

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Hisense USA Corporation
Petitioner

v.

Brightplus Ventures LLC
Patent Owner

Patent No. 9,605,835
Filing Date: February 2, 2015
Issue Date: March 28, 2017
Title: SOLID-STATE LUMINAIRES FOR GENERAL ILLUMINATION

Inter Partes Review No. IPR2023-01168

**Ex. 1022 – Declaration of P. Morgan Pattison, Ph.D. in Response to Patent
Owner’s Contingent Motion to Amend**

Table of Contents

	<u>Page</u>
I. Introduction.....	3
II. Materials Considered	4
III. Patent Owner’s Substitute Claims.	5
IV. The Prior Art Addressed in My Prior Declaration Renders Every Element of Substitute Claims 21-25 Obvious.	6
A. A Reflector On the First Side of A Substrate, wherein the Reflector is Extended and Angled with Respect to the Surface of the Substrate. (Substitute Claim 21)	7
B. A Lighting Panel Wherein the Diffuser Sheet Contacts the Reflector. (Substitute Claims 22 and 24)	14
C. A Lighting Panel Wherein the Reflector Forms a Reflective Optical Cavity Around At Least One Solid State Lighting Device. (Substitute Claims 23 and 25).....	19
V. Other Prior Art Renders Every Element of Substitute Claims 21-25 Obvious.	21
A. Ayabe Renders Substitute Claims 21-25 Obvious	22
B. Roth Renders the New Elements of Substitute Claims 21, 23, and 25 Obvious	25
C. Saccomanno Renders Substitute Claims 21-25 Obvious	27
D. Chang Renders Substitute Claims 21-25 Obvious	29
VI. Motivations to Combine.	31
A. It Would Have Been Obvious to Incorporate the Teachings of Ayabe, Roth, Saccamanno, or Chang with the Prior Art of Ground I.....	31
B. It Would Have Been Obvious to Incorporate the Teachings of Ayabe, Roth, or Saccamanno with the Prior Art of Ground II.....	34

I, P. Morgan Pattison, declare as follows:

I. Introduction

1. I am an independent consultant. I am over eighteen years of age, and I would otherwise be competent to testify as to the matters set forth herein if I am called upon to do so.

2. I have prepared this Declaration for consideration by the Patent Trial and Appeal Board in the *Inter Partes* Review of U.S. Patent No. 9,605,835 (“the ‘835 Patent”) and the Contingent Motion to Amend (the “Motion”) Filed by Patent Owner in that *Inter Partes* Review Proceeding.

3. I provide this Declaration at the request of and have been retained by Kilpatrick Townsend & Stockton, LLP, which represents Hisense USA Corporation (“Hisense”) in connection with the above-captioned *Inter Partes* Review. I have been informed and understand that Hisense contends that substitute claims 21-25 submitted by the Patent Owner in the Motion are invalid.

4. I am being compensated at an hourly rate of \$550 per hour. My compensation is not dependent on the outcome of or any issue in relation to the above-captioned *Inter Partes* Review, and I have no interest in either party.

5. In forming my opinions, I relied on my knowledge, education, experience, and training in the field and on documents and information referenced in this Declaration.

6. My qualifications are summarized in Ex. 1003, which is my prior declaration in this proceeding and my CV, which was submitted as Ex. 1004. *See* Ex. 1003, ¶¶6-15. I am not a lawyer, however, my understanding of the legal issues, in particular with respect to obviousness are summarized in my prior declaration. *See* Ex. 1003, ¶¶16-23. My prior declaration also provides my opinion on the appropriate level of experience for a person to be a person of ordinary skill in the art. *See* Ex. 1003, ¶¶25-28.

II. Materials Considered

7. In addition to the materials identified in my prior declaration (*see* Ex. 1003, ¶30) in forming my opinions, in addition to my knowledge and experience, I have considered the following documents and things that I have obtained, or that have been provided to me:

Exhibit	Description
1017	US 2006/0083023 to Ayabe <i>et al.</i> (“Ayabe”)
1018	US 2005/0274972 to Roth <i>et al.</i> (“Roth”)
1019	US 2007/0188425 to Saccomanno (“Saccomanno”)
1020	Taiwanese Patent Application No. 93218806, entitled DIRECT TYPE BACKLIGHT MODULE/ DIRECT TYPE BACKLIGHT MODULE to Chang
1021	Certified Translation of Exhibit 1020, Taiwanese Patent Application No. 93218806, entitled DIRECT TYPE BACKLIGHT MODULE/ DIRECT TYPE BACKLIGHT MODULE to Chang (“Chang”)
1023	US 2006/0186425A1 to Yano <i>et al.</i> (“Yano”)

8. In addition to the documents above, in forming the opinions expressed below, I have also considered my own knowledge and experience based upon my education, research and work in the fields of optics, LEDs, and display technology, as described above and in my *curriculum vitae* (Ex. 1004).

III. Patent Owner's Substitute Claims.

9. I am informed and understand that Patent Owner has proposed to substitute original claims 1-5 of the '835 Patent with the following substitute claims (the "Substitute Claims"):

21. (proposed substitute for Claim 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, wherein the reflector is extended and angled with respect to the surface of the 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.

22. (proposed substitute for Claim 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 wherein the diffuser sheet contacts the reflector.¹

23. (proposed substitute for Claim 3) The lighting panel of claim 1, ~~wherein the reflector comprises a reflector sheet that is configured to reflect and scatter light incident thereon~~ wherein the reflector forms a reflective optical cavity around at least one solid state lighting device.

24. (proposed substitute for Claim 4) The lighting panel of claim 23, further comprising at least one additional layer on the brightness enhancement film configured to diffuse, polarize, collimate and/or reflect light, wherein the diffuser sheet contacts the reflector.

25. (proposed substitute for Claim 5) The lighting panel of claim ~~1~~ 3, wherein the reflector forms at least one reflective optical cavity around at least one solid state lighting device.

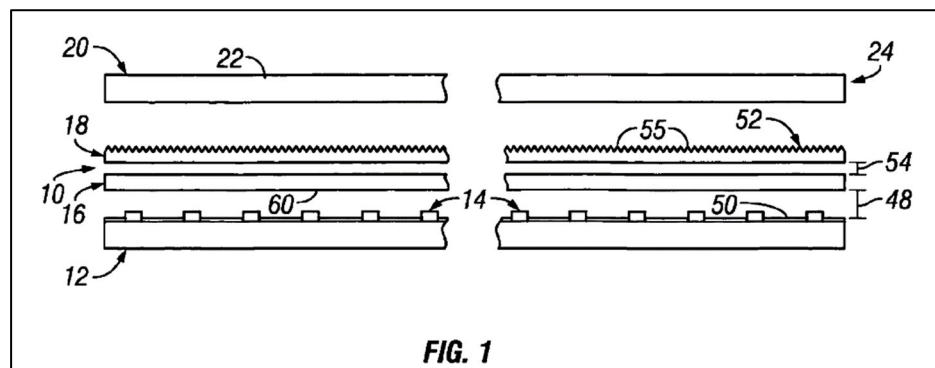
IV. The Prior Art Addressed in My Prior Declaration Renders Every Element of Substitute Claims 21-25 Obvious.

