

*Hisense USA Corporation (Petitioner) v.
Brightplus Ventures LLC (Patent Owner)*
IPR2023-01168
U.S. Patent No. 9,605,835

Petitioner's Demonstratives
December 4, 2024

Overview

- Challenged Patent
- Prior Art
 - Brief Discussion of the References
 - Motivation to Combine
- Disputed Claims
 - Original Claims
 - Substitute Claims
- Secondary Considerations Not Argued

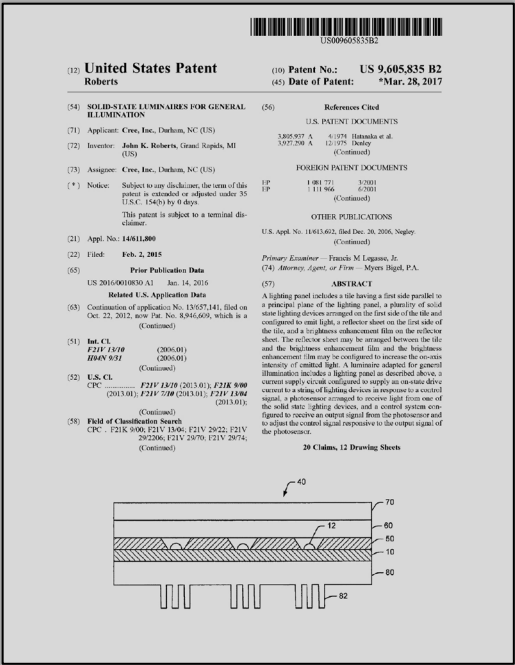
Contested Issues

Contested Issues

- “On”
- BEFs use structured refractive prisms to recycle light
- Claims 4 and 8, and using multiple diffusers was obvious
- Heat sinks are common in these systems
- Substitute Claims are Invalid

Challenged Patent

Challenged Patent



(12) United States Patent Roberts

(10) Patent No.: **US 9,605,835 B2**
(45) Date of Patent: ***Mar. 28, 2017**

(54) SOLID-STATE LUMINAIRES FOR GENERAL ILLUMINATION

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(72) Inventor: **John K. Roberts, Grand Rapids, MI (US)**

(73) Assignee: **Cree, Inc., Durham, NC (US)**

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **14/611,800**

(22) Filed: **Feb. 2, 2015**

(56) References Cited

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3,927,290 A 12/1975 Denley

(Continued)

FOREIGN PATENT DOCUMENTS

EP 1 081 771 3/2001

EP 1 111 966 6/2001

(Continued)

OTHER PUBLICATIONS

U.S. Appl. No. 11/613,692, filed Dec. 20, 2006, Negley.

(Continued)

Primary Examiner — Francis M Legasse, Jr.

Patent Disclosure

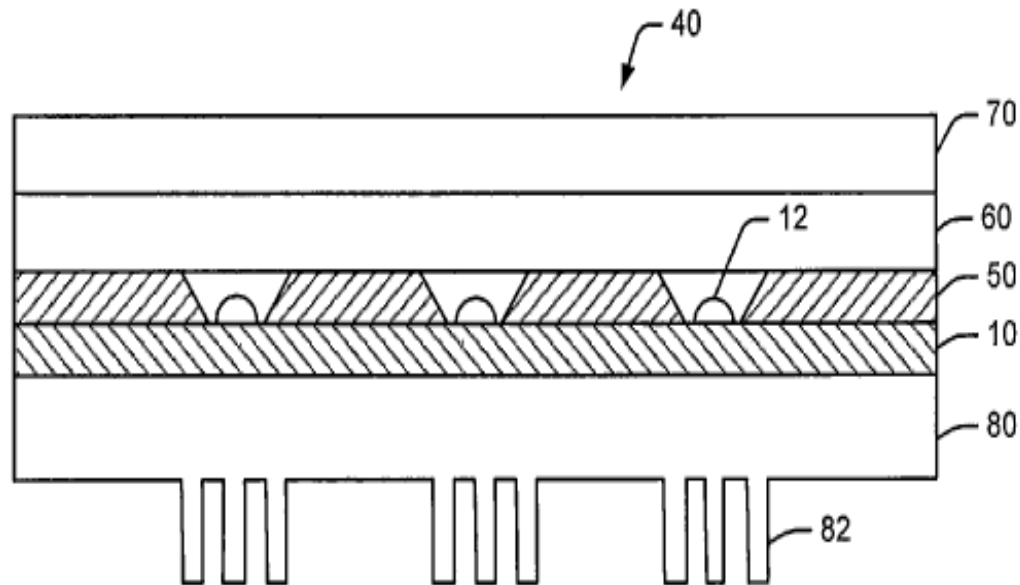


FIGURE 7

(57)

ABSTRACT

A lighting panel includes a tile having a first side parallel to a principal plane of the lighting panel, a plurality of solid state lighting devices arranged on the first side of the tile and configured to emit light, a reflector sheet on the first side of the tile, and a brightness enhancement film on the reflector sheet. The reflector sheet may be arranged between the tile and the brightness enhancement film and the brightness enhancement film may be configured to increase the on-axis intensity of emitted light. A luminaire adapted for general illumination includes a lighting panel as described above, a current supply circuit configured to supply an on-state drive current to a string of lighting devices in response to a control signal, a photosensor arranged to receive light from one of the solid state lighting devices, and a control system configured to receive an output signal from the photosensor and to adjust the control signal responsive to the output signal of the photosensor.

Ex. 1001

'835 Patent – Claims 1-5 and 7-14

1. A lighting panel, comprising:
at least one substrate having a first side parallel to a principal plane of the lighting panel;
a plurality of solid state lighting devices arranged on the first side of the at least one substrate and configured to emit light;
a reflector on the first side of the at least one substrate;
a brightness enhancement film on the reflector, wherein the reflector is arranged between the at least one substrate and the brightness enhancement film and the brightness enhancement film is configured to preferentially emit light having a first orientation from the lighting panel and to preferentially reflect light having a second orientation, different from the first orientation, back into the lighting panel, and
a generally planar diffuser sheet between the reflector and the brightness enhancement film, wherein the light having the second orientation that is reflected back into the lighting panel is recycled within at least the diffuser sheet.
2. The lighting panel of claim 1, wherein the reflector comprises a coating on the substrate that is configured to reflect and scatter light incident thereon.
3. The lighting panel of claim 1, wherein the reflector comprises a reflector sheet that is configured to reflect and scatter light incident thereon.
4. The lighting panel of claim 1, further comprising at least one additional layer on the brightness enhancement film configured to diffuse, polarize, collimate and/or reflect light.
5. The lighting panel of claim 3, wherein the reflector sheet includes a plurality of apertures therethrough, wherein respective ones of the plurality of apertures aligned with corresponding ones of the plurality of solid state lighting devices.

Ex. 1001, Col. 22:33-67

7. The lighting panel of claim 3, wherein the reflector sheet comprises a plastic foam.

8. The lighting panel of claim 1, further comprising a diffuser sheet between the reflector sheet and the brightness enhancement film.

9. The lighting panel of claim 1, wherein the brightness enhancement film comprises a plurality of three dimensional light extraction features configured to bend at least some light rays passing through the brightness enhancement film toward the direction normal to the principal plane of the lighting panel.

10. The lighting panel of claim 9, wherein the light extraction features are random features.

11. The lighting panel of claim 9, wherein the brightness enhancement film is configured to limit direct emission from the lighting panel of light emitted by the plurality of solid state light emitting devices to thereby encourage light recycling/diffusion in the lighting panel.

12. The lighting panel of claim 9, wherein the light extraction features comprise fresnel-type lenses.

13. The lighting panel of claim 9, wherein the brightness enhancement film is configured to substantially collimate light emitted by the lighting panel.

14. The lighting panel of claim 1, further comprising a heatsink panel on a second side of the at least one substrate opposite to the first side and configured to draw heat away from the at least one substrate in a direction opposite to a direction of light emission from the at least one substrate.

Ex. 1001, Col. 23:5-31

Ex. 1001

Grounds

Ground	35 U.S.C.	Claims	References
1	103	1-5 and 7-14	Mok, Holman, and Lamb in view of the Knowledge of a POSITA
2	103	1-5 and 7-14	Epstein, Holman, and Lamb in view of the Knowledge of a POSITA

Prior Art

Mok – Ex. 1005



US 20060227545A1

(19) **United States**

(12) **Patent Application Publication**
Mok et al.

(10) **Pub. No.: US 2006/0227545 A1**

(43) **Pub. Date: Oct. 12, 2006**

(54) **LIGHT EMITTING PANEL**

Publication Classification

(76) Inventors: **Thye Linn Mok**, Loveland, CO (US);
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Shin Wen Ng, Loveland, CO (US)

(51) **Int. Cl.**
B60Q 1/26 (2006.01)

(52) **U.S. Cl.** **362/227**

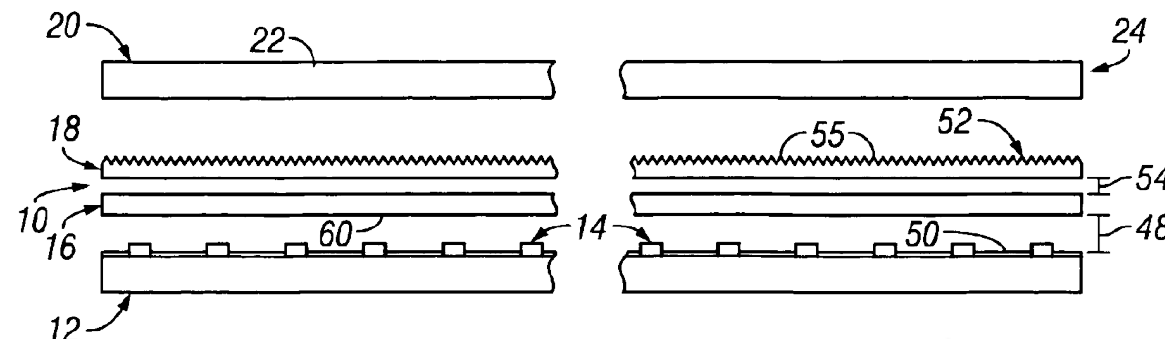
(57) **ABSTRACT**

In one embodiment, a light emitting panel includes a base panel and a plurality of light emitting elements mounted to the base panel. Each of the light emitting elements produces an illumination pattern having a region of substantially uniform intensity that extends over a radiation angle of at least about 60°. One or more light conditioners are positioned adjacent the base panel to receive and condition light produced by the light emitting elements.

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(21) Appl. No.: **11/103,172**

(22) Filed: **Apr. 11, 2005**



PETITIONER'S DEMONSTRATIVE EXHIBIT – NOT EVIDENCE

Ex. 1005

(57)

ABSTRACT

In one embodiment, a light emitting panel includes a base panel and a plurality of light emitting elements mounted to the base panel. Each of the light emitting elements produces an illumination pattern having a region of substantially uniform intensity that extends over a radiation angle of at least about 60°. One or more light conditioners are positioned adjacent the base panel to receive and condition light produced by the light emitting elements.

Mok – Ex. 1005

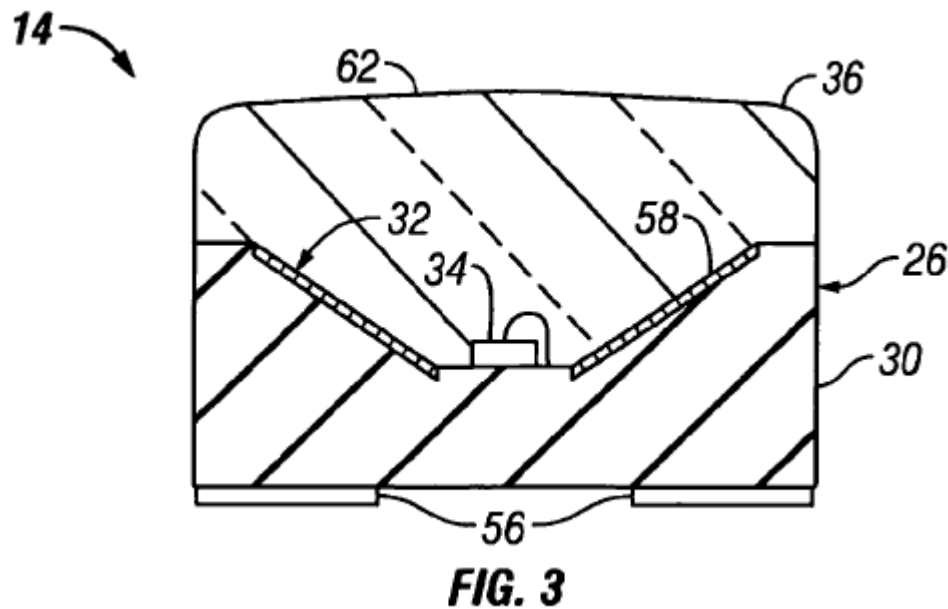
[0015] An exemplary light emitting panel **10** is shown in **FIGS. 1 and 2** and may comprise a base panel **12** having a plurality of light emitting elements **14** thereon. As will be described in greater detail below, each of the light emitting elements **14** produces an illumination pattern **46** that comprises a region **28** of substantially uniform intensity that extends over a large radiation angle (e.g., at least about 60°, and typically at least about 100°). See **FIG. 4**. One or more light conditioners **16, 18** are positioned adjacent the base panel to receive and condition light produced by the various light emitting elements **14**. The light conditioners may comprise a diffuser **16** that is positioned adjacent the base panel **12** so that the diffuser **16** receives and diffuses light produced by the various light emitting elements **14** provided on the base panel **12**, and a brightness enhancer **18** that is positioned adjacent the diffuser **16**. The brightness enhancer **18** collects diffused light from the diffuser **16** and directs it out of a front surface **52** of the brightness enhancer **18** to maximize the on-axis brightness of the light emitting panel **10**. In one application, the light emitting panel **10** may be positioned adjacent a display device **20**, such as a liquid crystal display panel **22**, to form a backlit display system **24**.

Mok – Ex. 1005

[0023] The diffuser 16 may be mounted in front of the base panel 12 and separated therefrom by a spaced-distance 48. Generally speaking, larger spaced-distances 48 will improve the uniformity of the light produced by the panel, but at the expense of panel thickness and some loss of efficiency. By way of example, in one embodiment, the diffuser 16 is separated from the base panel 12 by a distance 48 of about 50 millimeters (mm) or less.

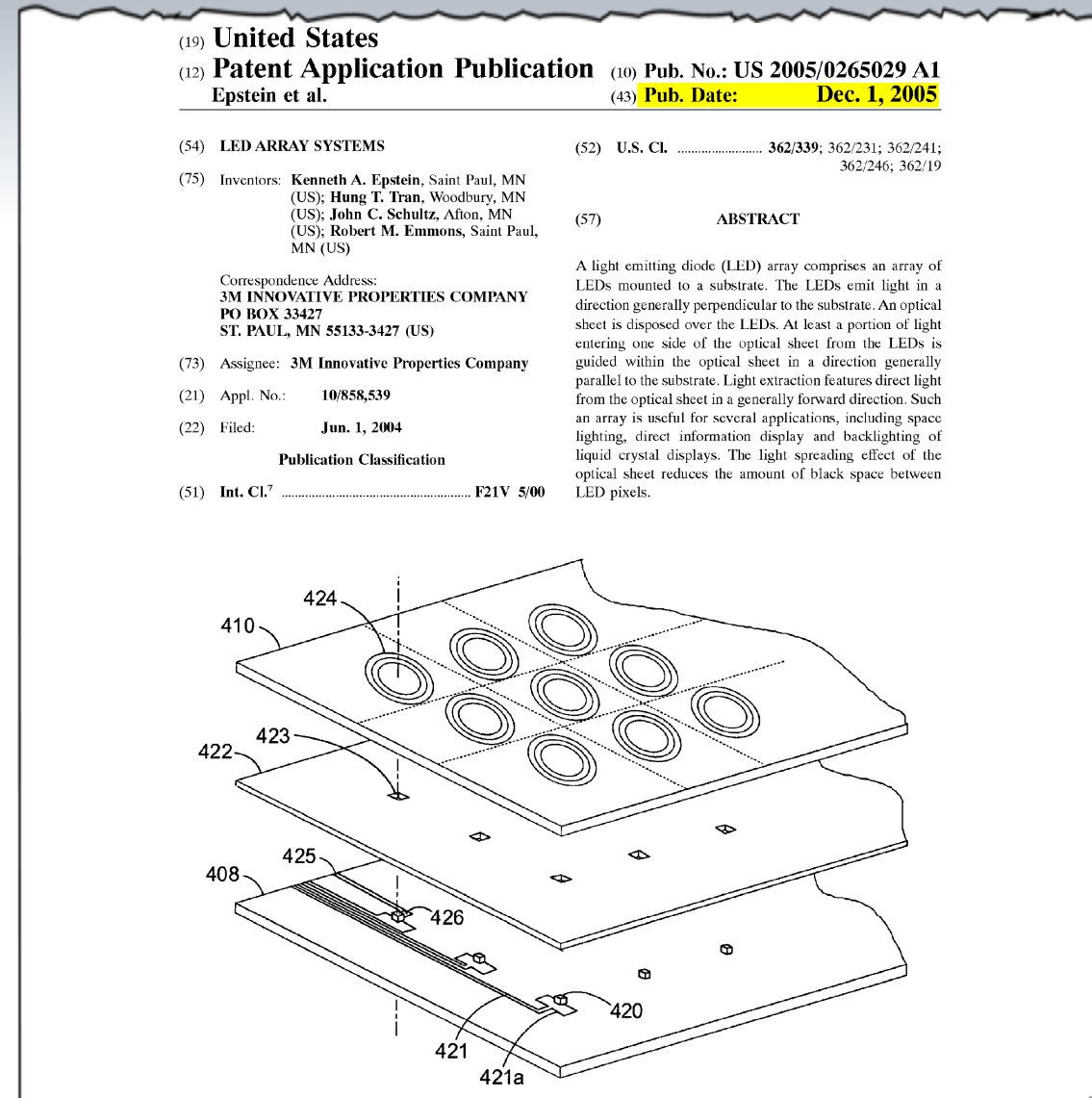
[0024] The brightness enhancer 18 is positioned adjacent the diffuser 16 and receives diffused light therefrom. The brightness enhancer 18 comprises a plurality of optical elements, such as prisms 55 defined by the front surface 52 of the brightness enhancer 18, that collect light from the diffuser 16 and direct it out the front surface 52 of the brightness enhancer 18. The brightness enhancer 18 thereby maximizes the on-axis brightness of the panel 10. By way of example, in the embodiment shown and described herein, the brightness enhancer 18 comprises a brightness enhance film (BEF) available from 3M and sold under the registered trademark Vikuiti®. Alternatively, other types of brightness enhancers could be used.

