Volkswagen Group of America, Inc. & Porsche Cars North America, Inc.
v.
Yechezkal Evan Spero

IPR2022-01586, IPR2023-01122

U.S. Patent No. 11,208,029

VOLKSWAGEN

GROUP OF AMERICA

Petitioner's Demonstratives

VWGoA EX1048
VWGoA v. Spero
IPR2022-01586

Issues Disputed by Patent Owner

- Whether the combinations disclose "increas[ing] light in a direction" (of a road curve) [1.5]/[12.5]/[23.5]
- Whether a POSA would have been motivated to combine the references in the two grounds
- Whether Dr. Turk qualifies as a POSA

POR, Paper 13, pp. 24, 37, 51, 56; PO Sur-Reply, Paper 20, pp. 10-20.

Instituted Grounds

IPR2022-01586 ('029 Patent)		
	Claim(s)	**References**
Ground 1	1-33	Beam (EX1005) and Kobayashi (EX1008)
Ground 2	1-33	Gotou (EX1012) and Karlsson (EX1010)

Pet., Paper 1, p. 4; DI, Paper 7, pp. 5, 22.

State of the Art at the Time of the ’029 Patent

Dr. Jiao explained the state of the art in EX1003, ¶¶44-61.

- “As early as the 1940s and 1950s, vehicles such as the Tucker Torpedo and Citroen DS-19 included headlamps that swiveled with the turning angle of the wheels via mechanical linkage. EX1030, 3- 4.” EX1003, ¶47.
- “Most notably with relation to the technology claimed in the ’029 patent, from about 1992 to 1999, a global consortium of headlamp and automobile manufacturers participated in the EUREKA Project to advance development of adaptive front lighting systems (AFS). EX1015, 3-6; EX1016, 1-19; EX1023, 514- 515; EX1024, 819. The EUREKA Project was a well known consortium that a POSA would have been aware of.” EX1003, ¶47.

Prior Art Examples of Desired/Adaptive Beam Patterns

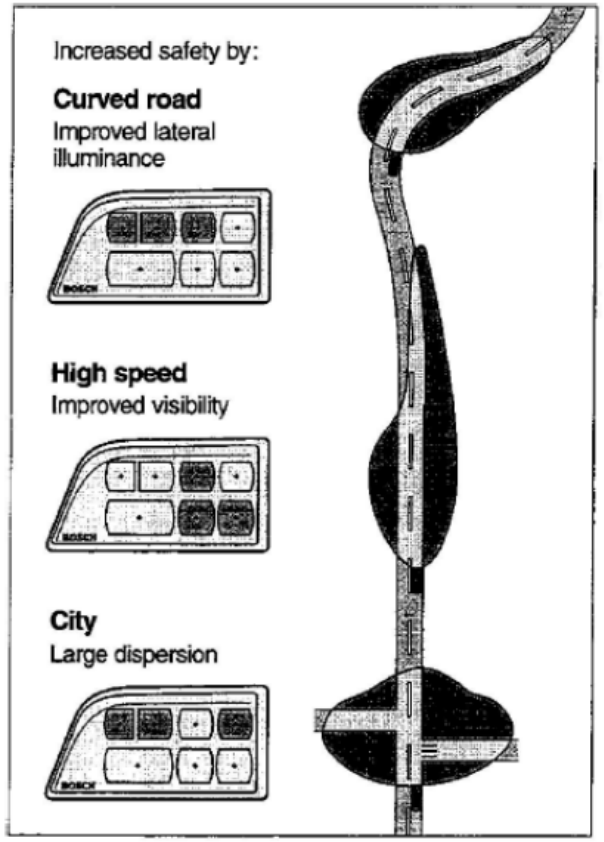


Fig.1: Three standard driving situations with adapted light pattern seen from the bird eye's view.

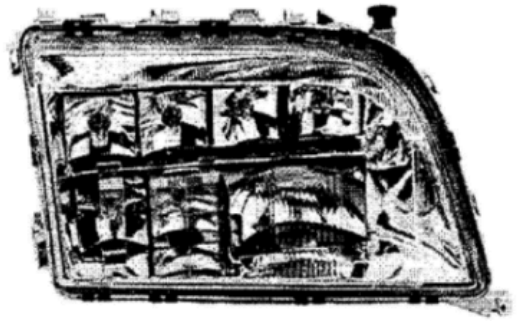
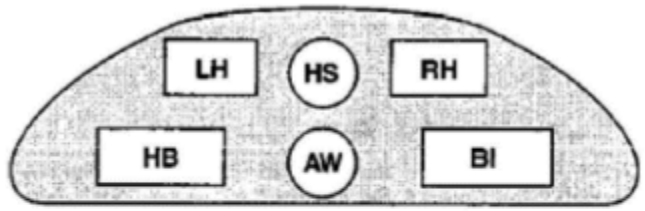


Fig 4: ALP *headlamp* sample



Single components:

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

Fig. 5 Advanced ALP sample layout

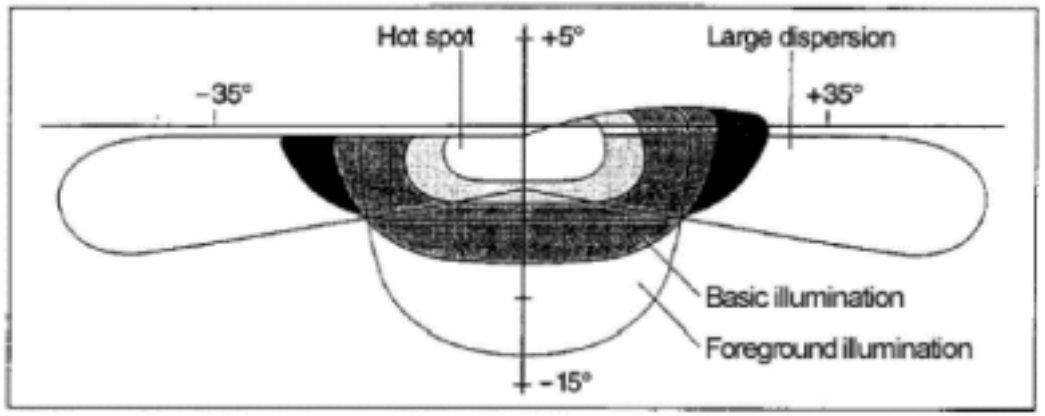
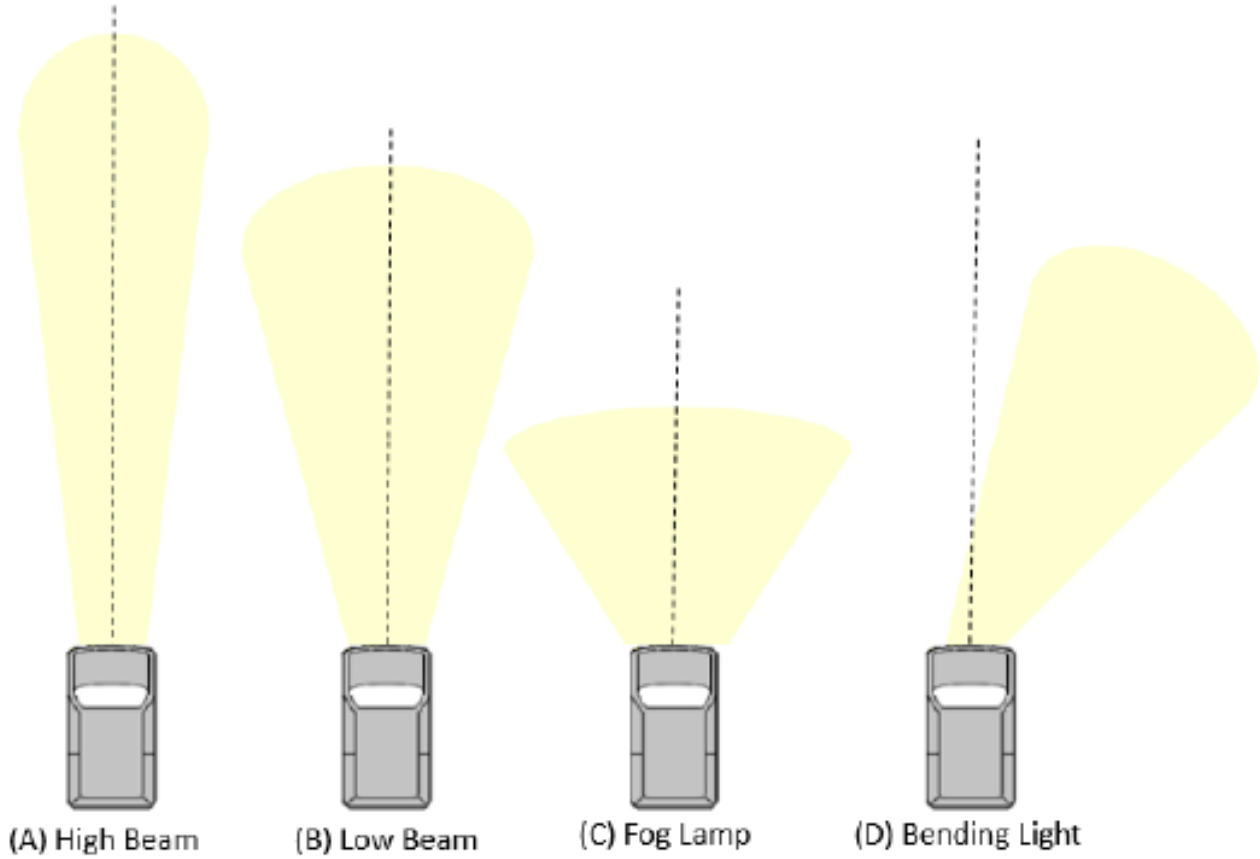


Fig. 3: Light pattern of multiple beam *headlamp (Isolux* curves in wall projection):
The individual light *pattern* of multiple sub-units sum up to the total adaptive light pattern

EX1017, FIGS. 1 & 3-5.

Pet., Paper 1, pp. 9-10; Jiao First Dec., EX1003, ¶¶48-50; Pet. Reply, pp. 14-15, 22-23, 27.

Examples of Desired Beam Patterns, as Illustrated by Dr. Jiao



Jiao Second Dec., EX1036, FIG. 1, ¶¶ 51-60; Pet. Reply, pp. 7-9.

State of the Art: Adaptive Beam Patterns

- "EX1017, 3-10 ("[A] curve or an intersection can be adaptively illuminated before reaching actually the point when the steering wheel is turned or the turn indicator is operated.")"
- "EX1018, 33-36 ("The advantage of using Adaptive Light Control is shown in Fig. 5, where one observes a country road lit correctly. Instead of illuminating some fields or trees, the available light is directed dynamically in the direction where it is actually needed, enhancing the visual information for the driver.")"
- "EX1019, 1-2 ("A major breakthrough in improving visibility, safety and comfort under all driving conditions is given by a headlamp with adjustable light intensity and beam pattern according to the vehicle speed, steering wheel angles and different driving conditions.")"
- "EX1020, 368, 370, 374-378 ("The results show, that significant improvements can be proven by the adaptive headlamp system, without generating additional glare for oncoming traffic.")" EX1003, ¶49.

Pet., Paper 1, pp. 1-4.; EX1003, ¶¶ 49, 51; *see also id.*, ¶¶ 44-61.

State of the Art: Reducing Glare

- "By 2000, adaptive headlamp systems with multiple directional light beams were developed with various means of sensors to detect surroundings while driving and resulted in glare reduction for oncoming and preceding vehicle drivers. EX1005, 1:5-3:44, 4:9-59; EX1010, 1:10-26, 9:18-26, 20:29-32; *see also* EX1015, 6-18, 21."
- "EX1016, 1-19 ('[A]ll GRE experts acknowledge the experience with the new technology of front lighting, designed to improve the illumination and to adapt it to various driving situations, whilst reducing glare.')"
- "EX1009, 6:4-7; 16:6-25, 20:15-33 ('According to an aspect of some embodiments of the present invention, the pattern recognition application identifies oncoming vehicles and automatically adjusts illumination provided by the luxels to prevent glare from light provided by the luxels from blinding a driver of the oncoming vehicle.')." EX1003, ¶52.

Pet., Paper 1, pp. 1-4.; EX1003, ¶52; *see also id.*, ¶¶ 44-61.

State of the Art: LED Arrays in Headlamps

- "Further, arrays of independently controlled narrow-beam directional light sources, for example, light-emitting diode (LED) arrays, were developed with sufficient illuminance, directionality, and dynamic control as an alternative to traditional incandescent and gas discharge bulbs to provide adaptive light patterns and real-time feedback. EX1005, 1:5-3:44, 4:9-59; EX1010, 1:10-26, 9:18-26, 20:29-32; EX1015, 6-18, 21; EX1009, 16:6-25, 20:15-33." EX1003, ¶52.

- Other references reflect "well known advantages of LEDs specifically used as headlamp light sources. *See* EX1010, 14:1-15, 14:26-30, 2:30- 35, 6:1-5; *see also* EX1005, 4:9-15, 6:9-12, 8:4-17; EX1006, ¶¶5, 7, 8, 20, 27; EX1009, 19:27-29, 20:9-12, 23:8-12; EX1010, 4:25-35, 13:24-29, 11:29-32; EX1011, 1:18-2:3, 3:18-27, 8:13-20, 10:6-11, 10:21-22; EX1029, 987, 991." EX1003, ¶240.

Pet., Paper 1, pp. 1-4, 59; EX1003, ¶¶ 52, 240; *see also id*., ¶¶ 44-61.

State of the Art: GPS-Controlled Headlamps

- "By 1999, there were AFS headlamps 'controlled by path prediction based on a vehicle's dynamics and navigation data.' EX1025, 186."
- "Although live data could be used by vehicle sensors, it was well known that GPS navigation system gave additional advantages by providing more accurate information on driving regions. EX1026, 461-462 ('To obtain more accurate information on driving regions, it is advantageous to use data from a GPS navigation system.'); EX1024, 815-816."
- "The increased accuracy of navigation systems at that time made it possible to anticipate the light distribution needed during critical driving conditions, such as curves and crossings. EX1023, 525 ('This predictive system would make possible to anticipate the needed light distribution avoiding dangerous changes in the beam during critical driving conditions such as curves and crossing.'); EX1027, Abstract." EX1003, ¶57.

Pet., Paper 1, pp. 1-4, 59; EX1003, ¶¶ 57; *see also id*., ¶¶ 44-61.