10. In my prior declaration I broke down the elements of claims 1-5 and 7-14 and demonstrated that each of the elements of those claims were known in the art before the April 21, 2006, priority date of the '835 Patent. *See* Ex. 1003, ¶¶41-157. In the analysis below I address the new elements of Substitute Claims 21-25 and demonstrate that each of these elements was also known in the art before the April 21, 2006, priority date of the '835 Patent.

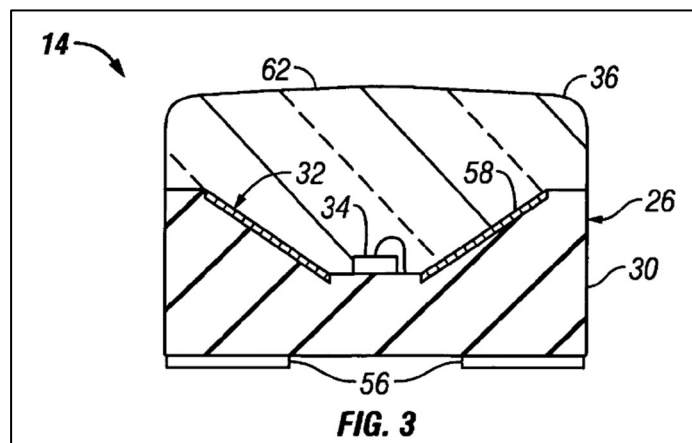
¹ I am informed that in its Motion to Amend Patent Owner requested that “if claims 1-5 are found to be unpatentable, substitute proposed amended claims 21, 22, 23, 24 and 25,” should be entered. However, proposed substitute claims 22, 23, and 25 purport to depend from claim 1, which would have been cancelled. I analyzed these claims as though they depend from substitute claim 21.

A. A Reflector On the First Side of A Substrate, wherein the Reflector is Extended and Angled with Respect to the Surface of the Substrate. (Substitute Claim 21)

11. As discussed in my prior declaration, the combination of Mok (Ex. 1005), Holman (Ex. 1006), and Lamb (Ex. 1007) discloses or renders obvious each element of original claim 1, and it would be obvious to combine those three references. In effect Patent Owner's proposed Substitute Claim 21 is directed to modifying claim 1 to include a reflector cup recessed around one or more LEDs. Such a design for a reflector was well-known in the art before April 2006. For example, Mok discloses reflective surface 50 on base panel 12 and light emitting elements 14. This is described in Mok's paragraph [0021], which explains "A reflective surface 50 may be provided on the base panel 12 to "recycle" (i.e., reflect) light which may be reflected...." Mok, [0021]; [0020] ("The various light emitting elements 14 may be mounted to the base panel 12 in any of a wide variety of configurations."). This configuration is shown in Figure 1:



12. In addition to this disclosure, with regard to Figures 3 and 4, Mok describes that “the light emitting diode 26 may comprise a base portion or substrate 30 in which is formed a reflector cup 32. The light emitting diode junction 34 or die is then positioned within the reflector cup 32.” Mok, [0026]. Mok explains that “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.” Mok, [0028]. Thus, a person of ordinary skill in the art would understand that Mok’s reflector cup 32 discloses, or at a minimum, renders obvious, a reflector. The “reflector cup 32” is clearly shown in Mok’s Figure 3:



13. As is shown in Figure 1 above, Mok discloses reflective surfaces 50 and 58 that are both extended and angled with respect to the substrate. In my

opinion, a person of ordinary skill in the art would review Mok, including the paragraphs noted above and Figure 3, and understand that Mok discloses an LED positioned within a reflector cup. As Mok further explains that the reflector cup 32 is formed in a base portion or substrate (Mok, [0026]), a person of ordinary skill in the art would recognize that Mok discloses a reflector on the first side of a substrate, wherein the reflector is extended and angled with respect to the surface of the substrate. To the extent Patent Owner contends that reflective surface 50 and reflective coating 58 are different components, one of skill in the art would understand that both components are disclosed in Mok as being made of the same material (e.g. metal) and/or a reflective coating. *See* Mok, [0021], [0028]. A person of ordinary skill in the art would be motivated to include the reflector cup 32 of Mok into the embodiments of Mok, Holman, and Lamb discussed in my original declaration in order to maximize the efficiency and uniformity of light output provided by increasing the surface area of the reflector.

14. Similarly, a person of ordinary skill in the art would review Holman (Ex. 1006) and recognize that it to discloses a reflecting layer on a base layer that has angled sidewalls and is extended. In particular, Holman describes with respect to Figure 13, “[t]he individual LEDs 70 are mounted flip-chip (electrodes below the light emission) on composite, electrically-insulating, reflective base layers 220 and 225....” Ex. 1006, p. 38. Holman also expressly discloses “sloped sidewalls

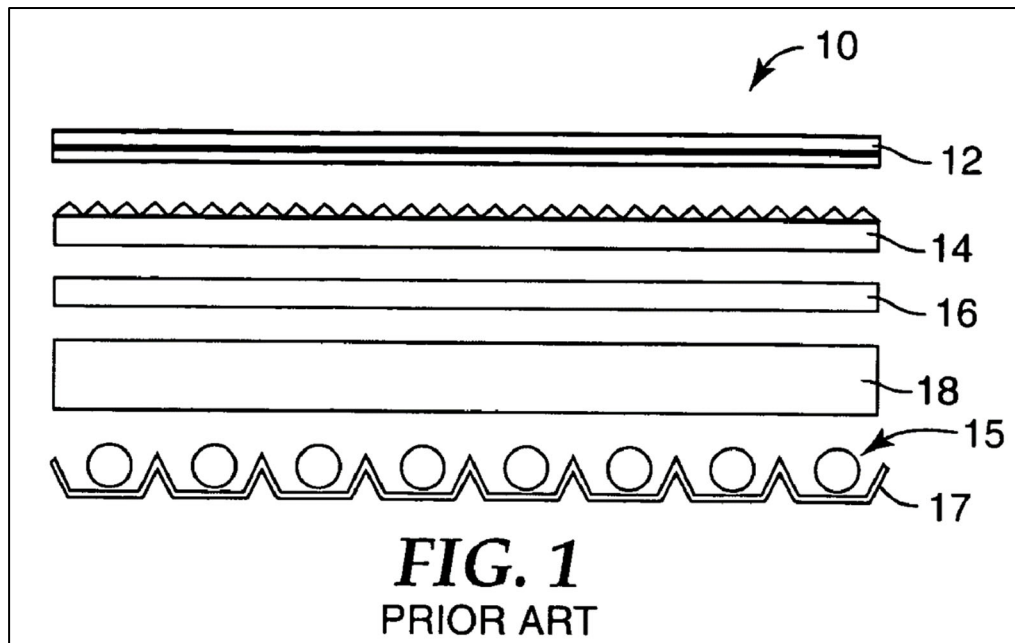
230,” which include reflecting capability to “increase the amount of LED light coupled to the light cavity’s output aperture....” Ex. 1006, pp. 38-39. As Holman explains, “[t]he sloped sidewall can be a diffusely reflecting material identical to the base layer material 220 or deposited as an external coating. The sloped sidewall 230 can also be made specularly reflecting. In either case, light emitted by the LED towards the side of the cavity is reflected generally upwards, towards the cavity aperture, 24.” The described structure is shown in Holman’s Figure 13:

15. A person of ordinary skill in the art reviewing the disclosure above would recognize that Holman's sloped sidewalls include reflective material. Similarly, a person of ordinary skill in the art would recognize that these sloped sidewalls side a substrate, because Holman describes "[t]he individual LEDs 70 are mounted flip-chip (electrodes below the light emission) on composite, electrically-insulating, reflective base layers 220 and 225 of thickness H, 222, that include

appropriate conductive circuits 224 and conductive vias 226 between those circuits and the LED contacts 228.” Holman, p. 38. A person of ordinary skill in the art would recognize that the reflector must be mounted to some structure, and, at a minimum would recognize that the circuit on which the reflector is positioned could be a substrate as recited by the claim.

16. Thus, a person of ordinary skill in the art reviewing Holman would recognize that Holman discloses or renders obvious a reflecting layer on a base layer that has angled sidewalls and is extended. A person of ordinary skill in the art would be motivated to include the sloped sidewalls include reflective material of Holman into the embodiments of Mok, Holman, and Lamb (Ground I) or Epstein, Holman, and Lamb (Ground II) discussed in my original declaration in order to maximize the efficiency and uniformity of light output provided by increasing the surface area of the reflector.

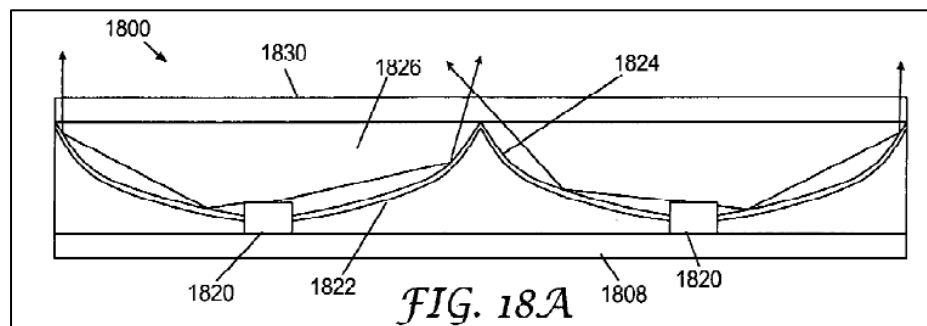
17. Further still, Lamb (Ex. 1007) also discloses shaping a reflector that is both angled and extended. For example, with respect to Figure 1, Lamb describes “a shaped reflector 17 located behind the array of light bulbs 15 for directing more light toward a viewer.” Lamb, [0034]. This configuration, including the shaped reflector 17 is shown in Figure 1:



18. As is shown above, Lamb expressly discloses “a shaped reflector 17 ... for directing more light toward a viewer.” Lamb, [0034]. A person of ordinary skill in the art reviewing this disclosure would recognize that Lamb thus discloses a reflector that is extended and angled with respect to the surface of the substrate on which it is positioned. Further, a person of skill in the art would recognize that Lamb is not limited to any particular type of lighting, as Lamb is explicit that “Light sources suitable for use with embodiments of the present disclosure include any source that emits light, such as ... a light emitting diode (LED), including organic LEDs (OLEDs), an array of LEDs, any other suitable light source(s), or any appropriate number or combination thereof.” Lamb, [0039].

19. Epstein (Ex. 1008) similarly discloses with respect to Figure 18A “LEDs 1820 are disposed on a substrate 1808.” Epstein, [0106]. Epstein further

describes that “[t]he sheet **1822** is provided with a reflecting surface **1824** that reflects the light emitted by the diodes **1820**. The reflecting surface **1824** is curved so as to direct the light in a desired direction. For example, the reflecting surface may be paraboloidal, elliptical or have some other shape.” Epstein, [0107]. This embodiment is shown in Figure 18A:



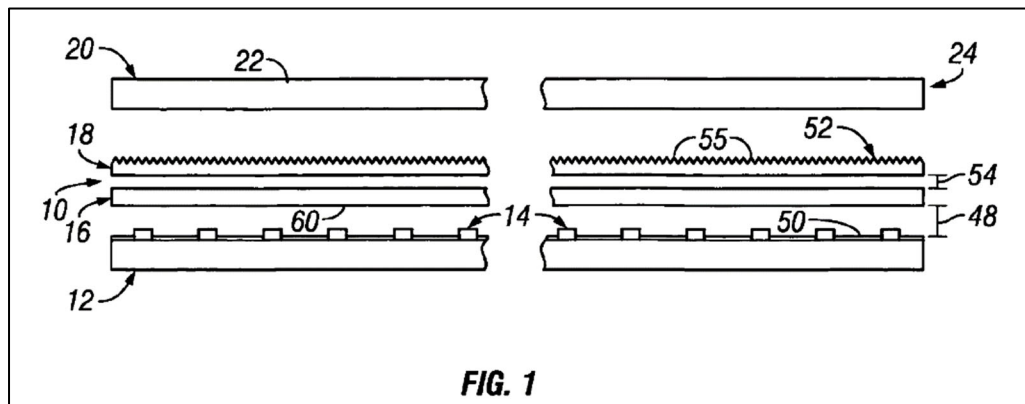
20. As is shown above, Epstein expressly discloses a “curved” “reflecting surface 1824.” The curved reflecting surface is mounted to a substrate 1808. Further, the reflector “may be paraboloidal, elliptical or have some other shape.” A person of ordinary skill in the art reviewing this disclosure would recognize that Epstein thus discloses a reflector that is extended and angled with respect to the surface of the substrate on which it is positioned. A person of ordinary skill in the art would be motivated to include the “curved” “reflecting surface 1824” into the embodiments of Epstein, Holman, and Lamb discussed in my original declaration in order to maximize the efficiency and uniformity of light output provided by increasing the surface area of the reflector.

