DOCKET NO.: TOR029
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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

UNIFIED PATENTS, LLC
Petitioner

v.

TORCHLIGHT TECHNOLOGIES LLC
Patent Owner

IPR2022-01500

PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT 11,208,029

TABLE OF CONTENTS

I. MANDATORY NOTICES

A. Real Party-in-Interest

Pursuant to 37 C.F.R. § 42.8(b)(1), Unified Patents, LLC ("Unified" or "Petitioner") certifies that Unified is the real party-in-interest and certifies that no other party exercised control or could exercise control over Unified's participation in this proceeding, filing this petition, or conduct in any ensuing trial. In view of *Worlds Inc. v. Bungie, Inc.*, 903 F.3d 1237, 1242-44 (Fed. Cir. 2018), Unified has submitted voluntary discovery to support its certification. *See* EX1014 (Declaration of Kevin Jakel).

B. Related Matters

To the best of Petitioner's knowledge according to public records, U.S. Patent 11,208,029 ("the '029 patent" (EX1001)) is owned by Torchlight Technologies LLC ("Patent Owner" or "PO").

As of the filing date of this petition, to the best of Petitioner's knowledge according to public records, the '029 patent is or has been involved in the litigation(s) listed below, of which Petitioner is not involved. *See* EX1015 (Docket Sheets).

	Case Caption	Number
1.	*Torchlight Technologies LLC v. Daimler AG et al.* (D.Del.)	1:22-cv-00751
2.	*Torchlight Technologies LLC v. General Motors LLC et al.* (D.Del.)	1:22-cv-00752

As of the filing date of this petition, to the best of Petitioner's knowledge according to public records, the '029 patent has not been involved in any post-grant proceedings. U.S. Patent 9,955,551, which is related to the '029 patent, has been involved in the post-grant proceedings listed below.

	Case Caption
1.	U.S. Reissue Application 16/858,342 (Reissue of U.S. Patent 9,955,551, pending (prosecution suspended))
2.	*Ex Parte* Reexamination 90/014,815 (Reexamination of U.S. Patent 9,955,551, pending)

As of the filing date of this petition, to the best of Petitioner's knowledge according to public records, the following patent application(s) or patent(s) claim, or may claim, the benefit of the priority of the filing date of the '029 patent.

	Patent Application(s) or Patent(s)
1.	U.S. Patent Application 17/563,897 (pending)

As of the filing date of this petition, to the best of Petitioner's knowledge according to public records, the following patent application(s) or patent(s) are related to the '029 patent.

	Patent Application(s) or Patent(s)
1.	U.S. Patent Application 17/563,897 (pending)
2.	U.S. Patent Application 15/961,861 (U.S. Patent 10,894,503)
3.	U.S. Patent Application 13/357,549 (U.S. Patent 9,955,551)
4.	U.S. Reissue Application 16/858,342 (Reissue of U.S. Patent 9,955,551, pending (prosecution suspended))
5.	*Ex Parte* Reexamination 90/014,815 (Reexamination of U.S. Patent 9,955,551, pending)
6.	U.S. Provisional Patent Application 61/535,981 (expired)
7.	U.S. Patent Application 10/604,360 (U.S. Patent 8,100,552)
8.	U.S. Provisional Patent Application 60/395,308 (expired)

C. Counsel

Ellyar Y. Barazesh (Reg. No. 74,096) is lead counsel; David C. Seastrunk (Reg. No. 73,723) is back-up counsel.

D. Service Information

Unified consents to electronic service at ellyar@unifiedpatents.com and david@unifiedpatents.com. Petitioner can be reached at Unified Patents, LLC, 4445 Willard Ave, Suite 600, Chevy Chase, MD 20815; Tel: (925) 434-8754.

II. CERTIFICATION OF GROUNDS FOR STANDING

Petitioner certifies pursuant to Rule 42.104(a) that the patent for which review is sought is available for *inter partes* review and Petitioner is not barred or estopped from requesting *inter partes* review challenging the patent claims on the grounds identified herein.

III. OVERVIEW OF CHALLENGE AND RELIEF REQUESTED

Pursuant to Rules 42.22(a)(1) and 42.104(b)(1)–(2), Petitioner challenges claims 1, 2, 10-13, 23, and 24 ("Challenged Claims") of the '029 patent based on the specific grounds identified below.

A. Prior Art Patents and Printed Publications

The following references were each filed and/or published before July 12, 2002,[1] the '029 patent's earliest claimed priority date, and are each prior art under at least 35 U.S.C. §§ 102(a), 102(b), and/or 102(e).[2]

1. U.S. Patent 5,588,733, filed June 7, 1995, published Dec. 31, 1996 ("Gotou") (EX1003).

2. U.S. Patent 6,406,172, filed June 22, 2000, published June 18, 2002 ("Harbers") (EX1004).

3. German Patent DE19923187C2, published May 3, 2001 ("Heinz") (EX1006).[3]

Gotou and Heinz are not cited by the '029 patent. Harbers is cited but was not applied to the patent's claims during prosecution or otherwise analyzed.

[1] The Challenged Claims are not entitled to this priority date. Section IV.B, *infra*.

[2] Since the '029 patent claims priority to applications filed before enactment of the America Invents Act ("AIA"), pre-AIA statutory framework applies.

[3] EX1006 is the certified translation of DE19923187C2. EX1007 is the original German-language version. EX1008 is the translator's declaration.

B. Grounds for Challenge

Ground 1: Claims 1, 2, 12, 13, 23, and 24 are unpatentable under 35 U.S.C. § 103(a) over Gotou in view of Harbers.

Ground 2: Claims 1, 2, 10-13, 23, and 24 are obvious under 35 U.S.C. § 103(a) over Heinz in view of Gotou.

Ground 3: Claims 1, 2, 10-13, 23, and 24 are obvious under 35 U.S.C. § 103(a) over Heinz in view of Gotou and Harbers.

This Petition, supported by Mr. A. Brent York's declaration (EX1002), demonstrates a reasonable likelihood Petitioner will prevail with respect to cancellation of at least one challenged claim. 35 U.S.C. § 314(a). Petitioner respectfully requests institution on all the challenged grounds. *SAS Institute Inc. v. Iancu*, 138 S. Ct. 1348 (2018).

IV. U.S. PATENT 11,208,029

A. Summary

The '029 patent's alleged invention provides a "Digital Lighting Fixture" or DLF that allows "control of individual lighting element 'digits' to provide the 'correct lighting solution for the situation at hand.'" EX1001, 1:26-28, 2:66-3:5, 11:8-13, 17:7-27, 18:29-40, 19:20-34. Figure 15 is specific to a "digital automotive headlamp" 270 of vehicle 271. *Id.*, 52:12-13, 53:24-39.

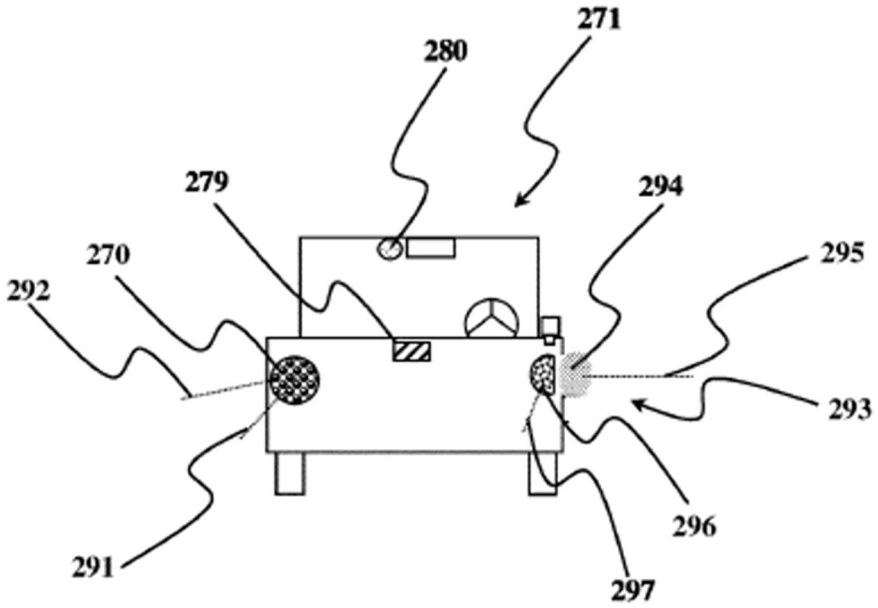
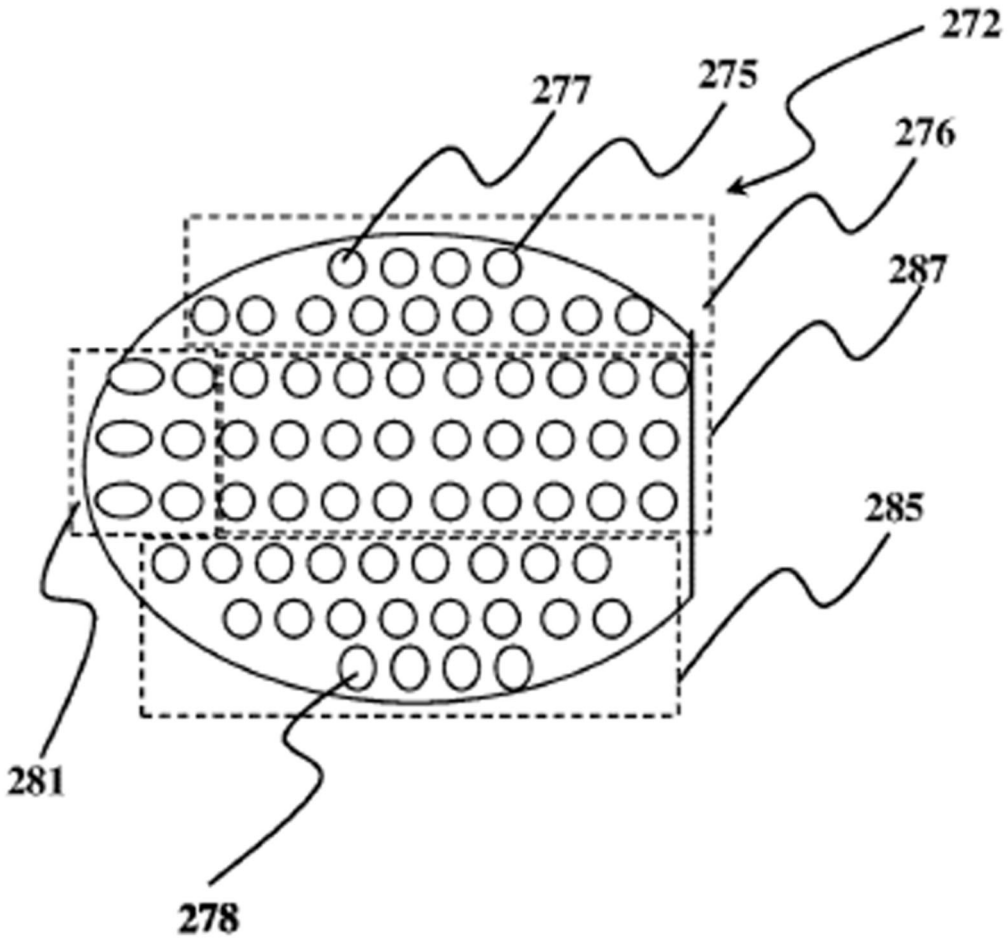


FIG. 15

EX1001, Fig. 15 (in part)

Headlamp 270 includes light emitting diodes (LEDs) 275 and 277 within a cluster 276. *Id.*, 16:59, 19:25, 53:24-39. LED clusters 281, 285, and 287 are also present. *Id.*, 53:39-45.



EX1001, Fig. 15 (in part)

In one example, "cluster 281 would be used to illuminate around a corner," and the patent explains "[a] GPS system on the car may also let the headlamps system know of curves up ahead" such that "the headlamp may be operated in the optimal mode at that instantaneous location." EX1001, 51:63-67, 54:8-15.

B. The ’029 Patent’s Claims are Not Entitled to the Earliest Claimed Priority Date

The ’029 patent claims priority via continuation and continuation-in-part applications to provisional application 60/395,308 filed July 12, 2002 (EX1012, “’308 provisional”). EX1001, 1:6-22, (63) (60). All prior art cited herein was published and/or filed before this date. Section III, *supra*. But to the extent PO relies on the July 12, 2002 date as part of an argument to swear behind the relevant dates of prior art cited herein, this priority date should not be afforded as the ’308 provisional does not provide written description or enablement support for the ’029 patent’s claims.[4]

The below chart shows the alleged priority chain for the ’029 patent.

[4] PO would be required to present evidence showing each application in the priority chain provides written support for the Challenged Claims under 35 U.S.C. § 112 ¶1. *Hollmer v. Harari*, 681 F.3d 1351 (Fed. Cir. 2012); *Dynamic Drinkware LLC v. National Graphics, Inc.*, 800 F.3d 1375, 1378-79 (Fed. Cir. 2015).

U.S. Patent 11,208,029

Filed January 19, 2021

continuation of

U.S. Patent 10,894,503

Filed April 24, 2018

continuation of

U.S. Patent 9,955,551

Filed January 24, 2012

claims priority to

U.S. Provisional Patent Application 61/535,981

Filed September 17, 2011

continuation-in-part of

U.S. Patent 8,100,552

Filed July 14, 2003[5]

claims priority to

U.S. Provisional Patent Application 60/395,308

Filed July 12, 2002

[5] July 12, 2003 (one year from provisional filing date of July 12, 2002) fell on a Saturday.

The earliest parent application is the ’308 provisional. During prosecution of the ’029 patent, the applicant recognized the ’029 patent’s claims did not have priority to the ’308 provisional. There, the applicant swore behind prior art references, but did not identify any portions of the ’308 provisional that supported the claims. EX1011, 390. Instead, the applicant alleged support from the disclosure of U.S. Patent 8,100,552 (application 10/604,360), filed July 14, 2003, and never asserted that the claims were entitled to the ’308 provisional’s July 12, 2002 filing date. *Id*. An examination of the record confirms the ’029 patent’s claims are not supported by the ’308 provisional.

Several figures of the ’029 patent (e.g., figures 15 and 16, relating to a headlamp) are missing from the ’308 provisional. *Compare* EX1012, 21-27 (showing only Figures 1-10) *with* EX1001, Figures 1-33; 15:60-65. Moreover, the ’308 provisional makes no mention of a “system, for a motor vehicle,” “a plurality of headlamps, each comprising a plurality of LED light sources” to “receive first data, including at least map data, indicating a road curvature upcoming along a road on which the motor vehicle is traveling,” to “determine a light change, the change adapting a light pattern of the headlamps in at least one of color, intensity or spatial distribution to increase light in a direction of the road curvature ahead of the motor vehicle and shaping light based at least in part on the road curvature,” or to “control at least a first plurality of the LED light sources to provide light based at least in part

on the determined light change and prior to the motor vehicle reaching the road curvature," which are required elements of the '029 patent's independent claims. *See generally* EX1012; EX1001, claims 1, 12, 23. All disclosure from the '029 patent relating to headlamps or headlights is missing from the '308 provisional. *Compare, e.g.,* EX1001, 50:49-57:49 *with* EX1012, 2-20.

Given these omissions, the '029 patent's claims do not have priority to the '308 provisional. *Lockwood v. American Airlines, Inc.*, 107 F.3d 1565, 1571-72 (Fed. Cir. 1997). Even if the '308 provisional did disclose similar concepts to those claimed by the '029 patent, it does not disclose how a POSITA could have used the allegedly similar concepts to generate those claimed concepts. *New Railhead Mfg., L.L.C. v. Vermeer Mfg. Co.*, 298 F.3d 1290, 1294 (Fed. Cir. 2002); EX1002, ¶¶42-44.

Therefore, the '029 patent's claims, including the Challenged Claims, should not be afforded the '308 provisional's July 12, 2002 filing date. Petitioner does not address whether the priority claim to later applications is proper but reserves the right to do so.

C. File History

The examiner issued a non-final office action that rejected originally filed claims 1-5, 12-16, and 23-27 as obvious and indicated originally filed claims 6-11, 17-22, and 28-33 included allowable subject matter. EX1011, 190, 195. In response,

the applicant asserted the applied references did not qualify as prior art because the claims were "entitled to at least the 2003 priority date" of July 14, 2003 and none of the prior art's relevant dates "precede" this priority date. *Id.*, 390. The examiner then issued a notice of allowance, stating the following limitations "in combination with the remaining claimed limitations" of independent claim 1 (and similarly for independent claims 12 and 23) were not "disclose[d] or fairly suggest[ed]" by the prior art of record:

> "the one or more processors receive first data, including at least map data, indicating a road curvature upcoming along a road on which the motor vehicle is traveling;"
>
> "determine a light change, the change adapting a light pattern of the headlamps in at least one of color, intensity or spatial distribution to increase light in a direction of the road curvature ahead of the motor vehicle and shaping light based at least in part on the road curvature;" and
>
> "control at least a first plurality of the LED light sources to provide light based at least in part on the determined light change and prior to the motor vehicle reaching the road curvature."

Id., 400.

D. Level of Ordinary Skill in the Art

A POSITA as of the earliest claimed priority date of the '029 patent would have had at least a bachelor's degree in physics, engineering physics, mechanical engineering, electrical engineering, or a related field, and at least two years of work experience in transportation lighting. More education can supplement practical experience and vice-versa. EX1002, ¶¶32-35.

V. CLAIM CONSTRUCTION

No terms of the '029 patent warrant construction beyond their ordinary and customary meaning. EX1002, ¶¶37-38. If Patent Owner, seeking to avoid the prior art, offers a specific construction or interpretation, Petitioner reserves the right to respond.

