UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

VOLKSWAGEN GROUP OF AMERICA, INC.,
Petitioner

v.

YECHEZKAL EVAN SPERO,
Patent Owner

Case IPR2023-00328
U.S. Patent No. 10,894,503 B2

DECLARATION OF JIANZHONG JIAO, PH.D., IN SUPPORT OF PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 10,894,503

Mail Stop "PATENT BOARD"
Patent Trial and Appeal Board
U.S. Patent & Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450

TABLE OF CONTENTS

I. INTRODUCTION 1
II. SUMMARY OF GROUNDS 3
III. SUMMARY OF OPINIONS 3
IV. QUALIFICATIONS 4
V. MATERIALS CONSIDERED 8
VI. LEGAL STANDARDS 10
A. My Understanding of Claim Construction 11
B. A Person of Ordinary Skill in the Art 12
C. My Understanding of Obviousness 12
VII. LEVEL OF ORDINARY SKILL IN THE ART 18
VIII. OVERVIEW OF THE '503 PATENT CLAIMS 19
A. Technology Overview of the Patent Claims 19
B. Independent Claims 26 and 65 29
C. Prosecution History Summary 33
D. Claim Construction 34
"light sources" (claim 65) 34
IX. SUMMARY OF THE APPLIED REFERENCES 37
A. Ground 1 – Beam and Thominet 37
1. U.S. Patent No. 6,144,158 to Beam 37
2. U.S. Patent Publication No. 2001/0019486 to Thominet 42
B. Ground 2 – WIPO Patent Publication No. 2001/070538 to Stam with Beam-Thominet 44
C. Grounds 3, 4 – U.S. Patent No. 6,049,749 to Kobayashi with Beam-Thominet/Beam-Thominet-Stam 46
D. Ground 5 – WIPO Patent Publication No. 2002/004247 to Braun with Beam-Thominet-Stam 52
E. Grounds 6, 7 – WIPO Patent Publication No. 2001/001038 to Harbers with Beam-Thominet/Beam-Thominet-Stam 53
F. Ground 8 – Karlsson and Harbers 55

1. WIPO Patent Publication No. 1998/054030 to Karlsson 55
2. Harbers 59
G. Ground 9 – U.S. Patent No. 5,588,733 to Gotou with Karlsson-Harbers 60
H. Ground 10 – Braun with Karlsson-Harbers 61
X. GROUND 1: THE COMBINATION OF BEAM AND THOMINET RENDERS OBVIOUS CLAIMS 26-27 AND 30-31.....62
A. A POSA would have been motivated to combine Beam and Thominet with a reasonable expectation of success. 65
B. Independent Claim 26 75
1. [26.P]: "A method for generating a headlight beam in an adaptive headlight system that provides illumination to at least a portion of a field-of-view, comprising:" 75
2. [26.1]: "utilizing one or more sensors of a vehicle including the adaptive headlight system to obtain and provide data" 76
3. [26.2]: "predefined as relevant to a determination of illumination requirements for the field-of-view, the data including data indicative of at least one of one or more other vehicles or a pedestrian;" 78
4. [26.3]: "determining illumination requirements for the field-of-view based on the data sensed by the sensors," 80
5. [26.4]: "including determining illumination for at least a first subsection of the field-of-view including the other vehicle or pedestrian, as indicated by the sensor data, and" 82
6. [26.5]: "for at least a second subsection of the field-of-view not including the other vehicle or pedestrian;" 86
7. [26.6]: "determining a control strategy for controlling one or more directional light clusters in a headlight assembly to create an output headlight beam meeting the determined illumination requirements," 90
(a) Beam discloses this element. 90
(b) Thominet also discloses this element. 97
(c) A POSA would have been motivated to combine Beam and Thominet with a reasonable expectation of success. .98

8. [26.7]: "the headlight beam spatial light distribution shaped to provide high beam illumination for a driver of the vehicle, in at least the second subsection,".....107

9. [26.8]: "while mitigating glaring light illuminating at least the first subsection including detected other vehicles or pedestrians;" .108

10. [26.9]: "sending control signals implementing the control strategy to an electronic control circuitry configured to operate the light-clusters; and".....110

11. [26.10]: "controlling the light clusters via the electronic control circuitry to collectively emit the headlight beam meeting the determined illumination requirements." 112

C. Claim 27: "The method of claim 26, wherein the determining illumination requirements further comprises: determining the illumination requirements based on headlight modes comprising one or more of parking lights, low beam, high beam, cornering lights, load leveling adjustment, integral turn signal indicators, inputtable alternate beam pattern selection, and specified preferential headlight illumination color of the driver." 114

D. Claim 30: "The method of claim 26, wherein the control strategy dynamically adapts the headlight beam based on real-time changes to the data sensed by the sensors indicating a change to at least one of beings, objects and preceding vehicles ahead of the first vehicle." 115

E. Claim 31: "The method of claim 26, further comprising receiving input to an override switch and, responsive to the input, adjusting automatic operation of the headlight system to reflect operator instruction as indicated by the input to the override switch or by further input to a different vehicle input other than the override switch."....115

XI. GROUND 2: THE COMBINATION OF BEAM, THOMINET, AND STAM RENDERS OBVIOUS CLAIM 65. 116

A. A POSA would have been motivated to combine Beam, Thominet, and Stam with a reasonable expectation of success. 119

B. Independent Claim 65 122

1. [65.P]: "A method for generating a headlight beam in an adaptive headlight system that provides illumination to at least a portion of a field-of-view, comprising:" 122

2. [65.1]: "utilizing one or more sensors of a first vehicle to obtain and provide data," 123

3. [65.2]: "the data including data indicating at least a second vehicle;" 123

4. [65.3]: "determining illumination for at least a first subsection including the second vehicle and" 124

5. [65.4]: "at least one or more second subsections, to either side of the first subsection," 124

6. [65.5]: "including determining an illumination level for the first subsection" 125

7. [65.6]: "that substantially illuminates the first subsection below a predefined illuminance, and" 128

   (a) Beam discloses this element. 128

   (b) Stam also discloses this element. 132

   (c) A POSA would have been motivated to combine Beam, Thominet, and Stam with a reasonable expectation of success. 134

8. [65.7]: "determining an illumination level for the one or more second subsections" 139

9. [65.8]: "that substantially illuminates the one or more second subsections above the predefined illuminance;" 142

   (a) Beam discloses this element. 143

   (b) Stam also discloses this element. 147

   (c) A POSA would have been motivated to combine Beam, Thominet, and Stam with a reasonable expectation of success. 148

10. [65.9]: "determining control instructions for controlling one or more directional light sources included in the adaptive headlight system to achieve the determined illumination levels for at least the first and one or more second subsections; and" 153

    (a) Beam discloses this element. 153

(b) Thominet also discloses this element. 160

(c) A POSA would have been motivated to combine Beam and Thominet with a reasonable expectation of success. 161

11. [65.10]: "controlling the light sources to emit the headlight beam in accordance with the control instructions."..... 170

XII. GROUND 3: THE COMBINATION OF BEAM, THOMINET, AND KOBAYASHI RENDERS OBVIOUS CLAIMS 32-36. 172

A. A POSA would have been motivated to combine Kobayashi with Beam-Thominet with a reasonable expectation of success.....172

B. Claim 32: "The method of claim 26, wherein the determining illumination requirements further includes determining illumination for an upcoming curve indicated by the sensor data, wherein the determining the control strategy further comprises determining the control strategy for controlling the directional light clusters to create an output headlight beam that illuminates around the curve." 179

Claim 33: "The method of claim 32, wherein the determining illumination requirements further includes determining illumination for an upcoming turn indicated by the sensor data, wherein the determining the control strategy further comprises determining the control strategy for controlling the directional light clusters to create an output headlight beam that illuminates the turn." 179

Claim 34: "The method of claim 32, wherein the determining illumination further includes determining illumination the increases illumination of an upcoming turn indicated by the sensor data, wherein the determining the control instructions further comprises determining the control instructions for controlling one or more of the directional light sources to achieve illumination of the turn." 179

Claim 35: "The method of claim 26, wherein the determining illumination requirements further includes determining illumination for an upcoming turn indicated by the sensor data, wherein the determining the control strategy further comprises determining the control strategy for controlling the directional

light clusters to create an output headlight beam that illuminates the turn." 180

Claim 36: "The method of claim 26, wherein the determining illumination further includes determining illumination the increases illumination of an upcoming turn indicated by the sensor data, wherein the determining the control instructions further comprises determining the control instructions for controlling one or more of the directional light sources to achieve illumination of the turn." 180

1. Beam-Thominet's disclosure 181

2. Kobayashi's disclosure 185

3. A POSA would have been motivated to combine Kobayashi with Beam-Thominet with a reasonable expectation of success. 187

XIII. GROUND 4: THE COMBINATION OF BEAM, THOMINET, STAM, AND KOBAYASHI RENDERS OBVIOUS CLAIM 70. 194

A. A POSA would have been motivated to combine Kobayashi with Beam-Thominet-Stam with a reasonable expectation of success. 194

B. Claim 70: "The method of claim 65, wherein the determining illumination further includes determining illumination that increases illumination of an upcoming curve indicated by the data, wherein the determining the control instructions further comprises determining the control instructions for controlling one or more of the directional light sources to achieve illumination around the curve." 195

XIV. GROUND 5: THE COMBINATION OF BEAM, THOMINET, STAM, AND BRAUN RENDERS OBVIOUS CLAIMS 66-67. 195

A. A POSA would have been motivated to combine Braun with Beam-Thominet with a reasonable expectation of success. 195

B. Claim 66: "The method of claim 65, wherein the data includes data indicating a pedestrian and wherein the determining illumination includes determining an illumination level, for at least a third subsection including the pedestrian." 202

Claim 67: "The method of claim 65, wherein the data includes data indicating a road-sign wherein the determining illumination includes determining an illumination level, for at least a third subsection including the road-sign." 202

1. Beam-Thominet-Stam's disclosure.....202
2. Braun's disclosure.....204
3. A POSA would have been motivated to combine Braun with Beam-Thominet-Stam with a reasonable expectation of success. 206

XV. GROUND 6: THE COMBINATION OF BEAM, THOMINET, AND HARBERS RENDERS OBVIOUS CLAIMS 28-29. 212

A. A POSA would have been motivated to combine Braun with Beam-Thominet with a reasonable expectation of success.....212

B. Claim 28: "The method of claim 26, wherein the illumination requirements accommodate peripheral night vision of the driver, by defining bluish headlamp illumination along a side of a road, while defining yellow tinted illumination along the road." 221

1. Beam-Thominet's disclosure 221
2. Harbers's disclosure.....224
3. A POSA would have been motivated to combine Harbers with Beam-Thominet with a reasonable expectation of success. 225

C. Claim 29: "The method of claim 26, wherein the illumination requirements accommodate sensed fog or snow environmental conditions by defining a shift of at least a portion of the headlight beam towards yellow." 234

1. Beam-Thominet's disclosure 234
2. Harbers's disclosure.....236
3. A POSA would have been motivated to combine Harbers with Beam-Thominet with a reasonable expectation of success. 237

XVI. GROUND 7: THE COMBINATION OF BEAM, THOMINET, STAM, AND HARBERS RENDERS OBVIOUS CLAIMS 68-69. 246

A. A POSA would have been motivated to combine Harbers with Beam-Thominet-Stam with a reasonable expectation of success. 246

B. Claim 68: "The method of claim 65, wherein the determining illumination further includes determining a yellowish illumination color for illumination illuminating a road within the field-of-view and a blueish illumination color for illumination illuminating areas off-road within the field-of-view." 246

C. Claim 69: "The method of claim 65, wherein the data includes data indicating fog or snow environmental conditions and the determining illumination includes determining a shift of at least a portion of the light output from the headlight system towards yellow." 246

XVII. GROUND 8: THE COMBINATION OF KARLSSON AND HARBERS RENDERS OBVIOUS CLAIMS 26-31, 65, AND 68-69.....247

"directional light [clusters / sources]" [26.6]/[65.9] 247

"predefined illuminance" [65.6]/[65.8].....250

A. A POSA would have been motivated to combine Karlsson and Harbers with a reasonable expectation of success. 253

B. Independent Claims 26 and 65.....261

1. [26.P]: "A method for generating a headlight beam in an adaptive headlight system that provides illumination to at least a portion of a field-of-view, comprising:".....262

[65.P]: "A method for generating a headlight beam in an adaptive headlight system that provides illumination to at least a portion of a field-of-view, comprising:".....262

2. [26.1]: "utilizing one or more sensors of a vehicle including the adaptive headlight system to obtain and provide data" 264

[65.1]: "utilizing one or more sensors of a first vehicle to obtain and provide data," 264

3. [26.2]: "predefined as relevant to a determination of illumination requirements for the field-of-view, the data including data indicative of at least one of one or more other vehicles or a pedestrian;" 265

[65.2]: "the data including data indicating at least a second vehicle;" 265

4. [26.3]: "determining illumination requirements for the field-of-view based on the data sensed by the sensors," 267

5. [26.4]: "including determining illumination for at least a first subsection of the field-of-view including the other vehicle or pedestrian, as indicated by the sensor data, and".....269

[65.3]: "determining illumination for at least a first subsection including the second vehicle and" 269

6. [26.5]: "for at least a second subsection of the field-of-view not including the other vehicle or pedestrian;" 273

[65.4]: "at least one or more second subsections, to either side of the first subsection," 273

7. [26.6]: "determining a control strategy for controlling one or more directional light clusters in a headlight assembly to create an output headlight beam meeting the determined illumination requirements," 277

(a) Karlsson discloses this element. 277

(b) Harbers also discloses this element. 284

(c) A POSA would have been motivated to combine Karlsson and Harbers with a reasonable expectation of success. 286

8. [26.7]: "the headlight beam spatial light distribution shaped to provide high beam illumination for a driver of the vehicle, in at least the second subsection," 295

9. [26.8]: "while mitigating glaring light illuminating at least the first subsection including detected other vehicles or pedestrians;" .298

10. [26.9]: "sending control signals implementing the control strategy to an electronic control circuitry configured to operate the light-clusters; and" 301

11. [26.10]: "controlling the light clusters via the electronic control circuitry to collectively emit the headlight beam meeting the determined illumination requirements." 303

C. Additional Elements of Independent Claim 65 305

1. [65.5]: "including determining an illumination level for the first subsection" 305

2. [65.6]: "that substantially illuminates the first subsection below a predefined illuminance, and" 309

3. [65.7]: "determining an illumination level for the one or more second subsections" 314

4. [65.8]: "that substantially illuminates the one or more second subsections above the predefined illuminance;" 318

5. [65.9]: "determining control instructions for controlling one or more directional light sources included in the adaptive headlight

system to achieve the determined illumination levels for at least the first and one or more second subsections; and”.....323

(a) Karlsson discloses this element. 323

(b) Harbers also discloses this element. 330

(c) A POSA would have been motivated to combine Karlsson and Harbers with a reasonable expectation of success...332

6. [65.10]: “controlling the light sources to emit the headlight beam in accordance with the control instructions.”.....341

D. Claim 27: “The method of claim 26, wherein the determining illumination requirements further comprises: determining the illumination requirements based on headlight modes comprising one or more of parking lights, low beam, high beam, cornering lights, load leveling adjustment, integral turn signal indicators, inputtable alternate beam pattern selection, and specified preferential headlight illumination color of the driver.” 343

E. Claim 28: “The method of claim 26, wherein the illumination requirements accommodate peripheral night vision of the driver, by defining bluish headlamp illumination along a side of a road, while defining yellow tinted illumination along the road.” 343

Claim 68: “The method of claim 65, wherein the determining illumination further includes determining a yellowish illumination color for illumination illuminating a road within the field-of-view and a blueish illumination color for illumination illuminating areas off-road within the field-of-view.”.....343

1. Karlsson’s disclosure 344

2. Harbers’s disclosure.....346

3. A POSA would have been motivated to combine Harbers with Karlsson with a reasonable expectation of success. 347

F. Claim 29: “The method of claim 26, wherein the illumination requirements accommodate sensed fog or snow environmental conditions by defining a shift of at least a portion of the headlight beam towards yellow.” 353

Claim 69: “The method of claim 65, wherein the data includes data indicating fog or snow environmental conditions and the determining illumination includes determining a shift of at least a

portion of the light output from the headlight system towards yellow." 353

1. Karlsson's disclosure 353

2. Harbers's disclosure 356

3. A POSA would have been motivated to combine Harbers with Karlsson with a reasonable expectation of success. 357

G. Claim 30: "The method of claim 26, wherein the control strategy dynamically adapts the headlight beam based on real-time changes to the data sensed by the sensors indicating a change to at least one of beings, objects and preceding vehicles ahead of the first vehicle." 362

H. Claim 31: "The method of claim 26, further comprising receiving input to an override switch and, responsive to the input, adjusting automatic operation of the headlight system to reflect operator instruction as indicated by the input to the override switch or by further input to a different vehicle input other than the override switch." 363

XVIII. GROUND 9: THE COMBINATION OF KARLSSON, HARBERS, AND GOTOU RENDERS OBVIOUS CLAIMS 32-36 AND 70.....365

A. A POSA would have been motivated to combine Gotou with Karlsson-Harbers with a reasonable expectation of success.....365

B. Claim 32: "The method of claim 26, wherein the determining illumination requirements further includes determining illumination for an upcoming curve indicated by the sensor data, wherein the determining the control strategy further comprises determining the control strategy for controlling the directional light clusters to create an output headlight beam that illuminates around the curve." 372

Claim 33: "The method of claim 32, wherein the determining illumination requirements further includes determining illumination for an upcoming turn indicated by the sensor data, wherein the determining the control strategy further comprises determining the control strategy for controlling the directional light clusters to create an output headlight beam that illuminates the turn." 372

Claim 34: "The method of claim 32, wherein the determining illumination further includes determining illumination the increases illumination of an upcoming turn indicated by the sensor data, wherein the determining the control instructions further comprises determining the control instructions for controlling one or more of the directional light sources to achieve illumination of the turn." 372

Claim 35: "The method of claim 26, wherein the determining illumination requirements further includes determining illumination for an upcoming turn indicated by the sensor data, wherein the determining the control strategy further comprises determining the control strategy for controlling the directional light clusters to create an output headlight beam that illuminates the turn." 373

Claim 36: "The method of claim 26, wherein the determining illumination further includes determining illumination the increases illumination of an upcoming turn indicated by the sensor data, wherein the determining the control instructions further comprises determining the control instructions for controlling one or more of the directional light sources to achieve illumination of the turn." 373

Claim 70: "The method of claim 65, wherein the determining illumination further includes determining illumination that increases illumination of an upcoming curve indicated by the data, wherein the determining the control instructions further comprises determining the control instructions for controlling one or more of the directional light sources to achieve illumination around the curve." 373

1. Karlsson-Harbers's disclosure 374
2. Gotou's disclosure 377
3. A POSA would have been motivated to combine Gotou with Karlsson-Harbers with a reasonable expectation of success. ...380

XIX. GROUND 10: THE COMBINATION OF KARLSSON, HARBERS, AND BRAUN RENDERS OBVIOUS CLAIMS 66-67. 387

A. A POSA would have been motivated to combine Braun with Karlsson-Harbers with a reasonable expectation of success. 387

B. Claim 66: "The method of claim 65, wherein the data includes data indicating a pedestrian and wherein the determining illumination includes determining an illumination level, for at least a third subsection including the pedestrian." 393

Claim 67: "The method of claim 65, wherein the data includes data indicating a road-sign wherein the determining illumination includes determining an illumination level, for at least a third subsection including the road-sign." 393

1. Karlsson-Harbers's disclosure 393

2. Braun's disclosure.....395

3. A POSA would have been motivated to combine Braun with Karlsson-Harbers with a reasonable expectation of success. ...397

XX. OBJECTIVE INDICIA DO NOT SUPPORT PATENTABILITY 402

XXI. CONCLUSION.....404

I. INTRODUCTION

I, Dr. Jianzhong Jiao, declare as follows:

1. I have been retained on behalf of Volkswagen Group of America, Inc. ("VWGoA" 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 26-36 and 65-70 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 $400 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
1	Beam (EX1005), Thominet (EX1006)	§103	26-27, 30-31
2	Beam, Thominet, Stam (EX1007)	§103	65
3	Beam, Thominet, Kobayashi (EX1008)	§103	32-36
4	Beam, Thominet, Stam, Kobayashi	§103	70
5	Beam, Thominet, Stam, Braun (EX1009)	§103	66-67
6	Beam, Thominet, Harbers (EX1011)	§103	28-29
7	Beam, Thominet, Stam, Harbers	§103	68-69
8	Karlsson (EX1010), Harbers	§103	26-31, 65, 68-69
9	Karlsson, Harbers, Gotou (EX1012)	§103	32-36, 70
10	Karlsson, Harbers, Braun	§103	66-67

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. My CV also lists peer-reviewed publications on which I am the primary author or a named author, and identifies parties on behalf of whom I have previously provided expert testimony.

10. I received my B.S. degree in Mechanical Engineering from the Beijing Polytechnic University in Beijing, China in 1980. Immediately thereafter, I completed my M.S. degree in Applied Physics from the Beijing Institute of Posts and Telecommunications in Beijing, China in 1983. I thereafter attended Rensselaer Polytechnic Institute for graduate studies for the Ph.D. program for Physics in 1985. I thereafter received my Ph.D. degree in Electrical Engineering from Northwestern University in Evanston, IL in 1989.

11. I worked at General Motors Corporation from 1989 to 1993 as a Senior Development Engineer on automotive lighting applications including leading and managing R&D projects to implement automotive lighting using LEDs and other technologies.

12. I worked at North American Lighting, Inc., a Koito Group Company, from 1993 to 2007 as a Manager and then General Manager of Engineering Technology on a variety of matters, including: strategic planning for new technology implementation including HID, LED, adaptive front-lighting system (AFS) technologies; establishing and managing an engineering team over four departments (Optical Design, Electronic Technologies, Engineering Analysis, Regulation and Standards); and growth of revenue and expansion of the U.S. customer base.

13. I worked at OSRAM Opto-Semiconductors Inc. from 2007 to 2015 as a Director of Regulations and Emerging Technologies on a variety of matters, including: establishing strategies for LED technology and applications; managing LED technology strategies and implementations in automotive lighting, general illumination, horticulture lighting, intelligent lighting, human centric lighting, displays, and others applications; managing activities relating to LED and lighting regulations and standards; and interfacing with academia, industrial consortium programs, and governmental agencies on technology development in LEDs and lighting applications.

14. Since 2015, I have been self-employed as a consultant in the areas of LEDs, lasers, and lighting technologies and the applications for industry, governmental agencies, and professional associations. I am also currently involved

in the academic arena through a variety of professional activities. For example, I serve as an instructor for short courses, workshops, and seminars for the SAE International (formerly Society of Automotive Engineers, Mar. 2003 – present); for the Society of International Optical Engineers (Jan. 2009 – Jan. 2014); for Strategies in Light (May 2011 – 2021); and for Light Fair International (May 2010 – present). I have also served as an adjunct professor, an assistant professor, and a teaching/research assistant at several universities in the U.S. and around the world, including Fudan University (Shanghai, China), Lawrence Technological University (Southfield, MI), Purdue University Anderson Campus (Anderson, IN), Northwestern University (Evanston, IL), and the Beijing Institute of Posts and Telecommunications (Beijing, China).

15. I am currently active in the following professional organizations: SAE International (SAE, since 1989 as an SAE Fellow Member); International Society for Optical Engineering (SPIE, since 1989 as an SPIE Senior Member); Illuminating Engineering Society (IES, since 2007); and International Commission on Illumination (CIE – U.S.A, since 2007).

16. I have served in the leadership roles in several U.S. professional associations, trade associations and standardization organizations that are developing LED and LED lighting standards, including: former Chair of the Plant Growth LED Lighting Committee of the American Society of Agricultural and

Biological Engineers (ASABE); former Chair of the Lighting Standard Committee of SAE; Past Treasurer of the Testing Procedures Committee of IES; current Vice Chair of the Light Sources Committee of IES; current Chair of the Computer Committee of IES; Member of the Roadway Lighting Committee of IES; and Member of Standard Technical Panel of UL.

17. I have received various honors and awards over the years, including: SAE James M. Crawford Executive Standards Committee Outstanding Achievement Award (2022); Senior Member of SPIE (2015); SAE Arch T. Colwell Cooperative Engineering Medal (2010); SAE Fellow (2008); SAE Technical Standards Board Outstanding Contribution Award (2008); SAE Forest R. McFarland Award (2007 and 2000); and Excellence in Oral Presentation Award at the SAE 2005 World Congress (2005).

18. I have written over fifty technical papers and articles and have served as Editor on fifteen books on LEDs and lighting technologies, as listed on my CV. EX1004. I have been invited to deliver numerous speeches and presentations on LEDs and LED lighting at various conferences since 1995.

19. Additionally, I am an inventor for nine U.S. patents: U.S. Patent No. 7,144,141 entitled “Self-Aim Vehicle Light Device”; U.S. Patent No. 7,059,754 entitled “Apparatus and Method for Providing a Modular Vehicle Light Device”; U.S. Patent No. 6,953,261 entitled “Reflector Apparatus for a Tubular Light

Source"; U.S. Patent No. D503,004 entitled "Vehicle Fog Lamp"; U.S. Patent No. 6,623,132 entitled "Light Coupler Hingedly Attached to a Light Guide for Automotive Lighting"; U.S. Patent No. 6,305,813 entitled "Display Device Using a Light Guide for Exterior Automotive Lighting"; U.S. Patent No. 6,007,224 entitled "Automotive Headlamp Reflector and Method for its Design"; U.S. Patent No. 5,390,265 entitled "Fiber Optic Light Coupler"; and U.S. Patent No. 5,197,792 entitled "Illuminator Device for a Display Panel."

20. A detailed description of my professional qualifications, including a listing of my specialties/expertise and professional activities, is contained in my CV. EX1004.

V. MATERIALS CONSIDERED

21. In formulating my opinions, I have relied upon my training, knowledge, and experience that are relevant to the '503 patent. 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	File History of U.S. Patent No. 10,894,503 B2 ("Prosecution History")
1004	*Curriculum Vitae* of Dr. Jianzhong Jiao
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*.

Exhibit #	***Description***
1008	U.S. Patent No. 6,049,749 to Kobayashi
1009	WIPO Patent Publication No. 2002/004247 to Braun *et al*.
1010	WIPO Patent Publication No. 1998/054030 to Karlsson
1011	WIPO Patent Publication No. 2001/001038 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).

Exhibit #	*Description*
1026	Kobayashi & Sugimoto, Development of the Phase-I AFS Front Lighting System, Progress in Automotive Lighting Vol. 5, pp. 449-464 (1999).
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
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 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. As an academic teaching, and an engineer-by-trade conducting engineering research, product design, and testing at the time of the '503 patent filing, I am particularly qualified to determine the level of ordinary skill in the art and recount the expectations of a B.S. degree and beyond in the above-cited

[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.

engineering fields. I am very familiar with the technology of the ’503 patent before, during, and after the July 12, 2002 timeframe. By this date, I had over 13 years of post-doctoral experience working with these technologies. *See above*, Section IV.

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 lighting systems and closely followed the real-time history of the development of such systems.

48. Indeed, Grounds 1-2 and 8 demonstrate why it would have been obvious for an adaptive headlamp system to utilize well-known sensor inputs to output multiple directional beam regions and output light below and above a predefined illuminance, in response to sensor inputs. Grounds 3-4 and 9 demonstrate why it would have been obvious to include well known sensor data and techniques to illuminate roadway curves. Grounds 5 and 10 demonstrate why it would have been obvious to implement well known pattern recognition to control illumination. Grounds 6-7 demonstrate why it would have been obvious to implement colored illumination for different driving situations.

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, 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).

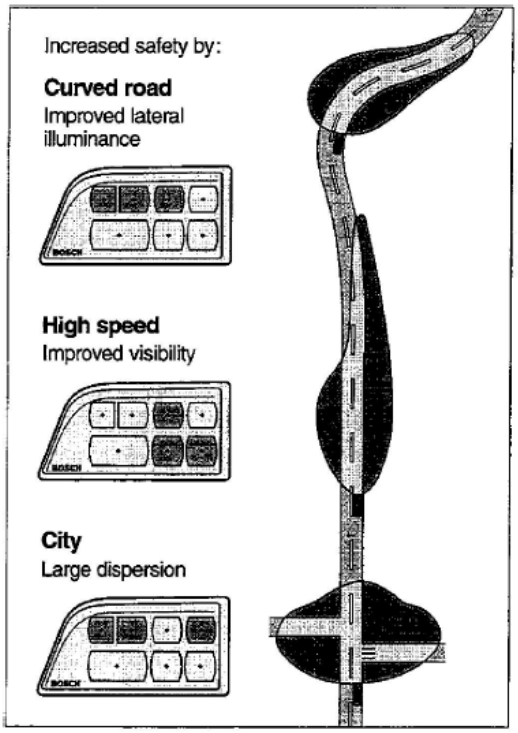


Fig.1: Three standard driving situations with adapted light pattern seen from the bird eye's view.

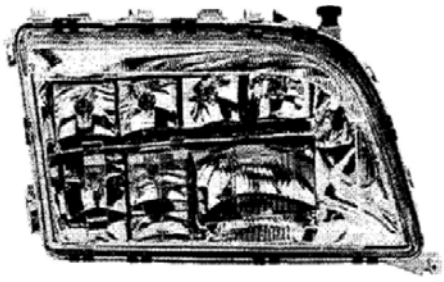
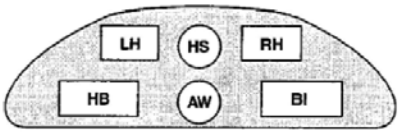


Fig 4: ALP *headlamp* sample



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

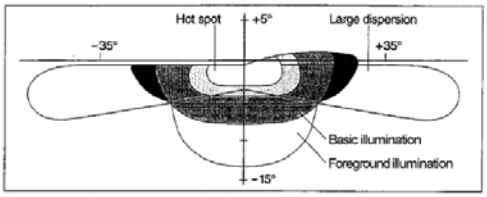


Fig. 3: Light pattern of multiple beam *headlamp (Isolux* curves in wall projection): The individual light *pattern* of multiple sub-units sum up to the total adaptive light pattern

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/clusters based on sensor data in a field-of-view. For example, light in a first subsection is provided below a predefined illuminance to prevent glare, and light in a second subsection is provided 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 65 recites, in part, a method:

> *utilizing* one or more *sensors* of a first vehicle to obtain and provide data, the data including data indicating at least a *second vehicle*;
>
> *determining* illumination for at least a *first subsection* including the second vehicle and at least one or more *second subsections*, to either side of the first subsection, including

determining an illumination level for the *first subsection* that substantially illuminates the first subsection *below a predefined illuminance*, and

determining an illumination level for the one or more *second subsections* that substantially illuminates the one or more second subsections *above the predefined illuminance*;

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

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

EX1001, 102:62-103:17.[3] The dependent claims merely add known features: colored illumination; indicating pedestrians/road-signs; illuminating a road curvature/planned turn; real-time 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

[3] Emphasis added throughout, unless noted.

differently aimed solid-state light sources (SLSs) such as light-emitting diodes (LEDs) 275, 277, 278, 283, 284, respectively. EX1001, 53:23-56:65, FIG. 15.

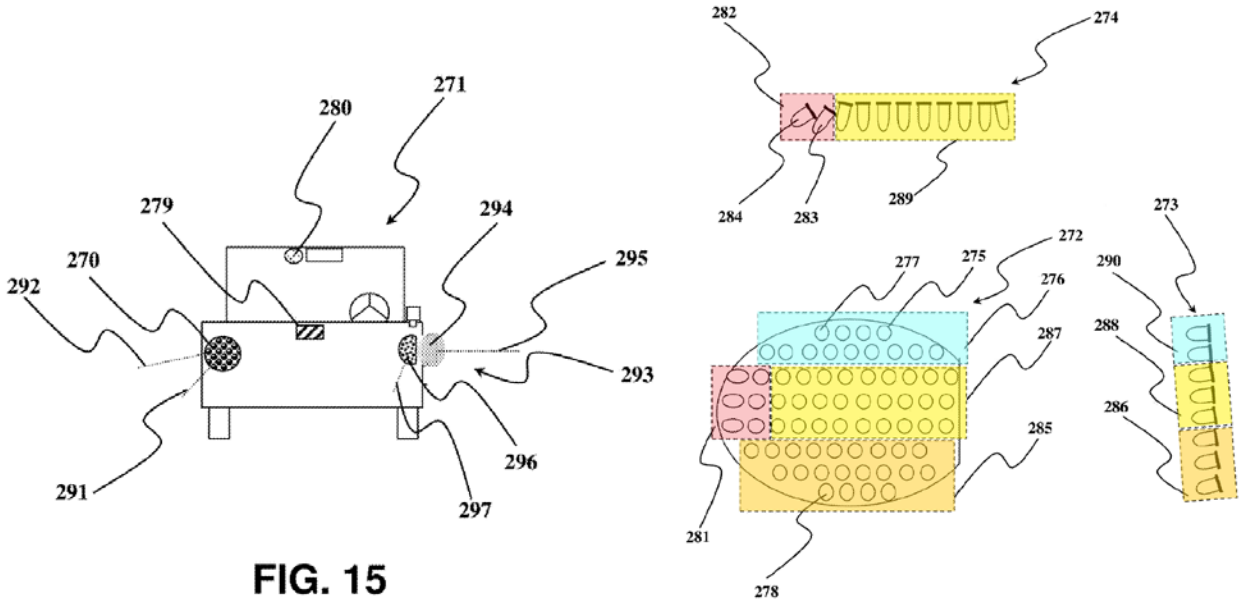


FIG. 15

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 26 and 65[4]

60. The independent claims recite a majority of patentably indistinct or substantially similar elements and concepts such that the same prior art disclosures are applicable to and map to those corresponding elements across the independent claims (e.g., [26.P]-[26.2]/[65.P]-[65.2], [26.4]/[65.3], [26.5]/[65.4], [26.10]/[65.10]). *See* Appendix A. 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 26 and 65 recite a "method for generating a headlight beam in an adaptive headlight system" for controlling illumination characteristics of a headlamp with "one or more directional light [clusters / sources]"; and independent claim 65 further recites a "predefined illuminance." *See* Appendix A.

62. The disclosures mapped below for the directional light clusters/sources, sensor, controller, etc., of method claims 26-36, apply equally to and render obvious method claims 65-70. Minor phrasing differences do not affect the substantive application of the prior art. *See* Appendix A.

[4] Appendix A compares independent claims 26 and 65.

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 26	Claim Element	Independent Claim 65
[26.P]	A method for generating a headlight beam in an adaptive headlight system that provides illumination to at least a portion of a field-of-view, comprising:	[65.P]	Identical to [26.P]
[26.1]	utilizing one or more sensors of a vehicle including the adaptive headlight system to obtain and provide data	[65.1]	utilizing one or more sensors of a first vehicle to obtain and provide data,
[26.2]	predefined as relevant to a determination of illumination requirements for the field-of-view, the data including data indicative of at least one of one or more other vehicles or a pedestrian;	[65.2]	the data including data indicating at least a second vehicle;
[26.3]	determining illumination requirements for the field-of-view based on the data sensed by the sensors,		

Claim Element	Independent Claim 26	Claim Element	Independent Claim 65
[26.4]	including determining illumination for at least a first subsection of the field-of-view including the other vehicle or pedestrian, as indicated by the sensor data, and	[65.3]	determining illumination for at least a first subsection including the second vehicle and
[26.5]	for at least a second subsection of the field-of-view not including the other vehicle or pedestrian;	[65.4]	at least one or more second subsections, to either side of the first subsection,
[26.6]	determining a control strategy for controlling one or more directional light clusters in a headlight assembly to create an output headlight beam meeting the determined illumination requirements,		
		[65.5]	including determining an illumination level for the first subsection
		[65.6]	that substantially illuminates the first subsection below a predefined illuminance, and
		[65.7]	determining an illumination level for the one or more second subsections

Claim Element	Independent Claim 26	Claim Element	Independent Claim 65
[26.7]	the headlight beam spatial light distribution shaped to provide high beam illumination for a driver of the vehicle, in at least the second subsection,		
		[65.8]	that substantially illuminates the one or more second subsections above the predefined illuminance;
[26.8]	while mitigating glaring light illuminating at least the first subsection including detected other vehicles or pedestrians;		
[26.9]	sending control signals implementing the control strategy to an electronic control circuitry configured to operate the light-clusters; and		
		[65.9]	determining control instructions for controlling one or more directional light sources included in the adaptive headlight system to achieve the determined illumination levels for at least the first and one or more second subsections; and

Claim Element	Independent Claim 26	Claim Element	Independent Claim 65
[26.10]	controlling the light clusters via the electronic control circuitry to collectively emit the headlight beam meeting the determined illumination requirements.	[65.10]	controlling the light sources to emit the headlight beam in accordance with the control instructions.

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" (claim 65)

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, '551 Reexam File History, 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.

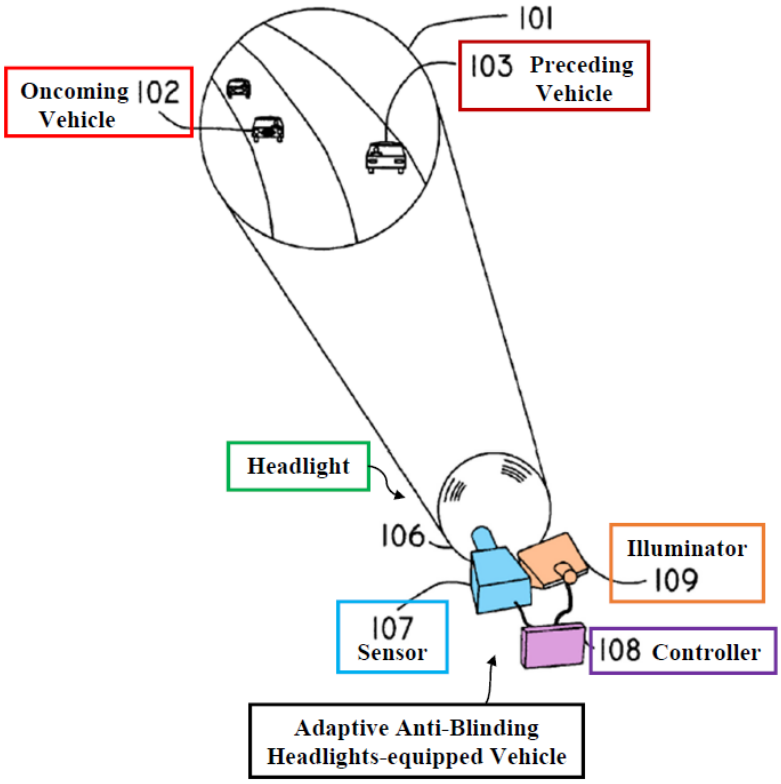
IX. SUMMARY OF THE APPLIED REFERENCES

74. In my opinion, each applied reference discloses an adaptive automotive lighting system and, thus, is from the same field as the ’503 patent.

A. Ground 1 – Beam and Thominet

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

75. Beam’s adaptive anti-blinding headlight/headlamp system (AABH) controls the intensity, shape, and/or angular position (direction) of one or more microbeam sources, such as individual, controllable, light-emitting diodes (LEDs). EX1005, Abstract, 8:4-17. Beam’s AABH detects headlights/taillights of vehicles ahead, and adjusts the headlight to provide significantly reduced illumination in certain areas, protecting other drivers’ vision. 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).

76. 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.

77. 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.

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

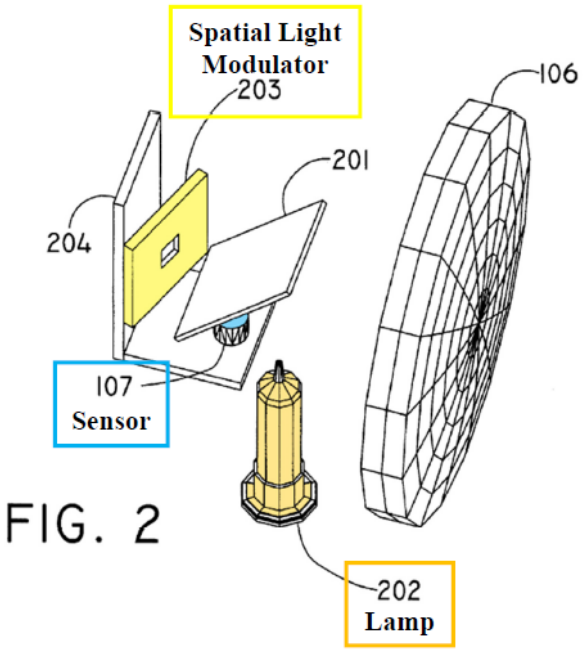


FIG. 2

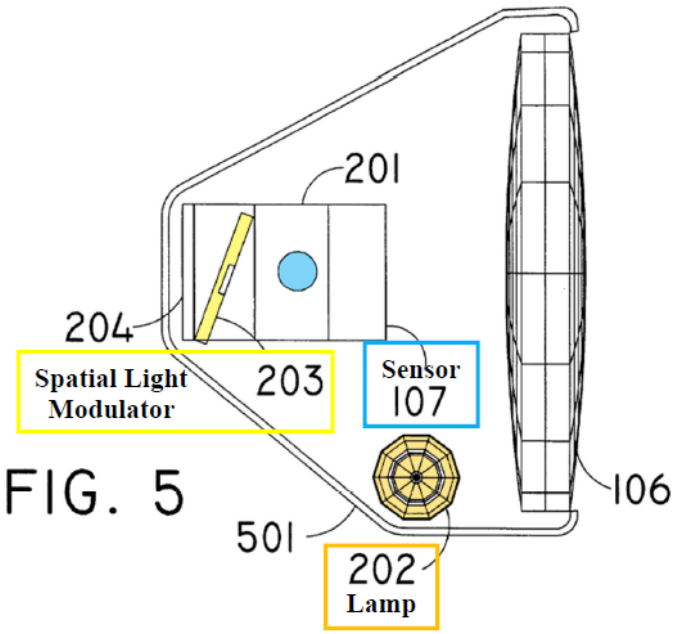


FIG. 5

EX1005, FIGS. 2, 5 (annotated).

79. As explained, Beam's microbeams are arranged in an X-Y matrix and the intensity and angular position of each microbeam is independently controlled. EX1005, 4:26-59, 8:4-17 ("digital mirror devices"), FIGS. 2, 5. Controller 108 selectively reduces illumination of microbeams directed at a particular object or objects, which commands SLM 203 in illuminator 109 to divert or attenuate the selected microbeams. EX1005, 4:26-59, FIGS. 2, 5.

80. 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 Figures 2 and 5. EX1005, 3:61-64, 5:3-16, 8:4-17 ("array of individual, independently controllable microbeam sources…light-emitting diodes…digital mirror devices"), FIGS. 4, 6.

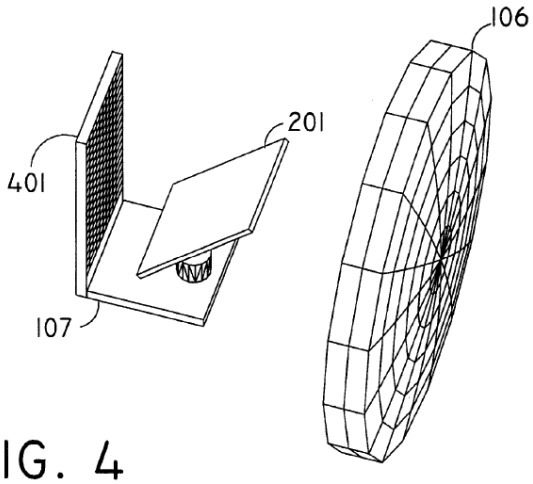


FIG. 4

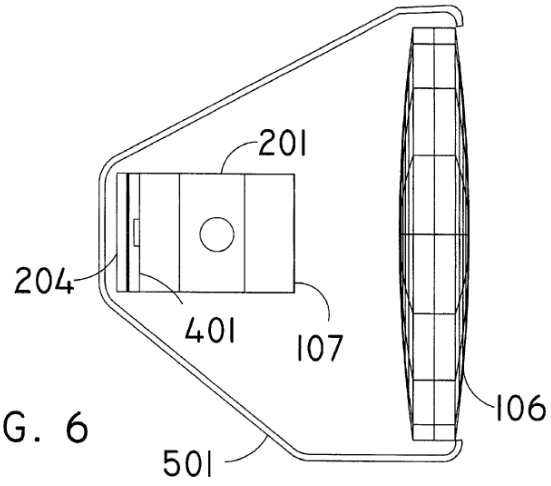
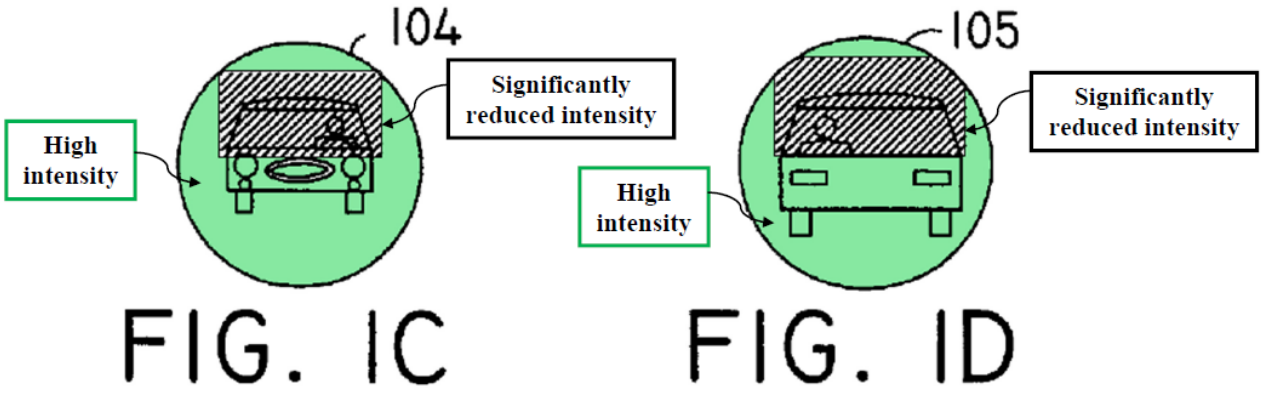


FIG. 6

EX1005, FIGS. 4, 6.

81. 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).

82. 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.

83. 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

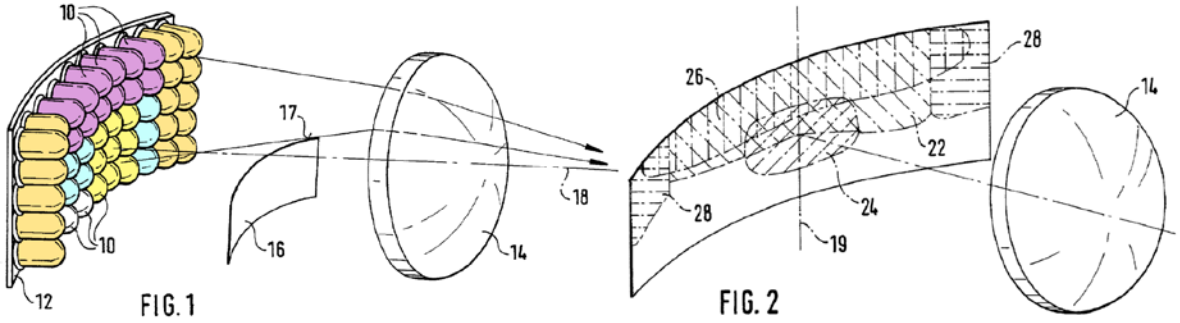
of both vehicles move, the *blanked area tracks the location of the oncoming vehicle, dynamically varying in position and in size*.

EX1005, 6:19-27, 5:46-54; *see also* EX1005, 2:59-3:3, 4:10-25.

84. 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, 8:4-17 (explaining that the microbeams may be from LEDs).

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

85. Like Beam, Thominet discloses a headlight with independently controllable LEDs in an array. EX1006, ¶¶17-18, 21, 23-26, FIGS. 1-2, 5. 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 functions (e.g., low beam, high beam, low sight, large width). EX1006, ¶¶17-18, 21, 23-26, FIGS. 1-2, 5.



EX1006, FIGS. 1-2 (annotated).

86. 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.

87. 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.

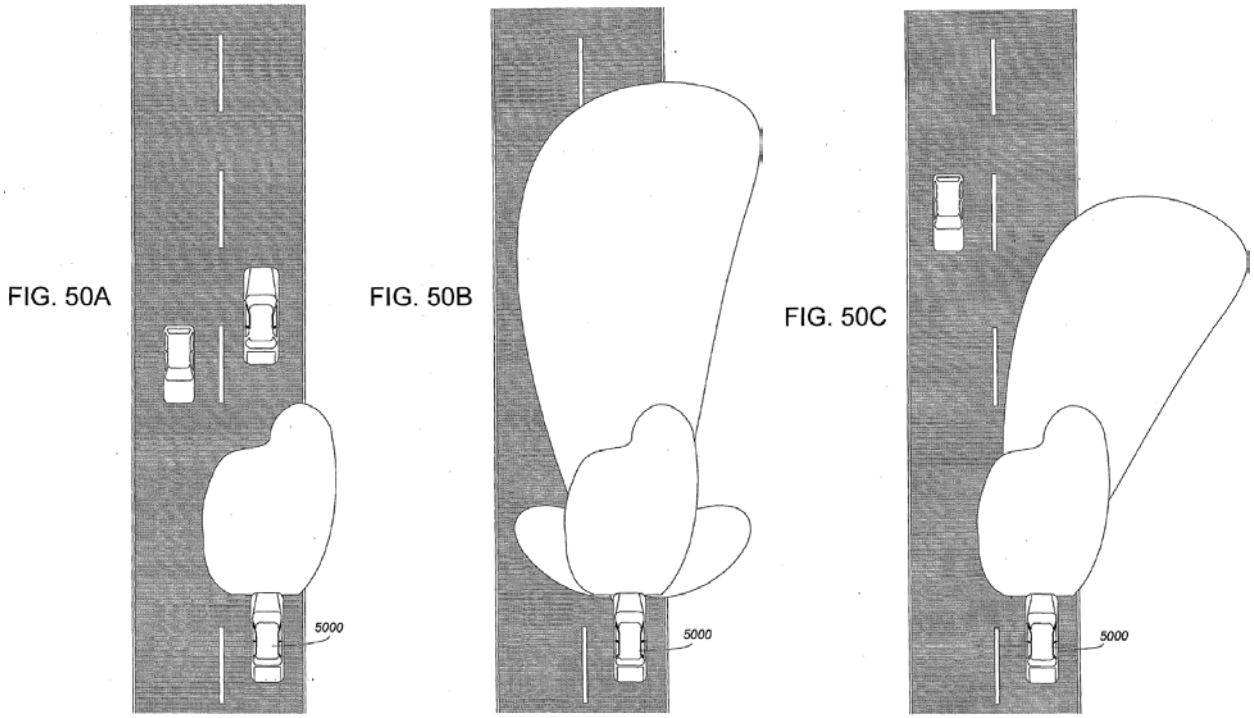
88. Thominet's technique (e.g., software implementation), seeks to enhance driver visibility, thereby increasing safety—using multiple directional beam regions for different functions. EX1006, ¶¶17-18, 21, 23-26, FIGS. 1-2; EX1006, ¶4 ("*characteristic* of the light beam…can be used for *different functions*"), ¶¶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").

89. 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

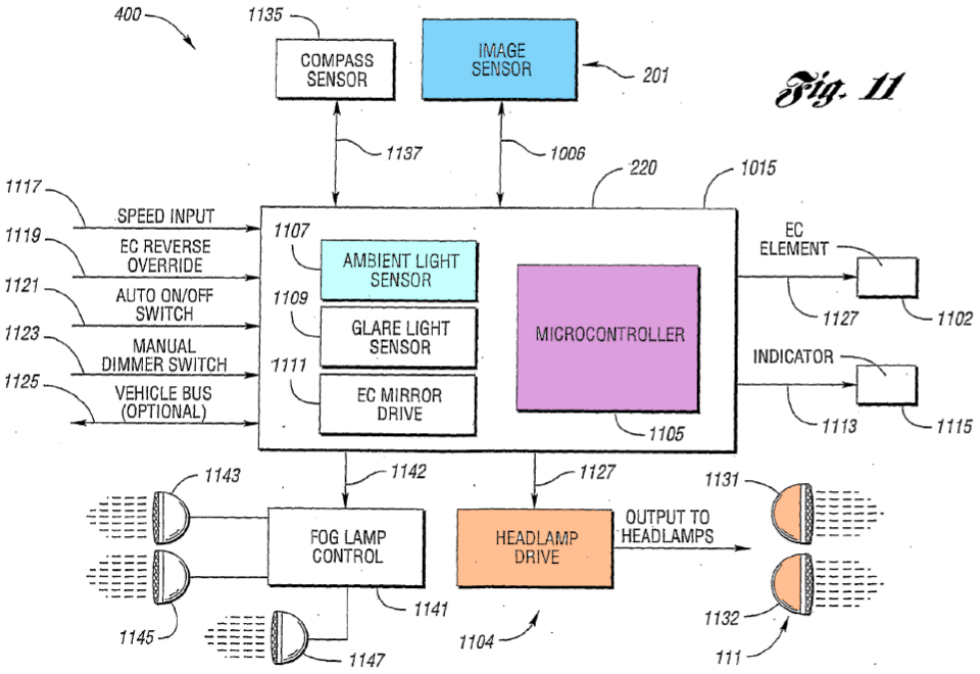
90. Like Beam, Stam discloses a headlight control system to automatically adjust beam patterns that maximize the illuminated area without causing excessive glare. EX1007, Abstract, 9:12-10:8, 77:30-78:17, FIGS. 11, 27-28, 33, 50A-50C.[5]



EX1007, FIGS. 50A-50C.

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

91. 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).

92. 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

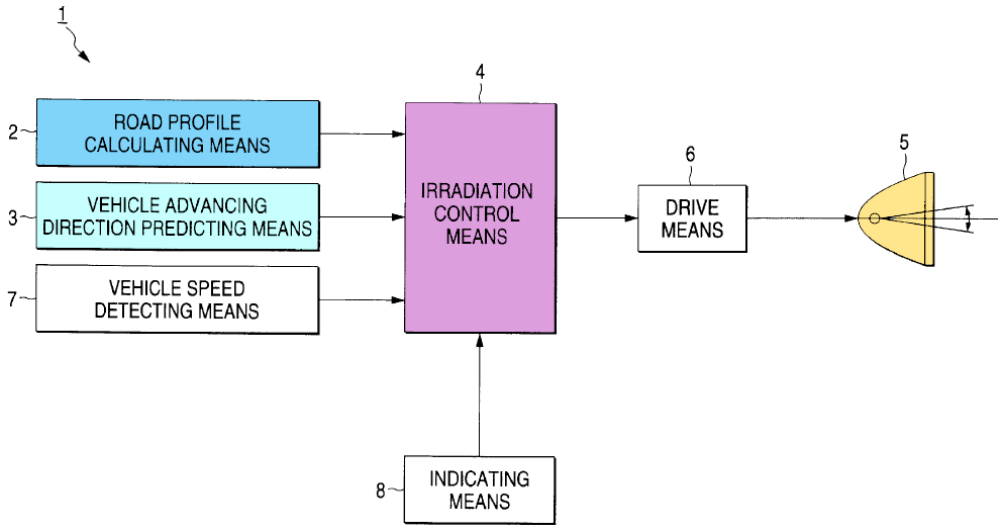
than 0.1 foot candles (fc) within 700 feet should be used to avoid glare to other drivers. EX1007, 1:14-31, 9:12-10:8.

93. 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.

94. 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

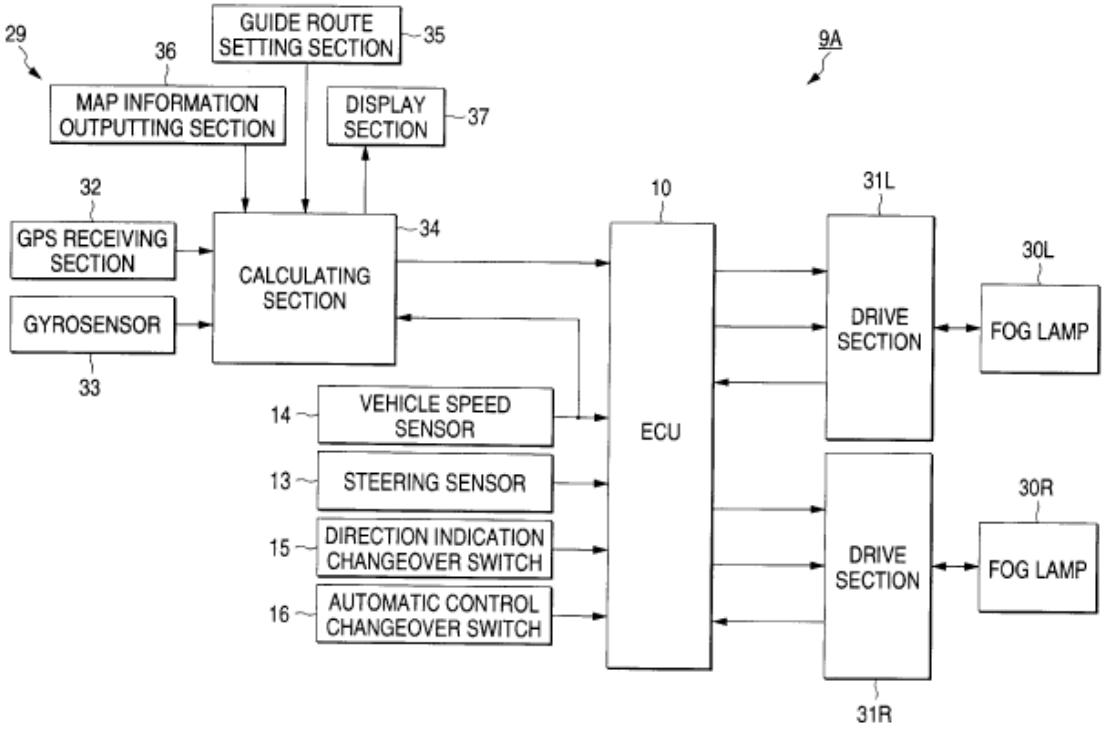
95. Like Beam, Kobayashi discloses an adaptive headlamp. EX1008, Abstract, 1:66-2:35, 4:60-64, FIGS. 1, 10. Kobayashi's adaptive lighting uses map data/information to predict and adjust illumination towards an advancing direction of the vehicle intended by the driver. EX1008, Abstract, 1:66-2:35, 3:9-34,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



EX1008, FIG. 1 (annotated).

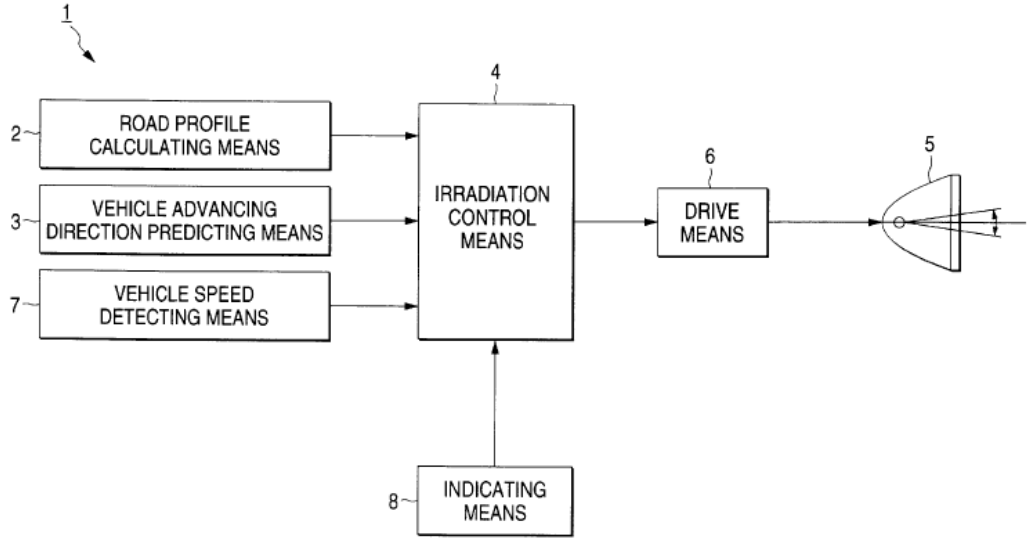
96. Kobayashi's ECU 10 receives input "from GPS navigation device 29, steering sensor 13, vehicle speed sensor 14, direction indicating switch 15 and automatic control changeover switch 16." EX1008, 17:8-15; *see also* EX1008, FIGS. 1, 6, 10:1-11:4. "GPS navigation device 29 corresponding to the road 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



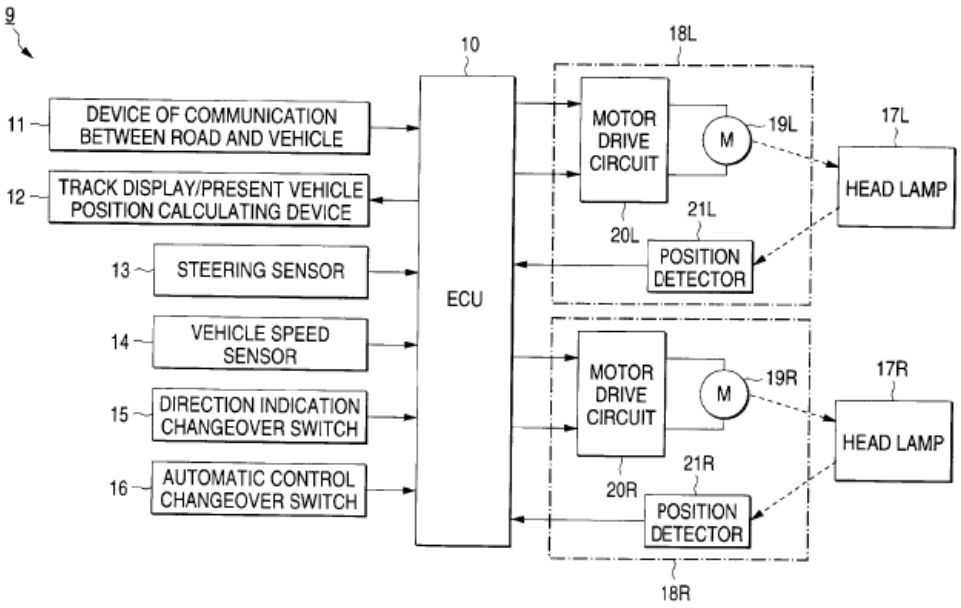
EX1008, FIG. 12.

FIG. 1



EX1008, FIG. 1.

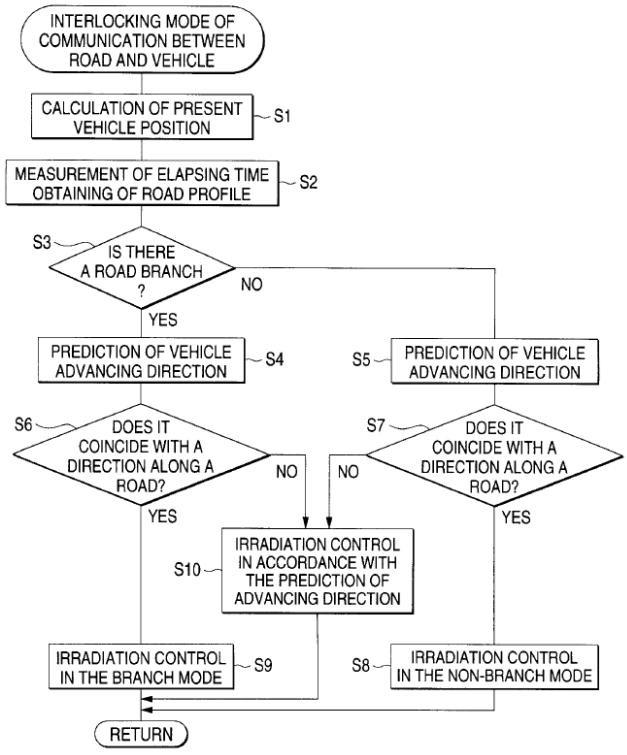
FIG. 6



EX1008, FIG. 6.

97. 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



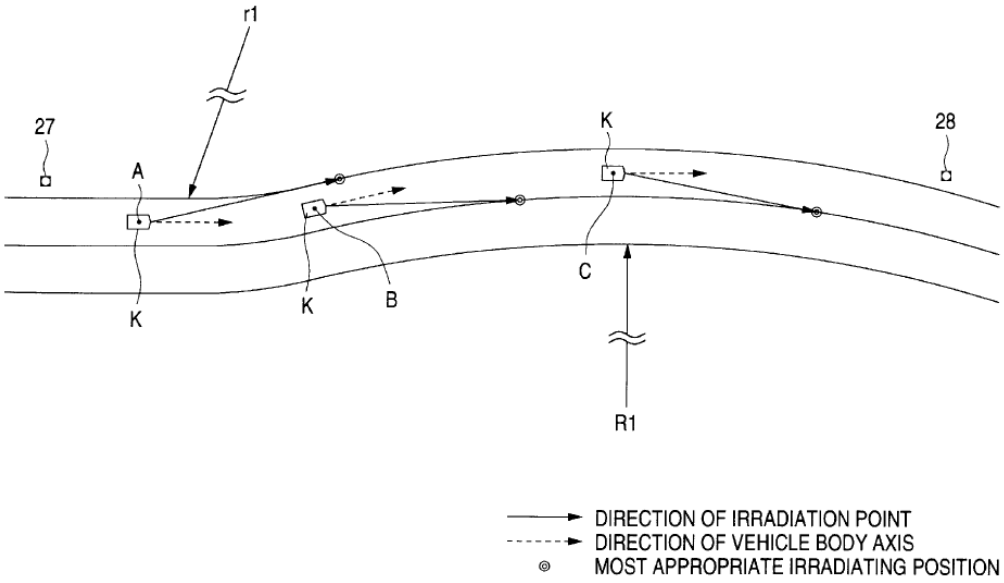
EX1008, FIG. 9.

98. 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.

99. 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.

100. 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 – WIPO Patent Publication No. 2002/004247 to Braun with Beam-Thominet-Stam

101. Similar to Beam, Braun's headlight includes independently controllable light sources (e.g., LEDs) for adaptive illumination. EX1009, Abstract, 2:7-13, 9:29-10:4, 12:17-20, 14:12-20, 15:3-24, FIGS. 1, 5-6. Braun's controller 118 identifies and illuminates objects in a roadway scene (e.g., pedestrians, road-signs 121, 122) by adapting colored luxels 26 (e.g., RGB) in illuminator 116. EX1009, 14:21-30, 23:28-24:27, FIGS. 5-6.

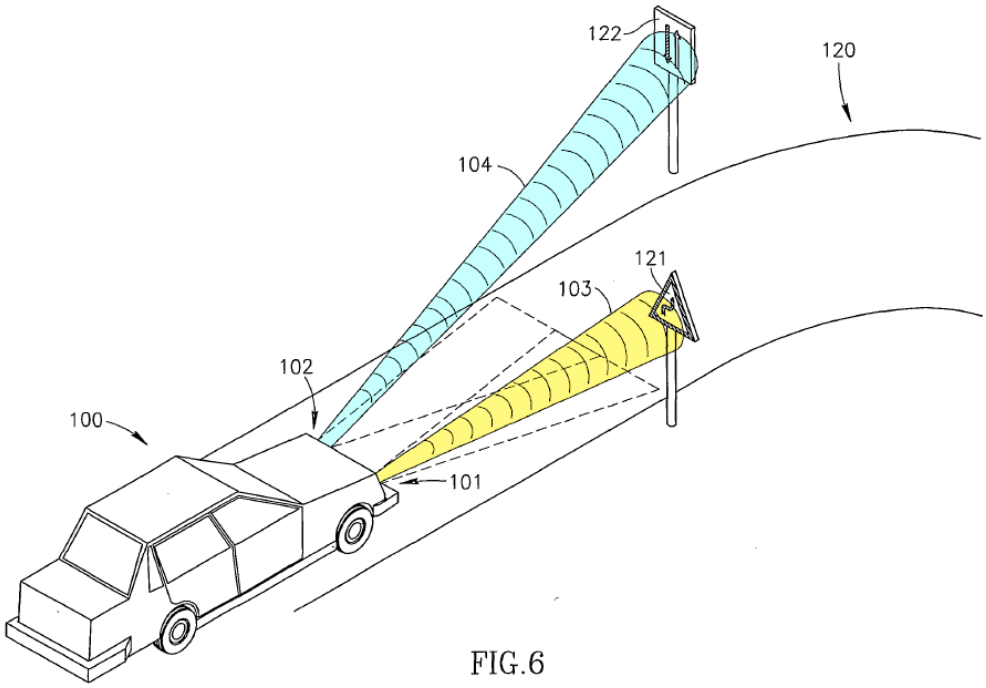


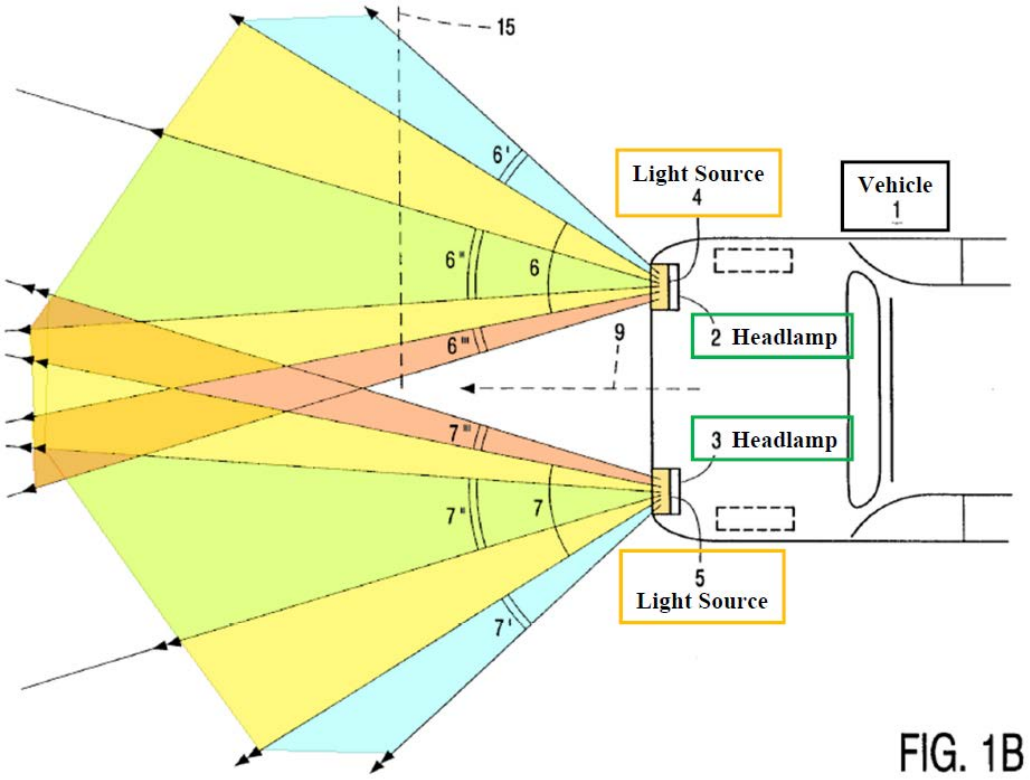
FIG.6

EX1009, FIG. 6 (annotated).

E. Grounds 6, 7 – WIPO Patent Publication No. 2001/001038 to Harbers with Beam-Thominet/Beam-Thominet-Stam

102. Likewise, Harbers's headlamp includes independently controllable opto-electronic elements (e.g., LEDs) for adaptive colored illumination. EX1011, Abstract, 2:27-3:10, 5:14-26, 6:27-7:32, FIGS. 1B-2.[6] Colored light beam segments 6-6'-6"-6"', 7-7'-7"-7"' have different aimings (angles relative to longitudinal direction 9) and spectral characteristics to improve visibility, thereby increasing safety. EX1011, 5:14-26, 6:1-7, 6:27-7:32, 8:28-33, FIGS. 1B-2.

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

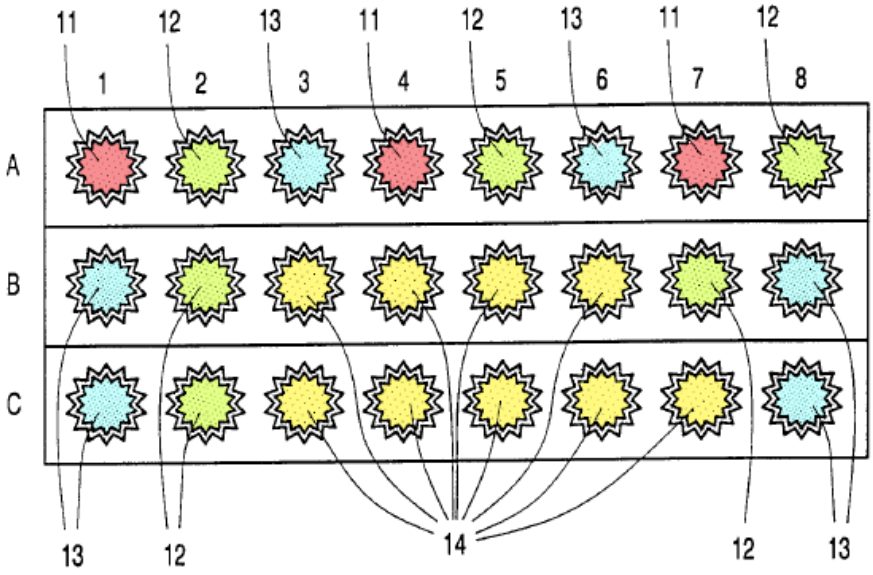


EX1011, FIG. 1B (annotated).

103. 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.

104. 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).

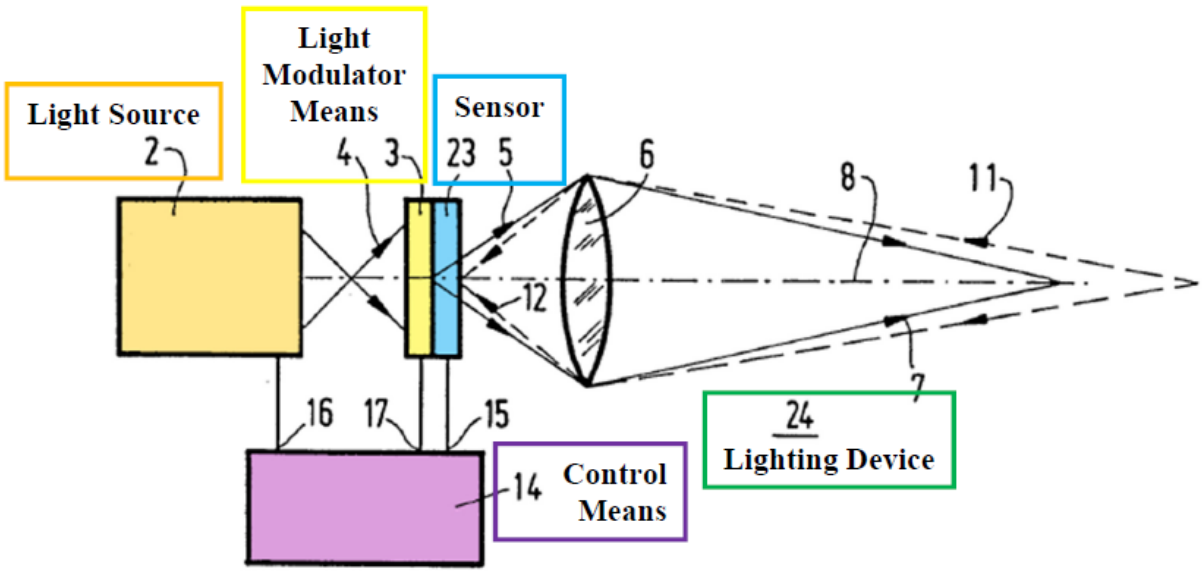
105. Additionally, Harbers discloses "a so-called *passing* beam and/or a so-called *main* beam…requires a luminous flux ranging *between 600 and 1000 lm*" and light source 4, 5 (e.g., LEDs) "meets the international *standard* ranging between *600 and 1000 lm*." EX1011, 2:8-10, 3:18-22, 8:13-18.

F. Ground 8 – Karlsson and Harbers

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

106. Karlsson discloses a headlight having spotlight beams and sensors to detect coming traffic and automatically control a lighting pattern to reduce blinding

of oncoming traffic. EX1010, Abstract, 2:30-35.[7] 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.



EX1010, FIG. 3 (annotated).

107. 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.

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

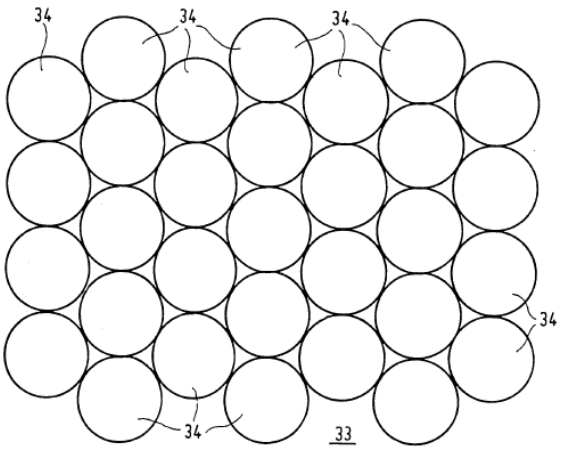


FIG. 6

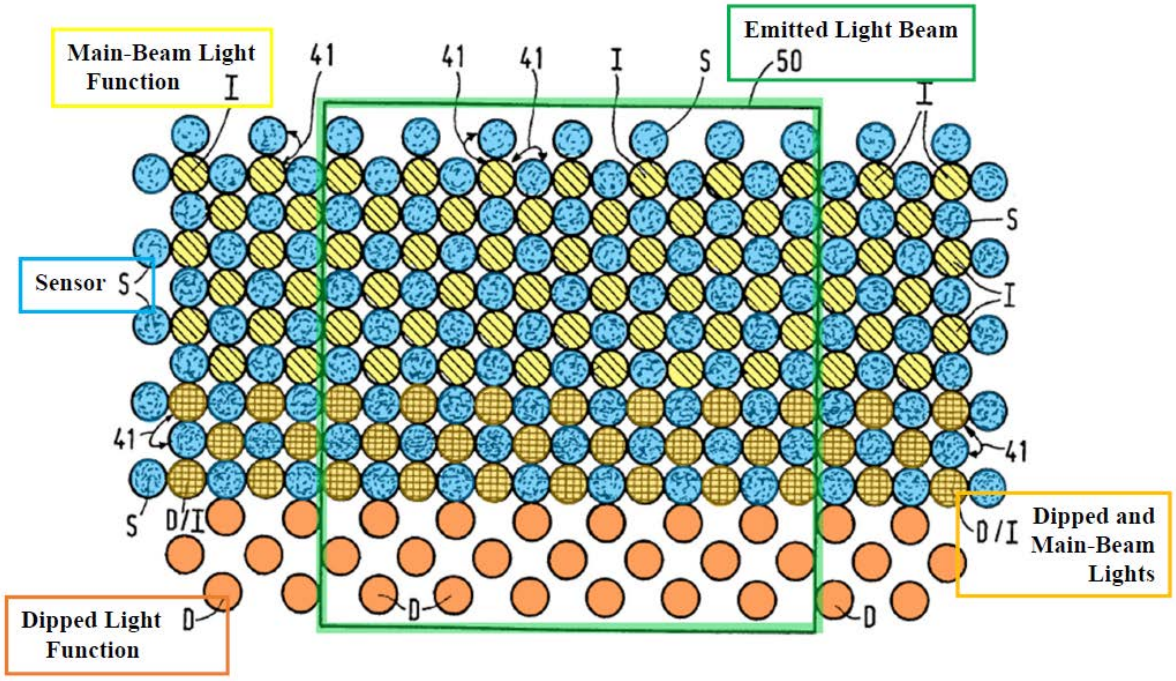
EX1010, FIG. 6.

108. 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.

109. 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

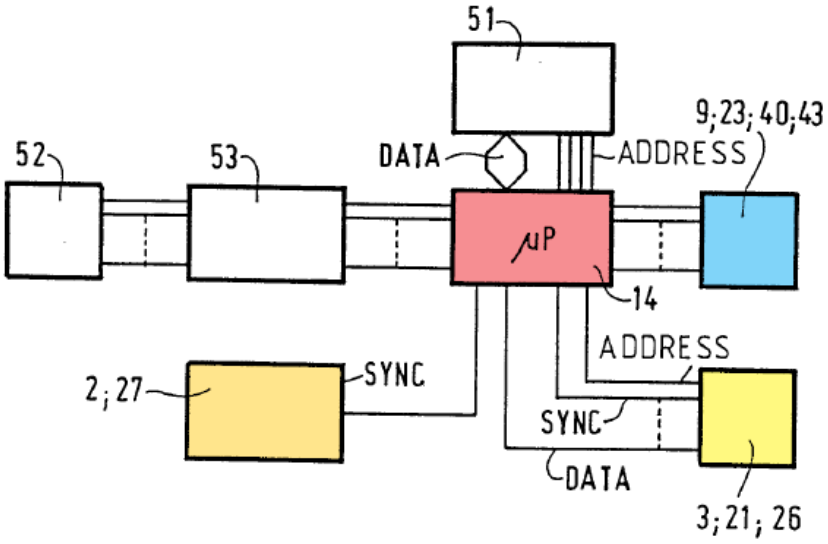
groups. EX1010, 13:24-14:4; *see also* EX1010, FIG. 3. The headlight includes a spatial distribution of LEDs (D, I, and D/I) and spotlight sensors S. EX1010, 19:18-20:3, FIGS. 6 and 14. The resulting emitted light beam 50 is represented as a window that can shift in the plane from left to right and from 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.

110. 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).

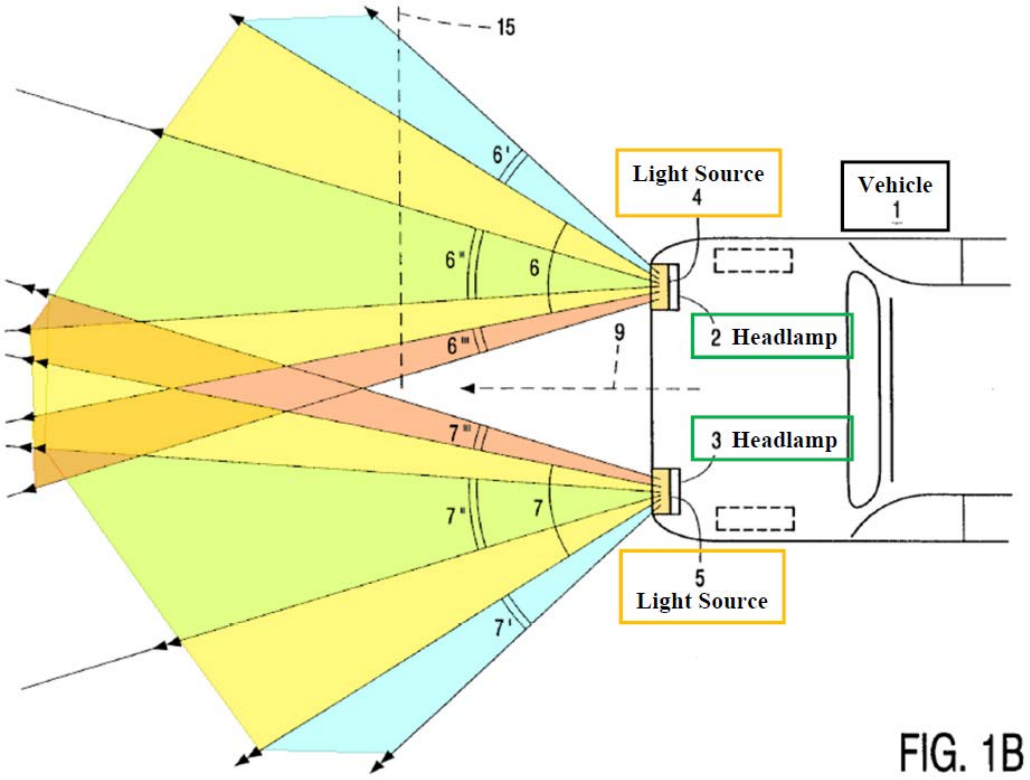
111. Processor-controlled control means 14 is synchronized to light source 2, light modulator means 3, and sensor 23 to produce adaptive light beam 7, 50. EX1010, 20:12-32, 21:36-22:4, FIG. 15.



EX1010, FIG. 15 (annotated).

2. Harbers

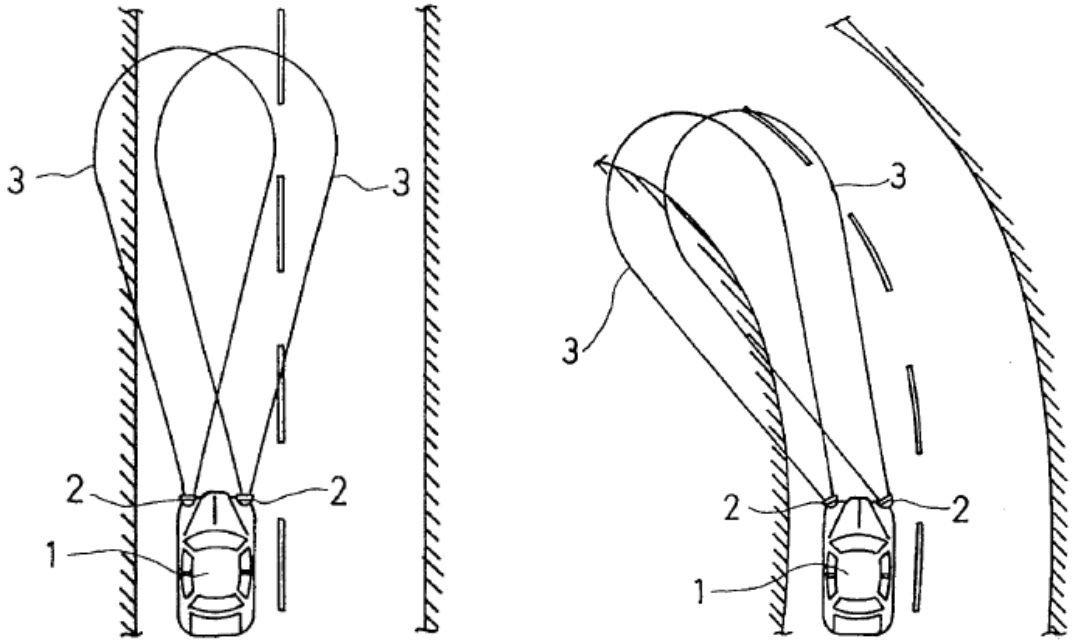
112. Likewise, Harbers's headlamp includes independently controllable opto-electronic elements (e.g., LEDs) providing adaptive colored light beam segments 6-6'-6"-6'", 7-7'-7"-7'". *See supra* Section IX.E.



EX1011, FIG. 1B (annotated).

G. Ground 9 – U.S. Patent No. 5,588,733 to Gotou with Karlsson-Harbers

113. Similarly, Gotou discloses an adaptive headlamp for illuminating certain areas. EX1012, Abstract, 1:34-40, 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 upcoming curves/turns—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.



EX1012, FIGS. 8-9.

H. Ground 10 – Braun with Karlsson-Harbers

114. Likewise, Braun's headlight includes independently controllable light sources (e.g., LEDs) for adaptively identifying and illuminating objects in a roadway scene (e.g., pedestrians, road-signs). *See supra* Section IX.D.

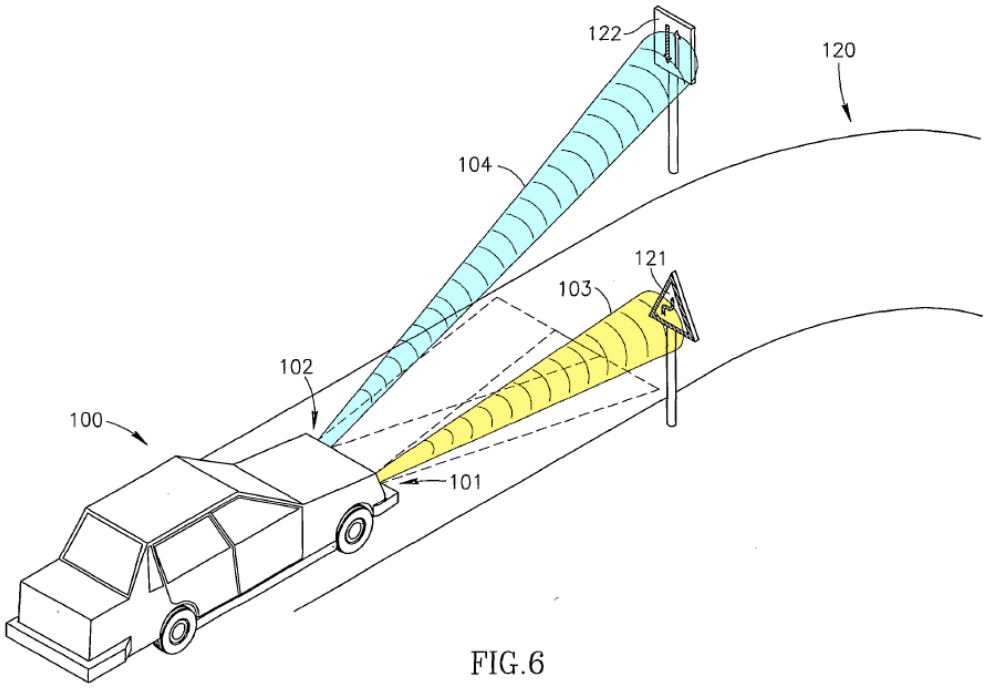


FIG.6

EX1009, FIG. 6 (annotated).

X. GROUND 1: THE COMBINATION OF BEAM AND THOMINET RENDERS OBVIOUS CLAIMS 26-27 AND 30-31.

115. It is my opinion that Beam explicitly or implicitly discloses every feature in claims 26-27 and 30-31. But to avoid doubt, Beam is combined with Thominet, for [26.6] (and [65.9] in Ground 2), which discloses a well-known implementation of adaptive headlamps—directional light clusters/sources for different functions—rendering the claims obvious.

116. Beam discloses "[t]he *angular* position or attenuation of *each of these microbeams* is *independently* set by the controller 108." EX1005, 4:46-48, Abstract, 7:25-29, 8:4-17, 8:23-34, FIGS. 1-2, 4. Each microbeam is a directional "cluster" or "source," having its own independent *angular* position, that combines

to form the headlamp beam; so Beam's lamp 202 and SLM 203 (*see* Figure 2) form at least one directional light cluster/source to provide illumination in desired subsections. EX1005, 7:25-29 ("*multiple* narrow angle microbeams"), 8:4-17 ("*array* of individual, independently controllable microbeam sources"), 8:23-34 ("area of illumination provided by *multiple* rays of light"), 4:26-59, 5:3-21, FIGS. 2, 4-6. Alternatively, if Patent Owner argues, incorrectly, that a "cluster" requires at least two (or more) microbeams, Beam also discloses this. EX1005, 4:26-59, 5:3-21, 4:46-48 ("[t]he *angular* position or attenuation of *each* of these microbeams is *independently* set by the controller 108"), FIGS. 2, 4-6.

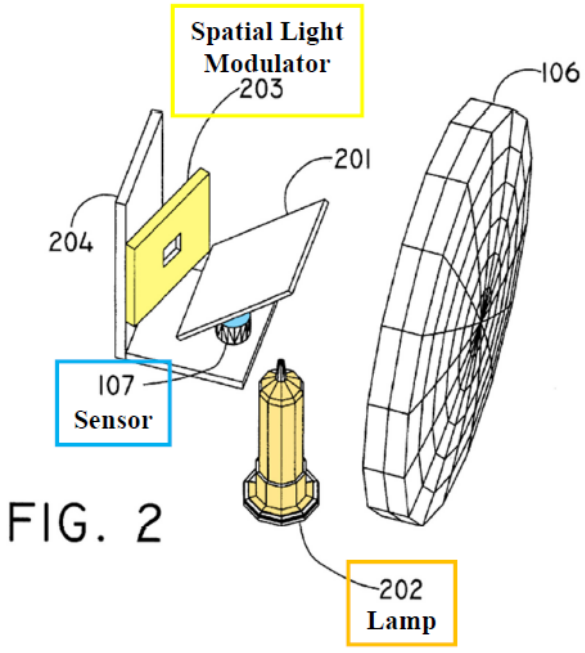


FIG. 2

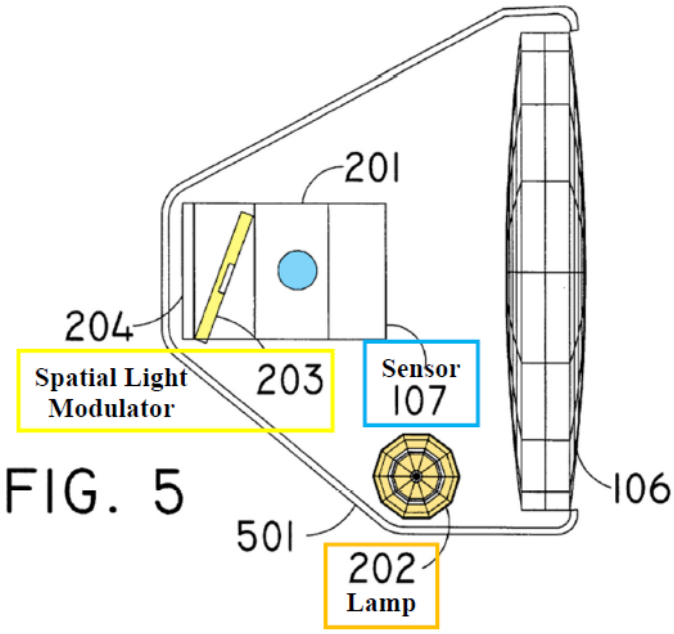


FIG. 5

EX1005, FIGS. 2, 5 (annotated).

117. Additionally, Beam discloses an array of individually controlled light sources 401 (e.g., LEDs, *see* Figure 4) having the same functionality as lamp 202

and SLM 203 shown in Figure 2. EX1005, 3:61-64, 5:3-16, 8:4-17, FIGS. 4, 6. Each light source (cluster) of the array has its own independent *angular* position, that combines to form the headlamp beam, so Beam's array of light sources 401 of Figure 4 form many, and at least one directional light cluster/source to provide illumination in desired subsections. EX1005, 3:61-64, 4:26-59, 5:3-16, 8:4-17, FIGS. 2, 4-6.

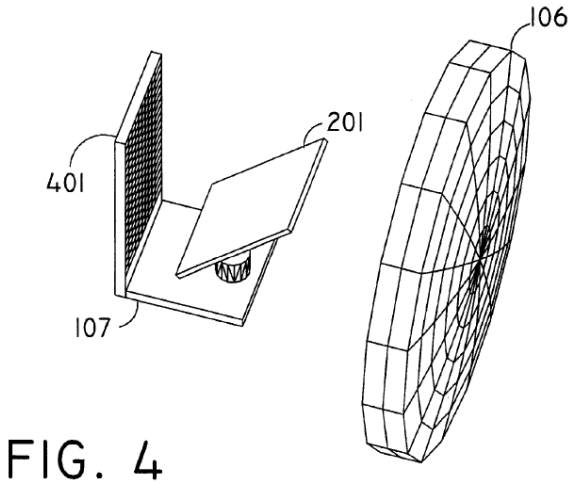


FIG. 4

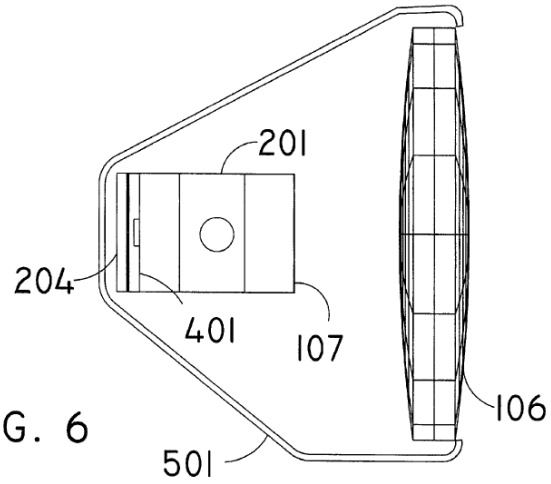


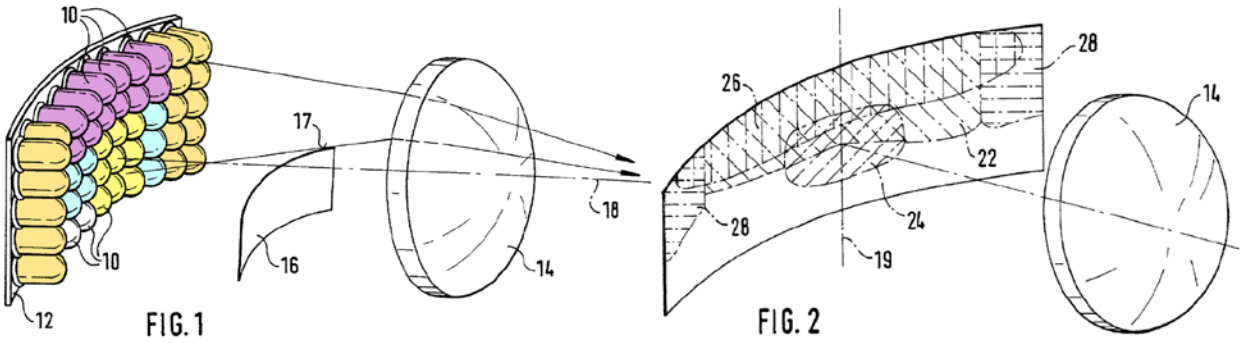
FIG. 6

EX1005, FIGS. 4, 6.

118. Thus, Beam discloses "directional light [clusters / sources]"—independently controllable angular microbeam clusters/sources—that "create an output headlight beam meeting the determined illumination requirements" and "achieve the determined illumination levels" as recited in [26.6] (and [65.9] in Ground 2).

119. If Patent Owner argues, incorrectly, that Beam does not disclose [26.6] (and [65.9] in Ground 2), Thominet does, and it would have been obvious to combine Thominet with Beam, as discussed below.

120. 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 [clusters / sources]" recited in elements [26.6] (and [65.9] 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.

121. As discussed, Beam discloses "directional light [clusters / sources]" with independently controlled angular positions for reducing glare towards other drivers. Thominet provides further detail on implementing "directional light

[clusters / 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—through either software or hardware—for different functions in Beam's system. EX1005, 3:8-14, 3:37-44, 5:33-54, 7:1-13.

122. Indeed, Thominet discloses such an implementation to *automatically* provide different spatial distributions for improved visibility in different driving situations (low visibility, fog, low/high speeds, recognizing a counter traffic, curves, etc., *see* EX1006, ¶¶7-8, 23-26, FIGS. 1-2), thereby automating some of Beam's *manual* control methods and improving driver safety—an express purpose of Beam. EX1005, 3:29-44 ("*manually* lower the beams for conditions like rain, snow, or fog"), 3:8-14, 5:33-54, 7:1-13; EX1006, ¶26 ("[b]y operation of the…corresponding partial region 22, 24, 26, 28…it is possible to switch over between the above mentioned *different light functions*…*automatically*").

123. Beam and Thominet are from the same field—controllable headlamps with dynamic illumination—and include the same building blocks (light sources, sensors, controllers). Further, improved visibility, thereby increasing safety, is paramount in both. EX1005, 1:54-59, 3:8-45, 4:48-59, 6:53-7:13; EX1006, ¶¶3-4, 23.

124. *First*, including an additional control technique (software implementation) for Beam—Thominet's *known technique* of using multiple directional beam regions for different functions—would have added more control methods for different functions to Beam's visibility for different driving situations, 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.

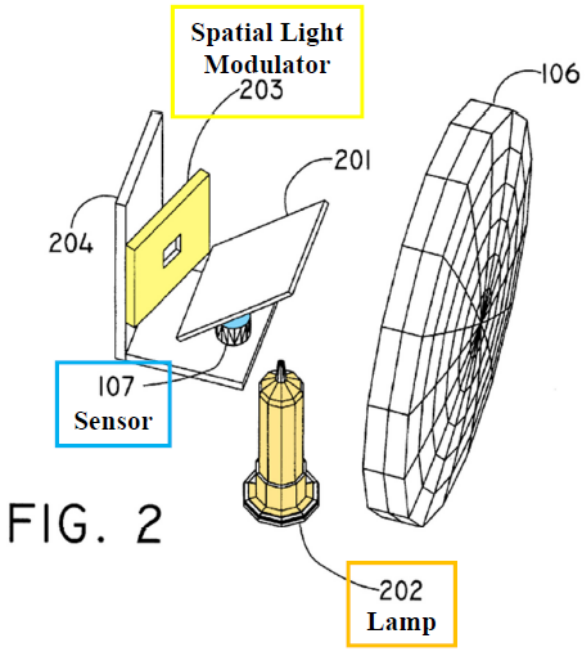


FIG. 2

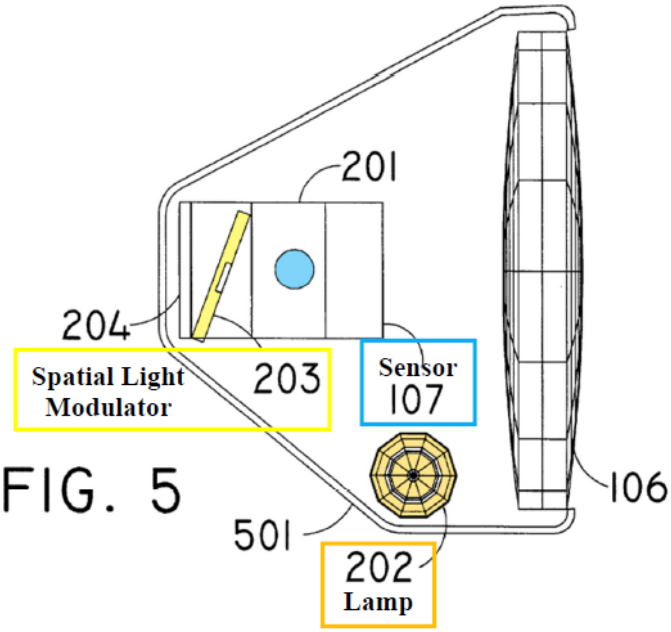
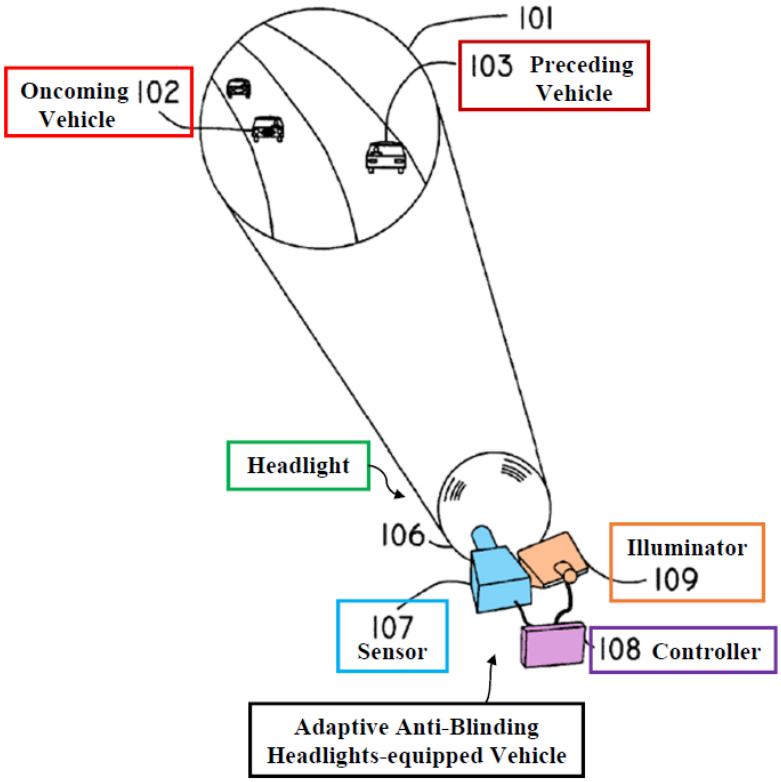


FIG. 5

EX1005, FIGS. 2, 5 (annotated).