’029 Patent – Independent Claim 1

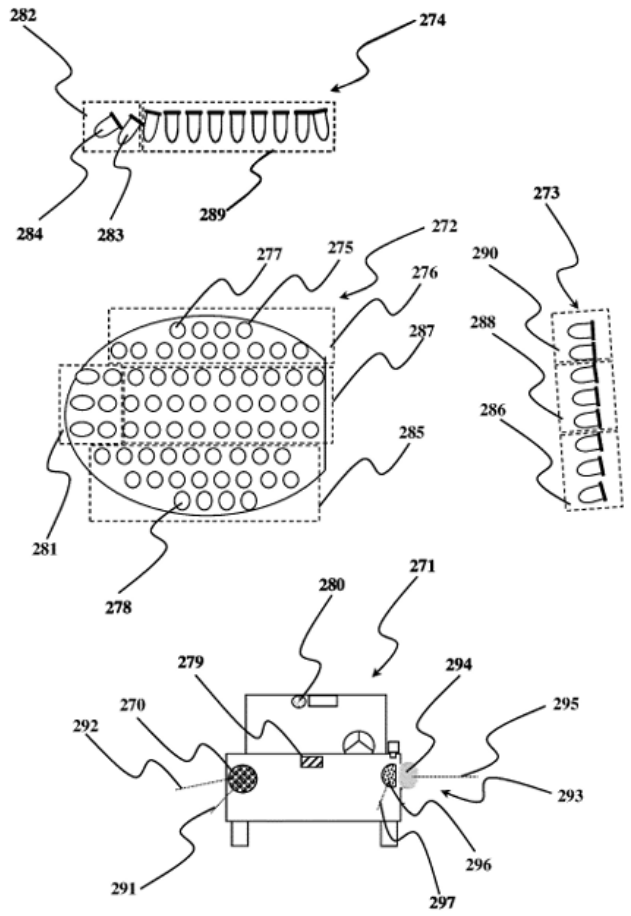


FIG. 15

’029 Patent, EX1001, FIG. 15.

Issued Claim 1	U.S. Pat. No. 11,208,029
1.P	A system, for a motor vehicle, comprising:
1.1	a plurality of headlamps, each comprising a plurality of LED light sources;
1.2	one or more processors; and
1.3	a memory storing instructions that, when executed by one or more of the one or more processors, enable the one or more processors to:
1.4	receive first data, including at least map data, indicating a road curvature upcoming along a road on which the motor vehicle is traveling;
1.5	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
1.6	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.

Pet., Paper 1, pp. 24-39, 55-79; ’029 Patent, EX1001, FIG. 15.

Petitioner’s Demonstrative Exhibit
Not Evidence

’029 Patent – Independent Claim 12

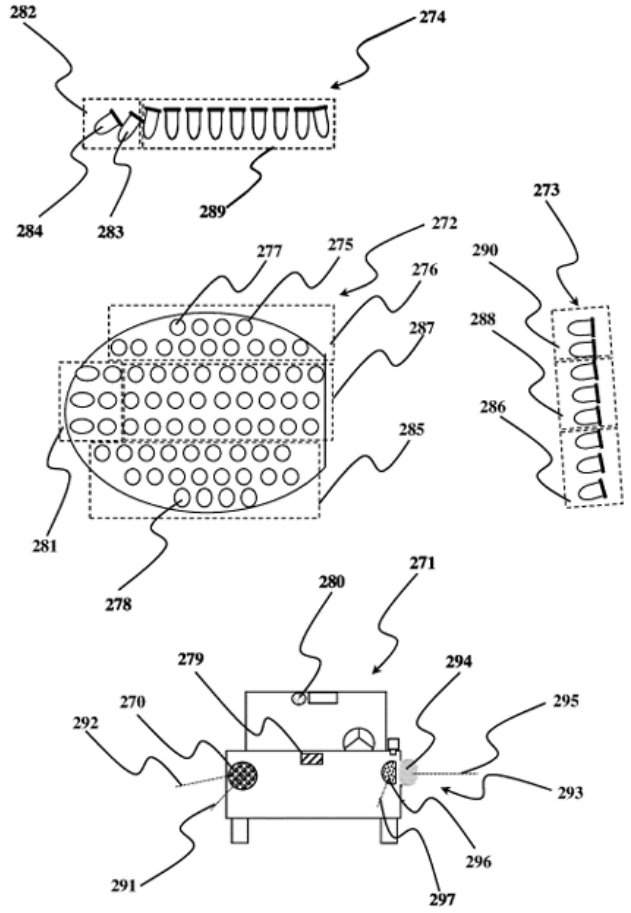


FIG. 15

’029 Patent, EX1001, FIG. 15.

Issued Claim 12	U.S. Pat. No. 11,208,029
[1.P-1.3] 12.P	[1.P] A non-transitory computer-readable storage medium, [1.3] storing instructions that, when executed by [1.2] one or more processors of a motor vehicle that includes [1.1] a plurality of headlamps that each comprise a plurality of LED light sources, enable the one or more processors to:
[1.4] 12.4	receive first data, including at least map data, indicating a road curvature upcoming along a road on which the motor vehicle is traveling;
[1.5] 12.5	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
[1.6] 12.6	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.

Pet., Paper 1, pp. 24-39, 55-79; ’029 Patent, EX1001, FIG. 15.

’029 Patent – Independent Claim 23

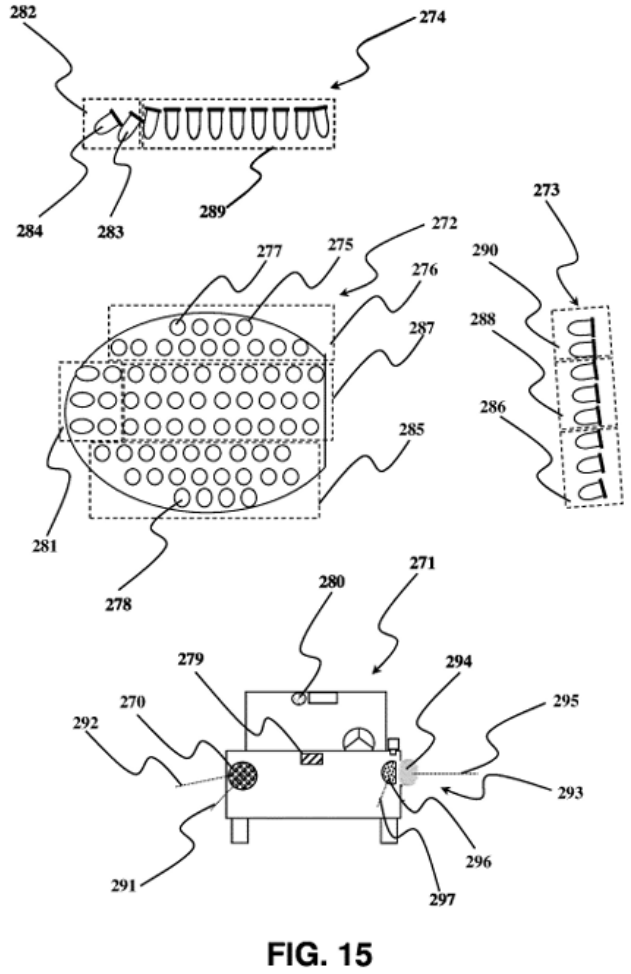


FIG. 15

’029 Patent, EX1001, FIG. 15.

Issued Claim 23	U.S. Pat. No. 11,208,029
[1.P-1.3] 23.P	[1.P, 1.2-1.3] A computer-implemented method for adapting light from headlamps of a motor vehicle to accommodate road shape changes, [1.1] the headlamps including a plurality of LED light sources, comprising:
[1.4] 23.4	determining an upcoming shape change of a road, ahead of the motor vehicle, based on first data, including map data, indicating the shape change;
[1.5] 23.5	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
[1.6] 23.6	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.

Pet., Paper 1, pp. 24-39, 55-79; ’029 Patent, EX1001, FIG. 15.

The ’029 Patent does not advance new lamp technology, LEDs, etc., nor does it purport to invent using GPS map data for automotive headlamp control

area to be illuminated. This invention comprises a different approach which is to provide the end user with the most correct lighting solution not a new technology lamp to replace the old one. The present invention comprises a novel

’029 Patent, EX1001, 11:5-8.

60 to 120 l/W as found in gaseous discharge lamps. This invention relates to technologies which are feasible at the present state of the art l/W as well as those which will become feasible in the future.

’029 Patent, EX1001, 19:66-20:2.

Present advances in automobile lighting include Adaptive Frontal-lighting Systems which aid in seeing around curves and other features in the road. In these systems the light distribution pattern and color spectrum will be changed according to the instantaneous road conditions at hand. Thus, the headlamp now has much more flexibility than the high beam/low beam variation of today. At any instant in time the intensity, spectrum and beam pattern of the head-lamp may be varied as a function of the driver’s intent, lay of the road and environmental factors. A GPS system on the car may also let the headlamps system know of curves up ahead, one-way traffic and others factors such the headlamp may be operated in the optimal mode at that instantaneous location. With sensors sensitive to environmental surround-

’029 Patent, EX1001, 51:54-67.

42. The ’029 Patent describes “a different approach which is to provide the end user with the most correct lighting solution not a new technology lamp to replace the old one.” (*Id.* at 11:5-7.) “In contrast to a prior art, single large, lamp

Turk Supp. Dec., EX2006, ¶42.

’029 Patent, EX1001; Pet. Reply, Paper 17, 9, 17; EX1037, 64:25-73:16; EX1036, ¶¶58-60.

The ’029 Patent does not provide any unique controller or algorithm for automotive lighting control or headlamp control

when ambient lighting levels are sufficient. A possible control system for such purposes is described in U.S. Pat. No. 6,281,632 by Stam, et-al from Aug. 28, 2001 titled: A Continuously variable headlamp control incorporated herein by reference. The patent describes how continuously variable headlamps offer greater flexibility for roadway illumination but offer challenges in automatic control design. Each continuously variable headlamp has an effective illumination range varied by changing at least one parameter from a set including horizontal direction aimed, vertical direction aimed, and intensity emitted. Stam discloses a system for automatically controlling continuously variable headlamps on a controlled vehicle includes an imaging system capable of determining lateral and elevational locations of headlamps from oncoming vehicles and tail lamps from leading vehicles.

’029 Patent, EX1001, 52:38-53.

Q. Column 52 of the '029 patent, line 38, do you see where it says, "A possible control system for such purposes is described in US Patent No. 6,281,632, by Stam, et al, from August 28, 2001"?
A. I see that.
Q. Have you reviewed US Patent No. 6,281,632?
A. I'm familiar with the name Stam, which makes me think I probably did review it, but I don't recall at the moment.
Q. But here the '029 patent is acknowledging that the Stam patent discloses a known control system for continuously variable headlights, right?
A. It says "for such purposes," so let me look to confirm what those purposes are. It's some kind of automatic control of headlamps, yes.

Turk Dep., EX1037, 76:2-16.

’029 Patent, EX1001; Turk. Dep., EX1037, 76:2-16.

Issues Disputed by Patent Owner

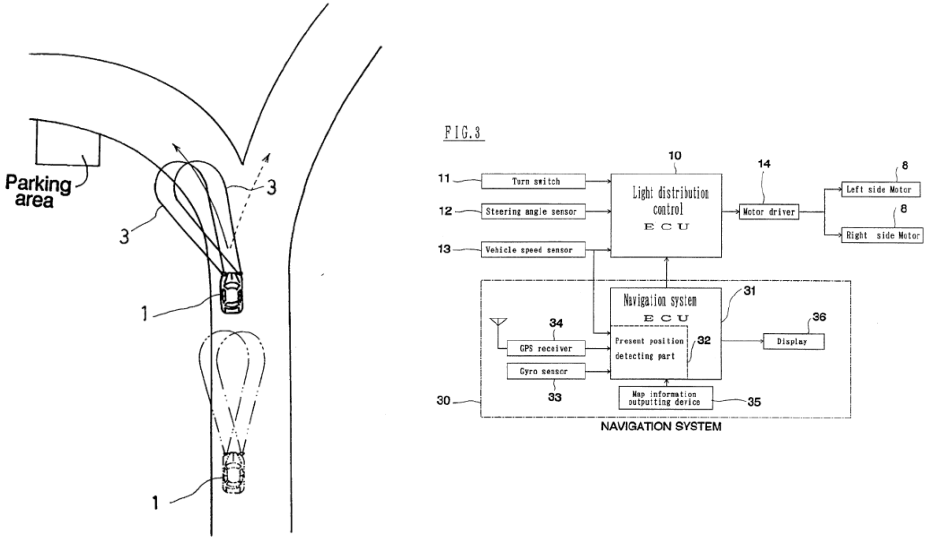
- Whether the combinations disclose "increas[ing] light in a direction" (of a road curve) [1.5]/[12.5]/[23.5]
  - **YES**
- Whether a POSA would have been motivated to combine the references in the two grounds
  - **YES**
- Whether Dr. Turk qualifies as a POSA
  - **NO**

POR, Paper 13, pp. 24, 37, 51, 56; PO Sur-Reply, Paper 20, pp. 10-20.

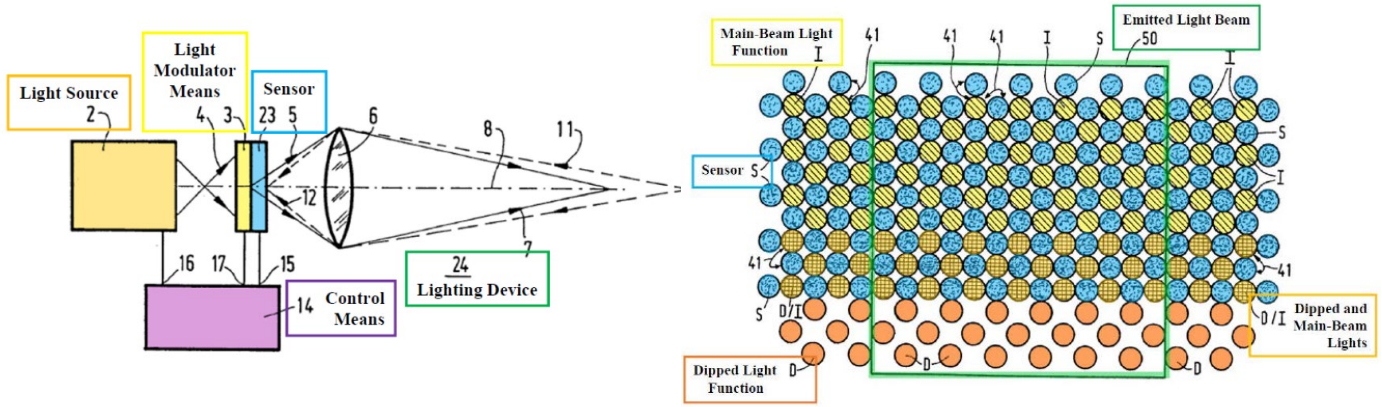
Ground 2 – Gotou and Karlsson

Ground 2 – Gotou and Karlsson: Undisputed Issues

- Patent Owner **does not dispute** that the combination of Gotou and Karlsson discloses elements:
  - 1.P, 1.1, 1.2, 1.3, 1.4, and 1.6 of claim 1;
  - 12.P, 12.1, 12.2, 12.3, 12.4, and 12.6 of claim 12; and
  - 23.P, 23.1, 23.2, 23.3, 23.4, and 23.6 of claim 23.



Gotou, EX1012, FIG. 10, FIG. 3.



Karlsson, EX1010, FIG. 3, FIG. 14 (annotated).

