. [20.7]: "defined as pertinent to determining illumination output from the one or more headlamps and" 97

9. [20.8]: "communicating the sensed information to a processor as sensor data;" 98

10. [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" 100

11. [20.10]: "at least a second subsection not including the detected vehicle," 102

12. [20.11]: "determine optimal use of the differently aimed directional light sources to maximize vehicle operator visibility in at least the second subsection," 106

13. [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".....109

14. [20.13]: "direct the control circuitry to adjust the directional light sources to achieve the determined optimal use."....111

C. Claim 24: "The system of claim 20, wherein at least one light source provided to at least one of the one or more headlamps further includes a laser diode." 113

1. Beam discloses this claim. 113

2. Thominet also discloses this claim. 114

3. A POSA would have been motivated to combine Beam and Thominet with a reasonable expectation of success. 114

D. Claim 25: "The system of claim 20, wherein at least one of the one or more headlamps further includes at least one of reflectors, refractors, or lenses usable to alter emitted light from at least one of the light sources." 115

XI. GROUND 2: THE COMBINATION OF BEAM, THOMINET, AND STAM RENDERS OBVIOUS CLAIMS 59, 63, AND 64. 116

A. A POSA would have been motivated to combine Beam, Thominet, and Stam with a reasonable expectation of success. 118

B. Independent Claim 59 119

1. [59.P]: "A vehicle headlight system, comprising:" 119

2. [59.1]: "one or more headlamps affixed to a first vehicle," ...120

3. [59.2]: "each headlamp including at least three directional light sources having different aimings relative to the first vehicle," 120

(a) Beam discloses this element. 120

(b) Thominet also discloses this element. 124

(c) A POSA would have been motivated to combine Beam and Thominet with a reasonable expectation of success. 125

4. [59.3]: "the light sources having one or more controllable illumination characteristics;" 134

5. [59.4]: "one or more sensors configured to sense information," 134

6. [59.5]: "at least a portion of the sensed information indicating a second vehicle, and" 134

7. [59.6]: "communicate sensor data reflecting the sensed information to at least one processor," 136

8. [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;".136

9. [59.8]: "determine light output for the headlight system that aims illumination at the first subsection," 136

10. [59.9]: "the illumination aimed at the first subsection substantially resulting in light below a first predefined illuminance in the first subsection, and".....138

(a) Beam discloses this element. 138

(b) Stam also discloses this element. 142

(c) A POSA would have been motivated to combine Beam, Thominet, and Stam with a reasonable expectation of success. 143

11. [59.10]: "that aims illumination at one or more second subsections of the field of view to either side of the first subsection," 148

12. [59.11]: "the illumination aimed at the one or more second subsections substantially resulting in light above the first predefined illuminance in the one or more second subsections; and" 152

(a) Beam discloses this element. 152

(b) Stam also discloses this element. 155

(c) A POSA would have been motivated to combine Beam, Thominet, and Stam with a reasonable expectation of success. 157

13. [59.12]: "instruct adjustment of one or more of the light sources to achieve the determined output." 161

C. Claim 63: "The system of claim 59, wherein at least one light source provided to at least one of the one or more headlamps further includes a laser diode." 161

D. Claim 64: "The system of claim 59, wherein at least one of the one or more headlamps further includes at least one of reflectors, refractors, or lenses usable to alter the light emitted from at least one of the light sources as part of the instructed adjustment." 162

XII. GROUND 3: THE COMBINATION OF BEAM, THOMINET, AND KOBAYASHI RENDERS OBVIOUS CLAIMS 21-23. 162

A. A POSA would have been motivated to combine Kobayashi with Beam-Thominet with a reasonable expectation of success.....162

B. Claim 21: "The system of claim 20, wherein the processor is further configured to determine at least a road curvature, indicated by the sensor data, ahead of the vehicle and to direct the control circuitry to adjust the directional light sources to increase illumination in a direction of the road curvature." 163

1. Beam-Thominet's disclosure 163

2. Kobayashi's disclosure 167

3. A POSA would have been motivated to combine Kobayashi with Beam-Thominet with a reasonable expectation of success. ...168

C. Claims 22: "The system of claim 21, wherein the processor is further configured to determine at least a planned upcoming turn, indicated by the sensor data, and to direct the control circuitry to increase illumination illuminating the turn." 175

Claim 23: "The system of claim 20, wherein the processor is further configured to determine at least a planned upcoming turn, indicated by the sensor data, and to direct the control circuitry to increase illumination illuminating the turn." 175

XIII. GROUND 4: THE COMBINATION OF BEAM, THOMINET, STAM, AND KOBAYASHI RENDERS OBVIOUS CLAIMS 60-62. 181

A. A POSA would have been motivated to combine Kobayashi with Beam-Thominet-Stam with a reasonable expectation of success. 181

B. Claim 60: "The system of claim 59, wherein at least one of the at least one processors is further configured to determine at least a road curvature, indicated by the sensor data, ahead of the first vehicle and to determine light output that aims illumination in a direction of the road curvature." 181

C. Claims 61: "The system of claim 60, wherein at least one of the at least one processors is further configured to determine at least a planned upcoming turn, indicated by the sensor data, and to determine light output that illuminates the turn." 181

Claim 62: "The system of claim 59, wherein at least one of the at least one processors is further configured to determine at least a planned upcoming turn, indicated by the sensor data, and to determine light output that illuminates the turn."....181

XIV. GROUND 5: THE COMBINATION OF KARLSSON AND HARBERS RENDERS OBVIOUS CLAIMS 20, 24, 25, 59, 63, AND 64. 182

A. A POSA would have been motivated to combine Karlsson and Harbers with a reasonable expectation of success. 187

B. Claims 20 and 59.....196

1. [20.P] "A vehicle headlight system, comprising:" 196

[59.P]: "A vehicle headlight system, comprising:" 196

2. [20.1]: "one or more headlamps affixed to a vehicle," 197

[59.1]: "one or more headlamps affixed to a first vehicle," ...197

3. [20.2]: "each headlamp including at least three directional light sources aimed at different angles relative to the vehicle," ... 199

[59:2]: "each headlamp including at least three directional light sources having different aimings relative to the first vehicle," 199

(a) Karlsson discloses this element. 199

(b) Harbers also discloses this element. 203

(c) A POSA would have been motivated to combine Karlsson and Harbers with a reasonable expectation of success. 205

4. [20.3]: “the light sources configured to have one or more controllable light characteristics,” 214

[59.3]: “the light sources having one or more controllable illumination characteristics;” 214

5. [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;” 216

6. [20.5]: “control circuitry configured to adjust the at least one light characteristic of at least one of the directional light sources;”.....218

7. [20.6]: “one or more sensors configured to sense information” 223

[59.4]: “one or more sensors configured to sense information,” 223

8. [20.7]: “defined as pertinent to determining illumination output from the one or more headlamps and” 224

[59.5]: “at least a portion of the sensed information indicating a second vehicle, and” 224

9. [20.8]: “communicating the sensed information to a processor as sensor data;” 226

[59.6]: “communicate sensor data reflecting the sensed information to at least one processor,” 226

10. [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” 228

[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;”.228

11. [20.10]: “at least a second subsection not including the detected vehicle,” 231

12. [20.11]: “determine optimal use of the differently aimed directional light sources to maximize vehicle operator visibility in at least the second subsection,” 235

13. [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" 239

[59.8]: "determine light output for the headlight system that aims illumination at the first subsection," 239

14. [20.13]: "direct the control circuitry to adjust the directional light sources to achieve the determined optimal use." 242

[59.12]: "instruct adjustment of one or more of the light sources to achieve the determined output." 242

C. Additional Elements of Claim 59.....245

1. [59.9]: "the illumination aimed at the first subsection substantially resulting in light below a first predefined illuminance in the first subsection, and".....245

2. [59.10]: "that aims illumination at one or more second subsections of the field of view to either side of the first subsection," 251

3. [59.11]: "the illumination aimed at the one or more second subsections substantially resulting in light above the first predefined illuminance in the one or more second subsections; and" 255

D. Claim 24: "The system of claim 20, wherein at least one light source provided to at least one of the one or more headlamps further includes a laser diode." 260

Claim 63: "The system of claim 59, wherein at least one light source provided to at least one of the one or more headlamps further includes a laser diode." 260

E. Claim 25: "The system of claim 20, wherein at least one of the one or more headlamps further includes at least one of reflectors, refractors, or lenses usable to alter emitted light from at least one of the light sources." 261

Claim 64: "The system of claim 59, wherein at least one of the one or more headlamps further includes at least one of reflectors, refractors, or lenses usable to alter the light emitted from at least one of the light sources as part of the instructed adjustment." 261

XV. GROUND 6: THE COMBINATION OF KARLSSON, HARBERS, AND GOTOU RENDERS OBVIOUS CLAIMS 21-23 AND 60-62. 263

A. A POSA would have been motivated to combine Gotou with Karlsson-Harbers with a reasonable expectation of success.....263

B. Claim 21: "The system of claim 20, wherein the processor is further configured to determine at least a road curvature, indicated by the sensor data, ahead of the vehicle and to direct the control circuitry to adjust the directional light sources to increase illumination in a direction of the road curvature." 263

Claim 60: "The system of claim 59, wherein at least one of the at least one processors is further configured to determine at least a road curvature, indicated by the sensor data, ahead of the first vehicle and to determine light output that aims illumination in a direction of the road curvature." 263

1. Karlsson-Harbers's disclosure 264

2. Gotou's disclosure 265

3. A POSA would have been motivated to combine Gotou with Karlsson-Harbers with a reasonable expectation of success. .269

C. Claim 22: "The system of claim 21, wherein the processor is further configured to determine at least a planned upcoming turn, indicated by the sensor data, and to direct the control circuitry to increase illumination illuminating the turn." 276

Claim 23: "The system of claim 20, wherein the processor is further configured to determine at least a planned upcoming turn, indicated by the sensor data, and to direct the control circuitry to increase illumination illuminating the turn." 276

Claim 61: "The system of claim 60, wherein at least one of the at least one processors is further configured to determine at least a planned upcoming turn, indicated by the sensor data, and to determine light output that illuminates the turn." 276

Claim 62: "The system of claim 59, wherein at least one of the at least one processors is further configured to determine at least a planned upcoming turn, indicated by the sensor data, and to determine light output that illuminates the turn."....276

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I. INTRODUCTION

I, Scott Andrews, declare as follows:

1. I have been retained on behalf of Porsche Cars North America, Inc. ("Porsche" or "Petitioner") for the above-captioned *inter partes* review proceeding to provide my expert opinions and expert knowledge. I understand that this proceeding involves U.S. Patent No. 10,894,503 ("the '503 patent") titled "Detector Controlled Headlight[1] System," to Yechezkal Evan Spero, and that Torchlight Technologies, LLC has purported to be the exclusive licensee of the '503 patent. I understand that the Petition submitted by Petitioner challenges claims 20-25 and 59-64 of the '503 patent.

[1] The term "headlight," is generally used to describe the concept of the resultant beam of light emitted from "headlamp," (e.g., the hardware including emitters, lenses, housing, etc., packaged into a system on a vehicle). As shown in this declaration, the '503 patent (and prior art) sometimes equates the two, and thus disclosures of "headlamps" provide "headlights" and vice versa. And a POSA would have understood based on the context of the term whether any appreciable technical meaning was intended by the author of a document.

2. The ’503 patent describes, generally, adaptive headlamp systems and methods. I am familiar with the technology described in the ’503 patent as of its earliest possible priority date, July 12, 2002.

3. I have been asked to provide my independent technical review, analysis, insights, and opinions regarding the ’503 patent and the references that form the basis for the grounds of unpatentability set forth in the Petition for *inter partes* review of the ’503 patent filed by Petitioner.

4. In preparing this declaration, I have reviewed and am familiar with all the documents cited in this declaration. I have reviewed and am familiar with the ’503 patent and its file history. I confirm that to the best of my knowledge, the accompanying exhibits are true and accurate copies of what they purport to be, and that an expert in the field would reasonably rely on them to formulate opinions such as those set forth in this declaration.

5. I am being compensated at my customary rate of $500 per hour for my work on this case. My compensation is not dependent upon my opinions, my testimony, or the outcome of this case.

II. SUMMARY OF GROUNDS

6. I understand that the Petition for *inter partes* review of the ’503 patent filed by Petitioner asserts the following Grounds of unpatentability:

Ground	References	Basis	Claims Challenged
1	Beam (EX1005), Thominet (EX1006)	§103	20, 24-25
2	Beam, Thominet, Stam (EX1007)	§103	59, 63-64
3	Beam, Thominet, Kobayashi (EX1008)	§103	21-23
4	Beam, Thominet, Stam, Kobayashi	§103	60-62
5	Karlsson (EX1010), Harbers (EX1011)	§103	20, 24-25, 59, 63-64
6	Karlsson, Harbers, Gotou (EX1012)	§103	21-23, 60-62

III. SUMMARY OF OPINIONS

7. In my opinion, the challenged claims of the ’503 patent would have been obvious in view of the combinations of references Petitioner asserts in the context of common knowledge and industry practice at the time of its filing.

8. Therefore, it is my opinion that the challenged claims would have been obvious in view of the disclosures in the asserted prior art references, as described in detail below.

IV. QUALIFICATIONS

9. My experience and education are detailed in my curriculum vitae ("CV"), a copy of which is provided as EX1004.

10. I have over 30 years of experience in automotive systems technology. In various positions at Cogenia Partners, LLC, TRW, and Toyota, I have been responsible for research and development projects relating to automotive systems technology, including automotive control systems, automotive safety systems, vehicle navigation systems, connected vehicle systems, and various applications of location technologies such as map databases for curve speed warning, adaptive cruise control, collision warning/avoidance systems, and automated vehicles.

11. I received an undergraduate Bachelor of Science degree in Electrical Engineering from the University of California, Irvine in 1977, and received a Master's of Science degree in Electronic Engineering from Stanford University in 1982.

12. From 1977 to 1983, I held engineering positions at Ford Aerospace and Teledyne Microwave where I worked on, among other things, transmitter-receiver systems for guided missiles and other related military electronics. From 1983 to 1993, I worked at TRW, Inc. ("TRW") in the Space & Electronics Group, where I served as a project manager, a department manager, and an assistant program manager on a variety of spacecraft communications systems projects. One

exemplary project I worked on was an adaptive antenna array that used amplitude and phase modulation together with a digital filtering system to adaptively generate nulls in the antenna gain pattern in response to coherent radio signals. This system was intended to reduce the effect of narrow spectrum jamming signals on spread spectrum communications by dynamically adapting the antenna array based on radio illumination from external sources. My last position at TRW in the Space & Electronics Group was as the manager of the Monolithic Microwave Integrated Circuits ("MMIC") Products Organization. In that role, I developed TRW's commercial gallium arsenide (GaAs) MMIC business. During my time in the MMIC Products Organization, I helped produce one of the first cellular phone related RF integrated circuits. I also developed the first single chip 94 GHz radar, intended for use in automotive adaptive cruise control systems. While I was at TRW in the Space & Electronics Group, I received several awards for outstanding performance on independent research and development projects.

13. In 1993, while still at TRW, I moved to the Automotive Electronics Group and became the Director of Systems Engineering and Advanced Products. In this role, I was responsible for the overall management of TRW's advanced development programs in the automotive electronics space. These programs included, among other things, wireless remote keyless entry systems, vehicle tracking and location systems (e.g., roadside assistance and emergency response

systems, including those using global positioning system ("GPS") technology), emergency vehicle warning systems (e.g., transmitter-receiver systems that would provide a warning inside the user's vehicle when an active emergency vehicle was in the vicinity), automotive collision avoidance radar, and other types of vehicle information systems. I served in this role until 1996. While at TRW, I also led the development of an in-vehicle information system based on off-board map databases, wireless data communications, and radio-based location technologies, and developed business and product strategies related to various remotely connected information services.

14. From 1996 to 2000, I worked at Toyota Motor Corporation ("Toyota") at the Toyota Headquarters in Toyota City, Japan, as a Project General Manager in the R&D Management Division. My responsibilities included the conceptualization and development of multimedia systems and new technology products and services for Toyota's future generations of passenger vehicles. My work at Toyota included, among other things, automated vehicles, applications of digital map database, including automated braking systems, curve speed warning systems, and adaptive cruise control, as well as early work on various connected vehicle technologies using on-board computing, map databases, and off-board communications to provide various services to the vehicle and the vehicle occupants.

15. While at Toyota, I also established the Automotive Multimedia Interface Collaboration ("AMI-C"), a partnership of carmakers to develop a uniform computing architecture for vehicle multimedia systems. AMI-C was primarily aimed at developing standards for the integration and use of consumer devices in vehicles, and for a common computing platform to facilitate the rapid introduction of new systems and software in the vehicle. For example, a typical AMI-C system might support the aftermarket integration of a cellular telephone subsystem and supporting software applications to provide location-based services such as off-board navigation and traffic information to support an in-vehicle navigation display system.

16. I founded Cogenia Partners, LLC as an independent consultant in the intelligent vehicles and mobile systems industry in January 2001. My primary clients have been various navigation and mobile device makers, automotive manufacturers, and the U.S. Department of Transportation. Since 2001 my work has focused on systems for delivery of services to vehicle occupants, either through personal devices, or through equipment embedded in the vehicle. These systems have included applications for vehicle and roadway safety, information and entertainment, and operational concepts and system designs for various types of connected vehicle systems.

17. Between 2006 and 2011, I served as the Chief System Architect for a large Connected Vehicle test bed in the greater Detroit area. This project included extensive systems engineering work, and real-world test and evaluation of short range vehicle to roadside and vehicle to vehicle communications systems and applications, including various tolling applications. This work also included active involvement with various vehicle communications standards, including SAE J2735, SAE J2945, and a variety of IEEE standards associated with Dedicated Short Range Communications (DSRC) systems used, for example in vehicle management, traffic data collection and distribution, safety, tolling and other applications.

18. More recently I have served as a technical lead on a series of projects to support the National Highway Traffic Safety Administration (NHTSA) with the development of performance standards for connected vehicle equipment in vehicles, the development of a security credential management system, and the development and simulation of a sensor based system to detect and mitigate the introduction of erroneous and/or malevolent information into the connected vehicle network. I have also led the development of a variety of test and evaluation systems for the Federal Highway Administration to support the assessment of connected vehicle systems in the roadway environment and developed security credential management systems in support of the connected vehicle effort.

19. In the various positions mentioned above, I was responsible for research and development projects relating to numerous vehicle information systems, user interface systems, sensory systems, control systems and safety systems, and also had the opportunity to collaborate with numerous researchers and suppliers to the auto industry. While at Toyota, I worked with a supplier on a concept for supplementing adaptive (steerable) headlights with navigational maps, so that the vehicle headlights would be controlled, at least in part by the curvature of the upcoming roadway based on the map data stored in the vehicle. This project also included warning systems to alert the driver if they were approaching a curve at excessive speed. Other related projects include alignment and control of radar beams for adaptive cruise control, including positioning the radar beam to adapt to curves in the forward vehicle trajectory, determination of roadway curves ahead using cameras, and a laser system for detecting the curvature of the road from reflective markers used to guide snowplows in winter conditions where the road edges cannot be otherwise detected.

20. I am a member of the Institute of Electrical and Electronics Engineers ("IEEE"), the IEEE Standards Association, the Institute of Navigation ("ION"), the International Council on Systems Engineering ("INCOSE"), and the Society of Automotive Engineers ("SAE"). I am a named inventor on twenty-four U.S. patents, three Japanese patents, and one European patent. A list of my patents can

be found in my curriculum vitae attached as Exhibit 1004. I have authored numerous technical papers, and have been invited to give professional talks at various conferences, including the World Congress on Intelligent Transportation Systems, the International Task Force on Vehicle Automation, the International Congress on Transportation Electronics (Convergence), and others. My curriculum vitae (Ex. 1004) includes a list of all publications I have authored in the last 10 years and provides further detail regarding my background and qualifications.

V. MATERIALS CONSIDERED

21. In formulating my opinions, I have relied upon my training, knowledge, and experience that are relevant to the '503 patent. I have read and agree with the opinions offered by Dr. Jianzhong Jiao in his expert declaration in IPR2023-00197, and herein adopt those opinions as my own. Furthermore, I have specifically considered the following documents, in addition to other sources cited in this Declaration:

Exhibit #	***Description***
1001	U.S. Patent No. 10,894,503 B2 to Spero ("the '503 patent")
1002	Prosecution File History of U.S. Patent No. 10,894,503 B2 ("Prosecution History")
1004	*Curriculum Vitae* of Scott Andrews
1005	U.S. Patent No. 6,144,158 to Beam
1006	U.S. Patent Publication No. 2001/0019486 to Thominet
1007	WIPO Patent Publication No. 2001/070538 to Stam *et al.*
1008	U.S. Patent No. 6,049,749 to Kobayashi
1009	WIPO Patent Publication No. 2002/04247 to Braun *et al.*

Exhibit #	*Description*
1010	WIPO Patent Publication No. 1998/54030 to Karlsson
1011	WIPO Patent Publication No. 2001/01038 to Harbers *et al.*
1012	U.S. Patent No. 5,588,733 to Gotou
1015	Westermann, "History and Scientific Back-up," 48th Session of GRE, EUREKA Project 1403, Informal Document No. 30, April 30, 2002
1016	"Adaptive Front Lighting Systems (AFS)," 48th Session of GRE, EUREKA Project 1403, Informal Document No. 28, April 12, 2002
1017	Hogrefe et al., "Adaptive Light Pattern – A New Way to Improve Light Quality," SAE Transactions, Vol. 106, No. 6, pp. 1-10, February 27, 1997
1018	Löwenau et al., "Adaptive Light Control – A New Light Concept Controlled by Vehicle Dynamics and Navigation, SAE Transactions, Vol. 107, No. 6, pp. 31-36, February 26, 1998
1019	Manassero et al., "Adaptive Headlamp: A contribution for Design and Development of Motorway Light," SAE Transactions, Vol. 107, No. 6, pp. 1-6, February 26, 1998
1020	Michael Hamm, "System Strategies for Adaptive Lighting Systems," 2001 Symposium: Progress in Automobile Lighting (PAL), pp. 368-380, September 26, 2001
1021	U.S. Patent Publication No. 2013/0258688 to Kalapodas
1023	Manassero et al., Adaptive Lighting Systems: Technical Solutions and Methodological Approach for Photometric Specifications, Progress in Automotive Lighting Vol. 6, pp. 514-525 (1999).
1024	Hanno Westermann, Lighting Performance Requirements in Vehicle Lighting Exemplified by System Requirements for AFS, Progress in Automotive Lighting Vol. 6, pp. 807-820 (1999).
1025	Diem et al., Analysis of the Eye-Movement Behaviour During Use Moveable Headlamps, Progress in Automotive Lighting Vol. 5, pp. 185-207 (1999).
1026	Kobayashi & Sugimoto, Development of the Phase-I AFS Front Lighting System, Progress in Automotive Lighting Vol. 5, pp. 449-464 (1999).

Exhibit #	*Description*
1028	Bernhard Wörner, Adaptive Frontlighting – Experimental System, Development and Functional Evaluation, Progress in Automotive Lighting Vol. 6, pp. 844-853 (1999).
1030	Assessment of Headlamp Glare and Potential Countermeasures, Survey of Advanced Front Lighting System (AFS) Research and Technology, National Highway Traffic Safety Administration (2005)
1033	File History of *Ex Parte* Reexamination of U.S. Patent No. 9,955,551, Control No. 90/014,815
1036	U.S. Patent No. 5,523,193 to Nelson
1037	U.S. Patent No. 5,537,433 to Watanabe
1038	U.S. Patent No. 4,662,746 to Hornbeck
1039	U.S. Patent No. 5,061,049 to Hornbeck
1040	U.S. Patent No. 5,933,183 to Enomoto *et al*.

VI. LEGAL STANDARDS

22. I have also relied upon various legal principles (as explained to me by Petitioner's counsel) in formulating my opinions. My understanding of these principles is summarized below.

23. I have been told the following legal principles apply to analysis of patentability. I also have been told that, in an *inter partes* review proceeding, a patent claim may be deemed unpatentable if it is shown by a preponderance of evidence that the claim is anticipated by one prior art reference under 35 U.S.C. § 102, or rendered obvious by one or more prior art references under 35 U.S.C. § 103.

24. I understand that documents and materials, such as printed publications or patents, that qualify as prior art can be used to render a patent claim as anticipated or as obvious.

25. I understand that once the claims of a patent have been properly construed, the second step in determining anticipation or obviousness of a patent claim requires a comparison of the properly construed claim language to the prior art on a limitation-by-limitation basis.

A. My Understanding of Claim Construction

26. I understand that during an *inter partes* review proceeding, claims are to be construed in light of the specification as would be read by a person of ordinary skill in the relevant art ("POSA") at the time of the purported priority date. I understand that claim terms are given their ordinary and customary meaning as would be understood by a POSA in the context of the entire disclosure. A claim term, however, will not receive its ordinary meaning if the patentee acted as his own lexicographer and clearly set forth a definition of the claim term in the specification. In this case, the claim term will receive the definition set forth in the patent.

B. A Person of Ordinary Skill in the Art

27. I understand that a POSA is presumed to be aware of all pertinent art, thinks along conventional wisdom in the art, and is a person of ordinary creativity—not an automaton.

28. I have been asked to consider the level of ordinary skill in the field that someone would have had at the time the alleged invention was made. In deciding the level of ordinary skill, I considered the following:

- the levels of education and experience of persons working in the field;
- the types of problems encountered in the field; and
- the sophistication of the technology.

29. I understand that the relevant time for considering whether a claim would have been obvious to a POSA is at the time of the alleged invention, which I have been told to assume for this case is July 12, 2002.

30. Regardless of if I use "I" or "POSA" during my technical analysis below, all of my statements and opinions are to be understood to be based on how a POSA would have understood or read a document at the time of the alleged invention.

C. My Understanding of Obviousness

31. I understand that a patent claim is unpatentable if the claimed invention would have been obvious to a POSA at the time of the alleged invention.

I understand that this means that even if all of the elements of the claim cannot be found in a single prior art reference that would anticipate the claim, the claim can still be unpatentable.

32. It is my understanding that to obtain a patent, a claimed invention must have been, as of its earliest possible priority date, non-obvious in view of the prior art in the field. I understand that a patent claim is obvious when the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious to a POSA at the time the alleged invention was made.

33. When considering the issues of obviousness, I have been told that I am to do the following:

- Determine the scope and content of the prior art;
- Ascertain the differences between the prior art and the claims at issue;
- Resolve the level of ordinary skill in the pertinent art; and
- Consider evidence of secondary indicia of non-obviousness (if available).

34. With respect to determining the proper scope of prior art to examine, I understand that in order for a prior art reference to be properly used in an obviousness ground under 35 U.S.C. § 103, the prior art reference must be analogous art to the claimed invention. I have been told that a reference is

analogous art to the claimed invention only if: (1) the reference is from the same field of endeavor as the claimed invention; or (2) the reference is reasonably pertinent to the particular problem solved by the inventor.

35. I understand that factors relevant to determining the proper field of endeavor include the inventor's explanations of the subject matter (including the patent specification), as well as the claimed invention's structure and function. And I further understand that to be reasonably pertinent to the particular problem solved by the inventor, a prior art reference must logically commend itself to the inventor's attention in considering his or her problem.

36. I have been told that an analogous reference may be modified or combined with other analogous references or with the POSA's own knowledge if the person would have found the modification or combination obvious. I have also been told that a POSA is presumed to know all relevant, analogous prior art, and that the obviousness analysis may take into account the inferences and creative steps that a POSA would employ.

37. In determining whether a prior art reference would have been combined with another prior art reference or other information known to a POSA, I have been told that the following principles may be considered:

- A combination of familiar elements according to known methods is likely to be obvious if it yields predictable results;

- The simple substitution of one known element for another is likely to be obvious if it yields predictable results;
- The use of a known technique to improve similar devices, products, or methods in the same way is likely to be obvious if it yields predictable results;
- The application of a known technique to a prior art reference that is ready for improvement is likely obvious if it yields predictable results;
- Any need or problem known in the field and addressed by the reference can provide a reason for combining the elements in the manner claimed;
- A skilled artisan often will be able to fit the teachings of multiple references together like a puzzle; and
- The proper analysis of obviousness requires a determination of whether a POSA would have a "reasonable expectation of success"—not "absolute predictability" of success—in achieving the claimed invention by combining prior art references.

38. I understand that whether a prior art reference renders a claim unpatentable as obvious is determined from the perspective of a POSA. I have also been told that, while there is no requirement for the prior art to contain an express suggestion to combine known elements to achieve the claimed invention, a

suggestion to combine known elements to achieve the claimed invention may come from the prior art as a whole or individually, as filtered through the knowledge of a POSA. In addition, I have been told the inferences and creative steps a POSA would employ are also relevant to the determination of obviousness.

39. I also understand that when a work is available in one field, design alternatives and other market forces can prompt variations of it, either in the same field or in another. I have also been told that if a POSA can implement a predictable variation and would see the benefit of doing so, that variation is likely to be obvious. I have been told that in many fields, there may be little discussion of obvious combinations, and in these fields market demand—not scientific literature—may drive design trends. I have been told that when there is a design need or market pressure and there are a finite number of predictable solutions, a POSA has good reason to pursue those known options.

40. I have been told there is no rigid rule prescribing a reference or combination of references must contain a "teaching, suggestion, or motivation" to combine references. But I also have been told that the "teaching, suggestion, or motivation" test can be a useful guide in establishing a rationale for combining elements of the prior art. I have been told this test poses the question as to whether there is an express or implied teaching, suggestion, or motivation to combine prior

art elements in a way that realizes the claimed invention, and that it seeks to counter impermissible hindsight analysis.

41. Further, it is my understanding that a claim or claim element that has no patentable difference between another claim or claim element means that the same prior art references can be applied to those claims or claim elements. Additionally, it is my understanding that a claim or claim element that has no patentable difference between another claim or claim element means that there is no difference in what is required from a technical standpoint, and the same prior art citations disclose the respective features. In addition, it is my understanding that a claim or claim element that has no patentable difference between another claim or claim element means and that there are some individual features across the claim sets or claim element sets that are similar, but have no patentable difference between them, for the same reasons. I have identified a claim or claim element that has no patentable difference between another claim or claim element throughout this declaration as appropriate, and the same prior art references are applied to those limitations as provided in the analysis.

VII. LEVEL OF ORDINARY SKILL IN THE ART

42. In my opinion, a POSA in the context of the '503 patent as of July 12, 2002 (the earliest possible priority date of the '503 patent)[2] would have had a bachelor of science (B.S.) degree in mechanical engineering, electrical engineering, optical engineering, applied physics, or an equivalent field, as well as at least 2 years of industry experience in the area of automotive lighting and lighting-control systems. The POSA may work as part of a team, for example, with computer engineers to integrate, program, etc., controllers and various control inputs to affect control of a given light source.

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

44. Based on my education, training, and professional experience in the field of the claimed invention, I am familiar with the level and abilities of a person of ordinary skill in the art at the time of the claimed invention. I also base this opinion on my experience hiring and managing approximately 20 engineers

[2] For this declaration, I have been asked to assume that July 12, 2002 is the earliest effective priority date, but the POSA definition would not change even if a later priority date is used.

engaged in the development of advanced automotive electronics systems, and in leading engineering staff from approximately 30 different automotive manufacturers and suppliers as part of various research and development consortia. Additionally, I met at least these minimum qualifications to be a person having ordinary skill in the art at least as of July 12, 2002. Further, although my qualifications may exceed those of the hypothetical person having ordinary skill in the art defined above, my analysis and opinions regarding the '503 Patent have been rendered from the perspective of a person having ordinary skill in the art at the time of the invention.

VIII. OVERVIEW OF THE '503 PATENT CLAIMS

A. Technology Overview of the Patent Claims

45. The '503 patent claims relate to motor vehicle headlamps; however the specification of the '503 patent focuses primarily on *non-vehicle* applications. Of the approximately 100 columns of description, most all of the vehicular headlamp disclosure is centered around Figure 15.

46. Because the focus of the claims relates to motor vehicle headlamp systems and methods, I provide the following historical background related to automotive headlamps, the application of adaptive front lighting systems/beam control, known glare-reduction techniques, anti-blinding systems, etc., including use of LEDs as light sources for headlamps.

47. By mid-2000 and several years before the earliest possible priority date, all the technologies claimed in the ’503 patent were well known by developers of automotive lighting systems, and specifically the adaptive automotive lighting systems. No individual elements of the ’503 patent claims were new, and there was nothing new about the manner in which those elements were combined in the claims. I know this because I had firsthand experience in automotive systems, including lighting control systems and related beam steering and beam forming technologies.

48. Indeed, Grounds 1, 2, and 5 demonstrate why it would have been obvious for an adaptive headlamp system to utilize known sensor inputs to output multiple directional (angular) light distributions with a predefined dimmed or desired illuminance, in response to the sensor inputs. And Grounds 3, 4, and 6 demonstrate why it would have been obvious to modify the system to use sensor data to illuminate curved roadways.

49. Adaptive lighting for headlamps to control one or more illumination characteristics was well known. As early as the 1940s and 1950s, vehicles such as the Tucker Torpedo and Citroen DS-19 included headlamps that swiveled with the turning angle of the wheels via mechanical linkage. EX1030, NHTSA Survey, 3-4. Most notably with relation to the technology claimed in the ’503 patent, from about 1992 to 1999, a global consortium of headlamp and automobile

manufacturers participated in the EUREKA Project to advance development of adaptive front lighting systems (AFS). EX1015, Westermann, 3-6; EX1016, AFS Presentation, 1-19; EX1023, Manassero, 514-515; EX1024, Westermann, 819. The EUREKA Project was a well-known consortium that a POSA would have been aware of. The EUREKA Project investigated, studied, and recommended AFS functions, including dynamic road illumination, glare control, explored reflectance of pedestrians and road signs, and other headlamp features. EX1015, 4.

50. By 1997, adaptive (dynamic) lighting's potential to increase road safety, driving safety, and drivers' visual comfort as an improvement over fixed (static) headlamps was well known. EX1017, Hogrefe, 3-10. Other background references support this finding. EX1018, Löwenau, 33-36 ("A new light concept called Adaptive Light Control (ALC) is developed with the aim to improve night time traffic safety."); EX1019, Manassero, 1-2 ("A major breakthrough in improving visibility, safety and comfort under all driving conditions is given by a headlamp with adjustable light intensity and beam pattern according to the vehicle speed, steering wheel angles and different driving conditions."); EX1020, Hamm, 368, 370, 374-378 ("The car's sensors analyze and evaluate the driving situation and generate a light distribution that is adapted to that particular situation. In this process, not only the driver's comfort is increased but the visibility is improved also. This has a direct positive impact on traffic safety."); EX1024, Westermann,

819 (“The challenge of such a system approach and the necessary and not so easy change towards performance and system requirements was clearly seen - but also the prospects of possible safety improvement.”); EX1025, Diem, 202 (“One explanation could be that because of the available luminous flux in direction of driving, the driver has the ability to recognize the subsequent direction peripherally and can fixate other interesting objects in the road area. With other words the driver has more time for driving and the tiredness of the eyes could be reduced.”); EX1028, Wörner, 844 (“The driver's comfort and safety can be improved considerably by adaptive motor vehicle headlighting, with the today's technical means in lighting design and manufacturing, as well as sensors and communication systems in cars.”).

51. Further, individually controllable spatial light modulators (SLMs), including digital mirror devices (DMDs), producing directional light beams with different angles/aimings were well known for illumination applications, including adaptive vehicle lighting applications. EX1005, Beam, 4:26-59 (“spatial light modulator”), 8:4-17 (“digital mirror devices”), FIGS. 1, 2, 4; EX1009, Braun, 21:13-16 (“digital mirror device, a ‘DMD’ device, and each luxel 76 comprises a micromirror”), 14:12-33; FIGS. 2-5; EX1010, Karlsson, 5:11-15 (“Micro Mirrors”), 14:1-15, FIGS. 3, 6, 14; EX1038, Hornbeck, 1:12-10:3, FIGS. 1-3;

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

52. Adaptive lighting commonly used multiple directional light sources (e.g., multiple directional beams, such as light modules or beam contributors) to produce an adaptive light pattern (angular light intensity distribution) by varying illumination characteristics including beam intensity, beam shape, beam color, beam direction around curved roads, and glare reduction. EX1017, 3-10 ("[A] curve or an intersection can be adaptively illuminated before reaching actually the point when the steering wheel is turned or the turn indicator is operated."); EX1018, 33-36 ("The advantage of using Adaptive Light Control is shown in Fig. 5, where one observes a country road lit correctly. Instead of illuminating some fields or trees, the available light is directed dynamically in the direction where it is actually needed, enhancing the visual information for the driver."); EX1019, 1-2 ("A major breakthrough in improving visibility, safety and comfort under all driving conditions is given by a headlamp with adjustable light intensity and beam pattern according to the vehicle speed, steering wheel angles and different driving conditions."); EX1020, 368, 370, 374-378 ("The results show, that significant improvements can be proven by the adaptive headlamp system, without generating additional glare for oncoming traffic").

53. As an example, EX1017, Hogrefe shows how adapted light patterns can increase safety on curved roads, at high speeds, and within cities, for example, by varying improved lateral illuminance (shaping light around curves), increasing projection length of the beam to improve driver's visibility, and expanding the beam width to capture a wider angle, for example. And as Hogrefe's Figure 3 explains, "the individual light *pattern* of multiple sub-units sum up to the total adaptive light pattern." EX1017, FIG. 3 (emphasis in original).

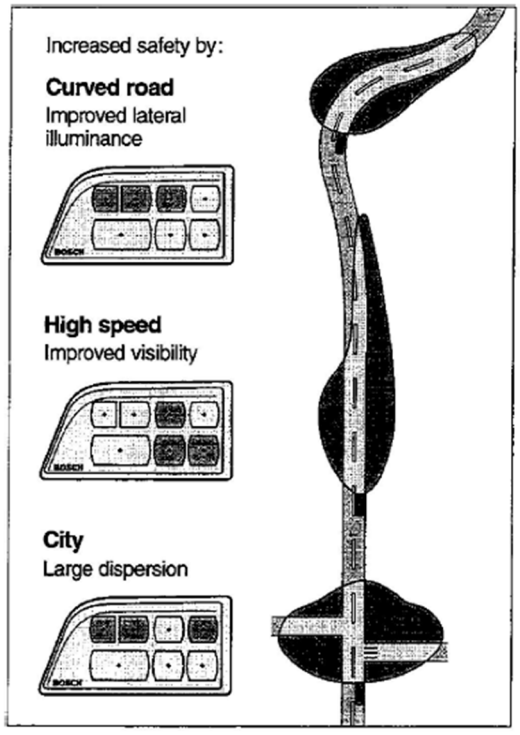


Fig.1: Three standard driving situations with adapted light pattern seen from the bird eye's view.

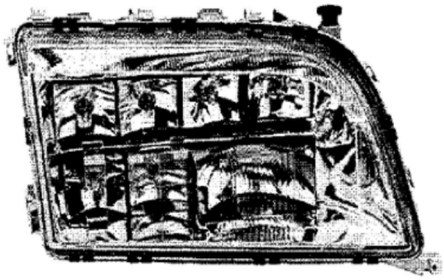
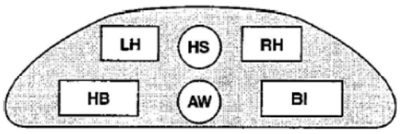


Fig 4: ALP *headlamp* sample



Single components:

LH Left hand bend	**BI** Basic illumination
RH Right hand bend	AW Adverse weather illumination
HB High beam	HS Hot spot

Fig. 5 Advanced ALP sample layout

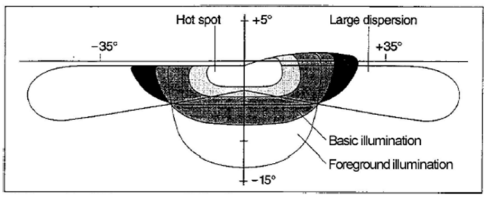


Fig. 3: Light pattern of multiple beam ***headlamp*** *(**Isolux** curves in wall projection):* The individual light *pattern* of multiple sub-units sum up to the total adaptive light pattern

EX1017, FIGS. 1 and 3-5.

54. Adaptive lighting to reduce glare in a portion of an oncoming or following driver's field-of-view was also well known. In 1999, the industry

understood that the beam pattern in AFS systems could be adapted for different driving, weather, and environment conditions, and to keep glare at a lower level when meeting or following other vehicles on the road. EX1023, 514-515. AFS systems could use existing sensor signals on the vehicle to measure and collect ambient conditions, then to modify the lighting performance to the traffic conditions, and to prevent deteriorating glare effects for other road users. EX1024, 815-816.

55. By 2000, adaptive headlamp systems with multiple directional light beams were developed with various means of sensors to detect surroundings while driving and resulted in glare reduction for oncoming and preceding vehicle drivers. EX1005, 1:5-3:44, 4:9-59; EX1010, 1:10-26, 9:18-26, 20:29-32; *see also* EX1015, 6-18, 21; EX1016, 1-19 ("[A]ll GRE experts acknowledge the experience with the new technology of front lighting, designed to improve the illumination and to adapt it to various driving situations, whilst reducing glare."); EX1009, 6:4-7; 16:6-25, 20:15-33 ("According to an aspect of some embodiments of the present invention, the pattern recognition application identifies oncoming vehicles and automatically adjusts illumination provided by the luxels to prevent glare from light provided by the luxels from blinding a driver of the oncoming vehicle."). Further, arrays of independently controlled narrow-beam directional light sources, for example, light-emitting diode (LED) arrays, were developed with sufficient illuminance,

directionality, and dynamic control as an alternative to traditional incandescent and gas discharge bulbs to provide adaptive light patterns and real-time feedback. EX1005, 1:5-3:44, 4:9-59; EX1010, 1:10-26, 9:18-26, 20:29-32; EX1015, 6-18, 21; EX1009, 16:6-25, 20:15-33.

56. As I explain in this declaration, the '503 patent claims are directed to systems and methods previously known in the art for adaptively controlling headlamp illumination characteristics. They recite known control schemes implemented by a known controller to control multiple directional light sources based on sensor data of a field-of-view. For example, light in a first subsection is below a predefined illuminance to prevent glare and light in a second subsection is above the predefined illuminance to improve road illumination. Thus, a known control input (for providing a predefined illuminance) is applied to a known way of controlling headlamp output light patterns and intensity.

57. As an example, independent claim 59 recites, in part, a system 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*;
>
> *determine* light output for the headlight system that *aims illumination at the first subsection*, the illumination aimed at the first subsection substantially resulting in light *below a first predefined illuminance* in the first subsection, and

that *aims illumination at one or more second subsections* of the field of view to either side of the first subsection, the illumination aimed at the one or more second subsections substantially resulting in light *above the first predefined illuminance* in the one or more second subsections; and

instruct adjustment of one or more of the light sources to achieve the determined output.

EX1001, 102:14-40.[3] The dependent claims merely add known features: illuminating a road curvature; illuminating a planned turn; a laser diode; reflectors/refractors/lenses; color illumination; adjustment; etc.

58. The '503 patent's system includes headlamp 270, controller 279, and sensors 280 on vehicle 271. EX1001, 52:63-54:52, FIG. 15. Headlamp 270 includes one or more clusters 276 (290), 281 (282), 285 (286), 287 (288, 289) of differently aimed solid-state light sources (SLSs) such as light-emitting diodes (LEDs) 275, 277, 278, 283, 284, respectively. EX1001, 53:24-56:61, FIG. 15.

[3] Emphasis added throughout, unless noted.

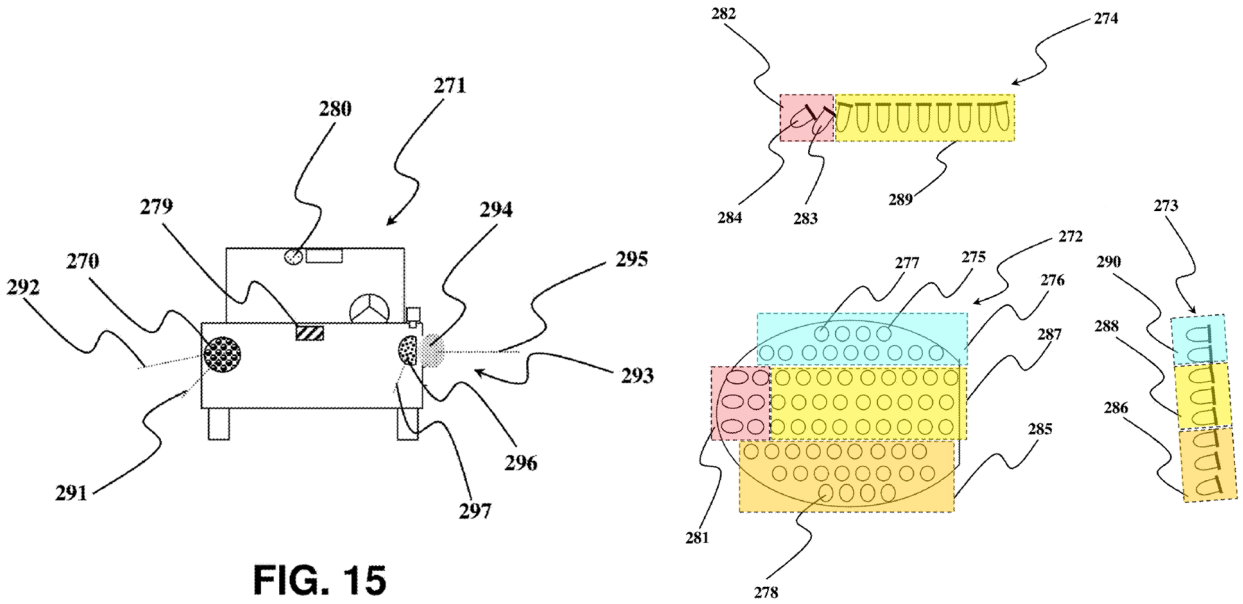


FIG. 15

EX1001, FIG. 15 (annotated).

59. The ’503 patent goes on and describes that controller 279 receives traffic data of oncoming vehicles from sensors 280 and determines the maximum illumination allowable for the traffic situation without blinding oncoming traffic. EX1001, 52:63-54:52, FIG. 15. But unsurprisingly, the ’503 patent’s specification leaves it to a POSA to determine the “predefined illuminance,” without describing an illuminance level, numerical value, algorithms, or control steps to achieve this. And a POSA would have readily incorporated multiple directional beam control and a predefined illuminance in an adaptive headlamp system, as demonstrated by the applied prior art. Such element (predefined illuminance) was well known and a POSA would have had no challenges in doing so.

B. Independent Claims 20 and 59

60. The independent claims recite patentably indistinct or substantially similar elements and concepts such that the same prior art disclosures are applicable to and map to corresponding elements across the independent claims. That is, even if the words used in a corresponding claim or corresponding claim feature are not exactly the same, the concepts, functions, and scope, are the same. And so the same prior art applies.

61. For example, independent claims 20 and 59 recite a "vehicle headlight system" for controlling illumination characteristics of a headlamp with "at least three directional light sources"; and independent claim 59 further recites a "predefined illuminance."

62. The disclosures mapped below for the directional light sources, sensor, processor, etc., of system claim 20, apply equally to and render obvious the other system claims (59-64). Minor phrasing differences do not affect the substantive application of the prior art.

63. Substantively, the disclosures showing the obviousness of the claims apply no matter how the features are phrased within the different claim sets.

64. The table below highlights the overwhelming overlap between the independent claims, and shows why a POSA would have understood that the same disclosures in the applied references satisfy the corresponding claim elements:

Table 1: Independent Claim Elements

Claim Element	Independent Claim 20	Claim Element	Independent Claim 59
[20.P]	A vehicle headlight system, comprising:	[59.P]	Identical to [20.P]
[20.1]	one or more headlamps affixed to a vehicle,	[59.1]	one or more headlamps affixed to a first vehicle,
[20.2]	each headlamp including at least three directional light sources aimed at different angles relative to the vehicle,	[59.2]	each headlamp including at least three directional light sources having different aimings relative to the first vehicle,
[20.3]	the light sources configured to have one or more controllable light characteristics,	[59.3]	the light sources having one or more controllable illumination 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,	[59.4]	Identical to [20.6]

Claim Element	Independent Claim 20	Claim Element	Independent Claim 59
[20.7]	defined as pertinent to determining illumination output from the one or more headlamps and	[59.5]	at least a portion of the sensed information indicating a second vehicle, and
[20.8]	communicating the sensed information to a processor as sensor data;	[59.6]	communicate sensor data reflecting the sensed information to at least one processor,
[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	[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]	Language shown below with [20.12]
		[59.9]	the illumination aimed at the first subsection substantially resulting in light below a first predefined illuminance in the first subsection, and
[20.10]	at least a second subsection not including the detected vehicle,		

Claim Element	Independent Claim 20	Claim Element	Independent Claim 59
		[59.10]	that aims illumination at one or more second subsections of the field of view to either side of the first subsection,
[20.11]	determine optimal use of the differently aimed directional light sources to maximize vehicle operator visibility in at least the second subsection,		
		[59.11]	the illumination aimed at the one or more second subsections substantially resulting in light above the first predefined illuminance in the one or more second subsections; and
[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	[59.8]	determine light output for the headlight system that aims illumination at the first subsection,
[20.13]	direct the control circuitry to adjust the directional light sources to achieve the determined optimal use.	[59.12]	instruct adjustment of one or more of the light sources to achieve the determined output.

C. Prosecution History Summary

65. The application that issued as the ’503 patent underwent nominal prosecution. A first Office Action rejected all claims 1-18. EX1002, Prosecution

History, 147-164. Applicant revived the previously abandoned application, amending claims 1-18, adding new claims 19-20, and arguing that the sole applied reference *did not qualify as prior art* due to the application *priority claim* of at least January 24, 2012. EX1002, 173-193; EX1021, Kalapodas. The Office did not apply any prior art references with an effective priority date before January 24, *2012*.

66. Additional non-art rejections were issued, and claims 1-70 issued without substantive, prior-art-based examination since the sole prior art rejection was overcome as allegedly not qualifying as prior art. Regardless, none of the prior art applied in the Petition or considered here was considered by the Office during prosecution.

D. Claim Construction

67. As above, I understand that during an *inter partes* review proceeding, claims are to be construed in light of the specification as would be read by a POSA at the time of the purported priority date.

68. Under any reasonable construction or interpretation, it is my opinion that the challenged claims are unpatentable for the grounds presented, as I describe in this declaration. Should Patent Owner introduce any proposed claim construction(s), I reserve the right to review and revisit my opinions presented here.

"light sources" (claims 20, 59)

69. Counsel has informed me that Patent Owner submitted a proposed claim construction in a reexamination proceeding involving U.S. Patent No. 9,955,551 ("the '551 patent")—particularly a position that a POSA would understand the term "light source" in the '551 patent claims to mean an "individual LED"—but I understand that the Central Reexamination Unit did not address Patent Owner's proposed construction. EX1033, 15 ("a person of ordinary skill in the art (POSITA) would understand the term *light source* to mean individual LED"), 19 ("[t]hus, pursuant to the broadest reasonable construction rubric, consistent with the teachings in the specification and the claim language, a person of ordinary skill in the art would construe the claim term *light source* to mean an individual LED").

70. The '503 patent, which shares the same specification as the '551 patent, states "[a]s used herein, the term 'light source', LED or 'solid state light source' means any system that is capable of receiving an electrical signal and producing light in response to the signal." EX1001, 17:7-10. Further, the '503 patent states "[t]hus, the term 'light source' should be understood to include light emitting diodes of all types…[and] [i]ncandescent and discharge light sources." EX1001, 17:10-20. Therefore, in my opinion, a POSA would have understood that "light sources" include any known headlamp light sources, for example but not

limited to, incandescent light sources, discharge light sources, laser diode (LD) light sources, and light emitting diode (LED) light sources that are electrically controllable, which also include the combination of light sources and spatial light modulators, for example, microbeam sources and spotlight beam sources. *See* EX1005, 8:4-17 ("microbeam sources"); EX1010, 4:32-5:10 ("spotlight beams"); EX1009, 14:16-20 ("luxels 26 may comprise one or a combination of light sources, such as for example semiconductor lasers, that provide light by emission, micro-mirrors that provide light by reflection and/or liquid crystal cells that provide light by transmission").

71. Furthermore, in my opinion, the proposed construction of Patent Owner in the reexamination proceeding involving the '551 patent would not be applicable here at least because the '503 patent involves different claims than those claims involved in the reexamination proceeding of the '551 patent. Additionally, the claims here do not recite "LED light source," and therefore do not require the light source to be only an individual LED, and the specification and claims further explain what the term "light source" means in the context of the '503 patent.

72. In any event, the applied references cover the Patent Owner's proposed construction of a "light source" to mean an "individual LED." *See* EX1005, 8:4-17 ("light source includes an array of individual, independently controllable microbeam sources selected from the group consisting of *light emitting diodes*,"

which explains that the term microbeam source is a type of LED light source configuration); EX1010, 4:32-5:10 ("[t]he spotlight beams can be made up of separate, spatially distributed, pixel type light sources, for example a plurality of *light-emitting diodes*," which also explains that the term spotlight beam source is another example of a type of LED light source configuration). Thus, the challenged claims are unpatentable under any reasonable construction. Again, should any proposed claim constructions be presented by Patent Owner, I reserve the right to provide an opinion thereon.

73. It is my opinion that none of the other claim terms require specific construction and should receive their plain and ordinary meaning in the context of the '503 patent specification. And under any reasonable construction, the challenged claims are unpatentable.

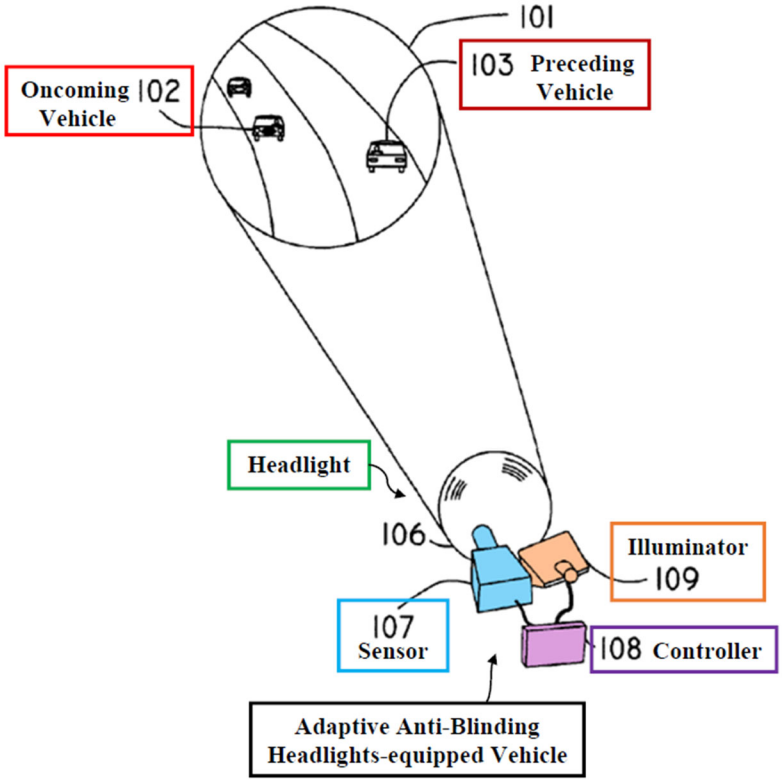
IX. SUMMARY OF THE APPLIED REFERENCES

A. Ground 1 – Beam and Thominet

1. U.S. Patent No. 6,144,158 to Beam

74. Beam discloses automotive adaptive anti-blinding headlights (AABH) that control the intensity and angular position of one or more narrow microbeams. EX1005, Abstract. Beam's AABH system detects headlights/taillights of vehicles ahead, and adjusts the headlight to provide significantly reduced illumination in certain areas, protecting the vision of other drivers. EX1005, 4:10-25, FIG. 1.

Sensor 107 inputs data to controller 108, which controls illuminator 109. EX1005, 4:10-25, FIG. 1.



EX1005, FIG. 1 (annotated).

75. Beam uses the term "microbeam," as light emitted from a "microbeam source," which includes "*individual, controllable, light-emitting diodes*" (LEDs). So, for clarity, when I refer to Beam's system and its LEDs, a POSA would have understood that all instances of "microbeam" in Beam's disclosure correlate with "*individual, controllable, light-emitting diodes (LEDs)*." Relatedly, as Beam uses the term "source," a POSA would have understood that the term "source" may include not only the *emitter* but also may include lenses/optics, packaging, etc.

76. Beam's LEDs are therefore controllable in direction, pattern, intensity, etc.—all with the purpose of providing enhanced safety to the driver and others. EX1005, 3:8-44; 6:53-7:13. Because headlamps are critical safety features in the motor vehicle, the overarching purpose of providing enhanced safety to the driver and others (whether in other vehicles, or pedestrians, etc.) makes sense—any additional features or elements that improve safety would have been a focus of a POSA.

77. Beam's controller 108 uses imaged data from sensor 107 to determine a particular area (or section) of microbeams to be reduced. EX1005, 4:26-59, FIGS. 2, 5. Rays from lamp 202 fall on and are reflected or blanked (attenuated) by spatial light modulator 203 mounted on support 204 to produce an overall beam pattern comprising many individually, differently aimed microbeams. EX1005, 4:26-59, FIGS. 2, 5.

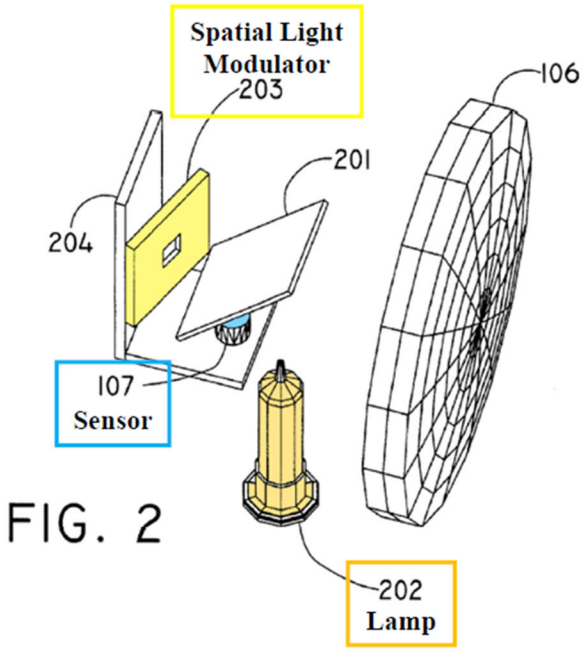


FIG. 2

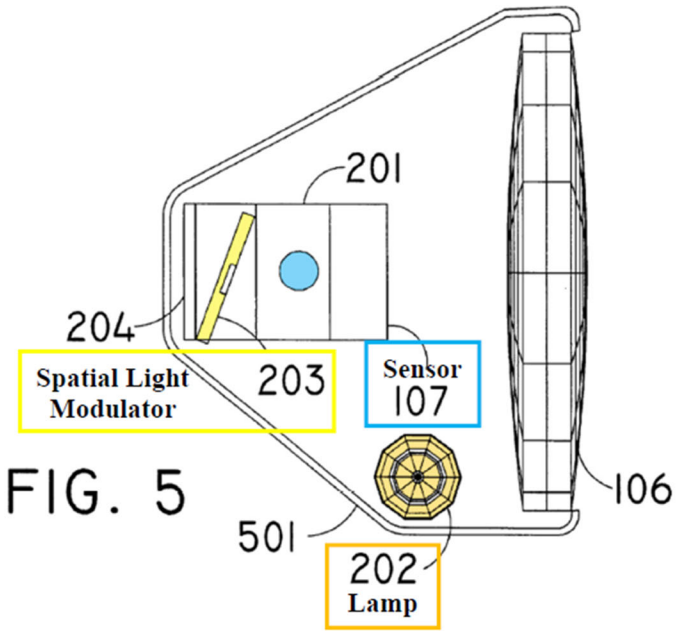


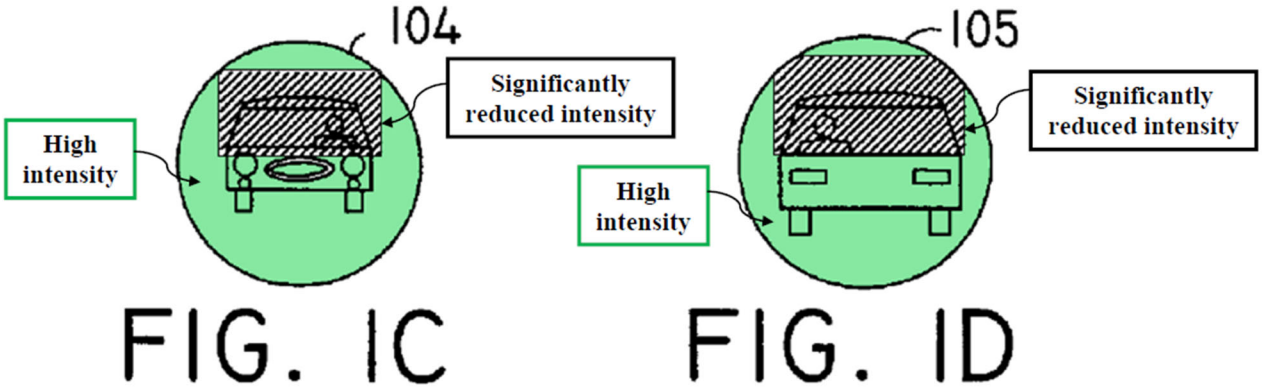
FIG. 5

EX1005, FIGS. 2 and 5 (annotated).

78. As explained, Beam's microbeams are arranged in an X-Y matrix and the intensity and angular position of each microbeam are independently controlled. EX1005, 4:26-59, FIGS. 2, 5. Controller 108 selectively reduces illumination of microbeams falling on a particular object or objects, which commands spatial light modulator 203 in illuminator 109 to either divert or attenuate the selected microbeams. EX1005, 4:26-59, FIGS. 2, 5.

79. As shown in the annotated figures below, Beam's system automatically provides the illumination with significantly reduced intensity, represented by shaded dark areas, to specific vehicle areas in circles 104, 105 where the light from the system is being projected to, for the purpose of *reducing blinding* of drivers of oncoming/preceding vehicles 102, 103—*while retaining high*

intensity illumination in unshaded areas. EX1005, 2:53-3:3, 4:10-25, FIGS. 1C-1D.



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

80. Beam's AABH system does this via an optical system 106, sensor 107 (e.g., camera), controller 108, and illuminator 109. EX1005, 4:10-25. Data from sensor 107 are input to controller 108, thereby controlling illuminator 109 to illuminate an area 101. EX1005, 4:10-25.

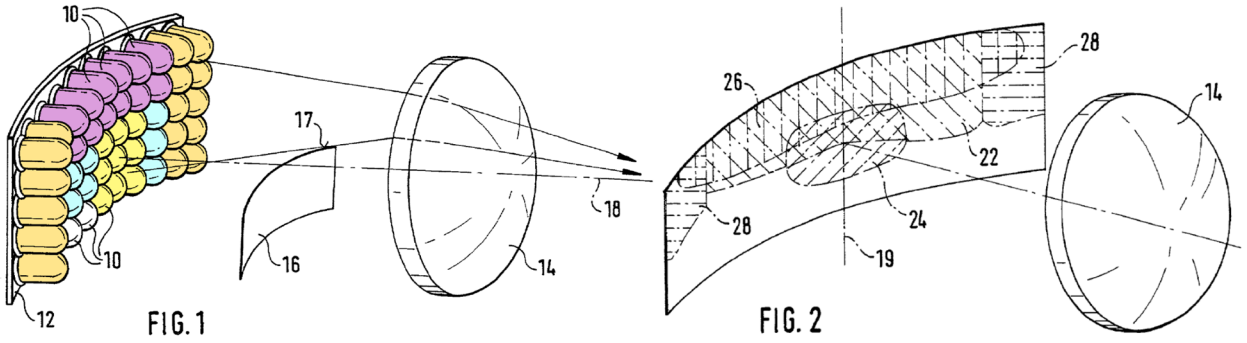
81. Beam explains:

> *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*. As the positions of both vehicles move, the *blanked area tracks the location of the oncoming vehicle, dynamically varying in position and in size*.
> EX1005, 6:19-27, 5:46-54; *see also* EX1005, 2:59-3:3, 4:10-25.

82. And in the example with reference to Figures 2 and 5, controller 108 selectively commands reduction of illumination of microbeams falling on a particular object or objects, which commands spatial light modulator 203 in illuminator 109 to either divert or attenuate the selected microbeams. EX1005, 5:46-54; *see also* EX1005, 2:59-3:3, 4:10-25; *see also* EX1005, 8:4-17 (explaining that the microbeams may be from LEDs).

2. U.S. Patent Publication No. 2001/0019486 to Thominet

83. Thominet (similar to Beam) discloses a headlight with independently controllable LEDs in an array. EX1006, ¶¶17-18, 21, 23-26, FIGS. 1, 2, 4, 5, claims 1-10. Semiconductor light sources 10 (e.g., LEDs) arranged on a curved surface provide regions 22, 24, 26, 28 with different aimings, independently controllable to provide different illumination characteristics (e.g., low beam, high beam, low sight, large width). EX1006.



EX1006, FIGS. 1 and 2 (annotated).

84. Thominet describes that two "illumination devices can be arranged at the front end" of a vehicle as headlights. EX1006, ¶17. The semiconductor sources

10 (e.g., LEDs) are distributed in a matrix on support element 12. EX1006, ¶17. The semiconductor light sources 10 are held and electrically contacted on support element 12. Support element 12 arranges semiconductor light sources 10 "distributed over a concavely curved surface or a stepped surface." EX1006, ¶18.

85. Thominet discloses such an implementation to provide different spatial distributions for improved visibility in different driving situations (e.g., low visibility, low/high speeds, recognizing a counter traffic, curves, etc., *see* EX1006, ¶¶7-8, 23-26, FIGS. 1-2), thereby improving driver safety.

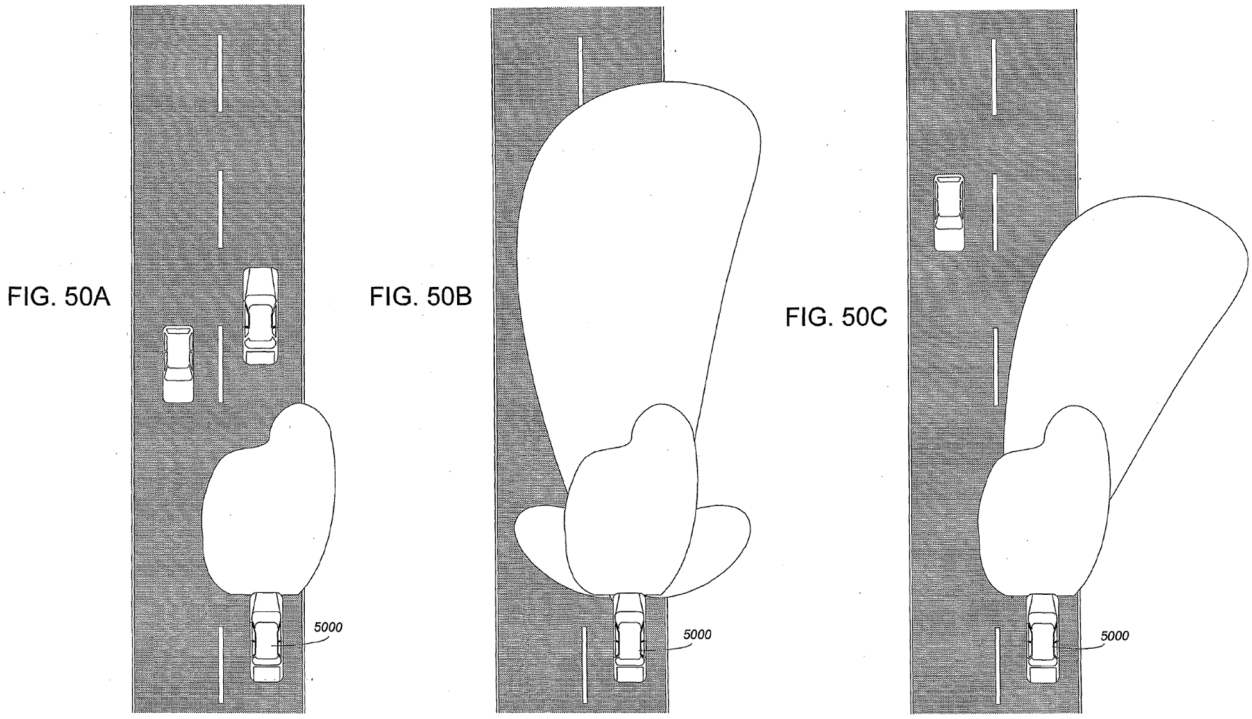
86. Thominet's technique (e.g., software implementation), seeks to enhance driver visibility, thereby increasing safety—using multiple directional beam regions for different functions. EX1006, ¶¶17-18, 21, 23-26, FIGS. 1-2; EX1006, ¶4 ("*characteristic* of the light beam…can be used for *different functions*"), ¶¶5-8. Semiconductor light sources 10 provide beam regions 22, 24, 26, 28 with different angles/aimings for different driving situations. EX1006, ¶¶7-8, 17-18, 21, 23-26, FIGS. 1-2; EX1006, ¶7 ("*wider* illumination"), ¶23 ("*improving* the illumination…at high speeds").

87. Thominet's hardware makes this possible— Thominet's semiconductor light sources 10 on curved surface 12 (e.g., with differently angled/aimed semiconductor light sources 10 relative to the vehicle, *see* EX1006, ¶¶17-20, 23-26, FIGS. 1-2, 5-7) results in different angles/aimings relative to the

vehicle, provide beam regions 22, 24, 26, 28 for different driving situations. EX1006, ¶¶7-8, 17-18, 21, 23-26, FIGS. 1-2.

B. Ground 2 – WIPO Patent Publication No. 2001/070538 to Stam with Beam-Thominet

88. Like Beam, Stam discloses a headlight control system to automatically adjust beam patterns that maximize the illuminated area without causing excessive glare. EX1007, Abstract, 9:12-10:8, 77:30-78:17, FIGS. 11, 27-28, 33, 50A-50C.[4]

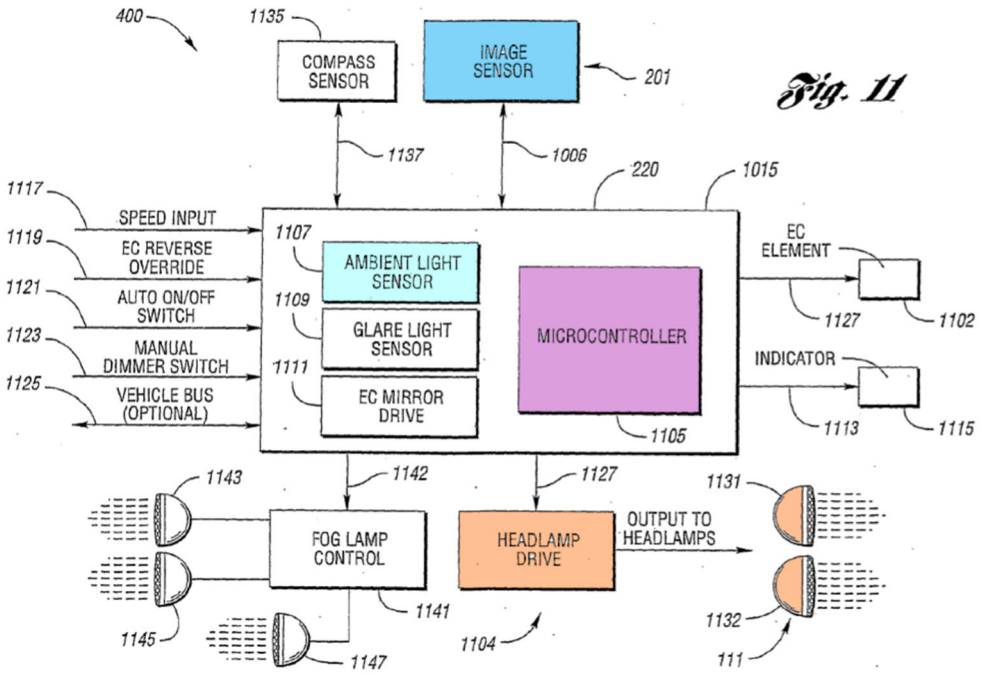


EX1007, FIGS. 50A-50C.

89. Stam's headlight control system uses an image sensor and controller to automatically adjust intensity, aim, and/or focus of exterior lights to generate beam

[4] In this declaration, for Stam, I use page:line citation format.

patterns that maximize the illuminated area without excessive glare. EX1007, Abstract, 9:12-10:8, 73:13-16, 77:30-78:17, FIGS. 3, 11, 13, 14, 19, 20, 26a, 27, 28, 33, 50A-50C. Stam also discloses an ambient light sensor 1107 can have one or more predefined light level thresholds to vary the headlamps' beam pattern and intensity when the ambient light level is above or below a light level threshold. EX1007, 4:7-15, 30:12-31:16, 48:20-26, FIGS. 11, 14.



EX1007, FIG. 11 (annotated).

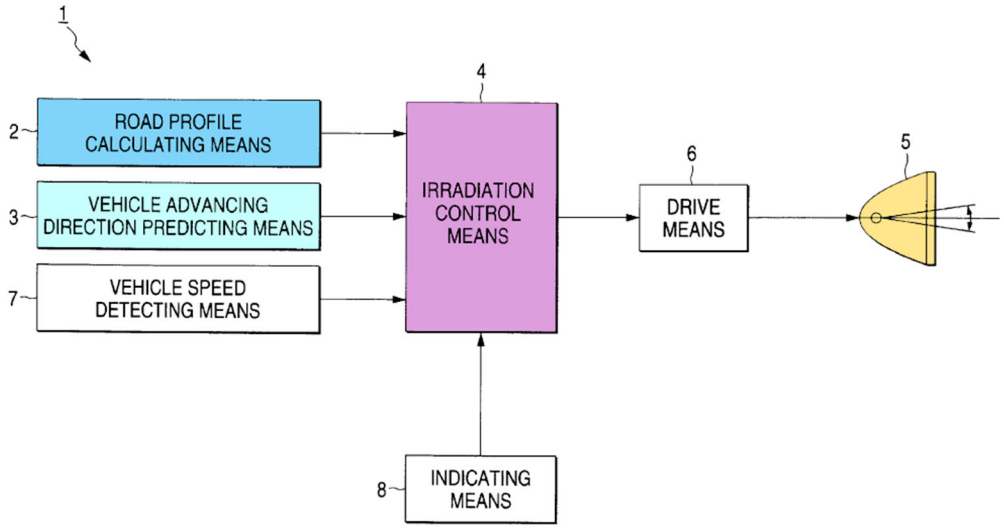
90. Further, Stam discloses laws and regulations governing the amount of glare experienced by drivers (e.g., a glare tolerance level or "perceived brightness") such that a predefined dimmed (low beam) illuminance of no greater than 0.1 foot candles (fc) within 700 feet should be used to avoid glare to other drivers. EX1007, 1:14-31, 9:12-10:8.

91. Stam provides a specific "predefined illuminance" value based on a dimmed illuminance to reduce glare, and indeed driver visibility and safety are paramount in Stam. EX1005, 3:8-45, 5:33-54, 6:53-7:13; EX1007, 1:14-31. In fact, Stam explains there are laws and regulations governing the amount of glare experienced by drivers and thus discloses techniques to further reduce glare. EX1007, 1:14-31, 9:12-10:8, Abstract, 58:11-33.

92. Stam's predefined dimmed illuminance (*see* EX1007, Abstract, 1:14-31, 9:12-10:8) is tied to particular glare reduction techniques and the relationship between such reduction and laws and regulations governing the amount of glare experienced by drivers.

C. Grounds 3, 4 – U.S. Patent No. 6,049,749 to Kobayashi with Beam-Thominet/Beam-Thominet-Stam

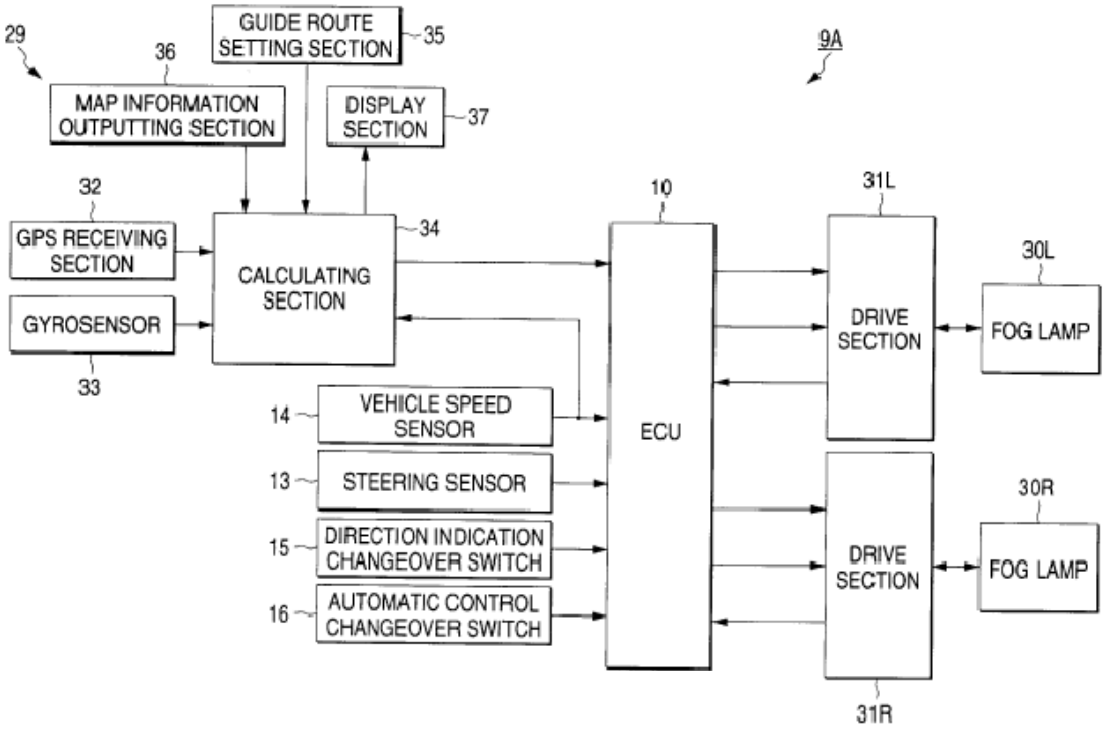
93. Like Beam, Kobayashi discloses an adaptive headlamp. EX1008, Abstract, 1:66-2:35, 4:60-64, FIGS. 1, 10. Kobayashi's adaptive lighting uses map data/information to predict and adjust illumination towards an advancing direction of the vehicle intended by the driver. EX1008, Abstract, 1:66-2:35, 3:9-34, 4:60-64, FIGS. 1, 10.



EX1008, FIG. 1 (annotated).

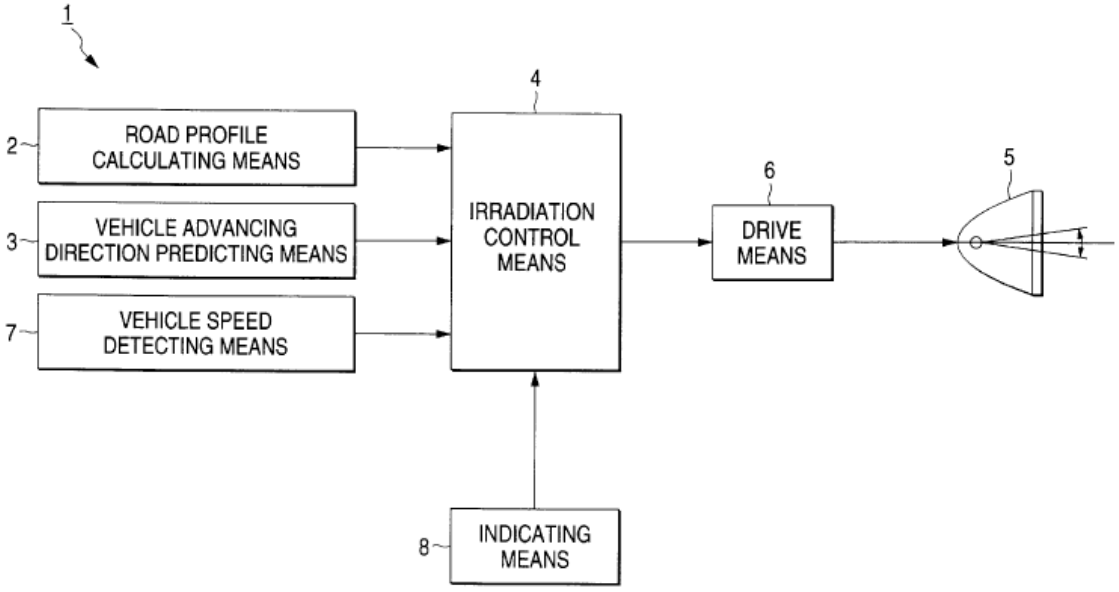
94. Kobayashi's ECU 10 receives input "from GPS navigation device 29, steering sensor 13, vehicle speed sensor 14, direction indicating switch 15 and automatic control changeover switch 16." EX1008, 17:8-15; *see also* EX1008, FIGS. 1, 6, 10:1-11:4. "GPS navigation device 29 corresponding to the road profile calculating means 2 includes: GPS receiving section 32, gyrosensor 33, calculating section 34, guide route setting section 35, map information output section 36, and display section 37." EX1008, 17:16-20.

FIG. 12



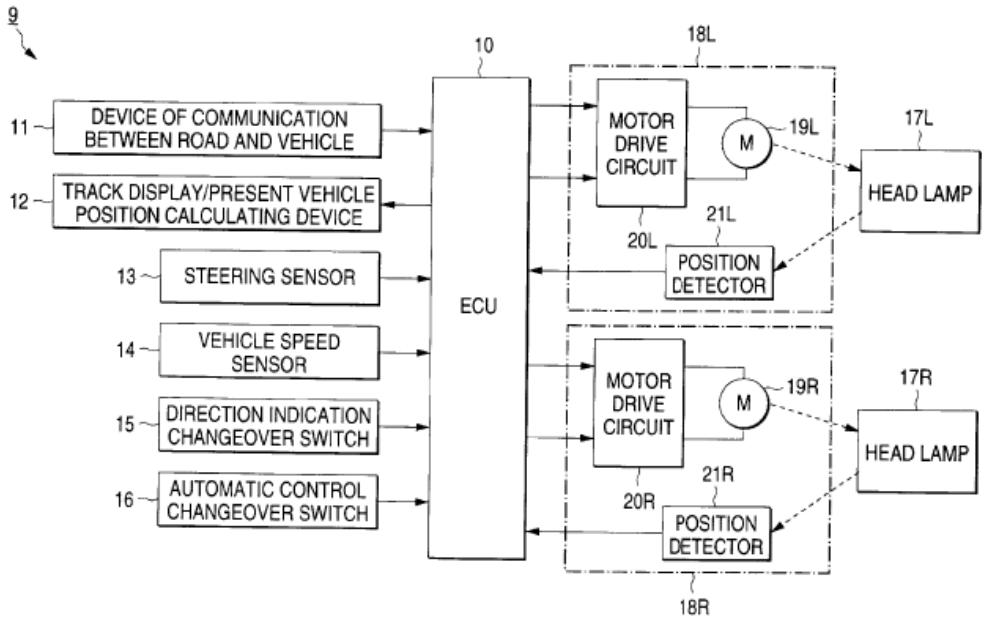
EX1008, FIG. 12.

FIG. 1



EX1008, FIG. 1.

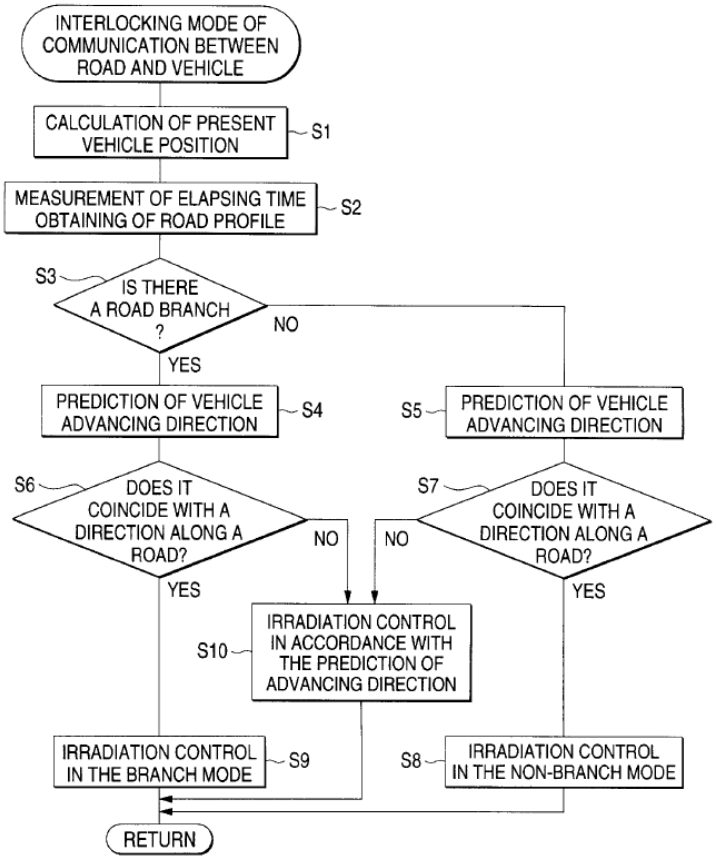
FIG. 6



EX1008, FIG. 6.

95. GPS navigation device 29 sends information about the road profile and the present vehicle position to ECU 10. EX1008, 17:39-40. In turn, output signals of ECU 10 are sent to drive sections 31L, 31R of the fog lamps 30L, 30R (which are head lamps) that are arranged at the left and right front portion of the vehicle, respectively. EX1008, 17:39-40, 3:9-19, FIGS. 1, 6, 12. ECU 10 processes information in Figure 12 in substantially the same way as that of Kobayashi's Figure 9 example. *See* EX1008, 11:34-14:52, including representative lookup tables; *see also* EX1008, 17:41-50, FIG. 9.