125. Indeed, Beam's techniques and system of controlling individual microbeams emphasize safety of all drivers. EX1005, 3:8-45, 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, 3:8-45. Beam enables "the driver to see more clearly at night," while protecting others from glare. EX1005, 3:8-45; EX1005, 4:9-24, 6:9-27.



EX1005, FIG. 1 (annotated).

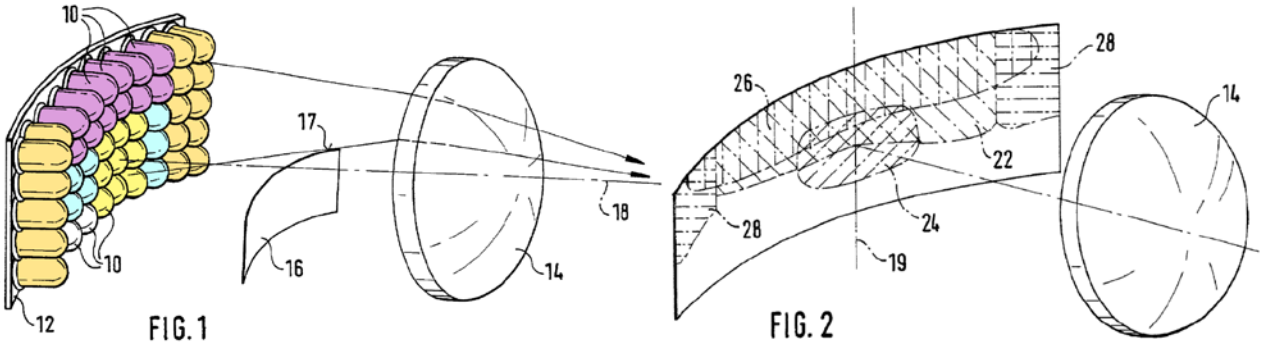
126. Beam's system "*determine[s] the location of light sources* forward of the apparatus and us[es] that information to *control the intensity, and/or the angular position*, of one or more" microbeams. EX1005, Abstract; EX1005, 4:10-59, 6:9-27, FIGS. 1, 1A-1D, 2. Beam recognizes the safety benefits 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 [clusters / sources]," 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 "directional light [clusters / sources]." 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.

127. And Thominet's *technique* (software implementation), like Beam, enhances driver visibility, increasing safety—using multiple directional beam regions (clusters) for different functions. EX1006, ¶¶17-18, 21-26, FIGS. 1-3; EX1006, ¶4 ("*characteristic* of the light beam…can be used for *different functions*"), ¶20 ("partial *regions* are defined on the *matrix*"), ¶27 ("partial *regions* with partial quantities of the semiconductor sources 10 are defined on the *matrix*"), ¶¶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.

128. Thominet's semiconductor light sources 10, arranged on curved surface 12, provide different beam regions 22, 24, 26, 28 for different driving

situations including for recognizing a counter traffic, thereby improving safety, including driver safety. EX1006, ¶¶7-8, 17-18, 21-27, FIGS. 1-3; EX1006, ¶7 ("*wider* illumination), ¶23 ("*improving* the illumination…at high speeds).



EX1006, FIGS. 1-2 (annotated).

129. The additional control (software implementation) of having multiple directional beam regions (clusters) 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.

130. A POSA would have understood that alternative or additional control for Beam's controller 108/illuminator 109 by using Thominet's different beam regions 22, 24, 26, 28, 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 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.

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

132. 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 for different functions—as already disclosed in the art.

133. *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 (arranged in different beam regions 22, 24, 26, 28, *see* EX1006, ¶¶17-20, 23-26, FIGS. 1-2, 5-7) into Beam's system (with flat array of light sources 401). 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. EX1006, ¶¶17-20, 23-26, FIGS. 1-2, 5-7. This is a simple hardware combination.

134. 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.

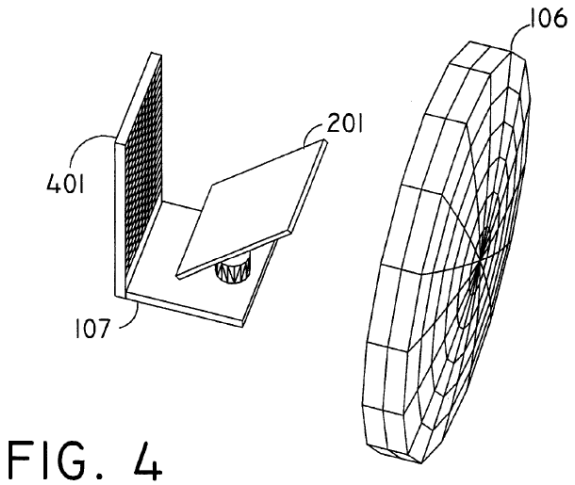


FIG. 4

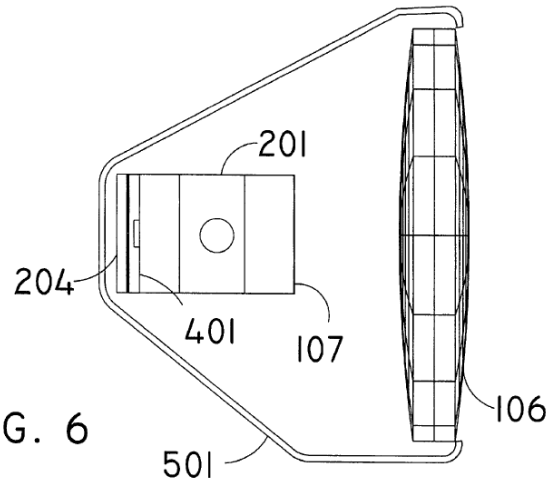


FIG. 6

EX1005, FIGS. 4, 6.

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

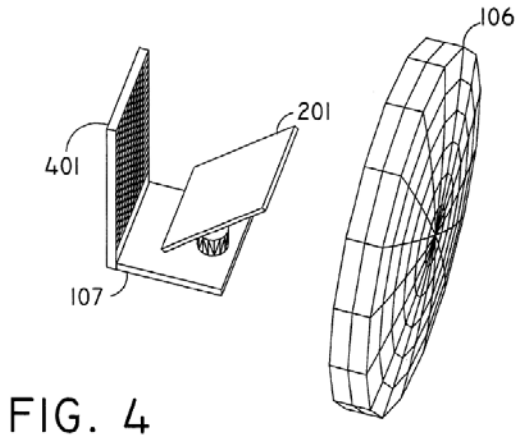


FIG. 4

EX1005, FIG. 4.

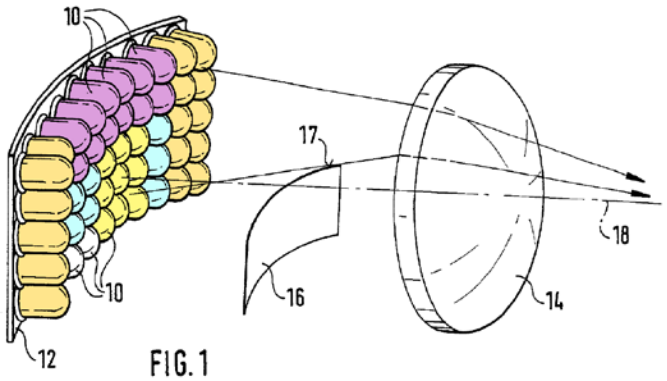


FIG.1

EX1006, FIG. 1 (annotated).

136. Like the software implementation above, this hardware combination—Beam's array of light sources 401 and Thominet's semiconductor sources 10 on curved surface 12 arranged in directional beam regions 22, 24, 26, 28—would have provided Beam's system with different spatial distributions for different driving situations, as in Thominet, thereby improving driver safety. This 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 (improved visibility and safety). Overall, this is a simple hardware implementation.

137. 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 clusters/sources (e.g., directional beam regions 22, 24, 26, 28) for different functions (hardware implementation).

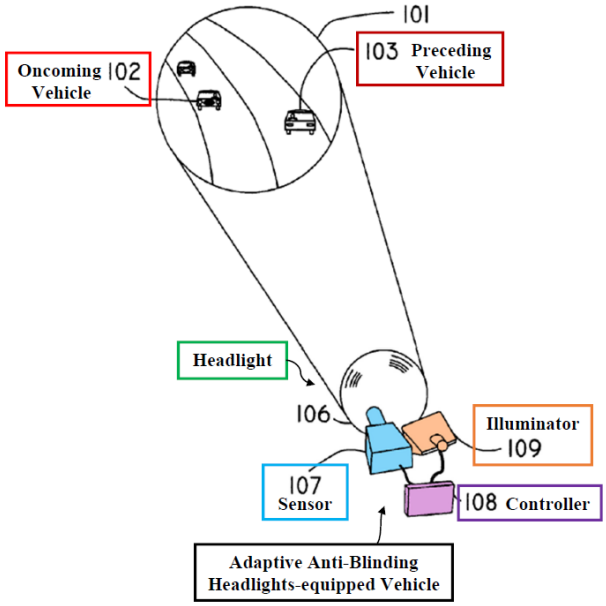
138. Such modification would have been routine and well within a POSA's skill due to the similarities in Beam's and Thominet's adaptive systems—their common components were well known and there would have been no limitations for a POSA to make such modifications. And in combining Beam with Thominet's 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).

139. 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 [26.6] (and [65.9] in Ground 2).

B. Independent Claim 26[8]

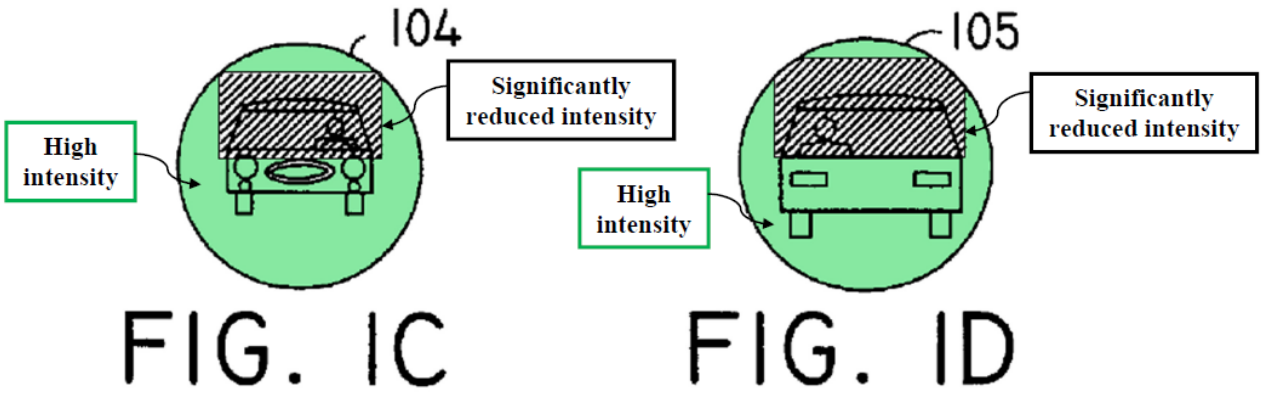
1. [26.P]: "A method for generating a headlight beam in an adaptive headlight system that provides illumination to at least a portion of a field-of-view, comprising:"

140. Beam discloses "[a] *method* for enabling drivers of vehicles to obtain…*bright headlights*" and an adaptive anti-blinding headlight (AABH) system that adjusts illumination of headlights. EX1005, 8:18-22, FIGS. 1-2, 7; EX1005, 3:8-24, 4:10-59. Beam's "controller module uses…*sensor spatial data (video) to determine*…*illumination sources*…in the headlight's *field-of-view*…to *control the Illuminator*." EX1005, 6:14-19, FIGS. 1, 1C-1D, 7; EX1005, 4:10-25.



EX1005, FIG. 1 (annotated).

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



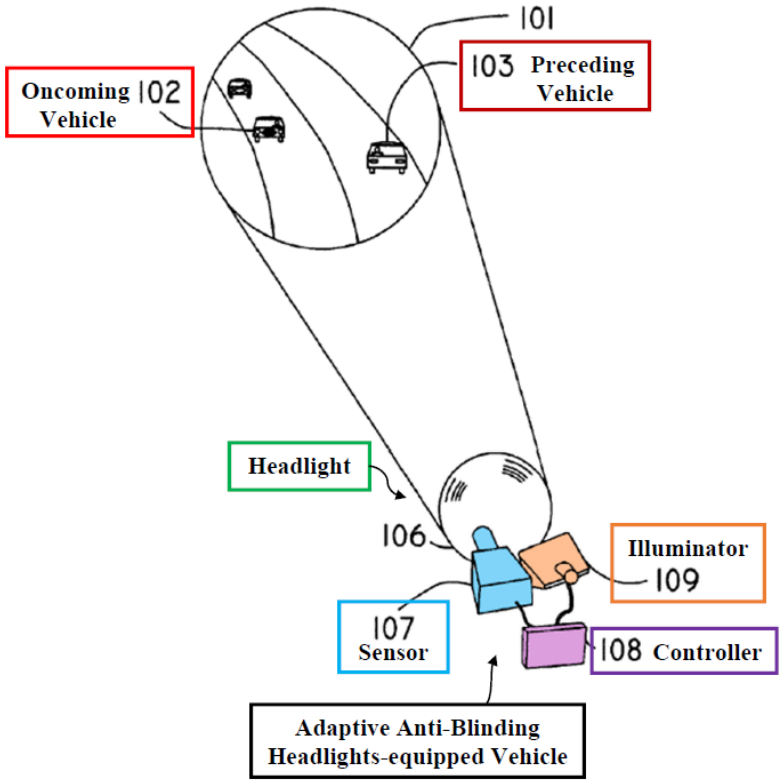
EX1005, FIGS. 1C-1D (annotated).

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

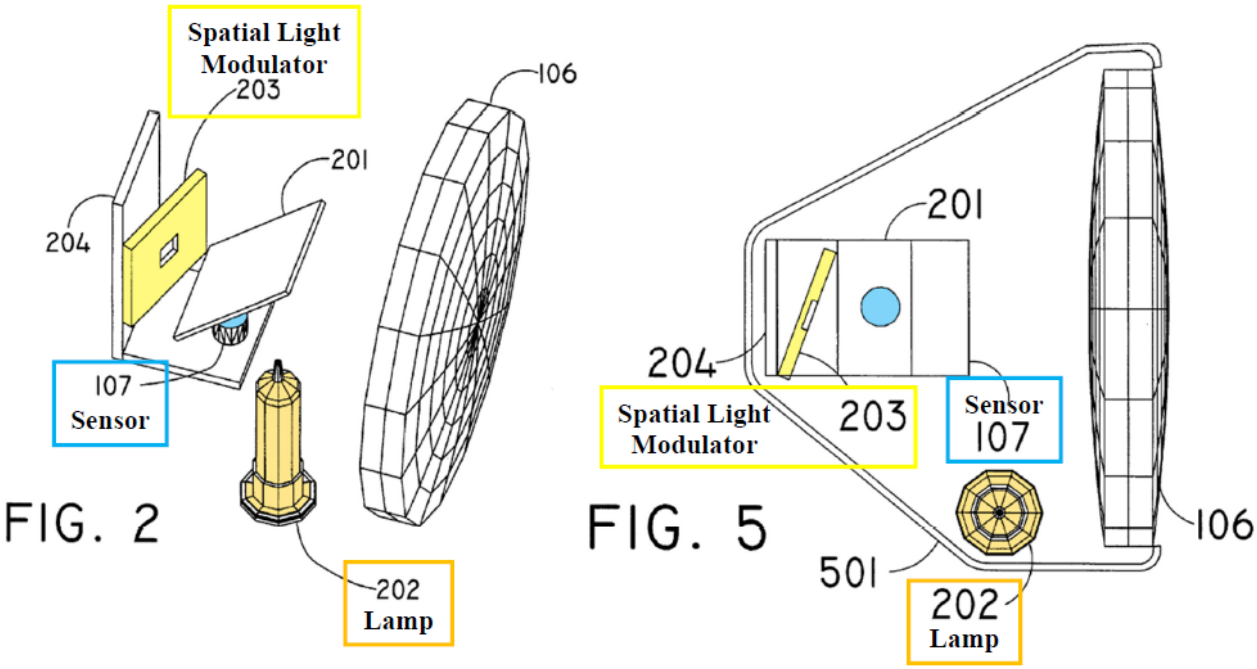
2. [26.1]: "utilizing one or more sensors of a vehicle including the adaptive headlight system to obtain and provide data"

142. In my opinion, [26.1] and [26.2] are part of the same clause but will be addressed separately for simplicity below.

143. Beam's *sensor 107* detects headlights/taillights of an oncoming/preceding vehicle 102, 103 and "*spatial scene data* from sensor 107…becomes the *input* to a processor 1105." EX1005, 4:10-25, 5:33-35, FIGS. 1-2, 5; EX1005, 6:12-14 ("imaging *sensor*"), 4:26-36 ("incoming rays are imaged by the sensor 107"), 8:23-27.



EX1005, FIG. 1 (annotated).



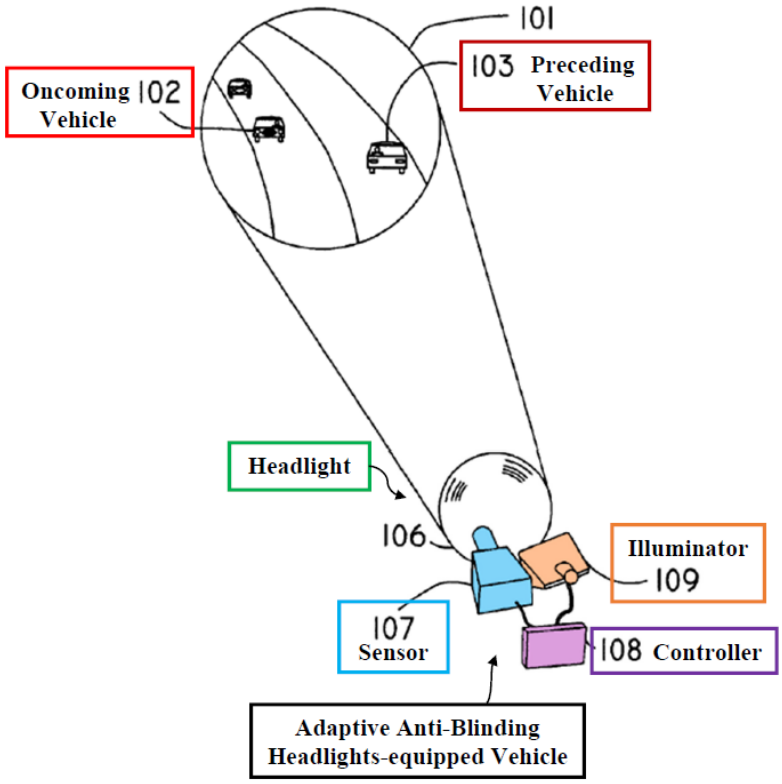
EX1005, FIGS. 2, 5 (annotated).

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

3. [26.2]: "predefined as relevant to a determination of illumination requirements for the field-of-view, the data including data indicative of at least one of one or more other vehicles or a pedestrian;"

145. In my opinion, [26.1] and [26.2] are part of the same clause but will be addressed separately for simplicity below.

146. Beam detects headlights/taillights of an oncoming/preceding *vehicle* 102, 103 in a field-of-view 101. EX1005, 4:10-25, FIGS. 1, 1A-1B; EX1005, 6:14-16 ("*determine[s]* whether there are *illumination sources* (headlights or tail lights) present"). The sensor spatial data (oncoming/preceding traffic) is "predefined as relevant" 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).

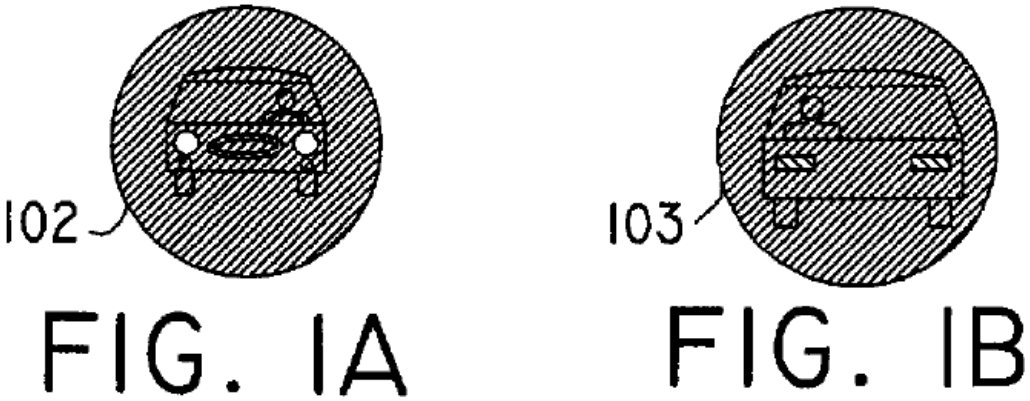


FIG. 1A FIG. 1B

EX1005, FIGS. 1A-1B.

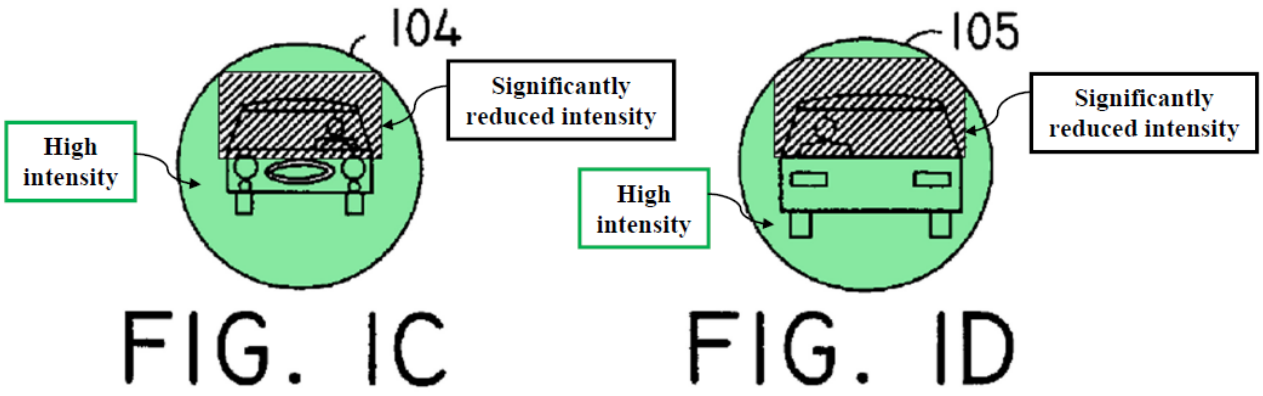


FIG. 1C FIG. 1D

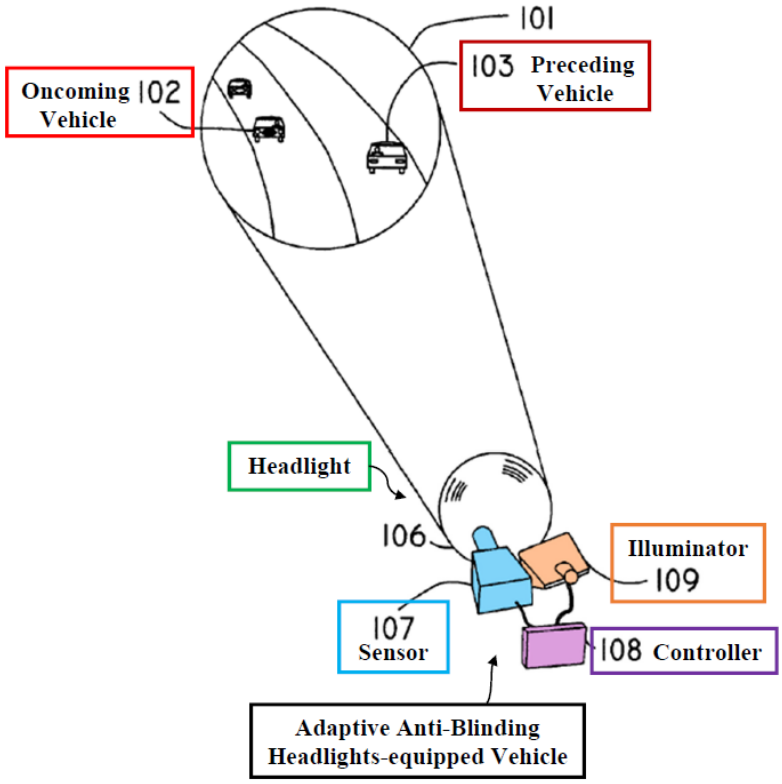
EX1005, FIGS. 1C-1D (annotated).

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

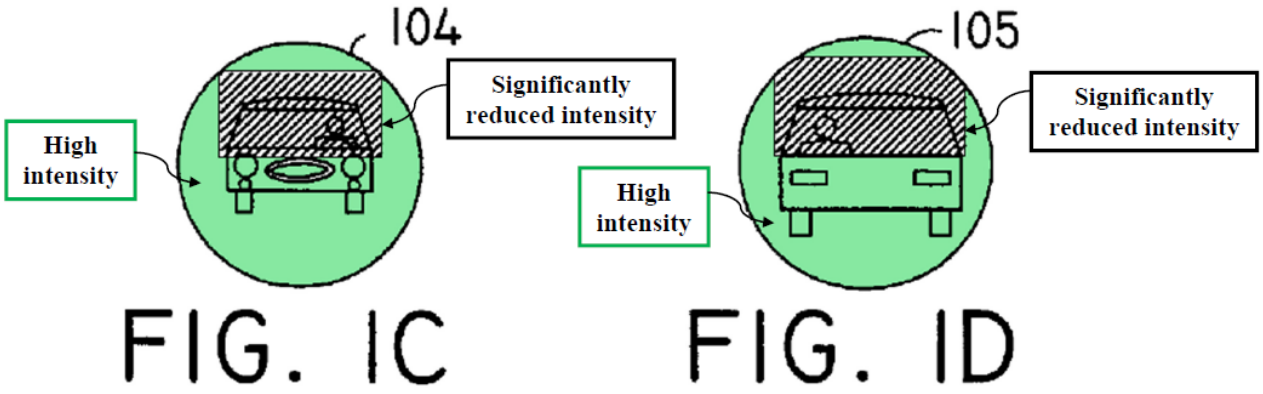
4. [26.3]: "determining illumination requirements for the field-of-view based on the data sensed by the sensors,"

148. In my opinion, [26.3]-[26.5] are part of the same clause but will be addressed separately for simplicity below.

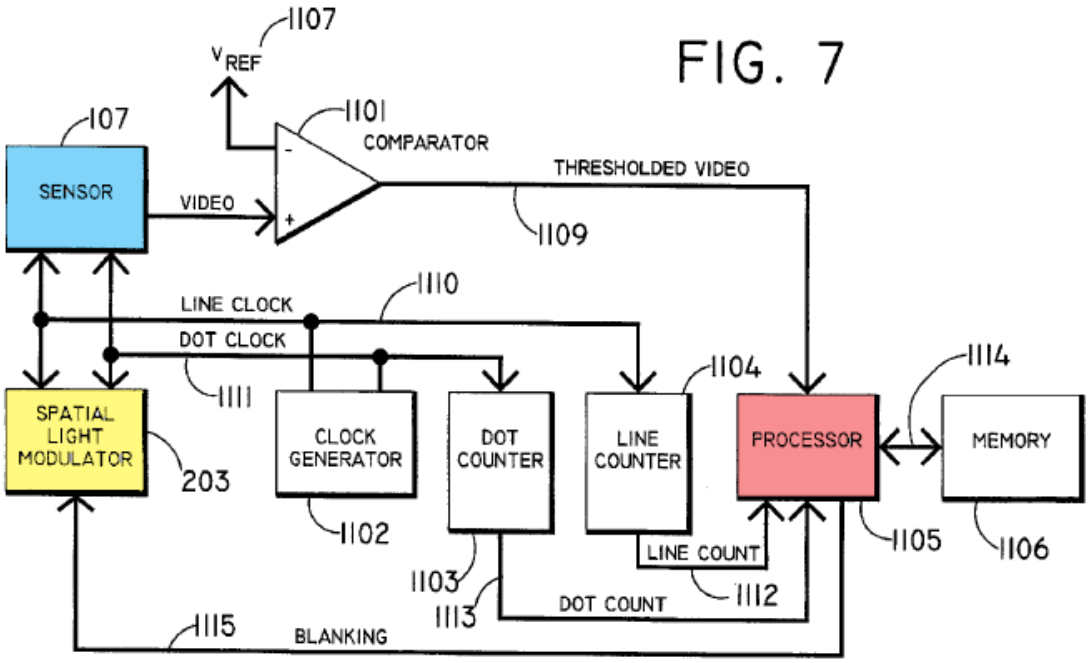
149. Beam discloses "*determining*, from the *detected presence* of the oncoming or followed vehicle…*the shape, size and location of an area to be darkened*…[and] *determining* which of said multiple rays of light must be *extinguished*." EX1005, 8:29-34, FIGS. 1, 1C-1D, 7; EX1005, 5:46-54 ("controller module uses the sensor spatial data (video)…to *control the Illuminator*"), 1:5-18 ("sensed by sensors…to *darken those microbeams*"), 4:16-19 ("*determine* which microbeams must be *reduced*"), 6:14-16 ("*determine*…in the headlight's *field-of-view*"), Abstract, 5:65-6:4, 4:10-25, 2:59-3:3, 5:33-54.



EX1005, FIG. 1 (annotated).



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



EX1005, FIG. 7 (annotated).

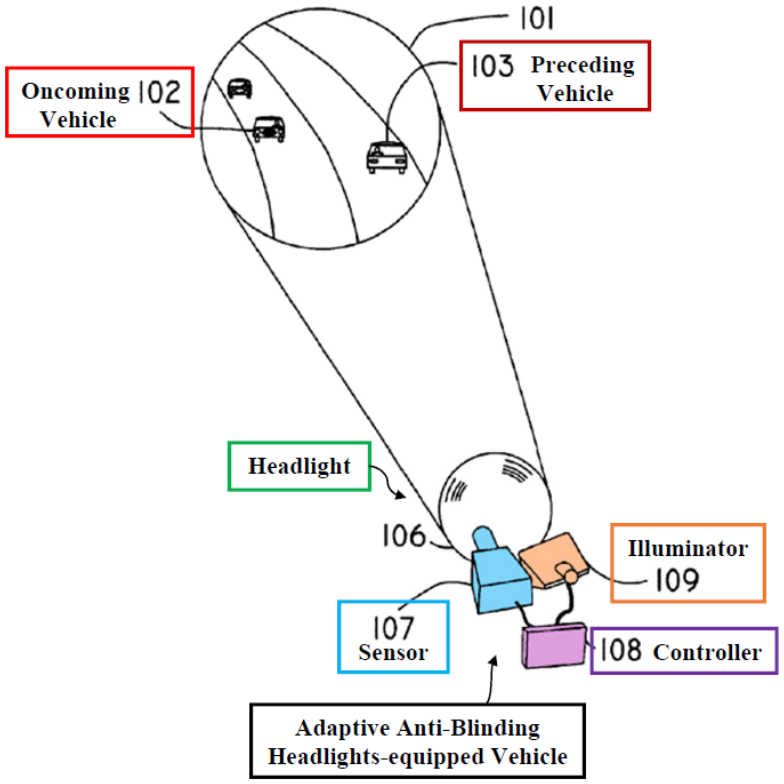
150. In view of the above, Beam discloses this element.

5. [26.4]: "including determining illumination for at least a first subsection of the field-of-view including the other vehicle or pedestrian, as indicated by the sensor data, and"

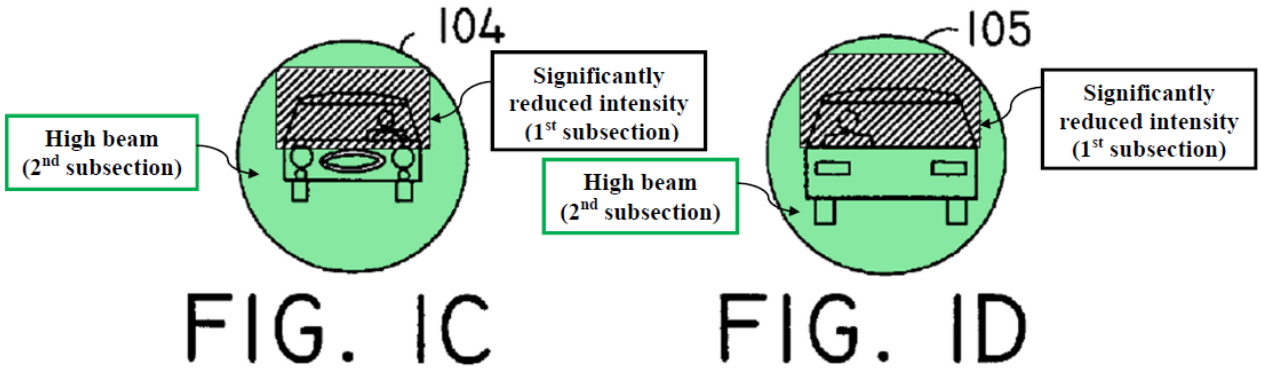
151. In my opinion, [26.3]-[26.5] are part of the same clause but will be addressed separately for simplicity below.

152. Beam discloses "*reformatting* the *pattern* of a beam…to *prevent* it from illuminating *certain areas*…thus eliminating the blinding of a driver in an *oncoming vehicle*." EX1005, 1:5-18, Abstract ("*determine* the location of light sources…using that information to *control the intensity*"), FIGS. 1, 1C-1D, 7; EX1005, 5:65-6:4 ("the *dimmed area*…based on input to the sensor"), 2:59-3:3 ("controlling an area *determined* by analyzing the position of the lights…the area

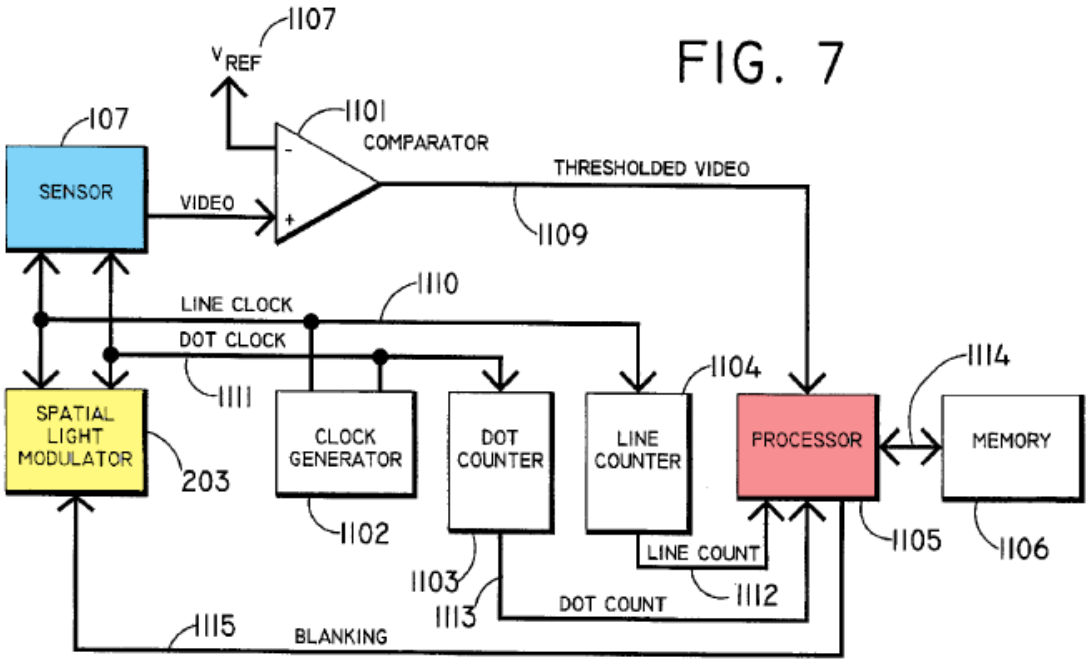
of the beam…*dazzl[ing]* the driver will be *darkened*"), 4:10-25 ("*determine* which microbeams must be reduced in intensity…*shaded areas* being *reduced significantly*"), 5:13-15 ("uses the data to *determine* the size and position of the light emitters to be dimmed"), 5:33-54 ("*determine the locations to be blanked*"), 8:23-38 ("*determining*…an area to be darkened within said area of illumination…*producing* a desired output pattern"). 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). EX1005, 5:33-54, 6:12-27, FIGS. 1C-1D; EX1005, 6:24-27 ("blanked area *tracks* the location of the *oncoming 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; 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).



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



EX1005, FIG. 7 (annotated).

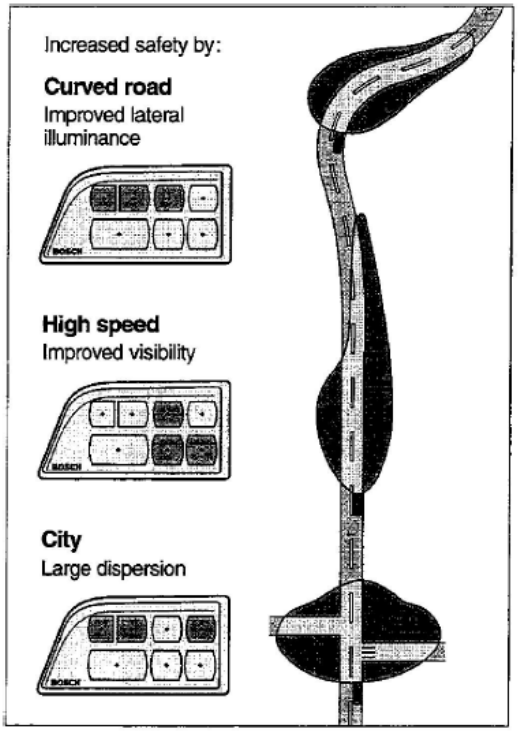


Fig.1: Three standard driving situations with adapted light pattern seen from the bird eye's view.

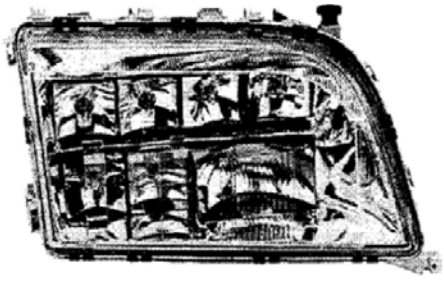
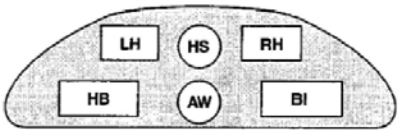


Fig 4: ALP *headlamp* sample



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

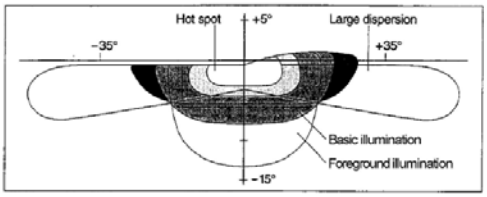


Fig. 3: Light pattern of multiple beam *headlamp (Isolux* curves in wall projection): The individual light *pattern* of multiple sub-units sum up to the total adaptive light pattern

EX1017, FIGS. 1 and 3-5.

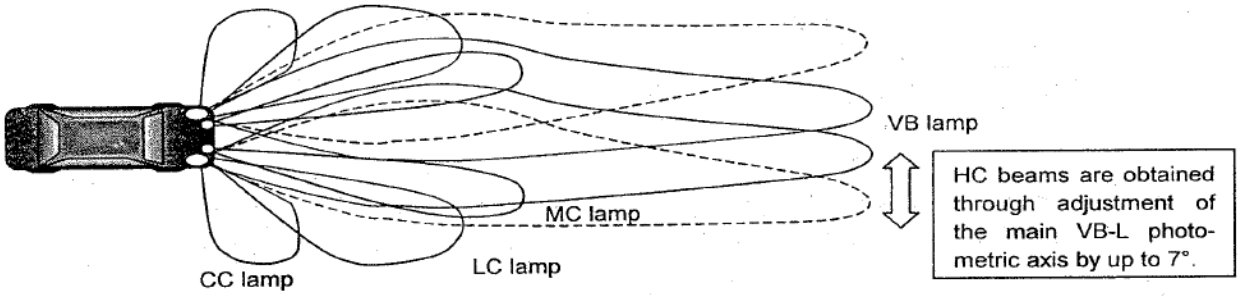


Fig. 3-3: Imaged Illumination Configurations on Road Surface

EX1026, FIG. 3-3.

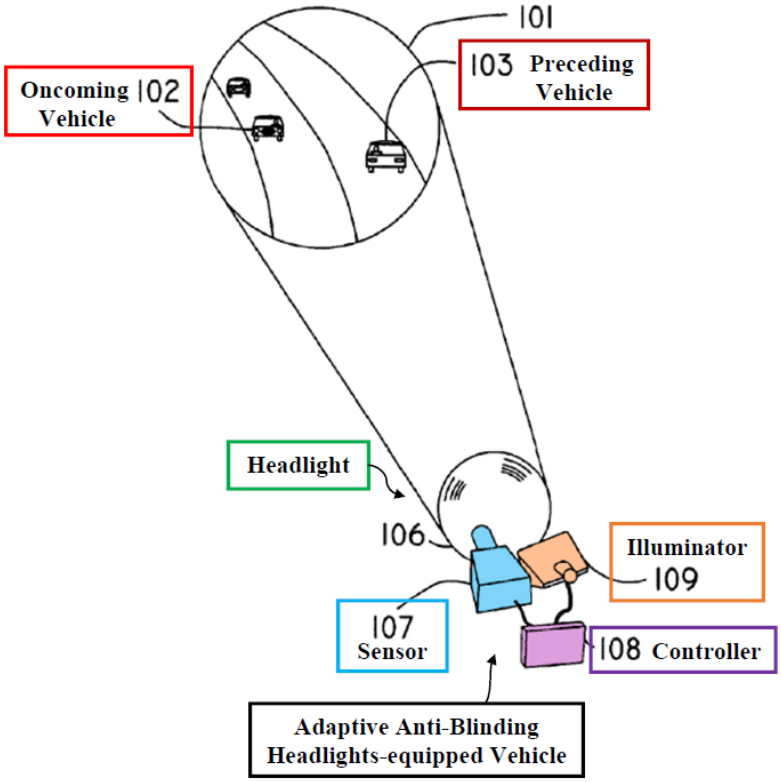
153. In view of the above, Beam discloses this element.

6. [26.5]: "for at least a second subsection of the field-of-view not including the other vehicle or pedestrian;"

154. In my opinion, [26.3]-[26.5] are part of the same clause but will be addressed separately for simplicity below.

155. Beam discloses determining illumination for a second subsection (without the vehicle) by providing "*higher brightness beam* in the areas which *do not dazzle* the drivers ahead" and "the area…that would dazzle the driver will be darkened, *while maintaining f[u]ll intensity elsewhere*." EX1005, 3:19-24, 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*"). Thus, the processor processes the inputted spatial sensor data, identifies a vehicle within the headlight's field-of-view, and determines an area (not including the vehicle) to be illuminated at "maximum intensity" within a second subsection of

the field-of-view (e.g., non-shaded area). EX1005, 3:19-24, 2:59-3:3, 6:11-12, 6:40-44, 7:30-36; *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).

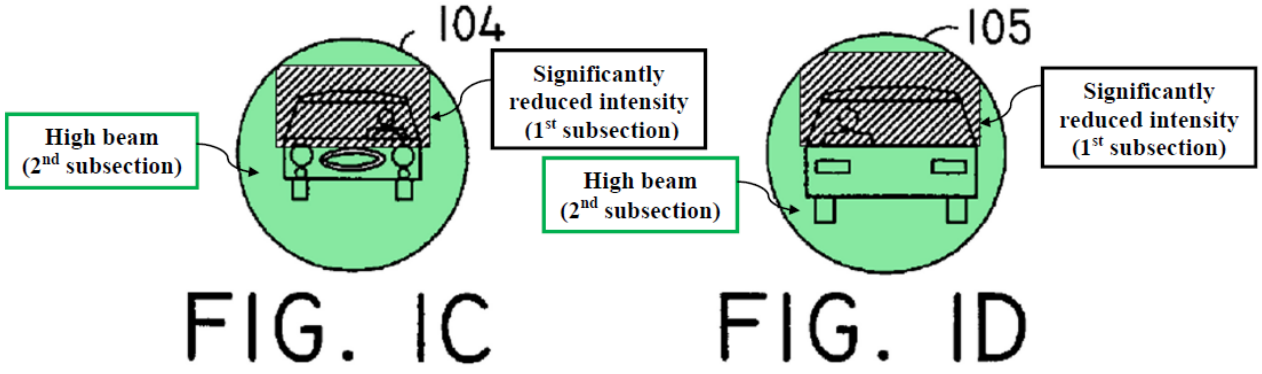
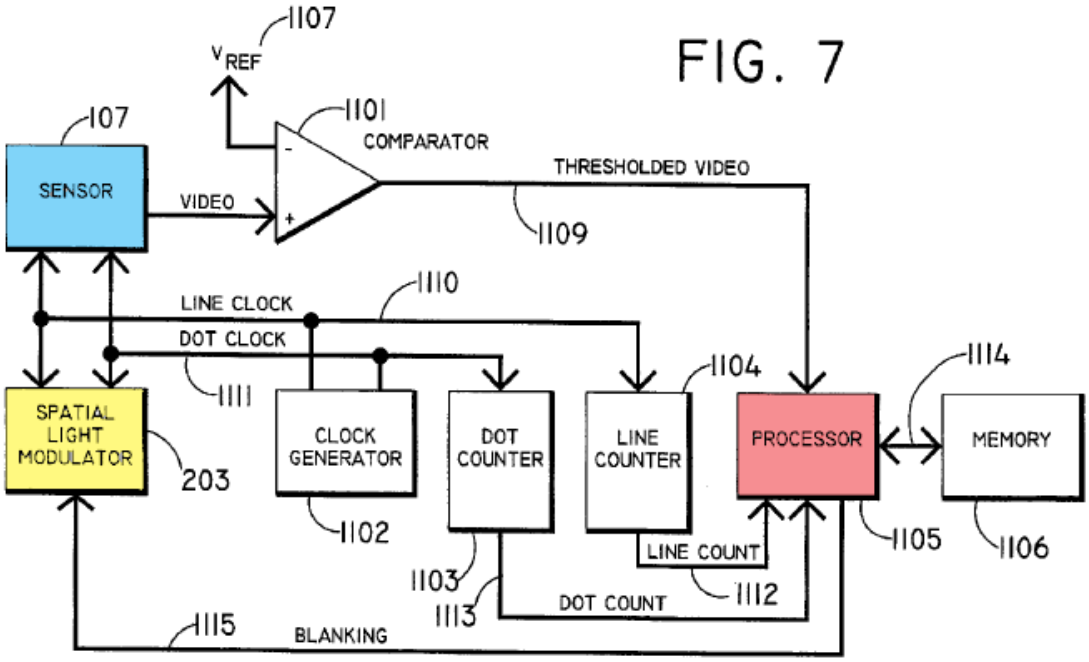


FIG. 1C FIG. 1D

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



EX1005, FIG. 7 (annotated).

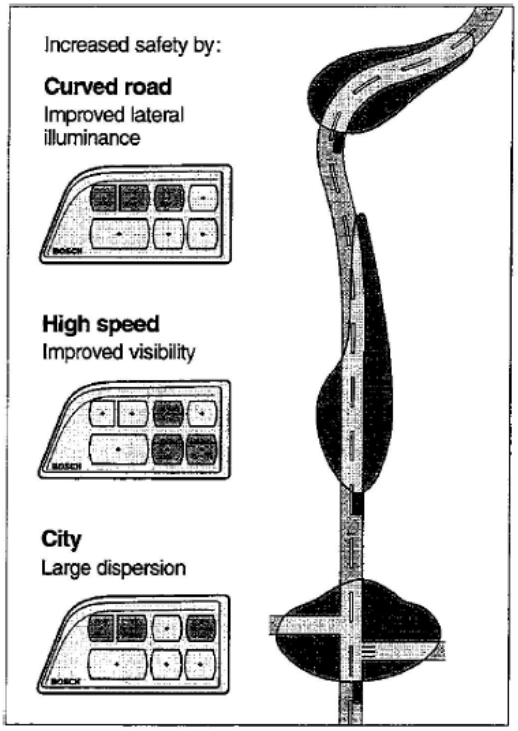


Fig.1: Three standard driving situations with adapted light pattern seen from the bird eye's view.

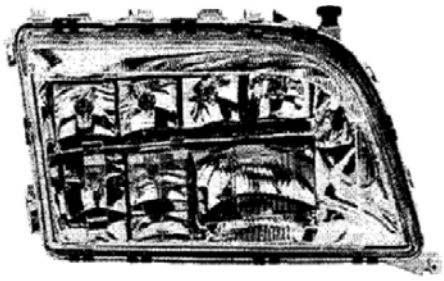
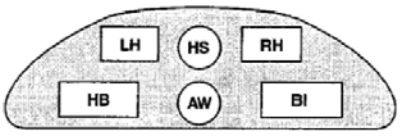


Fig 4: ALP *headlamp* sample



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

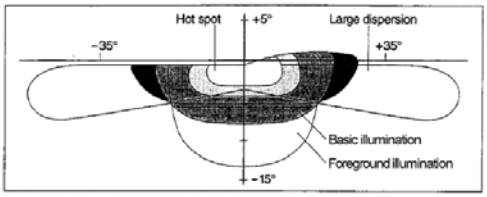


Fig. 3: Light pattern of multiple beam *headlamp* (*Isolux* curves in wall projection): The individual light *pattern* of multiple sub-units sum up to the total adaptive light pattern

EX1017, FIGS. 1 and 3-5.

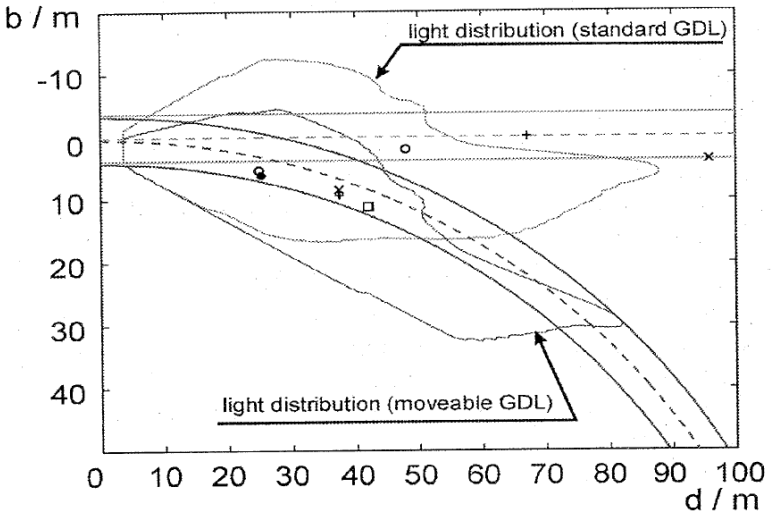


Figure 18: Fixation distance accumulation points (FDAP) for different headlamp systems and different road parts.
Accumulation points: X: *daylight*
○: *standard halogen*
●: *moveable halogen*
+: *standard gas discharge*
□: *moveable gas discharge*

EX1025, FIG. 18.

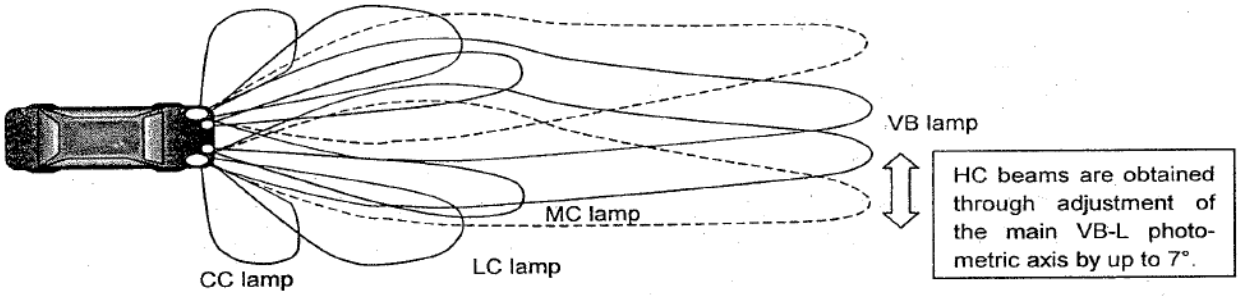


Fig. 3-3: Imaged Illumination Configurations on Road Surface

EX1026, FIG. 3-3.

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

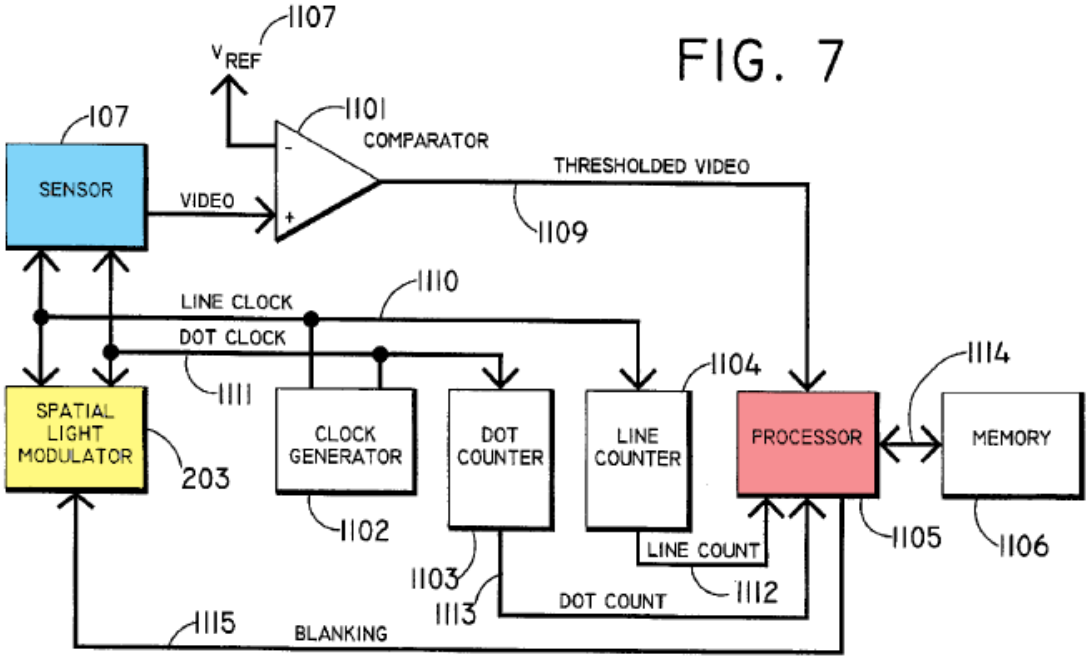
7. [26.6]: "determining a control strategy for controlling one or more directional light clusters in a headlight assembly to create an output headlight beam meeting the determined illumination requirements,"

157. In my opinion, [26.6]-[26.8] are part of the same clause but will be addressed separately for simplicity below.

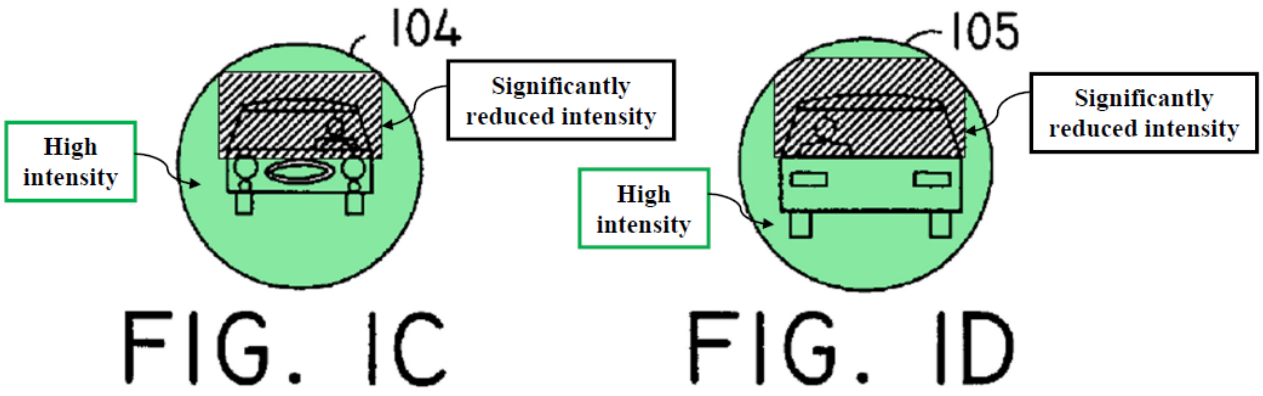
(a) Beam discloses this element.

158. In my opinion, Beam discloses this element, [26.6]. *See supra* Sections X/X.A. Beam's controller/processor determines a control strategy (e.g., feedback) to "cause the *intensity* of the selected microbeams to be reduced…illumination beam having a *high level of illumination*…with only selected portions…being *reduced*" to output illumination in the first subsection (with the vehicle) and the second subsection (without the vehicle). EX1005, 7:30-36, FIGS. 1, 1C-1D, 7; EX1005, Abstract, 1:5-18, 2:59-3:24, 4:10-25, 5:13-6:4, 6:11-19, 6:40-48, 8:23-38. Beam also discloses "controller module uses the *sensor*

spatial data (video)…to *control the Illuminator*" and "*processor*…outputs *blanking signals*…*command[ing] the appropriate pixels to be reduced*." EX1005, 5:34-54, 6:14-19, FIGS. 1, 1C-1D, 7; EX1005, 8:35-38 ("*controlling individual rays*…producing a *desired output*"), 5:61-65 ("*controlled by a processor*"), 1:5-18 ("*reformatting* the *pattern*"), 6:30-33. Thus, Beam's processor determines a control strategy for controlling the direction and illumination of microbeams to "create an output headlight beam meeting the determined illumination requirements."



EX1005, FIG. 7 (annotated).

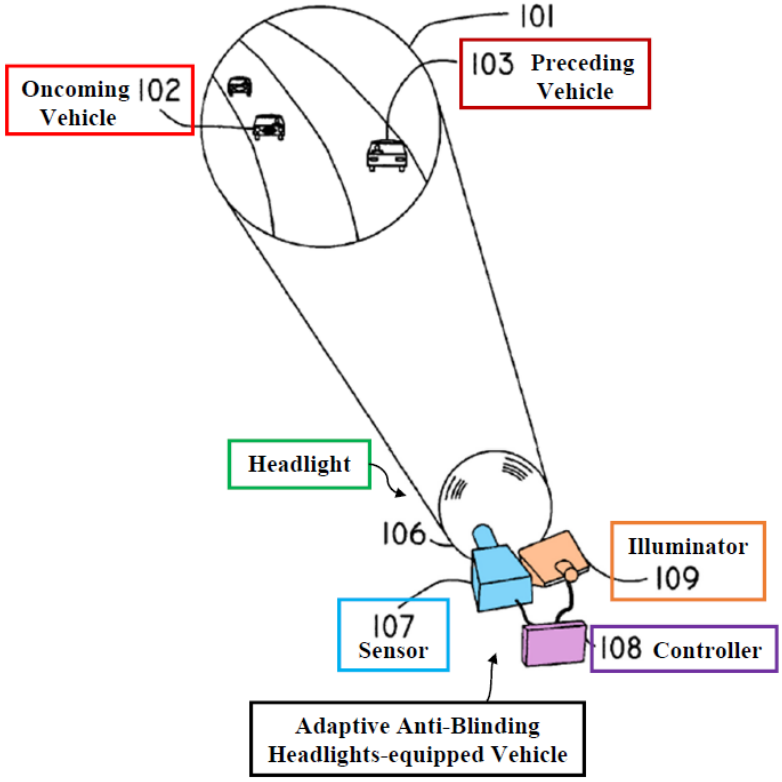


EX1005, FIGS. 1C-1D (annotated).

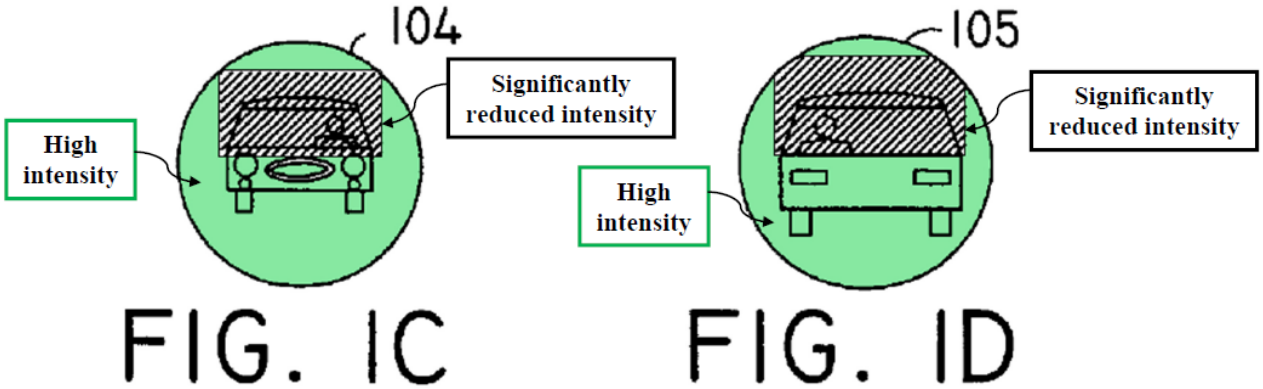
159. Also, Beam discloses "*individually directed narrow-angle beams…microbeams*" and controlling "the intensity, and/or the *angular position*, of one or more narrow-angle *microbeams*." EX1005, 5:61-63, Abstract, FIGS. 1-2, 5. Specifically, Beam discloses "an *array* of *individual, independently* controllable *microbeam* sources" for example, "light-emitting diodes." EX1005, 8:5-12; EX1005, 8:4-17, 8:35-38. Each microbeam is a directional "cluster" or "source," having its own independent *angular* position, that combines to form the headlamp beam; so Beam's lamp 202 and SLM 203 (see Figure 2) form many, and at least one directional light cluster/source to provide illumination in desired subsections. EX1005, 7:25-29 ("*multiple* narrow angle microbeams"), 8:4-17 ("*array* of individual, independently controllable microbeam sources"), 8:23-34 ("area of illumination provided by *multiple* rays of light"), 4:26-59, 5:3-21, FIGS. 2, 4-6.

160. Alternatively, if Patent Owner argues, incorrectly, that a "cluster" requires at least two (or more) microbeams, Beam also discloses this. EX1005,

4:26-59, 5:3-21, FIGS. 2, 4-6; EX1005, 4:46-48 ("[t]he *angular* position or attenuation of *each* of these microbeams is *independently* set by the controller 108").



EX1005, FIG. 1 (annotated).



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

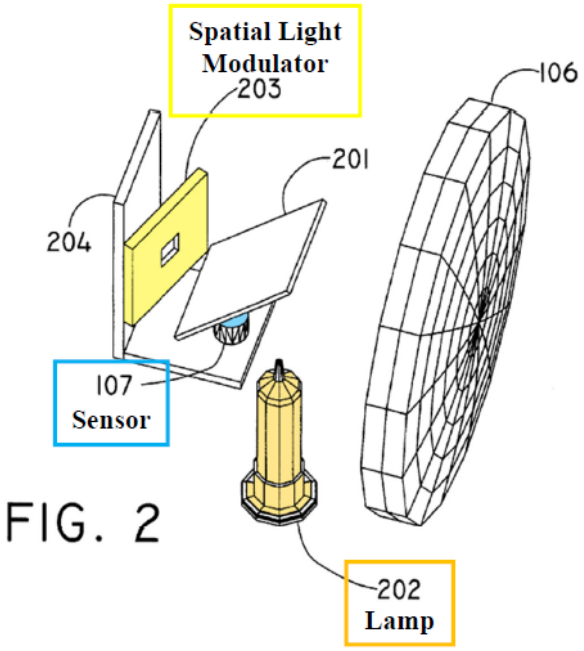


FIG. 2

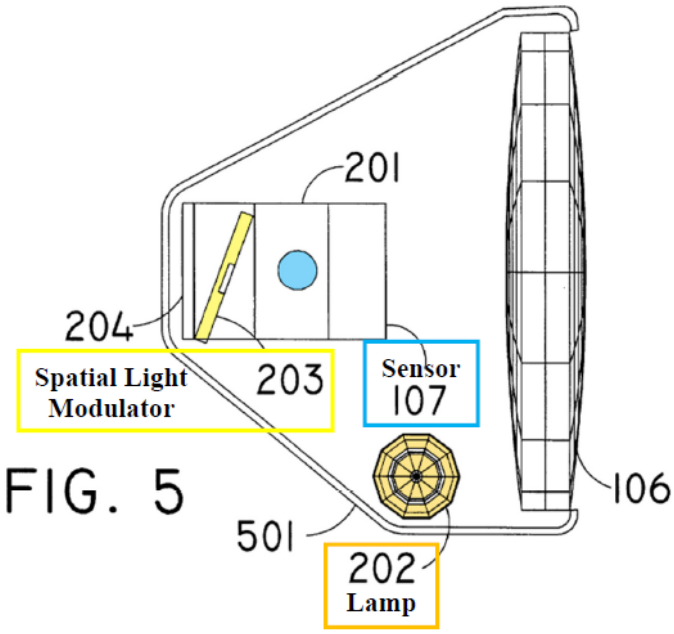


FIG. 5

EX1005, FIGS. 2, 5 (annotated).

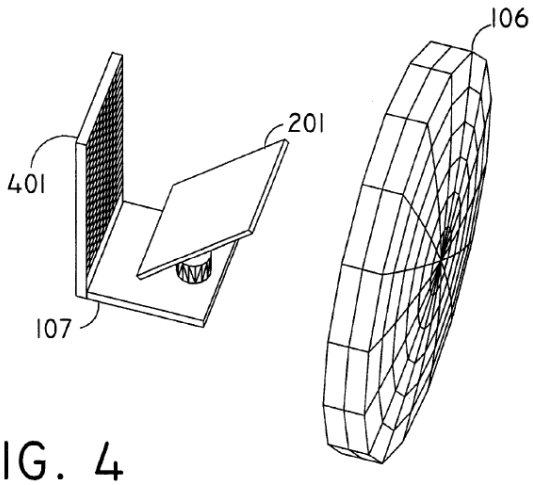


FIG. 4

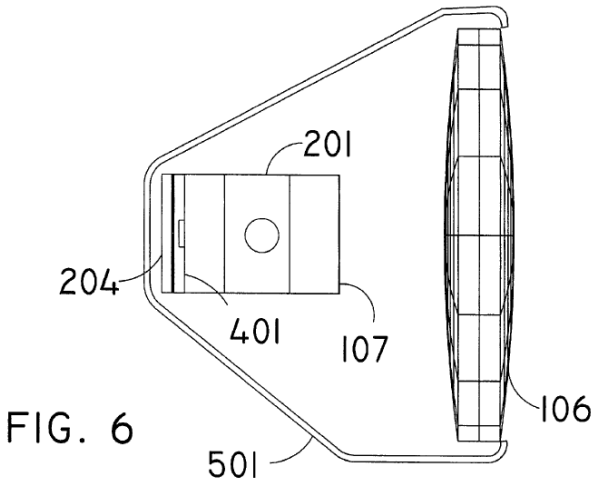


FIG. 6

EX1005, FIGS. 4, 6.

161. Such directionality results in *directional light clusters* that by definition will have different angles, which result in different aimings in desired subsections. So disclosure that discusses a control strategy for directional light *clusters* to create an output headlight beam applies the same to disclosure that

discusses control instructions for directional light *sources* for first and second subsections.

162. A POSA would have understood that controlling "intensity" and "angular position" of "one or more narrow-angle microbeams" is the same as controlling "one or more directional light clusters…meeting the determined illumination requirements," as the light output from a headlamp is all measured with its light intensity level in an angular distribution. *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; EX1019, 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.

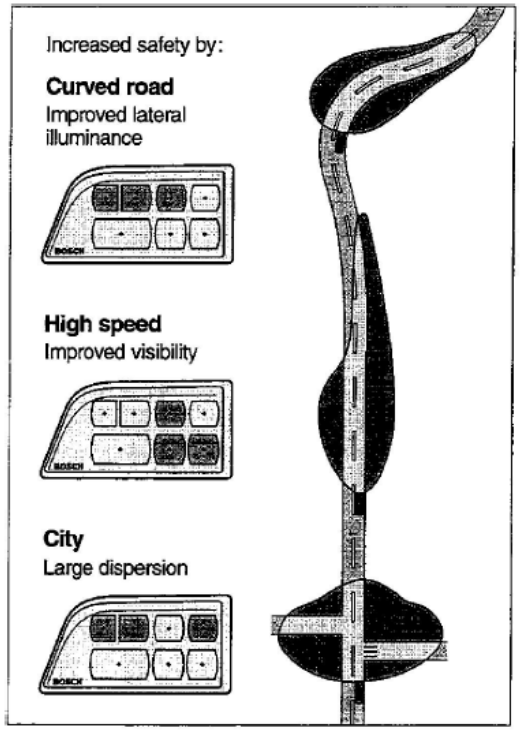


Fig.1: Three standard driving situations with adapted light pattern seen from the bird eye's view.

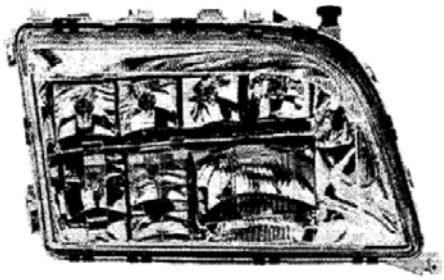
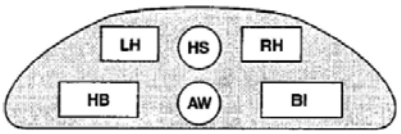


Fig 4: ALP *headlamp* sample



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

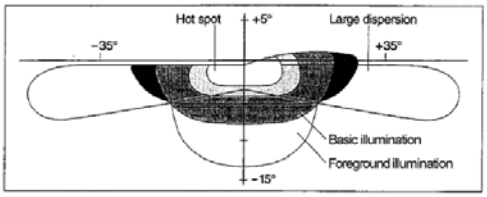


Fig. 3: Light pattern of multiple beam *headlamp* (*Isolux* curves in wall projection):
The individual light *pattern* of multiple sub-units sum up to the total adaptive light pattern

EX1017, FIGS. 1 and 3-5.

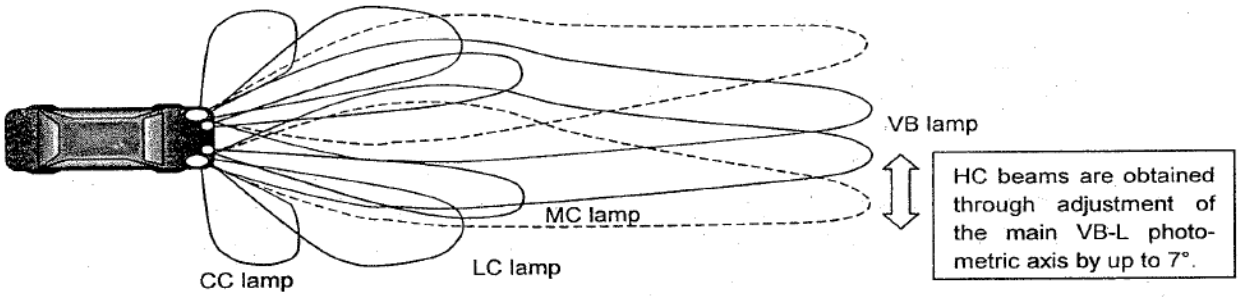
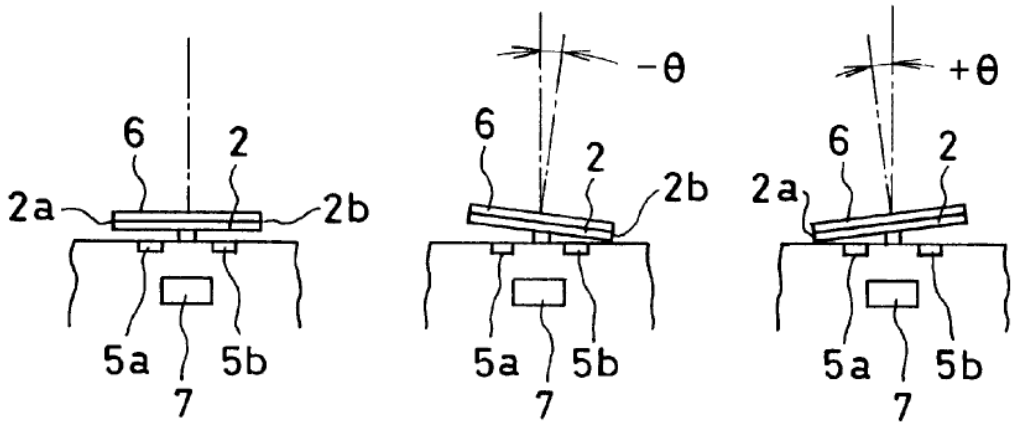


Fig. 3-3: Imaged Illumination Configurations on Road Surface

EX1026, FIG. 3-3.

FIG. 2A FIG. 2B FIG. 2C

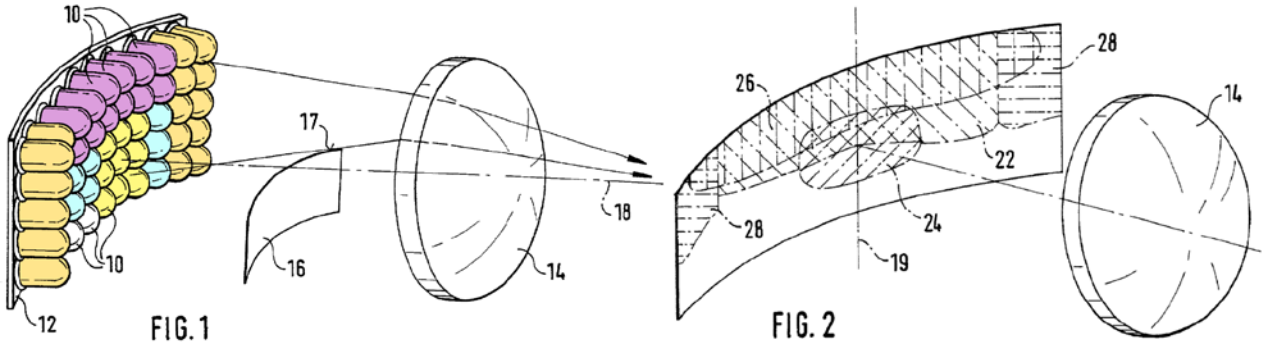


EX1040, FIGS. 2A-2C.

(b) Thominet also discloses this element.

163. If Patent Owner argues, incorrectly, that Beam does not disclose [26.6], Thominet also discloses [26.6], and it would have been obvious in view of Thominet. A POSA would have been motivated to combine Thominet with Beam with a reasonable expectation of success, providing predictable visibility and safety benefits. *See supra* Sections X/X.A.

164. As explained above (Section X.A), Thominet's headlights include directional, independently controllable semiconductor light sources 10 (e.g., LEDs) arranged on curved surface 12 to provide beam regions 22, 24, 26, 28 (directional light clusters) for different functions. EX1006, ¶¶17-18, 21-26, FIGS. 1-2. For example, Thominet's region 24 is "in the center" (first cluster) and regions 28 are "near the lateral edges" (second and third clusters). EX1006, ¶¶23, 25, FIGS. 1-2.



EX1006, FIGS. 1-2 (annotated).

165. 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 or renders obvious [26.6].

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

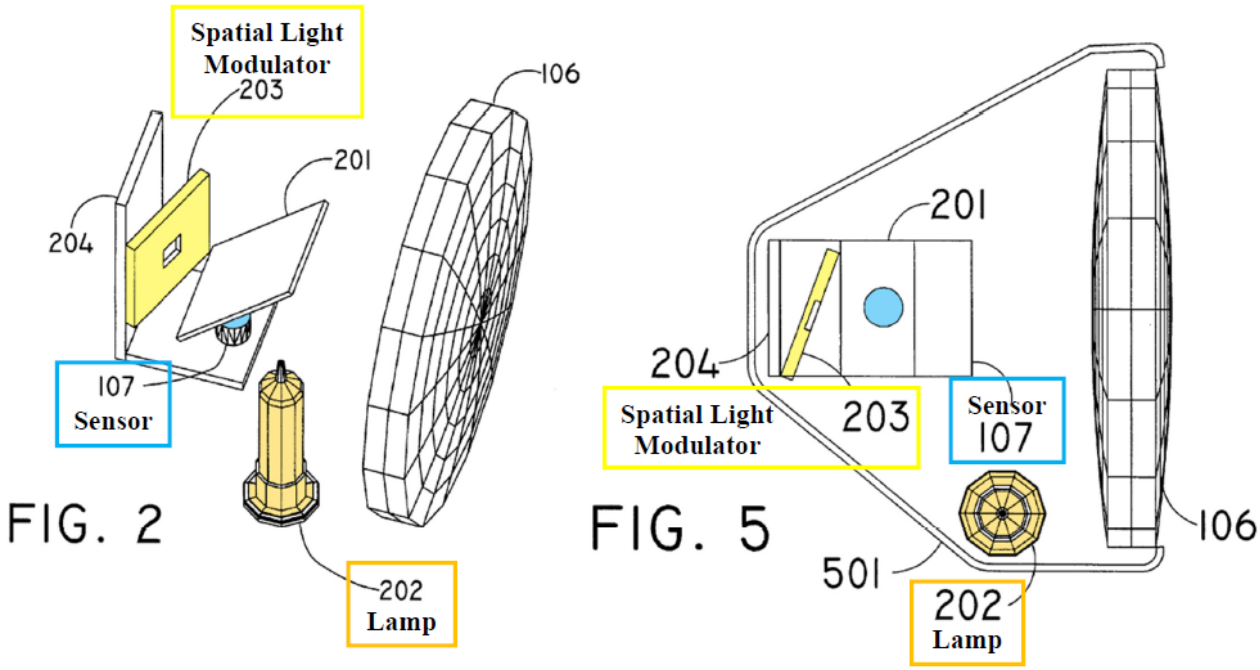
166. As discussed, Beam discloses "directional light clusters" with independently controlled angular positions for reducing glare towards other drivers. *Supra* Section X.A. Thominet provides further detail on implementing "directional light clusters" for different functions, conceptually and physically. So naturally, it would have been obvious to a POSA designing an adaptive headlamp to implement Thominet's multiple directional beam regions—through either software and/or hardware—for different functions in Beam's system. EX1005, 3:8-14, 3:37-44, 5:33-54, 7:1-13.

167. Indeed, Thominet discloses such an implementation to *automatically* provide different spatial distributions for improved visibility in different driving situations (low visibility, fog, low/high speeds, recognizing a counter traffic, curves, etc., *see* EX1006, ¶¶7-8, 23-26, FIGS. 1-2), thereby automating some of Beam's *manual* control methods and improving driver safety—an express purpose of Beam. EX1005, 3:29-44 ("*manually* lower the beams for conditions like rain, snow, or fog"), 3:8-14, 5:33-54, 7:1-13; EX1006, ¶26 ("[b]y operation of the…corresponding partial region 22, 24, 26, 28…it is possible to switch over between the above mentioned *different light functions*…*automatically*").

168. Beam and Thominet are from the same field—controllable headlamps with dynamic illumination—and include the same building blocks (light sources, sensors, controllers). Further, improved visibility, thereby increasing safety, is paramount in both. EX1005, 1:54-59, 3:8-45, 4:48-59, 6:53-7:13; EX1006, ¶¶3-4, 23.

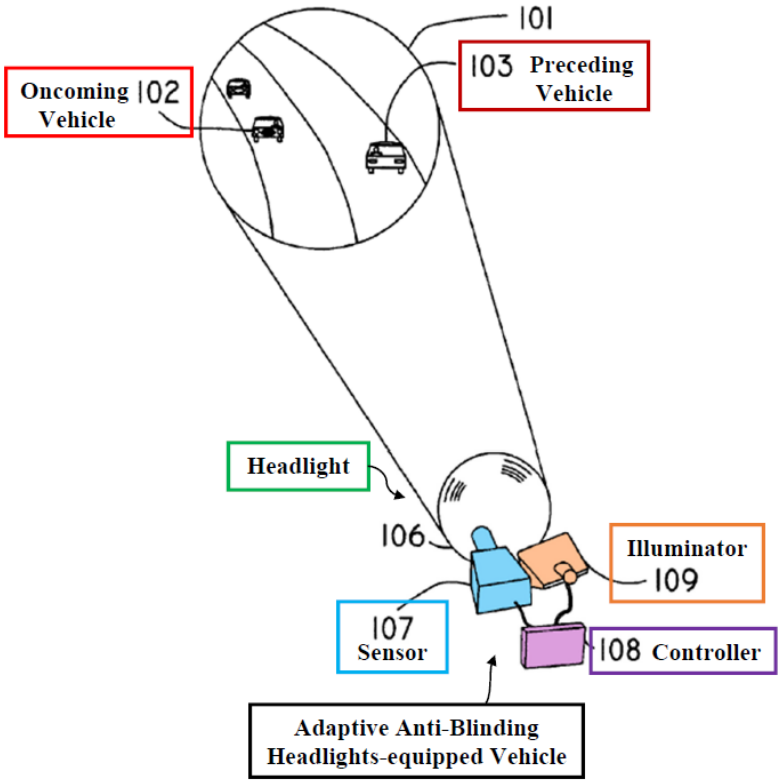
169. *First*, including an additional control technique (software implementation) for Beam—Thominet's *known technique* of using multiple directional beam regions for different functions—would have added more control methods for different functions to Beam's visibility for different driving situations, 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, 5 (annotated).

170. Indeed, Beam's techniques and system of controlling individual microbeams emphasize safety of all drivers. EX1005, 3:8-45, 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, 3:8-45. Beam enables "the driver to see more clearly at night," while protecting others from glare. EX1005, 3:8-45; EX1005, 4:10-25, 6:9-27.



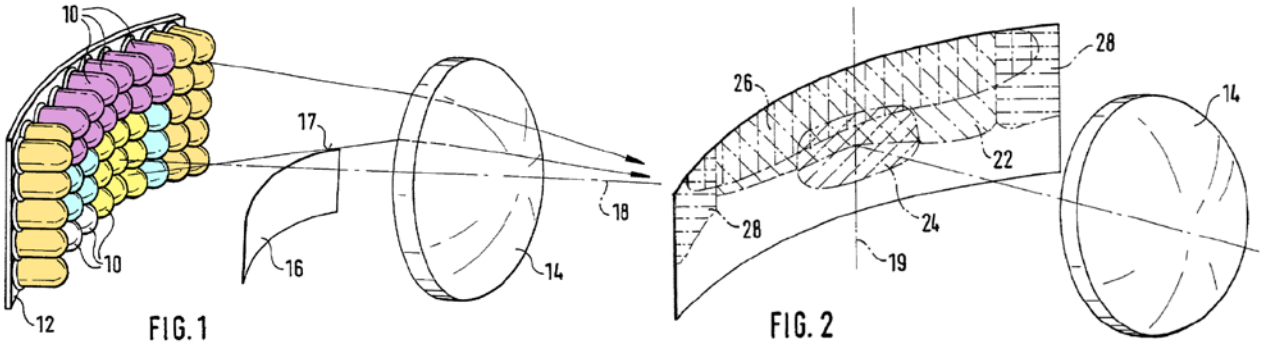
EX1005, FIG. 1 (annotated).

171. 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 [clusters / sources]," 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 "directional light

[clusters / sources].” 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.

172. And Thominet’s *technique* (software implementation), like Beam, enhances driver visibility, increasing safety—using multiple directional beam regions (clusters) for different functions. EX1006, ¶¶17-18, 21-26, FIGS. 1-3; EX1006, ¶4 (“*characteristic* of the light beam…can be used for *different functions*”), ¶20 (“partial *regions* are defined on the *matrix*”), ¶27 (“partial *regions* with partial quantities of the semiconductor sources 10 are defined on the *matrix*”), ¶¶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.

173. Thominet’s semiconductor light sources 10, arranged on curved surface 12, provide different beam regions 22, 24, 26, 28 for different driving situations including for recognizing a counter traffic, thereby improving safety, including driver safety. EX1006, ¶¶7-8, 17-18, 21-27, FIGS. 1-3; EX1006, ¶7 (“*wider* illumination), ¶23 (“*improving* the illumination…at high speeds).



EX1006, FIGS. 1-2 (annotated).

174. The additional control (software implementation) of having multiple directional beam regions (clusters) 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.

175. A POSA would have understood that alternative or additional control for Beam's controller 108/illuminator 109 by using Thominet's different beam regions 22, 24, 26, 28, 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 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.

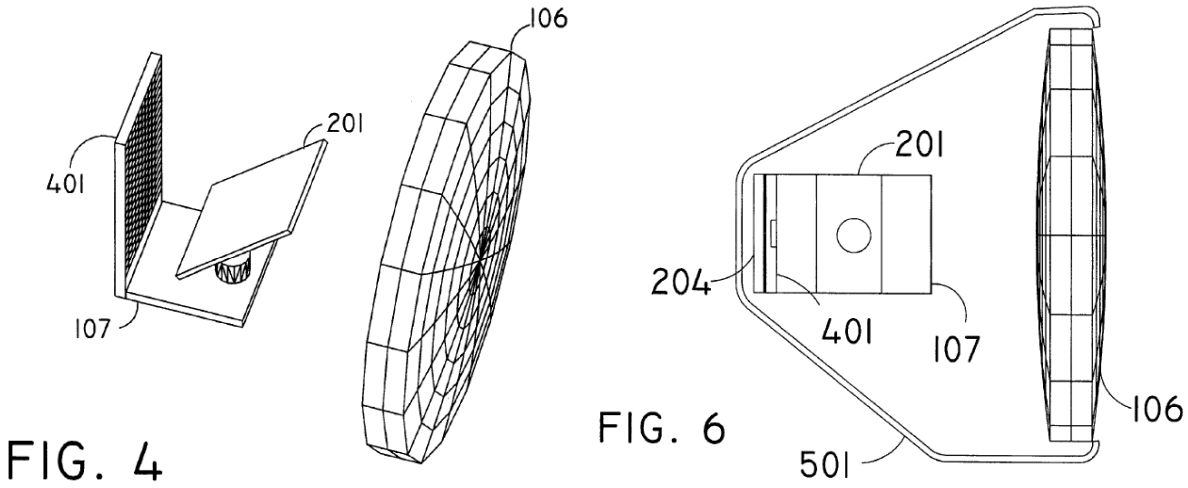
176. A POSA would have had a reasonable expectation of success combining Beam and Thominet, for example, by simply modifying software instructions in memory of Beam's controller/processor to organize Beam's array of microbeams into multiple directional beam regions for different functions. Overall, this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

177. 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 for different functions—as already disclosed in the art.

178. *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 (arranged in different beam regions 22, 24, 26, 28, *see* EX1006, ¶¶17-20, 23-26, FIGS. 1-2, 5-7) into Beam's

system (with flat array of light sources 401). 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. EX1006, ¶¶17-20, 23-26, FIGS. 1-2, 5-7. This is a simple hardware combination.

179. 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, 6.

180. 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

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

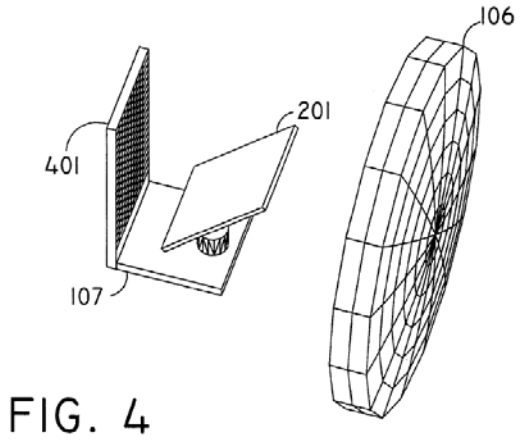


FIG. 4

EX1005, FIG. 4.

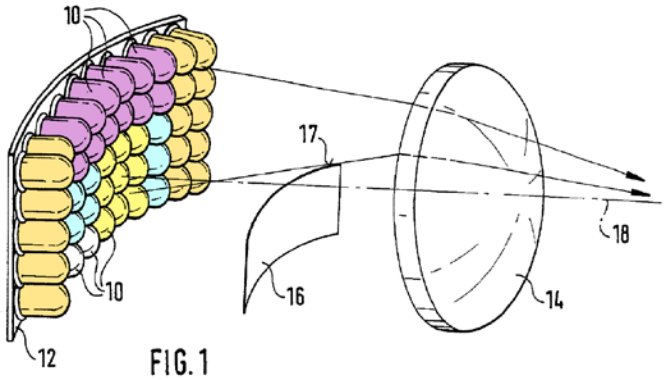


FIG. 1

EX1006, FIG. 1 (annotated).

181. Like the software implementation above, this hardware combination—Beam's array of light sources 401 and Thominet's semiconductor sources 10 on curved surface 12 arranged in directional beam regions 22, 24, 26, 28—would have provided Beam's system with different spatial distributions for different driving situations, as in Thominet, thereby improving driver safety. This 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 (improved visibility and safety). Overall, this is a simple hardware implementation.

182. 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 clusters/sources (e.g., directional beam regions 22, 24, 26, 28) for different functions (hardware implementation).

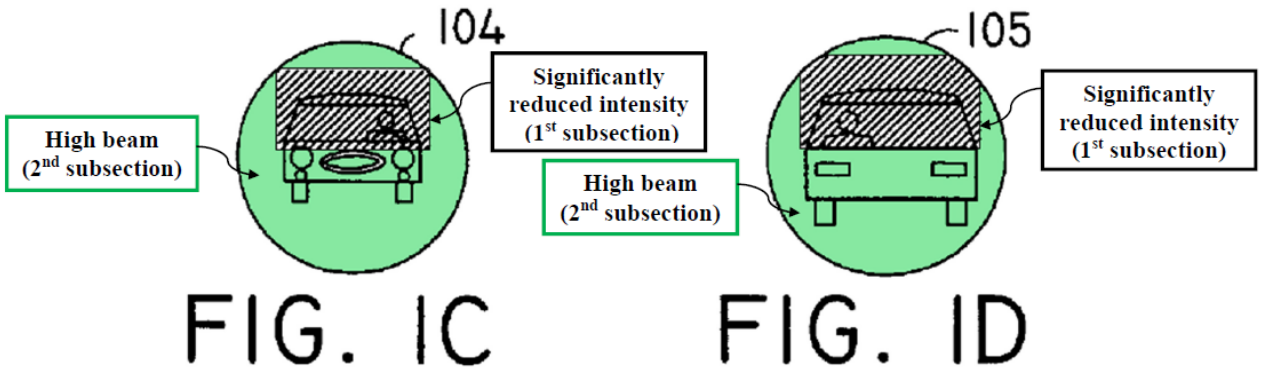
183. Such modification would have been routine and well within a POSA's skill due to the similarities in Beam's and Thominet's adaptive systems—their common components were well known and there would have been no limitations for a POSA to make such modifications. And in combining Beam with Thominet's 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).

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

8. [26.7]: "the headlight beam spatial light distribution shaped to provide high beam illumination for a driver of the vehicle, in at least the second subsection,"

185. In my opinion, [26.6]-[26.8] are part of the same clause but will be addressed separately for simplicity below.

186. Beam discloses illumination in non-shaded areas is "a *much higher brightness beam*" and "the area of the beam that would dazzle the driver will be darkened, *while maintaining f[u]ll intensity elsewhere*." EX1005, 3:19-24, 2:59-3:3, FIGS. 1, 1C-1D, 7; EX1005, 6:40-44 ("*bright high beams*"), 6:11-12 ("*maximum intensity*"), 1:5-18 ("*intense forward illumination*"). This "provide[s] high beam illumination" in the second subsection.



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

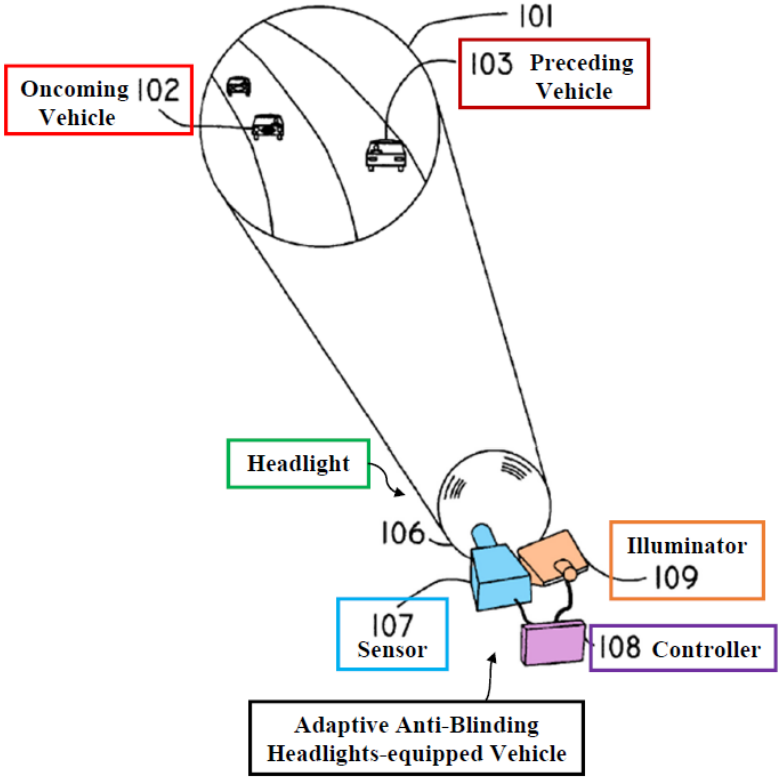
187. In view of the above, Beam discloses this element.

9. [26.8]: "while mitigating glaring light illuminating at least the first subsection including detected other vehicles or pedestrians;"

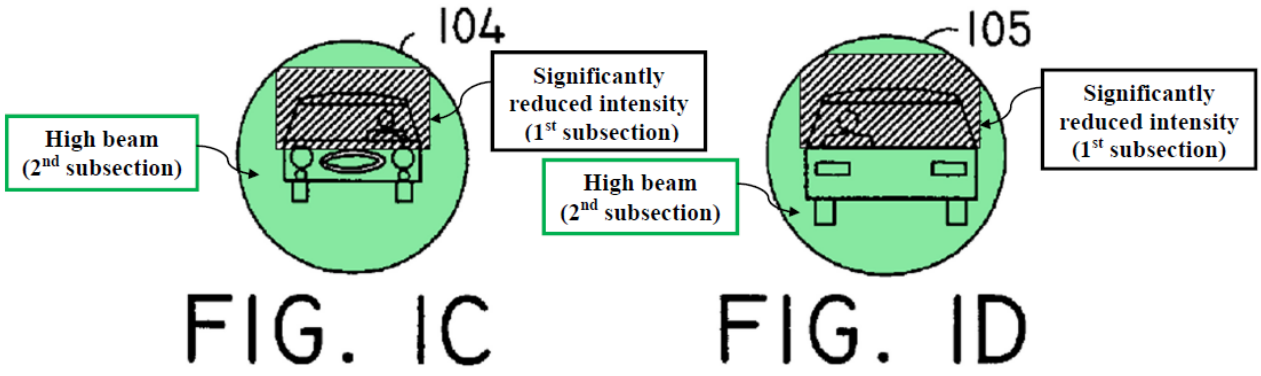
188. In my opinion, [26.6]-[26.8] are part of the same clause but will be addressed separately for simplicity below.

189. Beam discloses illumination in shaded areas is "*significantly less* than with current *low beams*" and "*reformatting* the *pattern*…to *prevent* it from illuminating *certain areas*…thus *eliminating the blinding* of a driver in an

oncoming vehicle." EX1005, 1:5-18, FIGS. 1, 1C-1D, 7; EX1005, 2:59-3:3 ("area…*dazzl[ing]* the driver will be *darkened*"), 4:20-25 ("*shaded areas*"), 5:46-54 ("*blanked area*"), 5:65-6:4. This "mitigat[es] glaring" 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).

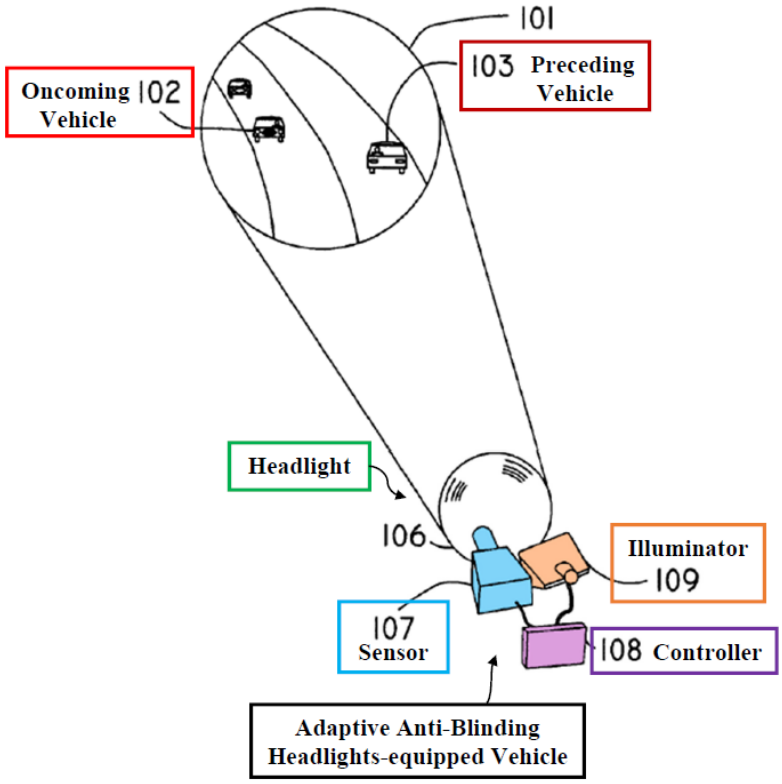


EX1005, FIGS. 1C-1D (annotated).

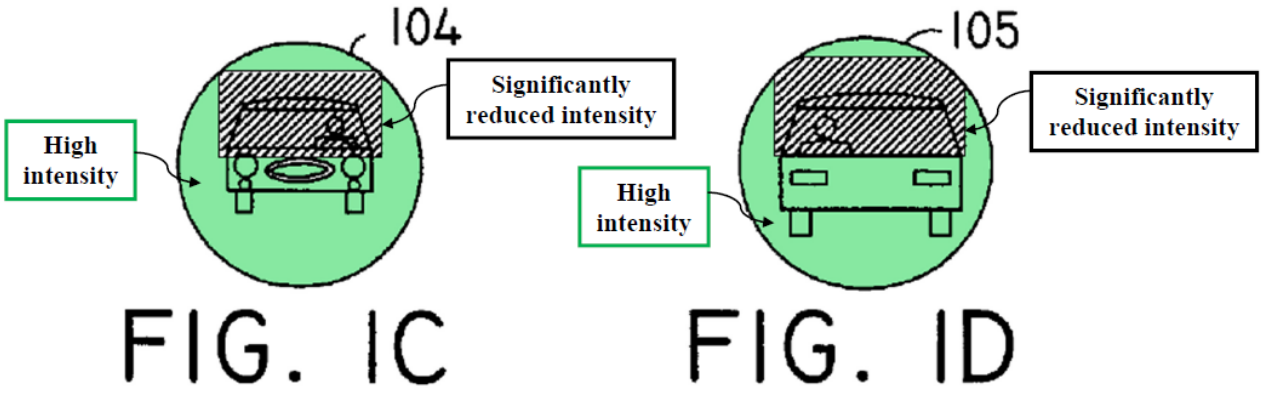
190. In view of the above, Beam discloses this element.