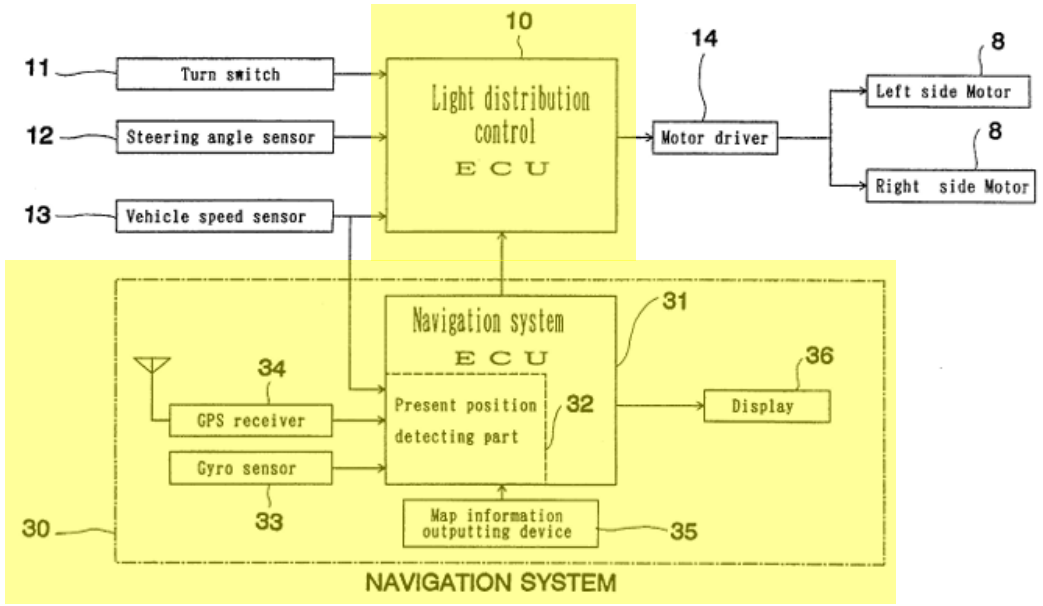
Pet. Reply, Paper 17, pp. 1, 7-11; Jiao Second Dec., EX1036, ¶¶50-64; *see generally* Pet.; POR; PO Sur-Reply.

Gotou, the primary reference, nearly anticipates claim 1 of the ’029 Patent

A head lamp device for a vehicle in which a lighting region in front of the vehicle in a traveling direction can be adjusted in rightward and leftward directions comprises: a direction

Gotou, EX1012, Abstract.

FIG.3



Gotou, EX1012, FIG. 3.

FIG.8

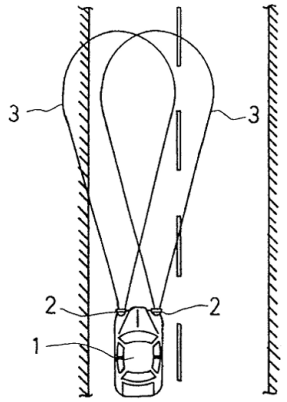
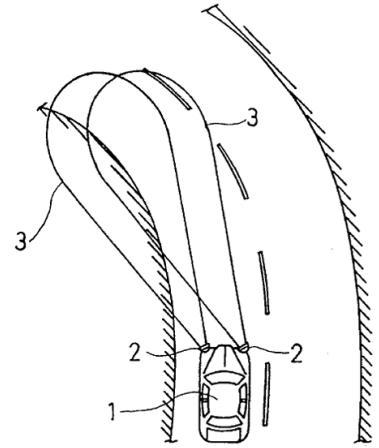


FIG.9

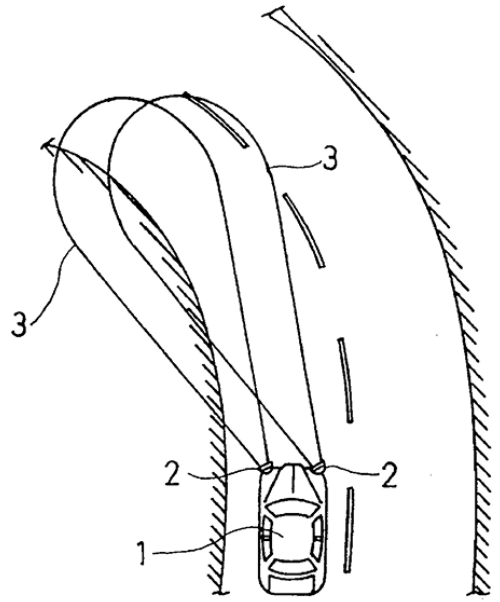


Gotou, EX1012, FIGS. 8 & 9.

Pet., Paper 1, pp. 17-21; Jiao First Dec., EX1003, ¶¶85-91; Jiao Second Dec., EX1036, ¶¶11-40.

Gotou, the primary reference, nearly anticipates claim 1 of the ’029 Patent

A head lamp device for a vehicle in which a lighting region in front of the vehicle in a traveling direction can be adjusted in rightward and leftward directions comprises: a direction



Gotou, EX1012, Abstract, FIG. 9.

in FIG. **8**. However, as shown in FIG. **9**, when there is a leftward curve in the forward location, a curve pre-noticing signal is present through an inputting of the map information (step **2**), and the operation enters the map information cooperating control mode (step **10**). In this case, the optical axis angle θ is determined in view of the state of the curve and the like at first, and the optical axis control based on the optical axis angle θ and the navigation accuracy or the like is started when the vehicle reaches the predetermined distance S before the curve entrance and the light distribution is deflected leftward at a proper timing before the curve, resulting in that a superior visibility can be attained.

Gotou, EX1012, 7:32-43.

Pet. Reply, Paper 17, pp. 6-11, 16-17; Jiao First Dec., EX1003, ¶¶230-50; Jiao Second Dec., EX1036, ¶¶78-85.

Gotou, the primary reference, nearly anticipates claim 1 of the ’029 Patent

There is also another method in which two bulbs are installed in one head light and the light distribution is changed by separately using one bulb illumination and two-bulb illumination, respectively.

Gotou, EX1012, 8:16-19.

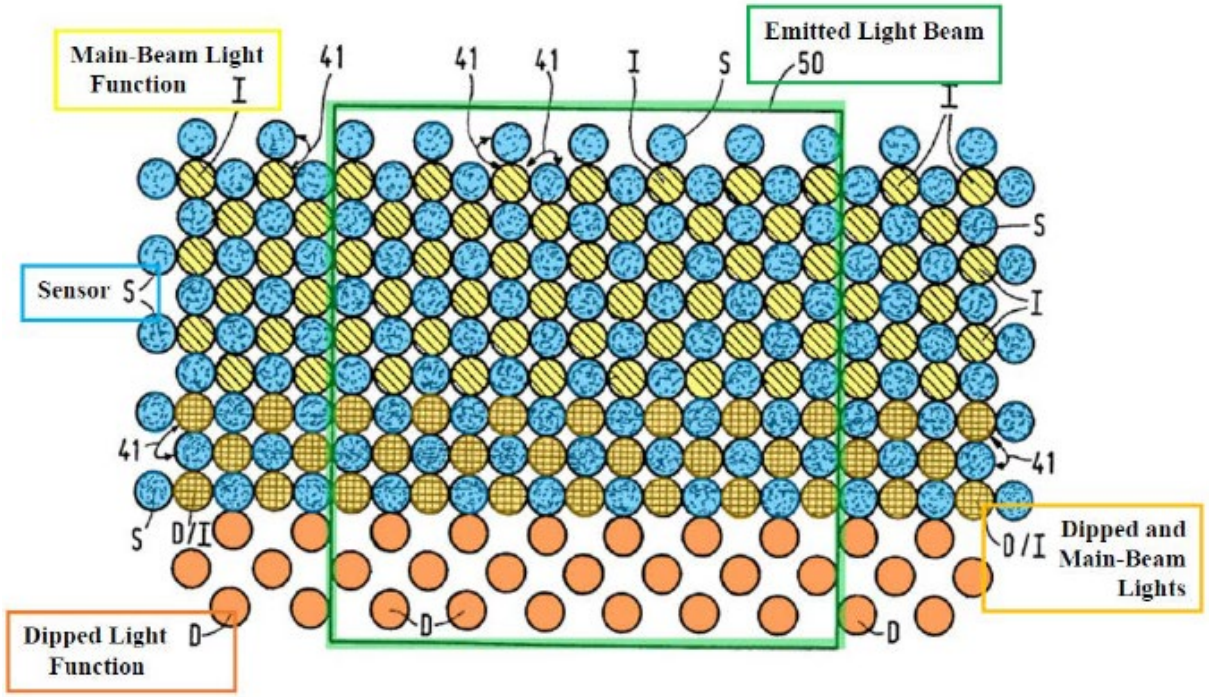
239. While Gotou does not expressly disclose that its lamp units 4 include LEDs—a technology well known to be used as headlamps—it *does describe that plural bulbs* may be installed in one head light and the light distribution is changed by “separately using one bulb illumination and two-bulb illumination, respectively.” EX1012, 8:15-19.

EX1012, 3:52-67, 4:1-29, 5:8-6:3, 6:18-7:4. However, Gotou also provides independent movement, as well as (1) using a plurality of light sources in each headlight and changing the light distribution by separately using one or more sources for illumination and (2) using one or more sub-reflectors to change the

Jiao First Dec., EX1003, ¶256.

Pet. Reply, Paper 17, pp. 6-11, 16-17; Jiao First Dec., EX1003, ¶¶230-50; Jiao Second Dec., EX1036, ¶¶78-85.

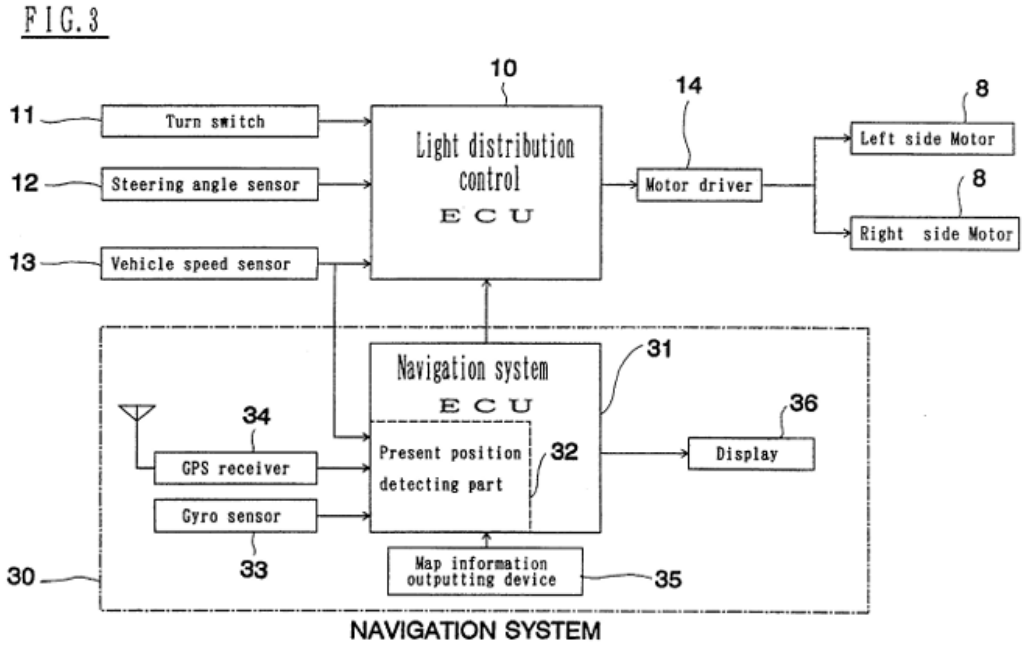
Karlsson Provides Headlamps with Controllable LED Arrays



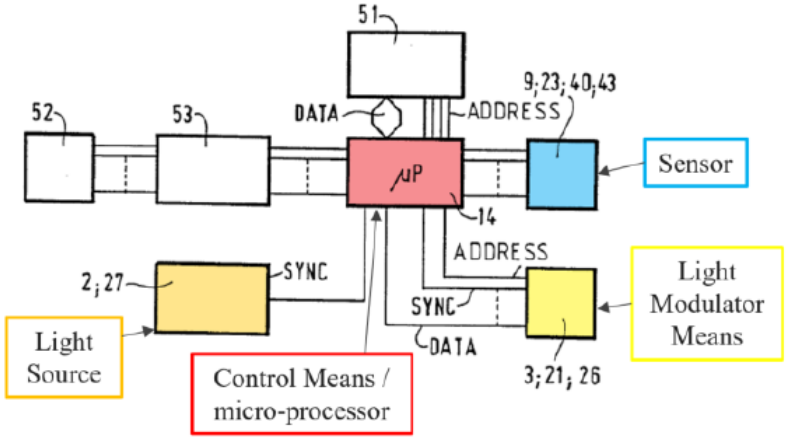
Karlsson, EX1010, FIG. 14 (annotated).

Pet., Paper 1, pp. 21-24; Jiao First Dec., EX1003, ¶¶92-93; Jiao Second Dec., EX1036, ¶¶11-40.

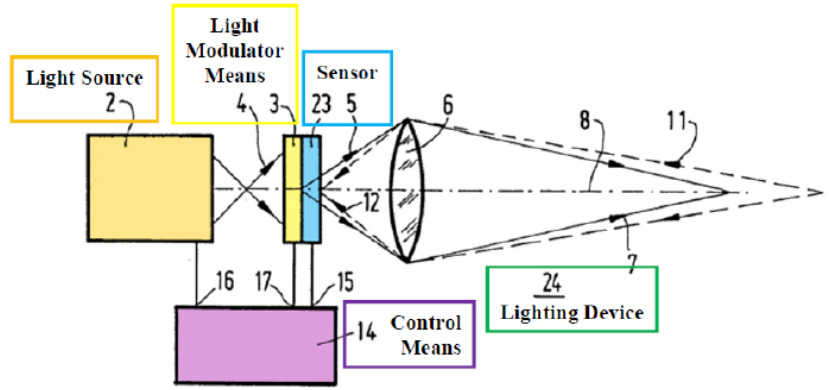
Gotou and Karlsson Include the Same Building Blocks



Gotou, EX1012, FIG. 3.



Karlsson, EX1010, FIG. 15 (annotated).