FIG. 9



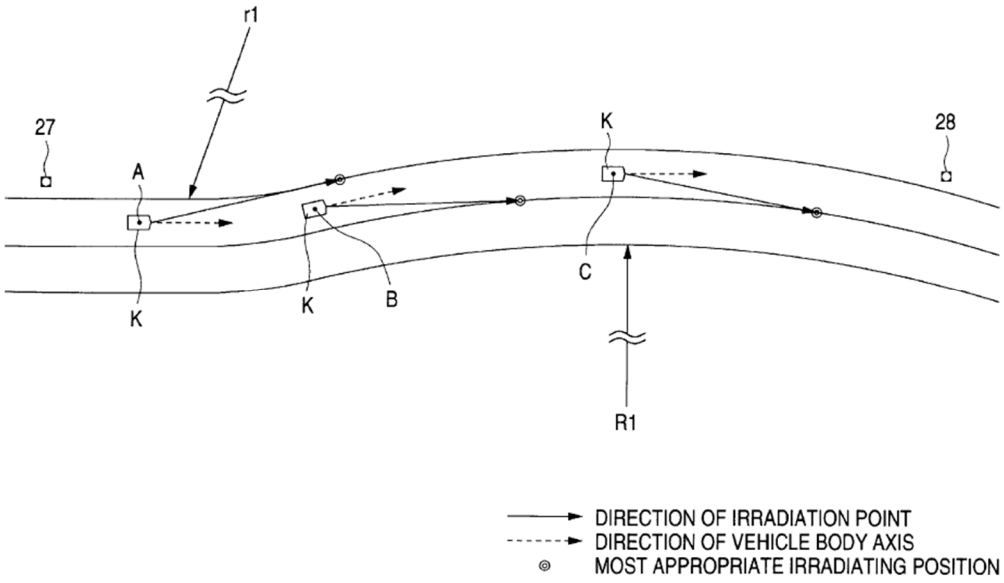
EX1008, FIG. 9.

96. Figure 12 uses map data including road curvature (e.g., by GPS navigation device 29) as the method of obtaining information, to implement the more general system diagram in Figure 1. EX1008, 17:44-50. And a scheduled course of the vehicle which is set by the guide route setting section 35 is fed to the prediction of the vehicle advancing direction in steps S4 and S5. EX1008, 17:44-50.

97. Kobayashi's road profile calculating means 2 (using map data such as GPS data including road curvature) and vehicle advancing direction predicting

means 3 cooperate with control means 4 to alter the direction/shape/intensity of headlamp 5. EX1008, 3:9-50, FIG. 1. Kobayashi discloses whole or partial directional control, including via portions of the lighting device or plurality of components composing the lighting device, e.g., reflecting mirrors, plurality of lighting devices, etc. *See generally* EX1008, 6:4-62.

98. Kobayashi's system responds to real-world conditions—multiple curves, intersections, etc. As an example, Figure 10 shows that the illumination control (including shaping/reshaping light and directionality) of vehicle K can be planned and controlled on curved roads r1 and R1 with the driver's line of sight to improve safety. For example, when vehicle K turns to the left (point A), the left shoulder is illuminated (the shape is adjusted towards the left shoulder), and when vehicle K turns to the right on a subsequent curve (point C), the right shoulder is illuminated (the light is reshaped towards the right shoulder). EX1008, 14:53-15:28. While Figure 10 is described in more detail relating to beacons 27 and 28, the GPS and other map data including road curvature are also accounted for in ECU 10. *See also* EX1008, FIG. 12, 17:3-18:67. Moreover, a POSA would have understood that the beacons 27 and 28 also convey map data, e.g., as road profile information including road curvature.



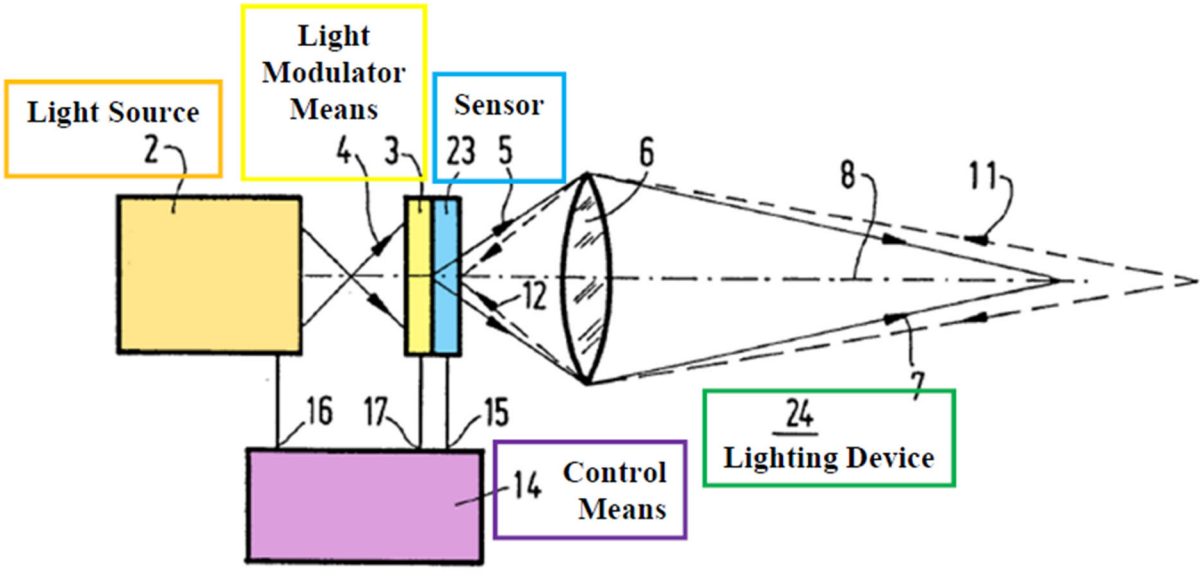
EX1008, FIG. 10.

D. Ground 5 – Karlsson and Harbers

1. WIPO Patent Publication No. 1998/054030 to Karlsson

99. Karlsson discloses a headlight having spotlight beams and sensors to detect oncoming traffic and automatically control a lighting pattern to reduce blinding of oncoming traffic. EX1010, Abstract, 2:30-35.[5] Lighting device 24 provides light beam 7 controlled by light source 2, light modulator means 3, and control means 14 based on light detected by sensor 9, 23, whose intensity and pattern are optimally adapted to the road and prevent glaring. EX1010, 9:18-26, FIG. 3.

[5] In this declaration, for Karlsson, I use page:line citation format.



EX1010, FIG. 3 (annotated).

100. Lighting device 24 includes a plurality of controllable spotlight beams for forming light beam 7. EX1010, 13:24-14:4, FIG. 6. Spotlight beams 34 are obtained by light source 2 composed of a grid of separate light sources, such as LEDs, controlled individually or in groups. EX1010, 13:24-14:4, FIG. 6.

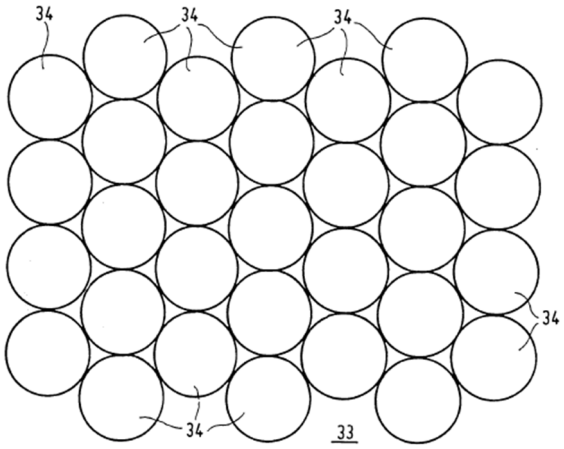


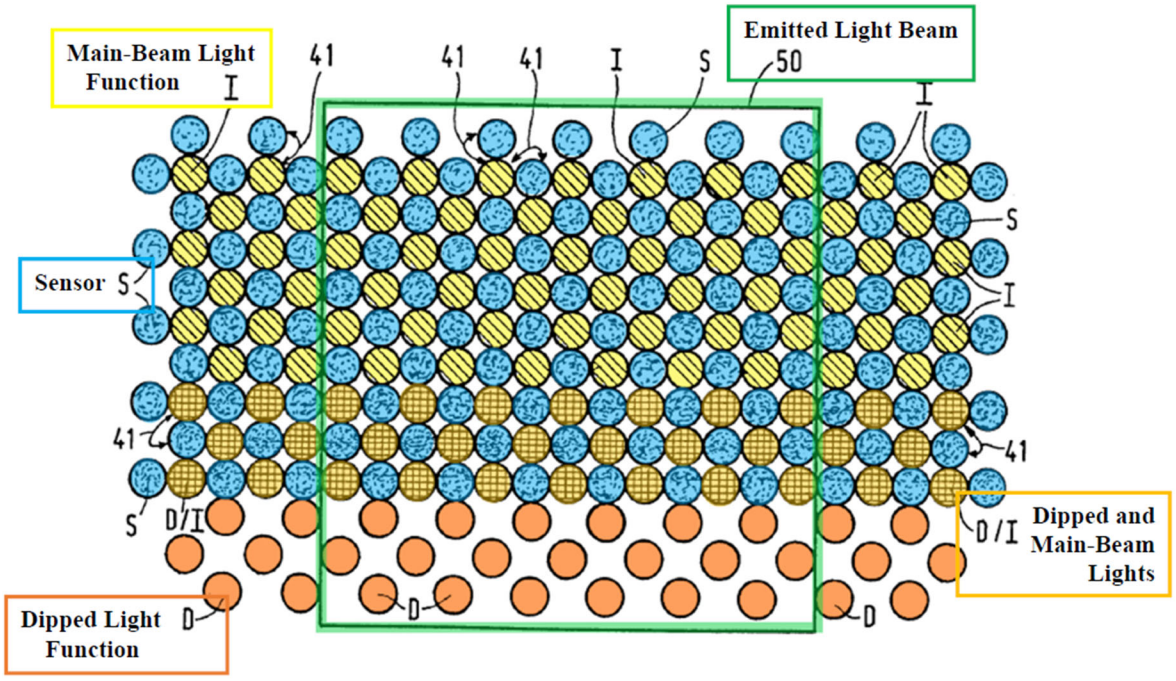
FIG. 6

EX1010, FIG. 6.

101. Karlsson's automotive headlights (headlamps) include LEDs that are automatically controlled in direction and/or intensity. In an example, sensors detect oncoming traffic and a lighting pattern of the LEDs is automatically changed to reduce blinding of oncoming traffic. EX1010, Abstract. Karlsson's lighting device automatically varies an LED pattern in an efficient manner and with maximum sensitivity in response to control signals delivered by light-sensitive sensors. EX1010, 2:30-35, FIG. 3.

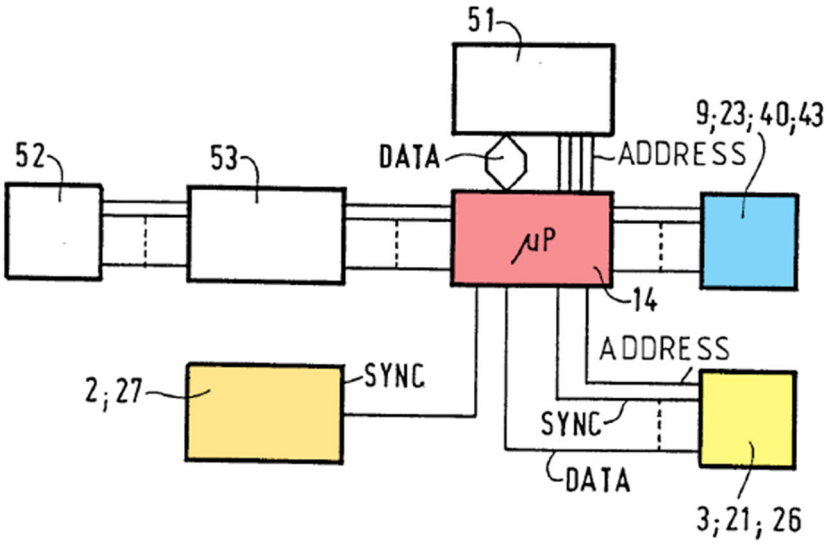
102. The spotlight beams (from LEDs) are controlled such that patterns of the emitted light beam are automatic and responsive to inputs. EX1010, 13:24-14:4. Switching one or more LEDs on or off or adjusting the intensity of the light emitted provides a desired pattern and intensity. EX1010, 13:24-14:4; *see also* EX1010, FIG. 3. Karlsson's spotlight beams 34 can be provided by a light source 2 composed of a grid of separate LEDs, which can be controlled individually or in groups. EX1010, 13:24-14:4; *see also* EX1010, FIG. 3. The headlight includes a spatial distribution of LEDs (D, I, and D/I) and spotlight sensors S. EX1010, 19:18-20:3, FIGS. 6 and 14. The resulting emitted light beam 50 is represented as a window that can shift in the plane from left to right and from top to bottom and produced by LEDs based on the data from inputs, e.g., data sensed from spotlight sensors S. EX1010, 19:18-20:3, FIGS. 6 and 14.

103. Emitted light beam 50 shifts in the plane from left to right and top to bottom, produced by spotlight sources D (dipped light), I (main-beam light), and D/I (dipped and main-beam lights) based on data from spotlight sensors S. EX1010, 19:18-20:3, FIG. 14.



EX1010, FIG. 14 (annotated).

104. Processor-controlled control means 14 is synchronized to light source 2, light modulator means 3, and sensor 23 to produce adaptive light beam 7, 50. EX1010, 20:12-32, 21:36-22:4, FIG. 15.

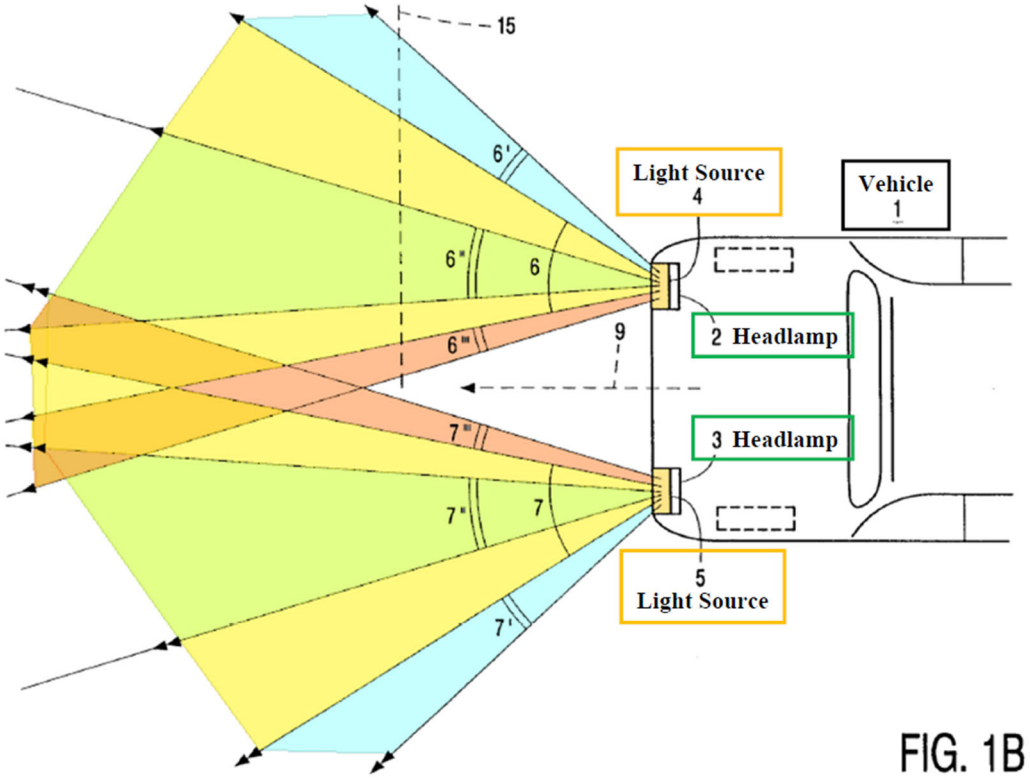


EX1010, FIG. 15 (annotated).

2. WIPO Patent Publication No. 2001/001038 to Harbers

105. Like Karlsson, Harbers discloses a headlamp with independently controllable opto-electronic elements (e.g., LEDs) for providing adaptive illumination. EX1011, Abstract, 2:27-3:10, 5:14-26, 6:27-7:19, 7:27-32, FIGS. 1B, 2.[6] Light beam segments 6-6'-6"-6"', 7-7'-7"-7"' have different aimings (angles relative to longitudinal direction 9) to improve visibility, thereby increasing safety. EX1011, 5:14-26, 6:1-7, 6:27-7:19, FIG. 1B.

[6] In this declaration, for Harbers, I use page:line citation format.

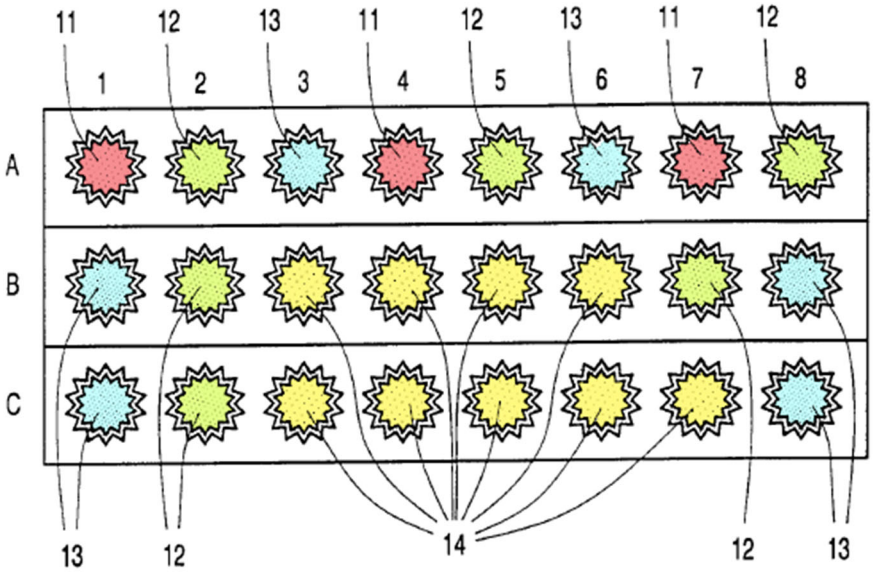


EX1011, FIG. 1B (annotated).

106. Harbers goes on to describe that first beam segment 6, 7 is "a kind of *passing* beam," second beam segment 6', 7' is "directed in particular towards the *edge of the road* (the shoulder of the road)," third beam segment 6", 7" is "directed particularly towards the *center of the road*," and fourth beam segment 6"', 7"' is "a kind of *main* beam." EX1011, 7:1-17.

107. Further, light source 4, 5 includes a plurality of opto-electronic elements 11-14 arranged on a curved substrate in a regular pattern to provide different colored illumination to different regions. EX1011, 7:20-32, 8:28-33, FIG. 2. For example, Harbers discloses "red LEDs are indicated by reference numeral

11, green LEDs by reference numeral 12, *blue LEDs* by reference *numeral 13*, and *yellow* or white LEDs by reference *numeral 14*." EX1011, 8:28-30.



EX1011, FIG. 2 (annotated).

108. Additionally, Harbers discloses "a so-called *passing* beam and/or a so-called *main* beam…requires a luminous flux ranging *between 600 and 1000 lm*" and light source 4, 5 (e.g., LEDs) "meets the international *standard* ranging between *600 and 1000 lm*." EX1011, 2:8-10, 3:18-22, 8:13-18.

E. Ground 6 – U.S. Patent No. 5,588,733 to Gotou with Karlsson-Harbers

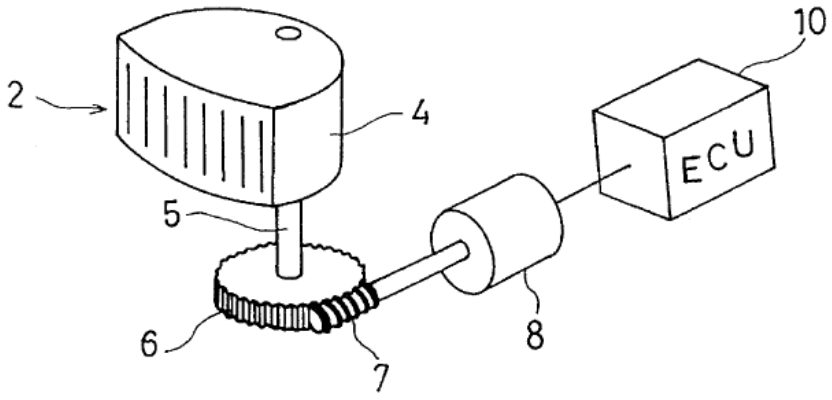
109. Like Karlsson, Gotou discloses an adaptive headlamp for projecting illumination in certain areas. EX1012, Abstract, 1:35-40, 2:8-26, 3:24-62, 6:4-61, FIGS. 1-3, 8-10. Gotou's adaptive lighting uses map data/information, including road curvature, to predict and adjust illumination towards an advancing direction

of vehicle 1—for example, when there is a leftward curve, lighting regions 3 adjust leftward prior to the curve. EX1012, 3:24-62, 7:32-43, 8:28-35, FIGS. 8, 9.

110. Gotou's automotive headlamp device can be adjusted in rightward and leftward directions, thereby adjusting lighting region in front of the vehicle in a travelling direction (such as around a curve), based on map data from a GPS system including road curvature. EX1012, Abstract, 1:6-47, 1:52-59, 3:24-4:49, 8:9-41. Gotou compares systems using steering wheel-based directional control (EX1012, 1:21-29) with navigation system control (EX1012, 1:30-40), including the observation that when "a *curved part* or the like is *foreseen in advance in reference to both map information of the navigation system* and information of the proper or subject vehicle position on the map, and the *lighting region* is changed *before* entering the *curved part*." EX1012, Abstract, 1:6-47, 1:52-59, 3:24-4:49, 8:9-41.

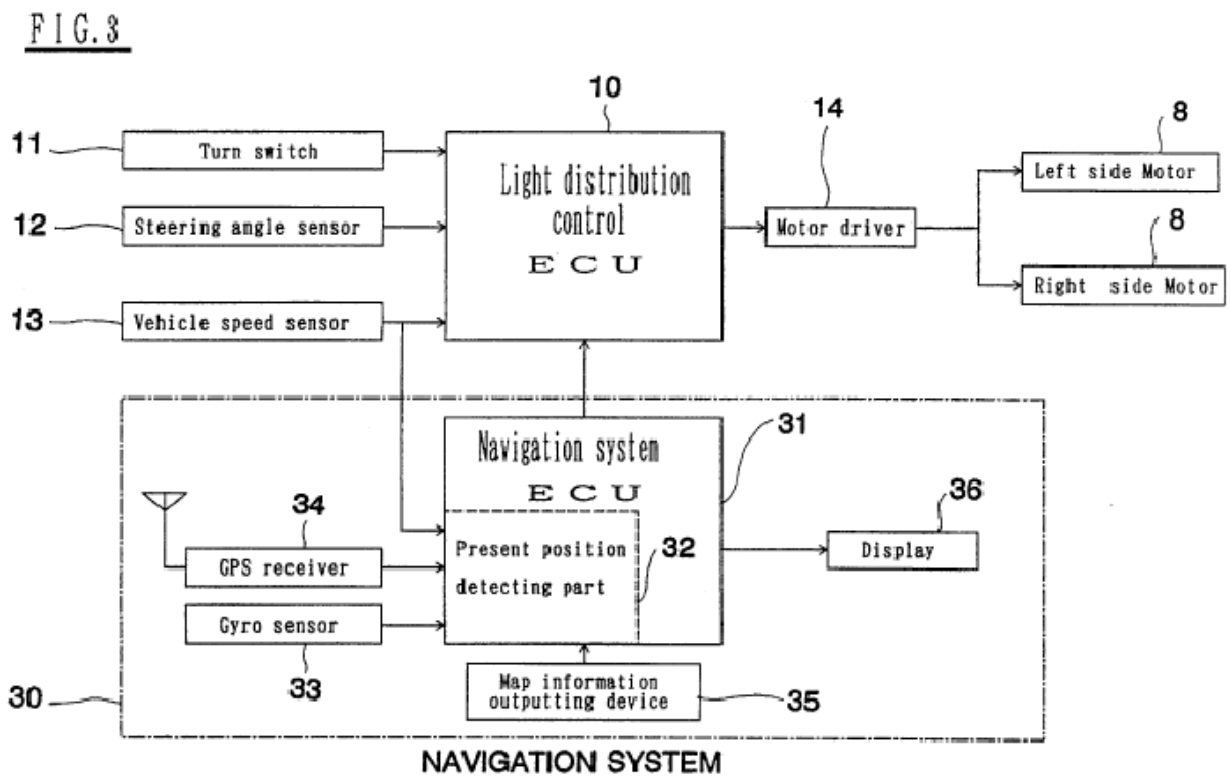
111. Gotou's ECU 10 controls its motor 8, adjusting the position of the headlight 2 in view of the map data including road curvature. EX1012, 3:24-47, FIG. 2.

FIG. 2



EX1012, FIG. 2.

112. Gotou's right and left headlights are generally concurrently swung in the same direction to shape and reshape light, but Gotou also provides for independent movement, as well as (1) using a plurality of light sources in each headlight and changing the light distribution by separately using one or more sources for illumination and (2) using one or more sub-reflectors to move and change the light distribution. EX1012, 8:9-22.



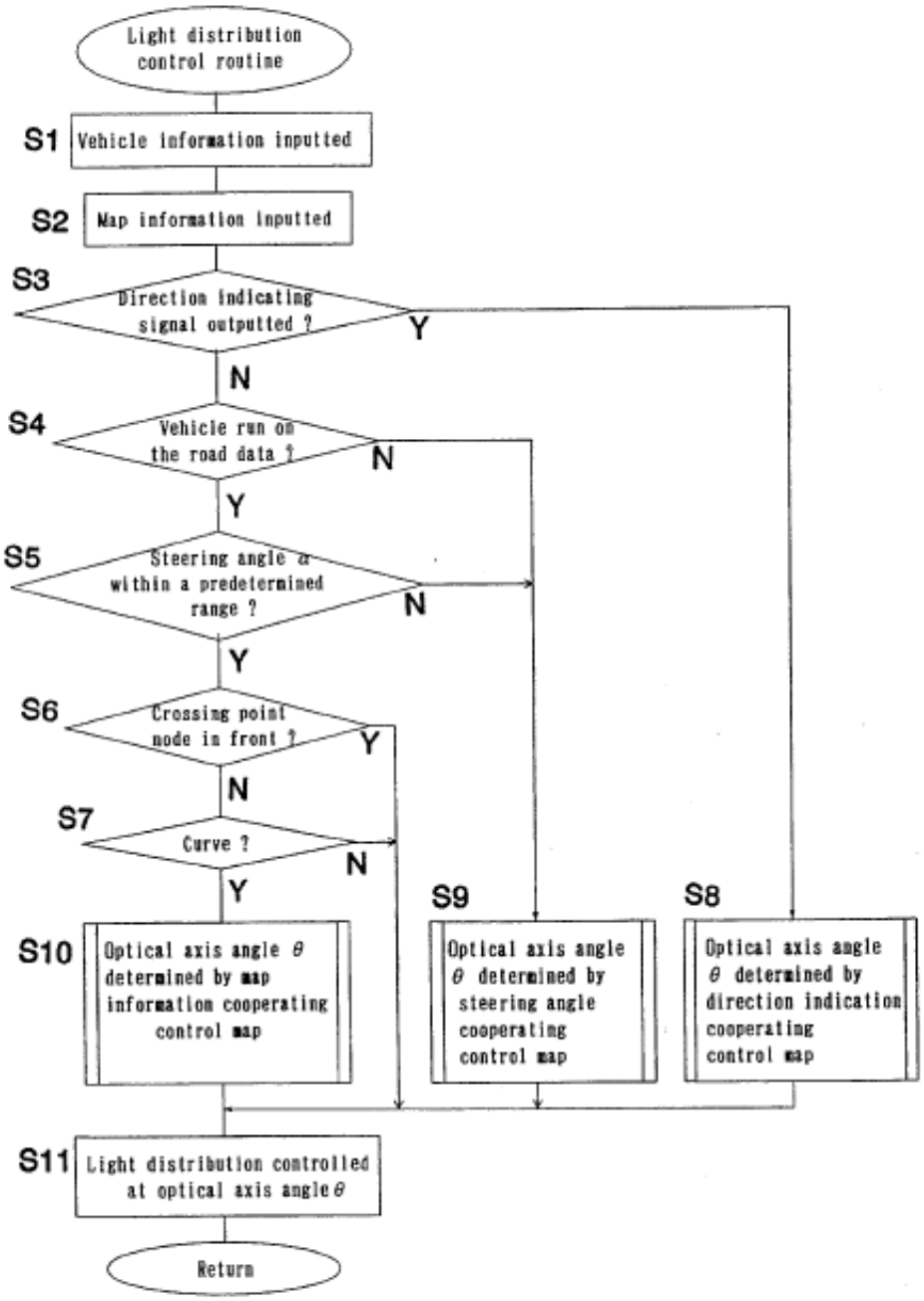
EX1012, FIG. 3.

113. As shown above, navigation system 30 communicates with light distributing control ECU 10, sending map data including road curvature. EX1012, 3:52-62. ECU 10 controls the shaping of the lights from the headlamps. EX1012, 3:52-62. Gotou provides additional details of the navigation system 30, including the GPS receiver 34. EX1012, 4:1-29.

114. Additional inputs, such as turn switch 11, steering angle sensor 12, vehicle speed sensor 13, etc., are all inputs into the light distribution control ECU 10. *See* EX1012, 4:1-29. In operation, ECU 10 processes the information and signals to determine a requisite optical axis angle θ, and an indicating signal is

outputted to motor driver 14 so as to achieve the optical axis angle θ, as shown in Figure 4. EX1012, 3:62-67.

FIG. 4

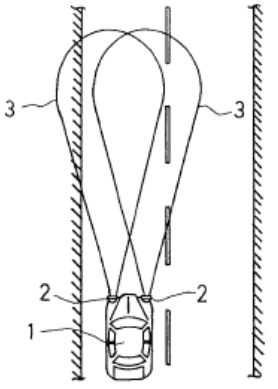


EX1012, FIG. 4.

115. At S2, map data is input (such as information stored as crossing points, directions of curves or degrees of sharpness of curves, e.g., road curvature). EX1012, 4:36-40. At S3-S6, determinations are made as to whether there are other considerations for the system to account for, such as a turn signal being on (S3), whether the steering angle is within a predetermined range (S5), etc. *See* EX1012, 5:8-6:3. At S7, the system determines whether or not a curve is present. EX1012, 6:18-27. If there is, the optical axis angle is adjusted via the map. *See* EX1012, 6:28-7:4.

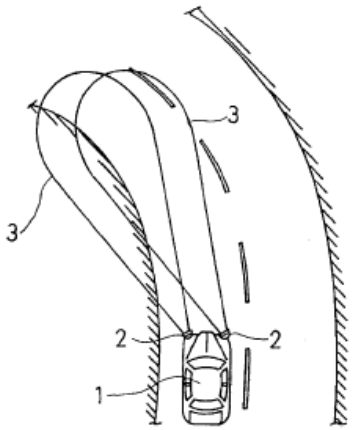
116. Gotou's Figures 8 and 9 show the effect of this adjustment—Figure 8 shows a lighting region on a straight road (as viewed from above, showing lighting regions 3 generally straight ahead of the vehicle 1), and Figure 9 shows a lighting region around a curved road (as viewed from above, showing lighting regions 3 shaped to the left, ahead of the curved portion of the road ahead of the vehicle 1).

FIG. 8



EX1012, FIG. 8.

FIG. 9



EX1012, FIG. 9.

X. GROUND 1: THE COMBINATION OF BEAM AND THOMINET RENDERS OBVIOUS CLAIMS 20, 24, AND 25.

117. It is my opinion that Beam explicitly or implicitly discloses every feature recited in claims 20, 24, and 25. However, to avoid doubt, Beam is combined with Thominet, for [20.2] (and [59.2] in Ground 2), which discloses a well-known implementation of adaptive headlamp systems—directional light sources with different angles/aimings for different functions—rendering the claims obvious.

118. Beam discloses "[t]he *angular* position or attenuation of *each of these microbeams* is *independently* set by the controller 108." EX1005, 4:46-48, FIGS. 1-2, 4; EX1005, Abstract, 8:4-17. Each microbeam is a directional "source," having its own independent *angular* position (angle/aiming), that combines to form the headlamp beam, so the combination of Beam's lamp 202 and SLM 203 of Figure 2 form multiple, at least three directional light sources having different angles/aimings. EX1005, 4:26-59, 5:3-21, FIGS. 2, 4-6.

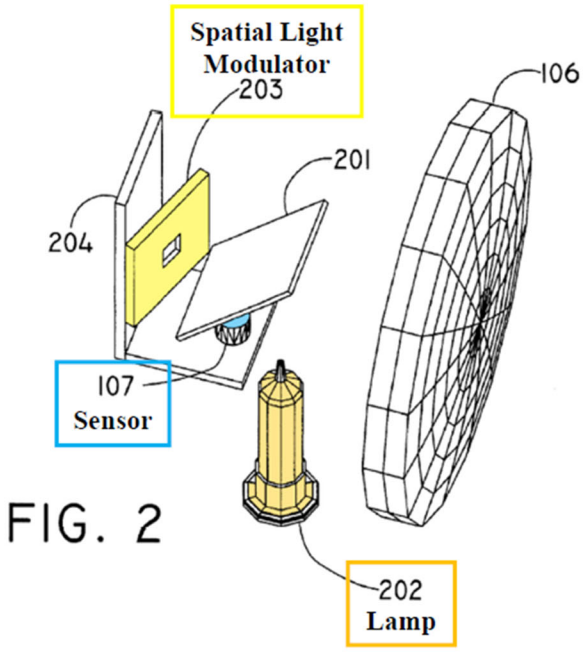


FIG. 2

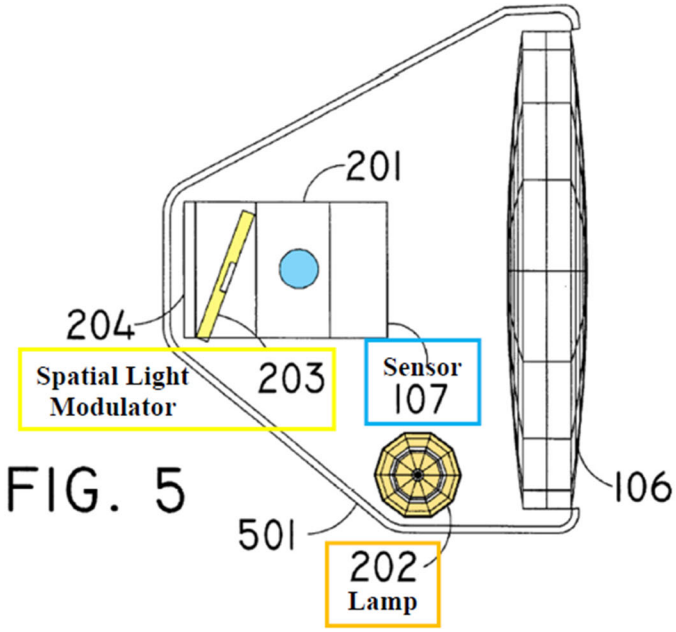


FIG. 5

EX1005, FIGS. 2 and 5 (annotated).

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

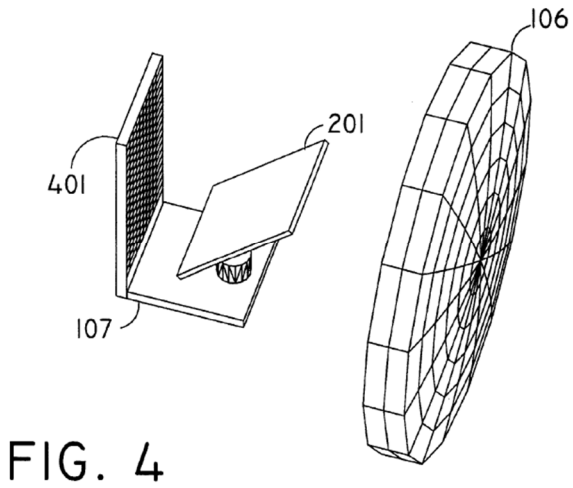


FIG. 4

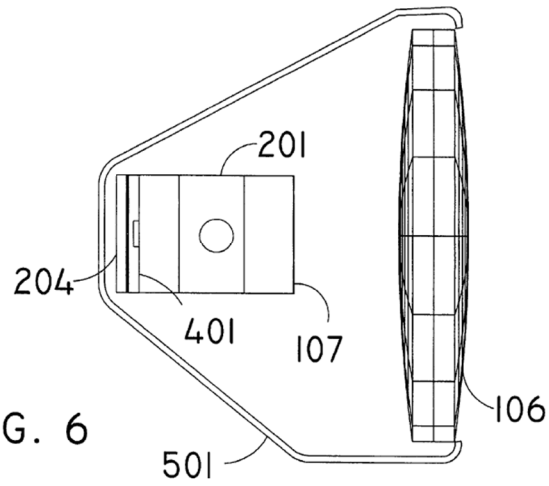


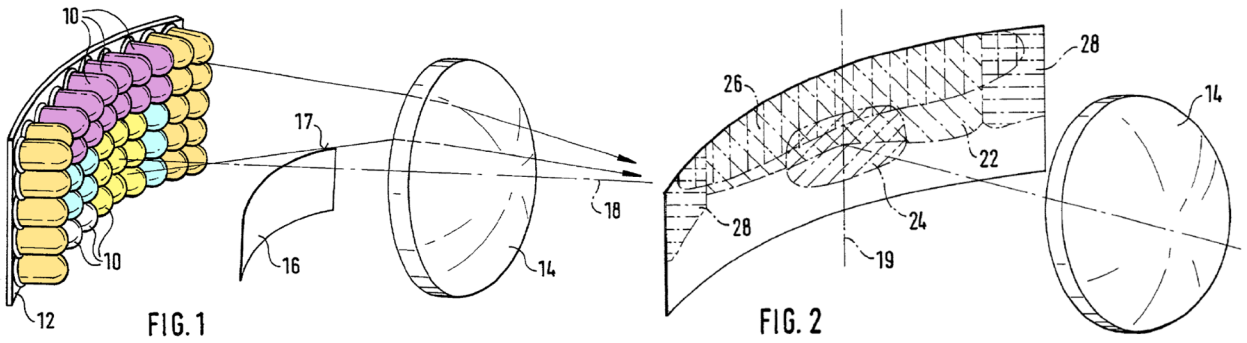
FIG. 6

EX1005, FIGS. 4 and 6.

120. Thus, Beam discloses "at least three directional light sources" (independently controllable angular microbeam sources) that are "aimed at different angles" and "hav[e] different aimings" as recited in [20.2] (and [59.2] in Ground 2).

121. If Patent Owner argues, incorrectly, that Beam does not disclose [20.2] (and [59.2] in Ground 2), Thominet does, and it would have been obvious to combine Thominet with Beam, as discussed below.

122. Specifically, while Beam discloses "[t]he *angular* position or attenuation of *each of these microbeams* is *independently* set by the controller 108," EX1005, 4:46-48, FIGS. 1, 2, and 4, Thominet expressly discloses "semiconductor light sources 10 *arranged in the different partial regions* [22, 24, 26, 28] are actuatable *independently*," EX1006, ¶20, FIGS. 1, 2, corresponding to the "directional light sources" recited in elements [20.2] (and [59.2] in Ground 2).



EX1006, FIGS. 1 and 2 (annotated).

A. A POSA would have been motivated to combine Beam and Thominet with a reasonable expectation of success.

123. It would have been obvious to a POSA to employ multiple directional beam regions with different angles/aimings in Beam's system, as in Thominet, to provide alternative control of Beam's directional microbeams and provide different spatial distributions for improved visibility in different driving situations, thereby improving driver safety—an express purpose of Beam. EX1005, 3:8-14, 3:37-44, 5:33-54, 7:1-13.

124. As discussed, Beam discloses "directional light sources" with independently controlled angular positions for reducing glare towards other drivers on the road. Thominet provides further detail on ways to implement "directional light sources" for different functions, conceptually and physically. So naturally, it would have been obvious to a POSA designing an adaptive headlamp to implement Thominet's multiple directional beam regions with different angles/aimings—through either software or hardware—for different functions in Beam's system.

Indeed, Thominet discloses such an implementation to provide different spatial distributions for improved visibility in different driving situations (low visibility, low/high speeds, recognizing a counter traffic, curves, etc., *see* EX1006, ¶¶7-8, 23-26, FIGS. 1-2), thereby improving driver safety—an express purpose of Beam. EX1005, 3:8-14, 3:37-44, 5:33-54, 7:1-13.

125. Beam and Thominet are from the same field—controllable headlamps with dynamic illumination—and include the same building blocks (light sources, sensors, controllers). EX1005, 4:10-59, FIGS. 1, 2, 5; EX1006, ¶¶17-18, 21, 23-26, FIGS. 1, 2, 4, 5. Further, improved visibility, thereby increasing safety is paramount in both. EX1005, 1:54-59, 3:8-44, 4:48-59, 6:53-7:13; EX1006, ¶¶3-4, 23.

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

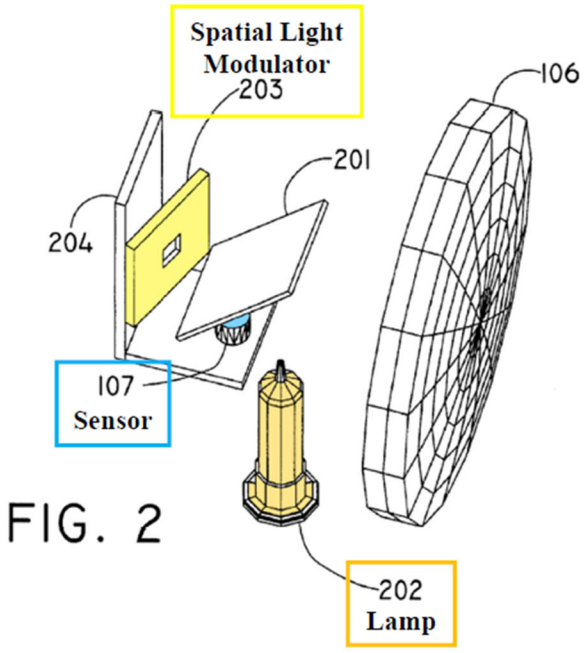


FIG. 2

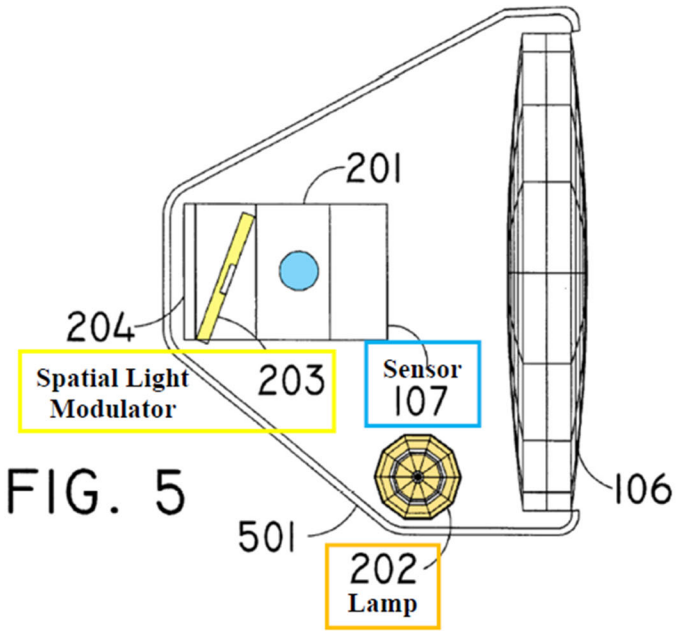
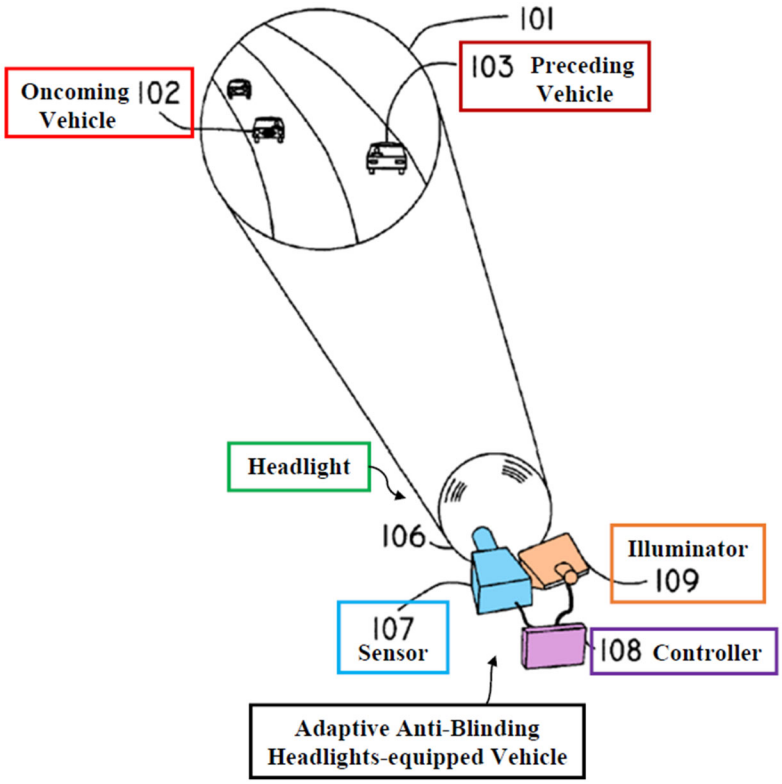


FIG. 5

EX1005, FIGS. 2 and 5 (annotated).

127. Indeed, Beam's techniques and system of controlling individual microbeams emphasize safety of all drivers. EX1005, 3:8-44, 6:53-7:13. Controllable headlamps "provide greatly improved safety and comfort to the motoring public," and a "brighter headlight beam while simultaneously protecting…all vehicles ahead," increases safety. EX1005, 3:8-44. Beam enables "the driver to see more clearly at night," while protecting others from glare. EX1005, 3:8-44; EX1005, 4:10-25, 6:9-27.



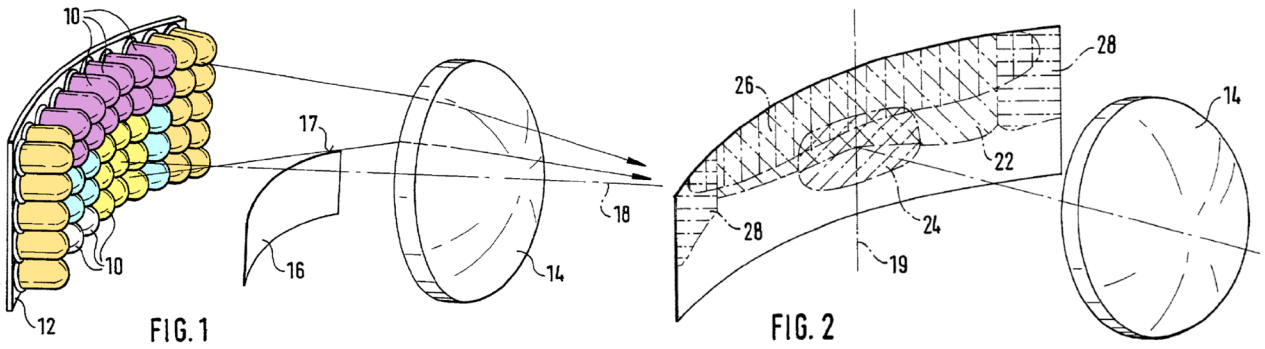
EX1005, FIG. 1 (annotated).

128. Beam's system "*determine[s] the location of light sources* forward of the apparatus and us[es] that information to *control the intensity, and/or the angular position*, of one or more" microbeams. EX1005, Abstract; EX1005, 4:10-59, 6:9-27, FIGS. 1, 1A-1D, 2. Beam recognizes the safety benefits of different spatial distributions "for conditions like rain, snow, or fog." EX1005, 3:29-36; EX1005, 1:54-59, 4:48-59. If Patent Owner argues, incorrectly, Beam does not expressly disclose "directional light sources aimed at different angles," even though Beam discloses different angular position control for different microbeams, it would have been obvious to a POSA to use such control for the feature of

"aimed at different angles." Combining Thominet with Beam would have made Beam's system more direct, or active, or specifically aimed for different functions than prior systems, as Beam seeks to do (*see* EX1005, 2:15-22), and further achieves Beam's purpose of improving driver safety.

129. And Thominet's *technique* (software implementation), like Beam, seeks to enhance driver visibility, thereby increasing safety—using multiple directional beam regions to provide different spatial distributions for different functions. EX1006, ¶¶17-18, 21, 23-26, FIGS. 1-2; EX1006, ¶4 ("*characteristic* of the light beam…can be used for *different functions*"), ¶¶5-8. Specifically, Thominet explains that the "characteristic" of the light beam, for example, color, direction, reaching distance, dispersion width, and/or intensity, "can be changed so that it can be used for *different functions*." EX1006, ¶¶3-4, FIGS. 1, 2; *see also* EX1006, ¶¶5-8.

130. Thominet's semiconductor light sources 10 arranged on curved surface 12 provide beam regions 22, 24, 26, 28 with different angles/aimings for different driving situations including for recognizing a counter traffic, thereby improving safety, including driver safety. EX1006, ¶¶7-8, 17-18, 21, 23-26, FIGS. 1, 2; EX1006, ¶7 ("*wider* illumination"), ¶23 ("*improving* the illumination…at high speeds").



EX1006, FIGS. 1-2 (annotated).

131. The additional control (software implementation) of having multiple directional beam regions with different angles/aimings as in Thominet, 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.

132. A POSA would have understood that alternative or additional control for Beam's controller 108/illuminator 109 by using Thominet's different angles/aimings, would have enhanced Beam's system, making it more direct, or active, or specifically aimed for different functions, by providing different spatial/angular distributions for different driving situations, thereby improving driver safety. Doing so would have merely been applying Thominet's known technique (software implementation: using multiple directional beam regions with different angles/aimings for different functions), to Beam's similar, known device (dynamic AAHB system with controllable microbeams), in the same way.

Thominet's known technique is fully described along with its benefits (improved visibility for different functions in different driving situations, thereby increased safety); thus, a POSA would have readily applied it to similar systems, such as Beam's, in the same way.

133. A POSA would have had a reasonable expectation of success combining Beam and Thominet, for example, by simply modifying software instructions stored 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. Overall, this is a simple software implementation.

134. Such modification would have been routine and well within a POSA's skill due to the similarities in Beam's and Thominet's adaptive systems—their common components were well known and there would have been no limitations for a POSA to make such modification. In applying Thominet's technique to Beam, a POSA would have simply been applying a known technique (software implementation) in a predictable way—controlling headlights in part based on multiple directional beam regions with different angles/aimings for different functions—as already disclosed in the art.

135. *Second*, additionally or alternatively, a POSA would have sought to incorporate *known components* (hardware implementation) of Thominet's

semiconductor light sources 10 on curved surface 12 (with differently angled/aimed semiconductor light sources 10 relative to the vehicle, *see* EX1006, ¶¶17-20, 23-26, FIGS. 1-2, 5-7) into Beam's system (with flat array of light sources 401). Again, this would have, like Thominet, provided different spatial distributions for different driving situations (e.g., low visibility, low/high speeds, traffic, curves, etc.), improving visibility and thereby safety. This is a simple hardware combination.

136. Beam discloses an array of light sources 401 (e.g., LEDs) that appears flat in Figures 4 and 6, and has the same functionality as lamp 202 and SLM 203 shown in Figure 2, and each light source is individually controlled. EX1005, 3:61-64, 5:3-16, FIGS. 4, 6; EX1005, 4:26-59 ("*angular* position"), 8:4-17.

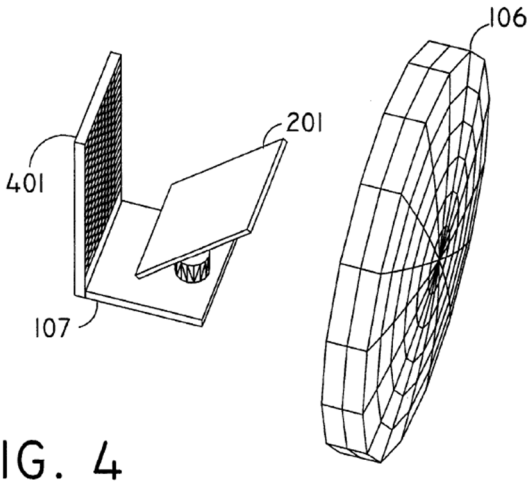


FIG. 4

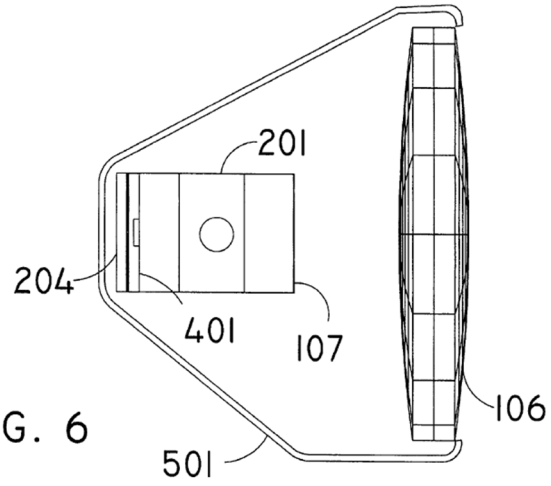


FIG. 6

EX1005, FIGS. 4 and 6.

137. Through its *system components* (hardware implementation), Thominet, like Beam, seeks to enhance driver visibility and thereby increase safety. Indeed,

semiconductor light sources 10 arranged on curved surface 12, with different angles/aimings relative to the vehicle, provide beam regions 22, 24, 26, 28 for different driving situations. EX1006, ¶¶7-8, 17-18, 21, 23-26, FIGS. 1-2.

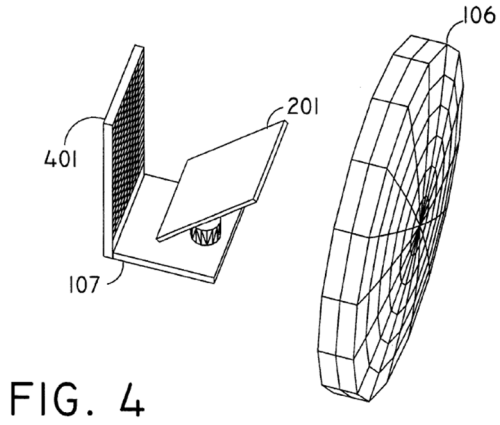


FIG. 4

EX1005, FIG. 4.

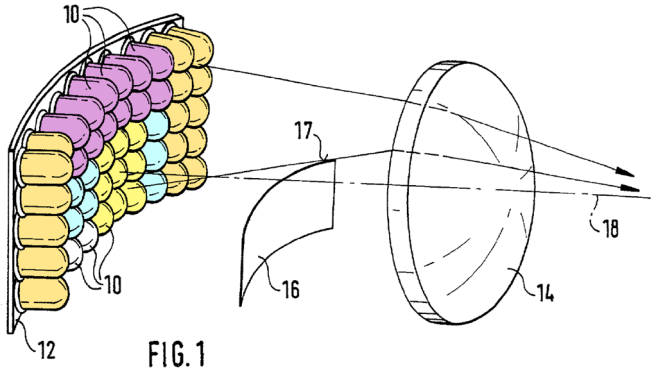


FIG.1

EX1006, FIG. 1 (annotated).

138. Like the software implementation above, this hardware combination of Beam's array of light sources 401 and Thominet's differently angled/aimed semiconductor sources 10 on curved surface 12, would have provided Beam's system with different spatial distributions for different driving situations, as in Thominet, thereby improving driver safety. Doing so would have been merely combining prior art elements or a simple substitution of one known element for another (e.g., Beam's array of light sources 401 on a flat surface and Thominet's semiconductor sources 10 on a curved surface 12) according to known methods (e.g., disclosed in Beam and Thominet) to yield predictable results (e.g., improved visibility and safety). Overall, this is a simple hardware implementation.

139. A POSA would have had a reasonable expectation of success combining Beam and Thominet, for example, by simply modifying the flat surface of Beam's array of light sources 401 with Thominet's curved surface 12 to provide multiple light sources with different angles/aimings relative to the vehicle for different functions (hardware implementation).

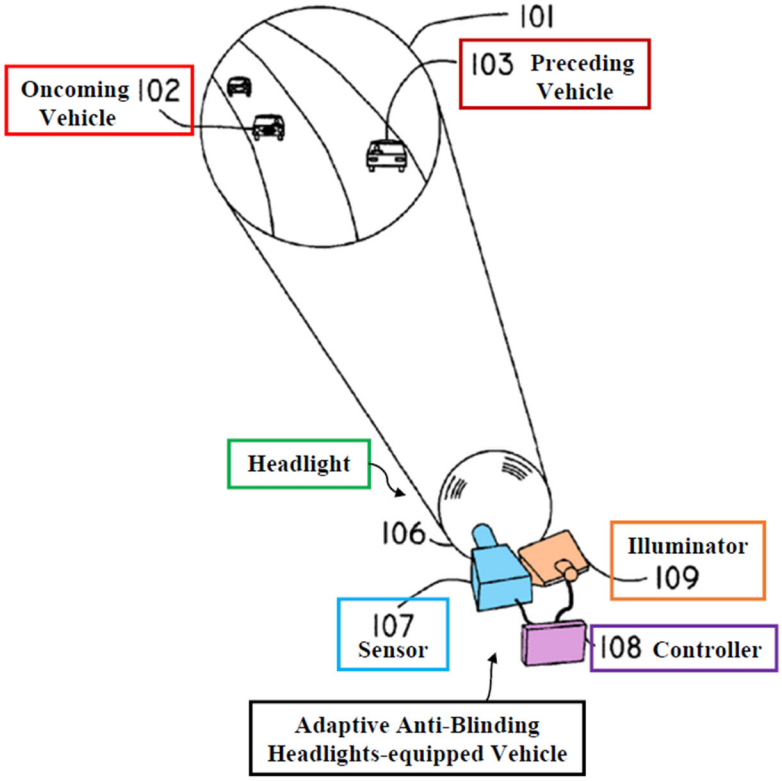
140. Such modification would have been routine and well within a POSA's skill due to the similarities in Beam's and Thominet's adaptive systems—their common components were well-known and there would have been no limitations for a POSA to make such modifications. And in combining Beam with Thominet's array of semiconductor sources 10 (e.g., modifying an illuminator), a POSA would have simply been combining known elements according to known methods (disclosed in Thominet) to yield predictable results (light control for different functions, hardware implementation).

141. I lay out below the specific disclosures of Beam and Thominet, and expand on this combination and reasonable expectation of success analysis below, specifically with reference to elements [20.2] (and [59.2] in Ground 2).

B. Independent Claim 20[7]

1. [20.P]: "A vehicle headlight system, comprising:"

142. Beam discloses an adaptive anti-blinding headlight (AABH) system of a *vehicle*. EX1005, 3:8-24, 4:10-59, FIGS. 1, 2, 7; *see also* Abstract, 1:5-18, 2:53-3:3, 5:33-54, 5:61-6:4, 6:9-27, 6:40-50.



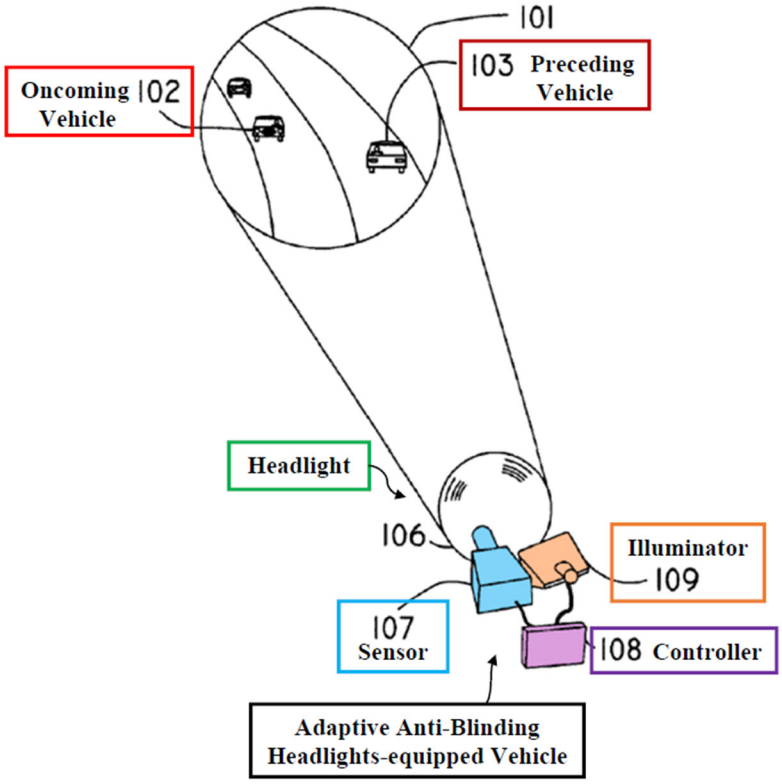
EX1005, FIG. 1 (annotated).

143. In view of the above, Beam discloses this element.

[7] All independent claim language is in Appendices A and B.

2. [20.1]: "one or more headlamps affixed to a vehicle,

144. Beam discloses "*AABH units* will be mounted on a *vehicle*." EX1005, 6:9-11, FIG. 1; EX1005, 6:33-34.



EX1005, FIG. 1 (annotated).

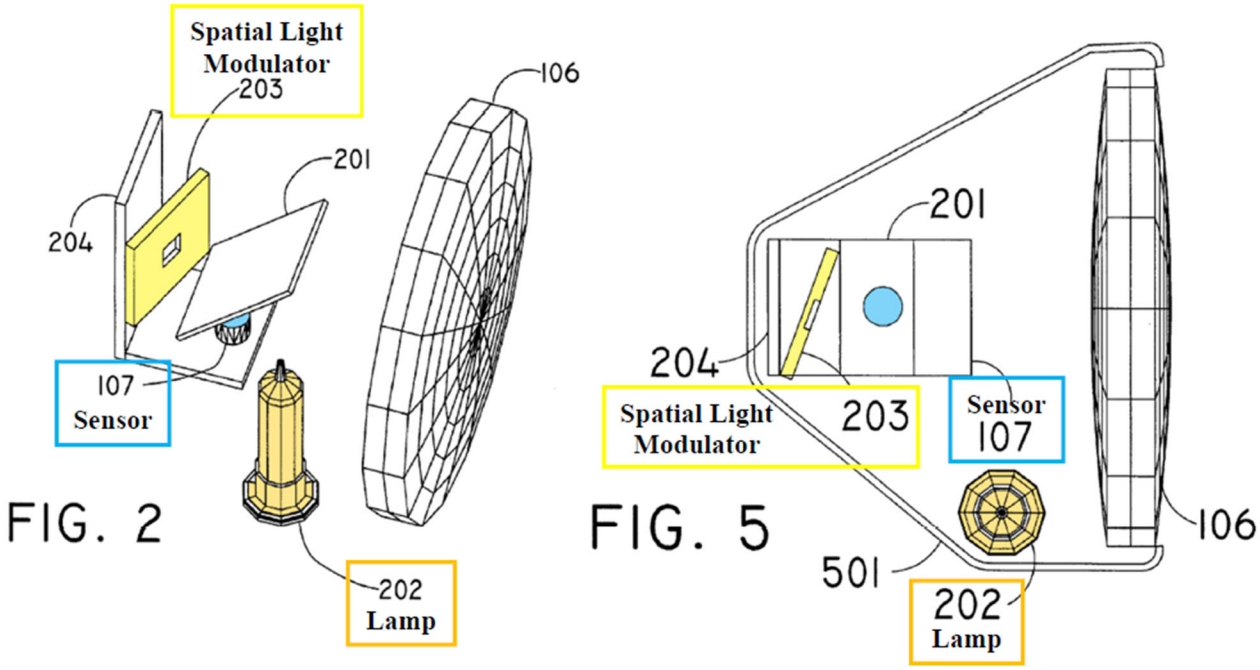
145. In view of the above, Beam discloses this element.

3. [20.2]: "each headlamp including at least three directional light sources aimed at different angles relative to the vehicle,"

(a) Beam discloses this element.

146. In my opinion, Beam discloses this element, [20.2]. Specifically, Beam discloses "an *array* of *individual*, *independently* controllable *microbeam* sources" for example, "light-emitting diodes." EX1005, 8:4-17.

147. Also, Beam discloses "*individually directed narrow-angle beams…microbeams*" and controlling "the intensity, and/or the *angular position*, of one or more narrow-angle *microbeams*." EX1005, 5:61-65, Abstract, FIGS. 2, 5. Each microbeam is a "source" that combines to form the headlamp beam, and the combination of Beam's lamp 202 and SLM 203 and/or array of light sources 401 form many, and at least three directional light sources having different directional (or aimed) angles/aimings. EX1005, 4:26-59, 5:3-21, FIGS. 2, 4, 5, 6; EX1005, 4:46-48 ("[t]he *angular* position or attenuation of *each* of these microbeams is *independently* set by the controller 108").



EX1005, FIGS. 2 and 5 (annotated).

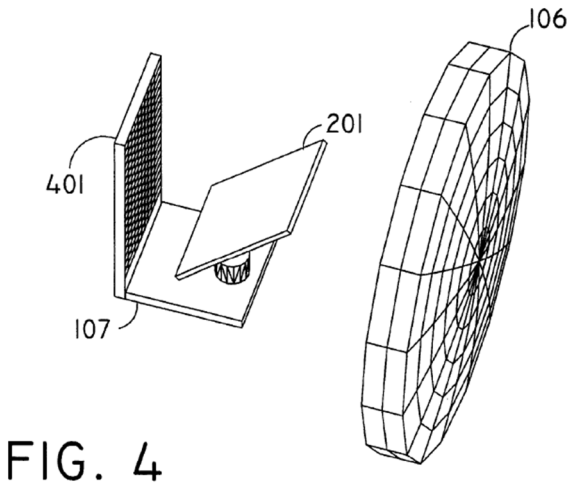


FIG. 4

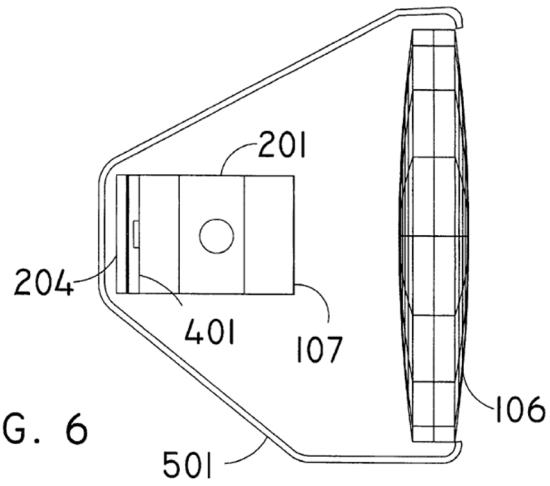


FIG. 6

EX1005, FIGS. 4 and 6.

148. Such directionality results in *directional light sources* that by definition will have different angles, which result in different aimings. So disclosure that discusses directional light sources with different angular positions applies the same to disclosure that discusses directional light sources with different aimings.

149. A POSA would have understood that controlling "angular position" of "one or more narrow-angle microbeams" is the same as "directional light sources aimed at different angles," as the light output from a headlamp is all measured with its light intensity level in an angular distribution. Aimed at different angles means different angular positions. *See* EX1017, 5 ("the adaptive light pattern should support to direct the concentration to the most important zone for the current driving situation"), FIGS. 1, 3-5; EX1018, 4 ("variable aiming"); EX1026, 451 ("[m]ore beams are necessary to match varied driving regions, traffic situations,

and driving operations"), 456 ("beam axes of the lamps are aimed at the directions indicated"), FIGS. 1, 3-3; EX1038, 1:12-10:3, FIGS. 1-3; EX1039, 9:16-11:11, FIGS. 1-6; EX1040, 1:16-30, FIGS. 1, 2A-2C; EX1036, 3:52-4:32, FIGS. 2-6.

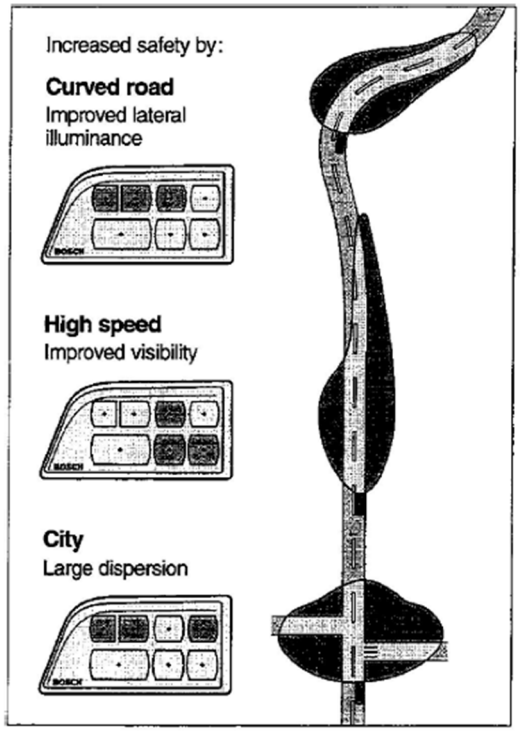


Fig.1: Three standard driving situations with adapted light pattern seen from the bird eye's view.

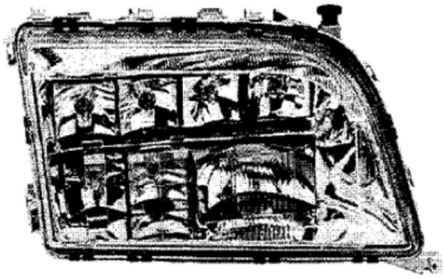
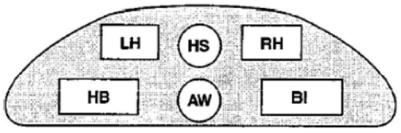


Fig 4: ALP *headlamp* sample



Single components:

LH Left hand bend
RH Right hand bend
HB High beam
BI Basic illumination
AW Adverse weather illumination
HS Hot spot

Fig. 5 Advanced ALP sample layout

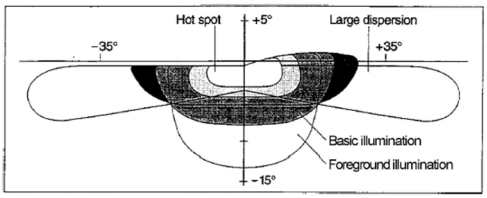


Fig. 3: Light pattern of multiple beam *headlamp (Isolux* curves in wall projection):
The individual light *pattern* of multiple sub-units sum up to the total adaptive light pattern

EX1017, FIGS. 1 and 3-5.

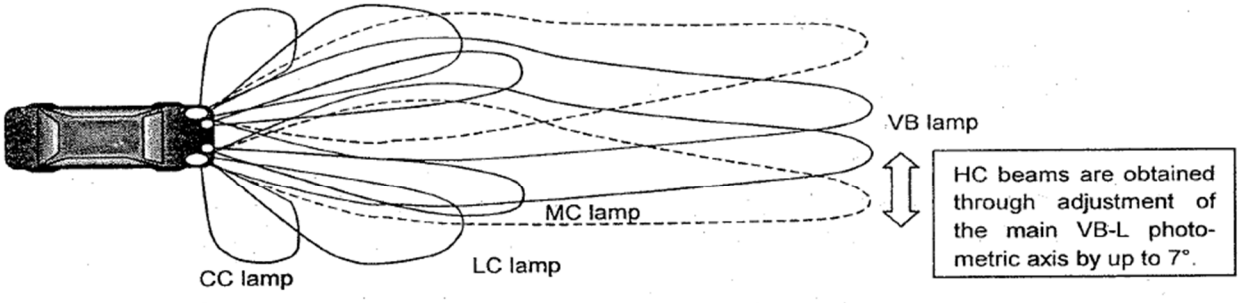
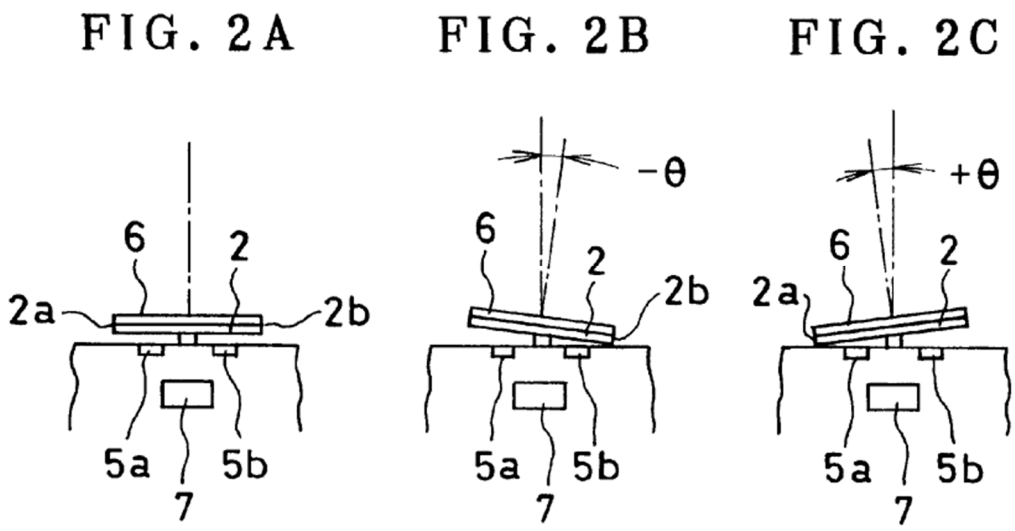


Fig. 3-3: Imaged Illumination Configurations on Road Surface

EX1026, FIG. 3-3.

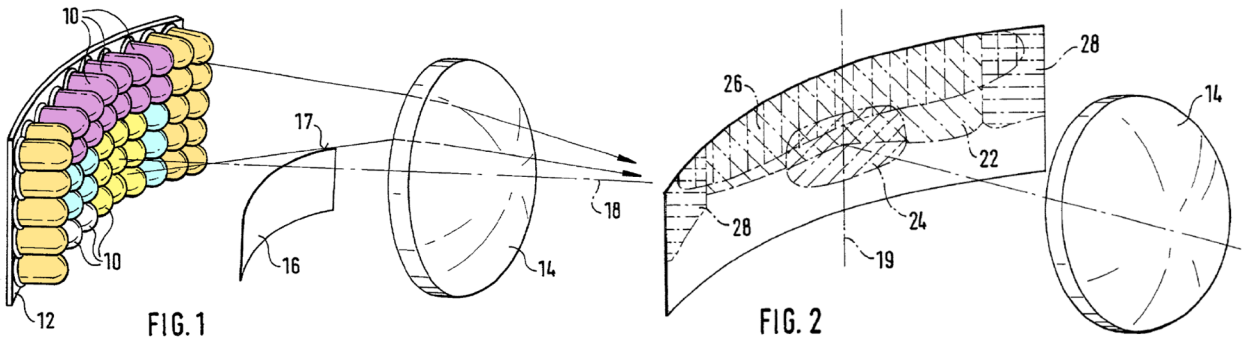


EX1040, FIGS. 2A-2C.

(b) Thominet also discloses this element.

150. If Patent Owner alleges, incorrectly, that Beam does not expressly disclose [20.2], Thominet also discloses [20.2], and it would have been obvious to incorporate Thominet's disclosure into Beam.

151. As explained above (Section X.A), Thominet's headlights include directional, independently controllable semiconductor light sources 10 (multiple e.g., LEDs) arranged on curved surface 12 to provide regions 22, 24, 26, 28 with different (aimed) angles for different illumination characteristics. EX1006, ¶¶17-18, 21-26, FIGS. 1, 2. For example, Thominet's region 24 is "in the center" (e.g., first angle/aiming) while regions 28 are "near the lateral edges" (e.g., second and third angles/aimings). EX1006, ¶¶23, 25, FIGS. 1, 2.



EX1006, FIGS. 1 and 2 (annotated).

152. A POSA would have been motivated to combine Thominet with Beam with a reasonable expectation of success, providing predictable visibility and safety benefits. I provide additional detail, evidence, and explanation of my conclusions below, showing that Beam, alone or combined with Thominet, discloses [20.2].

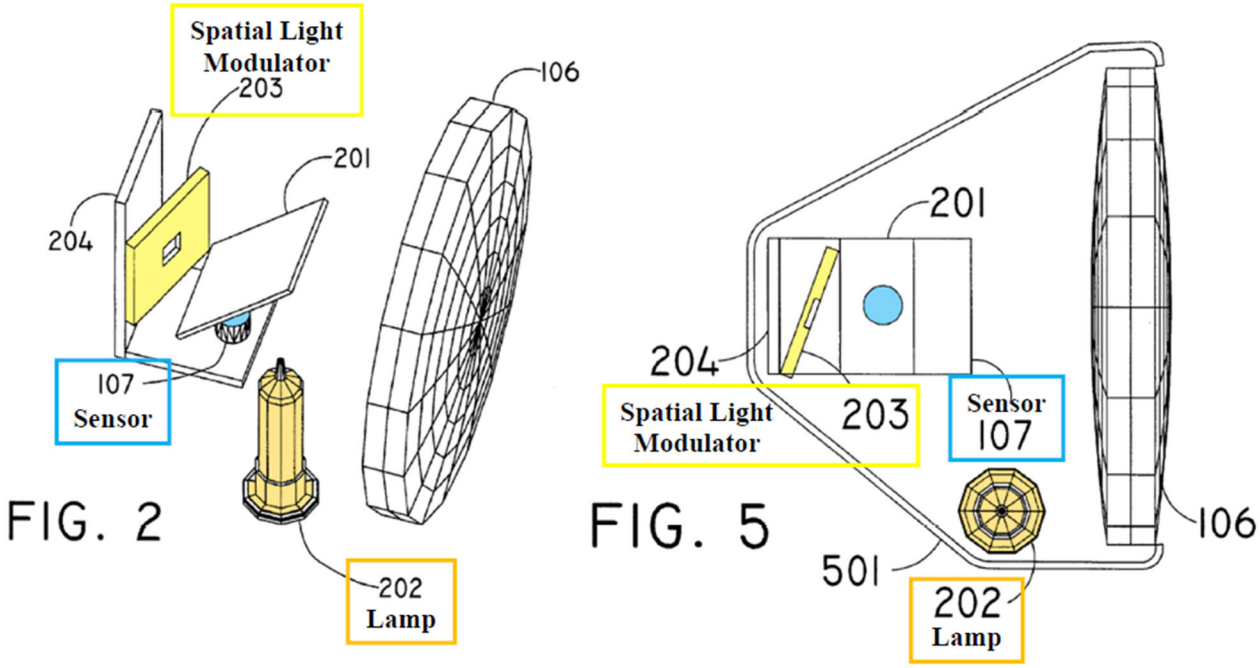
(c) A POSA would have been motivated to combine Beam and Thominet with a reasonable expectation of success.

153. It would have been obvious to a POSA to employ multiple directional beam regions with different directed (or aimed) angles/aimings in Beam's system, as in Thominet, to further control Beam's directional microbeams and provide different spatial distributions for improved visibility in different driving situations, thereby improving driver safety—an express purpose of Beam. EX1005, 3:8-14, 3:37-44, 5:33-54, 7:1-13.

154. Beam and Thominet are from the same field—controllable headlamps with dynamic illumination—and include the same building blocks (light sources, sensors, controllers). EX1005, 4:10-59, FIGS. 1, 2, 5; EX1006, ¶¶17-18, 21, 23-26,

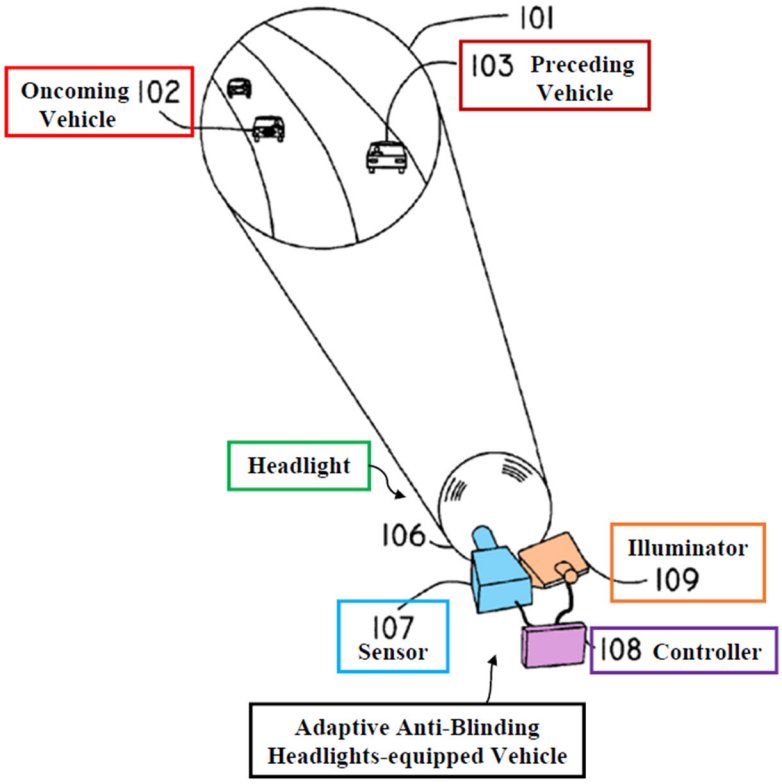
FIGS. 1, 2, 4, 5. Further, improved visibility, thereby increasing safety is paramount in both. EX1005, 1:54-59, 3:8-44, 4:48-59, 6:53-7:13; EX1006, ¶¶3-4, 23.

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



EX1005, FIGS. 2 and 5 (annotated).

156. Indeed, Beam's techniques and system of controlling individual microbeams emphasize safety of all drivers. EX1005, 3:8-44, 6:53-7:13. Controllable headlamps "provide greatly improved safety and comfort to the motoring public," and a "brighter headlight beam while simultaneously protecting…all vehicles ahead," increases safety. EX1005, 3:8-44. Beam enables "the driver to see more clearly at night," while protecting others from glare. EX1005, 3:8-44; EX1005, 4:10-25, 6:9-27.



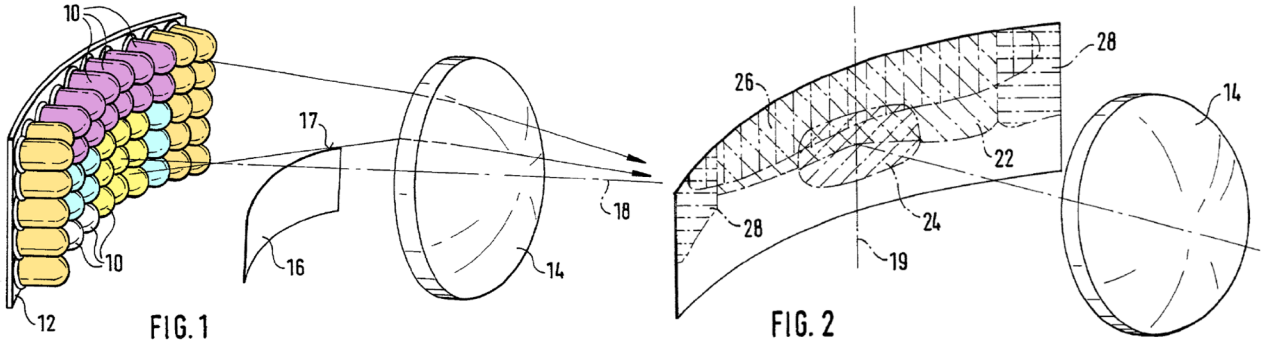
EX1005, FIG. 1 (annotated).

157. Beam's system "*determine[s] the location of light sources* forward of the apparatus and us[es] that information to *control the intensity, and/or the*

angular position, of one or more" microbeams. EX1005, Abstract; EX1005, 4:10-59, 6:9-27, FIGS. 1, 1A-1D, 2. Beam recognizes the safety benefits of different spatial distributions "for conditions like rain, snow, or fog." EX1005, 3:29-36; EX1005, 1:54-59, 4:48-59. If Patent Owner argues, incorrectly, Beam does not expressly disclose "directional light sources aimed at different angles," even though Beam discloses different angular position control for different microbeams, it would have been obvious to a POSA to use such control for the feature of "aimed at different angles." Combining Thominet with Beam would have made Beam's system more direct, or active, or specifically aimed for different functions than prior systems, as Beam seeks to do (*see* EX1005, 2:15-22), and further achieves Beam's purpose of improving driver safety.

158. And Thominet's *technique* (software implementation), like Beam, seeks to enhance driver visibility, thereby increasing safety—using multiple directional beam regions to provide different spatial distributions for different functions. EX1006, ¶¶17-18, 21, 23-26, FIGS. 1-2; EX1006, ¶4 ("*characteristic* of the light beam…can be used for *different functions*"), ¶¶5-8. Specifically, Thominet explains that the "characteristic" of the light beam, for example, color, direction, reaching distance, dispersion width, and/or intensity, "can be changed so that it can be used for *different functions*." EX1006, ¶¶3-4, FIGS. 1, 2; *see also* EX1006, ¶¶5-8.

159. Thominet's semiconductor light sources 10 arranged on curved surface 12 provide beam regions 22, 24, 26, 28 with different angles/aimings for different driving situations including for recognizing a counter traffic, thereby improving safety, including driver safety. EX1006, ¶¶7-8, 17-18, 21, 23-26, FIGS. 1, 2; EX1006, ¶7 ("*wider* illumination"), ¶23 ("*improving* the illumination…at high speeds").



EX1006, FIGS. 1-2 (annotated).

160. The additional control (software implementation) of having multiple directional beam regions with different angles/aimings as in Thominet, 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.

161. A POSA would have understood that alternative or additional control for Beam's controller 108/illuminator 109 by using Thominet's different angles/aimings, would have enhanced Beam's system, making it more direct, or

active, or specifically aimed for different functions, by providing different spatial/angular distributions for different driving situations, thereby improving driver safety. Doing so would have merely been applying Thominet's known technique (software implementation: using multiple directional beam regions with different angles/aimings for different functions), to Beam's similar, known device (dynamic AAHB system with controllable microbeams), in the same way. Thominet's known technique is fully described along with its benefits (improved visibility for different functions in different driving situations, thereby increased safety); thus, a POSA would have readily applied it to similar systems, such as Beam's, in the same way.