21. Thus, in my opinion, a person of ordinary skill in the art would recognize that any of Mok, Holman, Lamb, or Epstein discloses a reflector that is extended and angled with respect to the surface of the substrate on which it is positioned.

B. A Lighting Panel Wherein the Diffuser Sheet Contacts the Reflector. (Substitute Claims 22 and 24)

22. The prior art considered in my original declaration disclosed a diffuser sheet that contacts the reflector, or, at a minimum, would render such a design obvious to a person of ordinary skill in the art.

23. Mok explains that “[t]he diffuser 16 may be mounted in front of the base panel 12 and separated therefrom by a spaced-distance 48.” This space 48 is shown in Mok’s Figure 1, below:



24. Mok makes clear that the distance 48 may be very small, explaining that “the diffuser 16 is separated from the base panel 12 by a distance 48 of about 50 millimeters (mm) or less.” Mok, [0023]. The base panel further includes a reflective surface 50, as discussed above. *See* Mok, [0021] (“A reflective surface

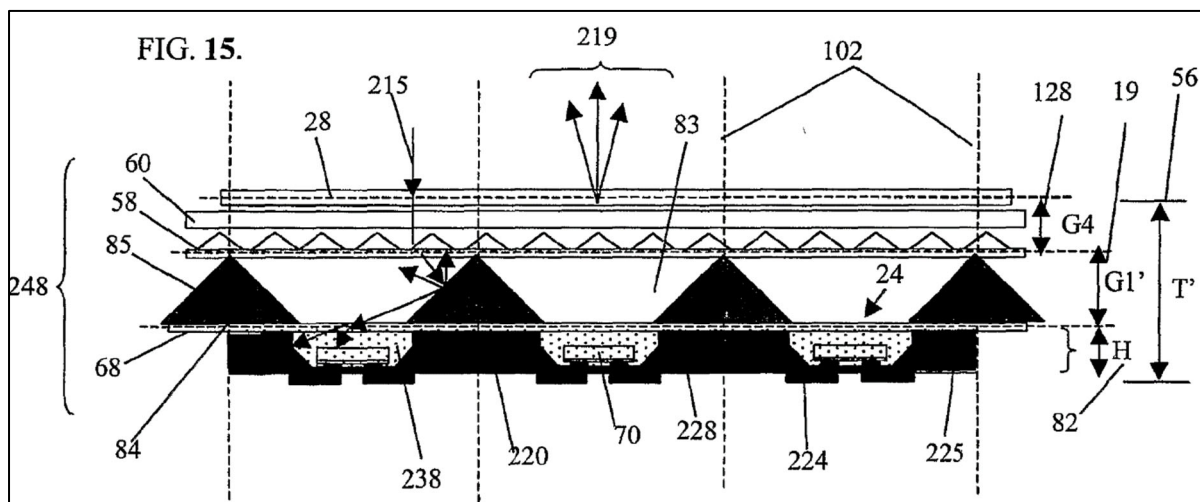
50 may be provided on the base panel 12 to ‘recycle’ (i.e., reflect) light which may be reflected by the back surface 60 of diffuser 16.”).

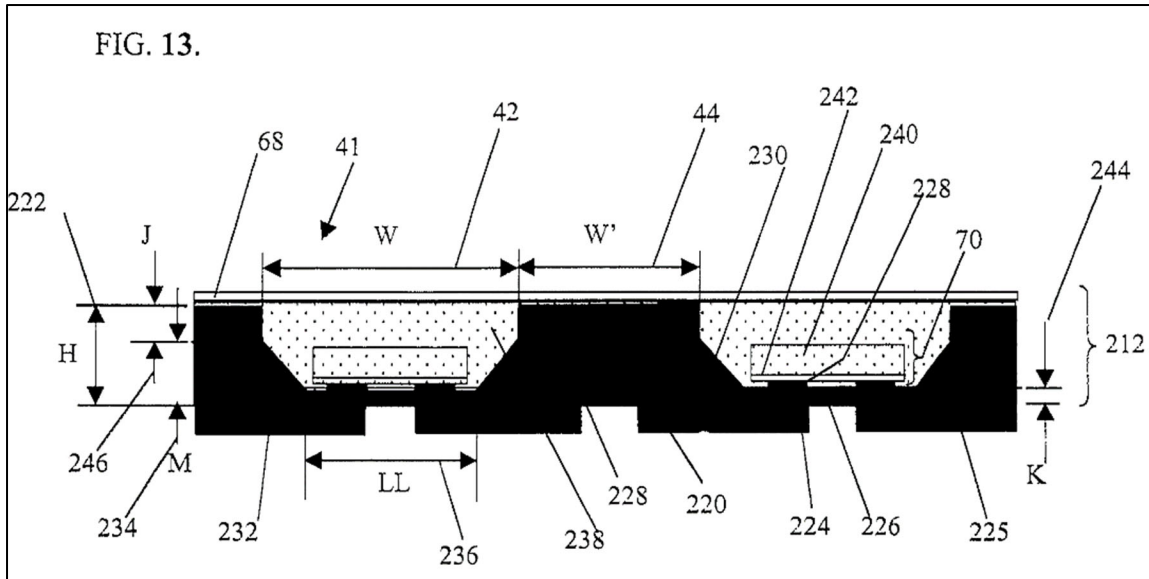
25. A person of ordinary skill in the art would recognize that zero is less than 50 mm, and thus is encompassed within the range provided by paragraph [0023]. Moreover, Mok describes that there are design trade-offs based on the size of space 48 provided, explaining that “[g]enerally speaking, larger 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.” Mok, [0023]. Thus, Mok explains that incentives for reducing the distance 48 would be: (1) a thinner panel, and (2) increased efficiency. A person of ordinary skill in the art would be motivated to modify Mok’s design to both provide a thinner lighting panel and increased efficiency and thus would be motivated to narrow the distance 48 to zero. Indeed, Mok further provides advantages for having layers in contact, expressly describing that the BEF 18 may stacked on the diffuser 16. *See* Mok, [0025]. This disclosure in Mok would further motivate a person of ordinary skill in the art to place the diffuser on the reflector of Mok, and Mok even claims a diffuser “positioned adjacent said base panel.” *See* Mok, Claim 13 (“a diffuser positioned adjacent said base panel,”); Claim 17 (“diffuser means positioned adjacent said base panel for diffusing light produced by said plurality of light emitting elements”).