[0025] The brightness enhancer 18 may be mounted in front of the diffuser 16 and may be separated therefrom by a spaced-distance 54. However, the brightness enhancer 18 is preferably stacked directly on (or applied to) the diffuser 16, thereby minimizing or eliminating the distance 54.



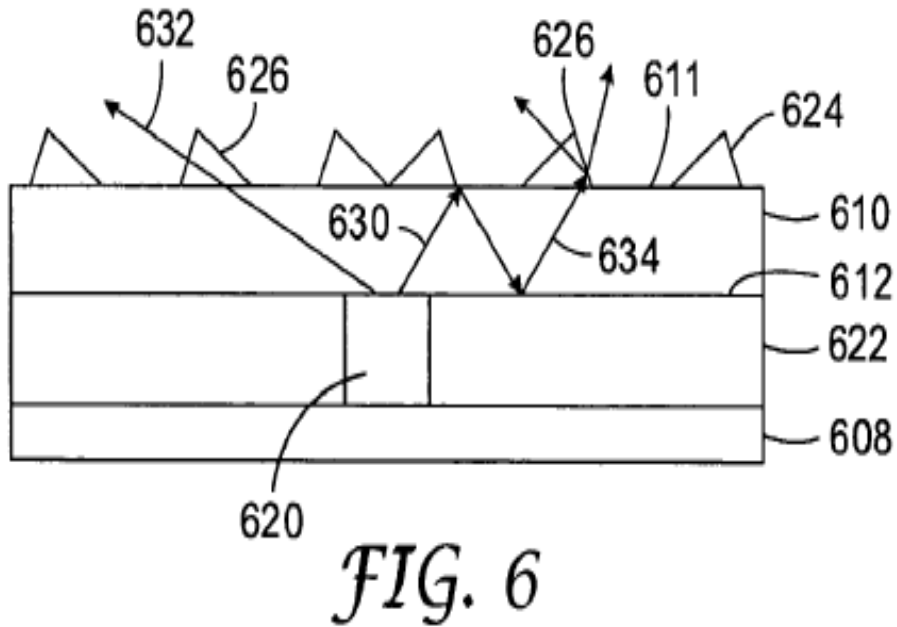
[0028] The reflector cup 32 may be formed in the base portion 30 during fabrication thereof. Alternatively, the reflector cup 32 may be mechanically formed after fabrication of the base portion 30, such as, for example, by drilling. It is generally preferred that the reflector cup 32 be provided with a reflective coating 58 thereon to improve efficiency. By way of example, in one embodiment, the reflector cup 32 is initially plated with copper, then with a subsequent layer of gold or silver to maximize reflectivity.

Epstein – Ex. 1008



PETITIONER'S DEMONSTRATIVE EXHIBIT – NOT EVIDENCE

Ex. 1008



[0067] In FIG. 6, an LED 620 is disposed on a substrate 608 and is surrounded by an intermediate layer 622, which may be a reflecting film. A guiding layer 610 lies over the LED 620. Light from the LED 620 passes into the guiding layer 610. The side of the guiding layer 610 facing away from the LED is provided with a light extraction feature 624. In this particular embodiment, the light extraction feature 624 includes prismatic structures 626 disposed about the LED 620. The prismatic structures 626 may be formed as a Fresnel lens with the LED 620 at its center. Light 630 from the LED 620 passes into the guiding layer 610. Some of the light 632 may be emitted directly via the prismatic structure 626. Other portions of the light 634 may be reflected within the guiding layer 610, for example by reflection off the upper surface 611 of the guiding layer 610. The light 634 may also reflect off the lower surface 612 of the guiding layer 610 or off the intermediate layer 622. The light 634 is directed in a forwards direction towards the viewer by the prismatic structures 626.

Epstein – Ex. 1008

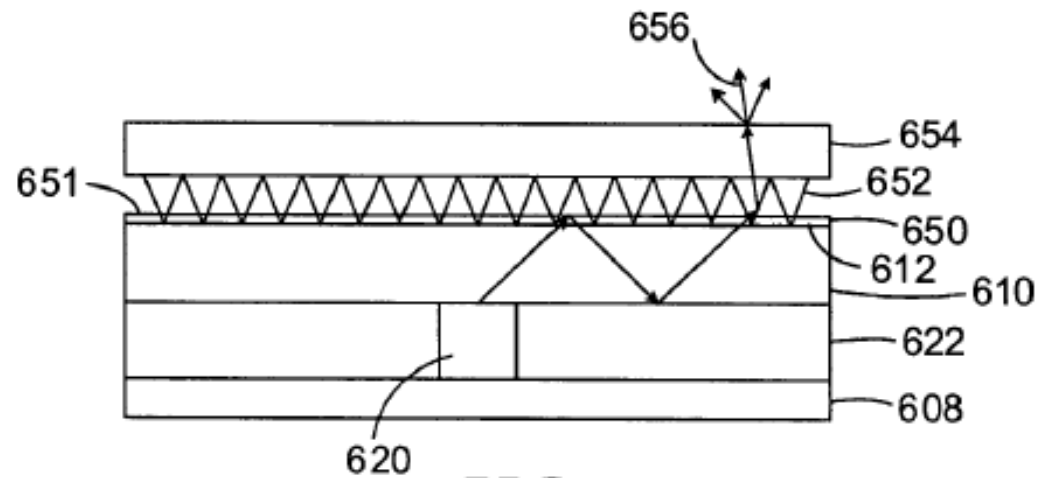


FIG. 10A

[0072] In the embodiment schematically shown in **FIG. 10A**, the light extraction feature **624** comprises a layer of optical coupling material **650** and a plurality of prism-type structures **652** whose apices penetrate into the optical coupling material **650**. The prism-type structure **652** may be attached to a base layer **654**. For example, the prism-type structures **652** may be molded with the base layer **654** or may be bonded to the base layer **654**. The optical coupling material **650** may be, for example, a thin layer of adhesive with a thickness in the range 1-20 μm . In this particular embodiment, the light **630** may pass out of the guiding layer **610** to be totally internally reflected at the upper surface **651** of the coupling material **650**. The light **630** is directed to the intermediate layer **622** which reflects the light back upwards. Some of the light incident on the upper surface **612** of the guiding layer **612** is coupled into the prism-type structures **652**, which reflect the light upwards in the general direction of the viewer. The base layer **654** may be provided with a surface or volume diffuser to diffuse the light **656** emitted from the base layer **654**. The prism-type structures **652** may be shaped in a pattern centered around the LED **620**, or may be provided in some other pattern. For example, the prism-type structures may be linear.

Ex. 1008

Paper 1, p. 40

Ex. 1003 at ¶¶80, 81, 148

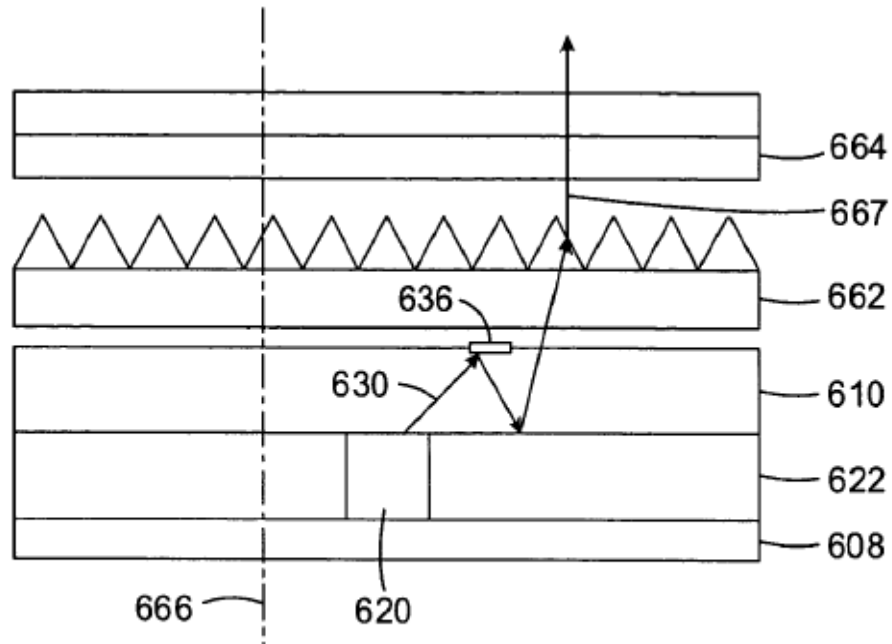


FIG. 11

[0074] One or more light management films may be used above the guiding layer for directing or redirecting the light. For example, one or more brightness enhancing films, available from 3M Company, St. Paul, Minn., under the trade name BEF™, may be used to direct the light more in a direction perpendicular to the substrate 608. Brightness enhancing films typically comprise a plurality of prismatic refractive elements which, when illuminated from the base side of the prismatic elements, refract the transmitted light in a direction more parallel to the axis. In the example illustrated in **FIG. 11**, a light emitting element that uses a diffractive light extraction element 636 emits light from the guiding layer 610 in a first direction relative to the axis 660. The light 667 is refracted upon exiting the first brightness-enhancing layer 662 in a second direction that is closer to the axis 666 than the first direction. In some embodiments, only one layer of brightness enhancing film 662 is used. Typically, the prisms of the first brightness enhancing film are ribbed, and so a single layer of brightness enhancing film redirects the light in only one dimension. A second additional layer of brightness enhancing film 664 may optionally be used, where the ribbed prisms of the second layer of brightness enhancing film 664 are oriented perpendicular to those of the first layer 662: the combination of the two layers 662 and 664 of brightness enhancing film redirects the light towards the axis 666 in two dimensions.

Holman – Ex. 1006

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(22) International Filing Date: 13 December 2002 (13.12.2002)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data: 60/340,453 14 December 2001 (14.12.2001) US

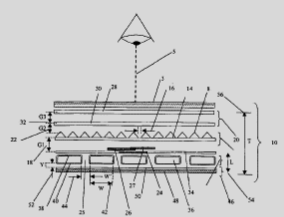
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(74) Agents: BROWN, Marshall, J. et al.; Foley & Lardner, 330 North Wabash Avenue, Suite 3300, Chicago, IL 60611 (US).

(54) Title: UNIFORM ILLUMINATION SYSTEM

(57) Abstract: A compact and efficient optical illumination system featuring planar multi-layered LED light source arrays concentr-ating their polarized or unpolarized output within a limited angular range. The optical system manipulates light emitted by a planar light emitters such as electrically interconnected LED chips. Each light emitting region in the array is surrounded by reflecting side-walls whose output is processed by elevated prismatic films, polarization converting films, or both. The optical interaction between light emitters, reflecting sidewalls and the elevated prismatic films create overlapping virtual images between emitting regions that contribute to the greater optical uniformity. Practical illumination applications of such uniform light source arrays include compact LCD of DMD video image projectors, as well as general lighting, automotive lighting, and LCD backlighting.



(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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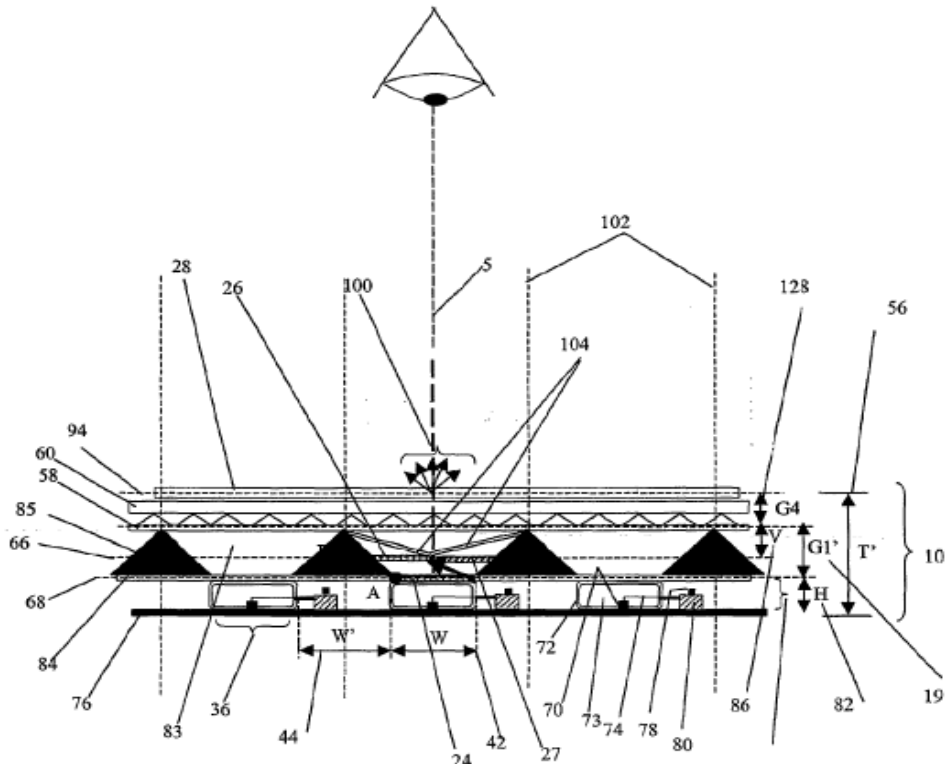
- (51) International Patent Classification⁷: H05B
- (21) International Application Number: PCT/US02/40026
- (22) International Filing Date:
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- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
60/340,453 14 December 2001 (14.12.2001) US
- (71) Applicant: DIGITAL OPTICS INTERNATIONAL CORPORATION [US/US]; 1820 Ridge Avenue, Evanston, IL 60201 (US).
- (72) Inventors: HOLMAN, Robert, L.; 1820 Ridge Avenue, Evanston, IL 60201 (US). COX, Arthur; 1116 South Al-dine Avenue, Park Ridge, IL 60068 (US).
- (74) Agents: BROWN, Marshall, J. et al.; Foley & Lardner, 330 North Wabash Avenue, Suite 3300, Chicago, IL 60611 (US).

- (81) Designated States (national): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZM, ZW.
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Published:
— without international search report and to be republished upon receipt of that report

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

FIG. 7



Ex. 1006, p. 1

The present invention is concerned generally with a thin and compact multi-layered optical system and method for generating well-organized output illumination from a spatially discontinuous one or two-dimensional array of discrete emitters, the output light emanating from one (or opposing sides) of the multi-layered system, uniformly over the system's aperture. The field of

Ex. 1006, p. 1

layers and output screens. The related layer or layers, in configurations that need them, can be conventional light spreading materials such as holographic diffusers, lenticular diffusers, lens arrays, bulk or surface scattering diffusers, opal glass, or ground glass. The related layer or layers can also be a reflective polarizer that holds light of one polarization state within the light source structure until it converts to light of the orthogonal polarization. A base-diffusing layer, positioned just above the light source's emitting plane is added in some applications to introduce additional randomization.

Ex. 1006

Lamb – Ex. 1007

(19) **United States**

(12) **Patent Application Publication**
Lamb et al.