10. [26.9]: "sending control signals implementing the control strategy to an electronic control circuitry configured to operate the light-clusters; and"

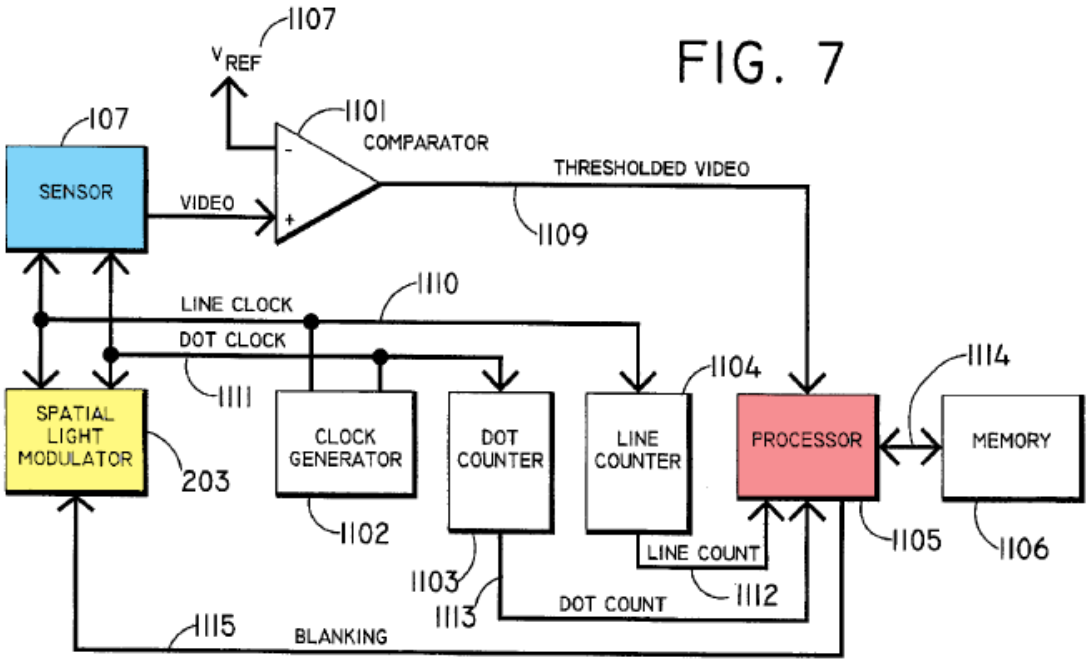
191. Beam discloses "controller module uses the sensor spatial data (video)…to control the Illuminator" and "processor…outputs blanking signals…command[ing] the appropriate pixels to be reduced." EX1005, 6:14-19, 5:34-54, FIGS. 1, 1C-1D, 7; EX1005, 8:35-38 ("controlling individual rays…producing a desired output"), 5:61-65 ("controlled by a processor"), 1:5-18 ("reformatting the pattern"), 6:30-33. Thus, Beam's processor sends control signals (blanking or non-blanking) to illuminator (SLM 203) to reduce or not reduce microbeams in the array to "implement the control strategy" and "operate the light-clusters." EX1005, 5:34-54, FIGS. 1, 1C-1D, 7; *see also supra* Section X.B.7.



EX1005, FIG. 1 (annotated).



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



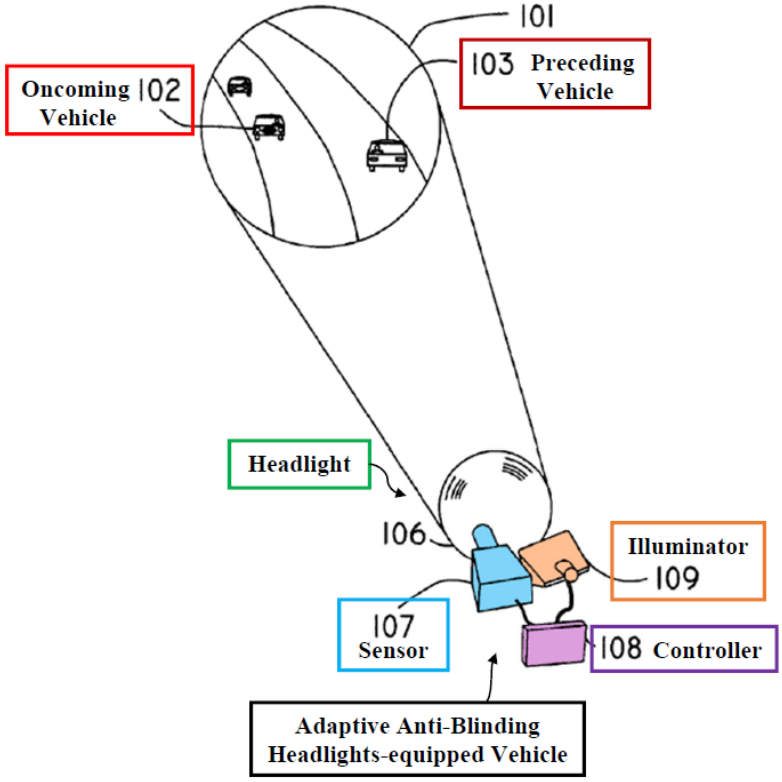
EX1005, FIG. 7 (control circuitry) (annotated).

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

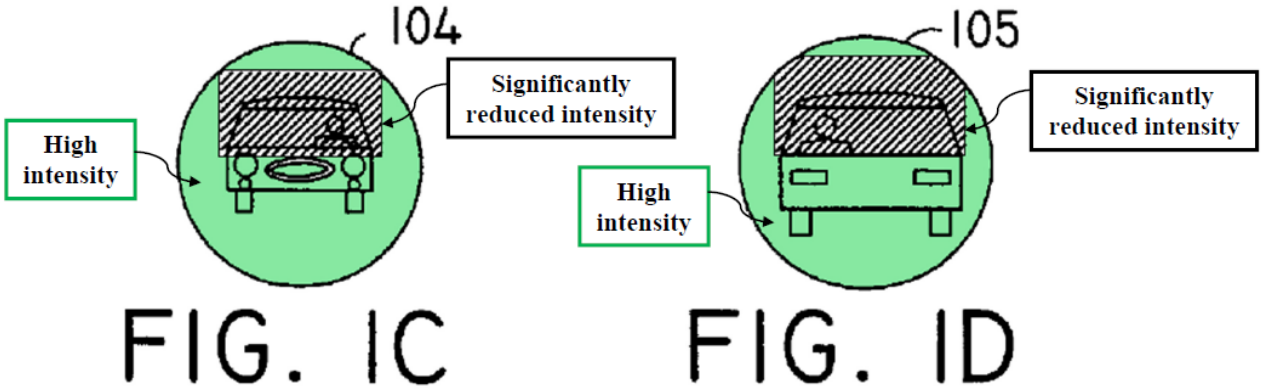
11. [26.10]: "controlling the light clusters via the electronic control circuitry to collectively emit the headlight beam meeting the determined illumination requirements."

193. Beam discloses "controller module uses the *sensor spatial data (video)*…to *control the Illuminator*" and "*processor*…outputs *blanking signals*…*command[ing] the appropriate pixels to be reduced*." EX1005, 6:14-19, 5:34-54, FIGS. 1, 1C-1D, 7; EX1005, 8:35-38, 5:61-65, 1:5-18, 6:30-33; *see supra* Section X.B.10.

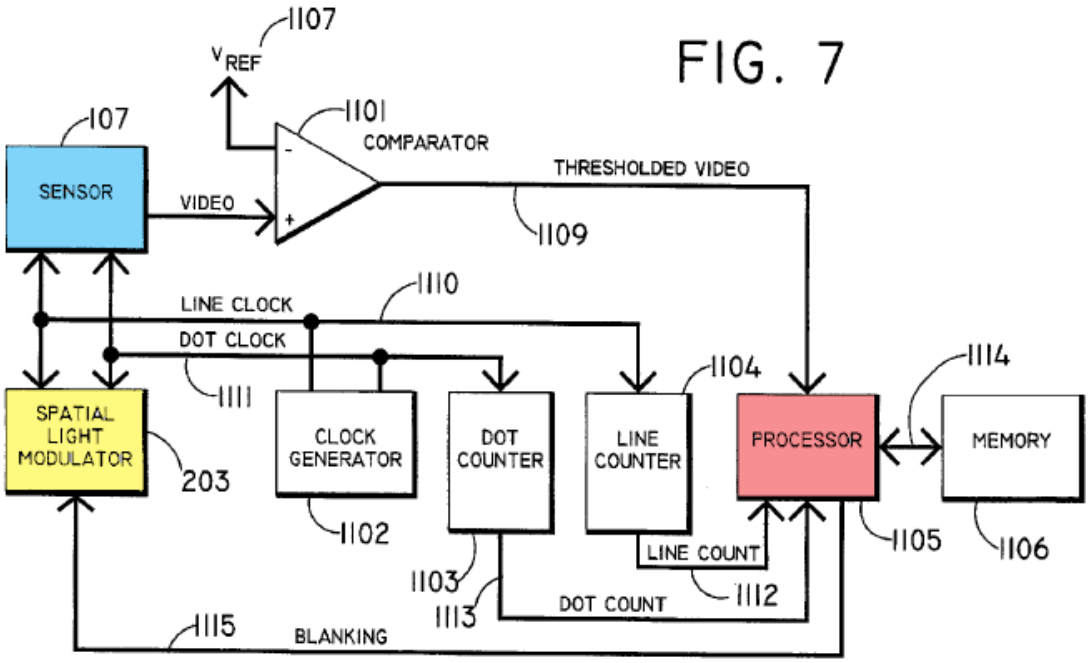
194. Thus, Beam's illuminator (via SLM 203) receives control signals (blanking or non-blanking) from processor to "control[] the light clusters…to collectively emit the headlight beam."



EX1005, FIG. 1 (annotated).



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



EX1005, FIG. 7 (control circuitry) (annotated).

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

C. Claim 27: "The method of claim 26, wherein the determining illumination requirements further comprises: determining the illumination requirements based on headlight modes comprising one or more of parking lights, low beam, high beam, cornering lights, load leveling adjustment, integral turn signal indicators, inputtable alternate beam pattern selection, and specified preferential headlight illumination color of the driver."

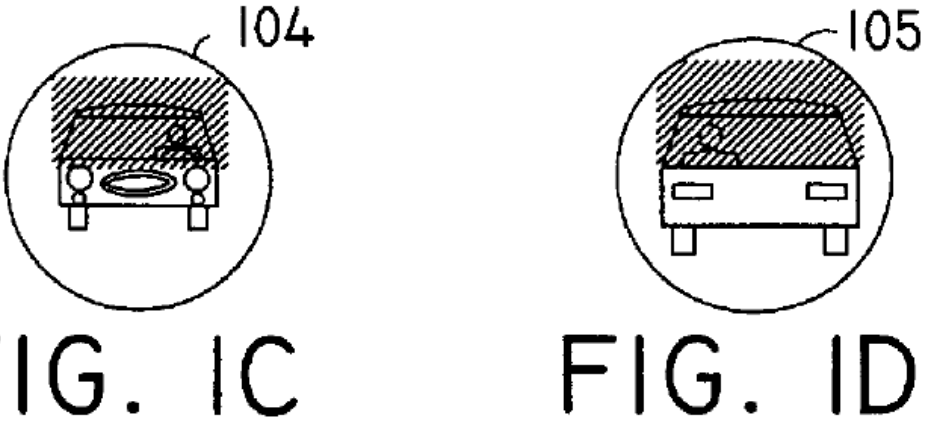
196. As discussed, Beam discloses "determining illumination requirements." *Supra* Section X.B.4. Beam also discloses "*bright high beams*" and "*high beam headlights*," and operating "at *maximum intensity* at all times." EX1005, 6:11-56; EX1005, 3:29-31 ("*bright light mode*"), 3:34-36 ("manually

lower[ing] the beams for…*rain, snow,* or *fog*"). Thus, Beam discloses multiple "headlight modes," for example, a "high beam" mode.

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

D. Claim 30: "The method of claim 26, wherein the control strategy dynamically adapts the headlight beam based on real-time changes to the data sensed by the sensors indicating a change to at least one of beings, objects and preceding vehicles ahead of the first vehicle."

198. Beam discloses "[s]election of the particular microbeams…is performed *continuously* and *dynamically*." EX1005, 5:61-6:4, FIGS. 1, 1C-1D; EX1005, 6:19-27 ("the blanked area *tracks the location* of the oncoming vehicle, *dynamically varying* in position and size"), 5:34-36, 4:10-25.



EX1005, FIGS. 1C-1D.

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

E. Claim 31: "The method of claim 26, further comprising receiving input to an override switch and, responsive to the input, adjusting automatic operation of the headlight system to reflect operator instruction as indicated by the input to the override switch or by

further input to a different vehicle input other than the override switch."

200. Beam discloses "[a]n *override*…to *activate* the high beams to signal another driver." EX1005, 3:31-34; EX1005, 6:28-30 ("a *manual override*"), 1:26-34 ("the driver will *switch* the headlights...*switch* to high beams"). A POSA would have understood that Beam discloses "an override switch" because "a *manual* override" includes a manual or digital actuator (e.g., a switch) to "activate" the override.

201. Further, a "switch" was well known and thus, at a minimum, a switch would have been an obvious actuator for Beam's override. EX1007, 48:12-15 ("activating the manual high beam *switch*…to allow the driver to override"); EX1010, 6:34-7:3 ("light switches"). And a POSA would have had a reasonable expectation of success, since a switch would have been just a simple substitution of one known prior art element for another.

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

203. Thus, Beam, alone or in combination with Thominet, discloses or renders obvious claims 26-27 and 30-31 of the '503 patent.

XI. GROUND 2: THE COMBINATION OF BEAM, THOMINET, AND STAM RENDERS OBVIOUS CLAIM 65.

204. In my opinion, Beam/Beam-Thominet explicitly or implicitly discloses every feature in claim 65. As discussed, Beam is combined with

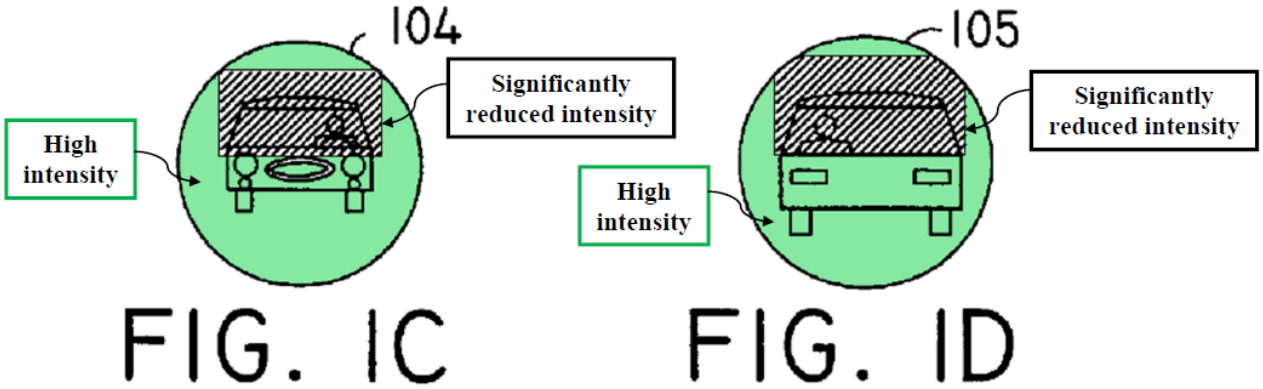
Thominet, for [65.9], which discloses a well-known implementation of adaptive headlamps—directional light clusters/sources for different functions—rendering the claim obvious. *See supra* Sections X.A/X.B.7. But to avoid doubt, Beam-Thominet is combined with Stam, for elements [65.6] and [65.8], which discloses a well-known feature of adaptive headlamps—outputting light above or below a predefined illuminance depending on the driving situation—rendering the claim obvious.

205. 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, 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.

206. 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.

207. Further, Beam discloses illumination in shaded areas is "*significantly less* than with current *low beams*" (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*" (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).

208. Thus, 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 [65.6] and [65.8].

209. 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 [65.6] and [65.8].

210. As explained, Stam discloses a predefined dimmed illuminance of 0.1 fc within 700 feet, which is equal to about 1.1 lux within 700 feet. 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 (lm/ft^2 to lm/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.

211. As described in Section X.A, a POSA would have been motivated to combine Beam-Thominet. As discussed, Beam discloses a "predefined illuminance" based on a low beam illuminance. Stam provides a specific

"predefined illuminance" value based on a dimmed illuminance to reduce glare. Naturally, it would have been obvious to a POSA designing an adaptive headlamp to implement Stam's predefined (dimmed) illuminance value in Beam-Thominet's system, to further control an intensity of Beam's directional microbeams to prevent glare, furthering the purpose of improving driver safety. EX1005, 3:8-14, 3:36-44, 5:33-54, 7:1-13.

212. Stam is from the same field—controllable headlamps with dynamic illumination—and includes the same building blocks (light sources, sensors, controllers). Like Beam-Thominet, driver visibility and safety is 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 reduce glare. EX1007, 1:14-31, 9:12-10:8, Abstract, 58:11-33.

213. *First*, including a predefined value for Beam-Thominet's controller—Stam's *technique* of predefined dimmed illuminance—would have further enhanced Beam-Thominet's system by outputting illuminance *relative to* the predefined value (below or above), preventing glare to other vehicles and increasing illumination to other areas. *Second*, a POSA would have sought to incorporate this *known feature* of Stam (a predefined dimmed illuminance, *see* EX1007, Abstract, 1:14-31, 9:12-10:8) into Beam's system (with controller 108

and/or illuminator 109). This would have, like Stam, provided a specific "predefined" illuminance, below and above which to adjust illumination for desired areas, further improving safety. EX1007, Abstract, 1:14-31, 9:12-10:8.

214. A POSA would have understood that a predefined value for Beam-Thominet's controller/illuminator, based on Stam's predefined dimmed illuminance (0.1 fc within 700 feet), would have provided greater illumination control *referenced to* a predefined value to prevent glare and increase illumination to other areas, thereby improving driver safety. This would have merely been applying Stam's *known technique* (a predefined dimmed illuminance) to Beam-Thominet's similar, known device (dynamic headlamp with controllable beams), in the same way. Stam's known technique is fully described along with its benefits (improved safety); thus, a POSA would have readily applied it to similar systems, such as Beam-Thominet's, in the same way.

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

216. A POSA would have had a reasonable expectation of success combining Beam-Thominet and Stam, 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 to output Beam's headlamp illumination below and above that value for respective illumination areas. This 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.

217. I lay out below the specific disclosures of Beam, Thominet, and Stam, and expand on this combination and reasonable expectation of success analysis below specifically with reference to elements [65.6], [65.8], and [65.9].

B. Independent Claim 65[9]

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

218. [65.P] is identical to [26.P]. *Supra* Section X.B.1.

[9] Claim 65 and claim 26 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

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

2. [65.1]: "utilizing one or more sensors of a first vehicle to obtain and provide data,"

220. In my opinion, [65.1] and [65.2] are part of the same clause but will be addressed separately for simplicity below.

221. In my opinion, the features of [65.1] are included in [26.1]. *Supra* Section X.B.2; EX1005, 5:34-36 ("*spatial scene data* from sensor 107"). Therefore, my above analysis in Section X.B.2 applies.

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

3. [65.2]: "the data including data indicating at least a second vehicle;"

223. In my opinion, [65.1] and [65.2] are part of the same clause but will be addressed separately for simplicity below.

224. In my opinion, the features of [65.2] are included in [26.2]. *Supra* Section X.B.3; EX1005, 4:10-25 ("headlights of an oncoming vehicle and/or taillights of a vehicle ahead are…detected by a sensor 107"). Therefore, my above analysis in Section X.B.3 applies.

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

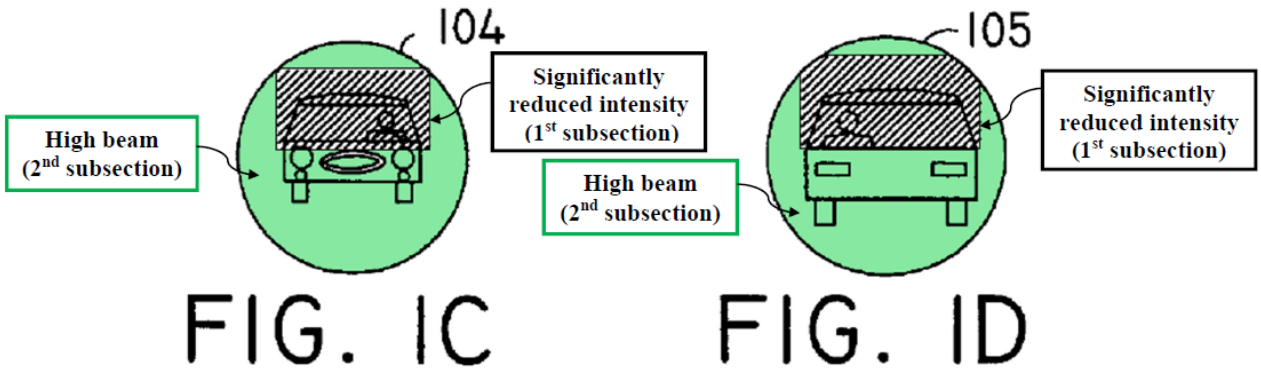
---

declaration as appropriate, and the same prior art citations are applicable to those elements as provided in the referenced analysis.

4. [65.3]: "determining illumination for at least a first subsection including the second vehicle and"

226. In my opinion, [65.3]-[65.8] are part of the same clause but will be addressed separately for simplicity below.

227. In my opinion, the features of [65.3] are included in [26.4]. *Supra* Section X.B.5; EX1005, 1:5-18 ("*reformatting* the *pattern* of a beam…to *prevent* it from illuminating *certain areas*…eliminating the blinding of a driver in an *oncoming vehicle*"). Therefore, my above analysis in Section X.B.5 applies.



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

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

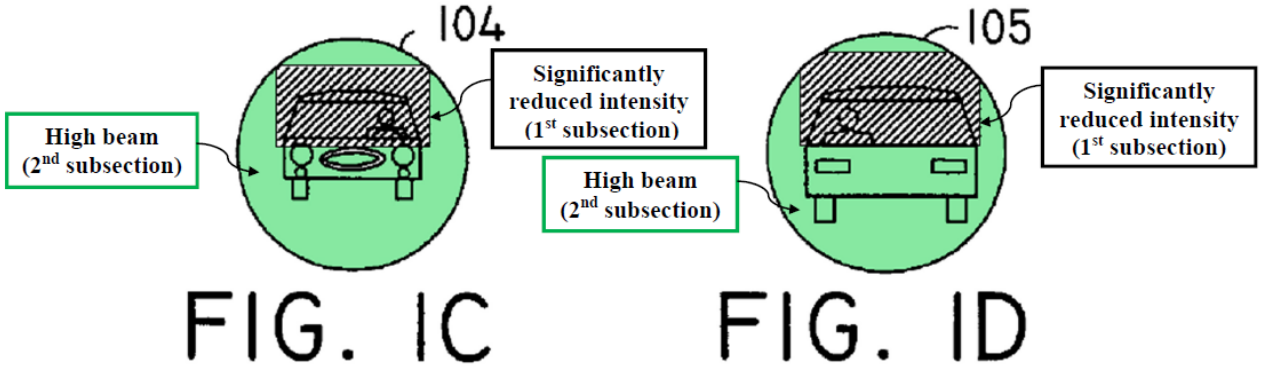
5. [65.4]: "at least one or more second subsections, to either side of the first subsection,"

229. In my opinion, [65.3]-[65.8] are part of the same clause but will be addressed separately for simplicity below.

230. In my opinion, the features of [65.4] are included in [26.5]. *Supra* Section X.B.6; EX1005, 3:19-24 ("*higher brightness beam* in the areas which *do*

not dazzle the drivers ahead"), FIGS. 1C-1D. Therefore, my above analysis in Section X.B.6 applies.

231. Thus, the processor processes the inputted spatial sensor data, identifies a vehicle, and determines an area (not including the vehicle) to be illuminated at "maximum intensity" within a second subsection (e.g., non-shaded area) to either side of the first subsection (e.g., shaded area). EX1005, 3:19-24, 2:59-3:3, 6:11-12, 6:40-44, 7:30-36.



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

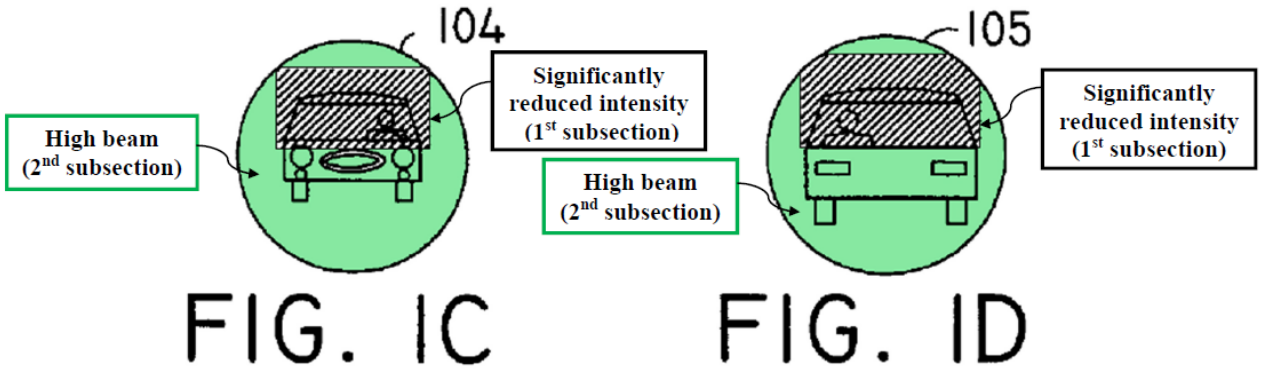
232. In view of the above, Beam discloses this element.

6. [65.5]: "including determining an illumination level for the first subsection"

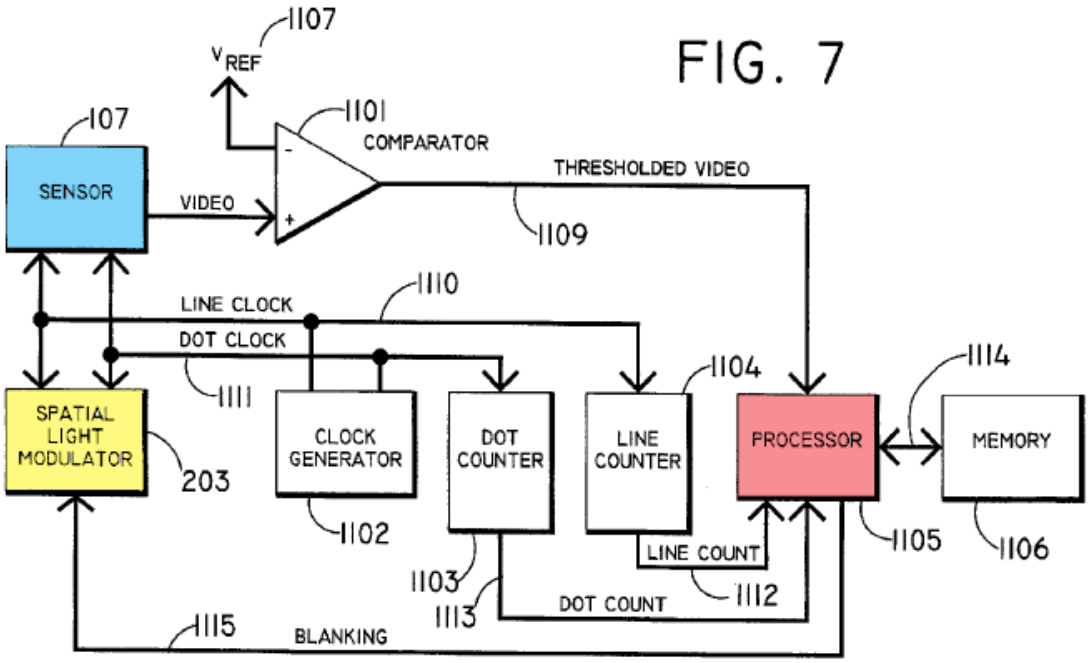
233. In my opinion, [65.3]-[65.8] are part of the same clause but will be addressed separately for simplicity below.

234. Beam discloses "*reformatting* the *pattern*…to *prevent* it from illuminating *certain areas*…thus *eliminating the blinding* of a driver in an *oncoming vehicle*" so that illumination in shaded areas is "*significantly less* than

with current *low beams*." EX1005, 1:5-18, Abstract ("*determine* the location of light sources…using that information to *control the intensity*"), FIGS. 1, 1C-1D, 7; EX1005, 2:59-3:3 ("controlling an area *determined* by analyzing the position of the lights…the area of the beam…*dazzl[ing]* the driver will be *darkened*"), 4:10-25 ("*determine* which microbeams must be reduced in intensity…*shaded areas*"), 5:13-15 ("uses the data to *determine* the size and position of the light emitters to be dimmed"), 5:33-54 ("*blanked area*"), 8:23-38 ("*determining*…an area to be darkened within said area of illumination…*producing* a desired output pattern"), 5:65-6:4. Thus, Beam's processor "determin[es] an illumination level" for the first subsection (shaded area). *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* Sections X.B.5/X.B.9.



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



EX1005, FIG. 7 (annotated).

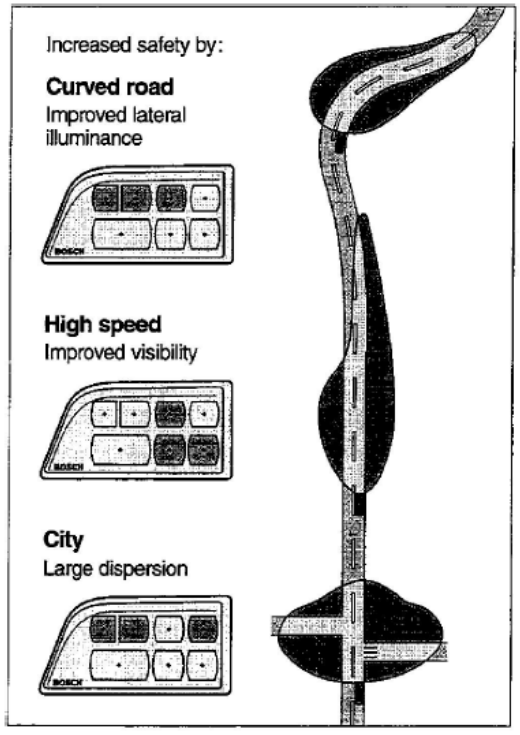


Fig.1: Three standard driving situations with adapted light pattern seen from the bird eye's view.

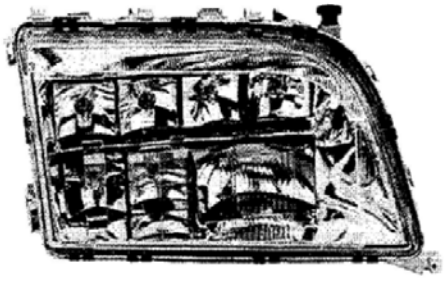
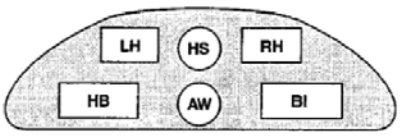


Fig 4: ALP *headlamp* sample



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

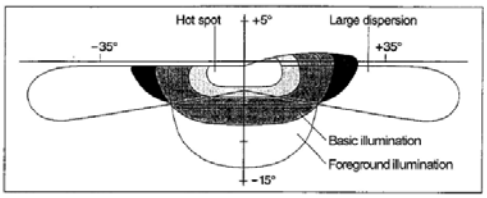


Fig. 3: Light pattern of multiple beam *headlamp (Isolux* curves in wall projection): The individual light *pattern* of multiple sub-units sum up to the total adaptive light pattern

EX1017, FIGS. 1 and 3-5.

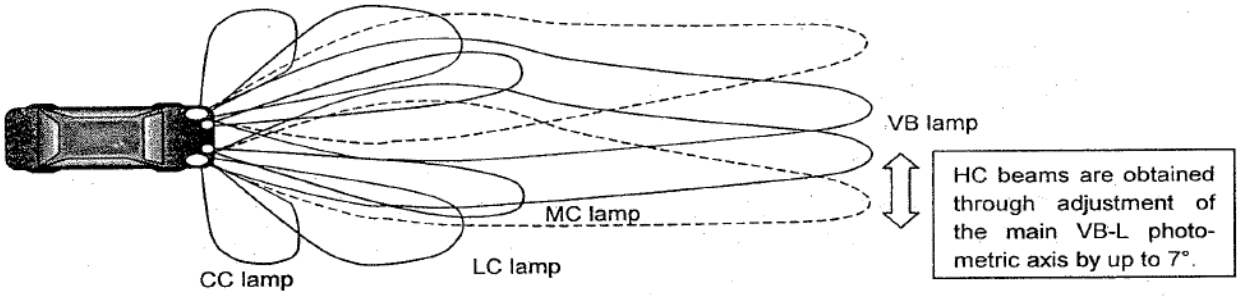


Fig. 3-3: Imaged Illumination Configurations on Road Surface

EX1026, FIG. 3-3.

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

7. [65.6]: "that substantially illuminates the first subsection below a predefined illuminance, and"

236. In my opinion, [65.3]-[65.8] are part of the same clause but will be addressed separately for simplicity below.

(a) Beam discloses this element.

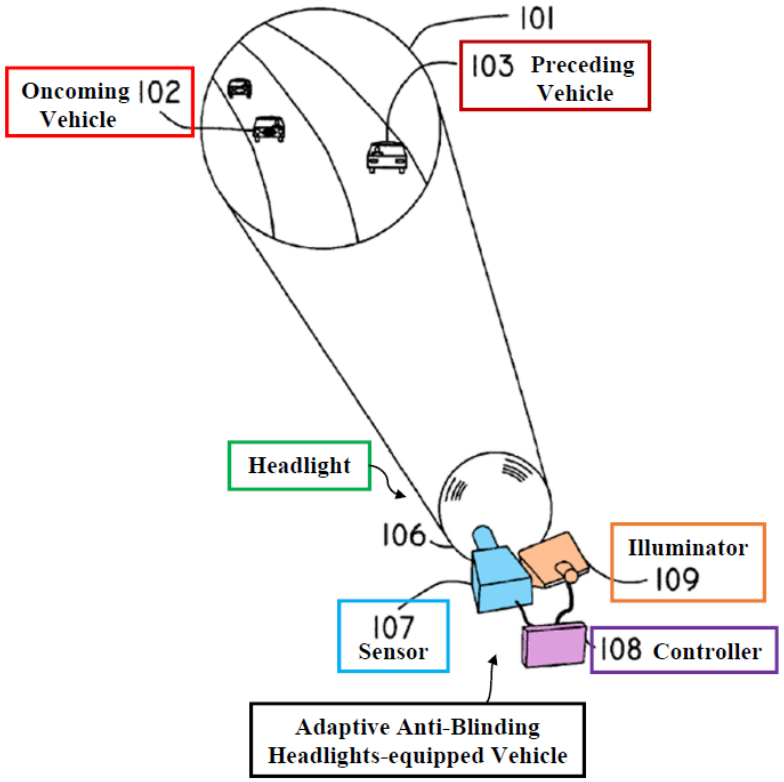
237. In my opinion, Beam discloses this element, [65.6]. *Supra* Section XI; EX1005, 1:5-18 ("*reformatting* the *pattern*…to *prevent* it from illuminating *certain areas*…thus *eliminating the blinding* of a driver in an *oncoming vehicle*"), 6:30-33 ("*default* illumination level"), 2:59-3:3 (controlling an area *determined* by analyzing the position of the lights…the area of the beam…*dazzl[ing]* the driver will be *darkened*), Abstract ("*determine* the location of light sources…using that information to *control the intensity*"), 4:10-25 (*determine* which microbeams must be reduced in intensity…*shaded areas*), 5:13-15 ("uses the data to *determine* the size and position of the light emitters to be dimmed"), 5:33-54 ("*blanked area*"),

8:23-38 ("*determining*…an area to be darkened within said area of illumination…*producing* a desired output pattern"), 5:65-6:4, FIGS. 1, 1C-1D, 7.

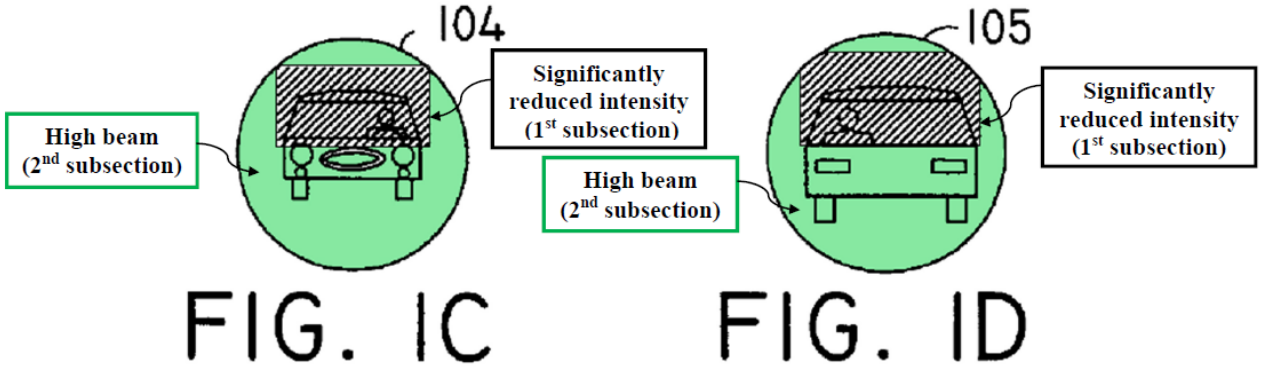
238. Specifically, Beam discloses a "*default* illumination level will be the equivalent of today's *low beams*" and that illumination in *shaded* areas is "*significantly less* than with current *low beams*" (e.g., below the default low beam illuminance level). EX1005, 6:30-33, 2:59-3:3, FIGS. 1, 1C-1D, 7; EX1005, Abstract, 4:21-25 ("illumination in the *shaded areas* being *reduced significantly*"). The first subsection (shaded area) is thus illuminated "below a 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."

239. 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

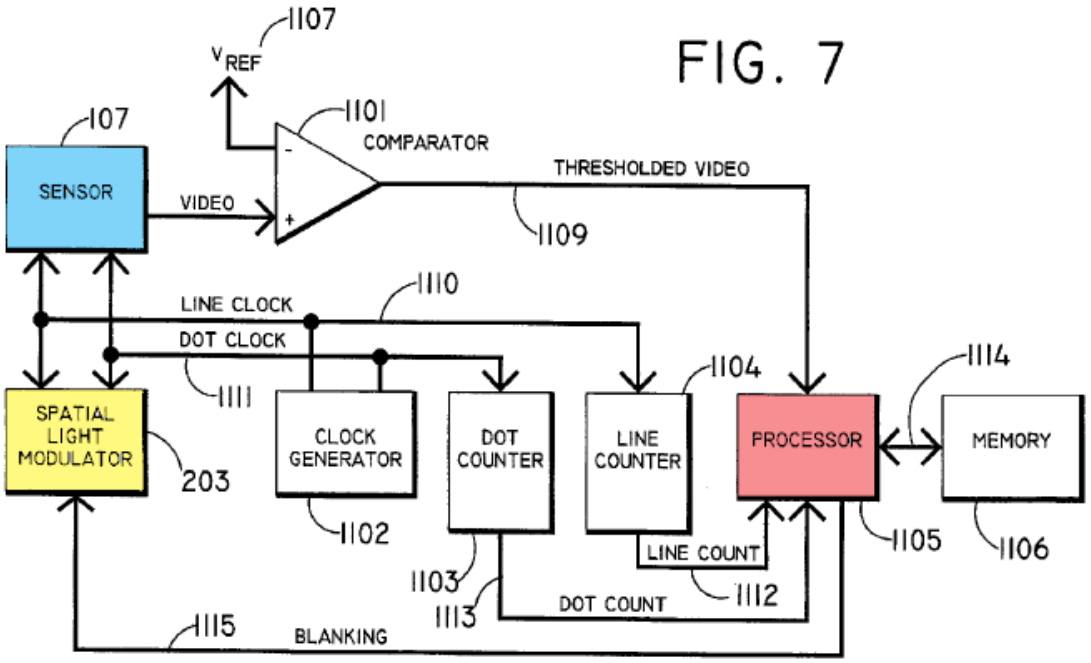
luminance"), 18 ("[g]lare reduction and visibility improvement"), FIGS. 2.1, 2.8; EX1017, 5 ("the adaptive light pattern should support to direct the concentration to the most important zone for the current driving situation"), FIGS. 1, 3-5; EX1026, 451, 456, FIGS. 1, 3-3; EX1030, 3-8, 21-41, 49, 62-69, Table 5.5.



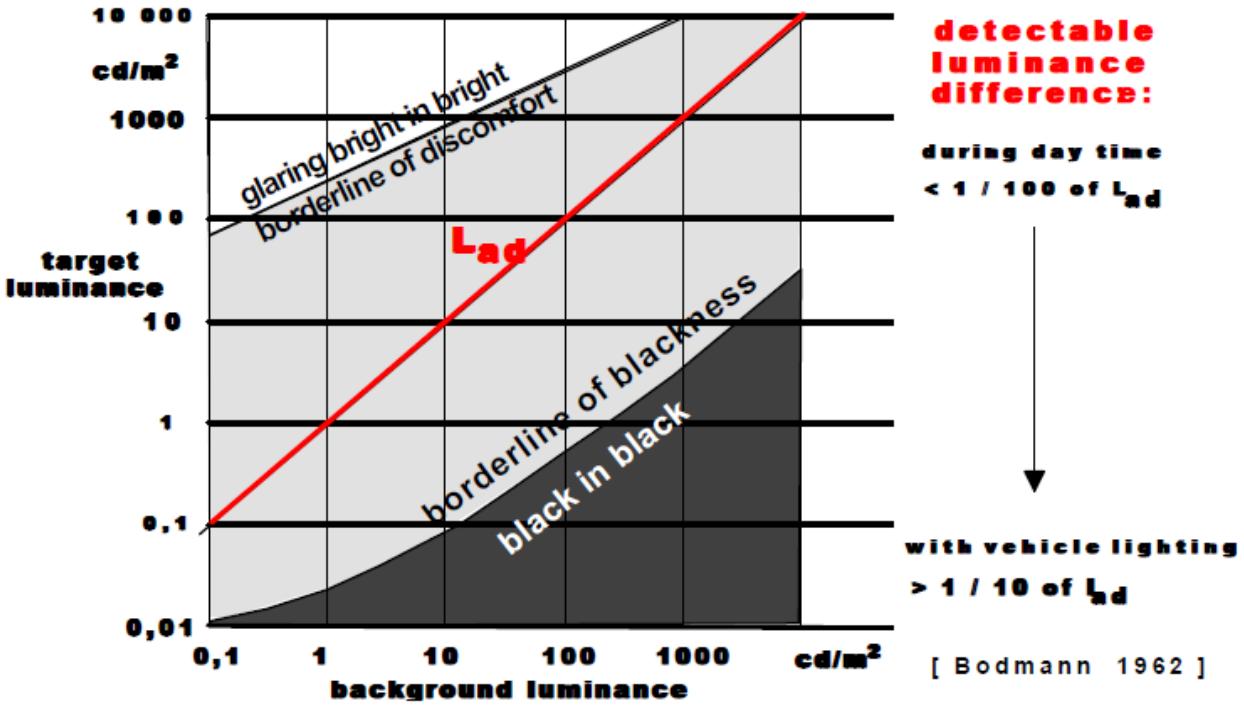
EX1005, FIG. 1 (annotated).



EX1005, FIGS. 1C-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.

240. If Patent Owner argues, incorrectly, that Beam-Thominet does not disclose [65.6], Stam also discloses [65.6], and it would have been obvious to incorporate Stam's disclosure into Beam-Thominet.

241. 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, 1:14-32; 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[10]) within 700 feet (or 213 meters), corresponding to the "predefined illuminance" recited in [65.6].

242. 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 reduce glare. EX1007, 1:14-31, 9:12-10:8, Abstract, 58:11-33.

243. 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.

244. 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).

245. 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 [65.6].

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

246. As described in Section X.A, a POSA would have been motivated to combine Beam-Thominet. As discussed, Beam discloses a "predefined illuminance" based on a low beam illuminance. Stam provides a specific "predefined illuminance" value based on a dimmed illuminance to reduce glare. Naturally, it would have been obvious to a POSA designing an adaptive headlamp to implement Stam's predefined (dimmed) illuminance value in Beam-Thominet's system, to further control an intensity of Beam's directional microbeams to prevent glare, furthering the purpose of improving driver safety. EX1005, 3:8-14, 3:37-45, 5:33-54, 7:1-13.

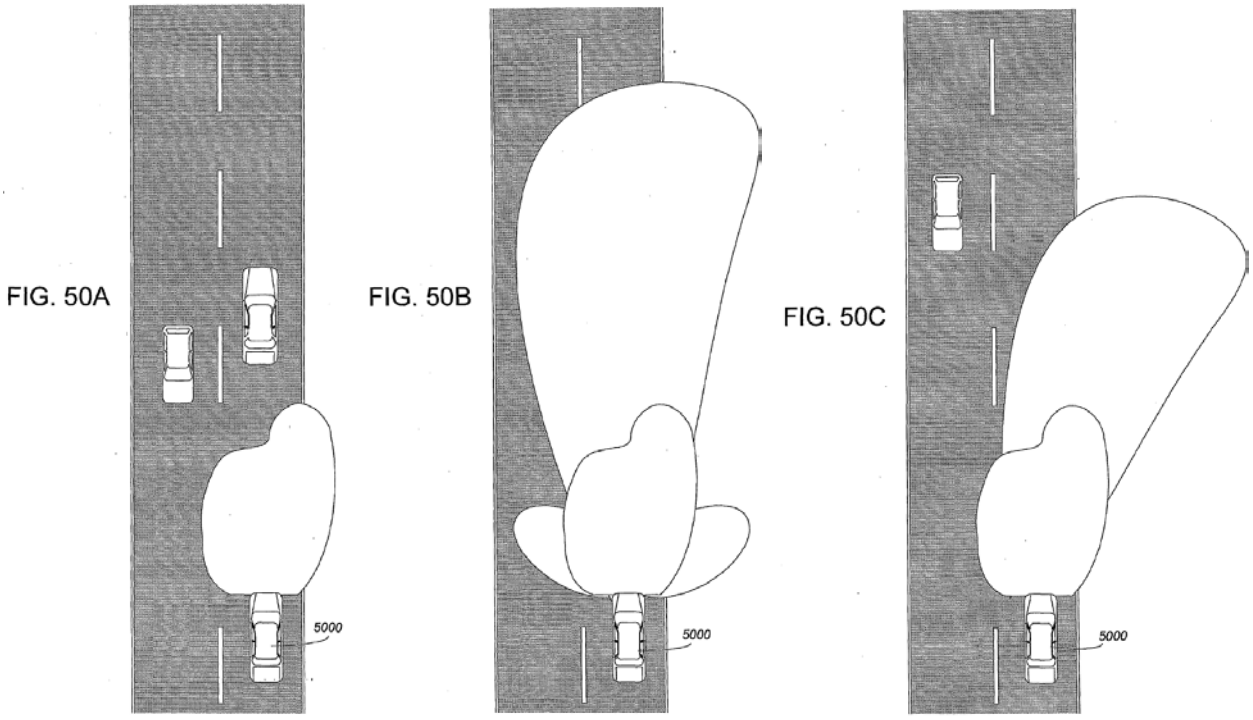
247. Stam is from the same field—controllable headlamps with dynamic illumination—and includes the same building blocks (light sources, sensors,

controllers). Like Beam-Thominet, driver visibility and safety is 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 reduce glare. EX1007, 1:14-31, 9:12-10:8, Abstract, 58:11-33.

248. *First*, including a predefined value for Beam-Thominet's controller—Stam's *known technique* of predefined dimmed illuminance—would have further enhanced Beam-Thominet's system by outputting illuminance *relative to* the predefined value (below or above), preventing glare to other vehicles and increasing illumination to other areas. *Second*, a POSA would have sought to incorporate this *known feature* of Stam (e.g., a predefined dimmed illuminance, *see* EX1007, Abstract, 1:14-31, 4:7-15, 9:12-10:8, FIGS. 11, 50A-50C) into Beam's system (with controller 108 and/or illuminator 109). This would have, like Stam, provided a specific "predefined" illuminance, below and above which to adjust illumination for desired areas, further improving safety. EX1007, Abstract, 1:14-31, 9:12-10:8.

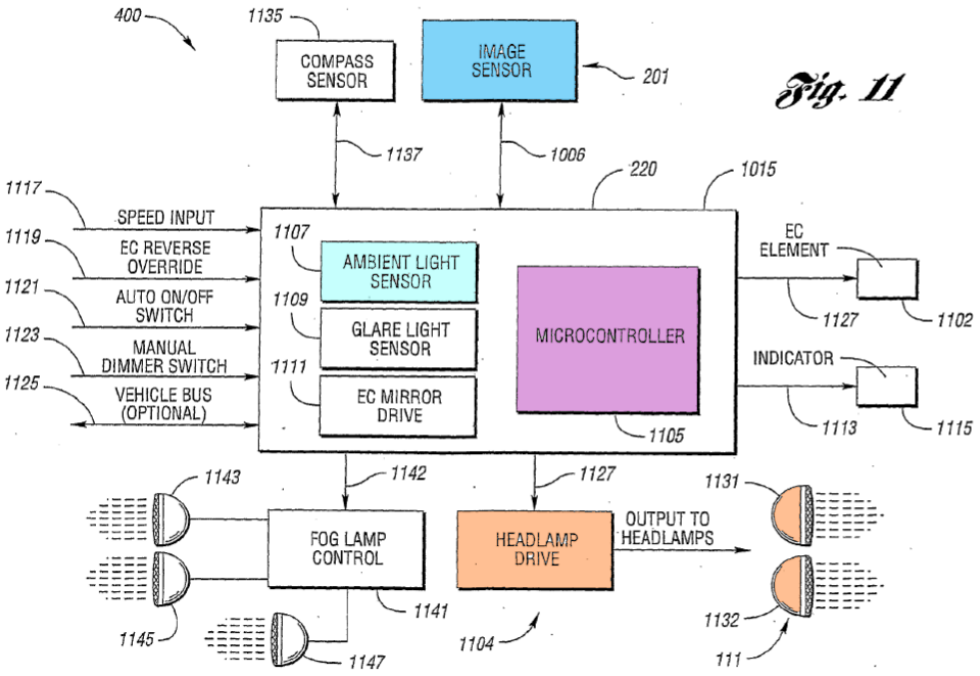
249. Stam's *technique*, like Beam-Thominet, seeks to enhance driver comfort and safety—using a predefined dimmed illuminance to reduce glare. EX1007, Abstract, 1:14-31, 9:12-10:8, FIGS. 50A-50C. Stam discloses "to *avoid an illuminance of 0.1 foot candles (fc)* incident on another vehicle…headlamps

should be *dimmed within 700 feet* of another vehicle." EX1007, 1:14-31 ("control the amount of *glare*"), 9:12-10:8, 58:11-33, FIG. 11.



EX1007, FIGS. 50A-50C.

250. 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).

251. A POSA would have understood that a predefined value for Beam-Thominet's controller/illuminator based on Stam's predefined dimmed illuminance (0.1 fc within 700 feet), would have provided greater illumination control *referenced to* a predefined value to prevent glare and increase illumination to other areas, thereby improving driver safety. This would have merely been applying Stam's *known technique* (a predefined dimmed illuminance) to Beam-Thominet's similar, known device (dynamic headlamp 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.

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

253. 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.

254. 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.

255. Thus, the combined Beam-Thominet-Stam system would illuminate the first subsection (e.g., shaded area) "below a predefined illuminance." *Supra* Section XI.A.

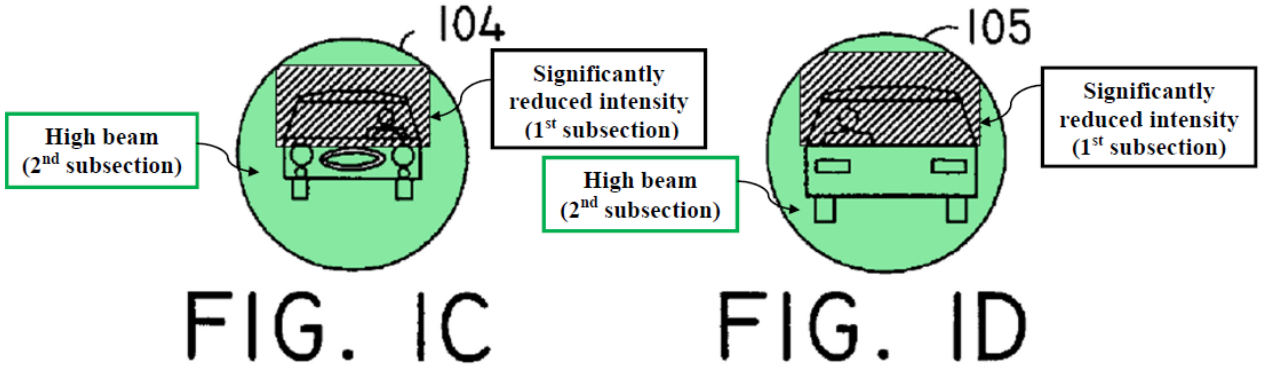
256. In view of the above, Beam (with Thominet), or in combination with Stam, discloses or renders obvious this element.

8. [65.7]: "determining an illumination level for the one or more second subsections"

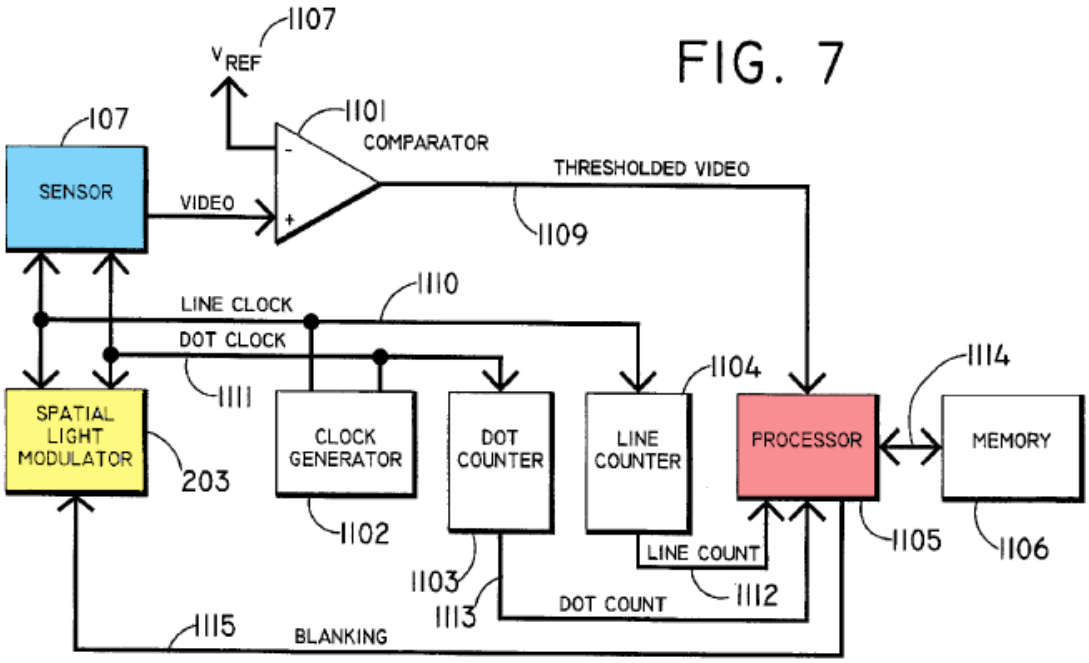
257. In my opinion, [65.3]-[65.8] are part of the same clause but will be addressed separately for simplicity below.

258. Beam discloses "*reformatting* the *pattern*…to *prevent* it from illuminating *certain areas*…while continuing to provide *intense forward illumination*" so that illumination in non-shaded areas is "a *much higher brightness beam*" and "the area of the beam that would dazzle the driver will be darkened, *while maintaining f[u]ll intensity elsewhere*." EX1005, 1:5-18, 3:19-24, 2:59-3:3, Abstract ("*determine* the location of light sources…using that information to *control the intensity*"), FIGS. 1, 1C-1D, 7; EX1005, 6:40-44 ("*bright high beams*"), 6:11-12 ("*maximum intensity*"), 7:30-36 ("controller providing feedback to cause…a *high level of illumination*"), 8:23-38 ("*determining*…an area to be darkened within said area of illumination…*producing* a desired output pattern"), 5:33-54. Thus, Beam's processor "determin[es] an illumination level" for the second subsection (non-shaded area). *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; *see also*, *supra* Sections X.B.6/X.B.8.



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



EX1005, FIG. 7 (annotated).

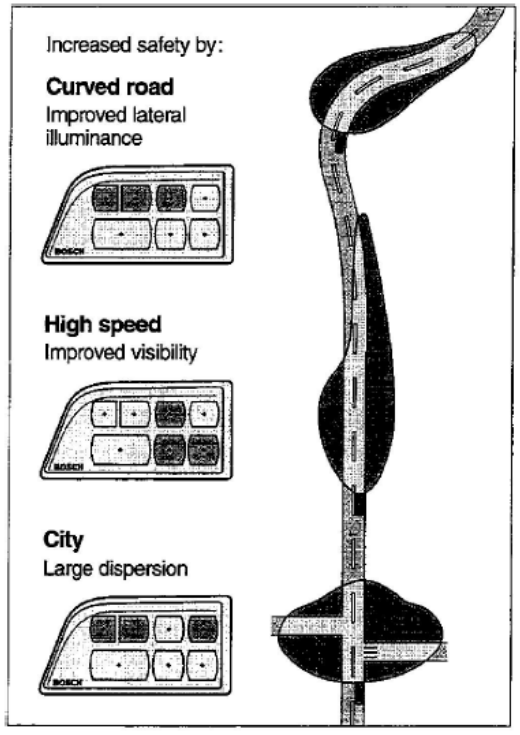


Fig.1: Three standard driving situations with adapted light pattern seen from the bird eye's view.

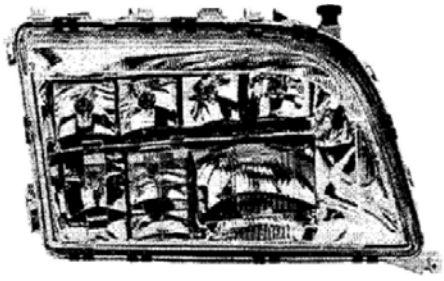
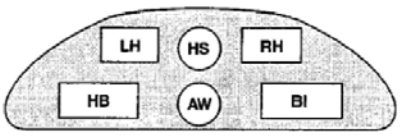


Fig 4: ALP *headlamp* sample



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

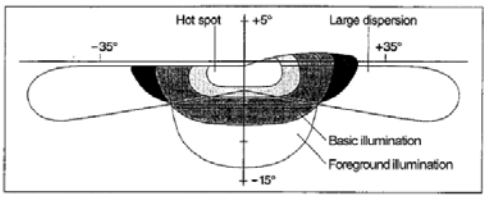


Fig. 3: Light pattern of multiple beam *headlamp (Isolux* curves in wall projection): The individual light *pattern* of multiple sub-units sum up to the total adaptive light pattern

EX1017, FIGS. 1 and 3-5.

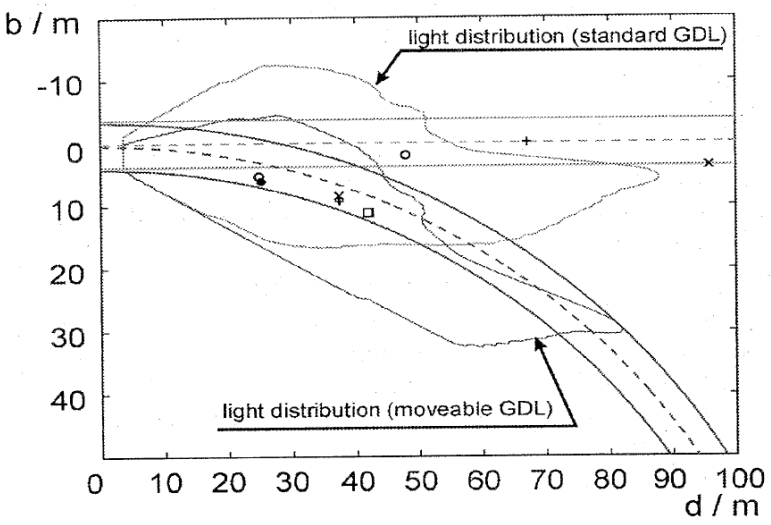


Figure 18: Fixation distance accumulation points (FDAP) for different headlamp systems and different road parts.
Accumulation points: X: *daylight*
○: *standard halogen*
●: *moveable halogen*
+: *standard gas discharge*
□: *moveable gas discharge*

EX1025, FIG. 18.

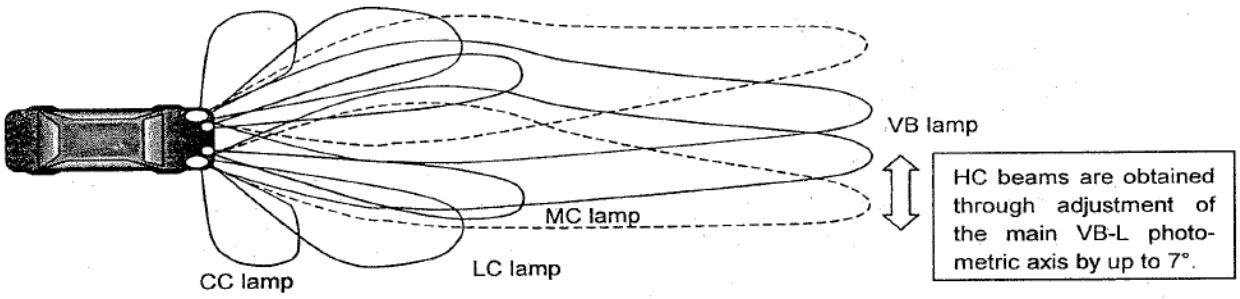


Fig. 3-3: Imaged Illumination Configurations on Road Surface

EX1026, FIG. 3-3.

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

9. [65.8]: "that substantially illuminates the one or more second subsections above the predefined illuminance;"

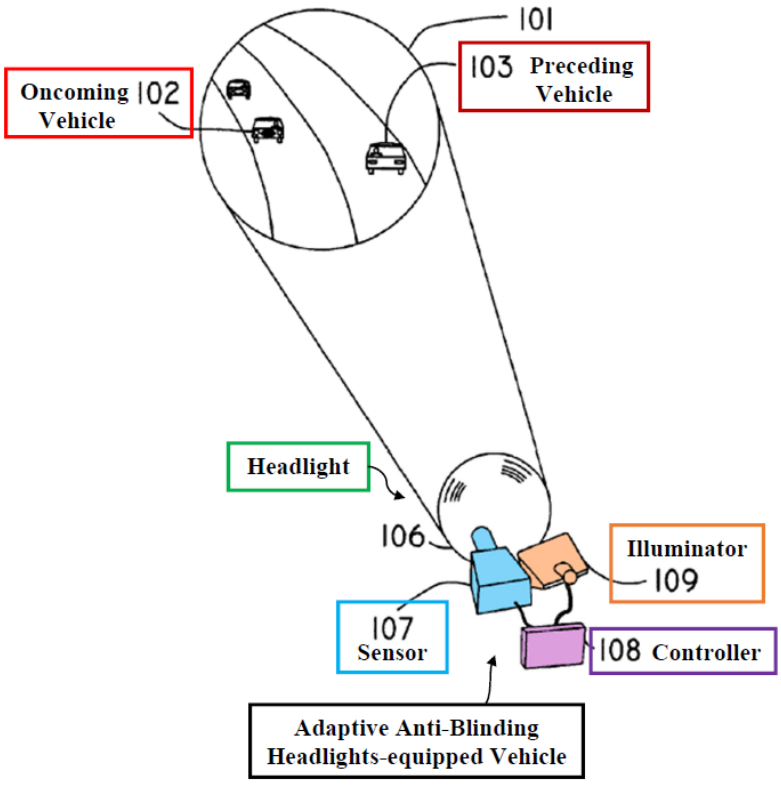
260. In my opinion, [65.3]-[65.8] are part of the same clause but will be addressed separately for simplicity below.

(a) Beam discloses this element.

261. In my opinion, Beam discloses this element, [65.8]. *Supra* Section XI; EX1005, 1:5-18 ("*reformatting* the *pattern*…to *prevent* it from illuminating *certain areas*…thus *eliminating the blinding* of a driver in an *oncoming vehicle*"), 6:11-56 ("*default* illumination level"), 2:59-3:3 (controlling an area *determined* by analyzing the position of the lights), Abstract ("*determine* the location of light sources…using that information to *control the intensity*"), 7:30-36 ("controller providing feedback to cause…a *high level of illumination*"), 8:23-38 ("*determining*…an area to be darkened within said area of illumination…*producing* a desired output pattern"), 4:10-25, 5:33-54, 5:65-6:4, FIGS. 1, 1C-1D, 7.

262. 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 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 ("[g]lare 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).

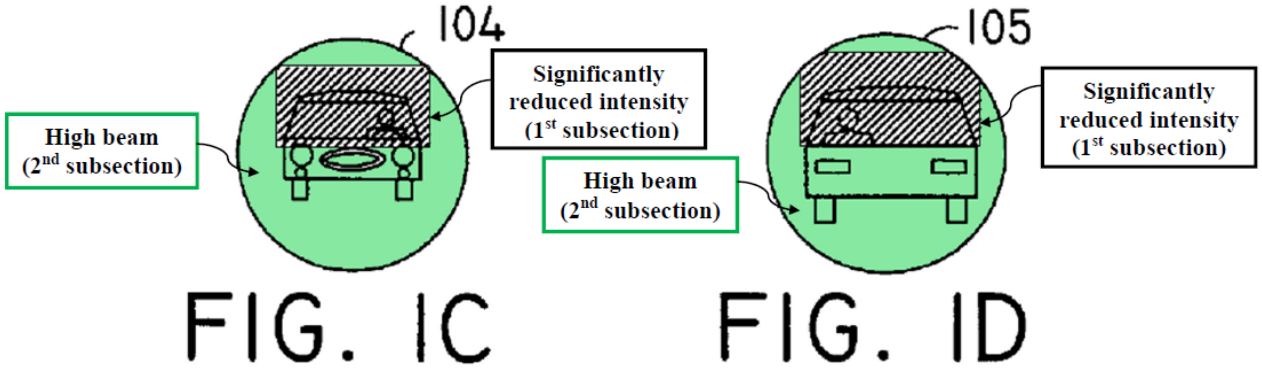
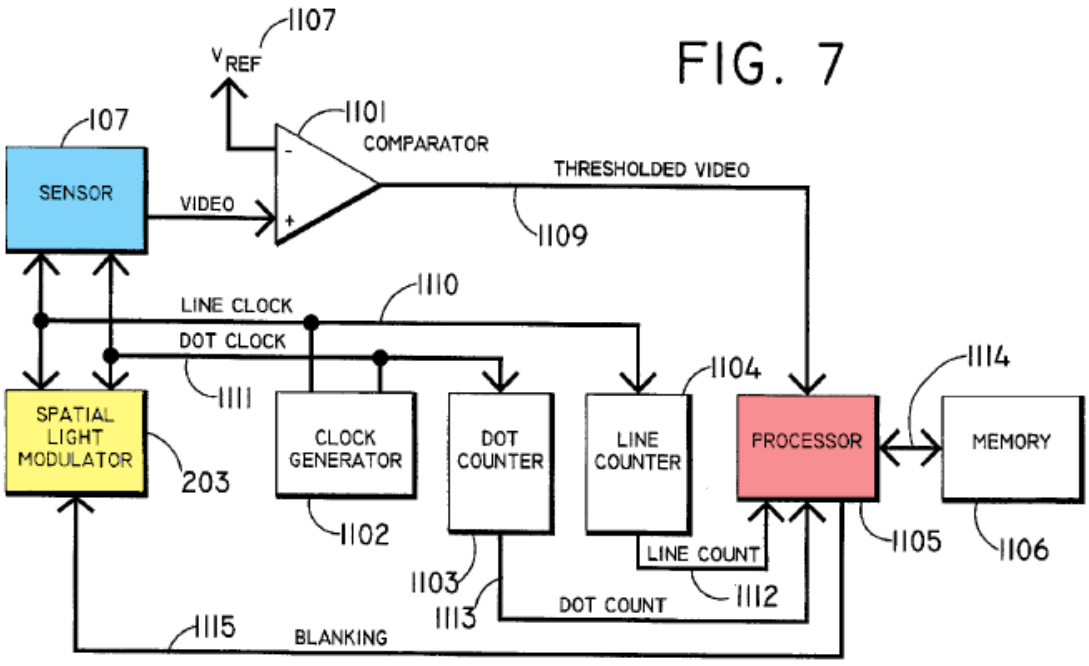
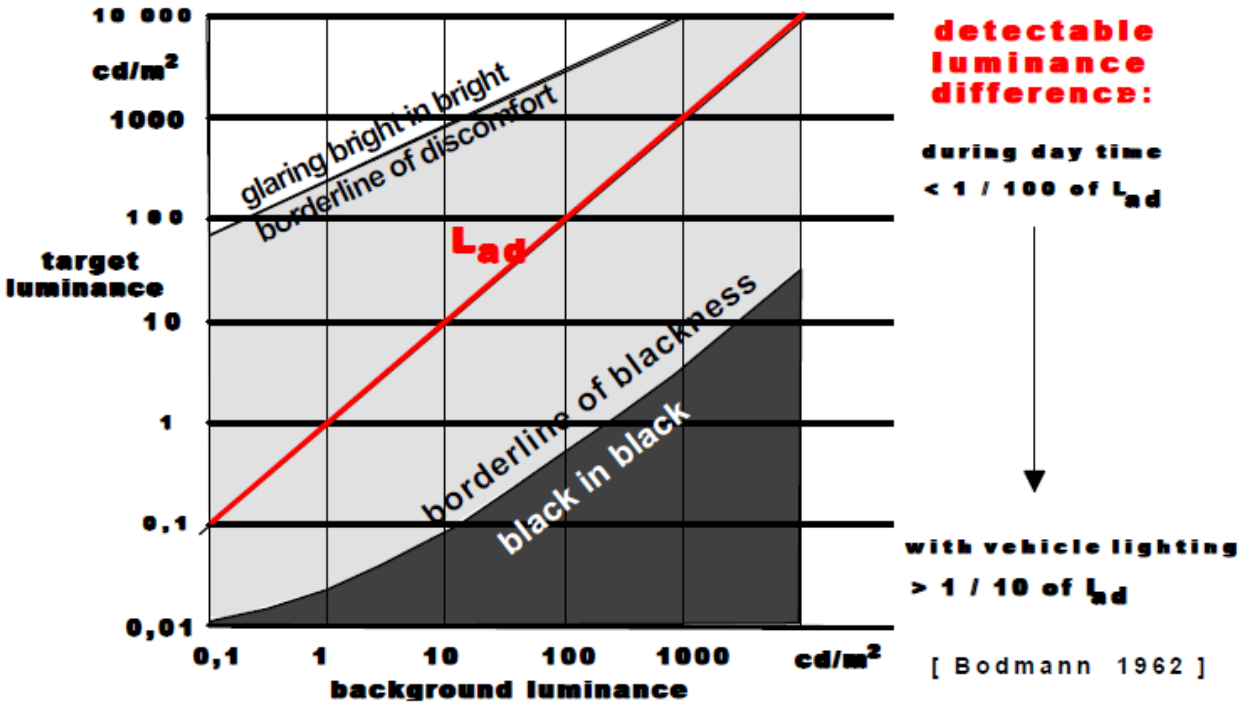


FIG. 1C FIG. 1D

EX1005, FIGS. 1C-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.

263. If Patent Owner alleges, incorrectly, that Beam-Thominet does not expressly disclose [65.8], Stam also discloses [65.8], and it would have been obvious to incorporate Stam's disclosure into Beam-Thominet.

264. 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[11]) within 700 feet, corresponding to the "predefined illuminance" recited in [59.11].

265. 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 reduce glare. EX1007, 1:14-31, 9:12-10:8, Abstract, 58:11-33.

[11] 1 foot candle (fc) is equal to 10.7639 lux.

266. 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.

267. 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).

268. 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 [65.8].

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

269. As described in Section X.A, a POSA would have been motivated to combine Beam-Thominet. As discussed, Beam discloses a "predefined

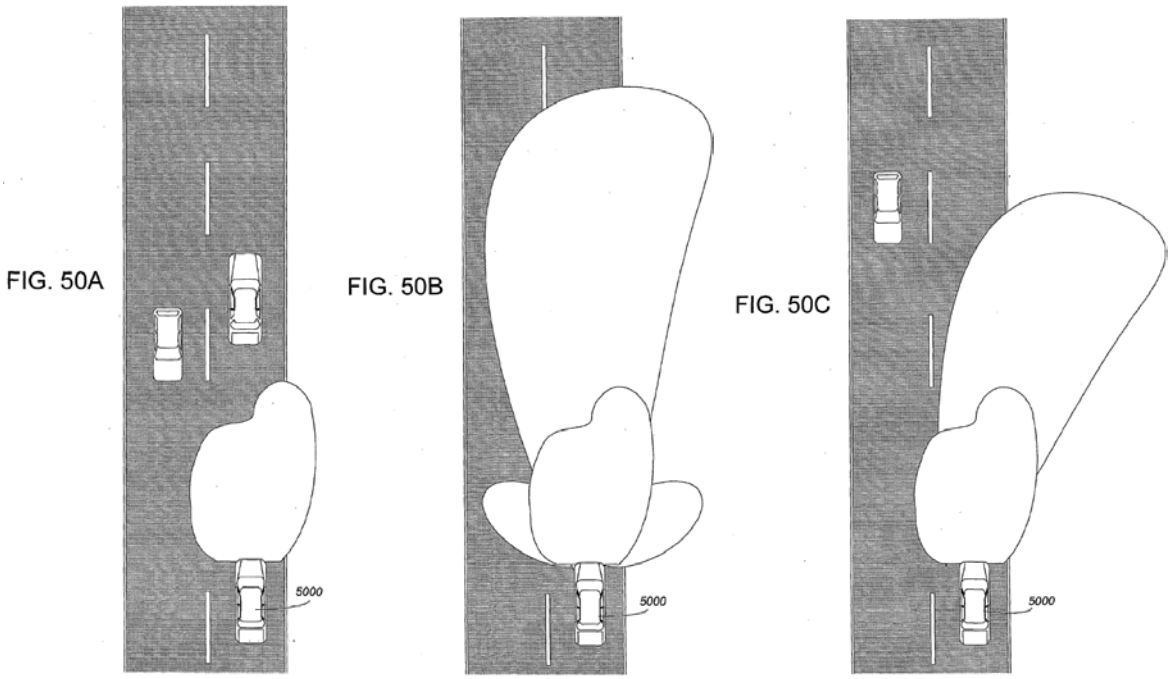
illuminance" based on a low beam illuminance. Stam provides a specific "predefined illuminance" value based on a dimmed illuminance to reduce glare. Naturally, it would have been obvious to a POSA designing an adaptive headlamp to implement Stam's predefined (dimmed) illuminance value in Beam-Thominet's system, 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.

270. Stam is from the same field—controllable headlamps with dynamic illumination—and includes the same building blocks (light sources, sensors, controllers). Like Beam-Thominet, driver visibility and safety is 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 reduce glare. EX1007, 1:14-31, 9:12-10:8, Abstract, 58:11-33.

271. *First*, including a predefined value for Beam-Thominet's controller—Stam's *known technique* of predefined dimmed illuminance—would have further enhanced Beam-Thominet's system by outputting illuminance *relative to* the predefined value (below or above), preventing glare to other vehicles and increasing illumination to other areas. *Second*, a POSA would have sought to incorporate this *known feature* of Stam (e.g., a predefined dimmed illuminance, *see*

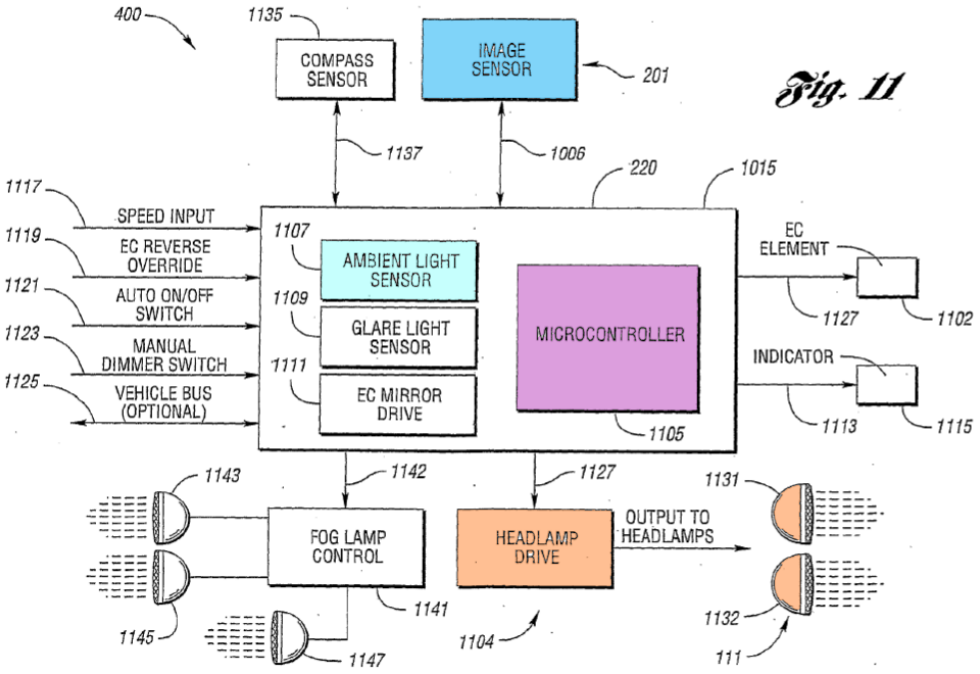
EX1007, Abstract, 1:14-31, 4:7-15, 9:12-10:8, FIGS. 11, 50A-50C) into Beam's system (with controller 108 and/or illuminator 109). This would have, like Stam, provided a specific "predefined" illuminance, below and above which to adjust illumination for desired areas, further improving safety. EX1007, Abstract, 1:14-31, 9:12-10:8.

272. 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, 1:14-31 ("control the amount of *glare*"), 9:12-10:8, 58:11-33, FIG. 11.



EX1007, FIGS. 50A-50C.

273. 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).

274. A POSA would have understood that a predefined value for Beam-Thominet's controller/illuminator based on Stam's predefined dimmed illuminance (0.1 fc within 700 feet), would have provided greater illumination control

referenced to a predefined value to prevent glare and increase illumination to other areas, thereby improving driver safety. This would have merely been applying Stam's *known technique* (a predefined dimmed illuminance) to Beam-Thominet's similar, known device (dynamic headlamp 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.

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

276. 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.

277. 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.

278. Thus, the combined Beam-Thominet-Stam system would illuminate the second subsection (non-shaded area) "above the predefined illuminance." *Supra* Sections XI.A/XI.B.7.

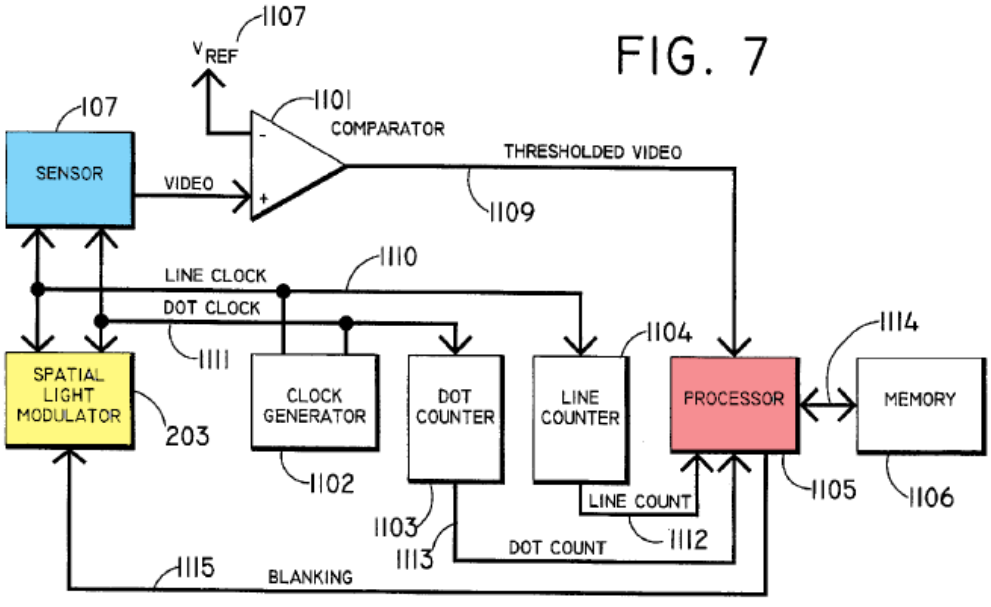
279. In view of the above, Beam (with Thominet), or in combination with Stam, discloses or renders obvious this element.

10. [65.9]: "determining control instructions for controlling one or more directional light sources included in the adaptive headlight system to achieve the determined illumination levels for at least the first and one or more second subsections; and"

(a) Beam discloses this element.

280. In my opinion, Beam discloses this element, [65.9]. *See supra* Sections X/X.A./X.B.7. Beam's controller/processor determines control instructions (e.g., feedback, blanking signals) to "cause the *intensity* of the selected microbeams to be reduced…illumination beam having a *high level of*

illumination…with only selected portions…being *reduced*" to output illumination in the first subsection (with the vehicle) and the second subsection (without the vehicle). EX1005, 7:30-36, FIGS. 1, 1C-1D, 7; EX1005, Abstract, 1:5-18, 2:59-3:24, 4:10-25, 5:13-6:4, 6:11-19, 6:40-48, 8:23-38. Beam also discloses "controller module uses the *sensor spatial data (video)*…to *control the Illuminator*" and "*processor*…outputs *blanking signals*…*command[ing] the appropriate pixels to be reduced*." EX1005, 6:11-19, 5:34-54, FIGS. 1, 1C-1D, 7; EX1005, 8:35-38 ("*controlling individual rays*…producing a *desired output*"), 5:61-65 ("*controlled by a processor*"), 1:5-18 ("*reformatting the pattern*"), 6:30-33. Thus, Beam's processor determines control instructions to "control[] one or more directional light sources" to output desired illumination in the first subsection (shaded area) and the second subsection (non-shaded area).



EX1005, FIG. 7 (control circuitry) (annotated).

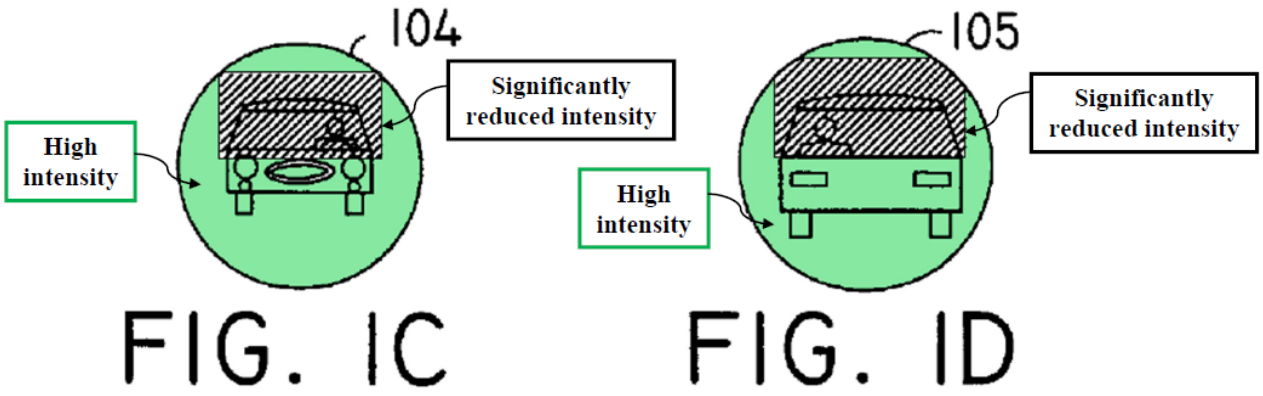
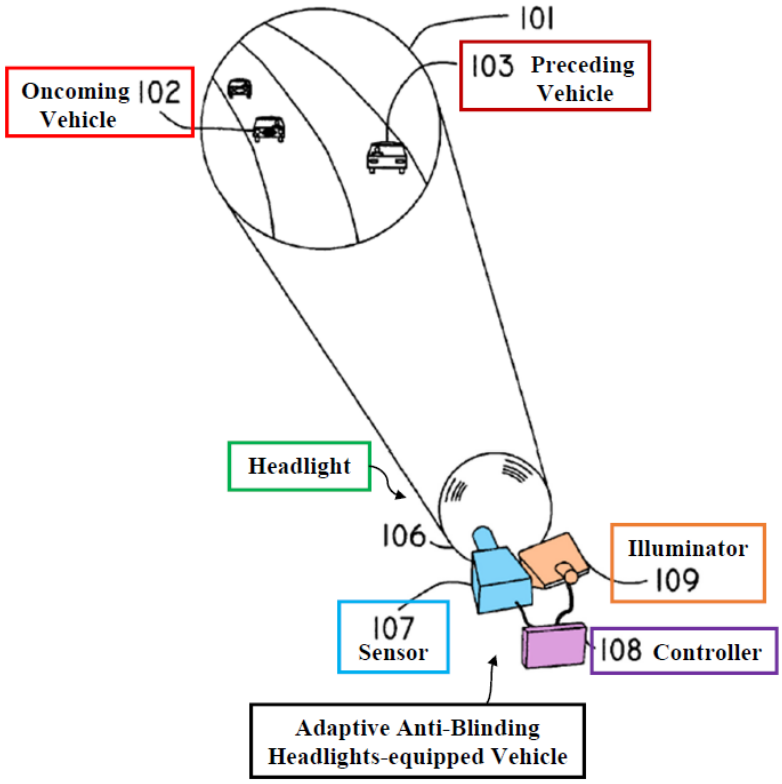


FIG. 1C FIG. 1D

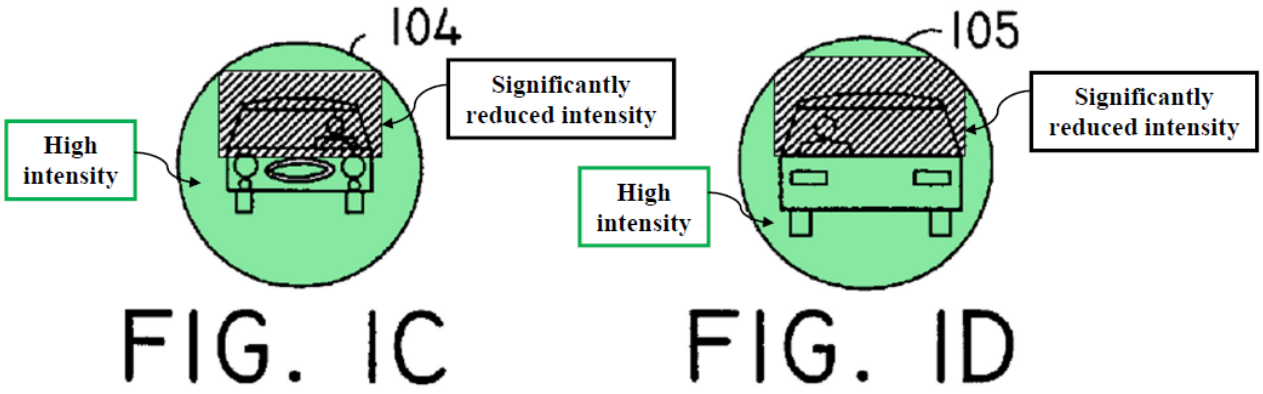
EX1005, FIGS. 1C-1D (annotated).

281. 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, 5:61-63, Abstract, FIGS. 1-2, 5. Specifically, Beam discloses "an *array* of *individual, independently* controllable *microbeam* sources" for example, "light-emitting diodes." EX1005, 8:5-12; EX1005, 8:4-17, 8:35-38. Further, as discussed, Beam/Beam-Thominet discloses "directional light [clusters / sources]." *Supra* Section X.B.7.

282. Each microbeam is a directional "cluster" or "source," having its own independent *angular* position, that combines to form the headlamp beam; so Beam's lamp 202 and SLM 203 (see Figure 2) form many, and at least one directional light cluster/source to provide illumination in desired subsections. EX1005, 7:25-29 ("*multiple* narrow angle microbeams"), 8:4-17 ("*array* of individual, independently controllable microbeam sources"), 8:23-34 ("area of illumination provided by *multiple* rays of light"), 4:26-59, 5:3-21, FIGS. 2, 4-6.



EX1005, FIG. 1 (annotated).



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

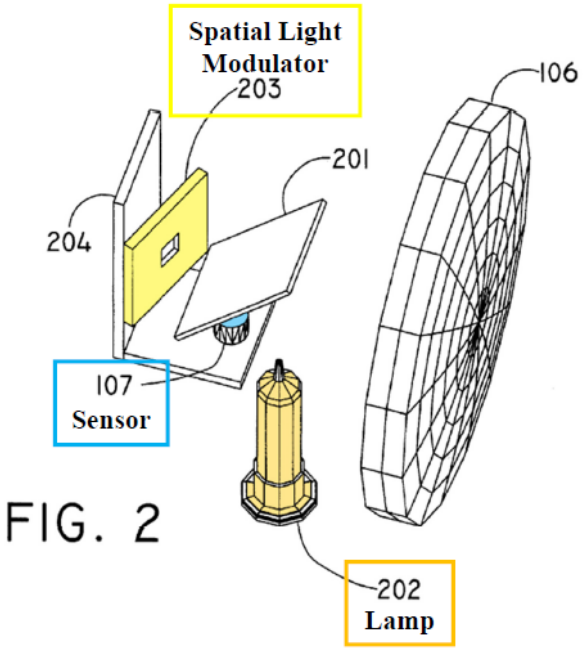


FIG. 2

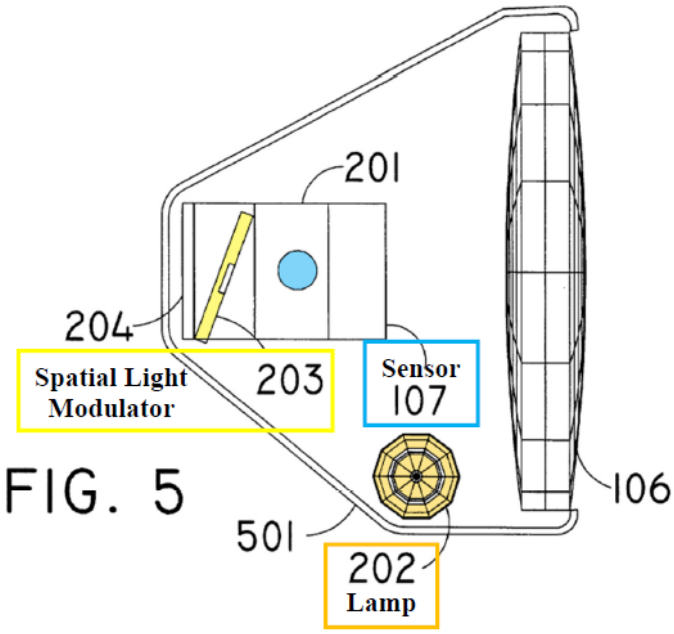


FIG. 5

EX1005, FIGS. 2, 5 (annotated).

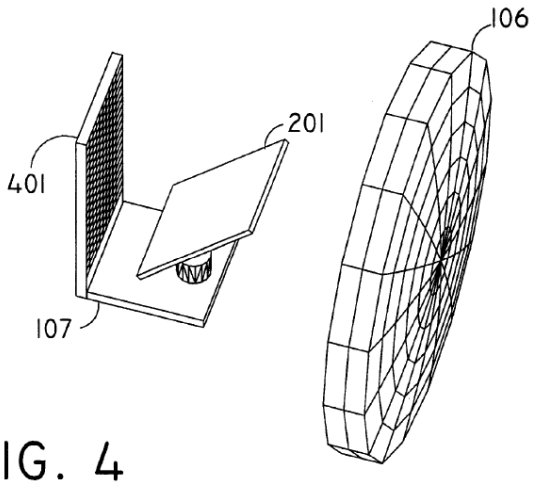


FIG. 4

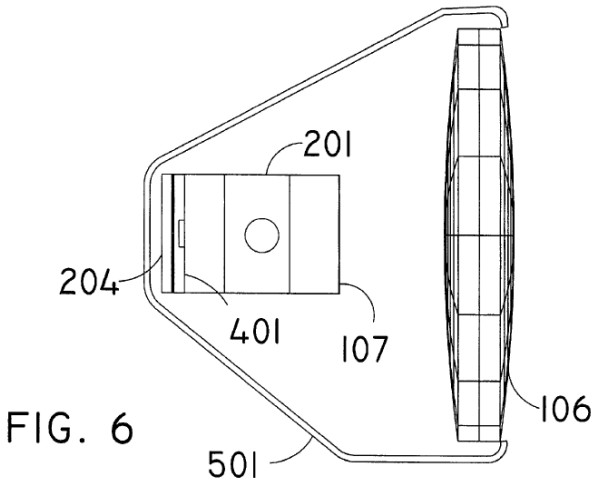


FIG. 6

EX1005, FIGS. 4, 6.

283. Such directionality results in *directional light sources* that by definition will have different angles, which result in different aimings in desired subsections. So disclosure that discusses a control strategy for directional light *clusters* to create an output headlight beam applies the same to disclosure that

discusses control instructions for directional light *sources* for first and second subsections.

284. A POSA would have understood that controlling "intensity" and "angular position" of "one or more narrow-angle microbeams" is the same as controlling "one or more directional light sources…to achieve the determined illumination levels," as the light output from a headlamp is all measured with its light intensity level in an angular distribution. *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; EX1019, 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.

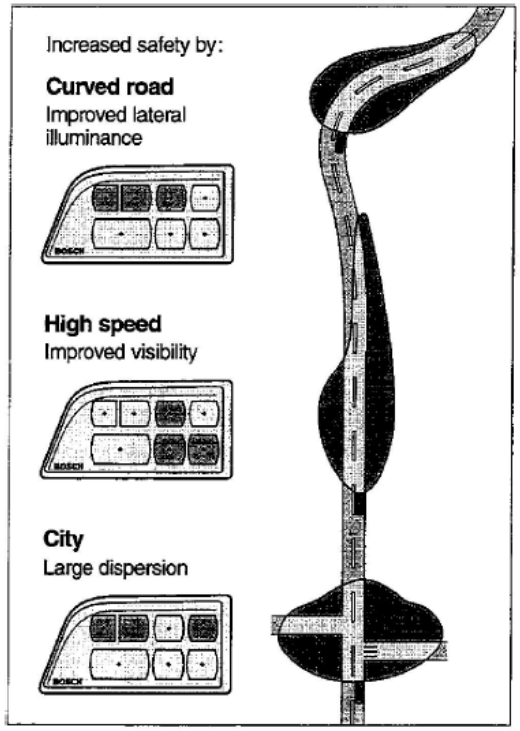


Fig.1: Three standard driving situations with adapted light pattern seen from the bird eye's view.

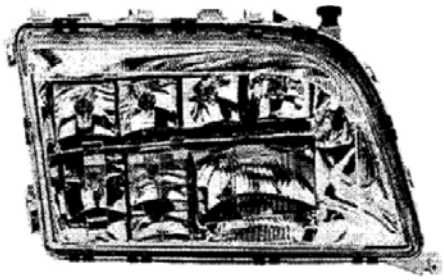
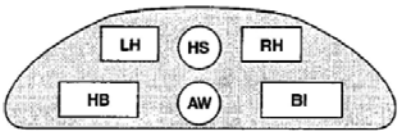


Fig 4: ALP *headlamp* sample



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

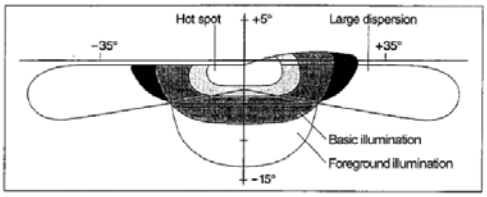


Fig. 3: Light pattern of multiple beam *headlamp* (*Isolux* curves in wall projection): The individual light *pattern* of multiple sub-units sum up to the total adaptive light pattern

EX1017, FIGS. 1 and 3-5.

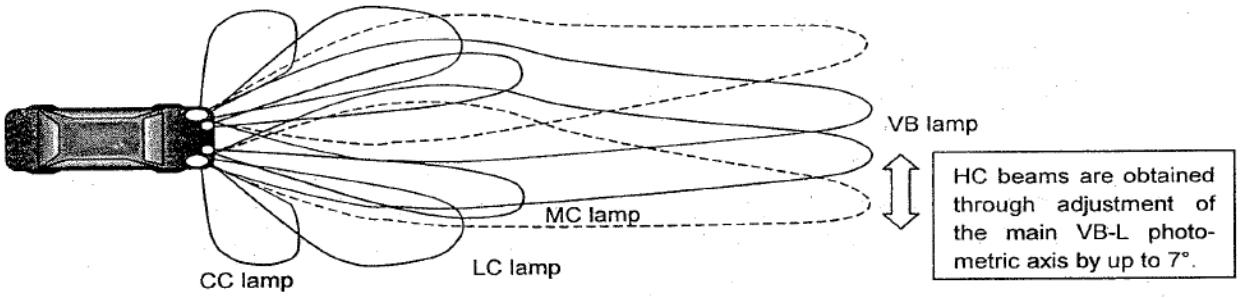
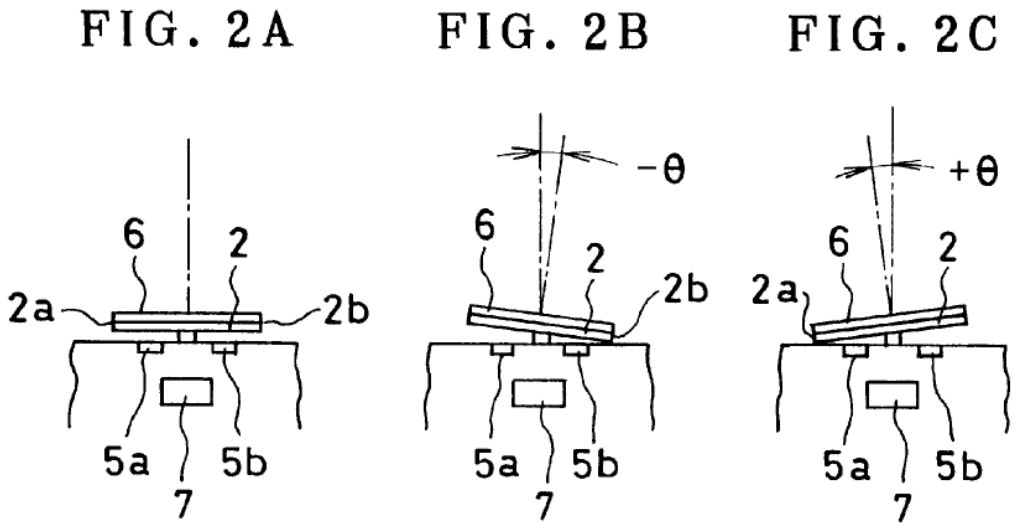


Fig. 3-3: Imaged Illumination Configurations on Road Surface

EX1026, FIG. 3-3.

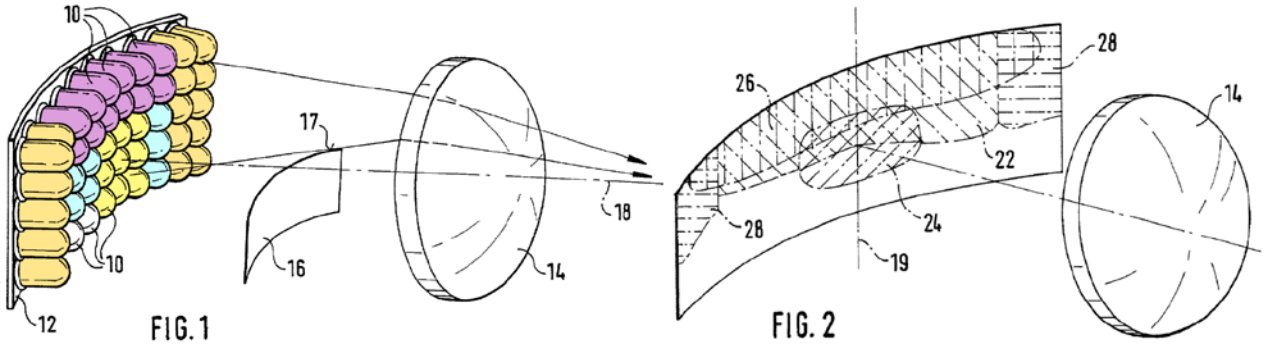


EX1040, FIGS. 2A-2C.

(b) Thominet also discloses this element.

285. If Patent Owner argues, incorrectly, that Beam does not disclose [65.9], Thominet also discloses [65.9], and it would have been obvious in view of Thominet. A POSA would have been motivated to combine Thominet with Beam with a reasonable expectation of success, providing predictable visibility and safety benefits. *See supra* Sections X/X.A.

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



EX1006, FIGS. 1-2 (annotated).

287. 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 or renders obvious [65.9].

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

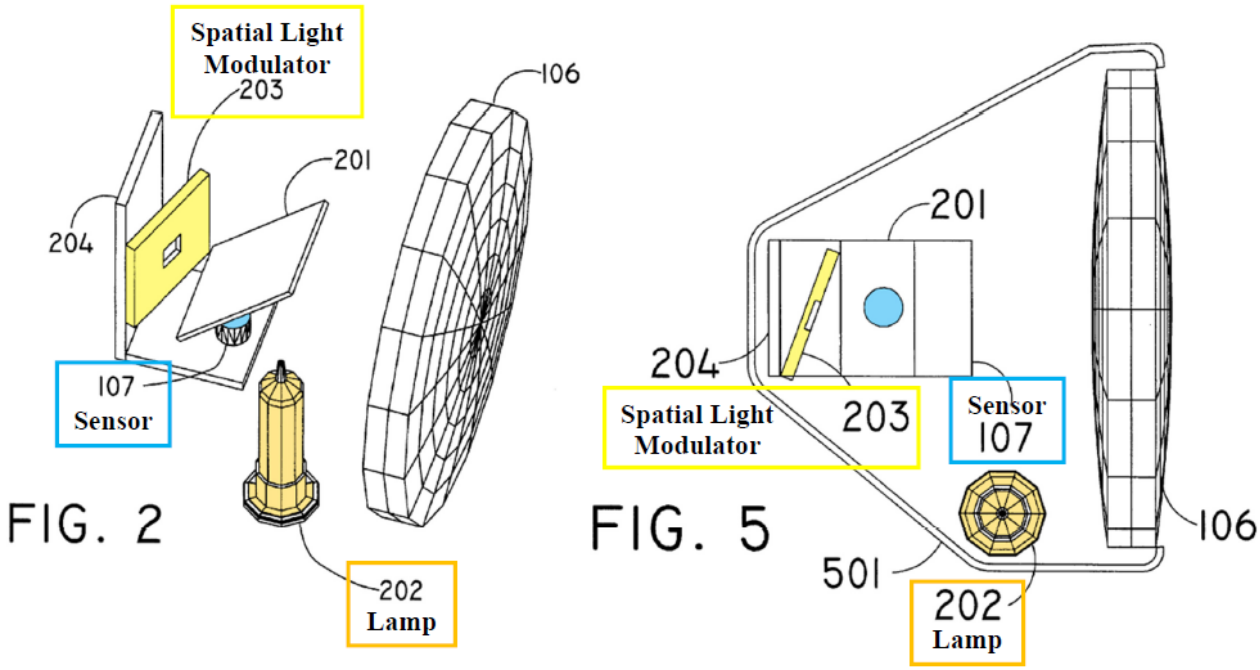
288. As discussed, Beam discloses "directional light sources" with independently controlled angular positions for reducing glare towards other drivers. Thominet provides further detail on implementing "directional light sources" for different functions, conceptually and physically. So naturally, it would have been obvious to a POSA designing an adaptive headlamp to implement Thominet's multiple directional beam regions—through either software or hardware—for different functions in Beam's system. EX1005, 3:8-14, 3:37-45, 5:33-54, 7:1-13.