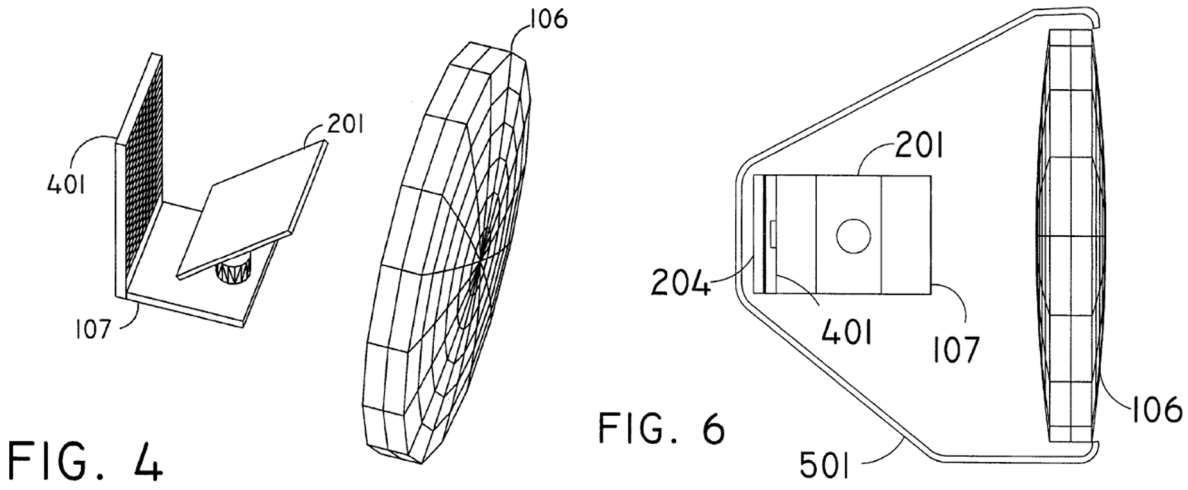
162. A POSA would have had a reasonable expectation of success combining Beam and Thominet, for example, by simply modifying software instructions stored in memory of Beam's controller/processor to organize Beam's array of microbeams into multiple directional beam regions with different angles/aimings for different functions. Overall, this is a simple software implementation.

163. Such modification would have been routine and well within a POSA's skill due to the similarities in Beam's and Thominet's adaptive systems—their common components were well-known and there would have been no limitations for a POSA to make such modification. In applying Thominet's technique to

Beam, a POSA would have simply been applying a known technique (software implementation) in a predictable way—controlling headlights in part based on multiple directional beam regions with different angles/aimings for different functions—as already disclosed in the art.

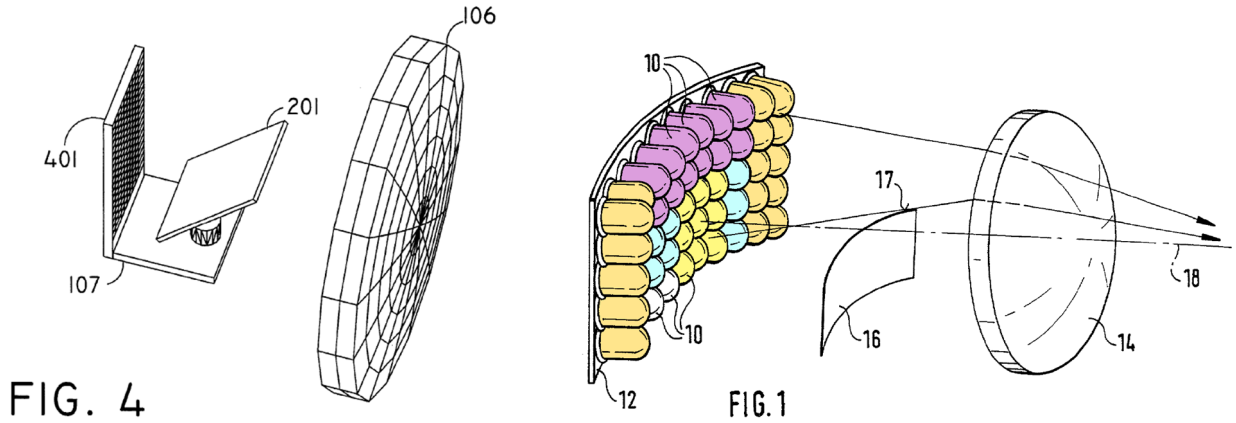
164. *Second*, additionally or alternatively, a POSA would have sought to incorporate *known components* (hardware implementation) of Thominet's semiconductor light sources 10 on curved surface 12 (with differently angled/aimed semiconductor light sources 10 relative to the vehicle, *see* EX1006, ¶¶17-20, 23-26, FIGS. 1-2, 5-7) into Beam's system (with flat array of light sources 401). Again, this would have, like Thominet, provided different spatial distributions for different driving situations (e.g., low visibility, low/high speeds, recognizing a counter traffic, curves, etc.), improving visibility and thereby safety. This is a simple hardware combination.

165. Beam discloses an array of light sources 401 (e.g., LEDs) that appears flat in Figures 4 and 6, and has the same functionality as lamp 202 and SLM 203 shown in Figure 2, and each light source is individually controlled. EX1005, 3:61-64, 5:3-16, FIGS. 4, 6; EX1005, 4:26-59 ("*angular* position"), 8:4-17.



EX1005, FIGS. 4 and 6.

166. Through its *system components* (hardware implementation), Thominet, like Beam, seeks to enhance driver visibility and thereby increase safety. Indeed, semiconductor light sources 10 arranged on curved surface 12, with different angles/aimings relative to the vehicle, provide beam regions 22, 24, 26, 28 for different driving situations. EX1006, ¶¶7-8, 17-18, 21, 23-26, FIGS. 1-2.



EX1005, FIG. 4. EX1006, FIG. 1 (annotated).

167. Like the software implementation above, this hardware combination of Beam's array of light sources 401 and Thominet's differently angled/aimed

semiconductor sources 10 on curved surface 12, would have provided Beam's system with different spatial distributions for different driving situations, as in Thominet, thereby improving driver safety. Doing so would have been merely combining prior art elements or a simple substitution of one known element for another (e.g., Beam's array of light sources 401 on a flat surface and Thominet's semiconductor sources 10 on a curved surface 12) according to known methods (e.g., disclosed in Beam and Thominet) to yield predictable results (e.g., improved visibility and safety). Overall, this is a simple hardware implementation.

168. A POSA would have had a reasonable expectation of success combining Beam and Thominet, for example, by simply modifying the flat surface of Beam's array of light sources 401 with Thominet's curved surface 12 to provide multiple light sources with different angles/aimings relative to the vehicle for different functions (hardware implementation).

169. Such modification would have been routine and well within a POSA's skill due to the similarities in Beam's and Thominet's adaptive systems—their common components were well-known and there would have been no limitations for a POSA to make such modifications. And in combining Beam with Thominet's array of semiconductor sources 10 (e.g., modifying an illuminator), a POSA would have simply been combining known elements according to known methods

(disclosed in Thominet) to yield predictable results (light control for different functions, hardware implementation).

170. In view of the above, Beam, alone or combined with Thominet, discloses or renders obvious this element.

4. [20.3]: "the light sources configured to have one or more controllable light characteristics,"

171. Beam discloses how the light sources are configured to have controllable light characteristics by controlling "the *intensity*, and/or the *angular position*" of the microbeams. EX1005, Abstract; EX1005, 1:5-8 ("*reformatting the pattern*"), 1:11-18 ("*darken those microbeams*"), 4:26-59, 5:17-21. *See also* EX1005, 1:5-18, 2:53-3:3, 3:8-24, 4:10-59, 5:33-54, 5:61-6:4, 6:9-27, 6:40-50. A POSA would have understood that both "intensity" and "angular position" are "controllable light characteristics." *See* EX1001, 16:43-50 ("the resultant light *characteristic*, be in its *intensity*, *spatial* intensity distribution"), 2:28-30 ("[e]ach fixture has its photometric distribution *characteristics*…how many *candela* at what *angle*"); *see also* EX1017, 5 ("variation of shape…variation of beam…variation of brightness"); EX1018, 34 ("manipulation of light distributions"); EX1019, 2 ("a variable beam shape could enhance visibility, together with a variable aiming"); EX1026, 452 ("[b]eam dipping or dimming (intensity adjustment)"), FIG. 1; EX1028, 849 ("adaptive passing lighting"), FIG. 2.

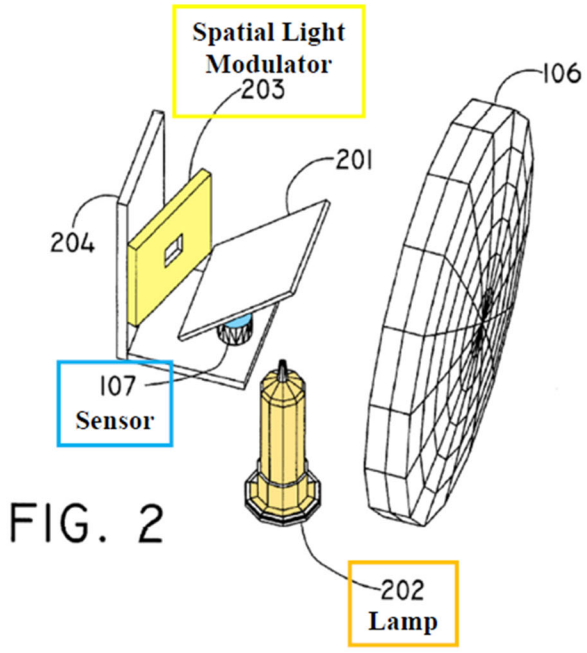


FIG. 2

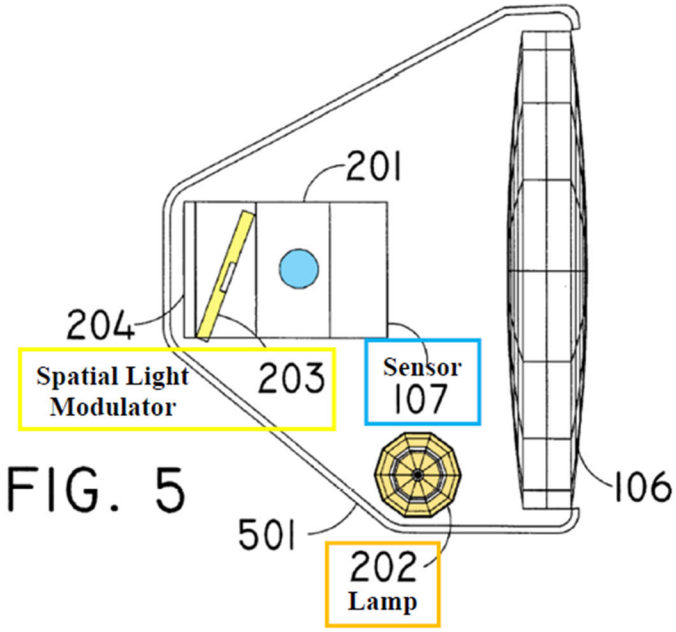


FIG. 5

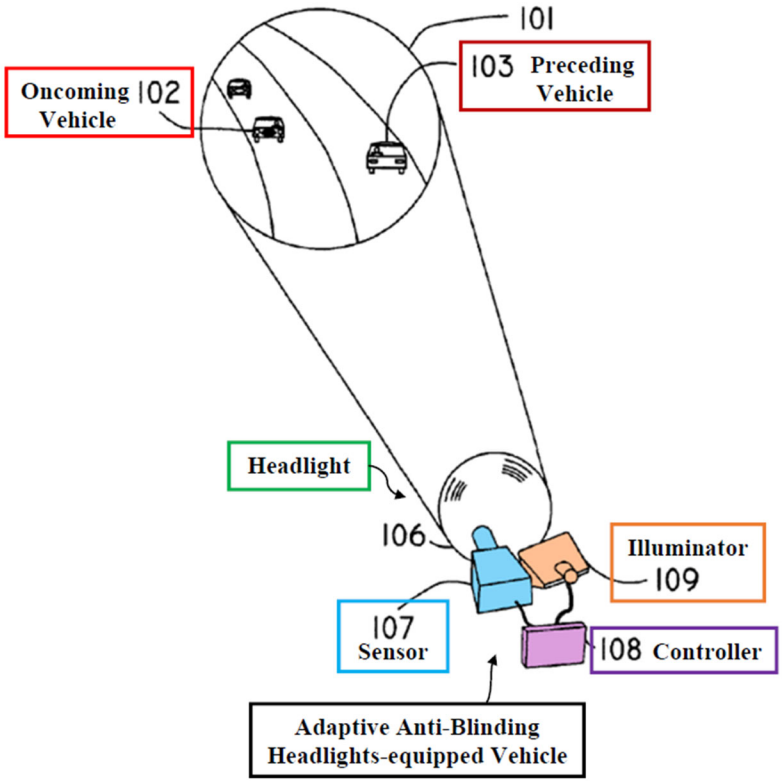
EX1005, FIGS. 2 and 5 (annotated).

172. In view of the above, Beam discloses this element.

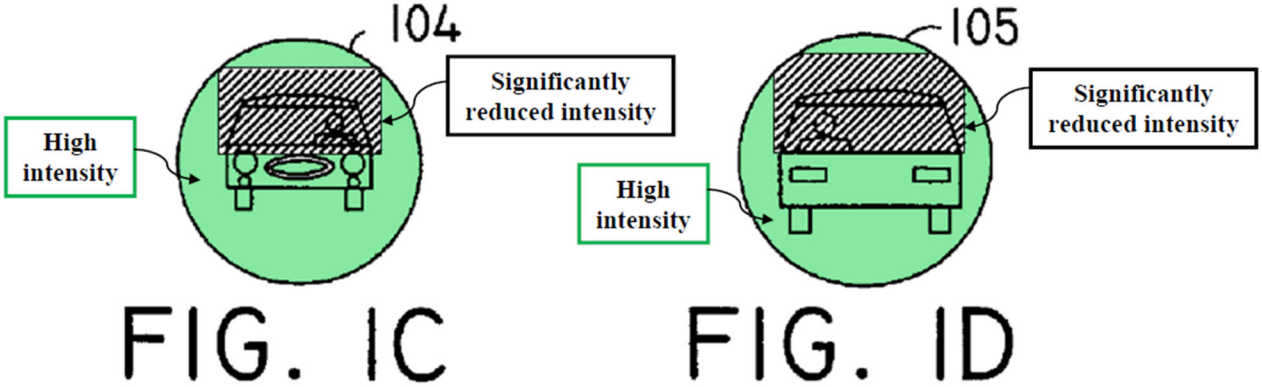
5. [20.4]: "wherein a first light source of the more than one light sources at a first angle is less visually disturbing to traffic than a second light source of the more than one light sources aimed at a second angle, different from the first angle;"

173. Beam discloses "controller 108…*determine[s]* which microbeams must be *reduced in intensity*" and "us[es] that information to control the intensity, and/or the *angular position*, of one or more narrow-angle microbeams." EX1005, 4:15-19, Abstract, FIGS. 1, 1C-1D; EX1005, 2:59-3:3 ("area of the beam that would *dazzle* the driver will be *darkened,* while maintaining *f[u]ll intensity elsewhere*"), 6:24-27 ("the *blanked area* tracks the location of the oncoming vehicle, *dynamically varying* in position and in size"), 4:10-25, 1:5-18, 5:65-6:4,

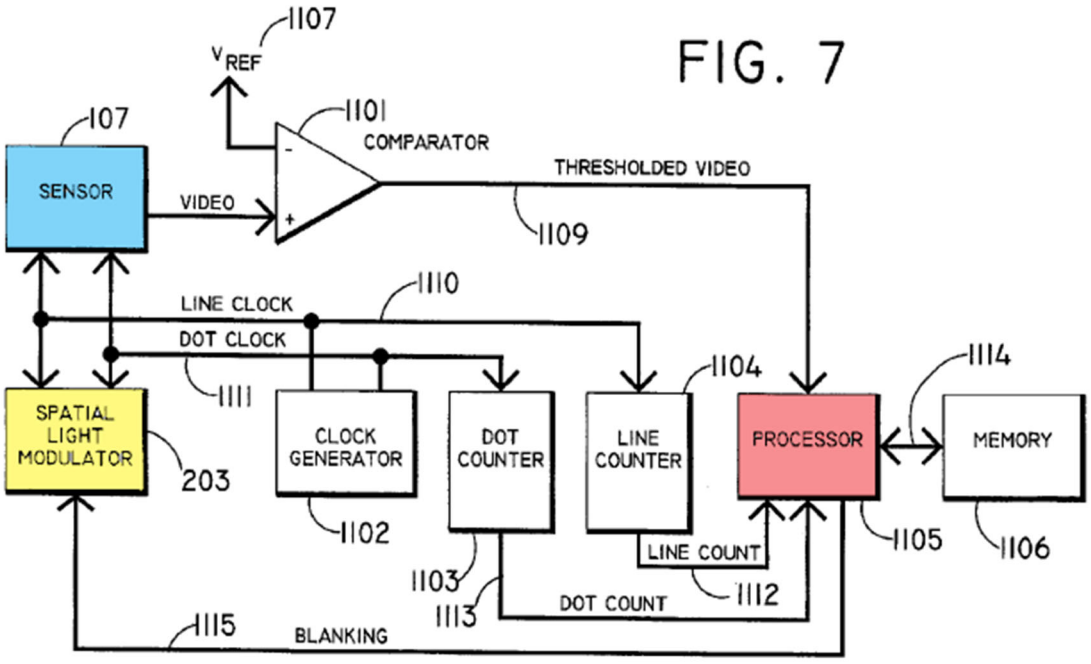
3:20-24, 5:33-54. As shown in Figures 1C and 1D of Beam, reproduced and annotated below, the angular section is "less visually disturbing" (shaded section, first angle) compared to the angular section (non-shaded section, second angle). EX1005, 2:59-3:24, 4:10-59, 5:33-6:4, FIGS. 1C-1D.



EX1005, FIG. 1 (annotated).



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

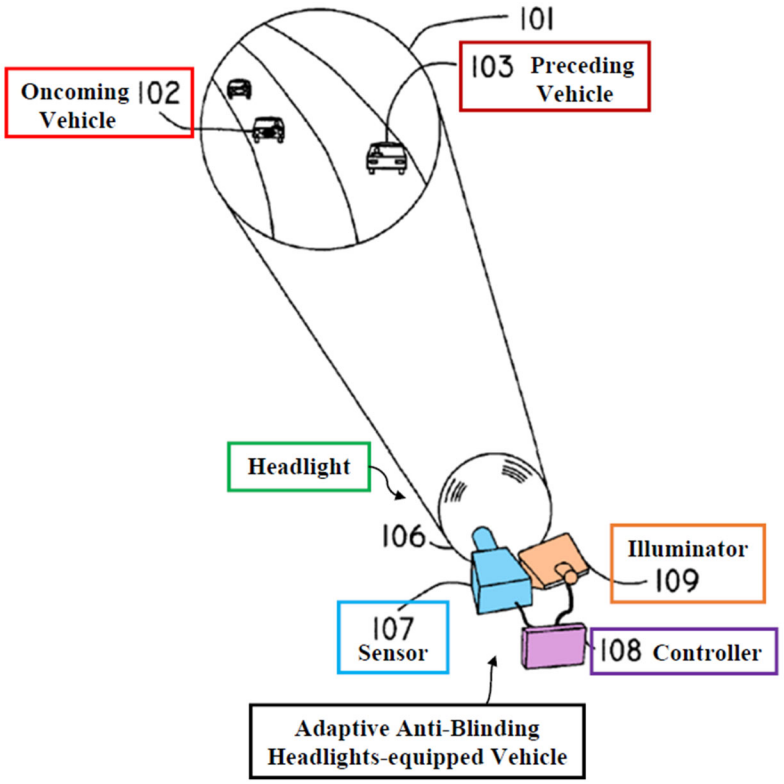


EX1005, FIG. 7 (annotated).

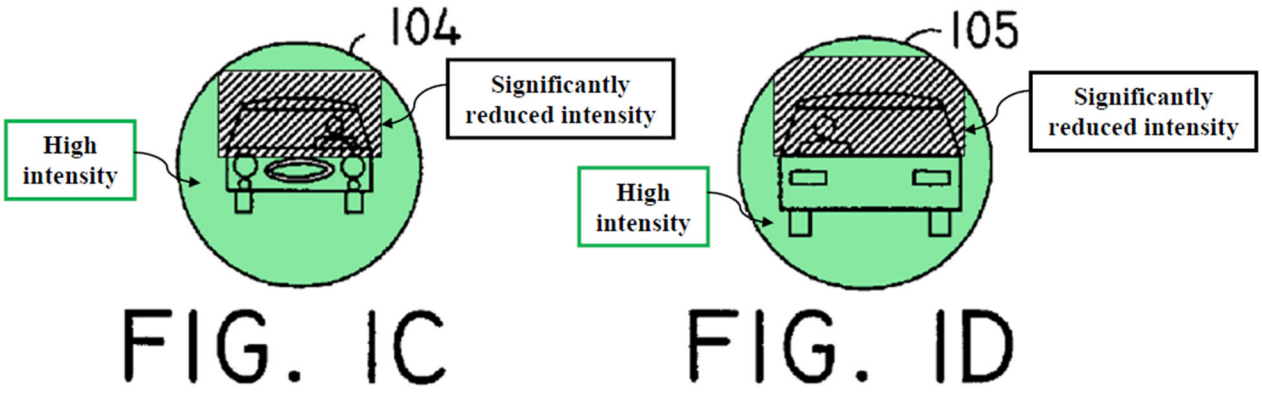
174. In view of the above, Beam discloses this element.

6. [20.5]: "control circuitry configured to adjust the at least one light characteristic of at least one of the directional light sources;"

175. Beam discloses "controller module uses the sensor spatial data (video)…to *control the Illuminator*." EX1005, 6:14-19, FIGS. 1, 1C-1D, 7; EX1005, 1:5-18 ("*reformatting* the *pattern*"), 4:15-19 ("*determine* which microbeams must be *reduced in intensity*"); Abstract, 4:10-25, 5:65-6:4, 3:20-24, 2:59-3:3, 5:33-54.



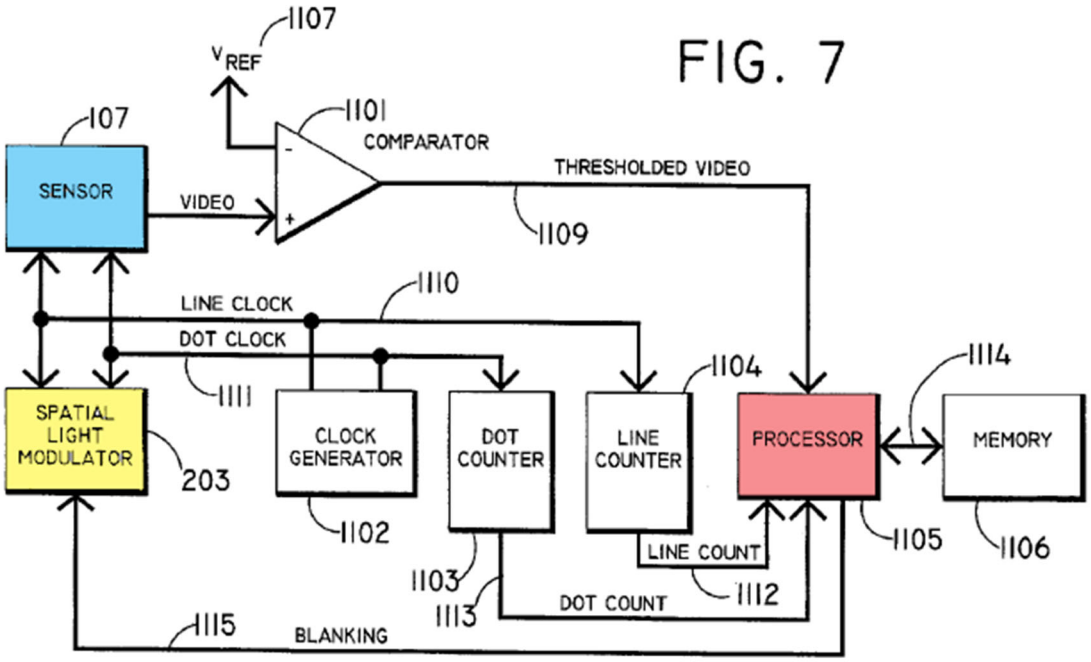
EX1005, FIG. 1 (annotated).



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

176. Beam discloses at least one processor, for example, referring to Figure 7 and its accompanying description. Specifically "[t]he spatial scene data from sensor 107…becomes the input to a processor 1105." EX1005, 5:34-36. Figure 7

shows that controller 108 includes processor 1105 that uses appropriate algorithms on the incoming data to determine locations to blank. EX1005, 5:33-6:4. Beam discloses memory 1106—specifically that controller 108 includes processor 1105 that uses appropriate algorithms on the incoming data to determine the locations to be blanked, and includes memory 1106. EX1005, 5:33-54.

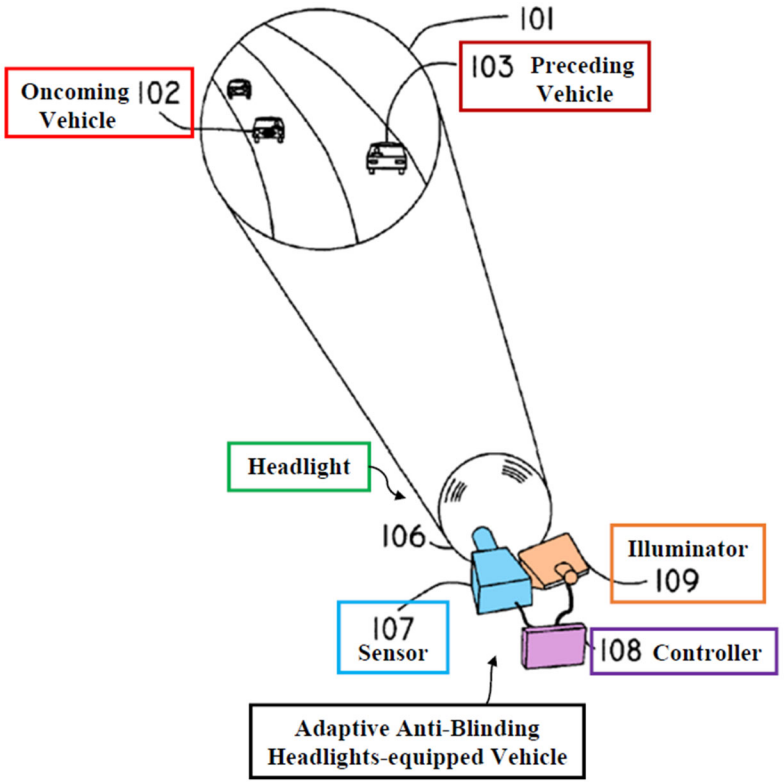


EX1005, FIG. 7 (annotated).

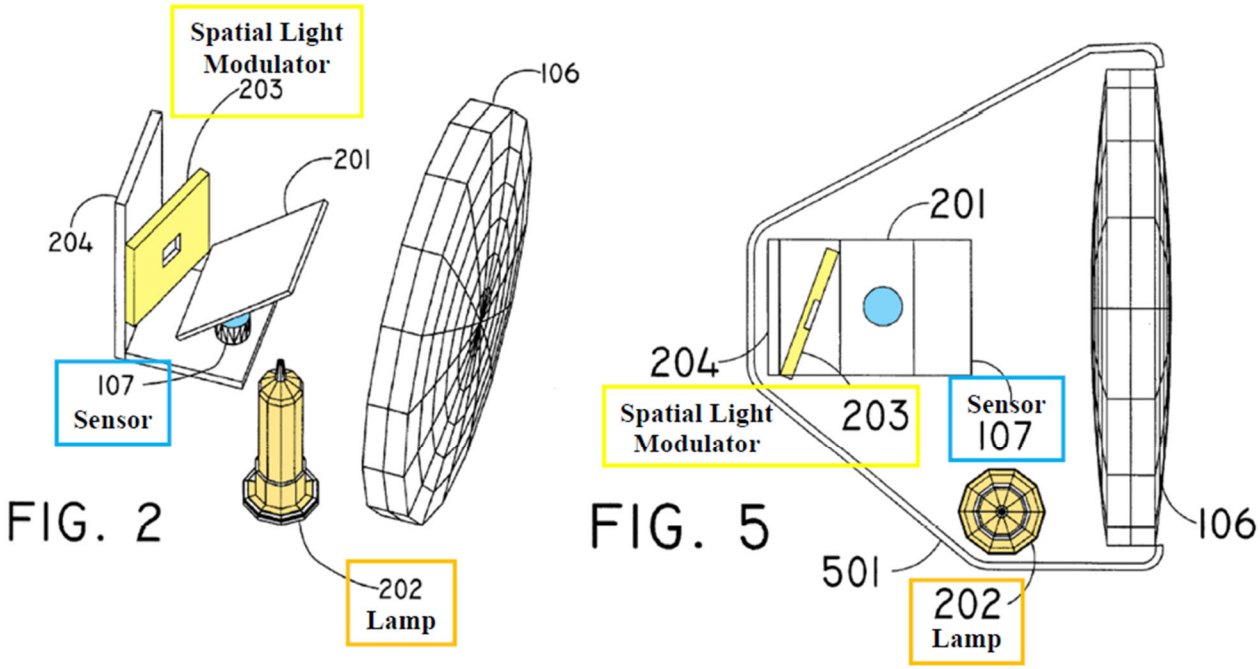
177. In view of the above, Beam discloses this element.

7. [20.6]: "one or more sensors configured to sense information"

178. Beam discloses *sensor 107* that detects the headlights/taillights of an oncoming/preceding vehicle 102, 103. EX1005, 4:10-25, FIGS. 1, 2, 5; EX1005, 6:12-14 ("[a]n imaging *sensor*"), 4:26-36.



EX1005, FIG. 1 (annotated).

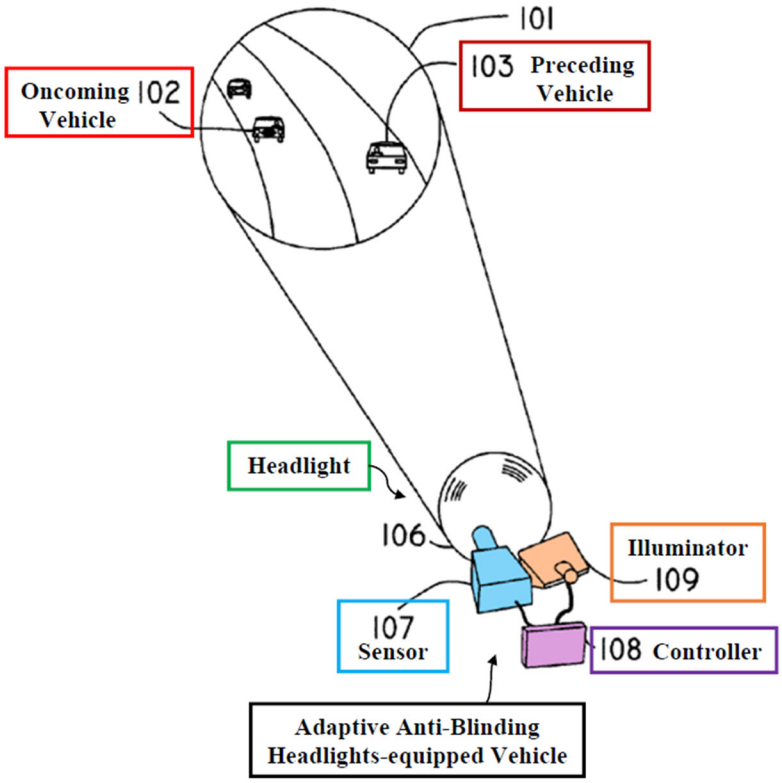


EX1005, FIGS. 2 and 5 (annotated).

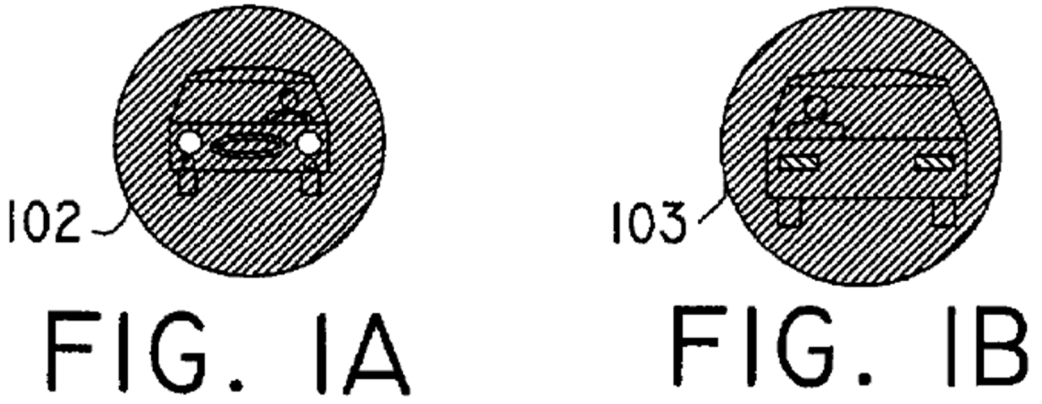
179. In view of the above, Beam discloses this element.

8. [20.7]: "defined as pertinent to determining illumination output from the one or more headlamps and"

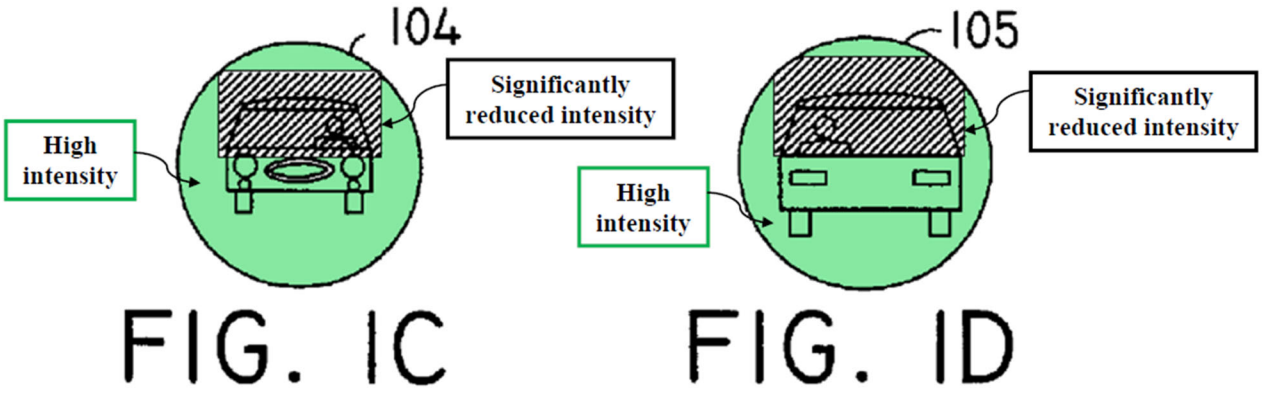
180. Beam discloses detecting headlights/taillights of an oncoming/preceding vehicle 102, 103 in a field-of-view 101. EX1005, 4:10-25, FIGS. 1, 1A, 1B; EX1005, 6:14-19 ("*determine[s]* whether there are *illumination sources* (headlights or tail lights) present"). By its nature, the sensor spatial data (oncoming/preceding traffic) *is pertinent to determining illumination output* because Beam "*tracks the location* of the…vehicle" and *uses* the sensor spatial data "*to determine the locations* to be blanked." EX1005, 5:46-54, 6:11-27, FIGS. 1, 1C-1D, 7.



EX1005, FIG. 1 (annotated).



EX1005, FIGS. 1A and 1B.

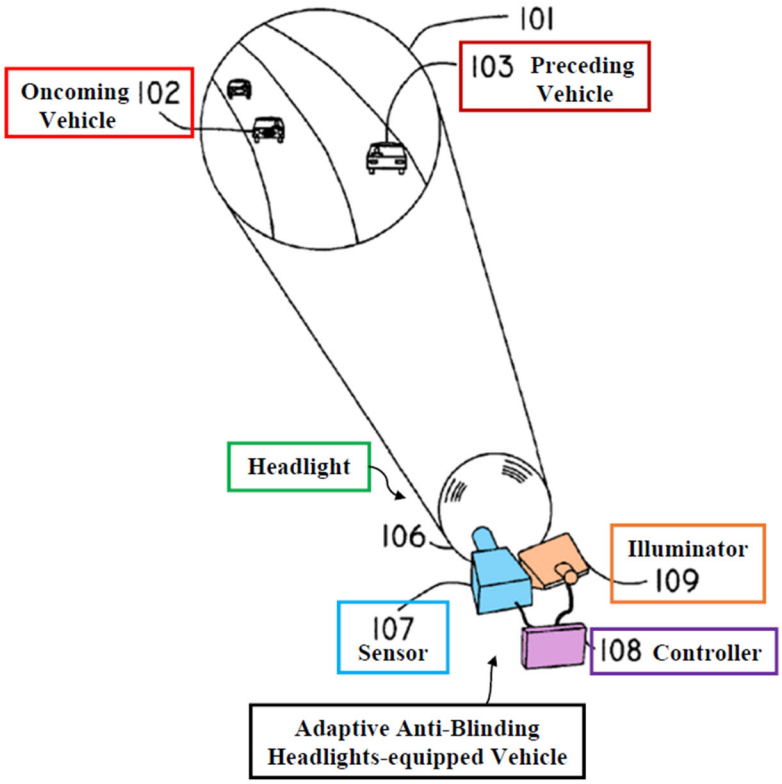


EX1005, FIGS. 1C-1D (annotated).

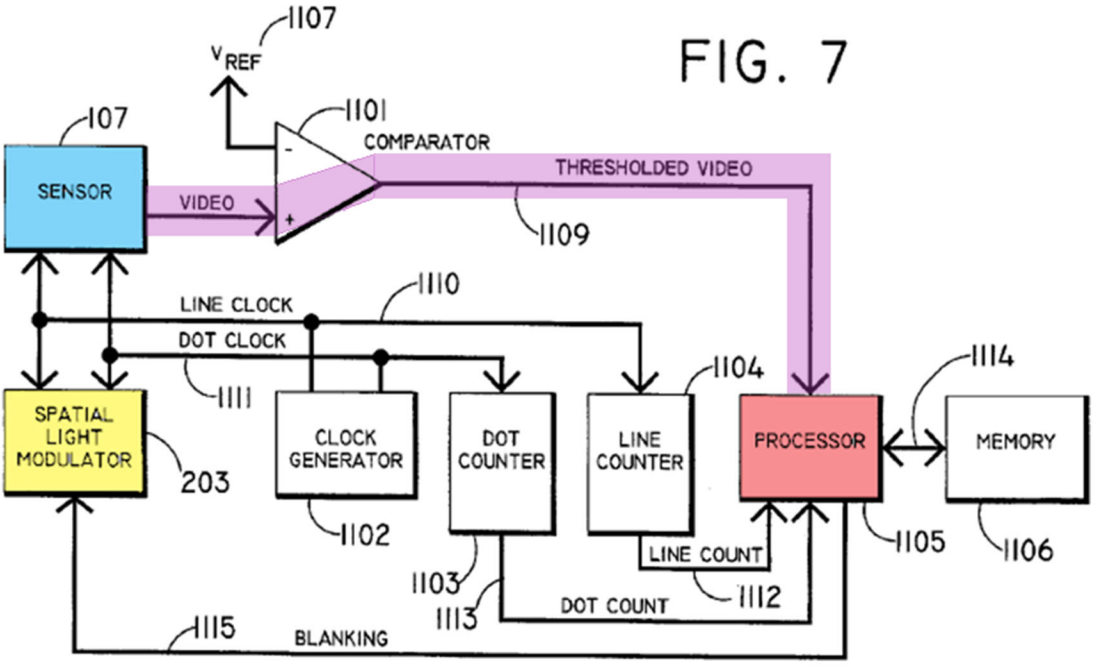
181. In view of the above, Beam discloses this element.

9. [20.8]: "communicating the sensed information to a processor as sensor data;"

182. Beam discloses "data from sensor 107 are input to a controller 108" (communicated to a processor) and "*spatial scene data* from sensor 107…becomes the input to *a processor 1105*." EX1005, 4:16-19, 5:33-54, 5:61-65, FIGS. 1, 7.



EX1005, FIG. 1 (annotated).

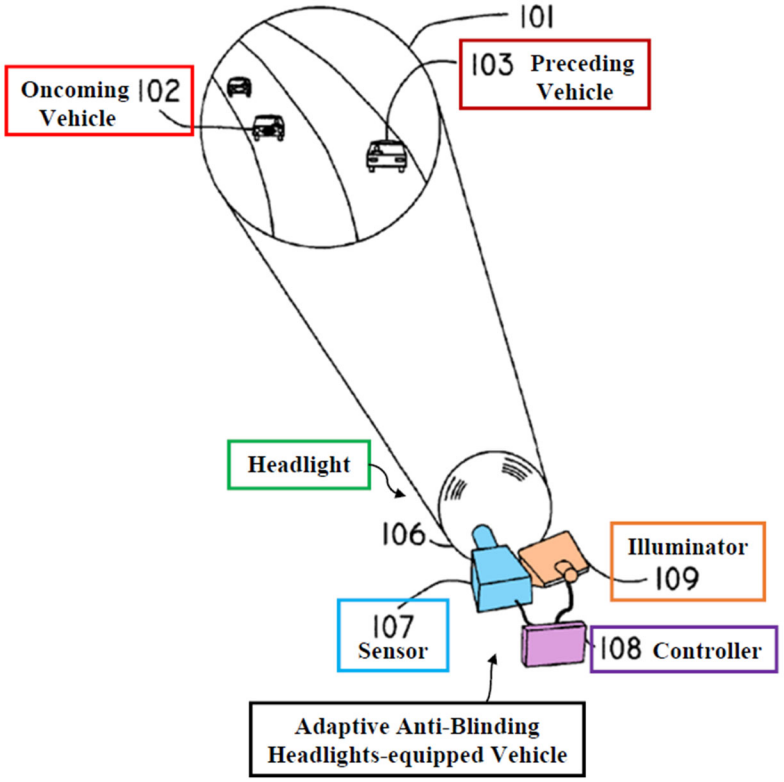


EX1005, FIG. 7 (annotated).

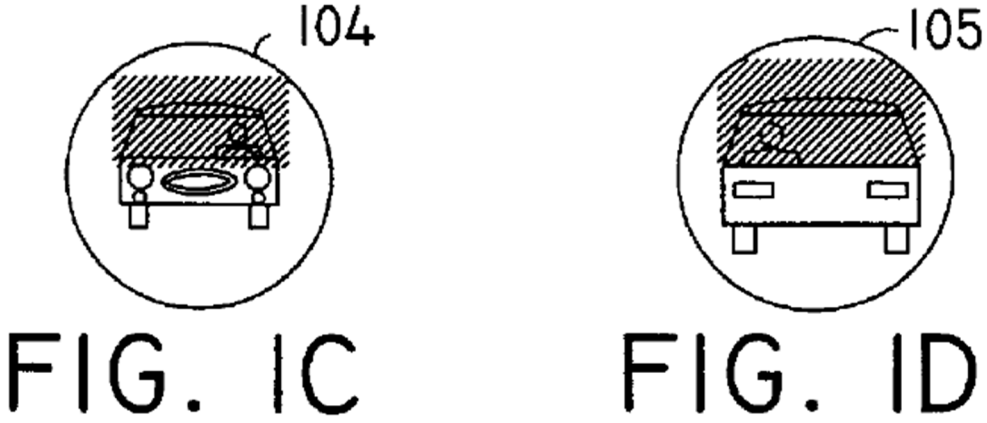
183. In view of the above, Beam discloses this element.

10. [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"

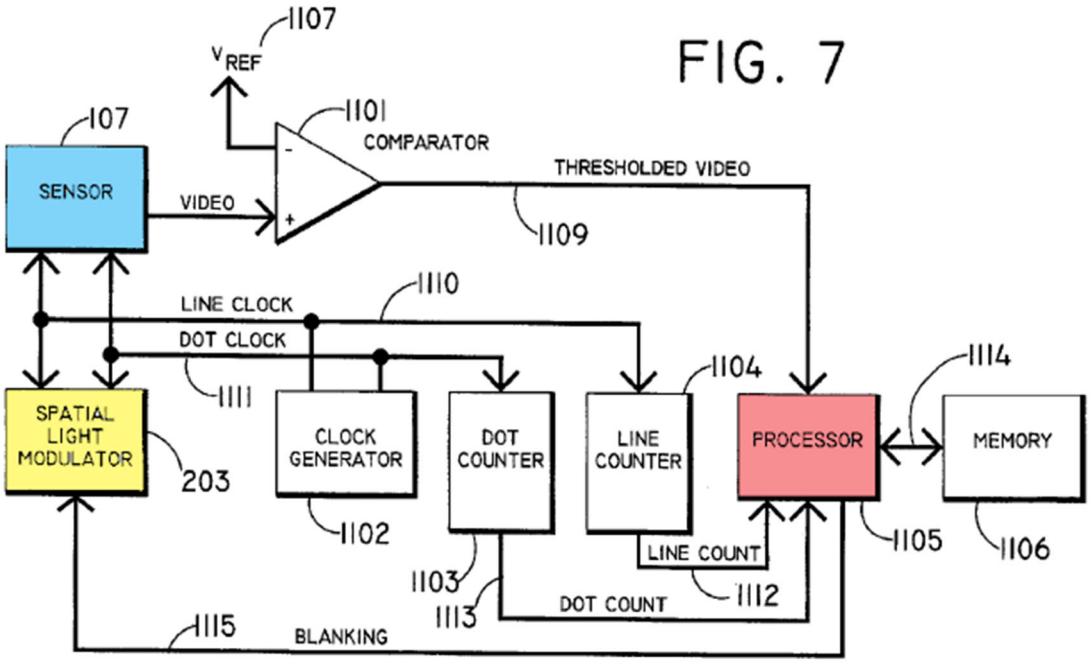
184. Beam discloses "*spatial scene data* from sensor 107…becomes the input to *a processor 1105*" and "*[p]rocessor 1105* uses appropriate algorithms on the incoming data to *determine the locations to be blanked*…outputs *blanking signals*…*commands* the appropriate pixels to be *reduced in intensity*." EX1005, 5:34-36, 5:46-54, FIGS. 1, 1C-1D, 7; EX1005, Abstract, 6:14-19 ("headlight's *field-of-view*"), 5:65-6:4 ("the *dimmed area*…based on input to the sensor"). Thus, the processor processes the inputted spatial sensor data, identifies a vehicle within the headlight's field-of-view, and determines an area to be dimmed within a subsection of the field-of-view (e.g., shaded area based on blanking, first subsection). EX1005, 5:33-54, 6:12-27, FIGS. 1C-1D; EX1005, 6:24-27 ("blanked area *tracks* the location of the *oncoming vehicle*").



EX1005, FIG. 1 (annotated).



EX1005, FIGS. 1C and 1D.



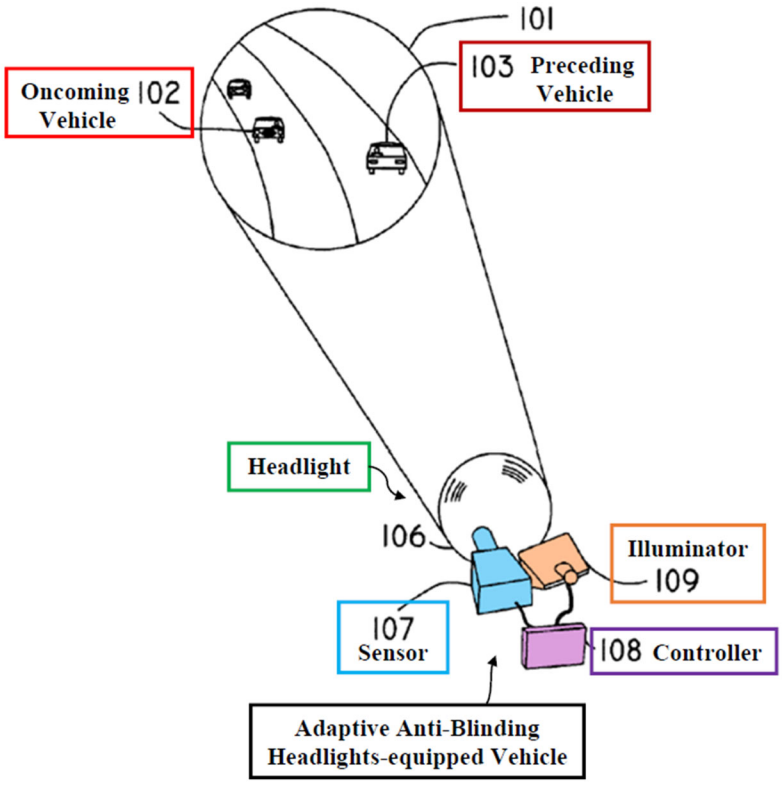
EX1005, FIG. 7 (annotated).

185. In view of the above, Beam discloses this element.

11. [20.10]: "at least a second subsection not including the detected vehicle,"

186. Beam discloses "*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 f[u]ll intensity elsewhere*." EX1005, 3:20-24, 2:59-3:3, FIGS. 1, 1C-1D, 7; EX1005, 6:40-44 ("*bright high beams*"), 6:11-12 ("*maximum intensity*"), 1:5-18 ("eliminating the blinding of a driver in an oncoming vehicle, while continuing to provide *intense forward illumination*"). Simply, the areas that "do not dazzle the drivers ahead" that are darkened are the second subsections of the projected headlamp light "not including the detected vehicle." *See also* EX1017, 5 ("the adaptive light pattern should support to direct

the concentration to the most important zone for the current driving situation"), FIGS. 1, 3-5; EX1025, 205 ("having the ability to fixate much farther with moveable GDLs [gas discharge lamps] the driver actually uses this to achieve information about the scenery ahead"), FIG. 18; EX1026, 451 ("[m]ore beams are necessary to match varied driving regions"), 456 ("beam axes of the lamps are aimed at the directions indicated"), FIGS. 1, 3-3.



EX1005, FIG. 1 (annotated).

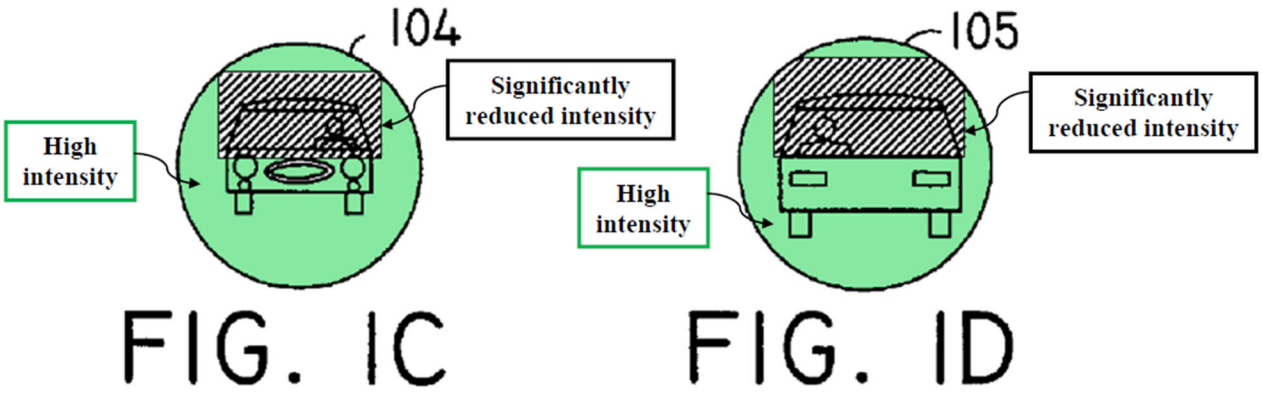
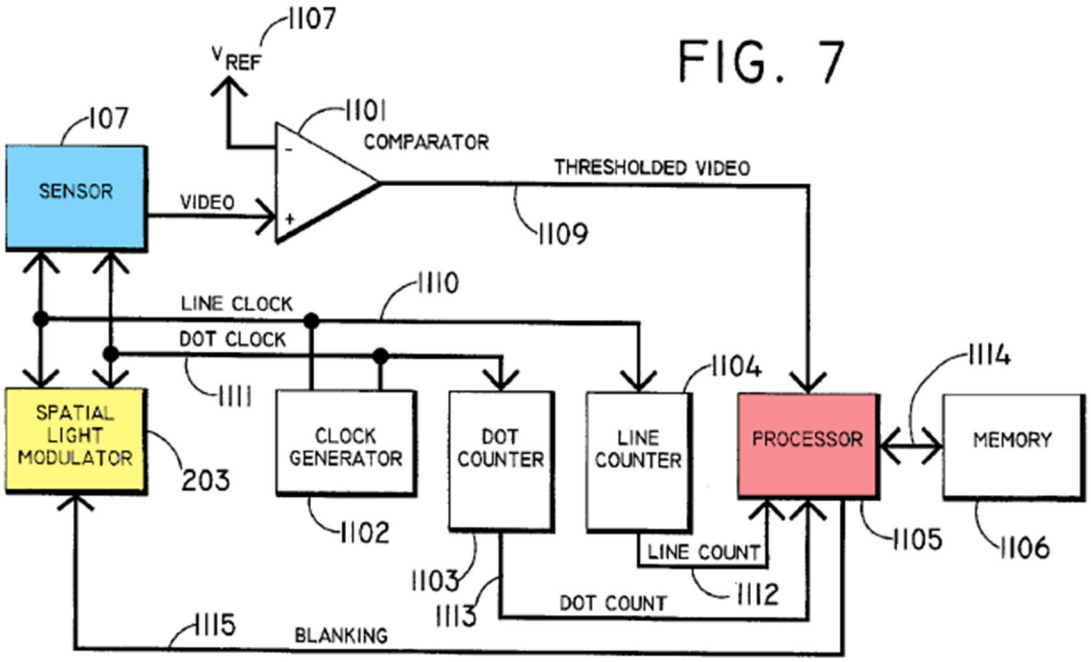


FIG. 1C FIG. 1D

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



EX1005, FIG. 7 (annotated).

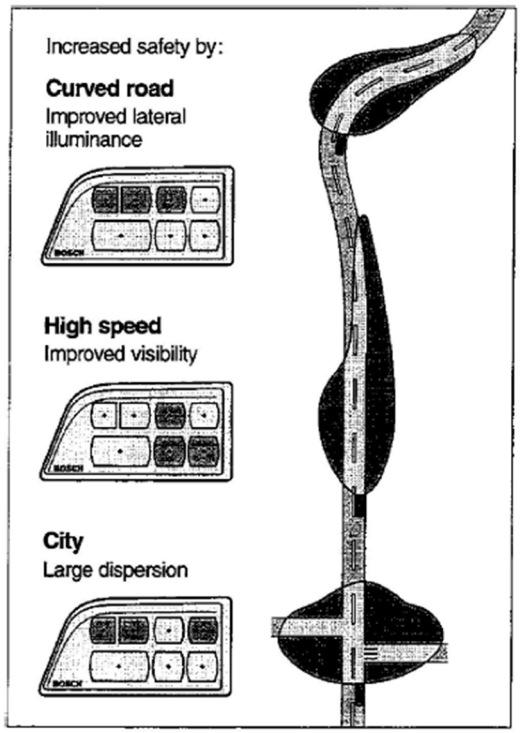


Fig.1: Three standard driving situations with adapted light pattern seen from the bird eye's view.

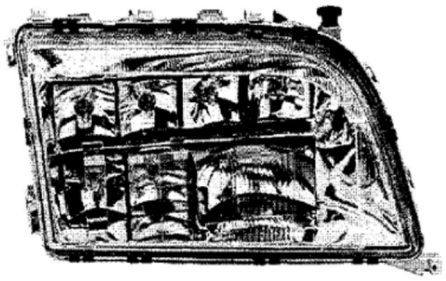
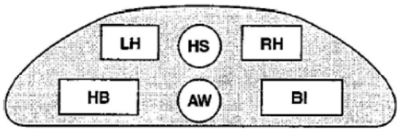


Fig 4: ALP *headlamp* sample



Single components:

LH Left hand bend
RH Right hand bend
HB High beam
BI Basic illumination
AW Adverse weather illumination
HS Hot spot

Fig. 5 Advanced ALP sample layout

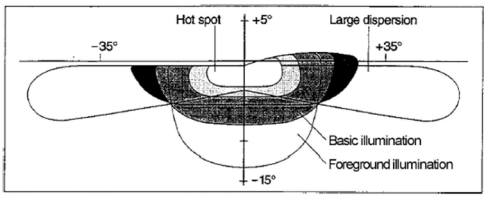


Fig. 3: Light pattern of multiple beam *headlamp (Isolux* curves in wall projection):
The individual light *pattern* of multiple sub-units sum up to the total adaptive light pattern

EX1017, FIGS. 1 and 3-5.

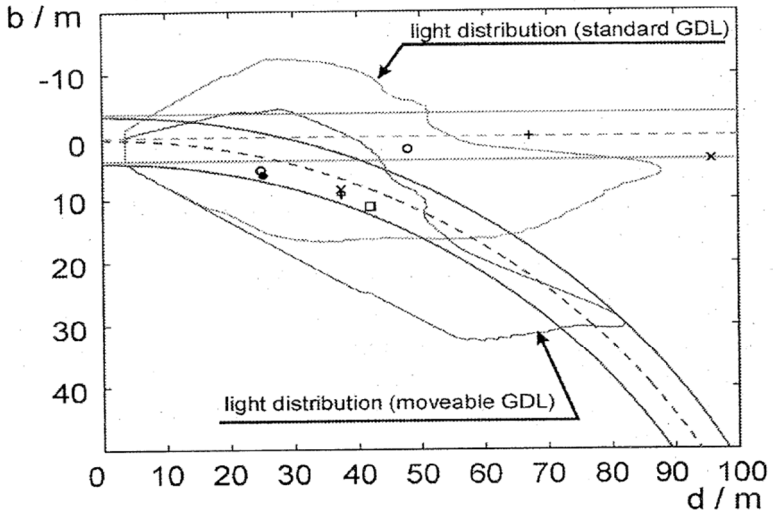


Figure 18: Fixation distance accumulation points (FDAP) for different headlamp systems and different road parts.
Accumulation points: X: *daylight*
O: *standard halogen*
●: *moveable halogen*
+: *standard gas discharge*
□: *moveable gas discharge*

EX1025, FIG. 18.

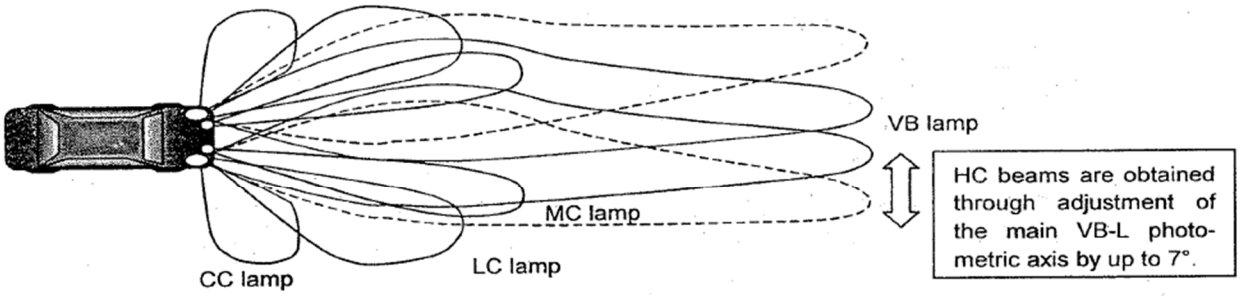


Fig. 3-3: Imaged Illumination Configurations on Road Surface

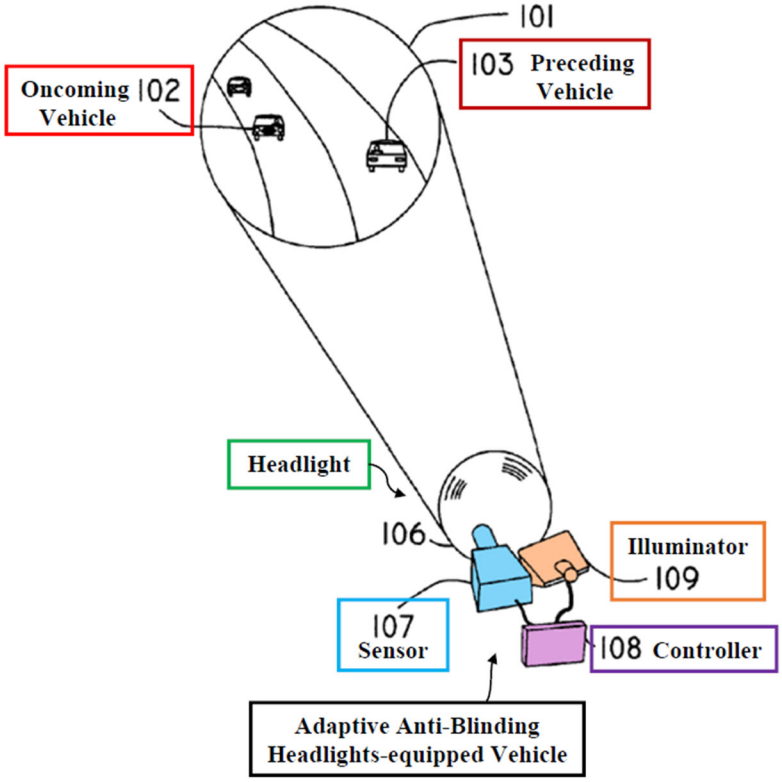
EX1026, FIG. 3-3.

187. In view of the above, Beam discloses this element.

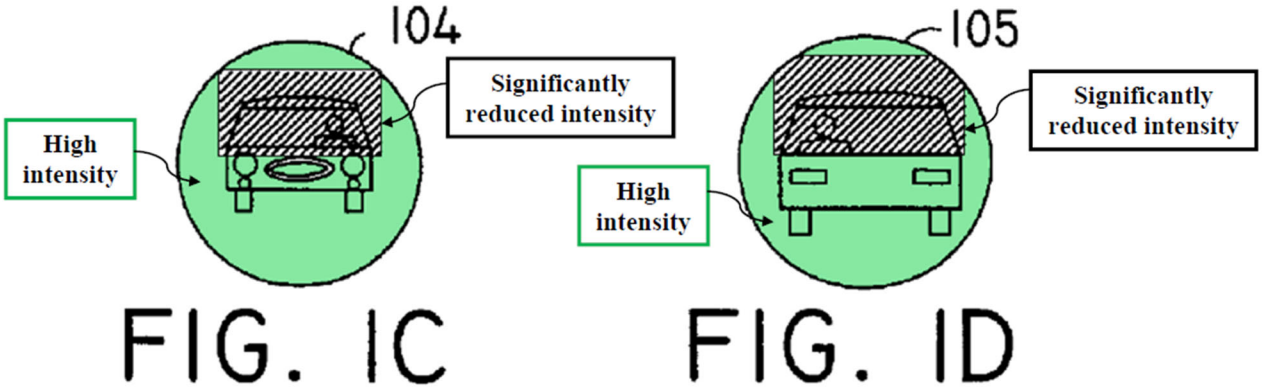
12. [20.11]: "determine optimal use of the differently aimed directional light sources to maximize vehicle operator visibility in at least the second subsection,"

188. Beam discloses illumination in non-shaded areas is "at *maximum* intensity" and "like having bright *high beams*." EX1005, 6:30-33, 6:11-12, 6:40-44, FIGS. 1, 1C-1D, 7; EX1005, 2:59-3:3 ("area of the beam that would dazzle the driver will be darkened, *while maintaining f[u]ll intensity elsewhere*"), 6:53-56. This disclosure of "having bright high beams" is to "maximize vehicle operator visibility" in the second subsection, and such "maximum intensity" in the second subsection is the "optimal use of differently aimed directional light sources." *See also* EX1017, 5 ("the adaptive light pattern should support to direct the concentration to the most important zone for the current driving situation"), FIGS. 1, 3-5; EX1025, 205 ("having the ability to fixate much farther with moveable GDLs [gas discharge lamps] the driver actually uses this to achieve information

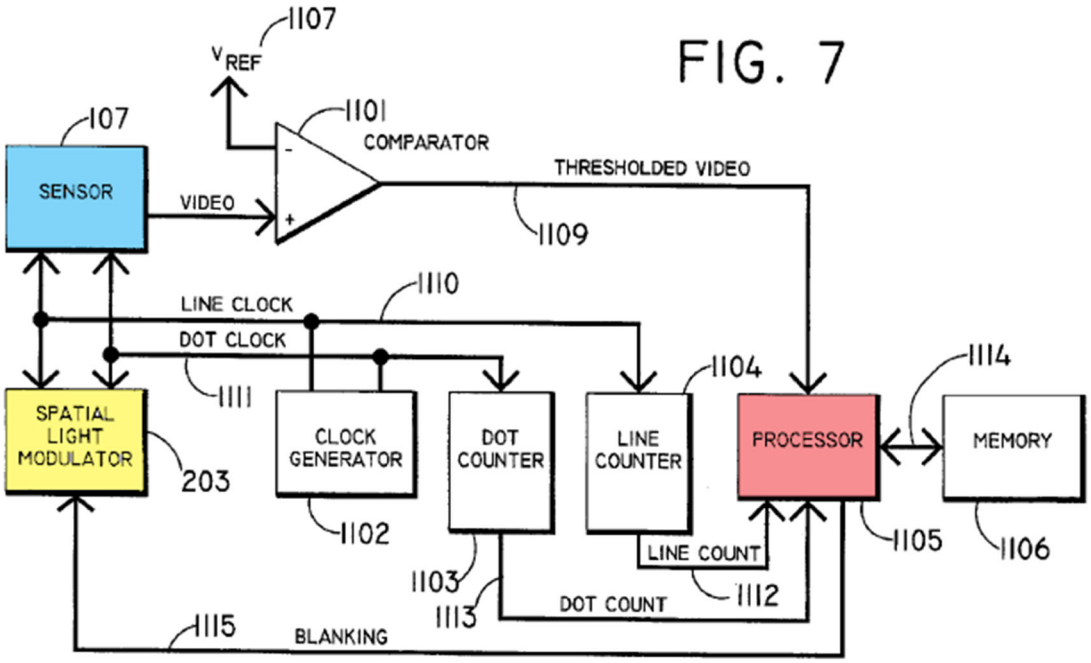
about the scenery ahead"), FIG. 18; EX1026, 451 ("[m]ore beams are necessary to match varied driving regions"), 456 ("beam axes of the lamps are aimed at the directions indicated"), FIGS. 1, 3-3.



EX1005, FIG. 1 (annotated).



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



EX1005, FIG. 7 (annotated).

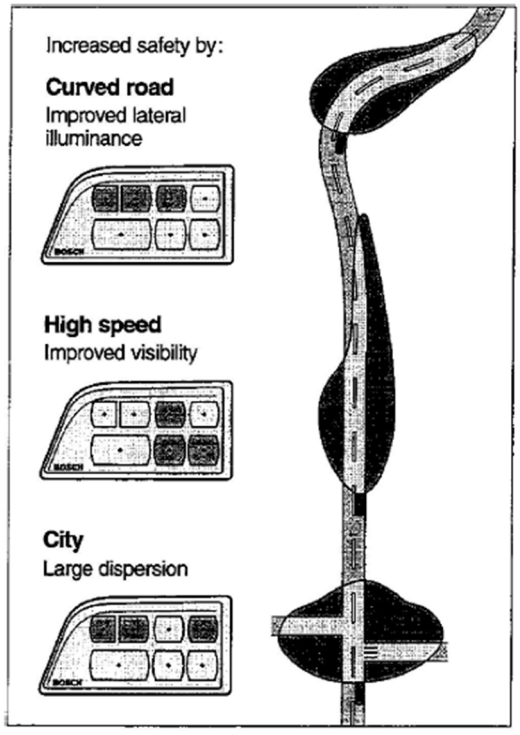


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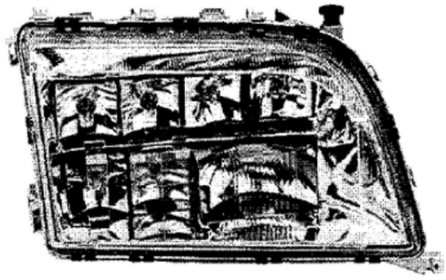
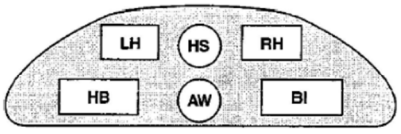


Fig 4: ALP *headlamp* sample



Single components:

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RH Right hand bend
HB High beam
BI Basic illumination
AW Adverse weather illumination
HS Hot spot

Fig. 5 Advanced ALP sample layout

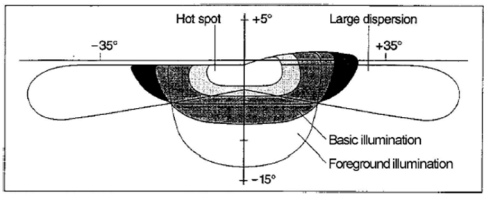


Fig. 3: Light pattern of multiple beam *headlamp (Isolux* curves in wall projection):
The individual light *pattern* of multiple sub-units sum up to the total adaptive light pattern

EX1017, FIGS. 1 and 3-5.

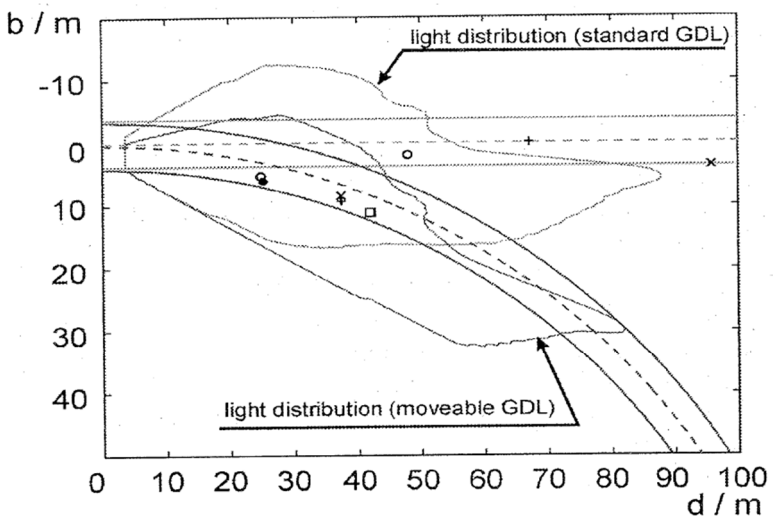


Figure 18: Fixation distance accumulation points (FDAP) for different headlamp systems and different road parts.
Accumulation points: X: *daylight*
○: *standard halogen*
●: *moveable halogen*
+: *standard gas discharge*
□: *moveable gas discharge*

EX1025, FIG. 18.

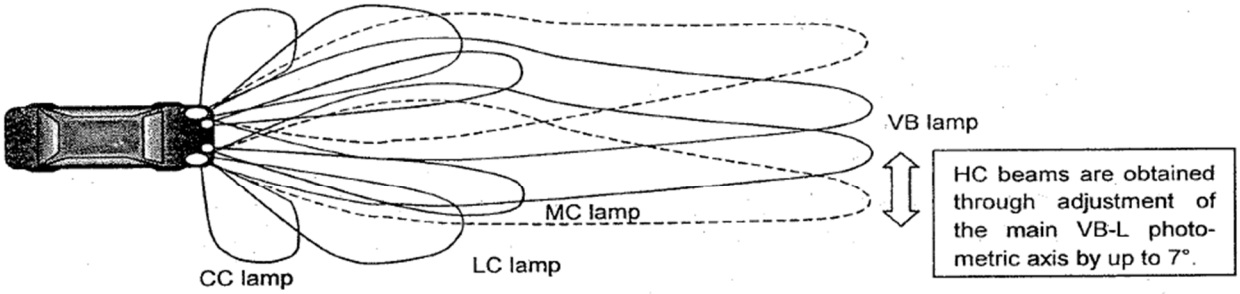


Fig. 3-3: Imaged Illumination Configurations on Road Surface

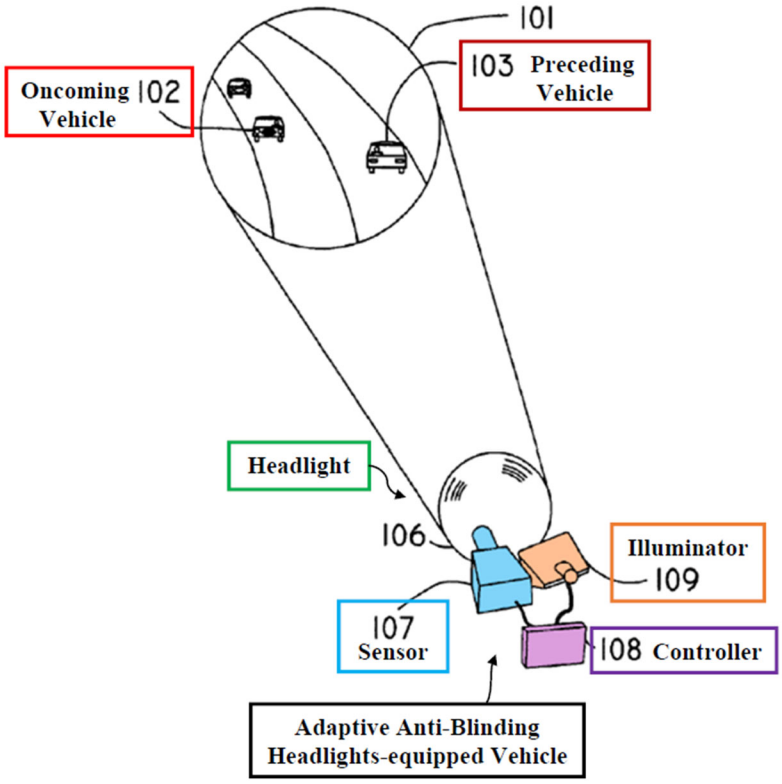
EX1026, FIG. 3-3.

189. In view of the above, Beam discloses this element.

13. [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"

190. Beam discloses illumination in shaded areas is "*significantly less* than with current *low beams*." EX1005, 6:30-33, 2:60-3:3, FIGS. 1, 1C-1D, 7; EX1005,

Abstract, 4:21-25 ("*shaded areas* being *reduced significantly*"), 2:59-3:3, 3:8-24. This disclosure of having "significantly less than with current low beam" is to "minimize[] a disturbing effect" (e.g., glare) to other traffic. *See also* EX1017, 5 ("the adaptive light pattern should support to direct the concentration to the most important zone for the current driving situation"), FIGS. 1, 3-5; EX1026, 456 ("beam axes of the lamps are aimed at the directions indicated"), FIG. 3-3; EX1030, 3-8, 21-41, 62-69; EX1016, 4-11.



EX1005, FIG. 1 (annotated).

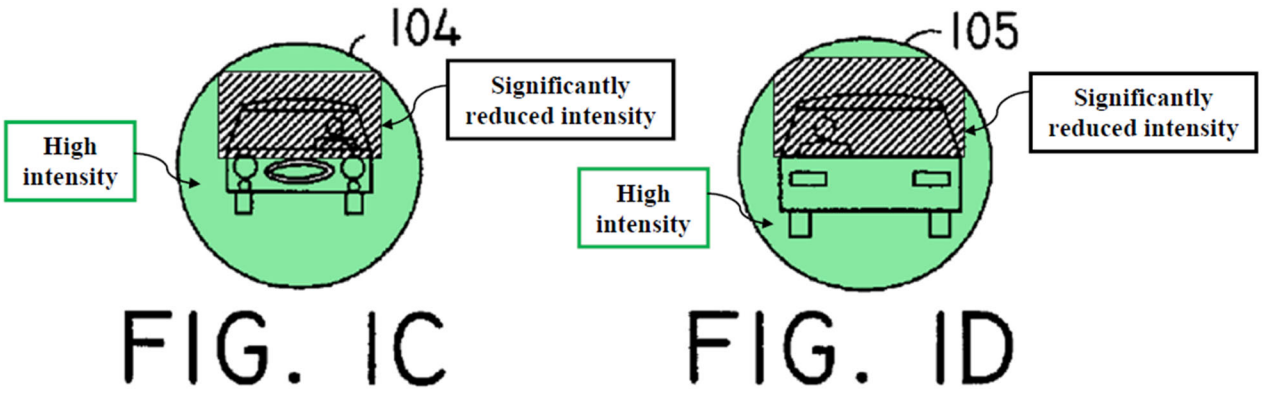


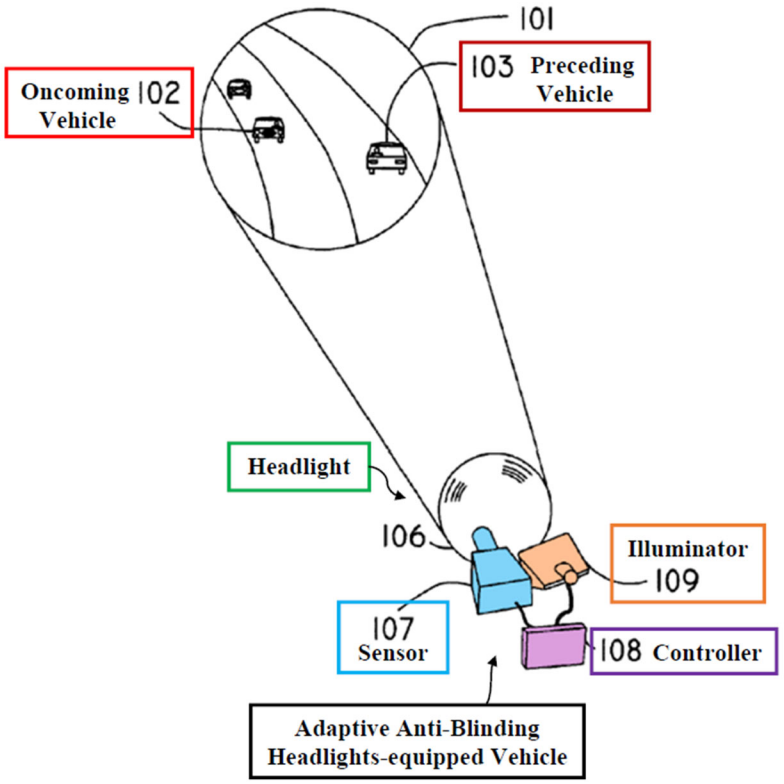
FIG. 1C FIG. 1D

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

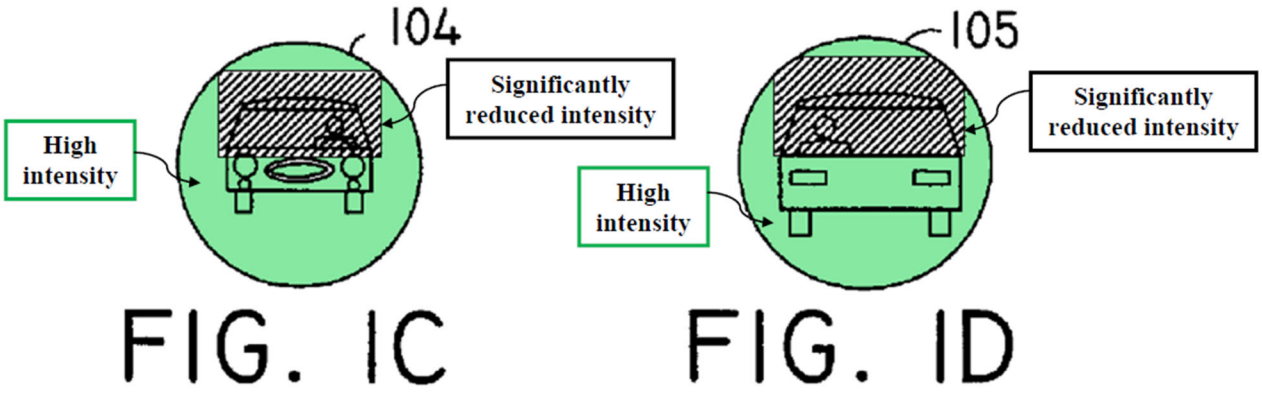
191. In view of the above, Beam discloses this element.

14. [20.13]: "direct the control circuitry to adjust the directional light sources to achieve the determined optimal use."

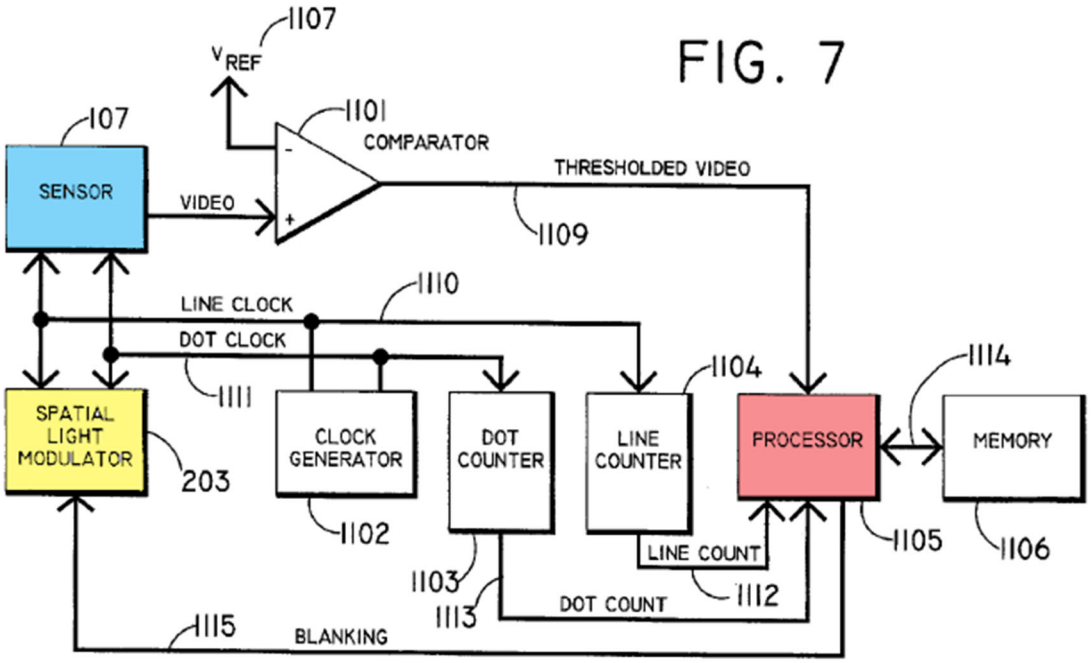
192. Beam discloses the "*[p]rocessor…determine[s] the locations to be blanked*…outputs *blanking signals…commands* the appropriate pixels to be *reduced in intensity*." EX1005, 5:46-54, FIGS. 1, 1C-1D, 7; EX1005, 6:14-27 ("controller module uses the *sensor spatial data (video)*…to *control the Illuminator*"), 4:10-25 ("*determine* which microbeams must be *reduced in intensity*"), 1:5-18. Beam thus discloses the control to adjust the light sources for "optimal use."



EX1005, FIG. 1 (annotated).



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



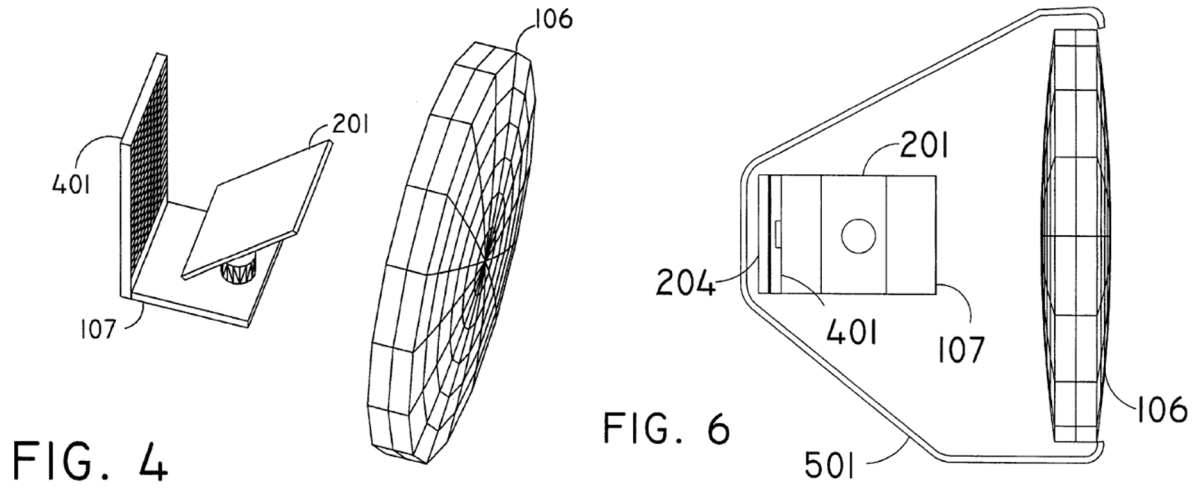
EX1005, FIG. 7 (annotated).

193. In view of the above, Beam, alone or in combination with Thominet, discloses or renders obvious this element.

C. Claim 24: "The system of claim 20, wherein at least one light source provided to at least one of the one or more headlamps further includes a laser diode."

1. Beam discloses this claim.

194. In my opinion, Beam discloses this element, claim 24. Specifically, Beam discloses the light source can include "light-emitting *diodes*" and "*lasers*." EX1005, 8:14-17; EX1005, 5:3-16 ("*matrix of lasers*"). Thus, a POSA would have understood that Beam discloses "a laser diode" in the system.



EX1005, FIGS. 4 and 6.

2. Thominet also discloses this claim.

195. If Patent Owner alleges, incorrectly, that Beam does not expressly disclose claim 24, Thominet also discloses claim 24, and it would have been obvious to incorporate Thominet's disclosure into Beam.

196. Thominet expressly discloses "*laser diodes* can be also utilized." EX1006, ¶28, FIGS. 1, 2.

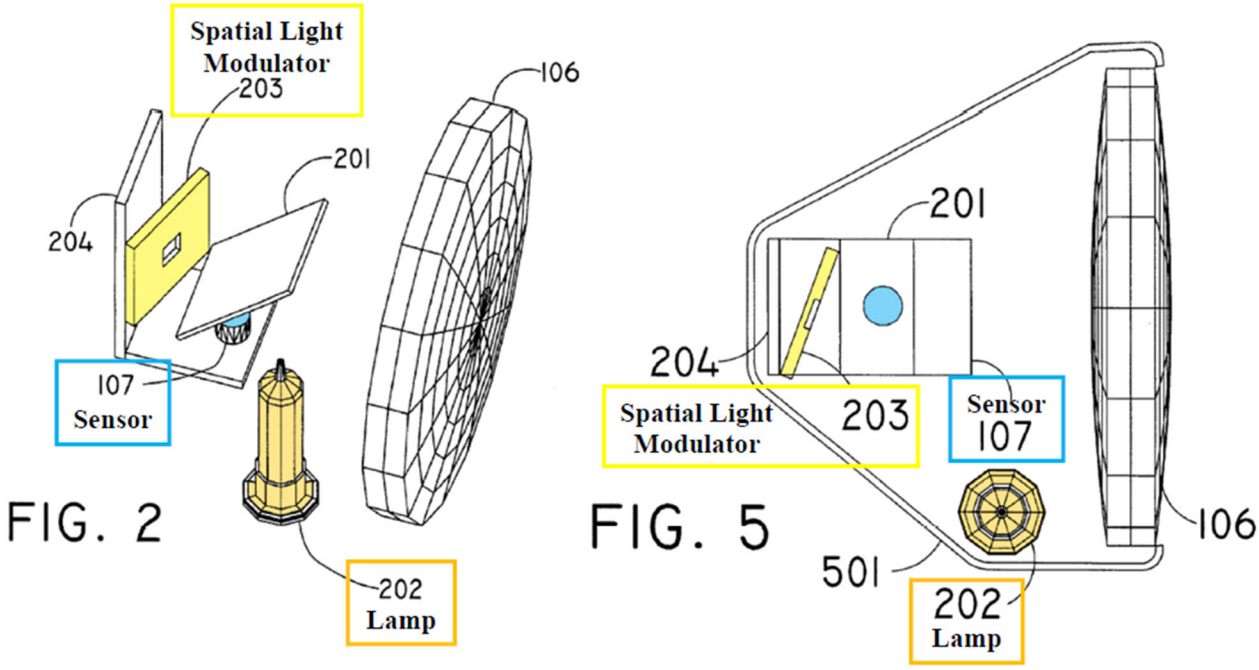
3. A POSA would have been motivated to combine Beam and Thominet with a reasonable expectation of success.