VI. GROUNDS OF UNPATENTABILITY

Pursuant to Rule 42.104(b)(4)–(5), the following sections detail the grounds of unpatentability, limitations of the Challenged Claims, and how these claims are obvious in view of the prior art.

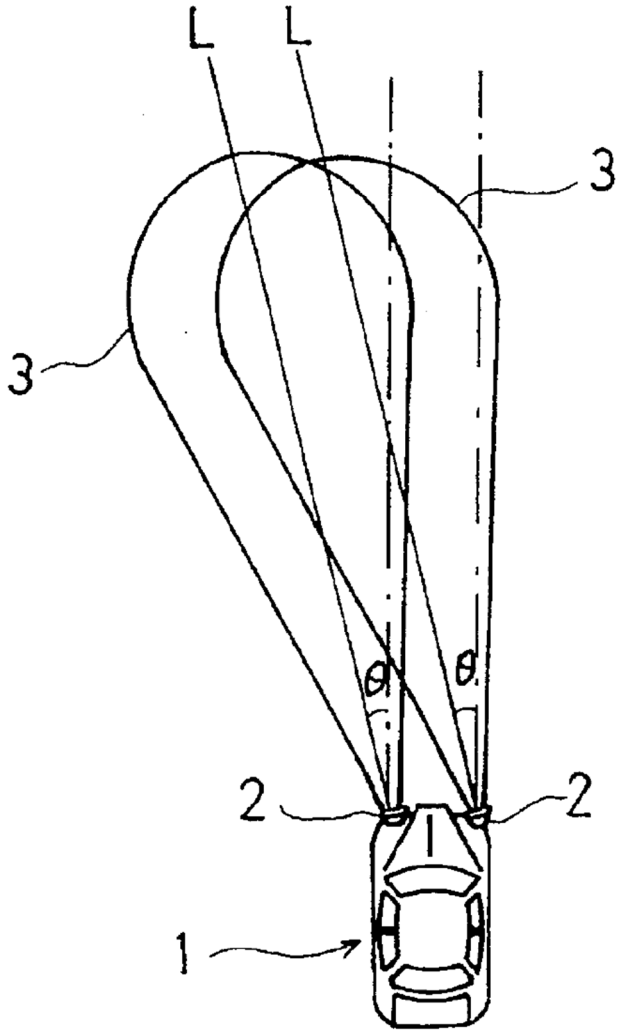
A. Ground 1: Claims 1, 2, 12, 13, 23, and 24 are unpatentable under 35 U.S.C. § 103(a) over Gotou in view of Harbers

1. Overview of Gotou

Gotou discloses a "head lamp device for a vehicle," and specifically, "controlling of a lighting region of the head lamp in a horizontal direction." EX1003,

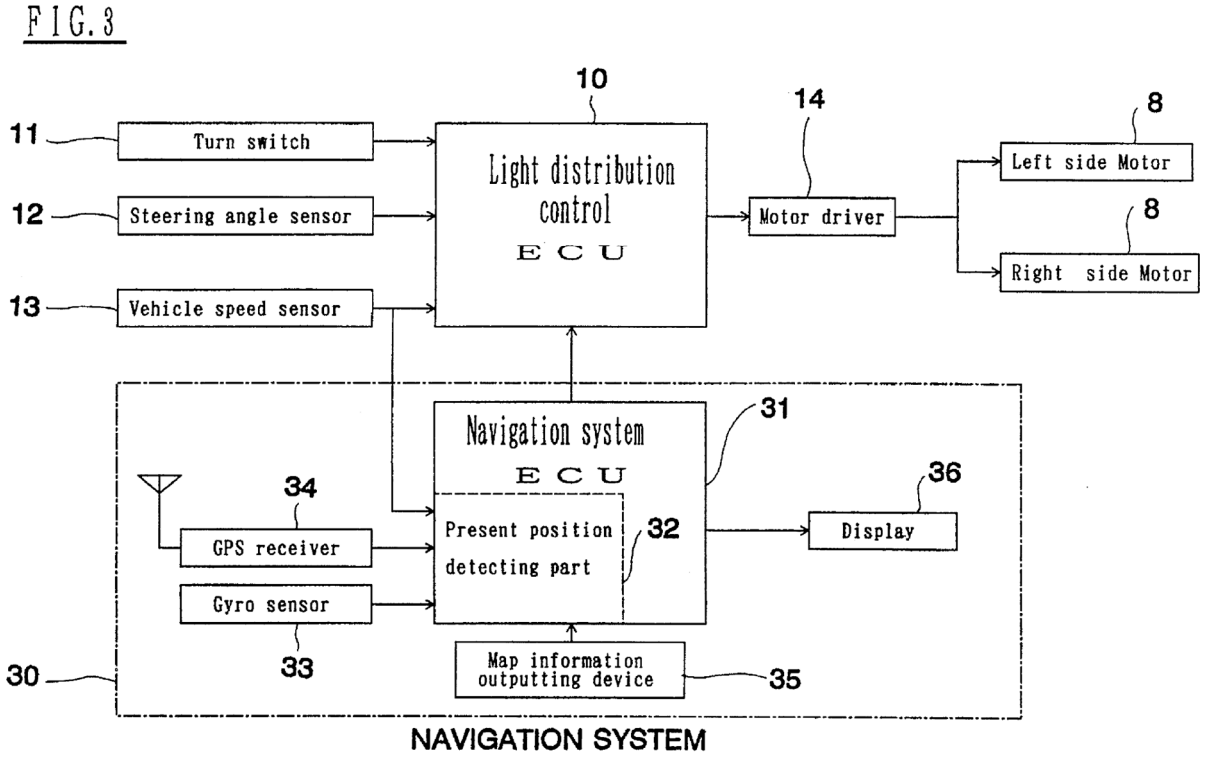
1:5-9. A vehicle 1 has right and left head lights 2 that output "lighting regions 3" and light "the space in front of the vehicle." *Id.*, 3:24-35, Fig. 1.

FIG. 1



EX1003, Fig. 1

Vehicle 1 includes a "light distributing control ECU 10" and a "navigation system 30." EX1003, 3:45-52.



EX1003, Fig. 3

"ECU 10 gets map information and information of a proper vehicle position from the navigation system 30," where the map information indicates "directions of the curves" and "degrees of sharpness of curves" on a road travelled by the vehicle. *Id.*, 3:52-62, 4:15-26, 4:36-40, 6:28-34. ECU 10 processes this information "to determine a requisite optical axis theta, and an indicating signal is outputted to a motor driver 14" to control the left and right headlights "so as to achieve the optical axis angle theta." *Id.*, 3:62-67; *id.*, 3:31-35, Fig. 4. For example, when the vehicle

approaches a curve, Gotou describes that this control "is started when the vehicle reaches the predetermined distance S before the curve entrance and the light distribution is deflected [] at a proper timing before the curve, resulting in that a superior visibility can be attained." *Id.*, 7:31-43.

Gotou is analogous art to the '029 patent, from the same field of endeavor as the patent (lighting systems, such as vehicle headlight systems) and reasonably pertinent to the particular problem the patent was trying to solve (how to control light output by vehicle headlights). EX1001, 11:8-13, 51:63-67, 52:12-16, 53:24-30, 54:8-15, Fig. 15; EX1003, Abstract, 1:5-9, 1:52-56, 1:60-63, 3:22-67, Figs. 1-3; EX1002, ¶46.

2. Overview of Harbers

Harbers discloses "a vehicle headlamp comprising a light source which includes a plurality of opto-electronic elements." EX1004, 1:11-13. Harbers describes a vehicle 1 having headlamps 2 and 3, where headlamp 2 includes a light source 4 and headlamp 3 includes a light source 5. *Id.*, 5:32-38, Figs. 1A, 1B.

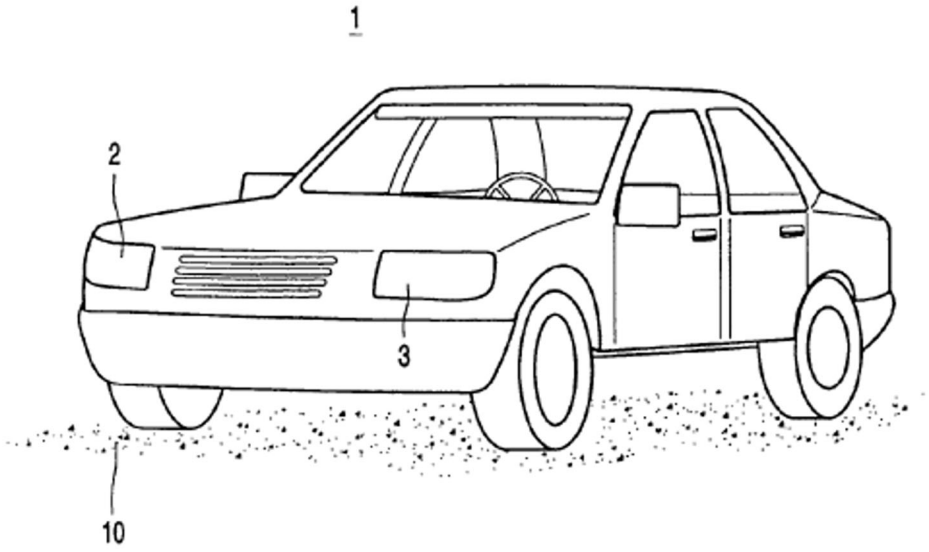


FIG. 1A

EX1004, Fig. 1A

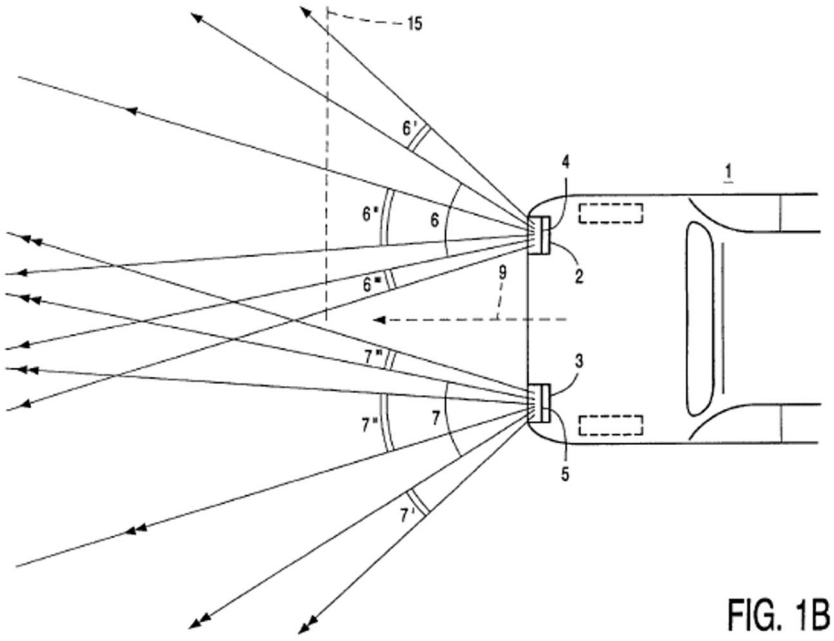


FIG. 1B

EX1004, Fig. 1B

As shown in Figure 1B, light source 4 of headlight 2 emits light beams 6, 6', 6'' and 6''', and light source 5 of headlight 3 emits light beams 7, 7',7'', and 7'''. *Id.*, 5:38-65, Fig. 1B.

Light sources 4 and 5 each comprise "a plurality of opto-electronic elements 11; 12; 13; 14 which are arranged in accordance with a regular pattern" as shown by Figure 2. EX1004, 6:7-11, Fig. 2. The opto-electronic elements 11, 12, 13, and 14 are light-emitting diodes (LEDs). *Id.*, 1:52-56, 6:41-45.

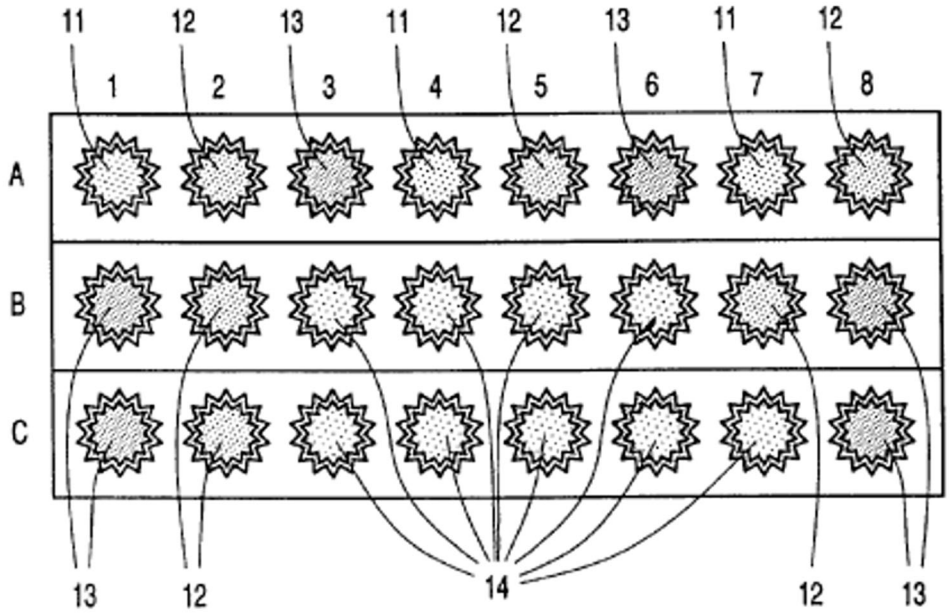


FIG. 2

EX1004, Fig. 2

The light beams output by each light source 4 and 5 have "continuously adjustable spatial distribution" provided by "switching on or off one or more opto-electronic

elements" (LEDs). *Id.*, 3:24-42, 5:44-65, 6:58-67, 7:20-22, 2:9-12, 2:23-52. The control of these LEDs, switching them on and off, is provided on an individual basis to each LED, where each LED is individually and/or separately controlled. *See, e.g.*, *Id.*, 9:54-55 (claims 13 and 18), 10:49-50 (, 3:24-27, 3:38-42, 6:64-67, 7:20-22; EX1002, ¶¶86-92.

Harbers is analogous art to the '029 patent, from the same field of endeavor as the patent (lighting systems, such as vehicle headlight systems) and reasonably pertinent to the particular problem the patent was trying to solve (how to control light output by vehicle headlights). EX1001, 11:8-13, 51:63-67, 52:12-16, 53:24-30, 54:8-15, Fig. 15; EX1004, Abstract, 5:32-65, 6:58-67, 7:12-49, Figs. 3A, 3B; EX1002, ¶47.

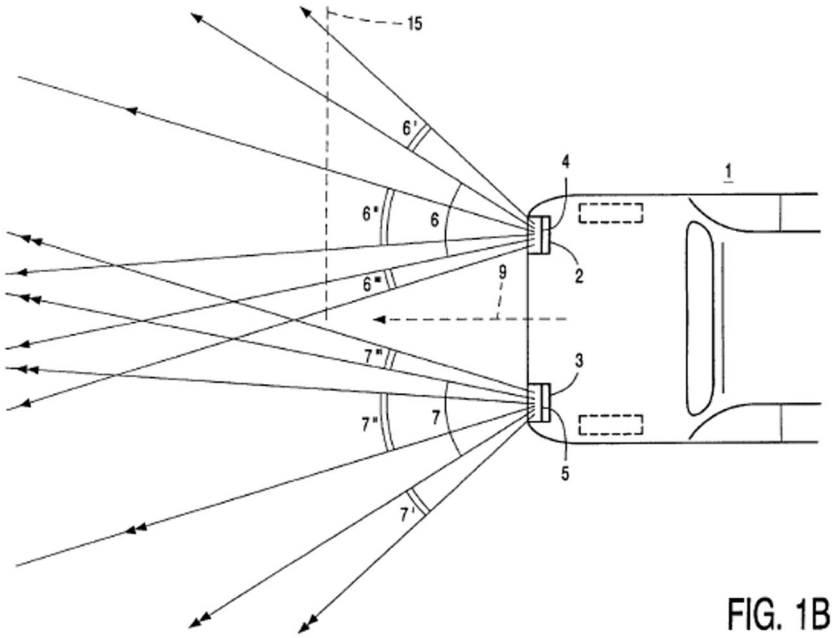
3. Motivation to Combine Gotou and Harbers

Gotou describes a vehicle headlight control system that considers information about a vehicle's approaching road path, such as the degree and direction of an approaching curve, and implements headlight control accordingly to better illuminate the vehicle's surroundings and provide superior driver visibility. *Supra*, Section VI.A.1. Similarly, Harbers teaches use of light emitting diodes (LEDs) in vehicle headlights, where individual LEDs are selectively controlled to provide "more dynamic lighting possibilities" and the "continuously adjustable spatial distribution" of light. *Supra*, Section VI.A.2; EX1004, 2:23-49; EX1002, ¶¶53-58.

Gotou does not explicitly describe headlights having LEDs or the control of LEDs. However, a POSITA would have been motivated to combine Gotou and Harbers such that Gotou's right and left headlights 2 each include a light source (e.g., Harber's light source 4; 5) having an array of LEDs 11, 12, 13, and 14 as taught by Harbers, and Gotou's modified system would provide selective LED control as taught by Harbers to continuously adjust the spatial distribution of output light. EX1002, ¶59. The combination would have enhanced how Gotou illuminates the surroundings of a vehicle, providing Gotou's headlights with Harbers' LEDs to provide "more dynamic lighting possibilities." EX1004, 1:43-45, 2:6-9; EX1003, 3:24-35, Fig. 1; EX1002, ¶59.