289. Indeed, Thominet discloses such an implementation to *automatically* provide different spatial distributions for improved visibility in different driving situations (low visibility, fog, low/high speeds, recognizing a counter traffic, curves, etc., *see* EX1006, ¶¶7-8, 23-26, FIGS. 1-2), thereby automating some of Beam's *manual* control methods and improving driver safety—an express purpose of Beam. EX1005, 3:29-45 ("*manually* lower the beams for conditions like rain, snow, or fog"), 3:8-14, 5:33-54, 7:1-13; EX1006, ¶26 ("[b]y operation of the…corresponding partial region 22, 24, 26, 28…it is possible to switch over between the above mentioned *different light functions*…*automatically*").

290. Beam and Thominet are from the same field—controllable headlamps with dynamic illumination—and include the same building blocks (light sources, sensors, controllers). Further, improved visibility, thereby increasing safety, is paramount in both. EX1005, 1:54-59, 3:8-45, 4:48-59, 6:53-7:13; EX1006, ¶¶3-4, 23.

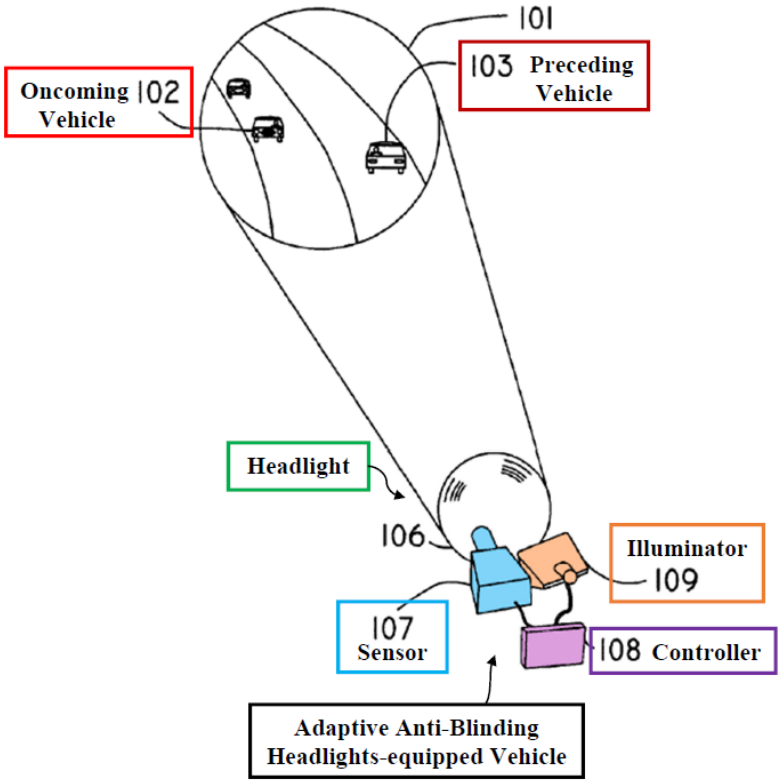
291. *First*, including an additional control technique (software implementation) for Beam—Thominet's *known technique* of using multiple directional beam regions for different functions—would have added more control methods for different functions to Beam's visibility for different driving situations, 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, 5 (annotated).

292. Indeed, Beam's techniques and system of controlling individual microbeams emphasize safety of all drivers. EX1005, 3:8-45, 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, 3:8-45. Beam enables "the driver to see more clearly at night," while protecting others from glare. EX1005, 3:8-45; EX1005, 4:9-24, 6:9-27.



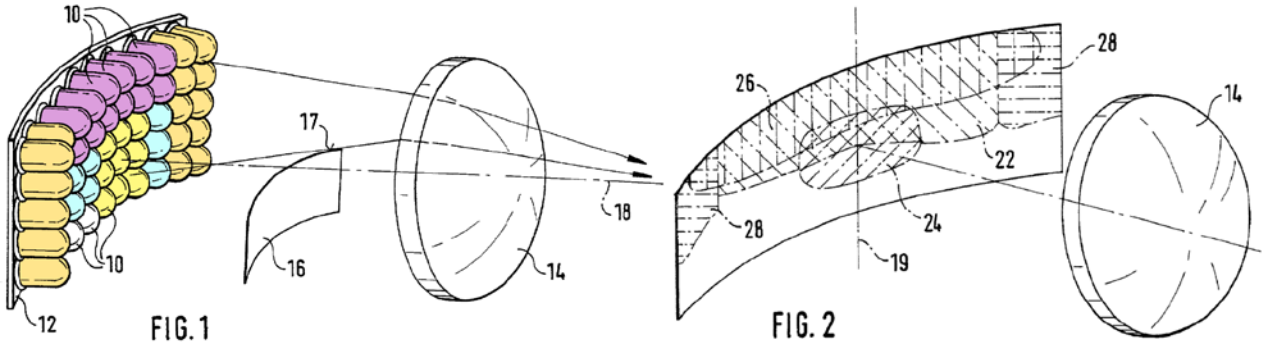
EX1005, FIG. 1 (annotated).

293. 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," 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 "directional light

sources." 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.

294. And Thominet's *technique* (software implementation), like Beam, enhances driver visibility, increasing safety—using multiple directional beam regions (sources) for different functions. EX1006, ¶¶17-18, 21-26, FIGS. 1-3; EX1006, ¶4 ("*characteristic* of the light beam…can be used for *different functions*"), ¶20 ("partial *regions* are defined on the *matrix*"), ¶27 ("partial *regions* with partial quantities of the semiconductor sources 10 are defined on the *matrix*"), ¶¶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.

295. Thominet's semiconductor light sources 10, arranged on curved surface 12, provide different beam regions 22, 24, 26, 28 for different driving situations including for recognizing a counter traffic, thereby improving safety, including driver safety. EX1006, ¶¶7-8, 17-18, 21-27, FIGS. 1-3; EX1006, ¶7 ("*wider* illumination), ¶23 ("*improving* the illumination…at high speeds).



EX1006, FIGS. 1-2 (annotated).

296. The additional control (software implementation) of having multiple directional beam regions (sources) 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.

297. A POSA would have understood that alternative or additional control for Beam's controller 108/illuminator 109 by using Thominet's different beam regions 22, 24, 26, 28, 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 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.

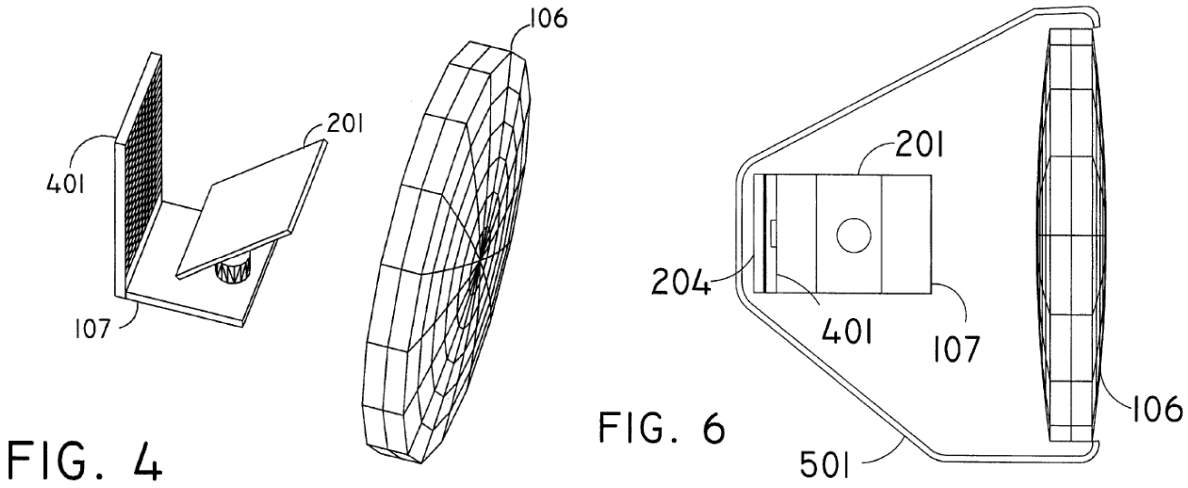
298. A POSA would have had a reasonable expectation of success combining Beam and Thominet, for example, by simply modifying software instructions in memory of Beam's controller/processor to organize Beam's array of microbeams into multiple directional beam regions for different functions. Overall, this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

299. 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 for different functions—as already disclosed in the art.

300. *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 (arranged in different beam regions 22, 24, 26, 28, *see* EX1006, ¶¶17-20, 23-26, FIGS. 1-2, 5-7) into Beam's

system (with flat array of light sources 401). 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. EX1006, ¶¶17-20, 23-26, FIGS. 1-2, 5-7. This is a simple hardware combination.

301. 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, 6.

302. 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

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

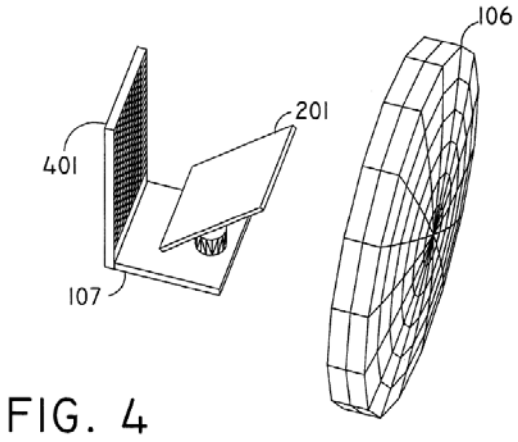


FIG. 4

EX1005, FIG. 4.

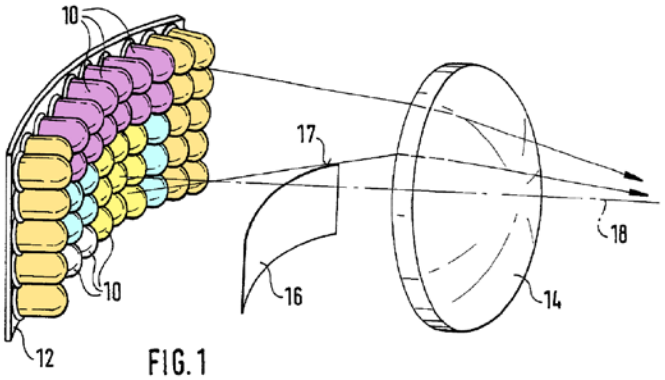


FIG. 1

EX1006, FIG. 1 (annotated).

303. Like the software implementation above, this hardware combination—Beam's array of light sources 401 and Thominet's semiconductor sources 10 on curved surface 12 arranged in directional beam regions 22, 24, 26, 28—would have provided Beam's system with different spatial distributions for different driving situations, as in Thominet, thereby improving driver safety. This 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 (improved visibility and safety). Overall, this is a simple hardware implementation.

304. 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 (e.g., directional beam regions 22, 24, 26, 28) for different functions (hardware implementation).

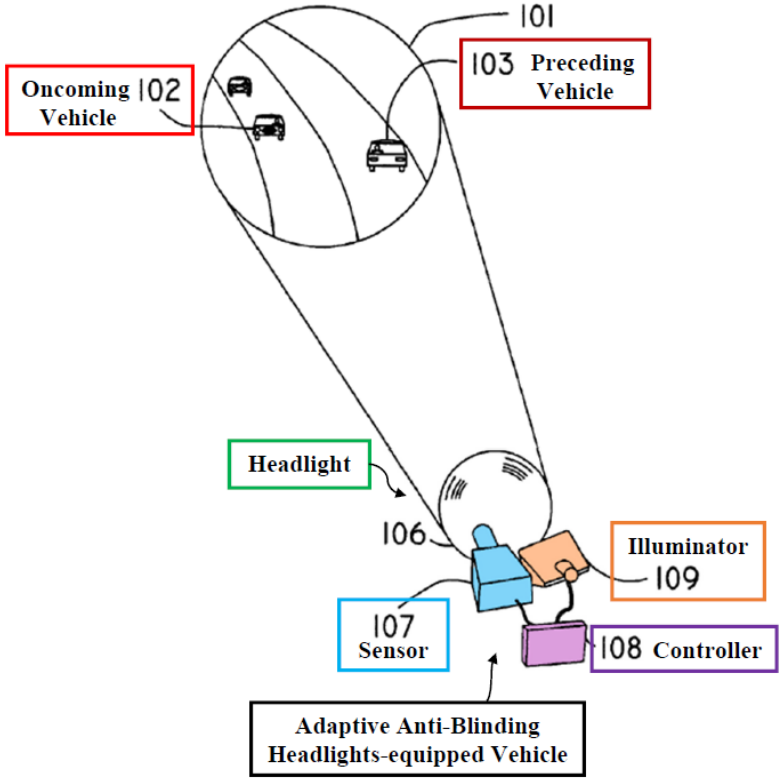
305. Such modification would have been routine and well within a POSA's skill due to the similarities in Beam's and Thominet's adaptive systems—their common components were well known and there would have been no limitations for a POSA to make such modifications. And in combining Beam with Thominet's 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).

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

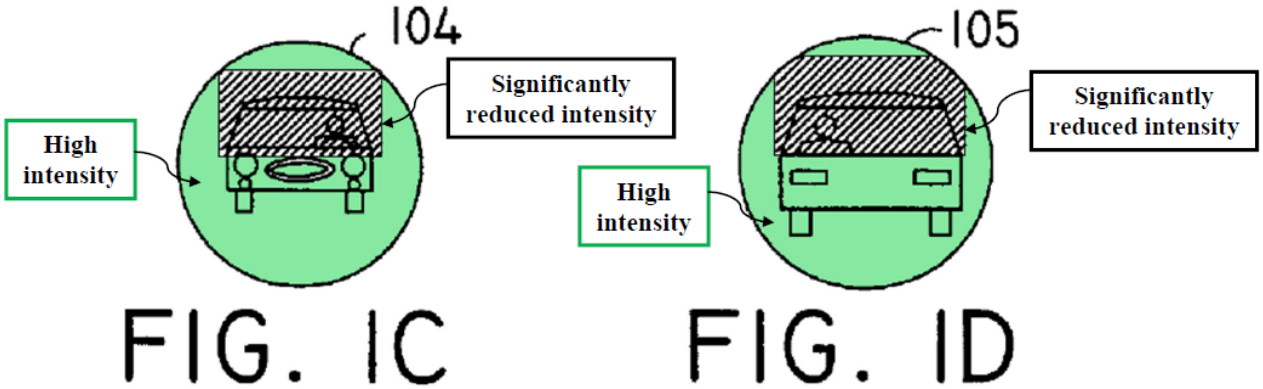
11. [65.10]: "controlling the light sources to emit the headlight beam in accordance with the control instructions."

307. Beam discloses "controller module uses the *sensor spatial data (video)*…to *control the Illuminator*" and "*processor*…outputs *blanking signals*…*command[ing] the appropriate pixels to be reduced*." EX1005, 6:11-19, 5:34-54, FIGS. 1, 1C-1D, 7; EX1005, 8:35-38, 5:61-65, 1:5-18, 6:30-33; *Supra*

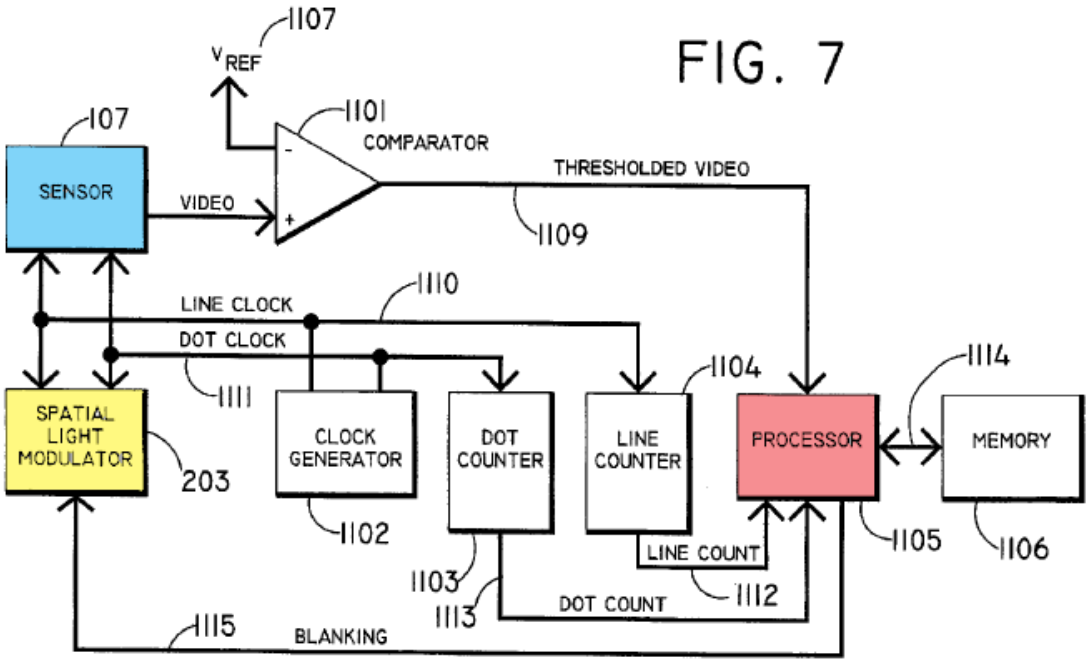
Section X.B.11. Thus, Beam's processor sends control instructions (blanking or non-blanking signals) to the illuminator (SLM 203) to "control[] the light sources to emit the headlight beam."



EX1005, FIG. 1 (annotated).



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



EX1005, FIG. 7 (control circuitry) (annotated).

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

309. Thus, Beam (with Thominet), alone or in combination with Stam, discloses or renders obvious claim 65 of the ’503 patent.

XII. GROUND 3: THE COMBINATION OF BEAM, THOMINET, AND KOBAYASHI RENDERS OBVIOUS CLAIMS 32-36.

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

310. 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 visibility and driver safety—an express purpose of Beam-Thominet. EX1005, 3:8-14, 3:37-45, 5:33-54, 7:1-13; EX1006, ¶¶8 ("over a *curve*"), 25 ("region 28…when the vehicle drives over a *curve* or during a *bending* process"), FIGS. 1B-2.

311. 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.").

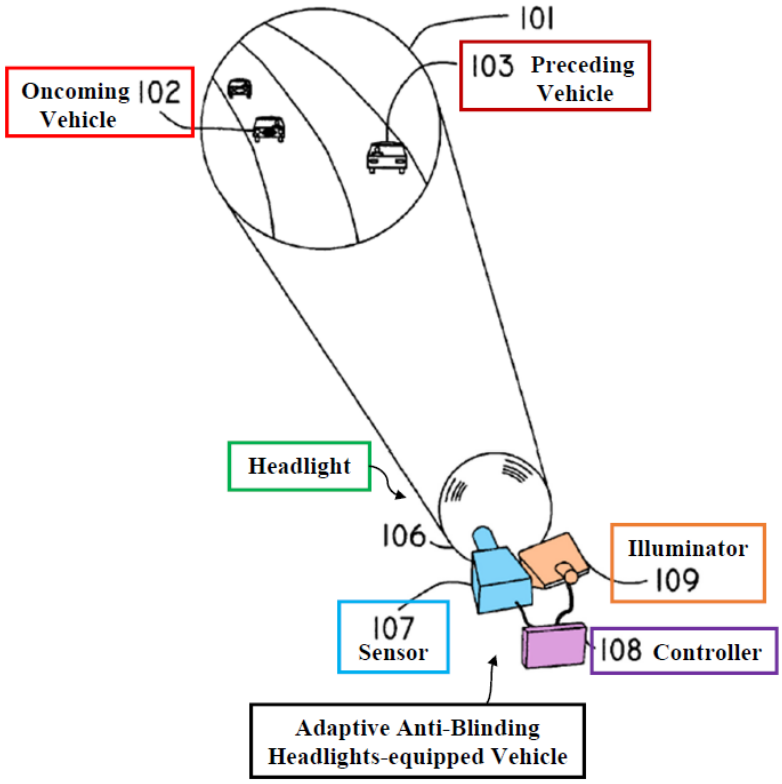
312. Further, conventional headlamps, with static high and low beams did not respond to changing driving conditions, and multiple beams were needed to provide "bending beams" for different types of road curvatures ("high speed," "middle speed," "low speed," "cross-roads"). EX1026, 451-452.

313. Beam-Thominet and Kobayashi are from the same field—controllable headlamps with dynamic illumination—and include the same building blocks (light sources, sensors, controllers). Further, driver safety is paramount. EX1005, 5:33-54, 3:8-45, 6:53-7:13; EX1008, 15:6-28.

314. *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

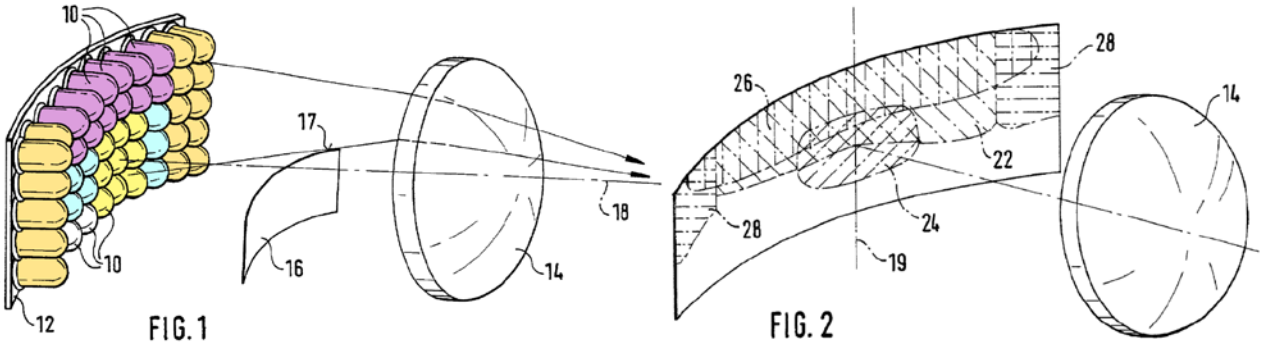
illumination based on an upcoming curve/turn, improving driver safety by providing light to where it is needed. *Second*, a POSA would have easily incorporated *known components* of Kobayashi's road profile calculating means 2 and/or vehicle advancing direction prediction means 3 (including GPS navigation 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 upcoming curve/turn, further improving safety.

315. Beam "*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, 4:15-20. 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 (tilt on a hill) and steering mechanism (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).

316. Furthermore, Thominet expresses the importance of illuminating "one side…to the right or to the left…during *d[r]iving over a curve* or…a *bending*" with directional light sources (region 28) to provide illumination in the "traveling direction." EX1006, ¶¶8, 25, FIGS. 1B-2.



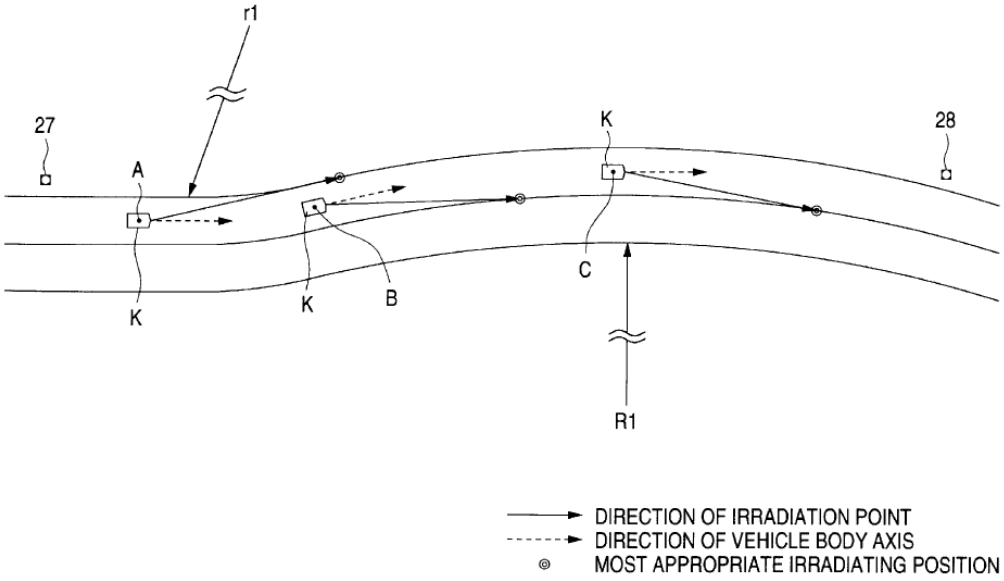
EX1006, FIGS. 1-2 (annotated).

317. Beam-Thominet does not disclose details on how to detect upcoming curves/turns, such as from GPS or navigation beacons, as an input to control the intensity, shape, and/or angular position of the microbeams, but this was well known in the art and 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 (EX1005, 2:15-22), and further achieves Beam's purpose of improving driver safety. EX1005, 3:8-45, 6:53-7:13. Kobayashi provides additional active techniques, specifically map data-based control including road curvature.

318. Kobayashi's active *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, 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.

319. 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.

320. A POSA would have understood that including an additional data source for Beam-Thominet's controller/processor—Kobayashi's map data including road curvature—would have enhanced Beam-Thominet by increasing illumination of upcoming curves/turns, thereby improving safety. This would have merely been applying Kobayashi's known technique (using map data including road curvature from GPS 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 (improved safety); thus, a POSA would have readily applied it to similar systems, such as Beam-Thominet's, in the same way.

321. Additionally, or alternatively, this modification would have been simply combining known prior-art elements (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 (illuminating curves/turns, improving safety).

322. 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 combination of prior-art elements: 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 (in communication with Beam's controller).

323. 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).

324. I lay out below the specific disclosures of Beam-Thominet and Kobayashi, and expand on this combination and reasonable expectation of success analysis below.

B. Claim 32: "The method of claim 26, wherein the determining illumination requirements further includes determining illumination for an upcoming curve indicated by the sensor data, wherein the determining the control strategy further comprises determining the control strategy for controlling the directional light clusters to create an output headlight beam that illuminates around the curve."

Claim 33: "The method of claim 32, wherein the determining illumination requirements further includes determining illumination for an upcoming turn indicated by the sensor data, wherein the determining the control strategy further comprises determining the control strategy for controlling the directional light clusters to create an output headlight beam that illuminates the turn."

Claim 34: "The method of claim 32, wherein the determining illumination further includes determining illumination the

increases illumination of an upcoming turn indicated by the sensor data, wherein the determining the control instructions further comprises determining the control instructions for controlling one or more of the directional light sources to achieve illumination of the turn."

Claim 35: "The method of claim 26, wherein the determining illumination requirements further includes determining illumination for an upcoming turn indicated by the sensor data, wherein the determining the control strategy further comprises determining the control strategy for controlling the directional light clusters to create an output headlight beam that illuminates the turn."

Claim 36: "The method of claim 26, wherein the determining illumination further includes determining illumination the increases illumination of an upcoming turn indicated by the sensor data, wherein the determining the control instructions further comprises determining the control instructions for controlling one or more of the directional light sources to achieve illumination of the turn."

325. In my opinion, claims 32-36 all recite language relating to illuminating an upcoming curve/turn by determining control strategy/instructions and appropriately controlling the headlight output to illuminate the curve/turn.

326. In my opinion, there is no patentable difference between the language of claim 33 and claim 32 as shown above (even though claim 32 uses the term "curve," and claim 33 uses the term "turn"). *See also* Appendix B. The same disclosures below address each feature.

327. In my opinion, there is no patentable difference between the language of claim 34 and claim 32 as shown above (even though claim 32 uses the term

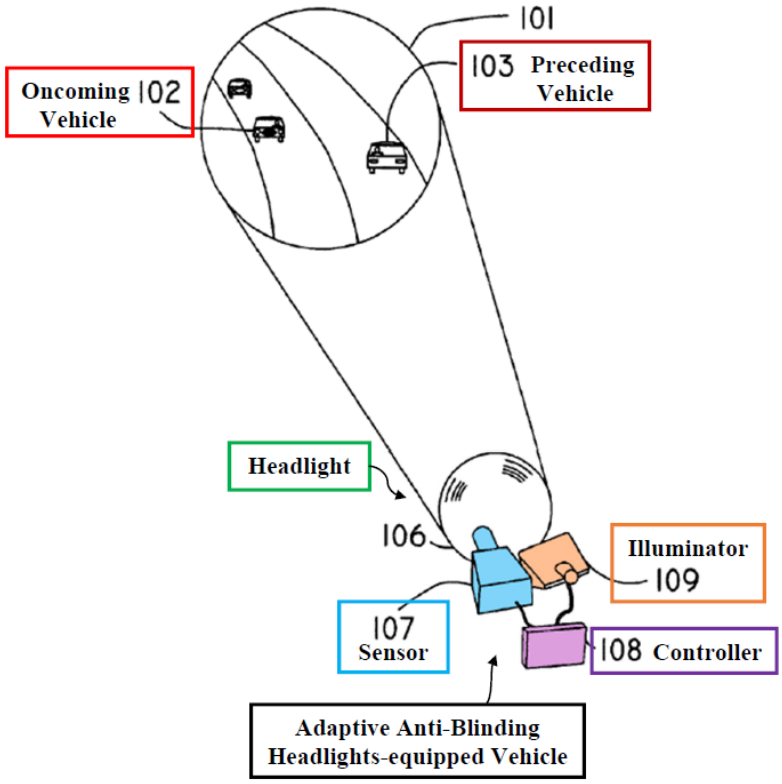
"curve," and claim 34 uses the term "turn"). *See also* Appendix B. The same disclosures below address each feature.

328. The language of claim 35 is identical to the language of claim 33 as shown above. *See also* Appendix B.

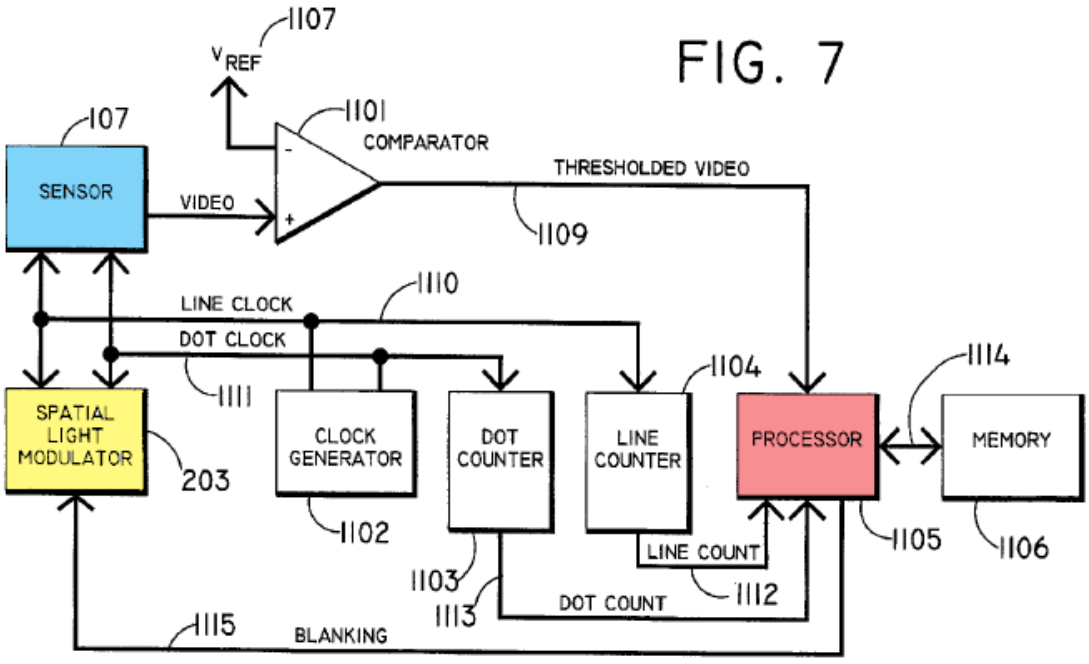
329. The language of claim 36 is identical to the language of claim 34 as shown above. *See also* Appendix B.

1. Beam-Thominet's disclosure

330. Beam discloses "controller module uses the *sensor spatial data (video)*…to *control the Illuminator*" and "*[p]rocessor*…*commands* the appropriate pixels." EX1005, 6:14-19, 5:46-54, FIGS. 1, 7; EX1005, 5:33-54 ("*spatial scene data [101]* from sensor 107…becomes the input to a processor 1105"), 4:53-59, 2:35-38, Abstract. As discussed, Beam/Beam-Thominet discloses "directional light [clusters / sources]." *Supra* Sections X.A/X.B.7.

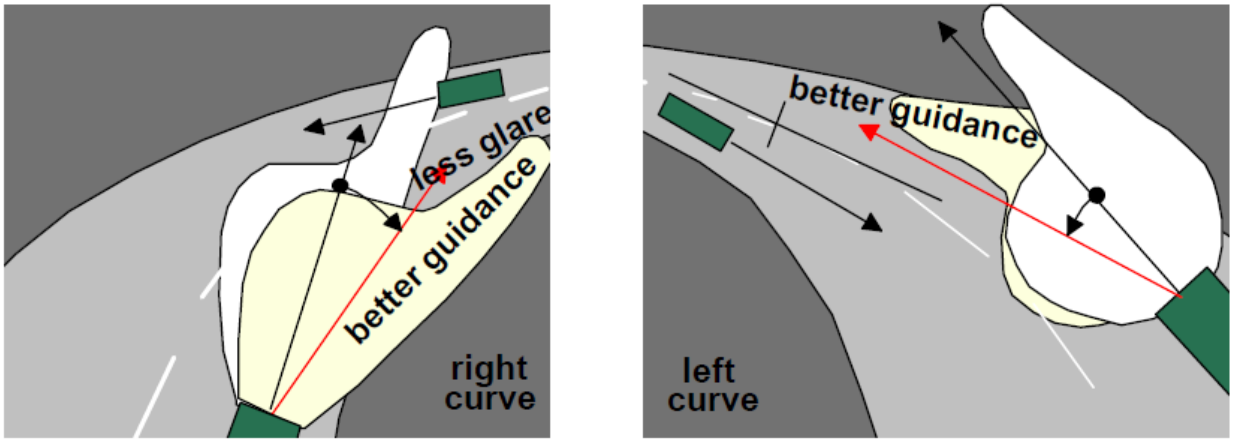


EX1005, FIG. 1 (annotated).



EX1005, FIG. 7 (annotated).

331. Beam-Thominet does not disclose determining illumination for an upcoming curve/turn (even though the spatial data disclosed by Beam should normally include the upcoming curve/turn information), but this feature was well known in the prior art, e.g., as explicitly disclosed by Kobayashi. *See also* EX1015, 18 ("[g]lare 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.

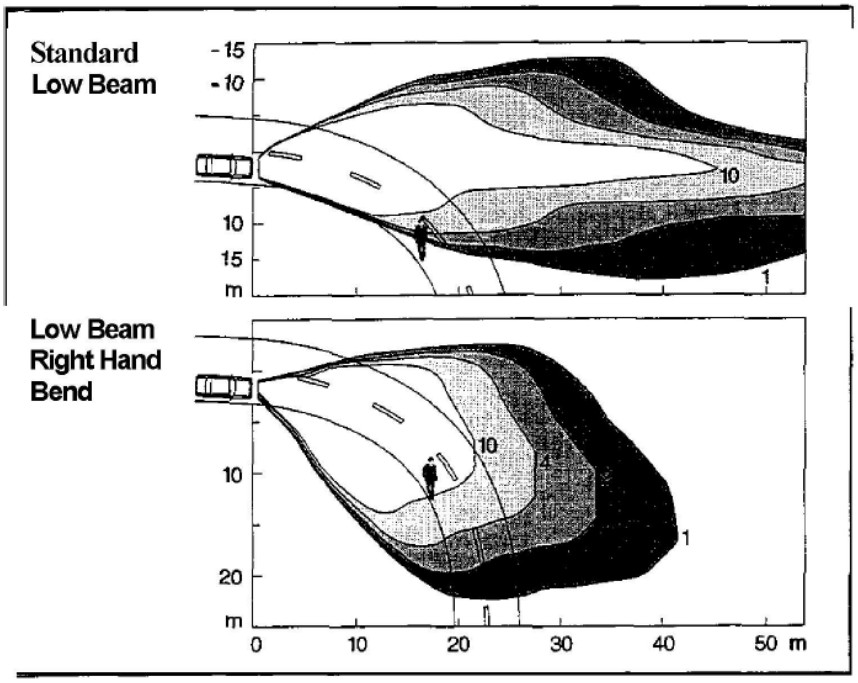


Fig. 7: comparison between basic low beam and right curve illumination, Isolux curves from bird eye's view

EX1017, FIG. 7.

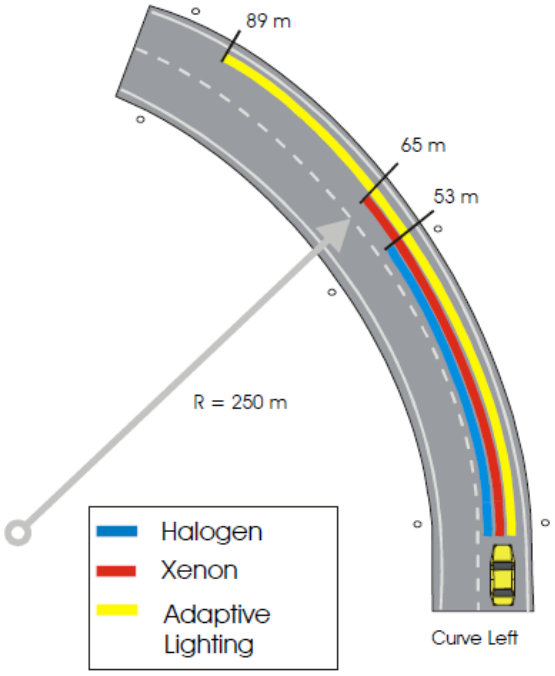


Figure 10: Static test: Results of the investigations about visibility distances obtained with halogen-, HID- and adaptive headlamps.

EX1020, FIG. 10.

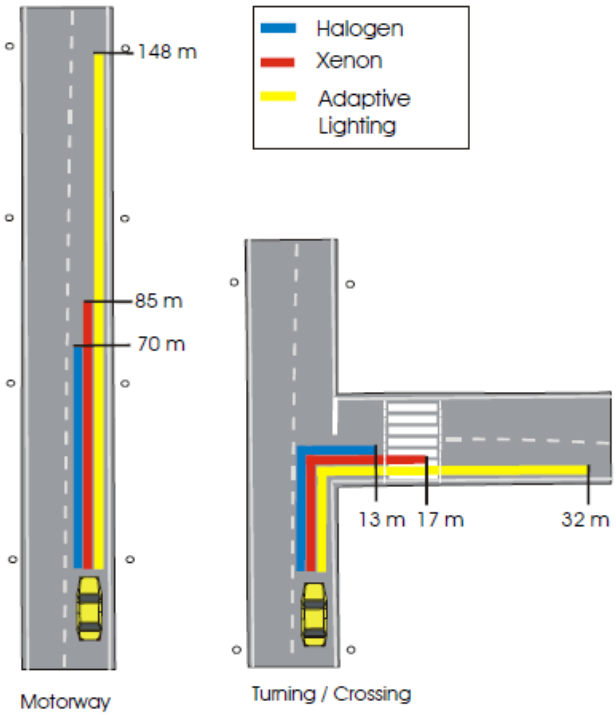


Figure 11: Static test: Results of the investigations about visibility distances obtained with halogen-, HID- and adaptive headlamps

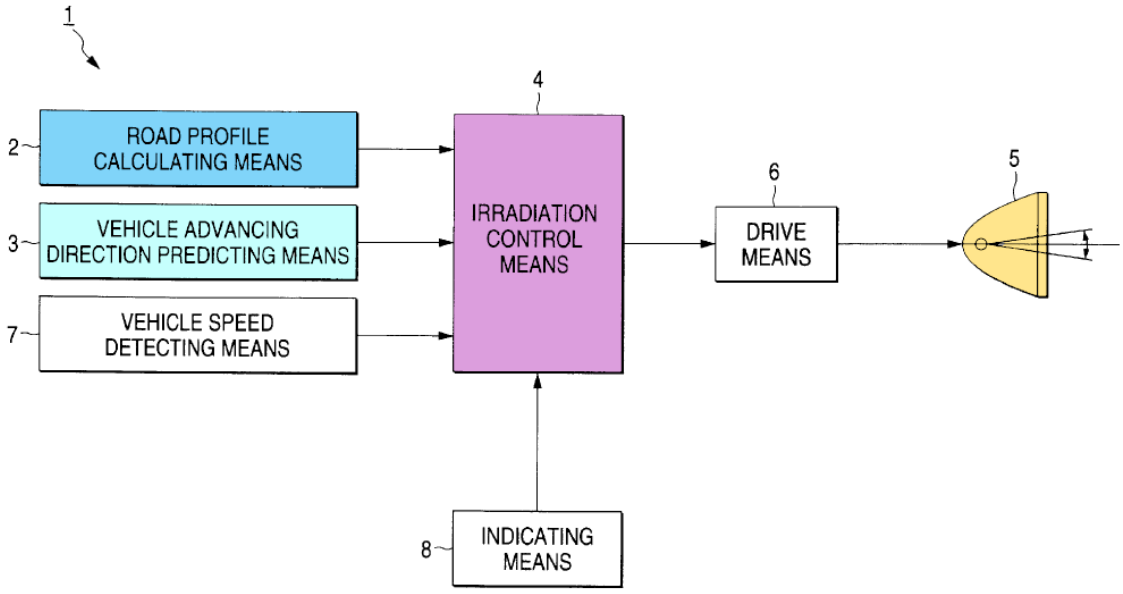
EX1020, FIG. 11.

2. Kobayashi's disclosure

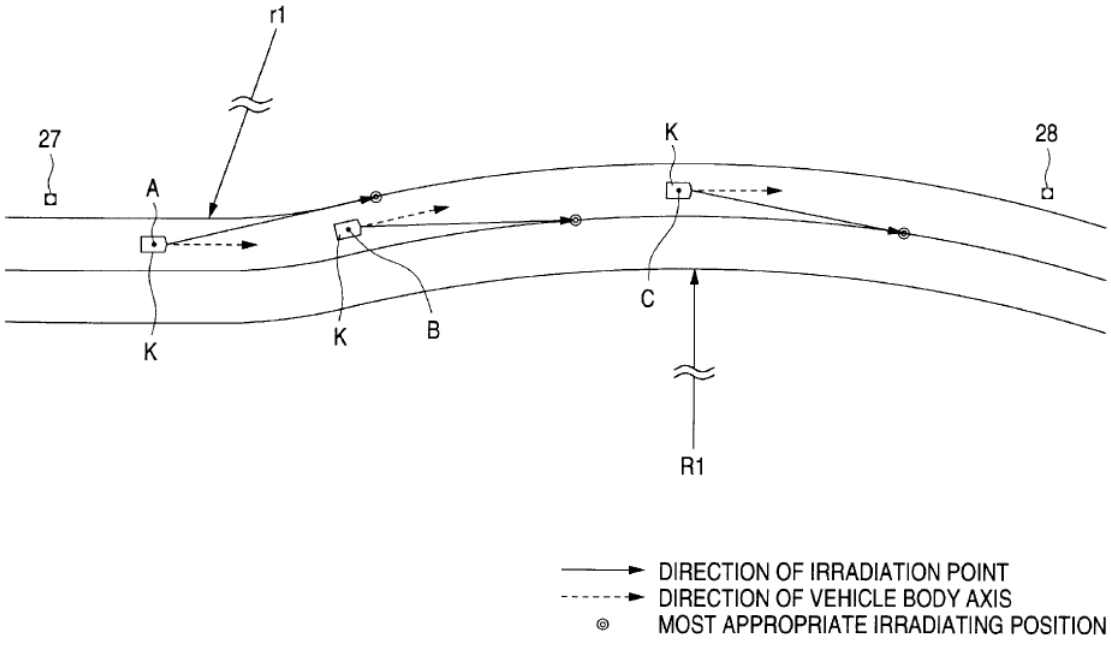
332. Kobayashi's headlamp illumination is controlled "[a]ccording to the *road profile information*" and "applied…[so] a portion of irradiating light is directed to a *specific direction*." EX1008, 14:53-15:28, 9:38-41, FIGS. 1, 9, 10; EX1008, 4:60-64 ("irradiation control…with the *road profile*"), 18:53-57 ("irradiation control…*along the scheduled course*"), 4:6-8 ("*predicts a vehicle advancing direction*"), 3:9-50.

333. A POSA would have understood that Kobayashi discloses illumination for "an upcoming curve" because illumination is controlled along the "road profile" (e.g., left or right curve) recited in claim 32. Further, a POSA would

have understood that Kobayashi discloses illumination for "an upcoming turn" because illumination is controlled along the "scheduled course" that includes an intended direction of a driver (e.g., left or right turn) recited in claims 33-36. *See* EX1008, 9:38-41; EX1001, 54:1-18 ("[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.

334. 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.

335. 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 visibility and driver safety—an express purpose of Beam-Thominet. EX1005, 3:8-14, 3:37-45, 5:33-54, 7:1-13; EX1006,

¶¶8 ("over a *curve*"), 25 ("region 28…when the vehicle drives over a *curve* or during a *bending* process"), FIGS. 1B-2.

336. 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.").

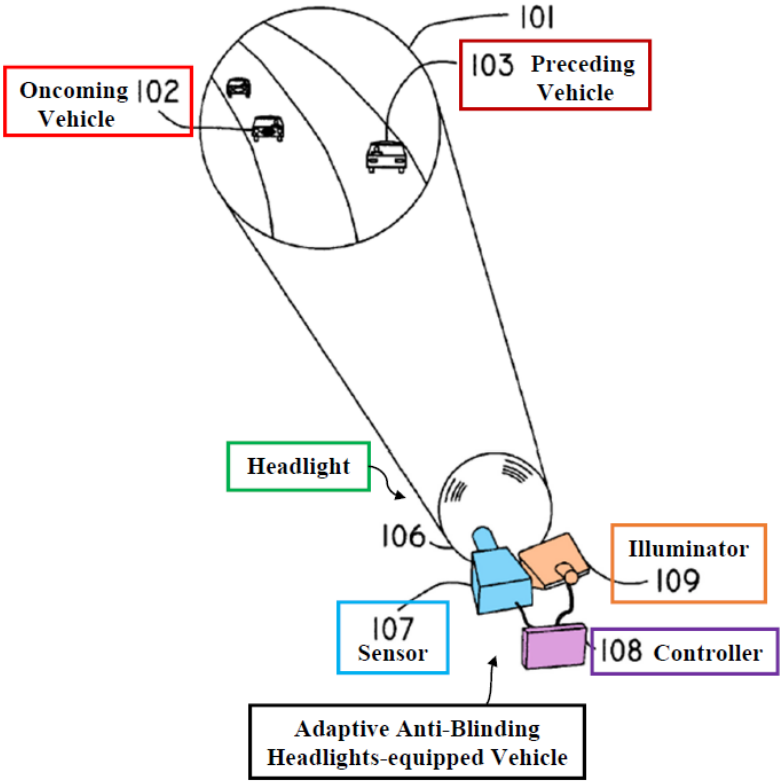
337. Further, conventional headlamps, with static high and low beams did not respond to changing driving conditions, and multiple beams were needed to provide "bending beams" for different types of road curvatures ("high speed," "middle speed," "low speed," "cross-roads"). EX1026, 451-452.

338. Beam-Thominet and Kobayashi are from the same field—controllable headlamps with dynamic illumination—and include the same building blocks (light sources, sensors, controllers). Further, driver safety is paramount. EX1005, 5:33-54, 3:8-45, 6:53-7:13; EX1008, 15:6-28.

339. *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 an upcoming curve/turn, improving driver safety by providing light to where it is needed. *Second*, a POSA would have easily

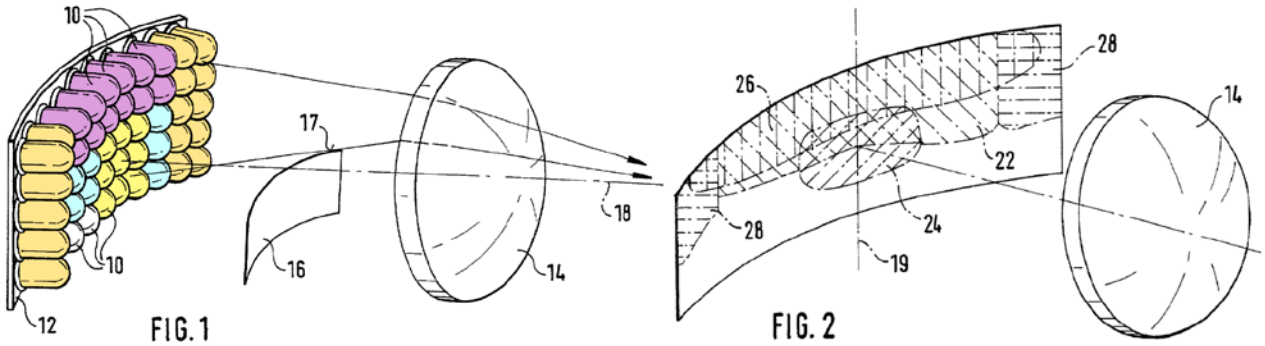
incorporated *known components* of Kobayashi's road profile calculating means 2 and/or vehicle advancing direction prediction means 3 (including GPS navigation device 29, *see* EX1008, Abstract, 1:10-2:35, 4:60-64, FIGS. 1, 10, 12) into Beam-Thominet. This would have, like Kobayashi, provided road curvature data for Beam's detected scene 101, allowing Beam-Thominet's system to increase illumination toward the upcoming curve/turn, further improving safety.

340. Beam "*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, 4:15-20. 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 (tilt on a hill) and steering mechanism (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).

341. Furthermore, Thominet expresses the importance of illuminating "one side…to the right or to the left…during *d[r]iving over a curve* or…a *bending*" with directional light sources (region 28) to provide illumination in the "traveling direction." EX1006, ¶¶8, 25, FIGS. 1B-2.



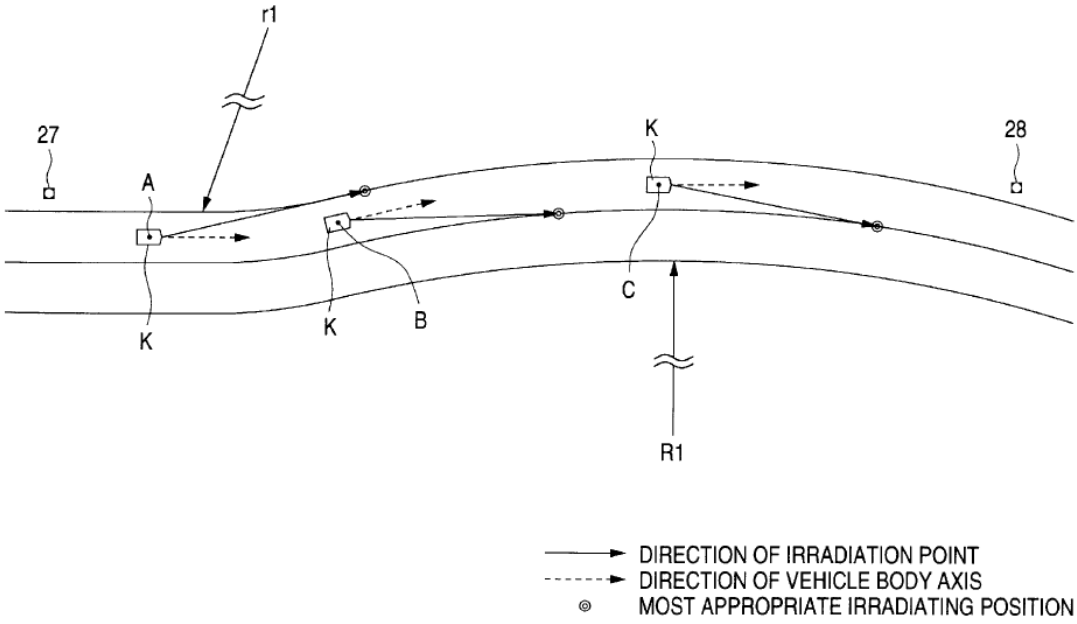
EX1006, FIGS. 1-2 (annotated).

342. Beam-Thominet does not disclose details on how to detect upcoming curves/turns, such as from GPS or navigation beacons, as an input to control the intensity, shape, and/or angular position of the microbeams, but this was well known in the art and 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 (EX1005, 2:15-22), and further achieves Beam's purpose of improving driver safety. EX1005, 3:8-45, 6:53-7:13. Kobayashi provides additional active techniques, specifically map data-based control including road curvature.

343. Kobayashi's active *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, 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.

344. 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.

345. A POSA would have understood that including an additional data source for Beam-Thominet's controller/processor—Kobayashi's map data including road curvature—would have enhanced Beam-Thominet by increasing illumination of upcoming curves/turns, thereby improving safety. This would have merely been applying Kobayashi's known technique (using map data including road curvature from GPS 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

(improved safety); thus, a POSA would have readily applied it to similar systems, such as Beam-Thominet's, in the same way.

346. Additionally, or alternatively, this modification would have been simply combining known prior-art elements (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 (illuminating curves/turns, improving safety).

347. 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 combination of prior-art elements: 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 (in communication with Beam's controller).

348. 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).

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

350. Thus, Beam-Thominet in combination with Kobayashi renders obvious claims 32-36 of the '503 patent.

XIII. GROUND 4: THE COMBINATION OF BEAM, THOMINET, STAM, AND KOBAYASHI RENDERS OBVIOUS CLAIM 70.

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

351. As described in Sections X.A/XI.A, a POSA would have been motivated to combine Beam-Thominet-Stam. For the same reasons described in Section XII.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 70: "The method of claim 65, wherein the determining illumination further includes determining illumination that increases illumination of an upcoming curve indicated by the data, wherein the determining the control instructions further comprises determining the control instructions for controlling one or more of the directional light sources to achieve illumination around the curve."

352. In my opinion, there is no patentable difference between the language of claim 70 and claim 34 as shown above (even though claim 70 uses the term "curve," and claim 34 uses the term "turn"). The same disclosures above address each feature. *Supra* Section XII.B; *See also* Appendix B. Therefore, my above analysis in Section XII.B applies.

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

354. Thus, Beam-Thominet-Stam in combination with Kobayashi renders obvious claim 70 of the '503 patent.

XIV. GROUND 5: THE COMBINATION OF BEAM, THOMINET, STAM, AND BRAUN RENDERS OBVIOUS CLAIMS 66-67.

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

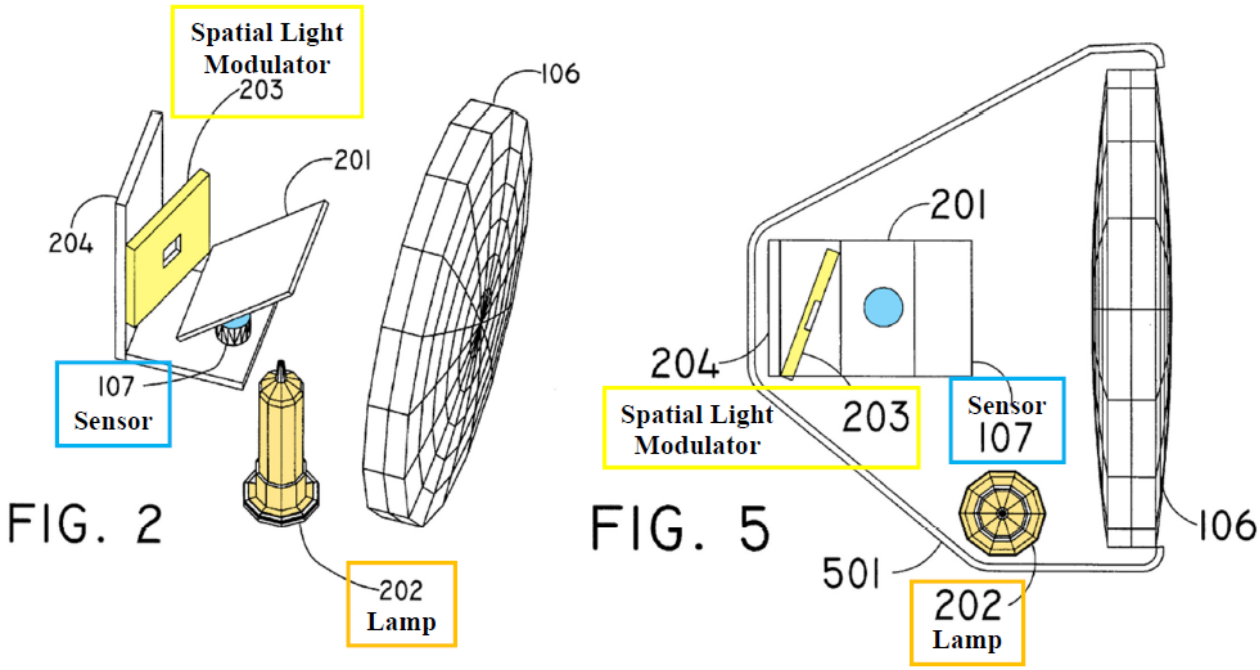
355. As described in Sections X.A and XI.A, a POSA would have been motivated to combine Beam-Thominet-Stam. A POSA would have been further motivated to modify Beam-Thominet-Stam to adjust light based on pattern

recognition (e.g., identifying pedestrians, road-signs, obstacles, etc.), as in Braun (EX1009, 5:27-31, 14:21-30, 22:19-23, 23:28-24:27, 26:29-27:2, FIGS. 1, 5-6), to further control Beam's directional microbeams to illuminate objects, thereby improving visibility and driver safety—an express purpose of Beam. EX1005, 3:8-14, 3:37-44, 5:33-54, 7:1-13.

356. Beam-Thominet-Stam and Braun are from the same field—controllable headlamps with dynamic illumination—and include the same building blocks (e.g., light sources, sensors, controllers). Improved visibility and driver safety is paramount. EX1005, 3:8-45, 6:53-7:13, 1:54-59, 4:48-59; EX1009, 22:19-23 ("*identify features and/or objects* in the scene"), 6:4-51 ("*prevent glare*"), 5:27-31 ("*improve…readability*"), 11:26-30 ("*maximize visibility*"), 26:29-27:4, 22:24-25.

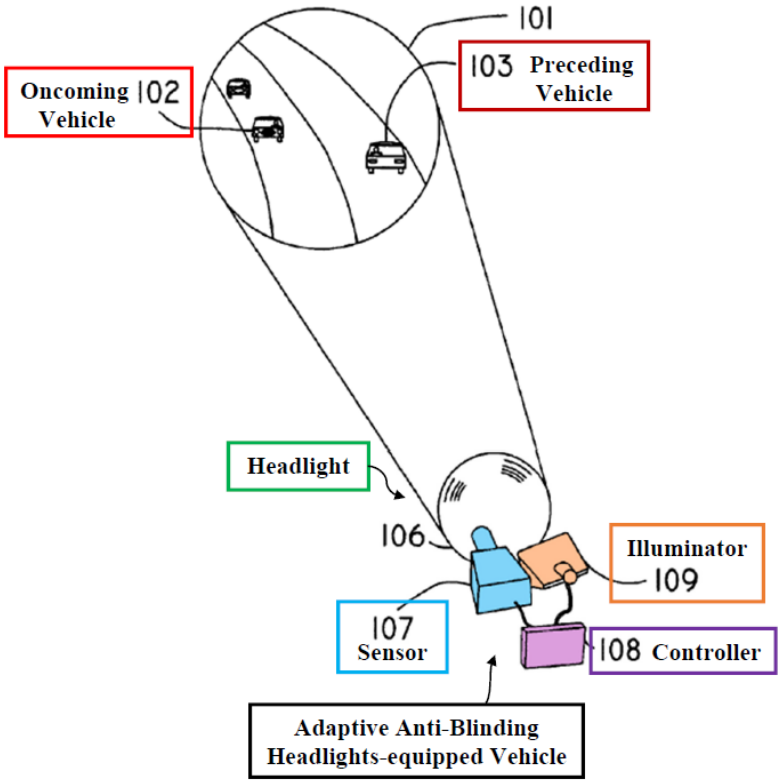
357. Including an additional control technique (software implementation) for Beam-Thominet-Stam's controller—Braun's *known technique* of pattern recognition—would have enhanced Beam-Thominet-Stam by identifying and illuminating objects of interest in a scene, increasing visibility and safety. EX1009, 5:27-31, 14:21-30, 22:19-23, 23:28-24:27, 26:29-27:2, FIGS. 1, 5-6. 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, 5 (annotated).

358. Indeed, Beam's techniques and system of controlling individual microbeams emphasize safety of all drivers. EX1005, 3:8-45, 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, 3:8-45. Beam enables "the driver to see more clearly at night," while protecting others from glare. EX1005, 3:8-45; EX1005, 4:9-24, 6:9-27.



EX1005, FIG. 1 (annotated).

359. Beam recognizes the problem of identifying and illuminating other objects, for example, "*street signs*, terrain features, obstructions…*pedestrians*, bicyclists or animals" with just low beam illumination, and acknowledges the safety benefits of illuminating those objects with high beam illumination. EX1005, 1:54-59; EX1005, 4:48-59. And Braun's *technique* (software implementation), like Beam-Thominet-Stam, enhances driver visibility and safety—using pattern recognition. EX1009, 5:21-6:7, 11:14-17, 11:27-30, 12:17-20, 38:19-22. Braun's pattern recognition application identifies objects of interest (e.g., pedestrian, road-sign) and controller 118 adaptively controls luxels in illuminator 116 to illuminate

the identified objects, improving visibility of the objects and capturing the driver's attention and/or alerting the driver to the danger of the objects, thereby enhancing safety. EX1009, 14:21-30, 23:28-24:27, FIGS. 1, 5-6; EX1009, 6:8-15 ("*alerts* the driver…with a suitable spatial and/or temporal illumination pattern"), 10:28-30 ("an optical cue that *alerts the driver* to the *danger*"), 22:19-23 ("identified *features and/or objects*"), 5:27-31 ("*road signs*"), 26:20-29 ("visually *alert* the driver…of a *dangerous* situation"), 26:29-27:2 ("'*pattern recognize*' presence of *people*…and *spotlight the people* to *alert* the driver"). And like Beam, Braun's pattern recognition application "identifies *oncoming vehicles* and automatically adjusts illumination…to *prevent glare*…[and] *blinding* a driver of the oncoming vehicle," so naturally Braun's pattern recognition technique (software implementation) would have been a natural extension and improvement on Beam's AABH system and would have been obvious to a POSA. EX1009, 6:4-7, 12:17-20, 38:19-22.

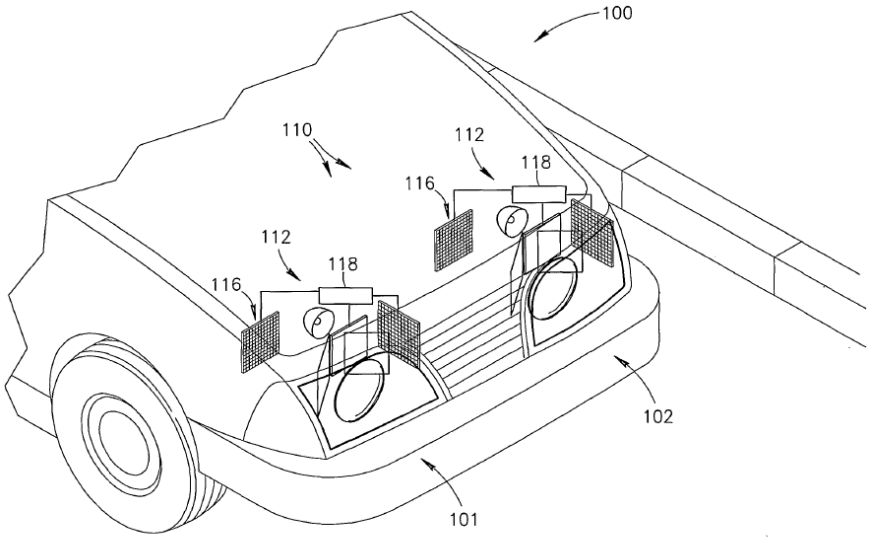


FIG.5

EX1009, FIG. 5.

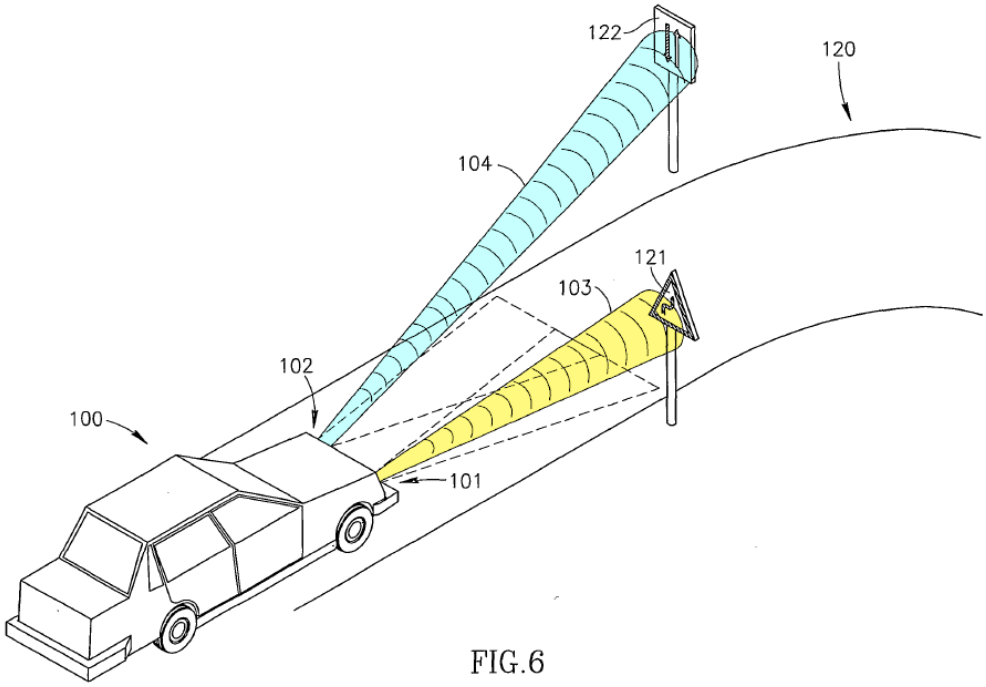


FIG.6

EX1009, FIG. 6 (annotated).

360. The additional control of having pattern recognition as in Braun, implemented with Beam's controller 108/illuminator 109 (including SLM 203),

would have enhanced Beam-Thominet-Stam's system by identifying and illuminating objects of interest, capturing the driver's attention and/or alerting the driver to the danger of the objects, thereby improving safety. This would have merely been applying Braun's known technique (software implementation: pattern recognition to identify/illuminate objects of interest) to Beam-Thominet-Stam's similar, known device (dynamic headlamp system with controllable beams), in the same way. EX1005, 5:46-54 ("[p]rocessor 1105 uses appropriate *algorithms* on the incoming data to determine the locations to be blanked"), 6:14-19 ("controller module uses…*sensor spatial data (video) to determine*…*illumination sources*…in the headlight's *field-of-view*…to *control the Illuminator*"), 5:33-36 ("*spatial scene data* from sensor 107…[is] *input* to a processor 1105"), 4:10-25, FIGS. 1, 1C-1D, 7. Braun's known technique is fully described along with its benefits (improved visibility, thereby increased safety); thus, a POSA would have readily applied it to similar systems, such as Beam-Thominet-Stam's, in the same way.

361. A POSA would have had a reasonable expectation of success combining Braun with Beam-Thominet-Stam, for example, by simply modifying software instructions stored in memory of Beam-Thominet-Stam's controller/processor (e.g., an algorithm) to adjust/direct light of the microbeams appropriately in view of Braun's pattern recognition. Overall, this is a simple software implementation. This would have been routine and well within a POSA's

skill due to the similarities in Beam-Thominet-Stam's and Braun's adaptive systems—their common components were well known and there would have been no limitations for a POSA to make such modifications. EX1009, 22:17-25 ("a *pattern recognition* application…using *algorithms* and *methods known in the art*").

362. I lay out below the specific disclosures of Beam-Thominet-Stam and Braun, and expand on this combination and reasonable expectation of success analysis below.

B. Claim 66: "The method of claim 65, wherein the data includes data indicating a pedestrian and wherein the determining illumination includes determining an illumination level, for at least a third subsection including the pedestrian."

Claim 67: "The method of claim 65, wherein the data includes data indicating a road-sign wherein the determining illumination includes determining an illumination level, for at least a third subsection including the road-sign."

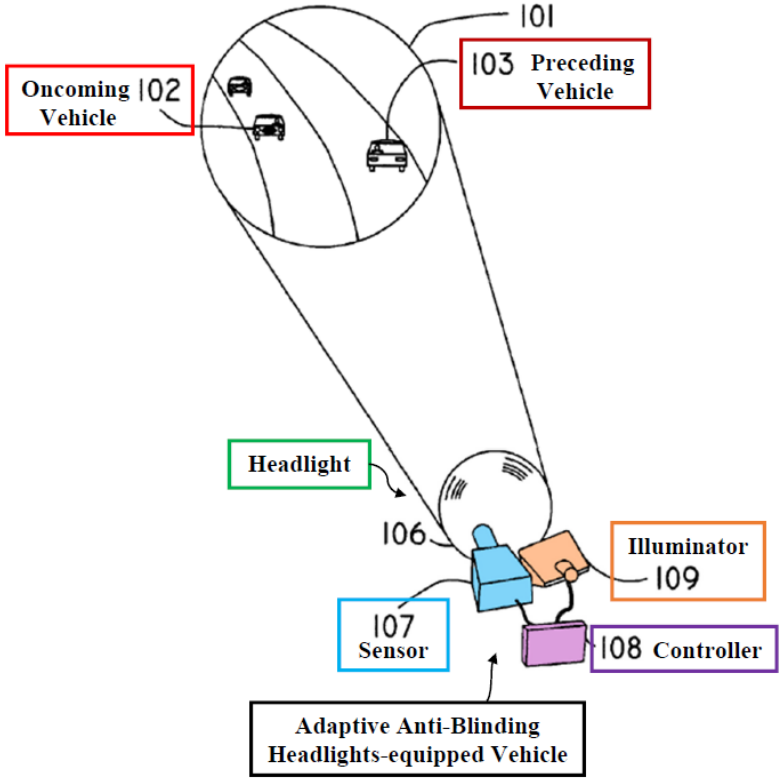
363. In my opinion, claims 66-67 recite language having no patentable difference, relating to identifying and illuminating an object: a "pedestrian" (claim 66) and a "road-sign" (claim 67).

364. In my opinion, there is no patentable difference between the language of claim 66 and claim 67. The same disclosures below address each feature. *See also* Appendix B.

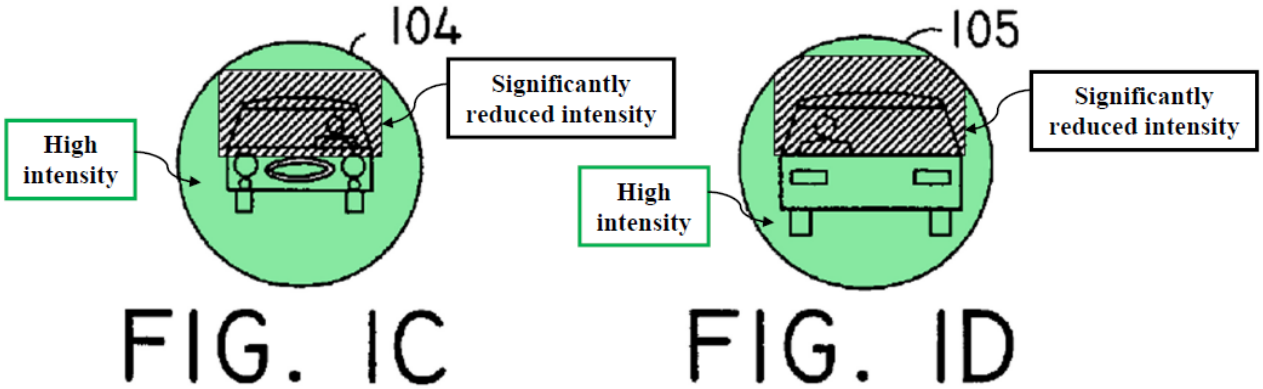
1. Beam-Thominet-Stam's disclosure

365. Beam discloses "spatial scene data [101] from sensor 107…becomes the input to a processor 1105" and recognizes the problem of identifying and

illuminating other objects, for example, “pedestrians” and “street signs” with just low beam illumination. EX1005, 5:33-36, 1:54-59, FIGS. 1, 1C-1D, 7; EX1005, 3:37-44 (“to see more clearly at night”), 4:53-59, 5:33-54.



EX1005, FIG. 1 (annotated).



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

366. Beam-Thominet-Stam does not disclose data indicating a pedestrian/road-sign, but this feature was well known in the prior art, e.g., as explicitly disclosed by Braun.

2. Braun's disclosure

367. Braun's system "'pattern recognize[s]' presence of *people*…and *spotlight[s] the people* to alert the driver" and "controls illumination…to the *identified features and/or objects*." EX1009, 26:31-27:1, 22:17-23, FIGS. 5-6; EX1009, 26:33-27:1 ("illuminate…the *presence of people*"), 22:19-22 ("pattern recognition"), 5:21-6:7, 14:21-30, 23:8-24:27. Also, Braun's "*pattern recognition* application processes the *images*…and *identifies roadway signs 121 and 122*" and "[c]ontroller 118…controls luxels in illuminators 116…to provide light beams 103 and 104 that *spotlight roadway signs 121 and 122*." EX1009, 24:4-7, FIGS. 5-6.

368. A POSA would have understood that Braun discloses "determining an illumination level…for at least a third subsection" because Braun's system "spotlights" (illuminates) "people" and "roadway signs" in particular regions of the roadway scene. EX1009, 4:17-20 ("controller comprises a *pattern recognition* application that *processes* images of a scene…controller *controls* the luxels to illuminate the scene *responsive* to the identified features and/or objects"), 4:21-5:1 ("controller *determines*…the component velocity and then *controls* the luxels *responsive* to the determined component of velocity"), 7:1-7 ("light that

illuminates a *different region* of the scene…a range finder that *determines* distances to regions of the scene…and a controller that controls the plurality of light providing regions…for illuminating the scene *responsive* to the distances determined"), 11:14-17 ("controller processes an image of the sign to *determine* its color components and *controls* hue and saturation of light that illuminates the sign to enhance its readability"), 23:5-7 ("velocity of an object is used by the controller to *determine* how fast to pan a light pattern that *highlights* the object").

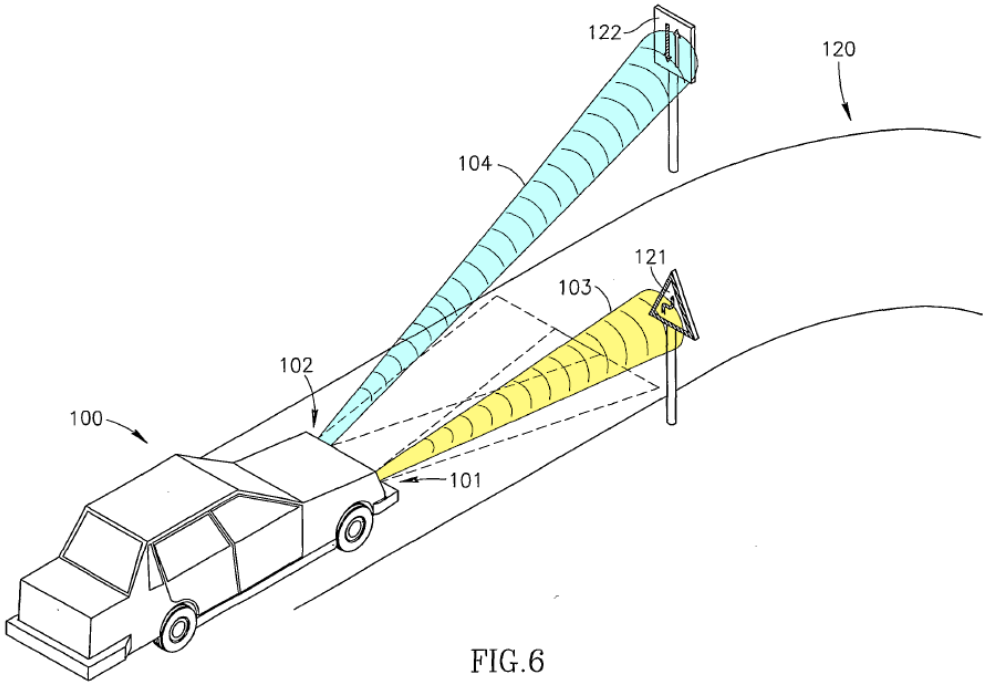


FIG.6

EX1009, FIG. 6 (annotated).

369. As discussed, a POSA would have been motivated to combine Braun with Beam-Thominet-Stam with a reasonable expectation of success. *Supra* Section XIV.A.

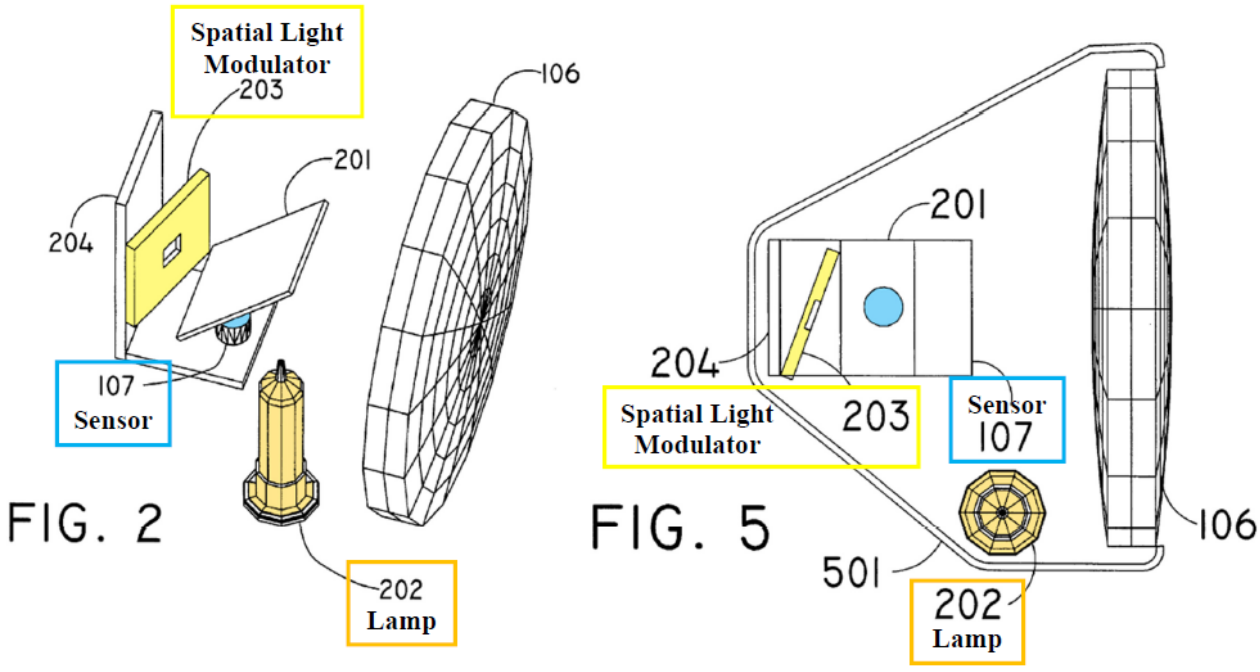
3. A POSA would have been motivated to combine Braun with Beam-Thominet-Stam with a reasonable expectation of success.

370. As described in Sections X.A/XI.A, a POSA would have been motivated to combine Beam-Thominet-Stam. A POSA would have been further motivated to modify Beam-Thominet-Stam to adjust light based on pattern recognition (e.g., identifying pedestrians, road-signs, obstacles, etc.), as in Braun (EX1009, 5:27-31, 14:21-30, 22:19-23, 23:28-24:27, 26:29-27:2, FIGS. 1, 5-6), to further control Beam's directional microbeams to illuminate objects, thereby improving visibility and driver safety—an express purpose of Beam. EX1005, 3:8-14, 3:37-44, 5:33-54, 7:1-13.

371. Beam-Thominet-Stam and Braun are from the same field—controllable headlamps with dynamic illumination—and include the same building blocks (e.g., light sources, sensors, controllers). Improved visibility and driver safety is paramount. EX1005, 3:8-45, 6:53-7:13, 1:54-59, 4:48-59; EX1009, 22:19-23 ("*identify features and/or objects* in the scene"), 6:4-15 ("*prevent glare*"), 5:27-31 ("*improve…readability*"), 11:26-30 ("*maximize visibility*"), 26:29-27:4, 22:24-25.

372. Including an additional control technique (software implementation) for Beam-Thominet-Stam's controller—Braun's *known technique* of pattern recognition—would have enhanced Beam-Thominet-Stam by identifying and

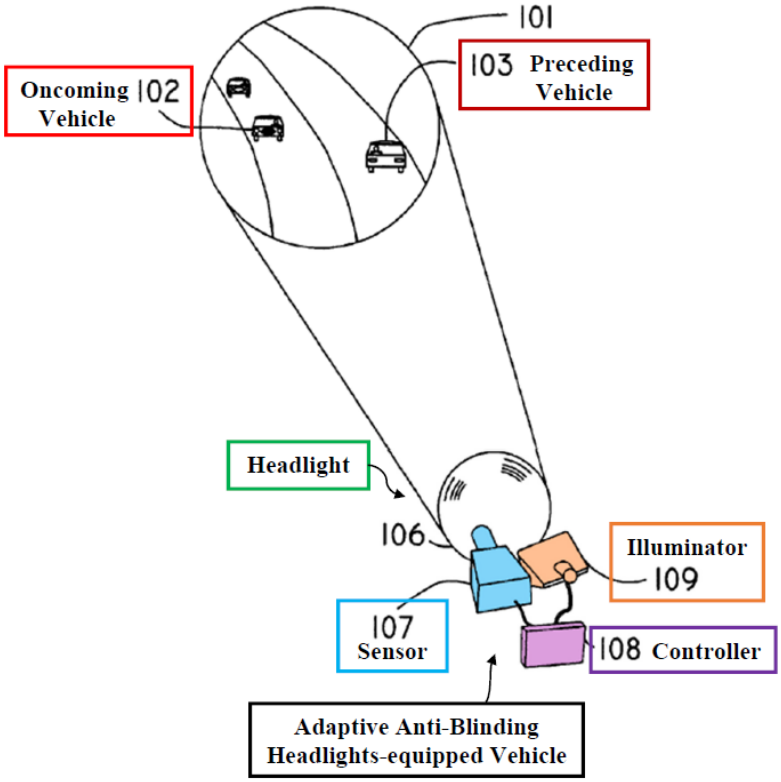
illuminating objects of interest in a scene, increasing visibility and safety. EX1009, 5:27-31, 14:21-30, 22:19-23, 23:28-24:27, 26:29-27:2, FIGS. 1, 5-6. Beam discloses "[t]he *angular* position" of each microbeam can be set by controller 108, which commands SLM 203 in illuminator 109, to reduce glare. EX1005, 4:26-59, 5:3-21, FIGS. 1-2, 5; EX1005, Abstract, 8:4-17.



EX1005, FIGS. 2, 5 (annotated).

373. Indeed, Beam's techniques and system of controlling individual microbeams emphasize safety of all drivers. EX1005, 3:8-45, 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, 3:8-45. Beam enables

"the driver to see more clearly at night," while protecting others from glare. EX1005, 3:8-45; EX1005, 4:9-24, 6:9-27.



EX1005, FIG. 1 (annotated).

374. Beam recognizes the problem of identifying and illuminating other objects, for example, "*street signs*, terrain features, obstructions…*pedestrians*, bicyclists or animals" with just low beam illumination, and acknowledges the safety benefits of illuminating those objects with high beam illumination. EX1005, 1:54-59; EX1005, 4:48-59. And Braun's *technique* (software implementation), like Beam-Thominet-Stam, enhances driver visibility and safety—using pattern recognition. EX1009, 5:21-6:7, 11:14-17, 11:27-30, 12:17-20, 38:19-22. Braun's

pattern recognition application identifies objects of interest (e.g., pedestrian, road-sign) and controller 118 adaptively controls luxels in illuminator 116 to illuminate the identified objects, improving visibility of the objects and capturing the driver's attention and/or alerting the driver to the danger of the objects, thereby enhancing safety. EX1009, 14:21-30, 23:28-24:27, FIGS. 1, 5-6; EX1009, 6:8-15 ("*alerts* the driver…with a suitable spatial and/or temporal illumination pattern"), 10:28-30 ("an optical cue that *alerts the driver* to the *danger*"), 22:19-23 ("identified *features and/or objects*"), 5:27-31 ("*road signs*"), 26:20-29 ("visually *alert* the driver…of a *dangerous* situation"), 26:29-27:2 ("'*pattern recognize*' presence of *people*…and *spotlight the people* to *alert* the driver"). And like Beam, Braun's pattern recognition application "identifies *oncoming vehicles* and automatically adjusts illumination…to *prevent glare*…[and] *blinding* a driver of the oncoming vehicle," so naturally Braun's pattern recognition technique (software implementation) would have been a natural extension and improvement on Beam's AABH system and would have been obvious to a POSA. EX1009, 6:4-7, 12:17-20, 38:19-22.

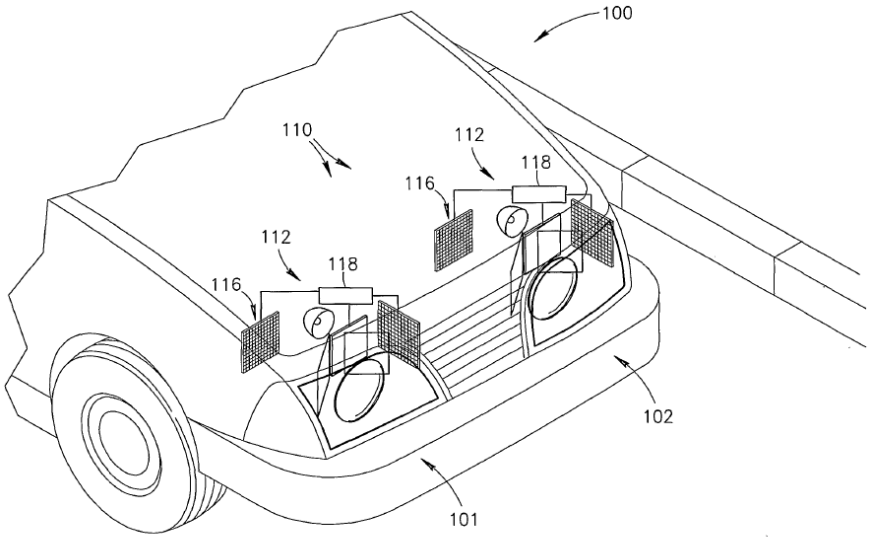


FIG.5

EX1009, FIG. 5.

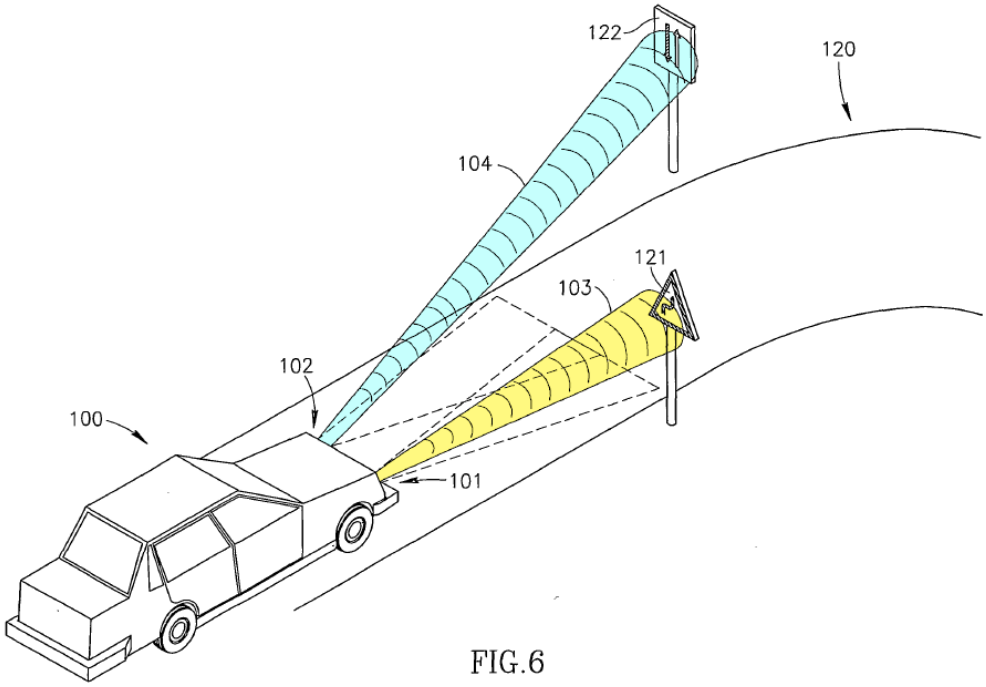


FIG.6

EX1009, FIG. 6 (annotated).

375. The additional control of having pattern recognition as in Braun, implemented with Beam's controller 108/illuminator 109 (including SLM 203),

would have enhanced Beam-Thominet-Stam's system by identifying and illuminating objects of interest, capturing the driver's attention and/or alerting the driver to the danger of the objects, thereby improving safety. This would have merely been applying Braun's known technique (software implementation: pattern recognition to identify/illuminate objects of interest) to Beam-Thominet-Stam's similar, known device (dynamic headlamp system with controllable beams), in the same way. EX1005, 5:46-54 ("[p]rocessor 1105 uses appropriate *algorithms* on the incoming data to determine the locations to be blanked"), 6:14-19 ("controller module uses…*sensor spatial data (video) to determine*…*illumination sources*…in the headlight's *field-of-view*…to *control the Illuminator*"), 5:33-35 ("*spatial scene data* from sensor 107…[is] *input* to a processor 1105"), 4:10-25, FIGS. 1, 1C-1D, 7. Braun's known technique is fully described along with its benefits (improved visibility, thereby increased safety); thus, a POSA would have readily applied it to similar systems, such as Beam-Thominet-Stam's, in the same way.

376. A POSA would have had a reasonable expectation of success combining Braun with Beam-Thominet-Stam, for example, by simply modifying software instructions stored in memory of Beam-Thominet-Stam's controller/processor (e.g., an algorithm) to adjust/direct light of the microbeams appropriately in view of Braun's pattern recognition. This would have been routine and well within a POSA's skill due to the similarities in Beam-Thominet-Stam's

and Braun's adaptive systems—their common components were well known and there would have been no limitations for a POSA to make such modifications. EX1009, 22:17-25 ("a *pattern recognition* application…using *algorithms* and *methods known in the art*").

377. In view of the above, Beam-Thominet-Stam in combination with Braun renders obvious these claims.

378. Thus, Beam-Thominet-Stam in combination with Braun renders obvious claims 66-67 of the '503 patent.

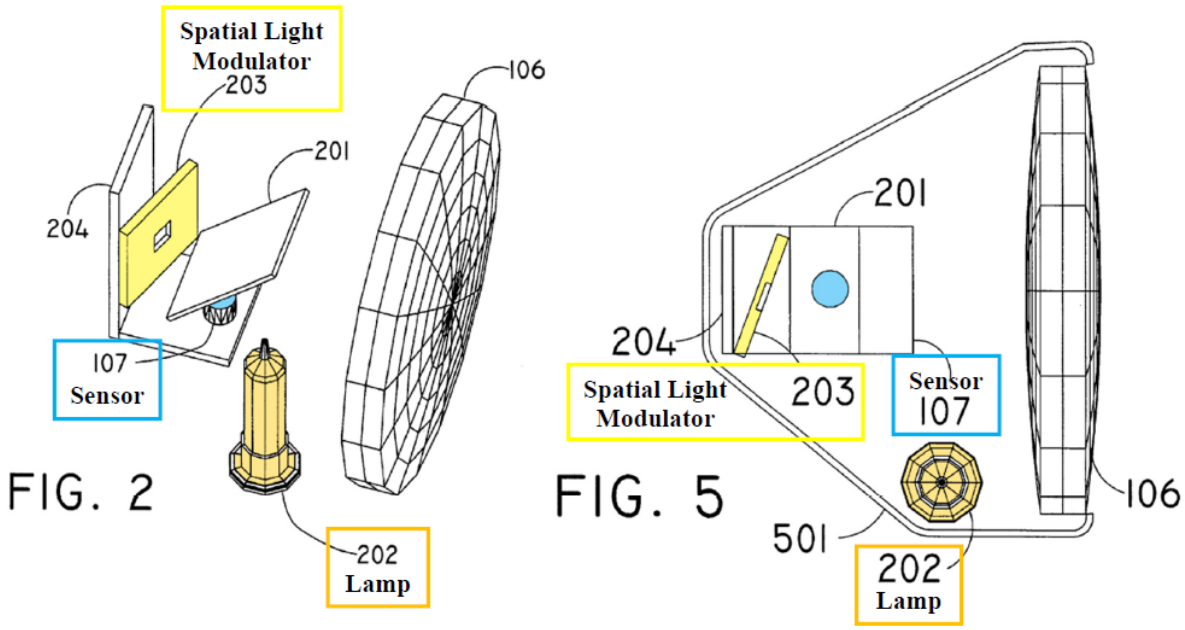
XV. GROUND 6: THE COMBINATION OF BEAM, THOMINET, AND HARBERS RENDERS OBVIOUS CLAIMS 28-29.

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

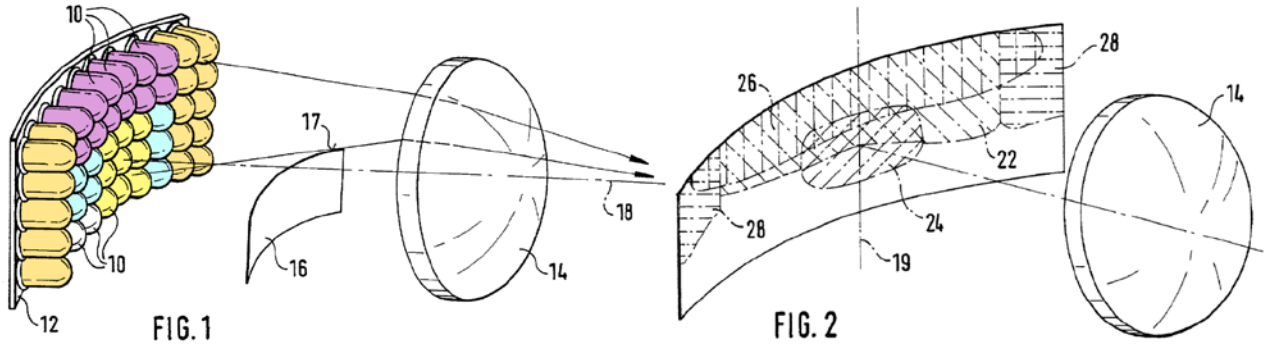
379. As described in Section X.A, a POSA would have been motivated to combine Beam-Thominet. A POSA would have been further motivated to modify Beam-Thominet to adjust light based on multiple colored directional illumination for different functions, as in Harbers, to further control Beam-Thominet's adaptive headlamps to illuminate a roadway, thereby improving visibility and driver safety—an express purpose of Beam-Thominet. EX1005, 3:29-44 ("*manually* lower the beams for conditions like rain, snow, or fog"), 3:8-14, 5:33-54, 7:1-13; EX1006, ¶¶5 ("light beams of *different light colors*"), 7 ("*wider* illumination…in fog"), 17-18, 21-26.

380. Beam-Thominet and Harbers are from the same field—controllable headlamps with dynamic illumination—and include the same building blocks (light sources, sensors, controllers). Improved visibility, thereby increasing safety, is paramount. EX1005, 1:54-59, 3:8-45, 4:48-59, 6:53-7:13; EX1006, ¶¶3-4, 23; EX1011, 5:1-26, 7:1-14, 9:1-32.

381. *First*, including an additional control technique (software implementation) for Beam-Thominet—Harbers's *known technique* of using multiple colored directional beam regions for different functions—would have added different functions to Beam-Thominet's visibility for different driving situations, thereby 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. Further, Thominet discloses "light beams of *different light colors* is possible…for different signal functions" and "different partial regions [22, 24, 26, 28] emit light of *different colors*." EX1006, ¶¶5-6, 27, FIGS. 1B-2.



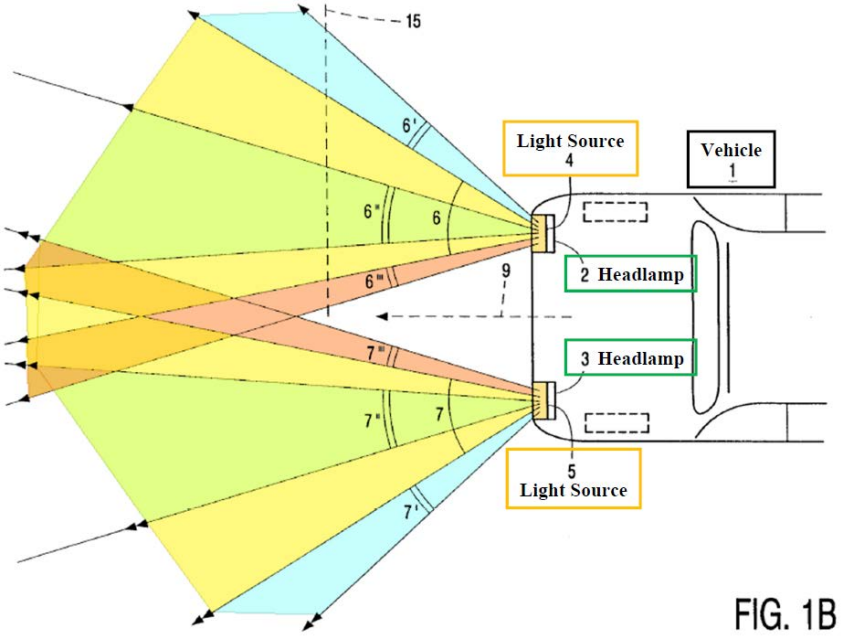
EX1005, FIGS. 2, 5 (annotated).



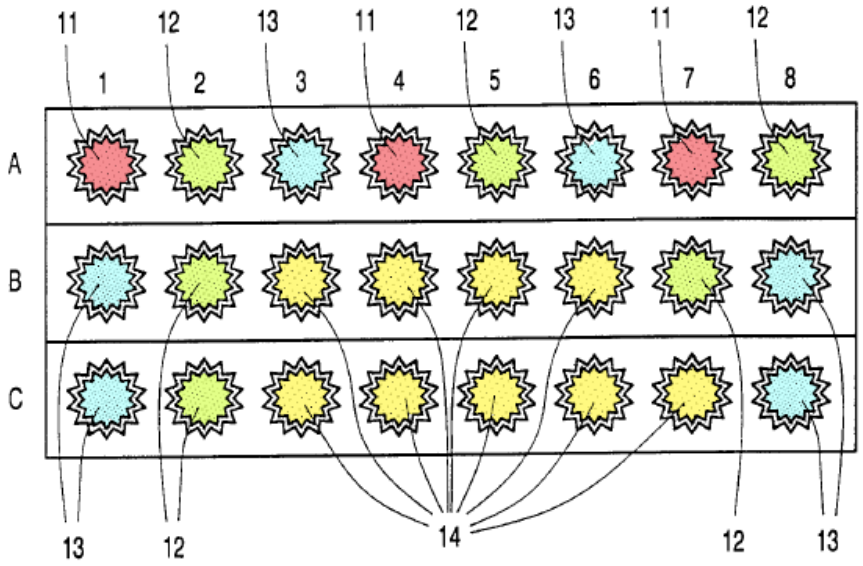
EX1006, FIGS. 1-2 (annotated).

382. Indeed, Beam's techniques and system enable "the driver to see more clearly at night," while protecting others from glare. EX1005, 3:8-45; EX1005, 4:9-24, 6:9-27. Beam recognizes the safety benefits of different spatial distributions "for conditions like…*fog*." EX1005, 3:29-36; EX1005, 1:54-59, 4:48-59; EX1006, ¶¶5 ("*different light colors*"), 7 ("*wider* illumination…in *fog*). And Harbers's *technique* (software implementation), like Beam-Thominet, seeks to

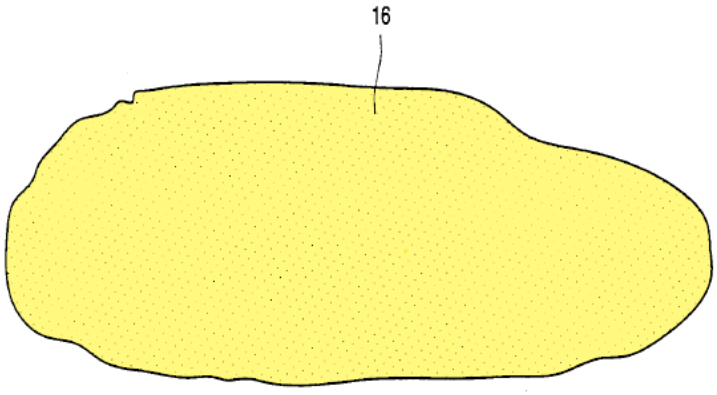
enhance driver visibility, thereby increasing safety—using multiple colored directional beam segments for different functions. EX1011, 5:14-26, 6:1-7, 6:27-7:19, 8:10-18, FIGS. 1B-2. Opto-electronic elements 11-14 provide differently colored beam segments 6-6'-6"-6'", 7-7'-7"-7'" to form different distributions. EX1011, 5:14-26, 6:1-7, 6:27-7:19, FIGS. 1B-2, 4A; EX1011, 9:18-25 ("*yellow light*…to *improve*…*visibility*"), 10:6-14 ("*fog and snow*"), 7:27-32, 7:1-17, 9:28-10:5, 13:5-7.