(10) Pub. No.: US 2005/0135115 A1

(43) Pub. Date: Jun. 23, 2005

(54) **MULTIPLE LIGHTGUIDE BACKLIGHT**

(52) U.S. Cl. 362/613; 362/19

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(21) Appl. No.: **10/744,569**

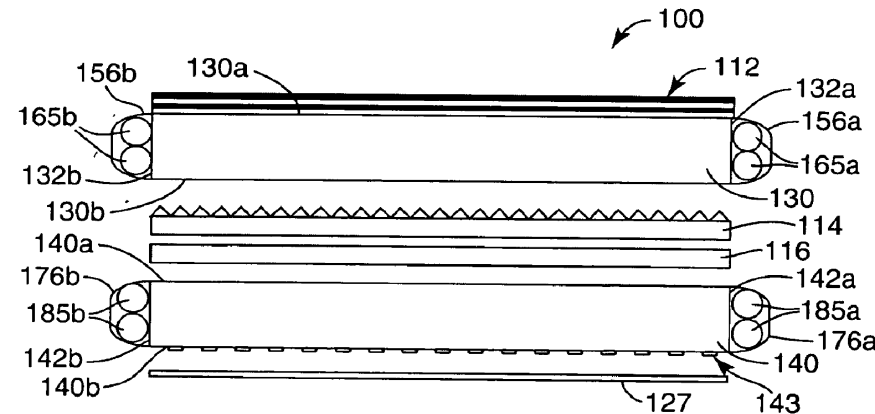
(22) Filed: **Dec. 23, 2003**

Publication Classification

(51) Int. Cl.⁷ **F21V 8/00; F21V 9/14**

ABSTRACT

The present disclosure is directed to backlighting systems, which include first and second lightguides, at least one light source optically connected to an edge of the first lightguide and at least one light source optically connected to an edge of the second lightguide for supplying light into their respective interiors. In the appropriate exemplary embodiments, the backlighting systems of the present disclosure include an extractor disposed at a surface of the second lightguide for diffuse extraction of light from the interior of the second lightguide. In such exemplary embodiments, at least a portion of the light supplied into the interior of the second lightguide and then diffusely extracted therefrom enters the interior of the first lightguide through a substantially optically clear surface. In some exemplary embodiments, the backlighting systems of the present disclosure include recycling enhancement structures, which may be attached to the first lightguide.



[0035] The traditional backlight **10** further includes a thin diffuser sheet **16** and a layer of enhancement film **14** having prismatic surface structures, such as Vikuiti™ Brightness Enhancement Film BEF, available from 3M Company. The enhancement film **14** refracts light within a certain angle toward the viewer. Light outside that angle is “recycled,”

i.e., reflected back into the backlight **10**, where it travels within the system until reaching the proper angle for exiting the system. In addition, the traditional backlight **10** includes a layer of reflective polarizer **12** placed over the enhancement film **14**. The reflective polarizer **12** is usually a multilayer reflective polarizer, such as Vikuiti™ Dual Brightness Enhancement Film (DBEF), also available from 3M Company. The reflective polarizer **12** transmits light with a predetermined polarization, while reflecting light with a different polarization into the backlight **10** where the polarization state is altered and the light is fed back to the reflective polarizer **12**. This process is also referred to as “recycling.”

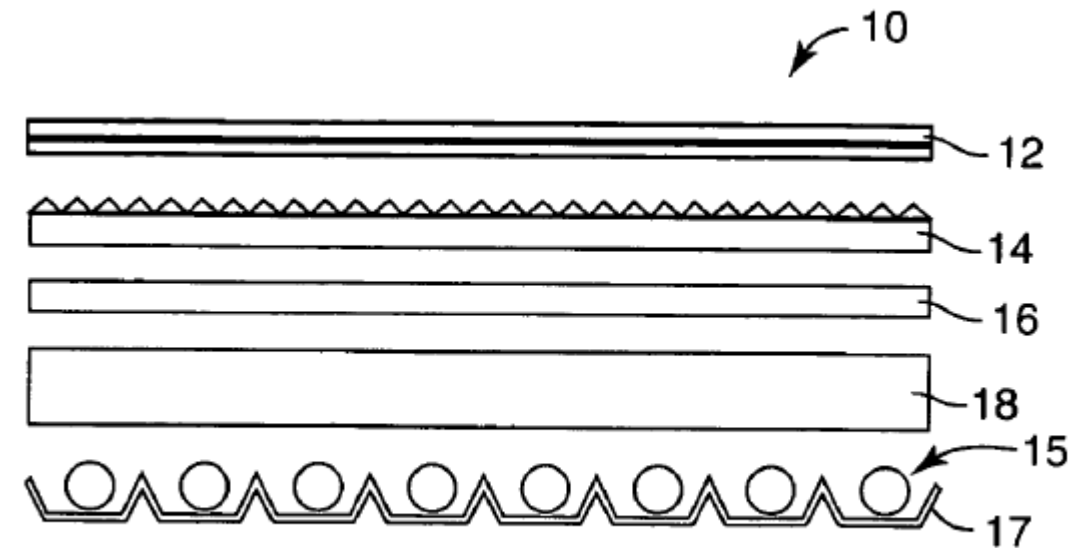


FIG. 1

Ground I

Mok + Holman + Lamb

Core of Independent claim 1 disclosed by Mok

- Including, lighting panel (preamble), substrate (1A), solid state lighting device (1B), reflector (1C), BEF (1D), reflector between substrate and diffuser (1E), and recycling light (1F-G)

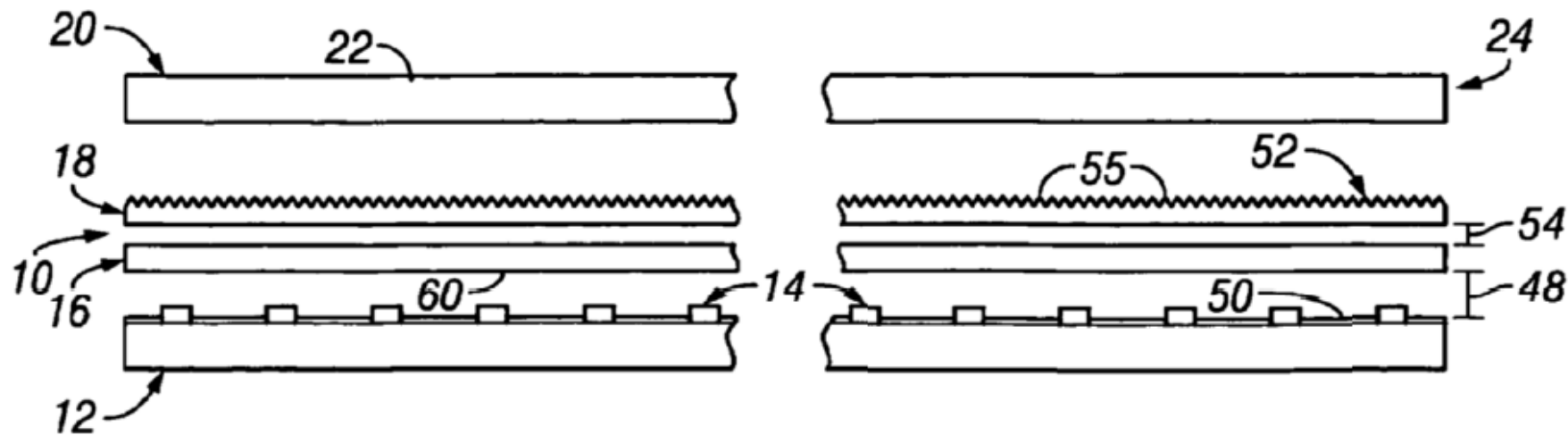


FIG. 1

PETITIONER'S DEMONSTRATIVE EXHIBIT – NOT EVIDENCE

Claim Construction – “on”

Hisense's Construction	Brightplus's Proposed Construction
directly on the other element or intervening elements may be present	directly on, or on with intervening elements present

- “air gap” is intervening element

It will be understood that when an element such as a layer, **region** or substrate is referred to as being “on” or extending

Ex. 1001, 6:66-67

- Invalid under either understanding

BEF “on” a reflector

If “air gap” is an intervening element

- Ground I: Mok discloses
 - Mok discloses BEF is “preferably stacked” on diffuser Ex. 1005, [0025]
 - Mok then discloses that reflector distance can be “50 or less” Ex. 1005, [0032]

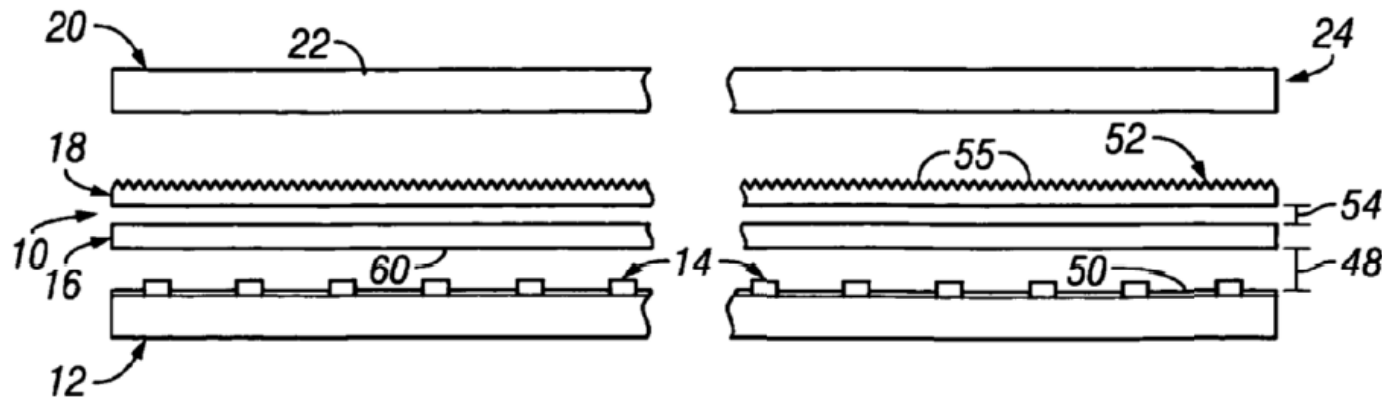
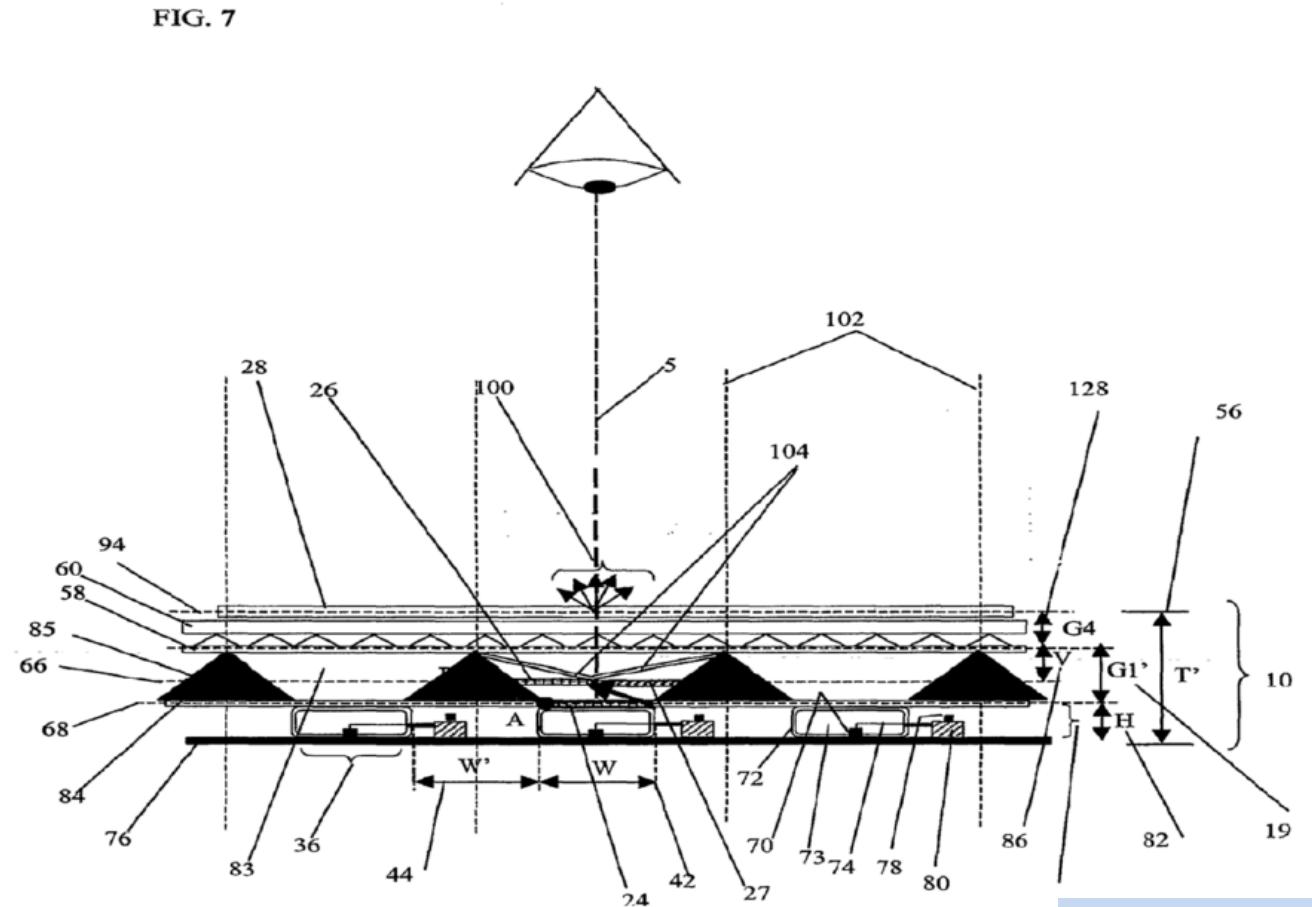


FIG. 1

Ex. 1005, Fig. 1
Paper 20, at 2-3

If “air gap” is not an intervening element

- **Both Grounds I and II**
- Holman discloses direct stacking
 - Prism sheets 58 and 60 are on the reflector (*i.e.*, “reflecting layer 76”) via intervening elements that include “confining structure 72” (*see* Ex. 1006 at 37-38), “diffusely scattering layer 68” (*id.* at 44), “compartmentalized spacer layer 84”



Ex. 1006, Fig. 7
Paper 20, at 6-8

BEF “on” a reflector

If “air gap” is not an intervening element (Ground I and II)

- Holman teaches coupling layers:

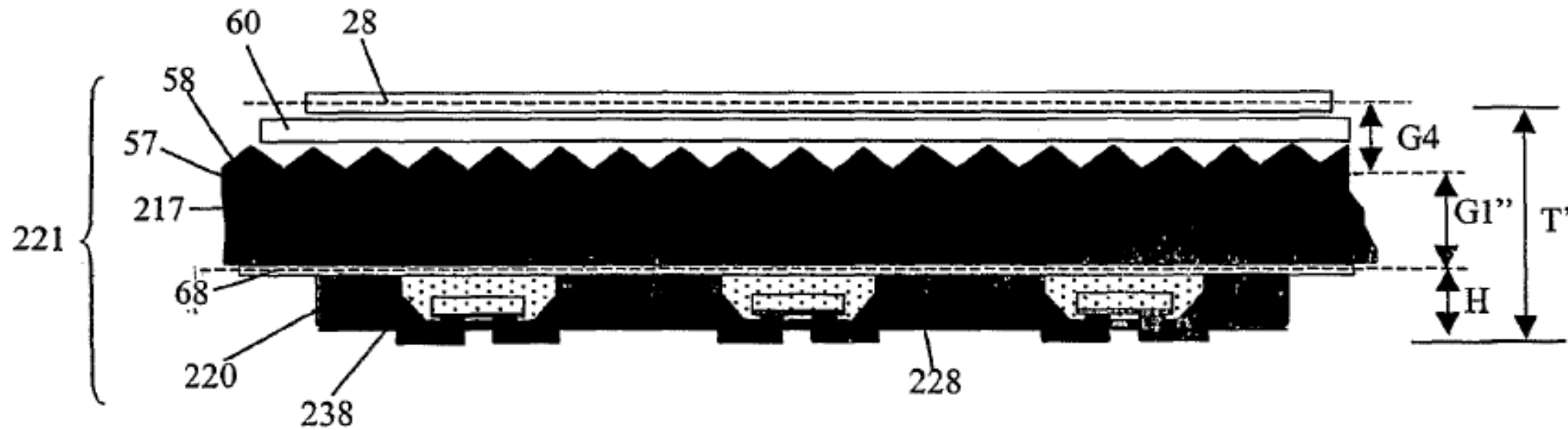


FIG. 15 shows one possible set of fully integrated two-dimensional light source panels combining the high-density LED back plane of FIG. 13 with the multi-layer illuminator arrangement of FIG. 7. The same type of integration applies to the arrangements of FIG. 14 and FIG. 7, and also to the light sources of either FIG. 13 or FIG. 14 and the system of FIG. 8.

Ex. 1006, Fig. 15, page 40
Paper 20, at 6-8

If “air gap” is not an intervening element (Ground I and II)

The four illustrative cross-sections 248, 221, 223, and 225 of FIG. 15 all use elevated prism sheets 58 and 60, separated from the plane of emitting apertures by spacer layer 84 (or 217) of thickness $G1'$ or $G1''$, $G1'$ and $G1''$ being the appropriate physical thickness for the degree of virtual image separation required, the spacing medium being air ($G1'$) or transparent dielectric ($G1''$). Boundary 57 between lower prism sheet 58 and dielectric spacer layer 217 is either a thin air gap formed by mechanically resting one discrete layer 58 on another 217, or a purposeful optical coupling wherein layers 58 and 217 are bonded together, for example, by means of optical adhesive or epoxy. In many cases, the existence of an air boundary between the lower prism sheet and the emitters beneath is preferable, in that it imposes a limit on the range of angles input to the lower prism sheet's substrate layer. While this limitation in turn may limit the percentage of power transferred from layer 217 to layer 58, it leads to a more narrowly confined output beam 219. Making all media boundaries between the LED chips 70 and lower prism sheet layer 58 optically coupled increases the amount of output light 219 emitted in higher angles, generally widening the beam's angular extent.