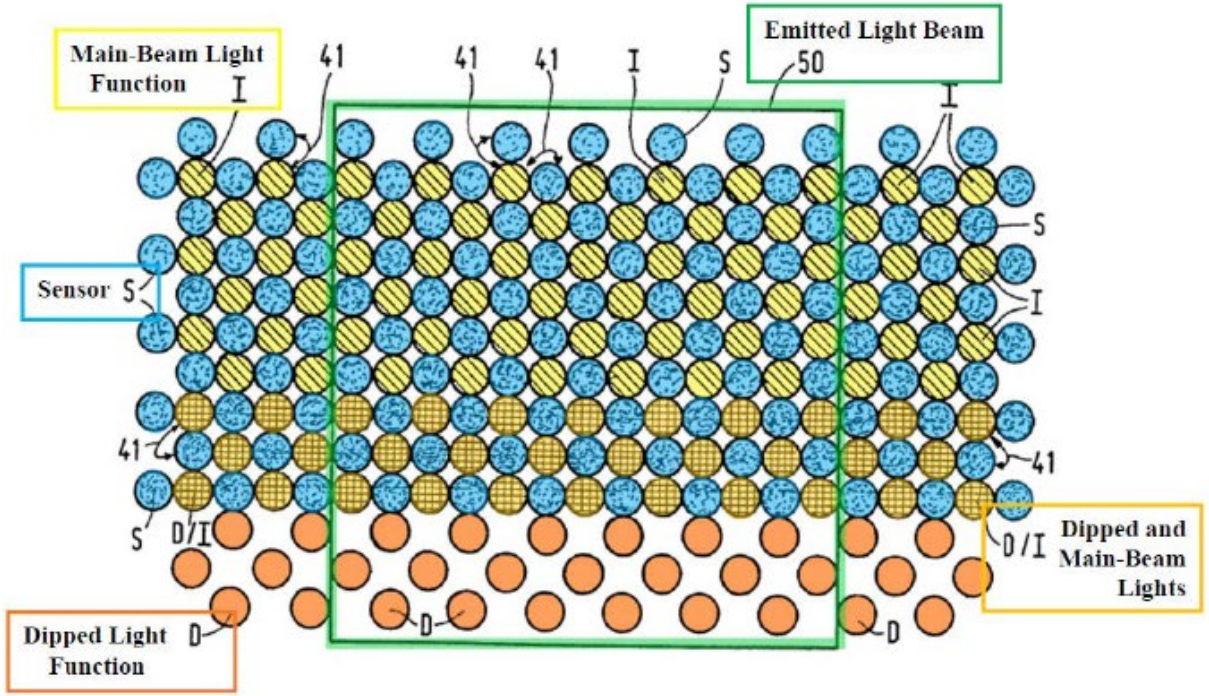
Karlsson, EX1010, FIG. 3 (annotated).

Pet., Paper 1, pp. 21-24, 56-63; Jiao First Dec., EX1003, ¶¶92-93, 239; Jiao Second Dec., EX1036, ¶¶11-40.

Karlsson's Adaptive LED Array Does Not Default to "all LEDs on"

The emitted light beam 50 is represented as a window which can shift in the plane of the drawings from the left to the right and from the top to the bottom, if desired, and vice versa, and which may vary as regards its shape and dimension in dependence on the desired pattern and direction of the beam.

Karlsson, EX1010, 19:29-33.



Karlsson, EX1010, FIG. 14 (annotated).

Pet. Reply, Paper 17, pp. 6-11; Pet., Paper 1, pp. 21-24; Jiao First Dec., EX1003, ¶¶92-93, 242, 254, 296, 334; Jiao Second Dec., EX1036, ¶¶51-64.

Karlsson's Adaptive LED Array Does Not Default to "all LEDs on"

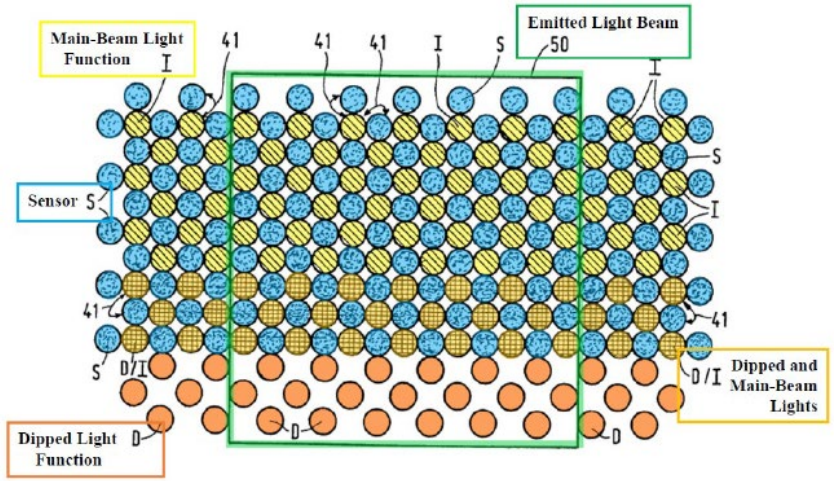
52. In paragraph 76 of the Second Turk Declaration (EX2006), Dr. Turk states that "Karlsson, like Beam, forms emitted beam 7 (Fig. 1) by using the entire beam array at full intensity, except when avoiding glare, at which point, window 50, of reduced illumination (Fig. 14) is created to address glare situations." This is a gross misstatement of Karlsson. Karlsson does not disclose full or maximum intensity.

54. Simply put, in direct contradiction to Dr. Turk's mischaracterization above and his misstatement in EX2006, ¶134 that "There is nothing in Karlsson to suggest that window 50 is the actual beam that would be used for driving," Karlsson expressly states that "The *emitted light beam 50 is represented as a window* which can *shift* in the plane of the drawings *from the left to the right* and *from the top to the bottom*, if desired, and vice versa, and which may *vary as regards its shape* and *dimension* in dependence on the *desired pattern* and *direction of the beam*." EX1010, 19:29-34. A POSA would not find anything unclear about this statement in Karlsson. Below, I illustrate several beam patterns

Jiao Second Dec., EX1036, ¶¶52, 54.

Pet. Reply, Paper 17, pp. 6-11; Pet., Paper 1, pp. 21-24; Jiao First Dec., EX1003, ¶¶92-93, 242, 254, 296, 334; Jiao Second Dec., EX1036, ¶¶51-64.

Karlsson (like Gotou) Considers Road Curves



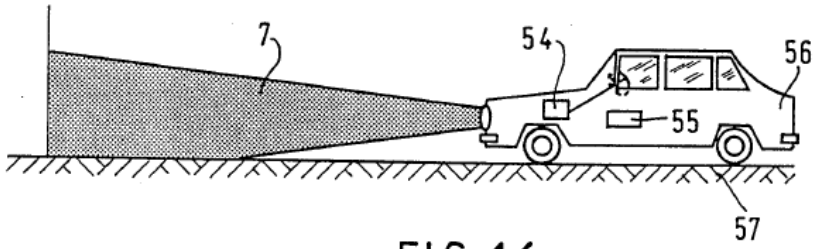


FIG.16

The car 56 shown in Figure 16 is furthermore provided with an inclination sensor 55 and with a direction sensor 54, which is for example connected to the steering wheel. The inclination sensor 55 delivers a signal with regard to the angle of inclination of the car with respect to the road surface 57, in such a manner that the light beam 7 to be emitted is adapted to the respective regulations at all times, also if the car 56 accelerates or decelerates with great force, or when said car is for example overloaded. The direction sensor 54 is in particular intended for determining when the car 56 is taking a bend, so that the light beam 7 can be adapted to prevent the traffic on the other side of the road from being blinded as much as possible.

Karlsson, EX1010, 20:22-32.

Karlsson, EX1010, FIG. 14 (annotated), FIG. 16.

Pet. Reply, Paper 17, pp. 6-11; Jiao First Dec., EX1003, ¶¶242, 279-80; Jiao Second Dec., EX1036, ¶¶51-64; Pet., Paper 1, pp. 75-78; ID, pp. 7-8, 12-13.

Prior Art Examples of Desired/Adaptive Beam Patterns

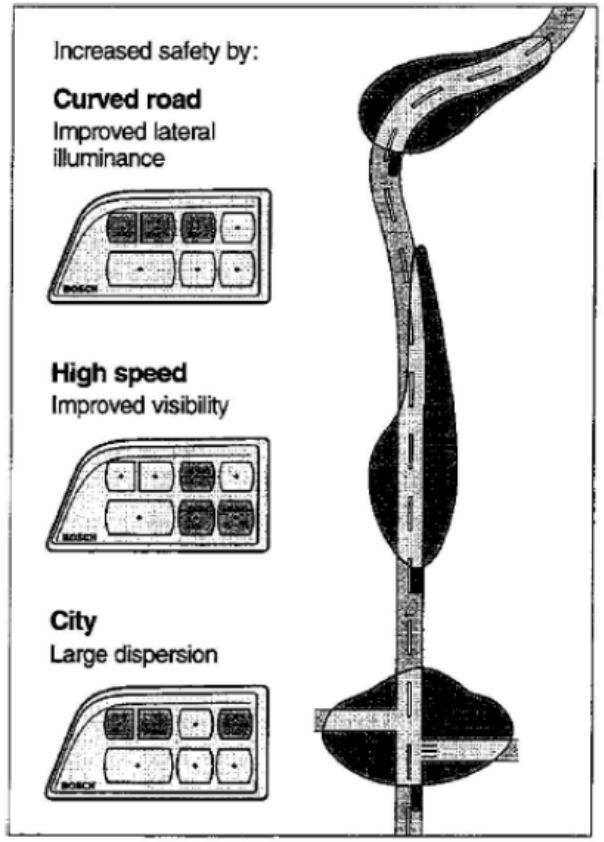


Fig.1: Three standard driving situations with adapted light pattern seen from the bird eye's view.

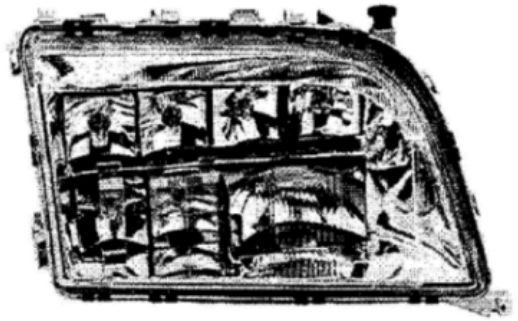
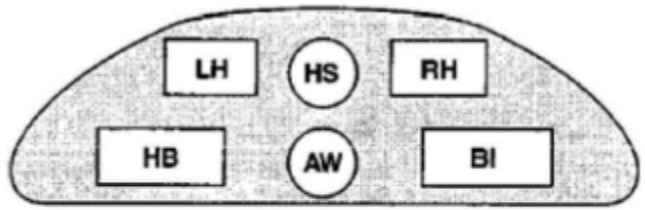


Fig 4: ALP *headlamp* sample



Single components:

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

Fig. 5 Advanced ALP sample layout

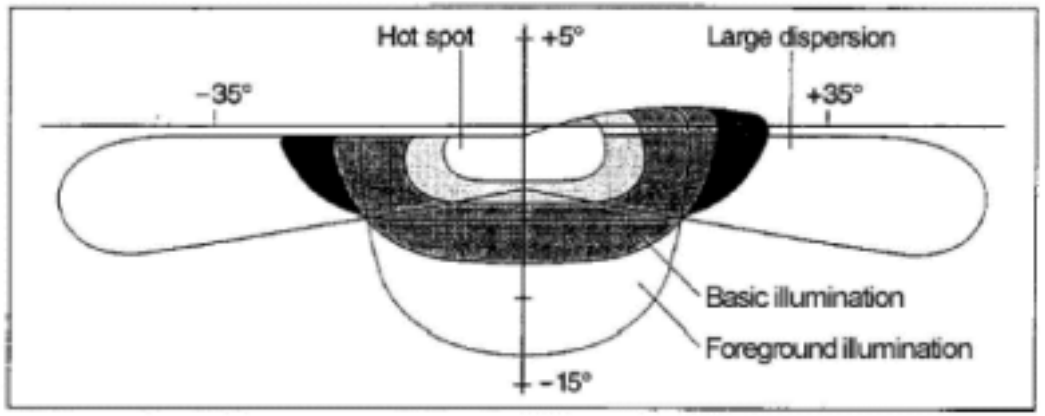


Fig. 3: Light pattern of multiple beam *headlamp (Isolux* curves in wall projection):
The individual light *pattern* of multiple sub-units sum up to the total adaptive light pattern

EX1017, FIGS. 1 & 3-5.

Pet., Paper 1, pp. 9-10; Jiao First Dec., EX1003, ¶¶48-50; Pet. Reply, pp. 14-15, 22-23, 27.

Karlsson (like Gotou) Discloses “Increas[ing] Light in a Direction”

Consequently, the objective of the invention is to provide a lighting device, in particular a headlight of a motor vehicle, wherein the pattern of the emitted light beam is varied automatically in an efficient manner and with maximum sensitivity in response to at least one control signal delivered by light-sensitive sensor means during operation.

Karlsson, EX1010, 2:30-35 (annotated).

Pet. Reply, Paper 17, pp. 6-11; Jiao First Dec., EX1003, ¶¶279-80; Jiao Second Dec., EX1036, ¶¶51-64; Pet., Paper 1, pp. 75-78.

Karlsson (like Gotou) Discloses "Increas[ing] Light in a Direction"

The spotlight beams 34 may also be made up of suitable modulator means, for example light modulator means which are built up of a grid of light modulators which can be switched individually, which light modulators can be controlled to transmit light, to block light and/or to reflect light, depending on the type that is used. In the simplest embodiment, it is possible to use light modulators which can be controlled in two univocal positions, for example fully light-transmitting or fully light-blocking. In a more sophisticated embodiment it may be considered to use light modulators which can be controlled to transmit light to a specified degree, so that a desired light intensity can be adjusted for each individual spotlight beam 34 or for a group of spotlight beams.

Karlsson, EX1010, 14:5-15.

Pet. Reply, Paper 17, pp. 6-11; Jiao First Dec., EX1003, ¶¶279-80; Jiao Second Dec., EX1036, ¶¶51-64; Pet., Paper 1, pp. 75-78.

Karlsson Is Not Limited to Decreasing Light, as Patent Owner Alleges

Section VII.A.1.a. below): Karlsson, like Beam, forms emitted beam 7 (Fig 1) by using the entire beam array at full intensity, except when avoiding glare, at which point, window 50, of reduced illumination (Fig. 14) is created to address glare situations. (Ex. 2006, ¶76.) Per Karlsson, this configuration creates a light beam

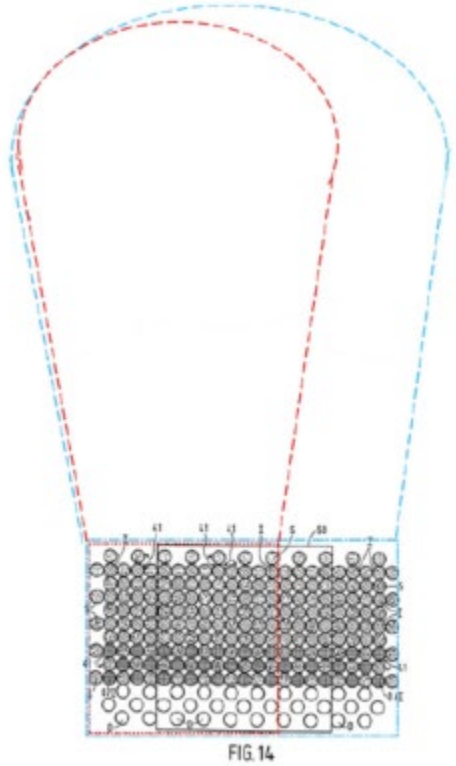
Patent Owner's Argument, POR, Paper 13, p. 13.