EX1011, FIG. 1B (annotated).



EX1011, FIG. 2 (annotated).



EX1011, FIG. 4A (annotated), showing a relatively wide beam substantially composed of yellow light, such that the absence of the blue component in the visible light casues the effect of backscattering to be substantially reduced, such as in unfavorable weather conditions such as fog and snow. *See also* EX1011, 10:6-14, FIG. 4B.

383. The additional control of having multiple colored directional beam segments as in Harbers, implemented with Beam-Thominet's

controller/illuminator, would have provided Beam-Thominet's system with different colored distributions for different driving situations beyond reducing glare for drivers, increasing visibility and the driver's observation of the road and objects, thereby improving safety. EX1011, 2:33-3:10 ("driver's view of the road and the surroundings of the vehicle is *improved*…observation of *objects*…is *improved*"), 4:15-21 ("when the *visibility* is reduced…the light beam can be *adapted*…[so] the overall spatial distribution of the light is changed"), 5:21-26 ("*visibility of objects* situated outside the center of the light beam is *improved*"). This would have merely been applying Harbers's known technique (software implementation: using multiple colored directional beam segments for different functions), to Beam-Thominet's similar, known device (dynamic system with controllable headlamps), 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 Beam-Thominet's, in the same way. EX1011, 2:33-3:10, 4:15-21, 5:21-26.

384. A POSA would have had a reasonable expectation of success combining Beam-Thominet and Harbers, for example, by simply modifying software instructions in memory of Beam's controller/processor to organize Beam's array of microbeams into multiple colored directional beam segments for

different functions. Overall, this is a simple software implementation. This would have been routine and well within a POSA's skill due to the similarities in Beam-Thominet'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.

385. *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 colored opto-electronic elements 11-14, *see* EX1011, 5:14-26, 6:1-7, 6:27-7:32, FIGS. 1B-2) into Beam-Thominet's system (illuminator). Again, this would have, like Harbers, provided different colored spatial distributions for different driving situations, improving visibility and thereby safety. This is a simple hardware implementation.

386. Beam discloses flat array of light sources 401 (e.g., LEDs) has the same functionality as lamp 202 and SLM 203 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. Further, Thominet discloses "light beams of *different light colors* is possible…for different signal functions" and "different partial regions [22, 24, 26, 28] emit light of *different colors*." EX1006, ¶¶6, 27, FIGS. 1B-2.

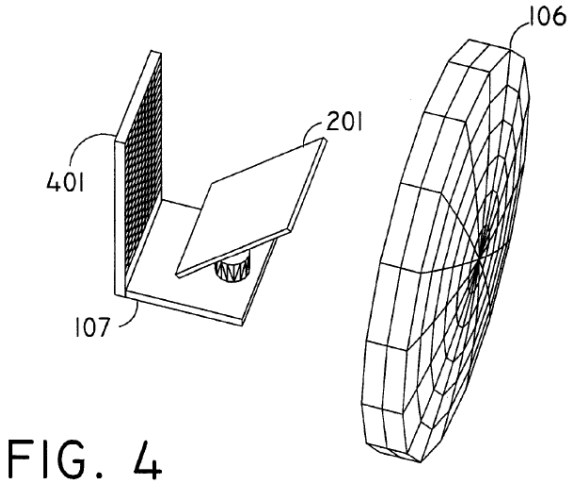


FIG. 4

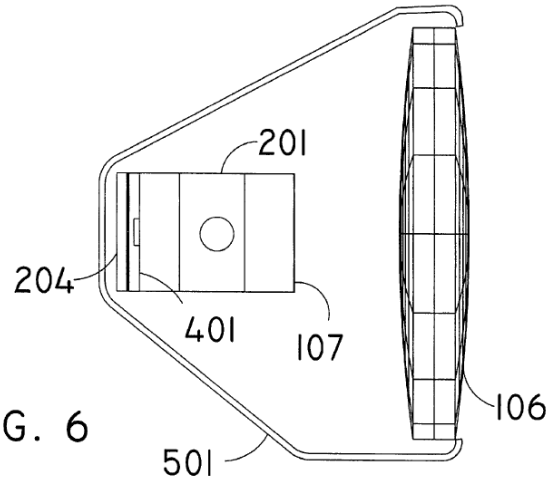
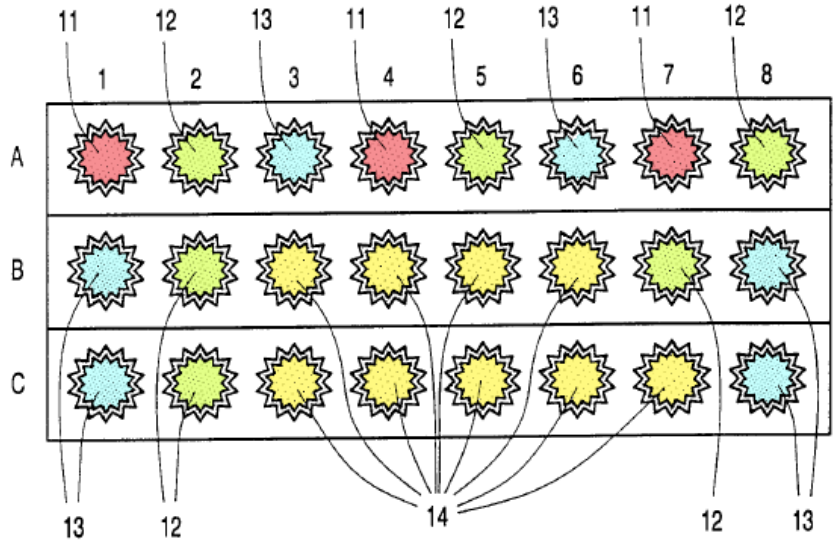


FIG. 6

EX1005, FIGS. 4, 6.

387. Through its *system components*, Harbers, like Beam-Thominet, 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. Opto-electronic elements 11-14 arranged on a "curved substrate," with different angles/aimings relative to the vehicle, provide colored 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, 7:27-32 ("*curved* substrate"), 7:1-17, 9:28-10:5, 13:5-7.



EX1011, FIG. 2 (annotated).

388. Like the software implementation, this hardware combination—Beam's array of light sources 401 and Harbers's differently colored opto-electronic elements 11-14 on a curved substrate—would have provided Beam-Thominet's system with different colored spatial distributions for different driving situations, as in Harbers, thereby improving driver safety. This would have been merely combining prior-art elements or a simple substitution of one known element for another (Beam's array of light sources 401 on a flat surface and Harbers's opto-electronic elements 11-14 on a curved substrate) according to known methods (disclosed in Beam-Thominet and Harbers) to yield predictable results (improved visibility and safety). Overall, this is a simple hardware implementation.

389. A POSA would have had a reasonable expectation of success combining Beam-Thominet and Harbers, for example, by simply modifying the

flat surface of Beam's array of light sources 401 with Harbers's curved substrate to provide multiple colored light sources (e.g., directional beam segments 6-6'-6"-6"', 7-7'-7"-7"') for different functions (hardware implementation).

390. Such modification would have been routine and well within a POSA's skill due to the similarities in Beam-Thominet'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 Beam-Thominet's 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).

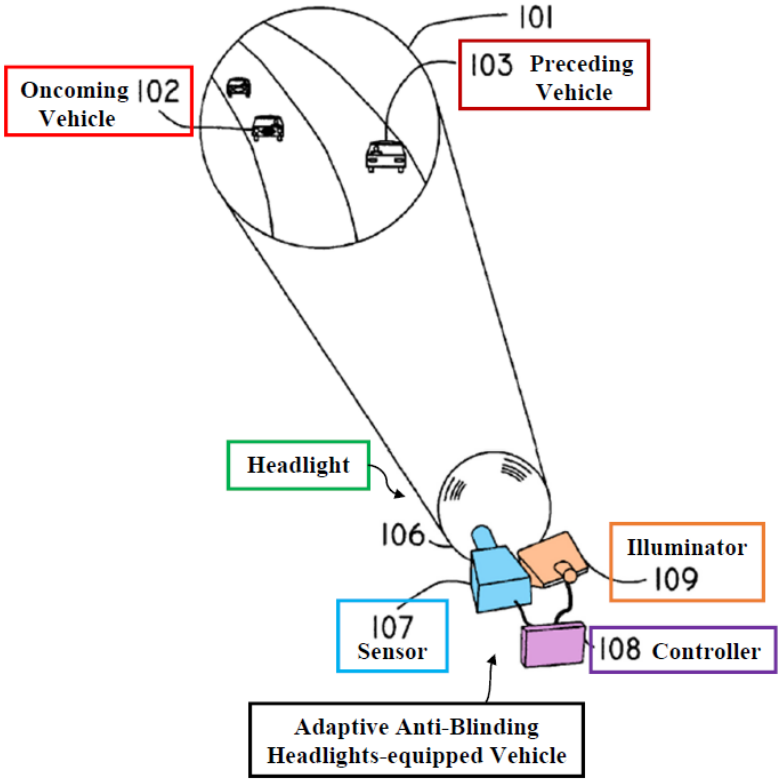
391. I lay out below the specific disclosures of Beam-Thominet and Harbers, and expand on this combination and reasonable expectation of success analysis below.

B. Claim 28: "The method of claim 26, wherein the illumination requirements accommodate peripheral night vision of the driver, by defining bluish headlamp illumination along a side of a road, while defining yellow tinted illumination along the road."

1. Beam-Thominet's disclosure

392. Beam discloses "*spatial scene data [101]* from sensor 107…becomes the input to a processor 1105" and recognizes the problem of illuminating "terrain features, obstructions or potholes in the road" with just low beam illumination.

EX1005, 5:33-36, 1:54-59, FIGS. 1, 1C-1D, 7; EX1005, 3:37-44 ("to see more clearly *at night*"), 4:53-59, 5:33-54.



EX1005, FIG. 1 (annotated).

393. Beam-Thominet does not disclose bluish illumination along a side of a road and yellow illumination along the road, but this feature was well known in the prior art, e.g., as explicitly disclosed by Harbers. *See also* EX1009, 5:22-25 ("adaptive illumination of a *roadway* and *neighboring regions*"), 14:21-30 ("luxels 26 are 'color' luxels…to provide *different color light...combinations of R, G, and B light*"), 23:28-24:27 ("illuminate…with predominantly yellow and green light"), 9:21-22 ("*B [blue] light* in controllable amounts"), FIGS. 2-3, 5-6.

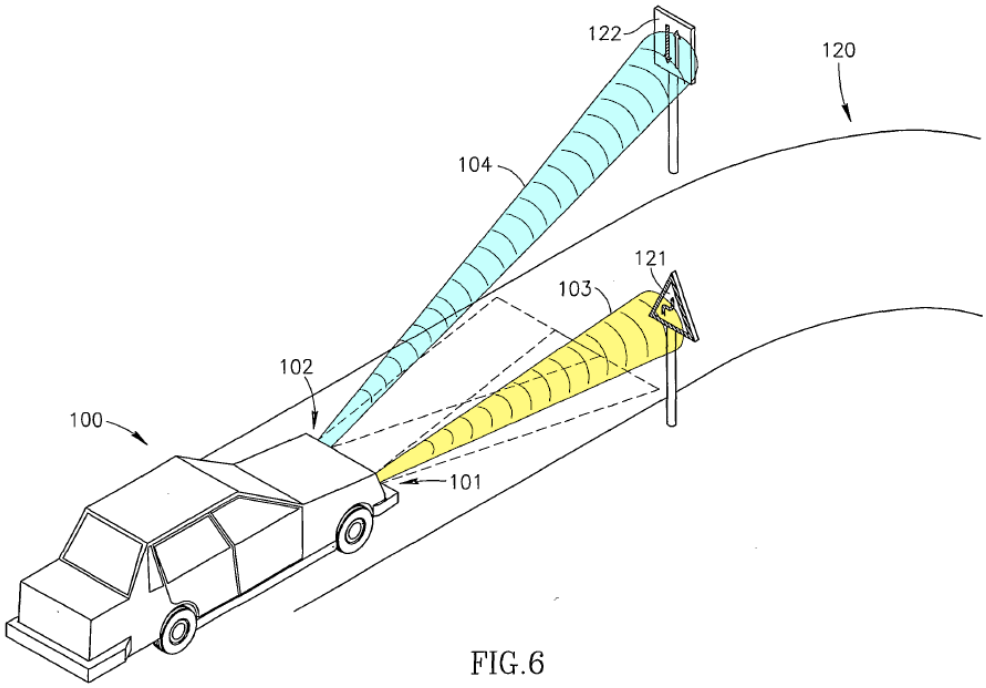


FIG.6

EX1009, FIG. 6 (annotated).

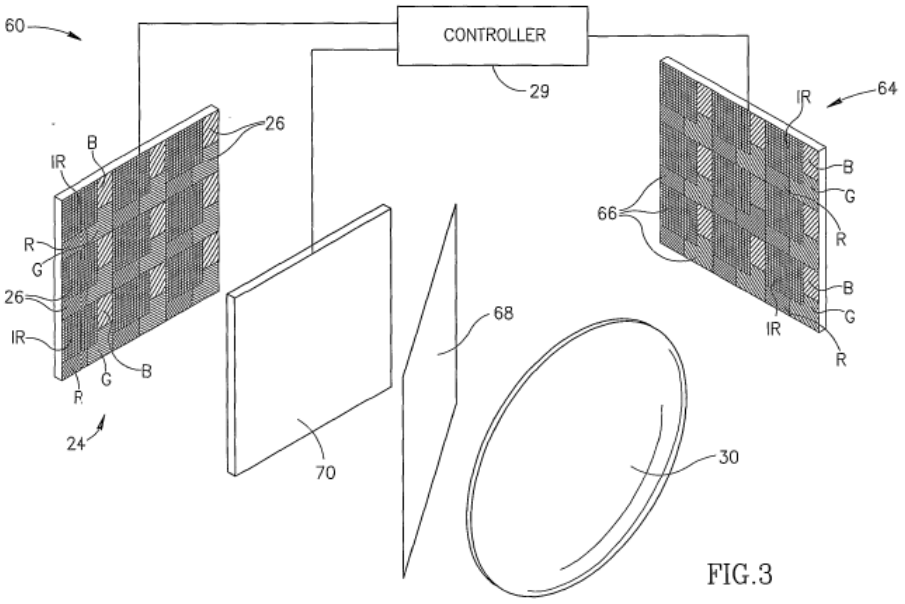
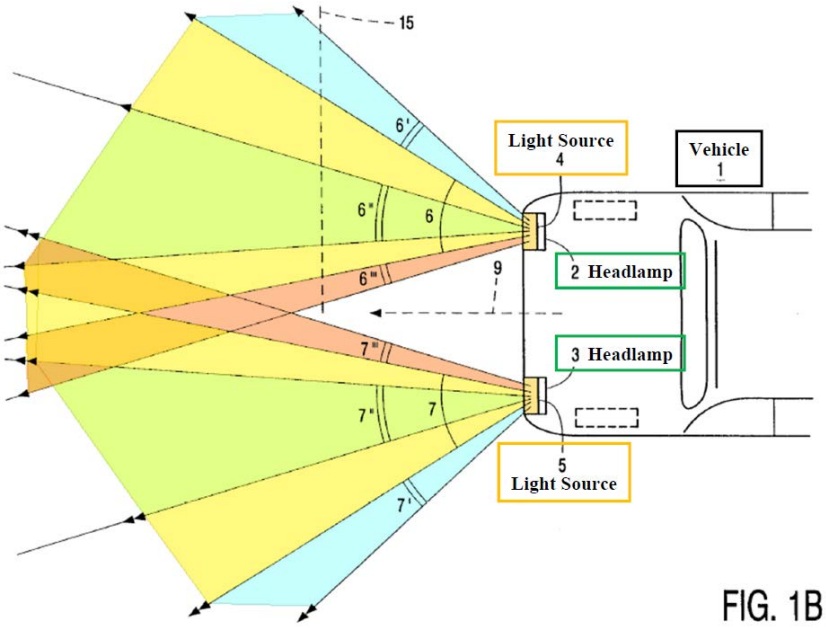


FIG.3

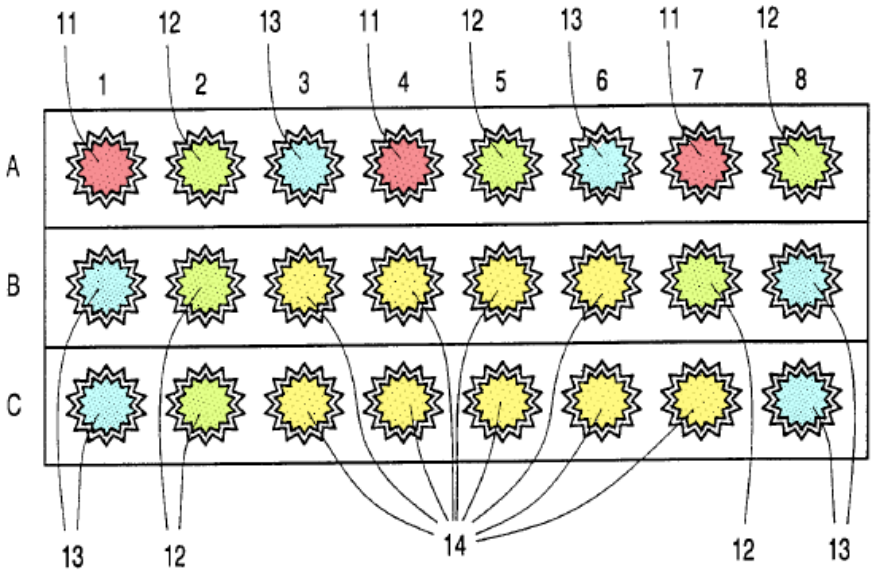
EX1009, FIG. 3.

2. Harbers's disclosure

394. Harbers discloses "*on-axis* part…is adapted to…*green-yellow light*…*off-axis* parts…is adapted to…*blue-green light*." EX1011, 6:3-7, FIGS. 1B, 2; EX1011, 9:1-10:5 ("*6; 7*…*6'', 6'''; 7'', 7'''* with…*yellow-orange light*…*6'; 7'* with…*blue-green light*"), 9:28-10:5 ("*different spectral characteristic*"), 5:21-26 ("*visibility*…is *improved*"). Thus, Harbers's independently controllable, colored directional light beam segments 6-6'-6''-6''', 7-7'-7''-7''' provide "peripheral night vision" with "blueish…illumination along a side of a road…[and] yellow tinted illumination along the road."



EX1011, FIG. 1B (annotated).



EX1011, FIG. 2 (annotated).

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

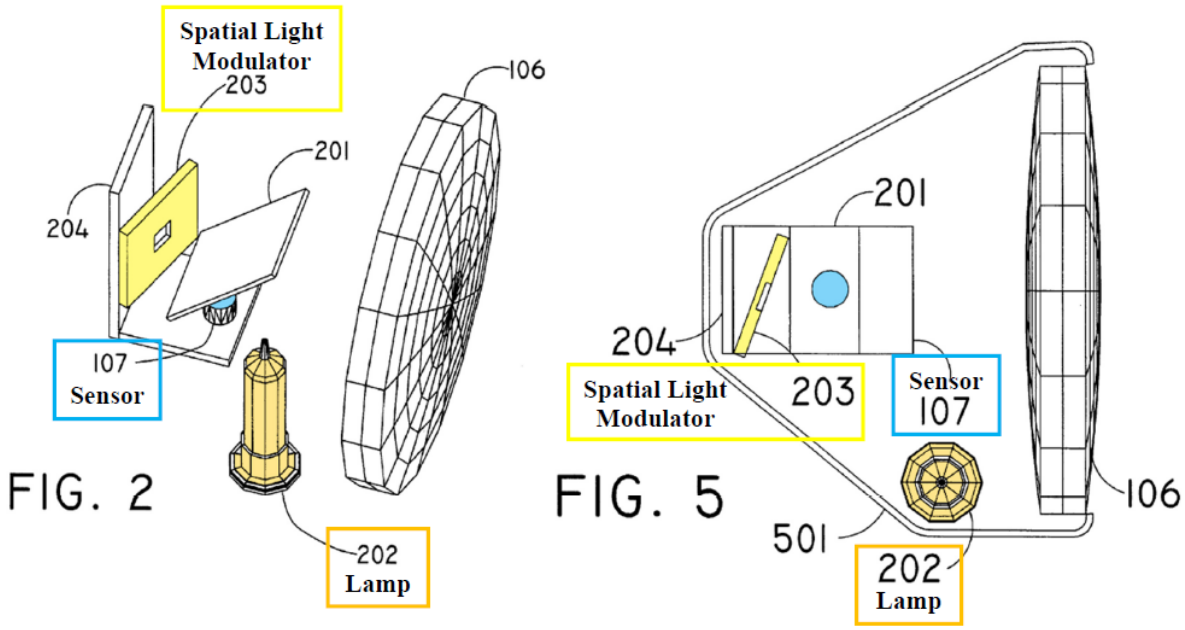
3. A POSA would have been motivated to combine Harbers with Beam-Thominet with a reasonable expectation of success.

396. 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 multiple colored directional illumination for different functions, as in Harbers, to further control Beam-Thominet's adaptive headlamps to illuminate a roadway, thereby improving visibility and driver safety—an express purpose of Beam-Thominet. EX1005, 3:29-44 ("*manually* lower the beams for conditions like rain, snow, or fog"), 3:8-14, 5:33-54, 7:1-13;

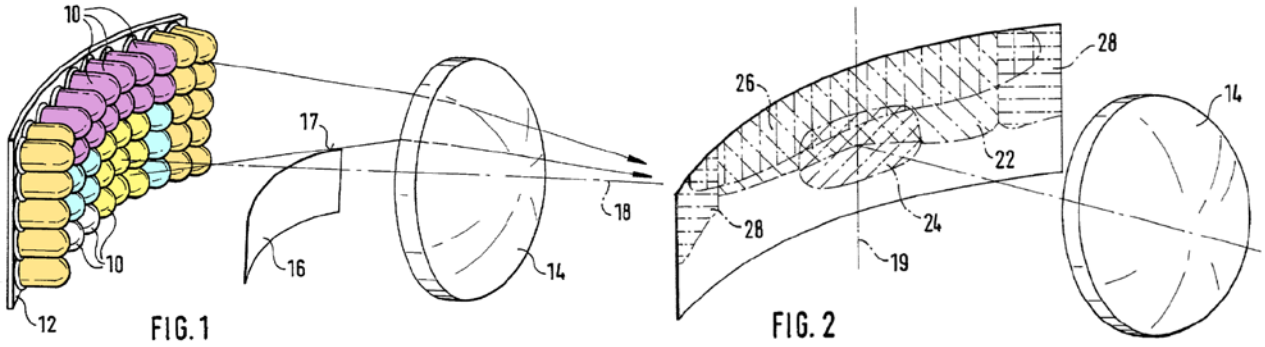
EX1006, ¶¶5 ("light beams of *different light colors*"), 7 ("*wider* illumination…in fog), 17-18, 21-26.

397. Beam-Thominet and Harbers are from the same field—controllable headlamps with dynamic illumination—and include the same building blocks (light sources, sensors, controllers). Improved visibility, thereby increasing safety, is paramount. EX1005, 1:54-59, 3:8-45, 4:48-59, 6:53-7:13; EX1006, ¶¶3-4, 23; EX1011, 5:1-26, 7:1-14, 9:1-32.

398. *First*, including an additional control technique (software implementation) for Beam-Thominet—Harbers's *known technique* of using multiple colored directional beam regions for different functions—would have added different functions to Beam-Thominet's visibility for different driving situations, thereby 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. Further, Thominet discloses "light beams of *different light colors* is possible…for different signal functions" and "different partial regions [22, 24, 26, 28] emit light of *different colors*." EX1006, ¶¶5-6, 27, FIGS. 1B-2.



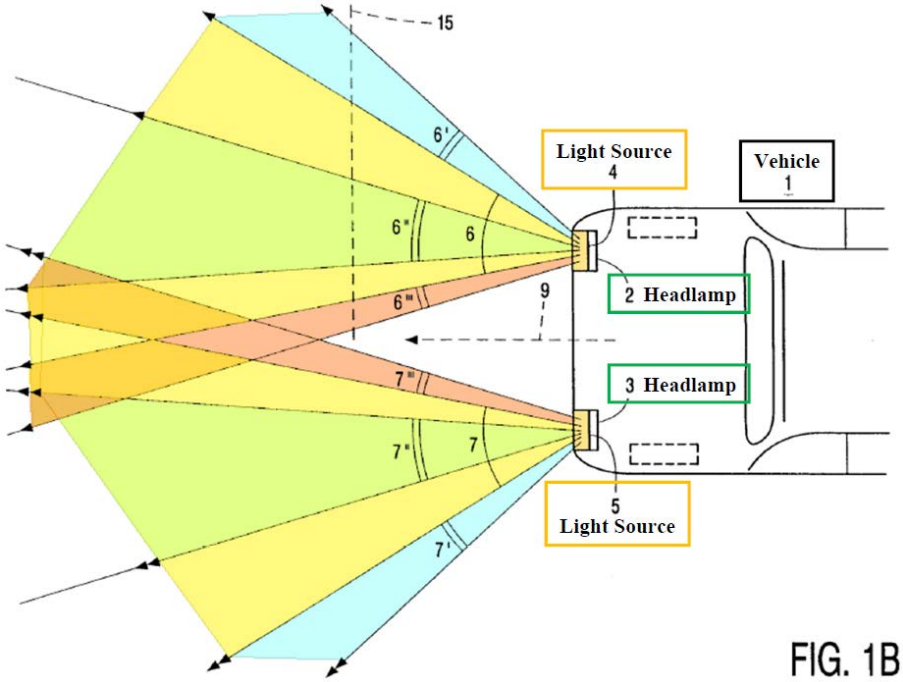
EX1005, FIGS. 2, 5 (annotated).



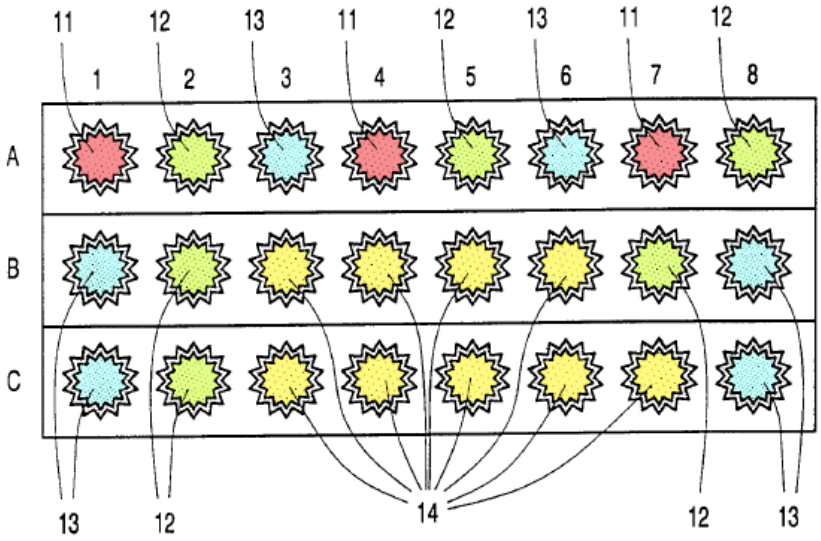
EX1006, FIGS. 1-2 (annotated).

399. Indeed, Beam's techniques and system enable "the driver to see more clearly at night," while protecting others from glare. EX1005, 3:8-45; EX1005, 4:9-24, 6:9-27. Beam recognizes the safety benefits of different spatial distributions "for conditions like…*fog*." EX1005, 3:29-36; EX1005, 1:54-59, 4:48-59; EX1006, ¶¶5 ("*different light colors*"), 7 ("*wider* illumination…in *fog*). And Harbers's *technique* (software implementation), like Beam-Thominet, seeks to

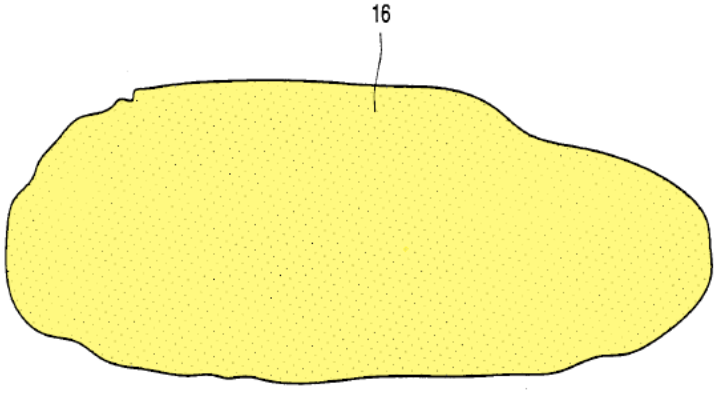
enhance driver visibility, thereby increasing safety—using multiple colored directional beam segments for different functions. EX1011, 5:14-26, 6:1-7, 6:27-7:19, 8:10-18, FIGS. 1B-2. Opto-electronic elements 11-14 provide differently colored beam segments 6-6'-6"-6'", 7-7'-7"-7'" to form different distributions. EX1011, 5:14-26, 6:1-7, 6:27-7:19, FIGS. 1B-2, 4A; EX1011, 9:18-25 ("*yellow light*…to *improve*…*visibility*"), 10:6-14 ("*fog and snow*"), 7:27-32, 7:1-17, 9:28-10:5, 13:5-7.



EX1011, FIG. 1B (annotated).



EX1011, FIG. 2 (annotated).



EX1011, FIG. 4A (annotated) , showing a relatively wide beam substantially composed of yellow light, such that the absence of the blue component in the visible light casues the effect of backscattering to be substantially reduced, such as in unfavorable weather conditions such as fog and snow. *See also* EX1011, 10:6-14, FIG. 4B.

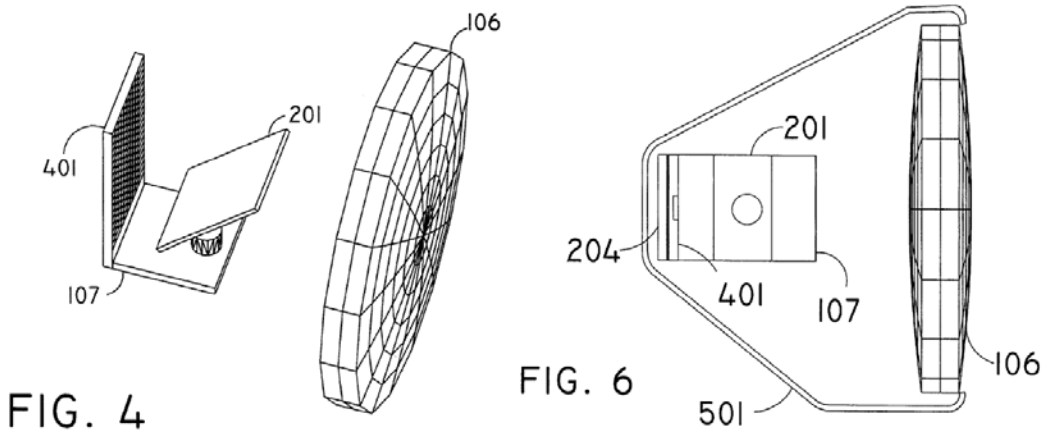
400. The additional control of having multiple colored directional beam segments as in Harbers, implemented with Beam-Thominet's

controller/illuminator, would have provided Beam-Thominet's system with different colored distributions for different driving situations beyond reducing glare for drivers, thereby improving safety. This would have merely been applying Harbers's known technique (software implementation: using multiple colored directional beam segments for different functions), to Beam-Thominet's similar, known device (dynamic system with controllable headlamps), 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 Beam-Thominet's, in the same way.

401. A POSA would have had a reasonable expectation of success combining Beam-Thominet and Harbers, for example, by simply modifying software instructions in memory of Beam's controller/processor to organize Beam's array of microbeams into multiple colored directional beam segments for different functions. Overall, this is a simple software implementation. This would have been routine and well within a POSA's skill due to the similarities in Beam-Thominet'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.

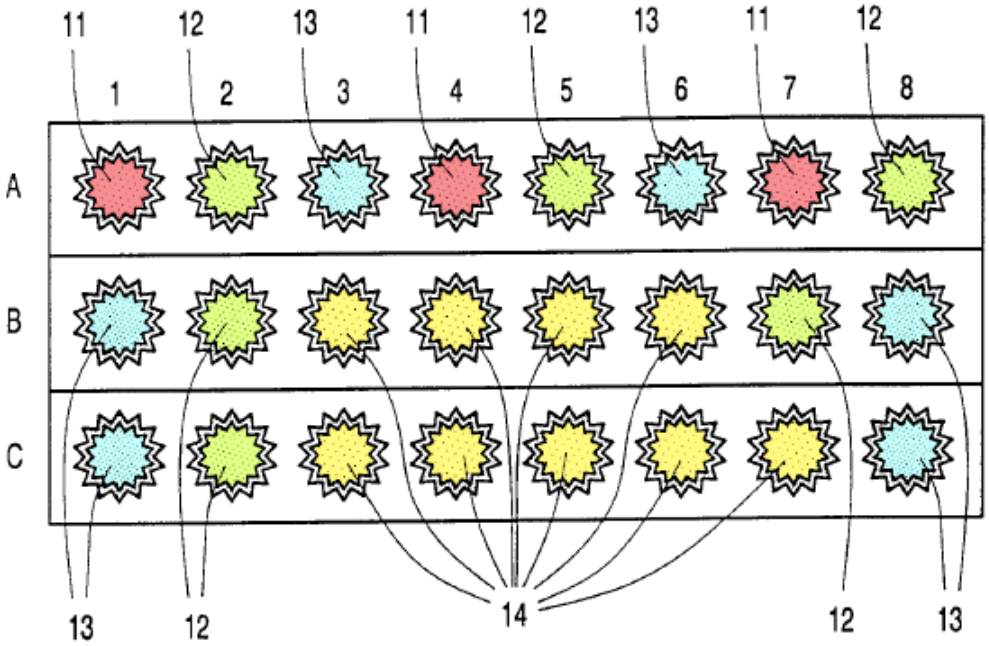
402. *Second*, additionally or alternatively, a POSA would have sought to incorporate *known components* (hardware implementation) of Harbers's opto-electronic elements 11-14 on a "curved substrate" (with differently colored opto-electronic elements 11-14, *see* EX1011, 5:14-26, 6:1-7, 6:27-7:32, FIGS. 1B-2) into Beam-Thominet's system (illuminator). Again, this would have, like Harbers, provided different colored spatial distributions for different driving situations, improving visibility and thereby safety. This is a simple hardware implementation.

403. Beam discloses flat array of light sources 401 (e.g., LEDs) has the same functionality as lamp 202 and SLM 203 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. Further, Thominet discloses "light beams of *different light colors* is possible…for different signal functions" and "different partial regions [22, 24, 26, 28] emit light of *different colors*." EX1006, ¶¶5-6, 27, FIGS. 1B-2.



EX1005, FIGS. 4, 6.

404. Through its *system components*, Harbers, like Beam-Thominet, 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. Opto-electronic elements 11-14 arranged on a "curved substrate," with different angles/aimings relative to the vehicle, provide colored 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, 7:27-32 ("*curved* substrate"), 7:1-17, 9:28-10:5, 13:5-7.



EX1011, FIG. 2 (annotated).

405. Like the software implementation, this hardware combination—Beam's array of light sources 401 and Harbers's differently colored opto-electronic elements 11-14 on a curved substrate—would have provided Beam-Thominet's system with different colored spatial distributions for different driving situations,

as in Harbers, thereby improving driver safety. This would have been merely combining prior-art elements or a simple substitution of one known element for another (Beam's array of light sources 401 on a flat surface and Harbers's opto-electronic elements 11-14 on a curved substrate) according to known methods (disclosed in Beam-Thominet and Harbers) to yield predictable results (improved visibility and safety). Overall, this is a simple hardware implementation.

406. A POSA would have had a reasonable expectation of success combining Beam-Thominet and Harbers, for example, by simply modifying the flat surface of Beam's array of light sources 401 with Harbers's curved substrate to provide multiple colored light sources (e.g., directional beam segments 6-6'-6"-6"', 7-7'-7"-7"') for different functions (hardware implementation).

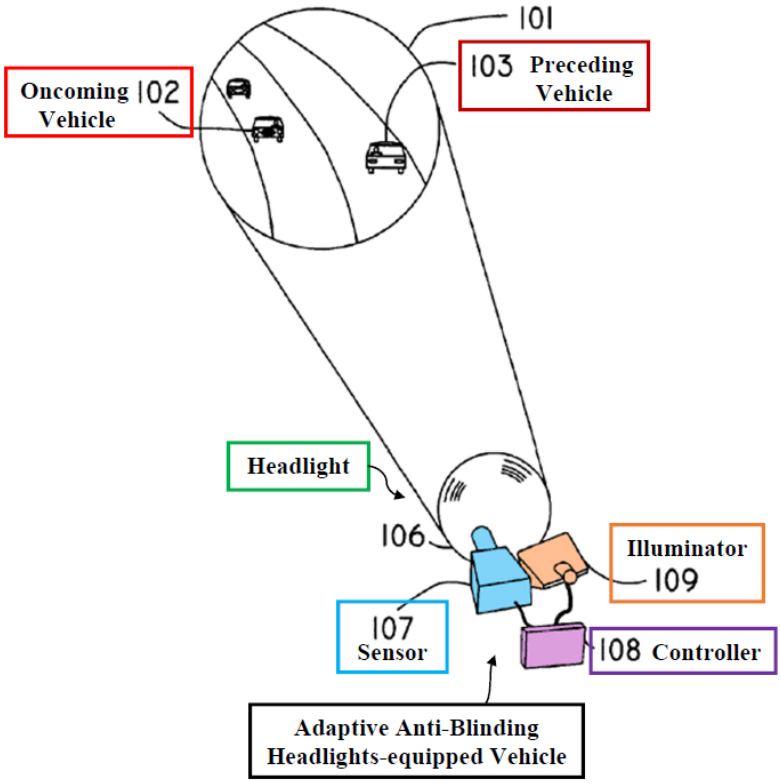
407. Such modification would have been routine and well within a POSA's skill due to the similarities in Beam-Thominet's and Harbers's adaptive systems—their common components were well known and there would have been no limitations for a POSA to make such modifications. And in combining Beam-Thominet's with Harbers's array of colored 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).

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

C. Claim 29: "The method of claim 26, wherein the illumination requirements accommodate sensed fog or snow environmental conditions by defining a shift of at least a portion of the headlight beam towards yellow."

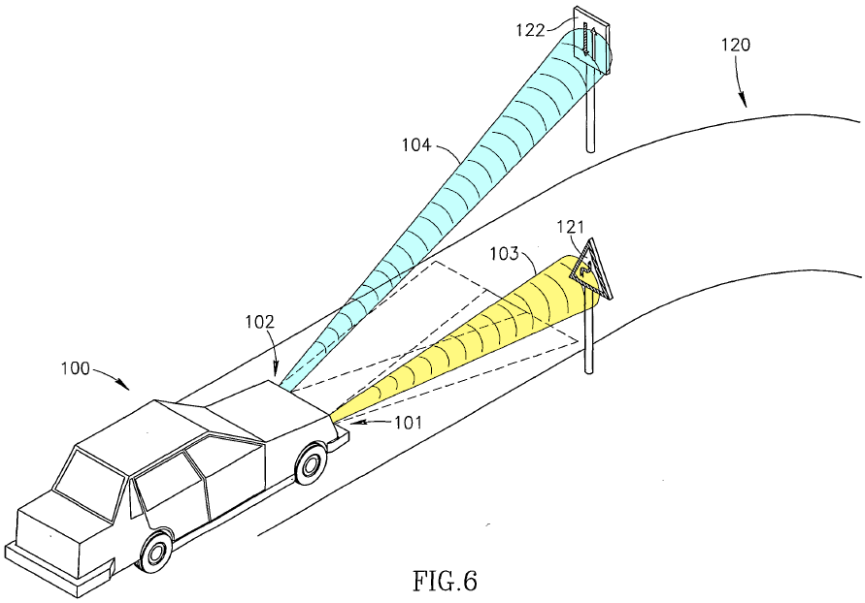
1. Beam-Thominet's disclosure

409. Beam discloses "*spatial scene data [101]* from sensor 107…becomes the input to a processor 1105" and "lower[ing] the beams for conditions like rain, *snow*, or …*fog*." EX1005, 5:33-36, 3:34-35, FIGS. 1, 1C-1D, 7; EX1005, 3:37-44 ("to see more clearly *at night*"), 4:53-59, 5:33-54.

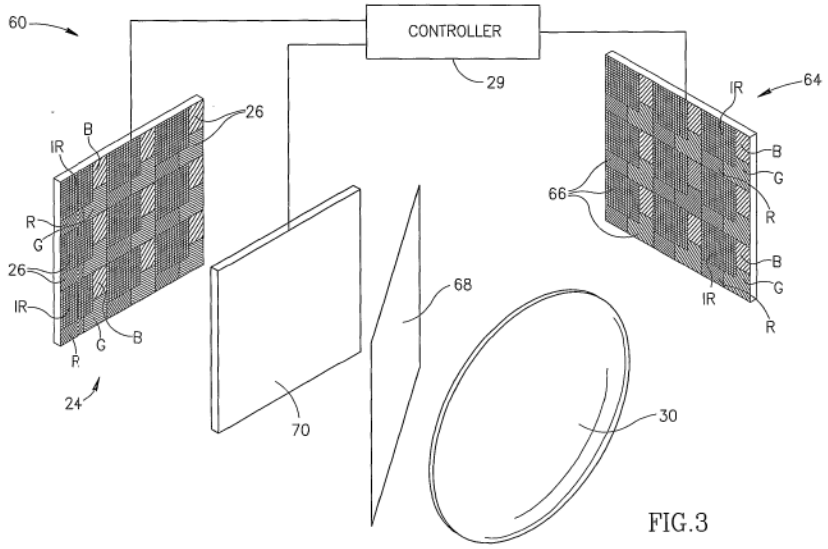


EX1005, FIG. 1 (annotated).

410. Beam-Thominet does not disclose shifting a portion of the beam towards yellow, but this feature was well known in the prior art, e.g., as explicitly disclosed by Harbers. *See also* EX1009, 25:20-25 ("headlights 101 and 102 are programmed…to detect *fog* and…provide *light appropriate for driving in fog*"), 24:15-18 ("illuminate…with predominantly *yellow*"), 14:21-25 ("provide *different color light*"), 25:20-26:5 ("*back-scatter*"), FIGS. 2-3, 5-6.



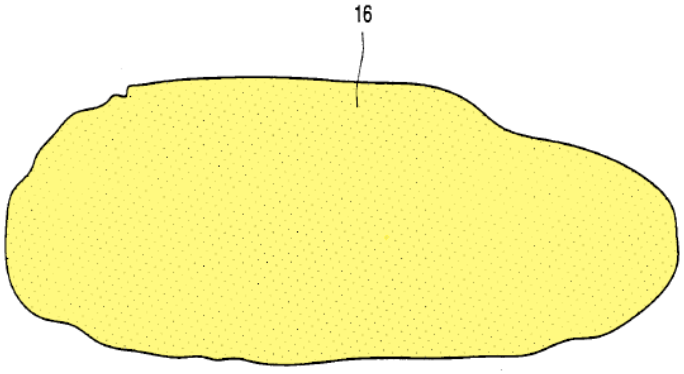
EX1009, FIG. 6 (annotated).



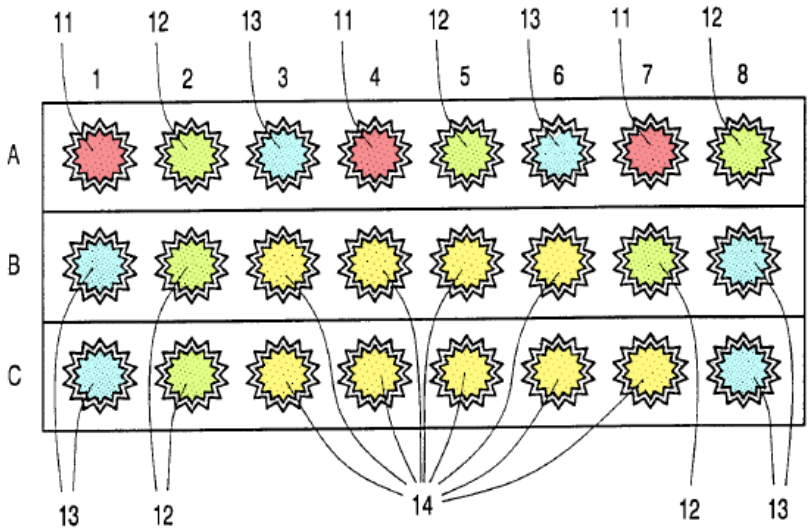
EX1009, FIG. 3.

2. Harbers's disclosure

411. Harbers discloses "[u]nder unfavorable weather conditions, in particular *fog and snow*…a *relatively wide beam 16* is obtained which is substantially composed of *yellow light*." EX1011, 10:6-14, FIGS. 1B, 2, 4A; EX1011, 9:23-25 ("*yellow light* in order to *improve the long-distance visibility*"), 4:17-21.



EX1011, FIG. 4A (annotated).



EX1011, FIG. 2 (annotated).

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

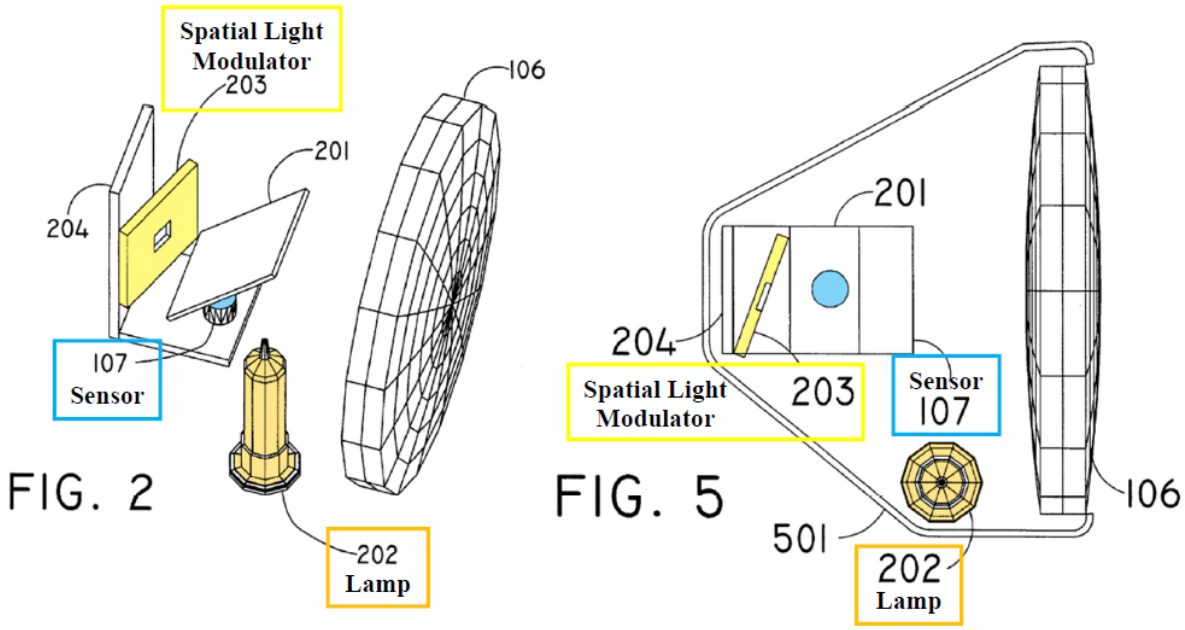
3. A POSA would have been motivated to combine Harbers with Beam-Thominet with a reasonable expectation of success.

413. 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 multiple colored directional illumination for different functions, as in Harbers, to further control Beam-Thominet's adaptive headlamps to illuminate a roadway, thereby improving visibility and driver safety—an express purpose of Beam-Thominet. EX1005, 3:29-44 ("*manually* lower the beams for conditions like rain, snow, or fog"), 3:8-14, 5:33-54, 7:1-13;

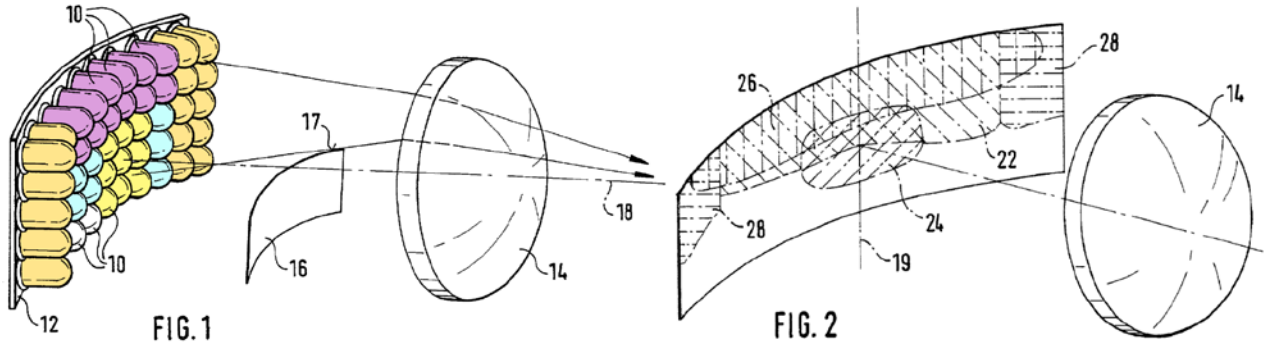
EX1006, ¶¶5 ("light beams of *different light colors*"), 7 ("*wider* illumination…in fog), 17-18, 21-26.

414. Beam-Thominet and Harbers are from the same field—controllable headlamps with dynamic illumination—and include the same building blocks (light sources, sensors, controllers). Improved visibility, thereby increasing safety, is paramount. EX1005, 1:54-59, 3:8-45, 4:48-59, 6:53-7:13; EX1006, ¶¶3-4, 23; EX1011, 5:1-26, 7:1-14, 9:1-32.

415. *First*, including an additional control technique (software implementation) for Beam-Thominet—Harbers's *known technique* of using multiple colored directional beam regions for different functions—would have added different functions to Beam-Thominet's visibility for different driving situations, thereby 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. Further, Thominet discloses "light beams of *different light colors* is possible…for different signal functions" and "different partial regions [22, 24, 26, 28] emit light of *different colors*." EX1006, ¶¶5-6, 27, FIGS. 1B-2.



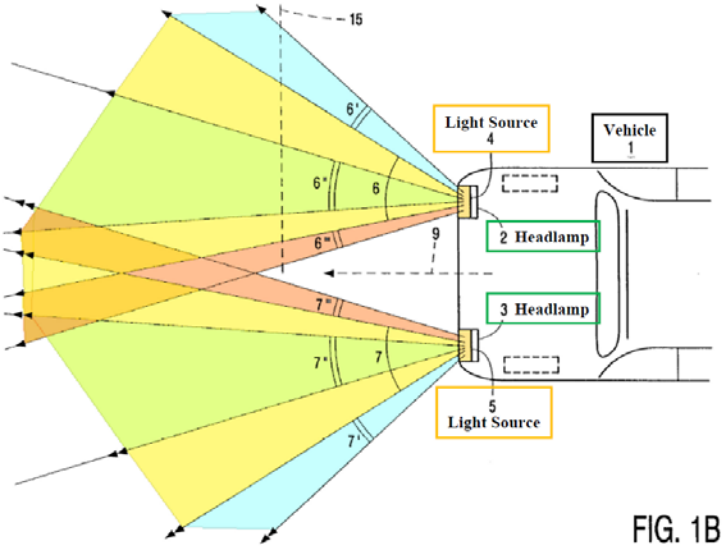
EX1005, FIGS. 2, 5 (annotated).



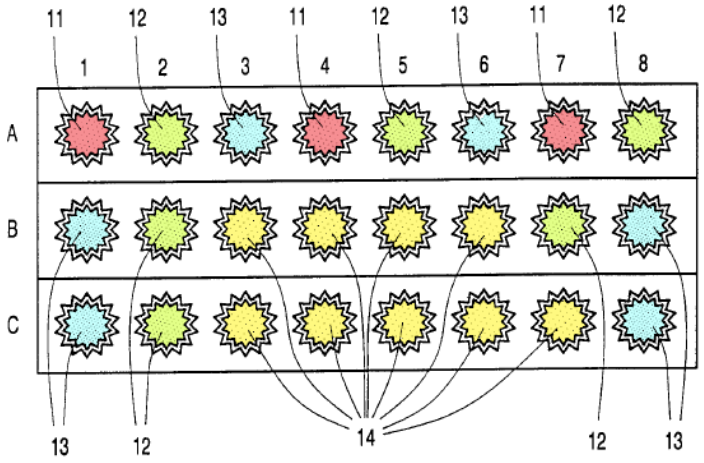
EX1006, FIGS. 1-2 (annotated).

416. Indeed, Beam's techniques and system enable "the driver to see more clearly at night," while protecting others from glare. EX1005, 3:8-45; EX1005, 4:9-24, 6:9-27. Beam recognizes the safety benefits of different spatial distributions "for conditions like…*fog*." EX1005, 3:29-36; EX1005, 1:54-59, 4:48-59; EX1006, ¶¶5 ("*different light colors*"), 7 ("*wider* illumination…in *fog*). And Harbers's *technique* (software implementation), like Beam-Thominet, seeks to

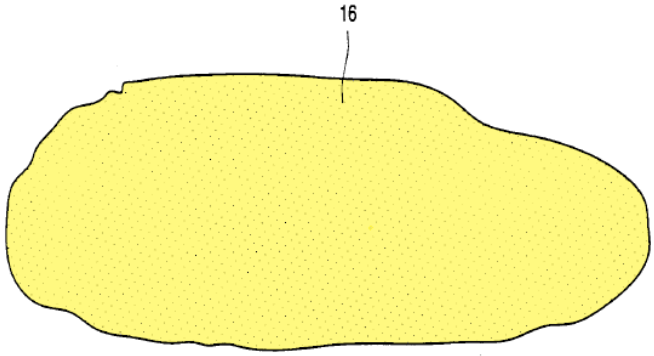
enhance driver visibility, thereby increasing safety—using multiple colored directional beam segments for different functions. EX1011, 5:14-26, 6:1-7, 6:27-7:19, 8:10-18, FIGS. 1B-2. Opto-electronic elements 11-14 provide differently colored beam segments 6-6'-6"-6'", 7-7'-7"-7'" to form different distributions. EX1011, 5:14-26, 6:1-7, 6:27-7:19, FIGS. 1B-2, 4A; EX1011, 9:18-25 ("*yellow light*…to *improve*…*visibility*"), 10:6-14 ("*fog and snow*"), 7:27-32, 7:1-17, 9:28-10:5, 13:5-7.



EX1011, FIG. 1B (annotated).



EX1011, FIG. 2 (annotated).



EX1011, FIG. 4A (annotated).

417. The additional control of having multiple colored directional beam segments as in Harbers, implemented with Beam-Thominet's controller/illuminator, would have provided Beam-Thominet's system with different colored distributions for different driving situations beyond reducing glare for drivers, thereby improving safety. This would have merely been applying Harbers's known technique (software implementation: using multiple colored directional beam segments for different functions), to Beam-Thominet's similar, known device (dynamic system with controllable headlamps), 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 Beam-Thominet's, in the same way.

418. A POSA would have had a reasonable expectation of success combining Beam-Thominet and Harbers, for example, by simply modifying software instructions in memory of Beam's controller/processor to organize Beam's array of microbeams into multiple colored directional beam segments for different functions. Overall, this is a simple software implementation. This would have been routine and well within a POSA's skill due to the similarities in Beam-Thominet'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.

419. *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 colored opto-electronic elements 11-14, *see* EX1011, 5:14-26, 6:1-7, 6:27-7:32, FIGS. 1B-2) into Beam-Thominet's system (illuminator). Again, this would have, like Harbers, provided different colored spatial distributions for different driving situations, improving visibility and thereby safety. This is a simple hardware implementation.

420. Beam discloses flat array of light sources 401 (e.g., LEDs) has the same functionality as lamp 202 and SLM 203 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. Further, Thominet discloses "light beams of *different light colors* is possible…for different signal functions" and "different partial regions [22, 24, 26, 28] emit light of *different colors*." EX1006, ¶¶5-6, 27, FIGS. 1B-2.

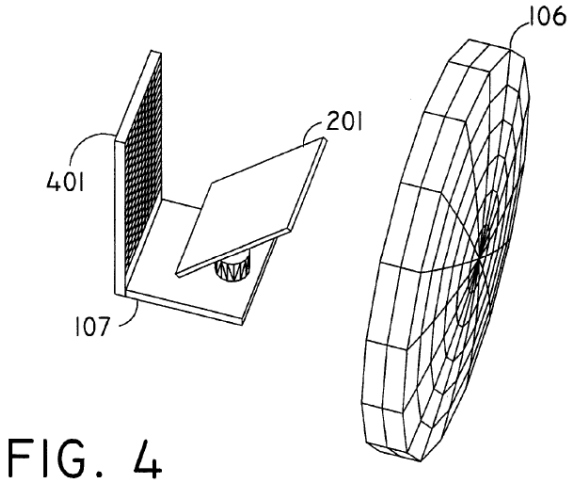


FIG. 4

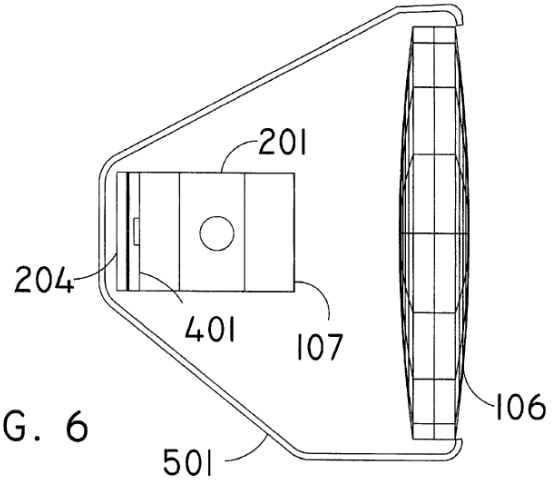
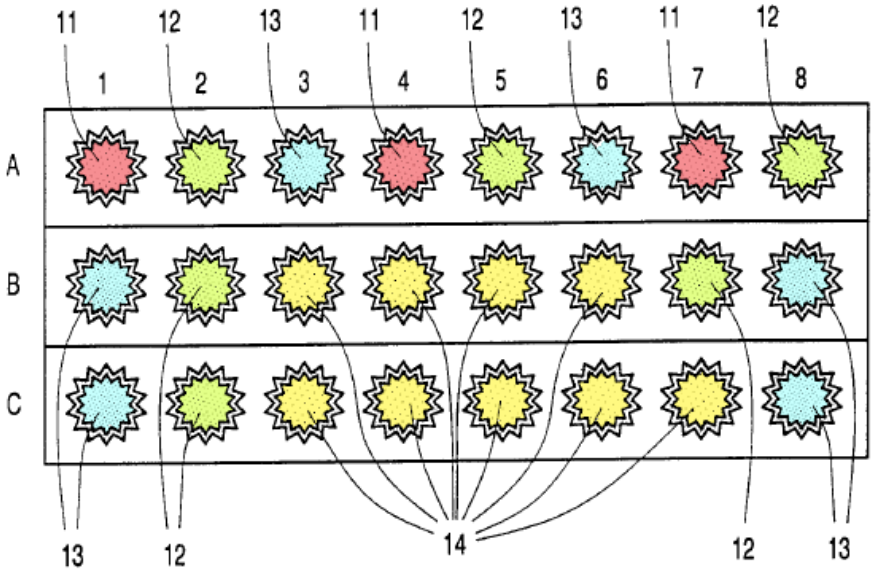


FIG. 6

EX1005, FIGS. 4, 6.

421. Through its *system components*, Harbers, like Beam-Thominet, 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. Opto-electronic elements 11-14 arranged on a "curved substrate," with different angles/aimings relative to the vehicle, provide colored 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, 7:27-32 ("*curved* substrate"), 7:1-17, 9:28-10:5, 13:5-7.



EX1011, FIG. 2 (annotated).

422. Like the software implementation, this hardware combination—Beam's array of light sources 401 and Harbers's differently colored opto-electronic elements 11-14 on a curved substrate—would have provided Beam-Thominet's system with different colored spatial distributions for different driving situations, as in Harbers, thereby improving driver safety. This would have been merely combining prior-art elements or a simple substitution of one known element for another (Beam's array of light sources 401 on a flat surface and Harbers's opto-electronic elements 11-14 on a curved substrate) according to known methods (disclosed in Beam-Thominet and Harbers) to yield predictable results (improved visibility and safety). Overall, this is a simple hardware implementation.

423. A POSA would have had a reasonable expectation of success combining Beam-Thominet and Harbers, for example, by simply modifying the flat surface of Beam's array of light sources 401 with Harbers's curved substrate to provide multiple colored light sources (e.g., directional beam segments 6-6'-6"-6"', 7-7'-7"-7"') for different functions (hardware implementation).

424. Such modification would have been routine and well within a POSA's skill due to the similarities in Beam-Thominet'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 Beam-Thominet's 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).

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

426. Thus, Beam-Thominet in combination with Harbers renders obvious claims 28-29 of the '503 patent.

XVI. GROUND 7: THE COMBINATION OF BEAM, THOMINET, STAM, AND HARBERS RENDERS OBVIOUS CLAIMS 68-69.

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

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

B. Claim 68: "The method of claim 65, wherein the determining illumination further includes determining a yellowish illumination color for illumination illuminating a road within the field-of-view and a blueish illumination color for illumination illuminating areas off-road within the field-of-view."

428. In my opinion, there is no patentable difference between claim 68 and claim 28. *Supra* Section XV.B. Therefore, my above analysis in Section XV.B applies.

429. In view of the above, Beam-Thominet-Stam in combination with Harbers renders obvious this claim.

C. Claim 69: "The method of claim 65, wherein the data includes data indicating fog or snow environmental conditions and the determining illumination includes determining a shift of at least a

portion of the light output from the headlight system towards yellow."

430. In my opinion, there is no patentable difference between claim 69 and claim 29. *Supra* Section XV.C. Therefore, my above analysis in Section XV.C applies.

431. In view of the above, Beam-Thominet-Stam in combination with Harbers renders obvious this claim.

432. Thus, Beam-Thominet-Stam in combination with Harbers renders obvious claims 68–69 of the '503 patent.

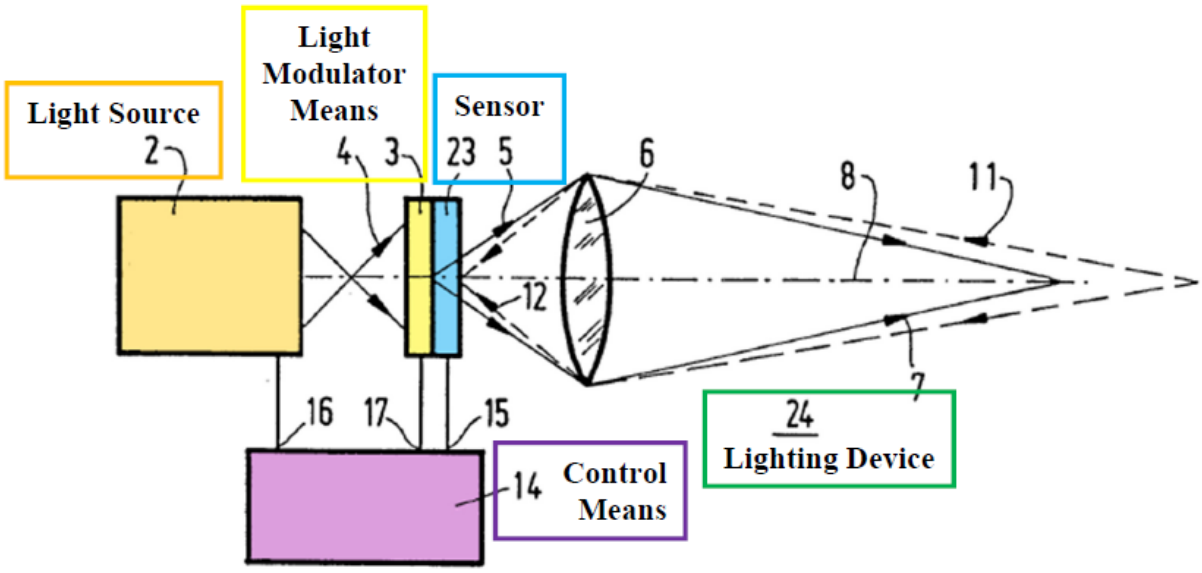
XVII. GROUND 8: THE COMBINATION OF KARLSSON AND HARBERS RENDERS OBVIOUS CLAIMS 26-31, 65, AND 68-69.

433. In my opinion, Karlsson explicitly or implicitly discloses every feature recited in claims 26-27, 30-31, and 65. But to avoid doubt, Karlsson is combined with Harbers, for elements [26.6] and [65.9], which discloses wellknown features of adaptive headlamps—directional light clusters/sources for different functions—rendering the claims obvious. Further, Karlsson is combined with Harbers, for claims 28/68 and claims 29/69, which discloses well known features of adaptive headlamps—color options for different functions and beam sections—rendering the claims obvious. *See infra* Sections XVI.D/XVI.E.

"directional light [clusters / sources]" [26.6]/[65.9]

434. Karlsson's "spotlight beams 34 can be…a *grid of separate light sources*, such as *LEDs*…controlled either *individually* or in *groups*…[and] may

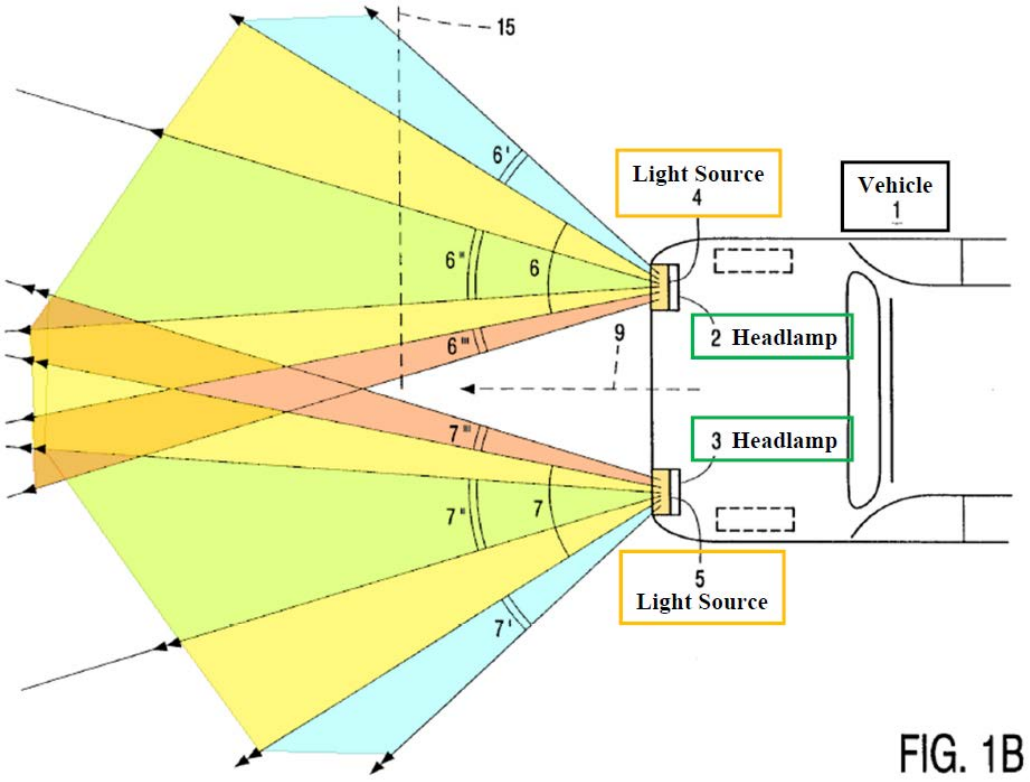
also be made up of…*light modulator means*" and "*light modulator means 3* advantageously can be switched to…*given directions*." EX1010, 11:25-28, 14:1-9, FIGS. 3, 6, 14. Each spotlight beam is a directional "cluster" or "source," having its own independent *direction* (angle/aiming), that combines to form the headlamp beam; so the combination of Karlsson's spotlight beams form at least one directional light cluster/source to provide illumination in desired subsections. EX1010, 4:26-31, 14:1-15, FIGS. 6, 14. Alternatively, if Patent Owner argues, incorrectly, that a "cluster" requires at least two (or more) spotlight beams, Karlsson also discloses this. EX1010, 14:1-9 ("spotlight beams 34 can…be controlled either individually or in *groups*"), 14:12-15 ("a desired light *intensity* can be adjusted for…a *group* of spotlight beams"), 14:26-30, FIGS. 6, 14.



EX1010, FIG. 3 (annotated).

435. Thus, Karlsson discloses "directional light [clusters / sources]"—independently controllable directional spotlight beam clusters/sources—that "create an output headlight beam meeting the determined illumination requirements"/"achieve the determined illumination levels" as in [26.6]/[65.9].

436. 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 [clusters / sources]" recited in [26.6]/[65.9].



EX1011, FIG. 1B (annotated).

437. If Patent Owner argues, incorrectly, that Karlsson does not disclose [26.6]/[65.9], Harbers does; and it would have been obvious to combine Harbers with Karlsson, as discussed below.

"predefined illuminance" [65.6]/[65.8]

438. 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.

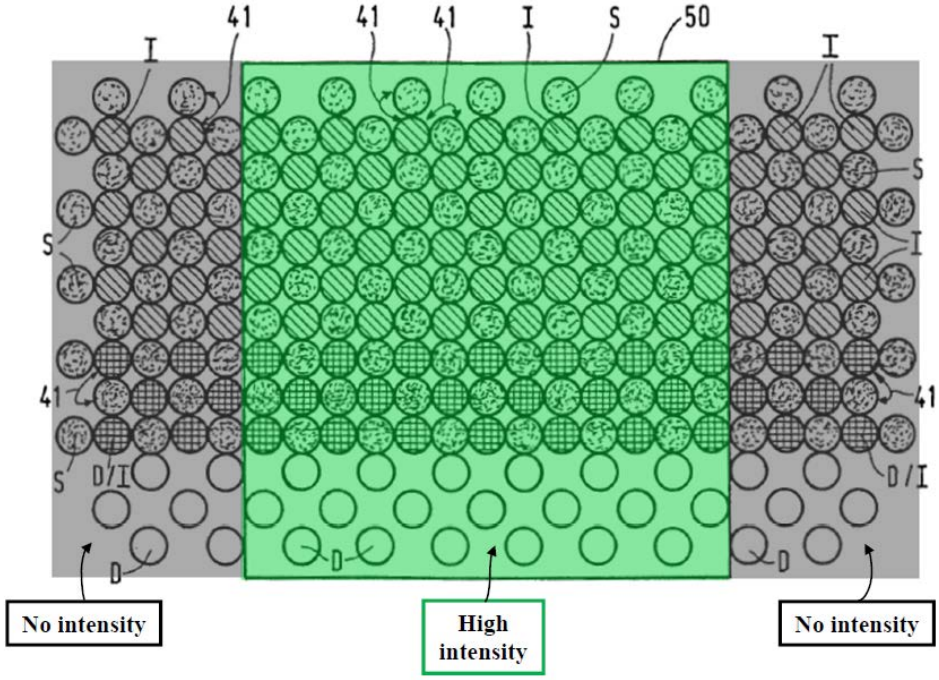
439. Further, Karlsson discloses "spotlight sources indicated at D provide the *dipped light function*." EX1010, 19:24-27, FIGS. 14-15, 1:27-29 ("*low beams* or *dipped* headlights"), Abstract, 1:16-18. The concept of a "dipped light function" or a low beam illumination level would have been known to 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.

440. 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.

441. 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).

442. 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) as in [65.6] and [65.8].

443. The '503 patent does not disclose a predefined illuminance value, so a value is not required to satisfy [65.6] and [65.8]. Further, a POSA reading Karlsson would have understood Karlsson's "dipped" illuminance, for example, teaches a "predefined" illuminance, because Karlsson uses the dipped illuminance as a reference point below and above which to output illumination, preventing glare to

other vehicles while 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.

444. Therefore, a POSA would have understood that Karlsson discloses or renders obvious a "predefined illuminance" recited in [65.6] and [65.8].

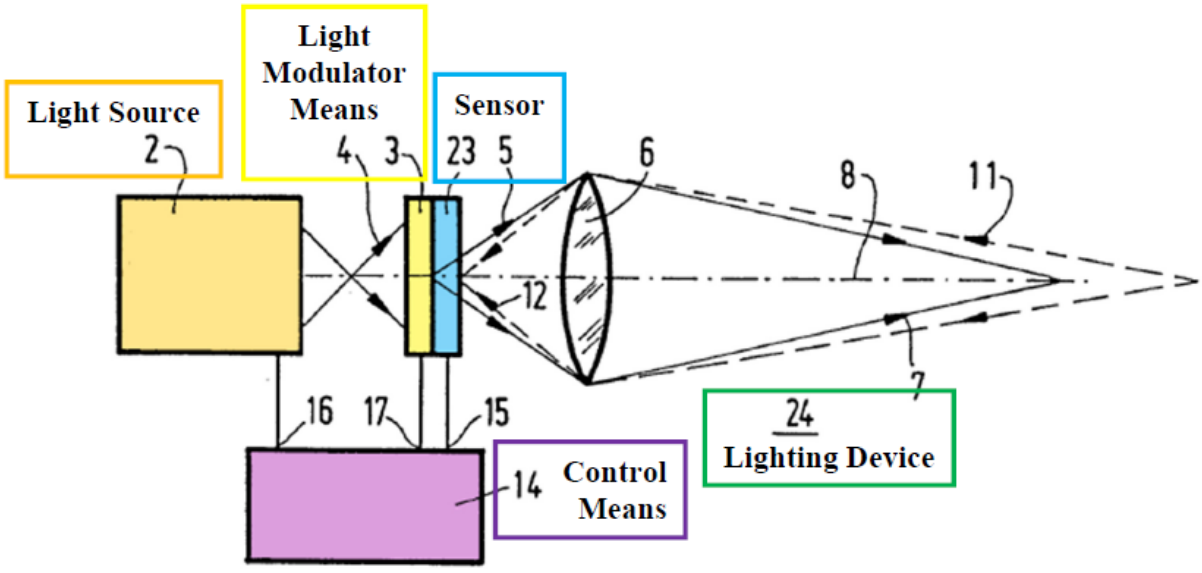
A. A POSA would have been motivated to combine Karlsson and Harbers with a reasonable expectation of success.

445. As discussed, Karlsson discloses "directional light [clusters / sources]" with independently controlled angular positions for reducing glare towards other drivers. *Supra* Section XVII. Harbers provides further detail on implementing "directional light [clusters / 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—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 (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, 1:10-26, 4:17-21, 9:18-26.

446. 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.

447. *First*, including an additional control technique (software implementation) for Karlsson—Harbers's *known technique* of using multiple directional beam segments for different functions—would have added more control methods for different functions to Karlsson's system 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).

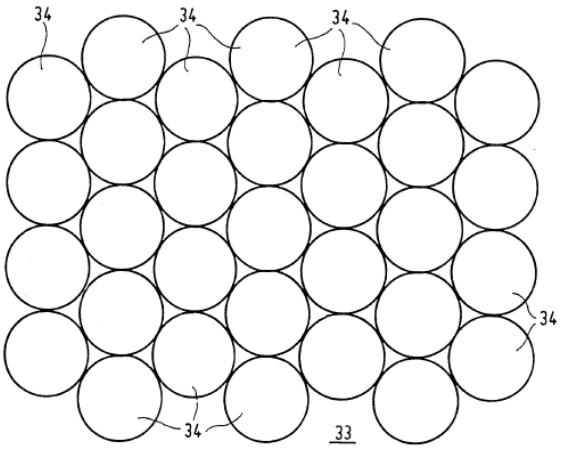


FIG. 6

EX1010, FIG. 6.

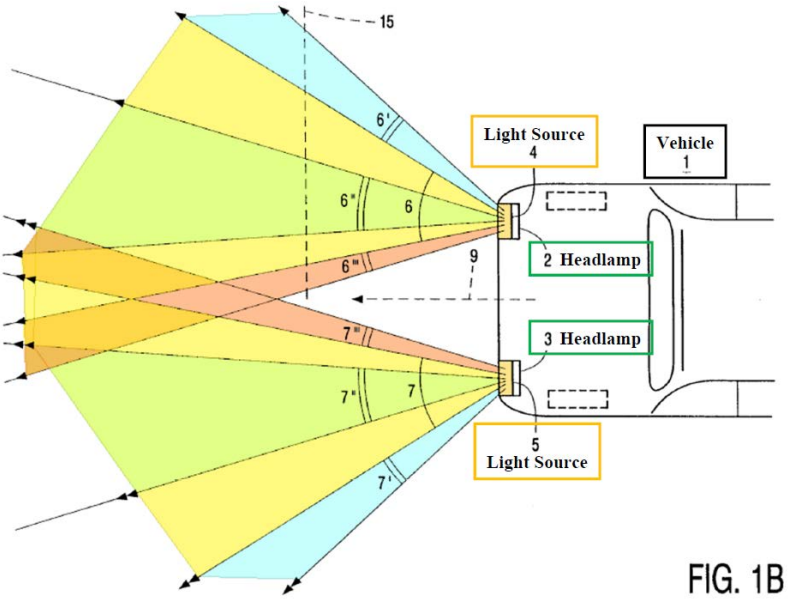
448. Indeed, Karlsson's techniques and system of controlling individual spotlight beams emphasize safety of all drivers. EX1010, 1:16-26, 4:17-21, 9:18-26. Controllable headlamps "significantly increase the driving comfort and the road safety," and "glaring or blinding of oncoming traffic is effectively 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, 1:10-13 ("comply with…regulations…preventing the *blinding* or *glare*").

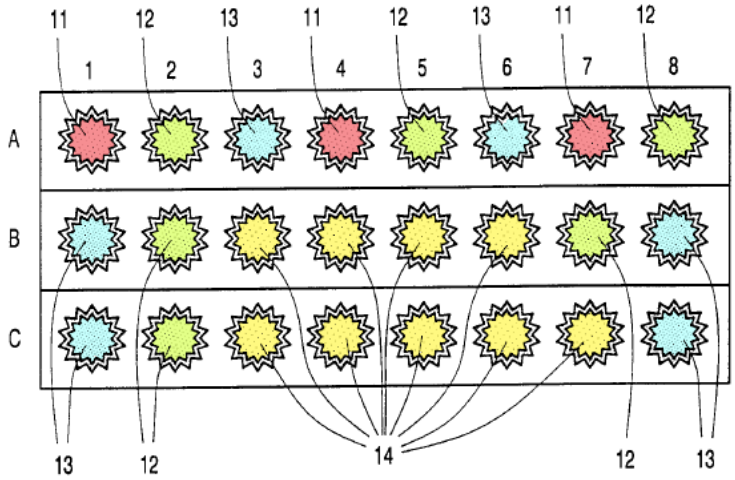
449. Karlsson's system "*selectively adjust[s]*…spotlight beam[s] 34, in response to a *control signal from sensor means 23*…to provide a *desired lighting pattern*" in "given *directions*." EX1010, 14:26-30, 11:25-28, FIGS. 3, 6, 14. Karlsson recognizes the safety benefits of identifying "oncoming traffic" 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, 3:19-31, 12:19-35, 2:2-4, 5:16-32. If Patent Owner argues, incorrectly, Karlsson does not expressly disclose directional light clusters/sources, even though Karlsson discloses different angular positions control for different spotlight beams, it would have been obvious to a POSA to use such control to "create an output headlight beam meeting the determined illumination requirements" and "achieve the determined illumination levels for at least the first and one or more second subsections." 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.

450. And Harbers's *technique* (software implementation), like Karlsson, seeks to enhance driver visibility, thereby increasing safety—using multiple directional beam segments for different functions. EX1011, 5:14-26, 6:1-7, 6:27-

7:19, 8:10-18, FIGS. 1B-2. Specifically, Harbers's explains opto-electronic elements 11-14 provide differently angled/aimed beam segments 6-6'-6"-6"', 7-7'-7"-7"' 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).

451. The additional control (software implementation) of having multiple directional beam segments 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.

452. This would have merely been applying Harbers's known techniques (software implementation: using multiple directional beam segments for different functions) to Karlsson's similar, known device (adaptive 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.

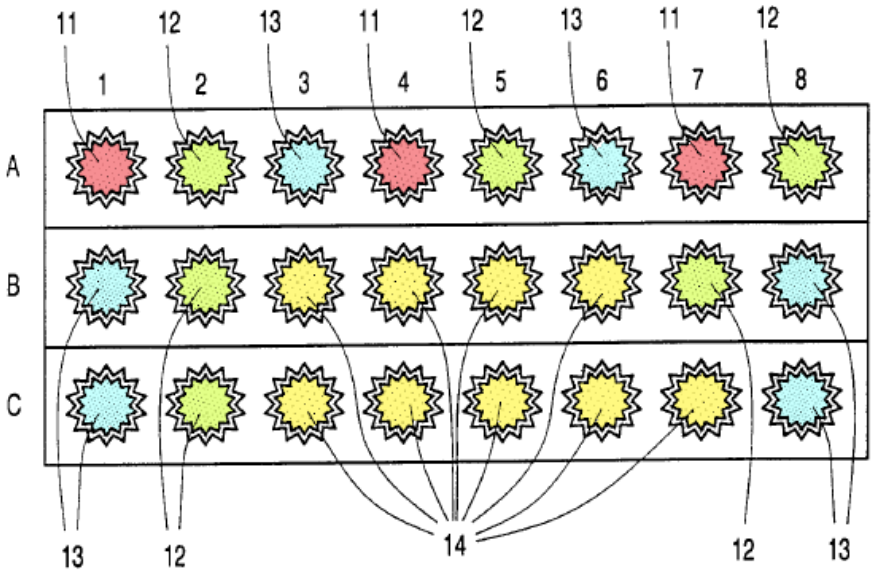
453. A POSA would have had a reasonable expectation of success combining Harbers with Karlsson, for example, by simply modifying software instructions stored in memory of Karlsson's controller/processor to organize Karlsson's spotlight beams into multiple directional beam segments for different functions.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

454. 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 for different functions—as already disclosed in the art.

455. *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, *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.

456. 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).

457. 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. This would have been merely combining prior-art elements or a simple substitution of one known element for another (Karlsson's lighting means 2, 3 on a flat substrate and Harbers's opto-electronic elements 11-14 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.

458. 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 directional light clusters/sources for different functions (hardware implementation).

459. 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).

460. 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 [26.6] and [65.9].

B. Independent Claims 26 and 65

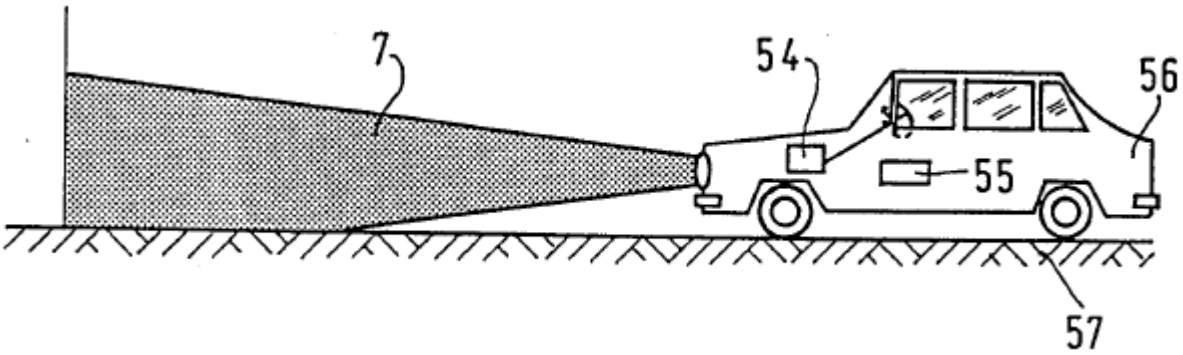
461. Karlsson, alone or in combination with Harbers, renders independent claims 26 and 65 obvious.

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

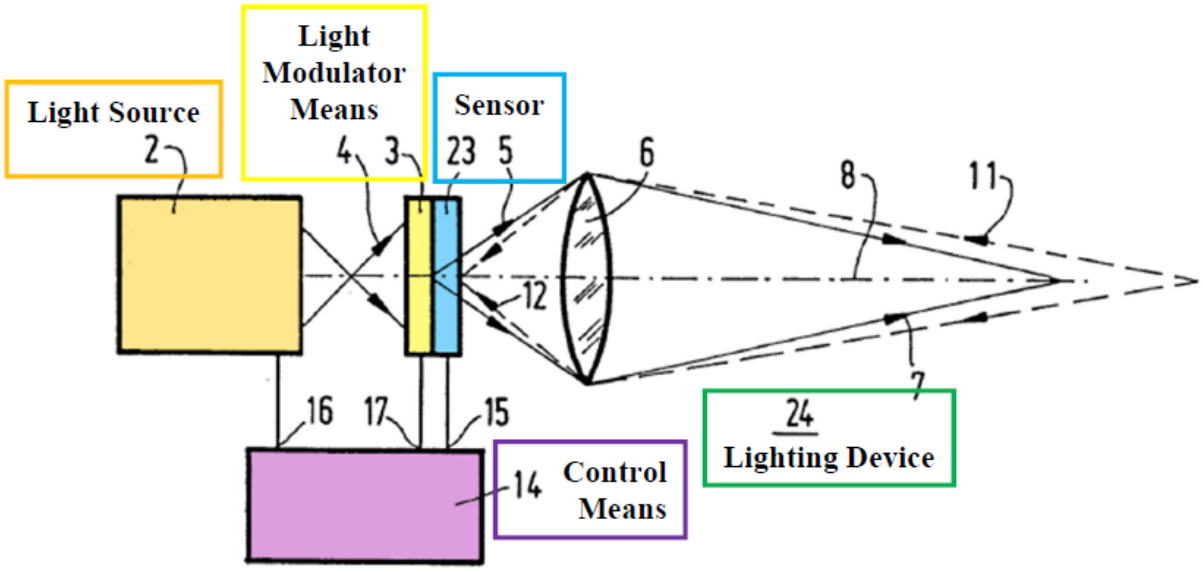
[65.P]: "A method for generating a headlight beam in an adaptive headlight system that provides illumination to at least a portion of a field-of-view, comprising:"

462. [65.P] is identical to [26.P].

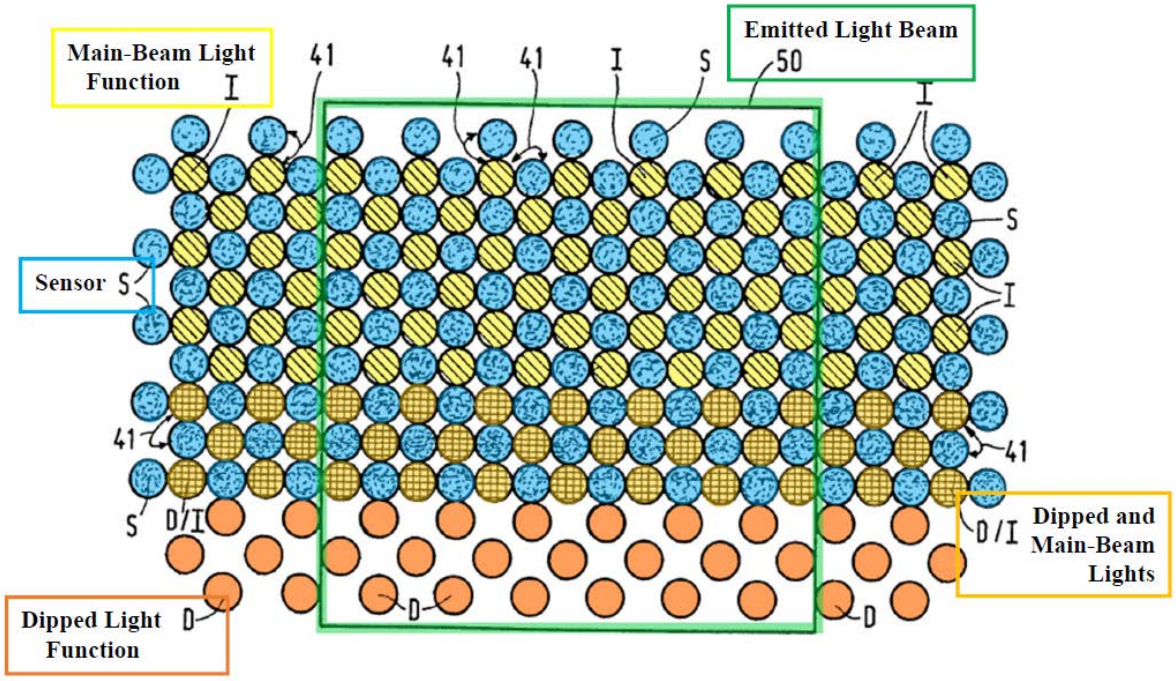
463. Karlsson's headlight system for a car 56 provides an adaptive light beam 7. EX1010, 20:16-32, FIGS. 1, 3, 16; EX1010, 2:4-6 ("*dynamically adapted*"), 9:24-25 ("*optimally adapted*"), Abstract, 8:29-35, 9:3-33. Also Karlsson discloses "a plurality of *controllable spotlight beams*" and "the *field of view* of the light-sensitive sensors and the illumination field of the light beam to be emitted, will *coincide*." EX1010, 3:27-31, 4:26-31, FIGS. 3, 6, 14; EX1010, 14:5-15 ("*spotlight beams*…transmit light *to a specified degree*"), 11:25-28 ("*given directions*"), 19:19-33 ("desired *pattern* and *direction* of the beam"), 14:1-4.



EX1010, FIG. 16.



EX1010, FIG. 3 (annotated).



EX1010, FIG. 14 (annotated).

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

2. [26.1]: "utilizing one or more sensors of a vehicle including the adaptive headlight system to obtain and provide data"

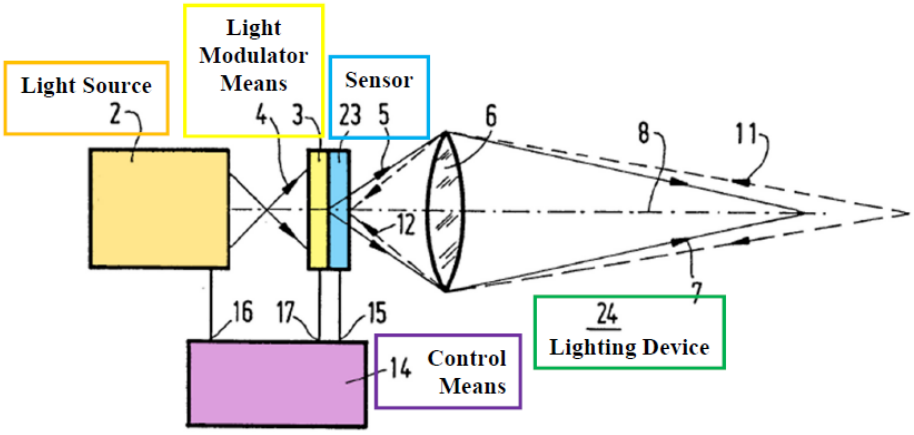
[65.1]: "utilizing one or more sensors of a first vehicle to obtain and provide data,"

465. In my opinion, [26.1] and [26.2] are part of the same clause but will be addressed separately for simplicity below.

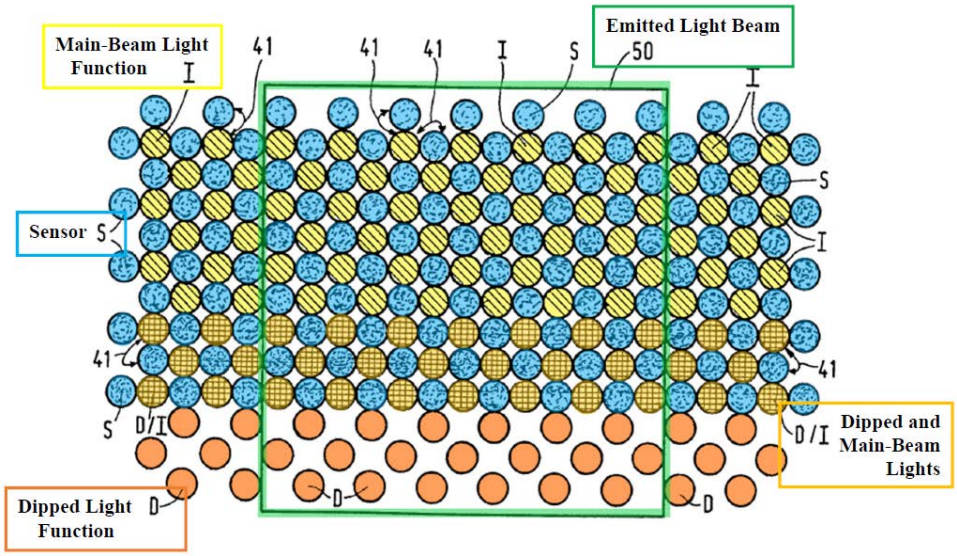
466. In my opinion, [65.1] and [65.2] are part of the same clause but will be addressed separately for simplicity below.

467. In my opinion, the features of [65.1] are included in [26.1].

468. Karlsson's "*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, 9:9-17 ("*incident light 11* on the *light-sensitive sensor 9*…is *processed* into an *electric control signal* on input 15 of the *control means 14*"), 19:18-19 ("*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).

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

3. [26.2]: "predefined as relevant to a determination of illumination requirements for the field-of-view, the data including data indicative of at least one of one or more other vehicles or a pedestrian;"

[65.2]: "the data including data indicating at least a second vehicle;"

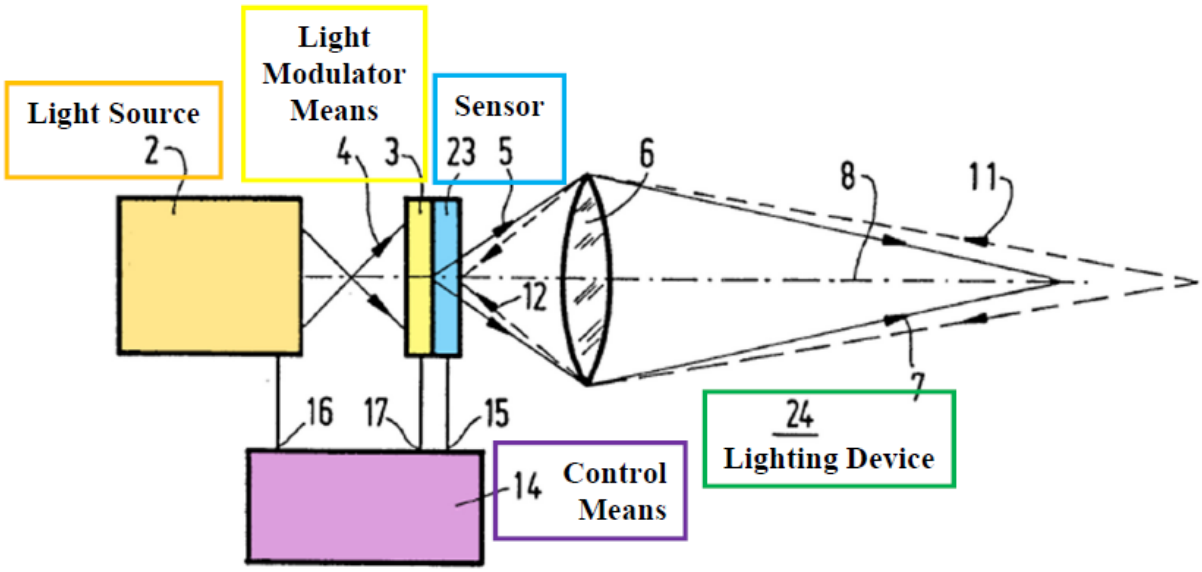
470. In my opinion, [26.1] and [26.2] are part of the same clause but will be addressed separately for simplicity below.

471. In my opinion, [65.1] and [65.2] are part of the same clause but will be addressed separately for simplicity below.

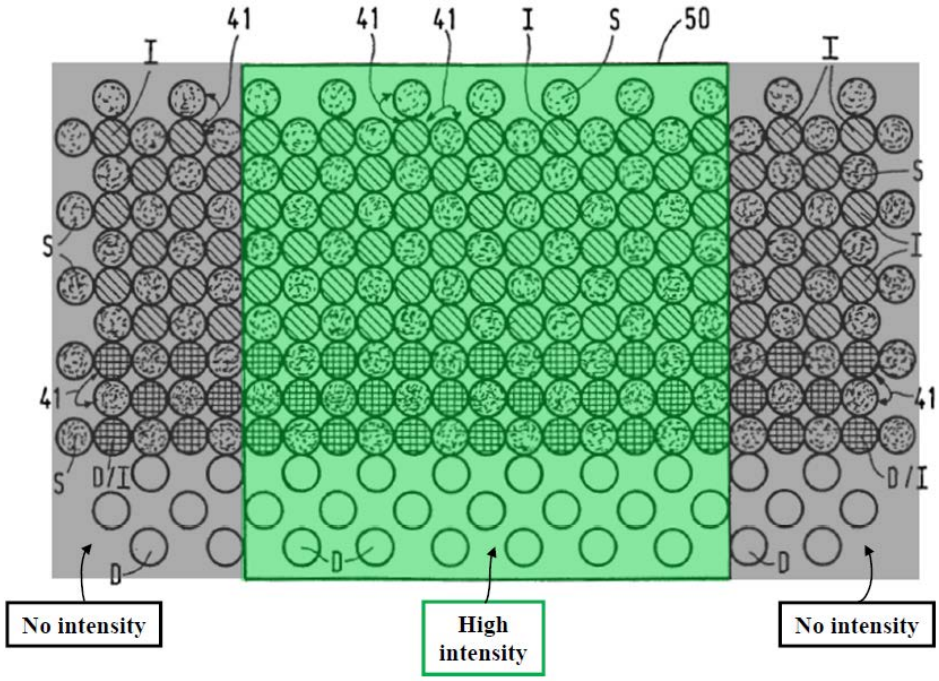
472. In my opinion, the features of [65.2] are included in [26.2].

473. Karlsson's "light-sensitive sensor…*detects* the distribution and the intensity of light in the *area ahead of a vehicle*" for "*detecting* light from

oncoming traffic." EX1010, 2:2-4, Abstract, FIGS. 3, 14; EX1010, 3:19-20 ("*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 "data indicating at least [one of one or more other vehicles / a second vehicle]" (oncoming) as recited in [26.2]/[65.2], which is "predefined as relevant to a determination of illumination," as additionally recited in [26.2], because Karlsson processes incident light 11 "into output signals…to *control*…*light beam 7*." EX1010, 9:11-17, 12:19-24, FIGS. 3, 14-15.



EX1010, FIG. 3 (annotated).



EX1010, FIG. 14 (annotated).

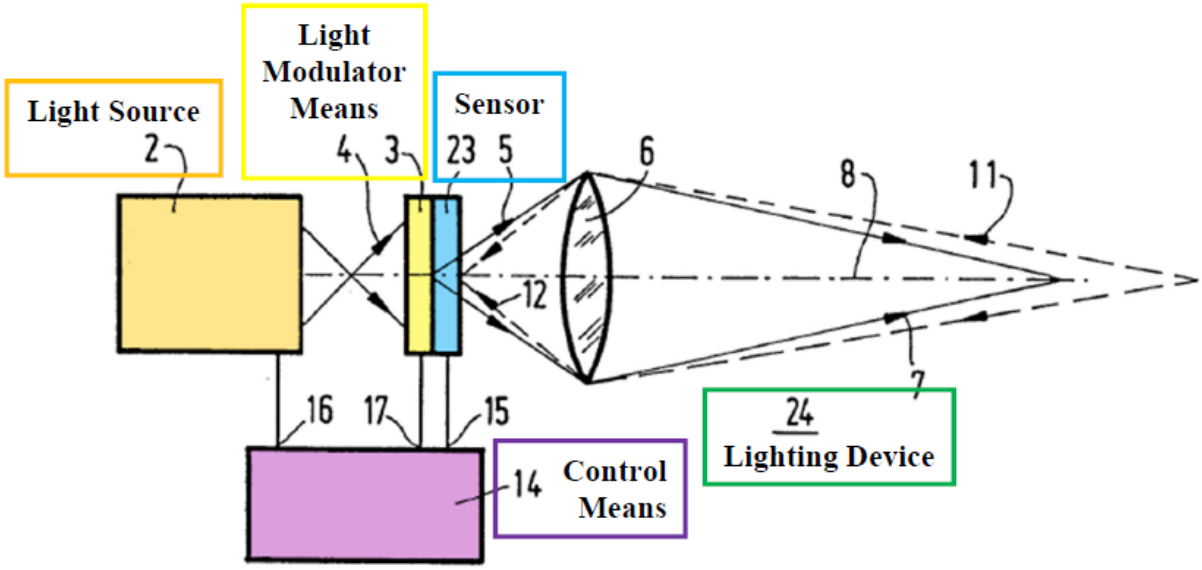
474. In view of the above, Karlsson discloses these elements.

4. [26.3]: "determining illumination requirements for the field-of-view based on the data sensed by the sensors,"

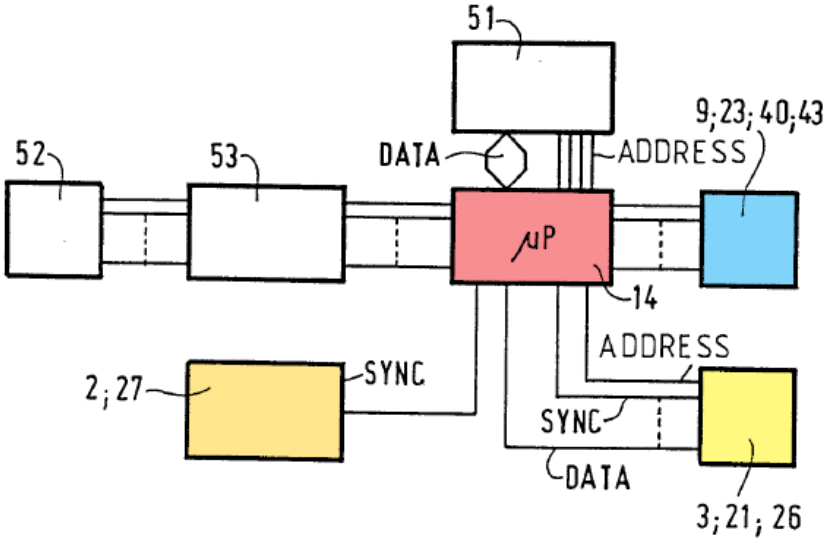
475. In my opinion, [26.3]-[26.5] are part of the same clause but will be addressed separately for simplicity below.