197. As discussed, a POSA would have been motivated to combine Thominet with Beam with a reasonable expectation of success, since a laser diode would have been just a simple substitution of one known prior art element for another. *See supra* Section X.A.

198. In view of the above, Beam, alone or in combination with Thominet, discloses or renders obvious this claim.

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

199. Beam discloses "a *spatial light modulator*…digital mirror devices" and "an optical system 106" (e.g., a bi-convex lens). EX1005, 8:4-12, FIGS. 2, 5; EX1005, 1:61-65 ("a *reflector* or *lens*"), 4:26-41 ("*reflected* by a *beamsplitter 201*"), 4:10-59, 5:17-21. And these optical elements disclosed by Beam are all "usable to alter emitted light from at least one of the light sources."



EX1005, FIGS. 2 and 5 (annotated).

200. In view of the above, Beam discloses this claim.

201. Thus, Beam, alone or in combination with Thominet, discloses or renders obvious claims 20, 24, and 25 of the '503 patent.

XI. GROUND 2: THE COMBINATION OF BEAM, THOMINET, AND STAM RENDERS OBVIOUS CLAIMS 59, 63, AND 64.

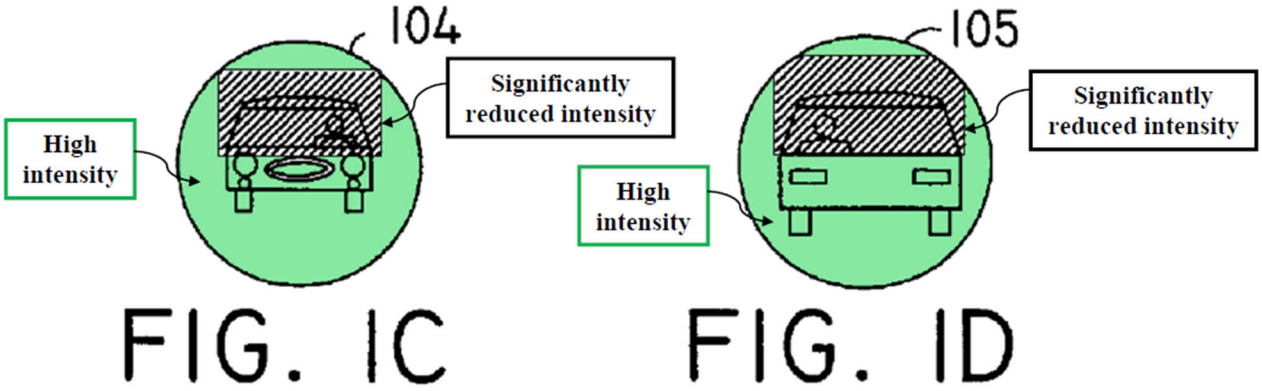
202. In my opinion, Beam-Thominet explicitly or implicitly discloses every feature recited in claims 59, 63, and 64. But to avoid doubt, Beam-Thominet is combined with Stam, for elements [59.9] and [59.11], which discloses a well-known feature of adaptive headlamp systems—outputting light above and below a predefined illuminance depending on the driving situation—rendering the claims obvious.

203. Beam discloses a "*default* illumination level will be the equivalent of today's *low beams*." EX1005, 6:30-33. The concept of a "default illumination level" or a low beam illumination level would have been known to a POSA. Because all automotive exterior lighting devices (headlamps, tailing lamps, and other road illumination devices and signaling and marking devices) are highly regulated in the U.S. as well as in the rest of world, all lighting products installed on a vehicle must comply with these regulations. *See* EX1030, 62-69; EX1016, 4-11. As such, common practice in the automotive lighting industry is to set up the performance level including light output for a product, such as a headlamp, to produce predefined illumination values (in angular light intensity distribution) either per the regulations, or in a higher performance level set by automakers.

204. Such default illumination level for driver's visibility and glare light control is defined in all regulations, standards, and automaker's specifications,

which is predefined as the illumination level in terms of the light intensity distribution in the low beam illuminating area or low beam projected angular section. *See* EX1030, 3-8, 21-41, 62-69; EX1016, 4-11. Therefore, Beam's "default illumination level" is an example of a "predefined" illumination level, for example, equivalent to a "low beam" illuminance.

205. Further, Beam discloses illumination in shaded areas is "*significantly less* than with current *low beams*" (e.g., significantly reduced intensity in shaded area is *below* Beam's predefined *low beam* illuminance: shaded illuminance < low beam illuminance); and illumination in non-shaded areas is "at *maximum* intensity" and "like having bright *high beams*" (e.g., high intensity in non-shaded area is *above* Beam's predefined *low beam* illuminance: non-shaded illuminance > low beam illuminance). EX1005, 6:30-33, 2:59-3:3, 6:11-12, 6:40-44, FIGS. 1, 1C-1D.



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

206. Therefore, Beam discloses a "predefined" (e.g., low beam) illuminance and outputting illumination "below…[the] predefined illuminance" and

"above…[the] predefined illuminance" (e.g., shaded < low beam < non-shaded) recited in [59.9] and [59.11].

207. However, if Patent Owner argues the claims require a concrete threshold value, even though the '503 patent does not disclose such value, Stam discloses: "to *avoid* an illuminance of *0.1 foot candles (fc)* incident on another vehicle…high beam headlamps should be *dimmed within 700 feet* of another vehicle," EX1007, 1:27-32, corresponding to the "predefined illuminance" recited in [59.9] and [59.11].

208. As explained, Stam discloses a predefined dimmed illuminance of 0.1 fc within 700 ft, which is equal to about 1.1 lux within 700 ft. Note, the definition of 1 lux (SI unit) is 1 lumen of luminous flux being intersected by 1 square meter surface, or 1 lux = 1 lm/m^2. The definition of 1 foot-candle (fc) (non-SI unit) is 1 lumen of luminous flux being intersected by 1 square foot surface, or 1 fc = 1 lm/ft^2. The conversion from fc to lux (ft^2 to m^2) is 1 fc = 10.7639 lux. Thus, 0.1 fc is about 1.1 lux. Therefore, Stam provides another example of a quantitative (e.g., 0.1 fc) glare prevention level.

A. A POSA would have been motivated to combine Beam, Thominet, and Stam with a reasonable expectation of success.

209. As described in Section X.A, a POSA would have been motivated to combine Beam-Thominet. It would have been obvious to a POSA to provide a predefined dimmed (low beam) illuminance level in the combined Beam-Thominet

system, as in Stam, to further control an intensity of Beam's directional microbeams to prevent glare, furthering the purpose of improving driver safety. EX1005, 3:8-14, 3:37-44, 5:33-54, 7:1-13.

210. I lay out below the specific disclosures of Beam and Thominet, and expand on this combination and reasonable expectation of success analysis below specifically with reference to elements [59.2], [59.9], and [59.11].

B. Independent Claim 59[8]

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

211. [59.P] is identical to [20.P]. *Supra* Section X.B.1.

212. In view of the above, Beam discloses this element.

[8] Claim 59 and claim 20 recite many identical elements or elements that are so technically similar that, in my opinion, there is no patentable difference between corresponding elements, even where the claim elements may be worded slightly different. (*See* Appendix A.) That is, there is no difference in what is required from a technical standpoint, and so the same prior art citations disclose the respective features. To avoid undue repetition, I have identified these elements throughout my declaration as appropriate, and the same prior art citations are applicable to those elements as provided in the referenced analysis.

2. [59.1]: "one or more headlamps affixed to a first vehicle,"

213. In my opinion, there is no patentable difference between [59.1] and [20.1]. *Supra* Section X.B.2. Therefore, my above analysis in Section X.B.2 applies.

214. In view of the above, Beam discloses this element.

3. [59.2]: "each headlamp including at least three directional light sources having different aimings relative to the first vehicle,"

215. In my opinion, there is no patentable difference between [59.2] and [20.2]. *Supra* Section X.B.3. Therefore, my above analysis in Section X.B.3 applies.

(a) Beam discloses this element.

216. In my opinion, Beam discloses this element, [59.2]. Specifically, Beam discloses "an *array* of *individual*, *independently* controllable *microbeam* sources" for example, "light-emitting diodes." EX1005, 8:4-17.

217. Also, Beam discloses "*individually directed narrow-angle beams…microbeams*" and controlling "the intensity, and/or the *angular position*, of one or more narrow-angle *microbeams*." EX1005, 5:61-65, Abstract, FIGS. 2, 5. Each microbeam is a "source" that combines to form the headlamp beam, and the combination of Beam's lamp 202 and SLM 203 and/or array of light sources 401 form many, and at least three directional light sources having different angles (aimings). EX1005, 4:26-59, 5:3-21, FIGS. 2, 4, 5, 6; EX1005, 4:46-48 ("[t]he

angular position or attenuation of *each* of these microbeams is *independently* set by the controller 108").

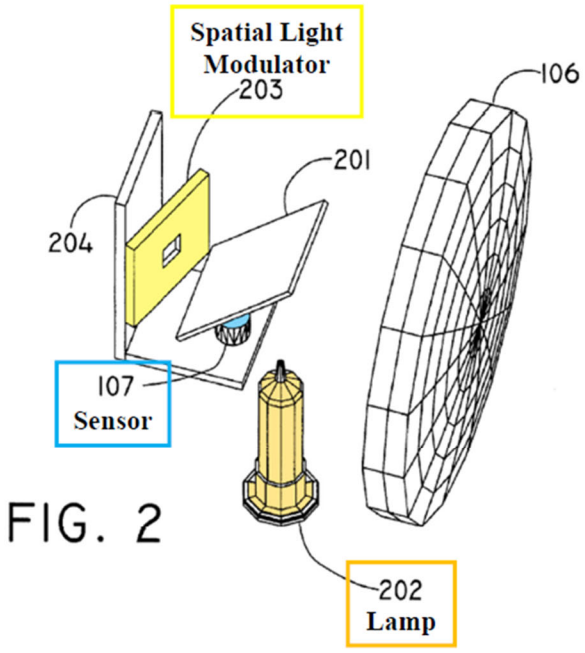


FIG. 2

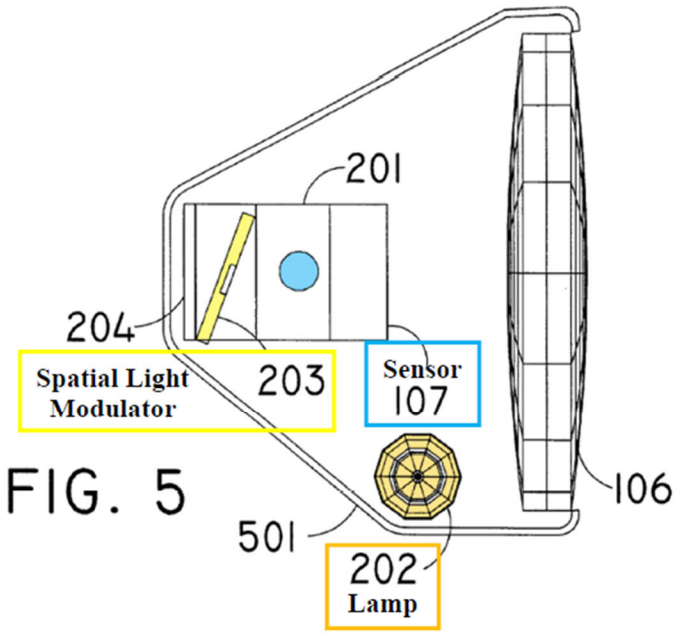


FIG. 5

EX1005, FIGS. 2 and 5 (annotated).

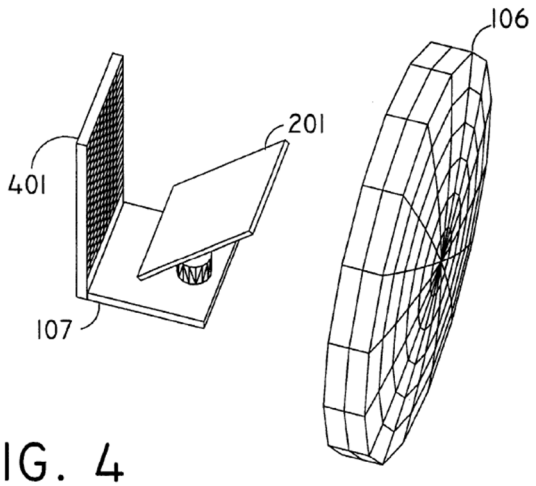


FIG. 4

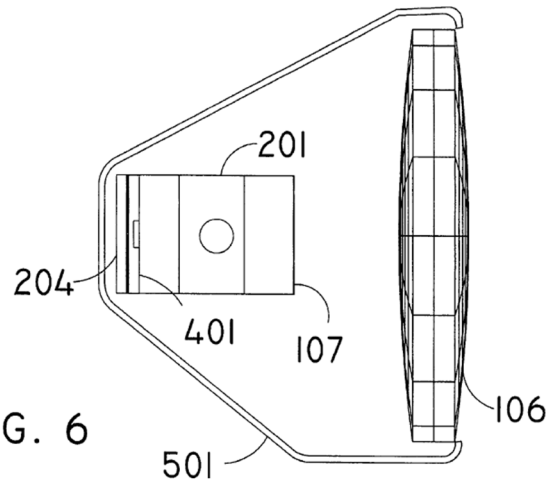


FIG. 6

EX1005, FIGS. 4 and 6.

218. Such directionality results in *directional light sources* that by definition will have different angles, which result in different aimings. So

disclosure that discusses directional light sources with different angles applies the same to disclosure that discusses directional light sources with different aimings.

219. A POSA would have understood that controlling "angular position" of "one or more narrow-angle microbeams" is the same as "directional light sources having different aimings," as the light output from a headlamp is all measured with its light intensity level in an angular distribution. Different aimings means different angular positions. *See* EX1017, 5 ("the adaptive light pattern should support to direct the concentration to the most important zone for the current driving situation"), FIGS. 1, 3-5; EX1018, 4 ("variable aiming"); EX1026, 451 ("[m]ore beams are necessary to match varied driving regions, traffic situations, and driving operations"), 456 ("beam axes of the lamps are aimed at the directions indicated"), FIGS. 1, 3-3; EX1038, 1:12-10:3, FIGS. 1-3; EX1039, 9:16-11:11, FIGS. 1-6; EX1040, 1:16-30, FIGS. 1, 2A-2C; EX1036, 3:52-4:32, FIGS. 2-6.

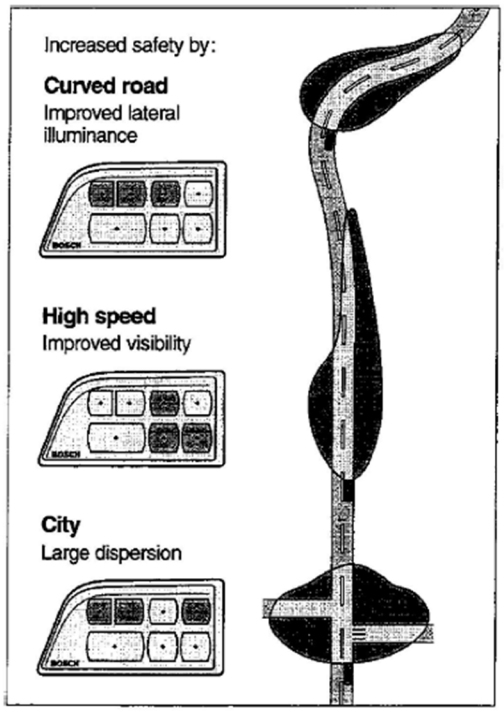


Fig.1: Three standard driving situations with adapted light pattern seen from the bird eye's view.

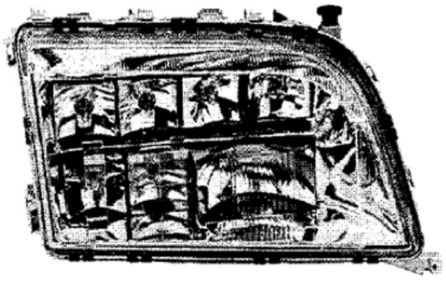
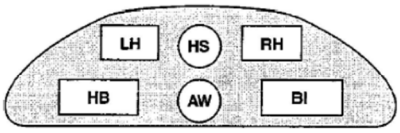


Fig 4: ALP *headlamp* sample



Single components:

LH Left hand bend	**BI** Basic illumination
RH Right hand bend	AW Adverse weather illumination
HB High beam	HS Hot spot

Fig. 5 Advanced ALP sample layout

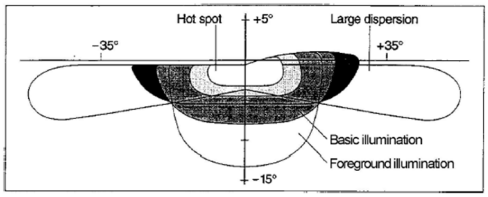


Fig. 3: Light pattern of multiple beam *headlamp* (*Isolux* curves in wall projection):
The individual light *pattern* of multiple sub-units sum up to the total adaptive light pattern

EX1017, FIGS. 1 and 3-5.

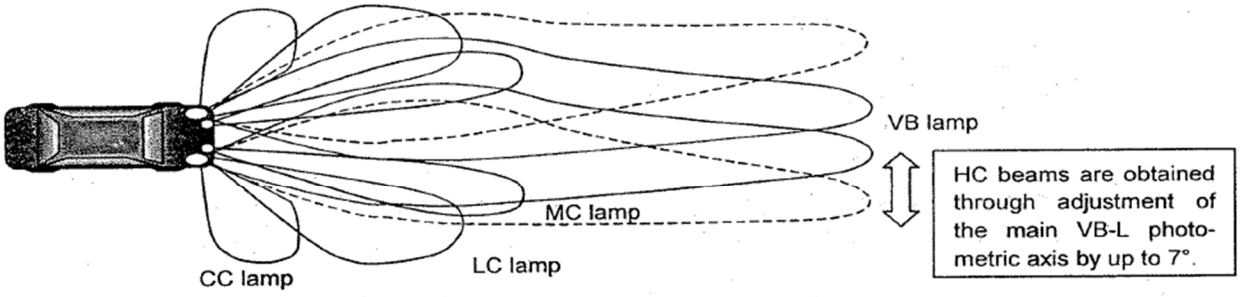
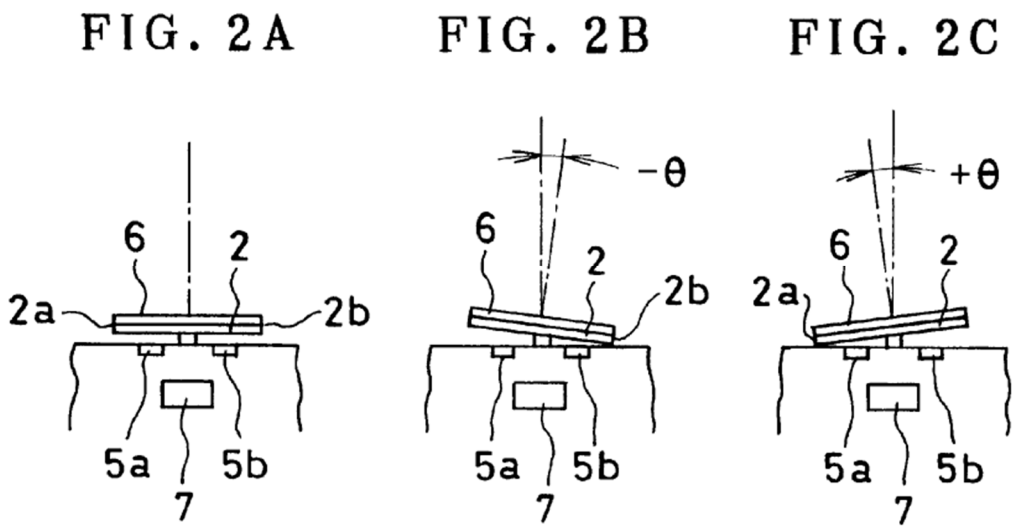


Fig. 3-3: Imaged Illumination Configurations on Road Surface

EX1026, FIG. 3-3.

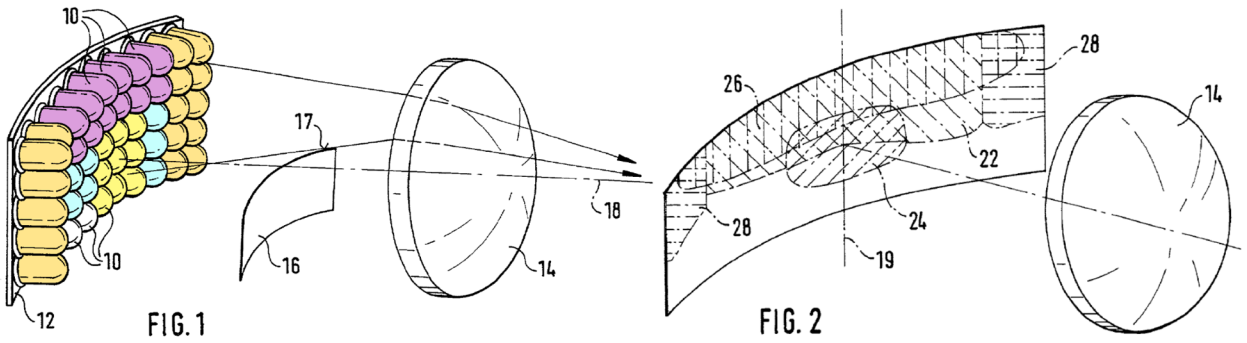


EX1040, FIGS. 2A-2C.

(b) Thominet also discloses this element.

220. If Patent Owner alleges, incorrectly, that Beam does not expressly disclose [59.2], Thominet also discloses [59.2], and it would have been obvious to incorporate Thominet's disclosure into Beam.

221. As explained above (Section X.B.3), Thominet's headlights include independently controllable semiconductor light sources 10 (e.g., LEDs) arranged on curved surface 12 to provide regions 22, 24, 26, 28 with different angles (aimings) for different illumination characteristics. EX1006, ¶¶17-18, 21-26, FIGS. 1, 2. For example, Thominet's region 24 is "in the center" (e.g., first aiming) while regions 28 are "near the lateral edges" (e.g., second, third, etc., multiple aimings). EX1006, ¶¶23, 25, FIGS. 1, 2.



EX1006, FIGS. 1 and 2 (annotated).

222. A POSA would have been motivated to combine Thominet with Beam with a reasonable expectation of success, providing predictable visibility and safety benefits. I provide additional detail, evidence, and explanation of my conclusions below, showing that Beam, alone or combined with Thominet, discloses [59.2].

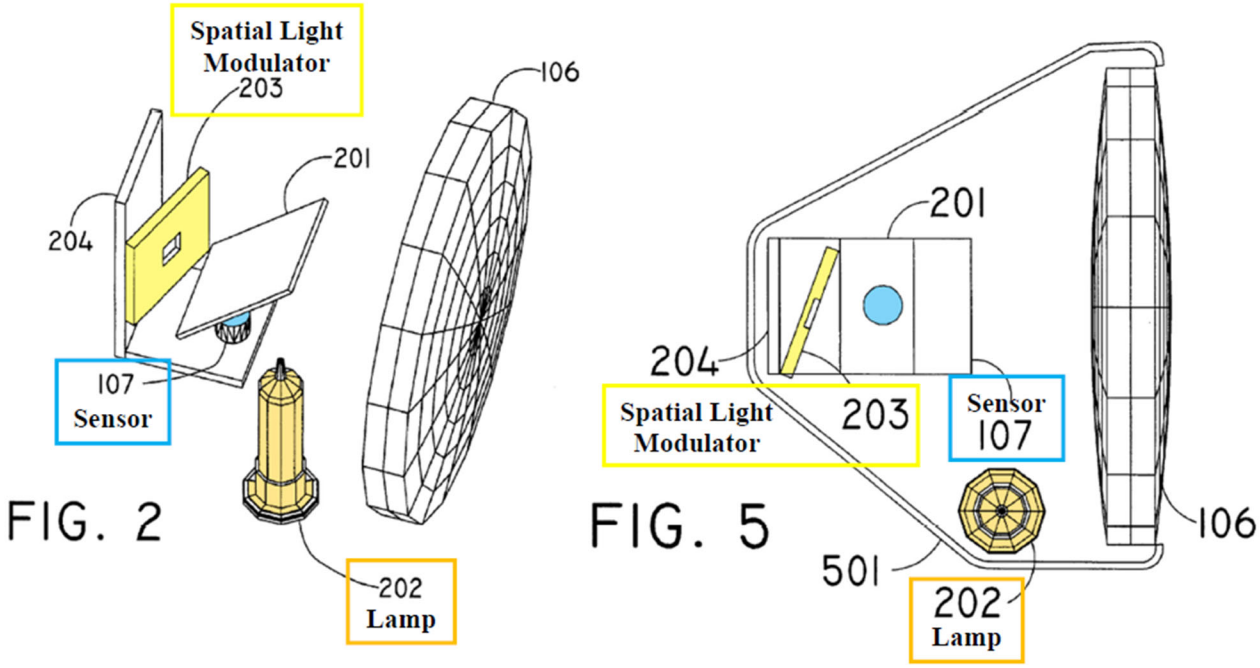
(c) A POSA would have been motivated to combine Beam and Thominet with a reasonable expectation of success.

223. It would have been obvious to a POSA to employ multiple directional beam regions with different angles (aimings) in Beam's system, as in Thominet, to further control Beam's directional microbeams and provide different spatial distributions for improved visibility in different driving situations, thereby improving driver safety—an express purpose of Beam. EX1005, 3:8-14, 3:37-44, 5:33-54, 7:1-13.

224. Beam and Thominet are from the same field—controllable headlamps with dynamic illumination—and include the same building blocks (light sources, sensors, controllers). EX1005, 4:10-59, FIGS. 1, 2, 5; EX1006, ¶¶17-18, 21, 23-26,

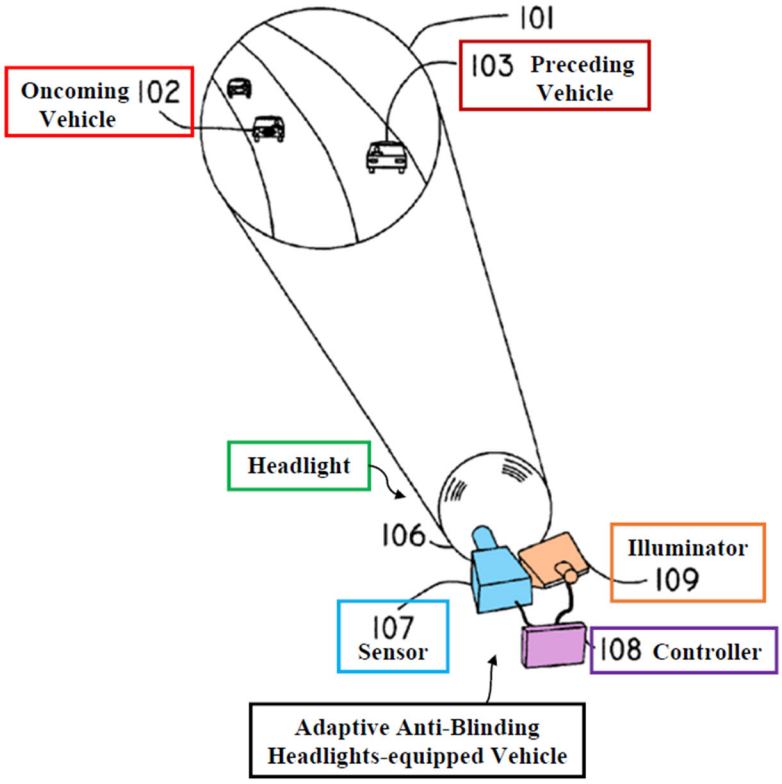
FIGS. 1, 2, 4, 5. Further, improved visibility, thereby increasing safety is paramount in both. EX1005, 1:54-59, 3:8-44, 4:48-59, 6:53-7:13; EX1006, ¶¶3-4, 23.

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



EX1005, FIGS. 2 and 5 (annotated).

226. Indeed, Beam's techniques and system of controlling individual microbeams emphasize safety of all drivers. EX1005, 3:8-44, 6:53-7:13. Controllable headlamps "provide greatly improved safety and comfort to the motoring public," and a "brighter headlight beam while simultaneously protecting…all vehicles ahead," increases safety. EX1005, 3:8-44. Beam enables "the driver to see more clearly at night," while protecting others from glare. EX1005, 3:8-44; EX1005, 4:10-25, 6:9-27.



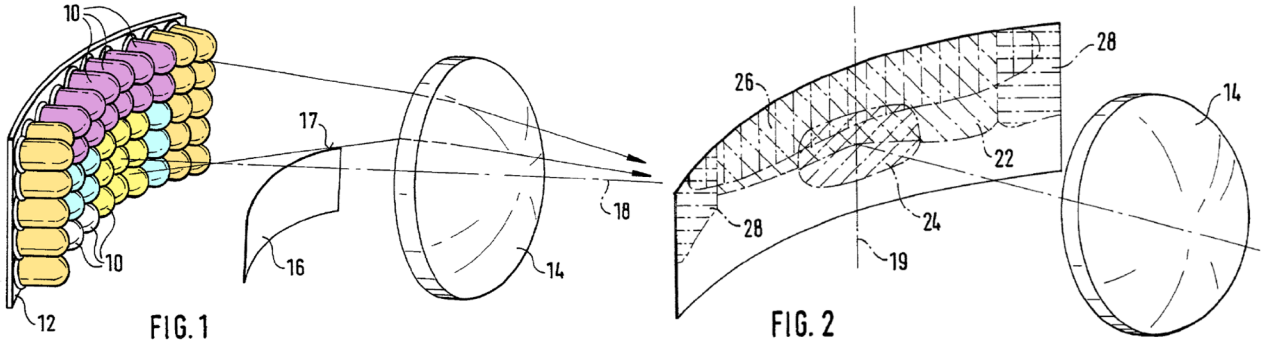
EX1005, FIG. 1 (annotated).

227. Beam's system "*determine[s] the location of light sources* forward of the apparatus and us[es] that information to *control the intensity, and/or the*

angular position, of one or more" microbeams. EX1005, Abstract; EX1005, 4:10-59, 6:9-27, FIGS. 1, 1A-1D, 2. Beam recognizes the safety benefits of different spatial distributions "for conditions like rain, snow, or fog." EX1005, 3:29-36; EX1005, 1:54-59, 4:48-59. If Patent Owner argues, incorrectly, Beam does not expressly disclose "directional light sources having different aimings," even though Beam discloses different angular position control for different microbeams, it would have been obvious to a POSA to use such control for the feature of "different aimings." Combining Thominet with Beam would have made Beam's system more direct, or active, or specifically aimed for different functions, than prior systems, as Beam seeks to do (*see* EX1005, 2:15-22), and further achieves Beam's purpose of improving driver safety.

228. And Thominet's *technique* (software implementation), like Beam, seeks to enhance driver visibility, thereby increasing safety—using multiple directional beam regions to provide different spatial distributions for different functions. EX1006, ¶¶17-18, 21, 23-26, FIGS. 1-2; EX1006, ¶4 ("*characteristic* of the light beam…can be used for *different functions*"), ¶¶5-8. Specifically, Thominet explains that the "characteristic" of the light beam, for example, color, direction, reaching distance, dispersion width, and/or intensity, "can be changed so that it can be used for *different functions*." EX1006, ¶¶3-4, FIGS. 1, 2; *see also* EX1006, ¶¶5-8.

229. Thominet's semiconductor light sources 10 arranged on curved surface 12 provide beam regions 22, 24, 26, 28 with different angles/aimings for different driving situations including for recognizing a counter traffic, thereby improving safety, including driver safety. EX1006, ¶¶7-8, 17-18, 21, 23-26, FIGS. 1, 2; EX1006, ¶7 ("*wider* illumination"), ¶23 ("*improving* the illumination…at high speeds").



EX1006, FIGS. 1-2 (annotated).

230. The additional control (software implementation) of having multiple directional beam regions with different angles/aimings as in Thominet, 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.

231. A POSA would have understood that alternative or additional control for Beam's controller 108/illuminator 109 by using Thominet's different angles (aimings), would have enhanced Beam's system, making it more direct, or active,

or specifically aimed for different functions, by providing different spatial/angular distributions for different driving situations, thereby improving driver safety. Doing so would have merely been applying Thominet's known technique (software implementation: using multiple directional beam regions with different angles/aimings for different functions), to Beam's similar, known device (dynamic AAHB system with controllable microbeams), in the same way. Thominet's known technique is fully described along with its benefits (improved visibility for different functions in different driving situations, thereby increased safety); thus, a POSA would have readily applied it to similar systems, such as Beam's, in the same way.

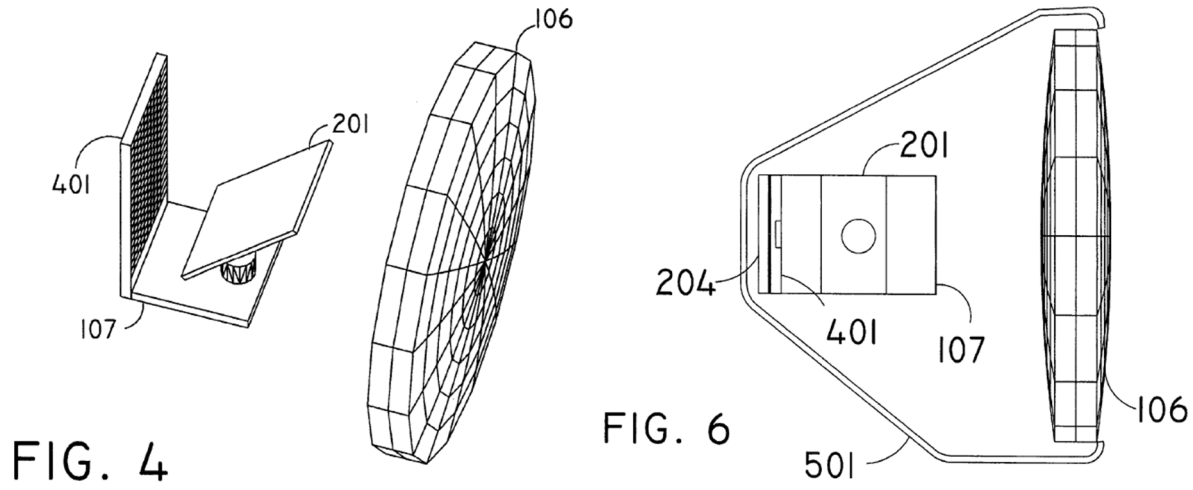
232. A POSA would have had a reasonable expectation of success combining Beam and Thominet, for example, by simply modifying software instructions stored in memory of Beam's controller/processor to organize Beam's array of microbeams into multiple directional beam regions with different angles/aimings for different functions. Overall, this is a simple software implementation.

233. Such modification would have been routine and well within a POSA's skill due to the similarities in Beam's and Thominet's adaptive systems—their common components were well-known and there would have been no limitations for a POSA to make such modification. In applying Thominet's technique to

Beam, a POSA would have simply been applying a known technique (software implementation) in a predictable way—controlling headlights in part based on multiple directional beam regions with different angles/aimings for different functions—as already disclosed in the art.

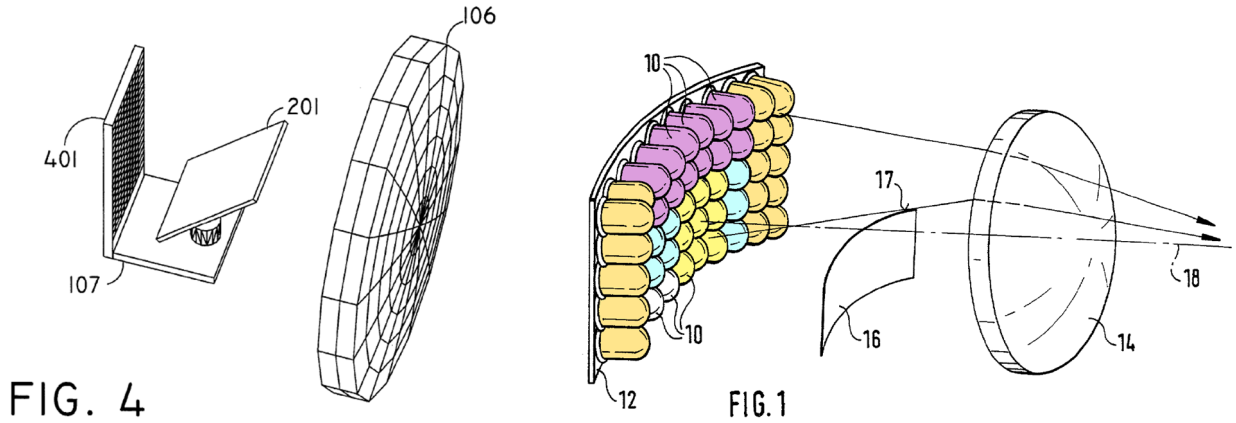
234. *Second*, additionally or alternatively, a POSA would have sought to incorporate *known components* (hardware implementation) of Thominet's semiconductor light sources 10 on curved surface 12 (with differently angled/aimed semiconductor light sources 10 relative to the vehicle, *see* EX1006, ¶¶17-20, 23-26, FIGS. 1-2, 5-7) into Beam's system (with flat array of light sources 401). Again, this would have, like Thominet, provided different spatial distributions for different driving situations (e.g., low visibility, low/high speeds, traffic, curves, etc.), improving visibility and thereby safety. This is a simple hardware combination.

235. Beam discloses an array of light sources 401 (e.g., LEDs) that appears flat in Figures 4 and 6, and has the same functionality as lamp 202 and SLM 203 shown in Figure 2, and each light source is individually controlled. EX1005, 3:62-64, 5:3-16, FIGS. 4, 6; EX1005, 4:26-59 ("*angular* position"), 8:4-17.



EX1005, FIGS. 4 and 6.

236. Through its *system components* (hardware implementation), Thominet, like Beam, seeks to enhance driver visibility and thereby increase safety. Indeed, semiconductor light sources 10 arranged on curved surface 12, with different angles/aimings relative to the vehicle, provide beam regions 22, 24, 26, 28 for different driving situations. EX1006, ¶¶7-8, 17-18, 21, 23-26, FIGS. 1-2.



EX1005, FIG. 4. EX1006, FIG. 1 (annotated).

237. Like the software implementation above, this hardware combination of Beam's array of light sources 401 and Thominet's differently angled/aimed

semiconductor sources 10 on curved surface 12, would have provided Beam's system with different spatial distributions for different driving situations, as in Thominet, thereby improving driver safety. Doing so would have been merely combining prior-art elements or a simple substitution of one known element for another (e.g., Beam's array of light sources 401 on a flat surface and Thominet's semiconductor sources 10 on a curved surface 12) according to known methods (e.g., disclosed in Beam and Thominet) to yield predictable results (e.g., improved visibility and safety). Overall, this is a simple hardware implementation.

238. A POSA would have had a reasonable expectation of success combining Beam and Thominet, for example, by simply modifying the flat surface of Beam's array of light sources 401 with Thominet's curved surface 12 to provide multiple light sources with different angles/aimings relative to the vehicle for different functions (hardware implementation).

239. Such modification would have been routine and well within a POSA's skill due to the similarities in Beam's and Thominet's adaptive systems—their common components were well-known and there would have been no limitations for a POSA to make such modifications. And in combining Beam with Thominet's array of semiconductor sources 10 (e.g., modifying an illuminator), a POSA would have simply been combining known elements according to known methods

(disclosed in Thominet) to yield predictable results (light control for different functions, hardware implementation).

240. In view of the above, Beam, alone or combined with Thominet, discloses or renders obvious this element.

4. [59.3]: "the light sources having one or more controllable illumination characteristics;"

241. In my opinion, there is no patentable difference between [59.3] and [20.3]. *Supra* Section X.B.4. Therefore, my above analysis in Section X.B.4 applies.

242. In view of the above, Beam discloses this element.

5. [59.4]: "one or more sensors configured to sense information,"

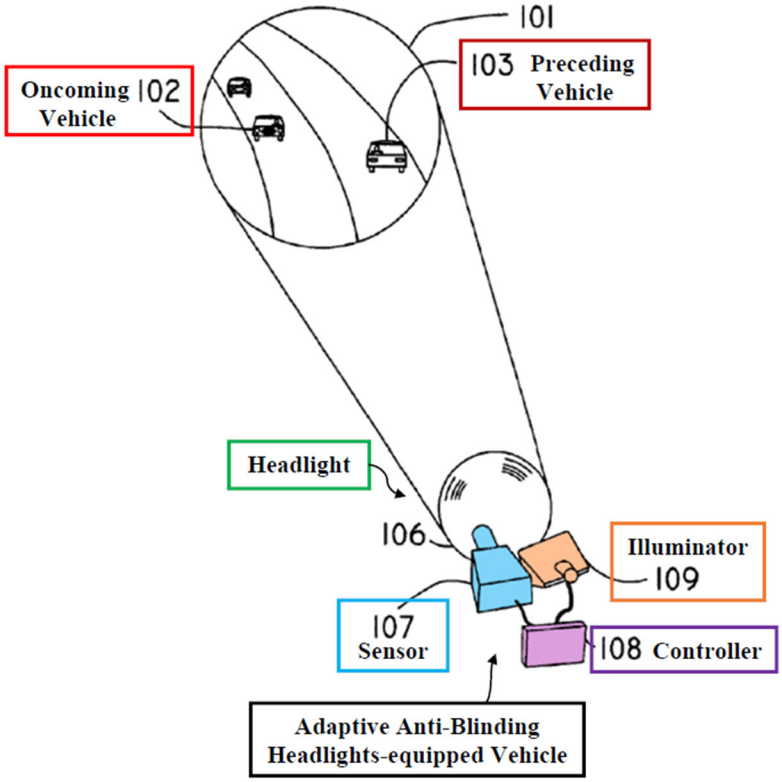
243. [59.4] is identical to [20.6]. *Supra* Section X.B.7.

244. In view of the above, Beam discloses this element.

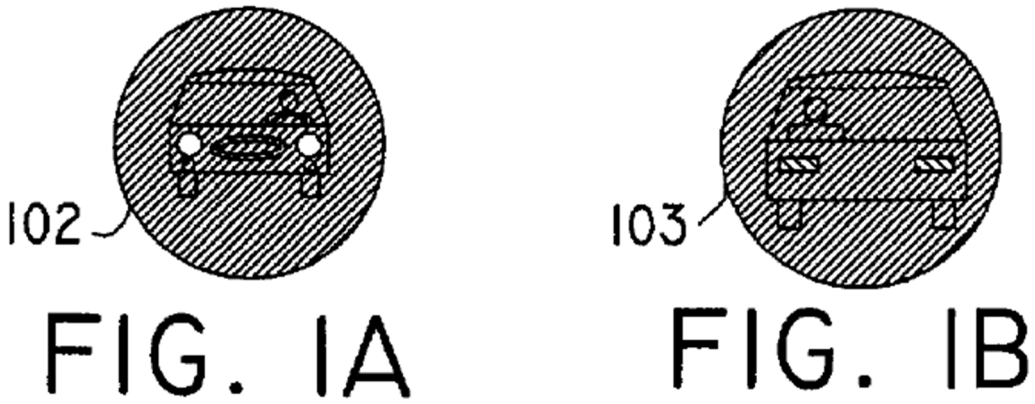
6. [59.5]: "at least a portion of the sensed information indicating a second vehicle, and"

245. As I previously discussed, Beam discloses detecting headlights/taillights of an oncoming/preceding vehicle 102, 103 in a field-of-view 101. EX1005, 4:10-25, FIGS. 1, 1A, 1B; EX1005, 6:14-19 ("*determine[s]* whether there are *illumination sources* (headlights or tail-lights) present"), 5:46-54, 6:11-27. Thus, the spatial sensor data identifies a vehicle within the headlight's field-of-

view (e.g., shaded area). EX1005, 5:33-54, 6:12-27, FIGS. 1A-1D; EX1005, 6:24-27. *See also, supra* Section X.B.8.



EX1005, FIG. 1 (annotated).



EX1005, FIGS. 1A and 1B.

246. In view of the above, Beam discloses this element.

7. [59.6]: "communicate sensor data reflecting the sensed information to at least one processor,"

247. In my opinion, there is no patentable difference between [59.6] and [20.8]. *Supra* Section X.B.9. Therefore, my above analysis in Section X.B.9 applies.

248. In view of the above, Beam discloses this element.

8. [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;"

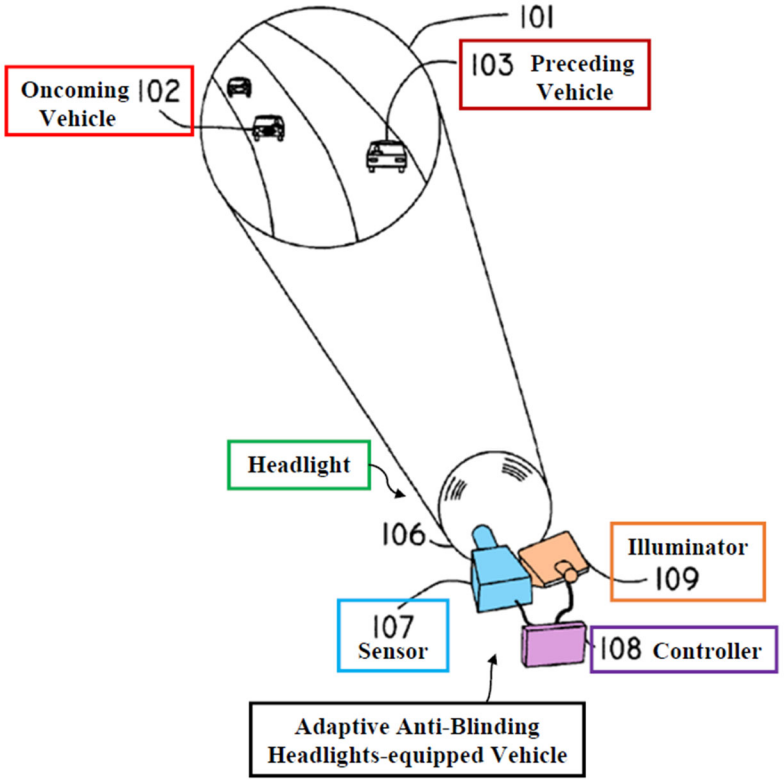
249. In my opinion, there is no patentable difference between [59.7] and [20.9]. *Supra* Section X.B.10. Therefore, my above analysis in Section X.B.10 applies.

250. In view of the above, Beam discloses this element.

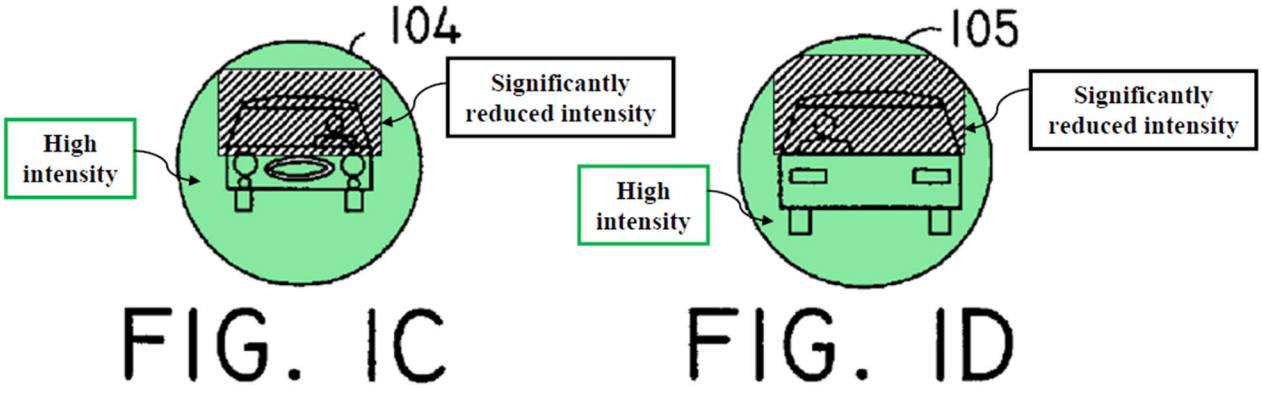
9. [59.8]: "determine light output for the headlight system that aims illumination at the first subsection,"

251. As I previously discussed, Beam discloses illumination in shaded areas is "*significantly less* than with current *low beams*." EX1005, 6:30-33, 2:59-3:3, FIGS. 1, 1C-1D, 7; EX1005, Abstract, 4:21-25 ("*shaded areas* being *reduced significantly*"), 3:8-24. This "aims illumination at the first subsection" (shaded area, first subsection) to prevent glare to other traffic. *See also* EX1017, 5 ("the adaptive light pattern should support to direct the concentration to the most important zone for the current driving situation"), FIGS. 1, 3-5; EX1026, 456

("beam axes of the lamps are aimed at the directions indicated"), FIG. 3-3; EX1030, 3-8, 21-41, 62-69; EX1016, 4-11. *See also, supra* Section X.B.13.



EX1005, FIG. 1 (annotated).



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

252. In view of the above, Beam discloses this element.

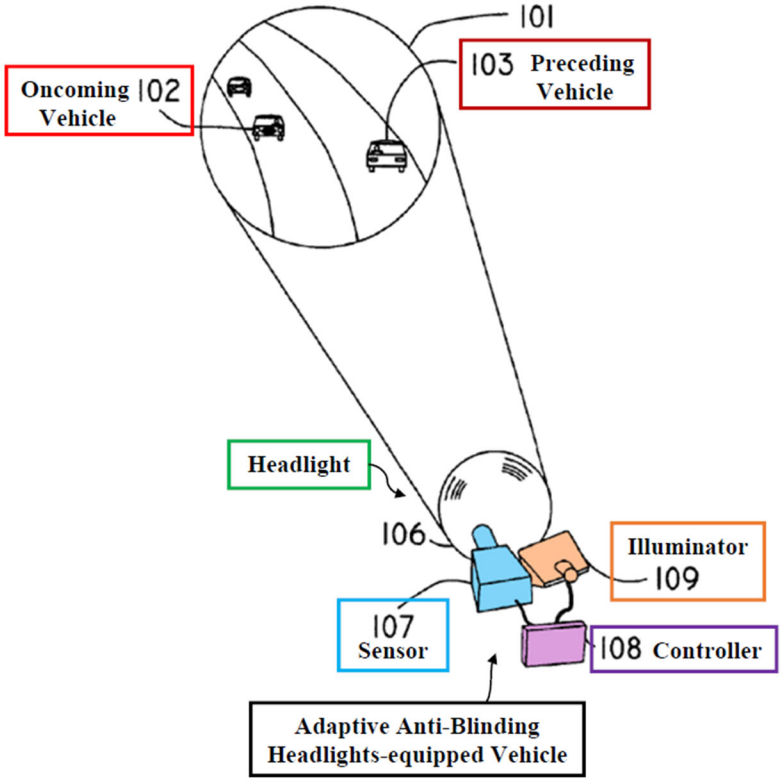
10. [59.9]: "the illumination aimed at the first subsection substantially resulting in light below a first predefined illuminance in the first subsection, and"

(a) Beam discloses this element.

253. In my opinion, Beam discloses this element, [59.9]. Specifically, Beam discloses a "*default* illumination level will be the equivalent of today's *low beams*" and that illumination in *shaded* areas is "*significantly less* than with current *low beams*" (e.g., below the default low beam illuminance level). EX1005, 6:30-33, 2:59-3:3, FIGS. 1, 1C-1D, 7; EX1005, Abstract, 4:21-25 ("illumination in the *shaded areas* being *reduced significantly*"). The first subsection (shaded area) is thus illuminated "below a first predefined illuminance" (below a *low beam* illuminance). A POSA would have understood that Beam's "default illumination level…equivalent of today's low beams" is a "predefined illuminance."

254. As discussed in Section XI.A, the concept of a "default illumination level" or a low beam illumination level would have been known to a POSA. Such default illumination level for driver's visibility and glare light control is defined in all regulations, standards, and automaker's specifications, which is a predefined illumination level in terms of the light intensity distribution in the low beam illuminating area or low beam projected angular section. Therefore, Beam's "default illumination level" is an example of a predefined illumination level. *See also* EX1015, 6 ("discomfort glare…disability glare…to what extent the eye

adaptation and therewith the threshold sensitivity is at a given adaptation luminance"), 18 ("glare reduction and visibility improvement"), FIGS. 2.1, 2.8; EX1017, 5 ("the adaptive light pattern should support to direct the concentration to the most important zone for the current driving situation"), FIGS. 1, 3-5; EX1026, 451, 456, FIGS. 1, 3-3; EX1030, 3-8, 21-41, 49, 62-69, Table 5.5.



EX1005, FIG. 1 (annotated).

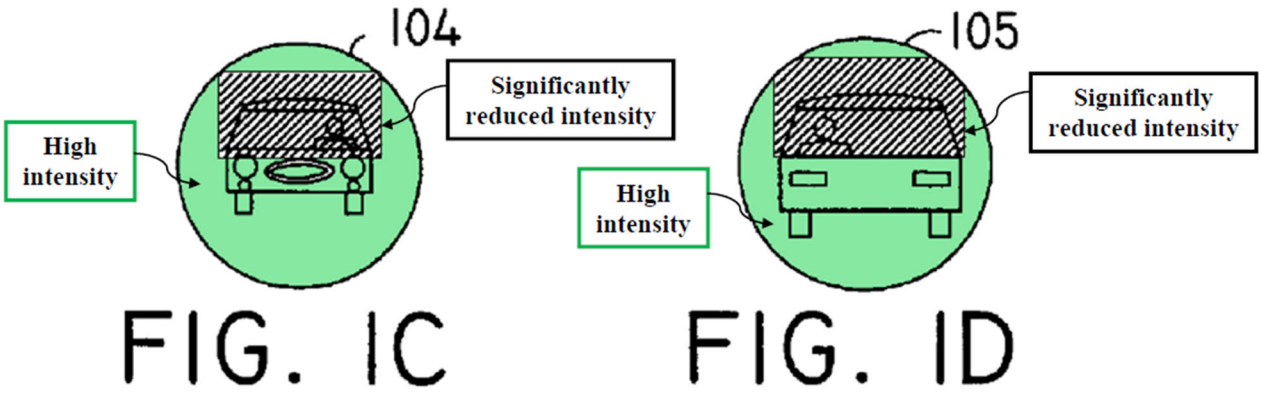
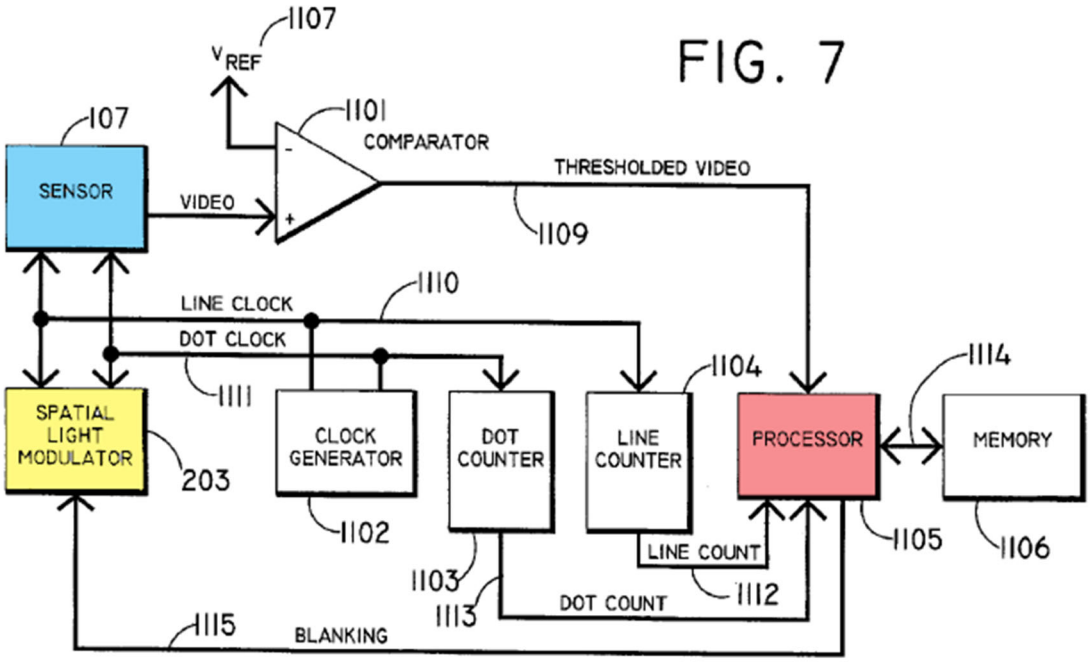
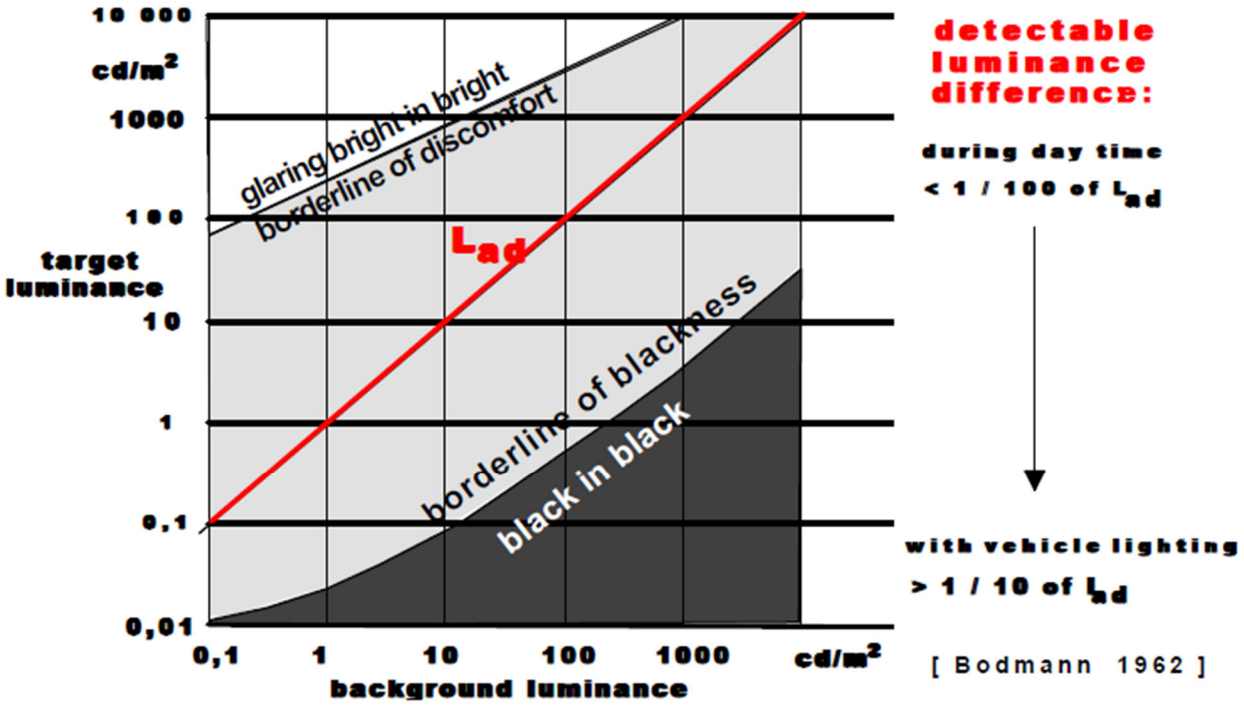


FIG. 1C FIG. 1D

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



EX1005, FIG. 7 (annotated).



EX1015, FIG. 2.1.

Table 5.5. Road illumination requirements for an adaptive lighting system.

Devices	Beam patterns	Visibility on straight (m)	Visibility on curve r=150m (m)	Illuminance (lx)	Angular window for specified visibility (deg.)
Conventional beam	Low beam	58	30	40	--
	High beam	140	--	120	--
AFS	Country	80	--	20	Hor.: -1° to 1° Ver.: -0.75° to 0.3°
	Bending	--	76	6	Hor.: -4° to 35° Ver.: -1° to -0.5°
	High speed	**200**	--	**3**	Hor.: -1° to 1° Ver.: -0.3° to 0°

EX1030, Table 5.5.

(b) Stam also discloses this element.

255. If Patent Owner alleges, incorrectly, that Beam-Thominet does not expressly disclose [59.9], Stam also discloses [59.9], and it would have been obvious to incorporate Stam's disclosure into Beam-Thominet.

256. As explained above (Section XI.A), Stam discloses laws and regulations limit the amount of glare experienced by drivers (e.g., a glare tolerance level or "perceived brightness") and "to *avoid* an illuminance of *0.1 foot candles (fc)* incident on another vehicle…high beam headlamps should be *dimmed within 700 feet* of another vehicle." EX1007, 1:27-32; EX1007, Abstract, 1:14-31, 9:12-10:8, FIG. 11. Thus, Stam defines a "predefined" (e.g., dimmed) illuminance value equal to 0.1 fc (about 1.1 lux[9]) within 700 feet (or 213 meter), corresponding to the "predefined illuminance" recited in [59.9].

257. Stam provides a specific "predefined illuminance" value based on a dimmed illuminance to reduce glare, and indeed driver visibility and safety are paramount in Stam. EX1005, 3:8-44, 5:33-54, 6:53-7:13; EX1007, 1:14-31, 1:25-27. In fact, Stam explains there are laws and regulations governing the amount of glare experienced by drivers and thus discloses techniques to reduce glare. EX1007, 1:14-31, 9:12-10:8, Abstract, 58:11-33.

[9] 1 foot-candle (fc) is equal to 10.7639 lux.

258. Stam's predefined dimmed illuminance (*see* EX1007, Abstract, 1:14-31, 9:12-10:8) is tied to particular glare reduction techniques and the relationship between such reduction and laws and regulations governing the amount of glare experienced by drivers.

259. Stam further discloses the "predefined illuminance" quantitatively (even though this claim element does not), based on regulation requirements. As I previously explained throughout this declaration, a POSA would have understood that the headlamp beam patterns would have a quantitatively defined illuminance level either based on regulations or based on automaker's specifications that often are above the regulations (with higher illuminance level for visibility and lower illuminance level for glare light control, comparing to the regulations).

260. A POSA would have been motivated to combine Stam with Beam-Thominet with a reasonable expectation of success, providing predictable visibility and safety benefits. I provide additional detail, evidence, and explanation of my conclusions below, showing that Beam (with Thominet), or combined with Stam, discloses [59.9].

(c) A POSA would have been motivated to combine Beam, Thominet, and Stam with a reasonable expectation of success.

261. As described in Section X.A, a POSA would have been motivated to combine Beam-Thominet. It would have been obvious to a POSA to provide a

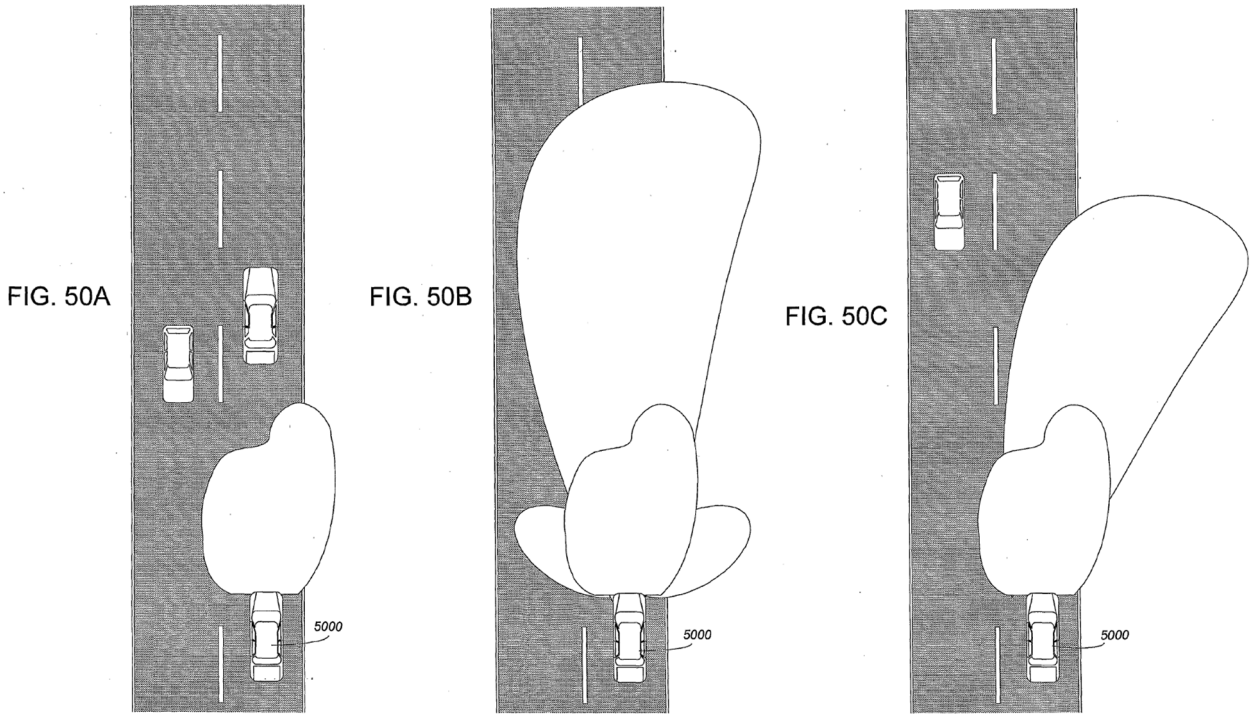
clarified or quantitative predefined dimmed (low beam) illuminance level in the combined Beam-Thominet system, as in Stam, to further control the precision of the intensity of Beam's directional microbeams to prevent glare, furthering the purpose of improving driver safety. EX1005, 3:8-14, 3:37-44, 5:33-54, 7:1-13.

262. *First*, including an additional control technique for Beam-Thominet's controller—Stam's *known technique* of using a predefined dimmed illuminance—would have enhanced Beam-Thominet's system by determining illuminance below or above a quantified-illuminance measured glare threshold level (e.g., 0.1 fc), increasing safety and preventing glare. *Second*, a POSA would have easily incorporated this *known feature* of Stam (e.g., predefined dimmed illuminance, *see* EX1007, Abstract, 1:14-31, 4:7-15, 9:12-10:8, FIGS. 11, 50A-50C) into Beam-Thominet's system (e.g., with controller 108 and/or illuminator 109). This would have, like Stam, provided a predefined glare threshold, below and above which illuminance could be adjusted for desired areas, further improving safety.

263. Stam and Beam-Thominet are from the same field—controllable headlamps with dynamic illumination—and include the same building blocks (e.g., light sources, sensors, controllers). Like Beam-Thominet, driver safety is also paramount in Stam. EX1005, 3:8-44, 5:33-54, 6:53-7:13; EX1007, 1:14-31, 1:25-27. If Patent Owner argues, incorrectly, Beam-Thominet does not expressly

disclose a predefined illuminance level, it would have been obvious to a POSA to do so.

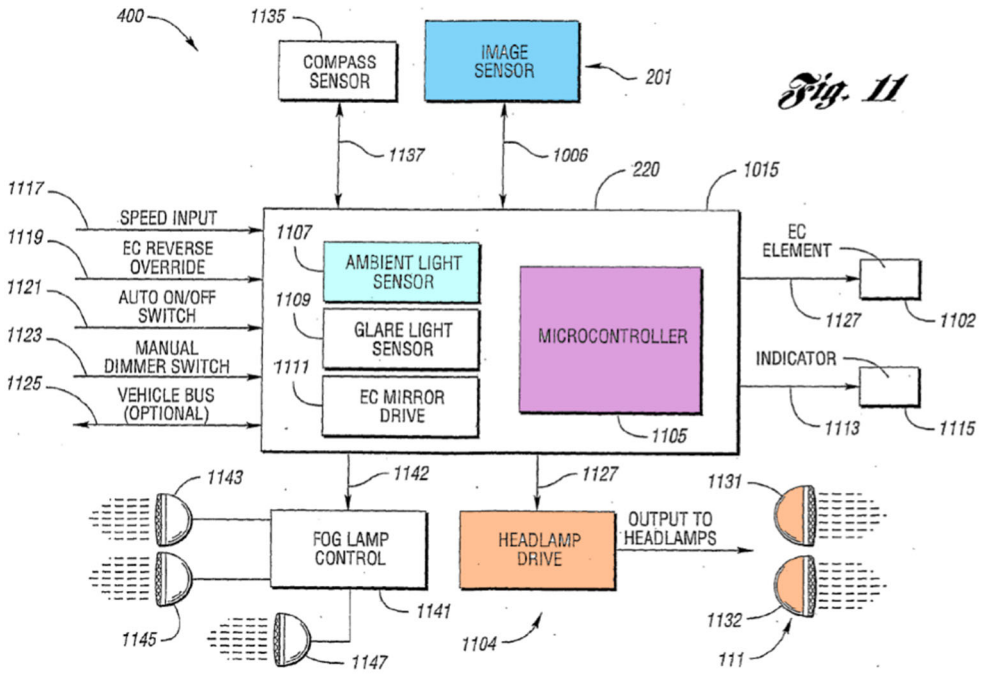
264. Stam's *technique*, like Beam-Thominet, seeks to enhance driver comfort and safety—using a predefined dimmed illuminance to reduce glare. EX1007, Abstract, 1:14-31, 9:12-10:8, FIGS. 50A-50C. Stam discloses "to *avoid an illuminance of 0.1 foot candles (fc)* incident on another vehicle…headlamps should be *dimmed within 700 feet* of another vehicle." EX1007, 1:25-27, 1:14-31 ("control the amount of *glare*"), 9:12-10:8, 58:11-33, FIG. 11.



EX1007, FIGS. 50A-50C.

265. Stam's headlight control system uses an image sensor and controller to automatically adjust intensity, aim, and/or focus of exterior lights to generate beam

patterns that maximize the illuminated area without excessive glare. EX1007, Abstract, 9:12-10:8, 73:13-16, 77:30-78:17, FIGS. 3, 11, 13, 14, 19, 20, 26a, 27, 28, 33, 50A-50C. Stam also discloses an ambient light sensor 1107 can have one or more predefined light level thresholds to vary the headlamps' beam pattern and intensity when the ambient light level is above or below a light level threshold. EX1007, 4:7-15, 30:12-31:16, 48:20-26, FIGS. 11, 14.



EX1007, FIG. 11 (annotated).

266. A POSA would have understood that additional control for Beam-Thominet's controller/illuminator from Stam's predefined dimmed illuminance, would have enhanced Beam-Thominet's system by providing more accurate illumination control referenced to a predefined value to prevent glare, thereby improving driver safety. Doing so would have merely been applying Stam's known

technique (using a predefined dimmed illuminance) to Beam-Thominet's similar, known device (dynamic headlamp system with controllable beams), in the same way. Stam's known technique is fully described along with its benefits (e.g., improved safety); thus, a POSA would have readily applied it to similar systems, such as Beam-Thominet's, in the same way.

267. Additionally, or alternatively, such a modification would have been simply combining prior art elements (e.g., Beam-Thominet's adaptive, direction-controllable headlamps and Stam's predefined dimmed illumination) according to known methods (e.g., disclosed in Beam-Thominet and Stam) to yield predictable results (e.g., reduced glare, improving safety).

268. A POSA would have had a reasonable expectation of success combining Beam-Thominet and Stam. A POSA would have understood *how* to combine their disclosures, for example, by simply storing a specific dimmed illuminance value (e.g., 0.1 fc within 700 feet) in memory of Beam-Thominet's controller/processor in order for the controller/processor to output Beam's headlamp illumination below and above that value (e.g., glare threshold level) for respective illumination areas.

269. Such modification would have been routine and well within a POSA's skill due to the similarities in Beam-Thominet's and Stam's adaptive systems—their common components were well-known and there would have been no

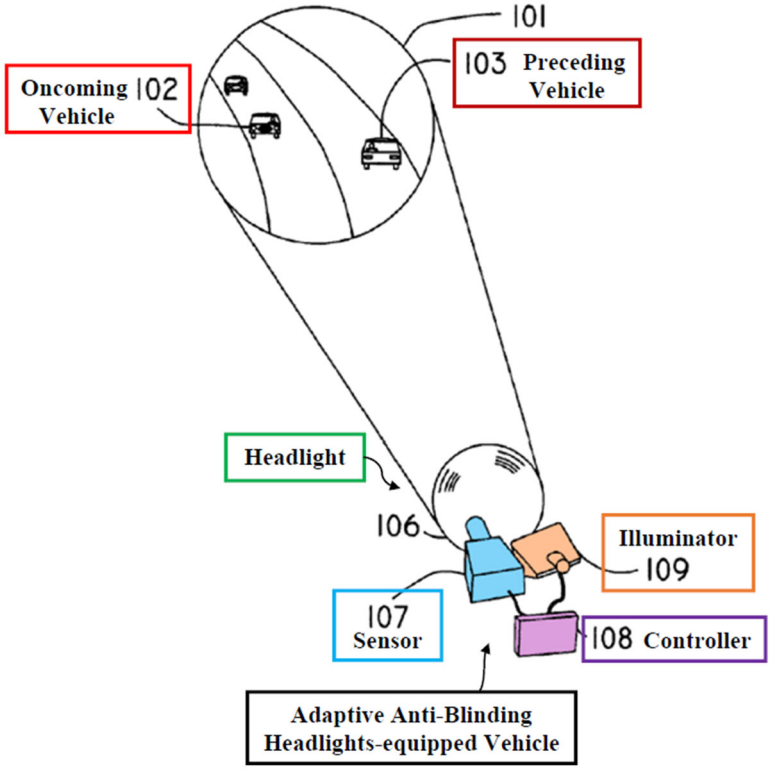
limitations for a POSA to make such a modification. In applying Stam's technique to Beam-Thominet, a POSA would have simply been applying a known technique in a predictable way—controlling headlights in part based on a predefined dimmed illuminance—as already disclosed in the art.

270. In view of the above, Beam (with Thominet), or in combination with Stam, discloses or renders obvious this element.

11. [59.10]: "that aims illumination at one or more second subsections of the field of view to either side of the first subsection,"

271. Beam discloses "*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 f[u]ll intensity elsewhere*." EX1005, 3:20-24, 2:59-3:3, FIGS. 1, 1C, 1D, 7; EX1005, 6:40-44 ("*bright high beams*"), 6:11-12 ("*maximum intensity*"), 1:5-18 ("eliminating the blinding of a driver in an oncoming vehicle, while continuing to provide *intense forward illumination*"), 6:53-55. Beam thus "aims" the illumination at the different subsections. As shown in Figures 1C and 1D of Beam, reproduced and annotated below, Beam's system "aims illumination" of higher brightness (non-shaded areas, second subsection) to both sides of the first subsection (shaded area) of the field of view. EX1005, 4:10-59, FIGS. 1C-1D; *see also* EX1017, 5 ("the adaptive light pattern should support to direct the concentration to the most important zone for the current driving

situation"), FIGS. 1, 3-5; EX1025, 205 ("having the ability to fixate much farther with moveable GDLs [gas discharge lamps] the driver actually uses this to achieve information about the scenery ahead"), FIG. 18; EX1026, 451 ("[m]ore beams are necessary to match varied driving regions"), 456 ("beam axes of the lamps are aimed at the directions indicated"), FIGS. 1, 3-3.



EX1005, FIG. 1 (annotated).

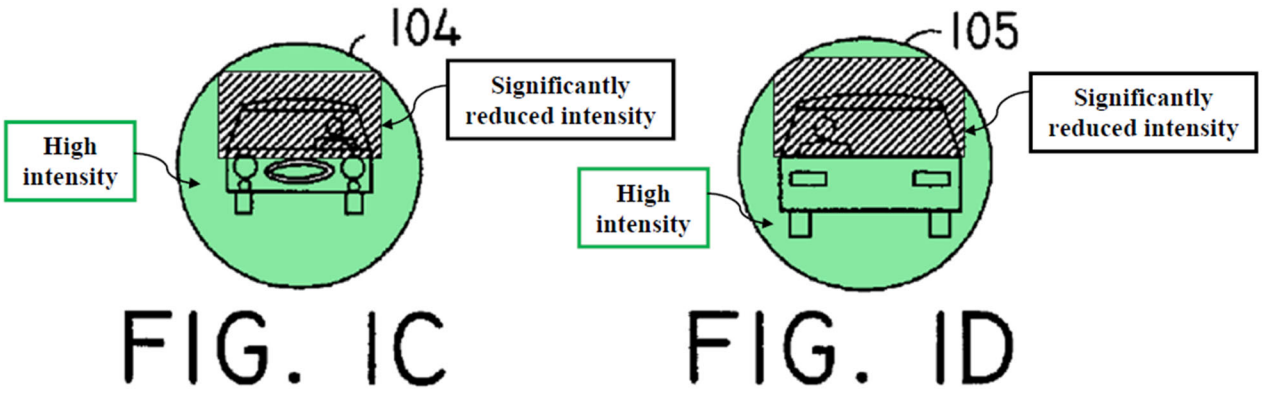
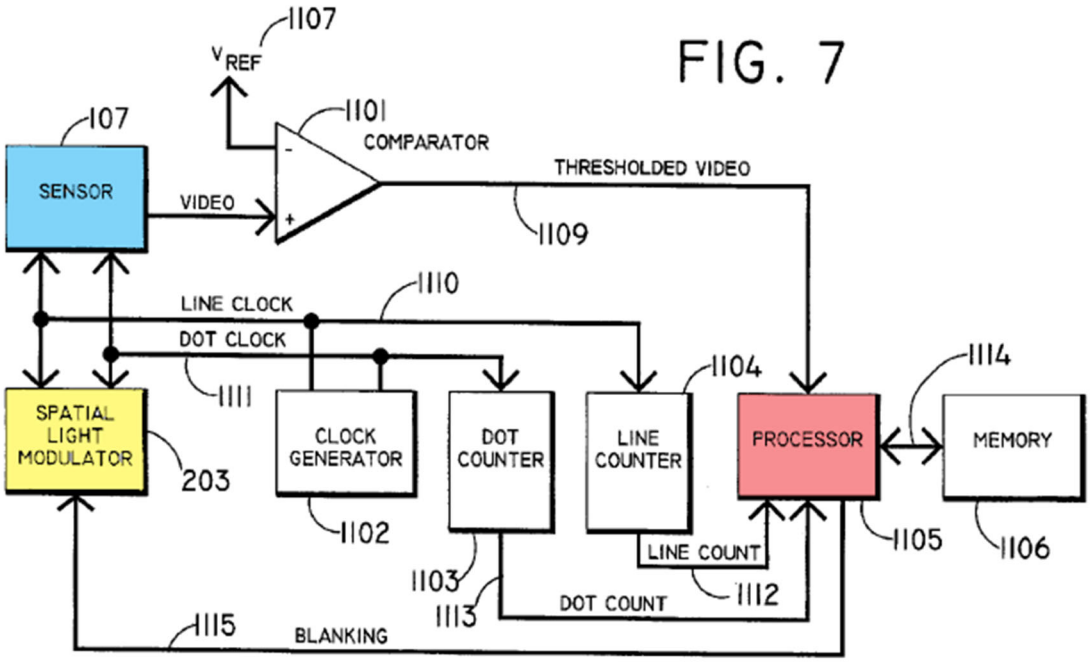


FIG. IC FIG. ID

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



EX1005, FIG. 7 (annotated).

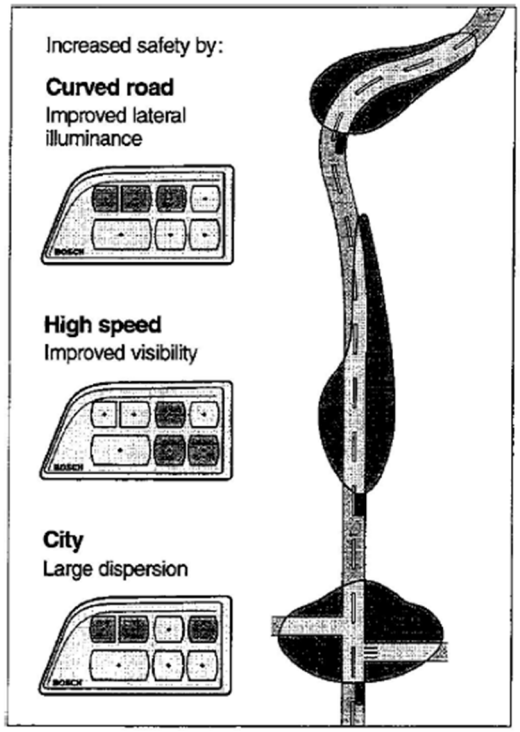


Fig.1: Three standard driving situations with adapted light pattern seen from the bird eye's view.

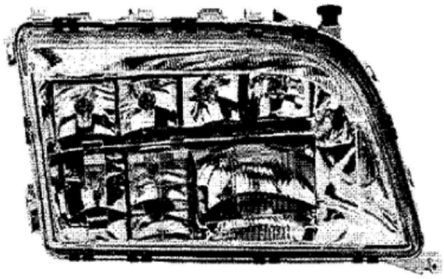
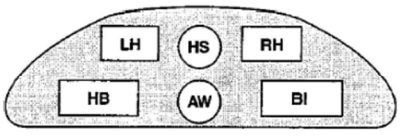


Fig 4: ALP *headlamp* sample



Single components:

LH Left hand bend	**BI** Basic illumination
RH Right hand bend	AW Adverse weather illumination
HB High beam	HS Hot spot

Fig. 5 Advanced ALP sample layout

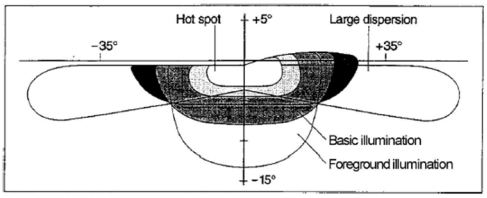


Fig. 3: Light pattern of multiple beam *headlamp (Isolux* curves in wall projection):
The individual light *pattern* of multiple sub-units sum up to the total adaptive light pattern

EX1017, FIGS. 1 and 3-5.

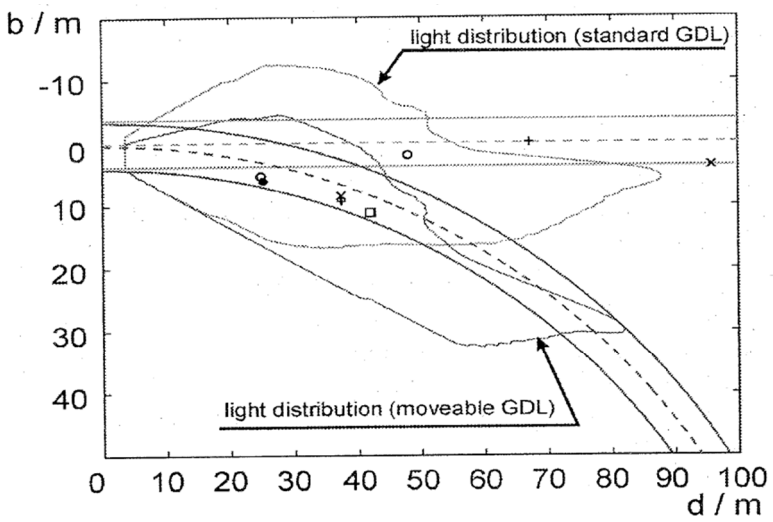


Figure 18: Fixation distance accumulation points (FDAP) for different headlamp systems and different road parts.
Accumulation points: X: *daylight*
○: *standard halogen*
●: *moveable halogen*
+: *standard gas discharge*
□: *moveable gas discharge*

EX1025, FIG. 18.

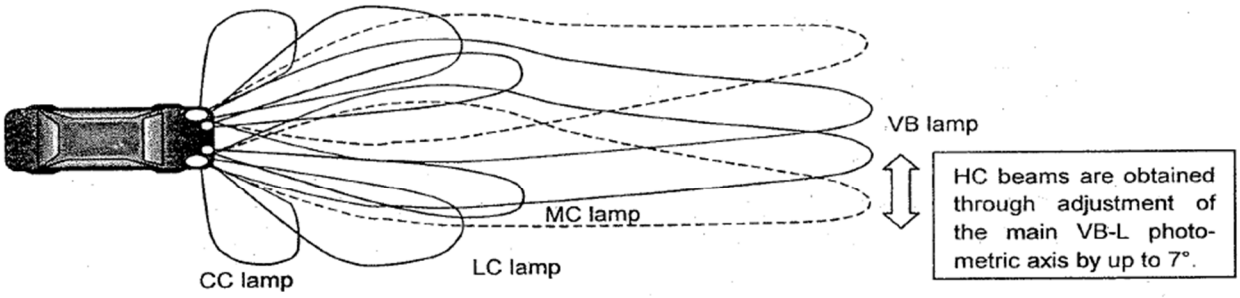


Fig. 3-3: Imaged Illumination Configurations on Road Surface

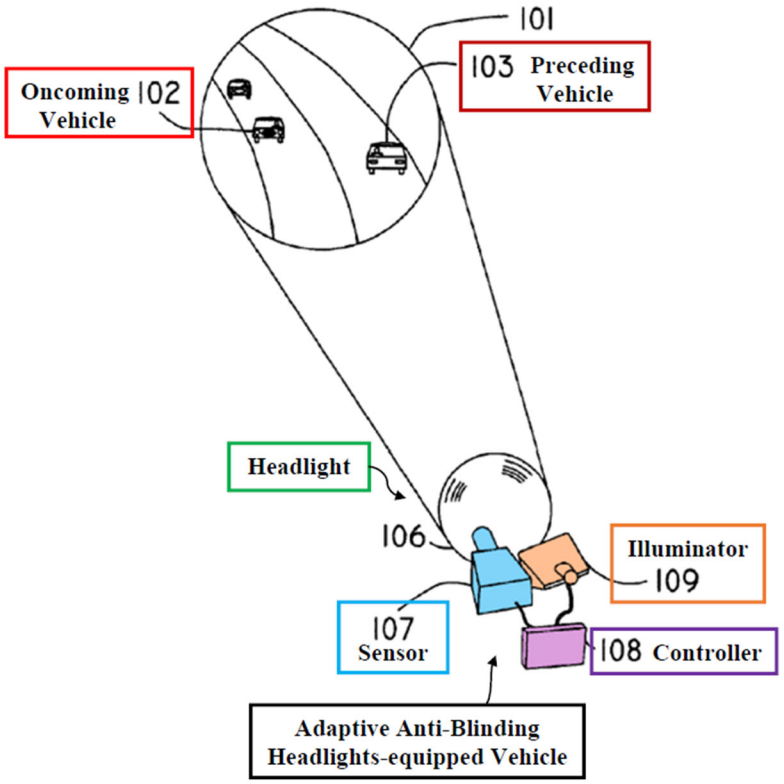
EX1026, FIG. 3-3.