Combined, Gotou's ECU would have sent control signals (referred to as "indicating signals" by Gotou) that, as modified by Harbers, individually and/or separately control each of Harbers' LEDs 11, 12, 13, and 14, selectively turning on or off LEDs or adjusting the luminous flux of LEDs, to direct how the optical axes of headlights 2 change (i.e., how light output by headlights 2 changes). EX1002, ¶59. Indeed, Gotou's system already provides controlling headlights using an ECU that outputs indicating signals to headlights to adjust their optical axis and allows "adjustment of the lighting region is properly carried out and a superior visibility is attained" (*See, e.g.*, EX1003, 1:53-57, 2:19-26, 7:28-43), and Harbers—applicable to Gotou in that it is similarly directed to controlling light output by headlights—

explains controlling LEDs in headlights provides such "more dynamic lighting possibilities," and that its system provides the "continuously adjustable spatial distribution" of light beams output by headlights to "improve[]" a "driver's view of the road and the surroundings of the vehicle" (EX1004, 2:23-49). EX1002, ¶59. Indeed, Harbers describes its LEDs providing, for example light beams 6, 6', 6'' and 6''', and light beams 7, 7',7'', and 7''' as shown by Figure 1B. *Id.*; EX1004, 5:38-65, Fig. 1B.

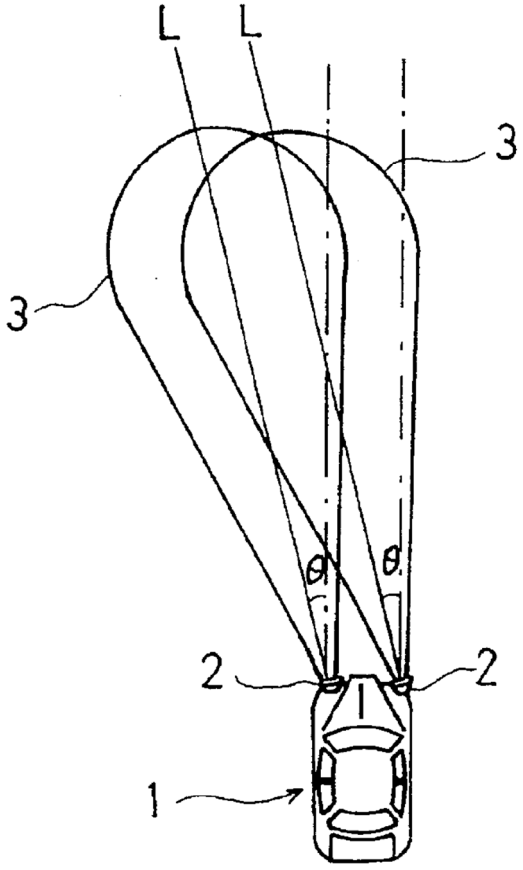


EX1004, Fig. 1B

Thus, enhancing Gotou with Harbers' teachings would have improved the efficacy of Gotou's system, providing improved lighting by right and left headlights 2, and

in turn, improvements to the driver's view of surroundings, furthering Gotou's goals of "superior visibility." *Id.*

FIG. 1



EX1003, Fig. 1

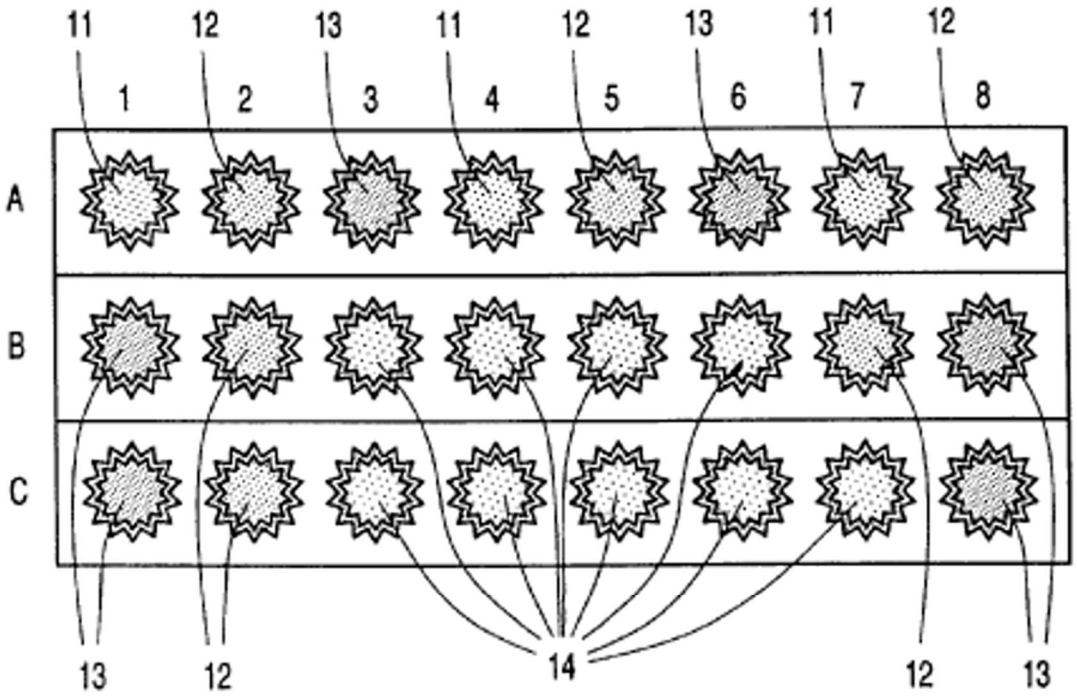


FIG. 2

EX1004, Fig. 2

A POSITA would have combined Gotou and Harbers as above using known hardware and software techniques associated with headlight systems, where Gotou's right and left headlights 2 would have each been adjusted to use Harbers' light source having an array of LEDs 11, 12, 13, and 14 and Gotou's ECU would have been enhanced to provide headlight control as taught by Harbers, where the ECU's control signals ("indicating signals") would have controlled LEDs as taught by Harbers. EX1002, ¶60. Indeed, a POSITA would have readily adjusted Gotou's ECU 10 such

that its control signals ("indicating signals") provide Harbers' LED control, at least because ECU 10 already provides headlight control, and therefore, only routine, known circuitry and/or programming changes would have been necessary to adjust ECU 10 such that its control signals implement Harbers' LED control. EX1002, ¶60. Separate or combined, the Gotou and Harbers systems (including the combined elements, e.g., Gotou's system including headlights 2 and its light distribution control system having ECU 10; Harbers' system including LEDs 11, 12, 13, and 14 and associated control) would have both performed the same function of providing adjustable lighting to a vehicle's surroundings. *Id.*

The combination would have further been predictable, straightforward, and routine for a POSITA, and a POSITA would have recognized as much. EX1002, ¶61. In a physical sense, this is so because Harbers explains that its "dimensions of a vehicle headlamp" comprising LEDs is "comparable to" or "much smaller than" the "dimensions of a conventional vehicle headlamp" (i.e., the headlights of Gotou). EX1004, 2:61-3:10, 6:54-57; EX1003, 3:22-30. This means that a POSITA would have easily enhanced Gotou's headlights with Harber's LEDs as sizing would not have been a constraint. EX1002, ¶61. Additionally, Gotou already explains that it uses an ECU to control right and left headlights 2 by having it send an "indicating signal" (determined based on information including an upcoming road curve) to a driving motor that causes the optical axis of headlights 2 to change. EX1003, 3:62-

67. Combined, Gotou's ECU would still send control signals that direct how the optical axis of headlights 2 change, but its signals would have been modified as taught by Harbers such that they are sent to the array of LEDs 11, 12, 13, and 14 in each headlight and selectively control these LEDs, as taught by Harbers. EX1002, ¶61. Thus, the results of the combination would have been predictable: Gotou's headlights using light sources having an array of LEDs and implementing selective control of the LEDs to output light having a "continuously adjustable spatial distribution" to a vehicle's surroundings as taught by Harbers. *Id.*

And a POSITA would have had a reasonable expectation of success in making this combination for the same reasons discussed above, and also due to the similarities of both references, where both references are at least directed to vehicle headlight control and discuss providing improved visibility for vehicle drivers, including adaptable forward lighting visibility. EX1003, 2:19-26; EX1004, 2:34-39 6:41-67, 7:23-49; EX1002, ¶61.

Further, POSITAs understood that use of mechanically movable headlights, as in Gotou's system, was a known disadvantage in adaptive headlight systems, and would have been a motivation for a POSITA to look to the similar system of Harbers that overcomes this disadvantage. EX1002, ¶62. This POSITA understanding is corroborated by Heinz, which explains a "not insignificant complexity in terms of design and manufacturing technology arises due to the movable arrangement of

individual components" in adaptive headlight systems, where "with lighting devices of this type, malfunctions occur relatively frequently during operation." EX1006, 2:5-10. Weidel further corroborates this understanding, explaining that such mechanically moveable systems have mechanisms that are "frequently expensive and liable to fail." EX1005, ¶0008. Thus, a POSITA would have been further motivated to combine Gotou and Harbers in the manner discussed above because it would have alleviated the need to rely on mechanically moving parts to control the optical axes of Gotou's right and left headlights 2, and instead provided an LED headlight system that changes the optical axes of headlights by selectively controlling (e.g., switching on or off or adjusting luminous flux) particular LEDs, as taught by Harbers. EX1002, ¶62. A POSITA would have further understood that this combination would have been advantageous because LEDs have a longer service life than the lighting components used in conventional headlights (i.e., those of Gotou). *Id.*; EX1004, 3:7-10.

This analysis therefore demonstrates at least the following motivations to combine, resulting in the Gotou-Harbers combination or combined system:

- Combining prior art elements (Gotou's headlight system including right and left headlights 2 and ECU 10; Harbers' headlight system that uses light sources having an array of LEDs 11, 12, 13, and 14 in headlights and implements selective control of those LEDs) according to known methods (known hardware

and software techniques associated with headlight adjustment) to yield predictable results (Gotou's headlights using light sources having an array of LEDs and implementing selective control of the LEDs to output light having a "continuously adjustable spatial distribution" to a vehicle's surroundings as taught by Harbers).

- Applying a known technique (Harbers' headlight system that uses an array of LEDs 11, 12, 13, and 14 in headlights to illuminate vehicle surroundings and implements selective control of those LEDs) to a known device ready for improvement (Gotou's headlight system including right and left headlights 2 and ECU 10, where headlights 2 illuminate vehicle surroundings according to the ECU's control) to yield predictable results (Gotou's headlights using light sources having an array of LEDs and implementing selective control of the LEDs to output light having a "continuously adjustable spatial distribution" to a vehicle's surroundings as taught by Harbers).

EX1002, ¶63.

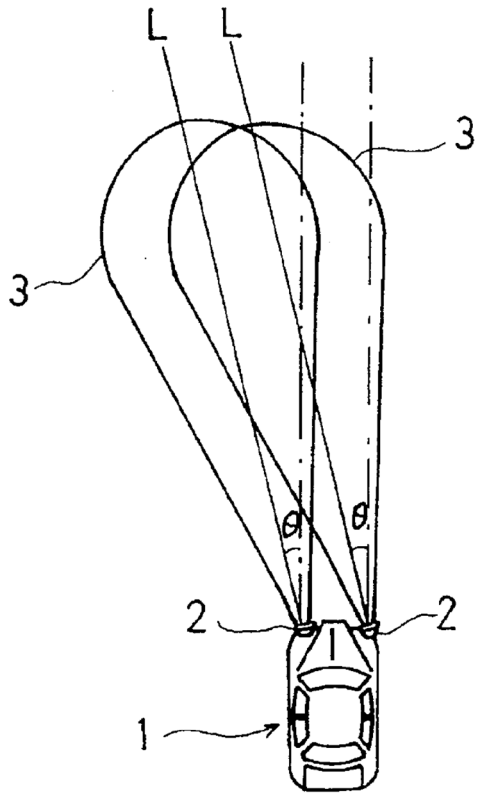
4. Claim 1

a) *[G1-1a-preamble] "A system, for a motor vehicle, comprising:"*

To the extent limiting, the Gotou-Harbers combination discloses or at least renders obvious the preamble. In the combination, Gotou describes a "head lamp

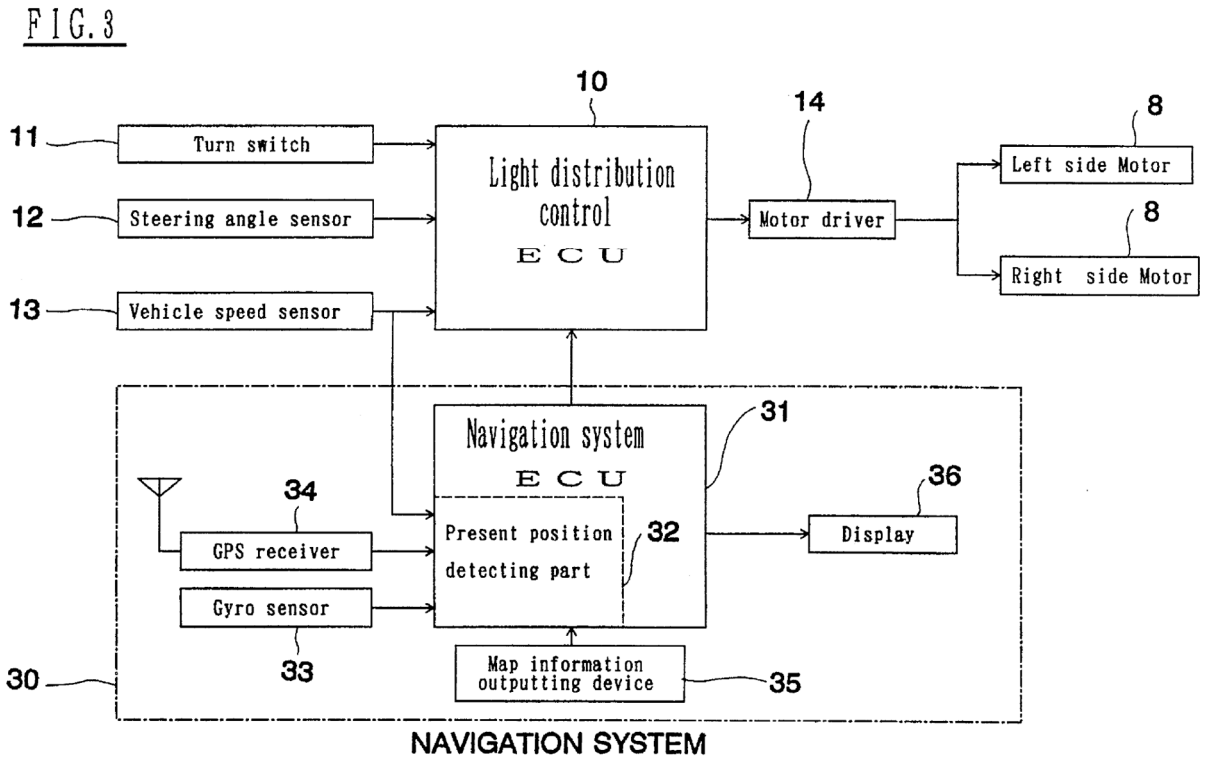
device for a vehicle" that is a system formed by the vehicle's left and right headlights 2 and "light distribution control system," shown by Figure 3, that is used to adjust the "lighting region in front of the vehicle" provided by the head lights (*A system, for a motor vehicle*).[6] EX1003, Abstract, 1:52-63, 2:66-67, 3:22-67, Figs. 1-3; EX1002, ¶65.

F I G. 1



[6] Claim language in the analysis is *italicized*, and **bolding** and/or underlining is emphasis added, unless otherwise noted.

EX1003, Fig. 1



EX1003, Fig. 3

b) ***[G1-1b] "a plurality of headlamps, each comprising a plurality of LED light sources;"***

The Gotou-Harbers combination discloses or at least renders obvious this limitation. In the combination, Gotou's system includes "right and left headlights[7]" 2 (*a plurality of headlamps*). EX1003, 3:24-35, Fig. 1. Headlights 2 are controlled by an electronic control unit ("ECU") 10 such that "angles of their optical axes L and L with respect to an advancing direction of the vehicle" are changed. EX1003, 3:31-35, 3:52-67.Gotou does not explicitly describe that its headlights are *each comprising a plurality of LED light sources*, but the Gotou-Harbers combination teaches this. In the combination, Gotou's right and left headlights 2 (*a plurality of headlamps*) each include Harber's light source (4; 5) comprising a plurality of opto-electronic elements (11; 12; 13; 14) that are "preferably light-emitting diodes (LEDs)" (*each comprising a plurality of LED light sources*). EX1004, Abstract, 5:32-65, Figs. 1A-1B, 2; Section VI.A.3. The LEDs may be formed in an "array of 8x3 LEDs." *Id.*; EX1004, 5:36-38, 6:25-57, Fig. 2; EX1002, ¶¶53-64, 66.

[7] A POSITA would have understood or at least found obvious that Gotou's vehicle headlights are *headlamps*. EX1002, ¶¶67-68. Gotou states its system forms a "head lamp device." EX1003, Abstract, 1:5-9, 1:60-61, claim 1. The '029 patent uses the terms "headlight" and "headlamp" interchangeably. *See, e.g.*, EX1001, 54:60-61 and 55:28-29 (referring to "headlights 300 and 301" as "headlamps 300 and 301").