476. 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, 9:11-17, FIGS. 3, 14-15; EX1010, 3:27-31, ("*field of view*"), 14:26-30 ("*selectively adjust* the light…in response to a *control signal from sensor means 23*"), 20:12-32, 21:36-22:4. Thus, incident light data from the sensor determines

"illumination requirements for the field-of-view." EX1010, 9:11-17, 12:19-24, FIGS. 14-15.



EX1010, FIG. 3 (annotated).



EX1010, FIG. 15 (annotated).

477. In view of the above, Karlsson discloses this element.

5. [26.4]: "including determining illumination for at least a first subsection of the field-of-view including the other vehicle or pedestrian, as indicated by the sensor data, and"

[65.3]: "determining illumination for at least a first subsection including the second vehicle and"

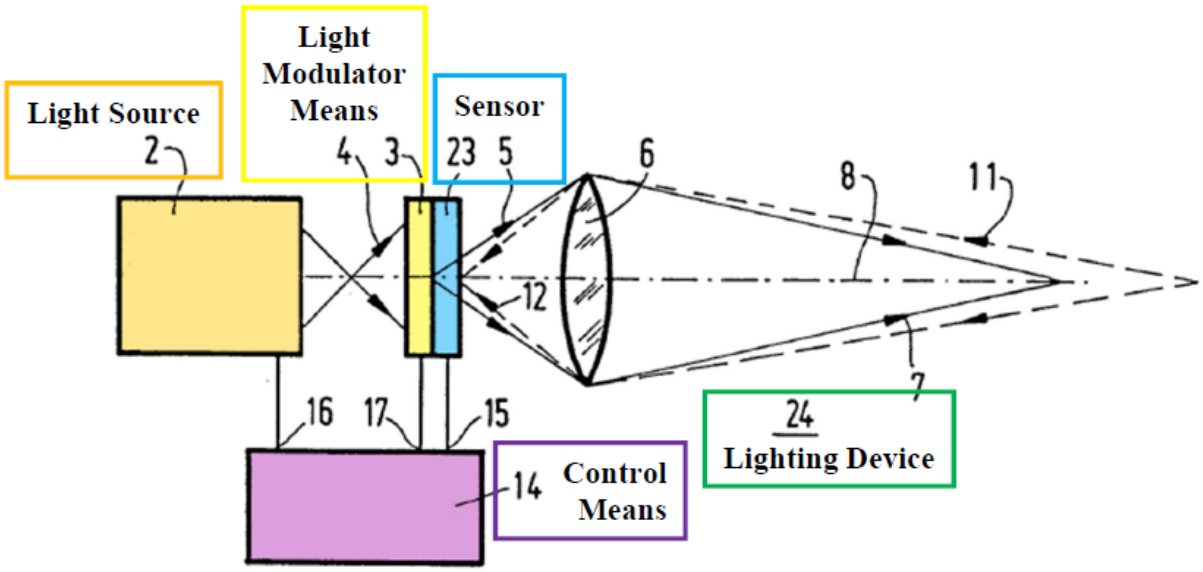
478. In my opinion, [26.3]-[26.5] are part of the same clause but will be addressed separately for simplicity below.

479. In my opinion, [65.3]-[65.8] are part of the same clause but will be addressed separately for simplicity below.

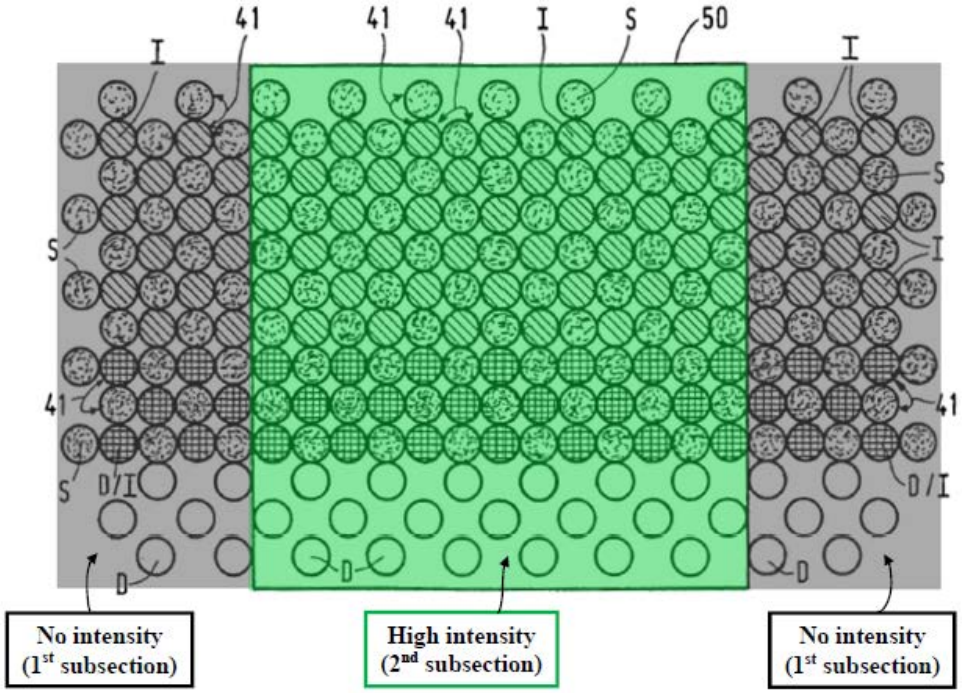
480. In my opinion, the features of [65.3] are included in [26.4].

481. Karlsson discloses "*incident light 11* on the *light-sensitive sensor 9*…[is] input 15 of the *control means 14*" and "light beam 7…controlled in such a manner that *no light at all or light having a low intensity* is emitted in…directions from which light is detected." EX1010, 9:11-26, FIGS. 3, 14-15; EX1010, 23:17-22 ("control means are arranged for…*determining* the *pattern* and/or the *intensity* of the light beam to be emitted"), 5:16-23 ("*detecting*…*oncoming traffic* as a *parameter*"), 5:28-32 ("spotlight sensors make[] it possible to *determine* precisely the direction from which light is being detected, so that subsequently a precise *adjustment of the pattern* of the light beam can be carried out"), 2:7-9 ("*part of the light beam*…is automatically suppressed"), 3:27-31 ("*field-of-view*"), 9:6-8 ("[t]he desired *pattern* and *intensity* of the light beam 7 are *determined* on the basis of the light 11 that is detected by the light-sensitive sensor 9"), 14:26-30, 17:21-26

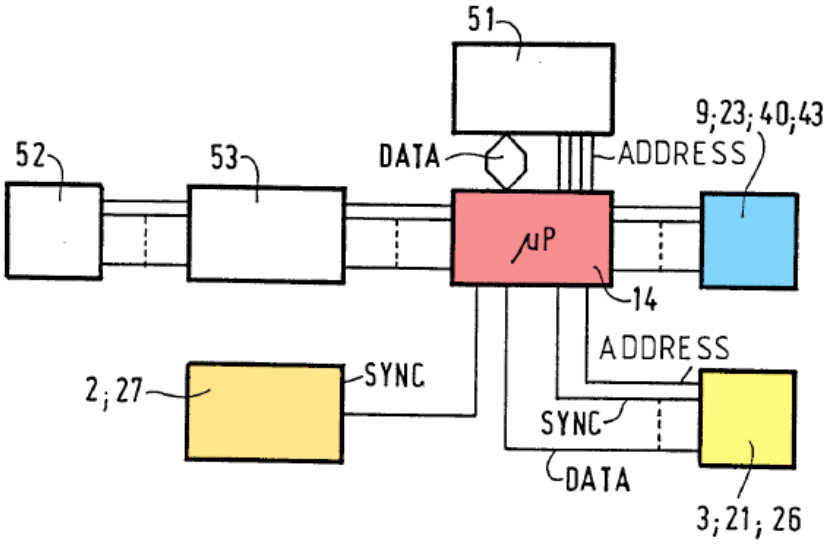
("external light sources are imaged on the light sensors 23 as light spots…[t]he horizontal position of the light spots *determines* which LCD segment 48 should be switched off"), 20:12-32, 21:36-22:4. Thus, the processor processes the inputted incident light data, identifies a vehicle within the headlight's field-of-view, and determines an area to be suppressed within a subsection of the field-of-view (e.g., shaded area with no intensity). EX1010, 9:11-17, 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; 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. 15 (annotated).

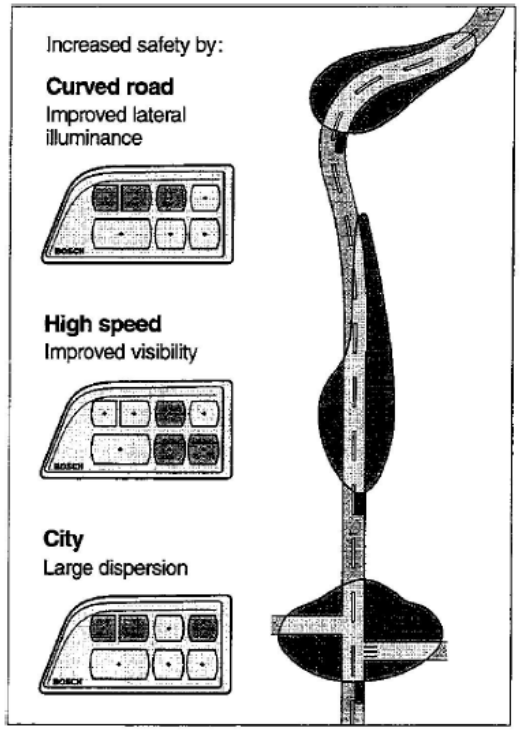


Fig.1: Three standard driving situations with adapted light pattern seen from the bird eye's view.

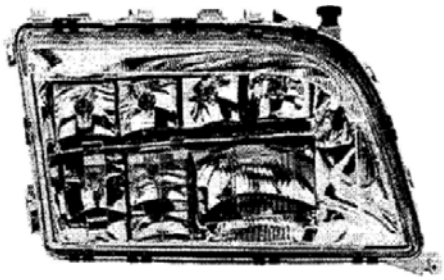
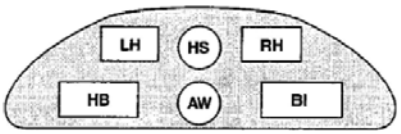


Fig 4: ALP *headlamp* sample



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

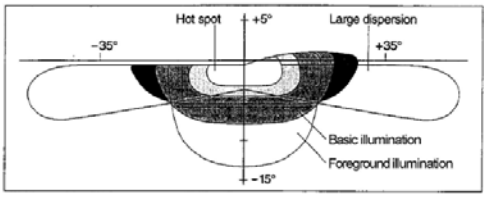


Fig. 3: Light pattern of multiple beam *headlamp* (*Isolux* curves in wall projection): The individual light *pattern* of multiple sub-units sum up to the total adaptive light pattern

EX1017, FIGS. 1 and 3-5.

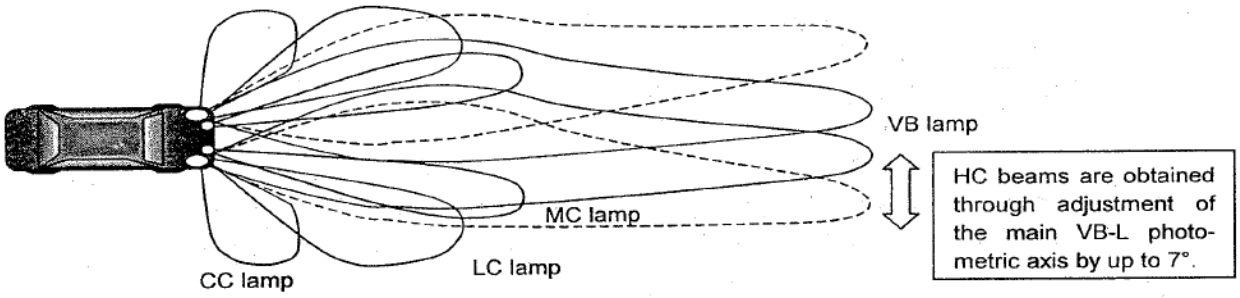


Fig. 3-3: Imaged Illumination Configurations on Road Surface

EX1026, FIG. 3-3.

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

6. [26.5]: "for at least a second subsection of the field-of-view not including the other vehicle or pedestrian;"

[65.4][12]: "at least one or more second subsections, to either side of the first subsection,"

483. In my opinion, [26.3]-[26.5] are part of the same clause but will be addressed separately for simplicity below.

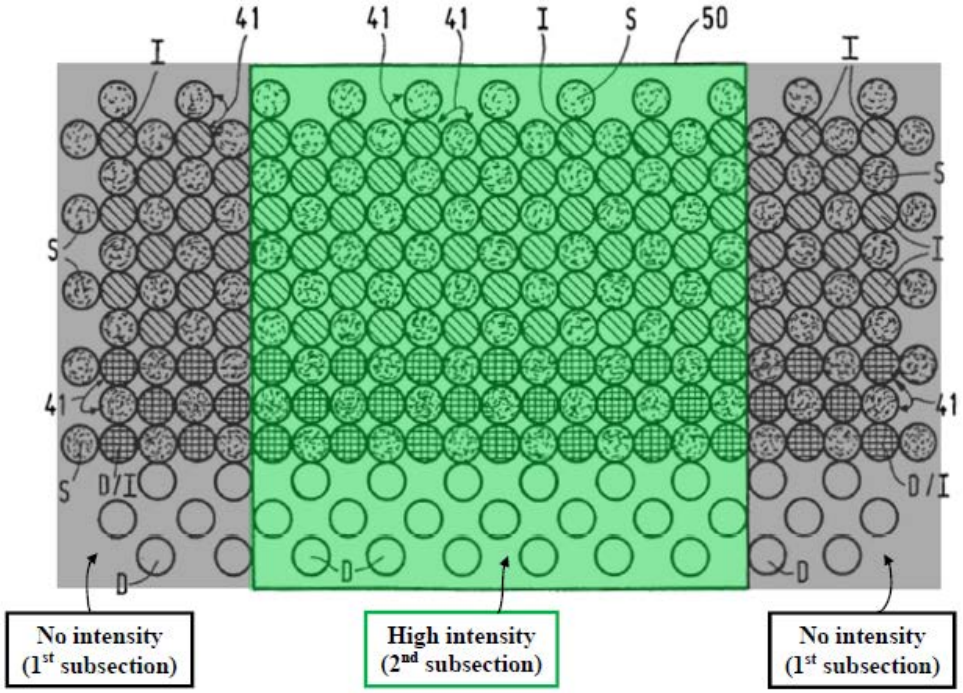
484. In my opinion, [65.3]-[65.8] are part of the same clause but will be addressed separately for simplicity below.

485. In my opinion, the features of [65.4] are included in [26.5].

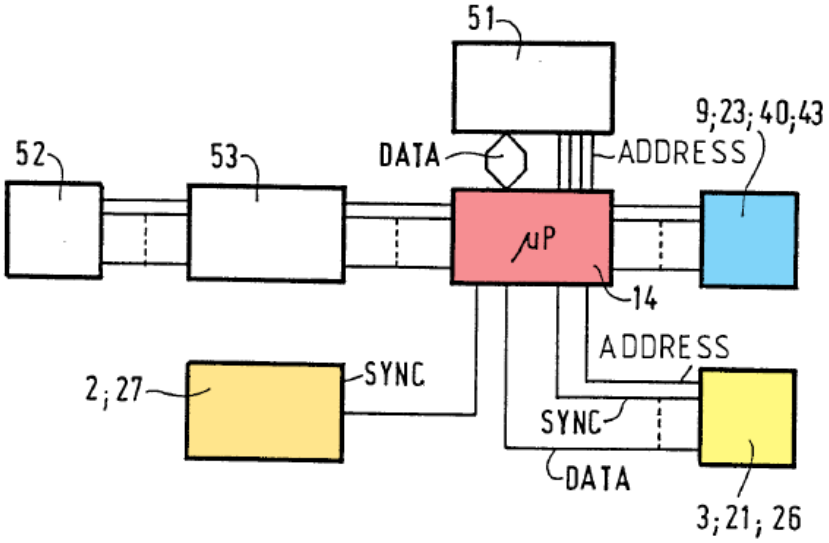
486. Karlsson discloses "*pattern* and…*intensity* are *automatically adjusted*…permitting a light intensity…generally *higher than that of conventional dipped headlights*." EX1010, Abstract, FIGS. 3, 14-15; EX1010, 19:29-33 ("*emitted light beam 50*"), 2:7-9 ("*part of the light beam*…is automatically suppressed, whilst *retaining an optimum lighting*"), 19:26-27 ("*main-beam light function*"), 14:26-30, 5:16-32, 9:11-17. Karlsson thus determines illumination for a different subsection outside of the detected vehicle (e.g., high intensity area to either side of first subsection). EX1010, 5:16-23, 9:11-17, 12:19-24, FIGS. 14-15; *see also* EX1017, 5 ("the adaptive light pattern should support to direct the

[12] Claim elements [65.5]-[65.10] will be addressed in Section XVII.C below with claim 65.

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. 14 (annotated).



EX1010, FIG. 15 (annotated).

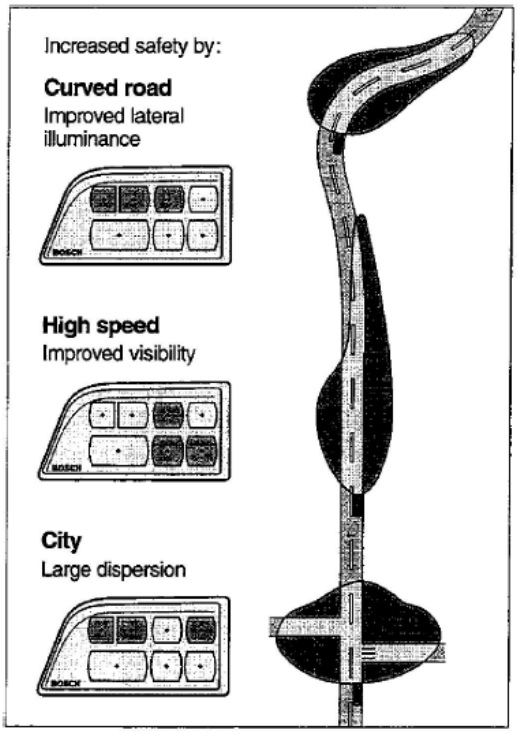


Fig.1: Three standard driving situations with adapted light pattern seen from the bird eye's view.

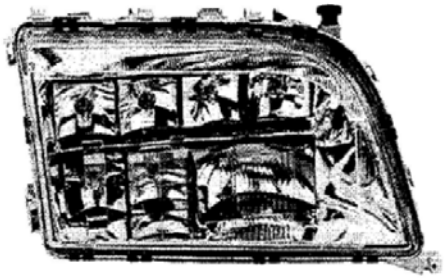
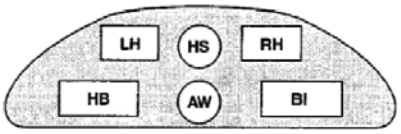


Fig 4: ALP *headlamp* sample



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

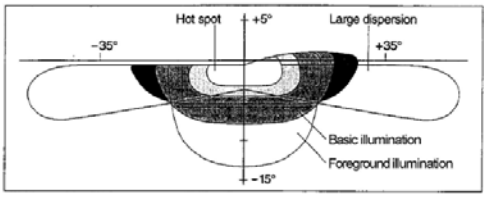


Fig. 3: Light pattern of multiple beam *headlamp* (*Isolux* curves in wall projection):
The individual light *pattern* of multiple sub-units sum up to the total adaptive light pattern

EX1017, FIGS. 1 and 3-5.

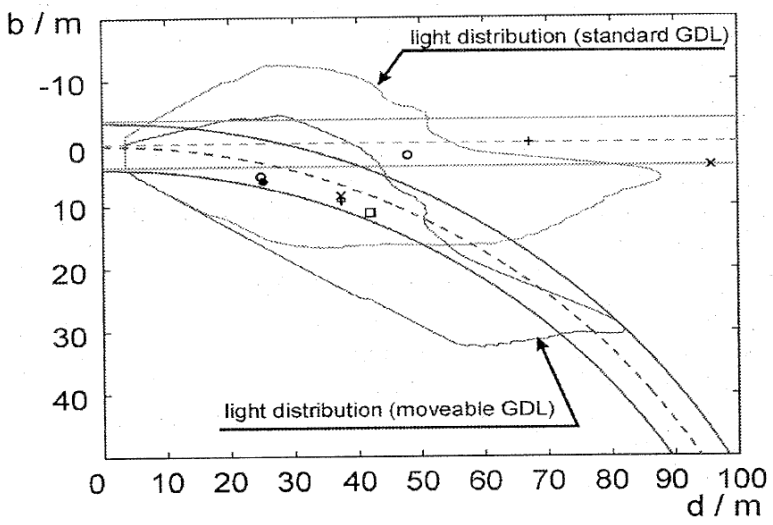


Figure 18: Fixation distance accumulation points (FDAP) for different headlamp systems and different road parts.
Accumulation points: X: *daylight*
O: *standard halogen*
●: *moveable halogen*
+: *standard gas discharge*
□: *moveable gas discharge*

EX1025, FIG. 18.

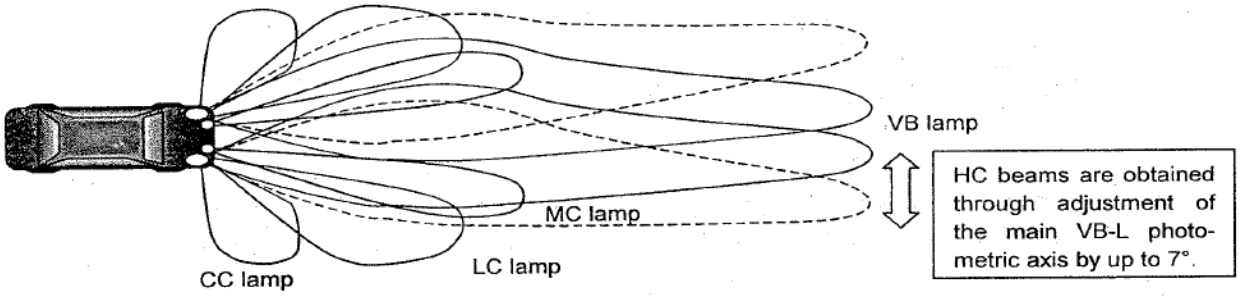


Fig. 3-3: Imaged Illumination Configurations on Road Surface

EX1026, FIG. 3-3.

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

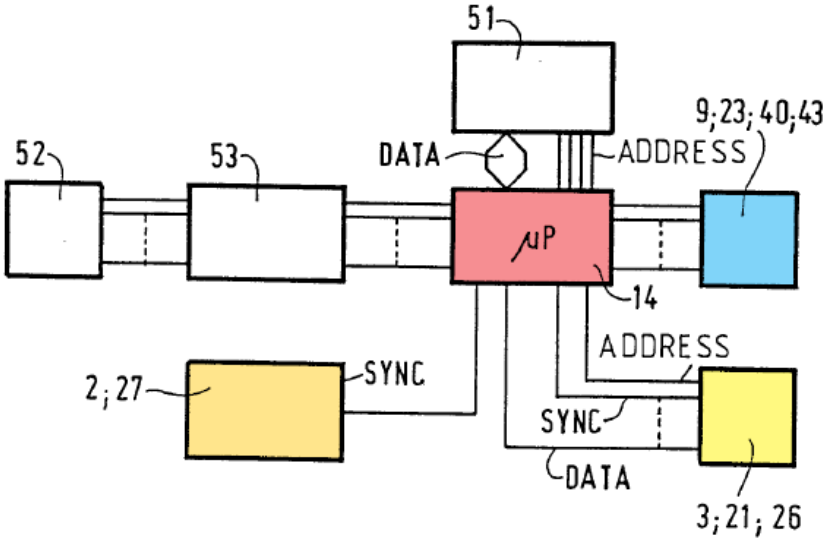
7. [26.6]: "determining a control strategy for controlling one or more directional light clusters in a headlight assembly to create an output headlight beam meeting the determined illumination requirements,"

488. In my opinion, [26.6]-[26.8] are part of the same clause but will be addressed separately for simplicity below.

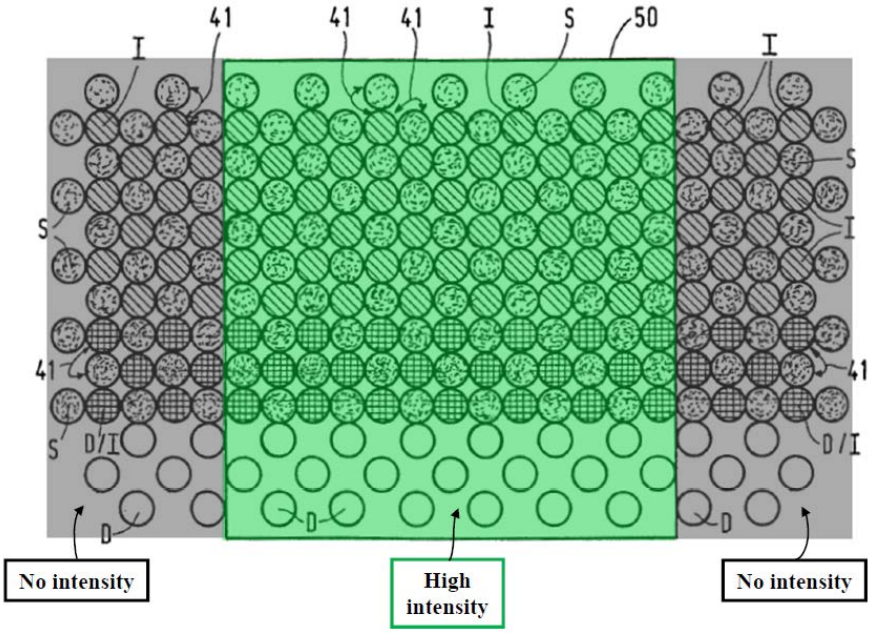
(a) Karlsson discloses this element.

489. In my opinion, Karlsson discloses [26.6]. *Supra* Sections XVII/XVII.A/XVII.B.5/XVII.B.6. Karlsson's control means determines a control strategy (e.g., control signal) to "selectively adjust the light *intensity* of a respective spotlight beam 34, in response to a *control signal* from sensor means 23, so as to provide a desired lighting pattern." EX1010, 14:26-30, FIGS. 3, 14-15; EX1010, 9:11-26 ("*incident light 11* on the *light-sensitive sensor 9*…[is] input 15 of the *control means 14*"), 23:17-22 ("control means are arranged for…*determining* the *pattern* and/or the *intensity* of the light beam to be emitted"), 5:28-32 ("spotlight sensors make[] it possible to *determine* precisely the direction from which light is being detected, so that subsequently a precise *adjustment of the pattern* of the light beam can be carried out"), 9:6-8 ("[t]he desired *pattern* and *intensity* of the light beam 7 are *determined* on the basis of the light 11 that is detected by the light-sensitive sensor 9"), 14:26-30, 17:21-24, 20:12-32, 21:36-22:4, 2:7-9, 3:27-31. Thus, Karlsson's controller determines a control strategy for controlling the direction and illumination of spotlight beams to "create an output headlight beam

meeting the determined illumination requirements." EX1010, 9:11-17, 12:19-24, FIGS. 14-15.



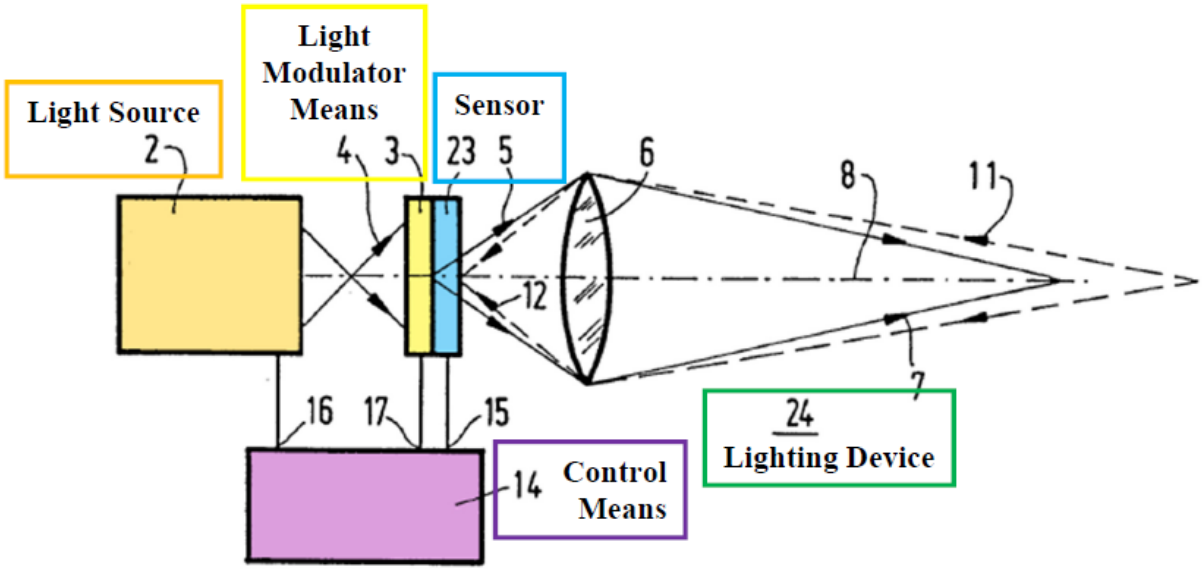
EX1010, FIG. 15 (annotated).



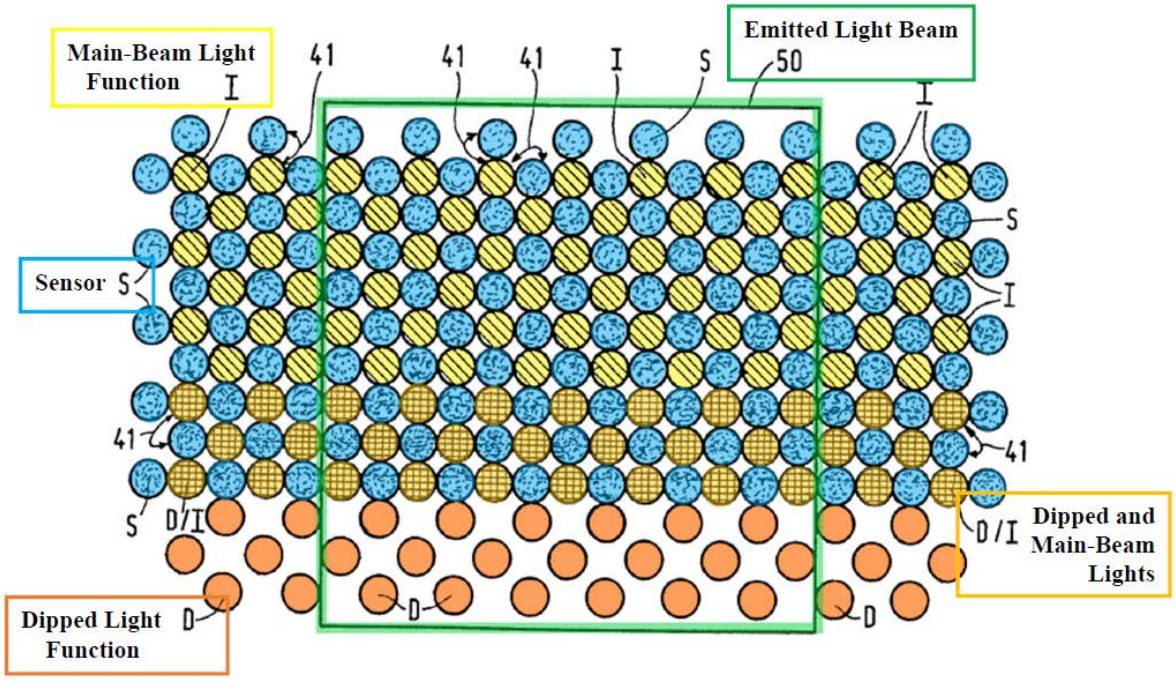
EX1010, FIG. 14 (annotated).

490. Also, Karlsson discloses "*lighting means 2, 3*…*controlled by control means 14*…in such a manner that…a *desired pattern* and a *desired intensity* is emitted" and "*spotlight beams 34* may also be made up of…*light modulators* which can be controlled to transmit light…for a *group* of spotlight beams." EX1010, 9:11-17, 14:5-15, FIGS. 3, 6, 14-15; EX1010, 11:25-28 ("*given directions*"), 14:1-4 ("spotlight beams 34…*controlled* either *individually* or in *groups*"), 19:29-33, 4:26-31, 20:12-32, 21:36-22:4. Each spotlight beam is a directional "cluster" or "source," having its own independent *direction* (angle/aiming), that combines to form the headlamp beam; so the combination of Karlsson's spotlight beams form at least one directional light cluster/source to provide illumination in desired subsections. EX1010, 4:26-31, 14:1-15, FIGS. 6, 14.

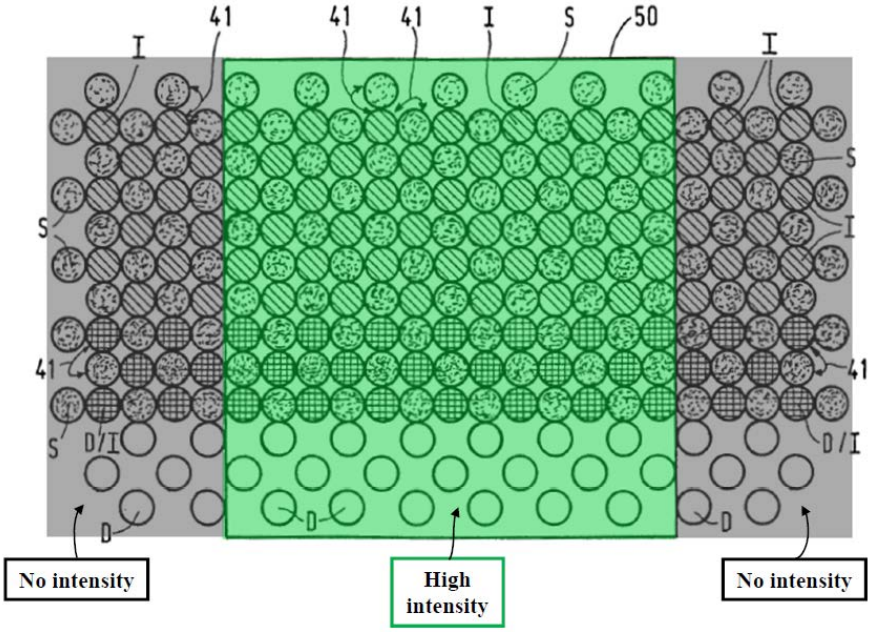
491. Alternatively, if Patent Owner argues, incorrectly, that a "cluster" requires at least two (or more) spotlight beams, Karlsson also discloses this. EX1010, 14:1-9 ("spotlight beams 34 can…be controlled either individually or in *groups*"), 14:12-15 ("a desired light *intensity* can be adjusted for…a *group* of spotlight beams"), 14:26-30, FIGS. 6, 14.



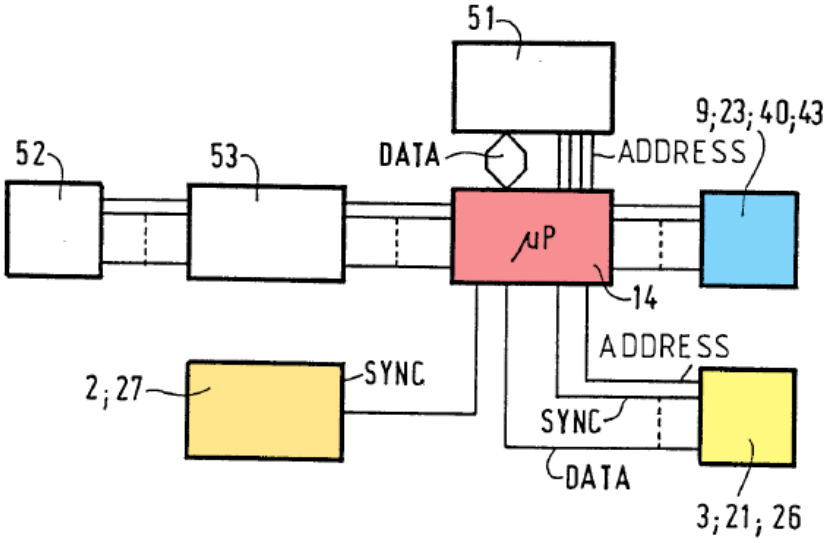
EX1010, FIG. 3 (annotated).



EX1010, FIG. 14 (annotated).



EX1010, FIG. 14 (annotated).



EX1010, FIG. 15 (annotated).

492. Such directionality results in *directional light clusters* that by definition will have different angles, which result in different aimings in desired subsections. So disclosure that discusses a control strategy for directional light

clusters to create an output headlight beam applies the same to disclosure that discusses control instructions for directional light *sources* for first and second subsections.

493. A POSA would have understood that controlling "intensity" and "directions" of "spotlight beams 34…controlled either individually or in *groups*" is the same as controlling "one or more directional light clusters…meeting the determined illumination requirements," as the light output from a headlamp is all measured with its light intensity level in an angular distribution. EX1010, 14:1-15 ("a desired light *intensity* can be adjusted…for a *group* of spotlight beams"); *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; EX1019, 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.

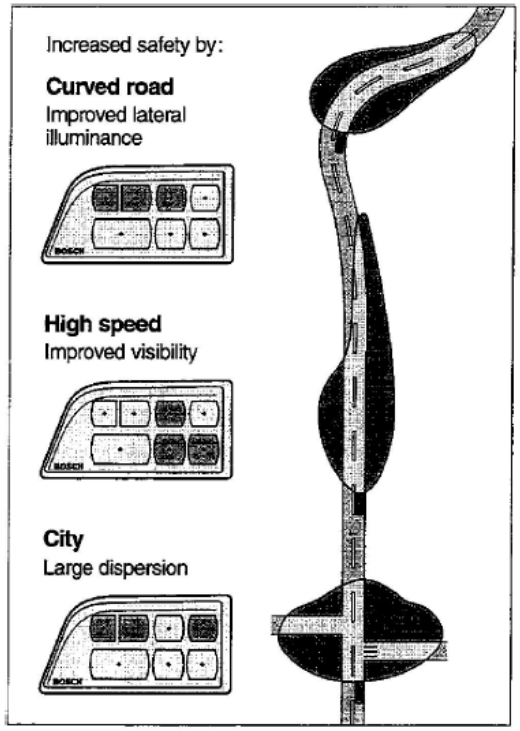


Fig.1: Three standard driving situations with adapted light pattern seen from the bird eye's view.

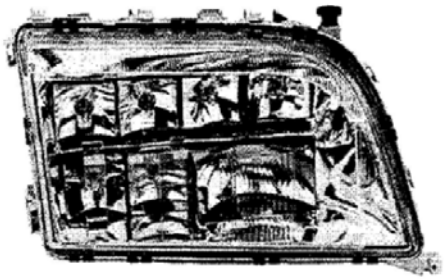
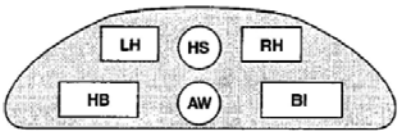


Fig 4: ALP *headlamp* sample



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

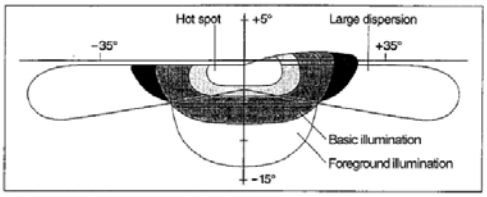


Fig. 3: Light pattern of multiple beam *headlamp* (*Isolux* curves in wall projection): The individual light *pattern* of multiple sub-units sum up to the total adaptive light pattern

EX1017, FIGS. 1 and 3-5.

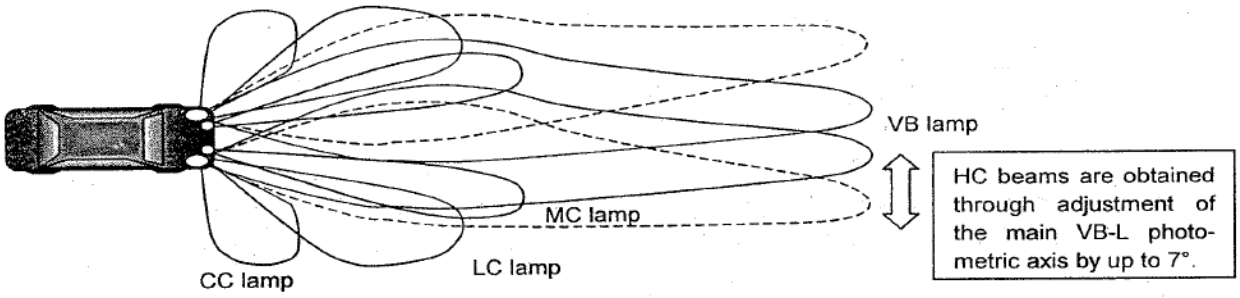
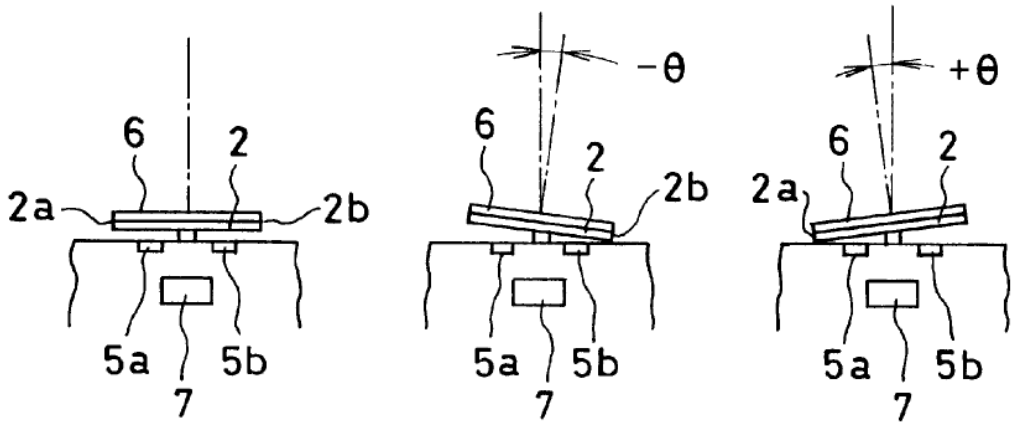


Fig. 3-3: Imaged Illumination Configurations on Road Surface

EX1026, FIG. 3-3.

FIG. 2A FIG. 2B FIG. 2C



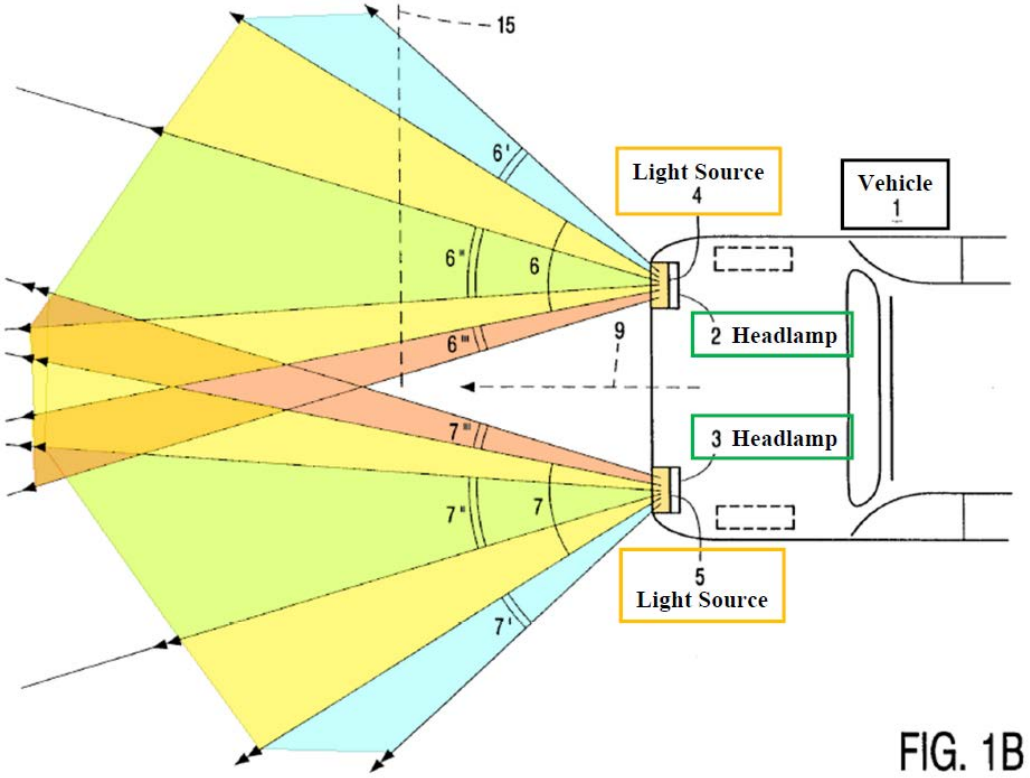
EX1040, FIGS. 2A-2C.

(b) Harbers also discloses this element.

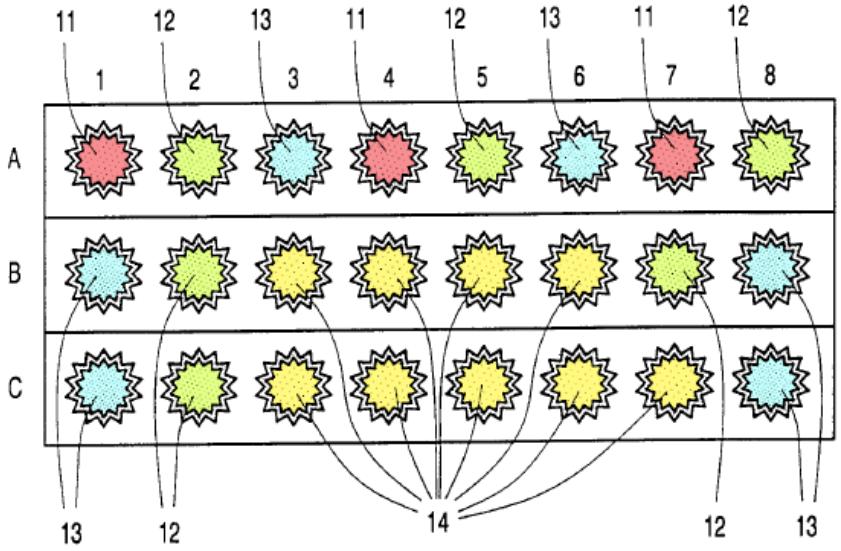
494. If Patent Owner argues, incorrectly, that Karlsson does not disclose [26.6], Harbers also discloses [26.6], and it would have been obvious in view of Harbers. A POSA would have been motivated to combine Harbers with Karlsson with a reasonable expectation of success, providing predictable visibility and safety benefits. *See supra* Sections XVII/XVII.A.

495. As explained above (Section XVII.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'" (directional light clusters) for different functions. EX1011, 5:14-26, 6:1-7, 6:27-7:19, FIGS. 1B-2, 7:27-32 ("*curved substrate…determined* to a substantial degree by the *desired direction* of the light beams emitted"), 7:1-17. For example, Harbers's beam segment 6, 7 is a "wide…passing beam" (first cluster), beam segment 6', 7' illuminates "the shoulder

of the road" (second cluster), and beam segment 6", 7" illuminates "the center of the road" (third cluster). EX1011, 7:1-17, FIG. 1B.



EX1011, FIG. 1B (annotated).



EX1011, FIG. 2 (annotated).

496. 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 or renders obvious [26.6]

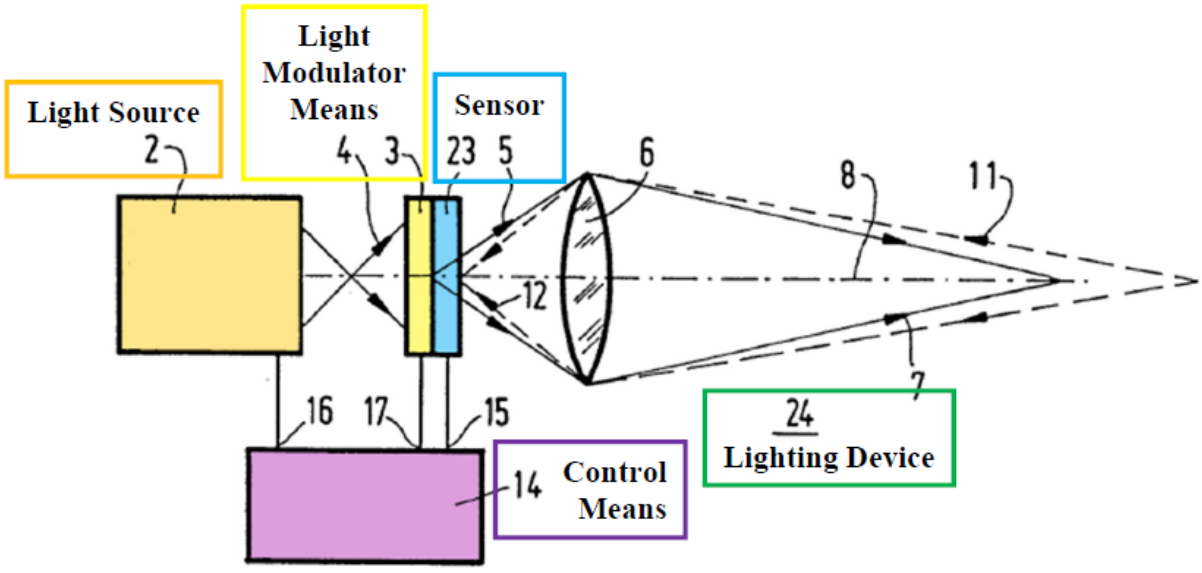
(c) A POSA would have been motivated to combine Karlsson and Harbers with a reasonable expectation of success.

497. As discussed, Karlsson discloses "directional light clusters" with independently controlled angular positions for reducing glare towards other drivers. *Supra* Section XVII.A. Harbers provides further detail on implementing "directional light clusters" 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—through either software or hardware—for different functions in Karlsson's system.

498. Indeed, Harbers discloses such an implementation to provide different spatial distributions for improved visibility in different driving situations (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.

499. 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.

500. *First*, including an additional control technique (software implementation) for Karlsson—Harbers's *known technique* of using multiple directional beam segments for different functions—would have added more control methods for different functions to Karlsson's system 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, 4:26-31, 11:25-28, 14:1-15, 19:29-33, FIGS. 3, 6.



EX1010, FIG. 3 (annotated).

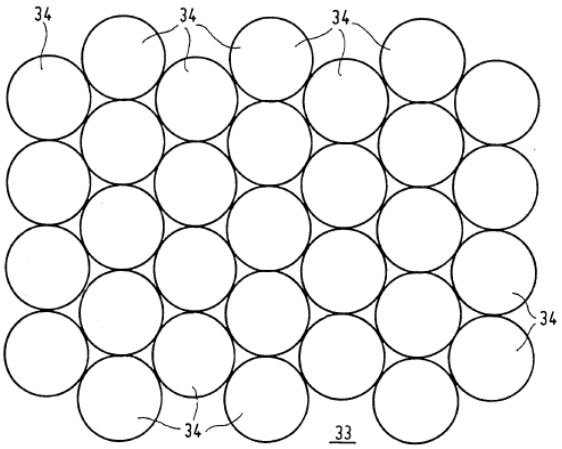


FIG. 6

EX1010, FIG. 6.

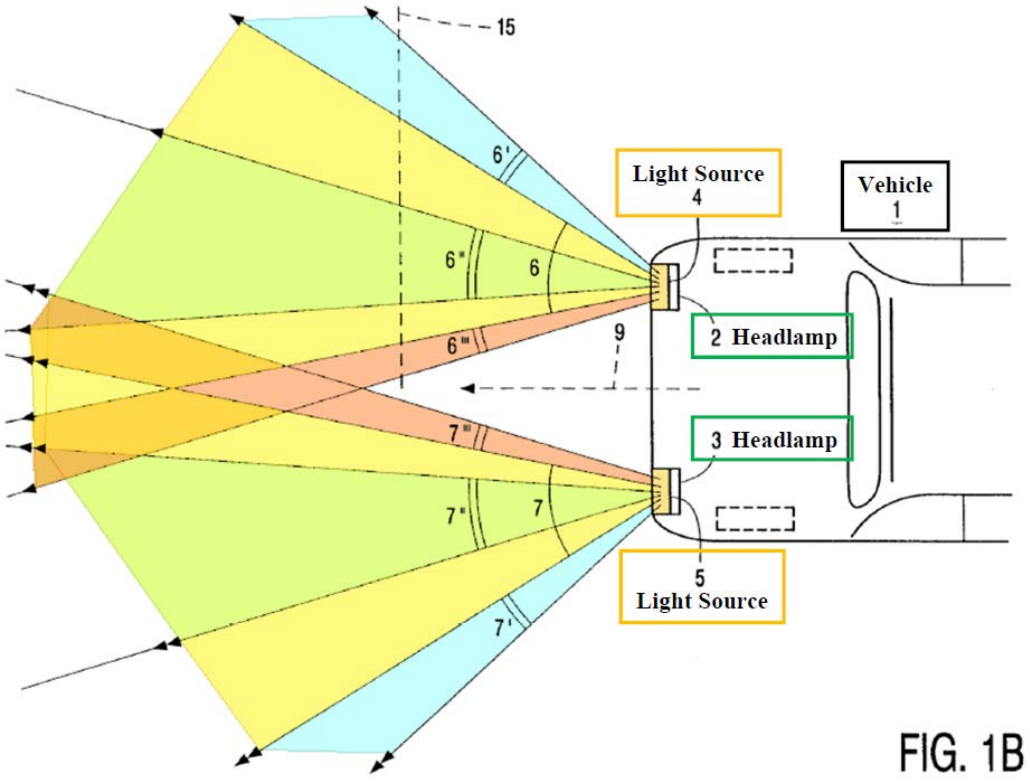
501. Indeed, Karlsson's techniques and system of controlling individual spotlight beams emphasize safety of all drivers. EX1010, 1:16-26, 4:17-21, 9:18-26. Controllable headlamps "significantly increase the driving comfort and the road safety," and "glaring or blinding of oncoming traffic is effectively 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, 1:10-13 ("comply with…regulations…preventing the *blinding* or *glare*").

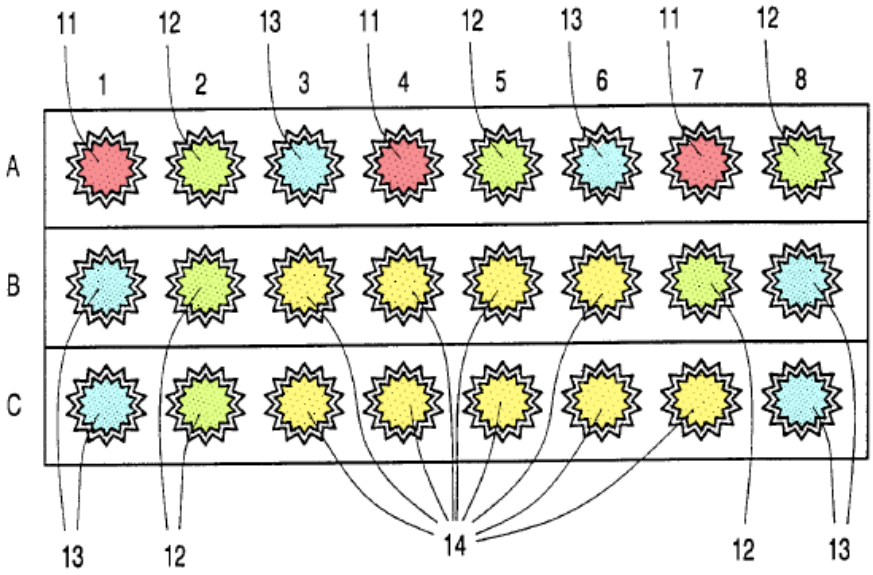
502. Karlsson's system "*selectively adjust[s]*…spotlight beam[s] 34, in response to a *control signal from sensor means 23*…to provide a *desired lighting pattern*" in "given *directions*." EX1010, 14:26-30, 11:25-28, FIGS. 3, 6, 14. Karlsson recognizes the safety benefits of identifying "oncoming traffic" 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, 3:19-31, 12:19-35, 2:2-4, 5:16-32. If Patent Owner argues, incorrectly, Karlsson does not expressly disclose "directional light [clusters / sources]," even though Karlsson discloses different angular positions control for different spotlight beams, it would have been obvious to a POSA to use such control to "create an output headlight beam meeting the determined illumination requirements" and "achieve the determined illumination levels for at least the first and one or more second subsections." 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.

503. And Harbers's *technique* (software implementation), like Karlsson, seeks to enhance driver visibility, thereby increasing safety—using multiple

directional beam segments for different functions. EX1011, 5:14-26, 6:1-7, 6:27-7:19, 8:10-18, FIGS. 1B-2. Specifically, Harbers's explains opto-electronic elements 11-14 provide differently angled/aimed beam segments 6-6'-6"-6'", 7-7'-7"-7'" 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).

504. The additional control (software implementation) of having multiple directional beam segments 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.

505. This would have merely been applying Harbers's known techniques (software implementation: using multiple directional beam segments for different functions) to Karlsson's similar, known device (adaptive 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.

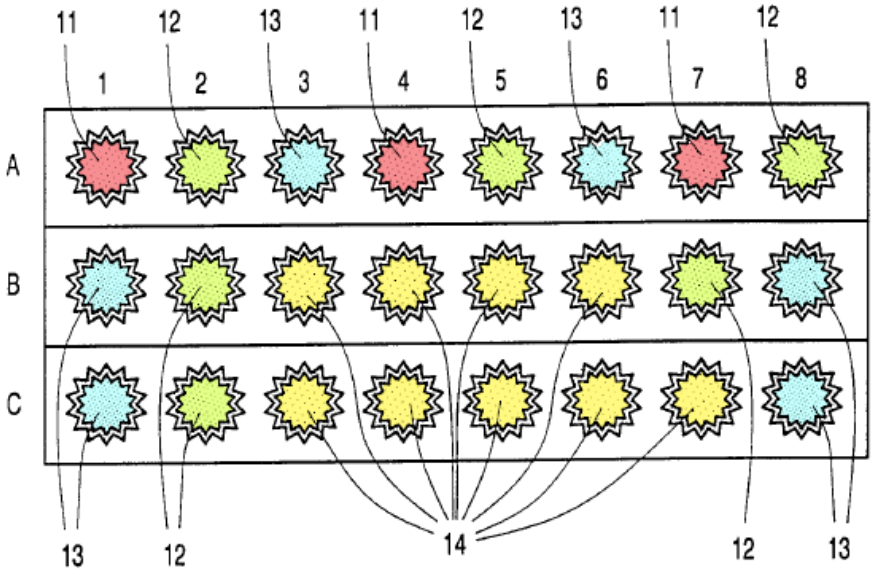
506. A POSA would have had a reasonable expectation of success combining Harbers with Karlsson, for example, by simply modifying software instructions stored in memory of Karlsson's controller/processor to organize Karlsson's spotlight beams into multiple directional beam segments for different functions.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

507. 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 for different functions—as already disclosed in the art.

508. *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, *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.

509. 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).

510. 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. This would have been merely combining prior-art elements or a simple substitution of one known element for another (Karlsson's lighting means 2, 3 on a flat substrate and Harbers's opto-electronic elements 11-14 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.

511. 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 directional light clusters/sources for different functions (hardware implementation).

512. 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).

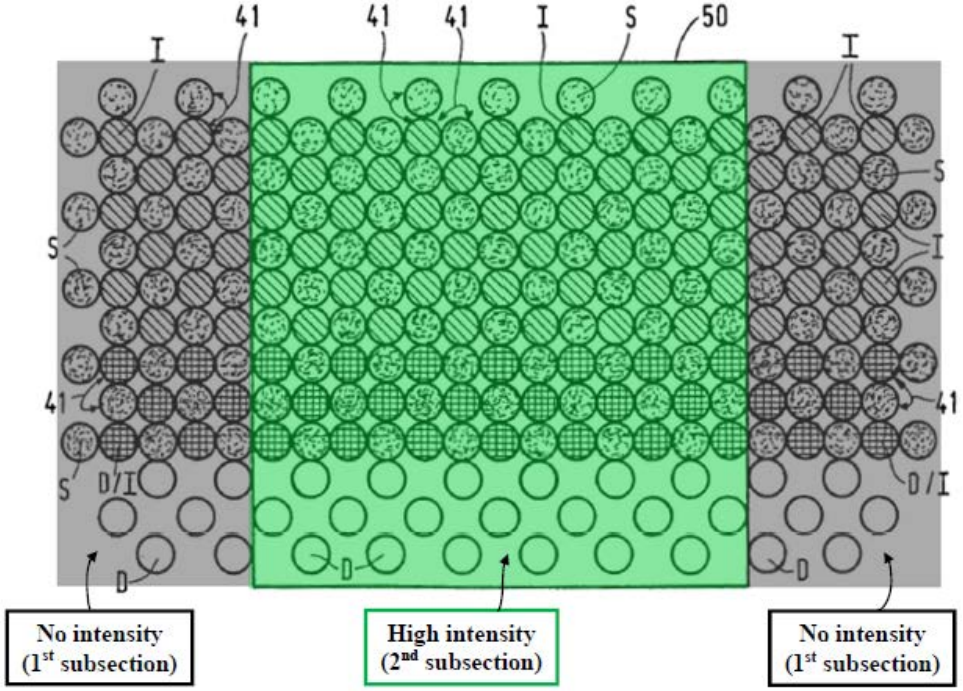
513. In view of the above, Karlsson, alone or in combination with Harbers, discloses or renders obvious this element.

8. [26.7]: "the headlight beam spatial light distribution shaped to provide high beam illumination for a driver of the vehicle, in at least the second subsection,"

514. In my opinion, [26.6]-[26.8] are part of the same clause but will be addressed separately for simplicity below.

515. 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, 9:11-26, Abstract, FIGS. 3, 14-15; EX1010, 19:26-27 ("*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 for the driver"), 1:18-23 ("*longer-range main-beam* constantly"), 19:29-33 ("*emitted light beam 50*"), 14:26-30, 5:16-32, 9:11-17. Thus, the light beam 7 is shaped to provide "high beam illumination" in a second subsection (e.g., high intensity area). *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. 14 (annotated).

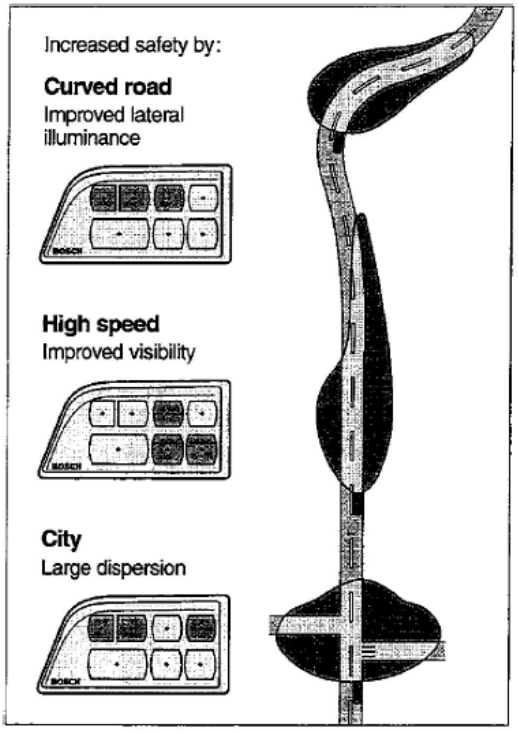


Fig.1: Three standard driving situations with adapted light pattern seen from the bird eye's view.

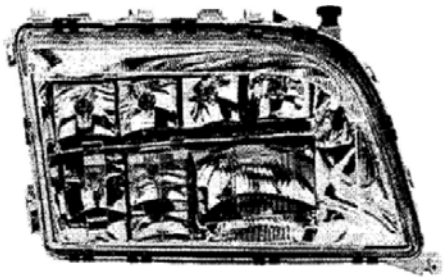
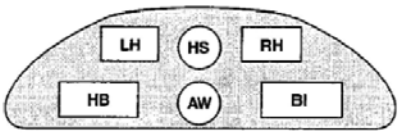


Fig 4: ALP *headlamp* sample



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

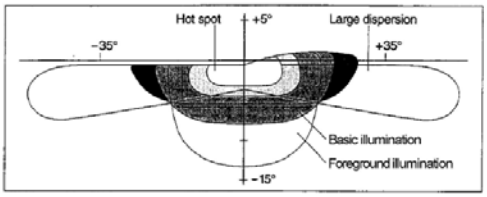


Fig. 3: Light pattern of multiple beam *headlamp* (*Isolux* curves in wall projection):
The individual light *pattern* of multiple sub-units sum up to the total adaptive light pattern

EX1017, FIGS. 1 and 3-5.

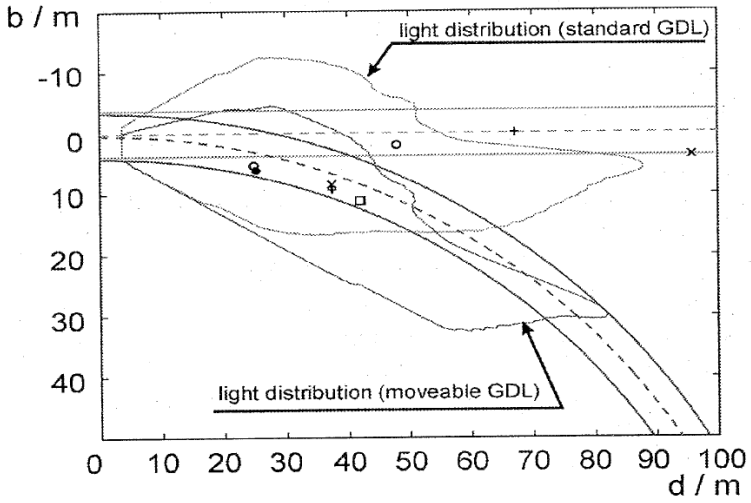


Figure 18: Fixation distance accumulation points (FDAP) for different headlamp systems and different road parts.
Accumulation points: X: *daylight*
O: *standard halogen*
●: *moveable halogen*
+: *standard gas discharge*
□: *moveable gas discharge*

EX1025, FIG. 18.

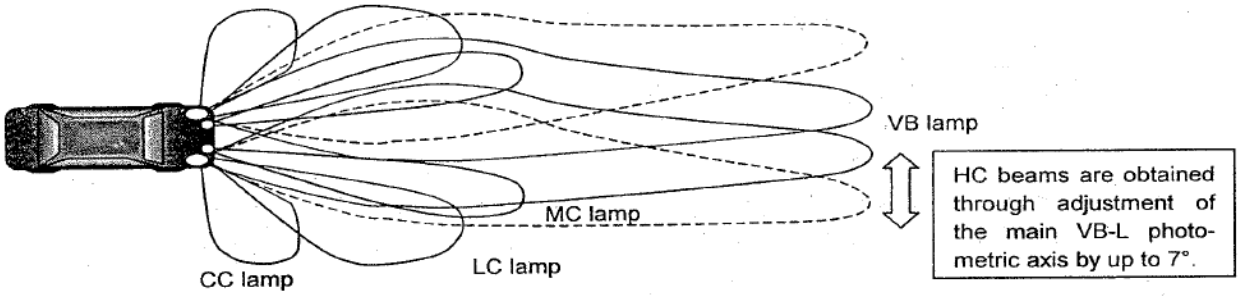


Fig. 3-3: Imaged Illumination Configurations on Road Surface

EX1026, FIG. 3-3.

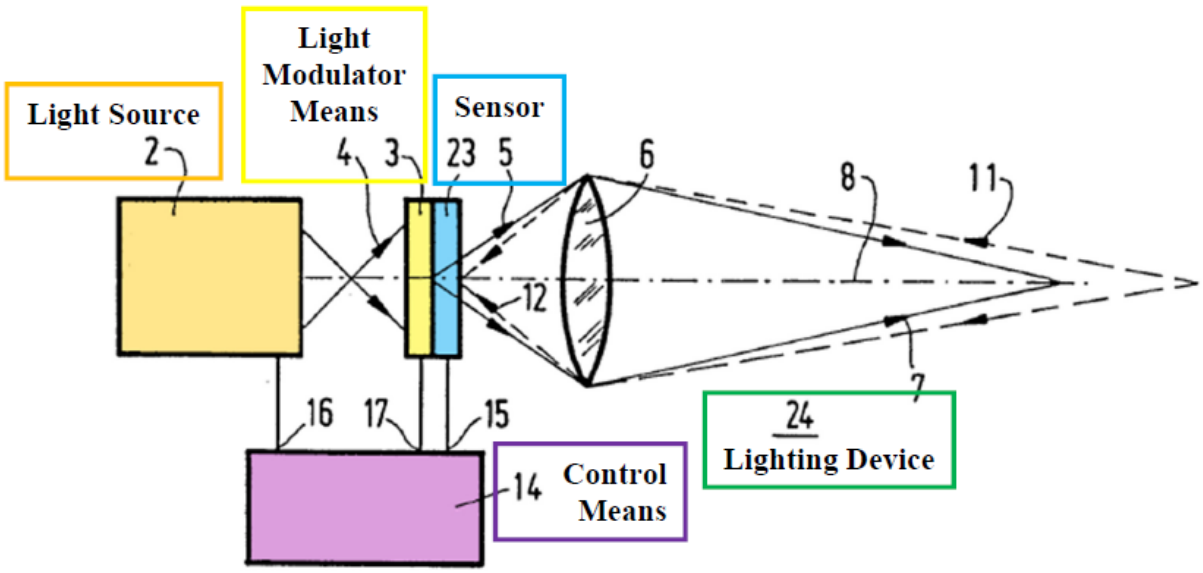
516. In view of the above, Karlsson discloses this element.

9. [26.8]: "while mitigating glaring light illuminating at least the first subsection including detected other vehicles or pedestrians;"

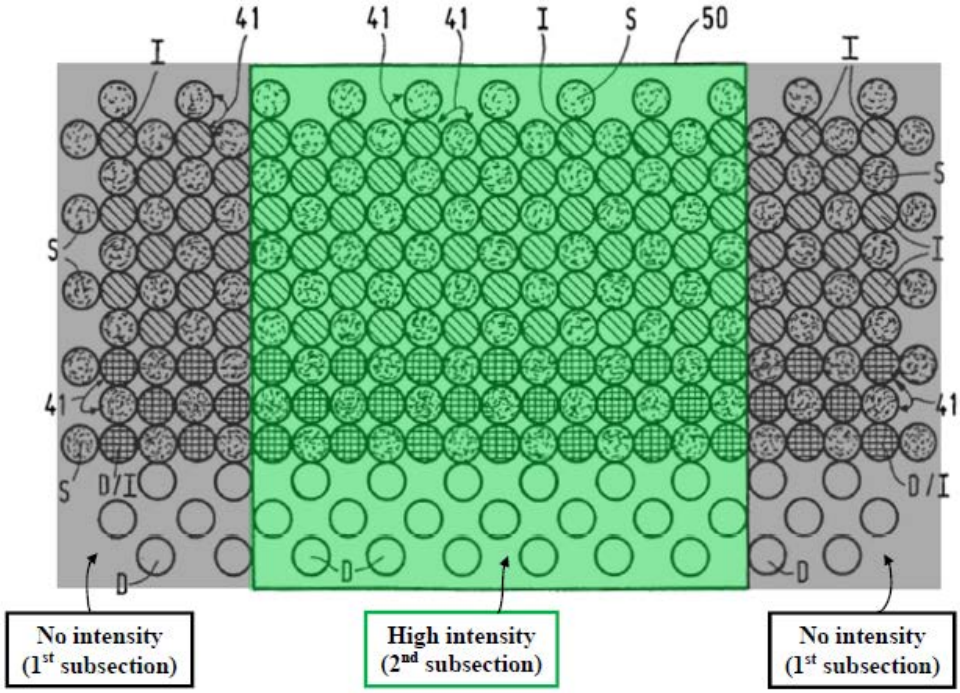
517. In my opinion, [26.6]-[26.8] are part of the same clause but will be addressed separately for simplicity below.

518. 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, 9:19-26, FIGS. 3, 14-15; EX1010, 19:24-25 ("*dipped light function*"), 2:7-9 ("*part of the light beam* which might cause *inconvenience to oncoming traffic* is automatically suppressed"), 5:30-32 ("*pattern of the light beam*…so as *not to emit light* in the direction of the detected light"), 14:26-30, 9:11-17, 5:16-23, 3:27-31. Karlsson thus "mitigat[es] glaring" to the detected vehicle. EX1010, 9:11-26, 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).

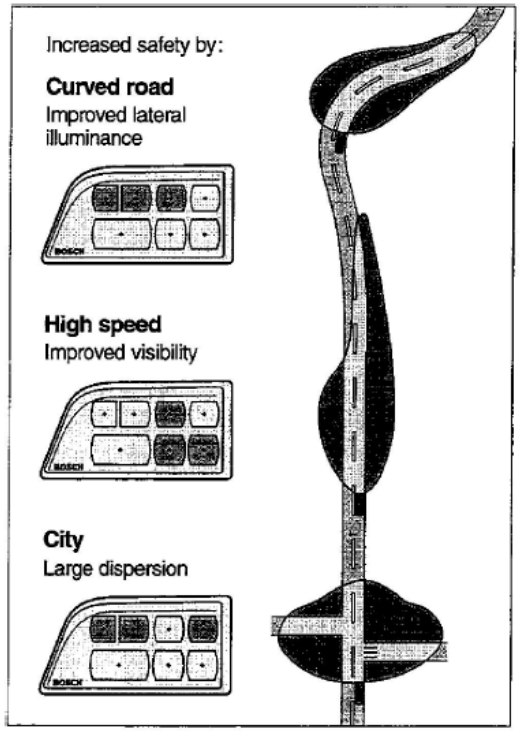


Fig.1: Three standard driving situations with adapted light pattern seen from the bird eye's view.

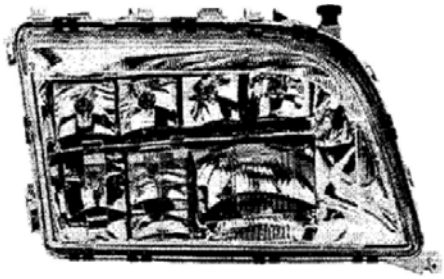
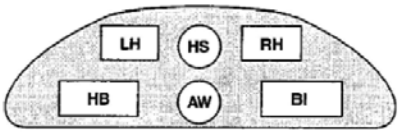


Fig 4: ALP *headlamp* sample



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

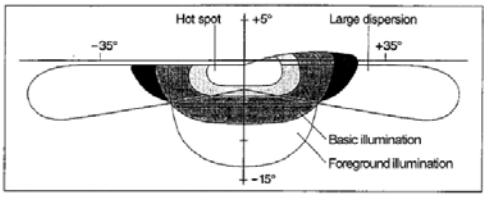


Fig. 3: Light pattern of multiple beam *headlamp (Isolux* curves in wall projection):
The individual light *pattern* of multiple sub-units sum up to the total adaptive light pattern

EX1017, FIGS. 1 and 3-5.

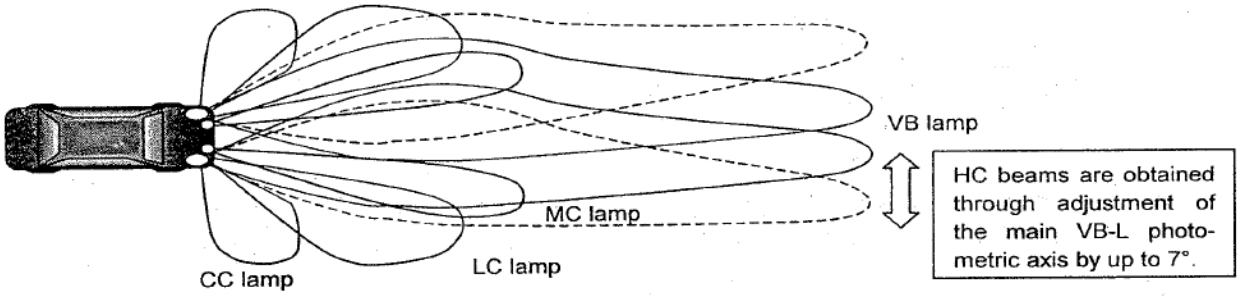


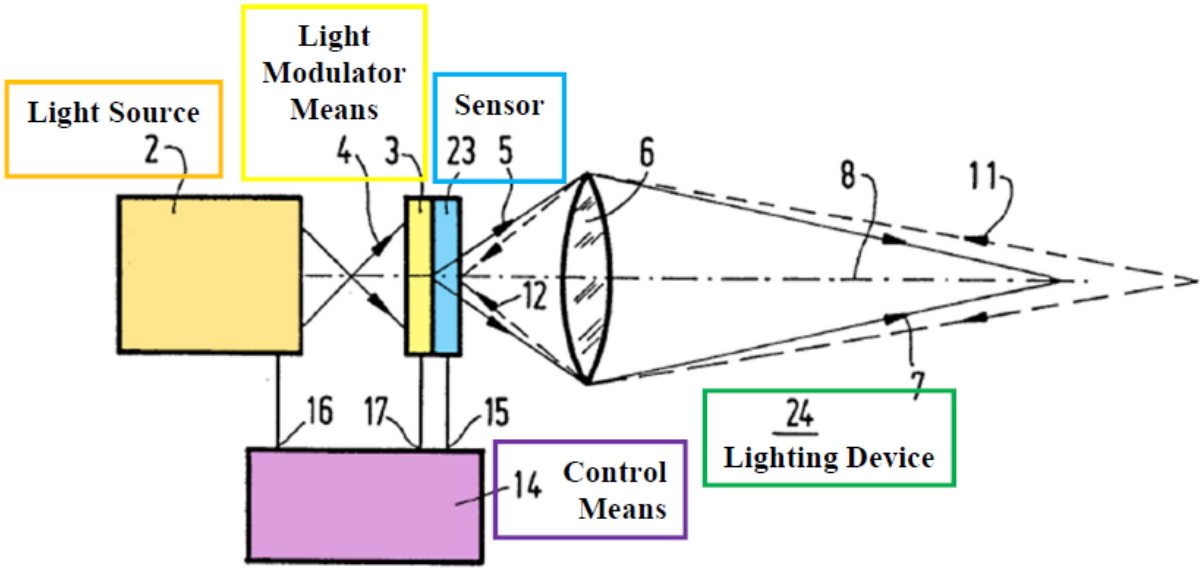
Fig. 3-3: Imaged Illumination Configurations on Road Surface

EX1026, FIG. 3-3.

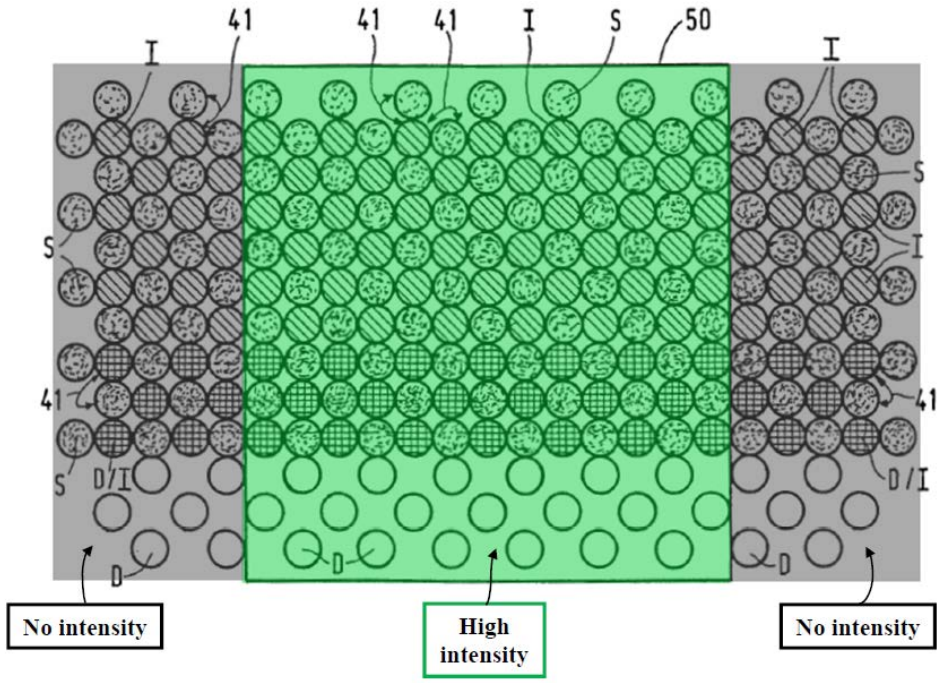
519. In view of the above, Karlsson discloses this element.

10. [26.9]: "sending control signals implementing the control strategy to an electronic control circuitry configured to operate the light-clusters; and"

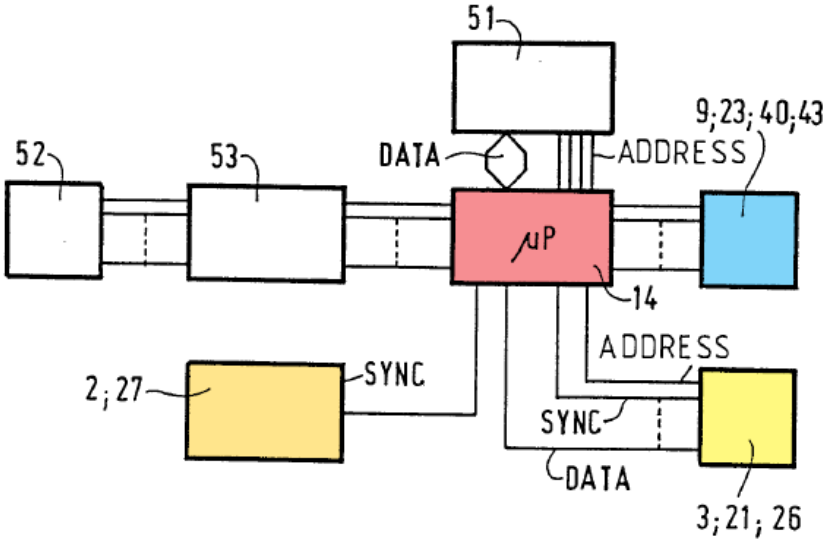
520. Karlsson discloses "lighting means 2, 3…controlled by control means 14, such that the incident light 11 on the light-sensitive sensor 9…is processed into an electric control signal…[and] processed by the control means 14 into output signals at outputs 16, 17 thereof, so as to control the lighting means 2, 3." EX1010, 9:11-17, FIGS. 3, 14-15; EX1010, 20:12-32, 21:36-22:4. As discussed, Karlsson/Karlsson-Harbers discloses "directional light clusters." *Supra* Section XVII.B.7. Thus, Karlsson's controller sends output signals 16, 17 to lighting means 2, 3 to adjust the pattern and the intensity of spotlight beams in the array to "implement the control strategy" and "operate the light-clusters." EX1010, 9:11-17, FIGS. 14-15.



EX1010, FIG. 3 (annotated).



EX1010, FIG. 14 (annotated).

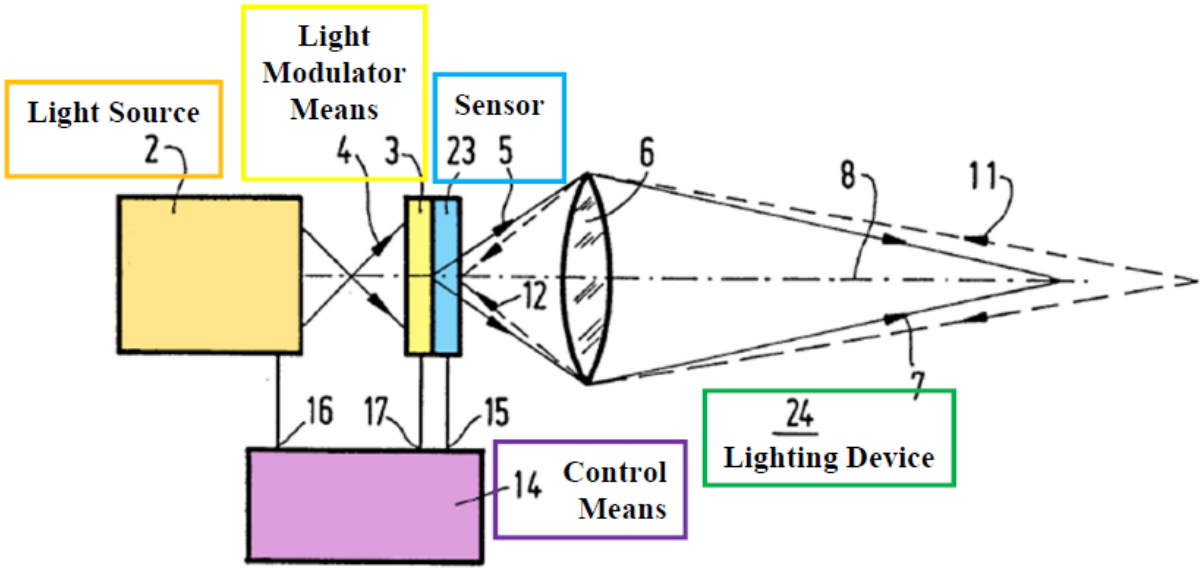


EX1010, FIG. 15 (control circuitry) (annotated).

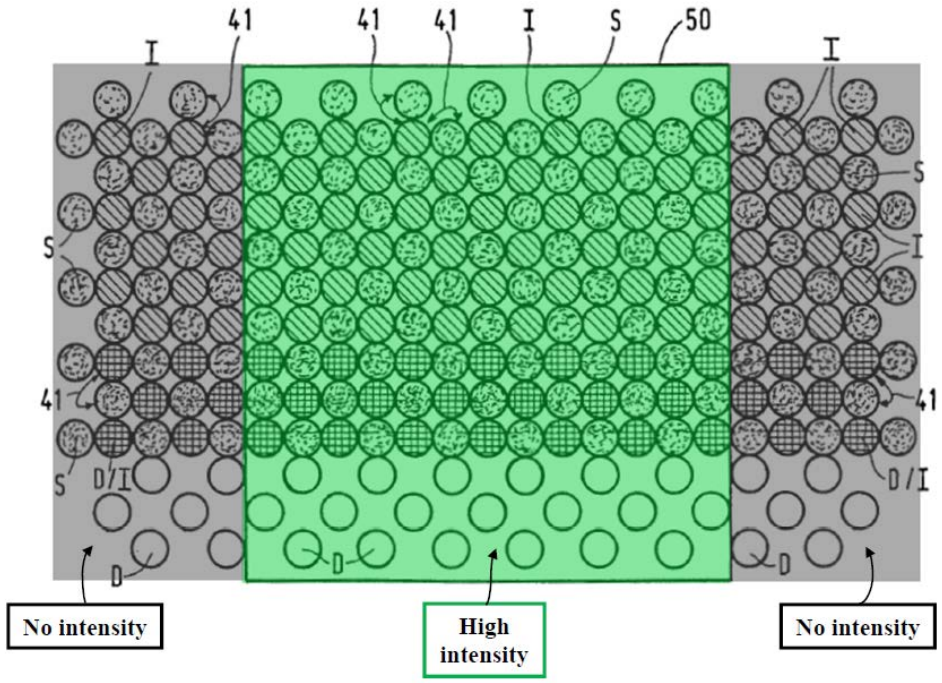
521. In view of the above, Karlsson discloses this element.

11. [26.10]: "controlling the light clusters via the electronic control circuitry to collectively emit the headlight beam meeting the determined illumination requirements."

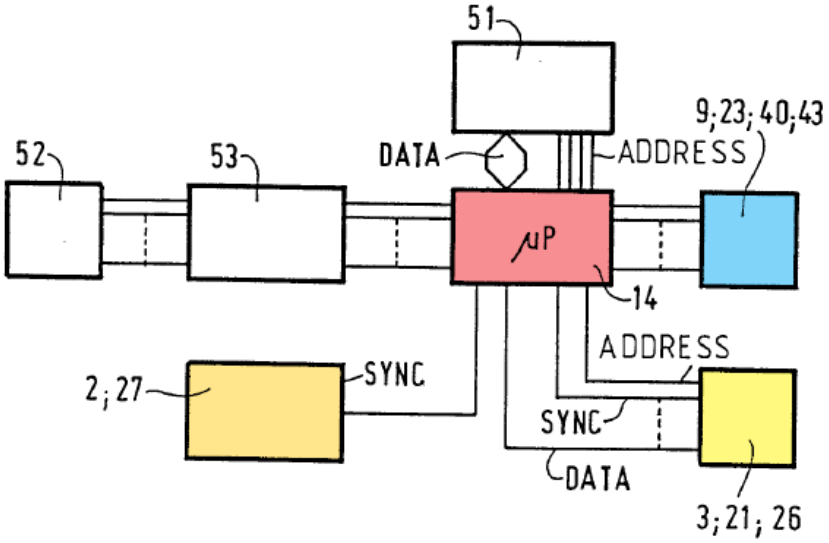
522. Karlsson discloses "*lighting means 2, 3*…*controlled by control means 14*, such that the *incident light 11* on the *light-sensitive sensor 9*…is *processed* into an *electric control signal*…[and] *processed* by the control means 14 into *output signals at outputs 16, 17* thereof, so as to *control the lighting means 2, 3*." EX1010, 9:11-17, FIGS. 3, 14-15; EX1010, 20:12-32, 21:36-22:4. Thus, Karlsson's lighting means 2, 3 (via light modulator means 3) receives output (control) signals 16, 17 from control means to lighting means 2, 3 to "control[] the light clusters…to collectively emit the headlight beam." EX1010, 9:11-17, FIGS. 14-15.



EX1010, FIG. 3 (annotated).



EX1010, FIG. 14 (annotated).



EX1010, FIG. 15 (control circuitry) (annotated).

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

C. Additional Elements of Independent Claim 65

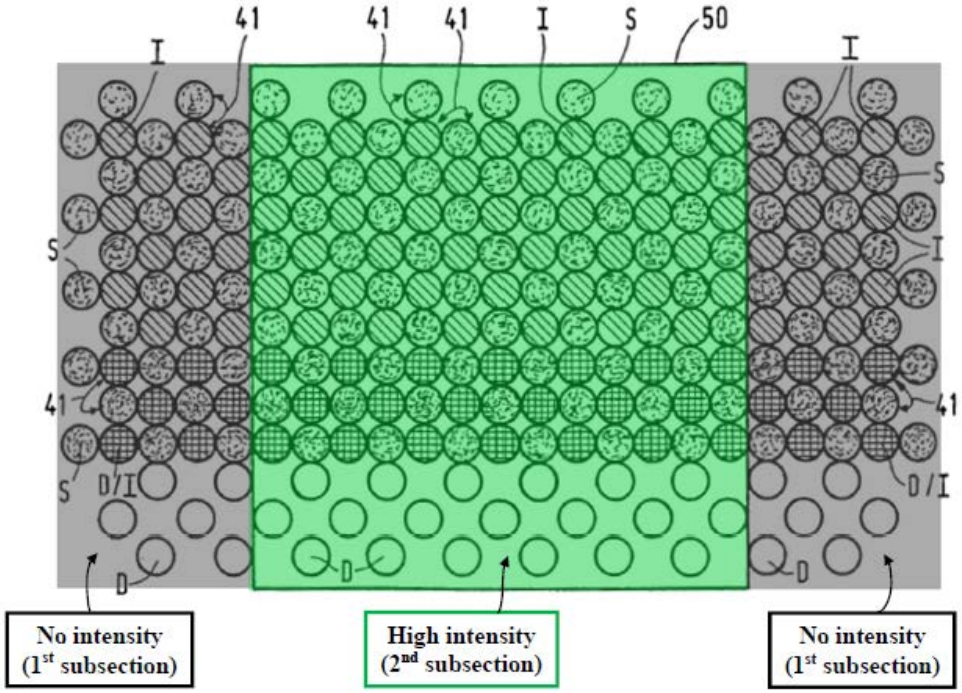
524. [65.P]-[65.4] are addressed above in Section XVII.B.

1. [65.5]: "including determining an illumination level for the first subsection"

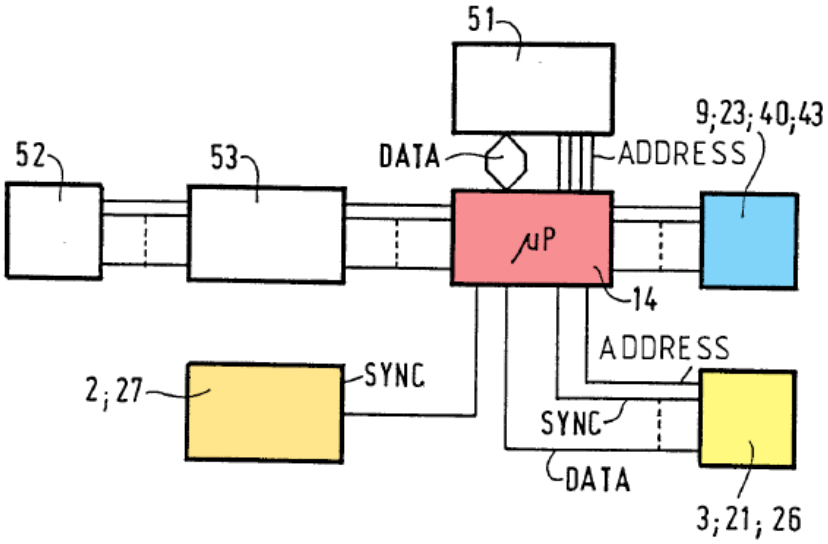
525. In my opinion, [65.3]-[65.8] are part of the same clause but will be addressed separately for simplicity below.

526. Karlsson discloses illumination in shaded areas is "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, 9:19-26, FIGS. 3, 14-15; EX1010, 23:17-22 ("control means are arranged for…*determining* the *pattern* and/or the *intensity* of the light beam to be emitted"), 19:24-25 ("*dipped light function*"),

5:28-32 ("spotlight sensors make[] it possible to *determine* precisely the direction from which light is being detected, so that subsequently a precise *adjustment of the pattern* of the light beam can be carried out"), 2:7-9 ("*part of the light beam* which might cause *inconvenience to oncoming traffic* is automatically suppressed"), 5:30-32 ("*pattern of the light beam*…so as *not to emit light* in the direction of the detected light"), 9:6-8 ("[t]he desired *pattern* and *intensity* of the light beam 7 are *determined* on the basis of the light 11 that is detected by the light-sensitive sensor 9"), 14:26-30, 9:11-17, 5:16-23, 3:27-31. Thus, Karlsson's processor "determin[es] an illumination level" for the first subsection (shaded area). *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. 14 (annotated).



EX1010, FIG. 15 (annotated).

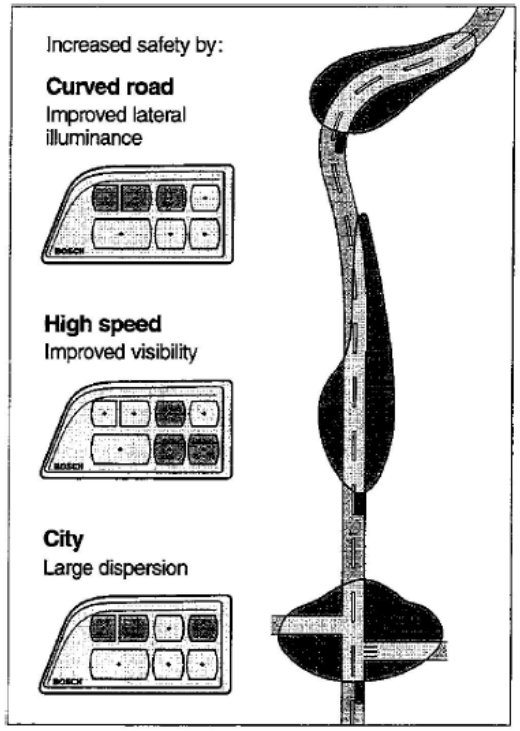


Fig.1: Three standard driving situations with adapted light pattern seen from the bird eye's view.

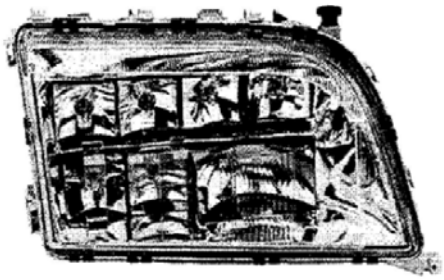
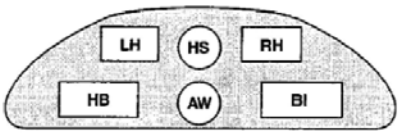


Fig 4: ALP *headlamp* sample



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

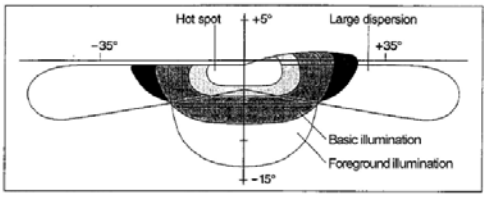


Fig. 3: Light pattern of multiple beam *headlamp* (*Isolux* curves in wall projection): The individual light *pattern* of multiple sub-units sum up to the total adaptive light pattern

EX1017, FIGS. 1 and 3-5.

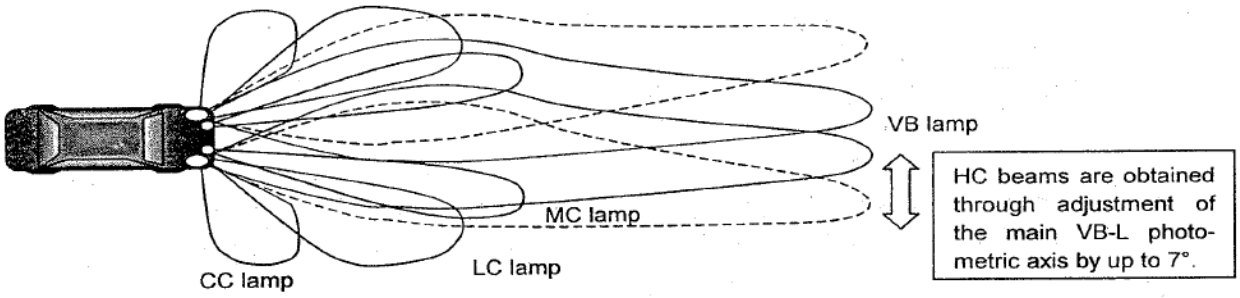


Fig. 3-3: Imaged Illumination Configurations on Road Surface

EX1026, FIG. 3-3.

527. In view of the above, Karlsson discloses this element.

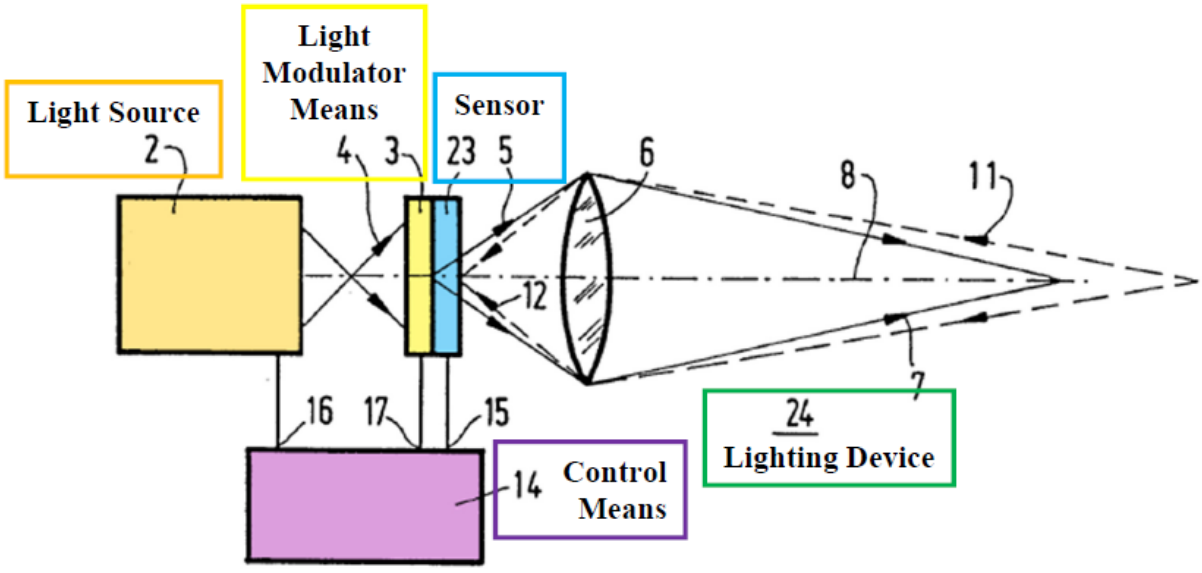
2. [65.6]: "that substantially illuminates the first subsection below a predefined illuminance, and"

528. In my opinion, [65.3]-[65.8] are part of the same clause but will be addressed separately for simplicity below.

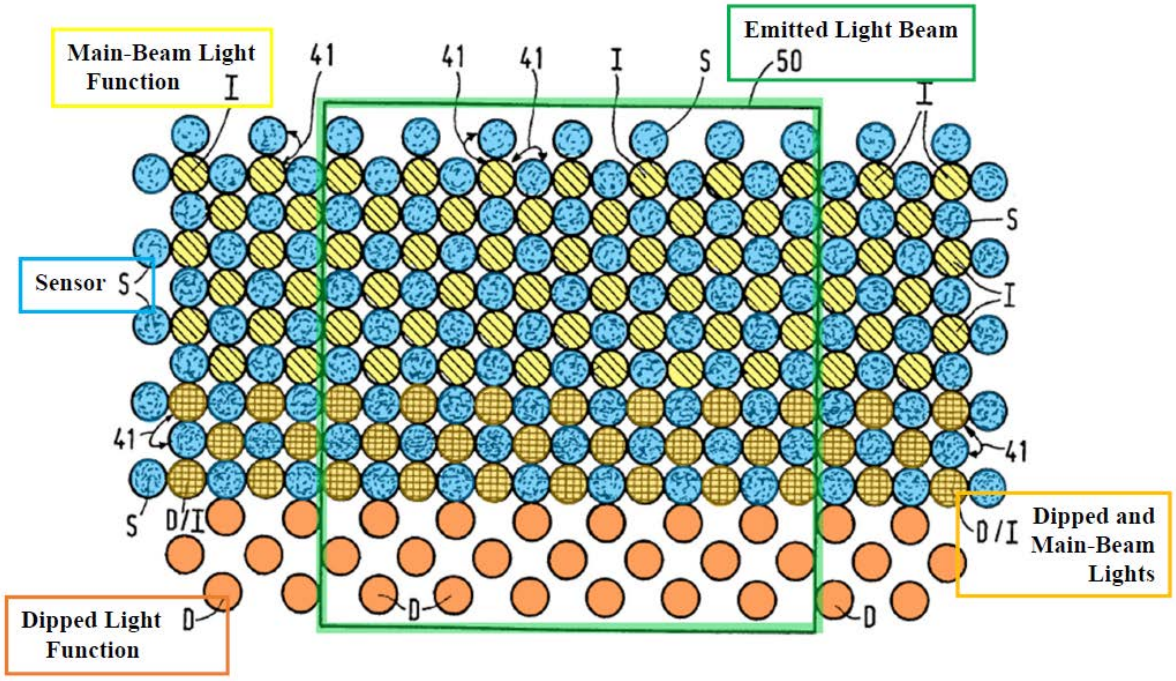
529. As discussed (Section XVII.A), in my opinion, Karlsson discloses this element, [65.6]. Specifically, Karlsson discloses "spotlight sources indicated at D provide the *dipped light function*." EX1010, 19:23-27, FIGS. 14-15; EX1010, 1:27-30 ("*low beams* or *dipped* headlights"), Abstract, 1:16-18. Thus, a POSA would have understood that Karlsson's headlight includes a "predefined" illuminance, for example, a "dipped headlights" illuminance.