272. In view of the above, Beam discloses this element.

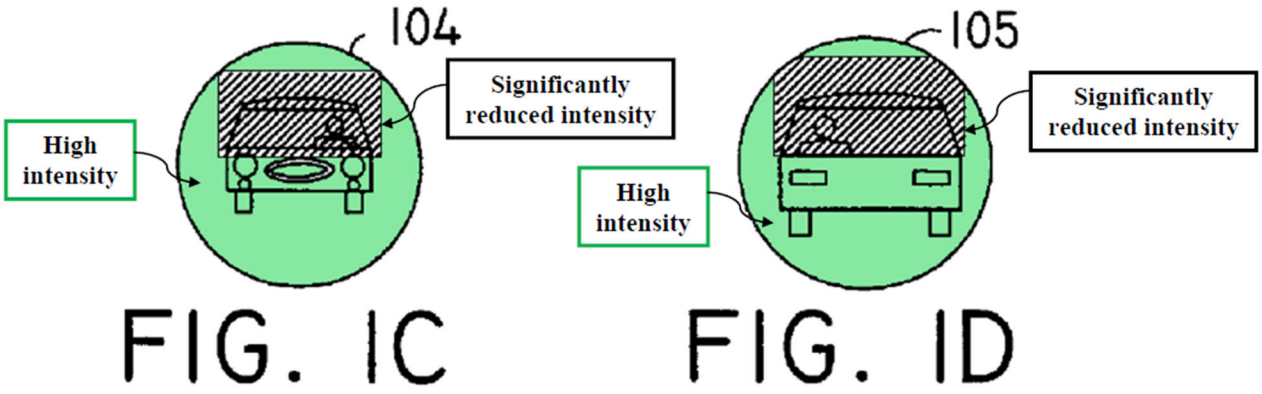
12. [59.11]: "the illumination aimed at the one or more second subsections substantially resulting in light above the first predefined illuminance in the one or more second subsections; and"

(a) Beam discloses this element.

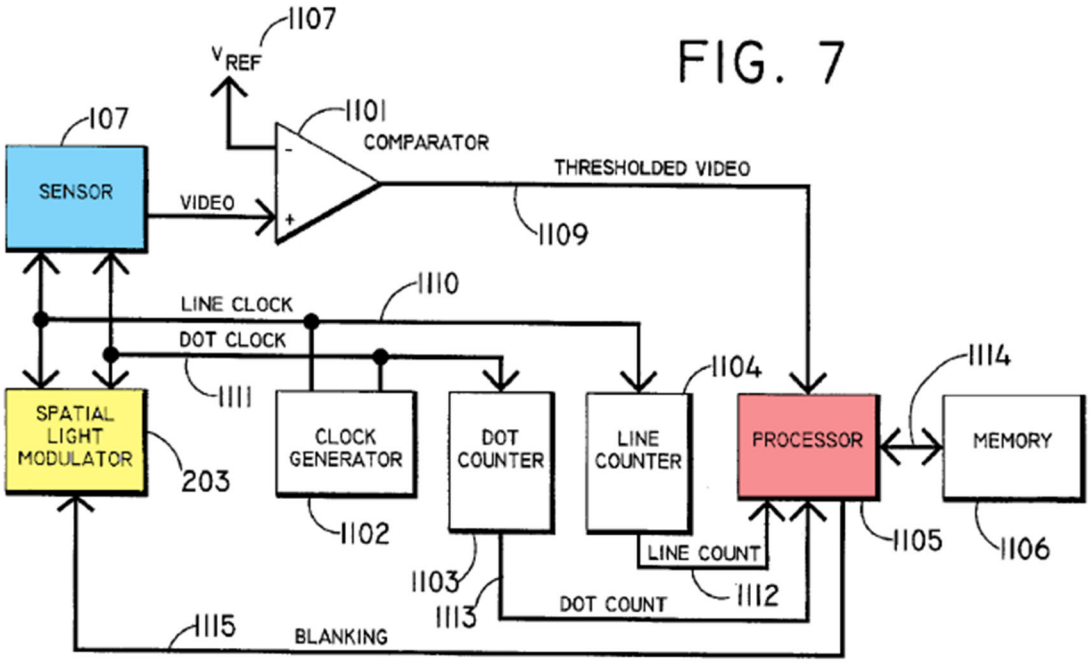
273. In my opinion, Beam discloses this element, [59.11]. Specifically, Beam discloses a "*default* illumination level will be the equivalent of today's *low beams*" and that illumination in *non-shaded* areas is "at *maximum* intensity" and "like having bright *high beams*" (e.g., above the default low beam illuminance level). EX1005, 6:30-33, 6:11-12, 6:40-44, FIGS. 1, 1C-1D, 7; EX1005, 2:59-3:3 ("*maintaining f[u]ll intensity elsewhere*"), 6:53-56 ("*high beam headlights or brighter*"). The second subsections (non-shaded areas) are thus illuminated "above the first predefined illuminance" (above a *low beam* illuminance). A POSA would have understood that Beam's "default illumination level…equivalent of today's low beams" is a "predefined illuminance." *See also* EX1015, 6 ("discomfort glare…disability glare…to what extent the eye adaptation and therewith the threshold sensitivity is at a given adaptation luminance"), 18 ("glare reduction and visibility improvement"), FIGS. 2.1, 2.8; EX1017, 5 ("the adaptive light pattern should support to direct the concentration to the most important zone for the current driving situation"), FIGS. 1, 3-5; EX1026, 451, 456, FIGS. 1, 3-3; EX1030, 3-8, 21-41, 49, 62-69, Table 5.5.



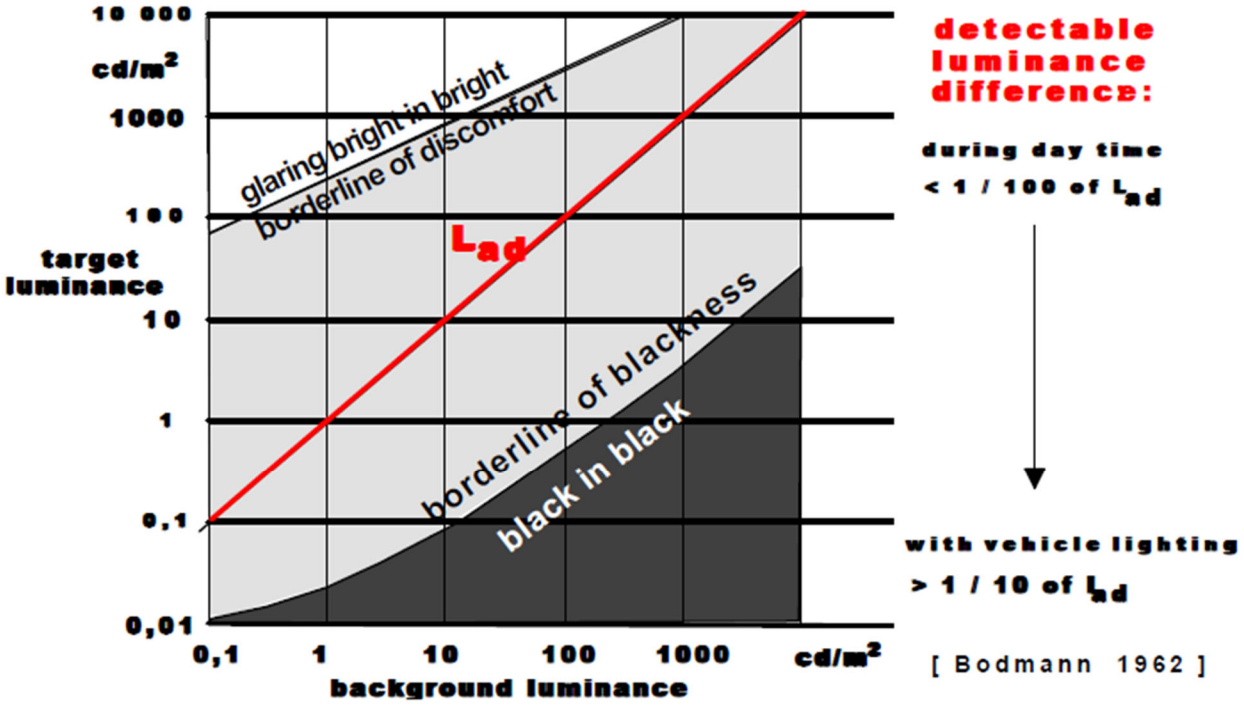
EX1005, FIG. 1 (annotated).



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



EX1005, FIG. 7 (annotated).



EX1015, FIG. 2.1.

Table 5.5. Road illumination requirements for an adaptive lighting system.

Devices	Beam patterns	Visibility on straight (m)	Visibility on curve r=150m (m)	Illuminance (lx)	Angular window for specified visibility (deg.)
Conventional beam	Low beam	58	30	40	--
	High beam	140	--	120	--
AFS	Country	80	--	20	Hor.: -1° to 1° Ver.: -0.75° to 0.3°
	Bending	--	76	6	Hor.: -4° to 35° Ver.: -1° to -0.5°
	High speed	**200**	--	**3**	Hor.: -1° to 1° Ver.: -0.3° to 0°

EX1030, Table 5.5.

(b) Stam also discloses this element.

274. If Patent Owner alleges, incorrectly, that Beam-Thominet does not expressly disclose [59.11], Stam also discloses [59.11], and it would have been obvious to incorporate Stam's disclosure into Beam-Thominet.

275. As explained above (Section XI.A), Stam discloses laws and regulations limit the amount of glare experienced by drivers (e.g., a glare tolerance level or "perceived brightness") and "to *avoid* an illuminance of *0.1 foot candles (fc)* incident on another vehicle…high beam headlamps should be *dimmed within 700 feet* of another vehicle." EX1007, 1:27-32; EX1007, Abstract, 1:14-31, 9:12-10:8, FIG. 11. Thus, Stam defines a "predefined" (dimmed) illuminance value

equal to 0.1 fc (about 1.1 lux[10]) within 700 feet, corresponding to the "predefined illuminance" recited in [59.11].

276. Stam provides a specific "predefined illuminance" value based on a dimmed illuminance to reduce glare, and indeed driver visibility and safety are paramount in Stam. EX1005, 3:8-44, 5:33-54, 6:53-7:13; EX1007, 1:14-31, 1:25-27. In fact, Stam explains there are laws and regulations governing the amount of glare experienced by drivers and thus discloses techniques to reduce glare. EX1007, 1:14-31, 9:12-10:8, Abstract, 58:11-33.

277. Stam's predefined dimmed illuminance (*see* EX1007, Abstract, 1:14-31, 9:12-10:8) is tied to particular glare reduction techniques and the relationship between such reduction and laws and regulations governing the amount of glare experienced by drivers.

278. Stam further discloses the "predefined illuminance" quantitatively (even though this claim element does not), based on regulation requirements. As I previously explained throughout this declaration, a POSA would have understood that the headlamp beam patterns would have a quantitatively defined illuminance level either based on regulations or based on automaker's specifications that often

[10] 1 foot candle (fc) is equal to 10.7639 lux.

are above the regulations (with higher illuminance level for visibility and lower illuminance level for glare light control comparing to the regulations).

279. A POSA would have been motivated to combine Stam with Beam-Thominet with a reasonable expectation of success, providing predictable visibility and safety benefits. I provide additional detail, evidence, and explanation of my conclusions below, showing that Beam (with Thominet), or combined with Stam, discloses [59.11].

(c) A POSA would have been motivated to combine Beam, Thominet, and Stam with a reasonable expectation of success.

280. As described in Section X.A, a POSA would have been motivated to combine Beam-Thominet. It would have been obvious to a POSA to provide a predefined dimmed (low beam) illuminance level in the combined Beam-Thominet system, as in Stam, to further control an intensity of Beam's directional microbeams to prevent glare, furthering the purpose of improving driver safety. EX1005, 3:8-14, 3:37-44, 5:33-54, 7:1-13.

281. *First*, including an additional control technique for Beam-Thominet's controller—Stam's *known technique* of using a predefined dimmed illuminance—would have enhanced Beam-Thominet's system by determining illuminance below or above a glare threshold level, increasing safety and preventing glare. *Second*, a POSA would have easily incorporated these *known features* of Stam (e.g.,

predefined dimmed illuminance, *see* EX1007, Abstract, 1:14-31, 4:7-15, 9:12-10:8, FIGS. 11, 50A-50C) into Beam-Thominet's system (e.g., with controller 108 and/or illuminator 109). This would have, like Stam, provided a predefined glare threshold, below and above which illuminance could be adjusted for different areas, further improving safety.

282. Stam and Beam-Thominet are from the same field—controllable headlamps with dynamic illumination—and include the same building blocks (e.g., light sources, sensors, controllers). Like Beam-Thominet, driver safety is also paramount in Stam. EX1005, 3:8-44, 5:33-54, 6:53-7:13; EX1007, 1:14-31, 1:25-27. Beam-Thominet does not expressly disclose a predefined illuminance level, but it would have been obvious to a POSA to do so.

283. Stam's *technique*, like Beam-Thominet, seeks to enhance driver comfort and safety—using a predefined dimmed illuminance to reduce glare. EX1007, Abstract, 1:14-31, 9:12-10:8, FIGS. 50A-50C. Stam discloses "to *avoid an illuminance of 0.1 foot candles (fc)* incident on another vehicle…headlamps should be *dimmed within 700 feet* of another vehicle." EX1007, 1:25-27, 1:14-31 ("control the amount of *glare*"), 9:12-10:8, 58:11-33, FIG. 11.

FIG. 50A

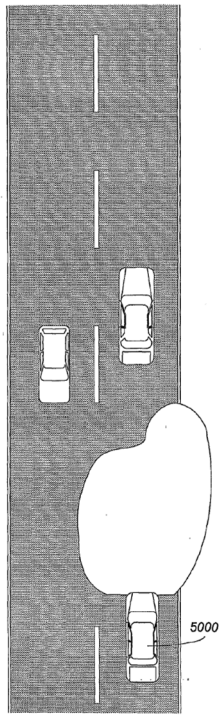


FIG. 50B

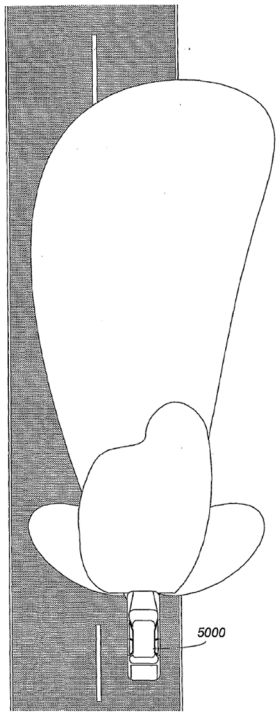
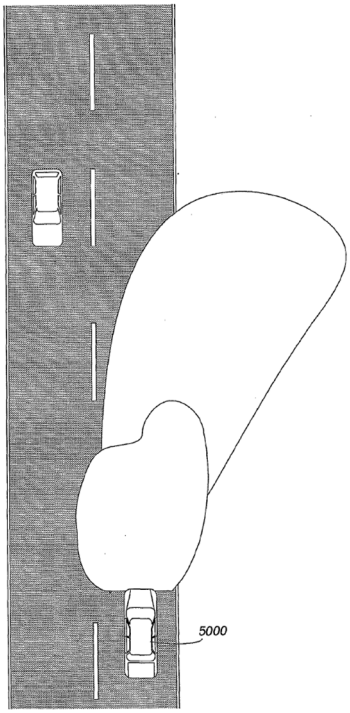
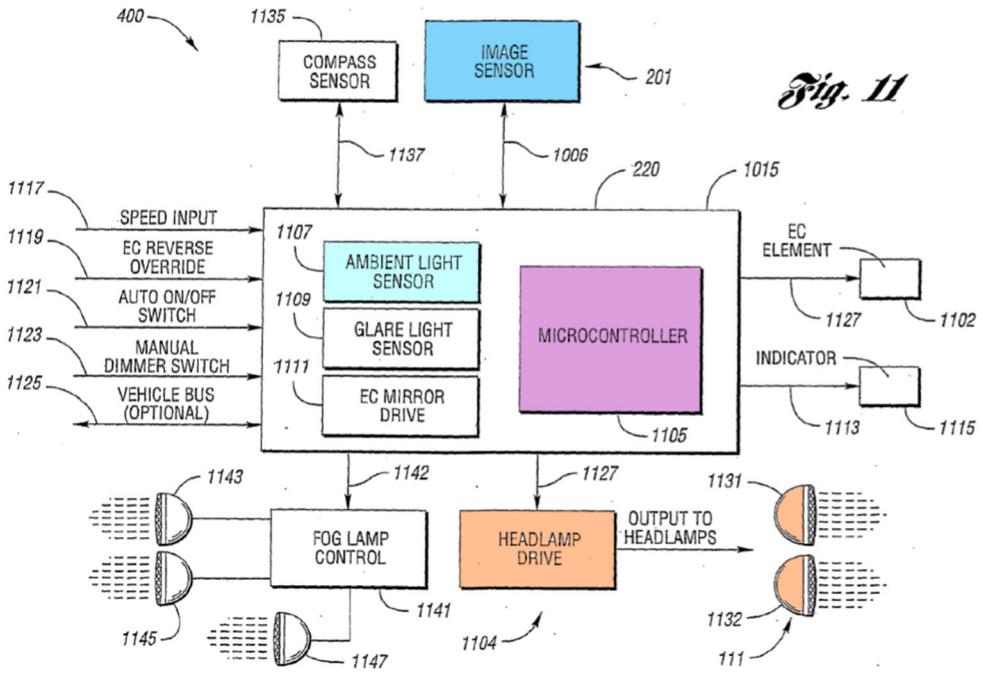


FIG. 50C



EX1007, FIGS. 50A-50C.



EX1007, FIG. 11 (annotated).

284. A POSA would have understood that additional control for Beam-Thominet's controller/illuminator from Stam's predefined dimmed illuminance, would have enhanced Beam-Thominet's system by providing more accurate illumination control referenced to a predefined value to prevent glare, thereby improving driver safety. Doing so would have merely been applying Stam's known technique (using a predefined dimmed illuminance) to Beam-Thominet's similar, known device (dynamic headlamp system with controllable beams), in the same way. Stam's known technique is fully described along with its benefits (e.g., improved safety); thus, a POSA would have readily applied it to similar systems, such as Beam-Thominet's, in the same way.

285. Additionally, or alternatively, such a modification would have been simply combining prior-art elements (e.g., Beam-Thominet's adaptive, direction-controllable headlamps and Stam's predefined dimmed illumination) according to known methods (e.g., disclosed in Beam-Thominet and Stam) to yield predictable results (e.g., improved safety).

286. A POSA would have had a reasonable expectation of success combining Beam-Thominet and Stam. A POSA would have understood *how* to combine their disclosures, for example, by simply modifying software instructions stored in memory of Beam-Thominet's controller/processor to predefine a

numerical dimmed illuminance level (e.g., glare threshold level) and adjust illuminance below and above that value for respective illumination areas.

287. Such modification would have been routine and well within a POSA's skill due to the similarities in Beam-Thominet's and Stam's adaptive systems—their common components were well-known and there would have been no limitations for a POSA to make such a modification. In applying Stam's technique to Beam-Thominet, a POSA would have simply been applying a known technique in a predictable way—controlling headlights in part based on a predefined dimmed illuminance—as already disclosed in the art.

288. In view of the above, Beam (with Thominet), or in combination with Stam, discloses or renders obvious this element.

13. [59.12]: "instruct adjustment of one or more of the light sources to achieve the determined output."

289. In my opinion, there is no patentable difference between [59.12] and [20.13]. *Supra* Section X.B.14. Therefore, my above analysis in Section X.B.14 applies.

290. In view of the above, Beam, alone or in combination with Thominet, discloses or renders obvious this element.

C. Claim 63: "The system of claim 59, wherein at least one light source provided to at least one of the one or more headlamps further includes a laser diode."

291. The language of claim 63 is identical to claim 24. *Supra* Section X.C.

292. In view of the above, Beam, or in combination with Thominet, discloses or renders obvious this claim.

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

293. In my opinion, there is no patentable difference between claim 64 and claim 25. *Supra* Section X.D. Therefore, my above analysis in Section X.D applies.

294. In view of the above, Beam, or in combination with Thominet, discloses or renders obvious this claim.

295. Thus, Beam, alone or in combination with Thominet and Stam, discloses or renders obvious claims 59, 63, and 64 of the '503 patent.

XII. GROUND 3: THE COMBINATION OF BEAM, THOMINET, AND KOBAYASHI RENDERS OBVIOUS CLAIMS 21-23.

A. A POSA would have been motivated to combine Kobayashi with Beam-Thominet with a reasonable expectation of success.

296. As described in Section X.A, a POSA would have been motivated to combine Beam-Thominet. A POSA would have been further motivated to modify Beam-Thominet to adjust light based on map data, including road curvature as in Kobayashi, to further control Beam's directional microbeams to illuminate roadway curves, thereby improving driver safety—an express purpose of Beam/ Beam-Thominet. EX1005, 3:8-14, 3:37-44, 5:33-54, 7:1-13. EX1006, ¶¶8 ("over a

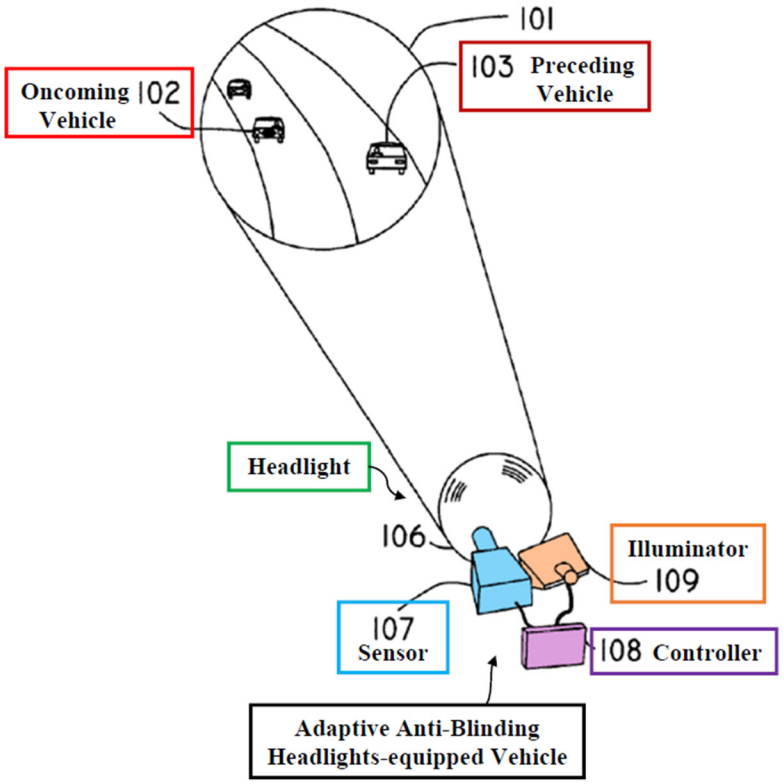
curve"), 25 ("regions 28…when the vehicle drives over a curve or during a bending process"), FIGS. 1B, 2.

297. I first turn to dependent claim 21 and the disclosures of the references, and further explain the combination and reasonable expectation of success, *infra* Section XII.B.3.

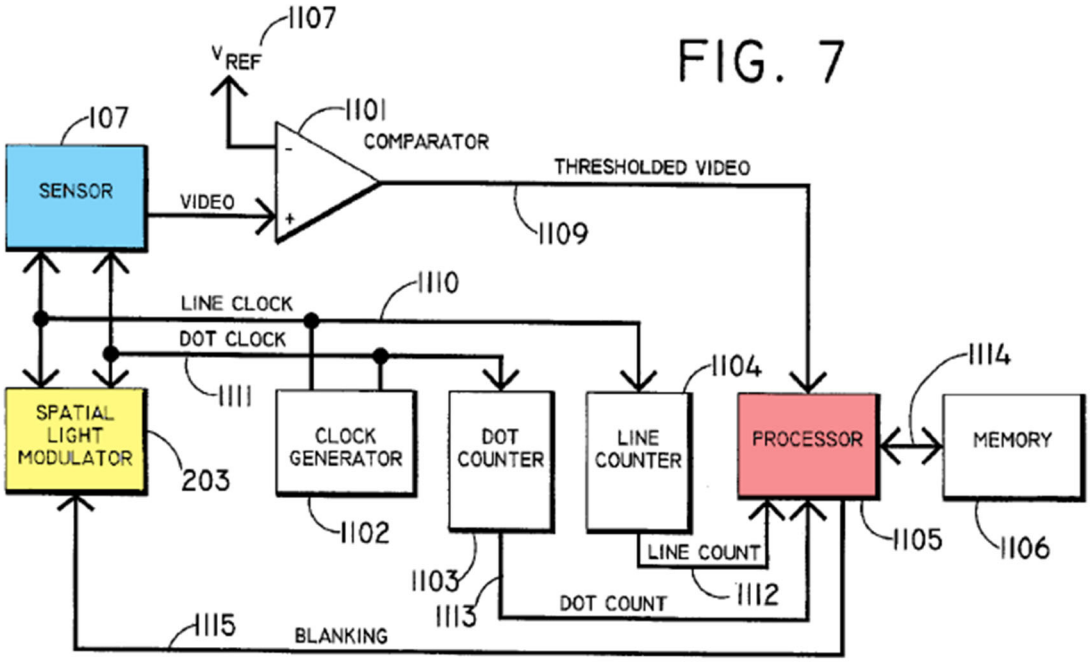
B. Claim 21: "The system of claim 20, wherein the processor is further configured to determine at least a road curvature, indicated by the sensor data, ahead of the vehicle and to direct the control circuitry to adjust the directional light sources to increase illumination in a direction of the road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

1. Beam-Thominet's disclosure

298. As described in Section X.B.3, Beam-Thominet discloses or renders obvious "directional light sources." Beam discloses "controller module uses the *sensor spatial data (video)*…to *control the Illuminator*" and "*[p]rocessor*…*commands* the appropriate pixels." EX1005, 6:14-27, 5:46-54, FIGS. 1, 7; EX1005, 5:33-54 ("*spatial scene data [101]* from sensor 107…becomes the input to a processor"), 4:53-59, 2:33-38, Abstract.

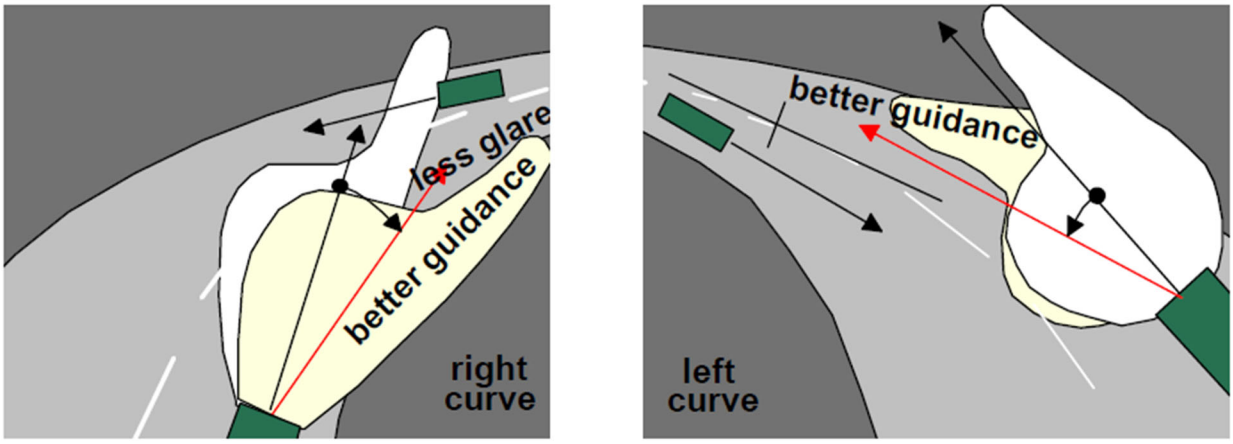


EX1005, FIG. 1 (annotated).



EX1005, FIG. 7 (annotated).

299. Beam-Thominet does not expressly disclose determining a road curvature (even though the spatial data disclosed by Beam should normally include the road curvature information) and adjusting illumination in a direction of the road curvature, but this feature was well known in the prior art, e.g., as explicitly disclosed by Kobayashi. *See also* EX1015, 18 ("glare reduction and visibility improvement in curves"), FIG. 2.8; EX1017, 5, 8 ("in a narrow bend a special curve illumination makes pedestrians or obstacles visible for the driver which normally will be hidden"), FIGS. 1, 3-5, 7; EX1020, 376 ("curve lighting"), 378 ("turns/crossings lighting"), FIGS. 10-11.



EX1015, FIG. 2.8.

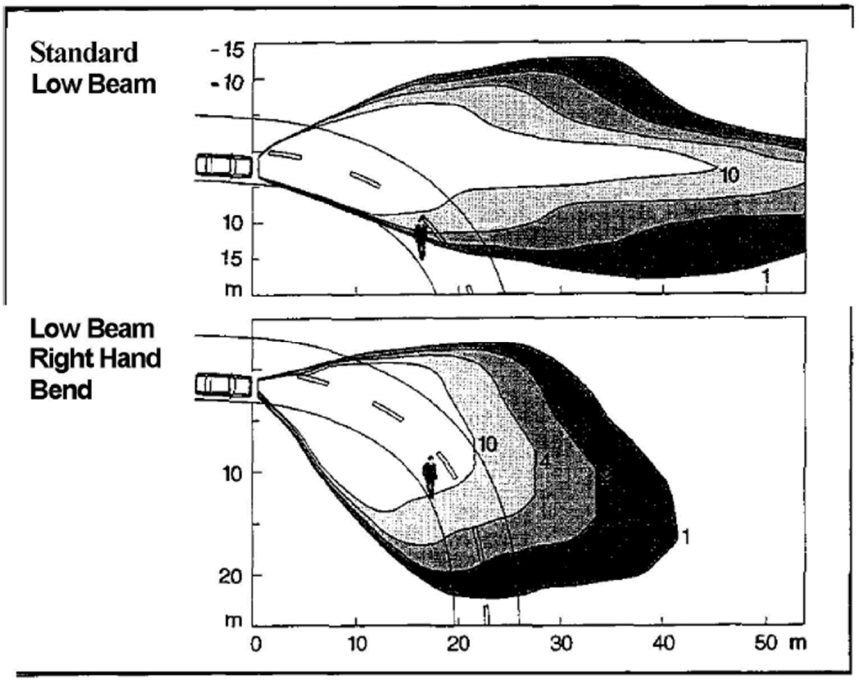


Fig. 7: comparison between basic low beam and right curve illumination, Isolux curves from bird eye's view

EX1017, FIG. 7.

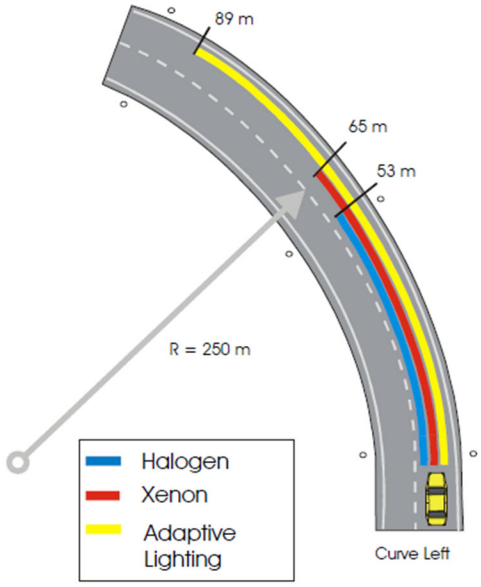
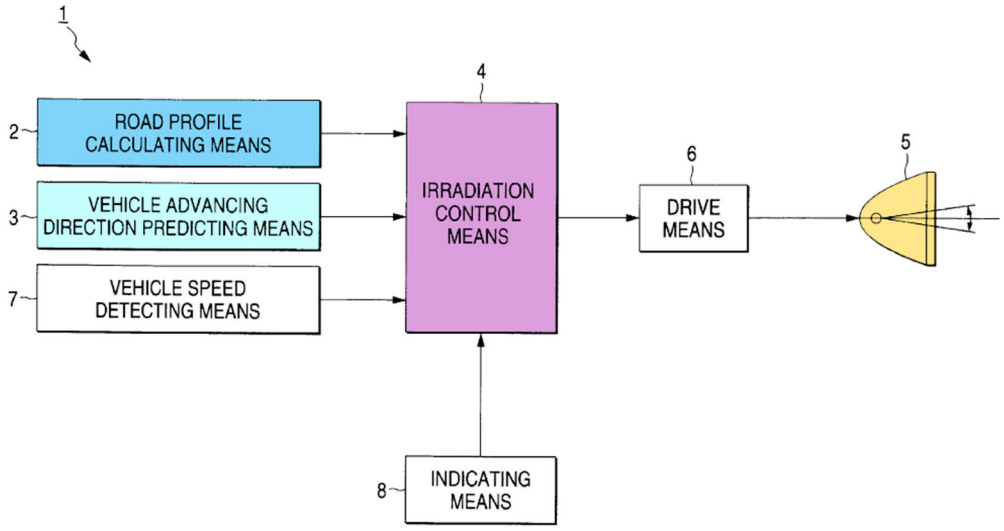


Figure 10: Static test: Results of the investigations about visibility distances obtained with halogen-, HID- and adaptive headlamps.

EX1020, FIG. 10.

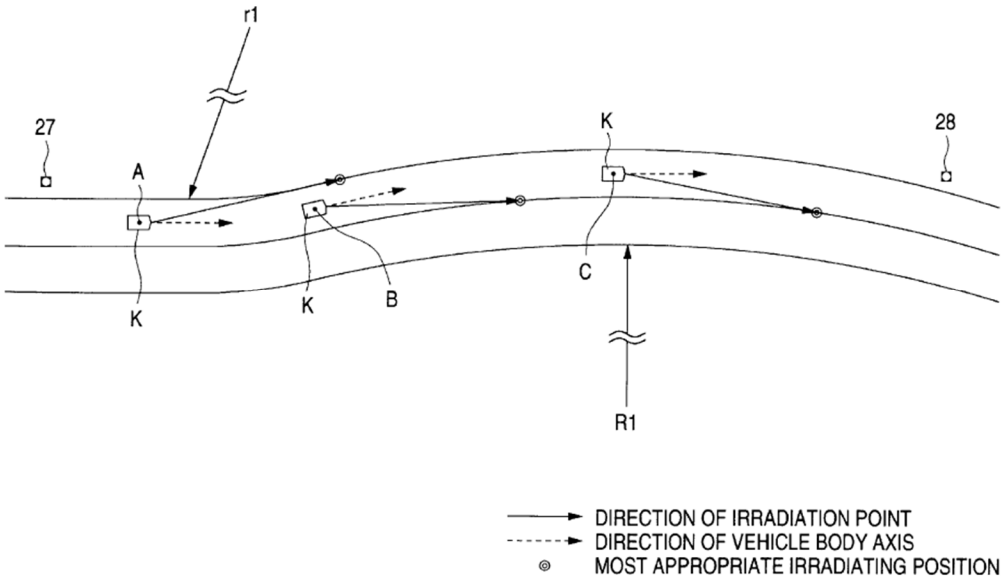
2. Kobayashi's disclosure

300. Kobayashi discloses headlamp illumination is controlled "[a]ccording to the *road profile information*" and "applied…[so] a portion of irradiating light is directed to a *specific direction*." EX1008, 14:59-66, 9:38-41, FIGS. 1, 10; EX1008, 4:60-64 ("irradiation control means 4 conducts irradiation control…with the *road profile*"), 3:9-50, 14:53-15:28.



EX1008, FIG. 1 (annotated).

301. For example, Kobayashi discloses irradiation control of vehicle K can be planned and controlled on curved roads r1, R1 to improve safety such that when vehicle K turns left (point A), the left shoulder is irradiated, and when vehicle K turns right (point C), the right shoulder is irradiated. EX1008, 14:53-15:28, FIG. 10.



EX1008, FIG. 10.

302. As discussed, a POSA would have been motivated to combine Kobayashi with Beam-Thominet with a reasonable expectation of success. *Supra* Section XII.A.

3. A POSA would have been motivated to combine Kobayashi with Beam-Thominet with a reasonable expectation of success.

303. As described in Section X.A, a POSA would have been motivated to combine Beam-Thominet. A POSA would have been further motivated to modify Beam-Thominet to adjust light based on road curvature, as in Kobayashi, to further control Beam's directional microbeams to illuminate roadway curves, thereby improving driver safety—an express purpose of Beam. EX1005, 3:8-14, 3:37-44, 5:33-54, 7:1-13.

304. Although live data could be used by vehicle sensors, it was well known that GPS navigation system gave additional advantages by providing more accurate information on driving regions. EX1026, 461-462 ("To obtain more accurate information on driving regions, it is advantageous to use data from a GPS navigation system.")

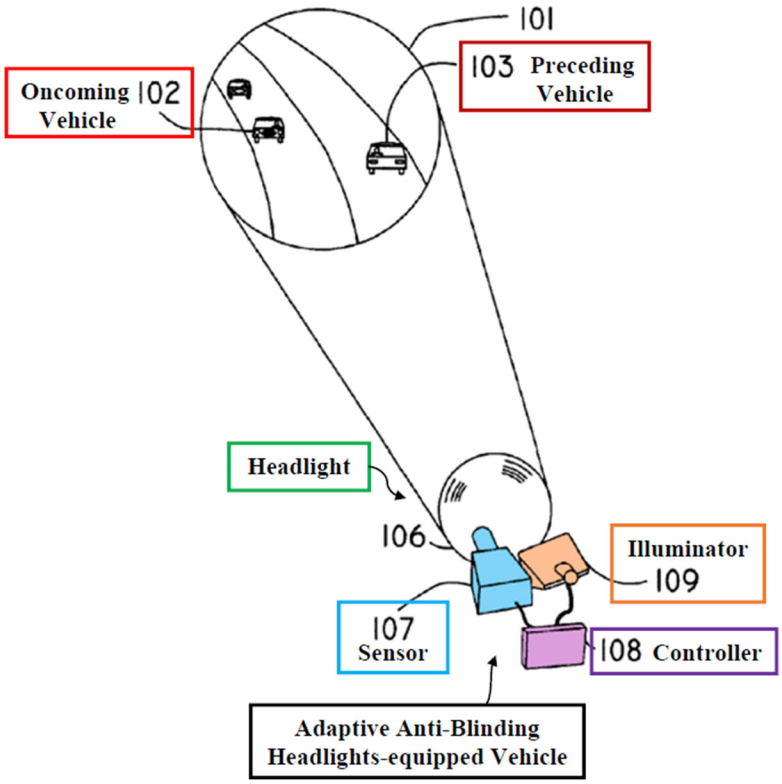
305. Further, conventional headlamps, with static high and low beams did not respond to changing driving conditions, and multiple beams were needed to provide "bending beams" for different types of road curvatures ("high speed," "middle speed," "low speed," "cross-roads"). EX1026, 451-452.

306. *First*, including an additional data source for Beam-Thominet's controller—Kobayashi's *known technique* of using map data including road curvature —would have enhanced Beam-Thominet by increasing/adjusting illumination based on road curvature or a planned turn, improving driver safety by providing light to where it is needed. *Second*, a POSA would have easily incorporated *known components* of Kobayashi's road profile calculating means 2 and/or vehicle advancing direction prediction means 3 (e.g., including GPS navigation device 29, *see* EX1008, Abstract, 1:10-2:35, 4:60-64, FIGS. 1, 10, 12) into Beam-Thominet. This would have, like Kobayashi, provided road curvature data for Beam's detected scene 101, allowing Beam-Thominet's system to increase illumination toward the road curvature, further improving safety.

307. Beam-Thominet and Kobayashi are from the same field—controllable headlamps with dynamic illumination—and include the same building blocks (e.g., light sources, sensors, controllers). Further, driver safety is paramount. EX1005, 5:33-54, 3:8-44, 6:53-7:13; EX1008, 15:6-28.

308. Indeed, Beam's technique and system of controlling individual microbeams emphasize safety of all drivers. EX1005, 3:8-44, 6:53-7:13. Controllable headlamps "provide greatly improved safety and comfort to the motoring public," and a "brighter headlight beam while simultaneously protecting the drivers of all vehicles ahead," increases safety. EX1005, 3:8-44; EX1005, 3:37-41 ("see more clearly at night").

309. Beam's system "*determine[s] the location of light sources* forward of the apparatus and us[es] that information to *control the intensity, and/or the angular position*, of one or more" microbeams. EX1005, Abstract; EX1005, 4:16-19. Control is "*dynamically varying* in position and in size," in response to the input. EX1005, 6:24-27, 5:46-54. Beam recognizes prior systems that control headlamps in response to changes in the vehicle's position (e.g., tilt on a hill) and steering mechanism (e.g., along a curve) and acknowledges those systems' safety benefits—noting that more active systems decrease the compromise between "reducing glare and providing enough light to the driver for adequate visibility." EX1005, 1:61-2:6, 2:15-22.

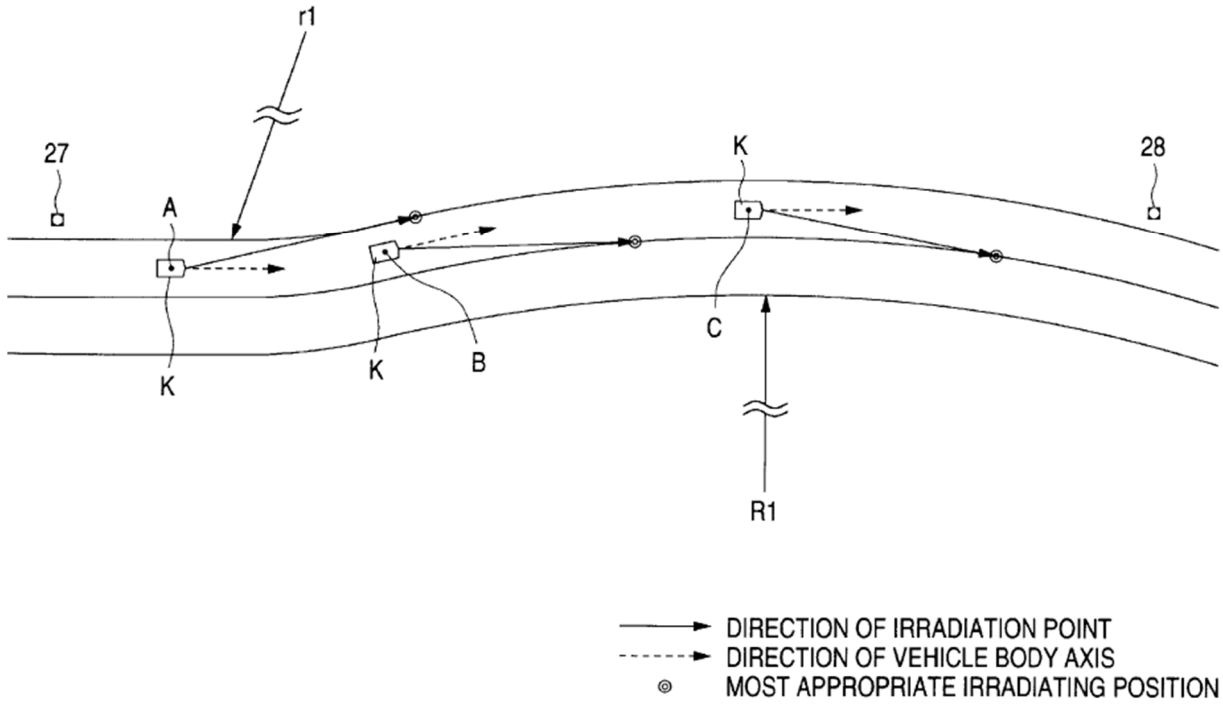


EX1005, FIG. 1 (annotated).

310. Beam-Thominet does not expressly disclose using road curvature data, such as from GPS or navigation beacons, as an input to control the intensity, shape, and/or angular position of the microbeams, but it would have been obvious to a POSA to do so. This would have made Beam-Thominet more active than prior systems, as Beam seeks to do (*see* EX1005, 2:15-22), and further achieves Beam's purpose of improving driver safety. EX1005, 3:8-44, 6:53-7:13. Kobayashi provides additional active techniques, specifically map data-based control including road curvature.

311. Kobayashi's *techniques and system components*, like Beam-Thominet, seek to enhance driver safety—using map data-based control including road curvature. EX1008, 15:6-28. Kobayashi's road profile calculating means 2 and/or vehicle advancing direction prediction means 3 are inputs to control means 4, which alters the light direction from headlamp 5 in response to map data including road curvature input, enhancing safety. EX1008, 3:9-50, 6:4-62, FIG. 1; EX1008, 15:6-28 ("safety of driving can be enhanced"). Kobayashi's system responds to real-world conditions, multiple curves, and intersections. EX1008, 11:34-14:52, 17:41-50.

312. Kobayashi's Figure 10 shows illumination control can be planned and controlled for multiple curves. When vehicle K turns left (point A), the light illuminates the left shoulder. Likewise, when vehicle K turns right on a subsequent curve (point C), the light illuminates the right shoulder. EX1008, 14:53-15:28, 17:3-18:67, FIG. 12.



EX1008, FIG. 10.

313. A POSA would have understood that including an additional data source for Beam-Thominet's controller/processor from Kobayashi's map data including road curvature, would have enhanced Beam-Thominet by increasing illumination based on road curvature data, thereby improving safety. Doing so would have merely been applying Kobayashi's known technique (using map data from GPS including road curvature to shape/reshape light) to Beam-Thominet's similar, known device (dynamic headlamp system with controllable beams), in the same way. Kobayashi's known technique is fully described along with its benefits (e.g., improved safety); thus, a POSA would have readily applied it to similar systems, such as Beam-Thominet's, in the same way.

314. Additionally, or alternatively, such a modification would have been simply combining known prior-art elements (e.g., Beam-Thominet's adaptive, direction-controllable headlamps with Kobayashi's directional control based on map data including road curvature) according to known methods (disclosed in Beam-Thominet and Kobayashi) to yield predictable results (e.g., improved safety).

315. A POSA would have had a reasonable expectation of success combining Kobayashi with Beam-Thominet. A POSA would have understood *how* to combine their disclosures, for example, by simply modifying software instructions stored in memory of Beam-Thominet's controller/processor (e.g., ECU) to adjust and direct light of the microbeams appropriately in view of Kobayashi's map data including road curvature. It also would have been straightforward to combine Kobayashi's road profile calculating means 2 and/or vehicle advancing direction prediction means 3 (e.g., including GPS navigation device 29) with Beam-Thominet.

316. Such modifications would have been routine and well within a POSA's skill due to the similarities in Beam-Thominet's and Kobayashi's adaptive light control systems and methods—their common components were well-known and there would have been no limitations for a POSA to make such modifications. In applying Kobayashi's technique to Beam-Thominet, a POSA would have simply

been applying a known technique in a predictable way—controlling headlights in part based on map data including road curvature —as already disclosed in the art. And in combining Beam-Thominet with Kobayashi's road profile calculating means 2 and/or vehicle advancing direction prediction means 3 (e.g., revising control input/output on an ECU), a POSA would have simply been combining known elements according to known methods (disclosed in Kobayashi) to yield predictable results (additional light control).

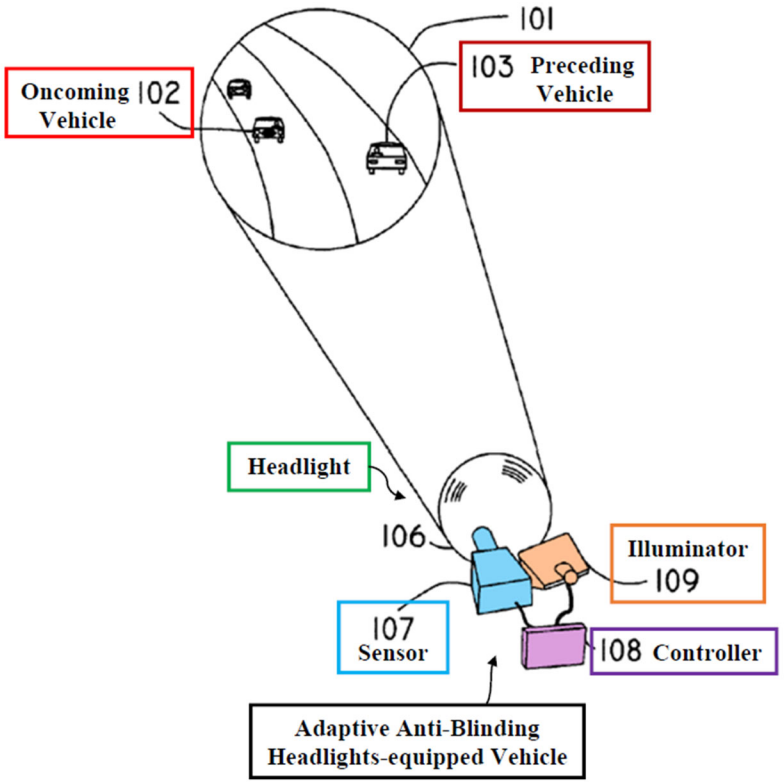
317. In view of the above, Beam-Thominet in combination with Kobayashi renders obvious this claim.

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

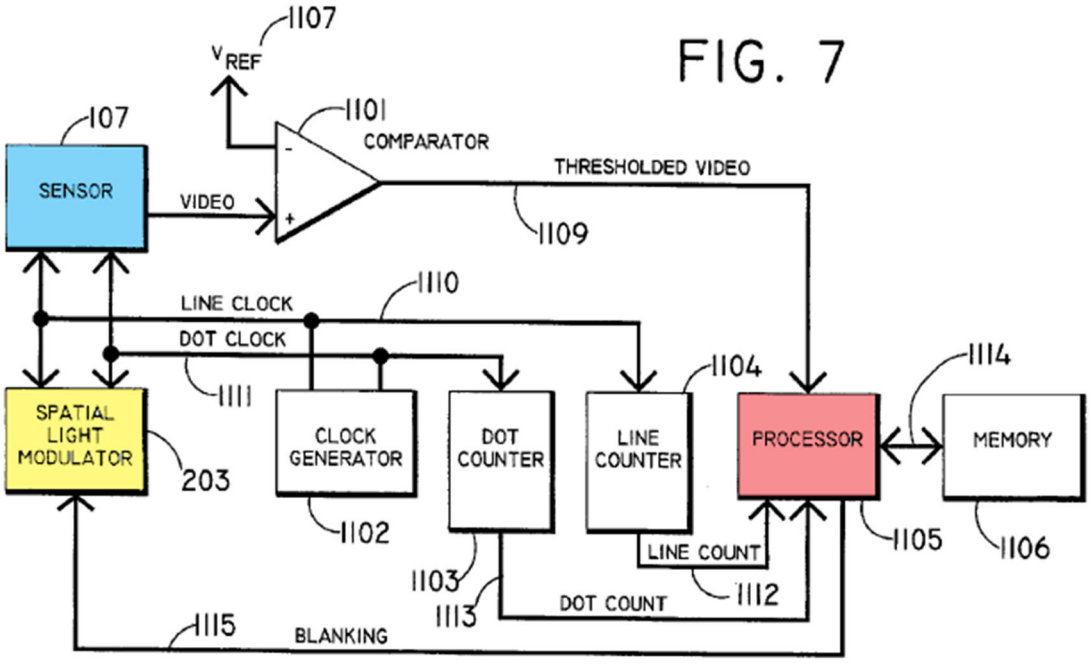
Claim 23: "The system of claim 20, wherein the processor is further configured to determine at least a planned upcoming turn, indicated by the sensor data, and to direct the control circuitry to increase illumination illuminating the turn."

318. The language of dependent claim 23 is identical to claim 22.

319. Beam discloses "controller module uses the *sensor spatial data (video)*…to *control the Illuminator*" and "*[p]rocessor*…*commands* the appropriate pixels." EX1005, 6:14-27, 5:46-54, FIGS. 1, 7; EX1005, 5:33-54 ("*spatial scene data [101]* from sensor 107…becomes the input to a processor"), 4:53-59, 2:33-38, Abstract.

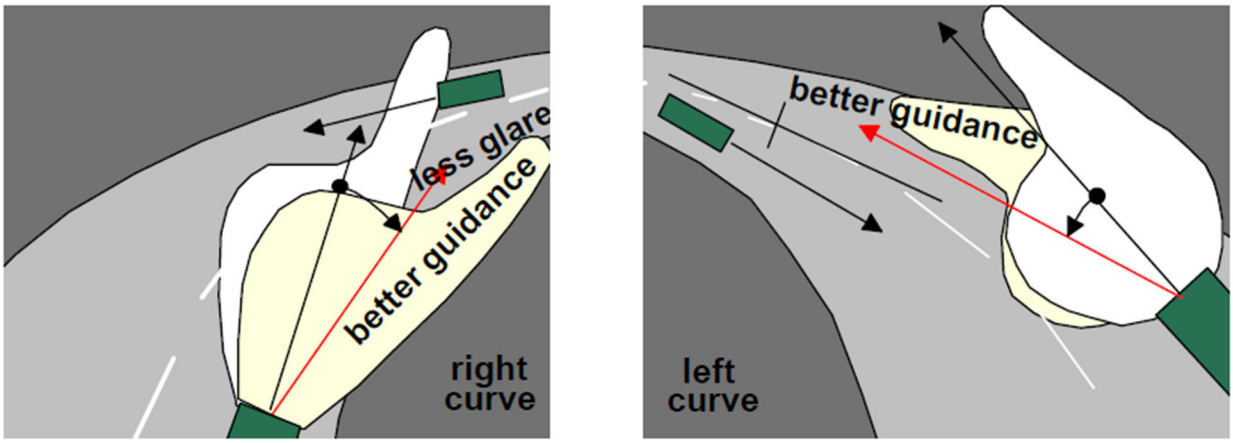


EX1005, FIG. 1 (annotated).



EX1005, FIG. 7 (annotated).

320. Beam-Thominet does not expressly disclose determining a planned upcoming turn (even though spatial data normally should include road curvature information), but this feature was well known in the prior art, e.g., as explicitly disclosed by Kobayashi. *See also* EX1015, 18 ("glare reduction and visibility improvement in curves"), FIG. 2.8; EX1017, 5, 8 ("in a narrow bend a special curve illumination makes pedestrians or obstacles visible for the driver which normally will be hidden"), FIGS. 1, 3-5, 7; EX1020, 376 ("curve lighting"), 378 ("turns/crossings lighting"), FIGS. 10-11.



EX1015, FIG. 2.8.

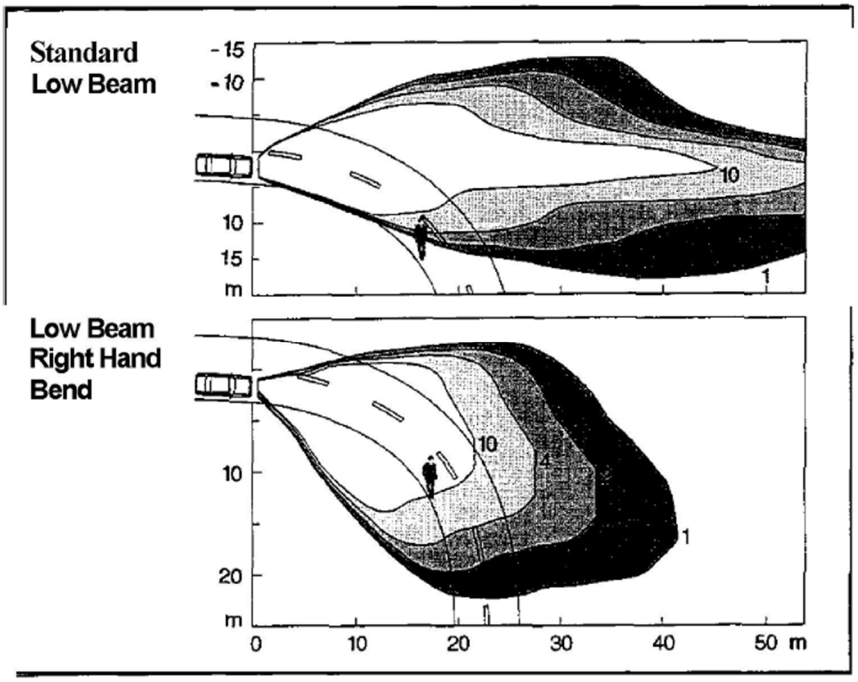


Fig. 7: comparison between basic low beam and right curve illumination, Isolux curves from bird eye's view

EX1017, FIG. 7.

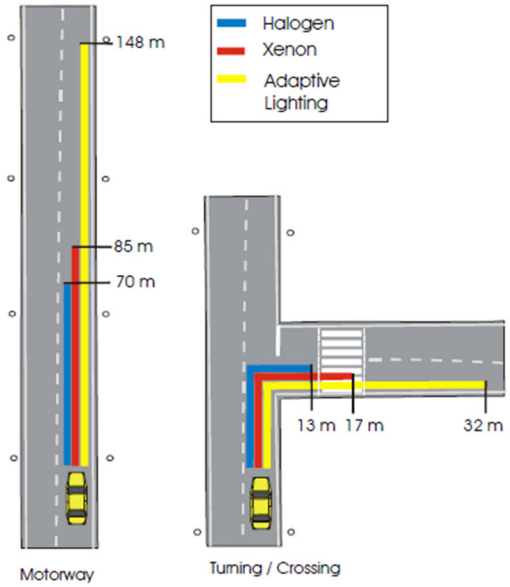
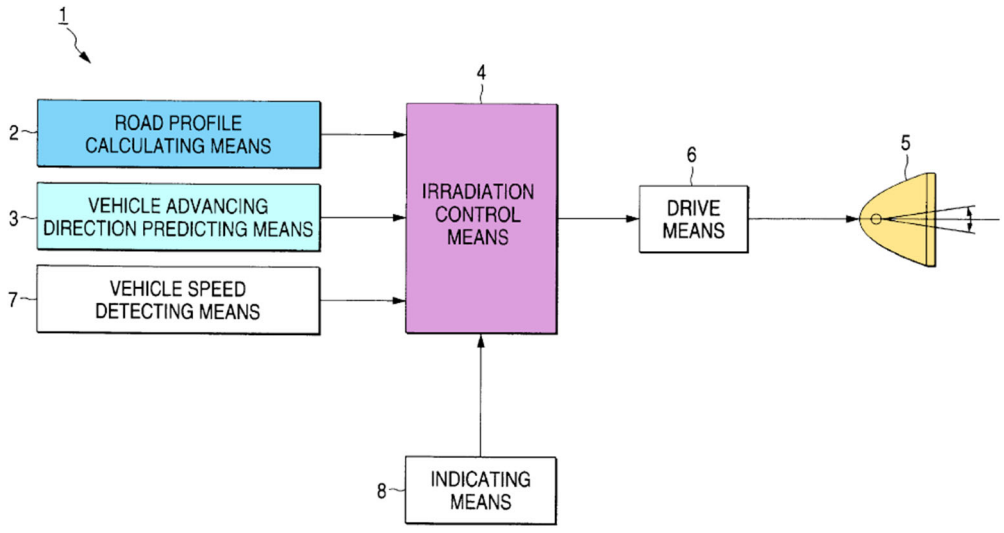


Figure 11:
Static test: Results of the investigations about visibility distances obtained with halogen-, HID- and adaptive headlamps

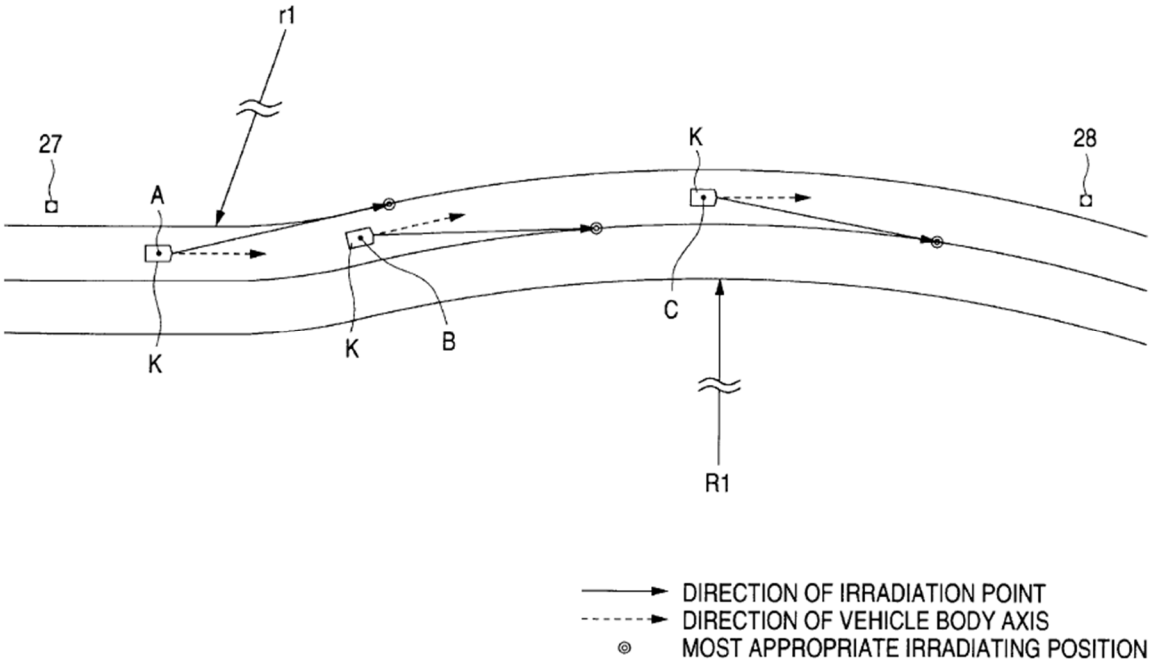
EX1020, FIG. 11.

321. Kobayashi discloses headlamp illumination is "applied…to a *specific direction*" and "can be conducted…*along the scheduled course*." EX1008, 9:38-

41, 18:53-57, FIGS. 1, 9, 10; EX1008, 4:6-8 ("*predicts a vehicle advancing direction* at which the driver aims"), 3:9-50, 11:34-14:52. A POSA would have understood that Kobayashi discloses a "planned upcoming turn" because the "scheduled course" includes an intended direction of a driver (e.g., left or right turn). *See* EX1008, 9:38-41; EX1001, 54:1-15 ("[a] driver can't make a 90-degree turn traveling 90 km/h but from a stop, the turn may be around a corner…the more angled SLS 284, closer in for illuminating [a] sharp turn, than that of the less angled SLS 283 for a shallow curve"), 56:33-54.



EX1008, FIG. 1 (annotated).



EX1008, FIG. 10.

322. As discussed, a POSA would have been motivated to combine Kobayashi with Beam-Thominet with a reasonable expectation of success. *Supra* Section XII.A.

323. In view of the above, Beam-Thominet in combination with Kobayashi discloses or renders obvious these claims.

324. Thus, Beam-Thominet in combination with Kobayashi discloses or renders obvious claims 21–23 of the ’503 patent.

XIII. GROUND 4: THE COMBINATION OF BEAM, THOMINET, STAM, AND KOBAYASHI RENDERS OBVIOUS CLAIMS 60-62.

A. A POSA would have been motivated to combine Kobayashi with Beam-Thominet-Stam with a reasonable expectation of success.

325. As described in Section XI.A, a POSA would have been motivated to combine Beam-Thominet-Stam. For the same reasons described in Section XI.A, a POSA would have been further motivated to combine Kobayashi with Beam-Thominet-Stam. The addition of Stam to Beam-Thominet would not change the inclusion of Kobayashi.

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

326. In my opinion, there is no patentable difference between claim 60 and claim 21. *Supra* Section XII.B. Therefore, my above analysis in Section XII.B applies.

327. In view of the above, Beam-Thominet-Stam in combination with Kobayashi discloses or renders obvious this claim.

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

Claim 62: "The system of claim 59, wherein at least one of the at least one processors is further configured to determine at least a

planned upcoming turn, indicated by the sensor data, and to determine light output that illuminates the turn."

328. The language of dependent claim 62 is identical to claim 61.

329. In my opinion, there is no patentable difference between claim 61 and claim 22, and no patentable difference between claim 62 and claim 23. *Supra* Section XII.C. Therefore, my above analysis in Section XII.C applies.

330. In view of the above, Beam-Thominet-Stam in combination with Kobayashi discloses or renders obvious these claims.

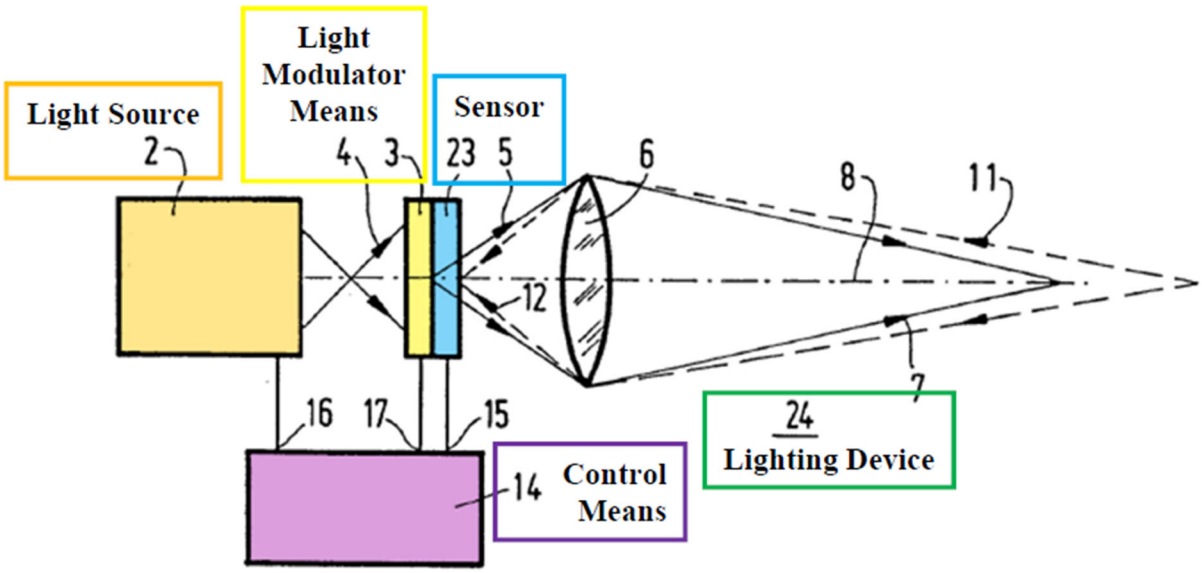
331. Thus, Beam-Thominet-Stam in combination with Kobayashi discloses or renders obvious claims 60–62 of the '503 patent.

XIV. GROUND 5: THE COMBINATION OF KARLSSON AND HARBERS RENDERS OBVIOUS CLAIMS 20, 24, 25, 59, 63, AND 64.

332. In my opinion, Karlsson explicitly or implicitly discloses every feature recited in claims 20, 24, 25, 59, 63, and 64. But to avoid doubt, Karlsson is combined with Harbers, for elements [20.2] and [59.2], which discloses well-known elements and techniques of adaptive headlamp systems—directional light sources with different angles/aimings for different functions—rendering the claims obvious.

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

advantageously can be switched to…given *directions*," EX1010, 11:25-28, 14:1-9, FIGS. 3, 6, 14. Each spotlight beam is a directional "source," having its own independent *direction* (angle/aiming), that combines to form the headlamp beam, so the combination of Karlsson's spotlight beams form many, and at least three directional light sources having different angles/aimings. EX1010, 4:25-31, 14:1-15, FIGS. 6, 14.



EX1010, FIG. 3 (annotated).

334. Thus, Karlsson discloses "at least three directional light sources" (independently controllable directional spotlight beams) that are "aimed at different angles" and "hav[e] different aimings" recited in [20.2] and [59.2].

335. Harbers expressly discloses "*array of opto-electronic elements 11; 12; 13; 14…determined* to a substantial degree by the *desired direction* of the light beams emitted," EX1011, 7:27-32, FIGS. 1B, 2, corresponding to the "directional

light sources" recited in [20.2] and [59.2]. If Patent Owner argues, incorrectly, that Karlsson does not disclose [20.2] and [59.2], Harbers does, and it would have been obvious to combine Harbers with Karlsson, as discussed below.

336. Karlsson discloses "accurate measurement of ambient light (11), which is not disturbed by the lighting device's own lighting means (27), is provided, for example for detecting light from oncoming traffic…[a]s a result, the lighting pattern and the *lighting intensity are automatically adjusted*, in such a manner that oncoming traffic *will not be blinded*, thus permitting a light intensity which is generally *higher than that of conventional dipped headlights*, for example." EX1010, Abstract.

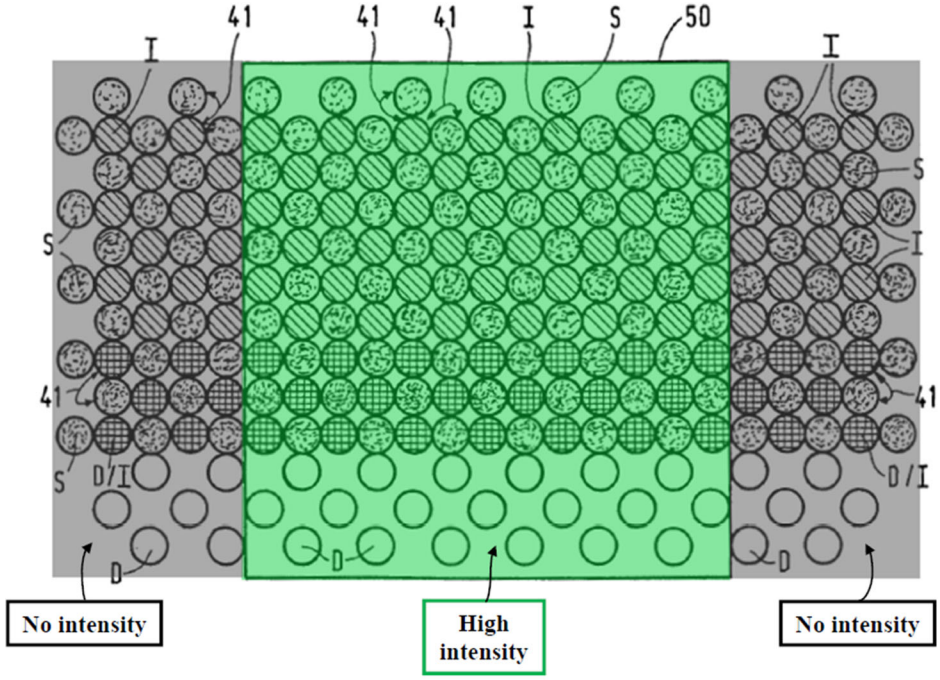
337. Further, Karlsson discloses "spotlight sources indicated at D provide the *dipped light function*." EX1010, 19:23-27, FIGS. 14-15; EX1010, 1:27-30 ("*low beams* or *dipped* headlights"), Abstract, 1:16-18. The concept of a "dipped light function" or a low beam illumination level would have been known to a POSA. As discussed, because all automotive exterior lighting devices (headlamps, tailing lamps, and other road illumination devices and signaling and marking devices) are highly regulated in the U.S. as well as in the rest of world, all lighting products installed on a vehicle must comply with these regulations. *See* EX1030, 62-69; EX1016, 4-11. As such, common practice in the automotive lighting industry is to set up the performance level including light output for a product,

such as a headlamp, to produce predefined illumination values (in angular light intensity distribution) either per the regulations, or in a higher performance level set by automakers. *See* EX1030, 62-69; EX1016, 4-11.

338. Such low beam (dipped headlights) illumination level for driver's visibility and glare light control is defined in all regulations, standards, and automaker's specifications, which is predefined as the illumination level in terms of the light intensity distribution in the low beam illuminating area or low beam projected angular section. *See* EX1030, 3-8, 21-41, 62-69; EX1016, 4-11. Therefore, Karlsson's "dipped light function" is an example of a "predefined" illumination level, for example, equivalent to a "dipped headlights" illuminance.

339. Further, Karlsson discloses illumination directed to the shaded areas (e.g., outside emitted light beam 50) is "*no light at all* or light having a low intensity is emitted in those directions from which light is detected," (e.g., no intensity in shaded area is *below* Karlsson's predefined *dipped* headlights illuminance: shaded illuminance < dipped headlights illuminance), and illumination directed to the non-shaded areas (e.g., within emitted light beam 50) is "a light intensity which is generally *higher* than that of conventional *dipped headlights*" and "longer-range *main-beam*" (e.g., high intensity in non-shaded area is *above* Karlsson's predefined *dipped* illuminance: non-shaded illuminance >

dipped headlights illuminance). EX1010, Abstract, 1:18-24, 9:18-22, 19:23-27, FIGS. 3, 14-15.



EX1010, FIG. 14 (annotated).

340. Therefore, Karlsson discloses a "predefined" (e.g., dipped) illuminance and outputting illumination "below…[the] predefined illuminance" and "above…[the] predefined illuminance" (e.g., shaded < dipped headlights < non-shaded) recited in [59.9] and [59.11].

341. The '503 patent does not disclose a predefined illuminance value, so such value is not needed to satisfy [59.9] and [59.11]. Further, a POSA reading the disclosure of Karlsson would have understood that Karlsson teaches a predefined illuminance, for example, a "dipped headlights" illuminance, because Karlsson uses the dipped headlights illuminance as a reference point to output illumination

below and above that value, preventing glare to other vehicles and increasing illumination to other areas. EX1010, 9:18-26 ("the pattern and the intensity of the light beam 7 are, for example, controlled in such a manner that *no light at all* or light having a low intensity is emitted…[i]n this manner *glaring or blinding* of oncoming traffic is *effectively prevented*"), Abstract ("the lighting pattern and the lighting intensity are automatically adjusted…thus *permitting a light intensity* which is generally *higher than that of conventional dipped headlights*"), 1:18-24, 19:23-27, FIGS. 3, 6, 14-15.

342. Therefore, a POSA would have understood that Karlsson discloses or renders obvious a "predefined illuminance" recited in [59.9] and [59.11].

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

343. It would have been obvious to a POSA to employ multiple directional beam segments with different angles/aimings in Karlsson's system, as in Harbers, to provide alternative control of Karlsson's directional spotlight beams and provide different spatial distributions for improved visibility in different driving situations, thereby improving driver safety—an express purpose of Karlsson. EX1010, 1:10-13, 1:16-26, 4:17-21, 9:18-26.

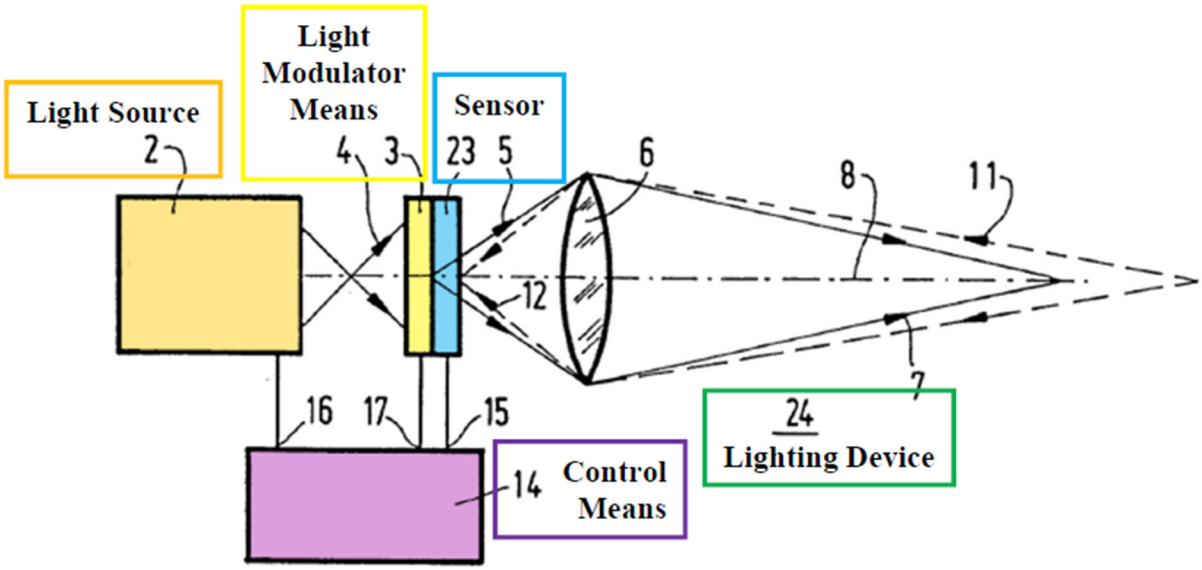
344. As discussed, Karlsson discloses "directional light sources" with independently controlled angular positions for protecting other drivers from glare. Harbers provides further detail on ways to implement "directional light sources"

for different functions, conceptually and physically. So naturally, it would have been obvious to a POSA designing an adaptive headlamp to implement Harbers's multiple directional beam segments with different angles/aimings—through either software or hardware—for different functions in Karlsson's system. Indeed, Harbers discloses such an implementation to provide different spatial distributions for improved visibility in different driving situations (e.g., off-axis viewing, bends, narrow roads, motorways, etc., *see* EX1011, 5:14-26, 6:1-7, 6:27-7:32, 9:28-10:5, 13:5-7, FIGS. 1B, 2), thereby improving driver safety—an express purpose of Karlsson. EX1010, 1:10-13, 1:16-26, 4:17-21, 9:18-26.

345. Karlsson and Harbers are from the same field—controllable headlamps with dynamic illumination—and include the same building blocks (light sources, sensors, controllers). EX1010, Abstract, 2:30-35, 9:18-26, 13:24-14:4, 19:18-20:3, FIGS. 3, 6, 14-15; EX1011, Abstract, 2:27-3:10, 5:14-26, 6:27-7:19, 7:27-32, FIGS. 1B, 2. Further, improved visibility, thereby increasing safety is paramount in both. EX1010, 1:10-26, 4:17-21, 9:18-26; EX1011, 5:1-26, 7:1-14, 9:1-32.

346. *First*, including an additional or alternative control technique (software implementation) for Karlsson—Harbers's *known technique* of using multiple directional beam segments for different functions—would have added more control methods for different functions to Karlsson's visibility for different driving situations, thereby increasing safety. This is a simple software combination.

Karlsson discloses "*controllable spotlight beams*" are controlled individually or in groups by control means 14 to "*given directions*" to reduce glare. EX1010, 4:25-31, 11:25-28, 14:1-15, 19:29-33, FIGS. 3, 6.



EX1010, FIG. 3 (annotated).

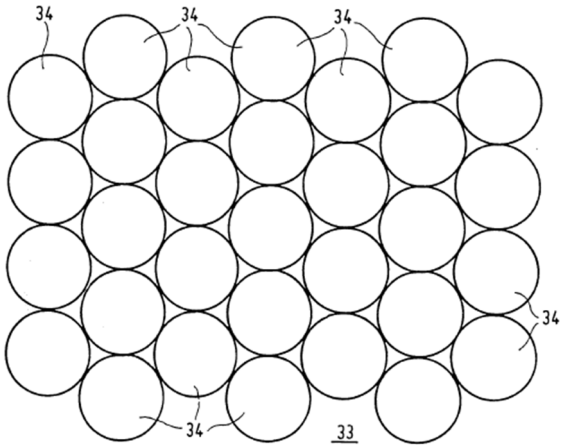


FIG. 6

EX1010, FIG. 6.

347. Indeed, Karlsson's techniques and system of controlling individual spotlight beams emphasize safety of all drivers. EX1010, 1:16-26, 4:17-21, 9:18-

26. Controllable headlamps "significantly increase the driving comfort and the road safety," and "glaring or blinding of oncoming traffic is effectively prevented," increasing safety. EX1010, 9:18-26. Karlsson enables "higher light intensity," for example "when driving on dark, unilluminated roads," while protecting others from glare. EX1010, 1:21-26; EX1010, 1:10-13 ("comply with…regulations…preventing the *blinding* or *glare*").

348. Karlsson's system "*selectively adjust[s]*…spotlight beam[s] 34, in response to a *control signal from sensor means 23*…to provide a *desired lighting pattern*" in "given *directions*." EX1010, 14:26-30, 11:25-28, FIGS. 3, 6, 14. Karlsson recognizes the safety benefits of identifying "oncoming traffic" and other objects ("road signs etc.") in the field of view and adjusting a pattern and/or an intensity of light beam 7. EX1010, Abstract, 3:17-31, 12:19-35; EX1010, 2:2-4, 5:16-32. If Patent Owner argues, incorrectly, Karlsson does not expressly disclose directional light sources at different angles/aimings, even though Karlsson discloses different angular positions control for different spotlight beams, it would have been obvious to a POSA to use such control for the features of "aimed at different angles" and "having different aimings." Combining Harbers with Karlsson would have made Karlsson's system more direct or active for different functions, and further achieves Karlsson's purpose of improving driver safety.

349. And Harbers's *technique* (software implementation), like Karlsson, seeks to enhance driver visibility, thereby increasing safety—using multiple directional beam segments to provide different spatial distributions for different functions. EX1011, 5:14-26, 6:1-7, 6:27-7:19, 8:10-18, FIGS. 1B, 2. Specifically, Harbers explains opto-electronic elements 11-14 arranged on a "curved substrate" provide differently angled/aimed beam segments 6-6'-6"-6'", 7-7'-7"-7'" relative to longitudinal direction 9 to form different spatial distributions, improving visibility of the road and/or road surrounding, thereby increasing safety. EX1011, 5:14-26, 6:1-7, 6:27-7:19, FIGS. 1B, 2; EX1011, 7:27-32 ("*curved* substrate"), 7:1-17, 9:28-10:5, 13:5-7.

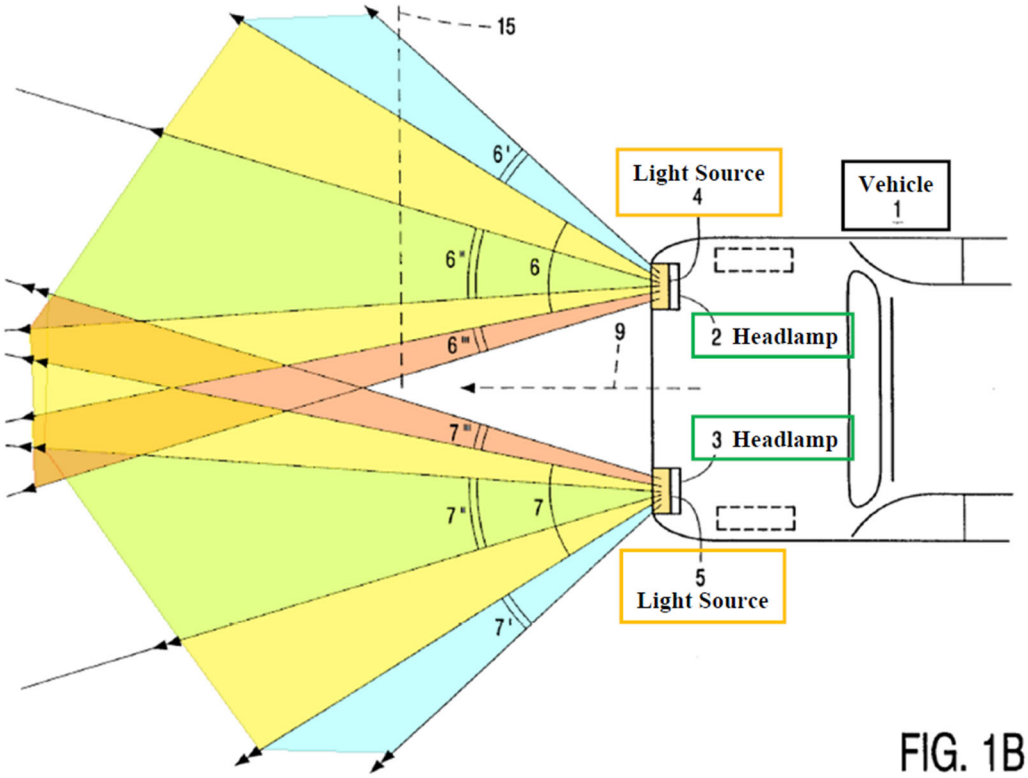
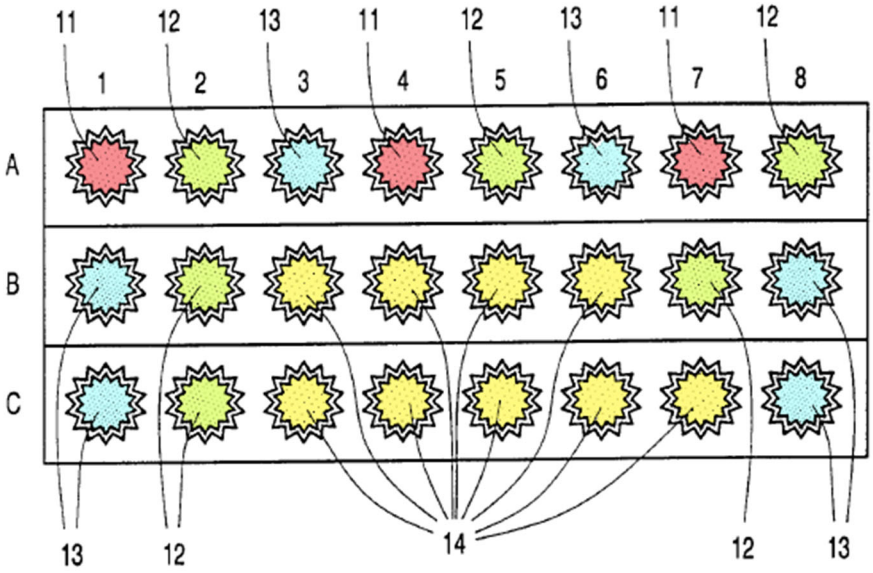


FIG. 1B

EX1011, FIG. 1B (annotated).



EX1011, FIG. 2 (annotated).

350. The additional control (software implementation) of having multiple directional beam segments with different angles/aimings as in Harbers, implemented with Karlsson's control means 14/spotlight beams 34 (including light modulator means 3), would have provided Karlsson's system with different spatial distributions for different driving situations beyond reducing glare for drivers, thereby improving safety.

351. A POSA would have understood that alternative or additional control for Karlsson's controller/illuminator by using Harbers's different angles/aimings, would have enhanced Karlsson's system, making it more direct or active, by providing different spatial/angular distributions for different driving situations, thereby improving driver safety. Doing so would have merely been applying

Harbers's known technique (software implementation: using multiple directional beam segments with different angles/aimings for different functions) to Karlsson's similar, known device (adaptive headlamp system with controllable spotlight beams), in the same way. Harbers's known technique is fully described along with its benefits (improved visibility for different functions, thereby increased safety); thus, a POSA would have readily applied it to similar systems, such as Karlsson's, in the same way.