Ex. 1006, p. 40

BEFs Were Well Known, Well Characterized

POSITAs knew about BEFs, including 3M's BEFs

- explicitly described as ***recycling***. Lamb, Ex. 1007, [0035]
- One of the “***most common***” films. Holman, Ex. 1006 at 118
- “***hallmark***” is recycling light. Holman, Ex. 1006 at 125
- collect light and maximizes on-axis brightness. Mok, Ex. 1005, [0015]
- Shown as limiting direct emission and recycling light. Epstein, Ex. 1008, FIG. 10B, [0074].
- Include prismatic structures to bend light “on axis” (aka collimate), thereby limiting direct emission. Epstein, Ex. 1008, [0074], [0110]; Lamb, Ex. 1007, [0052], Mok, Ex. 1005, [0021]

BEFs Were Well Known, Well Characterized

POSITAs knew about BEFs, including 3M's BEFs

- What does a POSITA Know about BEFs?
 - A POSITA knows that the BEFs described in Mok, Lamb, Epstein, and Holman, all function similarly. Ex. 1003, ¶¶ 71, 75, 98, and 115.
 - These are all the same 3M BEFs identified
 - That they bend light “on-axis”, i.e. collimate, and limit direct emission using prismatic structures that end up recycling light. Ex. 1003, ¶¶ 71-75, 86-89, and 96.

Claim 4 and 8 are obvious

- Claim 4: “one additional layer” on BEF
- Claim 8: further comprising a diffuser sheet between reflector and BEF

Ground II: Not Contested

- Claim 4: Epstein discloses contrast/projection filter 668 (Epstein, [0074-0075])
- Claim 8: guiding layer with diffuser integrated on far side between reflector and BEF [Epstein [0084], Figs. 19A, 11.

Claim 4 and 8 are obvious

- Claim 4: “one additional layer” on BEF
- Claim 8: further comprising a diffuser sheet between reflector and BEF

Ground I:

- Mok discloses using “one or more light conditioners”. Ex. 1005, [0015]
- Mok and Lamb disclose that diffusers can improve light uniformity and brightness, a goal of both. Ex. 1005, [0006]-[0007]; Ex. 1007, [0058].

Dr. Pattison confirms that use of “multiple diffusers” was common, and diffusers were well understood off the-shelf components. Ex. 1003, ¶34

Claim 14 recites:

“a heatsink panel on a second side of the at least one substrate opposite to the first side and configured to draw heat away from the at least one substrate”

Ground I: Mok

- Recognizes heat needs to be managed and discloses a PCB, which a POSITA knows would function as a heat sink. Mok, [0004], [0006], [0019]; Ex. 1003, ¶124-25
- Holman’s base layer 220 disclosed as part of a heat sink. Holman at 40.

Claim 14 recites:

“a heatsink panel on a second side of the at least one substrate opposite to the first side and configured to draw heat away from the at least one substrate”

- **Ground II: Epstein**

[0054] The substrate 408 may be provided with a metallic layer on its lower surface (not shown) for extracting heat generated by the LEDs 420. In addition, the conductors 421 may be provided with large area pads 421 a to aid in spreading the heat generated by the LEDs 420. Generally,

Ex. 1008, [0054]

Mok + Holman + Lamb

- Mok, Holman, and Lamb all relate to LED-based lighting devices to provide backlighting for display elements with similar components (LEDs, reflectors, diffusers, BEFs)
- Mok, Holman, and Lamb all seek to increase efficiency, create more uniform light, and a thinner display system

Mok + Holman + Lamb

- PO Attacks Mok – Holman Combination based on Mok's distance disclosure (50 mm or less)
 - Mok teaches trade-off between uniformity vs. efficiency and thickness
 - Holman's teachings including intervening elements with larger spaces

Motivations to Combine

- **Mok + Holman + Lamb**



“The fact that the motivating benefit comes at the expense of another benefit, however, should not nullify its use as a basis to modify the disclosure of one reference with the teachings of another.” *Winner Int’l Royalty Corp. v. Wang*, 202 F.3d 1340, 1349 n.8 (Fed. Cir. 2000)

Mok + Holman + Lamb

- PO Attacks Mok – Lamb Combination based on Lamb's Use of CCFL
 - PO misconstrues purpose of Lamb
 - Lamb makes explicit what everyone knows – BEFs recycle light

Motivations to Combine

- **Mok + Holman + Lamb**



“[T]he test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art.” *MCM Portfolio v. Hewlett-Packard Co.*, 812 F.3d 1284, 1294 (Fed. Cir. 2015).

Ground II

Epstein + Holman + Lamb

Independent claim 1 disclosed by Epstein

Core of Independent claim 1 disclosed by Epstein

- Including, lighting panel (preamble), substrate (1A), solid state lighting device (1B), reflector (1C), BEF (1D), reflector between substrate and diffuser (1E), and recycling light (1F-G)

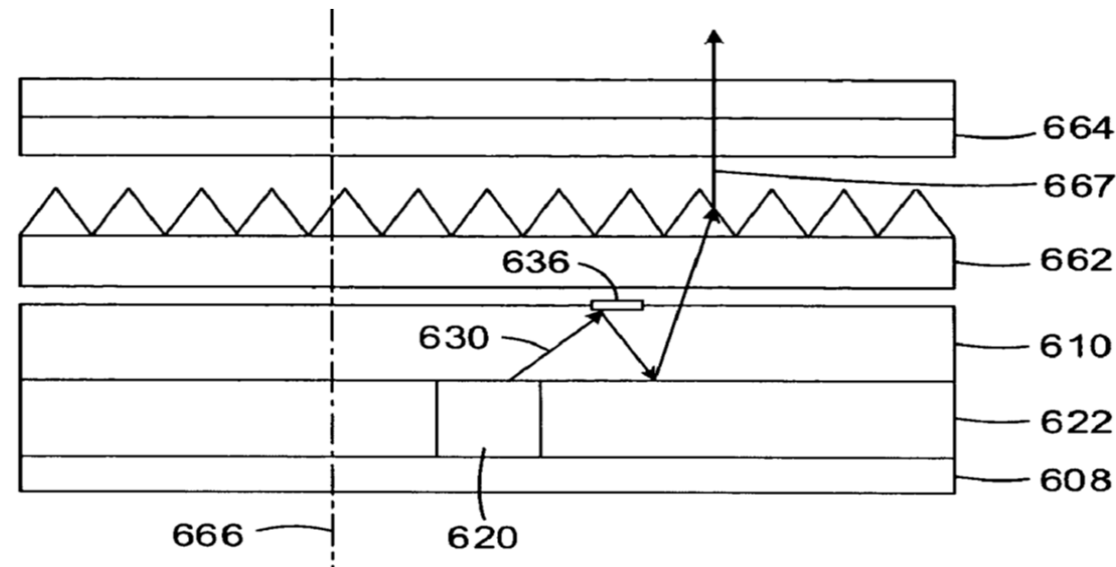


FIG. 11

Ex. 1008, Fig. 11
Paper 1, at 37-44

BEF “on” a reflector

- If “air gap” is an intervening element
- Ground II: Epstein discloses
- Epstein’s BEF 662 is “on” the reflector 622 with intervening element 610
- *See also*, Fig. 4, 10A, 12

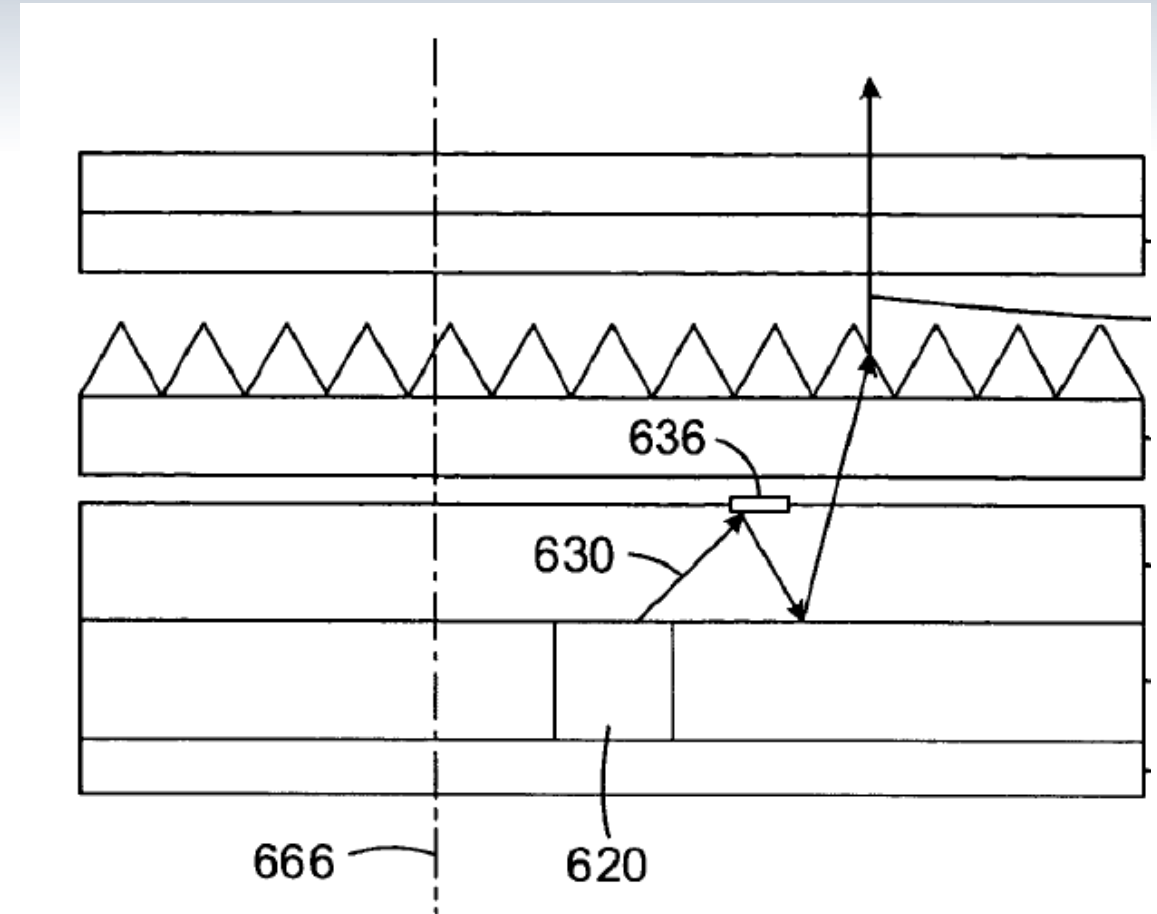


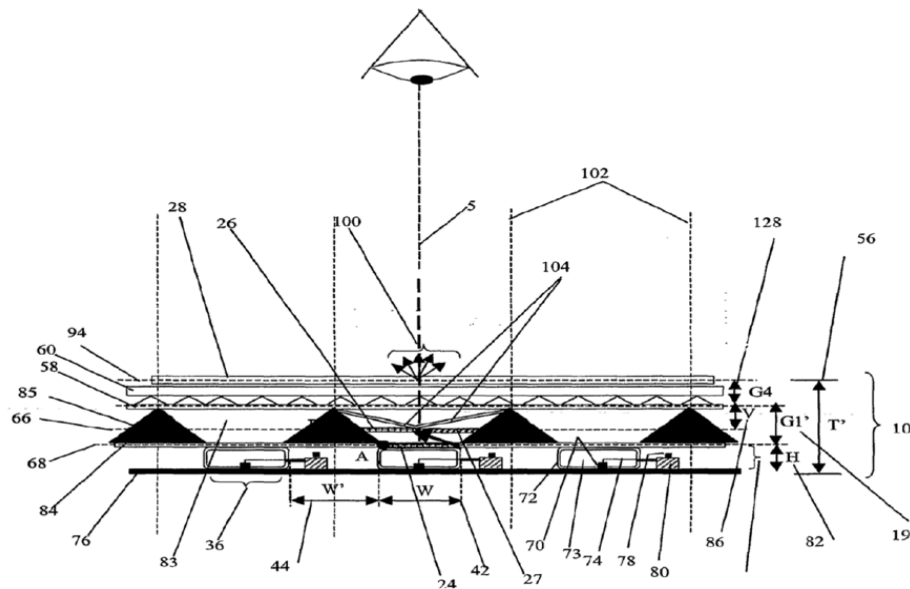
FIG. 11

Ex. 1008, Fig. 11
Paper 1, at 40
Paper 20, at 15-16

To the extent Epstein does not explicitly disclose

- Holman discloses “on”
- Lamb discloses recycling

FIG. 7



“[3M’s BEF] refracts light within a certain angle toward the viewer. Light outside that angle is ‘recycled,’ i.e., reflected back into the backlight 10, where it travels within the System until reaching the proper angle for exiting the system.”

Ex. 1003, ¶72-75.

Ex. 1006, Fig. 6
Paper 20, at 6-8

Epstein + Holman + Lamb

- PO Attacks Epstein – Holman Combination based on alleged loss of uniformity
 - Expert's opinion is conclusionary and parrots attorney argument
 - Holman's teachings including compact designs with uniformity
 - See Ex. 1006, e.g., 8 and 16
 - See *also*, Pattison (Ex. 1003) at ¶146

Epstein + Holman + Lamb

- Epstein, Holman, and Lamb all relate to LED-based lighting devices to provide backlighting for display elements with similar components (LEDs, reflectors, diffusers, BEFs)
- Epstein, Holman, and Lamb are all aimed at creating thinner, more efficient lighting systems with brighter, more uniform lighting

Compare and Contrast

- PO's sur-reply (Paper 24) identifies 4 examples
 - 2 examples are completely different
 - 1 example only a short section is the same
 - last example, again only short section
- PO's declaration is replete with verbatim copying on a scale that is quantifiably and qualitatively different
 - “recognizing this fallacy” even copies argumentative language
 - last forty-six paragraphs of the declaration are nearly an identical copy of pages 24-48 of the Response.
 - Compare Response at 24-48 with Ex 2006, ¶¶53-99.

Revised Substitute Claims

The Substitute Claims

21. (proposed substitute for Claim 1) A lighting panel, comprising:

at least one substrate comprising a metal core printed circuit board having traces formed thereon mounted on a lighting tile and having a first side parallel to a principal plane of the lighting panel;

a plurality of strings of packaged solid state lighting devices arranged on the first side of the at least one substrate and configured to emit light;

wherein the plurality of strings of packaged solid state lighting devices is mounted on the lighting tile;

wherein a lens is mounted over each one of the packaged solid state lighting devices;

a controller configured to control the plurality of strings of packaged solid state lighting devices;

wherein the controller is operable to deliver a control signal to a plurality of current supply circuits that are operable to control the pulse width of the current supplied to each one of the plurality of strings of packaged solid state lighting devices using information transmitted to the controller over a communication link;

a reflector mounted to the lighting tile and on the first side of the at least one substrate, the reflector being outside of the packaged solid state lighting devices;

wherein the reflector extends to cover the lighting tile and includes a plurality of sidewalls outside of the packaged solid state lighting devices that are angled with respect to the principal plane of the lighting panel;

a brightness enhancement film on the reflector, wherein the reflector is arranged between the at least one substrate and the brightness enhancement film and the brightness enhancement film is configured to preferentially emit light having a first orientation from the lighting panel and to preferentially reflect light having a second orientation, different from the first orientation, back into the lighting panel, and

a generally planar diffuser sheet between the reflector and the brightness enhancement film, wherein the generally planar diffuser contacts the reflector, and wherein the light having the second orientation that is reflected back into the lighting panel is recycled within at least the diffuser sheet.

The Substitute Claims

22. (proposed substitute for Claim 2) The lighting panel of claim ~~1~~ 21, ~~wherein the reflector comprises a coating on the substrate that is configured to reflect and scatter light incident thereon~~ wherein the lens surrounds each of the packaged solid state lighting devices

23. (proposed substitute for Claim 3) The lighting panel of claim ~~1~~ 21, ~~wherein the reflector comprises a reflector sheet that is configured to reflect and scatter light incident thereon~~ wherein the generally planar diffuser contacts the sidewalls of the reflector with no intervening elements.

24. (proposed substitute for Claim 4) The lighting panel of claim ~~1~~ 23, ~~further comprising at least one additional layer on the brightness enhancement film configured to diffuse, polarize, collimate and/or reflect light~~ wherein the generally planar diffuser is offset from the packaged solid state lighting devices.

25. (proposed substitute for Claim 5) The lighting panel of claim ~~1~~ 21, ~~wherein respective ones of the apertures include angled sidewalls to thereby form reflective optical cavities around the corresponding ones of the plurality of solid state lighting devices~~ wherein the controller transmits control signals to a plurality of current supply circuits.

26. (proposed substitute for Claim 7) The lighting panel of claim ~~3~~ 25, ~~wherein the reflector sheet comprises a plastic foam~~ wherein at least one of the current supply circuits transmit pulse width modulated signals to one or more of the plurality of strings of packaged solid state lighting devices.

27. (proposed substitute for Claim 9) The lighting panel of claim ~~1~~ 26, ~~wherein the brightness enhancement film comprises a plurality of three dimensional light extraction features configured to bend at least some light rays passing through the brightness enhancement film toward the direction normal to the principal plane of the lighting panel~~ wherein the current supply circuits are operable to individually control the current to each of the strings of packaged solid state lighting devices.

28. (proposed substitute for Claim 10) The lighting panel of claim ~~9~~ 27, ~~wherein the light extraction features are random features~~ wherein the pulse width modulation of the current delivered to each of the strings of packaged solid state lighting devices is based on one or more of: user input, ambient light information or other input.