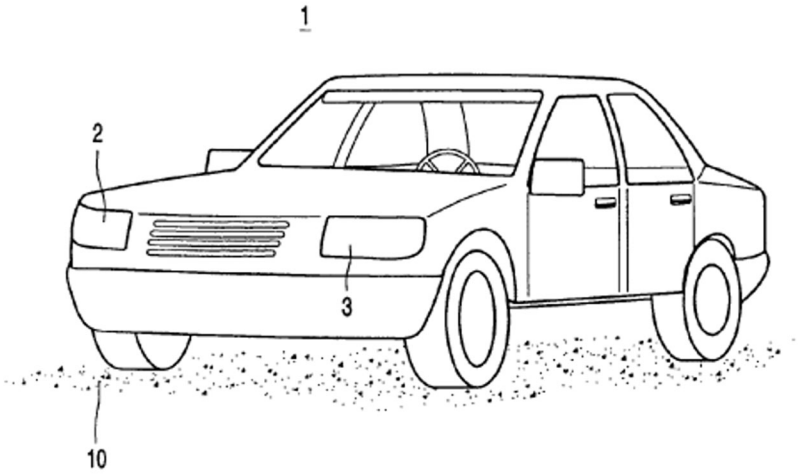


FIG. 1A

EX1004, Fig. 1A

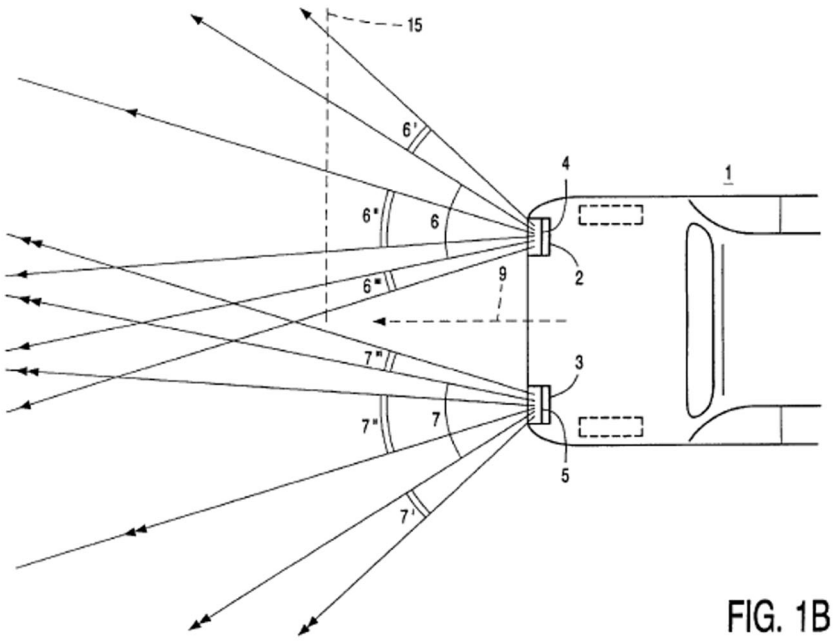


FIG. 1B

EX1004, Fig. 1B

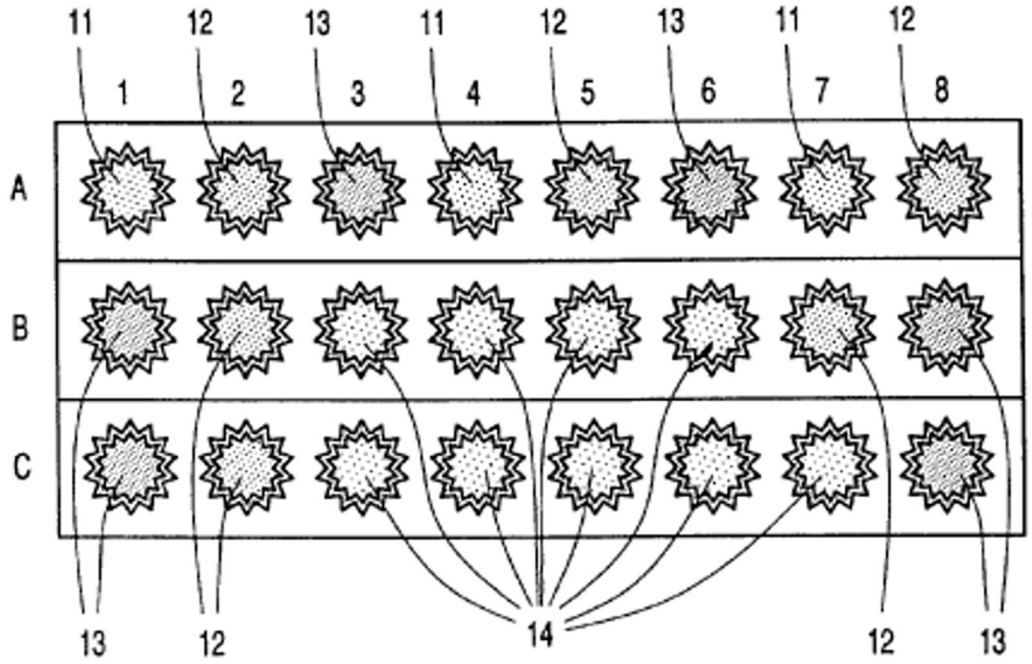


FIG. 2

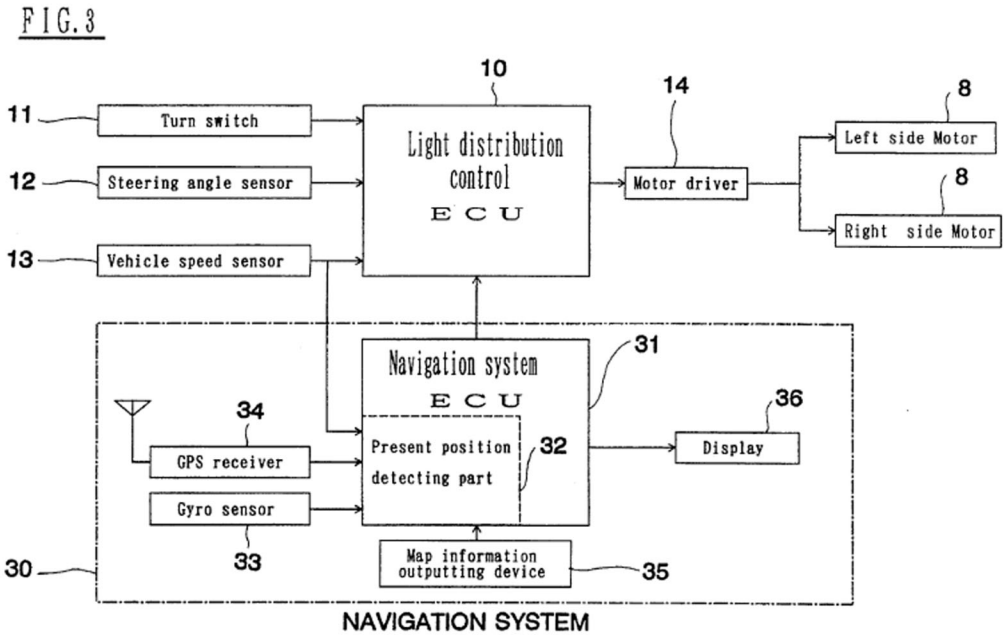
EX1004, Fig. 2

A POSITA would have been motivated to combine Gotou and Harbers for the reasons discussed in Section VI.A.3.

c) ***[G1-1c] "one or more processors; and a memory storing instructions that, when executed by one or more of the one or more processors, enable the one or more processors to:"***

The Gotou-Harbers combination discloses or at least renders obvious this limitation. In the combination, Gotou's system includes ECU 10 that "gets map information and information of a proper vehicle position from the navigation system 30," as well as other information and signals, "**processes** the information and signals

to determine a requisite optical axis angle theta" for headlights 2, and then outputs an "indicating signal" to motor driver 14, which controls the headlights 2 such that they have the determined optical axis angle theta. EX1003, 3:52-67, Fig. 3; EX1002, ¶¶69-71.



EX1003, Fig. 3

Because ECU 10 is described as performing such "process[][ing]" and control, it includes *one or more processors* and *a memory storing instructions that, when executed by one or more of the one or more processors, enable the one or more processors to* perform this processing and control. *Id.* For the same reasons, a POSITA would have understood this or at least found this limitation obvious. *Id.* Indeed, ECUs, such as Gotou's ECU, are ubiquitous in automotive electronic

systems and well known to include *one or more processors* and *a memory storing instructions that, when executed by one or more of the one or more processors, enable the one or more processors to* perform processing that allows for and provides the control of various automobile functions. *Id.*; *see also* EX1009, Abstract, ¶¶0006, 0008, 0035, 0056, claims 1 and 8; EX1010, 20:4-6, 49:15-19, 40:18-24.

d) *[G1-1d] "receive first data, including at least map data, indicating a road curvature upcoming along a road on which the motor vehicle is traveling;"*

The Gotou-Harbers combination discloses or at least renders obvious this limitation. In the combination, Gotou's "**ECU 10 gets map information** and **information of a proper vehicle position"** (*[the one or more processors to:] receive first data, including at least map data*) from navigation system 30 and processes such information, determining forward curve direction and sharpness from the map information, to determine an optical axis angle for its headlights 2. EX1003, 3:49-67, 3:31-35, 4:30-40, Fig. 4. Of Gotou's map information and vehicle position information (received *first data, including at least map data*), the **map information** (*map data*) is "information stored for every required node as crossing points, **directions of the curves or degrees of sharpness of curves**, etc" and is used to "analyze whether **the forward curve is directed, rightward or leftward**, and how is the **degree of curving of the curve**," where nodes are "predetermined points…which can be searched in sequence along a road" (*first data, including at*

least map data, indicating a road curvature upcoming along a road on which the motor vehicle is traveling). EX1003, 4:15-17, 4:32-40, 6:18-61. Additionally, the curve information analyzed by Gotou's system is further for a curve *upcoming along a road on which the motor vehicle is traveling* as claimed because analysis of it takes place so that control of the headlight is started "when **the vehicle reaches the predetermined distance S before the curve entrance**" such that "light distribution is deflected [] at a proper timing **before the curve**, resulting in that a superior visibility can be attained." *Id.*, 7:28-43; *see also id.*, 6:18-61; EX1002, ¶72.

e) ***[G1-1e] "determine a light change, the change adapting a light pattern of the headlamps in at least one of color, intensity or spatial distribution to increase light in a direction of the road curvature ahead of the motor vehicle and shaping light based at least in part on the road curvature; and"***

The Gotou-Harbers combination discloses or at least renders obvious this limitation. In the combination, Gotou's ECU 10 analyzes "whether the forward curve is directed, rightward or leftward, and how is the degree of curving of the curve in reference to the map information in the navigation system 30" and then "a **proper optical axis angle theta is determined through retrieval of the map**," where the optical axis angle theta can be the same for both right and left headlights 2 or different for each headlight. EX1003, 6:18-34; *id.*, 6:34-61; 3:31-35, 7:28-43, 8:9-15; Section VI.A.3. The optical axis angle theta represents the angle(s) at which

left and right headlights 2 are controlled to so that their light output is changed to be set at that angle(s). *Id.* In the Gotou-Harbers combination, in view of information about an upcoming road curve, Gotou's ECU 10 determines the "proper" optical axis angle for light output by headlights 2 and which LEDs should be selectively switched on or off, as taught by Harbers, to implement such an optical axis, thereby determining how light output by headlights 2 should be changed to account for the road curve (*one or more processors to:…determine a light change*). *Id.*; EX1002, ¶73.

Regarding *the change adapting a light pattern of the headlights* limitation, the '029 patent describes a *light pattern* as, for example, light output "where more of the light is directed where it is most useful," and provides an example of output light having a "bat wing" pattern that "yields horizontal illumination on a surface." EX1001, 22:1-9. This description corresponds to Gotou's teachings of a *light pattern* in the combination. Gotou describes that in determining how light output by headlights 2 should be changed to account for the road curve (*determin[ing] a light change*), the determined change in light output by headlights 2 is a *change adapting a light pattern of the headlights in at least one of color, intensity or spatial*

distribution[8] as claimed because Gotou's change adjusts the illumination pattern of light (i.e. *light pattern*) output by headlights 2 in its spatial distribution. EX1003, 6:18-34; *id.*, 6:34-61 ("**light distribution** is changed at a more early stage as a planned optical axis angle theta is larger…**light distribution** is changed more early when the curve is sharp"); 3:31-35, 7:28-43, 8:9-15; EX1002, ¶¶74-75.

Gotou provides an example of this functionality showing how it meets this claim language. Gotou explains that the optical angles of left and right headlights 2 can be different, including one example where only the "turning side" head light's optical axis is changed. EX1003, 3:31-35, 8:9-15; *id*., 6:18-61, 7:28-43. Here, when only the turning side headlight is adjusted and both headlights output light, a POSITA would have understood or at least found obvious that for a vehicle on a linear road portion approaching an upcoming left curve, the *determine[d] light*

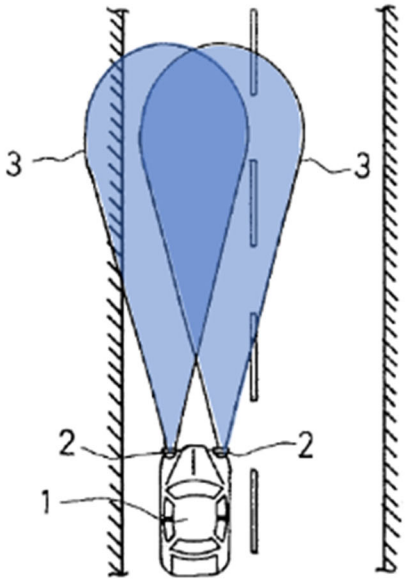
[8] Since limitation [G1-1e] recites "*the change adapting a light pattern of the headlamps in* ***at least one of color, intensity, or spatial distribution****,*" only one of *color* or *intensity* or *spatial distribution* must be shown in the prior art to teach this limitation. *SuperGuide Corp. v. DirecTV Enters., Inc.*, 358 F.3d 870, 887 (Fed. Cir. 2004); *Ex Parte Jung*, Appeal No. 2016-008290, 14 (P.T.A.B. March 22, 2017). As discussed in the analysis of limitation [G1-1e], Gotou shows *the change adapting a light pattern of the headlamps in* a *spatial distribution*.

change would adjust the left headlight to output light at an optical angle theta toward the left curve, but the right headlight 2 would keep outputting light at a forward facing optical angle, which would cause the illumination pattern of light output by headlights 2 collectively to be changed such that its *spatial distribution* is expanded to encompass the area toward the left of the vehicle (by left headlight 2) and to the front of the vehicle (by right headlight 2), yielding an adjusted distribution of illumination surrounding the vehicle that directs light toward a left-side turning direction (i.e., *determine[d] [] light change* changing the *light pattern of the headlamps* in a *spatial distribution*). *Id.*; *see also id.*, 3:24-30, 7:28-43, Fig. 8 (explaining and showing that for a linear road portion prior to recognition of an upcoming curve, light is output by both headlights to the front of the vehicle at a forward facing optical angle providing "lighting regions 3"); EX1002, ¶¶76-79. Here, the *spatial distribution* formed by both headlights originally outputting light to the front of the vehicle (as shown by the first figure below) is changed to a *spatial distribution* formed by the left headlight outputting light to the left of the vehicle and the right headlight outputting light to the front of vehicle (as shown by the second figure below), resulting in the overall *spatial distribution* formed by both headlights collectively being expanded. *Id.*

FIG. 8

Left headlight 2 outputting light forward

Right headlight 2 outputting light forward



EX1003, Figure 8 (annotated)

Left headlight 2 outputting light to the left for a left turn

Right headlight 2 outputting light forward

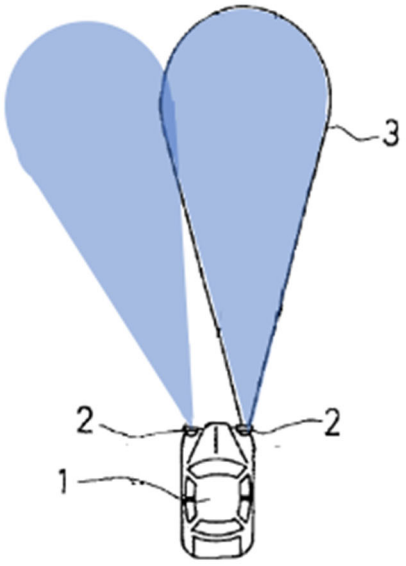


Figure showing expanded distribution of light for left turn in example (EX1002, ¶¶77-79)

Additionally, in the combination, Gotou describes that its change to the optical angle of light output by headlights 2 causes light to be "deflected" toward a curve, which thereby causes *to increase light in a direction of the road curvature ahead of the motor vehicle* as claimed. EX1003, 7:28-43. Specifically, for the example of a left curve, Gotou explains that "optical axis angle theta is determined in view of the state of the curve and the like at first" and "**the light distribution is deflected leftward at a proper timing before the curve, resulting in that a superior visibility can be attained**." *Id.*, 7:36-43. Here, for a left curve ahead of the vehicle as discussed above, the headlight spatial distribution is changed such that light is pointed toward the left before the curve is reached, meaning the change in spatial distribution causes *to increase light in a direction of the road curvature ahead of the motor vehicle. Id.*; EX1002, ¶80. And this discussed change in the spatial distribution of light of headlights 2 is further *based at least in part on the road curvature* because it is determined based on the direction of the road curve and degree of curve—i.e. road shape curving to the left—as indicated by the map information. *Id.*

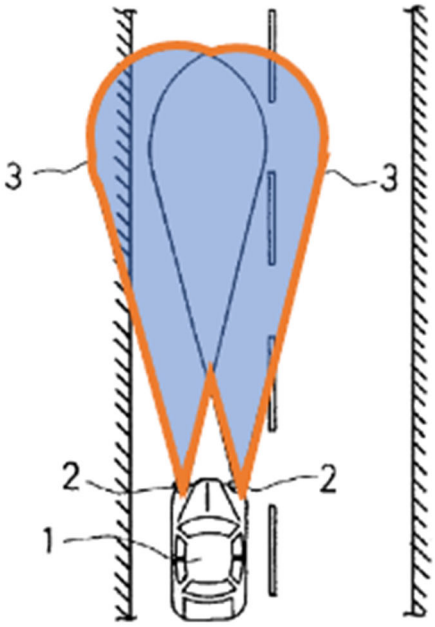
In the combination, Gotou further describes that its determined optical axis theta of left and right headlights 2 (*the [light] change*) performs *shaping light* as claimed. EX1003, 3:31-35, 8:9-15; *id*., 6:18-61, 7:28-43; EX1002, ¶81. For

example, when only the turning side headlight is adjusted, a POSITA would have understood or at least found obvious that for a vehicle on a linear road portion approaching an upcoming left curve, the *determine[d] light change* would adjust the left headlight to output light at an optical angle theta toward the left curve, but the right headlight 2 would keep outputting light at a forward facing optical angle, which would cause the shape of light output by headlights 2 collectively to be changed (i.e., *determine[d] [] light change [] shaping light* by changing the shape of output light). *Id.*; *see also id.*, 3:24-30, 7:28-43, Fig. 8; Section VI.A.4.d (limitation [G1-1d]); EX1002, ¶81-84. Here, the overall shape of light output by headlights 2 collectively would have been changed from that where both headlights output light to the front of the vehicle (as shown by the first figure below) to a shape formed by the left headlight outputting light to the left and the right headlight still outputting light to the front of the vehicle (as shown by the second figure below). *Id*.