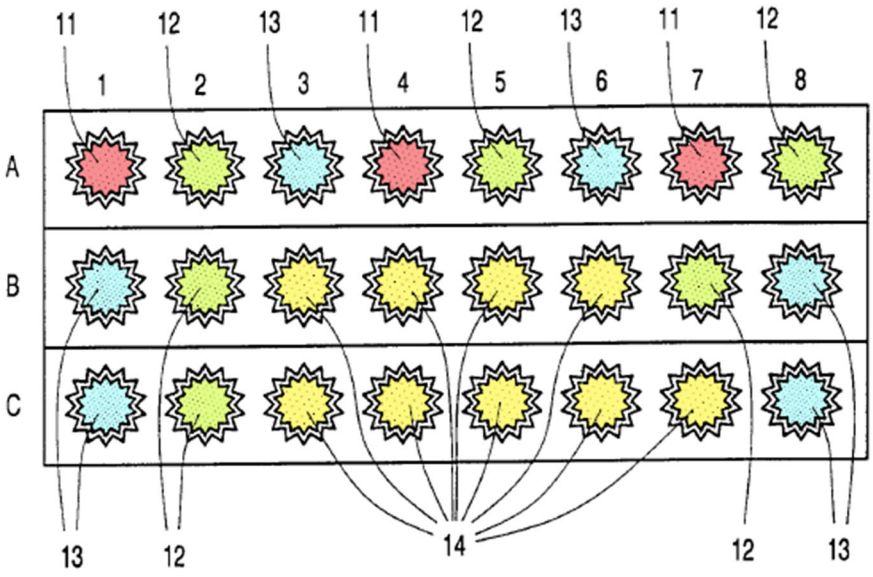
352. A POSA would have had a reasonable expectation of success combining Harbers with Karlsson, for example, by simply modifying software instructions stored in memory of Karlsson's controller/processor to organize Karlsson's array of spotlight beams into multiple directional beam segments with different angles/aimings for different functions. Overall, this is a simple software implementation.

353. Such modification would have been routine and well within a POSA's skill due to the similarities in Karlsson's and Harbers's adaptive systems—their common components were well-known and there would have been no limitations for a POSA to make such modification. In applying Harbers's technique to Karlsson, a POSA would have simply been applying a known technique (software implementation) in a predictable way—controlling headlights in part based on

multiple directional beam segments with different angles/aimings for different functions—as already disclosed in the art.

354. *Second*, additionally or alternatively, a POSA would have sought to incorporate *known components* (hardware implementation) of Harbers's opto-electronic elements 11-14 on a "curved substrate" (with differently angled/aimed opto-electronic elements 11-14 relative to the vehicle, *see* EX1011, 5:14-26, 6:1-7, 6:27-7:32, FIGS. 1B, 2) into Karlsson's system (with lighting means 2, 3). Again, this would have, like Harbers, provided different spatial distributions for different driving situations (e.g., off-axis viewing, bends, narrow roads, motorways, etc.), improving visibility and thereby safety. This is a simple hardware implementation.

355. Through its *system components* (hardware implementation), Harbers, like Karlsson, seeks to enhance driver visibility and thereby increase safety. EX1011, 5:14-26, 6:1-7, 6:27-7:19, 8:10-18, FIGS. 1B, 2. Indeed, opto-electronic elements 11-14 arranged on a "curved substrate," with different angles/aimings relative to the vehicle, provide beam segments 6-6'-6"-6"', 7-7'-7"-7"' for different driving situations. EX1011, 5:14-26, 6:1-7, 6:27-7:19, FIGS. 1B, 2; EX1011, 7:27-32 ("*curved* substrate"), 7:1-17, 9:28-10:5, 13:5-7.



EX1011, FIG. 2 (annotated).

356. Like the software implementation above, this hardware combination of Karlsson's lighting means 2, 3 and Harbers's differently angled/aimed opto-electronic elements 11-14 on a curved substrate, would have provided Karlsson's system with different spatial distributions for different driving situations, as in Harbers, thereby improving driver safety. Doing so would have been merely combining prior-art elements or a simple substitution of one known element for another (Karlsson's lighting means 2, 3 on a flat substrate and Harbers's opto-electronic elements 11-14 on a curved substrate) according to known methods (disclosed in Karlsson and Harbers) to yield predictable results (improved visibility and safety). Overall, this is a simple hardware implementation.

357. A POSA would have had a reasonable expectation of success combining Harbers with Karlsson, for example, by simply modifying the flat

substrate of Karlsson's lighting means 2, 3 with Harbers's curved substrate to provide multiple light sources with different angles/aimings relative to the vehicle for different functions (hardware implementation).

358. Such modification would have been routine and well within a POSA's skill due to the similarities in Karlsson's and Harbers's adaptive systems—their common components were well-known and there would have been no limitations for a POSA to make such modifications. And in combining Karlsson with Harbers's array of opto-electronic elements 11-14 (e.g., modifying an illuminator), a POSA would have simply been combining known elements according to known methods (disclosed in Harbers) to yield predictable results (light control for different functions, hardware implementation).

359. I lay out below the specific disclosures of Karlsson and Harbers, and expand on this combination and reasonable expectation of success analysis below specifically with reference to elements [20.2] and [59.2].

B. Independent Claims 20 and 59

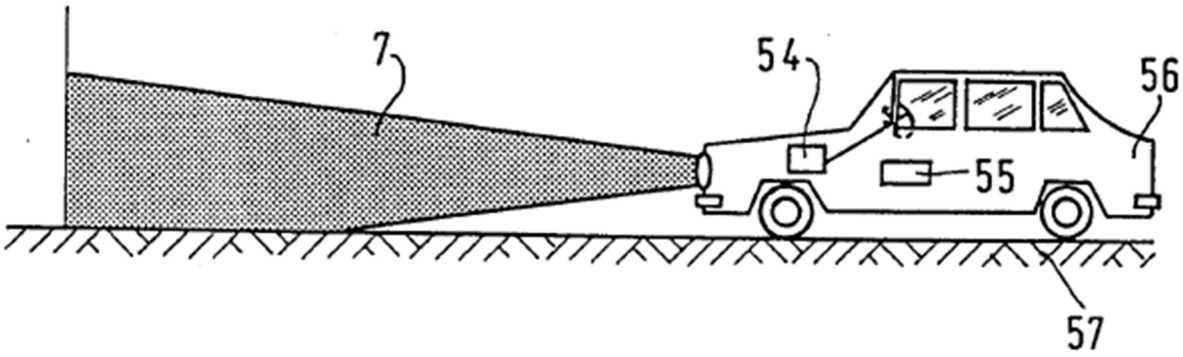
360. Karlsson, alone or in combination with Harbers, renders independent claims 20 and 59 obvious.

1. [20.P] "A vehicle headlight system, comprising:"

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

361. [59.P] is identical to [20.P].

362. Karlsson discloses a headlight system for a car (56) to provide an adaptive light beam (7). EX1010, 20:16-32, Abstract, FIG. 16.



EX1010, FIG. 16.

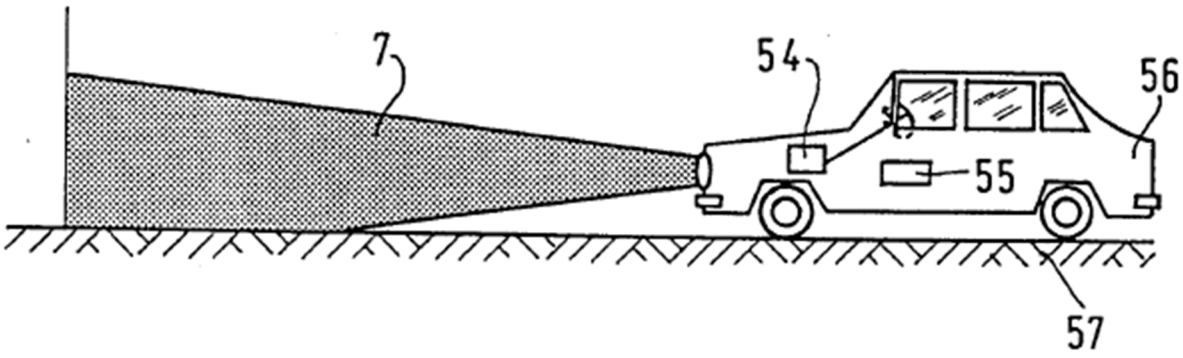
363. In view of the above, Karlsson discloses these elements.

2. [20.1]: "one or more headlamps affixed to a vehicle,"

[59.1]: "one or more headlamps affixed to a first vehicle,"

364. In my opinion, there is no patentable difference between [59.1] and [20.1].

365. Karlsson's lighting device (1, 24) is affixed to car (56) to provide adaptive light beam (7). EX1010, 20:16-32, FIGS. 1, 3, 16; EX1010, Abstract, 9:18-22.



EX1010, FIG. 16.

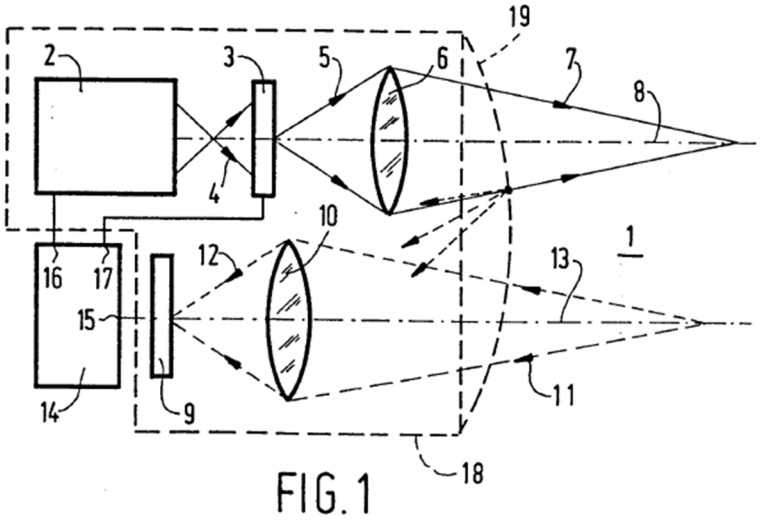
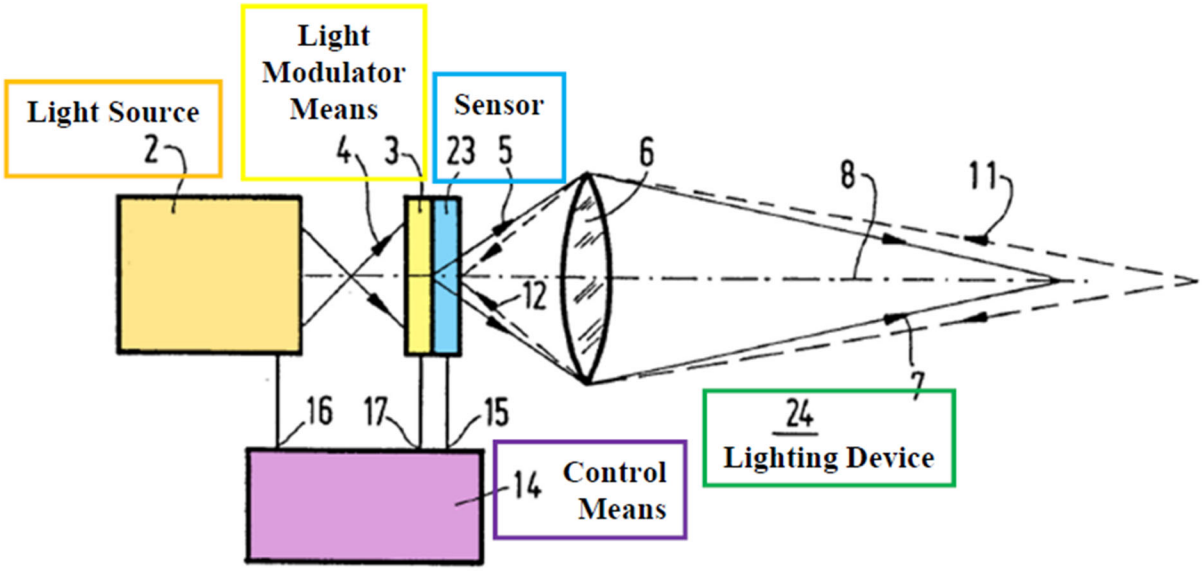


FIG. 1

EX1010, FIG. 1.



EX1010, FIG. 3 (annotated).

366. In view of the above, Karlsson discloses these elements.

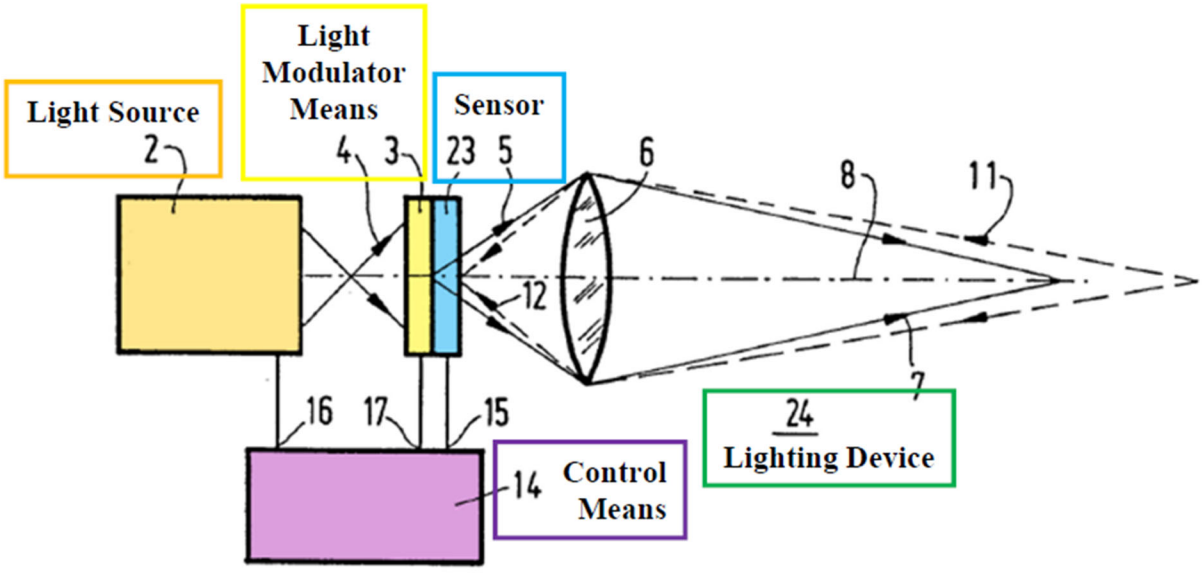
3. [20.2]: "each headlamp including at least three directional light sources aimed at different angles relative to the vehicle,"

[59:2]: "each headlamp including at least three directional light sources having different aimings relative to the first vehicle,"

367. In my opinion, there is no patentable difference between [59.2] and [20.2].

(a) Karlsson discloses this element.

368. In my opinion, Karlsson discloses [20.2]/[59.2]. Specifically, Karlsson discloses "a plurality of *controllable spotlight beams*" and "*spotlight beams 34* may also be made up of…*light modulators* which can be controlled to transmit light *to a specified degree*…for each *individual* spotlight beam 34 or for a *group* of spotlight beams." EX1010, 4:25-31, 14:5-15, FIGS. 3, 6; EX1010, 11:25-28 ("*given directions*"), 14:1-4 ("spotlight beams 34 can be…a *grid of separate light sources*"), 19:29-33 ("desired pattern and *direction of the beam*"), FIG. 14. Each spotlight beam is a "source" that combines to form the headlamp beam, and the combination of Karlsson's spotlight beams form many, and at least three directional light sources having different angles (aimings). EX1010, 4:25-31, 14:1-15, FIGS. 6, 14.



EX1010, FIG. 3 (annotated).

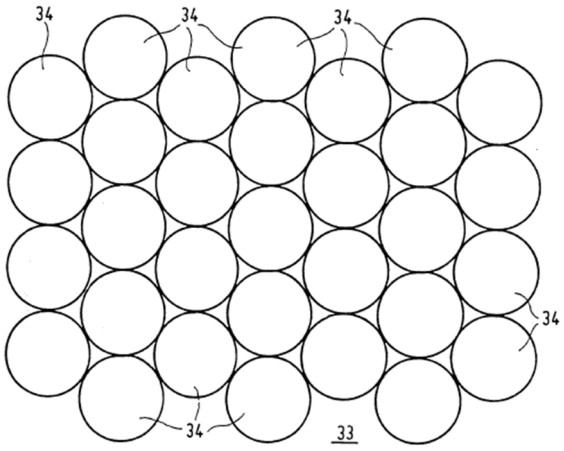
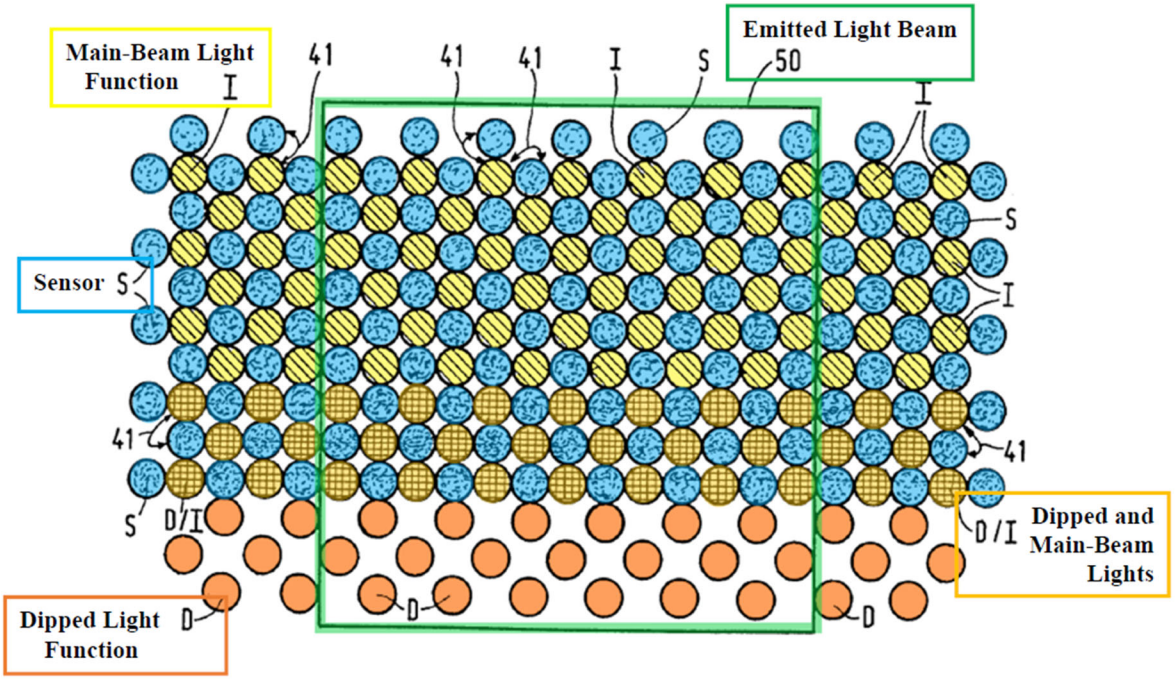


FIG. 6

EX1010, FIG. 6.



EX1010, FIG. 14 (annotated).

369. Such directionality results in *directional light sources* that by definition will have different angles, which result in different aimings. So disclosure that discusses directional light sources with different angles applies the same to disclosure that discusses directional light sources with different aimings. *See* EX1017, 5 ("the adaptive light pattern should support to direct the concentration to the most important zone for the current driving situation"), FIGS. 1, 3-5; EX1018, 4 ("variable aiming"); EX1026, 451 ("[m]ore beams are necessary to match varied driving regions, traffic situations, and driving operations"), 456 ("beam axes of the lamps are aimed at the directions indicated"), FIGS. 1, 3-3; EX1038, 1:12-10:3, FIGS. 1-3; EX1039, 9:16-11:11, FIGS. 1-6; EX1040, 1:16-30, FIGS. 1, 2A-2C; EX1036, 3:52-4:32, FIGS. 2-6.

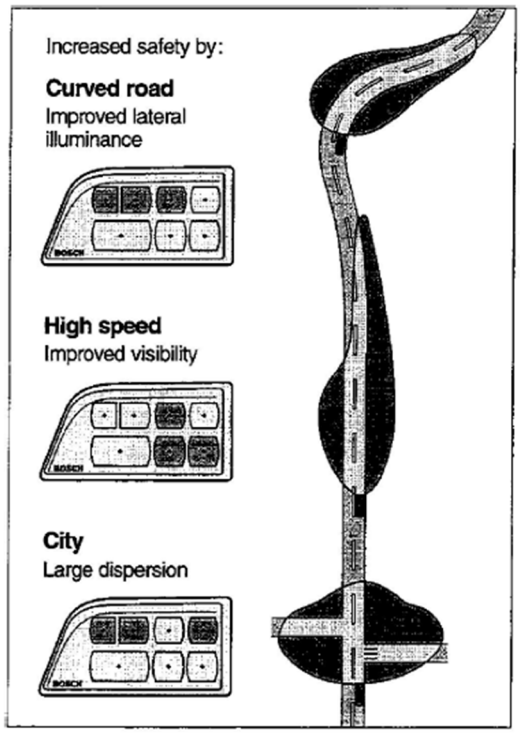


Fig.1: Three standard driving situations with adapted light pattern seen from the bird eye's view.

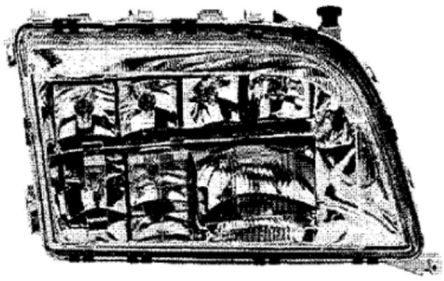
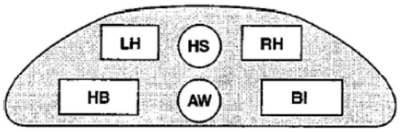


Fig 4: ALP *headlamp* sample



Single components:

LH Left hand bend	**BI** Basic illumination
RH Right hand bend	AW Adverse weather illumination
HB High beam	HS Hot spot

Fig. 5 Advanced ALP sample layout

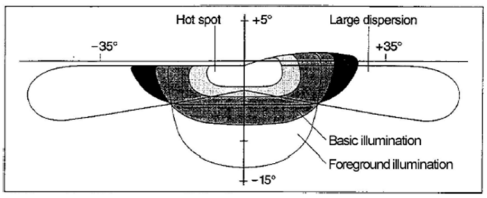


Fig. 3: Light pattern of multiple beam *headlamp* (*Isolux* curves in wall projection):
The individual light *pattern* of multiple sub-units sum up to the total adaptive light pattern

EX1017, FIGS. 1 and 3-5.

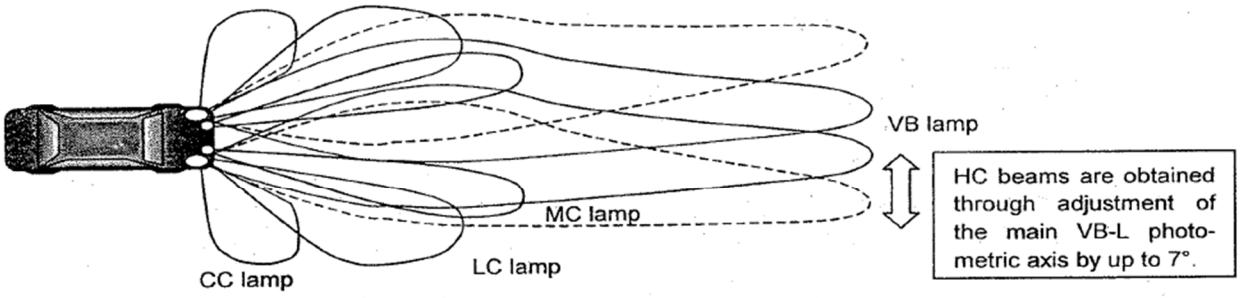
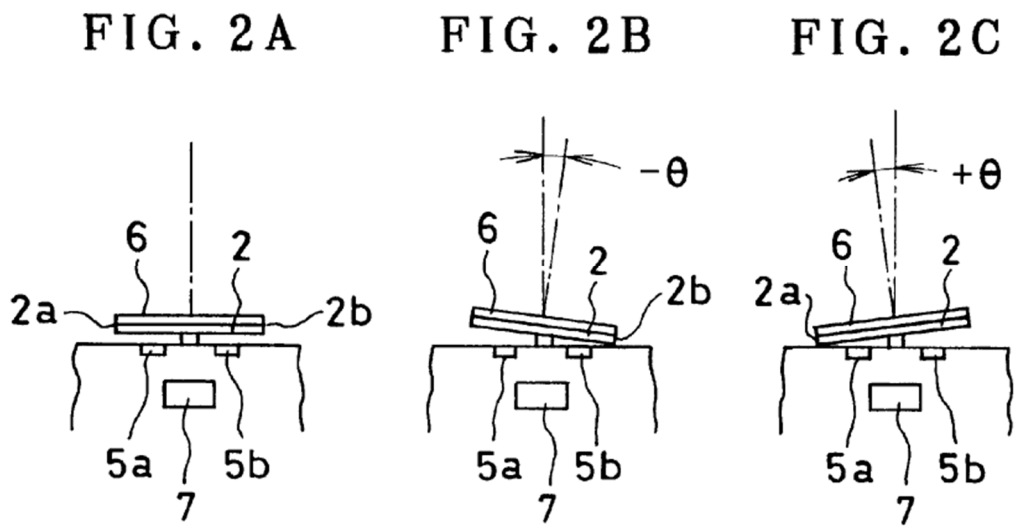


Fig. 3-3: Imaged Illumination Configurations on Road Surface

EX1026, FIG. 3-3.



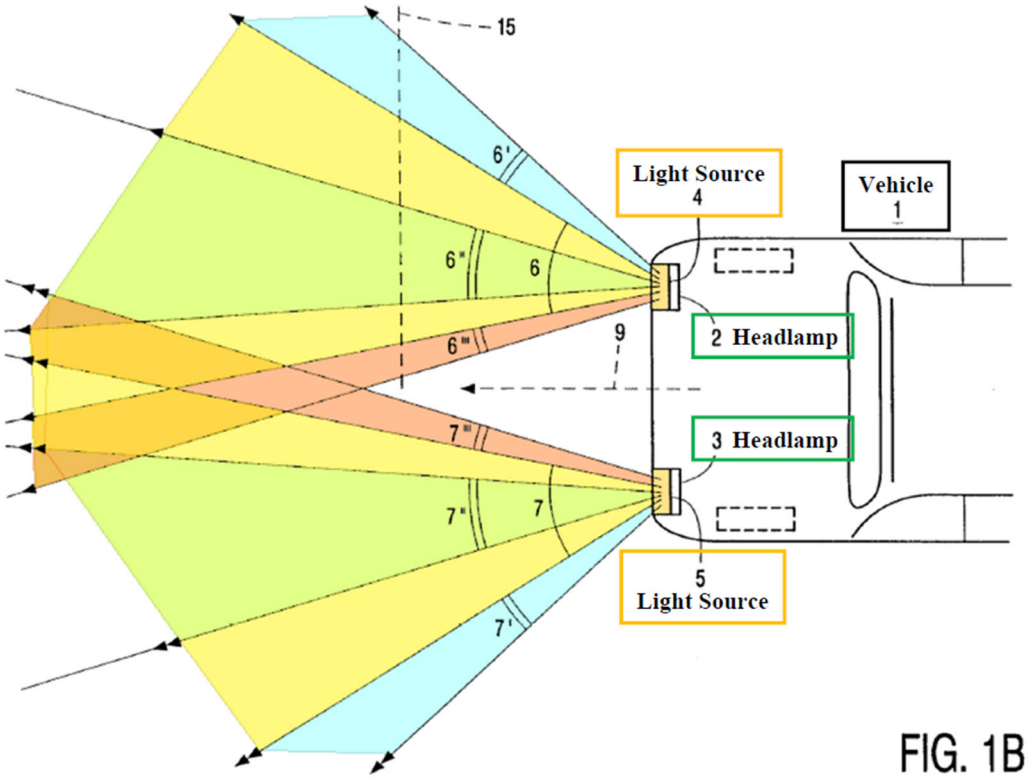
EX1040, FIGS. 2A-2C.

(b) Harbers also discloses this element.

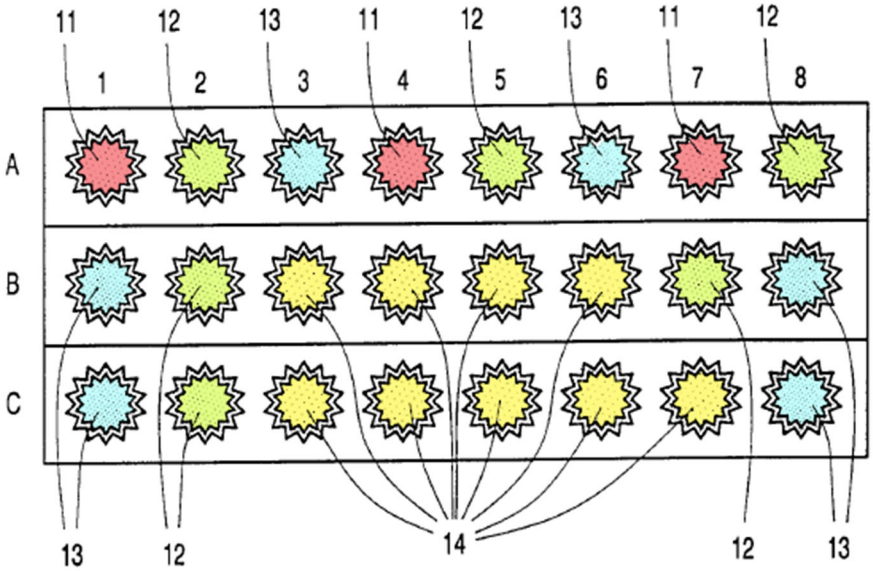
370. If Patent Owner alleges, incorrectly, that Karlsson does not expressly disclose [20.2]/[59.2], Harbers also discloses [20.2]/[59.2], and it would have been obvious to incorporate Harbers's disclosure into Karlsson.

371. As explained above (Section XIV.A), Harbers discloses an array of opto-electronic elements 11-14 on a curved substrate that emits light beam segments 6-6'-6"-6"', 7-7'-7"-7"' with different angles/aimings relative to longitudinal direction 9 for different spatial distributions. EX1011, 5:14-26, 6:1-7, 6:27-7:19, FIGS. 1B, 2; EX1011, 7:27-32 ("*curved substrate…determined* to a substantial degree by the *desired direction* of the light beams emitted"). For example, Harbers's beam segment 6, 7 is a "wide…passing beam" (e.g., first angle/aiming), beam segment 6', 7' illuminates "the shoulder of the road" (e.g.,

second angle/aiming), and beam segment 6", 7" illuminates “the center of the road” (e.g., third angle/aiming). EX1011, 7:1-17, FIG. 1B.



EX1011, FIG. 1B (annotated).



EX1011, FIG. 2 (annotated).

372. A POSA would have been motivated to combine Harbers with Karlsson with a reasonable expectation of success, providing predictable visibility and safety benefits. I provide additional detail, evidence, and explanation of my conclusions below, showing that Karlsson, alone or combined with Harbers, discloses [20.2]/[59.2].

(c) A POSA would have been motivated to combine Karlsson and Harbers with a reasonable expectation of success.

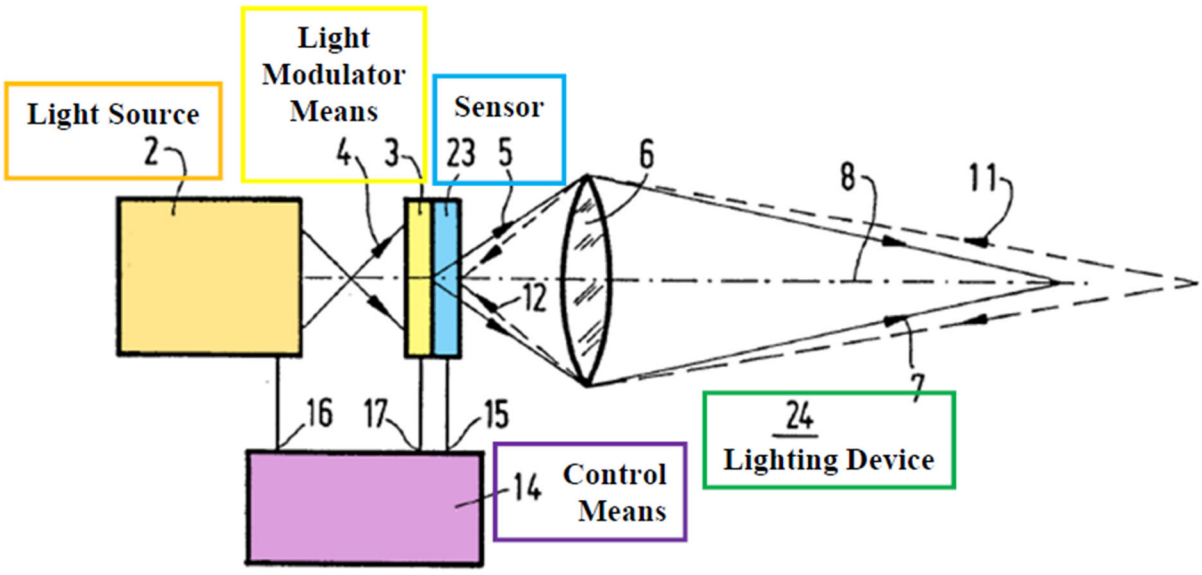
373. It would have been obvious to a POSA to employ multiple directional beam segments with different angles/aimings in Karlsson's system, as in Harbers, to provide alternative control of Karlsson's directional spotlight beams and provide different spatial distributions for improved visibility in different driving situations, thereby improving driver safety—an express purpose of Karlsson. EX1010, 1:10-13, 1:16-26, 4:17-21, 9:18-26.

374. As discussed, Karlsson discloses "directional light sources" with independently controlled angular positions for protecting other drivers from glare. Harbers provides further detail on ways to implement "directional light sources" for different functions, conceptually and physically. So naturally, it would have been obvious to a POSA designing an adaptive headlamp to implement Harbers's multiple directional beam segments with different angles/aimings—through either

software or hardware—for different functions in Karlsson's system. Indeed, Harbers discloses such an implementation to provide different spatial distributions for improved visibility in different driving situations (e.g., off-axis viewing, bends, narrow roads, motorways, etc., *see* EX1011, 5:14-26, 6:1-7, 6:27-7:32, 9:28-10:5, 13:5-7, FIGS. 1B, 2), thereby improving driver safety—an express purpose of Karlsson. EX1010, 1:10-13, 1:16-26, 4:17-21, 9:18-26.

375. Karlsson and Harbers are from the same field—controllable headlamps with dynamic illumination—and include the same building blocks (light sources, sensors, controllers). EX1010, Abstract, 2:30-35, 9:18-26, 13:24-14:4, 19:18-20:3, FIGS. 3, 6, 14-15; EX1011, Abstract, 2:27-3:10, 5:14-26, 6:27-7:19, 7:27-32, FIGS. 1B, 2. Further, improved visibility, thereby increasing safety is paramount in both. EX1010, 1:10-26, 4:17-21, 9:18-26; EX1011, 5:1-26, 7:1-14, 9:1-32.

376. *First*, including an additional or alternative control technique (software implementation) for Karlsson—Harbers's *known technique* of using multiple directional beam segments for different functions—would have added more control methods for different functions to Karlsson's visibility for different driving situations, thereby increasing safety. This is a simple software combination. Karlsson discloses "*controllable spotlight beams*" are controlled individually or in groups by control means 14 to "*given directions*" to reduce glare. EX1010, 4:25-31, 11:25-28, 14:1-15, 19:29-33, FIGS. 3, 6.



EX1010, FIG. 3 (annotated).

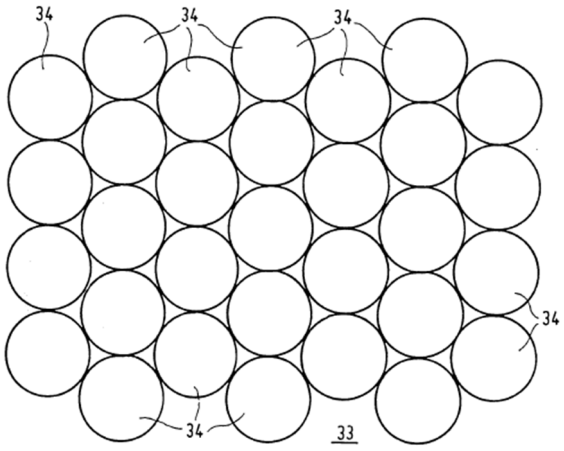


FIG. 6

EX1010, FIG. 6.

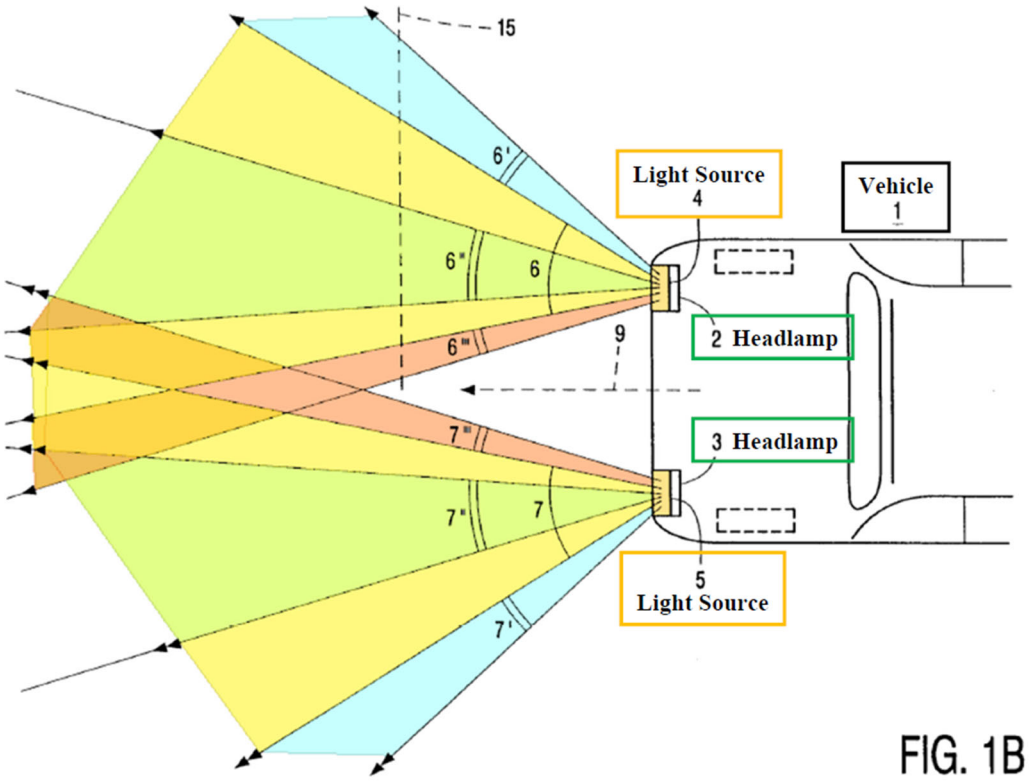
377. Indeed, Karlsson's techniques and system of controlling individual spotlight beams emphasize safety of all drivers. EX1010, 1:16-26, 4:17-21, 9:18-26. Controllable headlamps "significantly increase the driving comfort and the road safety," and "glaring or blinding of oncoming traffic is effectively prevented," increasing safety. EX1010, 9:18-26. Karlsson enables "higher light intensity," for

example "when driving on dark, unilluminated roads," while protecting others from glare. EX1010, 1:21-26; EX1010, 1:10-13 ("comply with…regulations…preventing the *blinding* or *glare*").

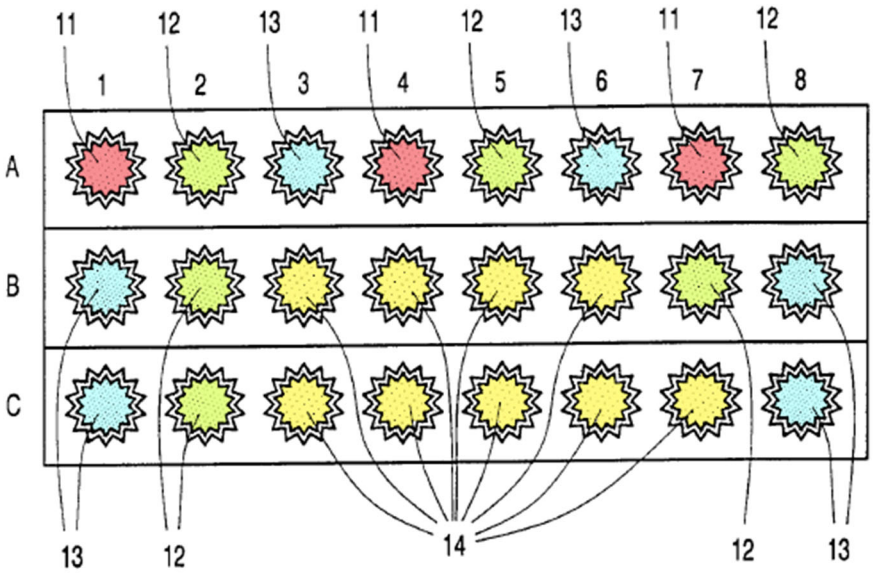
378. Karlsson's system "*selectively adjust[s]*…spotlight beam[s] 34, in response to a *control signal from sensor means 23*…to provide a *desired lighting pattern*" in "given *directions*." EX1010, 14:26-30, 11:25-28, FIGS. 3, 6, 14. Karlsson recognizes the safety benefits of identifying "oncoming traffic" and other objects ("road signs etc.") in the field of view and adjusting a pattern and/or an intensity of light beam 7. EX1010, Abstract, 3:17-31, 12:19-35; EX1010, 2:2-4, 5:16-32. If Patent Owner argues, incorrectly, Karlsson does not expressly disclose directional light sources at different angles/aimings, even though Karlsson discloses different angular positions control for different spotlight beams, it would have been obvious to a POSA to use such control for the features of "aimed at different angles" and "having different aimings." Combining Harbers with Karlsson would have made Karlsson's system more direct or active for different functions, and further achieves Karlsson's purpose of improving driver safety.

379. And Harbers's *technique* (software implementation), like Karlsson, seeks to enhance driver visibility, thereby increasing safety—using multiple directional beam segments to provide different spatial distributions for different functions. EX1011, 5:14-26, 6:1-7, 6:27-7:19, 8:10-18, FIGS. 1B, 2. Specifically,

Harbers explains opto-electronic elements 11-14 arranged on a "curved substrate" provide differently angled/aimed beam segments 6-6'-6"-6'", 7-7'-7"-7'" relative to longitudinal direction 9 to form different spatial distributions, improving visibility of the road and/or road surrounding, thereby increasing safety. EX1011, 5:14-26, 6:1-7, 6:27-7:19, FIGS. 1B, 2; EX1011, 7:27-32 ("*curved* substrate"), 7:1-17, 9:28-10:5, 13:5-7.



EX1011, FIG. 1B (annotated).



EX1011, FIG. 2 (annotated).

380. The additional control (software implementation) of having multiple directional beam segments with different angles/aimings as in Harbers, implemented with Karlsson's control means 14/spotlight beams 34 (including light modulator means 3), would have provided Karlsson's system with different spatial distributions for different driving situations beyond reducing glare for drivers, thereby improving safety.

381. A POSA would have understood that alternative or additional control for Karlsson's controller/illuminator by using Harbers's different angles/aimings, would have enhanced Karlsson's system, making it more direct or active, by providing different spatial/angular distributions for different driving situations, thereby improving driver safety. Doing so would have merely been applying Harbers's known technique (software implementation: using multiple directional

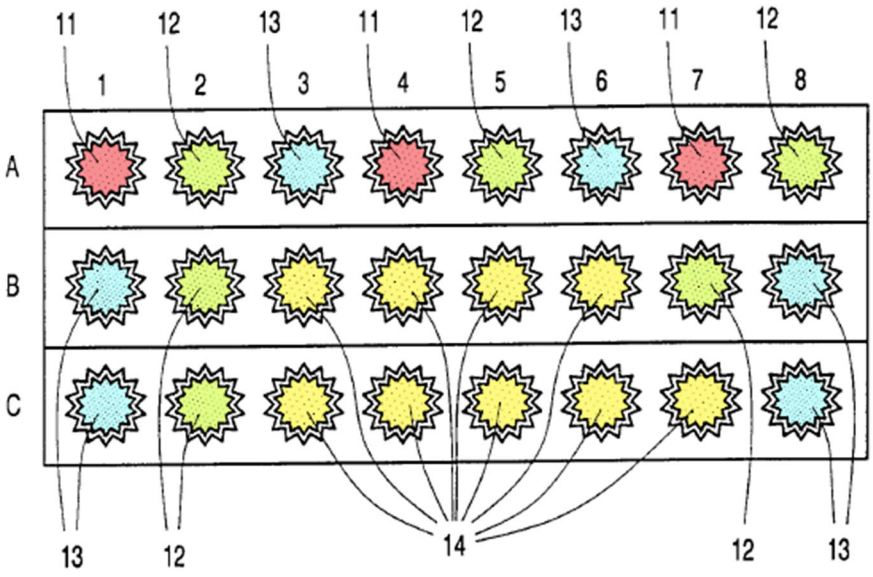
beam segments with different angles/aimings for different functions) to Karlsson's similar, known device (adaptive headlamp system with controllable spotlight beams), in the same way. Harbers's known technique is fully described along with its benefits (improved visibility for different functions, thereby increased safety); thus, a POSA would have readily applied it to similar systems, such as Karlsson's, in the same way.

382. A POSA would have had a reasonable expectation of success combining Harbers with Karlsson, for example, by simply modifying software instructions stored in memory of Karlsson's controller/processor to organize Karlsson's array of spotlight beams into multiple directional beam segments with different angles/aimings for different functions. Overall, this is a simple software implementation.

383. Such modification would have been routine and well within a POSA's skill due to the similarities in Karlsson's and Harbers's adaptive systems—their common components were well-known and there would have been no limitations for a POSA to make such modification. In applying Harbers's technique to Karlsson, a POSA would have simply been applying a known technique (software implementation) in a predictable way—controlling headlights in part based on multiple directional beam segments with different angles/aimings for different functions—as already disclosed in the art.

384. *Second*, additionally or alternatively, a POSA would have sought to incorporate *known components* (hardware implementation) of Harbers's opto-electronic elements 11-14 on a "curved substrate" (with differently angled/aimed opto-electronic elements 11-14 relative to the vehicle, *see* EX1011, 5:14-26, 6:1-7, 6:27-7:32, FIGS. 1B, 2) into Karlsson's system (with lighting means 2, 3). Again, this would have, like Harbers, provided different spatial distributions for different driving situations (e.g., off-axis viewing, bends, narrow roads, motorways, etc.), improving visibility and thereby safety. This is a simple hardware implementation.

385. Through its *system components* (hardware implementation), Harbers, like Karlsson, seeks to enhance driver visibility and thereby increase safety. EX1011, 5:14-26, 6:1-7, 6:27-7:19, 8:10-18, FIGS. 1B, 2. Indeed, opto-electronic elements 11-14 arranged on a "curved substrate," with different angles/aimings relative to the vehicle, provide beam segments 6-6'-6"-6"', 7-7'-7"-7"' for different driving situations. EX1011, 5:14-26, 6:1-7, 6:27-7:19, FIGS. 1B, 2; EX1011, 7:27-32 ("*curved* substrate"), 7:1-17, 9:28-10:5, 13:5-7.



EX1011, FIG. 2 (annotated).

386. Like the software implementation above, this hardware combination of Karlsson's lighting means 2, 3 and Harbers's differently angled/aimed opto-electronic elements 11-14 on a curved substrate, would have provided Karlsson's system with different spatial distributions for different driving situations, as in Harbers, thereby improving driver safety. Doing so would have been merely combining prior-art elements or a simple substitution of one known element for another (Karlsson's lighting means 2, 3 on a flat substrate and Harbers's opto-electronic elements 11-14 on a curved substrate) according to known methods (disclosed in Karlsson and Harbers) to yield predictable results (improved visibility and safety). Overall, this is a simple hardware implementation.

387. A POSA would have had a reasonable expectation of success combining Harbers with Karlsson, for example, by simply modifying the flat

substrate of Karlsson's lighting means 2, 3 with Harbers's curved substrate to provide multiple light sources with different angles/aimings relative to the vehicle for different functions (hardware implementation).

388. Such modification would have been routine and well within a POSA's skill due to the similarities in Karlsson's and Harbers's adaptive systems—their common components were well-known and there would have been no limitations for a POSA to make such modifications. And in combining Karlsson with Harbers's array of opto-electronic elements 11-14 (e.g., modifying an illuminator), a POSA would have simply been combining known elements according to known methods (disclosed in Harbers) to yield predictable results (light control for different functions, hardware implementation).

389. In view of the above, Karlsson, alone or combined with Harbers, discloses or renders obvious these elements.

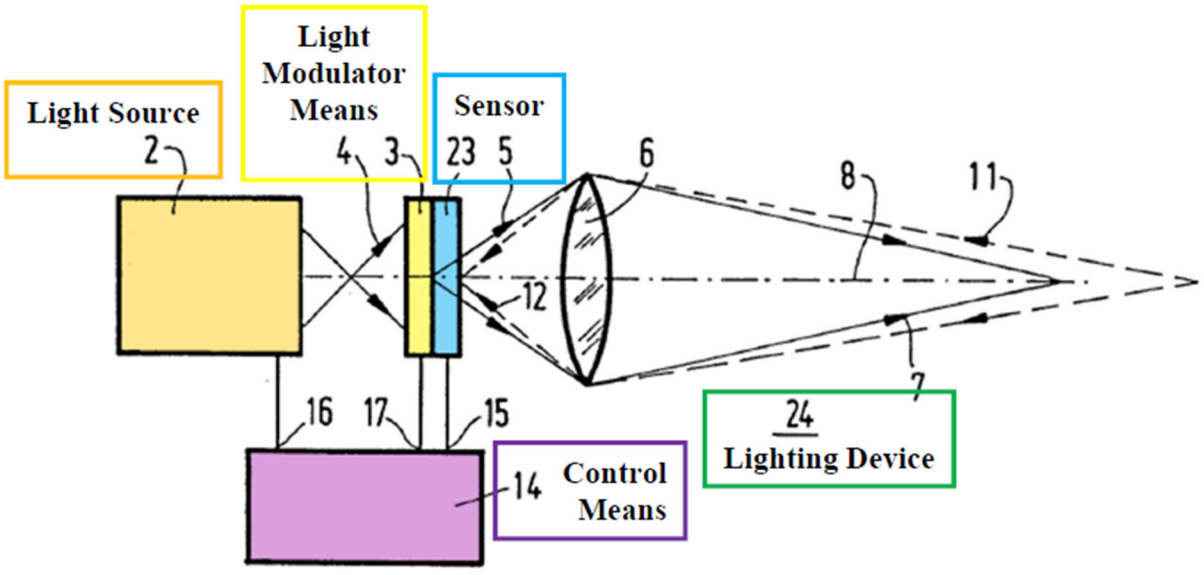
4. [20.3]: "the light sources configured to have one or more controllable light characteristics,"

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

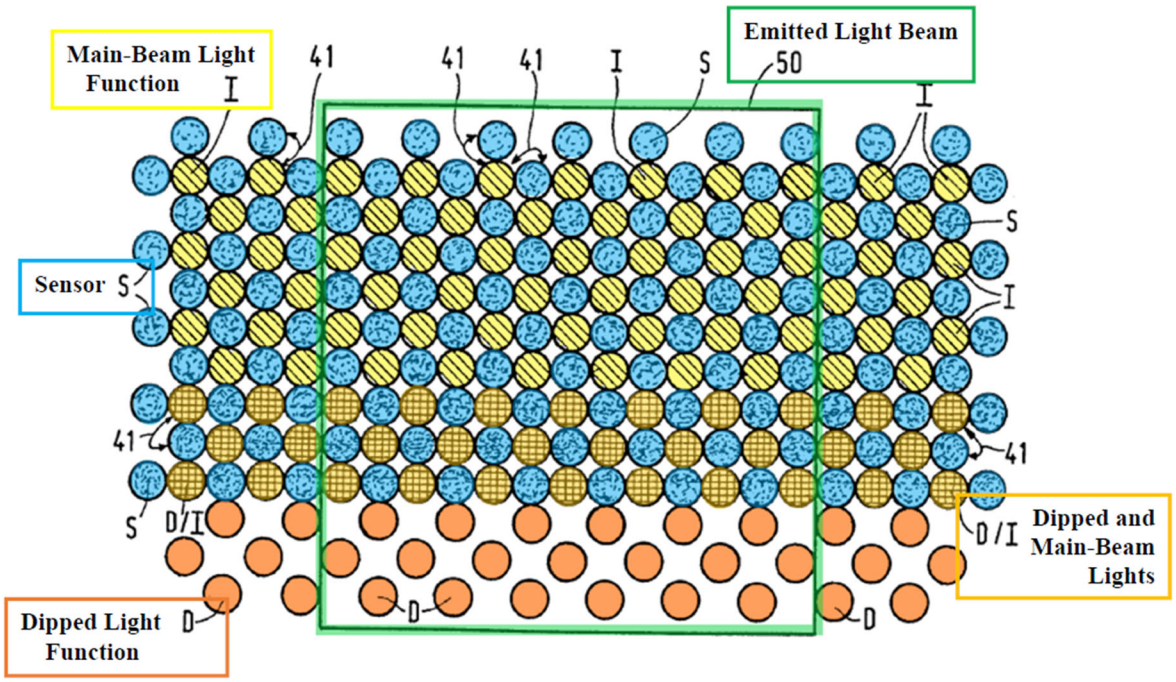
390. In my opinion, there is no patentable difference between [59.3] and [20.3].

391. Karlsson discloses "light beam 7 having a *desired pattern* and a *desired intensity* is emitted." EX1010, 9:13-17, FIGS. 3, 6, 14; EX1010, 4:25-29

("*desired pattern*"), 19:29-33 ("*vary* as regards its *shape* and *dimension*"), 9:18-22. A POSA would have understood that both "intensity" and "pattern" are "controllable [light / illumination] characteristics." *See* EX1001, 16:43-50 ("the resultant light *characteristic*, be in its *intensity*, *spatial* intensity distribution"), 2:28-30 ("[e]ach fixture has its photometric distribution *characteristics*…how many *candela* at what *angle*"); *see also* EX1017, 5 ("variation of shape…variation of beam…variation of brightness"); EX1018, 34 ("manipulation of light distributions"); EX1019, 2 ("a variable beam shape could enhance visibility, together with a variable aiming"); EX1026, 452 ("[b]eam dipping or dimming (intensity adjustment)"), FIG. 1; EX1028, 849 ("adaptive passing lighting"), FIG. 2.



EX1010, FIG. 3 (annotated).

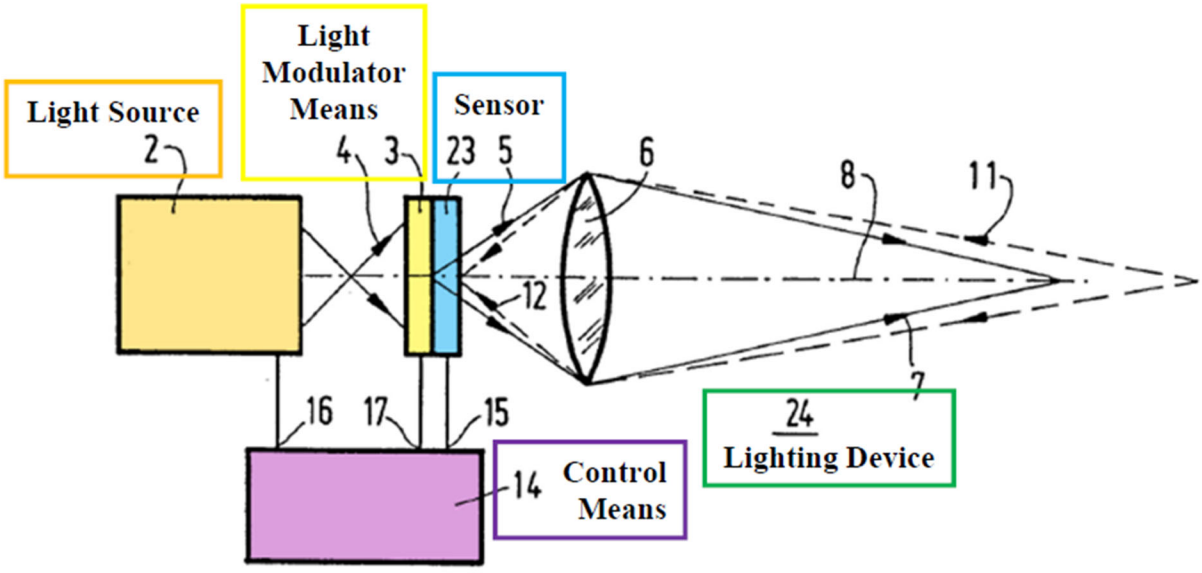


EX1010, FIG. 14 (annotated).

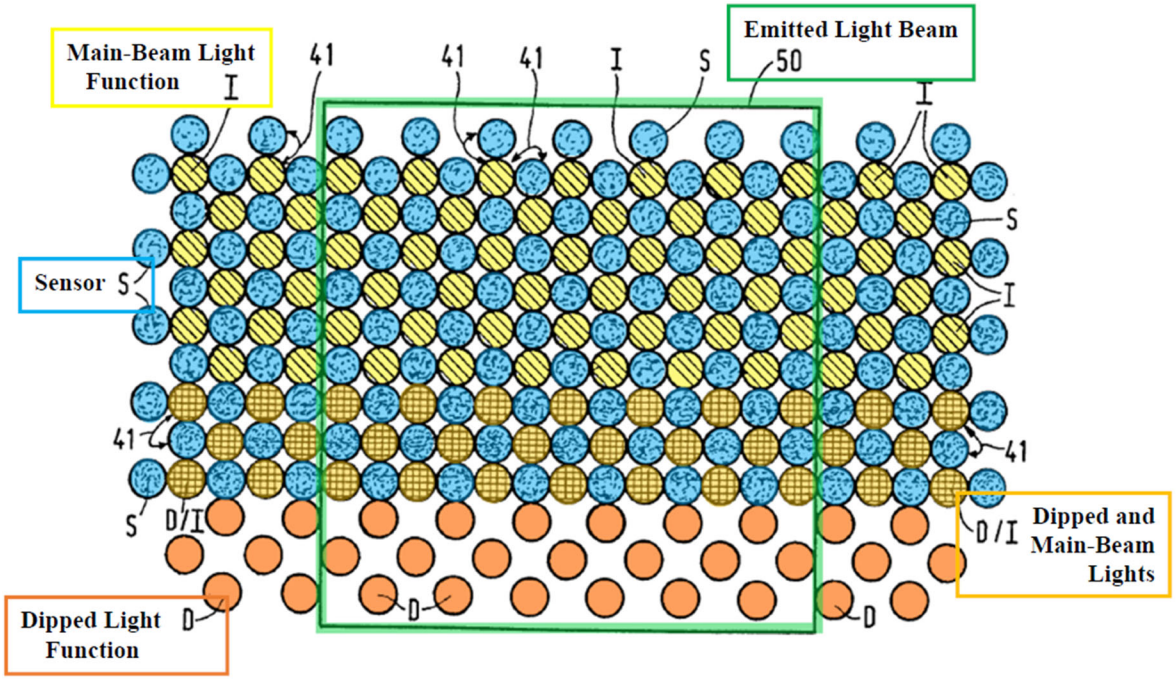
392. In view the above, Karlsson discloses these elements.

5. [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;"

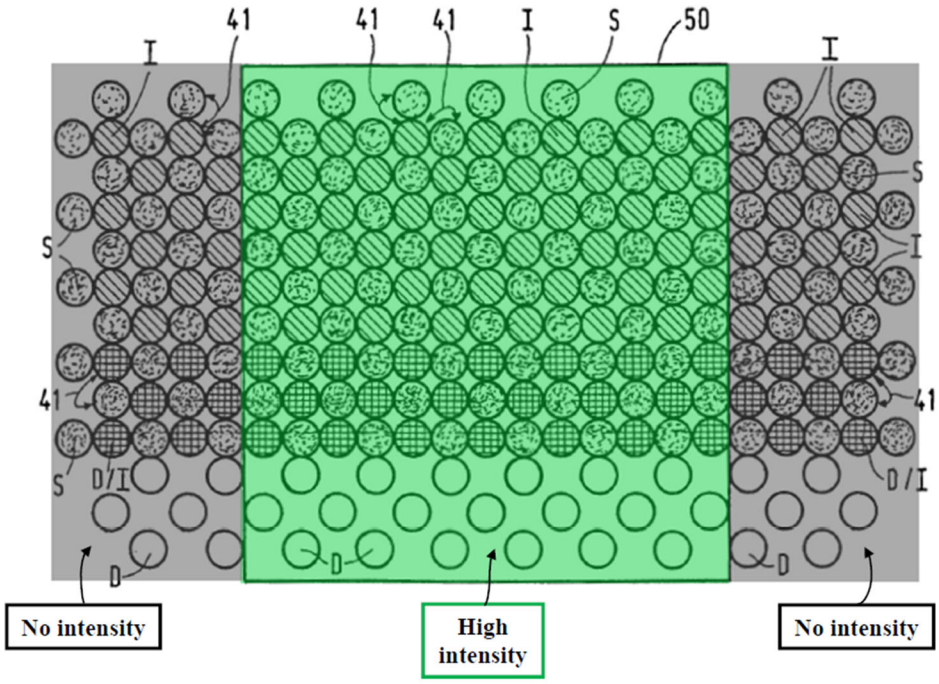
393. Karlsson discloses "*spotlight beams 34* may also be made up of…*light modulators* which can be controlled to transmit light *to a specified degree*" and "*part of the light beam* which might cause *inconvenience* to oncoming traffic is automatically *suppressed*, whilst *retaining an optimum lighting* effect for the driver." EX1010, 2:7-9, 14:5-15, FIGS. 3, 6, 14; EX1010, 11:25-28 ("*given directions*"), 9:18-33, 4:25-31.



EX1010, FIG. 3 (annotated).



EX1010, FIG. 14 (annotated).

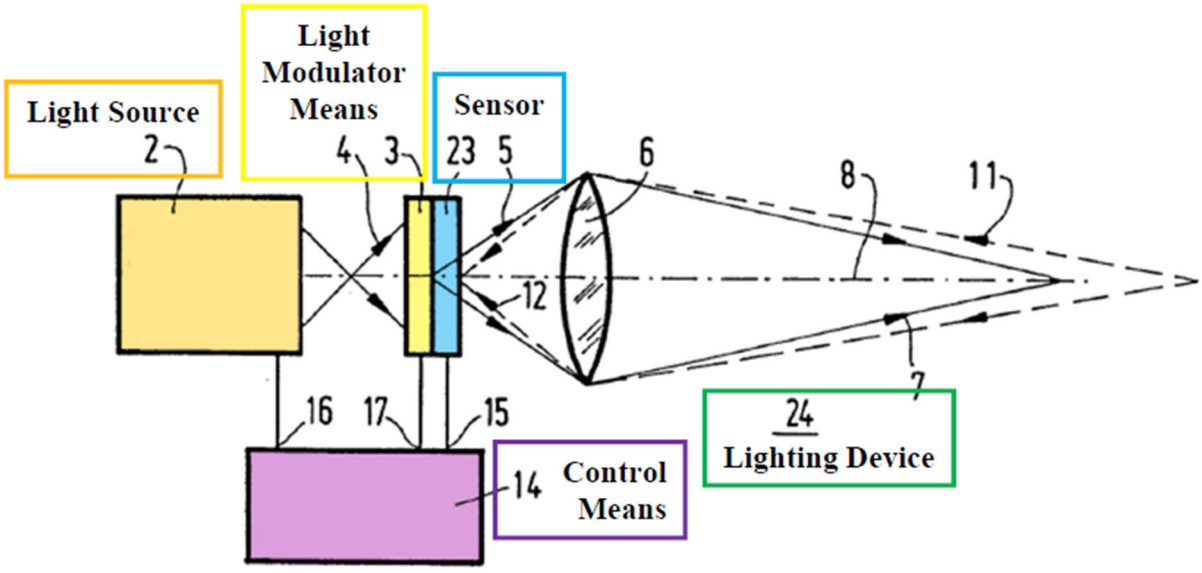


EX1010, FIG. 14 (annotated).

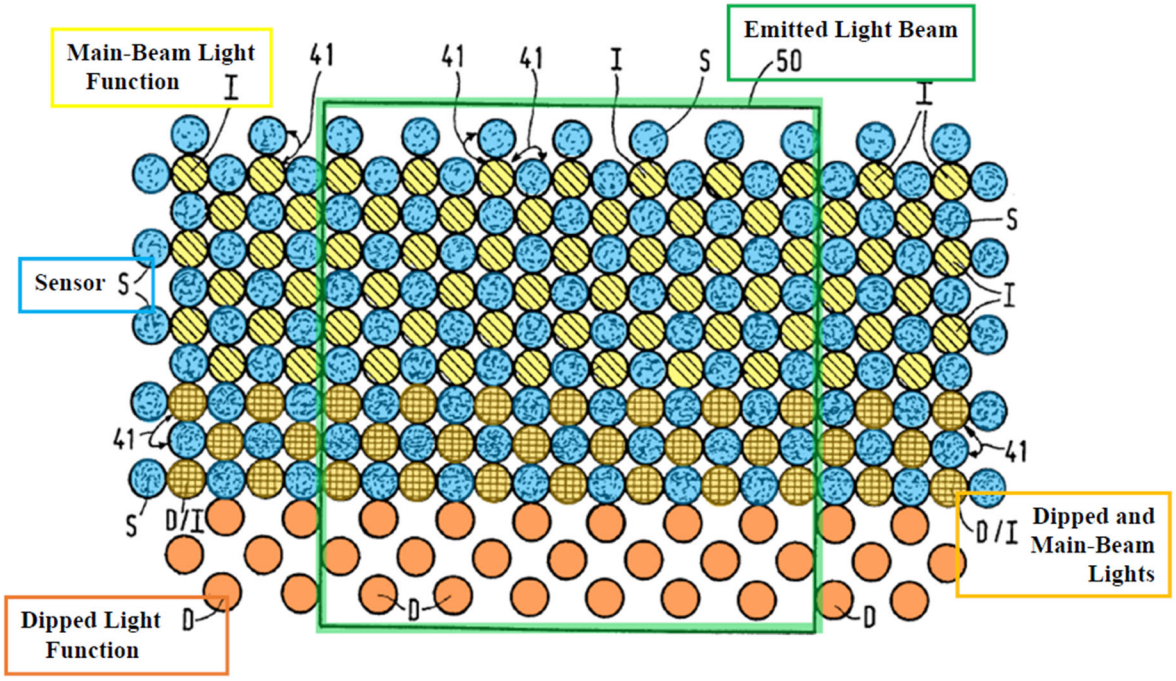
394. In view the above, Karlsson discloses this element.

6. [20.5]: "control circuitry configured to adjust the at least one light characteristic of at least one of the directional light sources;"

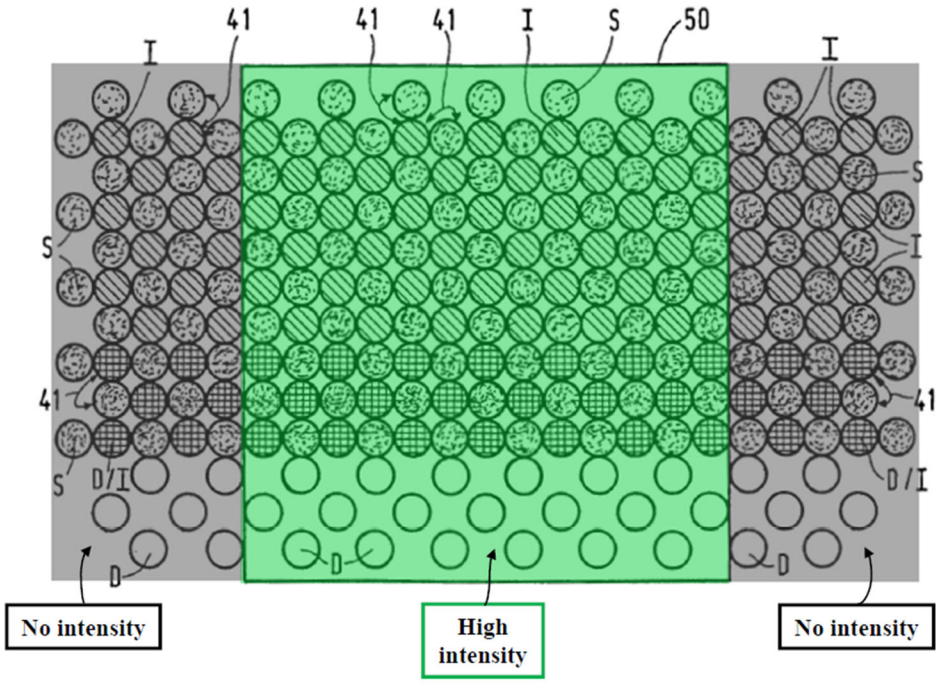
395. Karlsson discloses "*lighting means 2, 3…controlled by control means 14*, such that the *incident light 11* on the *light-sensitive sensor 9*…is *processed* into an *electric control signal*…[and] *processed* by the control means 14 into *output signals*…to *control*…*light beam 7* having a *desired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



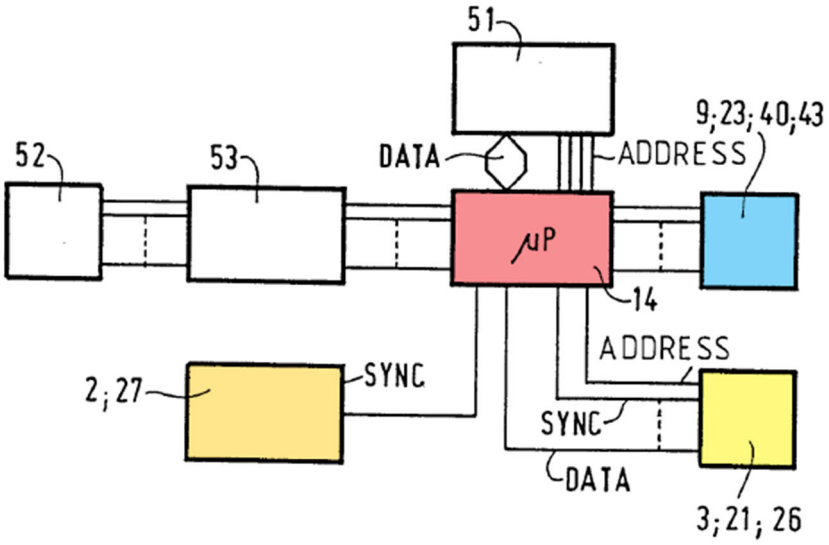
EX1010, FIG. 3 (annotated).



EX1010, FIG. 14 (annotated).



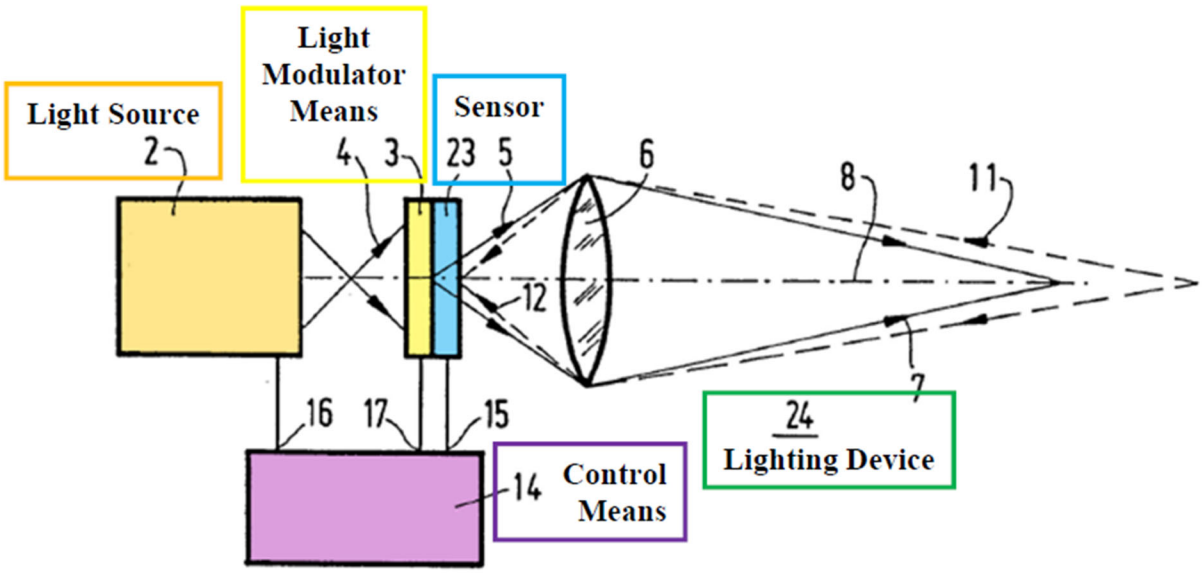
EX1010, FIG. 14 (annotated).



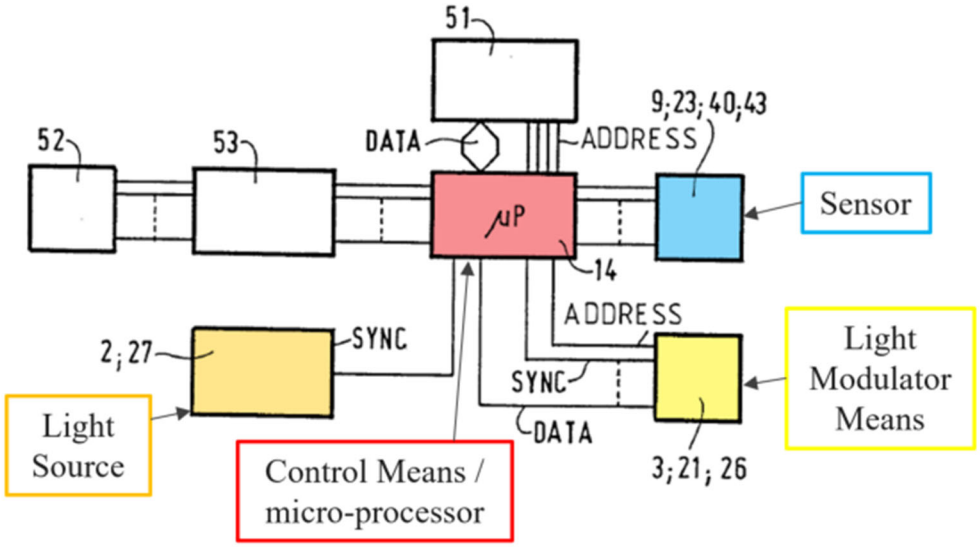
EX1010, FIG. 15 (annotated).

396. Further, indeed, Karlsson's control system includes processors, memory, etc., and specifically discloses that "[t]he *control means* may likewise be built up of various components, such as a *microprocessor, a microcontroller,*

programmable logic circuits, or of discrete logic components…A non-volatile *memory* 51 type PROM, EPROM or EEPROM may be used for *storing and recording the various adjustments*." EX1010, 21:36-22:4; *see also* EX1010, FIG. 15, 20:6-21. These were all well known components of a control system that a POSA would have known were included (or at a minimum obvious to include) in Gotou's ECU 10.



EX1010, FIG. 3 (annotated).



EX1010, FIG. 15 (annotated).

397. Karlsson too describes a control system with a memory. EX1010, 21:36-22:4; *see also* EX1010, FIG. 15, 20:6-21. Karlsson's control system includes processors, memory, etc., and specifically discloses that "[t]he *control means* may likewise be built up of various components, such as a *microprocessor, a microcontroller, programmable logic circuits, or of discrete logic components*…A non-volatile *memory* 51 type PROM, EPROM or EEPROM may be used for *storing and recording the various adjustments*." EX1010, 21:36-22:4; *see also* EX1010, FIG. 15, 20:6-21. These were all well known components of a control system that a POSA would have known were included (or at a minimum obvious to include).

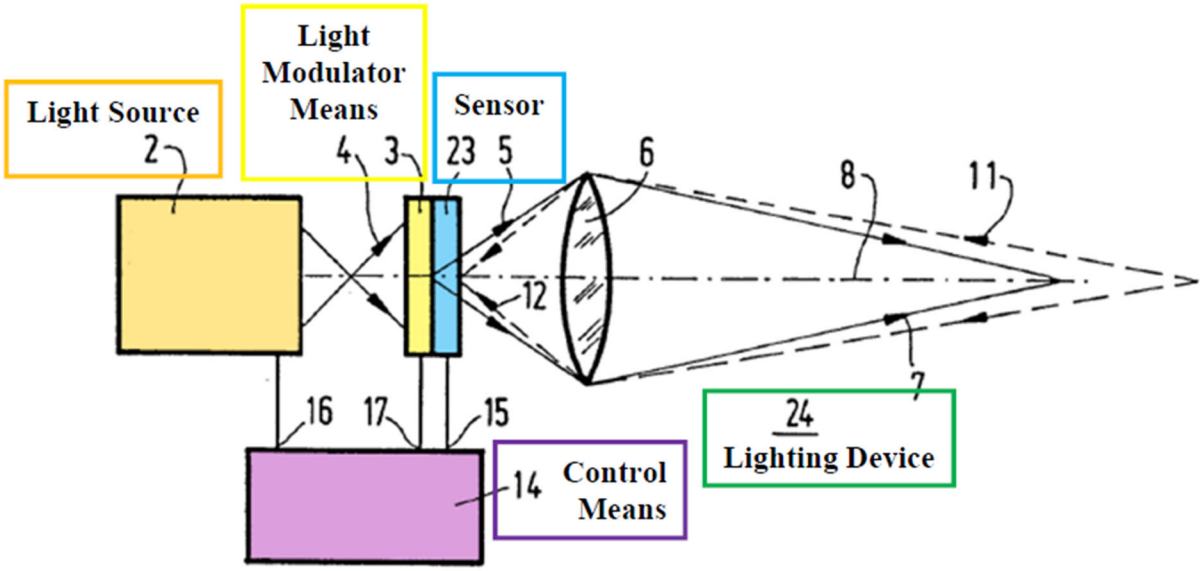
398. In view the above, Karlsson discloses this element.

7. [20.6]: "one or more sensors configured to sense information"

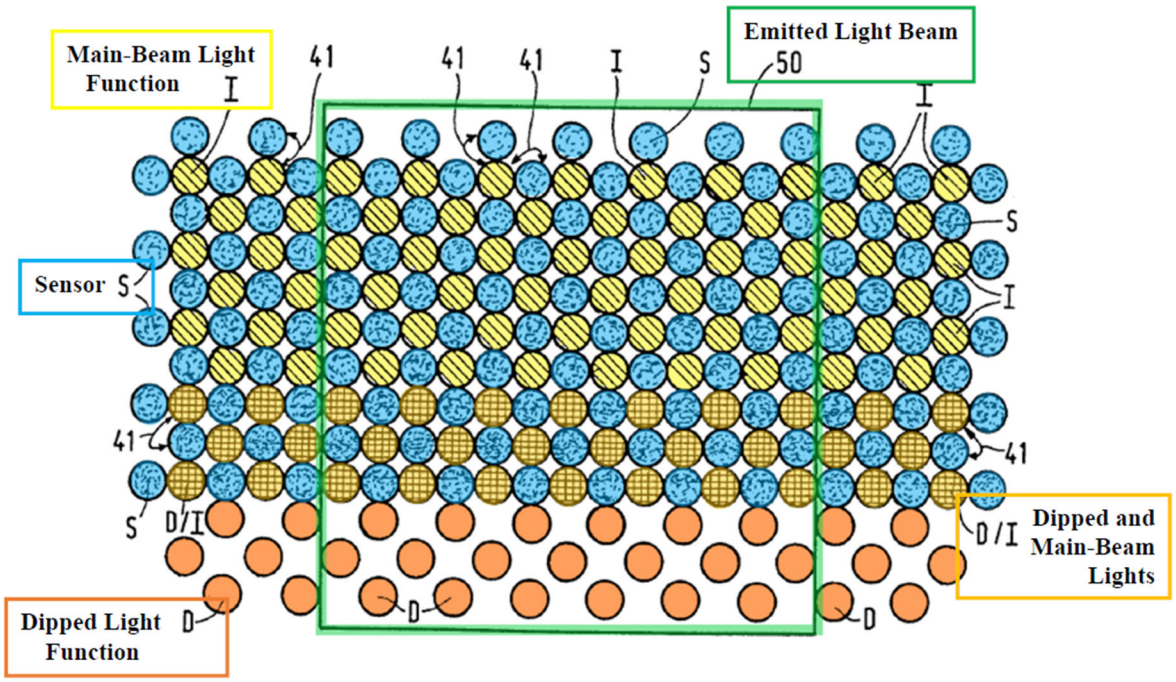
[59.4]: "one or more sensors configured to sense information,"

399. [59.4] is identical to [20.6].

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



EX1010, FIG. 3 (annotated).



EX1010, FIG. 14 (annotated).

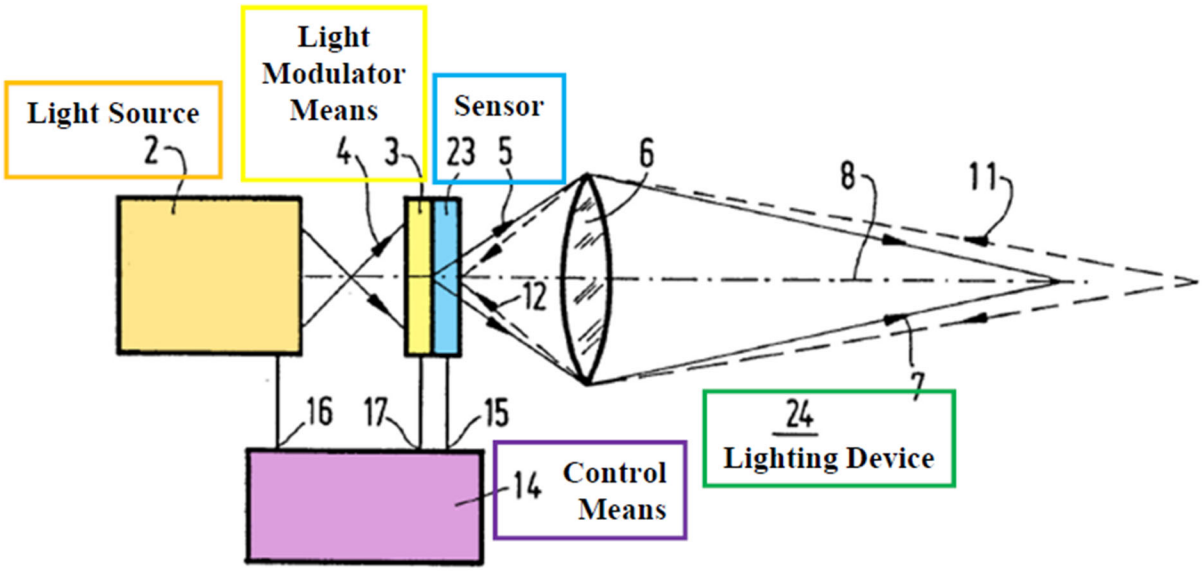
401. In view the above, Karlsson discloses these elements.

8. [20.7]: "defined as pertinent to determining illumination output from the one or more headlamps and"

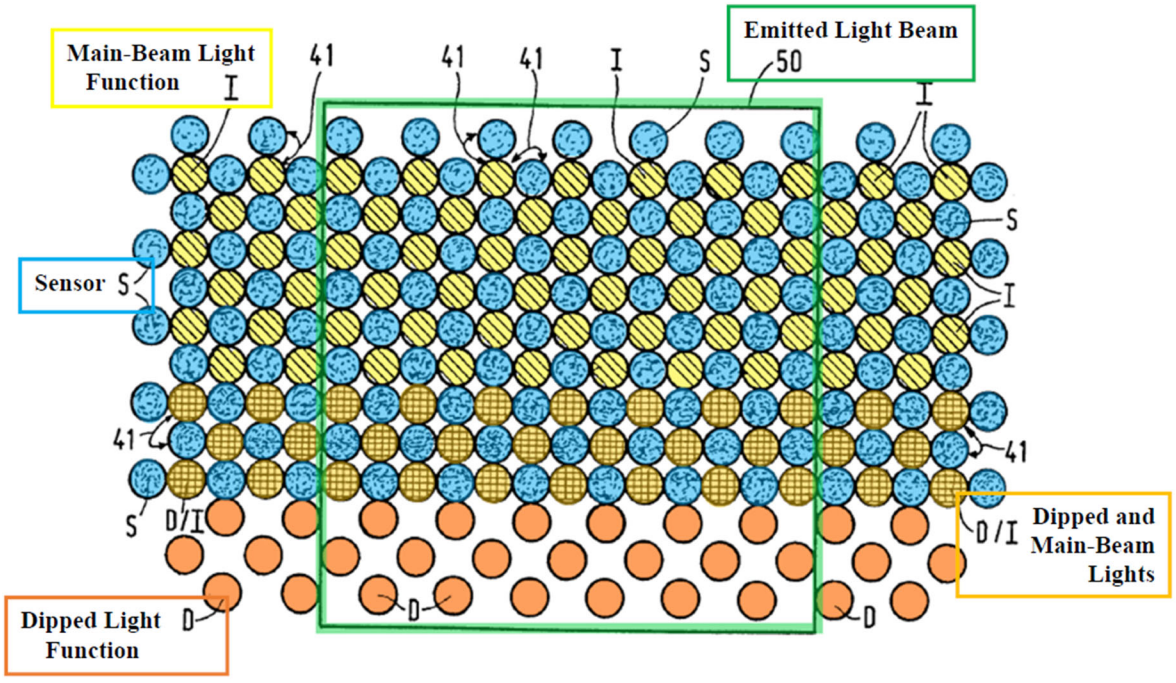
[59.5]: "at least a portion of the sensed information indicating a second vehicle, and"

402. Karlsson discloses "light-sensitive sensor…*detects* the distribution and the intensity of light in the *area ahead of a vehicle*" for "*detecting* light from *oncoming traffic*." EX1010, 2:2-4, Abstract, FIGS. 3, 14; EX1010, 3:17-21 ("*light of oncoming traffic*"), 12:19-24 ("precisely determining the *direction* and the *intensity* of the *detected light 11*"), 5:16-32, 3:27-31. The incident light data is "sensed information indicating a second vehicle" (oncoming/preceding) as recited

in [59.5], which is "pertinent to determining illumination output," as recited in [20.7]. EX1010, 9:9-17, 12:19-24, FIGS. 3, 15.