29. (proposed substitute for Claim 13) The lighting panel of claim ~~9~~ 21, ~~wherein the brightness enhancement film is configured to substantially collimate light emitted by the lighting panel~~ wherein the reflector is substantially planar to the surface of the lighting tile where the reflector is on the at least one substrate.

The Substitute Claims Violate § 112

No Written Description Support for “Mounted On A Lighting Tile”

sional array. The tile 10 may include, for example, a printed circuit board (PCB) on which one or more circuit elements, such as discrete light emitting components, may be mounted. In particular, a tile 10 may include a metal core PCB (MCPCB) including a metal core having thereon a polymer coating on which patterned metal traces (not shown) may be formed. MCPCB material, and material

Ex. 1001, 8:27-33

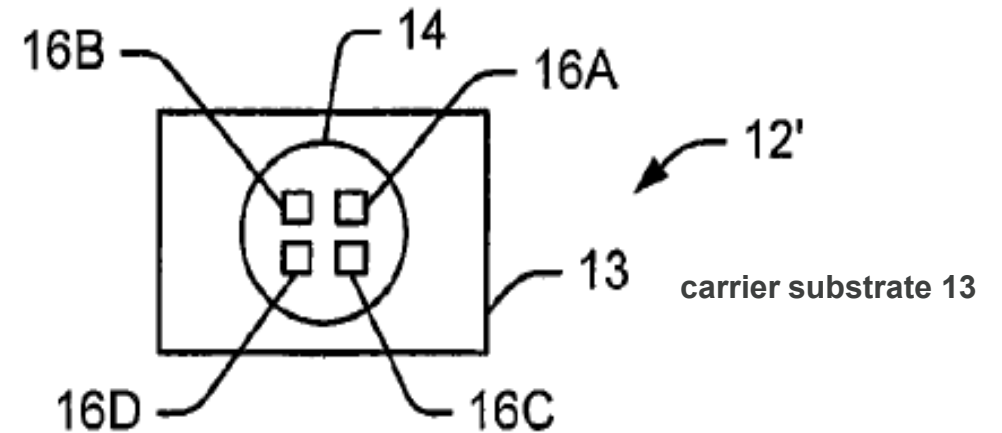


FIGURE 2

Ex. 1001, Fig. 2

The Substitute Claims Violate § 112

No Written Description Support for **a separate lighting tile**

PO Argues:

base panel 12 "comprise[s] a printed circuit board". Mok fails to disclose that the base panel 12 comprising a PCB is mounted to a separate lighting tile or that the

Paper 32, 6-7

Patent only ever discloses that PCB is part of substrate:

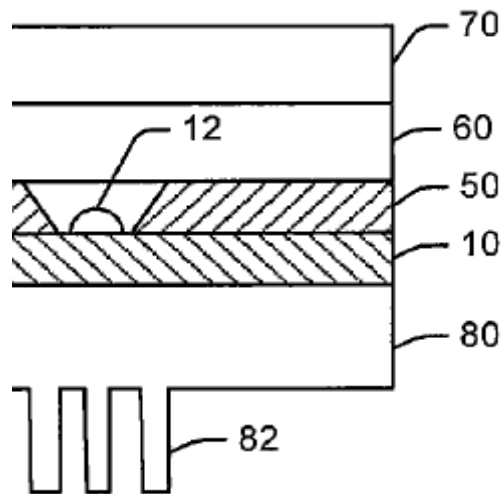
only one tile. A solid state lighting tile **10** may include thereon a number of solid state lighting elements **12** arranged in a regular and/or irregular one- or two-dimensional array. The tile **10** may include, for example, a printed circuit board (PCB) on which one or more circuit elements, such as discrete light emitting components, may be mounted. In particular, a tile **10** may include a metal core PCB (MCPCB) including a metal core having thereon a

Ex. 1001, 8:27-33

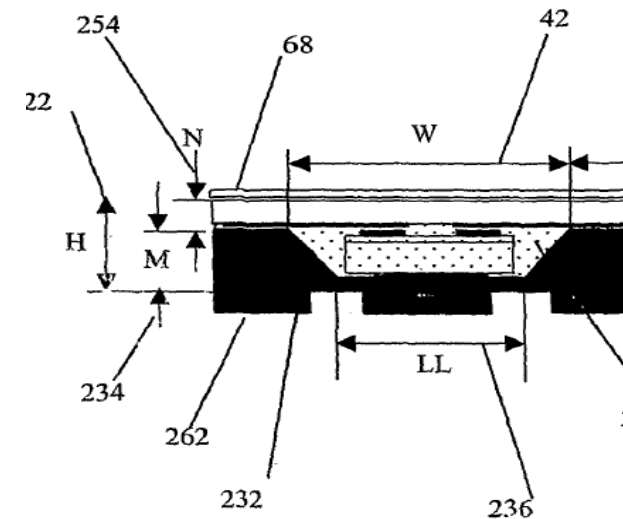
The Substitute Claims Violate § 112

No Written Description Support for “Extends To Cover The Lighting Tile And Includes A Plurality of Sidewalls Outside Of The Packaged Solid State Lighting Devices.”

- No description of sidewalls outside the device.



Ex. 1001, Fig. 7
Paper 28, at 1-2



Ex. 1006, Fig. 14
Paper 28, at 1-2

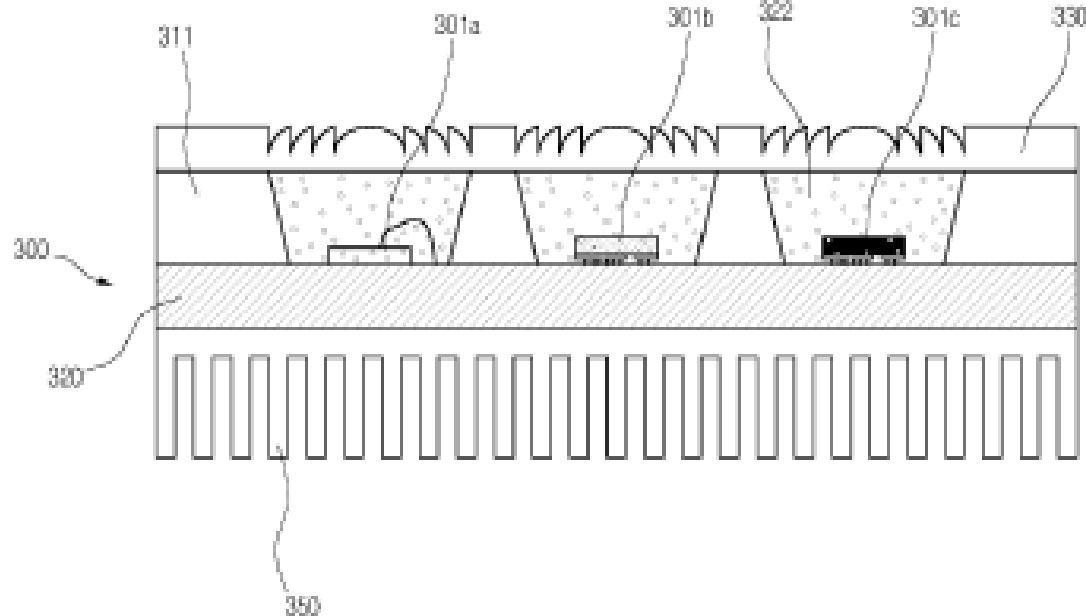
- PO says Holman does not disclose sidewalls outside the devices.

Additional Prior Art

Park – Ex. 1031

Patent Publication No. 10-2005-0012372	
(19) Korean Intellectual Property Office (KR) (12) Laid-Open Patent Publication (A)	
(51) Int. Cl.⁷ H01L 33/00	(11) Publication No. : 10-2005-0012372 (43) Publication Date : February 2, 2005
(21) Application No.:	10-2003-0051315
(22) Filing Date:	July 25, 2003
(71) Applicant	LG Innotek Co., Ltd. 738-1, Yeoksam-dong, Gangnam-gu, Seoul
(72) Inventor	Jun-Seok Park 518-83, Gaerim 2-dong, Dong-gu, Gwangju-si
(74) Attorney	Yong-Rok Heo
Request for Examination	Submitted
(54) LIGHT EMITTING DIODE PACKAGE AND MANUFACTURING METHOD THEREOF	
Abstract	
The present invention discloses a light emitting diode package which has a plurality of high-power light emitting diodes mounted in a package form, and achieves excellent heat dissipation while maintaining high luminance, and a manufacturing method thereof. The present invention includes: a wiring part configured to control power and signal input and output to a plurality of light emitting diodes; a plurality of light emitting diodes mounted on the wiring part; a reflection cup part coupled to the wiring part to reflect light of the light emitting diodes; and a lens part disposed on the reflection cup part to irradiate light generated in the light emitting diodes to an outside. Here, a heat sink is attached to a bottom surface of the wiring part on which the light emitting diodes are mounted to discharge heat generated from the light emitting diodes to the outside through the wiring part. The lens part is a Fresnel lens having various shapes, and the wiring part is a metal core PCB.	

Figure 3

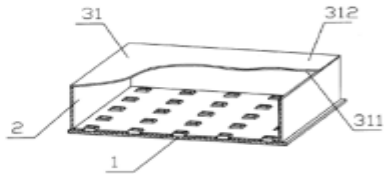


Explanation of Signs for Main Parts in the Drawings

300: LED package	301a: red LED chip
301b: green LED chip	301c: blue LED chip
311: reflection cup part	320: wiring part
322: silicon resin	330: lens part
350: heat sink	

Ex. 1031, p. 3

Li – Ex. 1033

[19] China National Intellectual Property Administration		[51] Int. Cl. G02F 1/1335 H01L 33/00 G09F 9/35
[12] Public Specification of Invention Patent Application [21] Application No. 200510034629.9		
[43] Publication Date November 9, 2005		[11] Publication No. CN 1693962A
[22] Application Date 05/20/2005 [21] Application No. 200510034629.9 [71] Applicant Shenzhen Zhongdian Miaohao Solid Light Source Co., Ltd. Address R&D Center, No. 1 Bao'an Taohuayuan Science and Technology Innovation Park, Bao'an District, Shenzhen, Guangdong Province, 518102 [72] Inventors Mingyuan Li, Yingchun Chen, Jun Xiao, Haoming Chen		Claims 2 pages Specification 7 pages Attached drawings 5 pages
[54] Title of Invention An LCD Backlight System Using Three-Primary-Color (RGB) unit-packaged LEDs		
(57) Abstract The present disclosure provides an LCD backlight system using three-primary-color (RGB) unit-packaged LEDs, comprising a light source module, a reflector, and a light diffuser, characterized in that the light source module comprises a plurality of light source devices, with each light source device being composed of RGB LED chips. The RGB LEDs are packaged in a unit device, and the unit device is arranged to form a light source. The RGB chips of each LED light source can be independently driven and controlled, allowing the RGB light to be initially mixed in the unit-packaged structure to achieve the desired color temperature and brightness before being emitted to the backlight system. The light diffuser comprises a refraction-diffraction hybrid light guide plate, which itself is a light refractive element and has a micro-step array structure on its surface. To achieve further light uniformity, different scattering layers or brightness enhancement films (BEFs) can be used.		
		ISSN 1008-4274

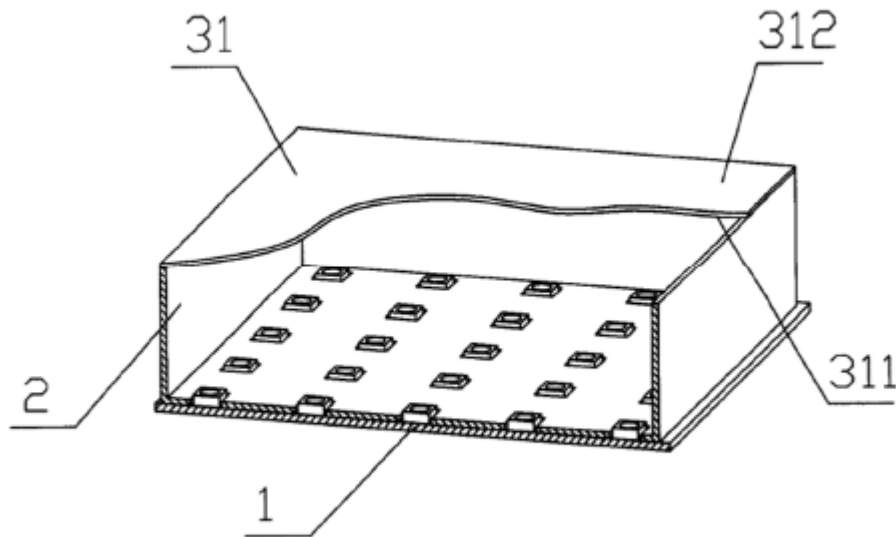


FIG. 1

(57) Abstract

The present disclosure provides an LCD backlight system using three-primary-color (RGB) unit-packaged LEDs, comprising a light source module, a reflector, and a light diffuser, characterized in that the light source module comprises a plurality of light source devices, with each light source device being composed of RGB LED chips. The RGB LEDs are packaged in a unit device, and the unit device is arranged to form a light source. The RGB chips of each LED light source can be independently driven and controlled, allowing the RGB light to be initially mixed in the unit-packaged structure to achieve the desired color temperature and brightness before being emitted to the backlight system. The light diffuser comprises a refraction-diffraction hybrid light guide plate, which itself is a light refractive element and has a micro-step array structure on its surface. To achieve further light uniformity, different scattering layers or brightness enhancement films (BEFs) can be used.

Mueller – Ex. 1034

(19) **United States**

(12) **Patent Application Publication**
Mueller et al.

(10) **Pub. No.: US 2005/0047134 A1**

(43) **Pub. Date:** Mar. 3, 2005

(54) **CONTROLLED LIGHTING METHODS AND APPARATUS**

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(73) **Assignee:** Color Kinetics, Boston, MA

(21) **Appl. No.:** 10/954,334

(22) **Filed:** Sep. 30, 2004

Related U.S. Application Data

(63) Continuation of application No. 10/325,635, filed on Dec. 19, 2002, and which is a continuation-in-part of application No. 09/971,367, filed on Oct. 4, 2001, now Pat. No. 6,788,011, which is a continuation of application No. 09/669,121, filed on Sep. 25, 2000, now Pat. No. 6,806,659, which is a continuation of application No. 09/425,770, filed on Oct. 22, 1999, now Pat. No. 6,150,774, which is a continuation of application No. 08/920,156, filed on Aug. 26, 1997, now Pat. No. 6,016,038
Said application No. 10/325,635 is a continuation-in-part of application No. 09/215,624, filed on Dec. 17, 1998, now Pat. No. 6,528,954.
Said application No. 10/325,635 is a continuation-in-part of application No. 09/213,607, filed on Dec. 17, 1998, now abandoned, and which is a continuation-in-part of application No. 09/213,581, filed on Dec. 17, 1998, and which is a continuation-in-part of application No. 09/213,540, filed on Dec. 17, 1998, now Pat. No. 6,720,745, and which is a continuation-

in-part of application No. 09/333,739, filed on Jun. 15, 1999, and which is a continuation-in-part of application No. 09/815,418, filed on Mar. 22, 2001, now Pat. No. 6,577,080, which is a continuation of application No. 09/213,548, filed on Dec. 17, 1998, now Pat. No. 6,166,496.
Said application No. 10/325,635 is a continuation-in-part of application No. 09/870,193, filed on May 30, 2001, now Pat. No. 6,608,453, and which is a continuation-in-part of application No. 09/344,699, filed on Jun. 25, 1999, and which is a continuation-in-part of application No. 09/805,368, filed on Mar. 13, 2001. Said application No. 10/325,635 is a continuation-in-part of application No. 09/663,969, filed on Sep. 19, 2000, now Pat. No. 6,548,967, and which is a continuation-in-part of application No. 09/716,819, filed on Nov. 20, 2000.

(List continued on next page.)

Publication Classification

(51) **Int. Cl.⁷** F21V 9/00

(52) **U.S. Cl.** 362/231

(57) **ABSTRACT**

Provided herein are methods and systems for providing controlled lighting, including methods and systems for providing both white and non-white colored lighting, including color temperature controlled lighting. Such methods and systems include optical facilities for modifying light from a lighting unit, such as an LED-based lighting unit, including variable optical facilities and fixed optical facilities. Also provided are methods and systems for using multi-color lighting units in a variety of commercial applications. Also provided are methods and systems for lighting control, including methods to assist lighting designers and installers to improve the quality of lighting in environments. Also provided are intelligent dimmers, switches, sockets and fixtures, as well as facilities for programming and using them. Also provided are various sensor-feedback applications of lighting technology, including sensor-feedback involving light sensors and forward voltage sensors. Also provided are lighting methods and systems that operate on time-based parameters.