FIG. 8

Left headlight 2 outputting light forward

Right headlight 2 outputting light forward



EX1003, Figure 8 (annotated)

Left headlight 2 outputting light to the left for a left turn

Right headlight 2 outputting light forward

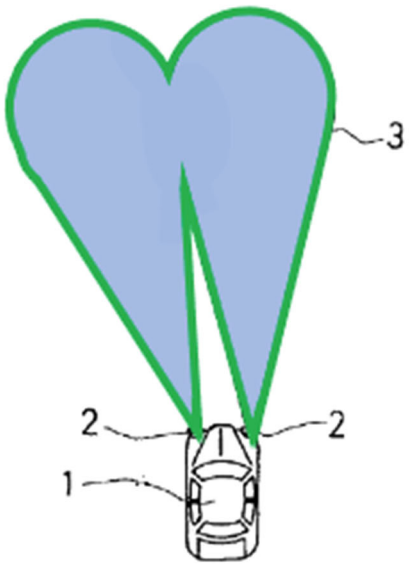


Figure showing shape of light for expanded distribution of light for left turn in example (EX1002, ¶¶81-84)

And the adjustment of the optical axis of the left headlight 2 shaping light output collectively by both headlights 2 (*shaping light*) is *based at least in part on the road curvature* because it is, for example, based on the direction of the road curve and degree of curve of the upcoming road from map information and accounts for the "turning side" of the vehicle in relation to this curve. EX1003, 3:24-35, 6:18-61, 7:28-43, 8:9-15, Fig. 8; EX1002, ¶81; Section VI.A.4.d (limitation [G1-1d]).

f) ***[G1-1f] "control at least a first plurality of the LED light sources to provide light based at least in part on the determined light change and prior to the motor vehicle reaching the road curvature."***

The Gotou-Harbers combination discloses or at least renders obvious this limitation. In the combination, after Gotou's ECU 10 determines the optical axis angle theta for left and right headlights 2 (*the determined light change*), signals are output that control selected LEDs 11, 12, 13, and 14 of the headlights (*control at least a first plurality of the LED light sources*) as taught by Harbers such that the headlights output light at the determined angle theta (*to provide light based at least in part on the determined light change*). EX1003, 3:52-67, 7:32-43; EX1004, Abstract, 5:32-65, 6:58-67, 7:12-34, Figs. 1A-1B, 2, 3A; Sections VI.A.3, VI.A.4.b (limitation [G1-1b]), VI.A.4.e (limitation [G1-1e]); EX1002, ¶¶85-86. In the

combination, Gotou's ECU 10 would have provided control as taught by Harbers that selectively switches on or off a *first plurality* of Harbers' opto-electronic elements 11; 12; 13; 14 to adjust their luminous flux with respect to each other. EX1004, 6:64-67, 6:58-67, 7:12-34, Fig. 3A; EX1002, ¶86. For instance, Harbers describes where a plurality of LEDs A1-A8, B3-B5, B1, B2, C1, and C2 (e.g., *at least a first plurality of the LED light sources*) in an array are controlled by turning them on to provide a particular light output that outputs light at a specific angle, creating beams 6 and 6'. EX1004, 6:58-67, 7:12-34, Figs. 1B, 3A; EX1002, ¶86. While this example is provided for headlamp 2, a POSITA would have understood or at least found obvious that it is applicable to headlamp 3 as well because headlamp 2 (to produce beams 7 and 7') as headlamps 2 and 3 can have "mirrored" arrangements of each other "for reasons of symmetry." EX1004, 6:12-16, 5:32-65; EX1002, ¶86.

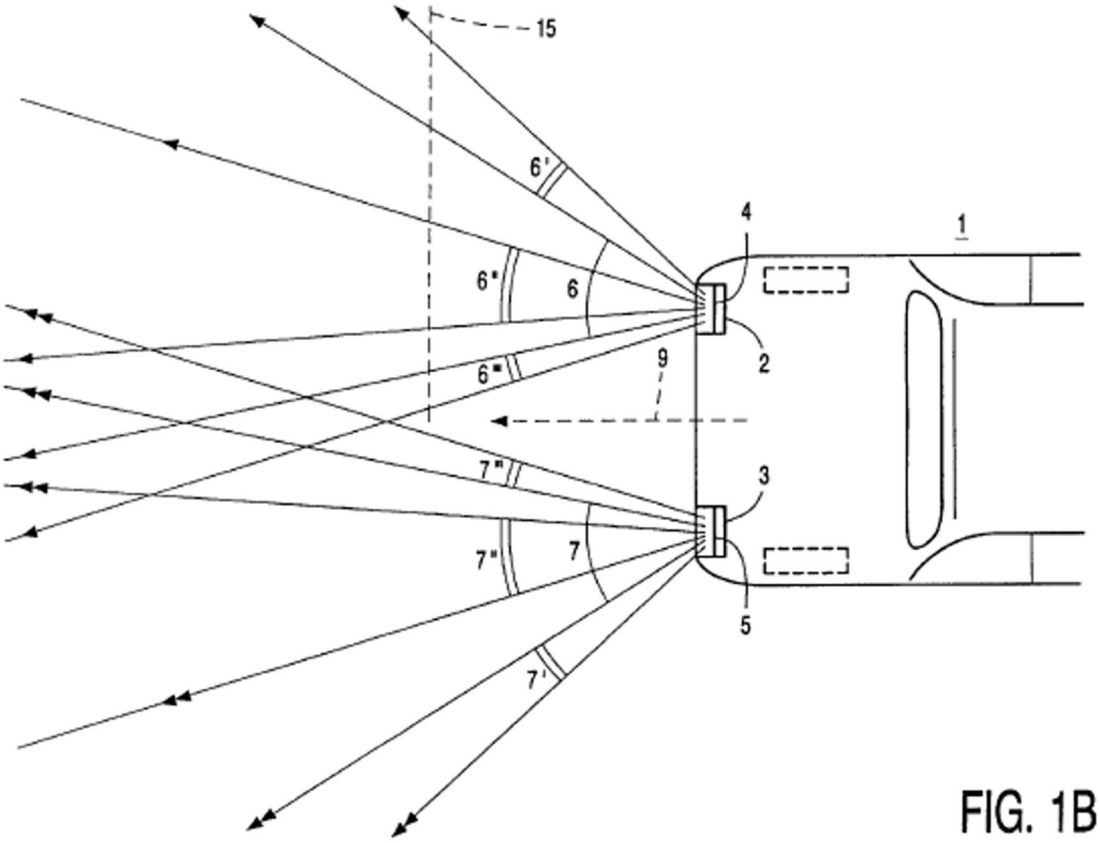


FIG. 1B

EX1004, Fig. 1B

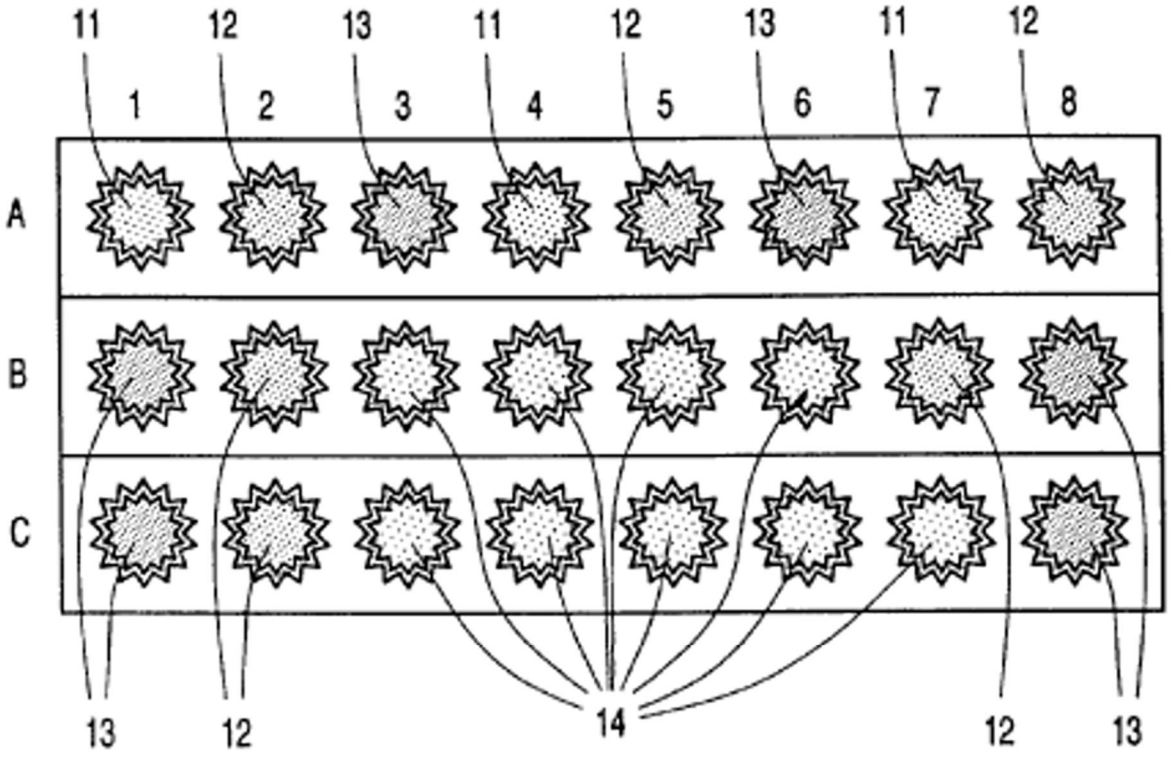


FIG. 2

EX1004, Fig. 2

Further, in the Gotou-Harbers combination, Gotou describes that the described LED headlight control takes place "when the vehicle reaches the predetermined distance S before the curve entrance" such that "light distribution is deflected…at a proper timing **before the curve**" (*control at least a first plurality of the LED light sources to provide light…prior to the motor vehicle reaching the road curvature*). EX1003, 3:52-67, 7:32-43; *see also id.*, 6:40-45 (control of optical axes takes place "before the steering wheel is actually turned"); EX1004, Abstract, 5:32-

65, 6:58-67, 7:12-34, Figs. 1A-1B, 2, 3A; Section VI.A.3, VI.A.4.b (limitation [G1-1b]); EX1002, ¶87.

To the extent the Board determines or the Patent Owner argues that the claimed *control* requires a narrower interpretation where each *LED light source* of the *first plurality of LED light sources* is individually and/or separately controlled, the Gotou-Harbers combination still teaches this. This is because in the combination Harbers describes that "a number of opto-electronic elements 11; 12; 13; 14" can be "**selectively** switch[][ed] on and off" and each of the opto-electronic elements 11, 12, 13, and 14 is an LED. EX1004, 1:52-56 ("**Opto-electronic elements**, also referred to as **optical-electro-optical elements**, for example electroluminescent elements, such as **light-emitting diodes (LEDs)**"); 2:9-10, 2:23-30, 6:7-64, 6:64-67 ("[t]he vehicle 1 or the headlamp 2;3 is preferably provided with means (not shown) for **changing the luminous flux of the opto-electronic elements 11; 12; 13; 14 with respect to each other"**), 7:20-22 ("[t]he ordering, providing and **selectively switching on and off of opto-electronic elements 11; 12; 13; and 14** in the form of an array may also be considered as an invention in itself"), 7:12-49, Figs. 2, 3A, 3B; *see also* 3:24-27 and 3:38-42 ("**switching on or off one or more opto-electronic elements"**). Indeed, Harbers describes that each of the LEDs is individually and separately controlled—for example, by separately switching on or off individual LEDs or separately changing the luminous flux of individual LEDS,

so that a headlight provides a desired spatial distribution of light; for instance, Harbers provides an example where plurality of LEDs A1-A8, B3-B5, B1, B2, C1, and C2 are controlled in such a way to switch them on (*control at least a first plurality of the LED light sources*). *Id.*, 6:58-67, 7:12-34, Fig. 3A*; see also id.*, 9:54-55 (claims 13 and 18) ("the **light emitted by each opto-electric element** is capable of being **turned on or off separately**" where the elements "comprise **light-emitting diodes**"), 10:44-45, 10:49-50 (claims 22 and 23) ("**each said opto-electronic element is adjustable** to emit light of **variable luminous flux**" where "the **opto-electronic elements** are varied by **turning each element on or off**"); 3:48-51 ("the shape of the light beam can be adapted by **activating different combination of opto-electronic elements** and by **changing the output levels of the different opto-electronic elements** [][;] [a]s a result of these adaptations, the overall spatial distribution of the light is changed"); 9:44-46 (claim 9) ("**each** said **opto-electronic element is adjustable** to emit light of **variable intensity**"); 10:29-30 (claim 19) ("the **opto-electronic-elements** are **each adjustable** to emit light of **varying intensity**"); EX1002, ¶¶88-90. For the same reasons, a POSITA would have understood or at least found obvious that Harbers teaches *control* where each *LED light source* of the *first plurality of LED light sources* is individually and/or separately controlled. EX1002, ¶¶88-91. And in the combination, Goutou's ECU 10 would have provided such control of LEDs as taught by Harbers. *Id.*; Section VI.A.3.

In the *ex parte* reexamination of U.S. Patent 9,955,551 (which is related to the '029 patent), initiated by PO, PO analyzed Harbers and argued it taught this narrower interpretation. *See* EX1013; EX1001, cover page. PO argued the term "light source" meant "individual LED," and that "electronic circuitry apparatus for the controlled powering of the light source and other illuminating elements," which is similar to *control at least a first plurality of the LED light sources* of limitation [G1-1f], required the controlled powering of the "[individual LED] *light source*." EX1013, 15-19, 51-56. PO stated Harbers taught this control of an individual LED light source as it describes "[t]he use of a plurality of opto-electronic elements [LED] with a relatively high luminous flux enables a vehicle headlamp to be manufactured having much more dynamic lighting possibilities that the known vehicle headlamp'" and "[t]he ordering, providing, and selectively switching on and off of opto-electronic elements…in the form of an array may also be considered as an invention itself." *Id.*, 56-57. Thus, PO's own statements support that Harbers teaches the narrower interpretation. EX1002, ¶92.

A POSITA would have been motivated to combine Gotou and Harbers for the reasons discussed in Section VI.A.3.

5. Claim 2

a) *"The system of claim 1, wherein the determination of the light change includes selection of the first plurality of the LED light sources."*

The Gotou-Harbers combination renders claim 1 unpatentable and further renders claim 2 unpatentable. In the Gotou-Harbers combination, in view of information about an upcoming road curve, Gotou's ECU 10 determines the "proper" optical axis angle for light output by headlights 2 and which LEDs should be selectively switched on or off, as taught by Harbers, to implement such an optical axis, thereby determining how light output by headlights 2 should be changed to account for the road curve (*the determination of the light change*). Sections VI.A.4.e-f. By determining which of Harbers' LEDs (i.e., forming a *first plurality of the LED light sources*) should be selectively switched on or off to implement such an optical axis, *the determination of the light change* includes *selection of the first plurality of the LED light sources*; the particular LEDs (*first plurality of the LED light sources*) that should be selectively switched on or off is determined. *Id.*; EX1004, 6:58-67, 7:12-49, Figs. 3A, 3B; EX1002, ¶¶93-94. A POSITA would have been motivated to combine Gotou and Harbers for the reasons discussed in Section VI.A.3.

6. Claim 12

a) ***[G1-12a-preamble] "A non-transitory computer-readable storage medium, storing instructions that, when executed by one or more processors of a motor vehicle that includes a plurality of headlamps that each comprise a plurality of LED light sources, enable the one or more processors to:"***

To the extent limiting, the Gotou-Harbers combination discloses or at least renders obvious the preamble for the same reasons discussed for limitations [G1-1a-preamble], [G1-1b], and [G1-1c] (Sections VI.A.4.a-c).

b) ***[G1-12b] "receive first data, including at least map data, indicating a road curvature upcoming along a road on which the motor vehicle is traveling;"***

The Gotou-Harbers combination discloses or at least renders obvious this limitation for the same reasons discussed for limitation [G1-1d] (Section VI.A.4.d).

c) ***[G1-12c] "determine a light change, the change adapting a light pattern of the headlamps in at least one of color, intensity or spatial distribution to increase light in a direction of the road curvature ahead of the motor vehicle and shaping light based at least in part on the road curvature; and"***

The Gotou-Harbers combination discloses or at least renders obvious this limitation for the same reasons discussed for limitation [G1-1e] (Section VI.A.4.e).

d) ***[G1-12d] "control at least a first plurality of the LED light sources to provide light based at least in part on the determined light change and prior to the motor vehicle reaching the road curvature."***

The Gotou-Harbers combination discloses or at least renders obvious this limitation for the same reasons discussed for limitation [G1-1f] (Section VI.A.4.f).