26. A person of ordinary skill in the art reviewing each of these disclosures would recognize that Mok discloses or at least renders obvious a diffuser sheet that contacts the reflector. Further, a person of ordinary skill in the art would be motivated to include a diffuser sheet that contacts the reflector in an embodiment like that shown in Mok's Figure 3, that uses a reflector cup 32. A person of ordinary skill in the art would be motivated to use a diffuser to provide more consistent and even light output, as Mok describes. *See* Mok, [0005] ("The panel diffuses (i.e., evens-out) the light from the LEDs so that the panel appears to provide more even illumination than would be possible with just the LEDs alone."). In an embodiment relying on a reflector cup 32, a person of ordinary skill in the art would be further motivated to reduce the distance between the diffuser and the top of the reflector cup to zero both to reduce the thickness of the lighting panel and because the reflector cup 32 is recessed thus providing additional space between the LED and the diffuser.

27. Similarly, Holman teaches diffuser layers that contact the reflector. Holman's Section 4.1.5 is entitled "Fully Integrated LED Light Source Panels" (Holman at p. 41) and describes the advantages of eliminating spacing between components within the lighting panel. In particular, Holman describes that "Making all media boundaries between the LED chips 70 and lower prism sheet

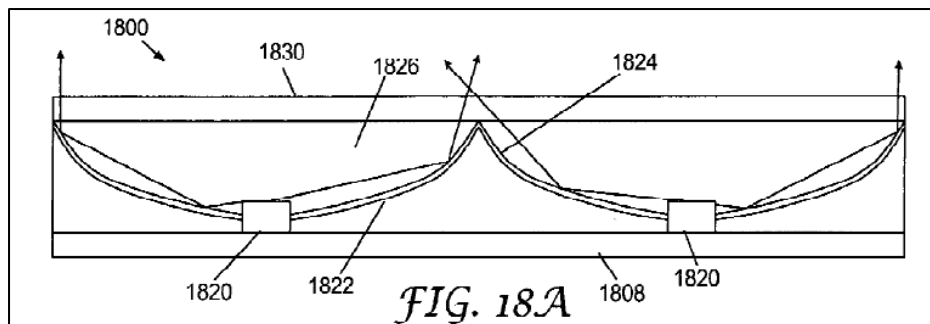
layer 58 optically coupled increases the amount of output light 219 emitted in higher angles, generally widening the beam's angular extent.” Holman, p. 41.





30. A person of ordinary skill in the art reviewing Holman's disclosures above, would recognize that Holman discloses or renders obvious a diffuser sheet that contacts the reflector. And such a person of ordinary skill in the art would further recognize that Holman discloses this configuration in embodiments that include a reflector cup, such as shown in Holman's Figure 13.

31. Similarly, Epstein discloses a diffuser in direct contact with a cup shaped reflector. This is shown in Epstein's Figure 18A, shown below:



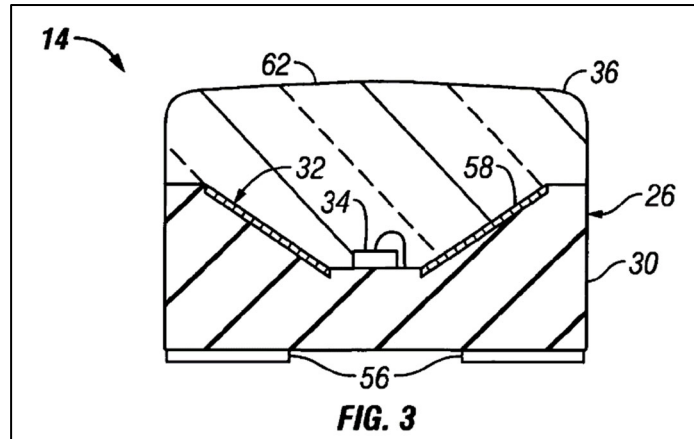
32. As discussed above, in Figure 18A, discloses a curved reflector 1824. This curved reflector is shown in direct contact with diffuser 1830. Epstein, [0109]

(“a diffuser or screen film 1830 may be disposed above the sheet 1822 to diffuse the light after being reflected by the reflecting surfaces 1824.”). A person of ordinary skill in the art reviewing this disclosure would recognize that Epstein discloses a configuration in which the diffuser contacts the reflector, including where the reflector is extended and angled with respect to the surface of the substrate.

C. A Lighting Panel Wherein the Reflector Forms a Reflective Optical Cavity Around At Least One Solid State Lighting Device. (Substitute Claims 23 and 25)

33. Each of the embodiments discussed in Section IV.A above shows a lighting panel wherein the reflector forms a reflective optical cavity around at least one solid state lighting device as is required by substitute claims 23 and 25.

34. For example, with respect to Mok, its Figure 3, “[i]t 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.” Mok, [0028]. A person of ordinary skill in the art reviewing the reflector cup shown in Mok, Figure 3 would understand that the reflector cup forms a reflective optical cavity around at least one solid state lighting device, which is the diode junction 34 shown in Figure 3. *See* Mok, [0016].



35. Holman also describes, with respect to its Figure 13, an embodiment in which the LED is positioned in a cavity with “sloped sidewalls 230,” which include reflecting capability to “increase the amount of LED light coupled to the light cavity’s output aperture....” Ex. 1006, pp. 38-39. A person of ordinary skill in the art reviewing the embodiment shown in Holman, Figure 13 would understand that the sloped sidewalls 230 form a reflective optical cavity around at least one solid state lighting device.

36. Lamb also describes “a shaped reflector 17 located behind the array of light bulbs 15 for directing more light toward a viewer.” Lamb, [0034]. And as discussed above, Lamb discloses that any type of light source, including an LED, may be used. Lamb, [0039]. Again, person of ordinary skill in the art reviewing this description and the embodiment shown in Lamb Figure 1 would understand that the “shaped reflector 17” forms a reflective optical cavity around at least one lighting device, which could be a solid state lighting device, e.g., an LED.