Mueller – Ex. 1034

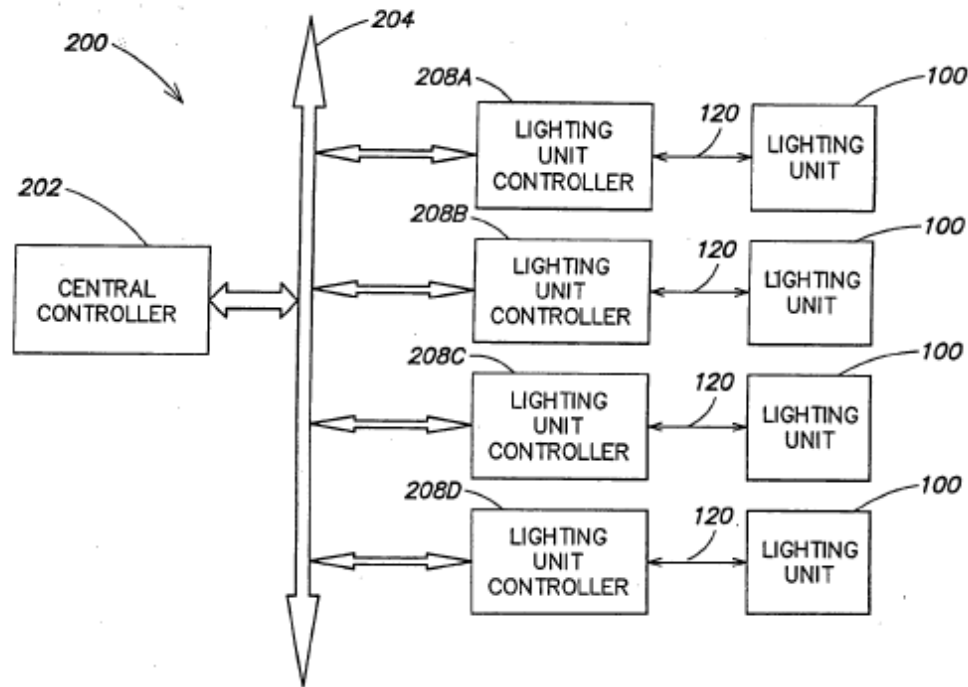


FIG. 2

[0156] As shown in FIG. 1, the lighting unit 100 also may include a processor 102 that is configured to output one or more control signals to drive the light sources 104A, 104B, 104C and 104D so as to generate various intensities of light from the light sources. For example, in one implementation, the processor 102 may be configured to output at least one control signal for each light source so as to independently control the intensity of light generated by each light source. Some examples of control signals that may be generated by the processor to control the light sources include, but are not limited to, pulse modulated signals, pulse width modulated signals (PWM), pulse amplitude modulated signals (PAM), pulse displacement modulated signals, analog control signals (e.g., current control signals, voltage control signals), combinations and/or modulations of the foregoing signals, or other control signals. In one aspect, the processor 102 may control other dedicated circuitry (not shown in FIG. 1), which in turn controls the light sources so as to vary their respective intensities.

Grootes – Ex. 1035

(19) **United States**

(12) **Patent Application Publication**

Grootes et al.

(10) **Pub. No.: US 2007/0046485 A1**

(43) **Pub. Date: Mar. 1, 2007**

(54) **LED LIGHT SOURCE FOR BACKLIGHTING
WITH INTEGRATED ELECTRONICS**

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(21) Appl. No.: **11/212,185**

(22) Filed: **Aug. 26, 2005**

Publication Classification

(51) **Int. Cl.**
G09F 9/33 (2006.01)

(52) **U.S. Cl.** **340/815.45**

(57) **ABSTRACT**

An LED backlight structure and technique for setting the voltages and currents for the LEDs are described. In one embodiment, red LEDs are connected in series between a

first voltage regulator and a first controllable current source, green LEDs are connected in series between a second voltage regulator and a second controllable current source, and blue LEDs are connected in series between a third voltage regulator and a third controllable current source. The current sources may linear current regulators. After all the LEDs are mounted on a printed circuit board, each voltage regulator is controlled so that there is a minimum voltage drop across the current source to minimize energy dissipation by the current source. Also, after all the LEDs are mounted on the printed circuit board, the current sources are controlled to balance the three colors to achieve a target light output of the board using a light detection chamber. In another embodiment, a constant current source is connected to the series string of LEDs. PWM controllers control transistor switches connected in parallel across groups of LEDs, where the duty cycles set the average current through each group of LEDs. The control values used to achieve the target light characteristics are then stored in a memory on the board. With such a technique, LEDs do not need to be binned to match their efficiencies, since the controllable voltage and current sources compensate for the variety of LED efficiencies. Accordingly, all boards will have the same target light output using the particular values stored on each board. In other embodiments, not all the LEDs of a particular color are connected in series. The brightness levels of the LEDs may be further controlled by a PWM controller. The backlight may be for an LCD television or other color display.

Grootes – Ex. 1035

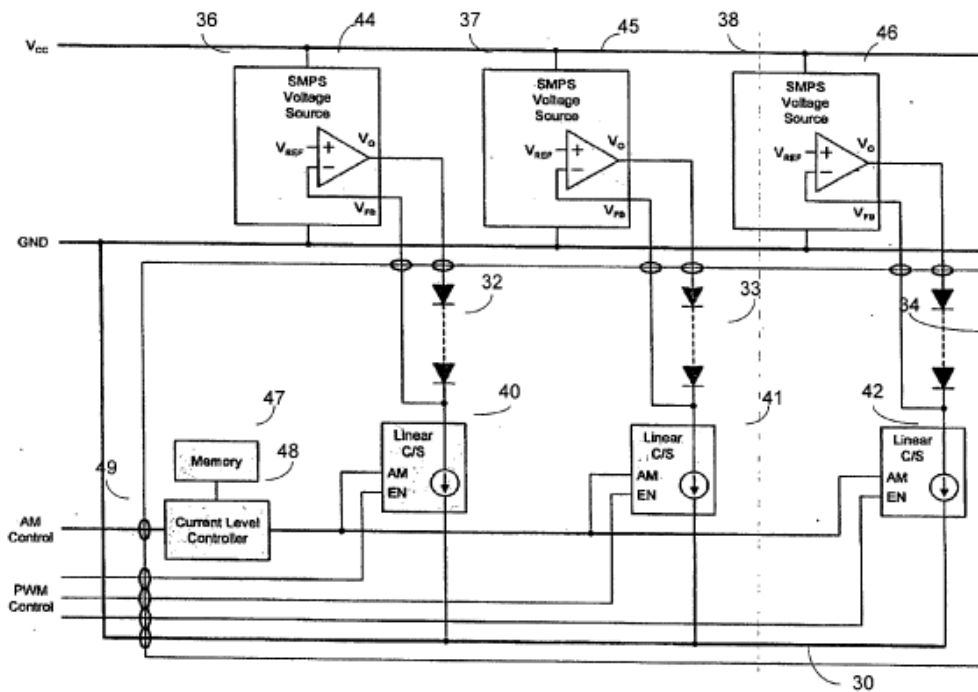


Fig. 4

[0017] In another embodiment, a PWM controller controls a transistor in parallel with one or more LEDs in a serial string mounted on a printed circuit board. There may be a separate transistor in parallel with different groups of LEDs in the serial string. The transistors are each controlled with a separate PWM controller on the PCB to substantially equalize the brightness of each group of LEDs and make the overall brightness of the entire string or cluster match a target value. A separate set of PWM controllers is provided for each LED color. The control values for each PWM controller are set to cause the board to have a target light output (e.g., predetermined brightness and white point). These control values are stored in a memory on the board. When the board is powered up, the control values from the memory are used to set the PWM duty cycles so that the board meets the target light output characteristics. In this way, all boards have the same light output characteristics when sold to the customers. Additionally, the brightness of each string of LEDs may be separately controlled by an external PWM or amplitude modulation controller (operating in conjunction with the aforementioned PWM controllers) to allow the user to adjust the brightness and white point to meet the particular specifications of the user.

Ayabe – Ex. 1017

(19) **United States**

(12) **Patent Application Publication**

Ayabe et al.

(10) **Pub. No.: US 2006/0083023 A1**

(43) **Pub. Date: Apr. 20, 2006**

(54) **LIGHT EMITTING SOURCE AND A LIGHT
EMITTING SOURCE ARRAY**

Publication Classification

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(51) **Int. Cl.**

F21V 7/04 (2006.01)

(52) **U.S. Cl.** 362/607

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(57) **ABSTRACT**

On the rear surface of a transparent molded unit is provided a reflecting member. In a central part of the molded unit are encapsulated light emitting devices. In the vicinity of the central part of the reflecting member is formed a reflecting area that is angularly inclined to the rear surface as it moves to the outer circumferential direction. A toric channel is provided on a light irradiation surface of the molded unit, and a slope total reflection area is provided in its inner circumferential side. Light emanating from the light emitting devices is reflected at the slope total reflection area, and further reflected at the direct output area. Then, after being further reflected at the reflecting area of the reflecting member, the light is guided to the outer circumferential end of the reflecting member, and is outputted forward from the total reflection area by being reflected at the outer circumferential end of the reflecting member.

(73) Assignee: **OMRON Corporation**, Kyoto (JP)

(21) Appl. No.: **11/252,518**

(22) Filed: **Oct. 18, 2005**

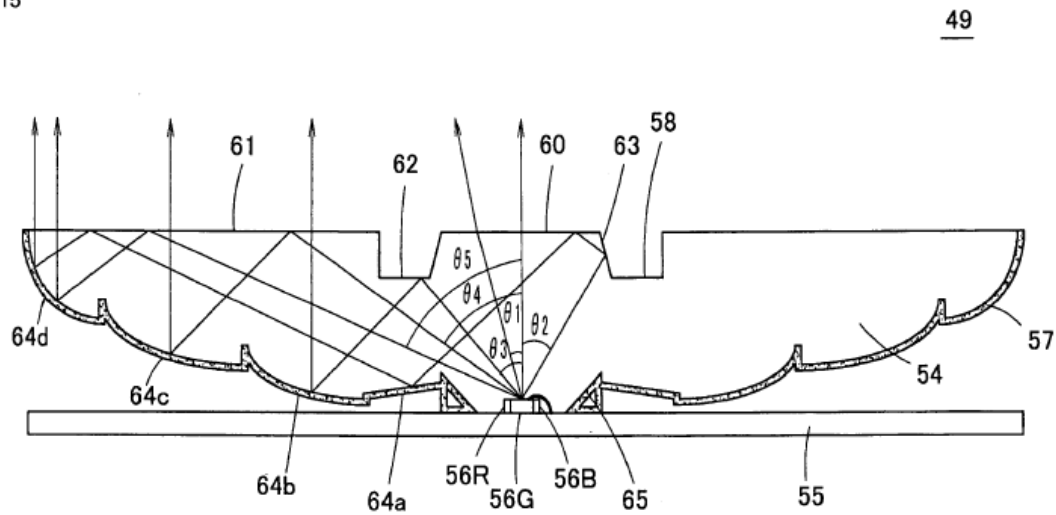
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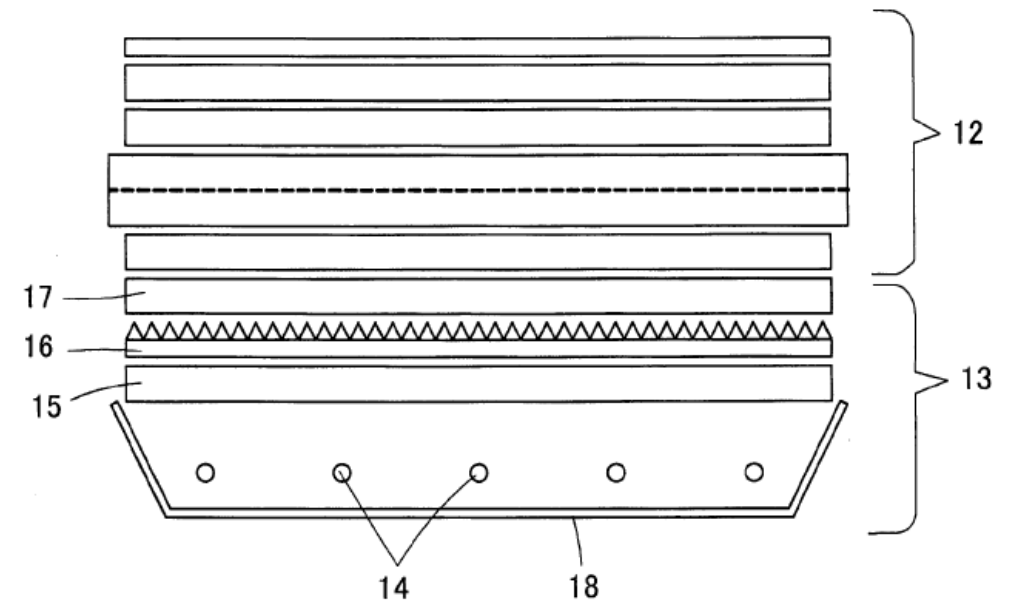
Ayabe – Ex. 1017

Fig. 15



49

Fig. 1



Saccomanno – Ex. 1019

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Saccomanno

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(54) **SYSTEMS AND METHODS FOR
CONTROLLING LIGHT SOURCES**

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(52) **U.S. Cl. 345/82**

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(57)

ABSTRACT

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A system for controlling a set of light sources may include a set of light sources, at least one optical conduit arranged relative to the set of light sources so as to collect excess light from the set of light sources, and at least one sensor coupled to the optical conduit and configured to sense light collected by the optical conduit. The system may also include a controller configured to control the emittance of the set of light sources based on the light sensed by the sensor. A method for controlling a set of light sources may comprise individually varying power supplied to at least some of the light sources in an imperceptible manner, sensing light emitted by a light source for which the power has been varied, and controlling the emittance of the set of light sources based on the sensed light.

(73) **Assignee: Honeywell International, Inc.**

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Saccomanno – Ex. 1019

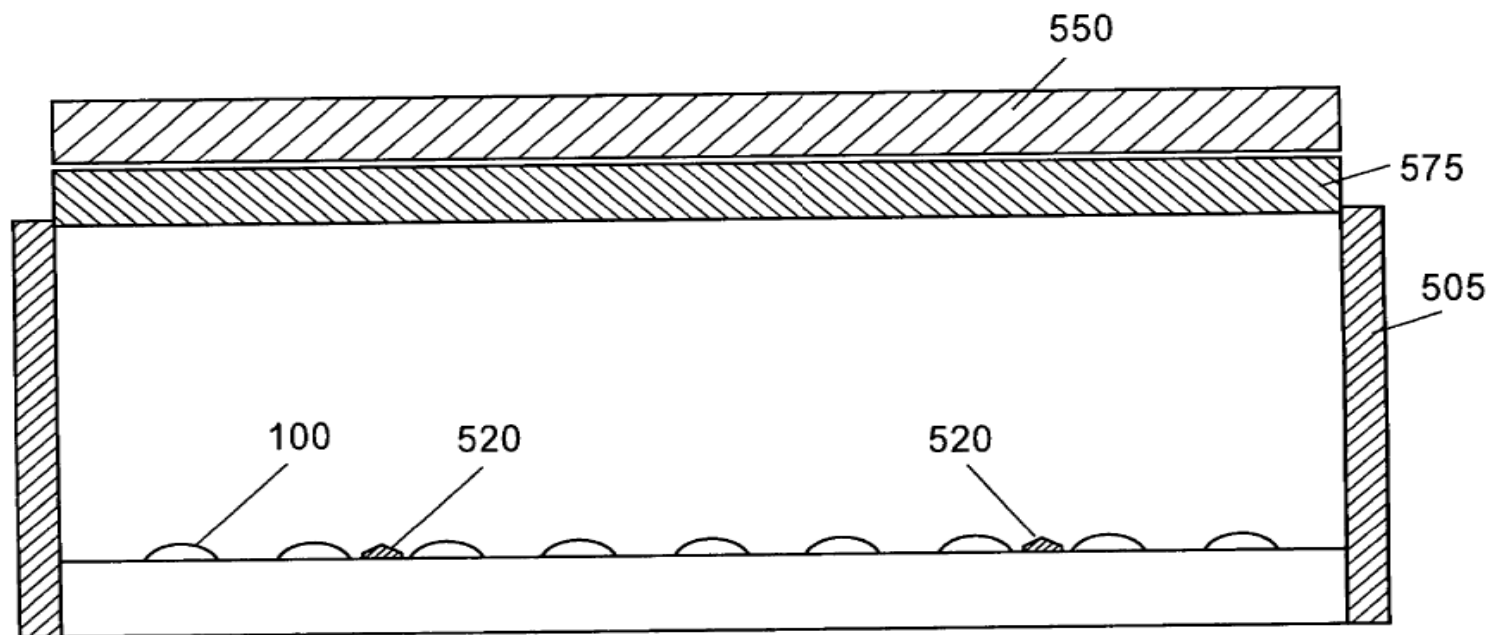


FIG. 5

Grounds

	Ground 1	Ground 2
Claim 21[a]	+ Park and/or Li	+ Park and/or Li
Claim 21[b]	+ Park, Li, and/or Grootes	+ Park, Li, and/or Grootes
Claim 21[c]	+ Park and/or Li	+ Park and/or Li
Claim 21[d]	+ Park and/or Li	+ Park and/or Li
Claim 21[e]	+ Mueller and/or Grootes	+ Mueller and/or Grootes
Claim 21[f]	+ Mueller and/or Grootes	+ Mueller and/or Grootes
Claim 21[g]	+ Ayabe, Park, and/or Li	+ Ayabe, Park, and/or Li
Claim 21[h]	+ Saccomanno, Ayabe, Park, and/or Li	+ Saccomanno, Ayabe, Park, and/or Li
Claim 21[i]	+ Li	+ Li
Claim 22	+ Park and/or Li	+ Park and/or Li
Claim 23	Ground 1	Ground 2
Claim 24	Ground 1	Ground 2
Claim 25	+ Mueller and/or Grootes	+ Mueller and/or Grootes
Claim 26	+ Mueller and/or Grootes	+ Mueller and/or Grootes
Claim 27	+ Mueller and/or Grootes	+ Mueller and/or Grootes
Claim 28	+ Mueller and/or Grootes	+ Mueller and/or Grootes
Claim 29	Ground 1	Ground 2

Ground 2 + Park, Li, Mueller, Grootes, Saccomanno, and/or Ayabe

- Ground 2, Park, Li, Mueller, Grootes, Saccomanno, and Ayabe all relate to LED based lighting devices to provide backlighting for display elements
- Utilize similar components such as LEDs, substrates, reflectors, diffusers, and brightness enhancement films.
- Ground 2+ Park, Li, Mueller, Grootes, Saccomanno, and Ayabe all seek to increase light output and uniformity, efficiency

Substitute Claim 21[a], 21[b], and 21[c]

- Mok's disclosure mirrors '835 Patent

835: Tile may comprise PCB

only one tile. A solid state lighting tile **10** may include thereon a number of solid state lighting elements **12** arranged in a regular and/or irregular one- or two-dimensional array. The tile **10** may include, for example, a printed circuit board (PCB) on which one or more circuit elements, such as discrete light emitting components, may be mounted. In particular, a tile **10** may include a metal core PCB (MCPCB) including a metal core having thereon a

Ex. 1001, 8:27-33

Mok: base panel may comprise PCB

[0019] Referring back now to **FIG. 1**, one embodiment of a light emitting panel **10** may comprise a base panel **12** suitable for receiving the various light emitting elements **14** in the manner described herein. The base panel **12** may comprise a generally rectangular shaped, plate-like member having a length **38** and a width **40** that are commensurate with the intended size of the panel **10**. The base panel **12** provides a convenient mounting location for the various light emitting elements **14**, allowing them to be arranged in a two dimensional array or pattern over both the length **38** and width **40** of the base panel **12**. Because each of the light emitting elements needs to be electrically connected to a source of electrical power, it will be convenient in most applications for the base panel **12** to comprise a printed circuit board, although this is not required. In an embodiment wherein the base panel **12** comprises a printed circuit board, the light emitting elements **14** may be electrically

connected (e.g., by soldering) to pads (not shown) provided on the base panel **12**. The pads of the base panel **12** may then be connected to drive circuitry (not shown) suitable for providing the required electric current to the light emitting elements **14**.