7. Claim 13

a) ***"The storage medium of claim 12, wherein the determination of the light change includes selection of the first plurality of the LED light sources."***

The Gotou-Harbers combination renders obvious claim 13 for the same reasons discussed for claim 2. Section VI.A.5.

8. Claim 23[9]

a) ***[G1-23a-preamble] "A computer-implemented method for adapting light from headlamps of a motor vehicle to accommodate road shape changes, the headlamps including a plurality of LED light sources, comprising:"***

To the extent limiting, the Gotou-Harbers combination discloses or at least renders obvious the preamble for the same reasons discussed for limitations [G1-1b], [G1-1e], and [G1-1f] (Sections VI.A.4.b, VI.A.4.e, VI.A.4.f); *see also* analysis

[9] Claim 23 is similar to claim 1 but recites different terminology, such as "road shape changes" and "shape change of a road" (instead of "road curvature" as in claim 1) and "determining a light output" (instead of "determine a light change" as in claim 1). However, these, and any other differences in terminology between claim 23 and claim 1, are still taught by the Gotou-Harbers combination for the same reasons discussed for claim 1. EX1002, ¶¶132-133.

of limitations [G1-1a-preamble], [G1-1c], and [G1-1d] (Sections VI.A.4.a, VI.A.4.c, VI.A.4.d).

b) ***[G1-23b] "determining an upcoming shape change of a road, ahead of the motor vehicle, based on first data, including map data, indicating the shape change;"***

The Gotou-Harbers combination discloses or at least renders obvious this limitation for the same reasons discussed for limitations [G1-1d] and [G1-1e]. Sections VI.A.4.d-e.

c) ***[G1-23c] "determining a light output, the output adapting a light pattern of the headlamps in at least one of color, intensity or spatial distribution to increase light in a direction associated with the shape change ahead of the motor vehicle and shaping light based on the shape change; and"***

The Gotou-Harbers combination discloses or at least renders obvious this limitation for the same reasons discussed for limitations [G1-1d] and [G1-1e]. Sections VI.A.4.d-e.

d) ***[G1-23d] "prior to reaching the road shape change, causing at least a first plurality of the LED light sources to provide light based at least in part on the determined light output."***

The Gotou-Harbers combination discloses or at least renders obvious this limitation for the same reasons discussed for limitation [G1-1f]. Section VI.A.4.f.

9. Claim 24

a) **"*The method of claim 23, wherein the determining the light includes selecting the first plurality of the LED light sources.*"**

The Gotou-Harbers combination discloses or at least renders obvious claim 24 for the same reasons discussed for claim 2. Section VI.A.5.

B. Grounds 2 and 3: Claims 1, 2, 10-13, 23, and 24 are unpatentable under 35 U.S.C. § 103(a) over Heinz in view of Gotou (Ground 2) or Hienz in view of Gotou and Harbers (Ground 3)

1. Overview of Heinz

Heinz describes a "lighting system for a motor vehicle" that generates "cornering lighting" that is "adapted for the driving situation." EX1006, Abstract. Heinz's system includes a vehicle KFZ having left headlight LSW and right headlight RSW, where each headlight includes illuminants LM1, LM2, and LM3. *Id.*, 4:42-46. Each illuminant contains "lighting elements LE" that are "light-emitting diodes (LEDs)." *Id.*, 5:49-6:10. For a vehicle turn, one or more of the illuminants produce turning light; for example, for a left turn (Figure 2), illuminants successively illuminate toward the left according to how sharp the left turn is, where LM1 produces turning light LB1, LM2 produces turning light LB2, and LM3 produces turning light LB3. *Id.*, 4:42-5:20, Fig. 2.

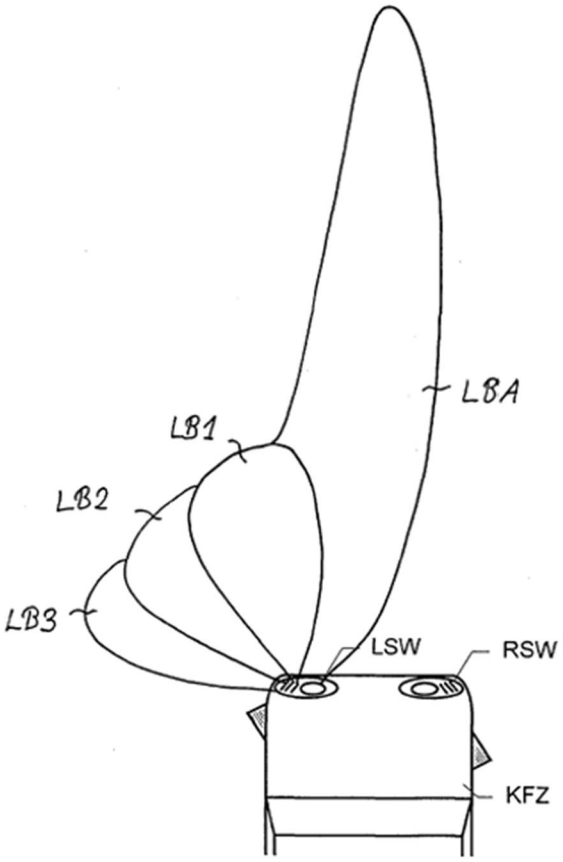


Fig. 2

EX1006, Fig. 2

Heinz is analogous art to the ’029 patent, from the same field of endeavor as the patent (lighting systems, such as vehicle headlight systems) and reasonably pertinent to the particular problem the patent was trying to solve (how to control light output by vehicle headlights). EX1001, 11:8-13, 51:63-67, 52:12-16, 53:24-30, 54:8-15, Fig. 15; EX1006, Abstract, 1:3-4, 4:3-4, 4:36-49, 5:13-20, Figs. 1, 2; EX1002, ¶48.

2. Claim 1

a) *[G2/3-1a-preamble] "A system, for a motor vehicle, comprising:"*

To the extent limiting, Heinz discloses or at least renders obvious the preamble. Heinz describes "a lighting system for a motor vehicle" (*[a] system ,for a motor vehicle, comprising*). EX1006, Abstract, 1:3-4, 4:3-4, Fig. 1.

b) *[G2/3-1b] "a plurality of headlamps, each comprising a plurality of LED light sources;"*

Heinz discloses or at least renders obvious this limitation. Heinz describes its system comprises "left and right front headlights LSW and RSW" (*system…comprising: a plurality of headlamps*) that each comprise illuminants LM1, LM2, and LM3, where each illuminant LM1, LM2, and LM3 comprises lighting elements LE that are light emitting diodes (LEDs) (*each comprising a plurality of LED light sources*). EX1006, 4:42-46, 5:49-6:10, 3:42-44, 7:13-17, Figs. 1, 2, 4.

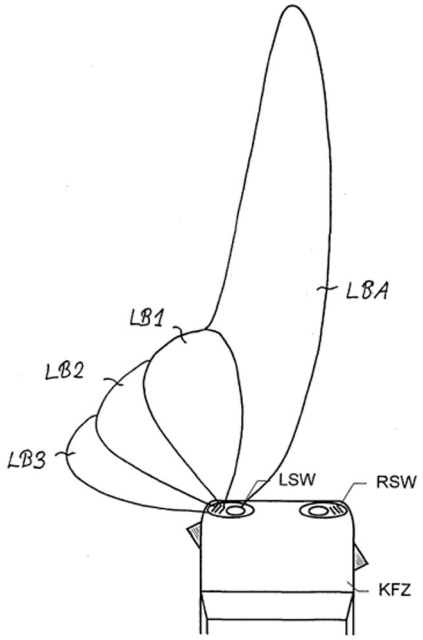


Fig. 2

EX1006, Fig. 2

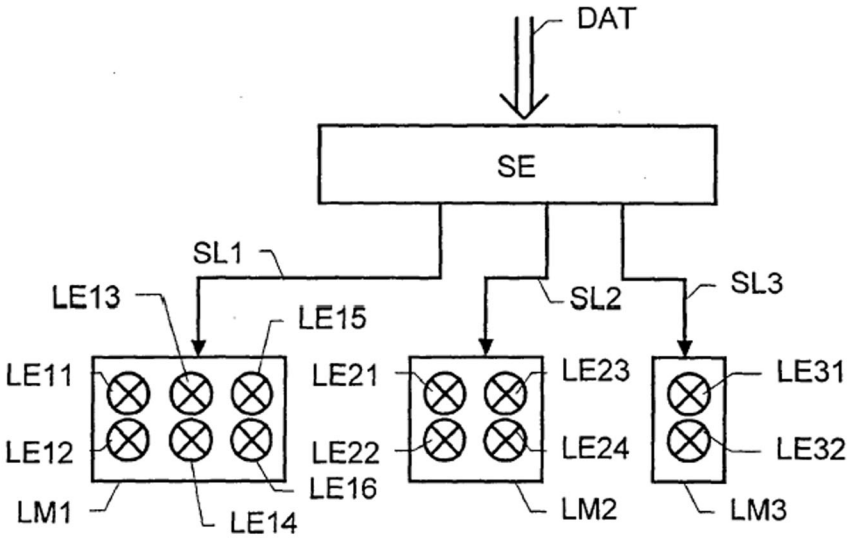


Fig. 4

EX1006, Fig. 4

c) ***[G2/3-1c] "one or more processors; and a memory storing instructions that, when executed by one or more of the one or more processors, enable the one or more processors to:""***

Heinz discloses or at least renders obvious this limitation. Heinz describes that its system includes a "control device SE," where "[a]ccording to a **predetermined program** or by means of a special analog circuit or digital control circuit, the control device determines how the individual illuminants LM1, LM2, and LM3 are to be switched on or off to form the desired cornering light in the given driving situation." EX1006, Abstract, 4:36-41, Figs. 1, 4. Moreover, Heinz explains that control device SE may be "part of [] central motor vehicle electronics," which are known to be vehicle electronic control units (ECUs) that include processor(s) and memory storing instructions for vehicle functionality that are executed by the processor(s). *Id.*, 4:29-34; Section VI.A.4.c; EX1002, ¶¶96-97. Thus, because control device SE is described as using such a program to implement its control of illuminants LM1, LM2, and LM3 and is implementable as part of central vehicle electronics, a POSITA would have understood or at least found obvious that the control device SE includes *one or more processors* and *a memory storing instructions* of the program *that, when executed by one or more of the one or more processors, enable the one or more processors to* execute the program and perform control of LM1, LM2, and LM3. *Id.*; EX1002, ¶¶96-97. To execute the "predetermined program" and

implement control, *one or more processors* would have been necessary in control device SE; moreover, the control device SE must have some *memory storing instructions* of the program so that the program can be stored, called by control device SE, and executed. *Id.*

d) *[G2/3-1d] "receive first data, including at least map data, indicating a road curvature upcoming along a road on which the motor vehicle is traveling;"*

Heinz in view of Gotou renders obvious this limitation. Heinz describes that "control device SE includes an interface via which external data may be provided" (*one or more processors to*:…*receive first* data) EX1006, 2:53-3:17, 4:20-36, 5:20-34. The external data includes data "for detecting the path of the roadway" the vehicle is traveling on (*indicating a road curvature upcoming along a road on which the motor vehicle is traveling*) and the data "used for this purpose" can be "of a vehicle navigation system." *Id.*, 5:29-34, 2:53-3:17.

Heinz does not explicitly describe that its external data is *including at least map data indicating a road curvature upcoming along a road on which the motor vehicle is traveling.* But Heinz in view of Gotou teaches this, with Gotou describing this limitation for the same reasons discussed for limitation [G1-1d] (Section VI.A.4.d), *supra*.

A POSITA would have been motivated to combine Heinz and Gotou such that Heinz's system is enhanced to explicitly receive map information indicating the

direction and sharpness of a road curve and information on proper vehicle position as taught by Gotou; the Heinz-Gotou combination would have resulted in a system that explicitly considers this information to determine where light output by LED headlights should be directed. EX1002, ¶¶98-99.

Heinz describes that "control device SE includes an interface via which external data may be provided," and explains that data is "for detecting the path of the roadway." EX1006, 2:53-3:17, 4:20-36, 5:20-34. Heinz further states that the data "used for this purpose" can be "of a vehicle navigation system." *Id.*, 5:29-34. This data is used by control device SE to provide "[a]ppropriate alignment of the individual cornering light beams and temporal control of the illuminants" and produce "optimal adaptation of the light distribution to the driving situation." *Id.*, 5:13-34; EX1002, ¶100.

Heinz therefore suggests using navigational data representing the "path of the roadway" to determine how its headlights will illuminate a road. EX1006, 2:53-3:17, 4:20-36, 5:20-34; EX1002, ¶101. So motivated, a POSITA would have looked to Gotou for explicit implementation details on the format of such navigational data. *Id.* This is because Gotou describes that its ECU obtains navigational data representing the path of a roadway in the form of "**map information** and **information of a proper vehicle position** from the navigation system 30," where the map information" is "information stored for every required node as crossing

points, **directions of the curves or degrees of sharpness of curves**, etc." EX1003, 3:31-35, 3:49-67, 4:15-17, 4:30-40, Fig. 4. Gotou's ECU processes such information to determine an optical axis angle of light output by headlights. *Id.*; EX1002, ¶101.

Thus, due to Heinz's suggestions, a POSITA would have enhanced Heinz with Gotou's explicit teachings, resulting in Heinz's system explicitly considering map information indicating the direction and sharpness of a road curve and information on proper vehicle position to determine where light from headlights should be directed. EX1002, ¶102.

A POSITA would have combined Heinz and Gotou as above using known software techniques, where the external data received by Heinz's control device SE would have simply included explicit map information and positional information as taught by Gotou. EX1002, ¶102. Separate or combined, the Heinz and Gotou systems (including the combined elements, e.g., Heinz's control device SE; Gotou's light distribution control system having ECU 10 and using map information) would have both performed the same function of providing adjustable lighting to the area in front of a vehicle. *Id.* And a POSITA would have recognized that the combination would have provided the predictable result of Heinz's system explicitly considering map information indicating the direction and sharpness of a road curve and information on proper vehicle position to determine where light from headlights should be directed as taught by Gotou. *Id.* A POSITA would have had a reasonable

expectation of success in making this combination for the same reasons discussed above, and also due to the similarities of both references, where both references are at least directed to vehicle headlight control and discuss providing improved visibility for vehicle drivers. EX1003, 2:19-26; EX1006, Abstract, 1:5-20, 2:21-25, 4:42-5:34; EX1002, ¶102.

This analysis therefore demonstrates at least the following motivations to combine, providing the Heinz-Gotou combination:

- Some teaching, suggestion, or motivation in the prior art (Heinz's suggesting use of navigational data representing the "path of the roadway" when determining how its headlights will illuminate a roadway) that would have led one of ordinary skill to modify the prior art reference or to combine prior art reference teachings (Heinz's control device SE that receives external navigational data used to control light output by headlights; Gotou's ECU that obtains navigational data in the form of "map information" indicating curve direction and sharpness and "information of a proper vehicle position" that is processed to determine the optical axis angle light output by headlights) to arrive at the claimed invention (Heinz-Gotou combination that renders obvious *including at least map data indicating a road curvature upcoming along a road on which the motor vehicle is traveling*).

- Combining prior art elements (Heinz's control device SE that receives external navigational data used to control light output by headlights; Gotou's ECU that obtains "map information" indicating curve direction and sharpness and "information of a proper vehicle position" that is processed to determine the optical axis angle of light output by headlights) according to known methods (known software techniques) to yield predictable results (Heinz's system explicitly considering map information indicating the direction and sharpness of a road curve and information on proper vehicle position to determine where light from headlights should be directed as taught by Gotou).

EX1002, ¶103.

e) ***[G2/3-1e] "determine a light change, the change adapting a light pattern of the headlamps in at least one of color, intensity or spatial distribution to increase light in a direction of the road curvature ahead of the motor vehicle and shaping light based at least in part on the road curvature; and"***

Heinz in view of Gotou renders obvious this limitation. Heinz's system explicitly considers map information indicating the direction and sharpness of a road curve and information on proper vehicle position to determine where light from headlights should be directed as taught by Gotou. *See* Section VI.B.2.d. In the combination, Heinz describes "[a]ccording to a predetermined program…the control device determines how the individual illuminants LM1, LM2, and LM3" formed by

LEDs "are to be switched on or off to form the desired turning light in the given driving situation" (*one or more processors to*:…*determine a light change*). EX1006, 4:36-41. A "vehicle navigation system" may be "used for [] [the] purpose" of indicating a "path of the roadway" such that "optimal adaptation of the light distribution to the driving situation" is provided. *Id.*, 5:13-34. An example of Heinz's operation is shown in Figure 2, for a left turn. *Id.*, 4:42-51, Fig. 2.