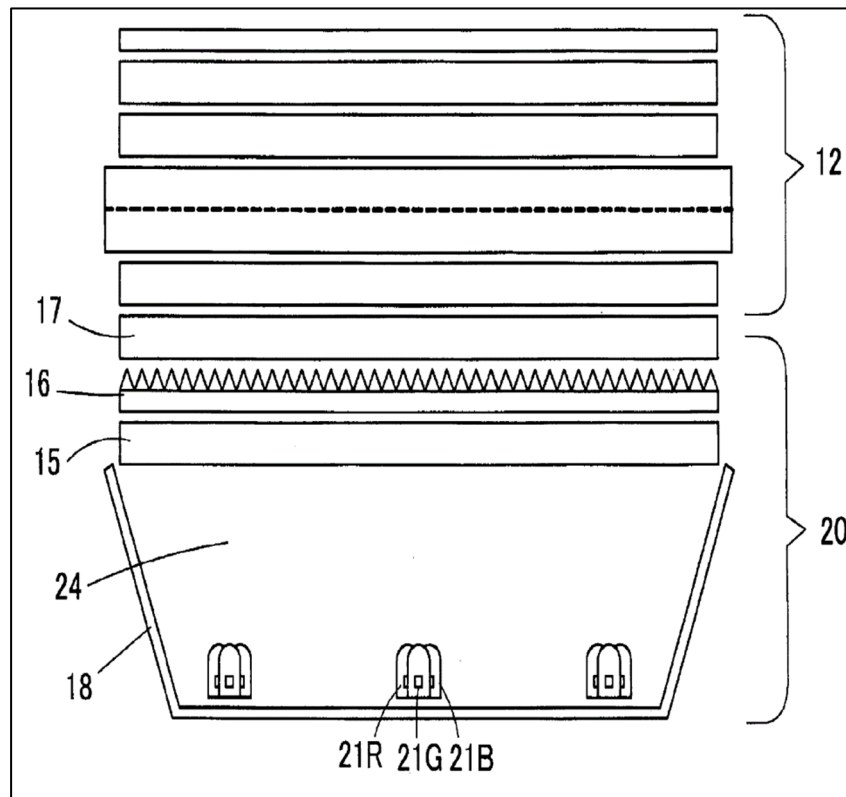
37. Further, Epstein describes a “reflecting surface 1824 is curved so as to direct the light in a desired direction. For example, the reflecting surface may be paraboloidal, elliptical or have some other shape.” Epstein, [0107]. Again, person of ordinary skill in the art reviewing this description and the embodiment shown in Epstein Figure 18A would understand that the curved reflecting surface 1824 a reflective optical cavity around a solid state lighting device, e.g., LED 1820 shown in Figure 18A.

V. Other Prior Art Renders Every Element of Substitute Claims 21-25 Obvious.

38. Substitute Claims 21-25 cover the well-known concept of a reflecting cup, which as discussed above was shown in the prior art addressed in my prior declaration. However, other prior art demonstrates that each of the concepts that these claims attempt to cover was well-known in the art before the April 21, 2006, priority date of the '835 Patent.

A. Ayabe Renders Substitute Claims 21-25 Obvious

39. I am informed and understand that Ayabe is prior art to the '835 Patent. Ayabe is entitled “light emitting source and a lighting emitting source array,” and describes with respect to its Figure 2, “a schematic sectional view illustrating a conventional liquid crystal display 19,” which is shown below:



40. Ayabe describes that the design in Figure 2 uses “cannonball type LEDs, 21R, 21G, and 21B” and that these are positioned below a “light diffusing film 15.” Ayabe, [0006], [0007]. Further, as shown in Figure 2, the LEDs are positioned with a “reflective film 18” forming a cup-shaped area around the LEDs.

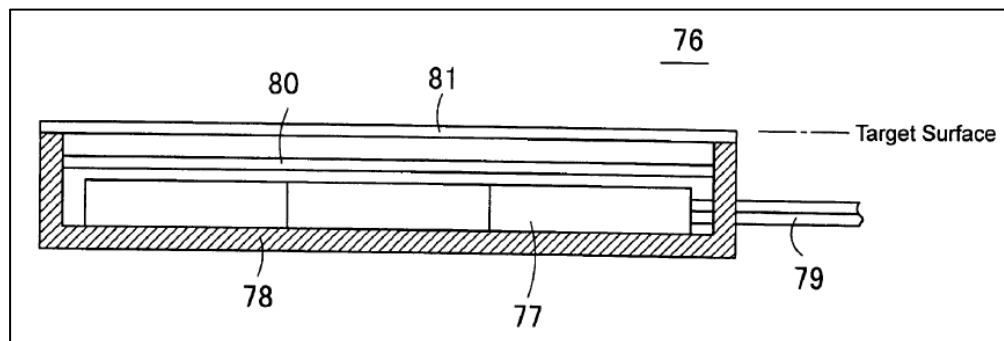
See Ayabe, [0003] and [0009]. As is shown above, the light diffusing film 15 is configured to contact the reflecting film 18.

41. A person of ordinary skill in the art reviewing the disclosure of Ayabe, and in particular Figure 2 above, would understand that Ayabe discloses or renders obvious the additional limitations of “a reflector on the first side of a substrate, wherein the reflector is extended and angled with respect to the surface of the substrate (Substitute Claim 21) and a lighting panel wherein the reflector forms a reflective optical cavity around at least one solid state lighting device. (Substitute Claims 23 and 25). As is shown by Figure 2 of Ayabe, the reflective film 18” forming a cup-shaped area around the “cannonball type LEDs, 21R, 21G, and 21B.” Thus, this reflector 18 is extended and angled with respect to the mounting surface of the LEDs. Further, the reflector 18 forms an optical cavity around at least one LED, which is a solid state lighting device.

42. Further, Ayabe discloses or renders obvious a lighting panel wherein the diffuser sheet contacts the reflector. (Substitute Claims 22 and 24). In particular, as explained above, a person of ordinary skill in the art reviewing Figure 2 would understand that light diffusing film 15 is configured to contact the reflecting film 18. To the extent light diffusing film 15 is not shown contacting reflecting film 18, a person of ordinary skill in the art would be motivated to modify the design such that the reflecting film 18 and the diffusing film 15 contact.

Such a design would be thinner than a design with additional spacing. Further, the reflecting cup design shown in Ayabe reduces any need for spacing between the reflecting film 18 and the diffusing film 15.

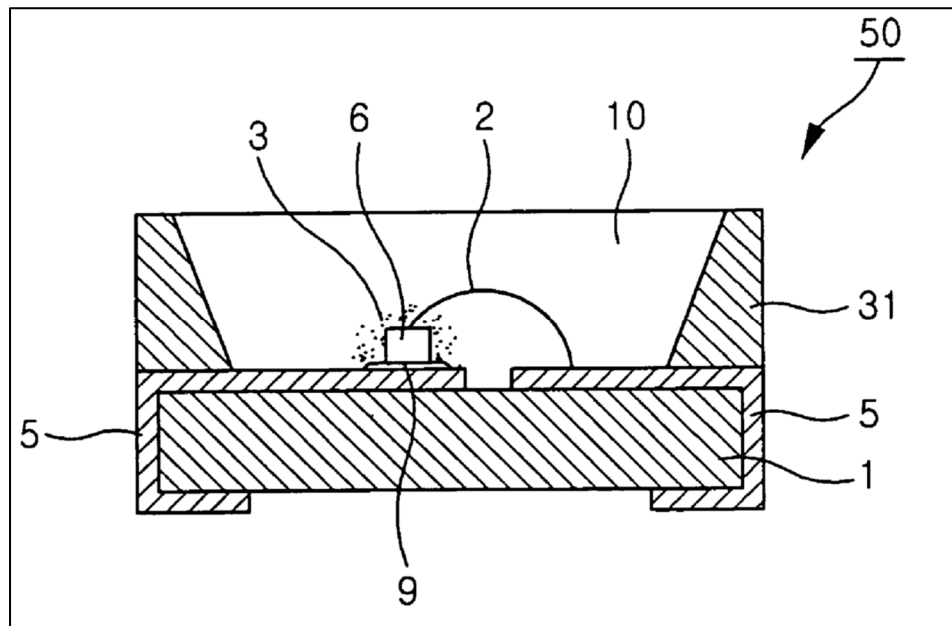
43. Further, additional embodiments in Ayabe expressly describe a reflector sheet “affixed to the inner surface of the casing 78.” Ayabe, [0155]. Ayabe further discloses that “as many optical components 80, 81 as necessary, such as a ... diffusing plate, ... are installed in the interior or top surface of the casing 78.” Ayabe, [0155]. This is shown in Figure 39 below, in which the diffusing plate 80 makes direct contact with the reflector sheet affixed to the inner surface of the casing:



44. Thus, a person of ordinary skill in the art reviewing the disclosure of Ayabe would recognize that Ayabe discloses or renders obvious a lighting panel wherein the diffuser sheet contacts the reflector. (Substitute Claims 22 and 24)

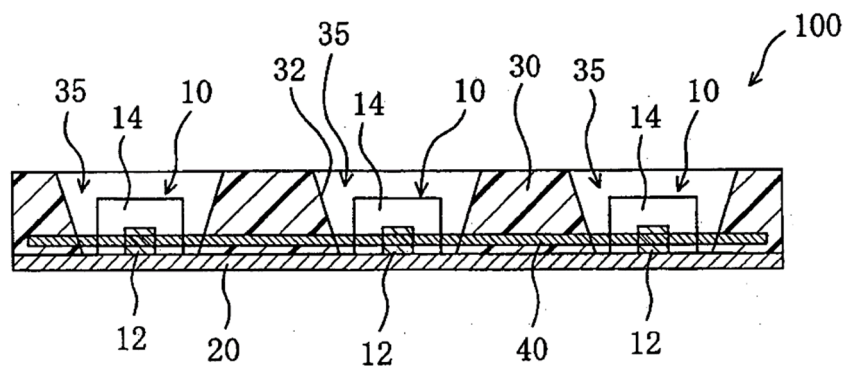
B. Roth Renders the New Elements of Substitute Claims 21, 23, and 25 Obvious

45. I am informed and understand that Roth is prior art to the '835 Patent. Roth is entitled "light emitting device." Roth describes an angled reflector 31 on substrate 1 creating an optical cavity. As described by Roth, its "device may have reflector 31 which may reflect the light from the light emitting diode 6 to the desire[d] direction." Roth, [0028]. This is shown in Roth, Figure 2 below:



46. A person of ordinary skill in the art reviewing the disclosure of Roth, and in particular Figure 2 above, would understand that Roth discloses or renders obvious the additional limitations of "a reflector on the first side of a substrate, wherein the reflector is extended and angled with respect to the surface of the substrate (Substitute Claim 21) and a lighting panel wherein the reflector forms a reflective optical cavity around at least one solid state lighting device. (Substitute

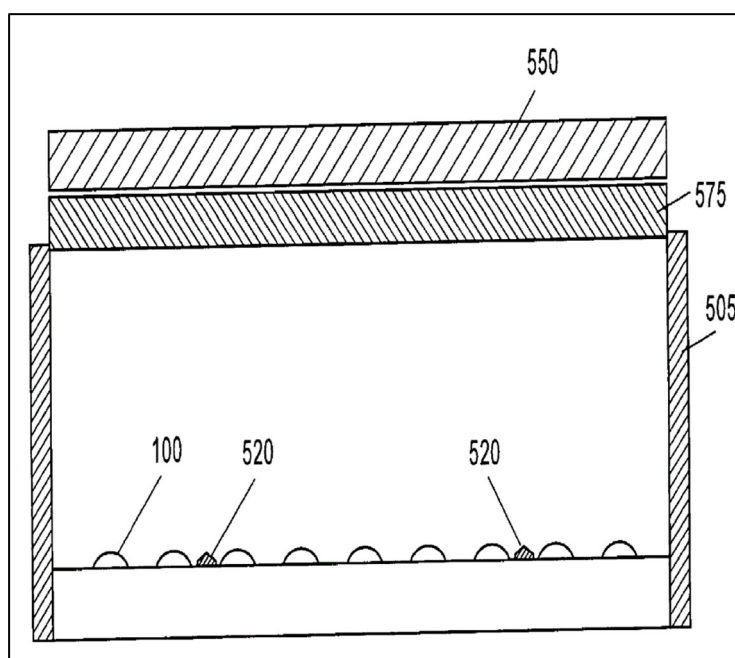
Claims 23 and 25). As is shown by Figure 2 of Roth, the reflector 31 forms a cup shape around the LED 6. Thus, this reflector 31 is extended and angled with respect to the mounting surface of the LEDs. Further, the reflector 31 forms an optical cavity around at least one LED, which is a solid state lighting device. Roth further makes clear that it can be used in a backlight application. *See, e.g.,* Roth, [0121] (“In such a wavelength conversion light emitting device is capable of applying on mobile phone, note book and electronic devices Such as home appliance, Stereo, telecommunication products, but also for custom display's key pad and back light application.”). To the extent it is not expressly described in Roth, a person of ordinary skill in the art would recognize that in a back light application the reflector design of Roth would be used in an array configuration. Such a prior art array configuration is shown in Figure 3 of Yano, which Yano describes as an “LED lamp 100 include[ing] a substrate 20, LED elements 10 that are arranged two-dimensionally on the substrate 20, and a reflector 30 with reflective surfaces 32 for reflecting the emissions of the LED elements 10.” Yano, [0057].



Yano, Fig. 3.