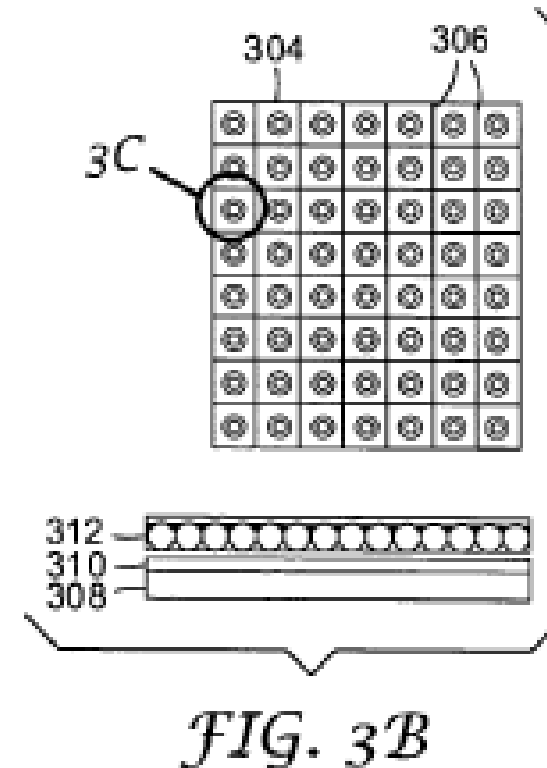
Ex. 1005, [0019]
Paper 28, at 3

Substitute Claim 21[a], 21[b], and 21[c]

- Epstein teaches a **tile 304** with a number of layers, *including a MCPCB*

[0039] An embodiment of the structure of the lighting unit 300 is further explained with reference to FIGS. 3A-3B. The display panel 302 of the lighting unit 300 comprises a number of tiles 304, and each tile 304 comprises a number of light emitting elements 306. The layers of the tile 306 comprise a substrate 308, a guiding layer 310 and an optional contrast/projection filter 312.

Ex. 1008, [0039]
Paper 28, at 4



Substitute Claim 21[a], 21[b], and 21[c]

- ***Strings*** of LEDs were common, well-known. For example:

Mok

with the intended size of the panel 10. The base panel 12 provides a convenient mounting location for the various light emitting elements 14, allowing them to be arranged in a two dimensional array or pattern over both the length 38 and width 40 of the base panel 12. Because each of the light emitting elements needs to be electrically connected to a source of electrical power, it will be convenient in most applications for the base panel 12 to comprise a printed circuit board, although this is not required. In an embodi-

Ex. 1005, [0019]
Paper 28, at 4-5

Grootes

[0010] An LED light source for backlighting is described that can store optimal current settings for strings of LEDs, such that color and brightness uniformity in the backlight application is ensured. Storing the optimal current settings for a particular light source board on the board results in all light source boards having uniform light output characteristics.

Ex. 1035, [0010]
Paper 28, at 5

Substitute Claim 21[a], 21[b], and 21[c]

- ***Packaged LEDs*** were common, well-known. For example:

Holman

A wide variety of LEDs are presently manufactured in two types of packages: clear plastic elements of a wide variety of sizes and shapes, or 1.5-3.0 mm square ceramic surface mounts suitable for conventional printed circuit boards. The physical package size determines how many lumens can be supplied in a given application area. The package's optical design determines the characteristic with which the lumens are emitted. Some packages have a lens that causes a more directional emission of light. Other packages emit light in all directions. All present packages are larger than their emitting apertures, making light strongest from the center of the package and giving conventionally packaged LEDs a point-like appearance.

Ex. 1006, 25
Paper 28, at 5

Epstein

[0044] The LEDs may be packaged LEDs or non-packaged LEDs, for example, LED dies, surface-mounted LEDs, chip-on-board LEDs and LEDs of other configurations. The term LED also includes LEDs packaged or associated with a phosphor where the phosphor is used to convert light emitted from the LED to light at a different wavelength. Chip-on-board (COB) is a hybrid technology that employs face-up-bonded chip devices interconnected to a substrate conventionally, for example using wire bonding. Connections may be made by wire bonding, tape automated bonding (TAB), or flip-chip bonding. The examples illustrated herein mostly show LED dies, but this is not intended as a limitation, and other types of packaged LED, as described in this paragraph, may also be used.

Ex. 1008, [0044]
Paper 28, at 5

Substitute Claim 21[a], 21[b], and 21[c]

- Mok and Epstein disclose packaged LED *mounted on a tile*:

suitable for receiving the various light emitting elements **14** in the manner described herein. The base panel **12** may comprise a generally rectangular shaped, plate-like member having a length **38** and a width **40** that are commensurate with the intended size of the panel **10**. The base panel **12** provides a convenient mounting location for the various light emitting elements **14**, allowing them to be arranged in a two dimensional array or pattern over both the length **38** and width **40** of the base panel **12**. Because each of the light

Ex. 1005, [0019]
Paper 28, at 3-6

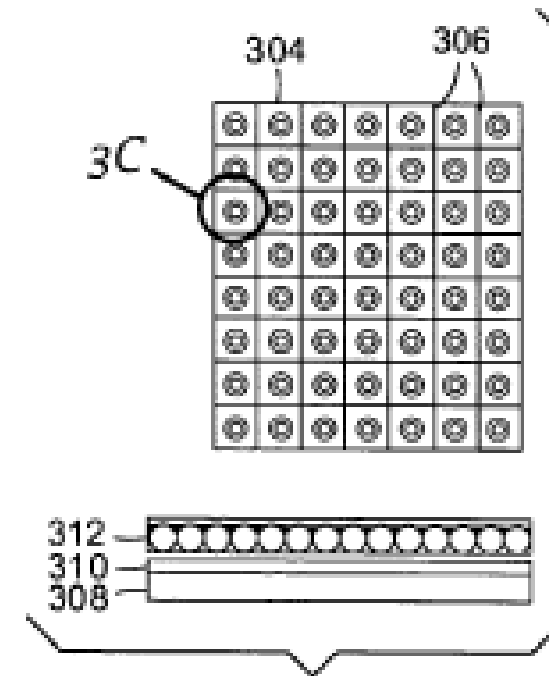
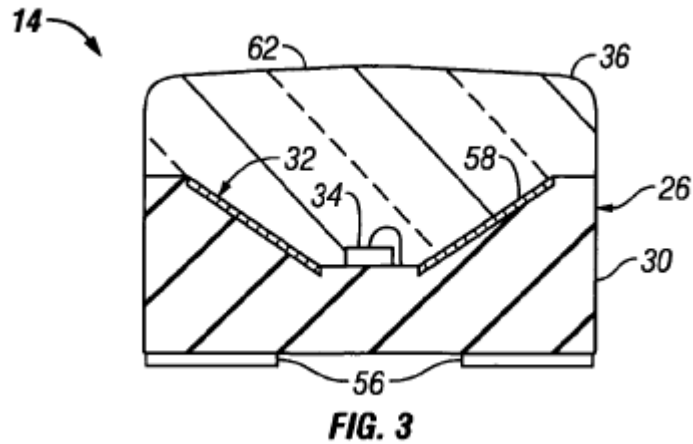


FIG. 3B

Ex. 1008, Fig. 3B
Paper 28, at 3-6

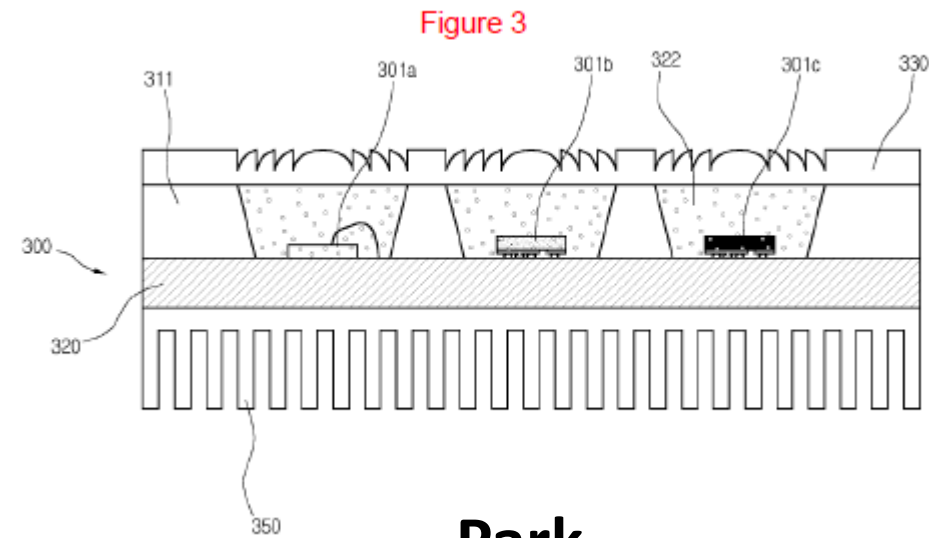
Substitute Claim 21[d]

- Prior art, such as Mok and Park disclose a lens mounted over each packaged LED (*see also* Holman and Lee)



Mok

Ex. 1005, Fig. 3
Paper 28, at 7



Park

Ex. 1031, Fig. 3
Paper 28, at 7

Substitute Claim 21[e] + 21[f]

- Mueller discloses a PWM controller that sends control signal to current supply circuits over communications link

[0156] As shown in FIG. 1, the lighting unit 100 also may include a processor 102 that is configured to output one or more control signals to drive the light sources 104A, 104B, 104C and 104D so as to generate various intensities of light from the light sources. For example, in one implementation, the processor 102 may be configured to output at least one control signal for each light source so as to independently control the intensity of light generated by each light source. Some examples of control signals that may be generated by the processor to control the light sources include, but are not limited to, pulse modulated signals, pulse width modulated signals (PWM), pulse amplitude modulated signals (PAM), pulse displacement modulated signals, analog control signals (e.g., current control signals, voltage control signals), combinations and/or modulations of the foregoing signals,

or other control signals. In one aspect, the processor 102 may control other dedicated circuitry (not shown in FIG. 1), which in turn controls the light sources so as to vary their respective intensities.

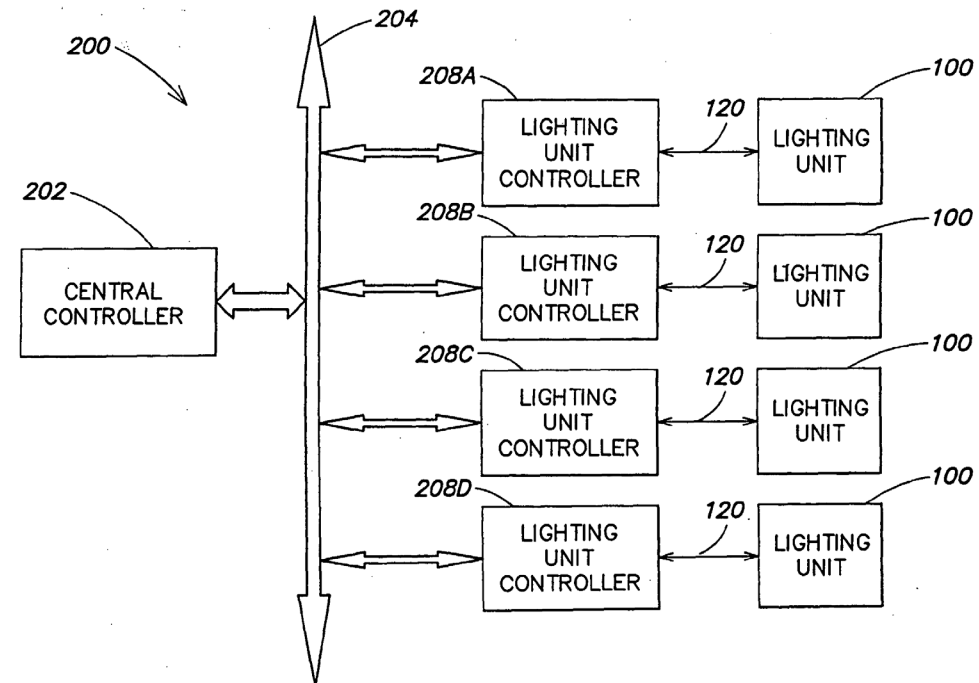


FIG. 2

Ex. 1034 Fig. 2
Paper 28, at 8-10

Substitute Claim 21[e] + 21[f]

- Grootes discloses a PWM controller that sends control signal to current supply circuits over communications link

[0041] Each current source 40-42 is controllable to control the brightness of its associated LEDs to achieve the desired white point. Each current source may be that shown in FIG. 1, 2, or 3, with control inputs being V_{ref} (or I_{set}) and enable (EN). In FIG. 4, the V_{ref} or I_{set} terminals are labeled AM (amplitude modulation), and the EN terminals are coupled to a PWM controller. Either the magnitude of AM or the duty cycle of EN may be used to control the brightness of the respective LEDs. The AM lead is used to control the “linear” conductivity of the pass transistor 14 when the current source is enabled by the signal EN.