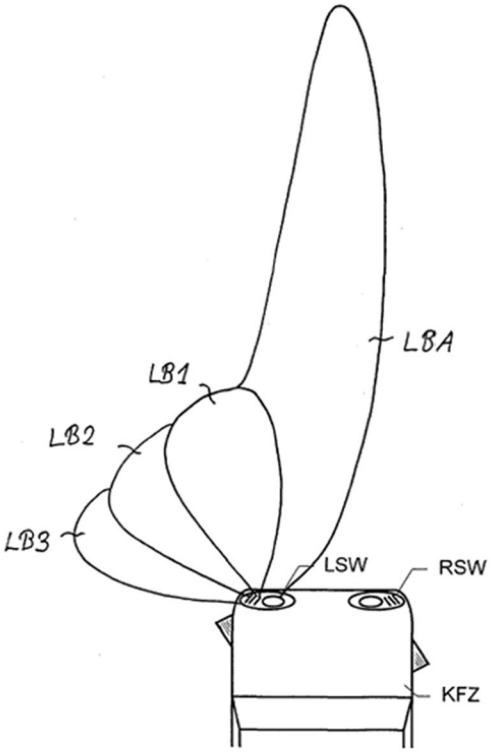


Fig. 2

EX1006, Fig. 2

Here, Heinz describes that turning light (formed by LB1, LB2, and/or LB3), provided by the left headlight LSW, is adjusted by the control device switching on

or off illuminants LM1, LM2, and/or LM3 of the left headlight LSW, and that left headlight LSW also outputs a low beam light beam LBA. *Id.*; *see also id.*, 4:46-49, 5:13-20. The right headlight RSW does not provide turning light (since a left turn rather than right turn is occurring), but a POSITA would have understood or at least found obvious that right headlight RSW provides a "low beam light beam LBA" because Heinz describes that in its system, "**low beam light remains available** to the driver in the usual way while turning, because the illuminants are provided **in addition to the low beam headlights**." *Id.* (note plural "low beam headlight**s**"); *see also id.*, 2:49-52; EX1002, ¶¶104-106. Thus, left head light LSW and right head light RSW collectively output a light pattern comprising low beam light beams LBA from both headlights, and for a left turn, one or more of light beams LB1, LB2, and LB3 output by left head light LSW. *Id.* Heinz therefore describes that the switching on or off of illuminants LM1, LM2, and LM3 of left headlight LSW for a left turn, producing one or more of light beams LB1, LB2, and LB3, adjusts a light pattern collectively output by left headlight LSW and right headlight RSW in a spatial distribution because the light pattern spatially changes—for example, increasing spatially to the left for a left turn as light beams LB1, LB2, and LB3 are produced—providing "cornering light [that] widens in a fan-like manner towards the turning direction" (*the change adapting a light pattern of the headlamps in at least one of*

color, intensity or spatial distribution).[10] *Id.*; *see also id.*, 2:35-40, 5:13-20. This change in the spatial distribution of light is shown by the annotated figures below. EX1002, ¶¶104-110.

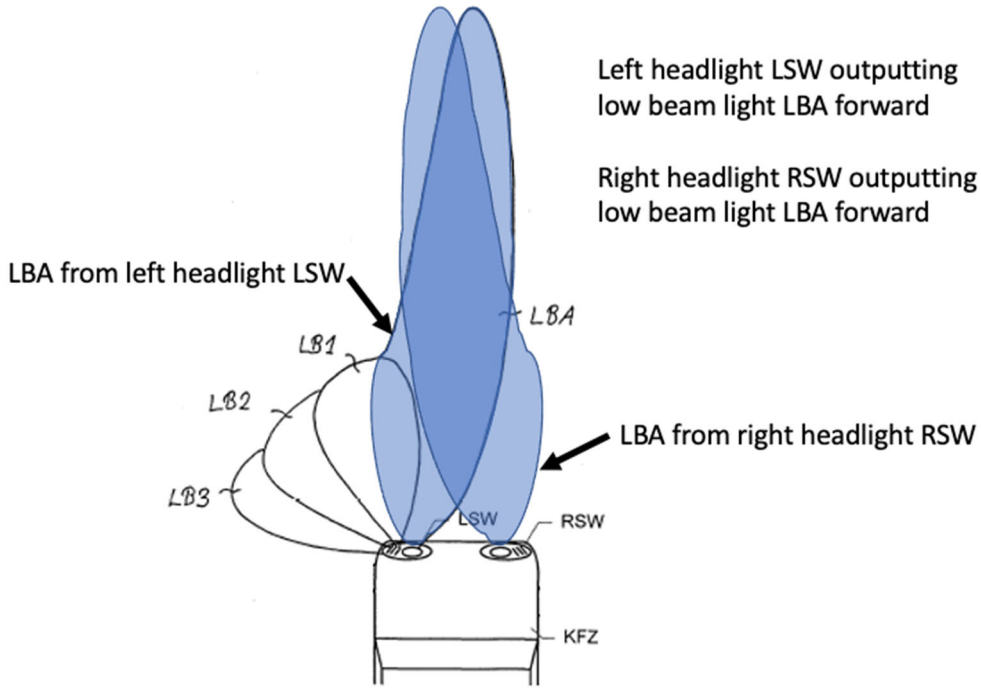


Figure showing collective LBA spatial distribution of light from left and right headlights (EX1002, ¶¶104-110)

[10] *See supra* note 8. As discussed in the analysis of limitation [G2/3-1e], Heinz shows *the change adapting a light pattern of the headlamps in* a *spatial distribution*.

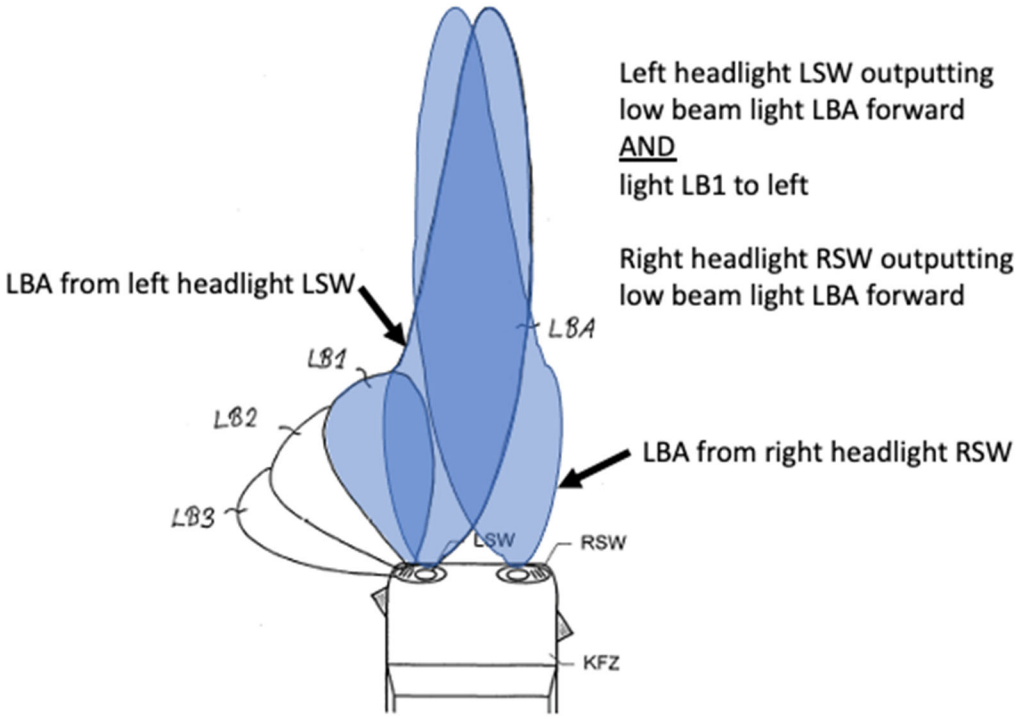


Figure showing collective LBA spatial distribution of light from left and right headlights and LB1 from left headlight (EX1002, ¶¶104-110)

Heinz's system further uses external data from a "vehicle navigation system" for "detecting the path of the roadway" and providing "optimal adaptation of the light distribution to the driving situation" according to the "path of the bend." EX1006, 5:13-34, 2:53-3:17. Thus, Heinz's adjustment of light pattern collectively output by left headlight LSW and right headlight RSW in the spatial distribution, such that the pattern is "widen[][ed] in a fan-like manner towards the turning direction," would be based on such external data reflecting the "path" of the roadway or bend, indicating road curvature, therefore proving that its adjustment in the light pattern is

to increase light in a direction of the road curvature ahead of the motor vehicle and is *based at least in part on the road curvature*. *Id.*; EX1002, ¶106.

And the adjustment in the light pattern provides *shaping light based at least in part on the road curvatur*e because the overall shape of light output by headlights LSW and RSW as discussed above is changed as light beams LB1, LB2, and LB3 are produced, and this change is based on the external data reflecting the "path" of the roadway or bend as discussed. *Supra,* Section VI.B.2.e; EX1002, ¶¶111-114. This shaping of light is shown in the example figures below.

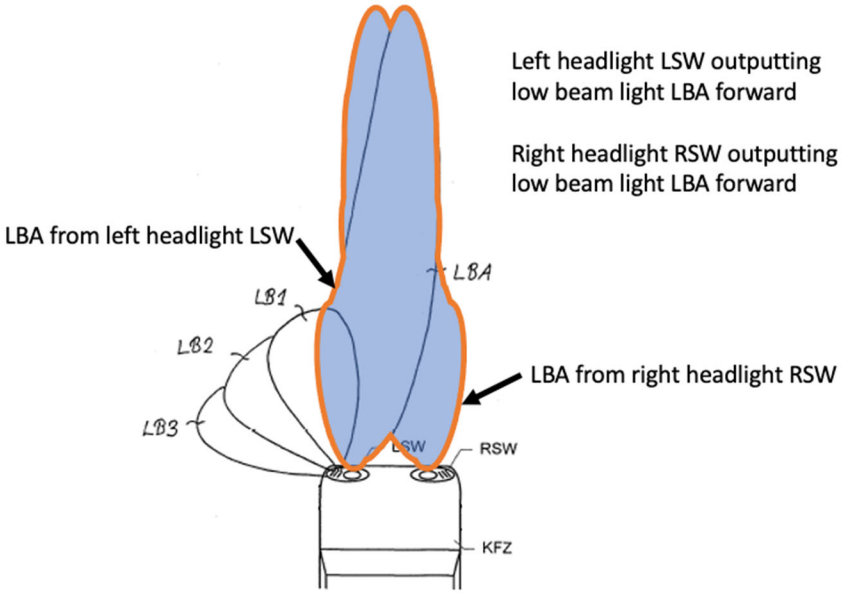


Figure showing collective LBA spatial distribution of light from left and right headlights having shape of light in orange (EX1002, ¶¶111-114)

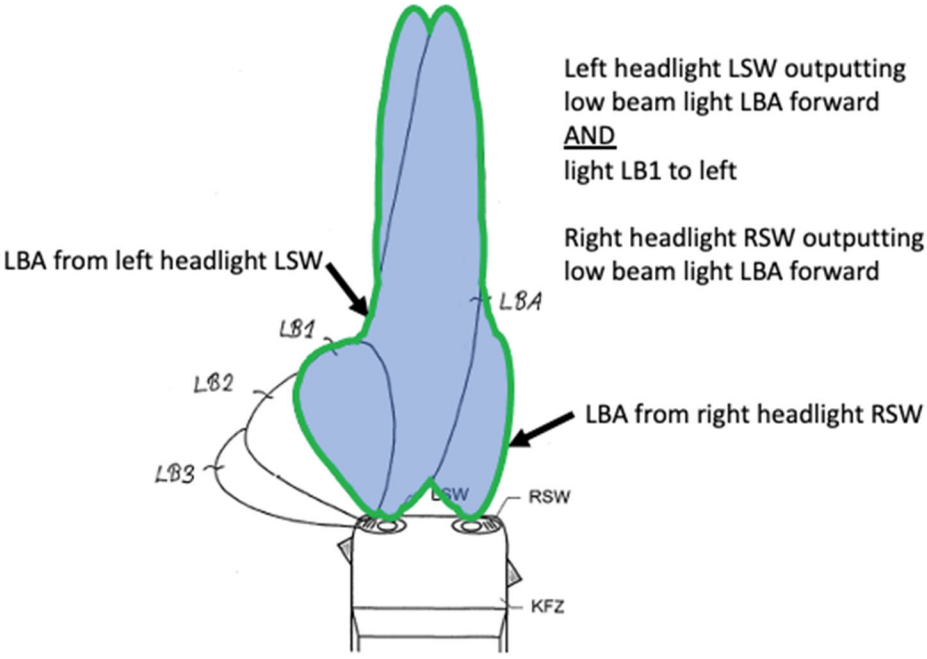


Figure showing collective LBA spatial distribution of light from left and right headlights and LB1 from left headlight having shape of light in green (EX1002, ¶¶111-114)

Additionally, as discussed in the Heinz-Gotou combination, Heinz's system explicitly considers map information indicating the direction and sharpness of a road curve and information on proper vehicle position to determine where light from headlights should be directed as taught by Gotou. *See* Section VI.B.2.d; EX1002, ¶115. Thus, in the combination, Heinz's adjustment of light pattern collectively output by left headlight LSW and right headlight RSW in the spatial distribution, such that the pattern is "widen[][ed] in a fan-like manner towards the turning direction," is based on the curvature of the road in the turning direction—the direction and sharpness of the curve—as taught by Gotou; this adjustment in the light pattern is therefore *to increase light in a direction of the road curvature ahead of the motor vehicle* and is *based at least in part on the road curvature*. *Id.*

And finally, in the Heinz-Gotou combination, the adjustment in the light pattern provides *shaping light based at least in part on the road curvatur*e because the overall shape of light output by headlights LSW and RSW as discussed above is changed as light beams LB1, LB2, and LB3 are produced, which is based on the degree and sharpness of a turn as taught in the combination. *Supra,* Section VI.B.2.e; Section VI.B.2.d; EX1002, ¶116.

f) ***[G2/3-1f] "control at least a first plurality of the LED light sources to provide light based at least in part on the determined light change and prior to the motor vehicle reaching the road curvature."***

Heinz in view of Gotou (Ground 2), or alternatively, Heinz in view of Gotou and Harbers (Ground 3) renders obvious this limitation. EX1002, ¶¶117-118.

- **Heinz in view of Gotou (Ground 2)**

Based on how "the control device determines how the individual illuminants LM1, LM2, and LM3," each formed by a plurality of LEDs, "are to be switched on or off to form the desired turning light in the given driving situation," Heinz's control device switches on one or more of the illuminants LM1, LM2, and/or LM3 to provide turning light (*one or more processors to*:…*control at least a first plurality of the LED light sources to provide light based at least in part on the determined light change*). EX1006, 2:43-49, 4:20-46, 4:49-5:34, Fig. 2; *see also* limitation [G2/3-1e]. For example, LM1 comprises a first plurality of LEDs out of the LEDs that form LM1, LM2, and LM3 (*a first plurality of the LED light sources*); when the control device determines that LM1 should be switched on to provide desired turning light in a given driving situation (e.g., driving situation that is a certain path of the roadway), the control device controls the LEDs of LM1 by switching them on, which discloses or at least renders obvious *one or more processors to*:…*control at least a first plurality of the LED light sources to provide light based at least in part on the*

determined light change. *Id.* Alternatively, all of the LEDs that form sources LM1, LM2, and LM3 of the left headlight can collectively be considered the *first plurality of the LED light sources*. *Id.* Here, when the control device determines that LM1, LM2, and LM3 of the left headlight should be switched on to provide desired turning light in a given driving situation (e.g., driving situation that is a certain path of the roadway), such as for a tighter turn, the control device controls the LEDs of LM1, LM2, and LM3 by switching them on in succession, which discloses or at least renders obvious *one or more processors to*:…*control at least a first plurality of the LED light sources to provide light based at least in part on the determined light change*. *Id.*; EX1002, ¶119.

Heinz does not explicitly describe control of light sources *prior to the motor vehicle reaching the road curvature.* However, the combination of Heinz and Gotou renders this limitation obvious. Gotou describes controlling light source(s) of headlights to activate their light output *prior to the motor vehicle reaching the road curvature*— e.g., a predetermined distance before a curve. *See* limitation [G1-1f] (Section VI.A.4.f); EX1002, ¶120.

Motivation to Combine Heinz and Gotou

A POSITA would have been motivated to combine Heinz and Gotou for the reasons discussed for limitation [G2/3-1d]. A POSITA would have been further motivated to combine Heinz and Gotou such that Heinz's system controls its

headlights to produce turning light prior to its vehicle KFZ reaching a road curvature, as well as when driving through the road curvature (e.g., during a turn). EX1002, ¶121.

In Heinz's system, the illuminants LM1, LM2, and LM3 of each headlight LSW and RSM contains "lighting elements LE" that are "light-emitting diodes (LEDs)." EX1006, 4:42-46, 5:49-6:10. For a vehicle turn, one or more of the illuminants produce turning light; in the left turn example of Figure 2, illuminants successively illuminate toward the left according to how sharp the left turn is, where LM1 produces turning light LB1, LM2 produces turning light LB2, and LM3 produces turning light LB3. *Id.*, 4:42-5:20, Fig. 2.