530. 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.

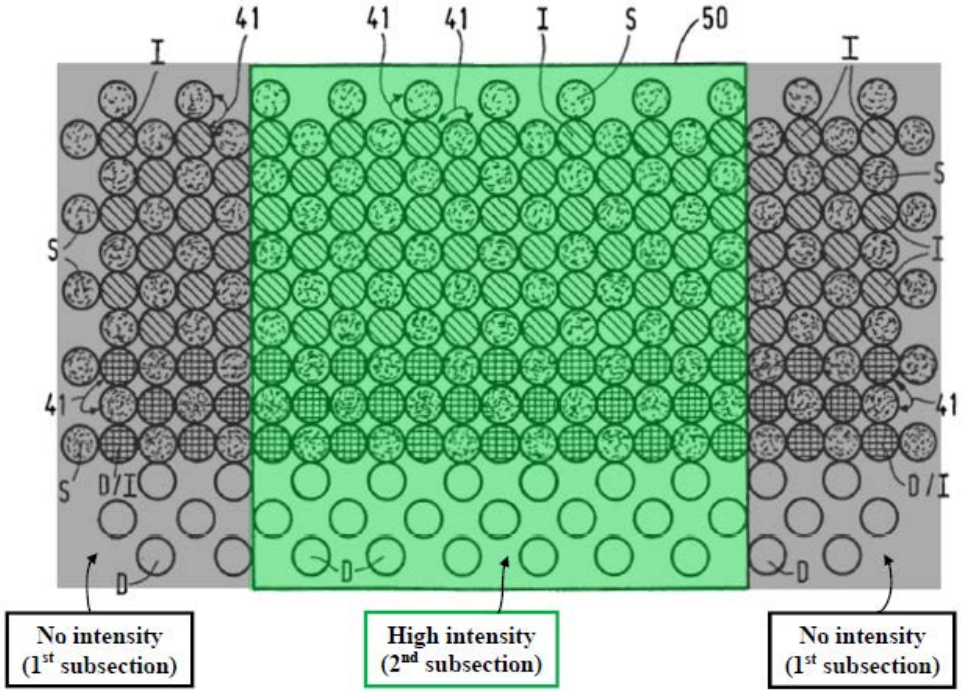
531. As discussed in Section XVII.A, the concept of a "dipped light function" or a low beam illumination level would have been known to a POSA. Such low beam (dipped headlights) illumination level for driver's visibility and glare light control is defined in all regulations, standards, and automaker's 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.



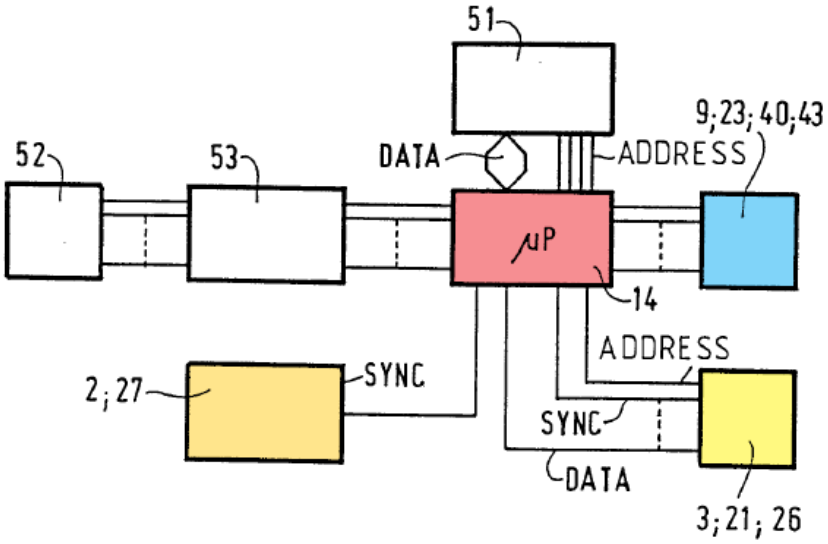
EX1010, FIG. 3 (annotated).



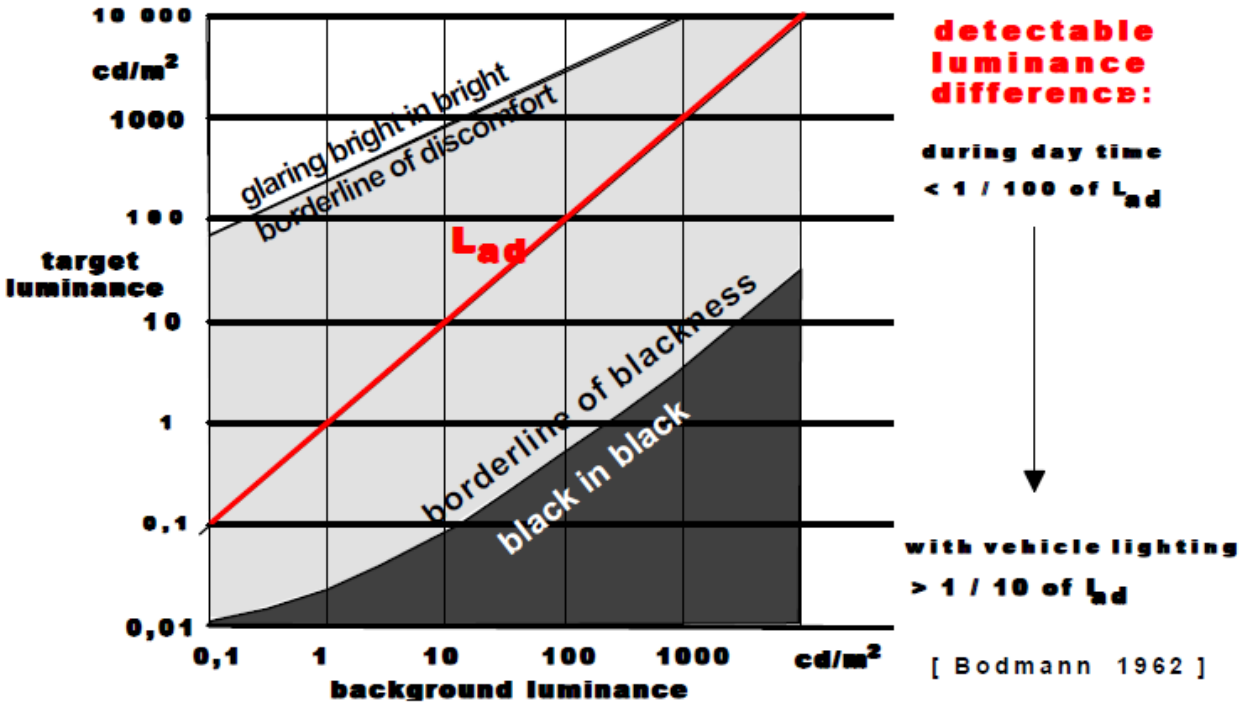
EX1010, FIG. 14 (annotated).



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.

532. The ’503 patent does not disclose a predefined illuminance value, so such value is not needed to satisfy [65.6]. 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.

533. Thus, Karlsson's system would illuminate the first subsection (shaded area) "below a predefined illuminance." *Supra* Section XVII.A.

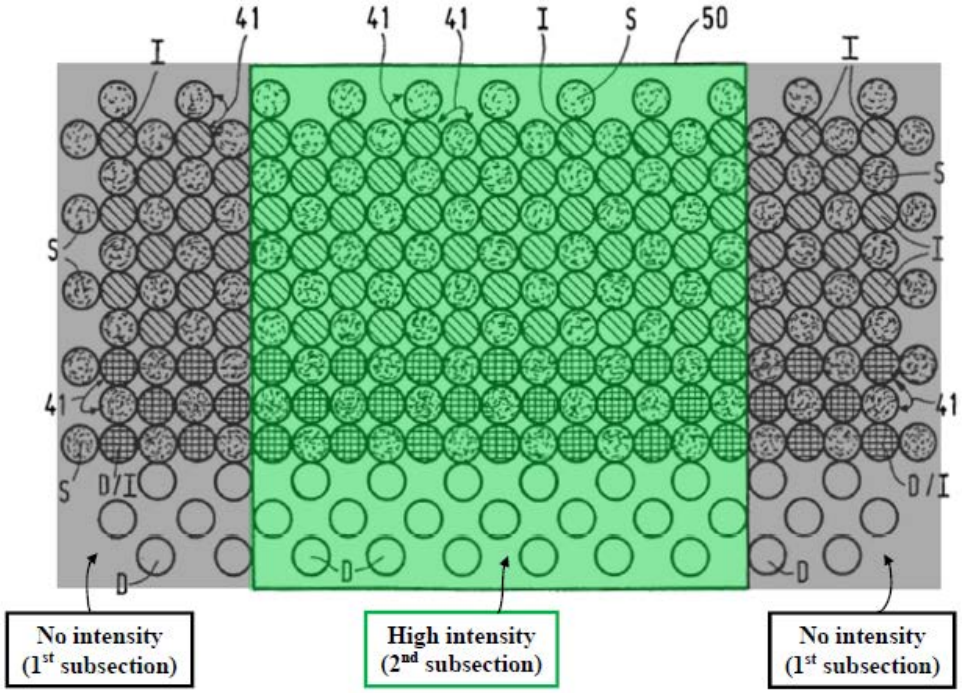
534. In view of the above, Karlsson discloses or renders obvious this element.

3. [65.7]: "determining an illumination level for the one or more second subsections"

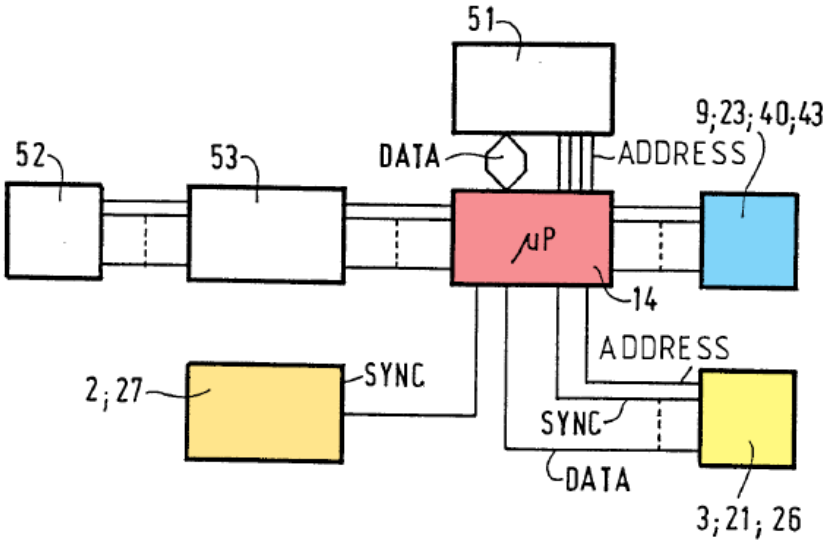
535. In my opinion, [65.3]-[65.8] are part of the same clause but will be addressed separately for simplicity below.

536. Karlsson discloses illumination in non-shaded areas is "*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,

9:19-26, Abstract, FIGS. 3, 14-15; EX1010, 23:17-22 ("control means are arranged for…*determining* the *pattern* and/or the *intensity* of the light beam to be emitted"), 19:26-27 ("*main-beam light function*"), 19:29-33 ("*emitted light beam 50*"), 5:28-32 ("spotlight sensors make[] it possible to *determine* precisely the direction from which light is being detected, so that subsequently a precise *adjustment of the pattern* of the light beam can be carried out"), 2:7-9 ("*part of the light beam*…is automatically suppressed, whilst *retaining an optimum lighting* effect for the driver"), 1:18-23 ("*longer-range main-beam* constantly"), 19:29-33 ("*emitted light beam 50*"), 9:6-8 ("[t]he desired *pattern* and *intensity* of the light beam 7 are *determined* on the basis of the light 11 that is detected by the light-sensitive sensor 9"), 14:26-30, 5:16-32, 9:11-17. Thus, Karlsson's processor "determin[es] an illumination level" for the second subsection (non-shaded area). *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. 14 (annotated).



EX1010, FIG. 15 (annotated).

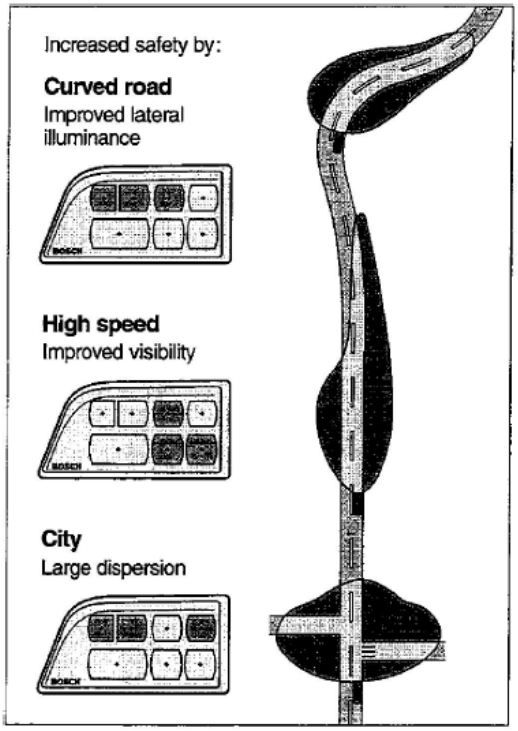


Fig.1: Three standard driving situations with adapted light pattern seen from the bird eye's view.

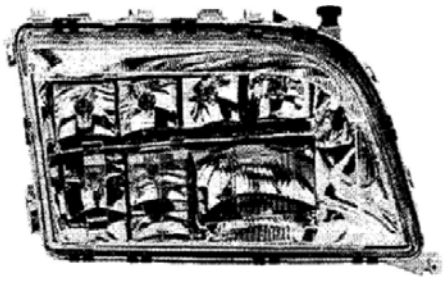
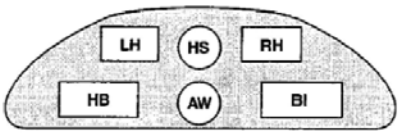


Fig 4: ALP *headlamp* sample



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

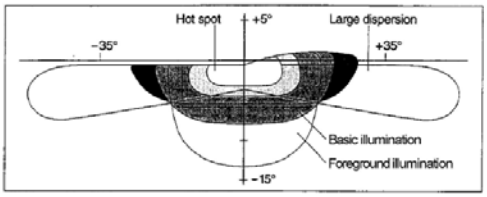


Fig. 3: Light pattern of multiple beam *headlamp* (*Isolux* curves in wall projection): The individual light *pattern* of multiple sub-units sum up to the total adaptive light pattern

EX1017, FIGS. 1 and 3-5.

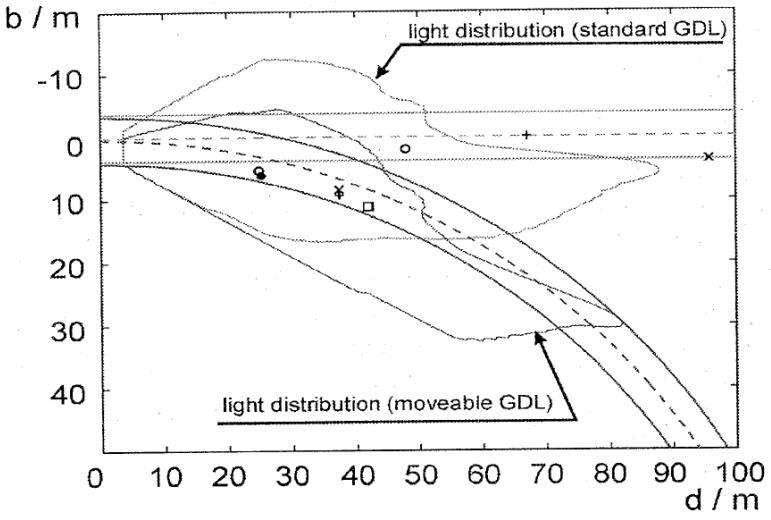


Figure 18: Fixation distance accumulation points (FDAP) for different headlamp systems and different road parts.
Accumulation points: X: *daylight*
○: *standard halogen*
●: *moveable halogen*
+: *standard gas discharge*
□: *moveable gas discharge*

EX1025, FIG. 18.

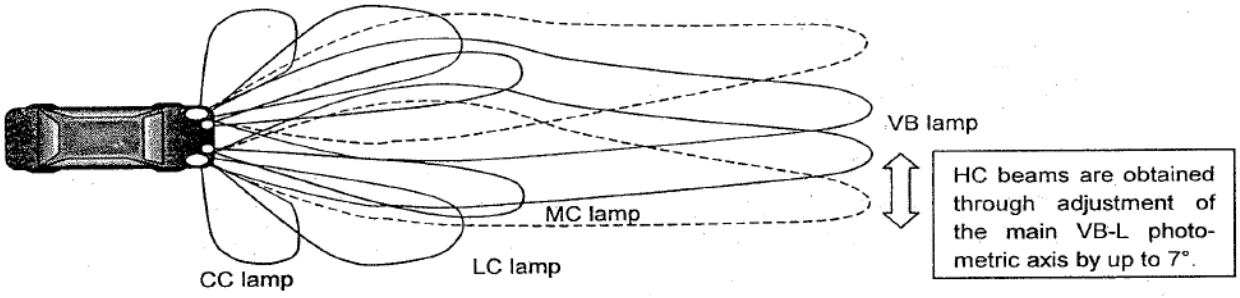


Fig. 3-3: Imaged Illumination Configurations on Road Surface

EX1026, FIG. 3-3.

537. In view of the above, Karlsson discloses this element.

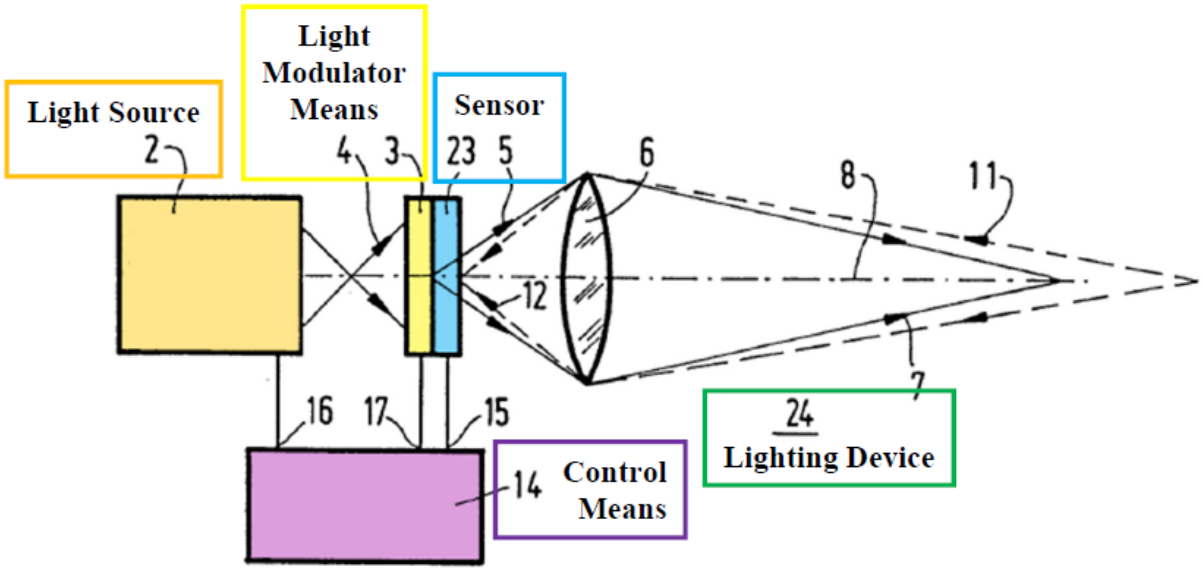
4. [65.8]: "that substantially illuminates the one or more second subsections above the predefined illuminance;"

538. In my opinion, [65.3]-[65.8] are part of the same clause but will be addressed separately for simplicity below.

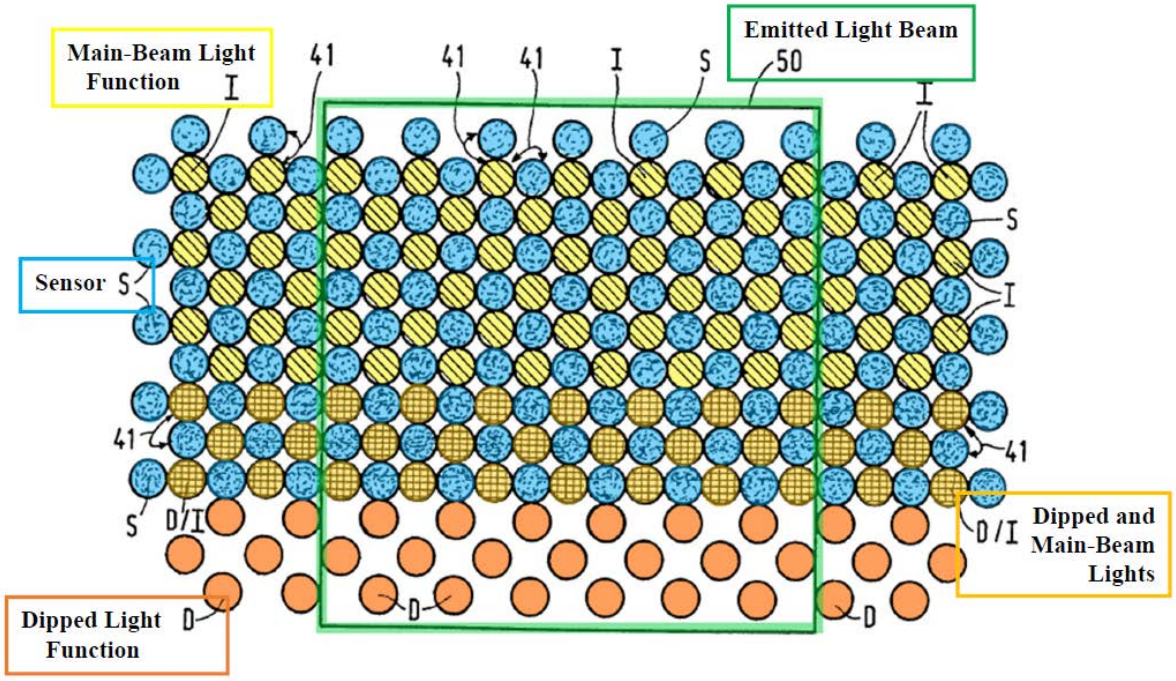
539. As discussed (Section XVII.A), in my opinion, Karlsson discloses this element, [65.8]. Specifically, Karlsson discloses "light beam 7…*optimally adapted* to the road and to the ambient light" and "permitting a light intensity which is generally *higher than that of conventional dipped headlights*." 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."

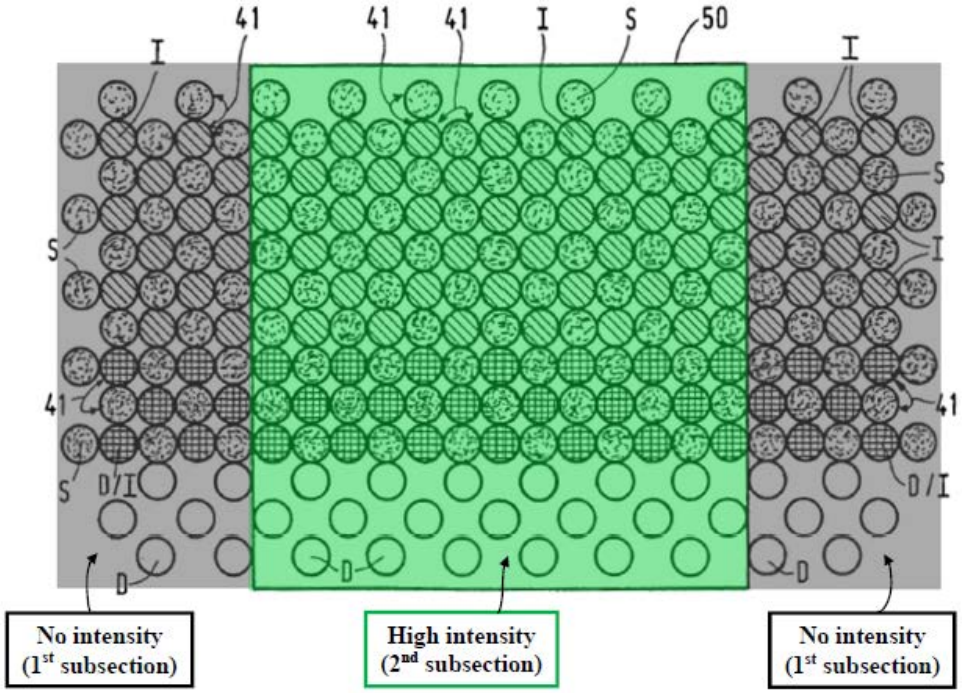
540. As discussed in Section XVII.A, the concept of a "dipped light function" or a low beam illumination level would have been known to a POSA. Such low beam (dipped headlights) illumination level for driver's visibility and glare light control is defined in all regulations, standards, and automaker's 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.



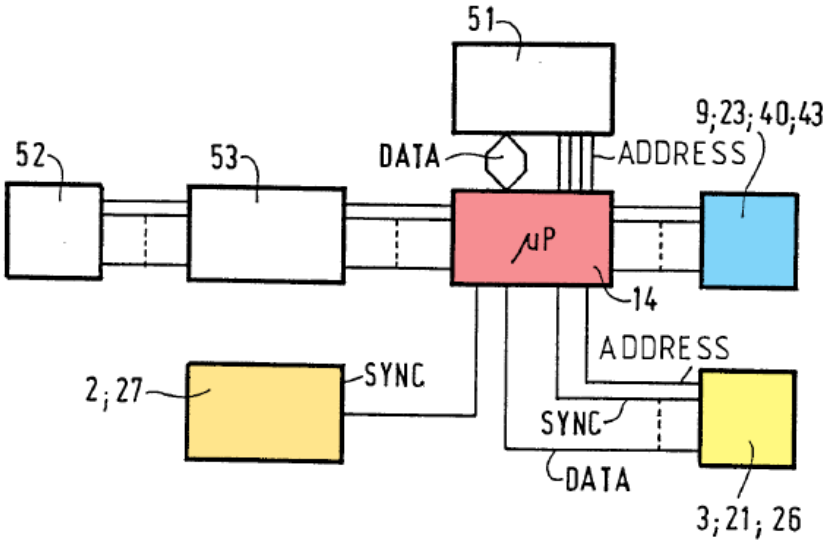
EX1010, FIG. 3 (annotated).



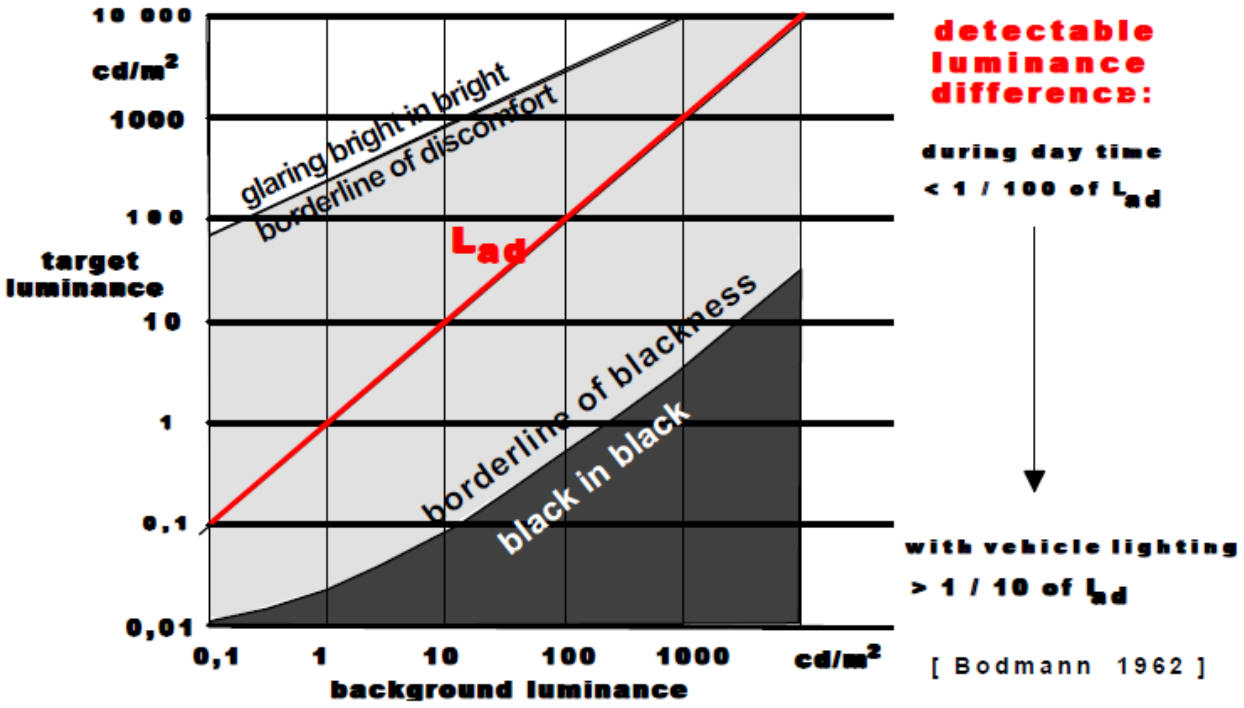
EX1010, FIG. 14 (annotated).



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.

541. The ’503 patent does not disclose the predefined illuminance value, so such value is not needed to satisfy [65.8]. 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.

542. Thus, Karlsson's system would illuminate the second subsection (non-shaded area) "above the predefined illuminance." *Supra* Section XVII.A.

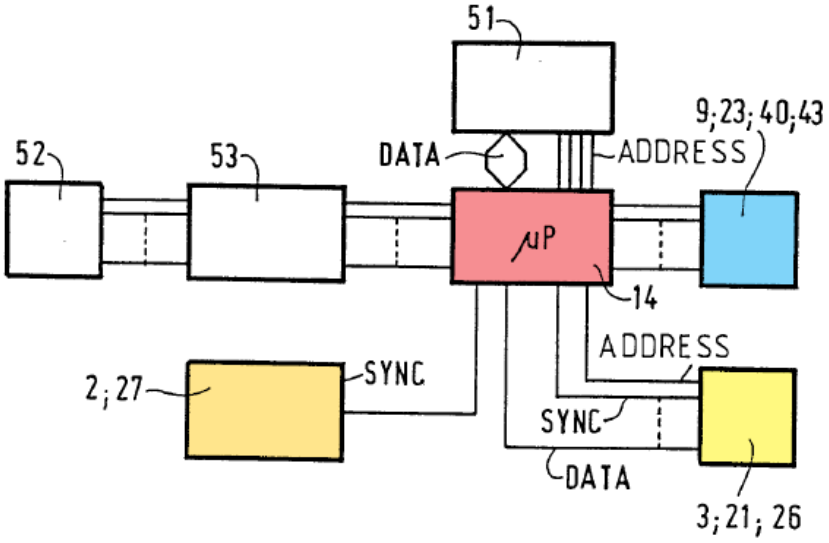
543. In view of the above, Karlsson discloses or renders obvious this element.

5. [65.9]: "determining control instructions for controlling one or more directional light sources included in the adaptive headlight system to achieve the determined illumination levels for at least the first and one or more second subsections; and"

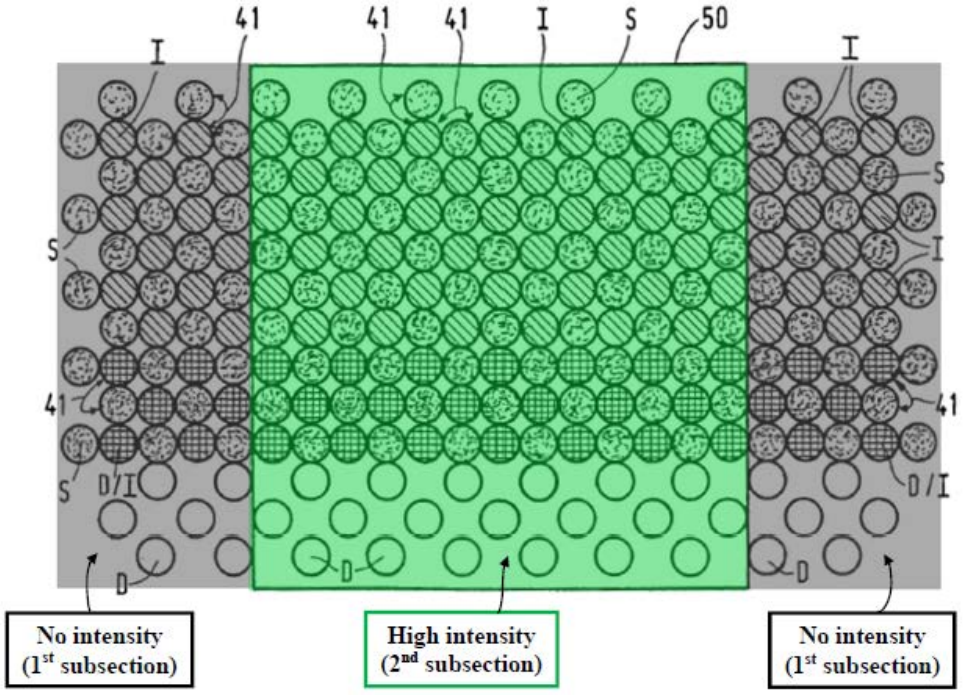
(a) Karlsson discloses this element.

544. In my opinion, Karlsson discloses [65.9]. *Supra* Sections XVII/XVII.A/XVII.B.7. 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 at outputs 16, 17* thereof, so as to *control the lighting means 2, 3*." EX1010, 9:11-17, FIGS. 3, 14-15; EX1010, 20:12-32, 21:36-22:4. Thus, Karlsson's processor determines control instructions to "control[] one or more directional light sources" to output desired illumination in the first subsection (shaded area) and the second subsection (non-shaded area). EX1010, 9:11-17, FIGS. 14-15.



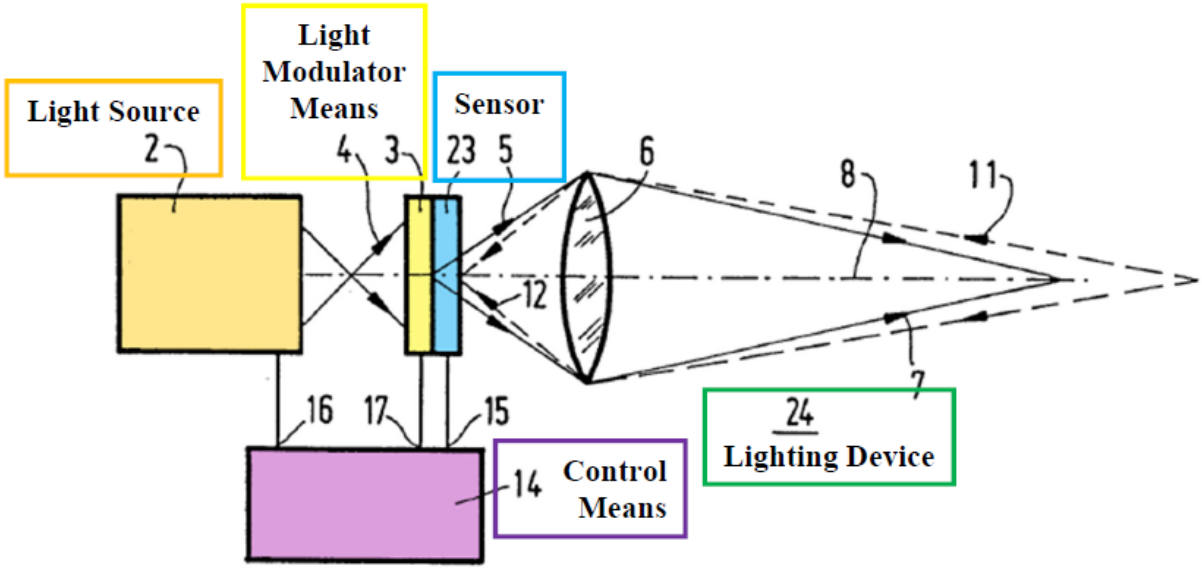
EX1010, FIG. 15 (control circuitry) (annotated).



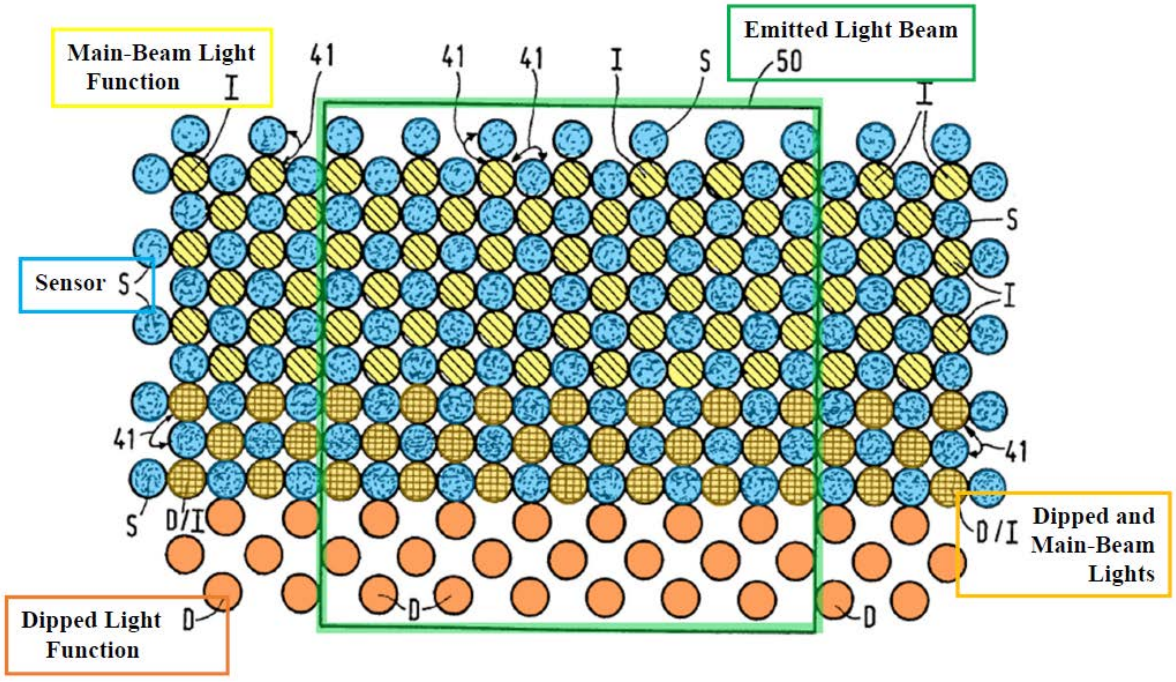
EX1010, FIG. 14 (annotated).

545. Also, Karlsson discloses "*spotlight beams 34* may also be made up of…*light modulators* which can be controlled to transmit light…for a *group* of spotlight beams." EX1010, 9:11-17, 14:5-15, FIGS. 3, 6, 14-15; EX1010, 11:25-28 ("*given directions*"), 14:1-4 ("spotlight beams 34…*controlled* either *individually* or in *groups*"), 19:29-33, 4:26-31, 20:12-32, 21:36-22:4. Further, as discussed, Karlsson/Karlsson-Harbers discloses "directional light [clusters / sources]." *Supra* Section XVII.B.7. Each spotlight beam is a directional "cluster" or "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

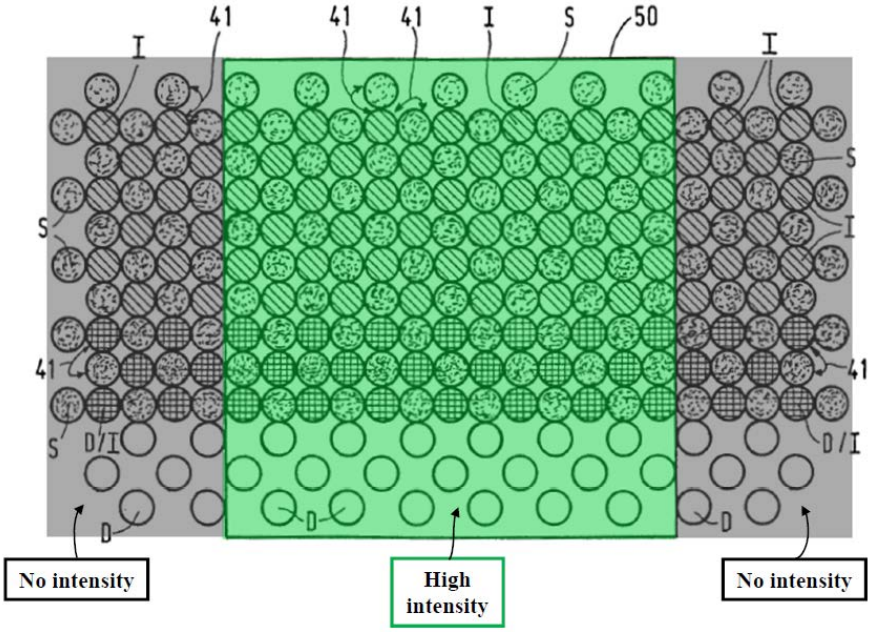
at least one directional light cluster/source to provide illumination in desired subsections. EX1010, 4:26-31, 14:1-15, FIGS. 6, 14.



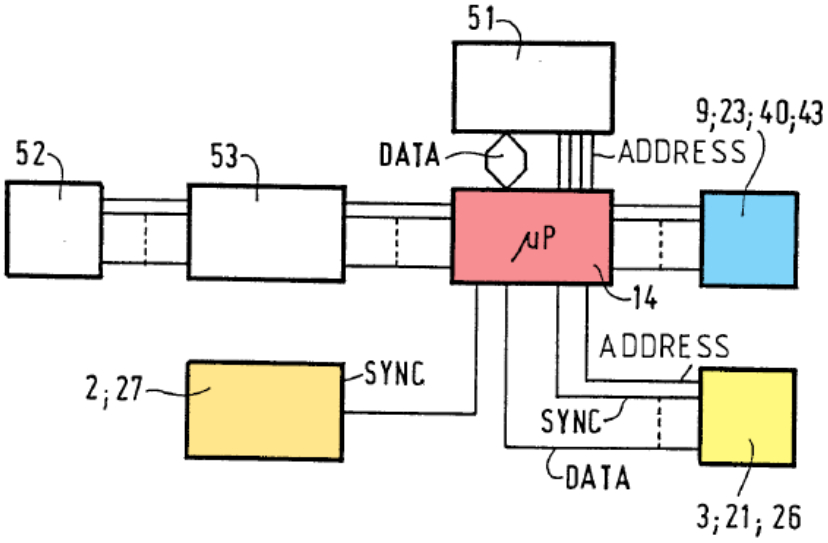
EX1010, FIG. 3 (annotated).



EX1010, FIG. 14 (annotated).



EX1010, FIG. 14 (annotated).



EX1010, FIG. 15 (annotated).

546. Such directionality results in *directional light sources* that by definition will have different angles, which result in different aimings in desired subsections. So disclosure that discusses a control strategy for directional light

clusters to create an output headlight beam applies the same to disclosure that discusses control instructions for directional light *sources* for first and second subsections.

547. A POSA would have understood that controlling "intensity" and "directions" of "spotlight beams 34…controlled either individually or in *groups*" is the same as controlling "one or more directional light sources…to achieve the determined illumination levels," as the light output from a headlamp is all measured with its light intensity level in an angular distribution. EX1010, 14:1-15 ("a desired light *intensity* can be adjusted…for a *group* of spotlight beams"); *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; EX1019, 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.

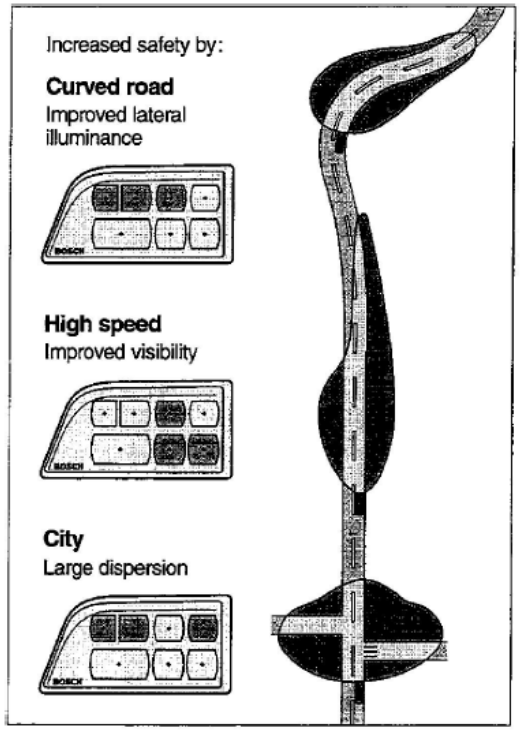


Fig.1: Three standard driving situations with adapted light pattern seen from the bird eye's view.

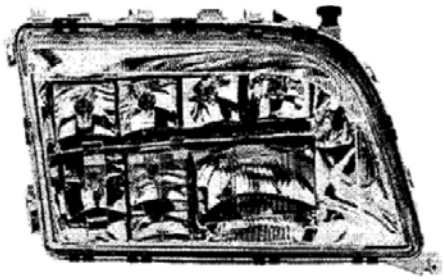
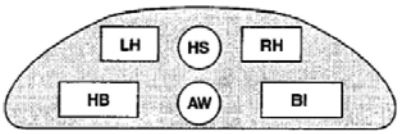


Fig 4: ALP *headlamp* sample



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

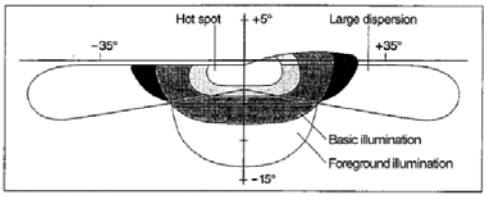


Fig. 3: Light pattern of multiple beam *headlamp* (*Isolux* curves in wall projection): The individual light *pattern* of multiple sub-units sum up to the total adaptive light pattern

EX1017, FIGS. 1 and 3-5.

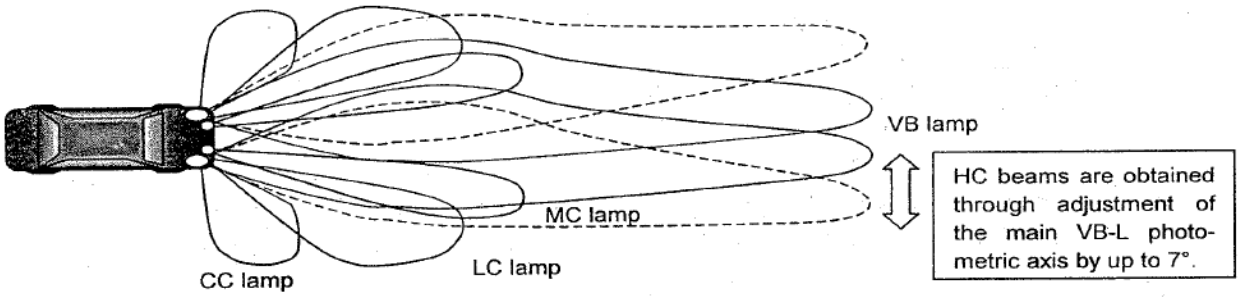
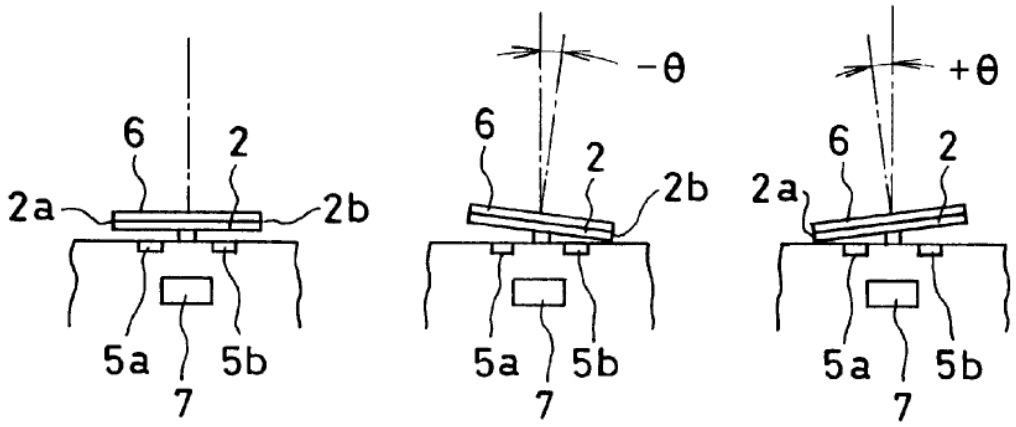


Fig. 3-3: Imaged Illumination Configurations on Road Surface

EX1026, FIG. 3-3.

FIG. 2A FIG. 2B FIG. 2C



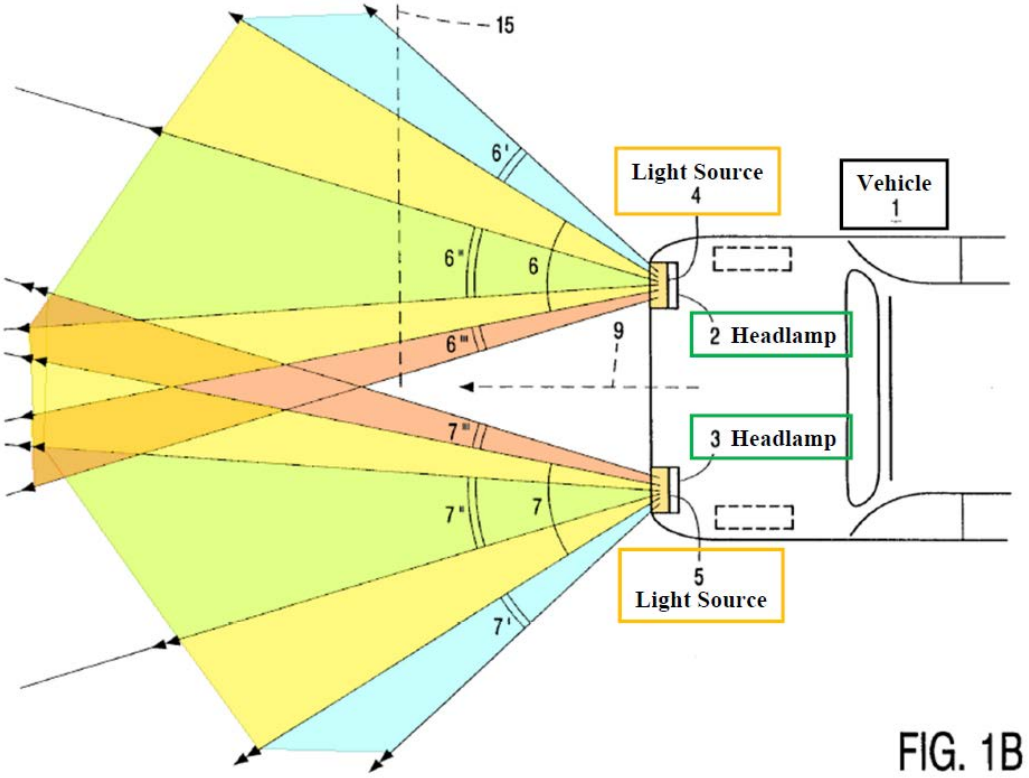
EX1040, FIGS. 2A-2C.

(b) Harbers also discloses this element.

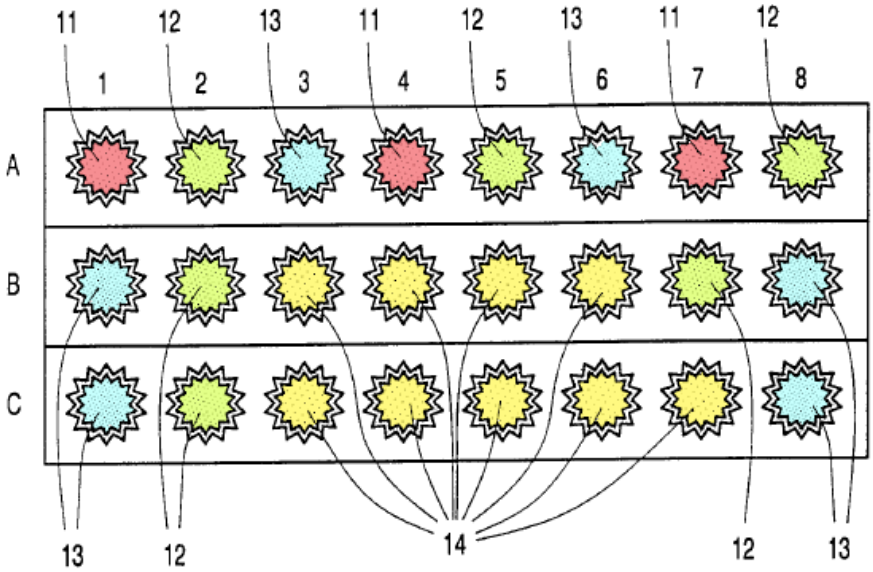
548. If Patent Owner argues, incorrectly, that Karlsson does not disclose [65.9], Harbers also discloses [65.9], and it would have been obvious in view of Harbers. A POSA would have been motivated to combine Harbers with Karlsson with a reasonable expectation of success, providing predictable visibility and safety benefits. *See supra* Sections XVII/XVII.A.

549. As explained above (Section XVII.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'" (directional light clusters) for different functions. EX1011, 5:14-26, 6:1-7, 6:27-7:19, FIGS. 1B-2, 7:27-32 ("*curved substrate…determined* to a substantial degree by the *desired direction* of the light beams emitted"), 7:1-17. For example, Harbers's beam segment 6, 7 is a "wide…passing beam" (first source), beam segment 6', 7' illuminates "the shoulder

of the road" (second source), and beam segment 6", 7" illuminates "the center of the road" (third source). EX1011, 7:1-17, FIG. 1B.



EX1011, FIG. 1B (annotated).



EX1011, FIG. 2 (annotated).

550. 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 or renders obvious [65.9].

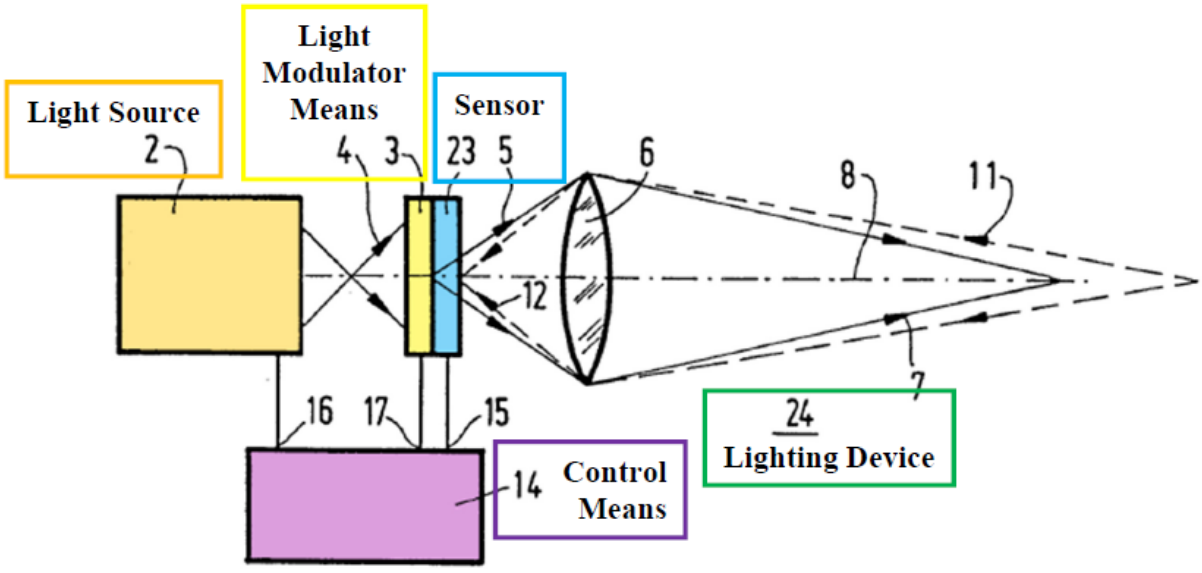
(c) A POSA would have been motivated to combine Karlsson and Harbers with a reasonable expectation of success.

551. As discussed, Karlsson discloses "directional light sources" with independently controlled angular positions for reducing glare towards other drivers. *Supra* Section XVII.A. Harbers provides further detail on implementing "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—through either software or hardware—for different functions in Karlsson's system.

552. Indeed, Harbers discloses such an implementation to provide different spatial distributions for improved visibility in different driving situations (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.

553. 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.

554. *First*, including an additional control technique (software implementation) for Karlsson—Harbers's *known technique* of using multiple directional beam segments for different functions—would have added more control methods for different functions to Karlsson's system 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, 4:26-31, 11:25-28, 14:1-15, 19:29-33, FIGS. 3, 6.



EX1010, FIG. 3 (annotated).

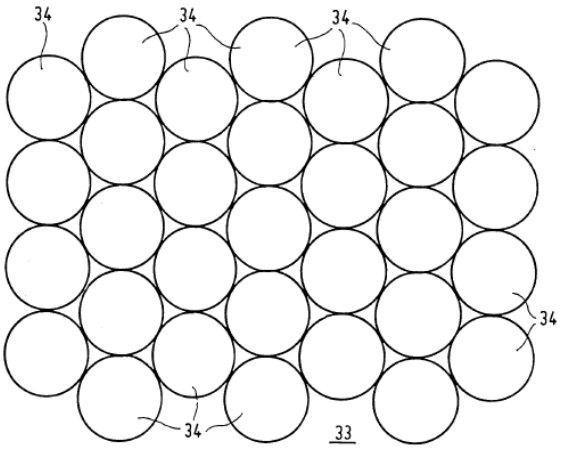


FIG. 6

EX1010, FIG. 6.

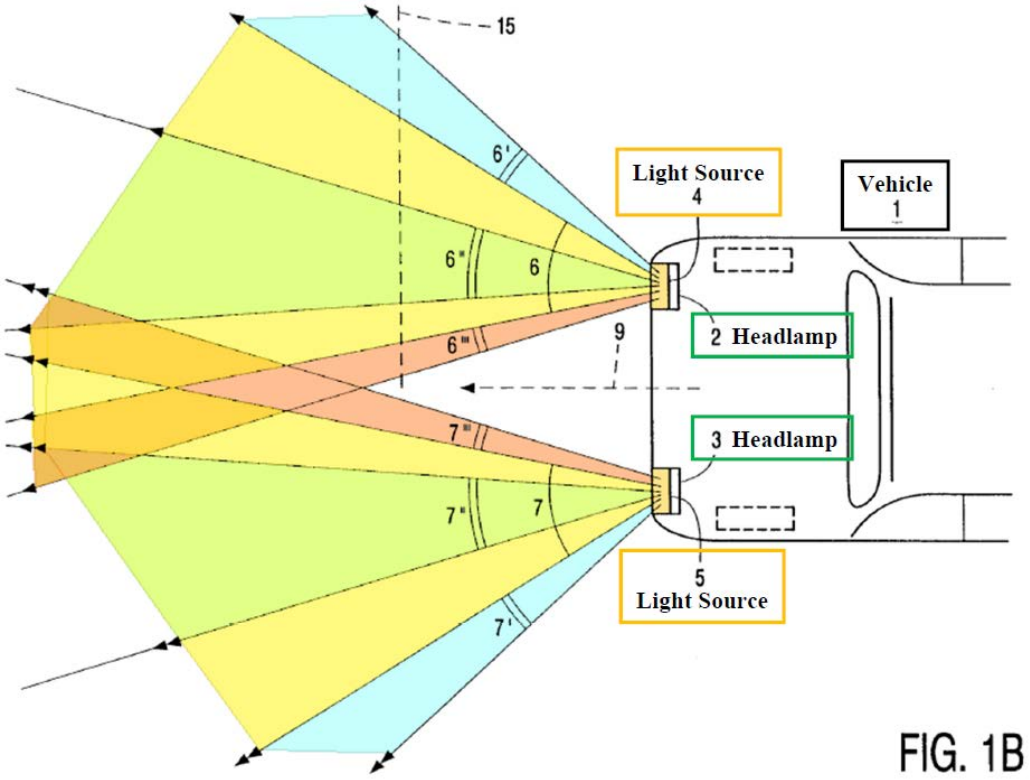
555. Indeed, Karlsson's techniques and system of controlling individual spotlight beams emphasize safety of all drivers. EX1010, 1:16-26, 4:17-21, 9:18-26. Controllable headlamps "significantly increase the driving comfort and the road safety," and "glaring or blinding of oncoming traffic is effectively 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, 1:10-13 ("comply with…regulations…preventing the *blinding* or *glare*").

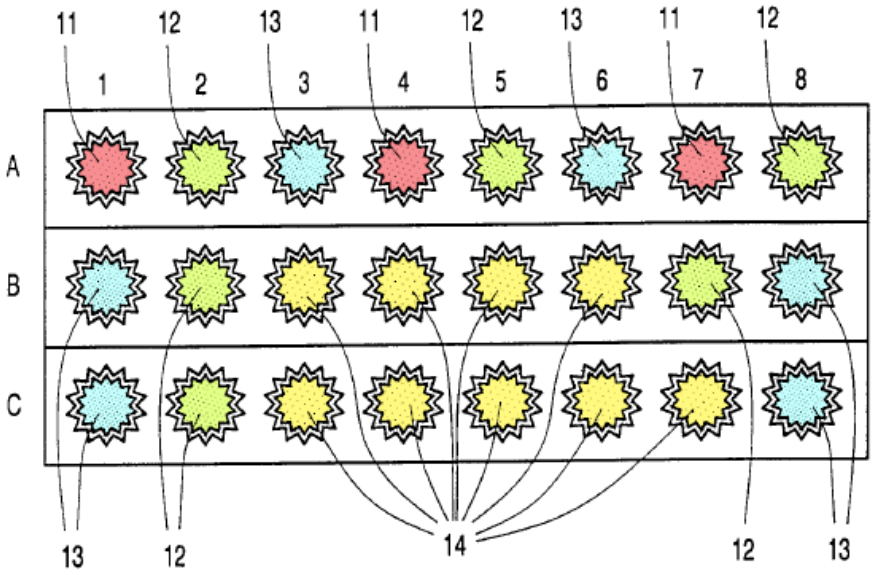
556. Karlsson's system "*selectively adjust[s]*…spotlight beam[s] 34, in response to a *control signal from sensor means 23*…to provide a *desired lighting pattern*" in "given *directions*." EX1010, 14:26-30, 11:25-28, FIGS. 3, 6, 14. Karlsson recognizes the safety benefits of identifying "oncoming traffic" 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, 3:19-31, 12:19-35, 2:2-4, 5:16-32. If Patent Owner argues, incorrectly, Karlsson does not expressly disclose "directional light sources," even though Karlsson discloses different angular positions control for different spotlight beams, it would have been obvious to a POSA to use such control to "achieve the determined illumination levels for at least the first and one or more second subsections." 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.

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

elements 11-14 provide differently angled/aimed beam segments 6-6'-6"-6'", 7-7'-7"-7'" 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).

558. The additional control (software implementation) of having multiple directional beam segments 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.

559. This would have merely been applying Harbers's known techniques (software implementation: using multiple directional beam segments for different functions) to Karlsson's similar, known device (adaptive 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.

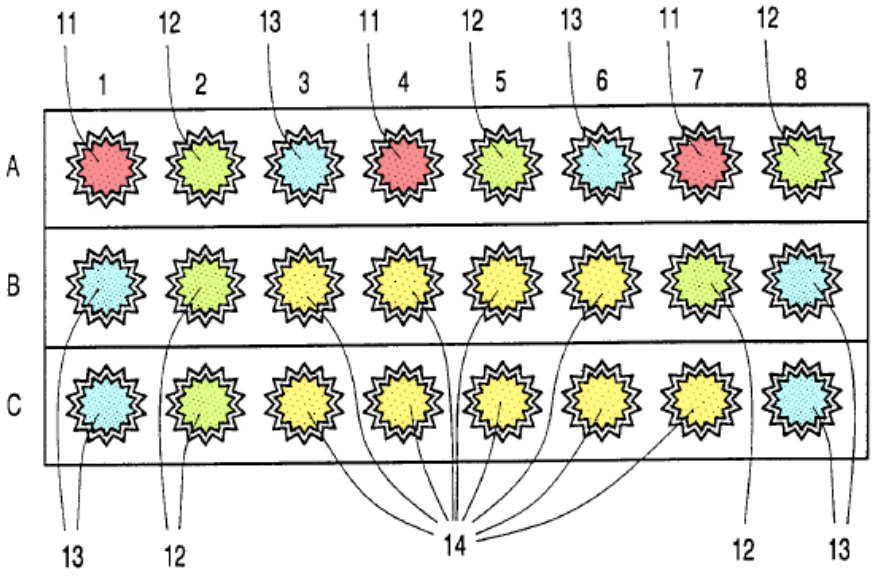
560. A POSA would have had a reasonable expectation of success combining Harbers with Karlsson, for example, by simply modifying software instructions stored in memory of Karlsson's controller/processor to organize Karlsson's spotlight beams into multiple directional beam segments for different functions.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

561. 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 for different functions—as already disclosed in the art.

562. *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, *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.

563. 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).

564. 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. This would have been merely combining prior-art elements or a simple substitution of one known element for another (Karlsson's lighting means 2, 3 on a flat substrate and Harbers's opto-electronic elements 11-14 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.

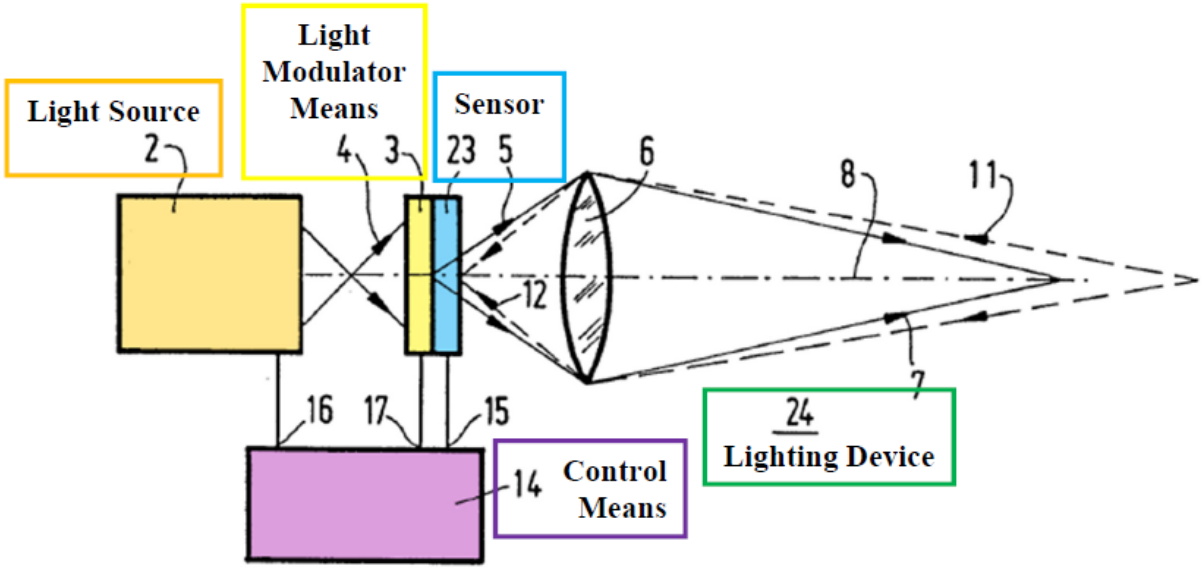
565. A POSA would have had a reasonable expectation of success combining Harbers with Karlsson, for example, by simply modifying the flat substrate of Karlsson's lighting means 2, 3 with Harbers's curved substrate to provide multiple directional light sources for different functions (hardware implementation).

566. 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).

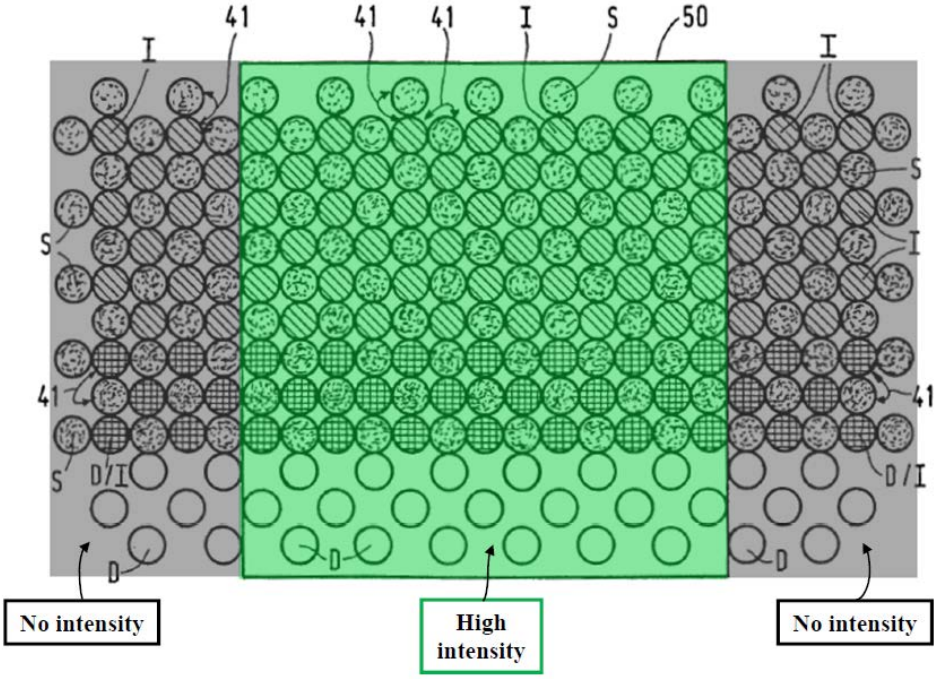
567. In view of the above, Karlsson, alone or in combination with Harbers, discloses or renders obvious this element.

6. [65.10]: "controlling the light sources to emit the headlight beam in accordance with the control instructions."

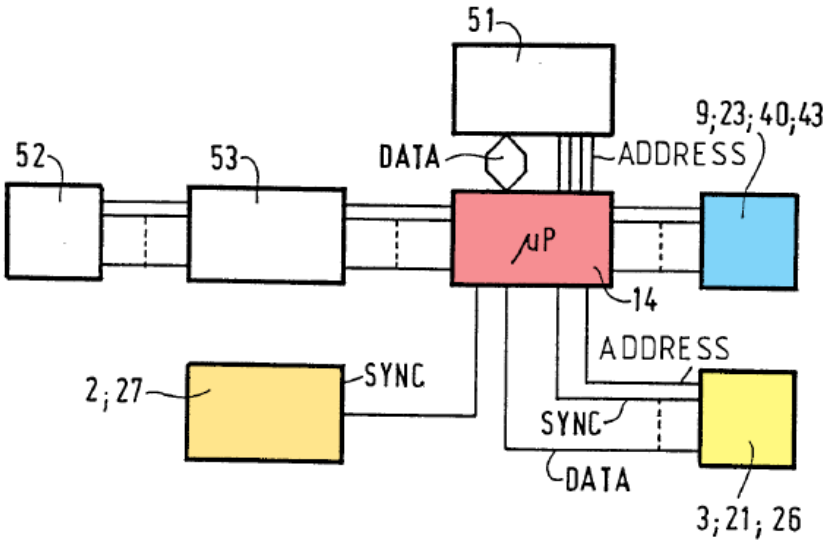
568. Karlsson discloses "*lighting means 2, 3…controlled by control means 14*, such that the *incident light 11* on the *light-sensitive sensor 9*…is *processed* into an *electric control signal*…[and] *processed* by the control means 14 into *output signals at outputs 16, 17* thereof, so as to *control the lighting means 2, 3*." EX1010, 9:11-17, FIGS. 3, 14-15; EX1010, 20:12-32, 21:36-22:4. Thus, Karlsson's lighting means 2, 3 (via light modulator means 3) receives output (control) signals 16, 17 from control means to lighting means 2, 3 to "control[] the light sources to emit the headlight beam." EX1010, 9:11-17, FIGS. 14-15.



EX1010, FIG. 3 (annotated).



EX1010, FIG. 14 (annotated).



EX1010, FIG. 15 (control circuitry) (annotated).

569. In view of the above, Karlsson, alone or in combination with Harbers, discloses or renders obvious this element.

D. Claim 27: "The method of claim 26, wherein the determining illumination requirements further comprises: determining the illumination requirements based on headlight modes comprising one or more of parking lights, low beam, high beam, cornering lights, load leveling adjustment, integral turn signal indicators, inputtable alternate beam pattern selection, and specified preferential headlight illumination color of the driver."

570. As discussed, Karlsson discloses "determining illumination requirements." *Supra* Section XVII.B.4.

571. Karlsson also discloses "intensity…higher than that of conventional dipped headlights" and "main-beam light function." EX1010, Abstract, 19:24-28, FIG. 14; EX1010, 1:27-30 ("high beams or main-beams…low beams or dipped headlights"), 19:24-28 ("dipped light function"), 15:7-10, 20:6-15, FIGS. 7, 15. Thus, Karlsson discloses multiple "headlight modes," for example, a "high beam" mode and a "low beam" mode.

572. In view of the above, Karlsson discloses this claim.

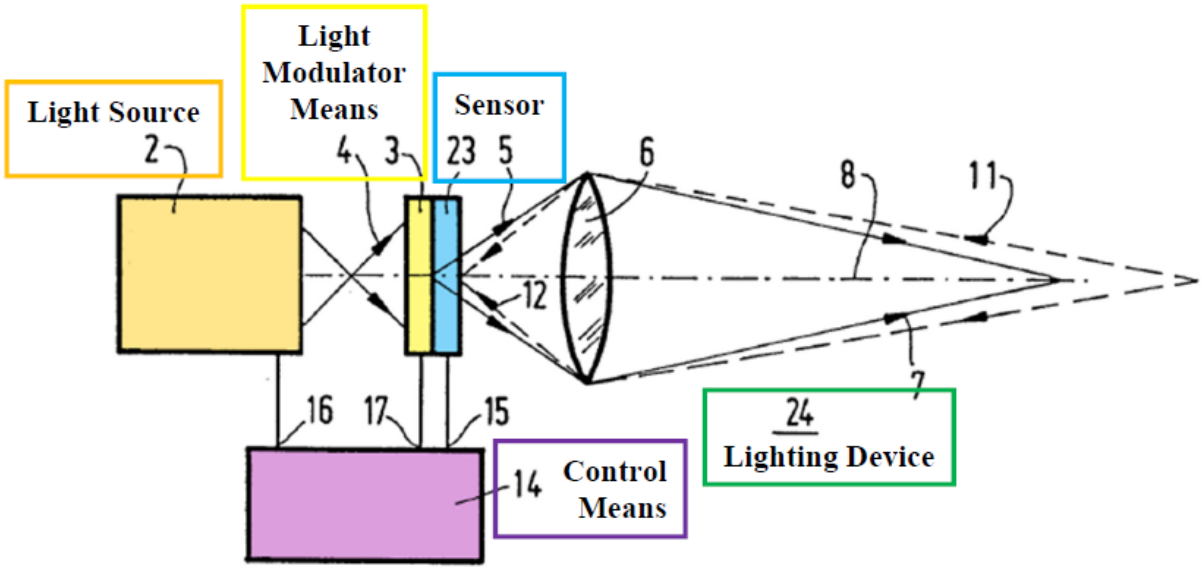
E. Claim 28: "The method of claim 26, wherein the illumination requirements accommodate peripheral night vision of the driver, by defining bluish headlamp illumination along a side of a road, while defining yellow tinted illumination along the road."

Claim 68: "The method of claim 65, wherein the determining illumination further includes determining a yellowish illumination color for illumination illuminating a road within the field-of-view and a blueish illumination color for illumination illuminating areas off-road within the field-of-view."

573. In my opinion, there is no patentable difference between claim 68 and claim 28.

1. Karlsson's disclosure

574. Karlsson discloses "spotlight beams 34 can be…a *grid of separate light sources, such as LEDs…controlled* either *individually* or in *groups*" and recognizes the problem of illuminating "when driving on *dark, unilluminated* roads" with just low beam illumination. EX1010, 1:16-24, 14:1-4, FIGS. 3, 6, 14; EX1010, 11:25-28 ("*given directions*"), 4:32-35, 4:26-5:15, 14:5-15.



EX1010, FIG. 3 (annotated).

575. Karlsson does not disclose bluish illumination along a side of a road (off-road) and yellow illumination along the road, but this feature was well known in the prior art, e.g., as explicitly disclosed by Harbers. *See also* EX1009, 5:22-25 ("adaptive illumination of a *roadway* and *neighboring regions*"), 14:21-30 ("luxels 26 are 'color' luxels…to provide *different color light...combinations of R, G, and B*

light"), 23:28-24:27 ("illuminate…with predominantly yellow and green light"), 9:21-22 ("*B [blue] light* in controllable amounts"), FIGS. 2-3, 5-6.

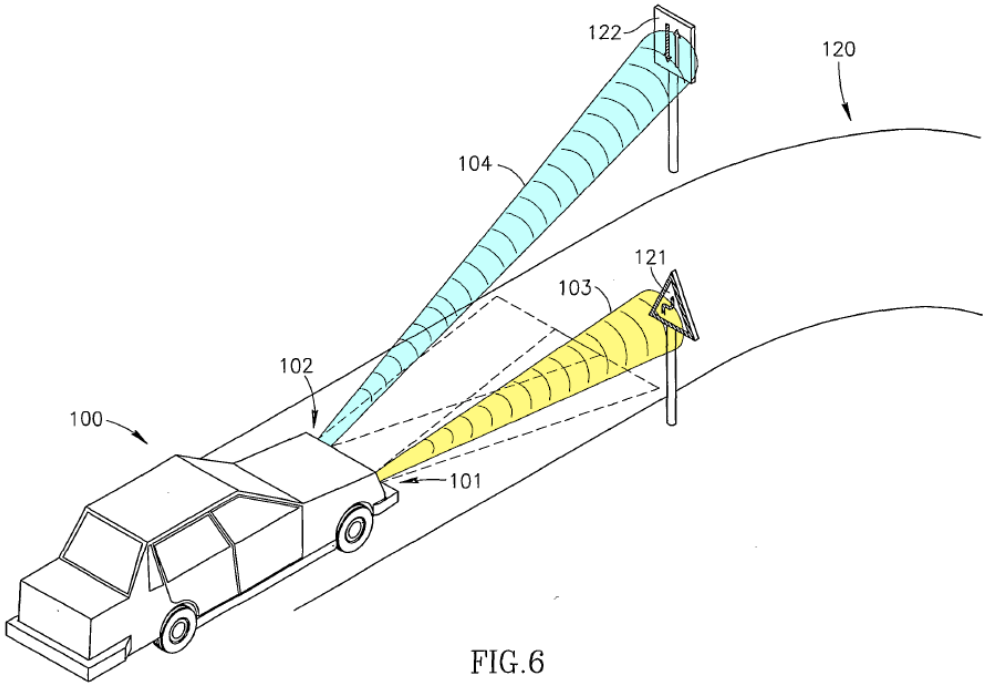


FIG.6

EX1009, FIG. 6 (annotated).

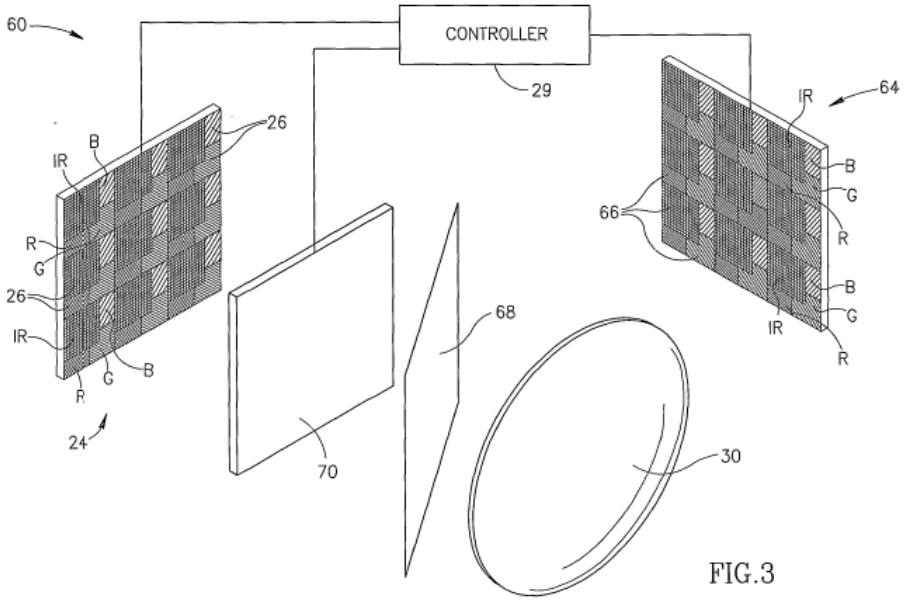
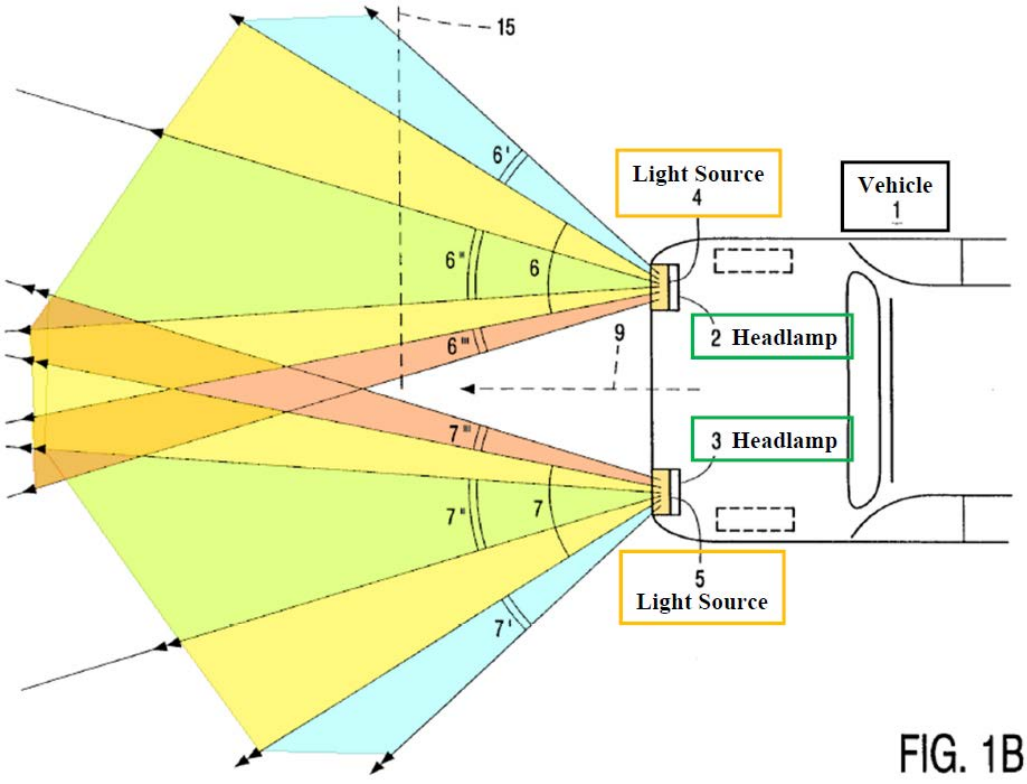


FIG.3

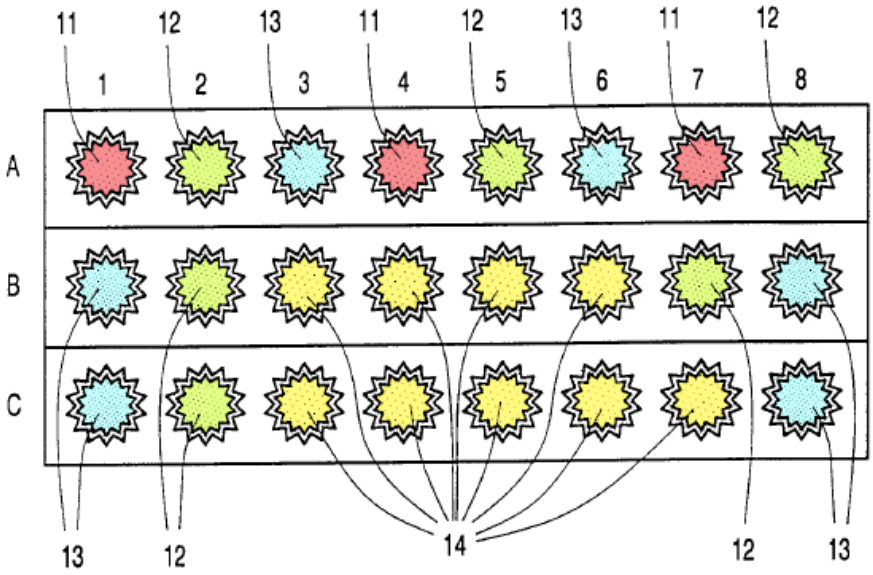
EX1009, FIG. 3.

2. Harbers's disclosure

576. Harbers discloses "*on-axis* part…is adapted to…*green-yellow light*…*off-axis* parts…is adapted to…*blue-green light*." EX1011, 6:3-7, FIGS. 1B, 2; EX1011, 9:1-10:5 ("*6; 7*…*6'', 6'''; 7'', 7'''* with…*yellow-orange light*…*6'; 7'* with…*blue-green light*"), 9:28-10:5 ("*different spectral characteristic*"), 5:21-26 ("*visibility*…is *improved*"). Thus, Harbers's independently controllable, colored directional light beam segments 6-6'-6"-6'", 7-7'-7"-7'" provide "peripheral night vision" with "blueish…illumination along a side of a road…[and] yellow tinted illumination along the road" (claim 28), and "yellowish illumination…illuminating a road…and a blueish illumination…illuminating areas off-road." (claim 68).



EX1011, FIG. 1B (annotated).



EX1011, FIG. 2 (annotated).

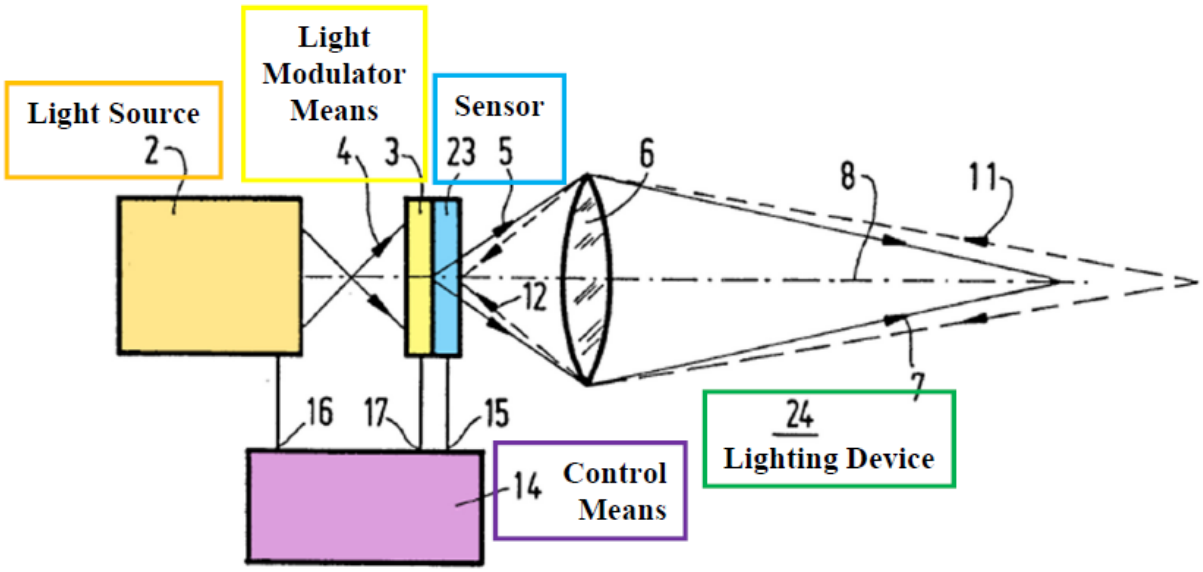
577. As discussed, a POSA would have been motivated to combine Harbers with Karlsson with a reasonable expectation of success. *Supra* Section XVII.A.

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

578. As described in Section XVII.A, a POSA would have been motivated to combine Karlsson-Harbers. It would have been obvious to a POSA to modify Karlsson to adjust light based on multiple colored directional illumination for different functions, as in Harbers, to further control Karlsson's adaptive headlamps to illuminate a roadway, thereby improving visibility and driver safety—an express purpose of Karlsson. EX1010, 1:10-13, 1:16-26, 4:17-21, 9:18-26; *see also* EX1011, 5:14-26, 6:1-7, 6:27-7:32, 9:28-10:5, 13:5-7, FIGS. 1B, 2.

579. 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.

580. Karlsson discloses "*controllable spotlight beams*" are controlled individually or in groups by control means 14 to "*given directions*" to reduce glare. EX1010, 4:26-31, 11:25-28, 14:1-15, 19:29-33, FIGS. 3, 6.



EX1010, FIG. 3 (annotated).

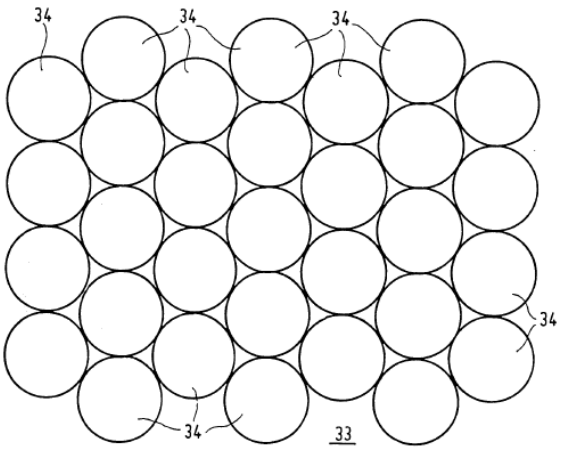


FIG. 6

EX1010, FIG. 6.

581. 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, 1:10-13 ("comply with…regulations…preventing the *blinding* or *glare*").

582. 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, 3:19-31, 12:19-35, 2:2-4, 5:16-32. 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.

583. 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 colored 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.

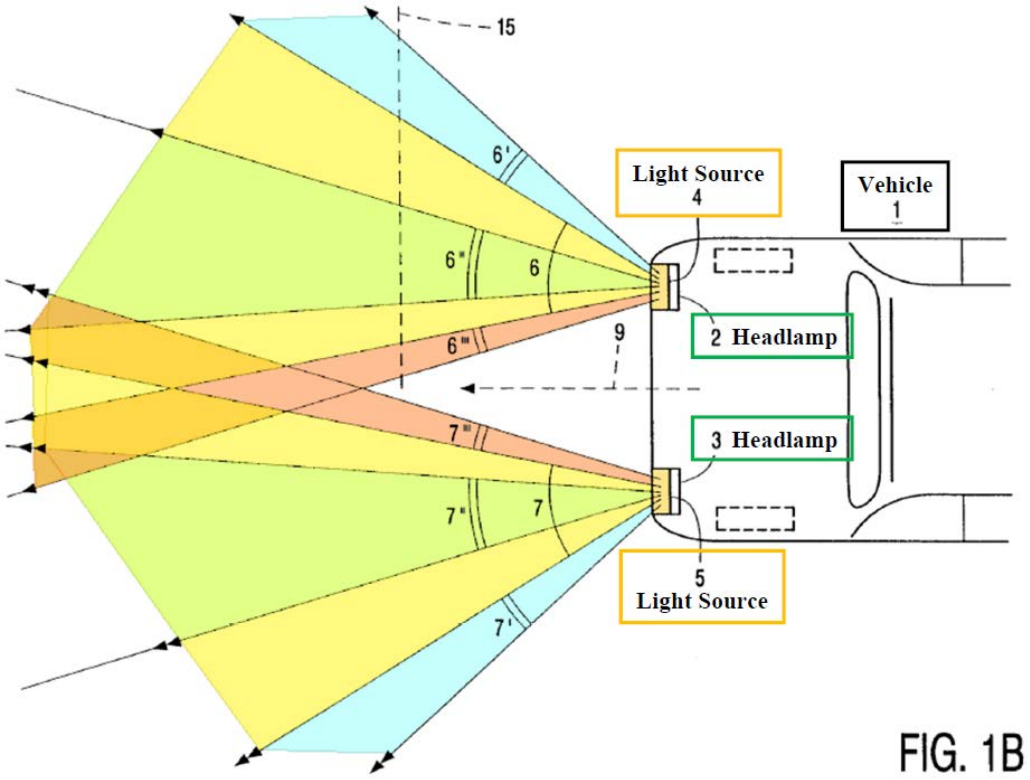
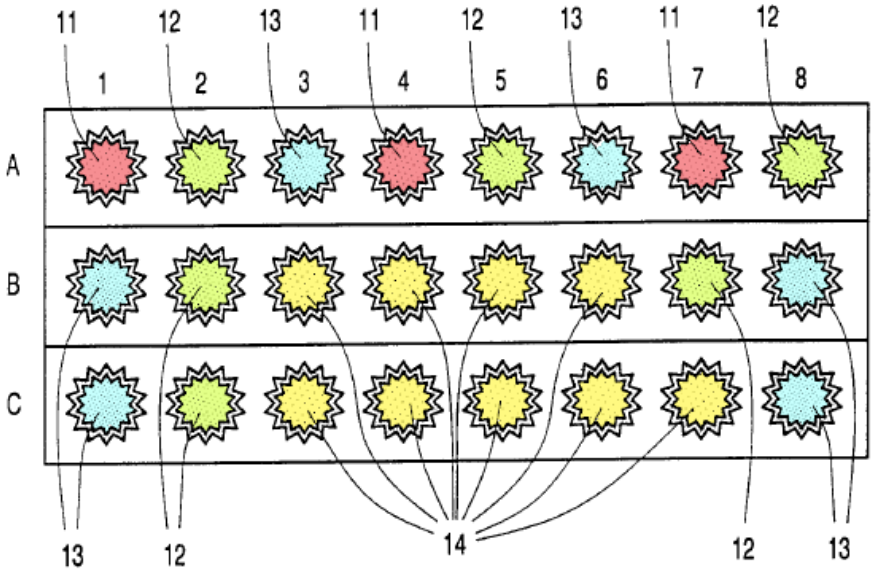


FIG. 1B

EX1011, FIG. 1B (annotated).



EX1011, FIG. 2 (annotated).

584. This hardware combination of Karlsson's lighting means 2, 3 and Harbers's differently colored opto-electronic elements 11-14 on a curved substrate, would have provided Karlsson's system with different colored spatial distributions for different driving situations, as in Harbers, thereby improving driver safety. This would have been merely combining prior-art elements or a simple substitution of one known element for another (Karlsson's lighting means 2, 3 on a flat substrate and Harbers's opto-electronic elements 11-14 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.

585. 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 colored directional light sources (e.g., directional beam segments 6-6'-6"-6"', 7-7'-7"-7"') for different functions (hardware implementation).

586. 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 colored 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).

587. In view of the above, Karlsson in combination with Harbers renders obvious claims 28 and 68.

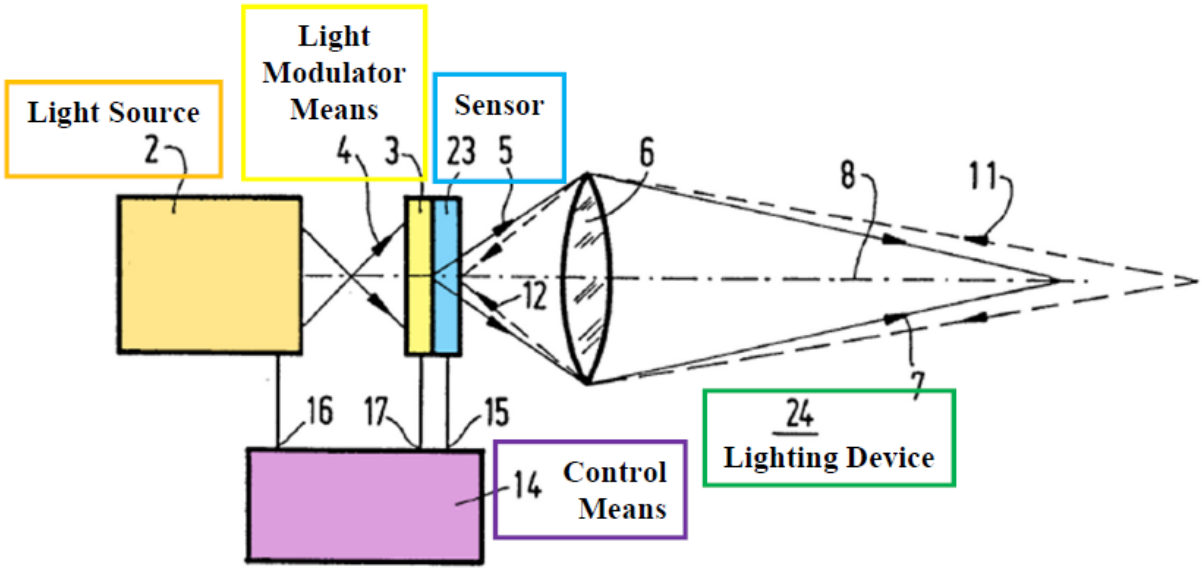
F. Claim 29: "The method of claim 26, wherein the illumination requirements accommodate sensed fog or snow environmental conditions by defining a shift of at least a portion of the headlight beam towards yellow."

Claim 69: "The method of claim 65, wherein the data includes data indicating fog or snow environmental conditions and the determining illumination includes determining a shift of at least a portion of the light output from the headlight system towards yellow."

588. In my opinion, there is no patentable difference between claim 69 and claim 29.

1. Karlsson's disclosure

589. Karlsson discloses "spotlight beams 34 can be…a *grid of separate light sources, such as LEDs*" and recognizes the problem of "*scattered* reflected light." EX1010, 9:34-37, 14:1-4, FIGS. 3, 6, 14; EX1010, 11:25-28 ("*given directions*"), 1:16-24 ("*dark, unilluminated* roads"), 4:26-5:15, 14:5-15.



EX1010, FIG. 3 (annotated).

590. Karlsson does not disclose shifting a portion of the headlight beam towards yellow, but this feature was well known in the prior art, e.g., as explicitly disclosed by Harbers. *See also* EX1009, 25:20-25 ("headlights 101 and 102 are programmed…to detect *fog* and…provide *light appropriate for driving in fog*"), 24:15-18 ("illuminate…with predominantly *yellow*"), 14:21-25 ("provide *different color light*"), 25:20-26:5 ("*back-scatter*"), FIGS. 2-3, 5-6.

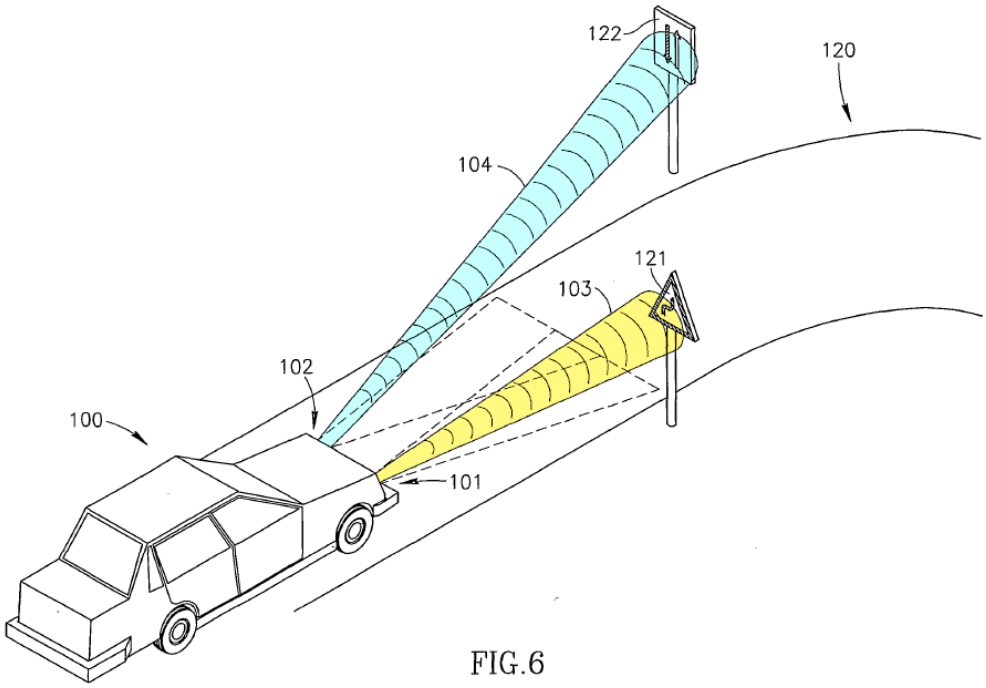


FIG.6

EX1009, FIG. 6 (annotated).