POR, Paper 13, p. 12-21; PO Sur-Reply, Paper 20, pp. 14-20.

Karlsson Is Not Limited to Decreasing Light, as Patent Owner Alleges

First, Dr. Turk creates new figures with Karlsson taking a curve. EX2006, Turk-created FIGS. 1A, 2A, 1B, 2B, 1C; POR, 14, 15, 18-20. While these are incorrect and self-serving, even they establish that Karlsson's beam shifts from left-to-right, as in the Preliminary Response at pages 41-42. And when applied to Gotou's system that controls for curvature via map data, it would do the same in the direction of the curve, meeting the claims, while still dealing with "a variety of possible glare situations." EX2006, ¶88. The Board appreciated this in its Institution Decision. Paper 7, 12-13 (noting Karlsson's beam shifts and "contemplates adjusting its LEDs 'when the car [] is taking a bend.'").

Petitioner's Reply, Paper 17, p. 11.



Patent Owner's annotated Karlsson FIG. 14, POPR, p. 41; cited by Institution Decision, pp. 11-13.

Motivation to Combine Gotou and Karlsson

231. *First*, a POSA would have sought to use Karlsson's LEDs because of the well known benefits of LEDs in vehicle headlamps—for example, life expectancy and redundancy, adaptation under unfavorable weather, and low-voltage direct current operation. *See* EX1008, 13:67-14:13, 14:25-30, 2:30-35, 5:66-6:5; EX1011, 3:18-26, 10:21-22.

234. *Second*, Karlsson's controllable LEDs (and camera-based glare reduction system) would have simplified controlling the illumination direction and beam shape by removing Gotou's complex moving parts (e.g., motors), while at the same time providing expanded beam shaping abilities.

Jiao First Dec., EX1003, ¶¶231, 234.

Pet., Paper 1, pp. 55-65; Pet. Reply, Paper 17, pp. 6-11, 16-17; Jiao First Dec., EX1003, ¶¶230-50; Jiao Second Dec., EX1036, ¶¶78-85.

Motivation to Combine Gotou and Karlsson

Karlsson expressly identifies several well-known benefits of using adjustable LEDs in vehicle lighting, like efficiency, size, and control.

The term spotlight beam used within the framework of the invention and of the present description is understood to mean a light beam comparable to the light beam emitted by a light source of limited physical dimensions, such as a light-emitting diode.

Karlsson, EX1010, 4:32-35.

For intermittently control of the light emitted by the lighting device according to the invention, both the spotlight beams as well as the spotlight sensors can be switched. It will be understood, that this makes it possible to construct a very compact and efficient lighting device.

Karlsson, EX1010, 6:1-5.

The control means 14 are arranged to selectively switch the individual small light sources, or a group of individual small light sources, on and off, or to selectively adjust the light intensity of a respective spotlight beam 34, in response to a control signal from sensor means 23, so as to provide a desired lighting pattern. In this respect, one may speak about

Karlsson, EX1010, 14:26-30.

Pet., Paper 1, pp. 55-65; Pet. Reply, Paper 17, pp. 6-11, 16-17; Jiao First Dec., EX1003, ¶¶230-50; Jiao Second Dec., EX1036, ¶¶78-85.

Motivation to Combine Gotou and Karlsson

Benefits of using adjustable LEDs in vehicle lighting were well known in the art well before the '029 patent's earliest priority date.

235. To the first point, there are several examples of prior art that shows that LEDs "are advantageously used as light sources" in headlamps, for example, in Muller. EX1022, 2:22-26. Muller explains that "[s]uch light-emitting diodes are very reliable and may…be mounted in locations which are barely accessible after installation, e.g., in vehicle-part cavities, without being in any way disadvantageous." EX1022, 2:22-26. Further, because of the reliability of LEDs, "in contrast to conventional lamps, the lamp only needs to be changed very infrequently." EX1022, 2:22-26, 3:44-47. Many others also recognized the benefit of using LEDs as light sources for headlamps and other automotive applications well before the '029 patent's earliest possible priority date. *See, e.g.*, EX1005, 4:9-15, 6:9-12, 8:4-17; EX1006, ¶¶5, 7, 8, 20, 27; EX1009, 19:27-31, 20:9-12, 23:8-13; EX1010, 4:25-35, 13:24-29, 11:29-32; EX1011, 1:18-2:3, 3:18-26, 8:13-20, 10:6-11, 10:21-22; EX1029, 987, 991 ("The reason for this large scale conversion

Jiao First Dec., EX1003, ¶235.

[0007] In accordance with still another feature of present invention, a partial region is defined in the matrix, by which the semiconductor light source produces a horizontally dispersed light beam. This makes possible the use of the illumination device as a headlight with a wider illumination in front to of the vehicle, as is specifically advantageous at low speeds, for example in street traffic and/or with low visibility distance for example in fog.

[0008] In accordance with another feature of present invention, in the matrix at least one partial region is defined, by which the semiconductor light sources produce at one side a light beam oriented to the right or to the left. This allow the use of the illumination device as a headlight with a one-sided oriented illumination in front of the vehicle, as especially advantageous during diving over a curve or in the case of a bending of the vehicle.

Thominet, EX1006, ¶¶0007-08.

Pet., Paper 1, pp. 55-65; Pet. Reply, Paper 17, pp. 6-11, 16-17; Jiao First Dec., EX1003, ¶¶230-50; Jiao Second Dec., EX1036, ¶¶78-85.

Motivation to Combine Gotou and Karlsson

Benefits of using adjustable LEDs in vehicle lighting were well known in the art well before the '029 patent's earliest priority date.

In the description of the current invention, a light beam having a continuously adjustable spatial distribution is to be taken to mean that the opto-electronic elements can be switched on and off in such a manner that the light beam can assume various shapes, which shapes may demonstrate a partial overlap and may, more or less gradually, merge. If a light beam is adjustable, also the intensity and/or spectral characteristic of the light beam, or of segments of the light beam, may be different.

Since the spatial distribution is (continuously) adjustable, the driver's view of the road and the surroundings of the vehicle is improved. On the one hand, objects situated on or in the axis of the light beam, such as oncoming traffic, can be better observed. On the other hand, also the observation of objects outside the center of the light beam is improved. This

Harbers, EX1011, 2:27-3:2.

Pet., Paper 1, pp. 55-65; Pet. Reply, Paper 17, pp. 6-11, 16-17; Jiao First Dec., EX1003, ¶¶230-50; Jiao Second Dec., EX1036, ¶¶78-85.

Motivation to Combine Gotou and Karlsson

Benefits of using adjustable LEDs in vehicle lighting were well known in the art well before the '029 patent's earliest priority date.

Under unfavorable weather conditions, in particular fog and snow, when visibility is reduced by backscattering caused by fog or snow particles, both the configuration and the spectral composition of the light beams generated by the light source 4; 5 can be adapted by activating different combinations of LEDs and by changing the output levels of the various LEDs. As a result of these adaptations, the spatial and/or spectral distribution of the light is changed. An example of such an adaptation is shown in Fig. 4A, wherein a relatively wide beam 16 is obtained which is substantially composed of yellow light. The absence of the blue component in the visible light causes the effect of backscattering to be substantially reduced.

In general, the LED modules operate at a low-voltage direct current, so that they can be advantageously employed in a vehicle.

Harbers, EX1011, 10:6-14, 21-22.

Pet., Paper 1, pp. 55-65; Pet. Reply, Paper 17, pp. 6-11, 16-17; Jiao First Dec., EX1003, ¶¶230-50; Jiao Second Dec., EX1036, ¶¶78-85.

Motivation to Combine Gotou and Karlsson

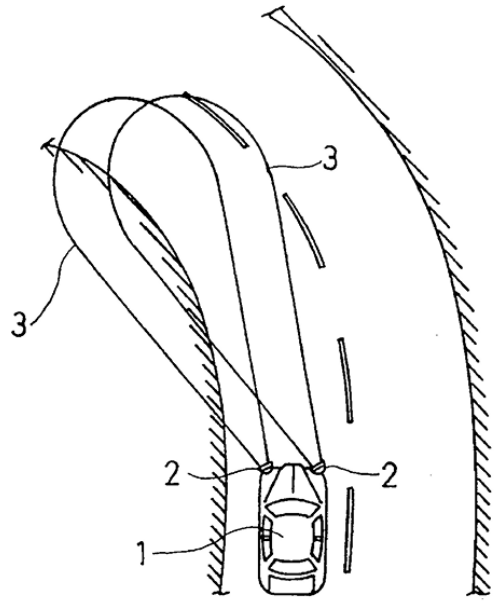
beam shaping abilities." (*Id.*) The applied references contradict Petitioner's assertions as Karlsson's "controllable LEDs" are not controllable by Gotou's ECU and the illumination direction and beam shaping abilities are not readily available without redesigning the optical system, thereby rendering Petitioner's combination and modification inoperable for its intended purpose of adjusting illumination. (Ex.

Patent Owner's Argument, POR, Paper 13, p. 48.

POR, Paper 13, pp. 47-51.

Motivation to Combine Gotou and Karlsson

A head lamp device for a vehicle in which a lighting region in front of the vehicle in a traveling direction can be adjusted in rightward and leftward directions comprises: a direction



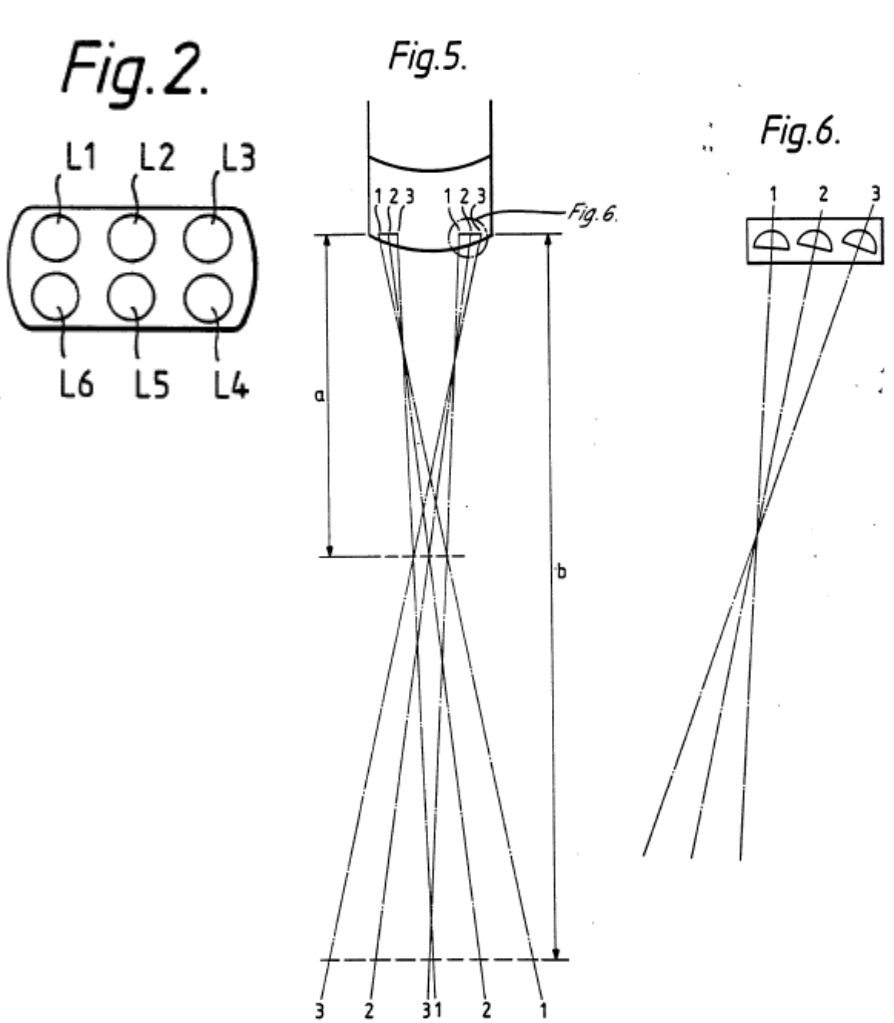
Gotou, EX1012, Abstract, FIG. 9.

There is also another method in which two bulbs are installed in one head light and the light distribution is changed by separately using one bulb illumination and two-bulb illumination, respectively.

Gotou, EX1012, 8:16-19.

Pet., Paper 1, pp. 55-65; Pet. Reply, Paper 17, pp. 6-11, 16-17; Jiao First Dec., EX1003, ¶¶230-50; Jiao Second Dec., EX1036, ¶¶78-85.

Patent Owner's Reference to Flaaten Actually Supports Obviousness of LEDs



- "Flaaten aims for an "optimum lighting effect." EX2006, ¶134 (citing EX2017, 1); see also EX2006, ¶89 (citing EX1010, 2:2-9); EX1036, ¶¶60-61. Flaaten's maximum "satisfactory illumination" (EX2017, Abstract) does not mean all of Flaaten's sources are on at all times. Nor does Flaaten conclude that there should be "full illumination to the 'greatest extent possible,'" as Dr. Turk alleges. EX2006, ¶90. Rather, a POSA would understand that "satisfactory illumination is maintained of the roadway in front of the vehicle," e.g., including ahead in curves. EX1036, ¶¶60-61, citing EX2017, Abstract."

- "Flaaten's sources are "dimmed gradually, one at a time." EX2017, 3:34-36. And Flaaten's sources automatically adjust their angular settings. EX2017, 5:27-31; EX1036, ¶¶62-77. So PO's position actually supports Karlsson's directional aiming of its LEDs—Flaaten provides curves, etc. are satisfactorily illuminated (EX2017, 2:2-6; 2:22-26, claim 3). EX1036, ¶76."

Flaaten, EX2017, FIGS. 2, 5, 6 & p. 4.

Pet. Reply, pp. 9-10.

Pet. Reply, Paper 17, pp. 9-11; Jiao Second Dec., EX1036, ¶¶60-64; POR, Paper 13, pp. 20-21.

Even Patent Owner's Declarant Draws Parallels Between the '029 Patent and Karlsson

through line 2. Do you see where it says, "The '029 patent lighting can be adapted to the optimal operating regime"?

A. I see that.

Q. What does "optimal operating regime" mean?

MS. SHAH: Objection. Relevance.

THE WITNESS: I don't recall opining about that in my declaration, but here it just seems to me to be used generally as how a device should be operating ideally.

Turk Dep., EX1037, 73:7-16.

Q. And so Karlsson discloses that its headlamp has an intensity which is optimally adapted to the road and to the ambient light, correct?

A. Karlsson discloses different headlights, and in a preferred embodiment as described here, it says it can be controlled that way.

Q. And by "controlled that way," you mean that the intensity is optimally adapted to the road and to the ambient light, correct?