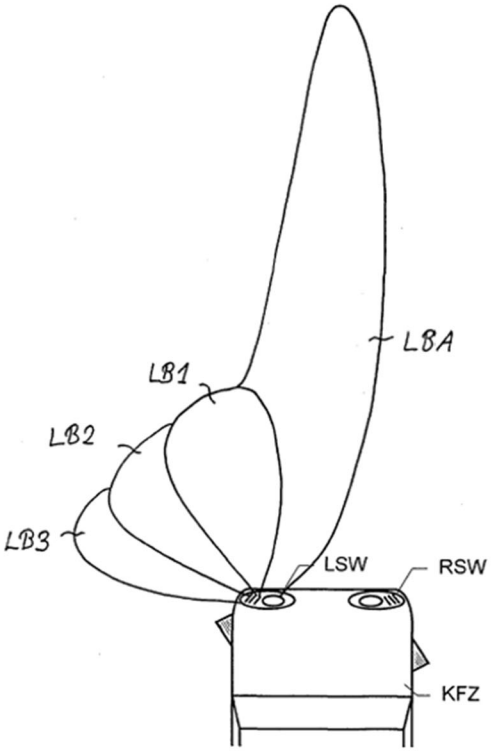


Fig. 2

EX1006, Fig. 2

The illuminants LM1, LM2, and LM3 illuminate to produce turning light LB1, LB2, and LB3 depending on how much the vehicle is turned. *Id.*; *see id.*, 2:28-35. To produce "**optimal adaptation of the light distribution to the driving situation**, in particular to the position and velocity of the motor vehicle depending on the path of the bend," a sufficiently "**precise determination of the driving situation**" is needed. *Id.*, 5:13-25. Heinz explains that using "the signal of a rotary position sensor" to determine the amount a vehicle has turned from, for example, a steering wheel, is one way of determining the "driving situation," that "such a rotary position

sensor may be **additionally supported or even replaced** by a video camera for detecting path of the roadway," and that "**data of a vehicle navigation system may be used for this purpose**" as well. *Id.*, 5:25-34, 4:27-32. Heinz further explains that using such data can be used "to **detect the driving situation** during and **just before turning.**" *Id.*, 2:53-3:2. Thus, Heinz's system recognizes the need to precisely determine a driving situation so its headlights provide optimal illumination of a road path, and explains that its determination of a driving situation using rotary position can be "supported or even replaced" by navigational data and detected before a turn. *Id.*; EX1002, ¶¶122-123.

Gotou also recognizes the need for a precise determination of a driving situation, but further recognizes the drawbacks associated with using only a rotary sensor to determine how headlights should illuminate a road curvature. Specifically, Gotou explains that some prior art systems required "the lighting region…is not changed unless the steering wheel is operated, so that a turning direction can not be lighted at a stage before entering the curved part." EX1003, 1:26-29. Thus, Gotou's system was "accomplished in view of the forgoing" prior art and provided a system that allows for adjusting the "light region" in "compliance with a road shape in the front of the vehicle expected from the map information and the present position…so that the lighting region is changed fast in advance toward a turning direction the driver wants and then a superior visibility can be attained." *Id.*, 2:22-26. Its

headlights are controlled "when the vehicle reaches the predetermined distance S before the curve entrance" such that "light distribution is deflected…at a proper timing before the curve." EX1003, 3:52-67, 7:32-43; *see also id.*, 6:40-45 (control of optical axes takes place "before the steering wheel is actually turned"); EX1002, ¶124.

Thus, to optimize headlight light distribution for driving situation, a POSITA would have been motivated to combine Heinz and Gotou such that Heinz's system is enhanced to control its headlights to produce turning light prior to its vehicle KFZ reaching a road curvature, as well as when driving through the road curvature (e.g., during a turn). EX1002, ¶125. The combination would have enhanced Heinz's system because controlling its headlights to produce turning light prior to the vehicle reaching the road curvature not only "improves visibility" for the driver but allows for "superior visibility." EX1003, 6:40-43, 7:36-43, 8:33-35. The combination enhances Heinz to address the known drawbacks (e.g., less visibility), recognized by Gotou, associated with using only a rotary sensor to determine how headlights should illuminate a road curvature. EX1002, ¶125.

A POSITA would have combined Heinz and Gotou as above using known software techniques, where Heinz's vehicle control device SE would have simply determined an angle at which light is to be output by headlights LSW and RSW and controlled for light to be output in accordance with the determination prior to the

vehicle reaching the road curvature as taught by Gotou. EX1002, ¶126. This would have been straightforward, at least because Heinz already contemplates detecting a "driving situation" before a turn. *Id.*; EX1006, 2:53-3:2. Separate or combined, the Heinz and Gotou systems (including the combined elements, e.g., Heinz's control by control device SE; Gotou's control by light distribution control system having ECU 10) would have both performed the same function of providing adjustable lighting to the area in front of a vehicle to illuminate a road curve. *Id.* And a POSITA would have recognized that the combination would have provided the predictable result of Heinz's system controlling its headlights to produce turning light during a turn as well as prior to its vehicle KFZ reaching the turn as taught by Gotou. *Id.* A POSITA would have had a reasonable expectation of success in making this combination for the same reasons discussed above, and also due to the similarities of both references, where both references are at least directed to vehicle headlight control and discuss providing improved visibility for vehicle drivers. EX1003, 2:19-26; EX1006, Abstract, 1:5-20, 2:21-25, 4:42-5:34; EX1002, ¶126.

This analysis therefore demonstrates at least the following motivations to combine:

- Use of known technique (known control of headlights prior to a road curvature in a headlight control system as taught by Gotou) to improve similar devices (to improve Heinz's headlight control system) in the same way (by implementing

Gotou's known control of headlights prior to a road curvature in a headlight control system in Heinz's headlight control system, Heinz's system is improved as its light distribution is more quickly adjusted in compliance with upcoming road shape to provide superior driver visibility).

- Applying a known technique (known control of headlights prior to a road curvature in a headlight control system as taught by Gotou) to a known device ready for improvement (to Heinz's known headlight control system that is ready for improvement as explained by Gotou in regard to prior systems) to yield predictable results (Heinz's system controlling its headlights to produce turning light during a turn as well as prior to its vehicle reaching the turn).

EX1002, ¶127.

- **Heinz in view of Gotou and Harbers (Ground 3)**

To the extent the Board determines, or the Patent Owner argues, that the claimed *control* requires a narrower interpretation where each *LED light source* of the *first plurality of LED light sources* is individually and/or separately controlled, Harbers teaches this for the same reasons discussed in limitation G1-1f, *supra*. Here, Heinz in view of Gotou and Harbers renders claim 1 obvious. EX1002, ¶128.

Motivation to Combine Heinz, Gotou, and Harbers

A POSITA would have been motivated to combine Heinz and Gotou for the same reasons discussed above for limitations [G2/3-1d] and [G2/3-1f]. A POSITA would have been further motivated to combine the Heinz-Gotou combined system with Harbers such that the LEDs of Heinz's headlights LSW and RSW are individually and separately controlled as taught by Harbers. EX1002, ¶129.

Heinz explains that in its system, control device SE is connected to illuminants LM1, LM2, and LM3 via control leads SL1, SL2, and SL3, respectively, and that the LED lighting elements of each illuminant "are interconnected within the illuminants such that they may be turned on or off together by the control device SE via the corresponding control lead." EX1006, 4:20-27. Harbers similarly describes that in its system, groups of headlight LEDs may be switched on or off to produce various headlight beams. *See, e.g.*, EX1004, 7:23-49. However, Harbers additionally adds that these LEDs are individually and separately controlled to switch them on or off or otherwise control their luminous flux, to provide a desired spatial distribution of light. *See* Limitation [G1-1f] (Section VI.A.4.f). Thus, a POSITA would have been motivated to combine the Heinz-Gotou system with Harbers as discussed above because the combination would have enhanced the Heinz-Gotou system, providing Harber's individualized and more precise control of Heinz's LED lighting elements to produce a desired spatial distribution of light. EX1002, ¶130. The combination

would have enhanced how the Heinz-Gotou system illuminates the front area of a vehicle, providing headlights LSW and RSW with "more dynamic lighting possibilities" EX1004, 1:43-45, 2:6-9 ("The use of a plurality of opto-electronic elements with a relatively high luminous flux enables a vehicle headlamp to be manufactured having much more dynamic lighting possibilities than the known vehicle headlamp."); EX1003, 3:24-35, Fig. 1. Heinz's system already provides controlling headlights by control device SE, and Harbers, applicable to Gotou in that it is similarly directed to controlling light output by headlights, explains that its use of controllable LEDs in headlights provides such "more dynamic lighting possibilities," for adjusting the "continuously adjustable spatial distribution" of light beams output by headlights to "improve[]" a "driver's view of the road and the surroundings of the vehicle" (EX1004, 2:23-49). Thus, enhancing the Heinz-Gotou system with Harbers' teachings would have improved the efficacy of the Heinz-Gotou system, providing improved and more precise lighting control of headlights LSW and RSW, and in turn, improving the driver's view. *Id.*; EX1002, ¶130.

A POSITA would have combined the Heinz-Gotou system with Harbers as above using known hardware and software techniques associated with headlight adjustment, where the LEDs of Heinz's headlights LSW and RSW are individually and separately controlled as taught by Harbers. EX1002, ¶131. While Heinz explains that its LED lighting elements "are interconnected within the illuminants such that

they may be turned on or off together by the control device SE via the corresponding control lead," a POSITA would have understood that adjusting Heinz's system such that the LEDs are not interconnected and are individually and separately controllable would have been straightforward and routine to a POSITA. *Id.*; EX1006, 6:2-5. This is because adjusting the LEDs' interconnectivity in this manner (i.e., such that they are not interconnected and are individually and separately controllable) was well known to POSITAs, as taught by Harbers, and would have resulted in a system that still allowed for adjusting the luminous flux and/or switching on or off groups of LEDs, but simply in the manner as taught by Harbers. EX1002, ¶131. Weidel corroborates this POSITA knowledge that individually and separately controllable headlight LEDs were well known, describing the LEDs that can be energized "individually or in groups." *Id.*; EX1005, Abstract, 0015, 0017, 0020, 0022, 0028, 0030, 0038. And Heinz already describes providing control signals to its LEDs; thus, as combined, Heinz's system would simply have had its control signals enhanced as taught by Harbers to control individual LEDs. EX1006, 4:20-42, 6:2-5. Accordingly, separate or combined, the Heinz-Gotou system and Harbers systems (including the combined elements, e.g., Heinz's headlights and control device of the Heinz-Gotou system; Harbers' teachings regarding individual and separate control of LEDs) would have both performed the same function of providing adjustable lighting to the area in front of a vehicle, where groups of LEDs are activated. *Id.*;

EX1002, ¶131. And a POSITA would have recognized that the combination would have provided the predictable result of the LEDs of Heinz's headlights LSW and RSW being individually and separately controlled by Heinz's control device as taught by Harbers. *Id.*

This analysis therefore demonstrates at least the following motivations to combine:

- Combining prior art elements (Heinz-Gotou headlight system including Heinz's headlights LSW and RSW having LEDs and control device; Harbers' headlight system that individually and separately controls LEDs) according to known methods (known hardware and software techniques) to yield predictable results (In the Heinz-Gotou system, LEDs of Heinz's headlights LSW and RSW being individually and separately controlled by Heinz's control device as taught by Harbers).
- Applying a known technique (individually and separately controlling headlight LEDs as taught by Harbers) to a known device ready for improvement (Heinz-Gotou headlight system including a control device and headlights LSW and RSW that each include LEDs) to yield predictable results (In the Heinz-Gotou system, LEDs of Heinz's headlights LSW and RSW being individually and separately controlled by Heinz's control device as taught by Harbers).

EX1002, ¶131.

3. Claim 2

a) *"The system of claim 1, wherein the determination of the light change includes selection of the first plurality of the LED light sources."*

Hienz in view of Gotou (Ground 2) and Hienz in view of Gotou and Harbers (Ground 3) render claim 1 obvious, and further render obvious claim 2.

The *first plurality of the LED light sources* is disclosed or at least rendered obvious by Heinz's plurality of LEDs that form illuminant LM1 or alternatively all the LEDs that form sources LM1, LM2, and LM3 of the left headlight. *See* Limitation [G2/3-1f]. Further, Heinz describes "[a]ccording to a predetermined program…the control device determines how the individual illuminants LM1, LM2, and LM3" formed by LEDs "are to be switched on or off to form the desired turning light in the given driving situation" (*one or more processors to*:…*determine a light change*). EX1006, 4:36-41. Because this *determination of the light change* selects which of the illuminants formed by LEDs to turn on (e.g., LM1 only (which can be formed by a *first plurality of LEDs* as discussed) or LM1, LM2, and LM3 (which collectively can formed by a *first plurality of LEDs* as discussed)), it *includes selection of the first plurality of the LED light sources. Id.*; *see also id.*, EX1006, 2:43-49, 4:20-46, 4:49-5:34, Fig. 2.

4. Claims 10 and 11

a) (Claim 10) "*The system of claim 1, further including one or more optical control elements for controlling light from one or more of the LED light sources.*"

b) (Claim 11) "*The system of claim 10, wherein the optical control elements include at least one of one or more reflectors, refractors or lenses.*"

Hienz in view of Gotou (Ground 2) and Hienz in view of Gotou and Harbers (Ground 3) render claim 1 obvious, and further render obvious claims 10 and 11. Hienz describes that in its system, "lighting elements" such as its LEDs of headlights "may be associated with optical beam-forming devices, e.g. lenses, reflectors or screens" to provide "beam forming" that controls the light output by the LEDs and allows for more precise light beams. EX1006, 3:42-54, 6:26-41.

5. Claim 12

Heinz in view of Gotou and Heinz in view of Gotou and Harbers render claim 12 unpatentable for the same reasons discussed for claim 1. Section VI.B.2.

6. Claim 13

Heinz in view of Gotou and Heinz in view of Gotou and Harbers render claim 13 unpatentable for the same reasons discussed for claim 2. Section VI.B.3.

7. Claim 23

Heinz in view of Gotou and Heinz in view of Gotou and Harbers render claim 23 unpatentable for the same reasons discussed for claim 1. Section VI.B.2.

8. Claim 24

Heinz in view of Gotou and Heinz in view of Gotou and Harbers render claim 24 unpatentable for the same reasons discussed for claim 2. Section VI.B.3.

VII. DISCRETIONARY INSTITUTION

A. 35 U.S.C. §314(a)

The *Apple Inc. v. Fintiv, Inc.*, IPR2020-00019, Paper 11 (PTAB March 20, 2020) and *NHK Spring Co. v. Intri-Plex Techs., Inc.*, IPR2018- 00752, Paper 8 (PTAB Sept. 12, 2018) (precedential) factors do not weigh in favor of denial. Unified is not a litigation defendant. Regardless, the factors weigh against exercising discretionary denial. The district court cases involving the '029 patent are at early stages, with no answers filed and no trial dates set. EX1015. Due to their early stages, there appears to have been little investment by the court and parties, and there appears to be little overlap between the issues raised in this Petition and in the cases. *Id.* Moreover, this Petition presents a "compelling unpatentability challenge," showing the Challenged Claims are obvious under three grounds that consider various potential claim interpretations. Section VI. This alone demonstrates the Board should not discretionarily deny institution. USPTO Interim Procedure For Discretionary Denials In AIA Post-Grant Proceedings With Parallel District Court Litigation, June 21, 2022, 4-5.

B. 35 U.S.C. §325(d)

Denial under §325(d) is not warranted. Gotou and Heinz were not before the examiner during prosecution. Harbors is cited by the '029 patent's face but was not applied to the Challenged Claims during prosecution or otherwise analyzed. And the references relied on herein are not cumulative; the only prior art rejection during the '029 patent's prosecution was withdrawn for non-substantive reasons. Section IV.C.

VIII. CONCLUSION

Petitioner requests *inter partes* review of the Challenged Claims.

Dated: September 22, 2022

Respectfully Submitted,

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Registration No. 74,096

Table of Exhibits for U.S. Patent 11,208,029 Petition for *Inter Partes* Review

Exhibit	Description
1001	U.S. Patent 11,208,029 ("the '029 patent")
1002	Declaration of A. Brent York
1003	U.S. Patent 5,588,733 ("Gotou")
1004	U.S. Patent 6,406,172 ("Harbers")
1005	U.S. Patent Application Publication 2002/0196639 ("Weidel")
1006	German Patent DE19923187C2 ("Heinz") (Certified Translation)
1007	German Patent DE19923187C2 (Original German-language version)
1008	Declaration of Dr. Carola F. Berger (regarding certified translation)
1009	U.S. Patent Application Publication 2003/0152088 ("Kominami")
1010	U.S. Patent 6,158,415 ("Ichikawa")
1011	File History of U.S. Patent 11,208,029
1012	U.S. Provisional Patent Application 60/395308

1013	File History of US Patent 9,955,551 Reexamination
1014	Declaration of Kevin Jakel
1015	Docket Sheets
1016	U.S. Patent 5,900,698 (“Fast”)
1017	U.S. Patent 6,161,950 (“Tsukamoto”)
1018	U.S. Patent 6,017,138 (“Reiss”)
1019	EP 0949118A2 (Certified Translation)
1020	EP 0949118A2 (Original German-language version)

CERTIFICATE OF COMPLIANCE REGARDING WORD COUNT

I hereby certify that the foregoing Petition for *Inter Partes* Review of U.S. Patent 11,208,029 contains 13,806 words as measured by the word processing software used to prepare the document, in compliance with 37 CFR § 42.24(d).

Respectfully submitted,

Dated: September 22, 2022

/Ellyar Y. Barazesh/
Ellyar Y. Barazesh
Reg. No. 74,096

CERTIFICATE OF SERVICE

I hereby certify that on September 22, 2022, I caused a true and correct copy of the foregoing materials:

1. Petition for *Inter Partes* Review of U.S. Patent 11,208,029 Under 35 U.S.C. § 312 and 37 C.F.R. § 42.10.
2. Exhibit List
3. Exhibits for Petition for *Inter Partes* Review of U.S. Patent 11,208,029 (EX1001-EX1020)
4. Power of Attorney
5. Certificate of Compliance Regarding Word Count Under 37 CFR § 42.24(d)

to be served via USPS Priority Express on the following correspondent of record as listed on USPTO Patent Center:

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Dated: September 22, 2022

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