EX1010, FIG. 3 (annotated).



EX1010, FIG. 14 (annotated).

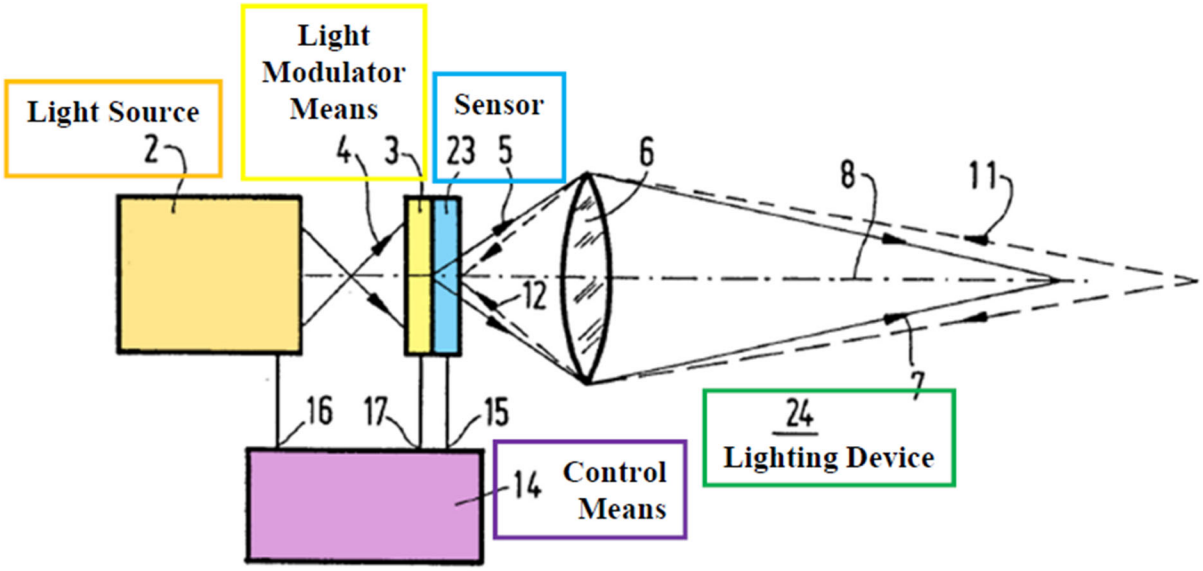
403. In view the above, Karlsson discloses these elements.

9. [20.8]: "communicating the sensed information to a processor as sensor data;"

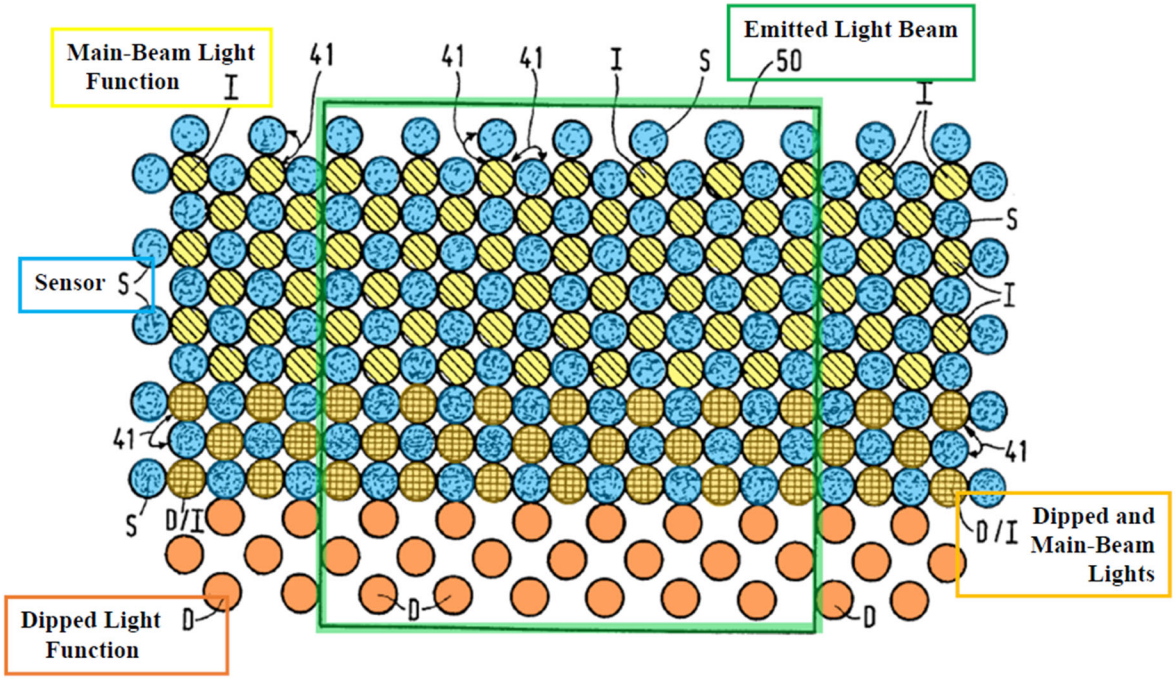
[59.6]: "communicate sensor data reflecting the sensed information to at least one processor,"

404. In my opinion, there is no patentable difference between [59.6] and [20.8].

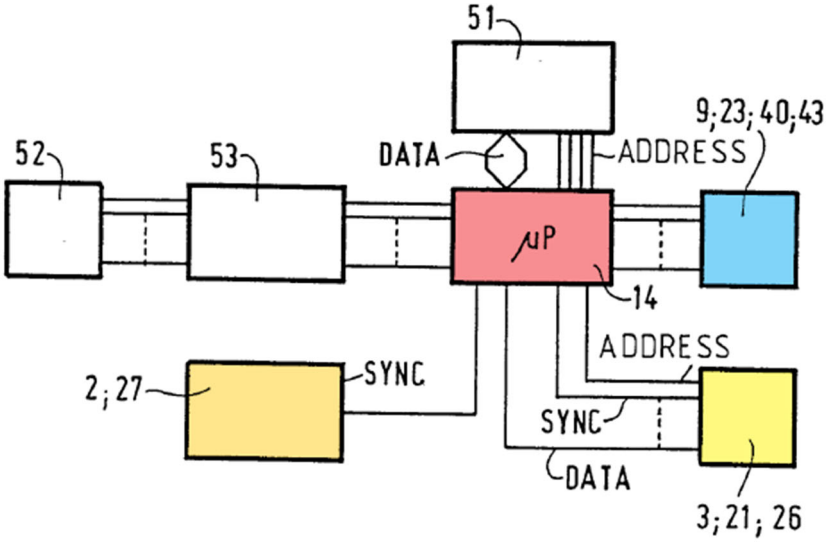
405. Karlsson discloses "*incident light 11* on the *light-sensitive sensor 9*…is *processed* into an *electric control signal* on input 15 of the *control means 14*." EX1010, 9:9-17, FIGS. 3, 14, 15; EX1010, 21:36-22:1 ("*microprocessor*"), 20:12-32, 21:36-22:4. Thus, the incident light data from the sensor is communicated to a processor. EX1010, 9:9-17, 12:19-24, FIG. 15.



EX1010, FIG. 3 (annotated).



EX1010, FIG. 14 (annotated).



EX1010, FIG. 15 (annotated).

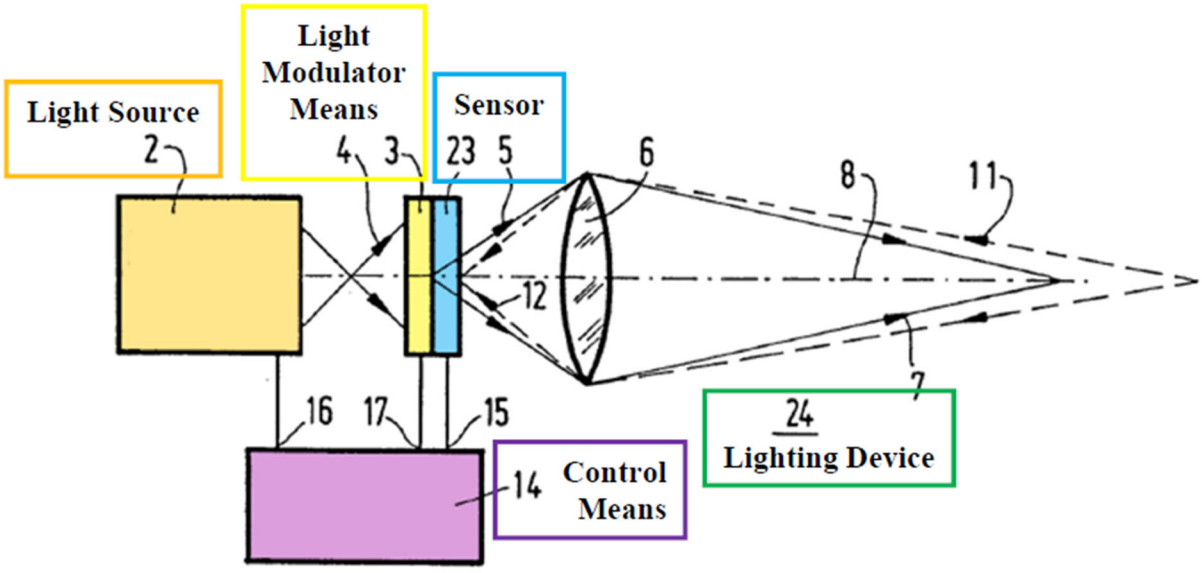
406. In view the above, Karlsson discloses these elements.

10. [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"

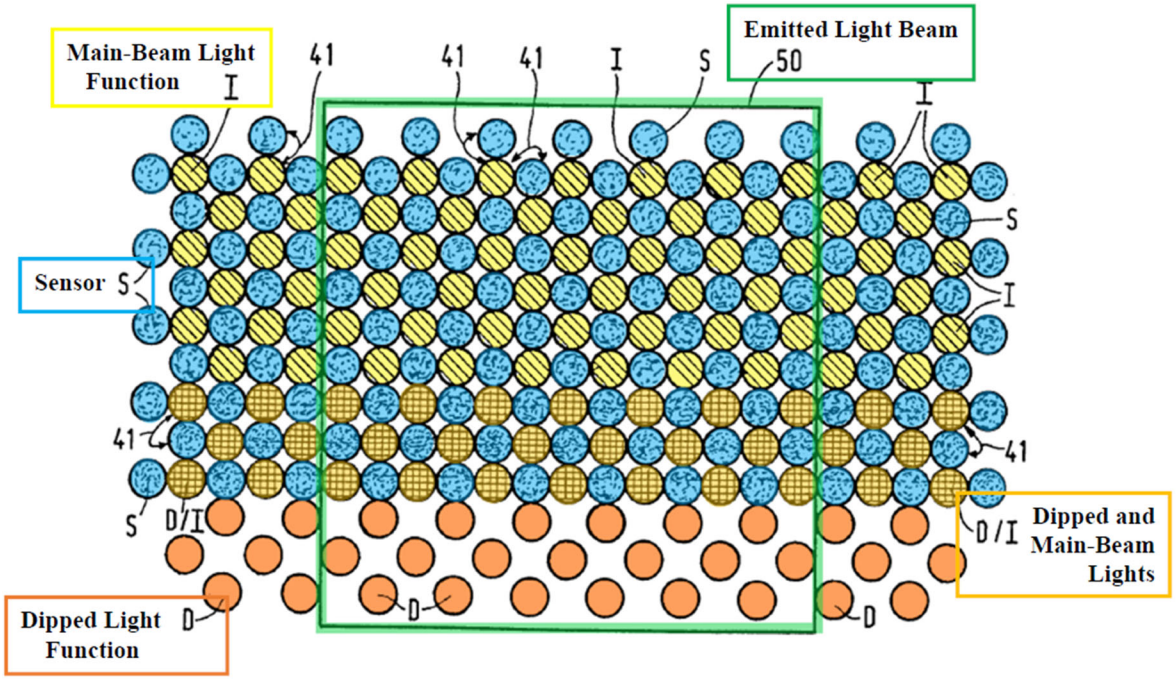
[59.7]: "wherein the at least one processor is configured to: process the sensor data to identify a first subsection, of a field of view, that includes at least a portion of the second vehicle;"

407. In my opinion, there is no patentable difference between [59.7] and [20.9].

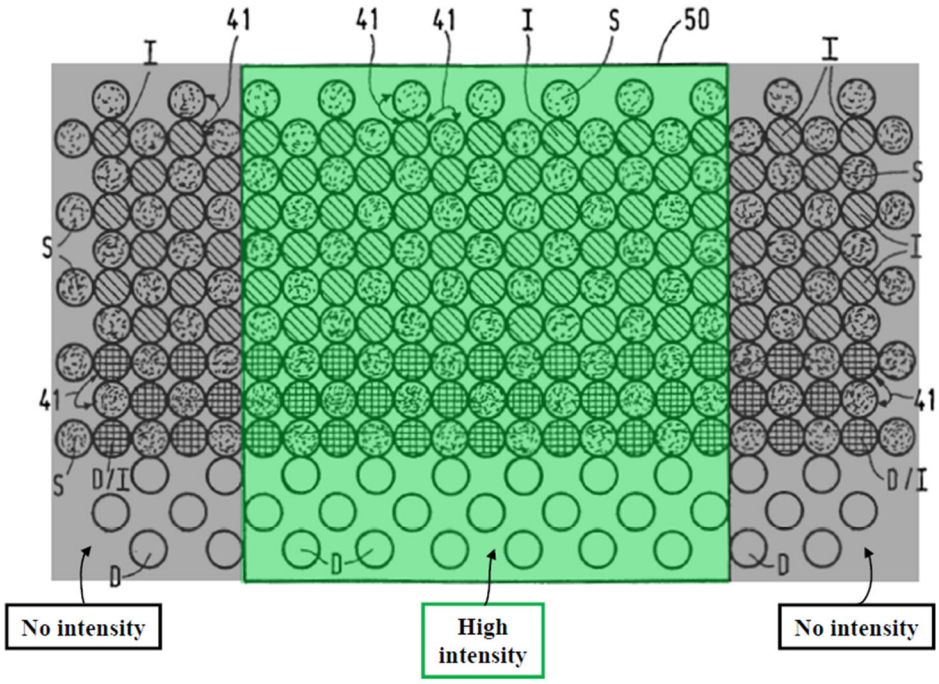
408. Karlsson discloses "*incident light 11* on the *light-sensitive sensor 9*…is *processed* into an *electric control signal* on input 15 of the *control means 14*." EX1010, 9:9-17, FIGS. 3, 14, 15; EX1010, 5:16-23 ("*detecting*…*oncoming traffic* as a *parameter*"), 2:7-9 ("*part of the light beam*…is automatically suppressed"), 3:27-31 ("*field of view*"), 5:28-32, 9:18-26, 20:12-32, 21:36-22:4, 14:26-30. Thus, the processor processes the inputted incident light data, determines/identifies a vehicle within the headlight's field-of-view, and determines/identifies an area to be suppressed within a subsection of the field-of-view (shaded area of no intensity, first subsection). EX1010, 9:9-17, 12:19-24, FIGS. 14, 15.



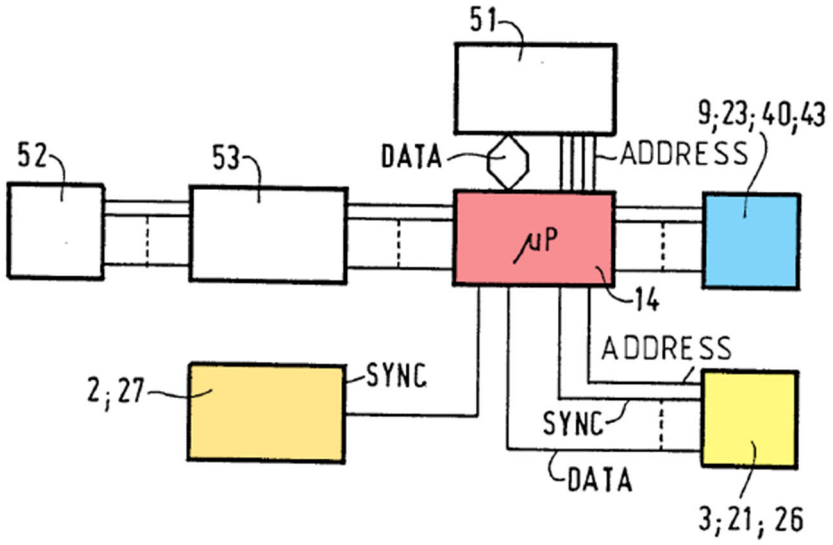
EX1010, FIG. 3 (annotated).



EX1010, FIG. 14 (annotated).



EX1010, FIG. 14 (annotated).

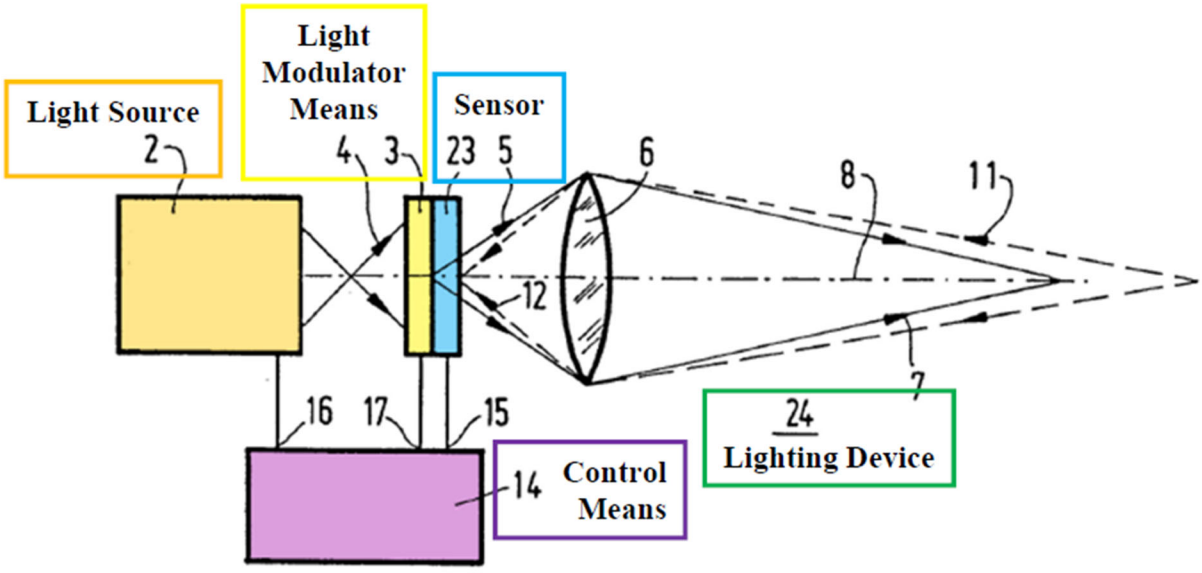


EX1010, FIG. 15 (annotated).

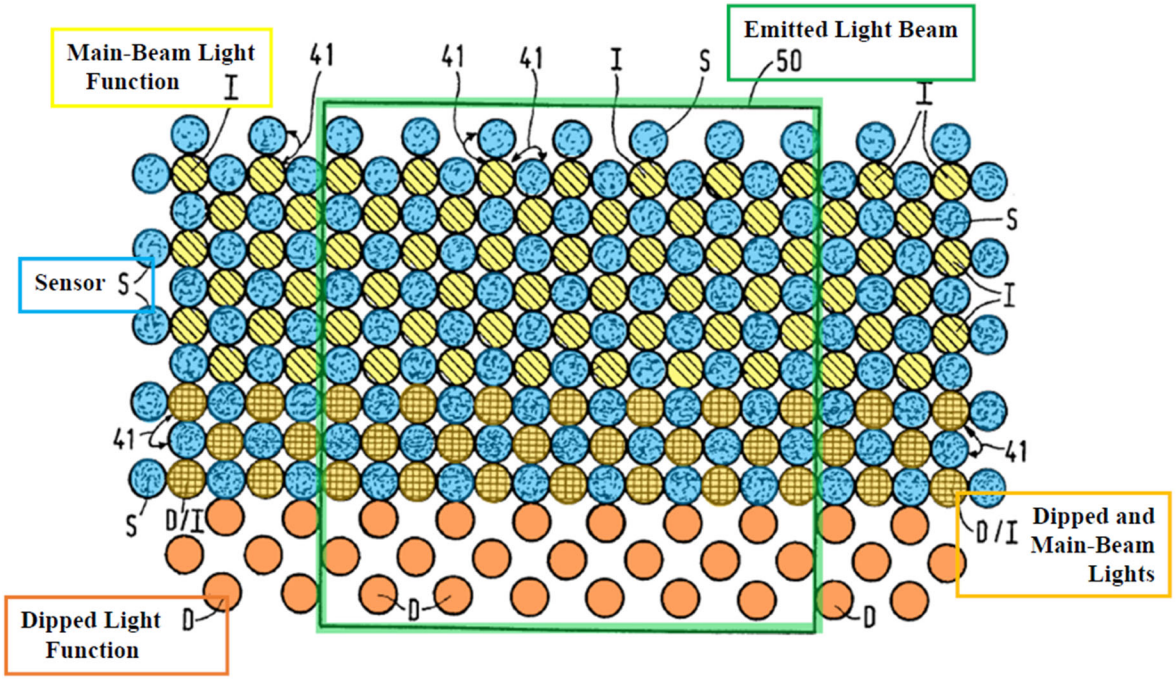
409. In view the above, Karlsson discloses these elements.

11. [20.10]: "at least a second subsection not including the detected vehicle,"

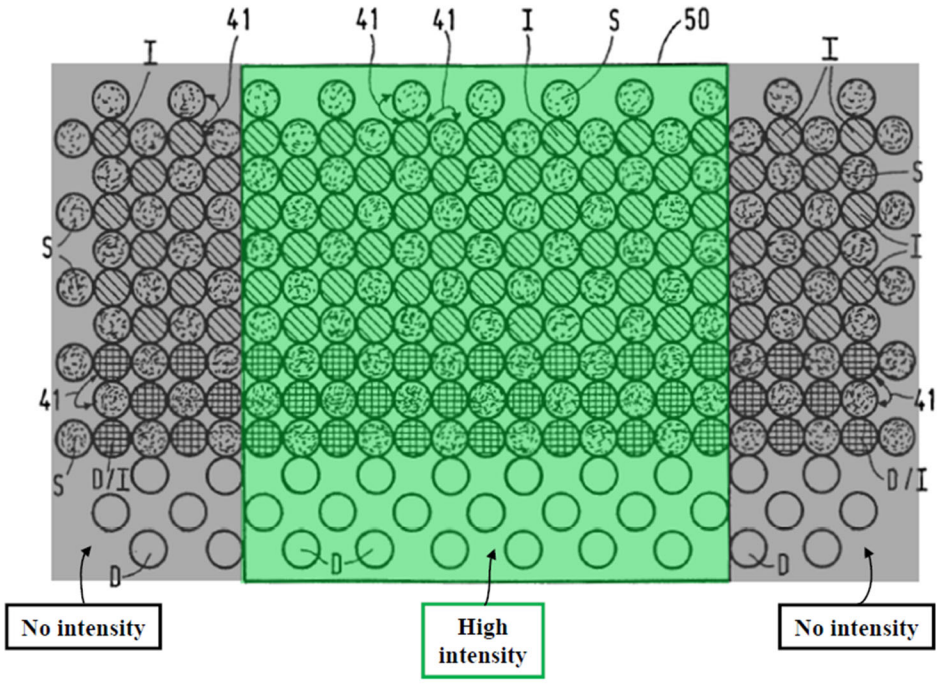
410. Karlsson discloses "the lighting *pattern* and the lighting *intensity* are *automatically adjusted*…permitting a light intensity which is generally *higher than that of conventional dipped headlights*." EX1010, Abstract, FIGS. 3, 14, 15; EX1010, 19:29-33 ("*emitted light beam 50*"), 2:7-9 ("*part of the light beam*…is automatically suppressed, whilst *retaining an optimum lighting* effect for the driver"), 19:23-27 ("*main-beam light function*"), 14:26-30, 5:16-32, 9:9-17. Karlsson thus determines different subsections (e.g., second subsection) outside of the detected vehicle. EX1010, 5:16-23, 9:9-17, 12:19-24, FIGS. 14, 15; *see also* EX1017, 5 ("the adaptive light pattern should support to direct the concentration to the most important zone for the current driving situation"), FIGS. 1, 3-5; EX1025, 205 ("having the ability to fixate much farther with moveable GDLs [gas discharge lamps] the driver actually uses this to achieve information about the scenery ahead"), FIG. 18; EX1026, 451 ("[m]ore beams are necessary to match varied driving regions"), 456 ("beam axes of the lamps are aimed at the directions indicated"), FIGS. 1, 3-3.



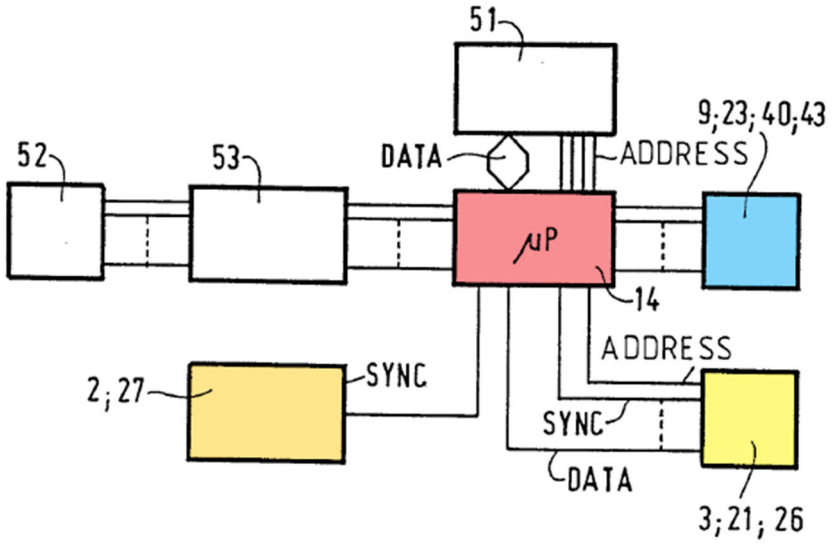
EX1010, FIG. 3 (annotated).



EX1010, FIG. 14 (annotated).



EX1010, FIG. 14 (annotated).



EX1010, FIG. 15 (annotated).

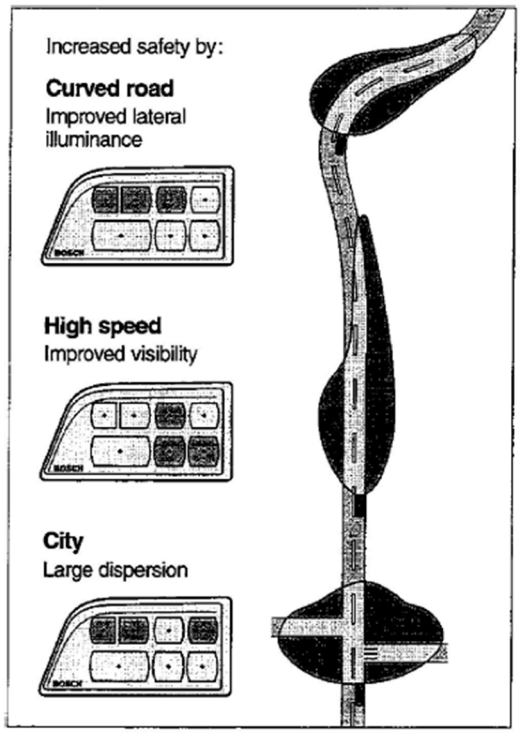


Fig.1: Three standard driving situations with adapted light pattern seen from the bird eye's view.

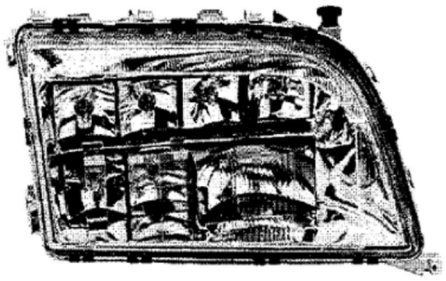
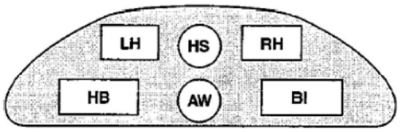


Fig 4: ALP *headlamp* sample



Single components:

LH Left hand bend
RH Right hand bend
HB High beam
BI Basic illumination
AW Adverse weather illumination
HS Hot spot

Fig. 5 Advanced ALP sample layout

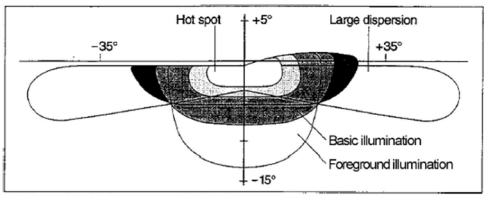


Fig. 3: Light pattern of multiple beam *headlamp* (*Isolux* curves in wall projection):
The individual light *pattern* of multiple sub-units sum up to the total adaptive light pattern

EX1017, FIGS. 1 and 3-5.

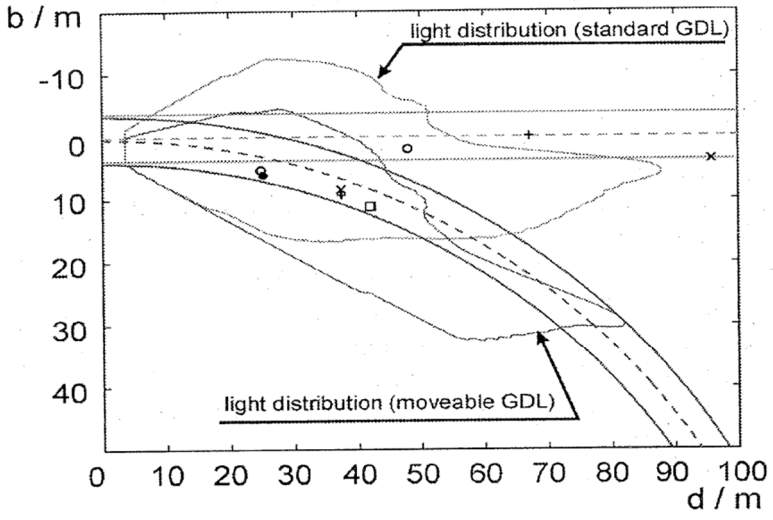


Figure 18: Fixation distance accumulation points (FDAP) for different headlamp systems and different road parts.
Accumulation points: X: *daylight*
O: *standard halogen*
●: *moveable halogen*
+: *standard gas discharge*
□: *moveable gas discharge*

EX1025, FIG. 18.

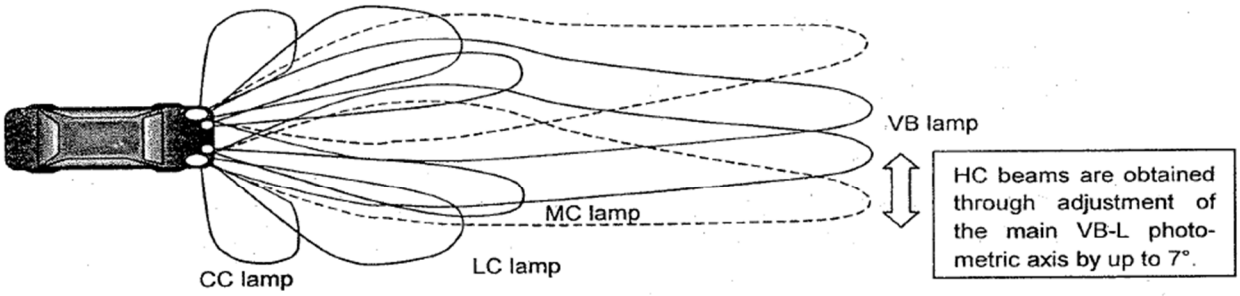


Fig. 3-3: Imaged Illumination Configurations on Road Surface

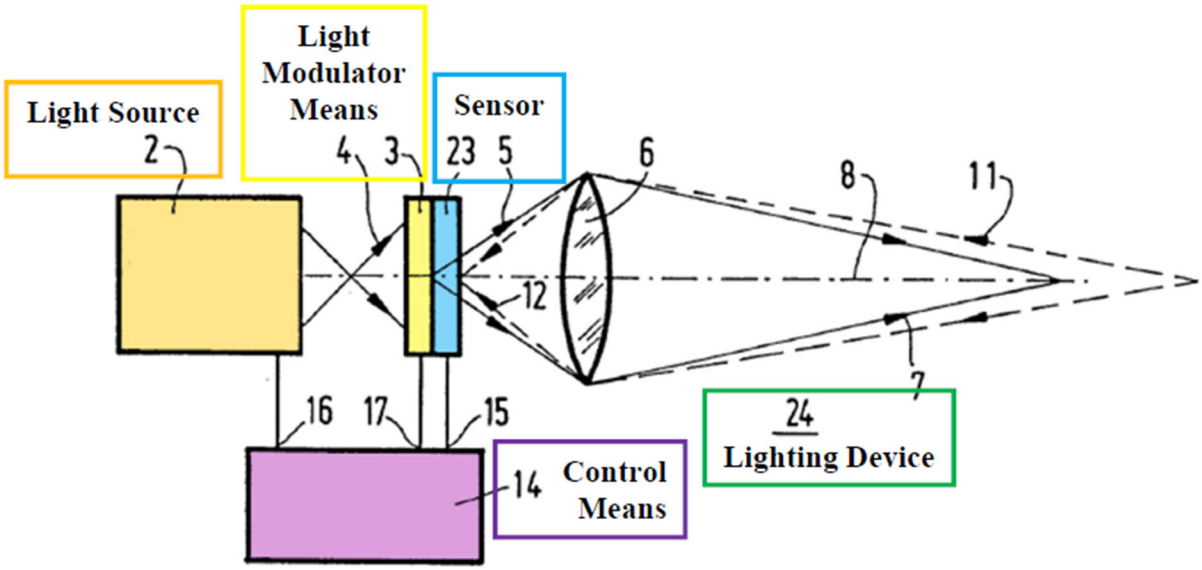
EX1026, FIG. 3-3.

411. In view the above, Karlsson discloses this element.

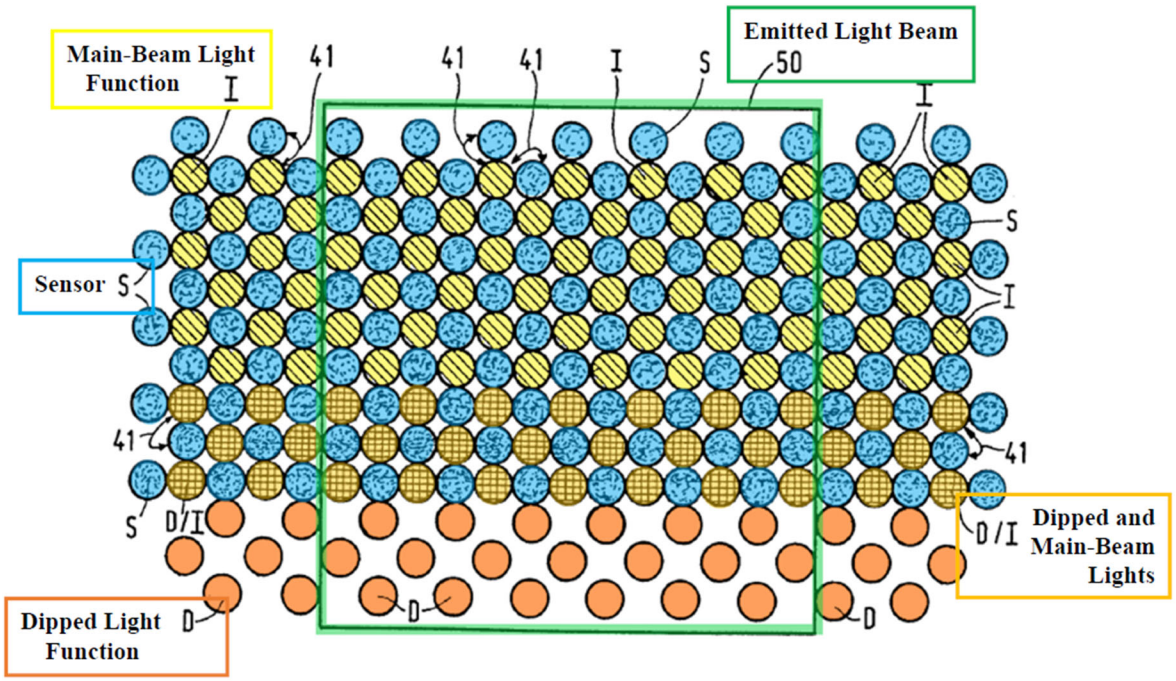
12. [20.11]: "determine optimal use of the differently aimed directional light sources to maximize vehicle operator visibility in at least the second subsection,"

412. Karlsson discloses "light beam 7…*optimally adapted* to the road and to the ambient light" and "permitting a light intensity which is generally *higher than that of conventional dipped headlights*." EX1010, 9:18-26, Abstract, FIGS. 3, 14, 15; EX1010, 19:23-27 ("*main-beam light function*"), 19:27-33 ("*emitted light beam 50*"), 2:7-9 ("*part of the light beam*…is automatically suppressed, whilst *retaining an optimum lighting* effect for the driver of the vehicle"), 14:26-30, 9:9-17, 5:16-32. The second subsections are thus illuminated, which "maximize[s] vehicle operator visibility." *See also* EX1017, 5 ("the adaptive light pattern should support to direct the concentration to the most important zone for the current driving situation"), FIGS. 1, 3-5; EX1025, 205 ("having the ability to fixate much farther with moveable GDLs [gas discharge lamps] the driver actually uses this to

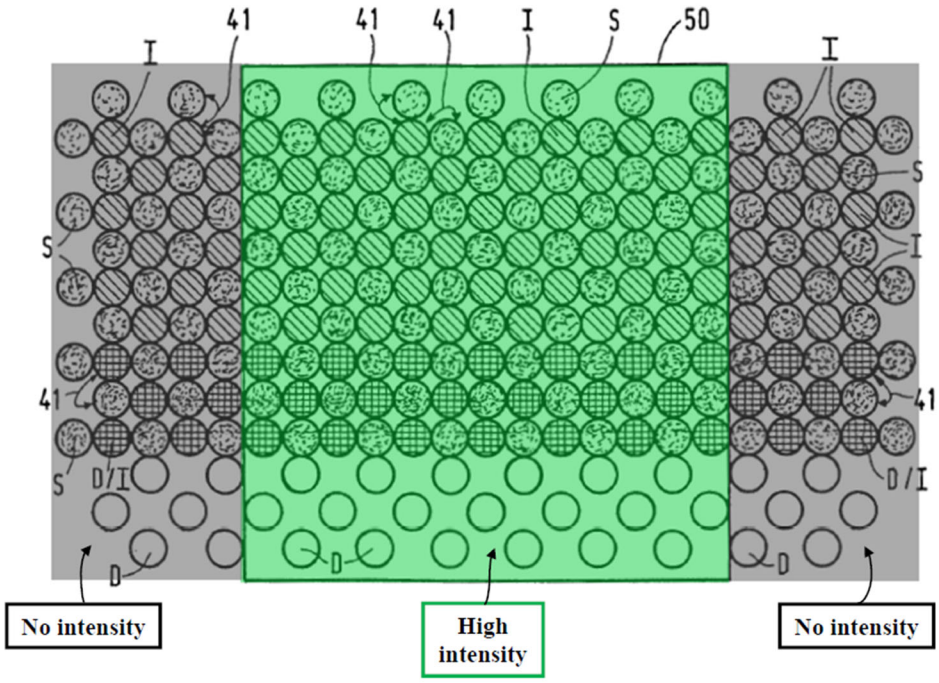
achieve information about the scenery ahead"), FIG. 18; EX1026, 451 ("[m]ore beams are necessary to match varied driving regions"), 456 ("beam axes of the lamps are aimed at the directions indicated"), FIGS. 1, 3-3.



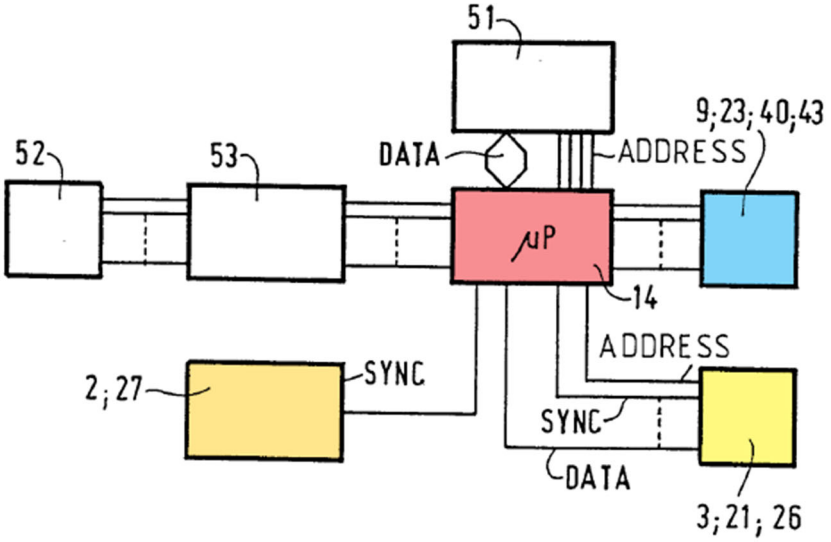
EX1010, FIG. 3 (annotated).



EX1010, FIG. 14 (annotated).



EX1010, FIG. 14 (annotated).



EX1010, FIG. 15 (annotated).

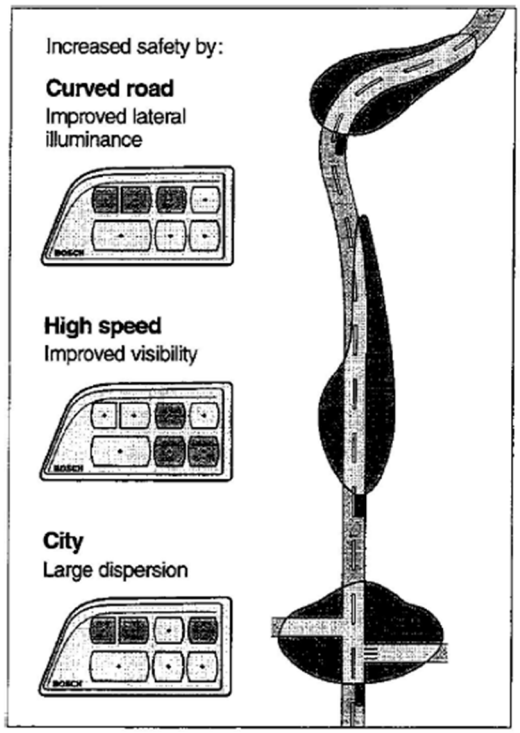


Fig.1: Three standard driving situations with adapted light pattern seen from the bird eye's view.

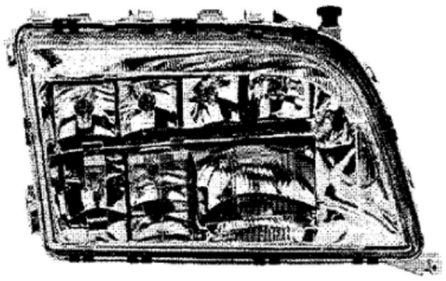
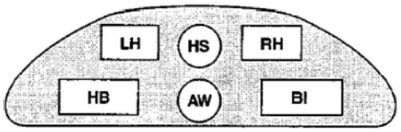


Fig 4: ALP *headlamp* sample



Single components:

LH Left hand bend
RH Right hand bend
HB High beam
BI Basic illumination
AW Adverse weather illumination
HS Hot spot

Fig. 5 Advanced ALP sample layout

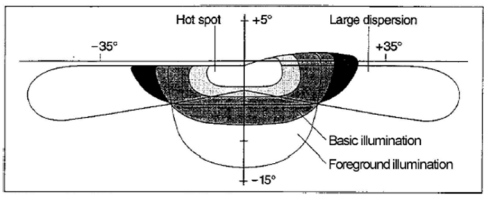


Fig. 3: Light pattern of multiple beam *headlamp* (*Isolux* curves in wall projection):
The individual light *pattern* of multiple sub-units sum up to the total adaptive light pattern

EX1017, FIGS. 1 and 3-5.

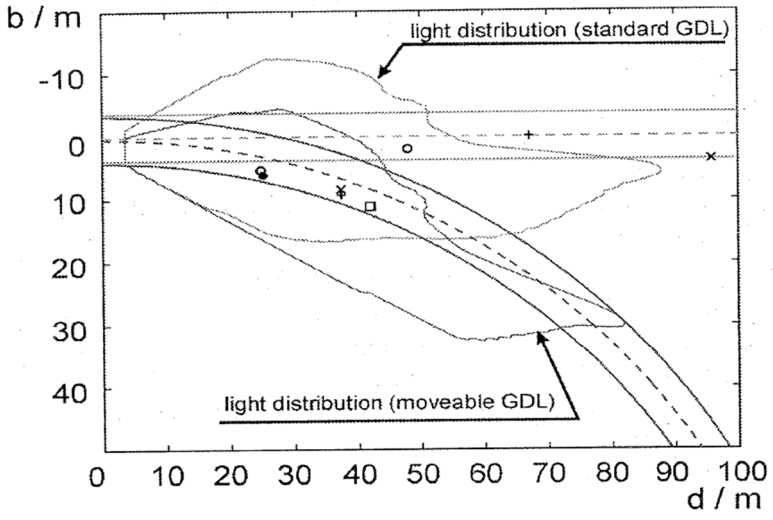


Figure 18: Fixation distance accumulation points (FDAP) for different headlamp systems and different road parts.
Accumulation points: X: *daylight*
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EX1025, FIG. 18.

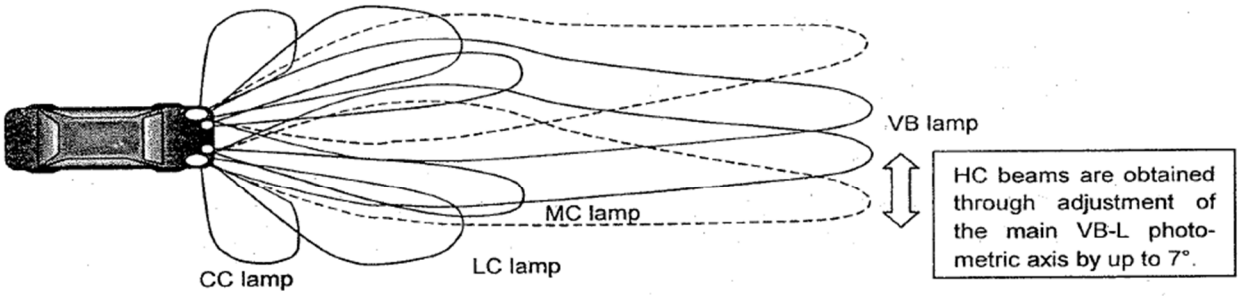


Fig. 3-3: Imaged Illumination Configurations on Road Surface

EX1026, FIG. 3-3.

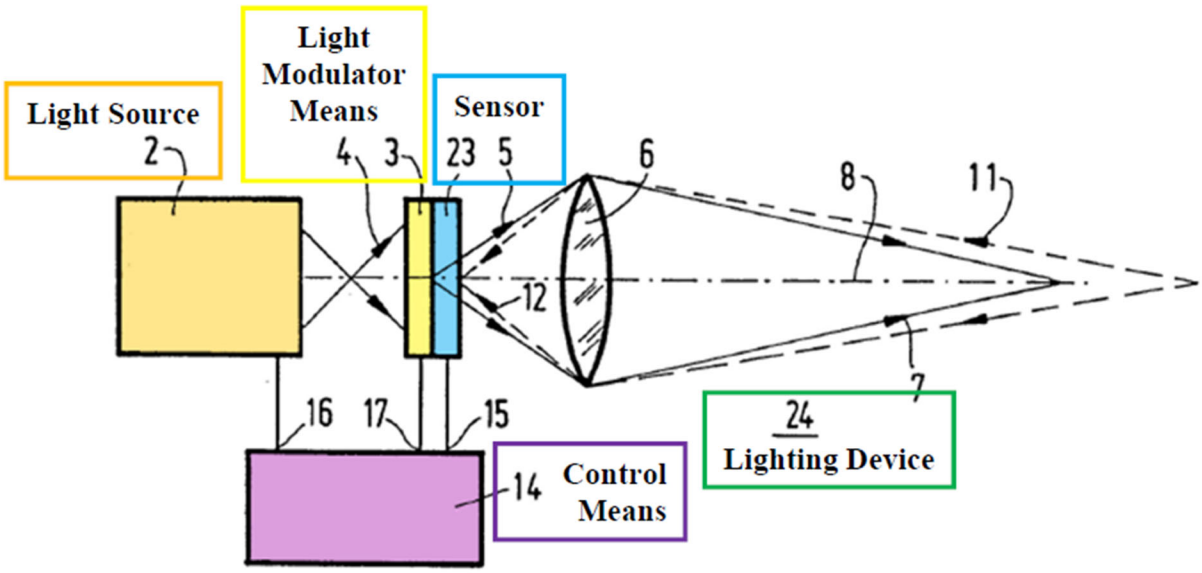
413. In view the above, Karlsson discloses this element.

13. [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"

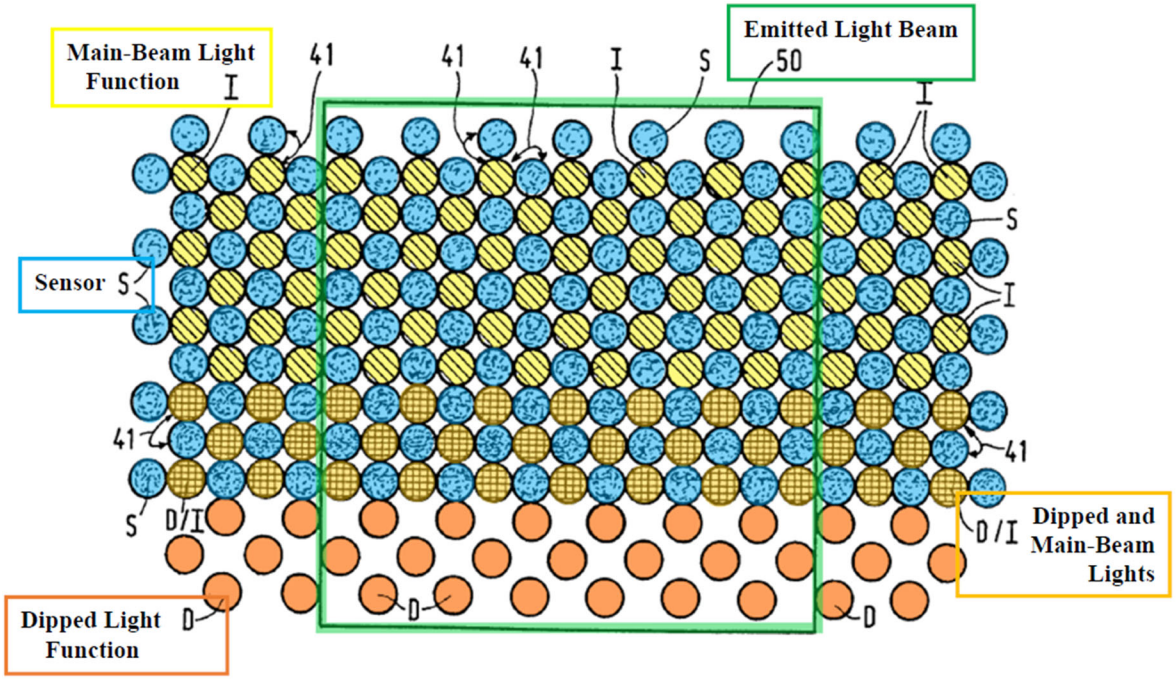
[59.8]: "determine light output for the headlight system that aims illumination at the first subsection,"

414. Karlsson discloses "light beam 7…controlled in such a manner that *no light at all* or *light having a low intensity* is emitted in those directions from which light is detected…[thus] *glaring or blinding of oncoming traffic* is effectively *prevented*." EX1010, 9:18-26, FIGS. 3, 14, 15; EX1010, 19:23-27 ("*dipped light function*"), 2:7-9 ("*part of the light beam* which might cause *inconvenience to oncoming traffic* is automatically *suppressed*"), 5:28-32 ("*pattern of the light beam*…so as *not to emit light* in the direction of the detected light"), 14:26-30, 9:9-17, 5:16-32, 3:27-31. Karlsson thus "aims" suppressed illumination at the identified vehicle area as recited in [59.8], which "minimize[s] a disturbing effect" (glare) to the vehicle as recited in [20.12]. EX1010, 9:9-26, 2:7-9, 5:28-32; *see*

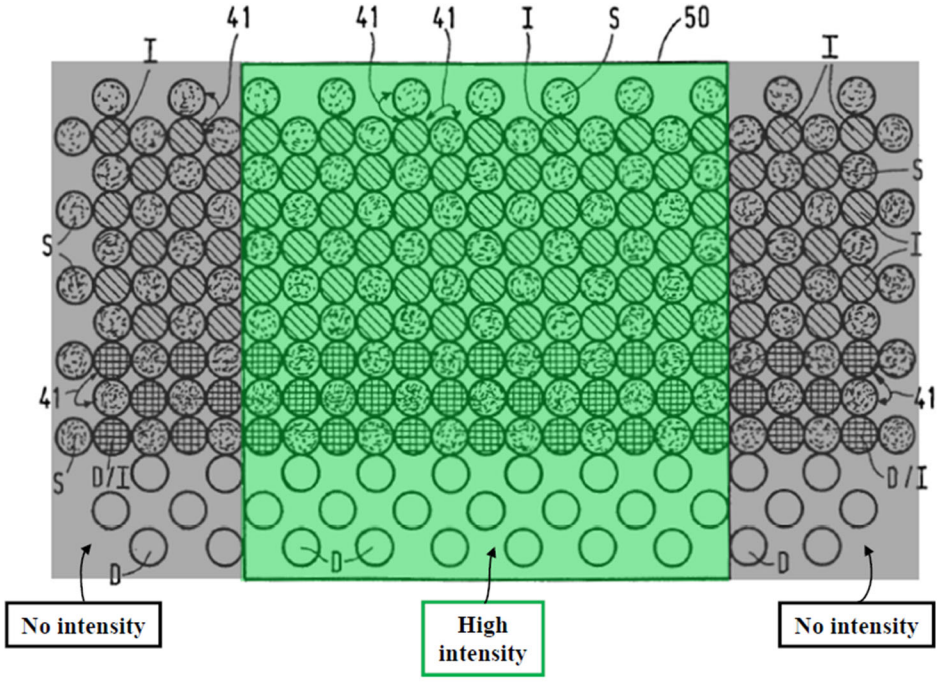
also EX1017, 5 ("the adaptive light pattern should support to direct the concentration to the most important zone for the current driving situation"), FIGS. 1, 3-5; EX1026, 456 ("beam axes of the lamps are aimed at the directions indicated"), FIG. 3-3; EX1030, 3-8, 21-41, 62-69; EX1016, 4-11.



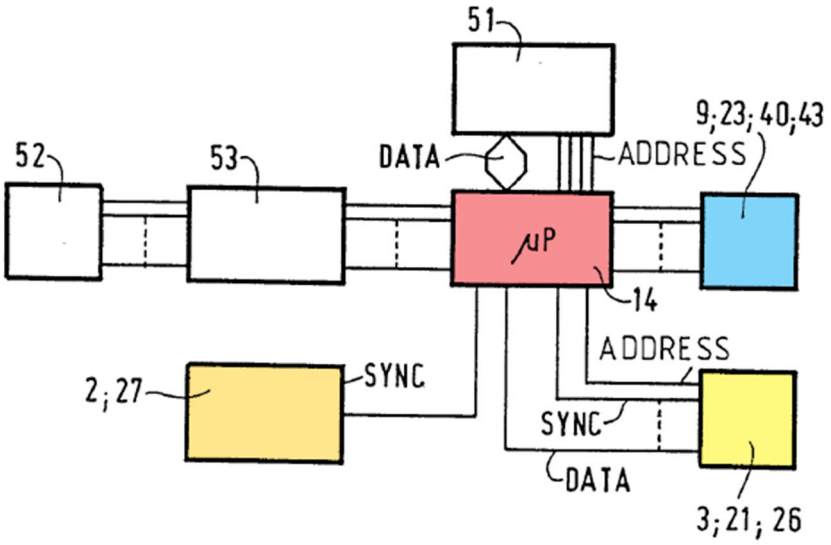
EX1010, FIG. 3 (annotated).



EX1010, FIG. 14 (annotated).



EX1010, FIG. 14 (annotated).



EX1010, FIG. 15 (annotated).

415. In view the above, Karlsson discloses these elements.

14. [20.13][11]: "direct the control circuitry to adjust the directional light sources to achieve the determined optimal use."

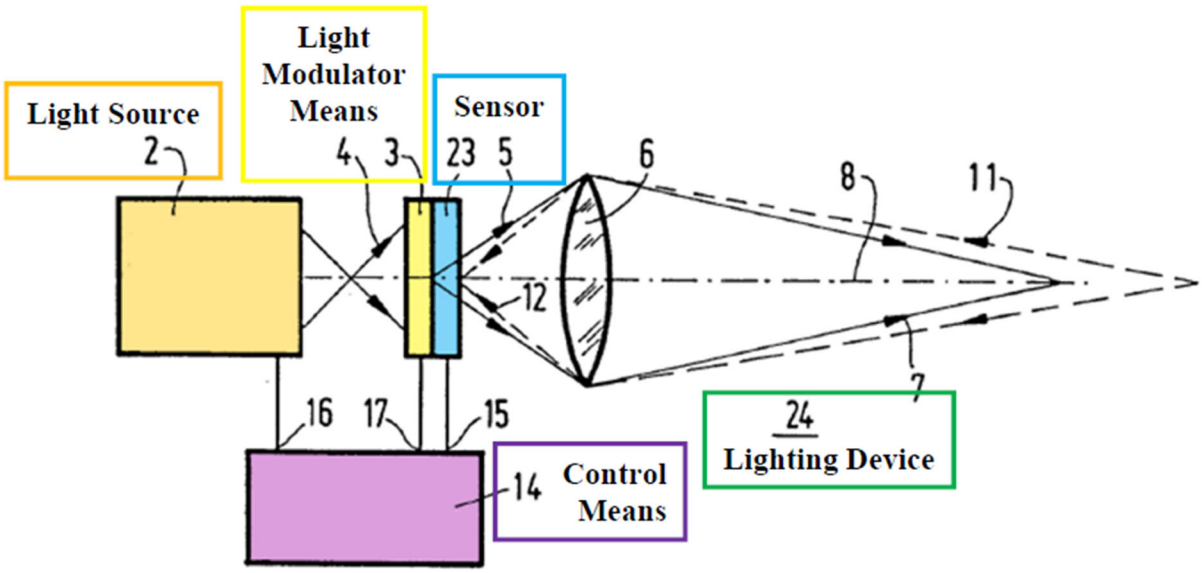
[59.12]: "instruct adjustment of one or more of the light sources to achieve the determined output."

416. In my opinion, there is no patentable difference between [59.12] and [20.13].

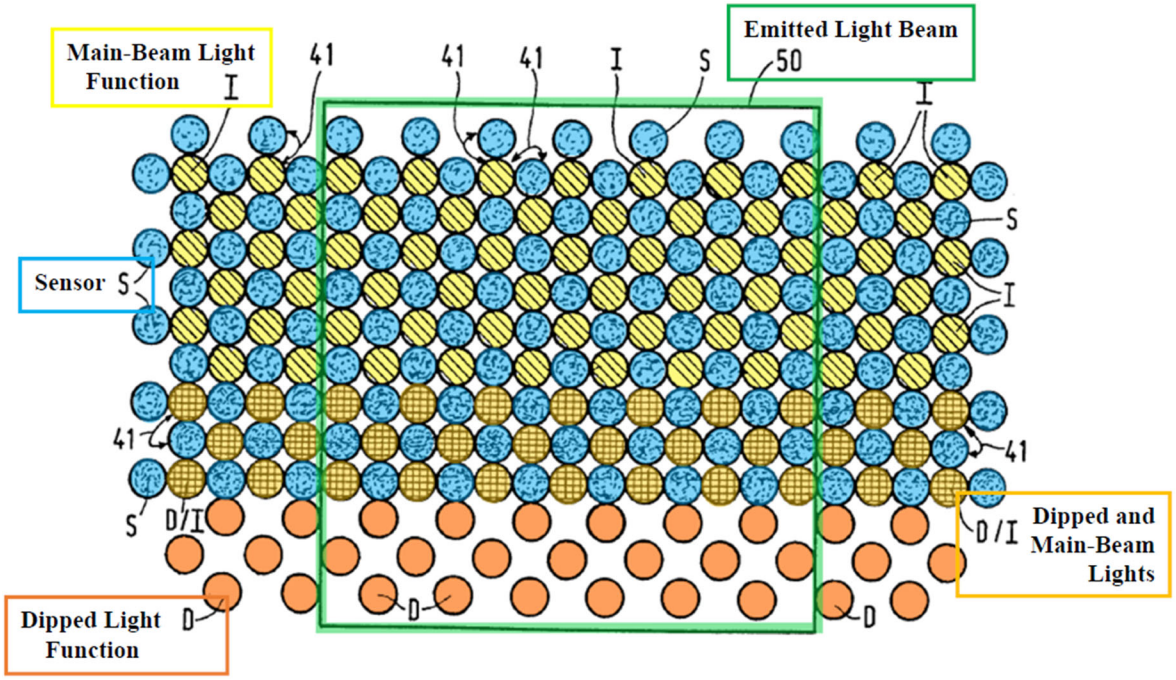
417. Karlsson discloses "*lighting means 2, 3…controlled by control means 14*, such that the *incident light 11* on the *light-sensitive sensor 9*…is *processed* into an *electric control signal* on input 15 of the *control means 14*…[and] *processed* by

[11] Claim elements [59.9]-[59.11] will be addressed in Section XIV.C below with claim 59.

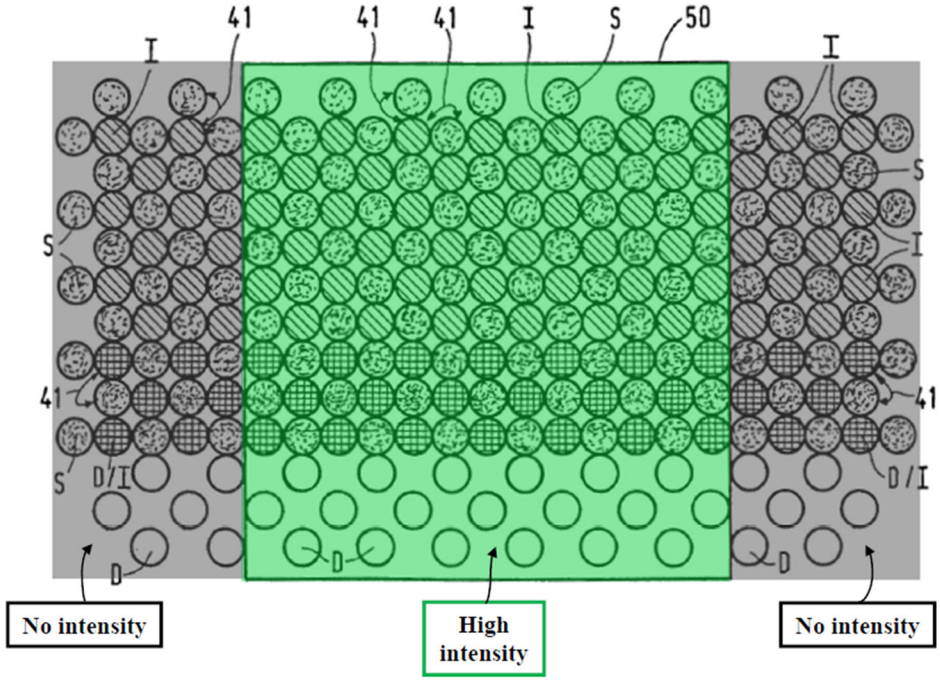
the control means 14 into *output signals at outputs 16, 17* thereof, so as to *control the lighting means 2, 3* in such a manner that a *light beam 7* having a des*ired pattern* and a *desired intensity* is emitted." EX1010, 9:9-17, FIGS. 3, 14, 15; EX1010, 20:12-32, 21:36-22:4.



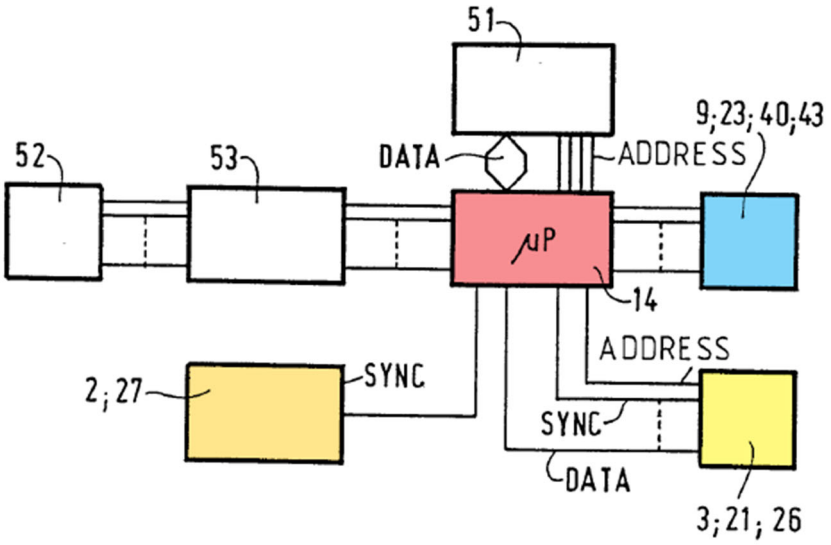
EX1010, FIG. 3 (annotated).



EX1010, FIG. 14 (annotated).



EX1010, FIG. 14 (annotated).



EX1010, FIG. 15 (annotated).

418. In view the above, Karlsson discloses these elements.

C. Additional Elements of Claim 59

419. [59.P]-[59.8] and [59.12] are addressed above in Section XIV.B.

1. [59.9]: "the illumination aimed at the first subsection substantially resulting in light below a first predefined illuminance in the first subsection, and"

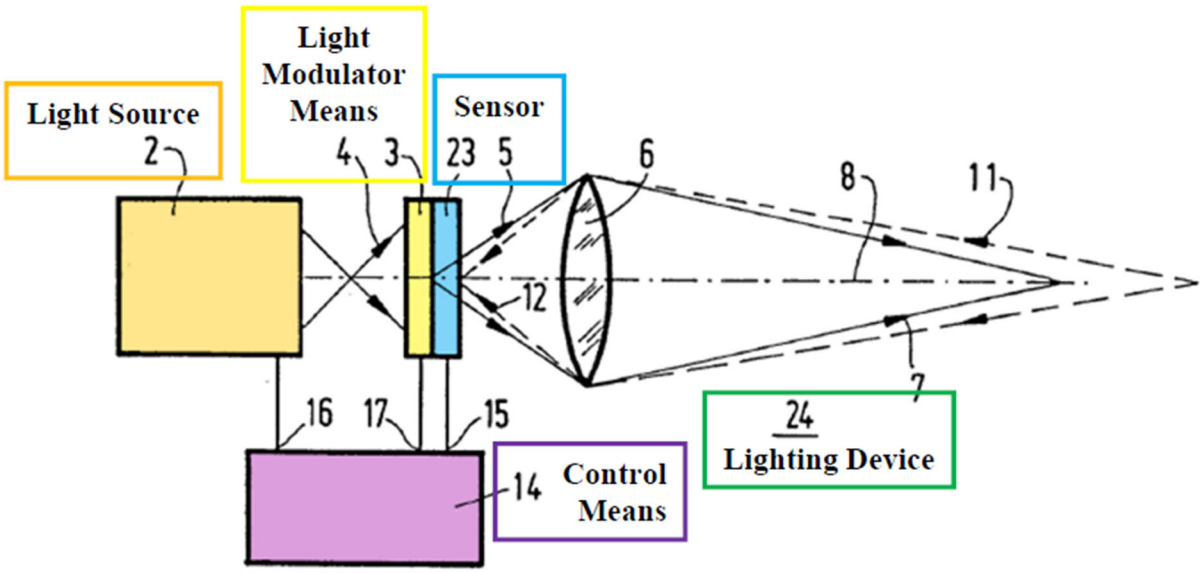
420. As discussed (Section XIV.A), in my opinion, Karlsson discloses this element, [59.9]. Specifically, Karlsson discloses "spotlight sources indicated at D provide the *dipped light function*." EX1010, 19:23-27, FIGS. 14-15; EX1010, 1:27-30 ("*low beams* or *dipped* headlights"), Abstract, 1:16-18. Thus, a POSA would have understood that Karlsson's headlight includes a "predefined" illuminance, for example, a "dipped headlights" illuminance.

421. Further, Karlsson discloses "light beam 7…controlled in such a manner that *no light at all* or *light having a low intensity* is emitted in those

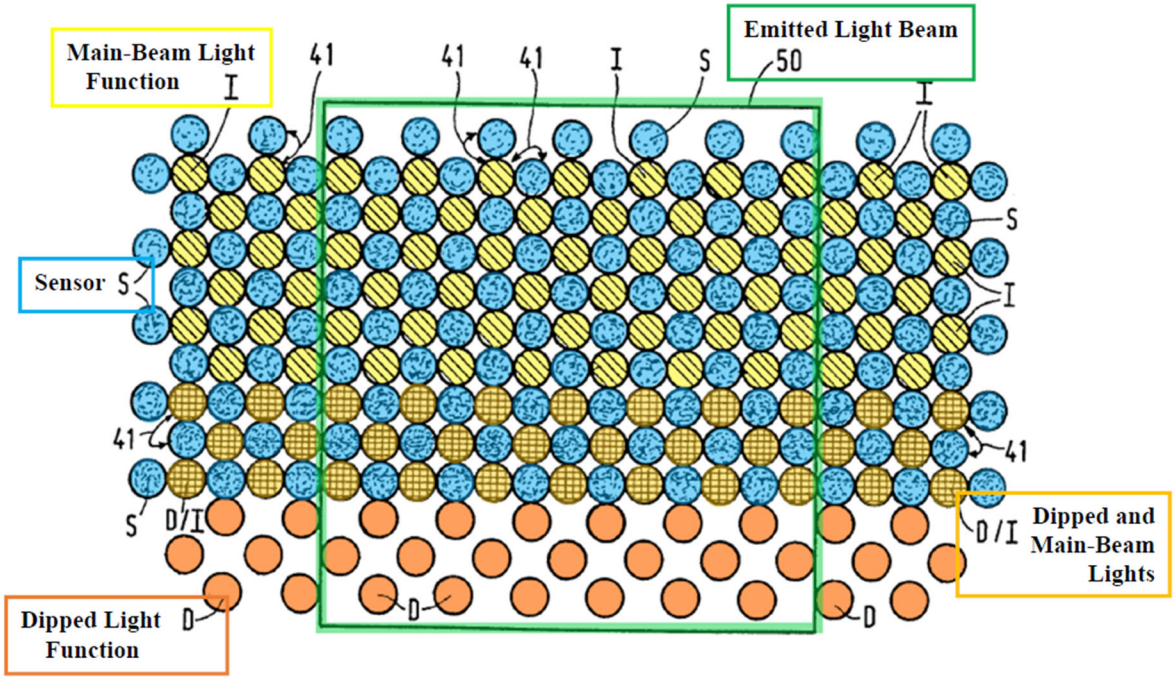
directions from which light is detected…[thus] *glaring or blinding of oncoming traffic* is effectively *prevented*." EX1010, 9:18-26, FIGS. 3, 14, 15; EX1010, 19:23-27 ("*dipped light function*"), 2:7-9 ("*part of the light beam*…which might cause *inconvenience to oncoming traffic* is automatically *suppressed*"), 5:28-32 ("precise adjustment…so as *not to emit light* in the direction of the detected light"), 14:26-30, 9:9-26, 5:16-32, 20:12-32, 21:36-22:4. The first subsection (shaded area, e.g., outside emitted light beam 50) is thus illuminated "below a first predefined illuminance" (e.g., below a *dipped* headlights illuminance) because "no light at all or light having a low intensity" is *below* a dipped headlights illuminance.

422. As discussed in Section XIV.A, the concept of a "dipped light function" or a low beam illumination level would have been known to a POSA. Such low beam (dipped headlights) illumination level for driver's visibility and glare light control is defined in all regulations, standards, and automaker's specifications, which is a predefined illumination level in terms of the light intensity distribution in the low beam illuminating area or low beam projected angular section. *See* EX1030, 3-8, 21-41, 62-69; EX1016, 4-11. Therefore, Karlsson's "dipped light function" is an example of a "predefined" illumination level, for example, equivalent to a "dipped headlights" illuminance. *See also* EX1015, 6 ("discomfort glare…disability glare…to what extent the eye adaptation and therewith the threshold sensitivity is at a given adaptation luminance"), 18

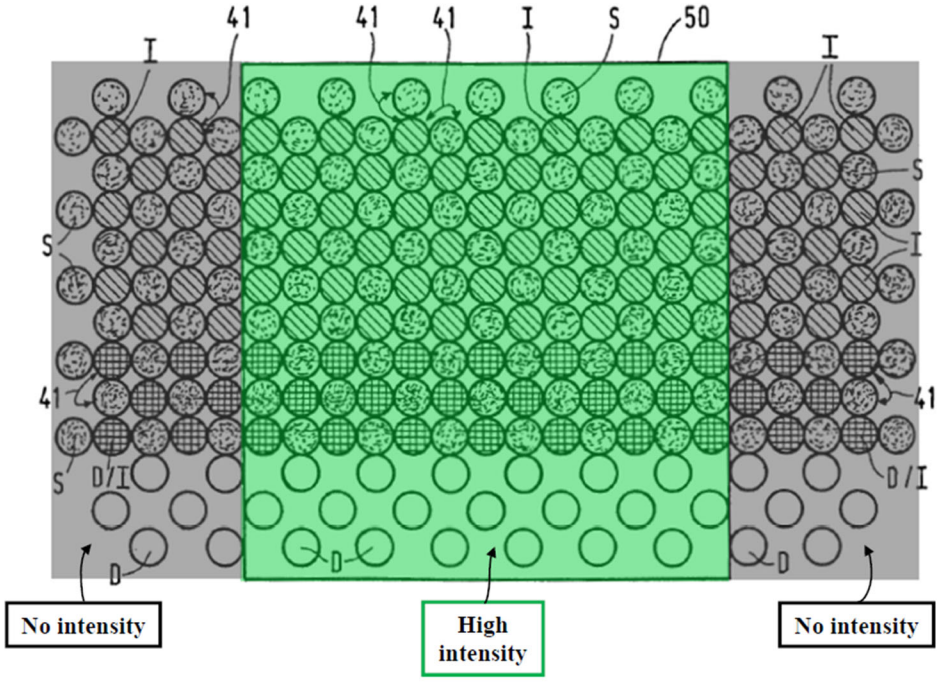
("glare reduction and visibility improvement"), FIGS. 2.1, 2.8; EX1017, 5 ("the adaptive light pattern should support to direct the concentration to the most important zone for the current driving situation"), FIGS. 1, 3-5; EX1026, 451, 456, FIGS. 1, 3-3; EX1030, 3-8, 21-41, 49, 62-69, Table 5.5.



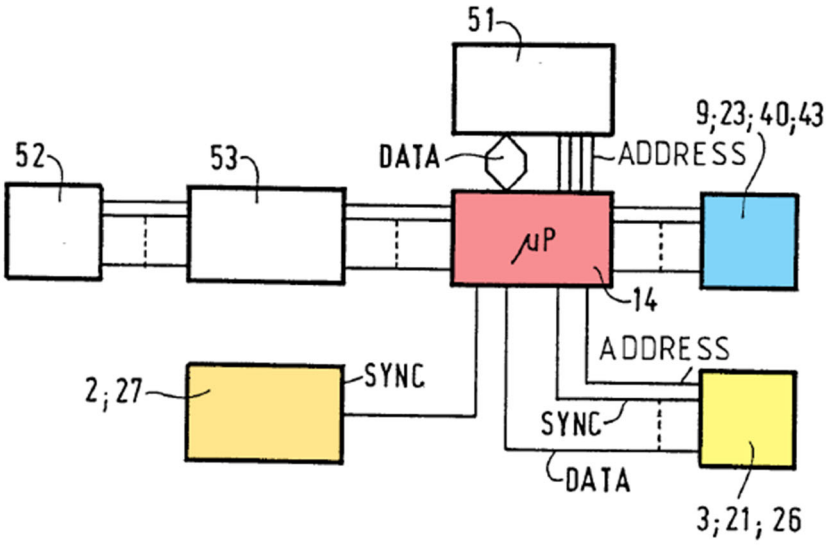
EX1010, FIG. 3 (annotated).



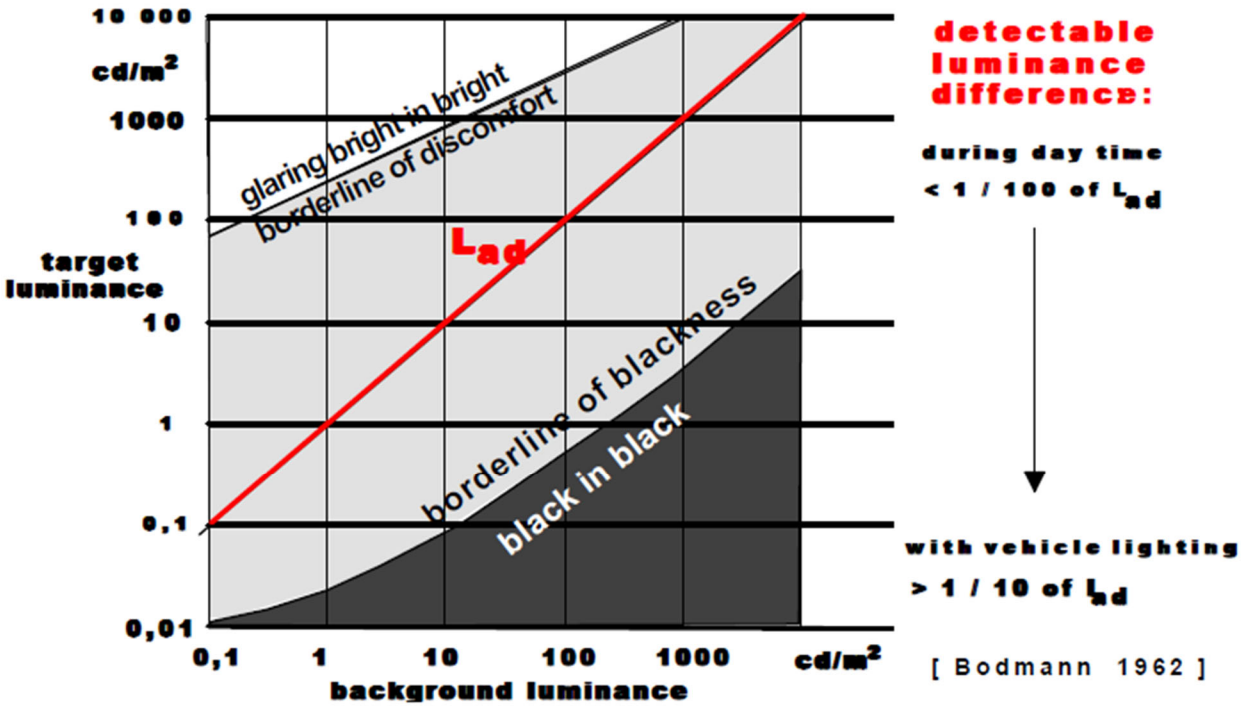
EX1010, FIG. 14 (annotated).



EX1010, FIG. 14 (annotated).



EX1010, FIG. 15 (annotated).



EX1015, FIG. 2.1.

Table 5.5. Road illumination requirements for an adaptive lighting system.

Devices	Beam patterns	Visibility on straight (m)	Visibility on curve r=150m (m)	Illuminance (lx)	Angular window for specified visibility (deg.)
Conventional beam	Low beam	58	30	40	--
	High beam	140	--	120	--
AFS	Country	80	--	20	Hor.: -1° to 1° Ver.: -0.75° to 0.3°
	Bending	--	76	6	Hor.: -4° to 35° Ver.: -1° to -0.5°
	High speed	**200**	--	**3**	Hor.: -1° to 1° Ver.: -0.3° to 0°

EX1030, Table 5.5.

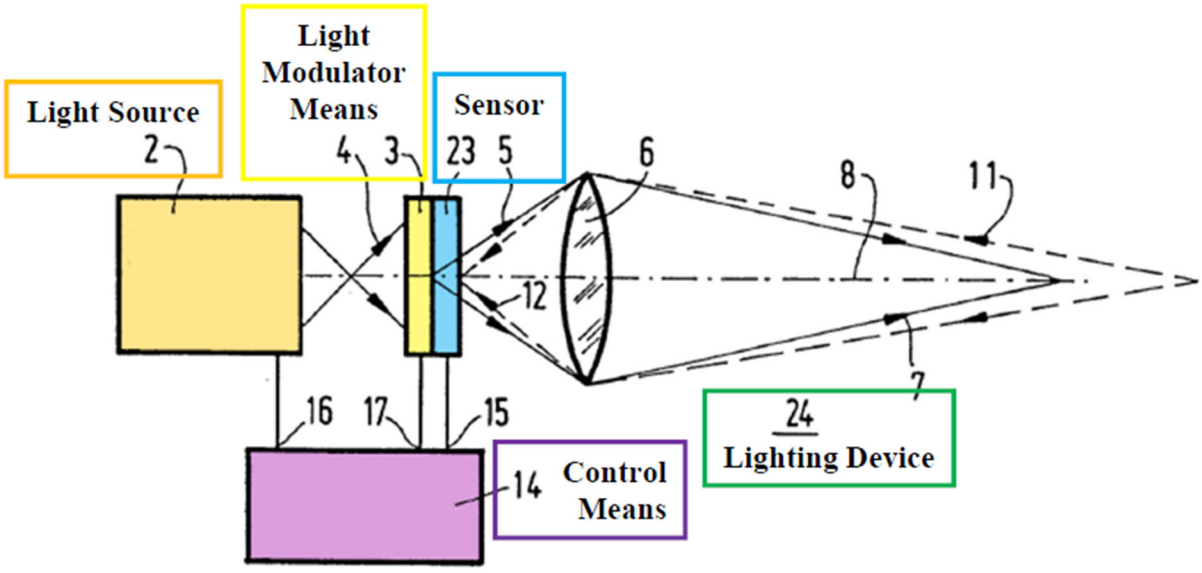
423. The '503 patent does not disclose a predefined illuminance value, so such value is not needed to satisfy [59.9]. As discussed, the '503 patent's specification leaves it to a POSA to determine the "predefined illuminance," without describing an illuminance level, numerical value, algorithms, or any control steps to achieve this. In any case, a POSA reading the disclosure of Karlsson would have understood that Karlsson teaches a predefined illuminance, for example, a "dipped headlights" illuminance, because Karlsson uses the dipped headlights illuminance as a reference point to output illuminance below that value, preventing glare to other vehicles. EX1010, 9:18-26 ("the pattern and the intensity of the light beam 7 are, for example, controlled in such a manner that *no light at all* or light having a low intensity is emitted…[i]n this manner *glaring or blinding* of

oncoming traffic is *effectively prevented*"), Abstract, 1:18-24, 19:23-27, FIGS. 3, 6, 14-15.

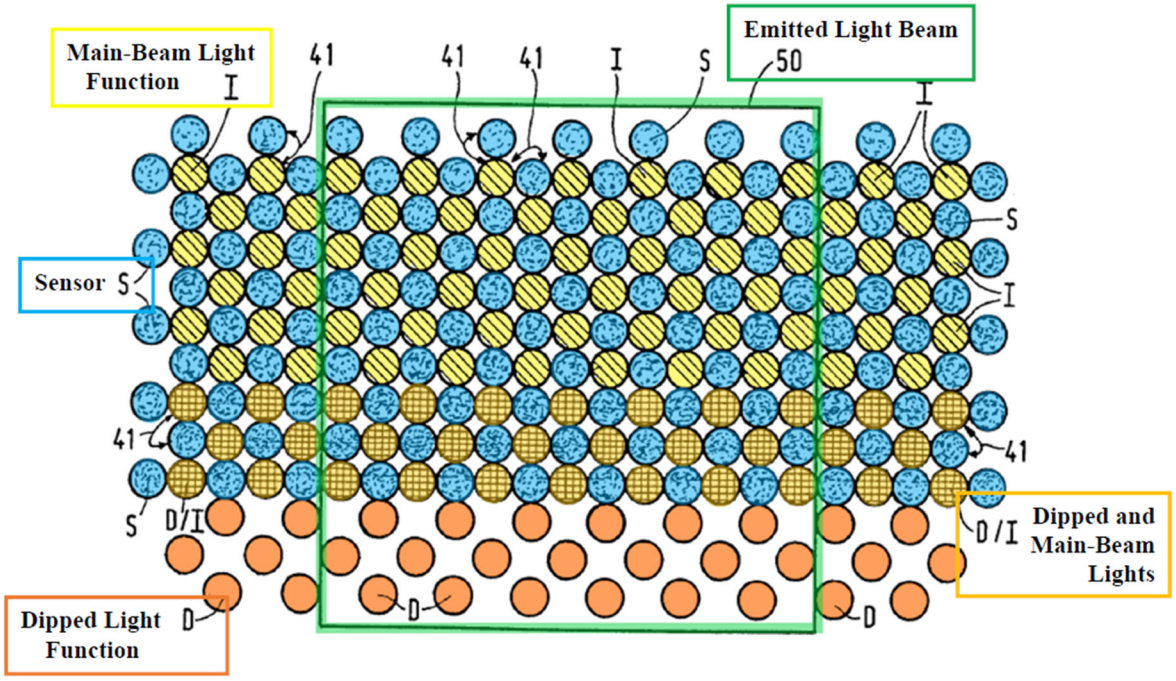
424. Thus, Karlsson discloses or renders obvious this element.