A. Yes.

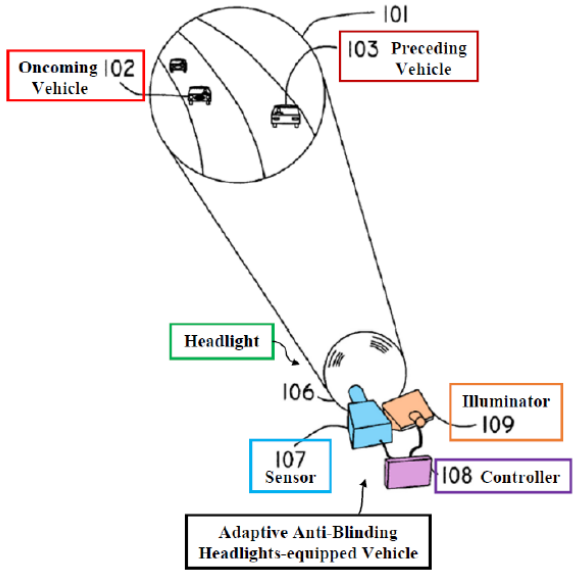
Turk Dep., EX1037, 130:15-24.

Pet. Reply, Paper 17, pp. 9-11; Turk Dep., EX1037, 73:5-75:15, 130:3-131:16; Jiao Second Dec., EX1036, ¶¶51-77.

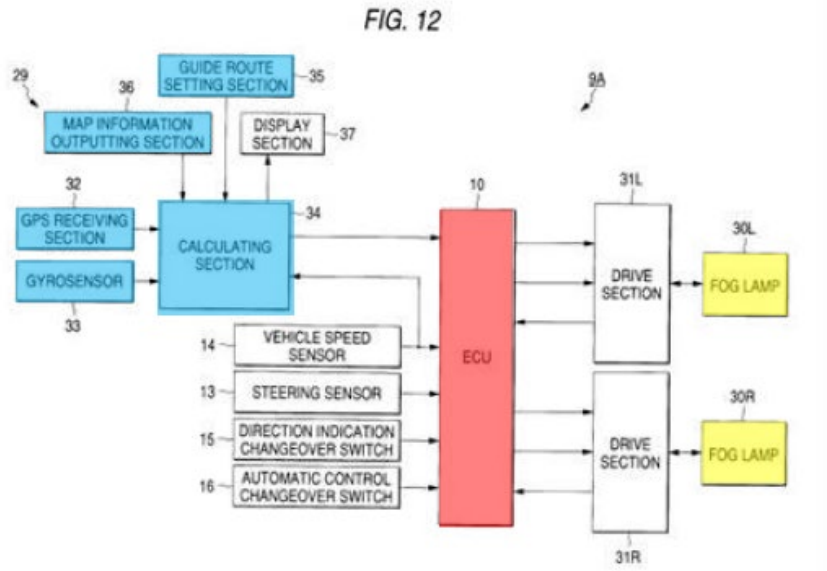
Ground 1 – Beam and Kobayashi

Ground 1 – Beam and Kobayashi: Undisputed Issues

- Patent Owner **does not dispute** that the combination of Beam and Kobayashi discloses elements:
  - 1.P, 1.1, 1.2, 1.3, 1.4, and 1.6 of claim 1;
  - 12.P, 12.1, 12.2, 12.3, 12.4, and 12.6 of claim 12; and
  - 23.P, 23.1, 23.2, 23.3, 23.4, and 23.6 of claim 23.



Beam, EX1005, FIG. 1 (annotated).



Kobayashi, EX1008, FIG. 12 (annotated).

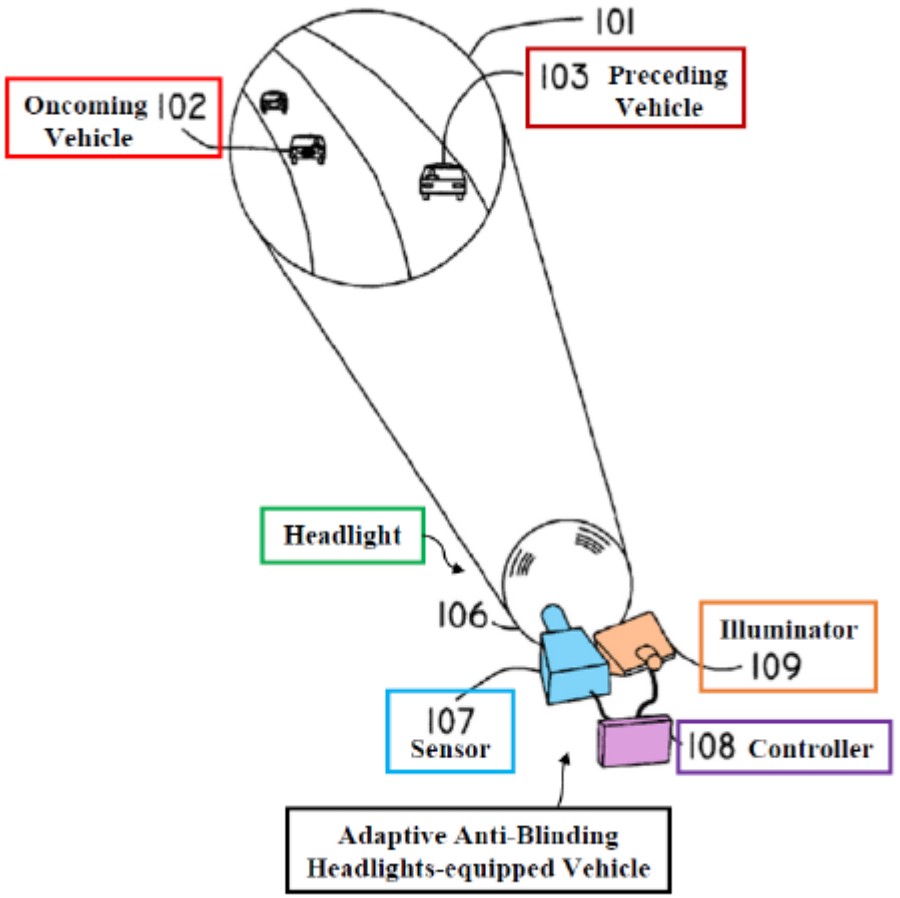
Pet. Reply, Paper 17, pp. 1-2, 25-27; Jiao Second Dec., EX1036, ¶¶110-18; *see generally* Pet.; POR; PO Sur-Reply.

Overview of Beam

This invention relates to the production of a beam of light comprised of many microbeams, controlled by incoming radiation, employing a sensor to determine the location of light sources forward of the apparatus and using that information to control the intensity, and/or the angular position, of one or more narrow-angle microbeams, which are part of a large number of beams comprising the overall output beam.

through beamsplitter **201** and out optical system **106**. Thus we produce an overall beam pattern comprising many (in this embodiment, ~300 000) individual narrow-angle microbeams of light, as contrasted with conventional headlights, which produce only a single beam. These microbeams are arranged in an X-Y matrix. The angular position or attenuation of each of these microbeams is independently set by the controller **108**. Controller **108** selectively commands

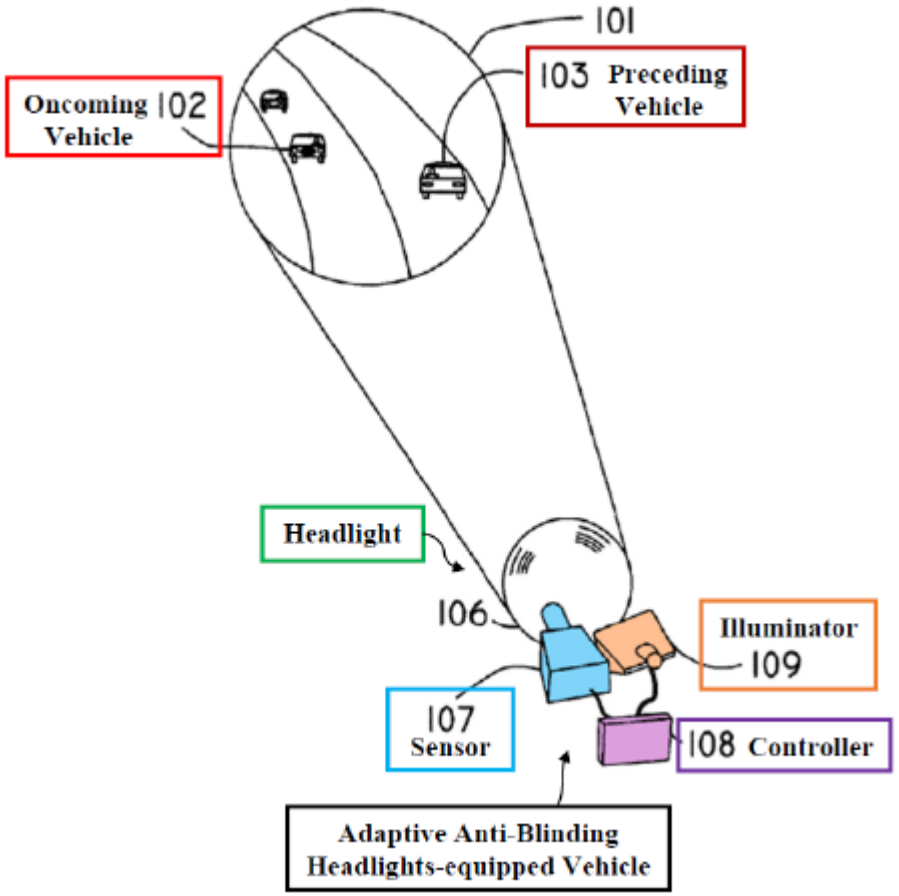
Beam, EX1005, Abstract, 4:41-48.



Beam, EX1005, FIG. 1 (annotated).

Pet., Paper 1, pp. 11-13; Jiao First Dec., EX1003, ¶¶74-78; Jiao Second Dec., EX1036, ¶¶11-40.

Overview of Beam



Beam, EX1005, FIG. 1 (annotated).

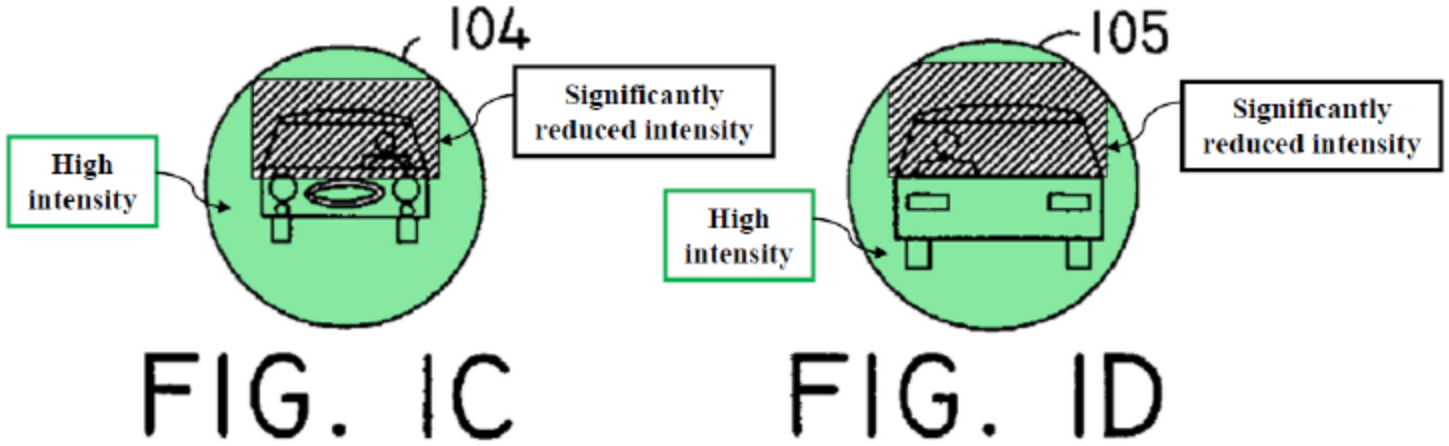


FIG. 1C FIG. 1D

Beam, EX1005, FIGS. 1C & 1D (annotated).

Pet., Paper 1, pp. 11-13; Jiao First Dec., EX1003, ¶¶74-78; Jiao Second Dec., EX1036, ¶¶11-40.

Overview of Beam

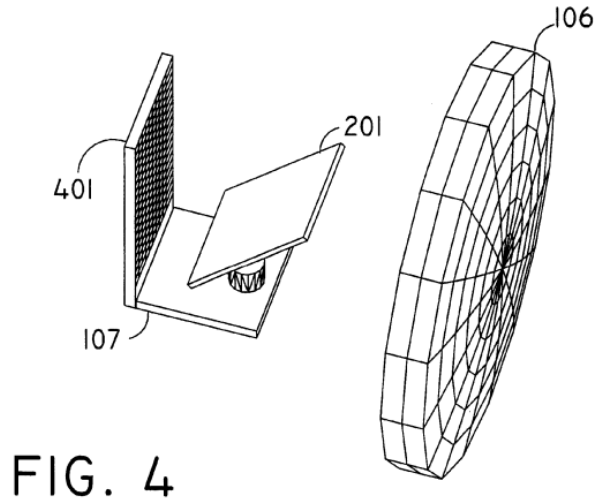


FIG. 4

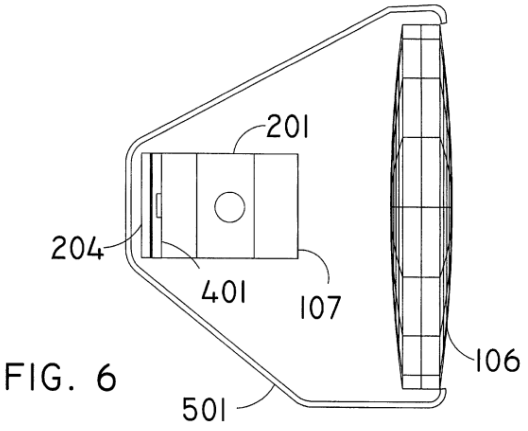


FIG. 6

Beam, EX1005, FIGS. 4 & 6.

4. The anti-blinding illumination system as set forth in claim **1** wherein said light source includes an array of individual, independently controllable microbeam sources selected from the group consisting of light-emitting diodes, lasers, incandescent lamps, arc lamps and electroluminescent lamps, and a spatial light modulator selected from the group consisting of digital mirror devices, liquid crystal devices, and grating light valves for selectively controlling the intensity of individual microbeam sources in said array.

Beam, EX1005, claim 4.

18 Q Okay. So what does Beam mean by
19 replacing the lamp and spatial light modulator
20 with an array of light sources?
21 MR. FITZSIMMONS: Objection. Form.
22 A I read it as combined.

36

1 Q Your reading of that is -- your
2 interpretation is that Figure 4 depicts a system
3 similar to Figure 2, except for the lamp and
4 spatial light modulator are combined with an array
5 of light sources?
6 A Which is consistent in his claim 4,
7 yes.

EX2018, 35:18-36:7.

Pet., Paper 1, pp. 11-13; Jiao First Dec., EX1003, ¶¶74-78; Jiao Second Dec., EX1036, ¶¶11-40.

Overview of Beam

4. The anti-blinding illumination system as set forth in claim **1** wherein said light source includes an array of individual, independently controllable microbeam sources selected from the group consisting of light-emitting diodes, lasers, incandescent lamps, arc lamps and electroluminescent lamps, and a spatial light modulator selected from the group consisting of digital mirror devices, liquid crystal devices, and grating light valves for selectively controlling the intensity of individual microbeam sources in said array.