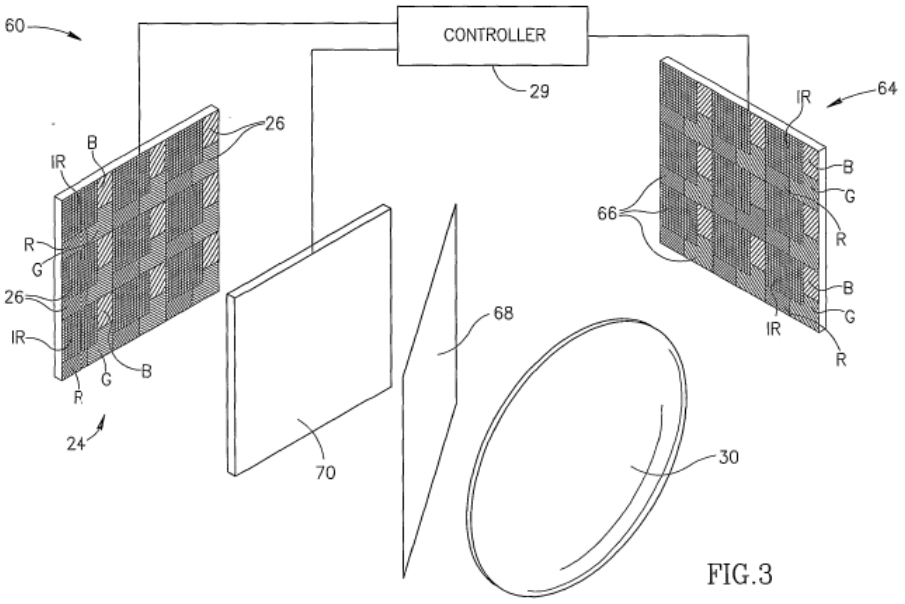
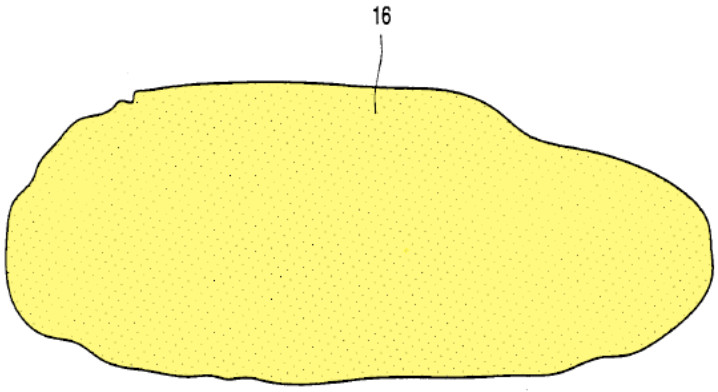


FIG.3

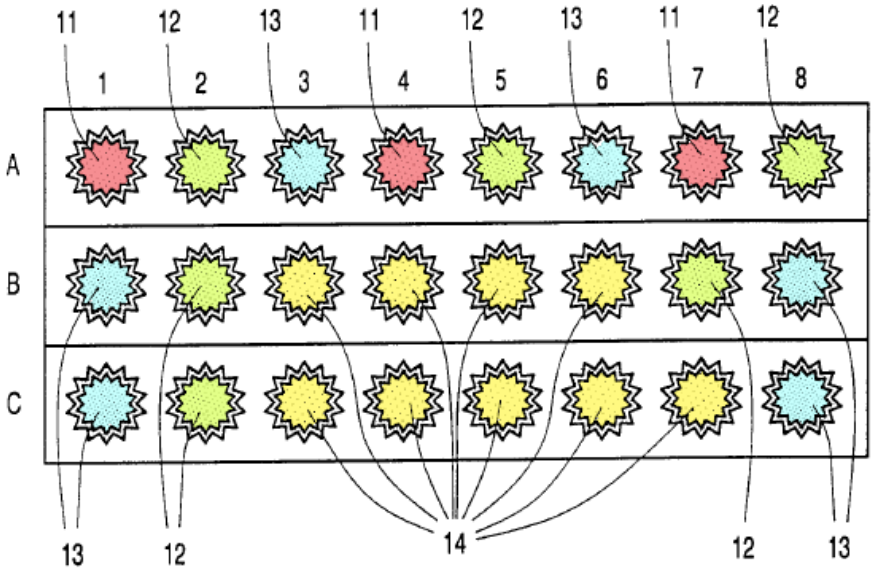
EX1009, FIG. 3.

2. Harbers's disclosure

591. Harbers discloses "[u]nder unfavorable weather conditions, in particular *fog and snow*…a *relatively wide beam 16* is obtained which is substantially composed of *yellow light*." EX1011, 10:6-14, FIGS. 1B, 2, 4A; EX1011, 9:23-25 ("*yellow light* in order to *improve the long-distance visibility*"), 4:17-21.



EX1011, FIG. 4A (annotated).



EX1011, FIG. 2 (annotated).

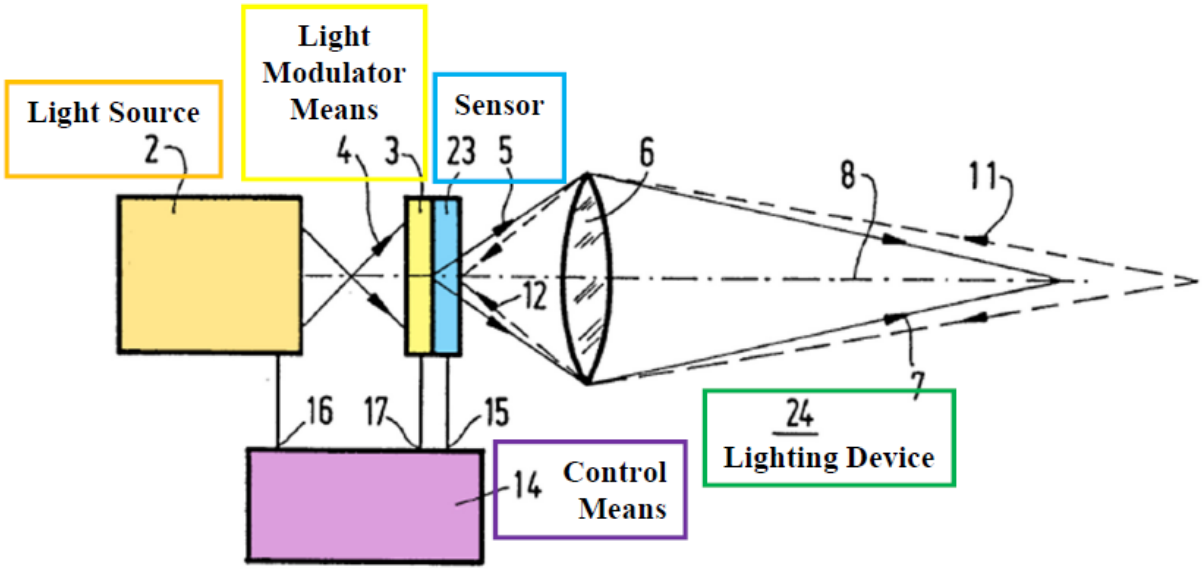
592. As discussed, a POSA would have been motivated to combine Harbers with Karlsson with a reasonable expectation of success. *Supra* Section XVII.A.

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

593. As described in Section XVII.A, a POSA would have been motivated to combine Karlsson-Harbers. It would have been obvious to a POSA to modify Karlsson to adjust light based on multiple colored directional illumination for different functions, as in Harbers, to further control Karlsson's adaptive headlamps to illuminate a roadway, thereby improving visibility and driver safety—an express purpose of Karlsson. EX1010, 1:10-13, 1:16-26, 4:17-21, 9:18-26; *see also* EX1011, 5:14-26, 6:1-7, 6:27-7:32, 9:28-10:5, 13:5-7, FIGS. 1B, 2.

594. 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.

595. Karlsson discloses "*controllable spotlight beams*" are controlled individually or in groups by control means 14 to "*given directions*" to reduce glare. EX1010, 4:26-31, 11:25-28, 14:1-15, 19:29-33, FIGS. 3, 6.



EX1010, FIG. 3 (annotated).

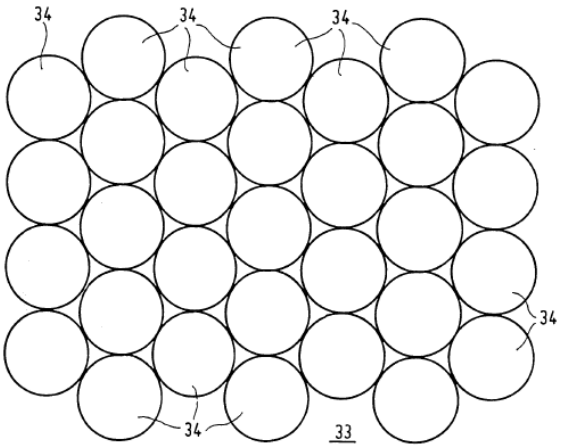


FIG. 6

EX1010, FIG. 6.

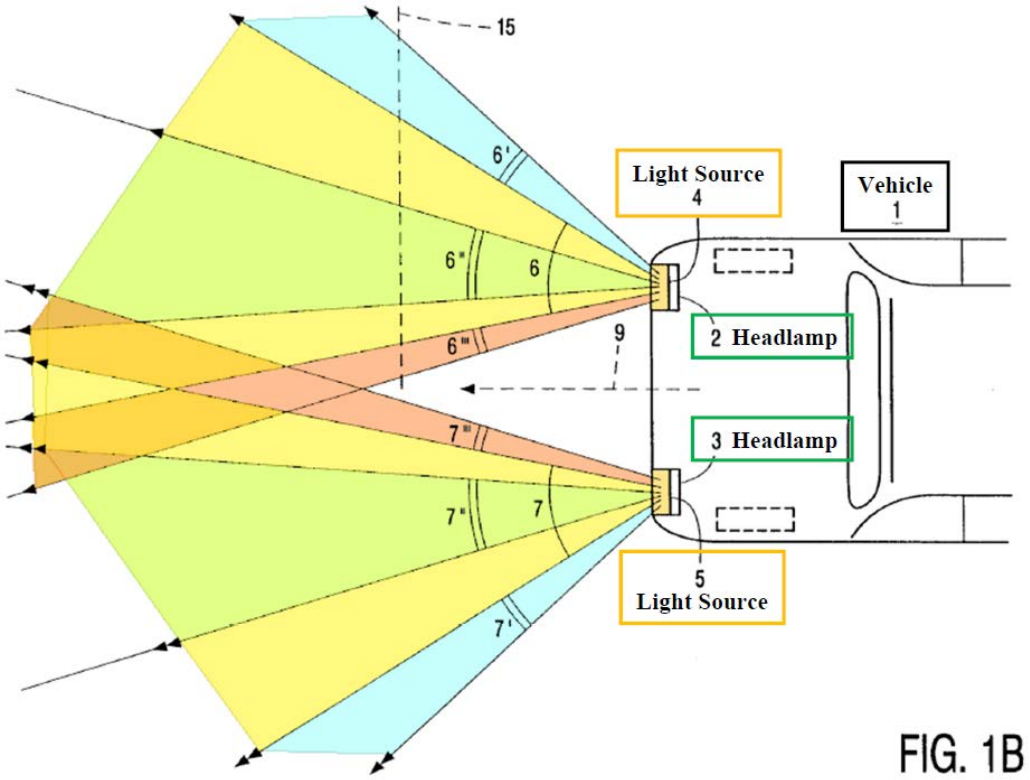
596. Indeed, Karlsson's techniques and system of controlling individual spotlight beams emphasize safety of all drivers. EX1010, 1:16-26, 4:17-21, 9:18-

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, 1:10-13 ("comply with…regulations…preventing the *blinding* or *glare*").

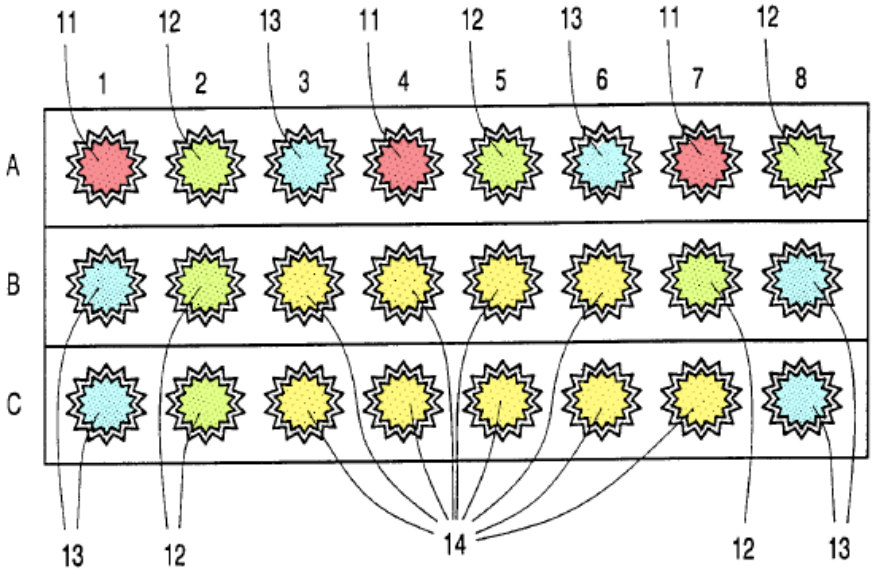
597. Karlsson's system "*selectively adjust[s]*…spotlight beam[s] 34, in response to a *control signal from sensor means 23*…to provide a *desired lighting pattern*" in "given *directions*." EX1010, 14:26-30, 11:25-28, FIGS. 3, 6, 14. Karlsson recognizes the safety benefits of identifying "oncoming traffic" 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, 3:19-31, 12:19-35, 2:2-4, 5:16-32. 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.

598. 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 differently colored beam segments 6-6'-6"-6"', 7-7'-

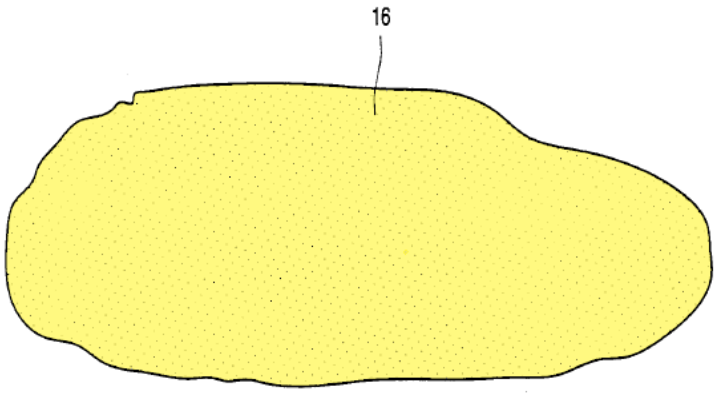
7"-7"' to form different distributions. EX1011, 5:14-26, 6:1-7, 6:27-7:19, FIGS. 1B-2, 4A; EX1011, 9:18-25 ("*yellow light*…to *improve*…*visibility*"), 10:6-14 ("*fog and snow*"), 7:27-32, 7:1-17, 13:5-7, 9:28-10:5.



EX1011, FIG. 1B (annotated).



EX1011, FIG. 2 (annotated).



EX1011, FIG. 4A (annotated).

599. This hardware combination of Karlsson's lighting means 2, 3 and Harbers's differently colored opto-electronic elements 11-14 on a curved substrate, would have provided Karlsson's system with different colored spatial distributions for different driving situations, as in Harbers, thereby improving driver safety. This would have been merely combining prior-art elements or a simple substitution of one known element for another (Karlsson's lighting means 2, 3 on a flat substrate

and Harbers's opto-electronic elements 11-14 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.

600. 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 colored directional light sources (e.g., directional beam segments 6-6'-6"-6"', 7-7'-7"-7"') for different functions (hardware implementation).

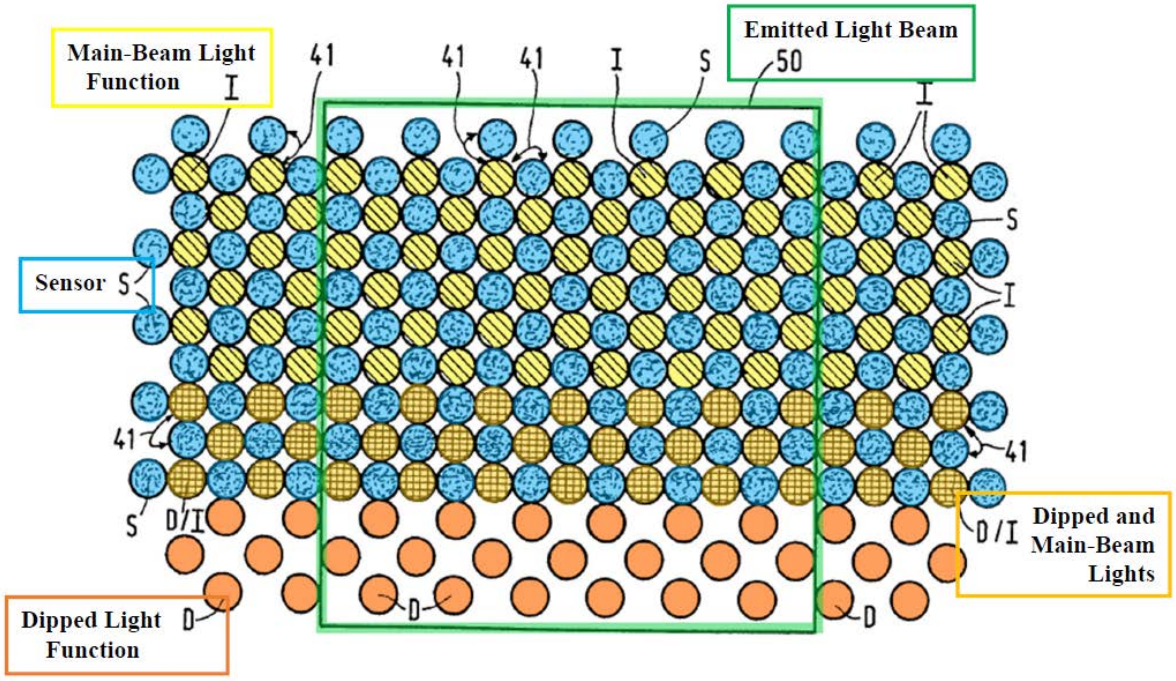
601. Such modification would have been routine and well within a POSA's skill due to the similarities in Karlsson's and Harbers's adaptive systems—their common components were well known and there would have been no limitations for a POSA to make such modifications. And in combining Karlsson with Harbers's array of colored 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).

602. In view of the above, Karlsson in combination with Harbers renders obvious claims 29 and 69.

G. Claim 30: "The method of claim 26, wherein the control strategy dynamically adapts the headlight beam based on real-time changes to the data sensed by the sensors indicating a change to at

least one of beings, objects and preceding vehicles ahead of the first vehicle."

603. Karlsson discloses "lighting device is…*dynamically adjusted* in dependence on the intensity and the direction of the light being detected." EX1010, 2:4-6, FIGS. 3, 14-15; EX1010, 2:32-35 ("*varied automatically*"), 20:26-27 ("*adapted…at all times*").



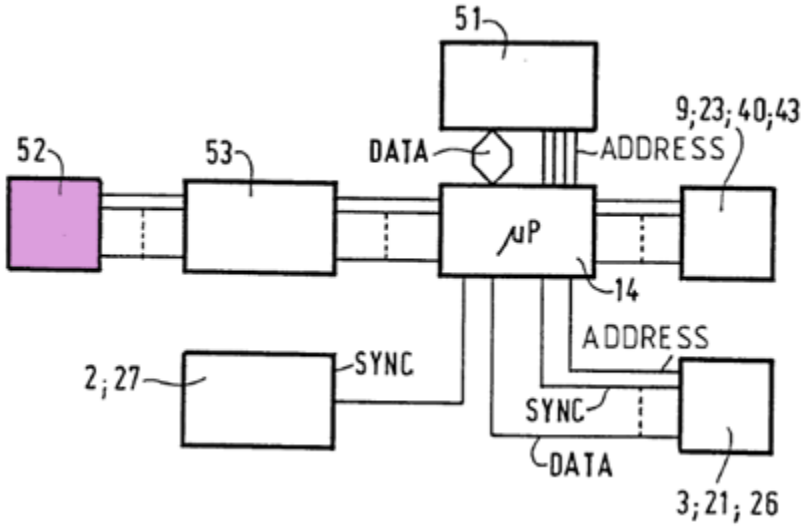
EX1010, FIG. 14 (annotated).

604. In view of the above, Karlsson discloses this claim.

H. Claim 31: "The method of claim 26, further comprising receiving input to an override switch and, responsive to the input, adjusting automatic operation of the headlight system to reflect operator instruction as indicated by the input to the override switch or by

further input to a different vehicle input other than the override switch."

605. Karlsson discloses "manually operated *switching means 52*" and "*manually adjusting said pattern…switched* in such a manner that *manual adjustment* takes precedence over *automatic adjustment*." EX1010, 20:12-15, 6:35-7:1, FIG. 15; EX1010, 7:1-3 ("*switching* to dipped headlights"), 20:6-15 ("*switched* on and off *manually*"). A POSA would have understood that Karlsson discloses "an override switch" because "manually operated *switching means 52*" includes a manual or digital switch to "adjust[] automatic operation."



EX1010, FIG. 15 (annotated).

606. In view of the above, Karlsson discloses this claim.

607. Thus, Karlsson, alone or in combination with Harbers, discloses or renders obvious claims 26-31, 65, 68, and 69 of the '503 patent.

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

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

608. As described in Section XVII.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.

609. 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.")

610. 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.

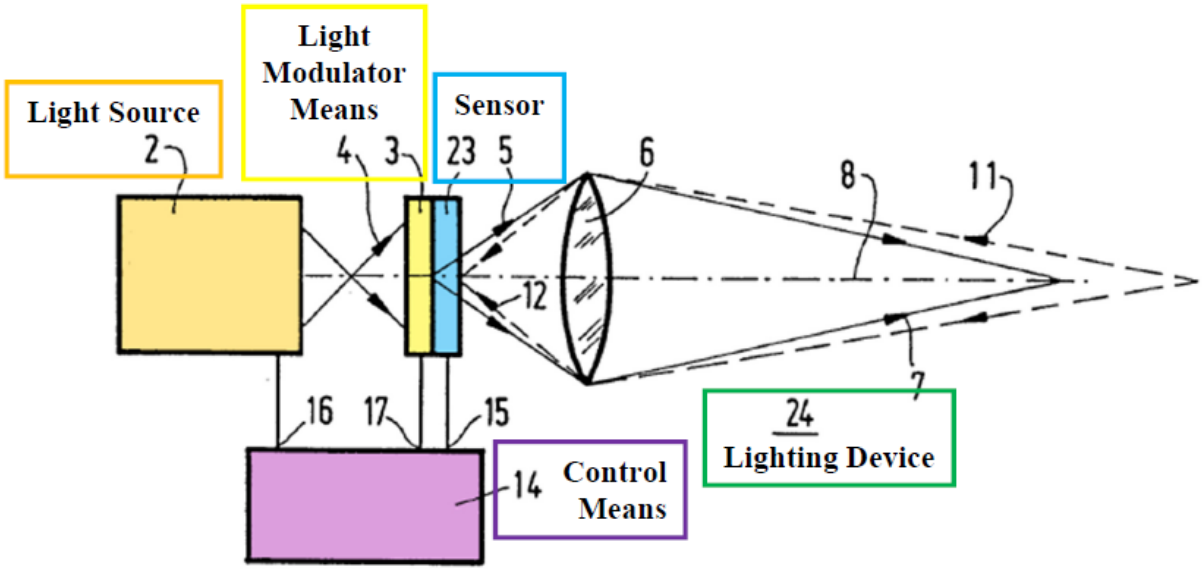
611. Karlsson-Harbers and Gotou are from the same field—controllable headlamps with dynamic illumination—and include the same building blocks (light

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, 6:40-43.

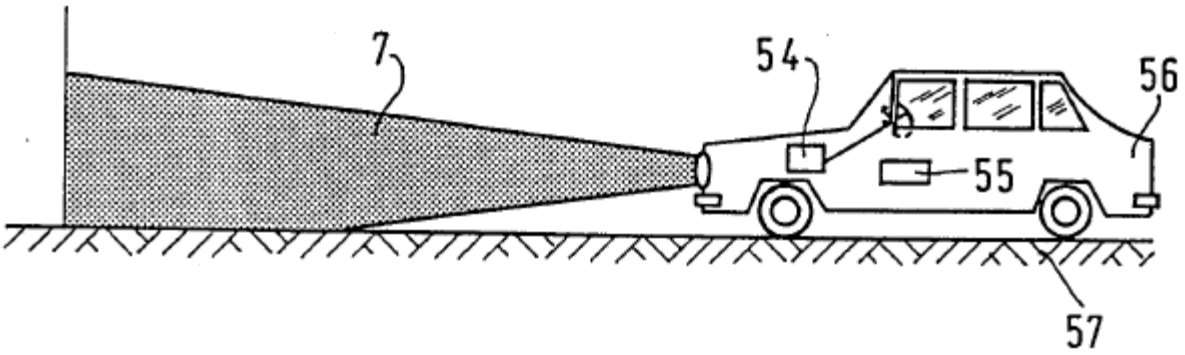
612. *First*, including an additional data source for Karlsson-Harbers's controller—Gotou's *known technique* of using map data including road curvature—would have enhanced Karlsson-Harbers by increasing/adjusting illumination based on an upcoming curve/turn, improving driver safety by providing light to where it is needed. *Second*, a POSA would have easily incorporated *known components* of Gotou's navigation system 30 (including GPS receiver 34, *see* EX1012, Abstract, 1:35-40, 2:8-26, 3:24-55, 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 upcoming curve/turn, further improving and safety.

613. 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.

614. 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 using additional sensors, 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).

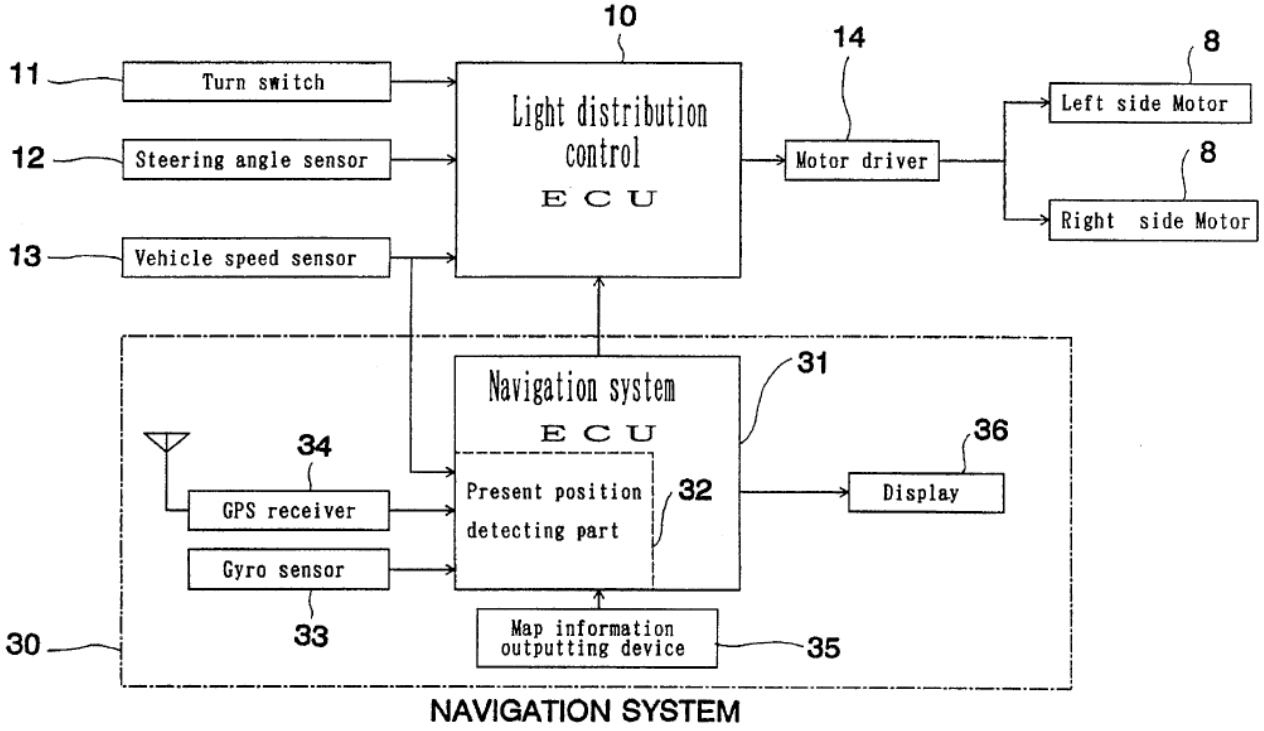


EX1010, FIG. 16.

615. Gotou discloses further details on how to detect upcoming curves/turns. Such modification would have made Karlsson more active than prior systems, and further achieved 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.

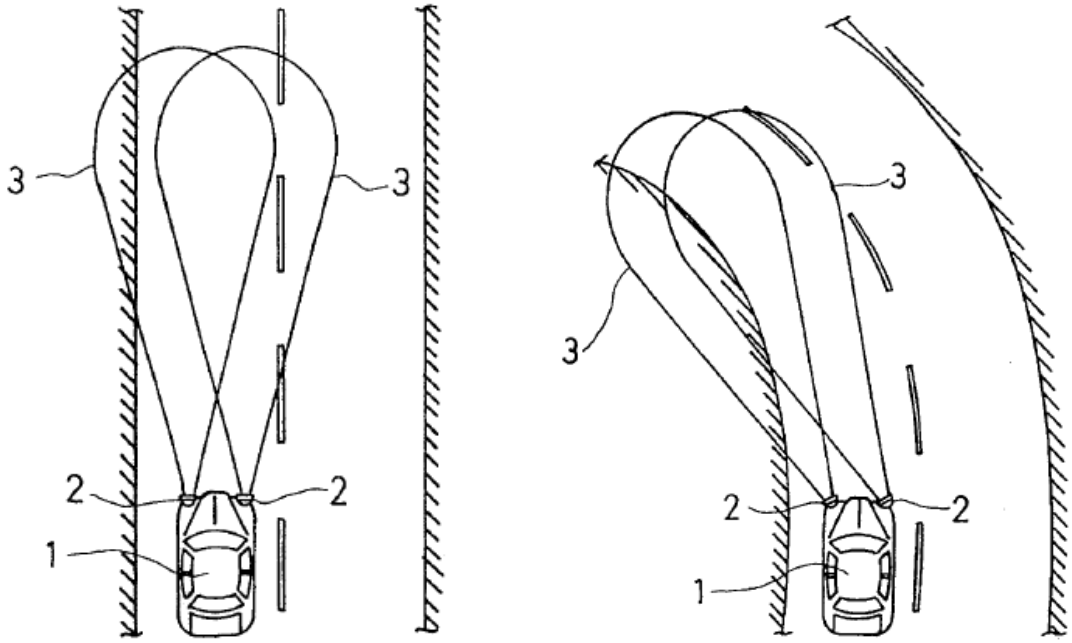
616. Gotou's active *techniques and system components*, like Karlsson-Harbers, seek to enhance driver safety—using map data-based control including road curvature. EX1012, 1:17-20, 2:19-26, 6:40-43. Gotou's navigation system 30 data is input to ECU 10, which alters the light direction from headlamp 2 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, 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, 6:40-43, 8:28-35.



EX1012, FIG. 3.

617. 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 is adjusted leftward prior to reaching the curve. EX1012, 3:24-55, 7:32-43, 8:28-35, FIGS. 8-9.



EX1012, FIGS. 8-9.

618. A POSA would have understood that including an additional data source for Karlsson-Harbers's controller/processor—Gotou's map data including road curvature—would have enhanced Karlsson-Harbers by increasing/adjusting illumination of upcoming curves/turns, thereby improving driver safety. This would have merely been applying Gotou's known technique (using map data including road curvature from 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 (improved visibility and safety); thus, a POSA would have readily applied it to similar systems, such as Karlsson-Harbers's, in the same way.

619. Additionally, or alternatively, this modification would have been simply combining known prior-art elements (Karlsson-Harbers's adaptive, direction-controllable headlamps with 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 (illuminating curves/turns, improving safety).

620. A POSA would have had a reasonable expectation of success combining Gotou with Karlsson-Harbers, for example, by simply modifying software instructions stored in memory of Karlsson-Harbers's controller/processor (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 a straightforward combination of prior-art elements: Gotou's navigation system 30 (including GPS receiver 34) with Karlsson-Harbers (in communication with Karlsson's controller).

621. 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/ouput 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).

622. I lay out below the specific disclosures of Karlsson-Harbers and Gotou, and expand on this combination and reasonable expectation of success analysis below.

B. Claim 32: "The method of claim 26, wherein the determining illumination requirements further includes determining illumination for an upcoming curve indicated by the sensor data, wherein the determining the control strategy further comprises determining the control strategy for controlling the directional light clusters to create an output headlight beam that illuminates around the curve."

Claim 33: "The method of claim 32, wherein the determining illumination requirements further includes determining illumination for an upcoming turn indicated by the sensor data, wherein the determining the control strategy further comprises determining the control strategy for controlling the directional light clusters to create an output headlight beam that illuminates the turn."

Claim 34: "The method of claim 32, wherein the determining illumination further includes determining illumination the increases illumination of an upcoming turn indicated by the sensor data, wherein the determining the control instructions further comprises determining the control instructions for

controlling one or more of the directional light sources to achieve illumination of the turn."

Claim 35: "The method of claim 26, wherein the determining illumination requirements further includes determining illumination for an upcoming turn indicated by the sensor data, wherein the determining the control strategy further comprises determining the control strategy for controlling the directional light clusters to create an output headlight beam that illuminates the turn."

Claim 36: "The method of claim 26, wherein the determining illumination further includes determining illumination the increases illumination of an upcoming turn indicated by the sensor data, wherein the determining the control instructions further comprises determining the control instructions for controlling one or more of the directional light sources to achieve illumination of the turn."

Claim 70: "The method of claim 65, wherein the determining illumination further includes determining illumination that increases illumination of an upcoming curve indicated by the data, wherein the determining the control instructions further comprises determining the control instructions for controlling one or more of the directional light sources to achieve illumination around the curve."

623. In my opinion, claims 32-36 and 70 all recite language relating to illuminating an upcoming curve/turn by determining control strategy/instructions and appropriately controlling the headlight output to illuminate the curve/turn.

624. In my opinion, there is no patentable difference between the language of claim 33 and claim 32 as shown above (even though claim 32 uses the term "curve," and claim 33 uses the term "turn"). *See also* Appendix B. The same disclosures below address each feature.

625. In my opinion, there is no patentable different between the language of claim 34 and claim 32 as shown above (even though claim 32 uses the term "curve," and claim 34 uses the term "turn"). *See also* Appendix B. The same disclosures below address each feature.

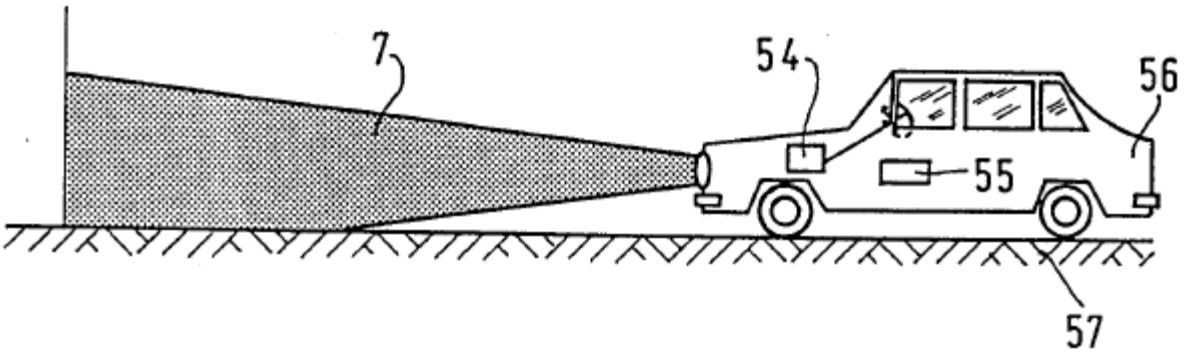
626. The language of claim 35 is identical to the language of claim 33 as shown above. *See also* Appendix B.

627. The language of claim 36 is identical to the language of claim 34 as shown above. *See also* Appendix B.

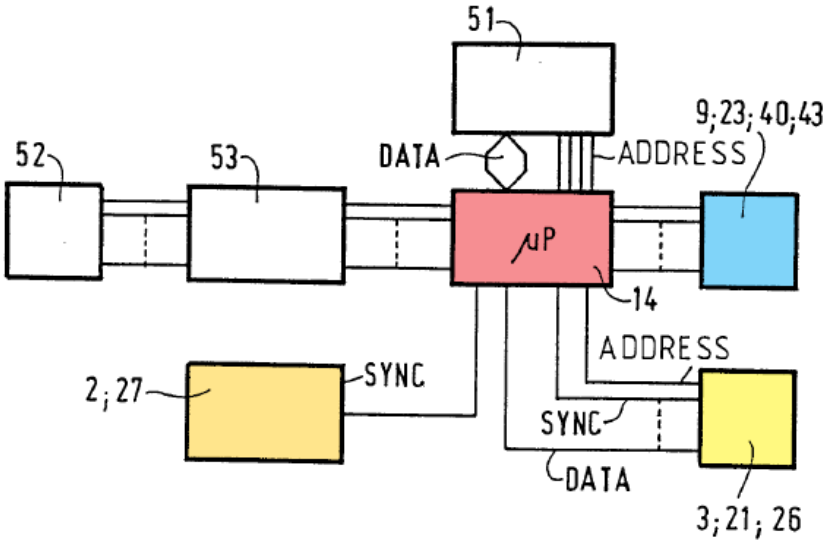
628. In my opinion, there is no patentable difference between the language of claim 70 and claim 34 as shown above (even though claim 70 uses the term "curve," and claim 34 uses the term "turn"). *See also* Appendix B. The same disclosures below address each feature.

1. Karlsson-Harbers's disclosure

629. Karlsson discloses "a light-sensitive sensor, which detects…the area *ahead of a vehicle*" and "*direction sensor 54*…determin[es] when the car 56 is *taking a bend*, so that the light beam 7 can be *adapted*." EX1010, 2:2-4, 20:29-32, FIGS. 3, 14-16; EX1010, 6:26-33 ("headlights are incorrectly adjusted"), 9:11-17 ("incident light 11…is *processed* by the control means 14…to control…*light beam 7*"), 1:35-2:4. As discussed, Karlsson/Karlsson-Harbers discloses "directional light [clusters / sources]." *Supra* Sections XVII.A/XVII.B.7.

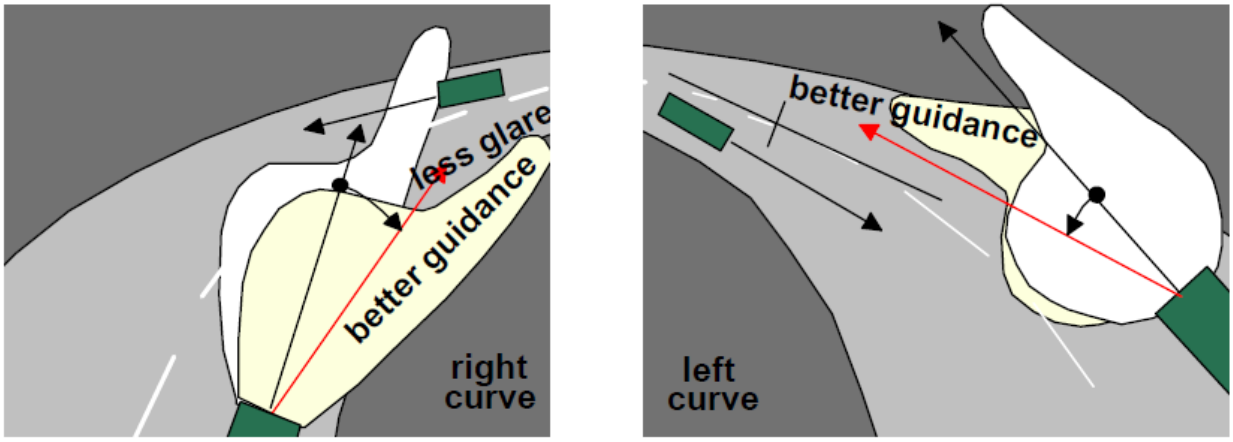


EX1010, FIG. 16.



EX1010, FIG. 15 (annotated).

630. If Patent Owner argues that Karlsson-Harbers does not disclose claims 32-36 and 70, this feature was well known in the prior art, e.g., as explicitly disclosed by Gotou. *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.

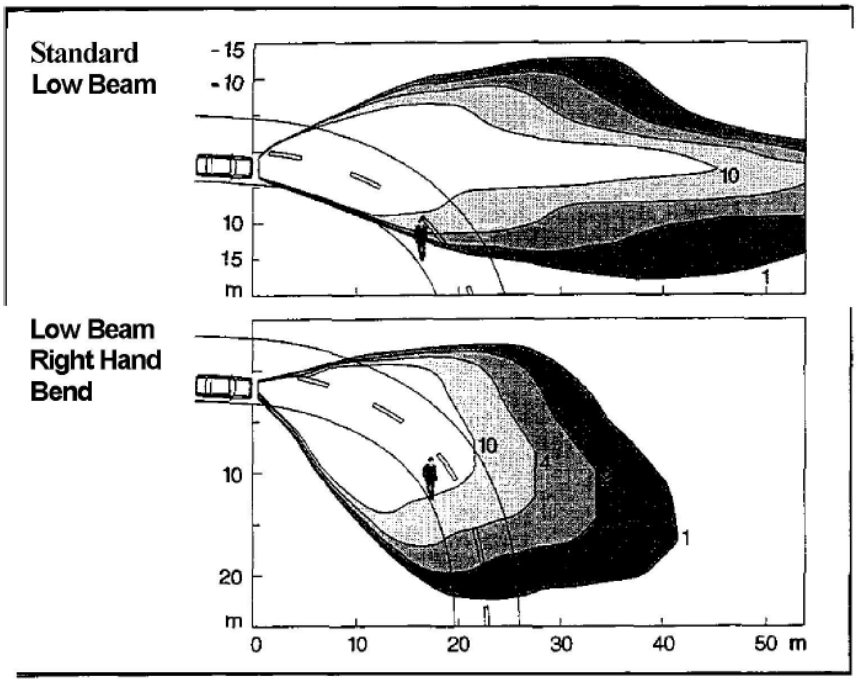


Fig. 7: comparison between basic low beam and right curve illumination, Isolux curves from bird eye's view

EX1017, FIG. 7.

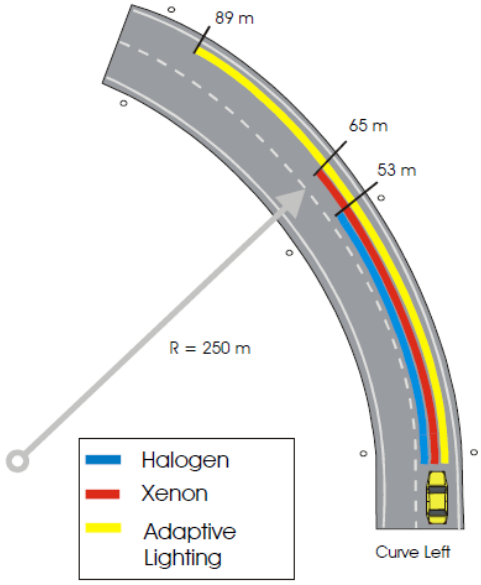


Figure 10: Static test: Results of the investigations about visibility distances obtained with halogen-, HID- and adaptive headlamps.

EX1020, FIG. 10.

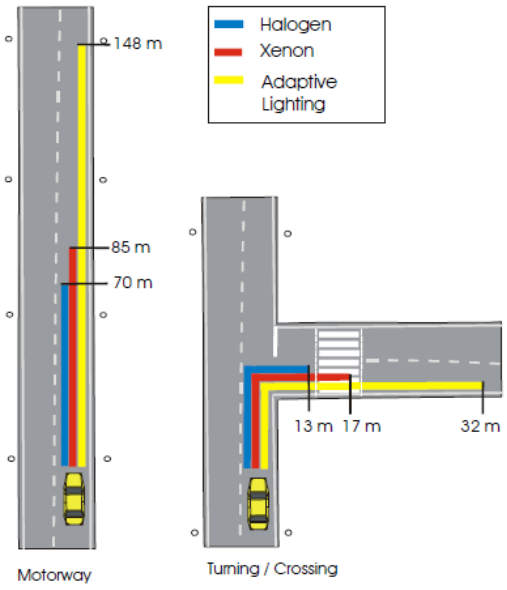


Figure 11: Static test: Results of the investigations about visibility distances obtained with halogen-, HID- and adaptive headlamps

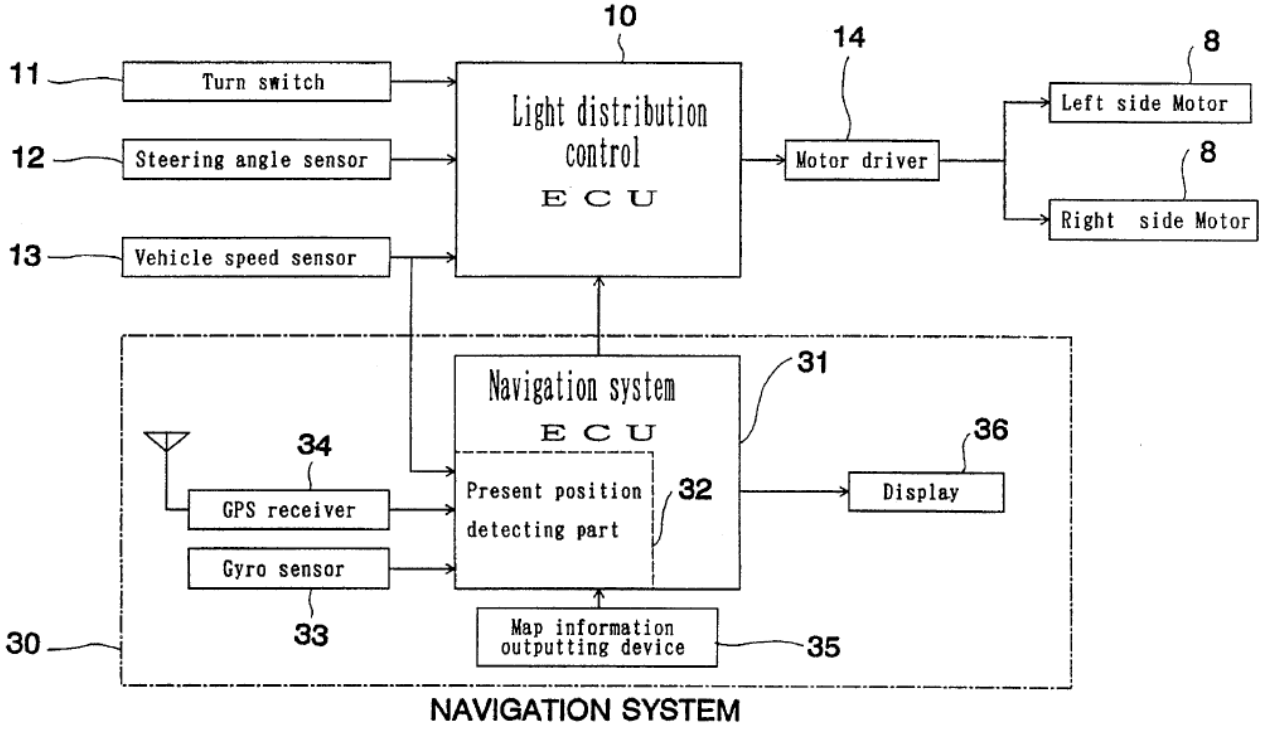
EX1020, FIG. 11.

2. Gotou's disclosure

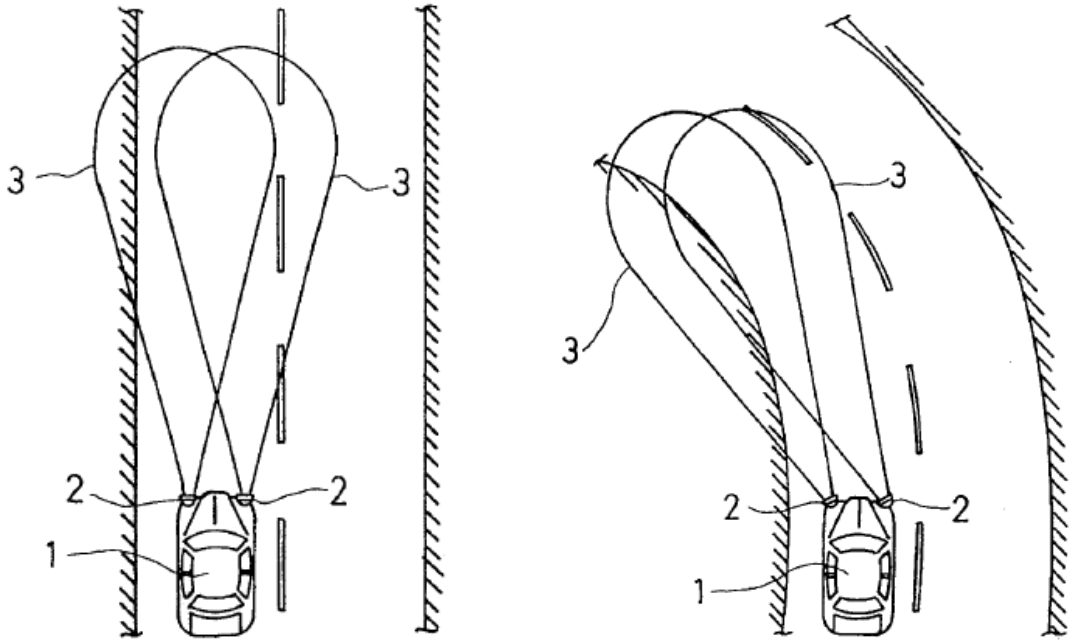
631. Gotou's "ECU 10 gets *map information*…from the navigation system 30…to *determine a requisite optical axis angle θ*" and "estimation of the *forward road shape*…[based] on the *road data* of the map information, so that the lighting

region is changed early *in the turning direction* and the *visibility is improved*." EX1012, 3:52-63, 8:28-35, FIGS. 3, 8-10; EX1012, 6:40-44 ("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*"), 4:30-49 ("*map information*…such as…*directions of the curves*"), 6:8-17 ("the optical axis is swung…toward the *planned* running path"), 6:28-39 ("*analyz[ing]* whether the *forward curve* is…rightward or leftward").

632. A POSA would have understood that Gotou discloses illumination for "an upcoming curve" because illumination is controlled along the "forward road shape" (e.g., left or right curve) recited in claims 32 and 70. Further, a POSA would have understood that Gotou discloses illumination for "an upcoming turn" because illumination is controlled along the "planned running direction" that includes an intended direction of a driver (e.g., left or right turn) recited in claims 33-36. *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. 8-9.

633. As discussed, a POSA would have been motivated to combine Gotou with Karlsson-Harbers with a reasonable expectation of success. *Supra* Section XVIII.A.

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

634. As described in Section XVII.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, 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"), 1:16-26, 4:17-21, 9:18-26.

635. 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.")

636. 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.

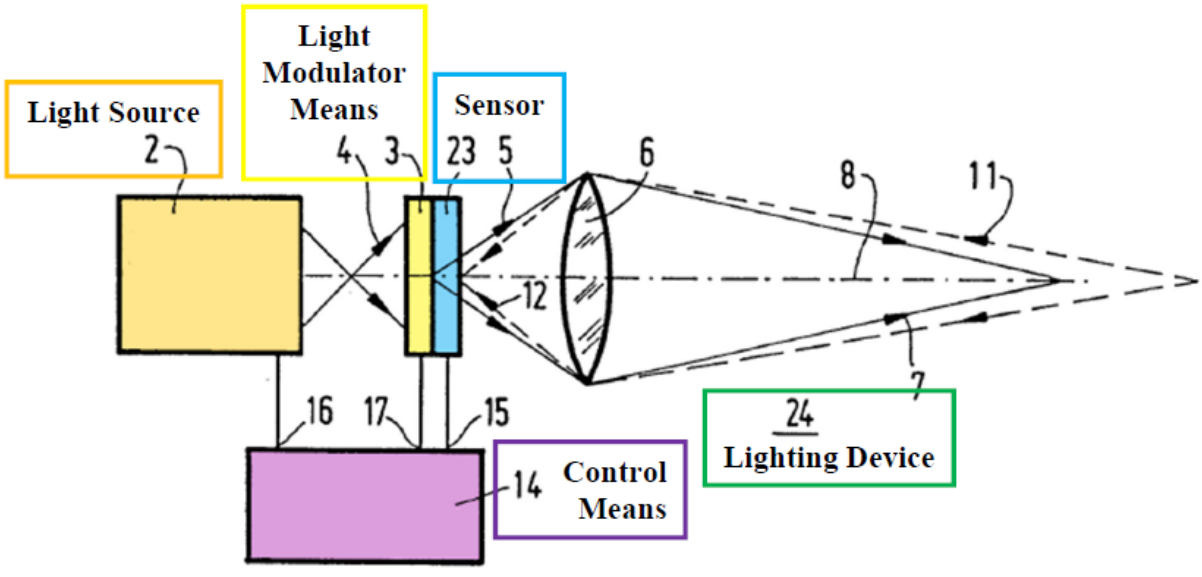
637. Karlsson-Harbers and Gotou are from the same field—controllable headlamps with dynamic illumination—and include the same building blocks (light sources, sensors, controllers). Further, driver safety is paramount. EX1010, 1:21-26, 1:35-2:1, 9:18-26, 20:22-32; EX1012, 1:17-20, 2:19-26, 6:40-43.

638. *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 an upcoming curve/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 (including GPS receiver 34, *see* EX1012, Abstract, 1:35-40, 2:8-26, 3:24-55, 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 upcoming curve/turn, further improving and safety.

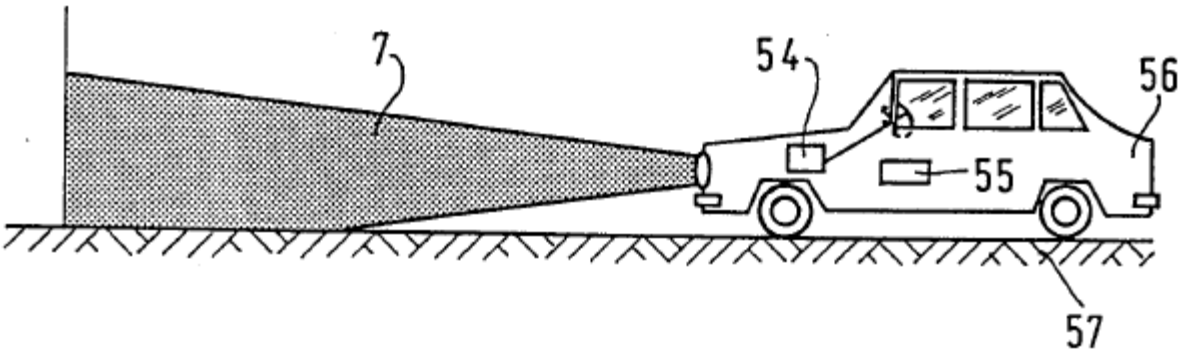
639. Indeed, Karlsson's technique and system of controlling individual spotlight beams emphasize safety of all drivers. EX1010, 1:16-26, 4:17-21, 9:18-26. Controllable headlamps "significantly increase the driving comfort and the

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.

640. 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 using additional sensors, 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).

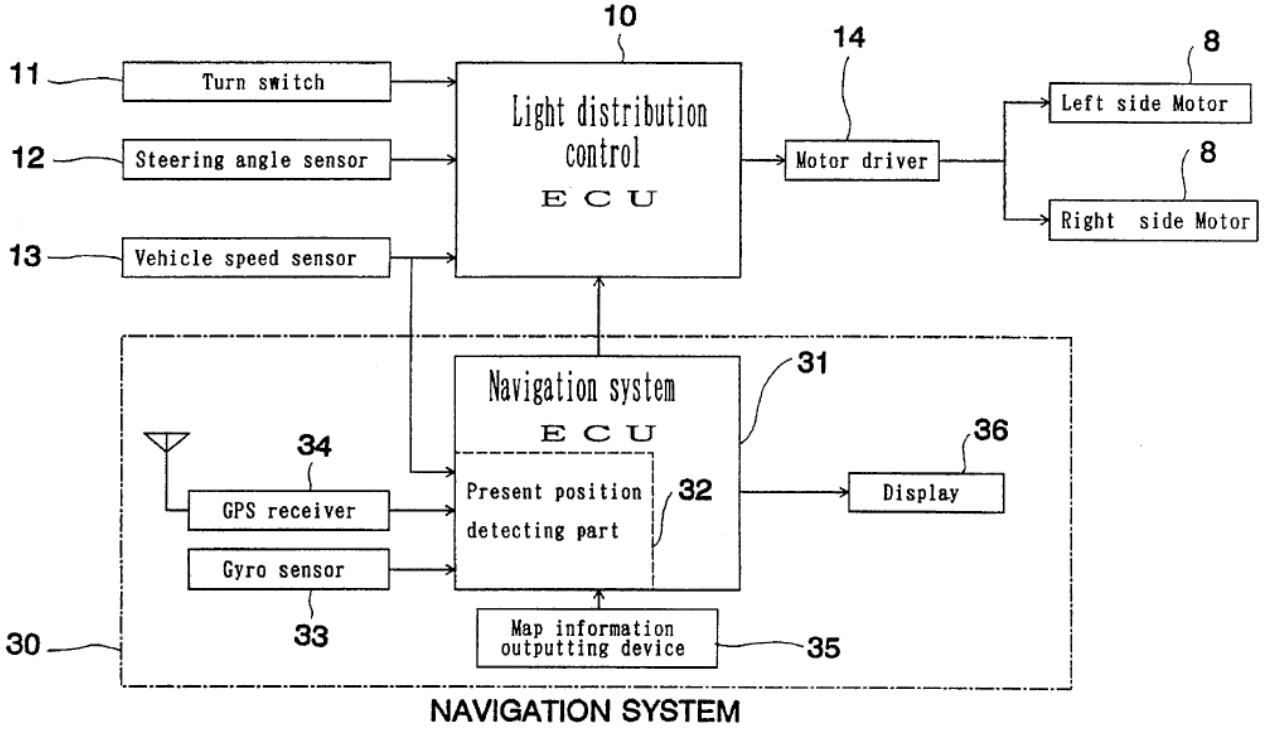


EX1010, FIG. 16.

641. Gotou discloses further details on how to detect upcoming curves/turns. Such modification would have made Karlsson more active than prior systems, and further achieved 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.

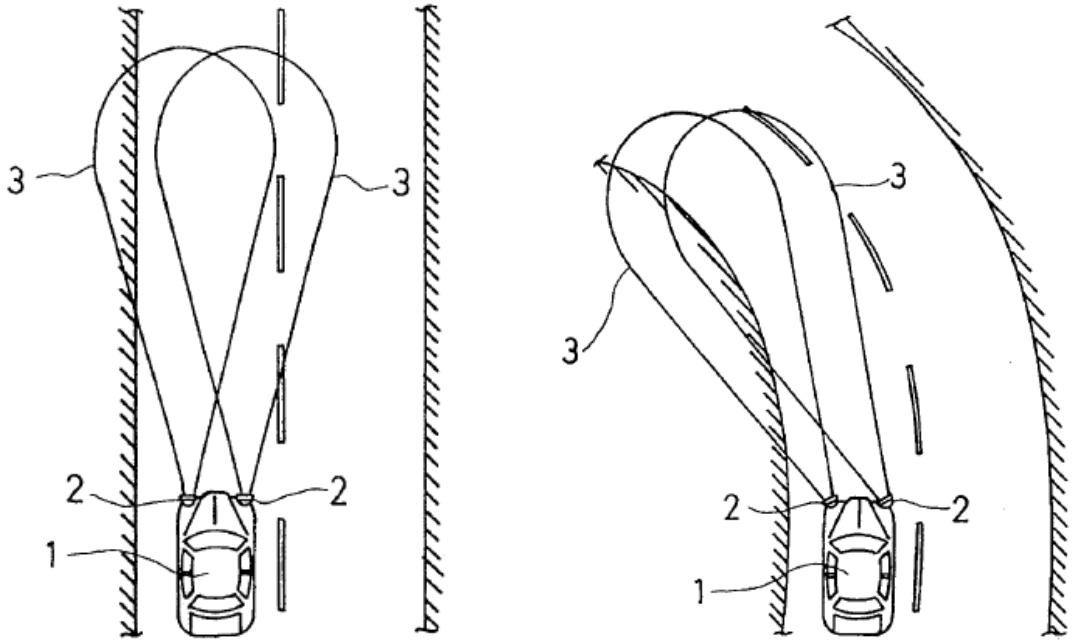
642. Gotou's active *techniques and system components*, like Karlsson-Harbers, seek to enhance driver safety—using map data-based control including road curvature. EX1012, 1:17-20, 2:19-26, 6:40-43. Gotou's navigation system 30 data is input to ECU 10, which alters the light direction from headlamp 2 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, 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, 6:40-43, 8:28-35.



EX1012, FIG. 3.

643. 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 is adjusted leftward prior to reaching the curve. EX1012, 3:24-55, 7:32-43, 8:28-35, FIGS. 8-9.



EX1012, FIGS. 8-9.

644. A POSA would have understood that including an additional data source for Karlsson-Harbers's controller/processor—Gotou's map data including road curvature—would have enhanced Karlsson-Harbers by increasing illumination of upcoming curves/turns, thereby improving driver safety. This would have merely been applying Gotou's known technique (using map data including road curvature from 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 (improved visibility and safety); thus, a POSA would have readily applied it to similar systems, such as Karlsson-Harbers's, in the same way.

645. Additionally, or alternatively, this modification would have been simply combining known prior-art elements (Karlsson-Harbers's adaptive, direction-controllable headlamps with 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 (illuminating curves/turns, improving safety).

646. A POSA would have had a reasonable expectation of success combining Gotou with Karlsson-Harbers, for example, by simply modifying software instructions stored in memory of Karlsson-Harbers's controller/processor (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 a straightforward combination of prior-art elements: Gotou's navigation system 30 (e.g., including GPS receiver 34) with Karlsson-Harbers (in communication with Karlsson's controller).

647. 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).

648. In view of the above, Karlsson (with Harbers) with Gotou, discloses or renders obvious these claims.

649. Thus, Karlsson (with Harbers) with Gotou, discloses or renders obvious claims 32-36 and 70 of the '503 patent.

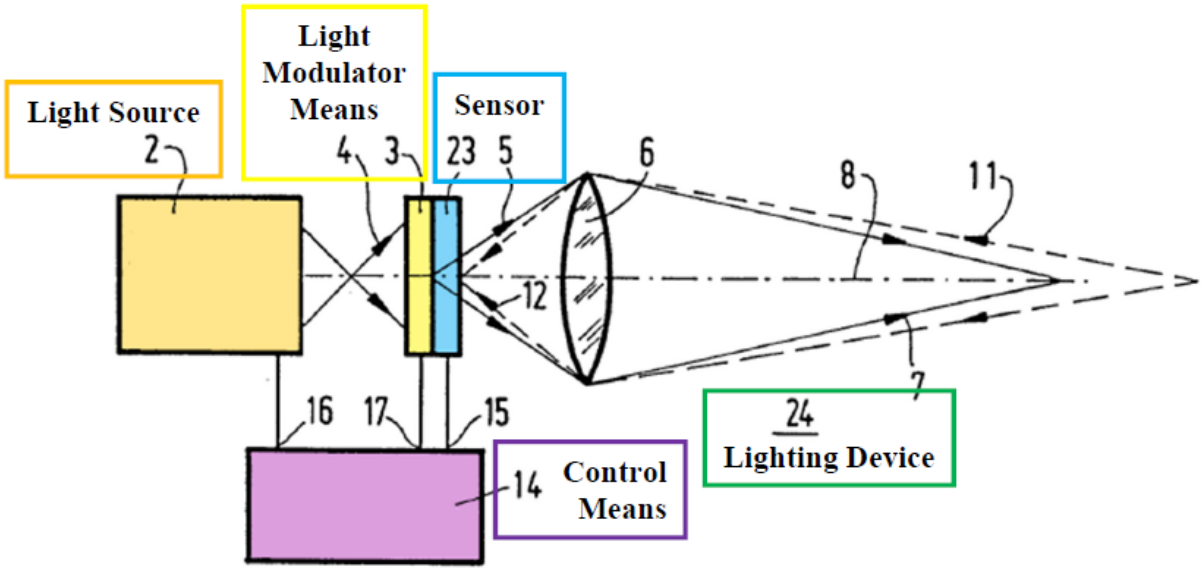
XIX. GROUND 10: THE COMBINATION OF KARLSSON, HARBERS, AND BRAUN RENDERS OBVIOUS CLAIMS 66-67.

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

650. As described in Section XVII.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 pattern recognition (e.g., identifying pedestrians, road signs, obstacles, etc.), as in Braun (EX1009, 5:27-31, 14:21-30, 22:19-23, 23:28-24:27, 26:29-27:2, FIGS. 1, 5-6), to further control Karlsson's directional spotlight beams to illuminate objects, thereby improving visibility and driver safety—an express purpose of Karlsson. EX1010, 1:16-26, 4:17-21, 9:18-26.

651. Karlsson-Harbers and Braun are from the same field—controllable headlamps with dynamic illumination—and include the same building blocks (e.g., light sources, sensors, controllers). Improved visibility and driver safety is paramount. EX1010, 1:16-26, 4:17-21, 9:18-26; EX1009, 22:19-23 ("*identify features and/or objects* in the scene"), 6:4-51 ("*prevent glare*"), 5:27-31 ("*improve…readability*"), 11:26-30 ("*maximize visibility*"), 26:29-27:4, 22:24-25.

652. Including an additional control technique (software implementation) for Karlsson-Harbers's controller—Braun's *known technique* of pattern recognition—would have enhanced Karlsson-Harbers by identifying and illuminating objects of interest in a scene, increasing visibility and safety. EX1009, 5:27-31, 14:21-30, 22:19-23, 23:28-24:27, 26:29-27:2, FIGS. 1, 5-6. 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.



EX1010, FIG. 3 (annotated).

653. 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 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 other drivers from glare. EX1010, 1:21-26.

654. Karlsson recognizes "light-sensitive sensors 9 and 23…precisely determin[e]…the *detected light 11*" and discloses identifying "oncoming traffic" and other objects (e.g., "road signs etc.") in the field of view. EX1010, 12:19-35, 3:19-31, FIGS. 3, 14-15; EX1010, 1:21-26, 2:2-4, 5:16-32, 9:3-33, 10:32-11:1, 11:7-28; EX1011, 2:27-3:10 ("objects, such as pedestrians"). And Braun's

technique (software implementation), like Karlsson-Harbers, enhances driver visibility and safety—using pattern recognition. EX1009, 5:21-6:7, 11:14-17, 11:27-30, 12:17-20, 38:19-22. Braun's pattern recognition application identifies objects of interest (e.g., pedestrian, road-sign) and controller 118 adaptively controls luxels in illuminator 116 to illuminate the identified objects, improving visibility of the objects and capturing the driver's attention and altering the driver to the danger of the objects, thereby enhancing safety. EX1009, 14:21-30, 23:28-24:27, FIGS. 1, 5-6; EX1009, 6:8-15 ("*alerts* the driver…with a suitable spatial and/or temporal illumination pattern"), 10:28-30 ("an optical cue that *alerts the driver* to the *danger*"), 22:19-23 ("identified *features and/or objects*"), 5:27-31 ("*road signs*"), 26:20-29 ("visually *alert* the driver…of a *dangerous* situation"), 26:29-27:2 ("'*pattern recognize*' presence of *people*…and *spotlight the people* to *alert* the driver"). And like Karlsson, Braun's pattern recognition application "identifies *oncoming vehicles* and automatically adjusts illumination…to *prevent glare*…[and] *blinding* a driver of the oncoming vehicle," so naturally Braun's pattern recognition technique (software implementation) would have been a natural extension and improvement on Karlsson's system and would have been obvious to a POSA. EX1009, 6:4-7, 12:17-20, 38:19-22.

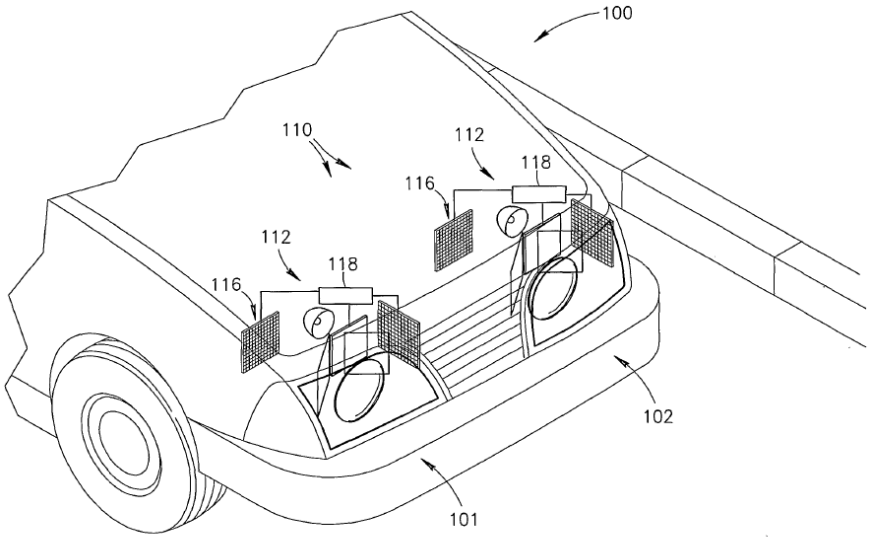


FIG.5

EX1009, FIG. 5.

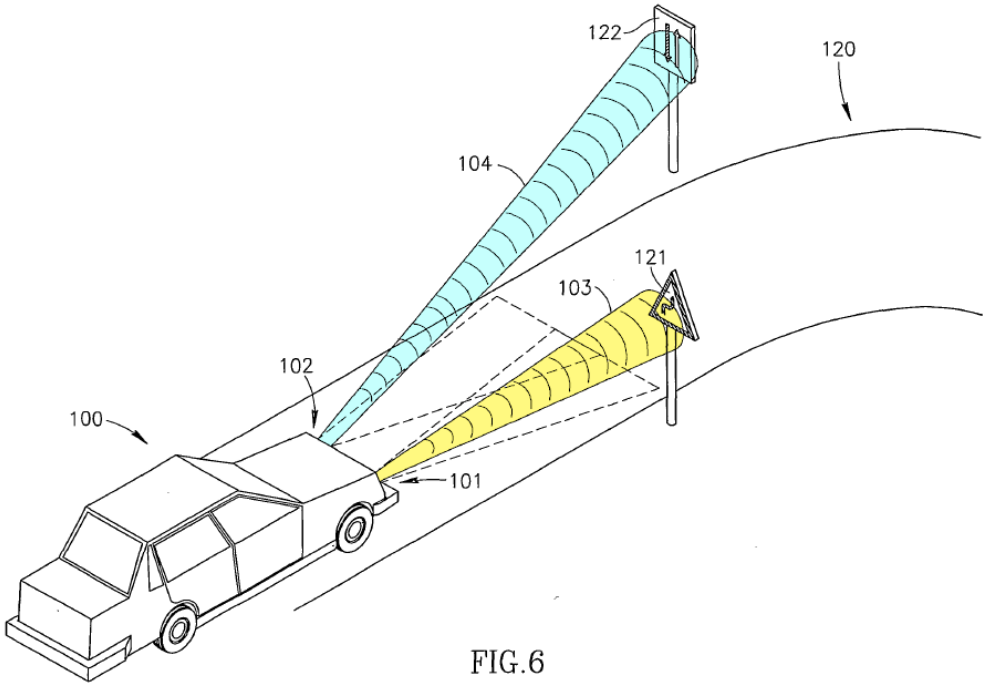


FIG.6

EX1009, FIG. 6 (annotated).

655. The additional control of having pattern recognition as in Braun, implemented with Karlsson-Harbers's controller/processor, would have enhanced

Karlsson-Harbers's system by identifying and illuminating objects of interest, capturing the driver's attention and/or alerting the driver to the danger of the objects, thereby improving safety. This would have merely been applying Braun's known technique (software implementation: pattern recognition to identify/illuminate objects of interest) to Karlsson-Harbers's similar, known device (dynamic headlamp system with controllable beams), in the same way. Braun's known technique is fully described along with its benefits (improved visibility, thereby increased safety); thus, a POSA would have readily applied it to similar systems, such as Karlsson-Harbers's, in the same way. EX1010, 21:36-22:4 ("control means may likewise be built up of various components, such as a microprocessor…ASIC…memory 51…for *storing* and recording the *various adjustments*"), 9:11-17, 12:19-24, 20:12-15.

656. A POSA would have had a reasonable expectation of success combining Braun with Karlsson-Harbers, for example, by simply modifying software instructions stored in memory of Karlsson-Harbers's controller/processor (e.g., an algorithm) to adjust/direct light of the spotlight beams appropriately in view of Braun's pattern recognition. This would have been routine and well within a POSA's skill due to the similarities in Karlsson-Harbers's and Braun's adaptive systems—their common components were well known and there would have been

no limitations for a POSA to make such modifications. EX1009, 22:17-25 ("a *pattern recognition* application…using *algorithms* and *methods known in the art*").

657. I lay out below the specific disclosures of Karlsson-Harbers and Braun, and expand on this combination and reasonable expectation of success analysis below.

B. Claim 66: "The method of claim 65, wherein the data includes data indicating a pedestrian and wherein the determining illumination includes determining an illumination level, for at least a third subsection including the pedestrian."

Claim 67: "The method of claim 65, wherein the data includes data indicating a road-sign wherein the determining illumination includes determining an illumination level, for at least a third subsection including the road-sign."

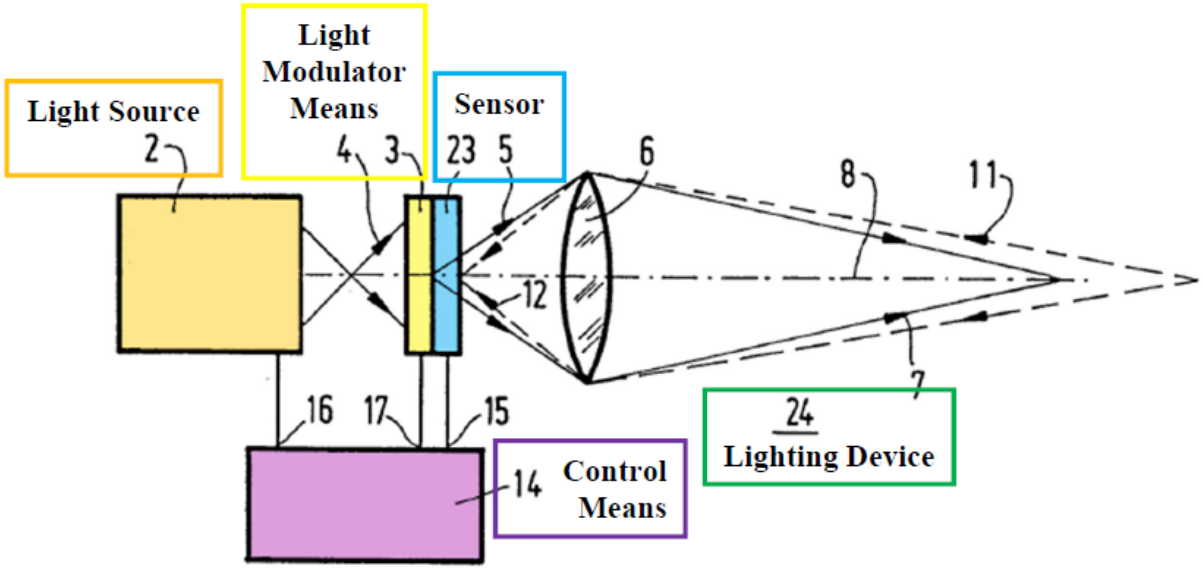
658. In my opinion, claims 66-67 recite language having no patentable difference, relating to identifying and illuminating an object: a "pedestrian" (claim 66) and a "road-sign" (claim 67).

659. In my opinion, there is no patentable difference between the language of claim 66 and claim 67. *See* Appendix B.

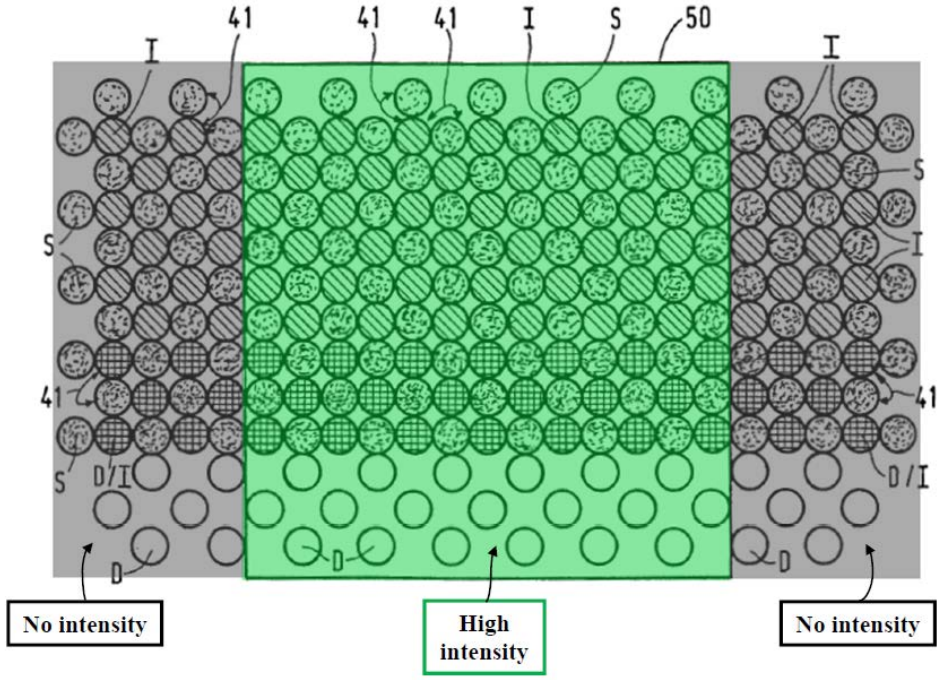
1. Karlsson-Harbers's disclosure

660. Karlsson discloses "a light-sensitive sensor, which detects…the area *ahead of a vehicle*" and identifying "oncoming traffic" and other objects (e.g., "*road signs etc.*") in the field of view. EX1010, 2:2-4, 3:19-31, 12:19-35, FIGS. 3, 14-15; EX1010, 9:11-17 ("incident light 11…*processed* by the control means

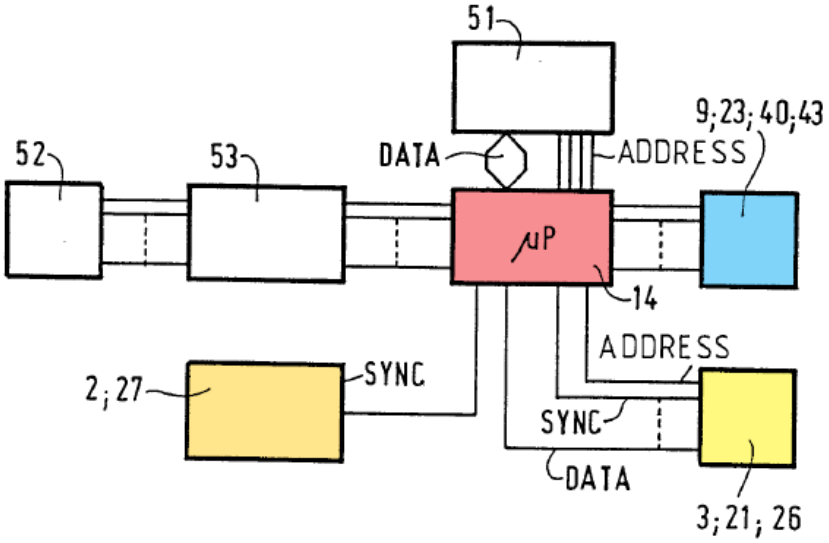
14…to control…*light beam 7*"), 5:16-32, 9:3-33, 10:32-11:1, 11:7-28; EX1011-2:27-3:10 ("objects, such as *pedestrians*").



EX1010, FIG. 3 (annotated).



EX1010, FIG. 14 (annotated).



EX1010, FIG. 15 (annotated).

661. Karlsson-Harbers does not disclose data indicating a pedestrian/road-sign, but this feature was well known in the prior art, e.g., as explicitly disclosed by Braun.

2. Braun's disclosure

662. Braun's system "'pattern recognize[s]' presence of *people*…and *spotlight[s] the people* to alert the driver" and "controls illumination…to the *identified features and/or objects*." EX1009, 26:31-27:1, 22:17-23, FIGS. 5-6; EX1009, 26:33-27:1 ("illuminate…the *presence of people*"), 22:19-22 ("pattern recognition"), 5:21-6:7, 14:21-30, 23:8-24:27. Also, Braun's "*pattern recognition* application processes the *images*…and *identifies roadway signs 121 and 122*" and "[c]ontroller 118…controls luxels in illuminators 116…to provide light beams 103 and 104 that *spotlight roadway signs 121 and 122*." EX1009, 24:4-7, FIGS. 5-6.

663. A POSA would have understood that Braun discloses "determining an illumination level…for at least a third subsection" because Braun's system "spotlights" (illuminates) "people" and "roadway signs" in particular regions of the roadway scene. EX1009, 4:17-20 ("controller comprises a *pattern recognition* application that *processes* images of a scene…controller *controls* the luxels to illuminate the scene *responsive* to the identified features and/or objects"), 4:21-5:1 ("controller *determines*…the component velocity and then *controls* the luxels *responsive* to the determined component of velocity"), 7:1-7 ("light that illuminates a *different region* of the scene…a range finder that *determines* distances to regions of the scene…and a controller that controls the plurality of light providing regions…for illuminating the scene *responsive* to the distances determined"), 11:14-17 ("controller processes an image of the sign to *determine* its color components and *controls* hue and saturation of light that illuminates the sign to enhance its readability"), 23:5-7 ("velocity of an object is used by the controller to *determine* how fast to pan a light pattern that *highlights* the object").

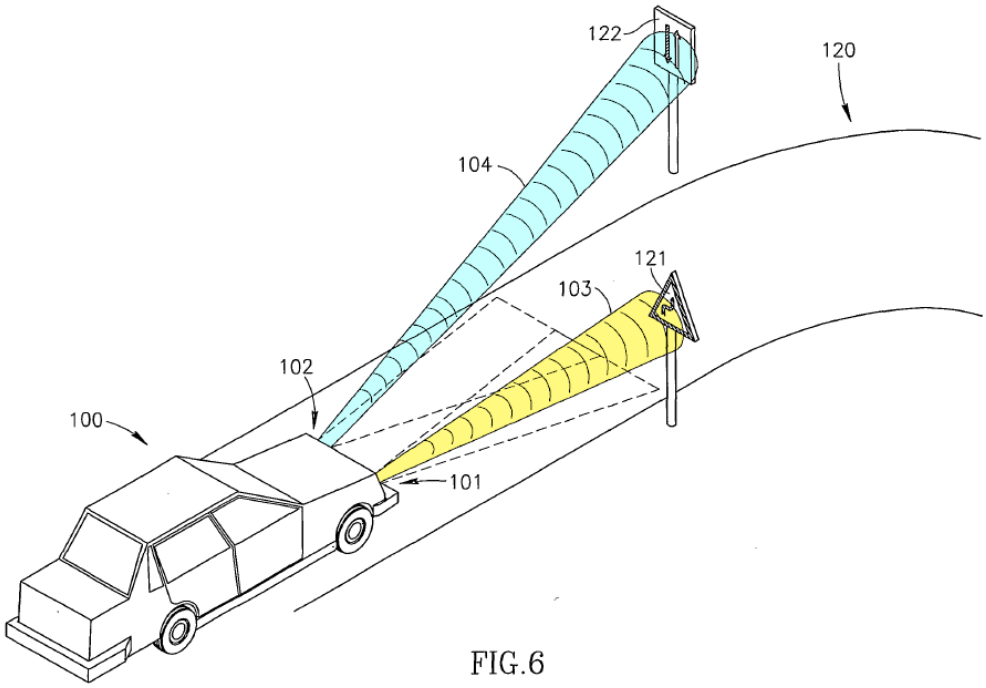


FIG.6

EX1009, FIG. 6 (annotated).

664. As discussed, a POSA would have been motivated to combine Braun with Karlsson-Harbers with a reasonable expectation of success. *Supra* Section XIX.A.

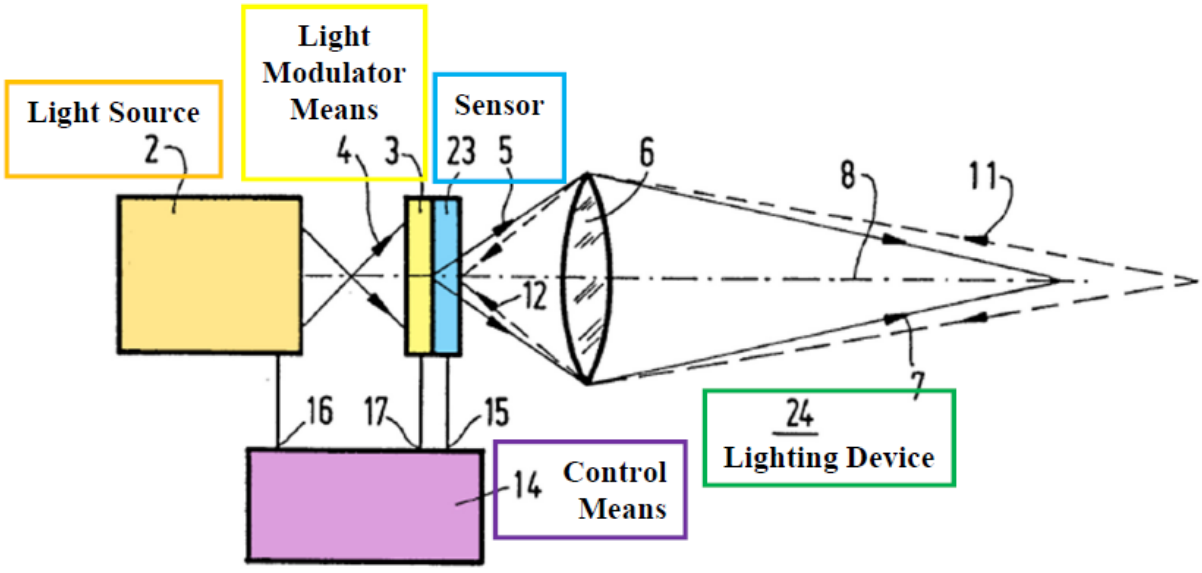
3. A POSA would have been motivated to combine Braun with Karlsson-Harbers with a reasonable expectation of success.

665. As described in Section XVII.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 pattern recognition (e.g., identifying pedestrians, road signs, obstacles, etc.), as in Braun, to further control Karlsson's directional spotlight beams to illuminate objects, thereby improving

visibility and driver safety—an express purpose of Karlsson. EX1010, 1:16-26, 4:17-21, 9:18-26.

666. Karlsson-Harbers and Braun are from the same field—controllable headlamps with dynamic illumination—and include the same building blocks (e.g., light sources, sensors, controllers). Improved visibility and driver safety is paramount. EX1010, 1:16-26, 4:17-21, 9:18-26; EX1009, 22:19-23 ("*identify features and/or objects* in the scene"), 6:4-51 ("*prevent glare*"), 5:27-31 ("*improve…readability*"), 11:26-30 ("*maximize visibility*"), 26:29-27:4, 22:24-25.

667. Including an additional control technique (software implementation) for Karlsson-Harbers's controller—Braun's *known technique* of pattern recognition—would have enhanced Karlsson-Harbers by identifying and illuminating objects of interest in a scene, increasing visibility and safety. 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.



EX1010, FIG. 3 (annotated).

668. 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 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 other drivers from glare. EX1010, 1:21-26.

669. Karlsson recognizes "light-sensitive sensors 9 and 23…precisely determin[e]…the *detected light 11*" and discloses identifying "oncoming traffic" and other objects (e.g., "road signs etc.") in the field of view. EX1010, 12:19-35, 3:19-31, FIGS. 3, 14-15; EX1010, 1:21-26, 2:2-4, 5:16-32, 9:3-33, 10:32-11:1, 11:7-28; EX1011-2:27-3:10 ("objects, such as pedestrians"). And Braun's

technique (software implementation), like Karlsson-Harbers, enhances driver visibility and safety—using pattern recognition. EX1009, 5:21-6:7, 11:14-17, 11:27-30, 12:17-20, 38:19-22. Braun's pattern recognition application identifies objects of interest (e.g., pedestrian, road-sign) and controller 118 adaptively controls luxels in illuminator 116 to illuminate the identified objects, improving visibility of the objects, thereby enhancing safety. EX1009, 14:21-30, 23:28-24:27, FIGS. 1, 5-6; EX1009, 22:19-23 ("identified *features and/or objects*"), 5:27-31 ("*road signs*"), 26:29-27:2 ("'*pattern recognize*' presence of *people*"), 26:31-27:1 ("*spotlight the people*").

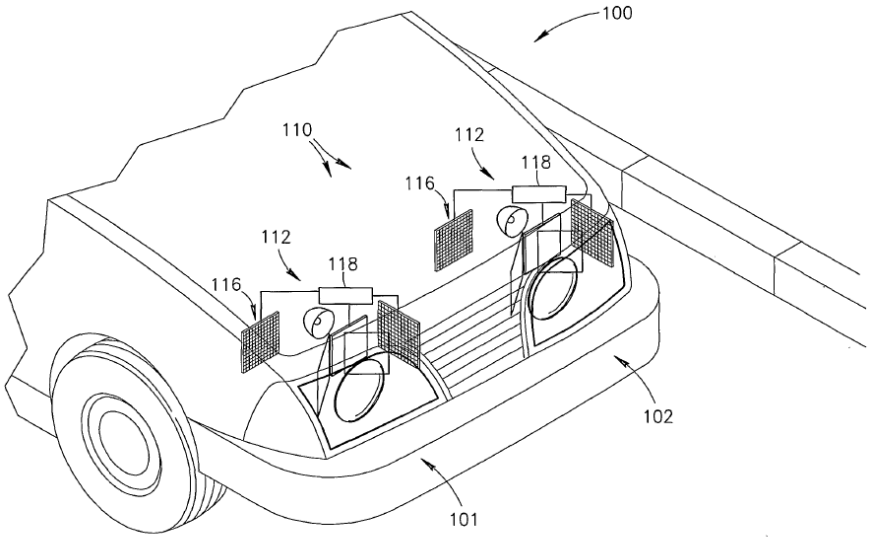


FIG.5

EX1009, FIG. 5.

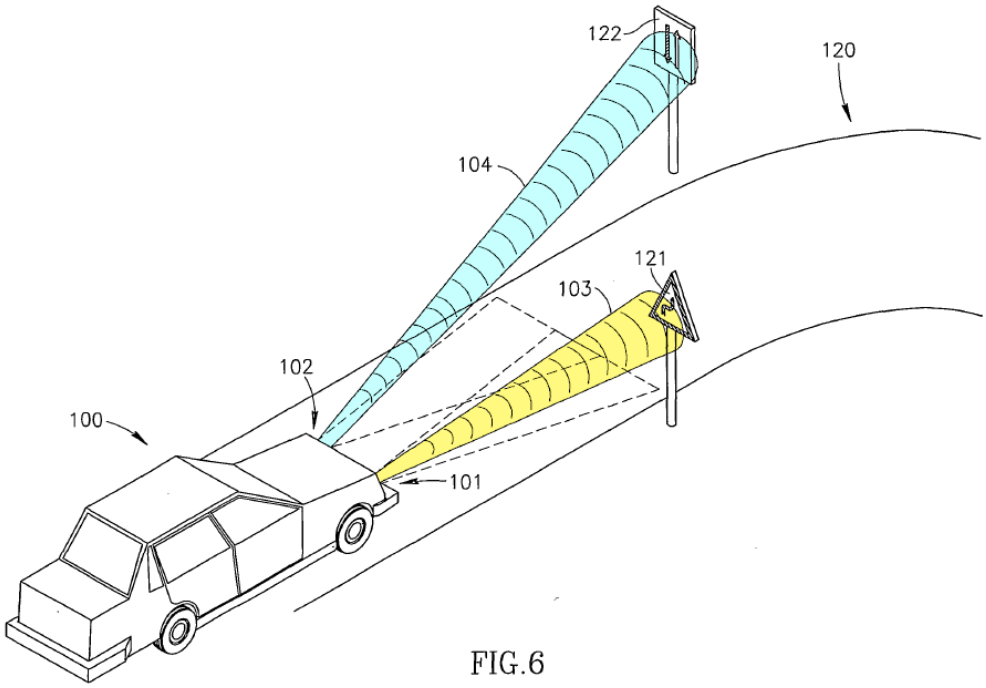


FIG.6

EX1009, FIG. 6 (annotated).

670. The additional control of having pattern recognition as in Braun, implemented with Karlsson-Harbers's controller/processor, would have enhanced Karlsson-Harbers's system by identifying and illuminating objects of interest, thereby improving safety. This would have merely been applying Braun's known technique (software implementation: pattern recognition to identify/illuminate objects of interest) to Karlsson-Harbers's similar, known device (dynamic headlamp system with controllable beams), in the same way. Braun's known technique is fully described along with its benefits (improved visibility, thereby increased safety); thus, a POSA would have readily applied it to similar systems, such as Karlsson-Harbers's, in the same way.

671. A POSA would have had a reasonable expectation of success combining Braun with Karlsson-Harbers, for example, by simply modifying software instructions stored in memory of Karlsson-Harbers's controller/processor (e.g., an algorithm) to adjust/direct light of the spotlight beams appropriately in view of Braun's pattern recognition. This would have been routine and well within a POSA's skill due to the similarities in Karlsson-Harbers's and Braun's adaptive systems—their common components were well known and there would have been no limitations for a POSA to make such modifications. EX1009, 22:17-25 ("a *pattern recognition* application…using *algorithms* and *methods known in the art*").

672. In view of the above, Karlsson-Harbers in combination with Braun renders obvious these claims.

673. Thus, Karlsson-Harbers in combination with Braun renders obvious claims 66-67 of the '503 patent.

XX. OBJECTIVE INDICIA DO NOT SUPPORT PATENTABILITY

674. 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.

675. 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.

676. 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.

XXI. 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 13th day of December 2022, in San Francisco, California.



Jianzhong Jiao, Ph.D.

Appendix A

Claim 26	Claim 65
[26.P] A method for generating a headlight beam in an adaptive headlight system that provides illumination to at least a portion of a field-of-view, comprising:	[65.P] identical to [26.P]
[26.1] utilizing one or more sensors of a vehicle including the adaptive headlight system to obtain and provide data	[65.1] utilizing one or more sensors of a first vehicle to obtain and provide data,
[26.2] predefined as relevant to a determination of illumination requirements for the field-of-view, the data including data indicative of at least one of one or more other vehicles or a pedestrian;	[65.2] the data including data indicating at least a second vehicle;
[26.3] determining illumination requirements for the field-of-view based on the data sensed by the sensors,	
[26.4] including determining illumination for at least a first subsection of the field-of-view including the other vehicle or pedestrian, as indicated by the sensor data, and	[65.3] determining illumination for at least a first subsection including the second vehicle and
[26.5] for at least a second subsection of the field-of-view not including the other vehicle or pedestrian;	[65.4] at least one or more second subsections, to either side of the first subsection,
[26.6] determining a control strategy for controlling one or more directional light clusters in a headlight assembly to create an output headlight beam meeting the determined illumination requirements,	

	[65.5] including determining an illumination level for the first subsection
	[65.6] that substantially illuminates the first subsection below a predefined illuminance, and
	[65.7] determining an illumination level for the one or more second subsections
[26.7] the headlight beam spatial light distribution shaped to provide high beam illumination for a driver of the vehicle, in at least the second subsection,	
	[65.8] that substantially illuminates the one or more second subsections above the predefined illuminance;
[26.8] while mitigating glaring light illuminating at least the first subsection including detected other vehicles or pedestrians;	
[26.9] sending control signals implementing the control strategy to an electronic control circuitry configured to operate the light-clusters; and	
	[65.9] determining control instructions for controlling one or more directional light sources included in the adaptive headlight system to achieve the determined illumination levels for at least the first and one or more second subsections; and

[26.10] controlling the light clusters via the electronic control circuitry to collectively emit the headlight beam meeting the determined illumination requirements.	[65.10] controlling the light sources to emit the headlight beam in accordance with the control instructions.

EX1001, 98:43-99:6, 102:62-103:17 (numbering and spacing added).

Appendix B

Claim listing:

Claim:	Element:	Claim Language:
Claim 26	[26.P]	A method for generating a headlight beam in an adaptive headlight system that provides illumination to at least a portion of a field-of-view, comprising:
	[26.1]	utilizing one or more sensors of a vehicle including the adaptive headlight system to obtain and provide data
	[26.2]	predefined as relevant to a determination of illumination requirements for the field-of-view, the data including data indicative of at least one of one or more other vehicles or a pedestrian;
	[26.3]	determining illumination requirements for the field-of-view based on the data sensed by the sensors,
	[26.4]	including determining illumination for at least a first subsection of the field-of-view including the other vehicle or pedestrian, as indicated by the sensor data, and
	[26.5]	for at least a second subsection of the field-of-view not including the other vehicle or pedestrian;
	[26.6]	determining a control strategy for controlling one or more directional light clusters in a headlight assembly to create an output headlight beam meeting the determined illumination requirements,
	[26.7]	the headlight beam spatial light distribution shaped to provide high beam illumination for a driver of the vehicle, in at least the second subsection,
	[26.8]	while mitigating glaring light illuminating at least the first subsection including detected other vehicles or pedestrians;

	[26.9]	sending control signals implementing the control strategy to an electronic control circuitry configured to operate the light-clusters; and
	[26.10]	controlling the light clusters via the electronic control circuitry to collectively emit the headlight beam meeting the determined illumination requirements.
Claim 27	-	The method of claim 26, wherein the determining illumination requirements further comprises: determining the illumination requirements based on headlight modes comprising one or more of parking lights, low beam, high beam, cornering lights, load leveling adjustment, integral turn signal indicators, inputtable alternate beam pattern selection, and specified preferential headlight illumination color of the driver.
Claim 28	-	The method of claim 26, wherein the illumination requirements accommodate peripheral night vision of the driver, by defining bluish headlamp illumination along a side of a road, while defining yellow tinted illumination along the road.
Claim 29	-	The method of claim 26, wherein the illumination requirements accommodate sensed fog or snow environmental conditions by defining a shift of at least a portion of the headlight beam towards yellow.
Claim 30	-	The method of claim 26, wherein the control strategy dynamically adapts the headlight beam based on real-time changes to the data sensed by the sensors indicating a change to at least one of beings, objects and preceding vehicles ahead of the first vehicle.
Claim 31	-	The method of claim 26, further comprising receiving input to an override switch and, responsive to the input, adjusting automatic operation of the headlight system to reflect operator instruction as indicated by the input to the override switch or by

		further input to a different vehicle input other than the override switch.
Claim 32	-	The method of claim 26, wherein the determining illumination requirements further includes determining illumination for an upcoming curve indicated by the sensor data, wherein the determining the control strategy further comprises determining the control strategy for controlling the directional light clusters to create an output headlight beam that illuminates around the curve.
Claim 33	-	The method of claim 32, wherein the determining illumination requirements further includes determining illumination for an upcoming turn indicated by the sensor data, wherein the determining the control strategy further comprises determining the control strategy for controlling the directional light clusters to create an output headlight beam that illuminates the turn.
Claim 34	-	The method of claim 32, wherein the determining illumination further includes determining illumination the increases illumination of an upcoming turn indicated by the sensor data, wherein the determining the control instructions further comprises determining the control instructions for controlling one or more of the directional light sources to achieve illumination of the turn.
Claim 35	-	The method of claim 26, wherein the determining illumination requirements further includes determining illumination for an upcoming turn indicated by the sensor data, wherein the determining the control strategy further comprises determining the control strategy for controlling the directional light clusters to create an output headlight beam that illuminates the turn.
Claim 36	-	The method of claim 26, wherein the determining illumination further includes determining

		illumination the increases illumination of an upcoming turn indicated by the sensor data, wherein the determining the control instructions further comprises determining the control instructions for controlling one or more of the directional light sources to achieve illumination of the turn.
Claim 65	[65.P]	A method for generating a headlight beam in an adaptive headlight system that provides illumination to at least a portion of a field-of-view, comprising:
	[65.1]	utilizing one or more sensors of a first vehicle to obtain and provide data,
	[65.2]	the data including data indicating at least a second vehicle;
	[65.3]	determining illumination for at least a first subsection including the second vehicle and
	[65.4]	at least one or more second subsections, to either side of the first subsection,
	[65.5]	including determining an illumination level for the first subsection
	[65.6]	that substantially illuminates the first subsection below a predefined illuminance, and
	[65.7]	determining an illumination level for the one or more second subsections
	[65.8]	that substantially illuminates the one or more second subsections above the predefined illuminance;
	[65.9]	determining control instructions for controlling one or more directional light sources included in the adaptive headlight system to achieve the determined illumination levels for at least the first and one or more second subsections; and

	[65.10]	controlling the light sources to emit the headlight beam in accordance with the control instructions.
Claim 66	-	The method of claim 65, wherein the data includes data indicating a pedestrian and wherein the determining illumination includes determining an illumination level, for at least a third subsection including the pedestrian.
Claim 67	-	The method of claim 65, wherein the data includes data indicating a road-sign wherein the determining illumination includes determining an illumination level, for at least a third subsection including the road-sign.
Claim 68	-	The method of claim 65, wherein the determining illumination further includes determining a yellowish illumination color for illumination illuminating a road within the field-of-view and a blueish illumination color for illumination illuminating areas off-road within the field-of-view.
Claim 69	-	The method of claim 65, wherein the data includes data indicating fog or snow environmental conditions and the determining illumination includes determining a shift of at least a portion of the light output from the headlight system towards yellow.
Claim 70	-	The method of claim 65, wherein the determining illumination further includes determining illumination that increases illumination of an upcoming curve indicated by the data, wherein the determining the control instructions further comprises determining the control instructions for controlling one or more of the directional light sources to achieve illumination around the curve.