2. [59.10]: "that aims illumination at one or more second subsections of the field of view to either side of the first subsection,"

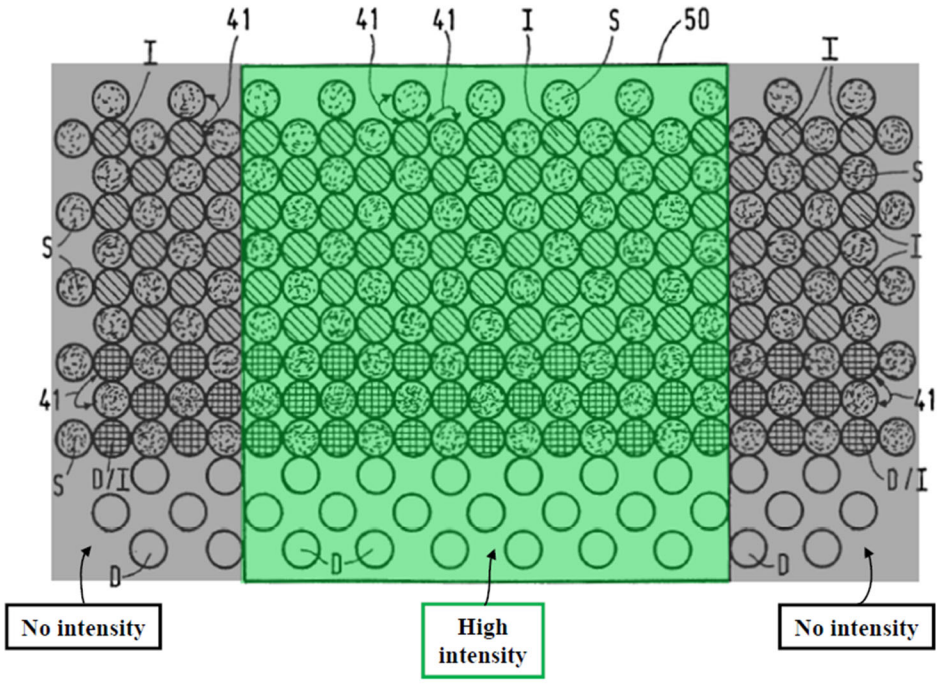
425. Karlsson discloses "the lighting *pattern* and the lighting *intensity* are *automatically adjusted*…permitting a light intensity which is generally *higher than that of conventional dipped headlights*." EX1010, Abstract, FIGS. 3, 14, 15; EX1010, 19:29-33 ("*emitted light beam 50*"), 2:7-9 ("*part of the light beam*…is automatically suppressed, whilst *retaining an optimum lighting* effect for the driver"), 19:23-27 ("*main-beam light function*"), 14:26-30, 5:16-32, 9:9-17. Karlsson thus "aims" the illumination at the different subsections (e.g., second subsection). *See also* EX1017, 5 ("the adaptive light pattern should support to direct the concentration to the most important zone for the current driving situation"), FIGS. 1, 3-5; EX1025, 205 ("having the ability to fixate much farther with moveable GDLs [gas discharge lamps] the driver actually uses this to achieve information about the scenery ahead"), FIG. 18; EX1026, 451 ("[m]ore beams are necessary to match varied driving regions"), 456 ("beam axes of the lamps are aimed at the directions indicated"), FIGS. 1, 3-3.



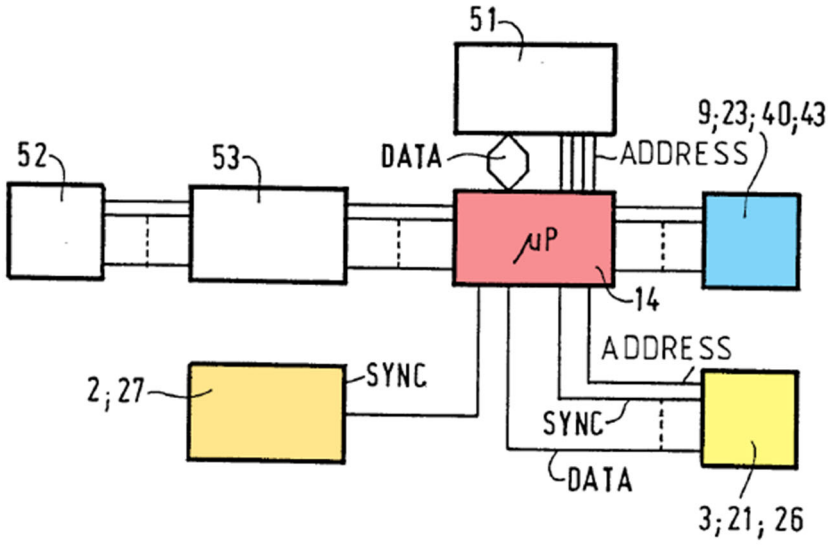
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EX1010, FIG. 14 (annotated).



EX1010, FIG. 14 (annotated).



EX1010, FIG. 15 (annotated).

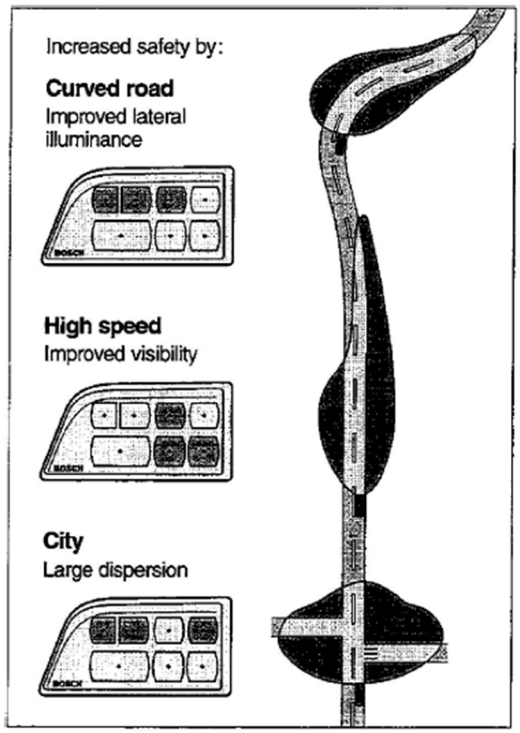


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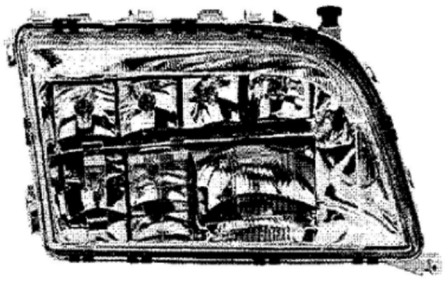
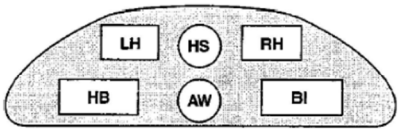


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Fig. 5 Advanced ALP sample layout

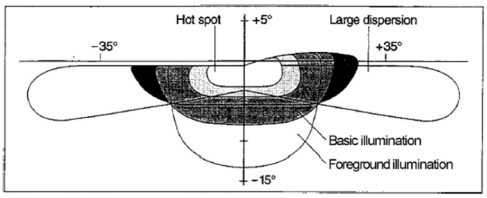


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EX1017, FIGS. 1 and 3-5.

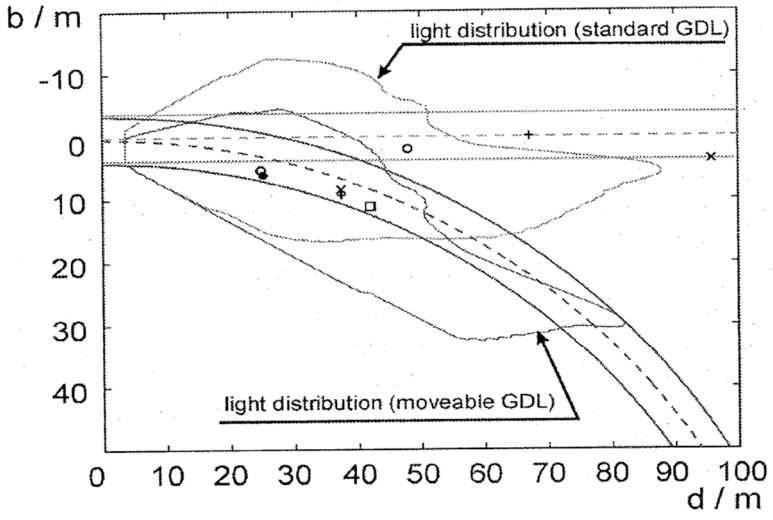


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□: *moveable gas discharge*

EX1025, FIG. 18.

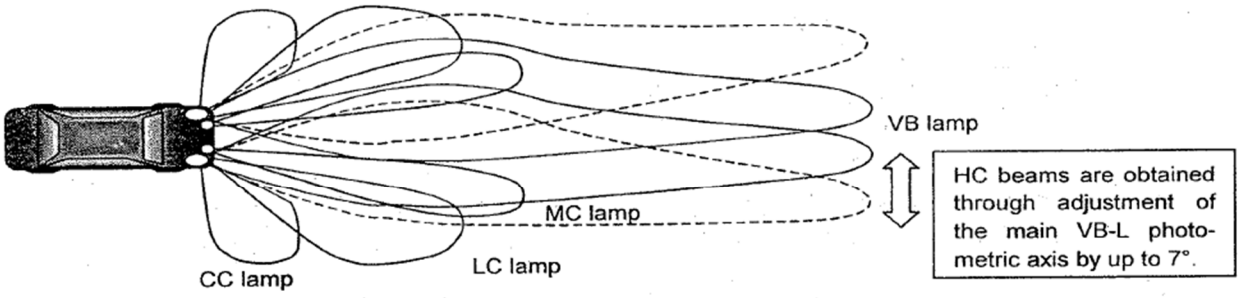


Fig. 3-3: Imaged Illumination Configurations on Road Surface

EX1026, FIG. 3-3.

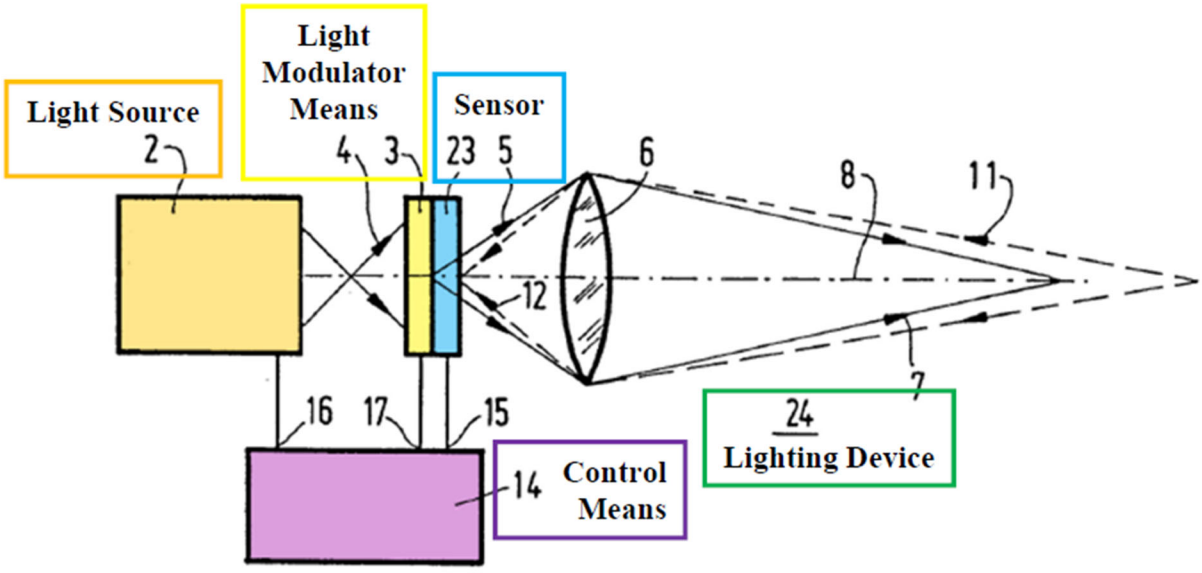
426. In view the above, Karlsson discloses this element.

3. [59.11]: "the illumination aimed at the one or more second subsections substantially resulting in light above the first predefined illuminance in the one or more second subsections; and"

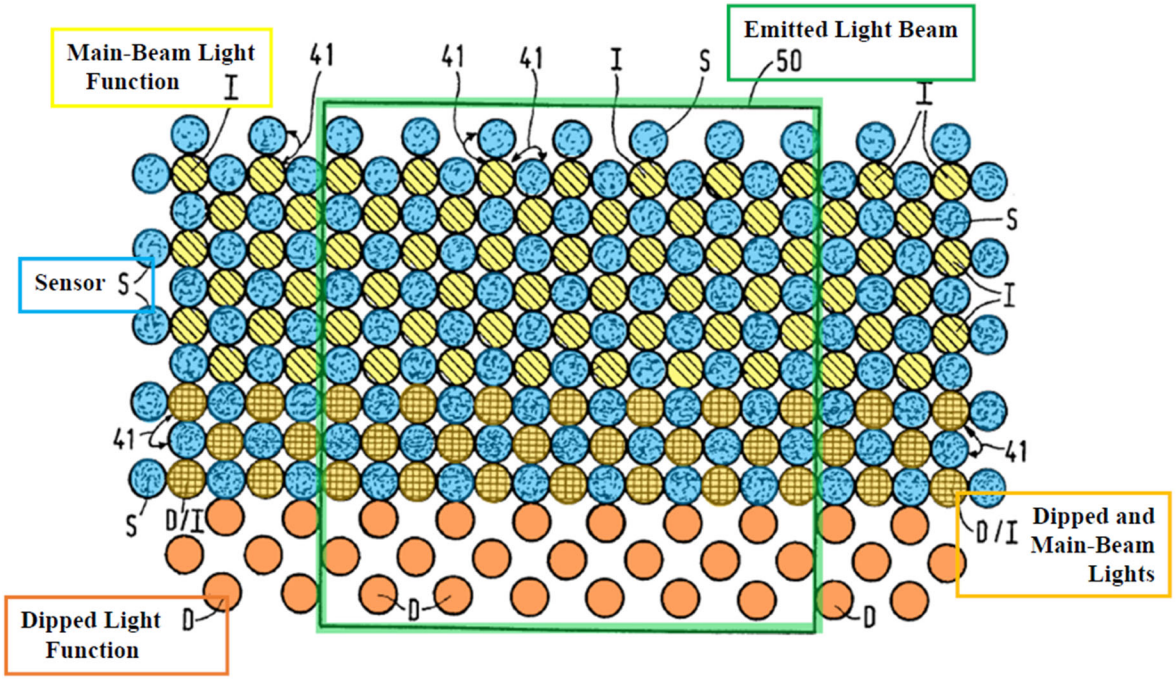
427. As discussed (Section XIV.A), in my opinion, Karlsson discloses this element, [59.11]. Specifically, Karlsson discloses "light beam 7…*optimally adapted* to the road and to the ambient light" and "permitting a light intensity which is generally *higher than that of conventional dipped headlights*." EX1010, 9:18-26, Abstract, FIGS. 3, 14, 15; EX1010, 19:23-27 ("*main-beam light function*"), 19:29-33 ("*emitted light beam 50*"), 2:7-9 ("*part of the light beam*…is automatically suppressed, whilst *retaining an optimum lighting* effect"), 14:26-30, 5:16-32, 9:9-17. The second subsections (non-shaded areas, e.g., emitted light beam 50) are thus illuminated "above the first predefined illuminance" (e.g., above a *dipped* headlights illuminance) because the illuminance in those areas is "*higher* than that of conventional *dipped headlights*," so it is above a *dipped* headlights

illuminance. Thus, a POSA would have understood that Karlsson's "dipped light function" is a "predefined illuminance."

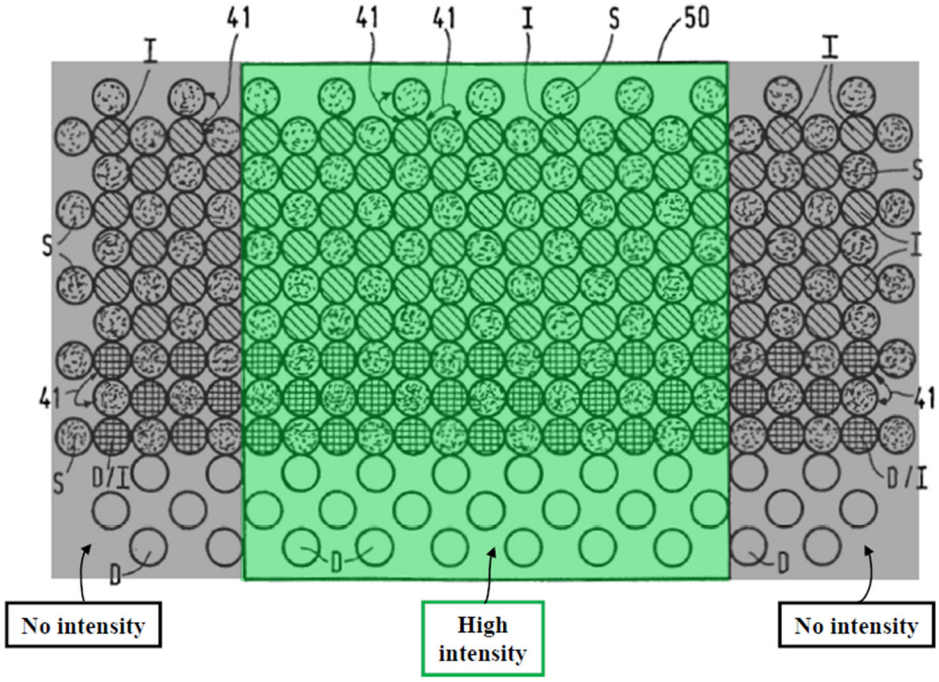
428. As discussed in Section XIV.A, the concept of a "dipped light function" or a low beam illumination level would have been known to a POSA. Such low beam (dipped headlights) illumination level for driver's visibility and glare light control is defined in all regulations, standards, and automaker's specifications, which is a predefined illumination level in terms of the light intensity distribution in the low beam illuminating area or low beam projected angular section. *See* EX1030, 3-8, 21-41, 62-69; EX1016, 4-11. Therefore, Karlsson's "dipped light function" is an example of a "predefined" illumination level, for example, equivalent to a "dipped headlights" illuminance. *See also* EX1015, 6 ("discomfort glare…disability glare…to what extent the eye adaptation and therewith the threshold sensitivity is at a given adaptation luminance"), 18 ("glare reduction and visibility improvement"), FIGS. 2.1, 2.8; EX1017, 5 ("the adaptive light pattern should support to direct the concentration to the most important zone for the current driving situation"), FIGS. 1, 3-5; EX1026, 451, 456, FIGS. 1, 3-3; EX1030, 3-8, 21-41, 49, 62-69, Table 5.5.



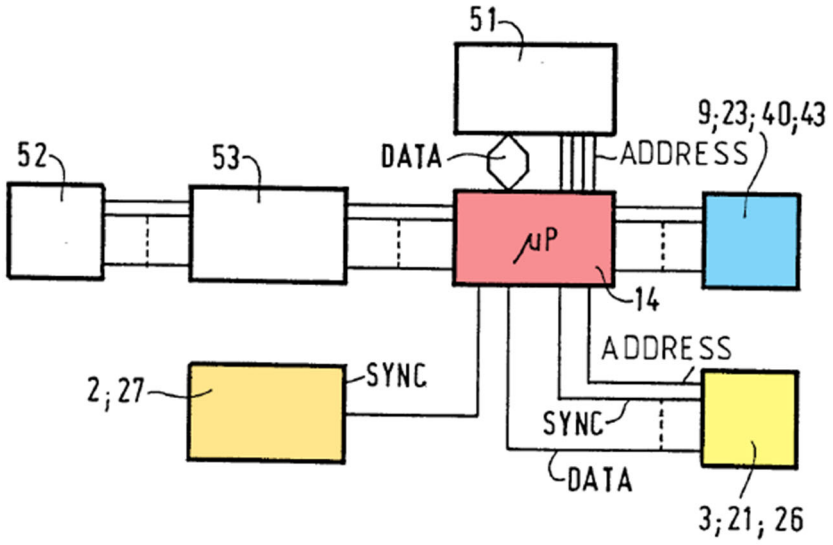
EX1010, FIG. 3 (annotated).



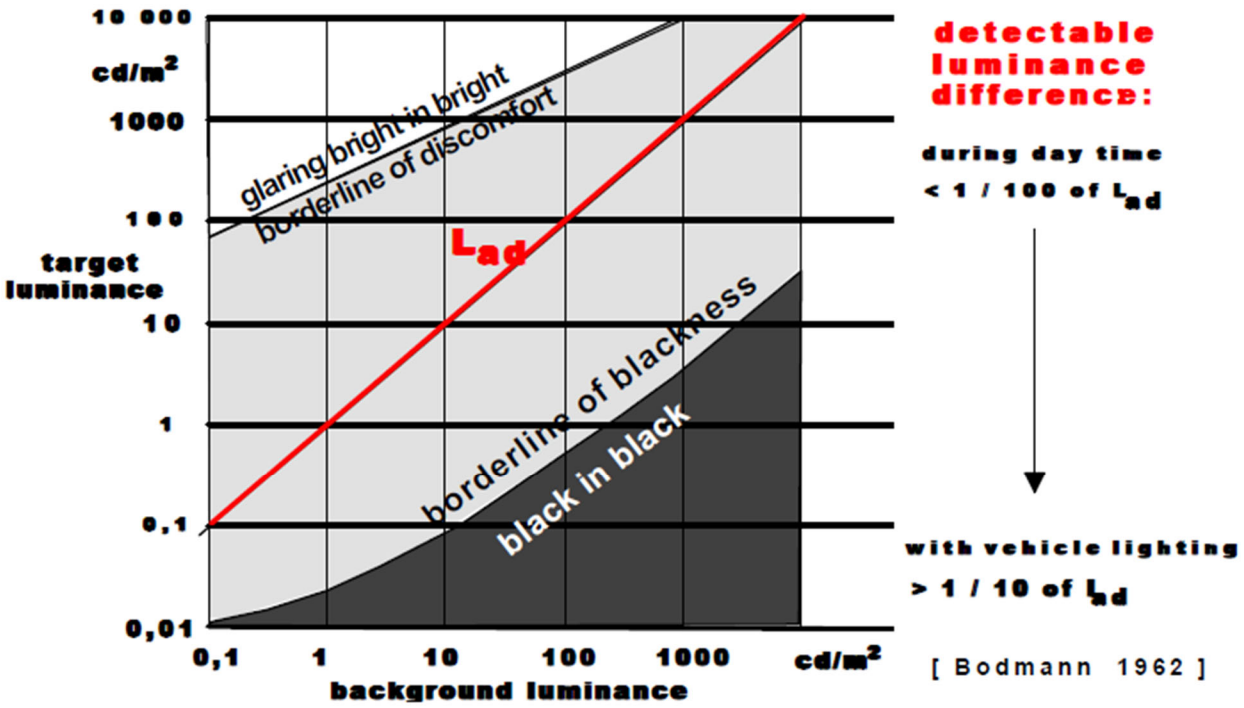
EX1010, FIG. 14 (annotated).



EX1010, FIG. 14 (annotated).



EX1010, FIG. 15 (annotated).



EX1015, FIG. 2.1.

Table 5.5. Road illumination requirements for an adaptive lighting system.

Devices	Beam patterns	Visibility on straight (m)	Visibility on curve r=150m (m)	Illuminance (lx)	Angular window for specified visibility (deg.)
Conventional beam	Low beam	58	30	40	--
	High beam	140	--	120	--
AFS	Country	80	--	20	Hor.: -1° to 1° Ver.: -0.75° to 0.3°
	Bending	--	76	6	Hor.: -4° to 35° Ver.: -1° to -0.5°
	High speed	**200**	--	**3**	Hor.: -1° to 1° Ver.: -0.3° to 0°

EX1030, Table 5.5.

429. The ’503 patent does not disclose the predefined illuminance value, so such value is not needed to satisfy [59.11]. As discussed, the ’503 patent’s specification leaves it to a POSA to determine the “predefined illuminance,”

without describing an illuminance level, numerical value, algorithms, or any control steps to achieve this. In any case, a POSA reading the disclosure of Karlsson would have understood that Karlsson teaches a predefined illuminance, for example, a "dipped headlights" illuminance, because Karlsson uses the dipped headlights illuminance as a reference point to output illuminance above that value, increasing illumination to other areas. EX1010, Abstract ("the lighting pattern and the lighting intensity are automatically adjusted…thus *permitting a light intensity* which is generally *higher than that of conventional dipped headlights*"), 9:18-26, 1:18-23, 19:23-27, FIGS. 3, 6, 14-15.

430. In view of the above, Karlsson discloses or renders obvious this element.

D. Claim 24: "The system of claim 20, wherein at least one light source provided to at least one of the one or more headlamps further includes a laser diode."

Claim 63: "The system of claim 59, wherein at least one light source provided to at least one of the one or more headlamps further includes a laser diode."

431. The language of dependent claim 63 is identical to claim 24.

432. Karlsson discloses "*spotlight beam*…is understood to mean…a *light source of limited physical dimensions*, such as a *light-emitting diode*." EX1010, 4:32-35, FIGS. 6, 14; EX1010, 5:4-15 ("*'Quantum Wells'* and the like"), 12:22-24 ("*photo diodes*"), 4:36-5:3 ("*pixel type light sources*").

433. Further, a "laser diode" was well-known, e.g., as expressly disclosed by Thominet. *See, e.g.*, EX1006, ¶28 ("*laser diodes*"). In addition, the '503 patent admits that a laser diode was a known light source. EX1001, 35:29-38 ("U.S. Pat. No. 5,537,433 by Watanabe, where a semiconductor light emitter, such as the light-emitting diode or the semiconductor laser"); EX1037, Abstract ("*semiconductor laser*"). Thus, at a minimum, a laser diode would have been an obvious light source for Karlsson's controllable light source of "limited physical dimensions." And a POSA would have had a reasonable expectation of success, since a laser diode would have been just a simple substitution of one known prior art element for another.

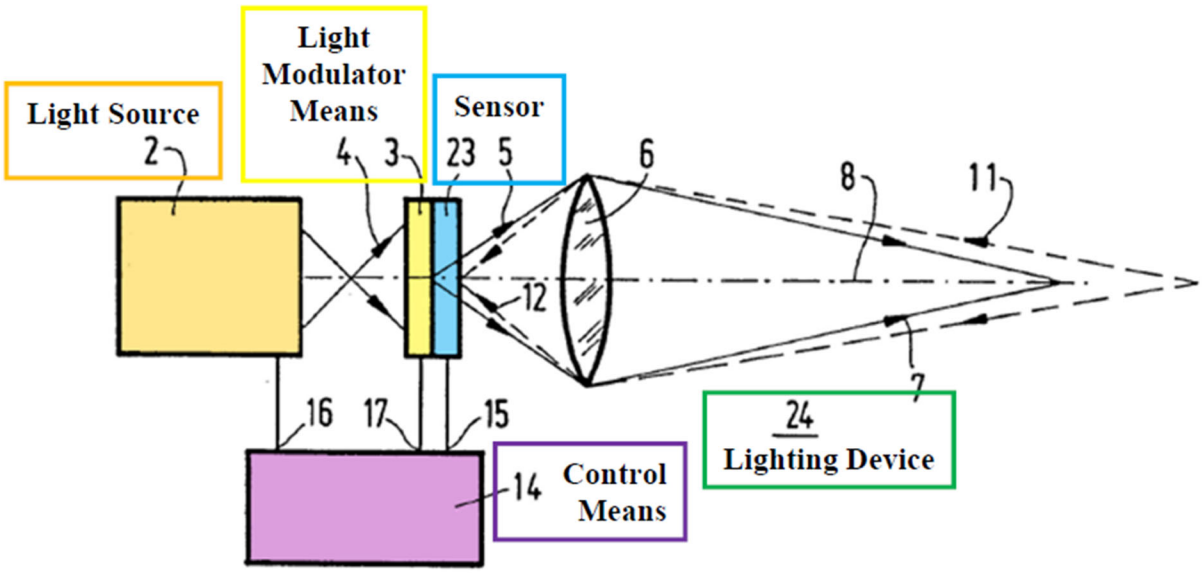
434. In view of the above, a POSA would have understood that Karlsson renders obvious this element.

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

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

435. In my opinion, there is no patentable difference between claim 64 and claim 25.

436. Karlsson discloses "light modulator means…of a type which *reflects light…'Micro Mirrors'*. EX1010, 5:7-15, FIGS. 1, 3; EX1010, 8:15-17 ("a *lens 6*, which forms light 5 into a desired emitted light beam 7"), 8:27-35 ("*lenses 6 and 10*"), Abstract, 5:11-15, 9:3-33, 10:32-11:1, 11:7-28.



EX1010, FIG. 3 (annotated).

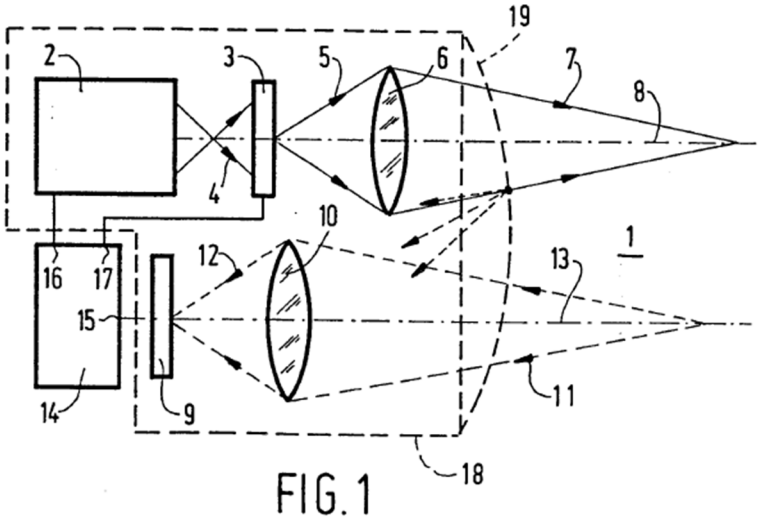


FIG. 1

EX1010, FIG. 1.

437. In view the above, Karlsson discloses these claims.

438. Thus, Karlsson, alone or in combination with Harbers, discloses or renders obvious claims 20, 24, 25, 59, 63, and 64 of the ’503 patent.

XV. GROUND 6: THE COMBINATION OF KARLSSON, HARBERS, AND GOTOU RENDERS OBVIOUS CLAIMS 21-23 AND 60-62.

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

439. As described in Section XIV.A, a POSA would have been motivated to combine Karlsson-Harbers. A POSA would have been further motivated to modify Karlsson-Harbers to adjust light based on map data including road curvature, as in Gotou, to further control Karlsson-Harbers’s directional spotlight beams to illuminate roadway curves, thereby improving driver safety—an express purpose of Karlsson. EX1010, 1:16-26, 4:17-21, 9:18-26.

440. I first turn to dependent claims 21 and 60, and the disclosures of the references, and further explain the combination and reasonable expectation of success, *infra* Section XV.B.3.

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

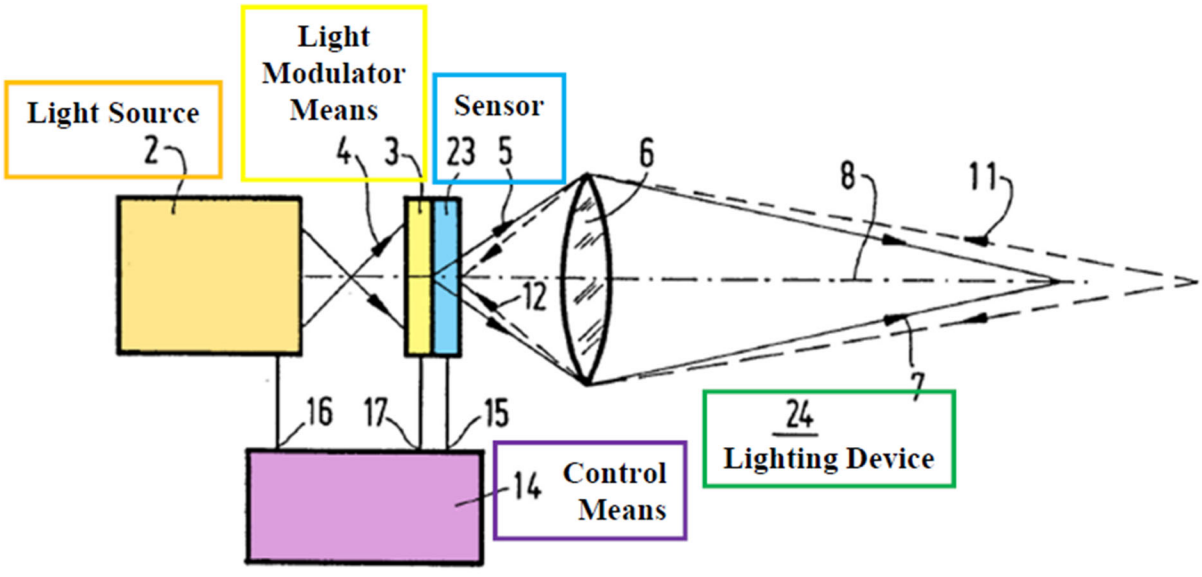
Claim 60: **“The system of claim 59, wherein at least one of the at least one processors is further configured to determine at least a road curvature, indicated by the sensor data, ahead of the first**

vehicle and to determine light output that aims illumination in a direction of the road curvature."

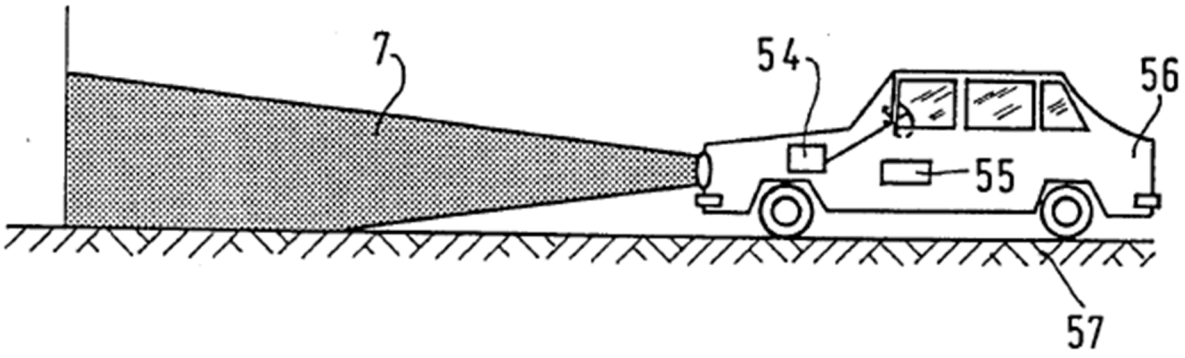
441. In my opinion, there is no patentable difference between claim 60 and claim 21.

1. Karlsson-Harbers's disclosure

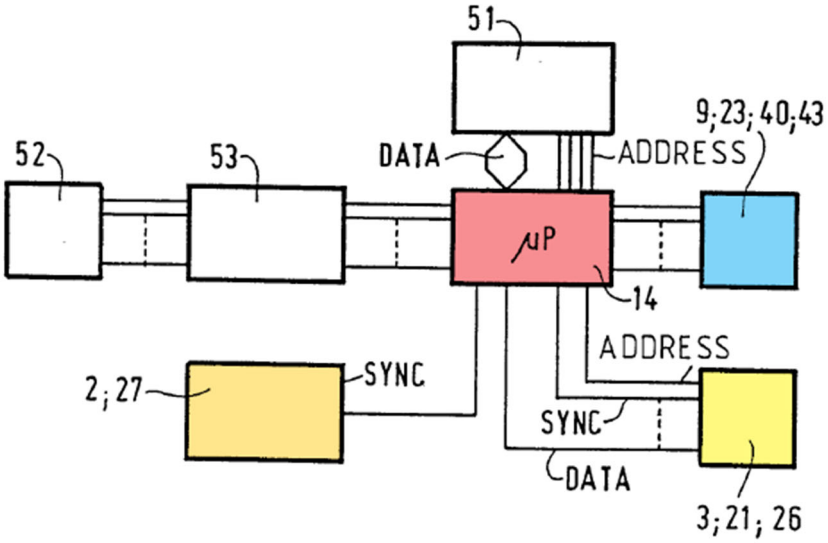
442. Karlsson-Harbers discloses claims 21 and 60. As described in Section XIV.B.3, Karlsson-Harbers discloses or renders obvious "directional light sources." Karlsson discloses "a light-sensitive sensor, which detects…the area *ahead of a vehicle*" and "*direction sensors*, for detecting whether a vehicle is *taking a bend*." EX1010, 2:2-4, 6:26-33, FIGS. 3, 14-16; EX1010, 20:29-32 ("*direction sensor 54*…determin[es] when the car 56 is *taking a bend*, so that the light beam 7 can be adapted"), 9:9-17.



EX1010, FIG. 3 (annotated).



EX1010, FIG. 16.

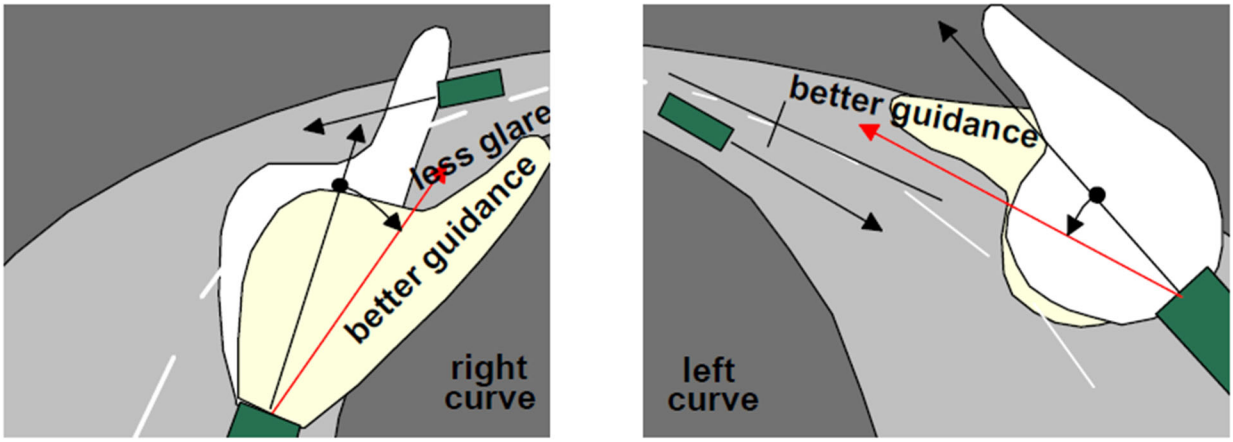


EX1010, FIG. 15 (annotated).

2. Gotou's disclosure

443. Should Patent Owner allege, incorrectly, that Karlsson-Harbers does not expressly disclose claims 21 and 60, Gotou discloses claims 21 and 60. *See also* EX1015, 18 ("glare reduction and visibility improvement in curves"), FIG. 2.8; EX1017, 5, 8 ("in a narrow bend a special curve illumination makes pedestrians or obstacles visible for the driver which normally will be hidden"),

FIGS. 1, 3-5, 7; EX1020, 376 (“curve lighting”), 378 (“turns/crossings lighting”), FIGS. 10-11.



EX1015, FIG. 2.8.

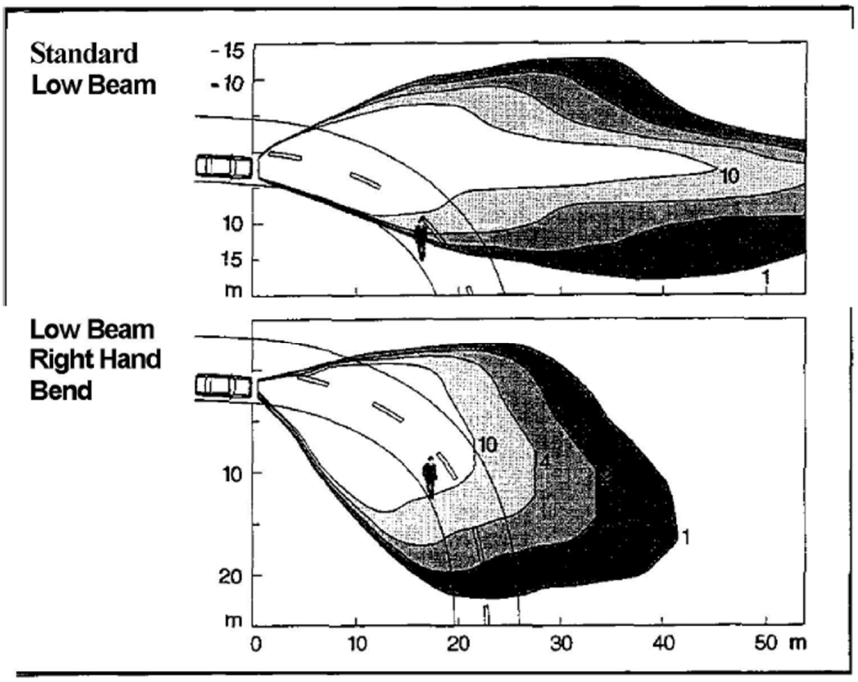


Fig. 7: comparison between basic low beam and right curve illumination, Isolux curves from bird eye's view

EX1017, FIG. 7.

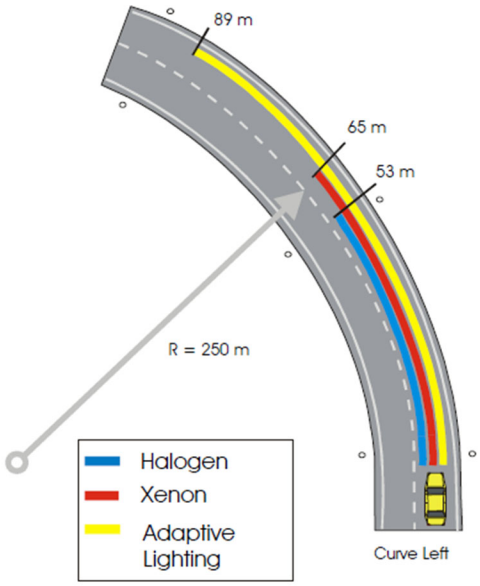
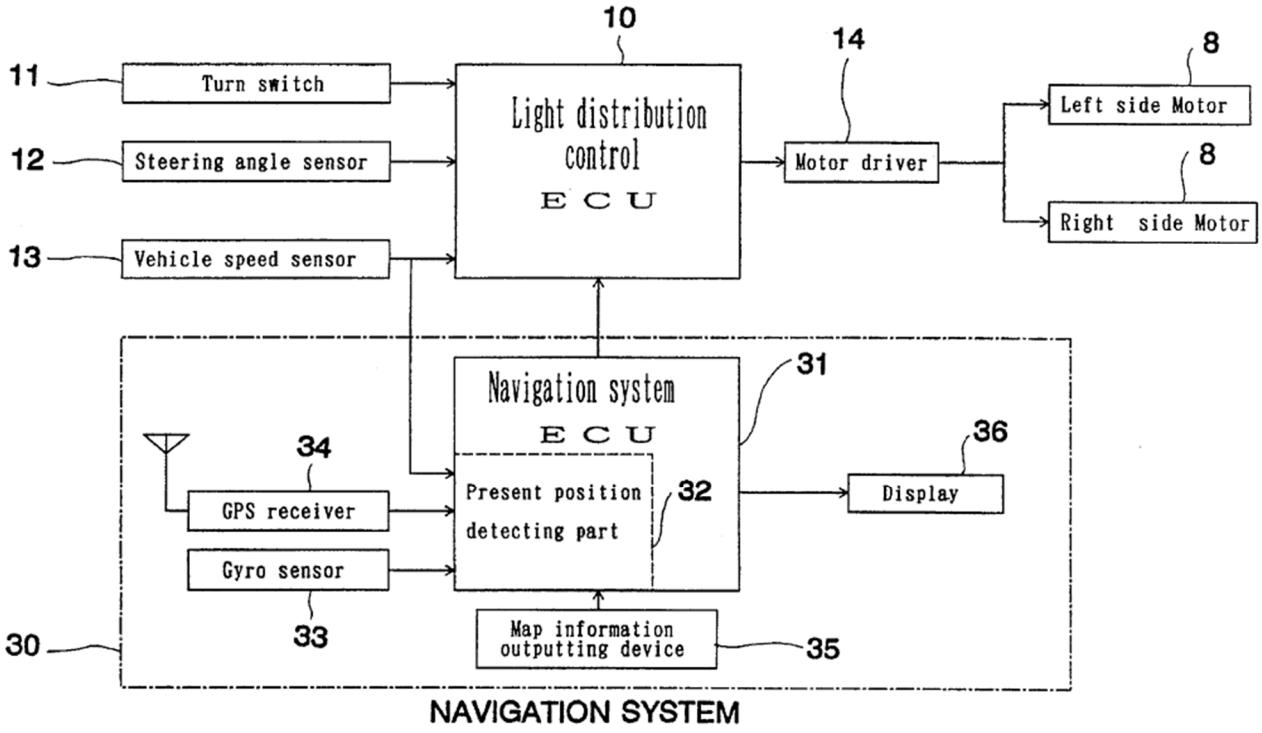


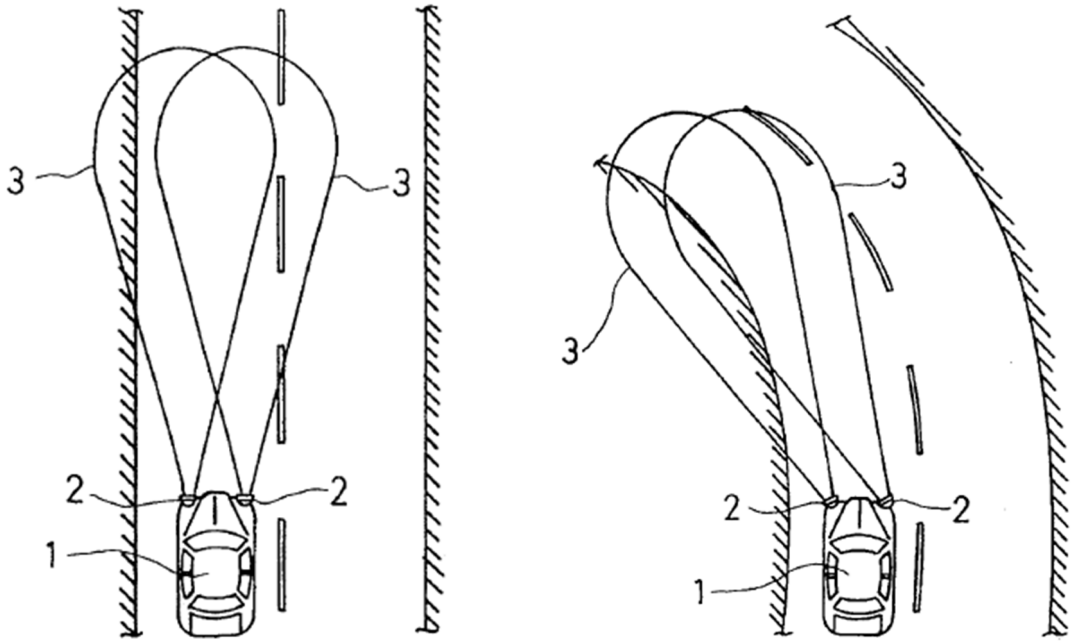
Figure 10: Static test: Results of the investigations about visibility distances obtained with halogen-, HID- and adaptive headlamps.

EX1020, FIG. 10.

444. Gotou discloses "ECU 10 gets *map information*…from the navigation system 30…to *determine a requisite optical axis angle θ*" and "estimation of the *forward road shape*…[based] on the *road data* of the map information, so that the lighting region is changed early *in the turning direction* and the *visibility is improved*." EX1012, 3:52-67, 8:28-35, FIGS. 3, 8, 9; EX1012, 4:30-49 ("*map information*…such as…*directions of the curves*"), 6:28-39 ("*analyz[ing]* whether the *forward curve* is…rightward or leftward").



EX1012, FIG. 3.



EX1012, FIGS. 8 and 9.

445. As discussed, a POSA would have been motivated to combine Gotou with Karlsson-Harbers with a reasonable expectation of success. *Supra* Section XV.A.

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

446. As described in Section XIV.A, a POSA would have been motivated to combine Karlsson-Harbers. A POSA would have been further motivated to modify Karlsson-Harbers to adjust light based on map data including road curvature, as in Gotou, to further control Karlsson-Harbers's directional spotlight beams to illuminate roadway curves, thereby improving driver safety—an express purpose of Karlsson. EX1010, 1:16-26, 4:17-21, 9:18-26.

447. Although live data could be used by vehicle sensors, it was well known that GPS navigation system gave additional advantages by providing more accurate information on driving regions. EX1026, 461-462 ("To obtain more accurate information on driving regions, it is advantageous to use data from a GPS navigation system.")

448. Further, conventional headlamps, with static high and low beams did not respond to changing driving conditions, and multiple beams were needed to provide "bending beams" for different types of road curvatures ("high speed," "middle speed," "low speed," "cross-roads"). EX1026, 451-452.

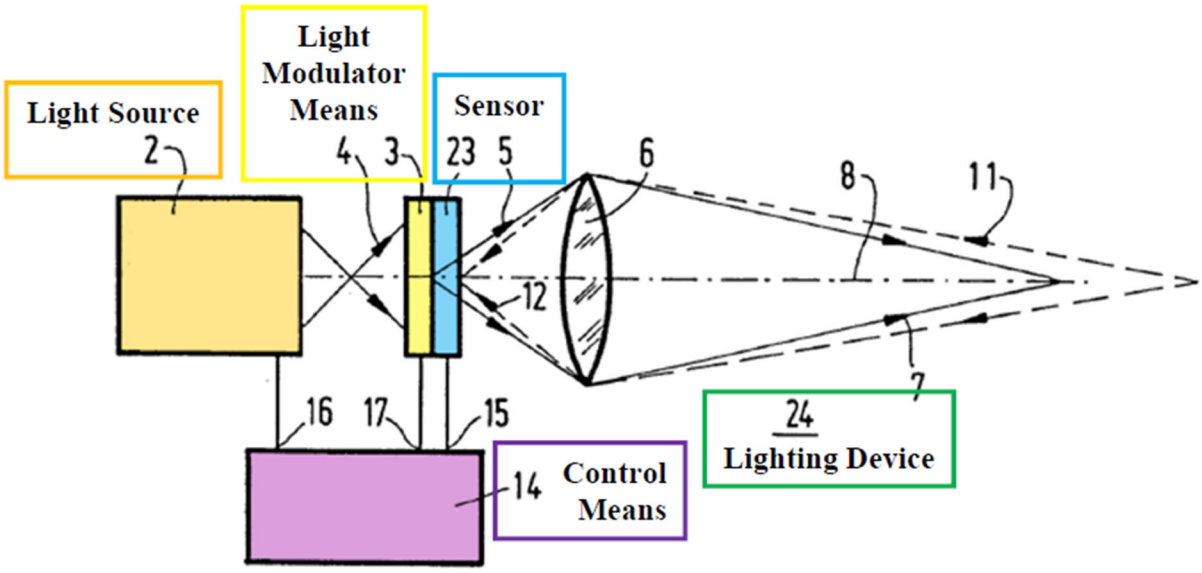
449. *First*, including an additional data source for Karlsson-Harbers's controller—Gotou's *known technique* of using map data including road curvature —would have enhanced Karlsson-Harbers by increasing/adjusting illumination based on the road curvature or a planned turn, improving driver safety by providing light to where it is needed. *Second*, a POSA would have easily incorporated *known components* of Gotou's navigation system 30 (e.g., including GPS receiver 34, *see* EX1012, Abstract, 1:35-40, 2:8-26, 3:24-62, 4:45-49, 6:4-61, 7:32-43, 8:28-35, FIGS. 1-3, 8-10) into Karlsson-Harbers. This would have, like Gotou, provided road curvature data for Karlsson-Harbers's detected field of view, allowing Karlsson-Harbers's system to increase increase/adjust illumination toward the road curvature, further improving visibility and safety.

450. Karlsson-Harbers and Gotou are from the same field—controllable headlamps with dynamic illumination—and include the same building blocks (e.g., light sources, sensors, controllers). Further, driver safety is paramount. EX1010, 1:21-26, 1:35-2:1, 9:18-26, 20:22-32; EX1012, 1:17-20, 2:19-26, 6:40-44.

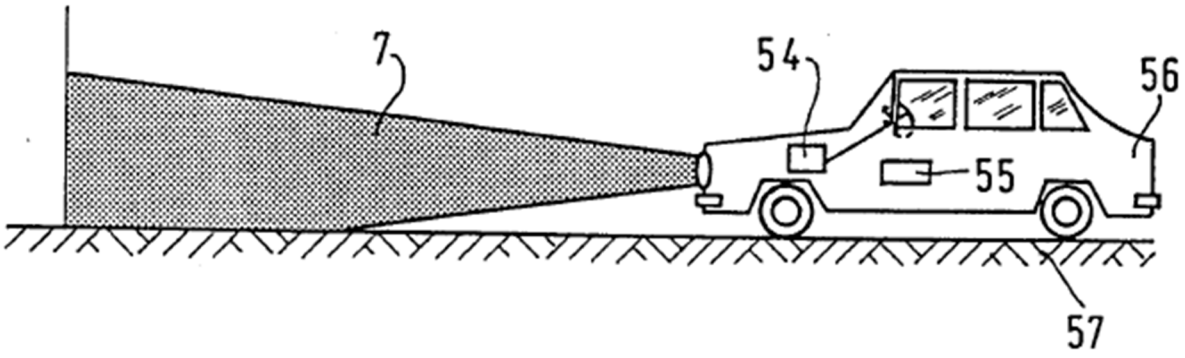
451. Indeed, Karlsson's technique and system of controlling individual spotlight beams emphasize safety of all drivers. EX1010, 1:16-26, 4:17-21, 9:18-26. Controllable headlamps "significantly increase the driving comfort and the road safety," and that "glaring or blinding of oncoming traffic is effectively prevented," increasing safety. EX1010, 9:18-26. Karlsson enables "higher light

intensity," for example, "when driving on dark, unilluminated roads," while protecting others from glare. EX1010, 1:21-26.

452. Karlsson's system "*selectively adjust[s]*…spotlight beam[s] 34, in response to a *control signal from sensor means 23*…provide a *desired lighting pattern*" in "given *directions*." EX1010, 14:26-30, 11:25-28, FIGS. 3, 6, 14. Karlsson recognizes "[w]hen *taking a bend*…the road ahead…is *insufficiently lit*" and discloses additional sensors can be used, for example, "*direction sensor 54*…for determining when the car 56 is *taking a bend*, so that the light beam 7 can be *adapted*," and acknowledges the safety benefits of those systems. EX1010, 1:35-2:1; 20:22-32, FIG. 16; EX1010, 6:26-33, 9:22-26.



EX1010, FIG. 3 (annotated).

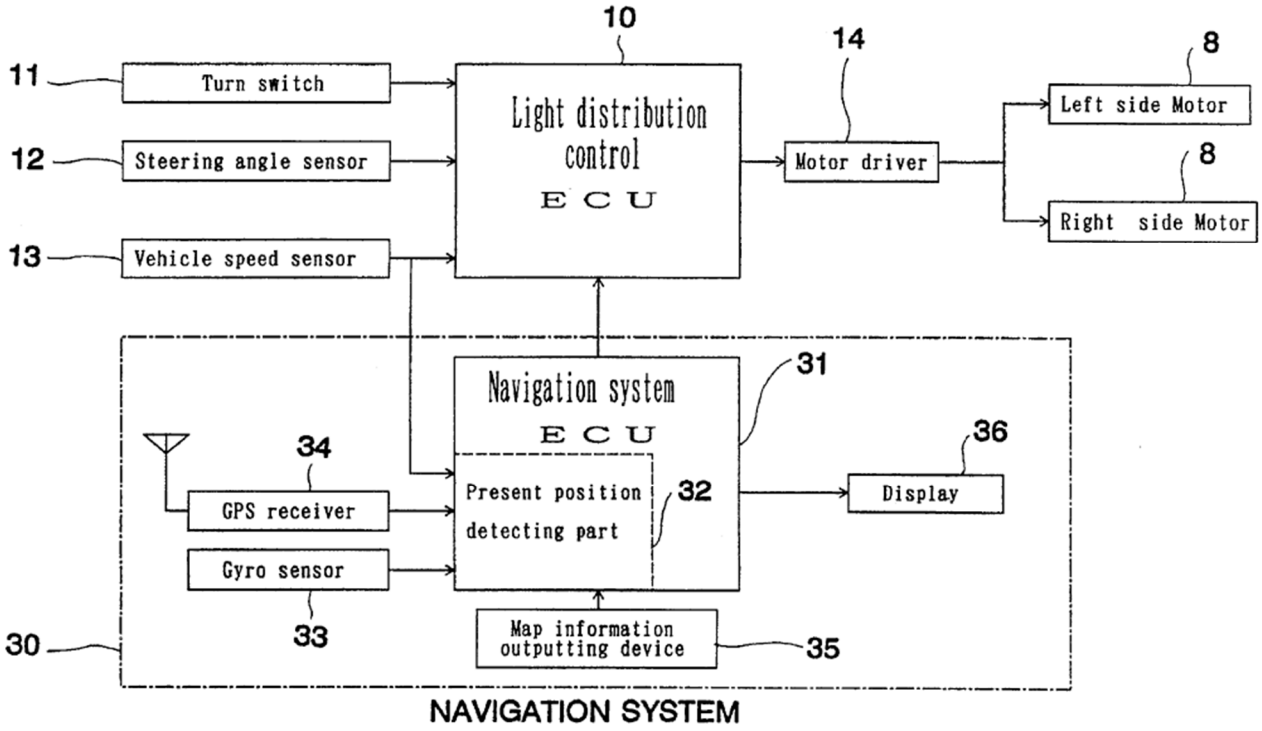


EX1010, FIG. 16.

453. Karlsson-Harbers does not expressly disclose using road curvature data (even though its spatial data should commonly include road curvature), such as from GPS or navigation systems, as an input to control the intensity, shape, and/or angular position of the spotlight beams, but it would have been obvious to a POSA to do so. This would have made Karlsson more active than prior systems, and further achieves Karlsson-Harbers's purpose of improving driver visibility and safety. EX1010, 1:35-2:1 ("[w]hen taking a bend"), 9:18-26, 20:22-32; EX1011, 5:14-26, 6:1-7, 6:27-7:19, 8:10-18. Gotou provides additional active techniques, specifically map data including road curvature-based control.

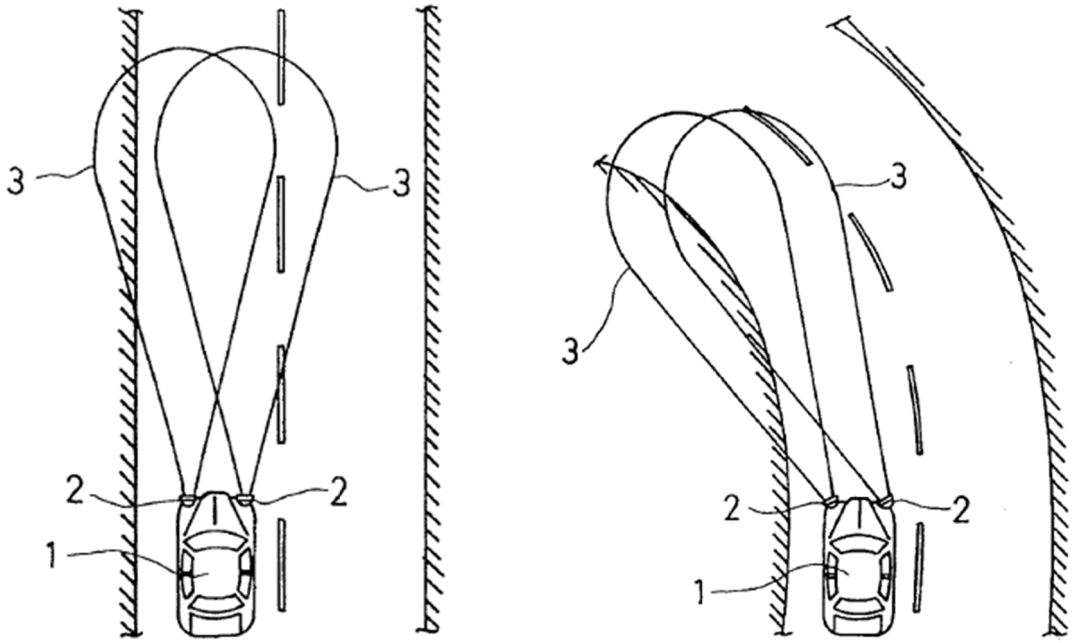
454. Gotou's *techniques and system components*, like Karlsson-Harbers, seek to enhance driver safety—using map data including road curvature-based control. EX1012, 1:17-20, 2:19-26, 6:40-44. Gotou's navigation system 30 is input to ECU 10, which alters the light direction from headlamp 2 in response to map data including road curvature input, directing light where it is needed at a given

time, enhancing safety. EX1012, 4:30-49, 6:4-61, 8:28-35, FIGS. 1-3; EX1012, 2:19-26 ("*superior visibility* can be attained"). Gotou's system responds to real-world conditions, multiple curves, and intersections. EX1012, 1:52-59, 2:19-26, 6:40-44, 8:28-35.



EX1012, FIG. 3.

455. Gotou's Figures 8 and 9 show that illumination control can be planned and controlled on roads with curves. When there is a leftward curve, the light distribution of headlamp 2 is adjusted leftward prior to the curve being reached. EX1012, 3:24-62, 7:32-43, 8:28-35, FIGS. 8, 9.



EX1012, FIGS. 8 and 9.

456. A POSA would have understood that including an additional data source for Karlsson-Harbers's controller/processor from Gotou's map data including road curvature, would have enhanced Karlsson-Harbers by increasing/adjusting illumination based on road curvature data, thereby improving driver safety. Doing so would have merely been applying Gotou's known technique (using map data including road curvature from Gotou's GPS to direct/redirect light) to Karlsson-Harbers's similar, known device (dynamic headlamp system with controllable spotlight beams), in the same way. Gotou's known technique is fully described along with its benefits (e.g., improved visibility and safety); thus, a POSA would have readily applied it to similar systems, such as Karlsson-Harbers's, in the same way.

457. Additionally, or alternatively, such a modification would have been simply combining known prior-art elements (e.g., Karlsson-Harbers's adaptive, direction-controllable spotlight beam headlamps and Gotou's directional control based on map data including road curvature) according to known methods (disclosed in Karlsson-Harbers and Gotou) to yield predictable results (e.g., improved safety from further directional light control to where it is needed, such as preemptively before a curve).

458. A POSA would have had a reasonable expectation of success combining Gotou with Karlsson-Harbers. A POSA would have understood *how* to combine their disclosures, for example, by simply modifying software instructions stored in memory of Karlsson-Harbers's controller/processor (e.g., ECU) to adjust and direct light of the spotlight beams appropriately in view of Gotou's map data including road curvature. It also would have been straightforward to combine Gotou's navigation system 30 (e.g., including GPS receiver 34) with Karlsson-Harbers.

459. Such modifications would have been routine and well within a POSA's skill due to the similarities in Karlsson-Harbers's and Gotou's adaptive light control systems and methods—their common components were well-known and there would have been no limitations for a POSA to make such modifications. In applying Gotou's technique to Karlsson-Harbers, a POSA would have simply

been applying a known technique in a predictable way—controlling headlights in part based on map data including road curvature —as already disclosed in the art. And in combining Karlsson-Harbers with Gotou's navigation system 30 (e.g., revising control input/output on an ECU), a POSA would have simply been combining known elements according to known methods (disclosed by Gotou) to yield predictable results (additional light control).

460. In view of the above, Karlsson-Harbers, alone or in combination with Gotou, discloses or renders obvious these claims.

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

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

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

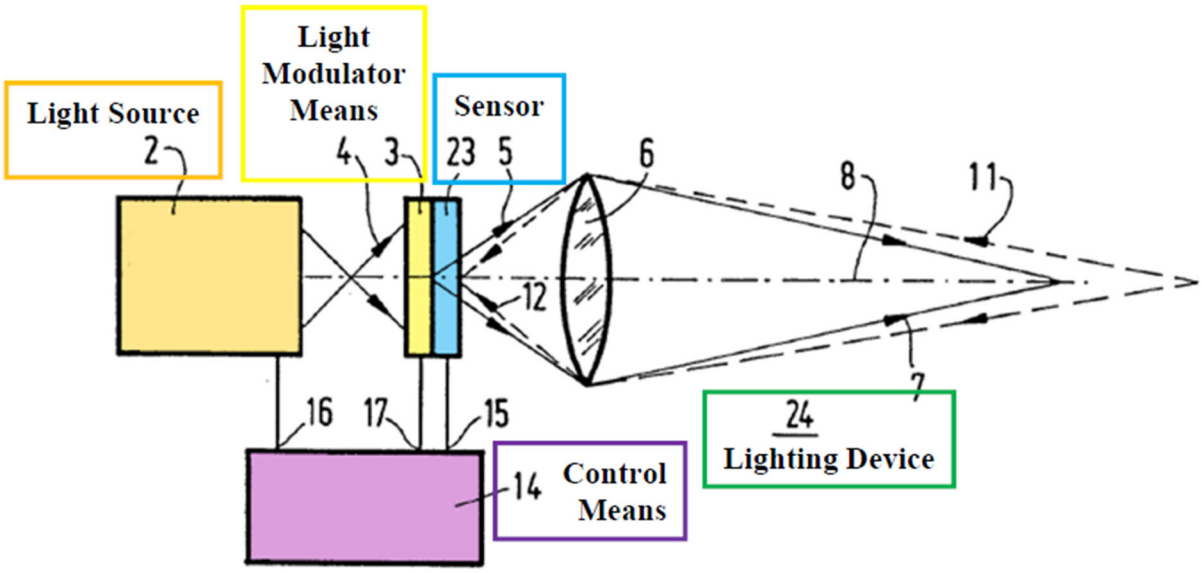
Claim 62: "The system of claim 59, wherein at least one of the at least one processors is further configured to determine at least a planned upcoming turn, indicated by the sensor data, and to determine light output that illuminates the turn."

461. The language of dependent claim 23 is identical to claim 22.

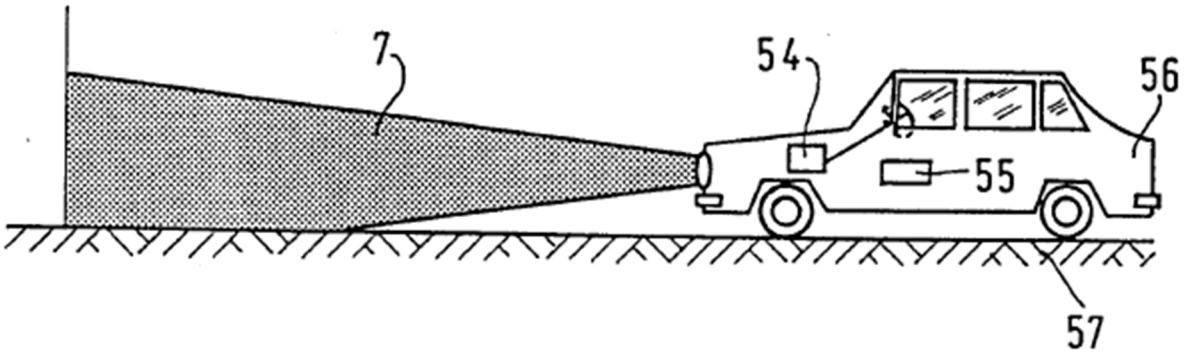
462. In my opinion, there is no patentable difference between claim 61 and claim 22.

463. The language of dependent claim 62 is identical to claim 61.

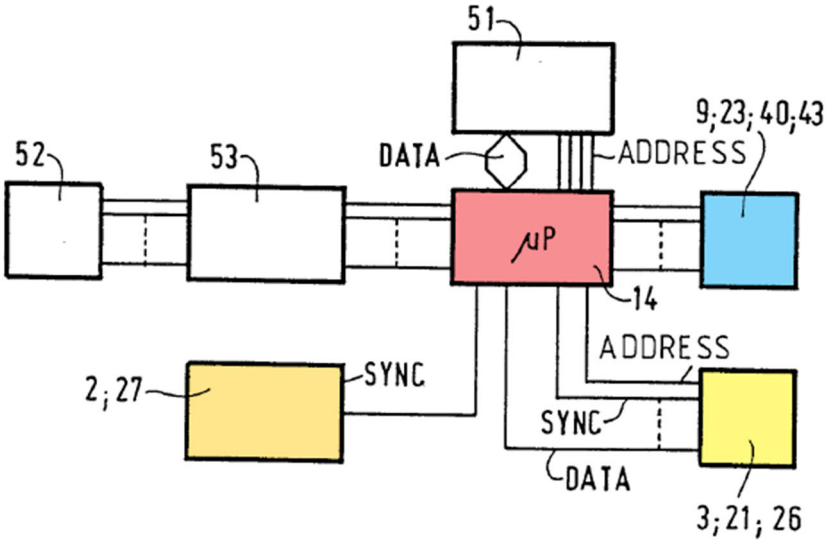
464. Karlsson-Harbers discloses claims 22, 23, 61, and 62. Karlsson discloses "a light-sensitive sensor, which detects…the area *ahead of a vehicle*" and "*direction sensors*, for detecting whether a vehicle is *taking a bend*." EX1010, 2:2-4, 6:26-33, FIGS. 3, 14-16; EX1010, 20:29-32 ("*direction sensor 54*…determin[es] when the car 56 is *taking a bend*, so that the light beam 7 can be adapted"), 9:9-17.



EX1010, FIG. 3 (annotated).

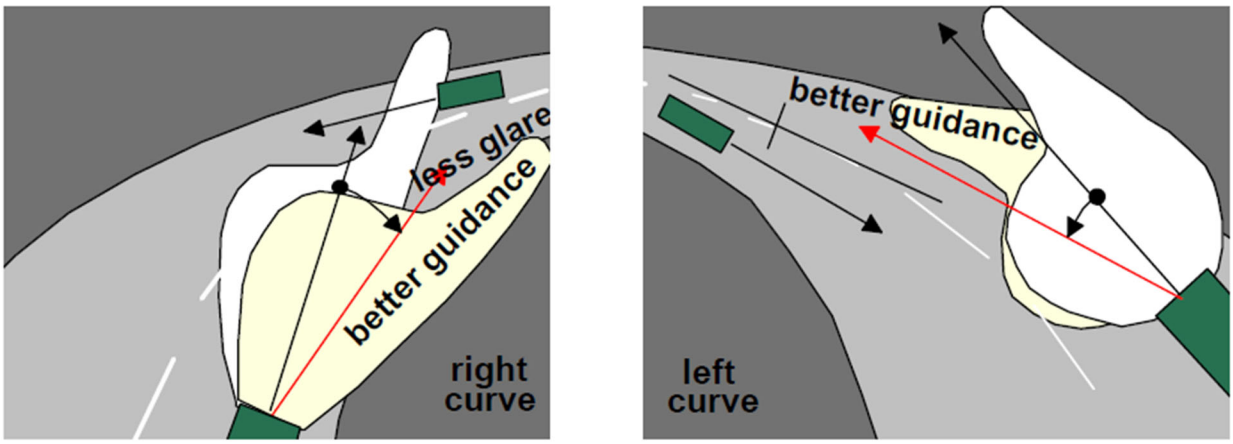


EX1010, FIG. 16.



EX1010, FIG. 15 (annotated).

465. Should Patent Owner allege, incorrectly, that Karlsson-Harbers does not expressly disclose claims 22, 23, 61, and 62, Gotou discloses claims 22, 23, 61, and 62. *See also* EX1015, 18 ("glare reduction and visibility improvement in curves"), FIG. 2.8; EX1017, 5, 8 ("in a narrow bend a special curve illumination makes pedestrians or obstacles visible for the driver which normally will be hidden"), FIGS. 1, 3-5, 7; EX1020, 376 ("curve lighting"), 378 ("turns/crossings lighting"), FIGS. 10-11.



EX1015, FIG. 2.8.

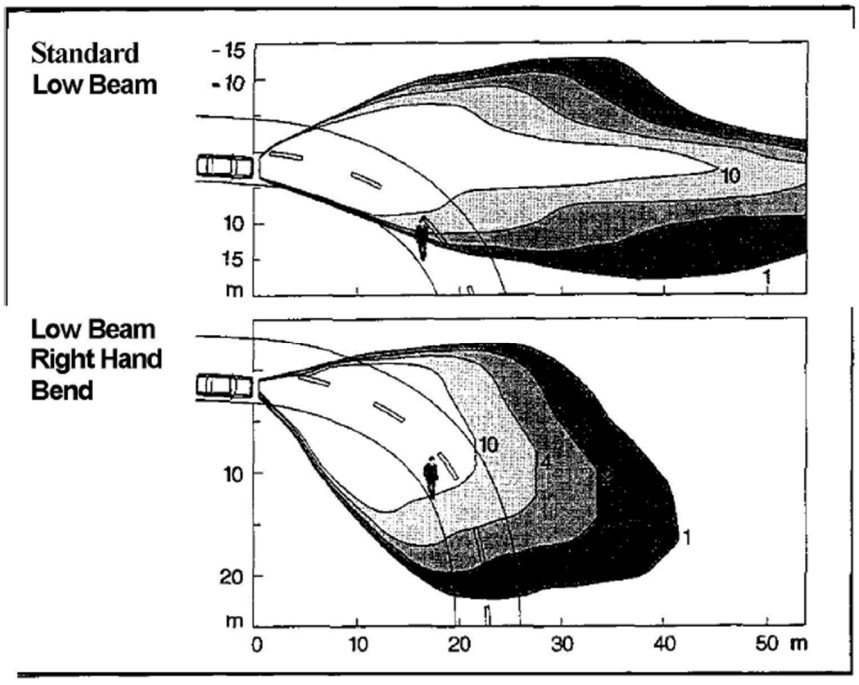


Fig. 7: comparison between basic low beam and right curve illumination, Isolux curves from bird eye's view

EX1017, FIG. 7.

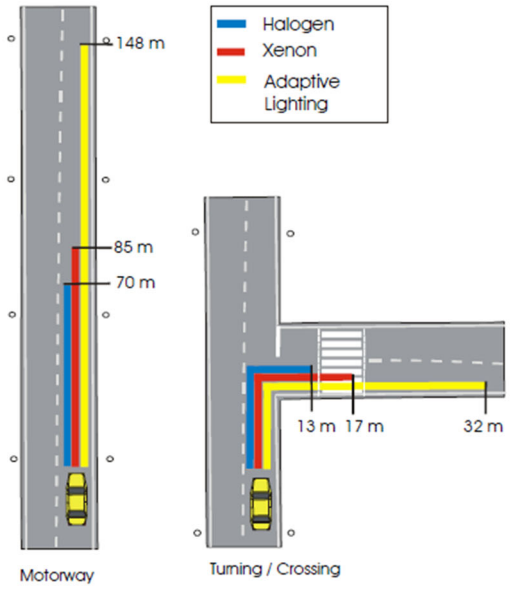
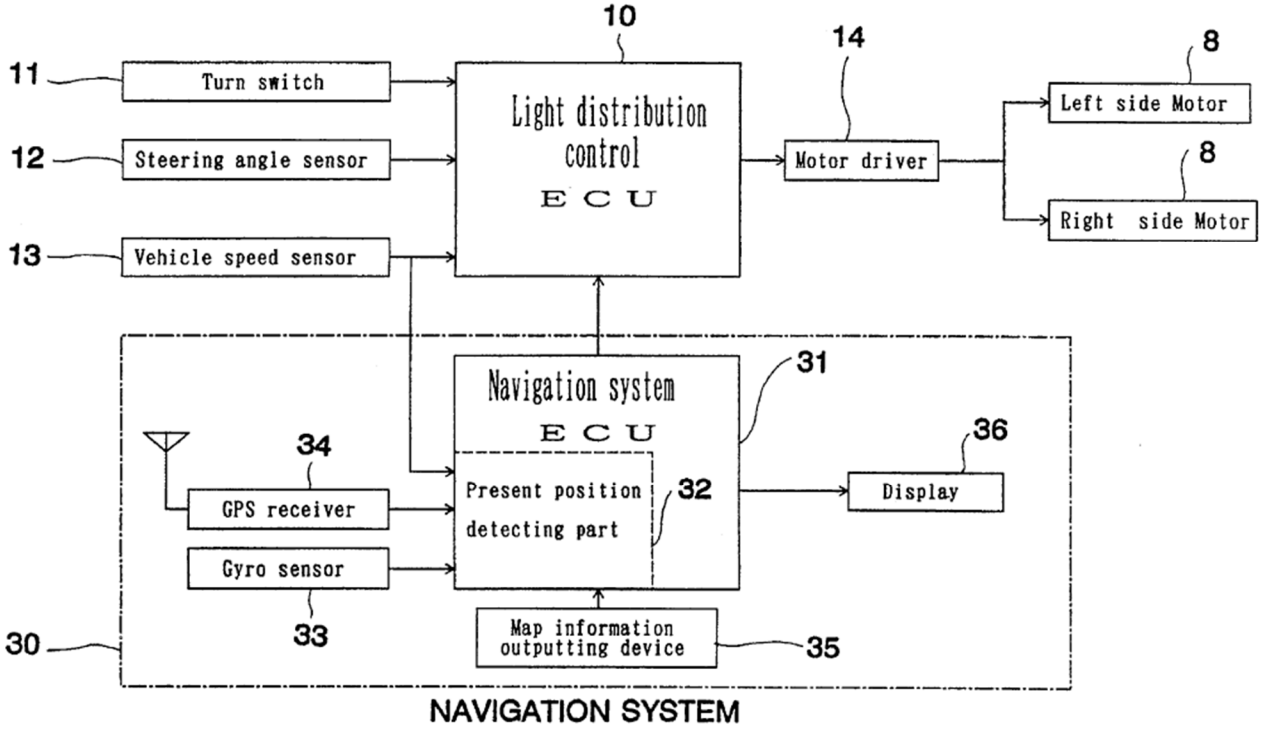


Figure 11:
Static test: Results of the investigations about visibility distances obtained with halogen-, HID- and adaptive headlamps

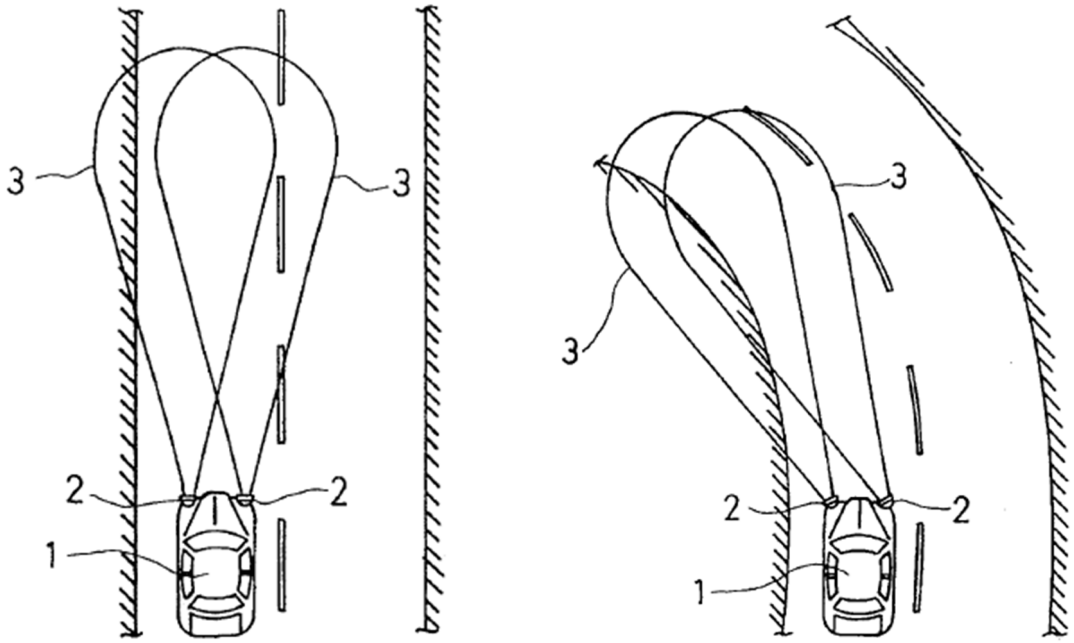
EX1020, FIG. 11.

466. Gotou discloses "ECU 10 gets *map information*…from the navigation system 30…to *determine a requisite optical axis angle θ*" and "map information…*improves the visibility* by varying the optical axis toward the *planned running direction* at an early stage *before the steering wheel is actually turned*." EX1012, 3:52-67, 6:40-44, FIGS. 3, 8-10; EX1012, 6:8-17 ("the optical axis is swung…toward the *planned* running path"), 4:30-49 ("*map information*…such as…*directions of the curves*"), 6:28-39. A POSA would have understood that Gotou discloses a "planned upcoming turn" because the "planned running direction" includes an intended direction of a driver (e.g., left or right turn). *See* EX1012, 6:40-44, FIGS. 8-10; EX1001, 54:1-15 ("[a] driver can't make a 90-degree turn traveling 90 km/h but from a stop, the turn may be around a

corner…the more angled SLS 284, closer in for illuminating [a] sharp turn, than that of the less angled SLS 283 for a shallow curve"), 56:33-54.



EX1012, FIG. 3.



EX1012, FIGS. 8 and 9.

467. As discussed, a POSA would have been motivated to combine Gotou with Karlsson-Harbers with a reasonable expectation of success. *Supra* Section XV.A.

468. In view of the above, Karlsson-Harbers, or in combination with Gotou, discloses or renders obvious these claims.

469. Thus, Karlsson-Harbers, or in combination with Gotou, discloses or renders obvious claims 21–23 and 60–62 of the ’503 patent.

XVI. OBJECTIVE INDICIA DO NOT SUPPORT PATENTABILITY.

470. I understand that the obviousness analysis includes considering evidence of secondary indicia of nonobviousness (if available). I understand that any secondary indicia of nonobviousness must have a nexus, or a close connection, to the novel aspects of the claimed invention. I understand that secondary indicia of nonobviousness include the following: commercial success, long-felt but unmet need, failure of others, copying, praise in the industry, and unexpectedly superior results as compared with the closest prior art.

471. Considering the information I have reviewed, my general knowledge of the field of headlamp systems, including adaptive headlamp systems, and publications within that and related fields, I am not aware of any objective evidence that might support the patentability of the claims of the ’503 patent.

Further, from my review of the file history (EX1002) of the ’503 patent, I did not see that the applicant raised any secondary indicia of nonobviousness during prosecution. I am not otherwise aware of any publicly available evidence of secondary indicia of nonobviousness. Should any alleged secondary indicia of nonobviousness be presented, I reserve the right to provide an opinion thereon.

472. Counsel has informed me that Patent Owner submitted alleged evidence of secondary considerations in a reexamination proceeding involving U.S. Patent No. 9,955,551, but I understand that the Central Reexamination Unit did not address it. In any event, in my opinion, that evidence would not be applicable here at least because the ’503 patent involves different claims than in the ’551 reexamination. Again, should any alleged secondary indicia of nonobviousness be presented, I reserve the right to provide an opinion thereon.

XVII. CONCLUSION

In signing this Declaration, I recognize that this Declaration will be filed as evidence in an *inter partes* review before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I also recognize that I may be subject to cross-examination in the case and that cross-examination will take place within the United States. If cross-examination is required, I will appear for cross-examination within the United States during the time allotted.

I hereby declare that all statements made herein are made of my own knowledge and are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Executed on this 5th day of July 2023, in Petaluma, California.



Scott Andrews

Appendix A

Claim 20	Claim 59
[20.P] A vehicle headlight system, comprising:	[59.P] identical to [20.P]
[20.1] one or more headlamps affixed to a vehicle,	[59.1] one or more headlamps affixed to a first vehicle,
[20.2] each headlamp including at least three directional light sources aimed at different angles relative to the vehicle,	[59.2] each headlamp including at least three directional light sources having different aimings relative to the first vehicle,
[20.3] the light sources configured to have one or more controllable light characteristics,	[59.3] the light sources having one or more controllable illumination 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,	[59.4] identical to [20.6]
[20.7] defined as pertinent to determining illumination output from the one or more headlamps and	[59.5] at least a portion of the sensed information indicating a second vehicle, and
[20.8] communicating the sensed information to a processor as sensor data;	[59.6] communicate sensor data reflecting the sensed information to at least one processor,

[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	[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] Language shown below with [20.12]
	[59.9] the illumination aimed at the first subsection substantially resulting in light below a first predefined illuminance in the first subsection, and
[20.10] at least a second subsection not including the detected vehicle,	
	[59.10] that aims illumination at one or more second subsections of the field of view to either side of the first subsection,
[20.11] determine optimal use of the differently aimed directional light sources to maximize vehicle operator visibility in at least the second subsection,	
	[59.11] the illumination aimed at the one or more second subsections substantially resulting in light above the first predefined illuminance in the one or more second subsections; and
[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	[59.8] determine light output for the headlight system that aims illumination at the first subsection,

[20.13] direct the control circuitry to adjust the directional light sources to achieve the determined optimal use.	[59.12] instruct adjustment of one or more of the light sources to achieve the determined output.

EX1001, 97:58-98:21, 102:14-40 (numbering and spacing added).

Appendix B

Claim listing:

Claim:	Element:	Claim Language:
Claim 20	[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,
	[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.
Claim 21	-	The system of claim 20, wherein the processor is further configured to determine at least a road curvature, indicated by the sensor data, ahead of the vehicle and to direct the control circuitry to adjust the directional light sources to increase illumination in a direction of the road curvature.
Claim 22	-	The system of claim 21, wherein the processor is further configured to determine at least a planned upcoming turn, indicated by the sensor data, and to direct the control circuitry to increase illumination illuminating the turn.
Claim 23	-	The system of claim 20, wherein the processor is further configured to determine at least a planned upcoming turn, indicated by the sensor data, and to direct the control circuitry to increase illumination illuminating the turn.
Claim 24	-	The system of claim 20, wherein at least one light source provided to at least one of the one or more headlamps further includes a laser diode.
Claim 25	-	The system of claim 20, wherein at least one of the one or more headlamps further includes at least one

		of reflectors, refractors, or lenses usable to alter emitted light from at least one of the light sources.
Claim 59	[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 a 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 second subsections of the field of view to either side of the first subsection,
	[59.11]	the illumination aimed 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.
Claim 60	-	The system of claim 59, wherein at least one of the at least one processors is further configured to determine at least a road curvature, indicated by the sensor data, ahead of the first vehicle and to determine light output that aims illumination in a direction of the road curvature.
Claim 61	-	The system of claim 60, wherein at least one of the at least one processors is further configured to determine at least a planned upcoming turn, indicated by the sensor data, and to determine light output that illuminates the turn.
Claim 62	-	The system of claim 59, wherein at least one of the at least one processors is further configured to determine at least a planned upcoming turn, indicated by the sensor data, and to determine light output that illuminates the turn.
Claim 63	-	The system of claim 59, wherein at least one light source provided to at least one of the one or more headlamps further includes a laser diode.
Claim 64	-	The system of claim 59, wherein at least one of the one or more headlamps further includes at least one of reflectors, refractors, or lenses usable to alter the light emitted from at least one of the light sources as part of the instructed adjustment.