Beam, EX1005, claim 4.

Q. Let's go to the claims of Beam. If you go toward the end of the document. Have you seen column 8, claim 4 of the Beam patent?

A. Yes.

Q. Claim 4 recites, "Said light source includes an array of individual independently controllable microbeam sources," correct?

A. Yes.

Q. And claim 4 recites that those microbeam sources can be light-emitting diodes, correct?

A. It says that, yes.

Q. Claim 4 also recites a spatial light modulator, correct?

A. Yes.

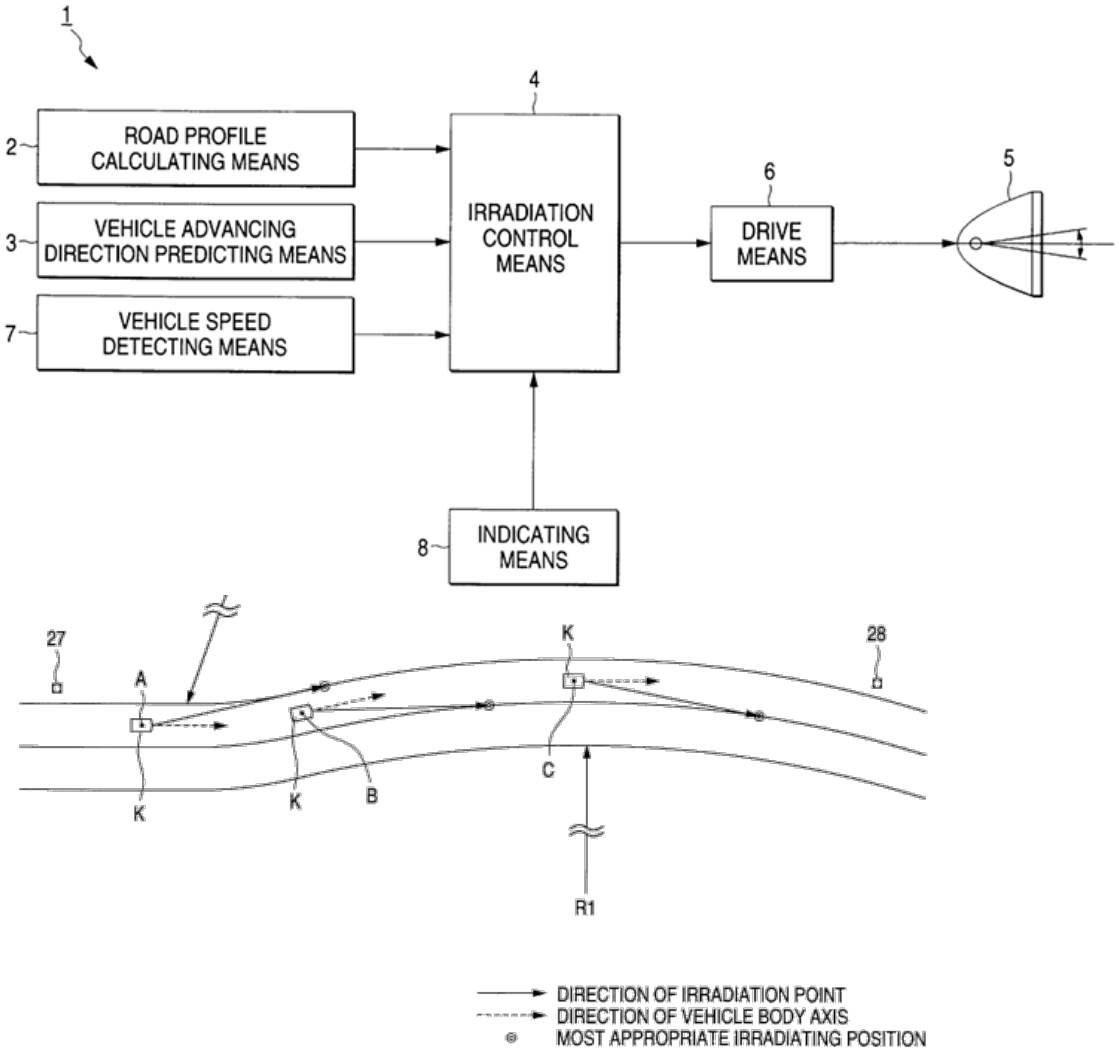
Turk Depo., EX1037, 89:13-90:1.

Pet. Reply, Paper 17, pp. 25-29; Jiao First Dec., EX 1003, ¶¶137-43; Jiao Second Dec., EX1036, ¶¶109-21; Pet., Paper 1, pp. 36-38.

Overview of Kobayashi

A lighting device in which the vehicle advancing direction at which a driver aims is predicted, and the irradiating direction and irradiating range of a lighting device are controlled by comparing the result of the prediction to the information of the profile of a road on which the vehicle is running at present. The lighting device (1) includes a road

Kobayashi, EX1008, Abstract.



Kobayashi, EX1008, FIG. 1 & 10.

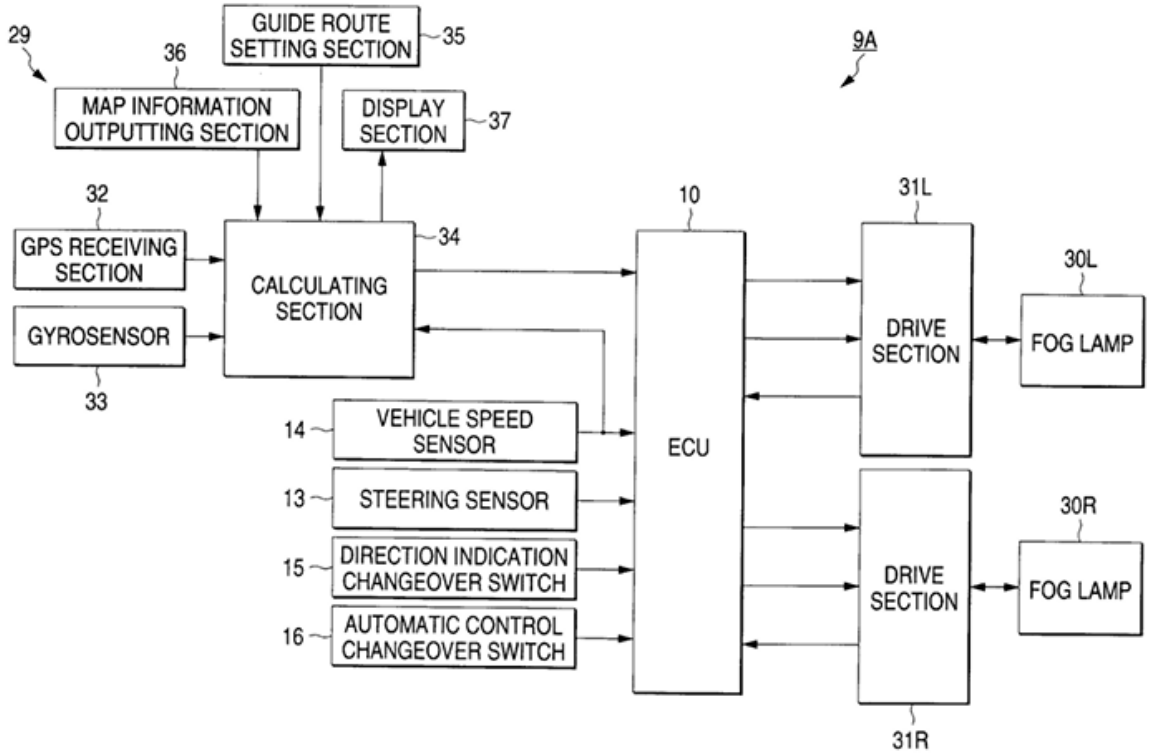
Pet., Paper 1, pp. 14-17; Jiao First Dec., EX1003, ¶¶79-84; Jiao Second Dec., EX1036, ¶¶11-40.

Overview of Kobayashi

FIG. **12** is a block diagram showing an arrangement of the device **9**A. ECU **10** is inputted with signals sent from GPS navigation device **29**, steering sensor **13**, vehicle speed sensor **14**, direction indicating switch **15** and automatic control changeover switch **16**. Output signals of ECU **10** are sent to the drive sections **31**L, **31**R of the fog lamps **30**L, **30**R respectively arranged at the right and left of the front portion of the vehicle.

guidance. Accordingly, when the vehicle advances along a scheduled course, irradiation control of the lamp is conducted in accordance with the course concerned. When it is predicted that the vehicle deviates from the scheduled course, irradiation control is conducted in accordance with the vehicle advancing direction predicted by information such as a direction indicating signal, steering angle detecting signal and vehicle speed detecting signal except for information about the scheduled course.

Kobayashi, EX1008, 17:8-15, 17:59-67.



Kobayashi, EX1008, FIG. 12.

Pet., Paper 1, pp. 14-17; Jiao First Dec., EX1003, ¶¶79-84; Jiao Second Dec., EX1036, ¶¶11-40.

PO is Wrong about Beam's "Maximum Intensity" Statements

"Beam does not, as PO contends, suggest to a POSA that it is unable to increase light in a direction by virtue of its "maximum intensity." EX1036, ¶111. A POSA would thus understand that Beam controls intensity including angular position to a maximum desired in a given direction, and does not default (using a colloquialism) "full blast" everywhere at all times. EX1036, ¶¶111-113."

Pet. Reply, p. 26; EX1036, ¶¶111-113

PO is Wrong about Beam's "Maximum Intensity" Statements

"Intensity" is not synonymous with "brightness," as Dr. Turk proposes (EX1037, 62:18-25, 84:3-6)—"brightness" is a human perception measurement, whereas "intensity" refers to luminous intensity measured in the unit candela (cd) in the International System of Units. EX1036, ¶15, EX1041, 18. Dr. Turk also incorrectly states that "beam pattern" is "related to brightness and darkness of illumination within the shape." EX1037, 43:2-4. This conflicts with the Second Turk Declaration's paragraph 26, quoting *from an article that Dr. Jiao co-authored*, explaining that "[a]ny automotive headlamp beam pattern, either high-beam or low-beam, is a light luminous intensity (candela) angular distribution." EX2010, 237; EX1036, ¶116.

Pet. Reply, Paper 17, pp. 25-26.

PO is Wrong about Beam's "Maximum Intensity" Statements

15. But in the automotive lighting context, a POSA would have readily understood that "intensity" refers to luminous intensity measured in the unit candela (cd) in the International System of Units. EX1041, 18. The candela value is a measurement of luminous flux per unit solid angle emitted by a light source *in a particular (or a given) direction*. It is a quantitative measurable widely known and regularly used by a POSA in the field of lighting including automotive lighting. It is not, contrary to Dr. Turk's misunderstanding, similar to or synonymous with "brightness," which is a human perception measurement. *See*

Jiao Second Dec., EX1036, ¶15.

Pet. Reply, Paper 17, pp. 25-29; Jiao First Dec., EX1003, ¶¶137-43; Jiao Second Dec., EX1036, ¶¶12-26, 109-21; Pet., Paper 1, pp. 36-38.

PO is Wrong about Beam's "Maximum Intensity" Statements

When Dr. Turk was asked "What does 'maximum intensity' mean in the context of automotive lighting?" he answered "In general, *I don't know*….*I think* it means you can't make it any brighter, any higher in terms of its intensity."

EX1037, 103:13-20. Dr. Turk was asked as a direct follow up: "You said, though, that you don't know in general what 'maximum intensity' means in the context of automotive lighting?" and he answered "Not as a general term in all circumstances, no." EX1037, 103:22-25.

Pet. Reply, Paper 17, p. 25.

PO is Wrong about Beam's "Maximum Intensity" Statements

This invention relates to the production of a beam of light comprised of many microbeams, controlled by incoming radiation, employing a sensor to determine the location of light sources forward of the apparatus and using that information to control the intensity, and/or the angular position, of one or more narrow-angle microbeams, which are part of a large number of beams comprising the overall output beam.

Beam, EX1005, Abstract.

Pet. Reply, Paper 17, pp. 25-29; Jiao First Dec., EX1003, ¶¶137-43; Jiao Second Dec., EX1036, ¶¶109-21; Pet., Paper 1, pp. 36-38.

PO is Wrong about Beam's "Maximum Intensity" Statements

through beamsplitter **201** and out optical system **106**. Thus we produce an overall beam pattern comprising many (in this embodiment, ~300 000) individual narrow-angle microbeams of light, as contrasted with conventional headlights, which produce only a single beam. These microbeams are arranged in an X-Y matrix. The angular position or attenuation of each of these microbeams is independently set by the controller **108**. Controller **108** selectively commands

Beam, EX1005, 4:41-48.

4. The anti-blinding illumination system as set forth in claim **1** wherein said light source includes an array of individual, independently controllable microbeam sources selected from the group consisting of light-emitting diodes, lasers, incandescent lamps, arc lamps and electroluminescent lamps, and a spatial light modulator selected from the group consisting of digital mirror devices, liquid crystal devices, and grating light valves for selectively controlling the intensity of individual microbeam sources in said array.

5. The anti-blinding illumination system as set forth in claim **1** wherein said light source includes an array of individual independently controllable microbeam sources selected from the group consisting of light-emitting diodes, lasers, incandescent lamps, arc lamps and electroluminescent lamps.

Beam, EX1005, claims 4-5.

Pet. Reply, Paper 17, pp. 25-29; Jiao First Dec., EX 1003, ¶¶137-43, 179, 189; Jiao Second Dec., EX1036, ¶¶109-21; Pet., Paper 1, pp. 36-38.

Motivation to Combine Beam and Kobayashi

The combination of Beam and Kobayashi would not be inoperable, as Patent Owner alleges.

system inoperative or unsatisfactory for its stated purpose. In particular, Petitioner's proposed combination would: 1) defeat Beam's stated purpose of providing high-intensity illumination all the time but for selective darkening relative to other vehicles, 2) be inoperative in that Beam's AABH system is incapable of changing the direction of light from the headlamps, or of increasing light beyond maximum intensity of the light source(s), and 3) as a result, would not accomplish Petitioner's proffered purpose of "improving driver safety." (Ex. 2001,

Patent Owner's Argument, POR, Paper 13, p. 58.

through beamsplitter **201** and out optical system **106**. Thus we produce an overall beam pattern comprising many (in this embodiment, ~300 000) individual narrow-angle microbeams of light, as contrasted with conventional headlights, which produce only a single beam. These microbeams are arranged in an X-Y matrix. The angular position or attenuation of each of these microbeams is independently set by the controller **108**. Controller **108** selectively commands

5. The anti-blinding illumination system as set forth in claim **1** wherein said light source includes an array of individual independently controllable microbeam sources selected from the group consisting of light-emitting diodes, lasers, incandescent lamps, arc lamps and electroluminescent lamps.

Beam, EX1005, 4:41-48 & claim 5.