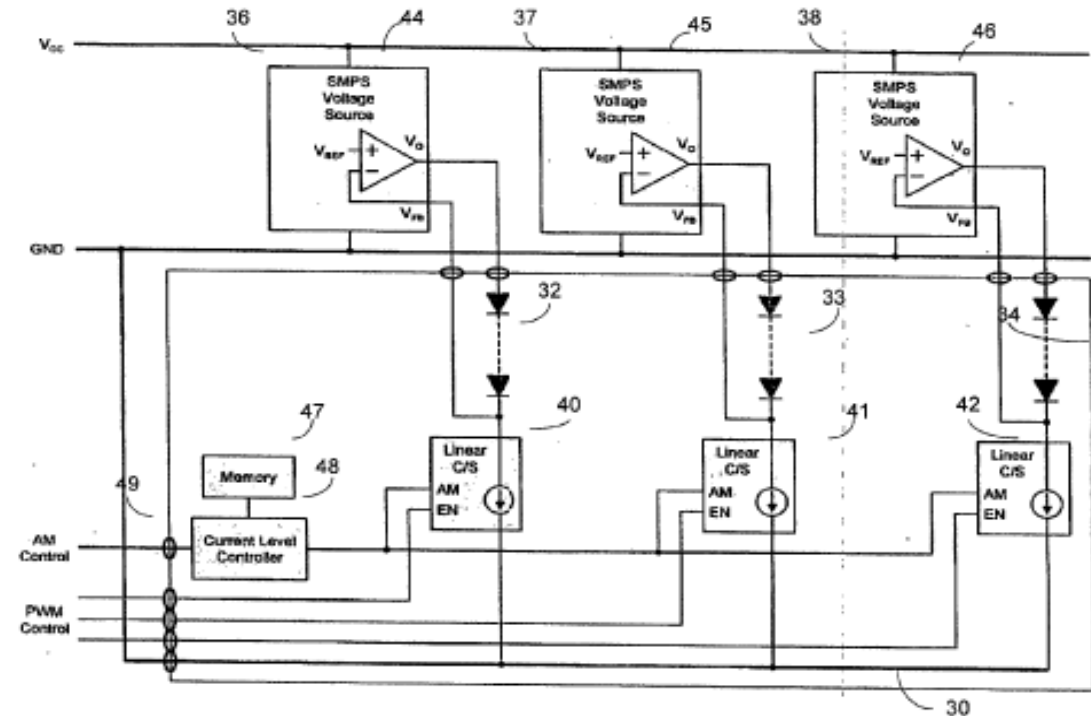
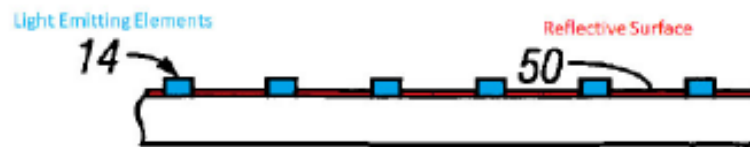


Fig. 4

Substitute Claim 21[g] + 21[h]

- PO's arguments with respect to “a reflector that is extended and angled with respect to a ***surface of a substrate***” inapplicable, as limitation not in claim
- Reflector mounted to and covering tile with angled sidewalls outside of packaged LEDs well known in the art:

Mok



Ex. 1005, Fig. 1
Paper 28, at 11-12

Epstein

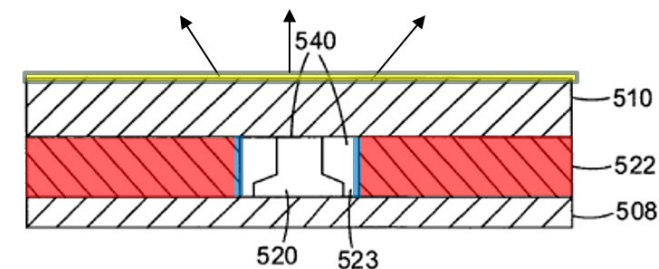


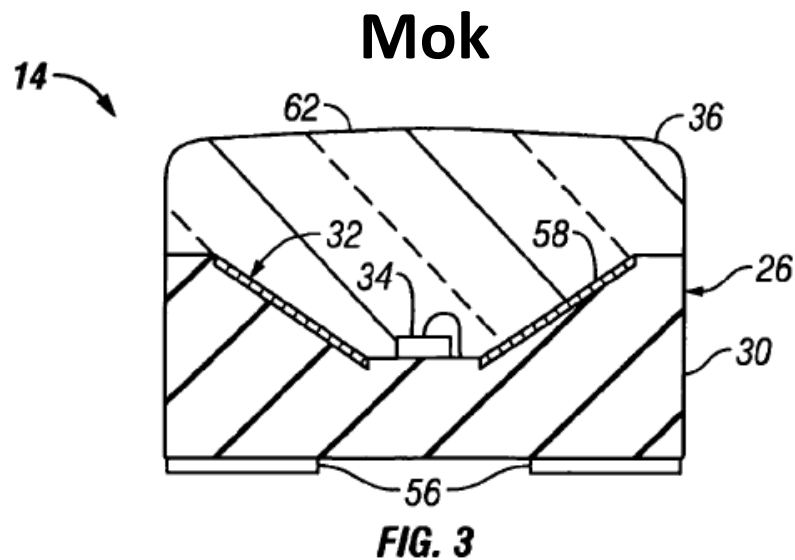
FIG. 5D

Ex. 1008, Fig. 5D
Paper 28, at 11-12

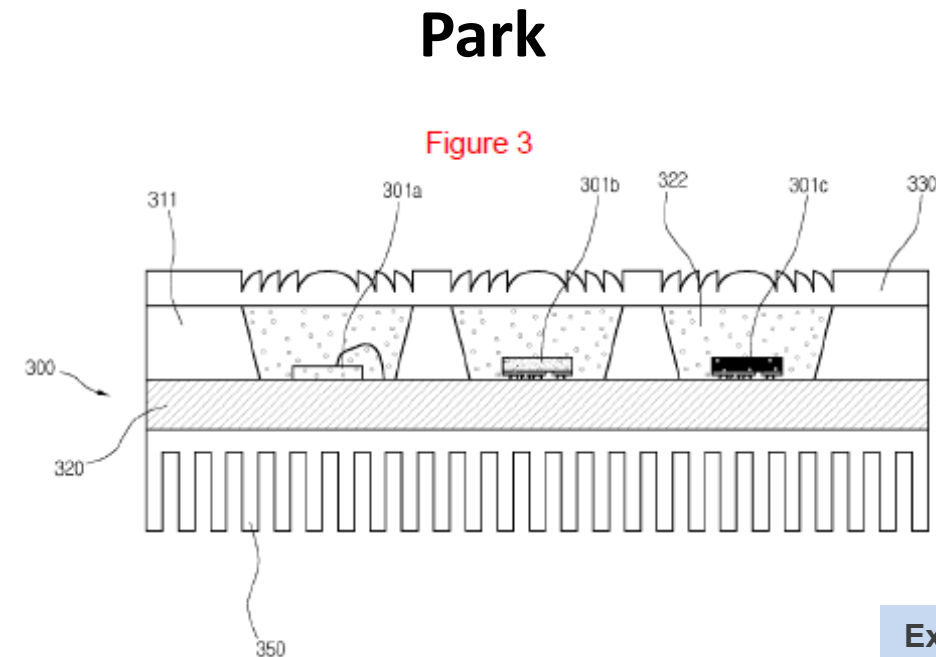
- *See also*, Holman, Ayabe, Saccomanno, Li, Lamb

Substitute Claim 22

- Requires “the lens surrounds each of the packaged solid state lighting devices” **not** a separate lens component that must be outside of the LED package.
- Either way, prior art discloses substitute claim 22. For example:



Ex. 1005, Fig. 3
Paper 28, at 17



Ex. 1031, Fig. 3
Paper 28, at 17

Substitute Claim 23

- Sidewalls of reflector in contact with planar diffuser disclosed by the art.
For example:

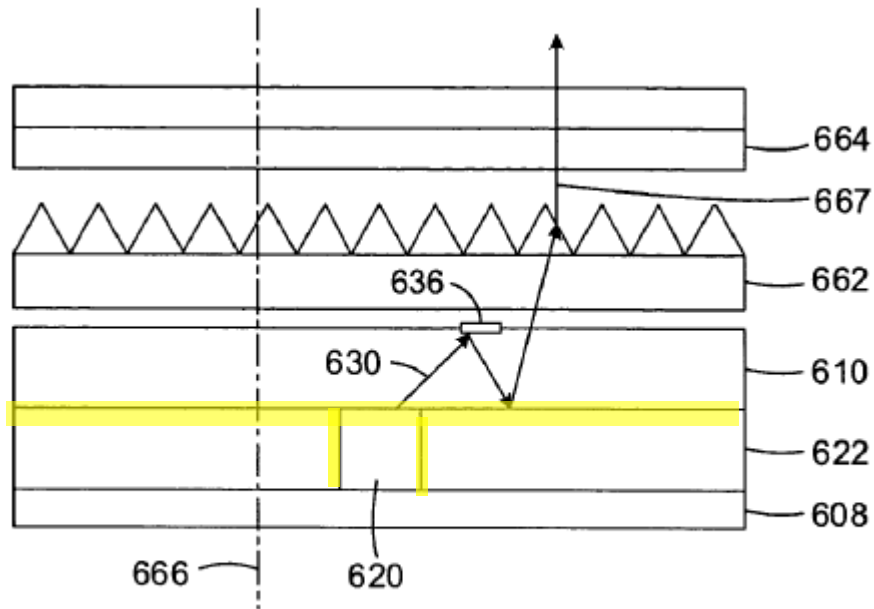
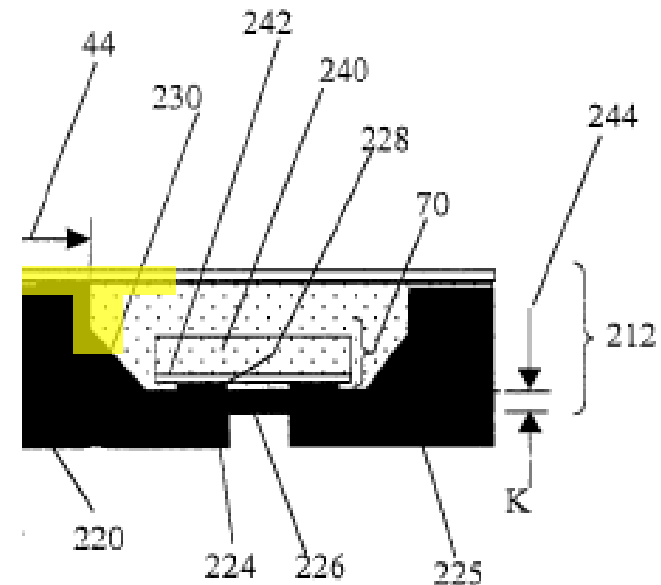


FIG. 11

Ex. 1008, Fig. 11
Paper 28, at 17-18

Epstein

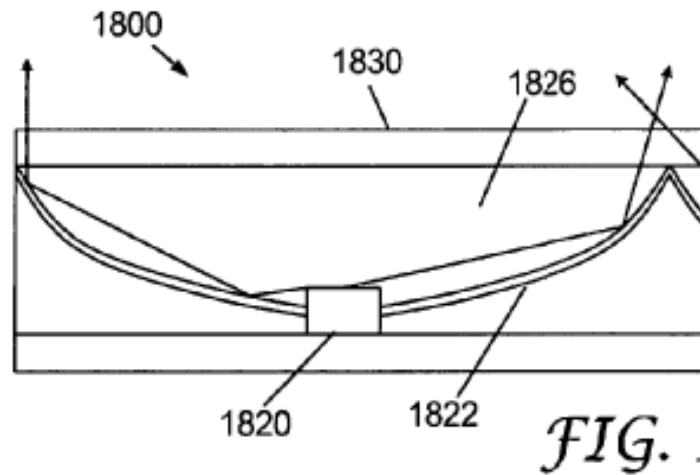


Ex. 1006, Fig. 13
Paper 28, at 17-18

Holman

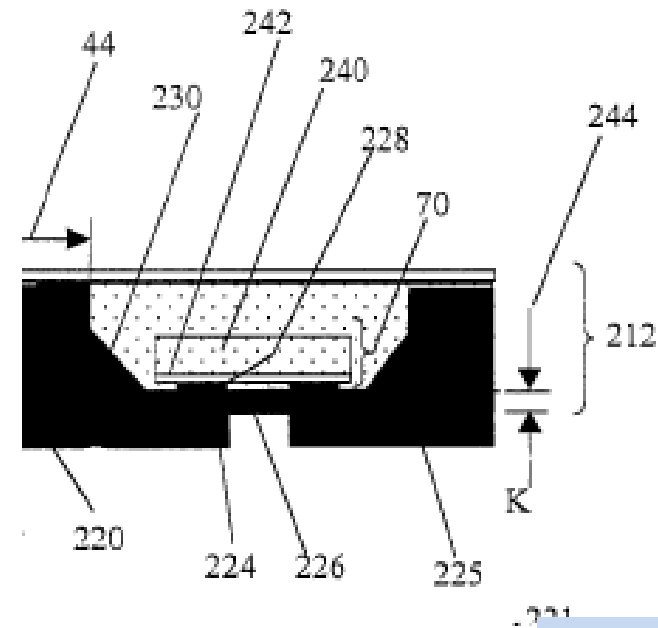
Substitute Claim 24

- Planar diffuser offset from packaged LEDs disclosed by the prior art. For example:



Ex. 1008, Fig. 18A
Paper 28, at 18

Epstein



Ex. 1006, Fig. 13
Paper 28, at 18

Holman

Substitute Claims 25 - 28

- Mueller discloses a PWM controller that sends PWM control signals for each light source via current supply circuits.
- Mueller's PWM control signals vary based ambient light information.

[0156] As shown in FIG. 1, the lighting unit 100 also may include a processor 102 that is configured to output one or more control signals to drive the light sources 104A, 104B, 104C and 104D so as to generate various intensities of light from the light sources. For example, in one implementation, the processor 102 may be configured to output at least one control signal for each light source so as to independently control the intensity of light generated by each light source.

the sensor. In embodiments, a closed-loop feedback system can read spectral properties and adjust color rendering index, color temperature, color, intensity, or other lighting characteristics based on user inputs or feedback based on additional ambient light sources to correct or change light output.

Ex. 1034, [0156]
Paper 28, at 19-12

Ex. 1034, [0291]
Paper 28, at 19-12

Substitute Claims 25 - 28

- Grootes teaches PWM controller that sends signals to control LEDs over PWM control lines.
- PWM control signals may be adjusted by user.

[0037] The anode of each string is connected to its own voltage regulator 36, 37, 38, and the cathode of each string is connected to its own current source 40, 41, 42.

Ex. 1035, [0037]
Paper 28, at 19-12

when sold to the customers. Additionally, the brightness of each string of LEDs may be separately controlled by an external PWM or amplitude modulation controller (operating in conjunction with the aforementioned PWM controllers) to allow the user to adjust the brightness and white point to meet the particular specifications of the user.

Ex. 1035, [0017]
Paper 28, at 19-12

Substitute Claim 29

- Planar reflector on substrate disclosed by the prior art. For example:

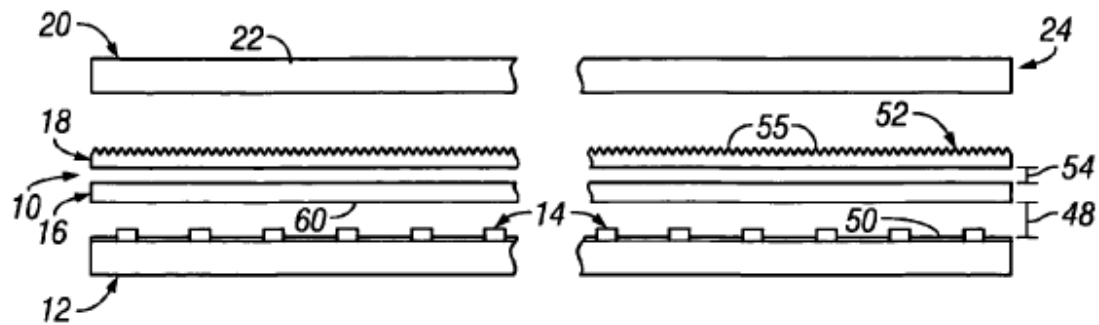


FIG. 1

Mok

Ex. 1005, Fig. 1
Paper 28, at 21

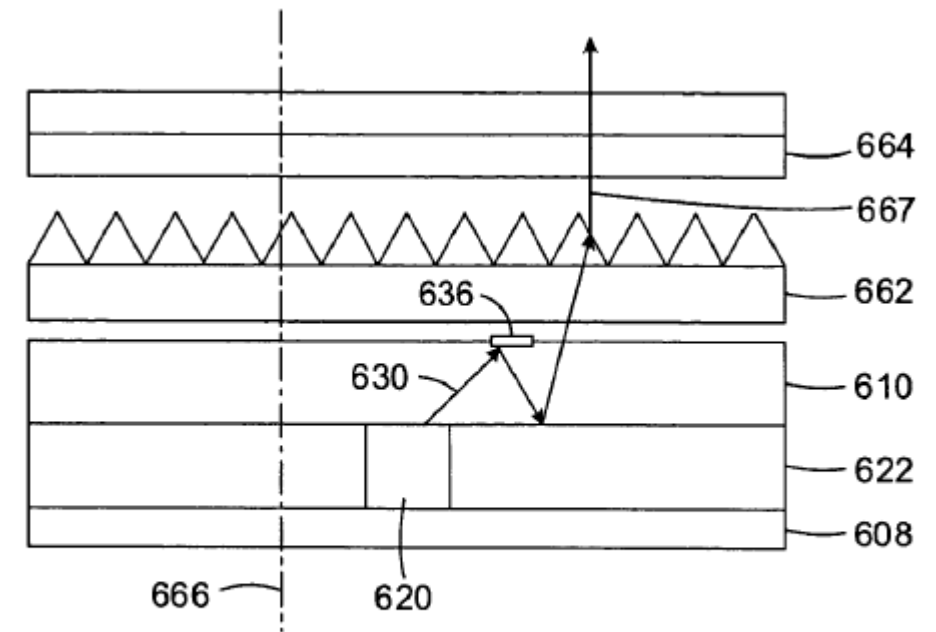


FIG. 11

Epstein

Ex. 1008, Fig. 11
Paper 28, at 21

Motivations to Combine

- Park, Li, Mueller, Grootes, Ayabe, and Saccomanno all focus on certain elements of the common lighting systems, such as those disclosed in Ground 1 and Ground 2 references
- Combining the optimal embodiments of the different components described in Park, Li, Mueller, Grootes, Ayabe, or Saccomanno with Ground 1 or Ground 2 lead to better overall lighting system

Ground 1 + Park, Li, Mueller, Grootes, Saccomanno, and/or Ayabe

- Ground 1, Park, Li, Mueller, Grootes, Saccomanno, and Ayabe all relate to LED based lighting devices to provide backlighting for display elements
- Utilize similar components such as LEDs, substrates, reflectors, diffusers, and brightness enhancement films.
- Ground 1, Park, Li, Mueller, Grootes, Saccomanno, and Ayabe all seek to increase light output and uniformity, efficiency