Petitioner's Demonstrative Exhibit Not Evidence

Pet., Paper 1, pp. 24-30; Pet. Reply, Paper 17, pp. 26, 29-30; Jiao First Dec., EX1003, ¶¶96-115; Jiao Second Dec., EX1036, ¶¶122-31; POR, Paper 13, pp. 56-70.

Motivation to Combine Beam and Kobayashi

To accomplish this, the spatial locations of the sources are mapped into controller **108** which then commands spatial light modulator **203** in illuminator **109** to either divert the selected microbeams or to attenuate them, depending on the implementation of spatial light modulator **203** chosen. The resulting beam is at full intensity except in areas that would dazzle a driver ahead.

EX1005, 4:53-59.

In a typical automotive installation, two AABH units will be mounted on a vehicle, facing forward, just as are conventional headlights. These AABH headlights will operate at maximum intensity at all times.

EX1005, 6:9-12.

It will then control the light output of a group selected from a multiplicity of narrow angle beams (microbeams) which comprise the overall headlight beam pattern. By controlling an area determined by analyzing the position of the lights sensed ahead, the area of the beam that would dazzle the driver w ill be darkened, while maintaining fall intensity elsewhere.

EX1005, 2:56-62.

Dr. Turk Is Indisputably Not a POSA: Motion to Exclude

The Federal Circuit's *Kyocera* Precedent Is Directly on Point Here

Dr. Turk's "expert testimony on issues from the vantage point of an ordinarily skilled artisan" must be excluded because Dr. Turk does not "possess ordinary skill in the art." *Kyocera*, 22 F.4th at 1377. The Federal Circuit's decision in *Kyocera* illustrates this principle and governs the outcome here.

Pet. Motion to Exclude, p. 11.

The Parties Agreed on the POSA Definition

Everyone agreed that the POSA definition in this case requires "at least 2 years of industry experience **in the area of automotive lighting and lighting-control systems.**"

Petition, Paper 1, p. 10 (annotated).

D. Level of Ordinary Skill in the Art

For the '029 patent, a POSA at the time of the alleged invention would have had a bachelor's degree (B.S.) in mechanical engineering, electrical engineering, optical engineering, applied physics, or an equivalent field, as well as at least 2 years of industry experience in the area of automotive lighting and lighting-control systems. The POSA may work as part of a team, for example, with computer engineers to integrate, program, etc., controllers and various control inputs to affect control of a given light source. EX1003, ¶¶41-43.

POR, Paper 13, p. 21 (annotated).

IV. Level of Ordinary Skill

Patent Owner does not dispute Petitioner's proposed level of ordinary skill.

(*See* Petition at 10.)

Pet. Motion to Exclude, Paper 27, pp. 1-15; Pet. Reply, Paper 17, pp. 1-5; Jiao Second Dec., EX1036, ¶¶11-49; PO Sur-Reply, Paper 20, pp. 1-9.

Dr. Jiao and Dr. Turk Agreed on the POSA Definition

Everyone agrees that the POSA definition in this case requires "at least 2 years of industry experience **in the area of automotive lighting and lighting-control systems.**"

Jiao First Dec., EX1003, ¶41.

41. In my opinion, a POSA in the context of the '029 patent as of July 12, 2002 (the earliest possible priority date of the '029 patent) would have had a bachelor of science (B.S.) degree in mechanical engineering, electrical engineering, optical engineering, applied physics, or an equivalent field, as well as at least 2 years of industry experience in the area of automotive lighting and lighting-control systems. The POSA may work as part of a team, for example, with computer engineers to integrate, program, etc., controllers and various control inputs to affect control of a given light source.

Turk Dep., EX1037, 60:15-22.

Q. In paragraph 49, you state, "I understand that patent owner accepts petitioner's proposed level of ordinary skill in the art," correct?

A. Yes.

Q. Do you also accept the petitioner's proposed level of ordinary skill in the art?

MS. SHAH: Objection. Vague.

THE WITNESS: Yes.

Pet. Motion to Exclude, Paper 27, pp. 1-15; Pet. Reply, Paper 17, pp. 1-5; Jiao Second Dec., EX1036, ¶¶11-49; PO Sur-Reply, Paper 20, pp. 1-9.

Dr. Turk Is Not a POSA

Dr. Turk does not have "at least 2 years of industry experience **in the area of automotive lighting and lighting-control systems.**"

Even under Petitioner's revised standard, however, Dr. Turk is a POSA. Dr. Turk worked for 3 years designing an autonomous vehicle system involving "computer vision work" and "various aspects of sensing and imaging," including vehicle lighting and lighting control systems. (Ex.1037, 21:10-12, 53:9-12.) As Dr. Turk confirmed in deposition: vehicle forward "illumination was an important part" of determining how the vehicle would drive at dusk and at night. (*Id.*, 54:7-8.)

Patent Owner's Argument, PO Sur-Reply, Paper 20, p. 3 (annotated).

Pet. Motion to Exclude, Paper 27, pp. 1-15; Pet. Reply, Paper 17, pp. 1-5; Jiao Second Dec., EX1036, ¶¶11-49; PO Sur-Reply, Paper 20, pp. 1-9.

Dr. Turk Is Not a POSA

26. These incorrect statements and understandings in Dr. Turk's declarations and deposition, along with the dearth of experience in the field reflected on his CV, convince me that he is not a POSA, and does not understand fundamentals in automotive lighting and lighting control with no knowledge of basic concepts, lighting principles, lighting metrics and measurements, lighting regulations and standards, which a POSA would have. The examples include the basic terms of "intensity," "brightness," "spatial distribution," high beam, low beam, and other automotive lighting devices and their well-defined functions and requirements, how those lighting devices are optically combined, and other basic and commonly used terms that a POSA would readily understand. He does not understand how a POSA would go about measuring such lighting quantities (e.g., in development or under certain regulations, EX1037, 103:22-108:14, 150:23-156:3), or what a POSA would have found obvious to combine with respect to the applied references discussed here and in my First Declaration, EX1003.

Jiao Second Dec., EX1036, ¶26.

Tellingly, Dr. Turk also admitted that he has no experience in the field of automotive lighting, lighting control, general lighting, light measurements, and lighting device development, design, process, testing, standard, and regulation compliance. EX1037, 52:18-53:1. He never worked for a vehicle headlamp company, never worked for an LED (or any other light source) company or for a general lighting company, never designed a vehicle forward lighting system, and has no patents, awards, or papers for any vehicle forward lighting. *Id.*, 54:24-56:12. The record demonstrates that Dr. Turk lacks the knowledge that a POSA with two years of industry experience in the area of automotive lighting and lighting-control systems would have, so his declarations should be excluded.

Pet. MTE, Paper 27, p. 8.

Pet. Motion to Exclude, Paper 27, pp. 1-15; Pet. Reply, Paper 17, pp. 1-5; Jiao Second Dec., EX1036, ¶¶11-49; PO Sur-Reply, Paper 20, pp. 1-9.

Dr. Turk Is Not a POSA

Dr. Turk does not have "at least 2 years of industry experience **in the area of automotive lighting and lighting-control systems.**"

Q. Did you personally work on the illumination portion of that project?

A. I did at times.

Q. And what did you specifically work on with regards to the illumination?

A. It was a long time ago and I don't remember too much detail about it, but certainly an important question was how much and what kind of illumination was necessary to be able to do what we needed to do.

Turk Dep., EX1037, 54:9-15.

1984-87	**Martin Marietta Denver Aerospace**	Denver, CO
	Senior Engineer Research in vision algorithm development and implementation for mobile robot navigation (DARPA Autonomous Land Vehicle program).	

Turk CV, EX2002, pp. 3-4.

Pet. Motion to Exclude, Paper 27, pp. 1-15; Pet. Reply, Paper 17, pp. 1-5; Jiao Second Dec., EX1036, ¶¶11-49; PO Sur-Reply, Paper 20, pp. 1-9.

All of the Dependent Claims Are Unpatentable

All of the Dependent Claims are Unpatentable

- Patent Owner **only disputes** the following dependent claims:
  - 5, 16, and 27
  - 6, 17, and 28
  - 7, 18, and 29
  - 9, 20, and 31
  - 10, 21, and 32

POR, Paper 13, pp. 31, 53.

Dependent Claims 5, 16, and 27 are Unpatentable

5. The system of claim **1**, wherein the increase of light in the direction of the road curvature includes at least an increase of light emitted at a level below high-beam light and directed in the direction of the road curvature.

’029 Patent, EX1001, Claim 5.

Pet. Reply, pp. 18-19, 31; EX1003, ¶¶ 300 -302, 239; Pet., 84, 19, 31, FN8, 27, 43-44

Dependent Claims 5, 16, and 27 are Unpatentable

"The Petition and First Jiao Declaration (e.g., EX1003, ¶299) explained these features recite increasing light (other than at high-beam intensity) in the direction of the road curvature. As Dr. Jiao explained, Gotou's variation of high-beam and low-beam is generally in a vertical direction and not affected by horizontal movement. EX1003, ¶300 (citing EX1012, 1:10-20); *see also* EX1012, 3:52-67, 4:1-29, FIG. 4, 4:36-40, 5:8-7:4, FIGS. 8-9; Pet., 84."

Pet. Reply, p.18; *see also id.*, pp. 18-25.

Dependent Claims 6, 17, and 28 are Unpatentable

6. The system of claim **1**, wherein the instructions include instructions that, when executed by the one or more processors, enable the one or more processors to:

determine a second light change, the second change adapting the light pattern of the headlamps in at least one of color, intensity or spatial distribution to increase light in a direction of a second road curvature ahead of the motor vehicle, determined based on at least one of the first data or second data including at least second map data, and the second change shaping light based at least in part on the second road curvature; and

control at least a second plurality of the LED light sources, having at least one LED light source different from the first plurality of LED light sources, to provide light based at least in part on the determined second light change and prior to the motor vehicle reaching the second road curvature.

'029 Patent, EX1001, Claim 6.

Pet. Reply, pp. 19-21, 31; EX1003, ¶¶ 304 -315, 295-298; Pet., 84-85, 45-48

Dependent Claims 6, 17, and 28 are Unpatentable

"PO does not separately argue claims 4, 15, and 26 (EX1003, ¶¶295–298), which are similar to claims 6, 17, and 28 and recite selecting one of the first plurality of LED's or some second plurality of LEDs with a different LED to provide *reshaped* light. EX1003, ¶295. Like claims 6, 17, and 28, a POSA would have understood this was obvious, at least because *reshaping* the Gotou-Karlsson system's light would have included taking action with *at least one* of Gotou's modified headlamps utilizing Karlsson's LEDs. EX1003, ¶295; EX1036, ¶98.

Pet. Reply, pp. 20-21; *see also id.*, pp. 18-25.

Dependent Claims 7, 18, and 29 are Unpatentable

7. The system of claim 1, wherein the increase of light in the direction of the road curvature includes at least one of expansion of the light pattern in the direction of the road curvature or an increase to intensity of light directed in the direction of the road curvature; and

wherein the determination of the light change includes determination of light changes to individual LEDs of the first plurality of LED light sources, at least one of the changes including at least one of:

a variation to at least one of intensity or color of individual LEDs of the first plurality of LED light sources, or

providing light directed in the direction of the road curvature from an LED not providing light directed in the direction of the road curvature prior to the change.

'029 Patent, EX1001, Claim 7.

Pet. Reply, pp. 21-23; EX1003, ¶¶ 321-328; Pet., 88, 48-50.

Dependent Claims 7, 18, and 29 are Unpatentable

"PO groups claims 7, 18, and 29 (POR, 35-36; EX2006, ¶¶148-150), ignoring the Petition's explanation of Gotou-Karlsson. Gotou-Karlsson increases light by increasing intensity of light directed toward the road curvature, as previously explained, *and* an expansion of the light pattern (only one is required). Pet., 85-86; EX1003, ¶¶316-320.

This discloses an expansion of the light pattern by increasing the number of lights providing light toward the road curvature (and controlling intensity, which includes direction) as shown in Dr. Jiao's annotated figures and other known art such as Hogrefe. EX1036, ¶102."

Pet. Reply, p.21; *see also id.*, pp. 18-25.

Dependent Claims 9, 20, and 31 are Unpatentable

9. The system of claim **8**, wherein:
the first plurality and second plurality of LED light sources include at least one common LED light source;
the control of the second plurality of LED light sources is based at least in part on third data received from a non-camera sensor of the motor vehicle;
the position includes at least one of:
a distance associated with the at least one other vehicle, at least one elevation associated with the at least one other vehicle, or
a position within image data captured by at least one of the cameras;
the first data includes data from a non-camera sensor of the motor vehicle;
either one of the control of the first plurality of LED light sources or control of the second plurality of LED light sources is subsequent to and accommodative of the other;
the control of the second plurality of LED light sources additionally includes termination of light from at least one LED providing light directed to the area prior to the termination; and
the light pattern includes at least one of an illumination pattern or an emission pattern of the headlamps.

’029 Patent, EX1001, Claim 9.

Pet. Reply, pp. 23-24, 31-32; EX1003, ¶¶ 321-328, 330; Pet., 88, 52-54.

Dependent Claims 9, 20, and 31 are Unpatentable

Claim 8 for example, from which claim 9 depends, clarifies that there is "control, *based at least in part* on the position [of a vehicle determined with a camera]" as in Karlsson, of "a second plurality of LED light sources…to diminish glare." EX1003, ¶¶321-328. But [9.3] only recites that "the control of the second plurality of LED light sources is based at least in part on third data received from a non-camera sensor of the motor vehicle;" it does *not* require the control is "to diminish glare," as the partial control of the second plurality of LEDs is based at least in part on the position of a vehicle. Rather, the *additional* control in [9.3] is not limited in its purpose; it is just based "at least in part on third data received from a non-camera sensor of the motor vehicle." EX1036, ¶¶103-106, 145.

Gotou's map data is not from a camera sensor; thus, in combination with Karlsson it meets the elements related to first and third data not from a camera sensor [9.3]/[20.3]/[31.3], [9.5]/[20.5]/[31.5]. EX1012, 3:52-67, 4:1-29, 5:8-6:3, 6:18-7:4, FIGS. 4, 7; Pet., 88; EX1003, ¶330.

Pet. Reply, Paper 17, pp. 23-24; *see also id.*, pp. 18-25.

Dependent Claims 10, 21, and 32 are Unpatentable

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.

’029 Patent, EX1001, Claim 10.

Pet. Reply, pp. 24-25; EX1003, ¶¶ 341-349; Pet., 91, 54.

Dependent Claims 10, 21, and 32

"Dr. Turk groups claims 10, 21, and 32 (EX2006, ¶154), alleging that "Petitioner does not identify which optics it is relying on for this combination." While not argued in the POR, a POSA would have understood that Karlsson's optical control elements would have been used in the Gotou-Karlsson system, as they provide the correct illumination and control for Karlsson's LEDs. Pet., 91; EX1003, ¶¶341-349; EX1036, ¶¶107-108.

Dr. Turk acknowledged that Karlsson's lenses and reflectors are "optical control elements." EX1037, 164:12-165:2; EX1036, ¶¶107-108."

Pet. Reply, pp. 24-25; *see also id.*, pp. 18-25.

Questions?