C. Saccomanno Renders Substitute Claims 21-25 Obvious

47. I am informed and understand that Saccomanno is prior art to the '835 Patent. Saccomanno is entitled “systems and methods for controlling light sources.” Figures 4 and 5 of Saccomanno, and their accompanying description, disclose a lighting panel in which a reflector 505 is extended and angled at a 90-degree angle. This is shown below in Figure 5:



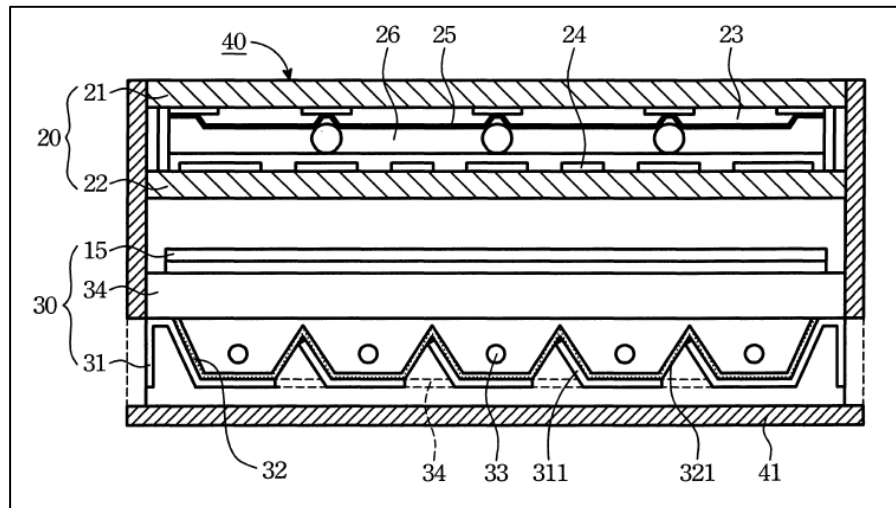
48. A person of ordinary skill in the art reviewing the disclosure of Saccomanno, and in particular Figure 5 above, would understand that Saccomanno discloses or renders obvious the additional limitations of “a reflector on the first side of a substrate, wherein the reflector is extended and angled with respect to the surface of the substrate (Substitute Claim 21) and a lighting panel wherein the reflector forms a reflective optical cavity around at least one solid state lighting device. (Substitute Claims 23 and 25). As is shown by Figure 5 of Saccomanno, the reflector 505 forms an enclosure around the light sources 100, which may be LEDs (*see* Saccomanno, [0038]). This reflector 505 is both extended and angled with respect to the mounting surface of the LEDs. In particular, the angle between the substrate and the reflector 505 is 90 degrees and the reflector 505 extends upward, as is shown. Further, the reflector 18 forms an optical cavity around at least one LED, which is a solid state lighting device.

49. Further, Saccomanno discloses or renders obvious a lighting panel wherein the diffuser sheet contacts the reflector. (Substitute Claims 22 and 24). In particular, Saccomanno describes including light management films 575 in contact with the reflect surfaces. Saccomanno, [0039]. Saccomanno provides as example light management films, BEF and/or DBEF films. A person of ordinary skill in the art would recognize that these are light management films and further that a diffuser is another type of light management film. A person of ordinary skill in the

art would be motivated to include a diffuser in the design of Saccomanno in order to provide more diffuse light from the light sources 100.

D. Chang Renders Substitute Claims 21-25 Obvious

50. I am informed and understand that Chang is prior art to the '835 Patent. Chang is entitled "direct type backlight module/direct type backlight module." Figures 1 through 6 of Chang, and their accompanying description, disclose a lighting panel in which a reflector 32, on base plate 31, is extended and angled and forms optical cavities around light emitting components 33, which may be LEDs. This is best shown below in Figure 6:



51. A person of ordinary skill in the art reviewing the disclosure of Chang, and in particular Figure 6 above, would understand that Chang discloses or renders obvious the additional limitations of "a reflector on the first side of a substrate, wherein the reflector is extended and angled with respect to the surface of the substrate (Substitute Claim 21) and a lighting panel wherein the reflector

forms a reflective optical cavity around at least one solid state lighting device. (Substitute Claims 23 and 25). As is shown by Figure 6 of Chang, the reflector 32 forms an enclosure around the light emitting component 33, which may be LEDs (see Chang, p. 9). Chang's reflector 32 is both extended and angled with respect to the mounting surface of the LEDs. Further, the reflector 32 forms an optical cavity around at least one light emitting component, which is a solid state lighting device.

52. Further, Chang discloses or renders obvious a lighting panel wherein the diffuser sheet contacts the reflector. (Substitute Claims 22 and 24). In particular, Chang describes including diffusing sheet 34 in contact with the reflector surfaces. Chang, pp. 10-11. Chang discloses optical films 15 that are in contact with diffuser sheet 14. Chang describes optical films as being used to "increase the light uniformity of the entire display product and brightness." A person of ordinary skill in the art would recognize that these are light management films, and further that an optical film that increases brightness is a brightness enhancement film. A person of ordinary skill in the art would be motivated to include this arrangement of films and extended and reflective surfaces in a panel design because it increases light uniformity and brightness.

VI. Motivations to Combine.

A. It Would Have Been Obvious to Incorporate the Teachings of Ayabe, Roth, Saccamanno, or Chang with the Prior Art of Ground I.

53. For similar reasons expressed in my original declaration for combining the prior art of Ground I (Mok, Holman, and Lamb), it would have been obvious to combine any of Ayabe, Roth, Saccamanno, or Chang with the prior art of Ground I.

54. For example, Ayabe, Roth, Saccamanno, and Chang all relate to the same field of endeavor as Mok, Holman, and Lamb, i.e., LED based lighting devices to provide backlighting for display elements. Additionally, each of Ayabe, Roth, Saccamanno, and Chang discuss and are directed to overcoming common issues in lighting panel designs, such as lighting efficiencies, light uniformity, light diffusion, on axis-brightness, reducing “hot-spots”, and other common lighting panel design considerations. Moreover, each of Ayabe, Roth, Saccamanno, and Chang employ similar structures and components, including LEDs, substrates, reflector sheets or reflective substrates, diffusers, and brightness enhancement films.

55. Ayabe, for example, discusses the importance of light mixing chamber (“equalizing chamber 24”) for light uniformity and color mixing. Ayabe, [0007]. And Ayabe’s teachings regarding the use of this conventional lighting

panel design, in conjunction with Ayabe's teaching regarding improvements in the configuration of reflective optical cavities with angled and extended sidewalls, would have combined with the prior art disclosures of Ground I to achieve better lighting efficiency, light distribution, and light output – all of which are common goals and aims across all of the cited prior art.

56. Similarly, Roth describes the common use of LED lights in lighting panel designs and the need to improve light quality. Roth, [0003-0006]. Moreover, Roth describes the use of a reflector forming an optical cavity with angled and extended sidewalls to improve light mixing and increase the amount of light emitted by the LED in the desired direction. Roth, [0007], [0028]. Thus, it would have been obvious to use Roth's angled reflector cup designs to improve light output in the lighting panel designs disclosed by the prior art in Ground I.

57. Saccamanno relates to optical sensing and controlling of light sources in conventional light panel designs. And as explained in conjunction with Figures 4 and 5 of Saccamanno, the use of conventional reflective surfaces and the recycling nature of the BEF can be optimized by the use of optical sensors to detect excess light being reflected by these reflective surfaces in conventional mixing chamber light panel designs. Saccamanno, [0038-0040], [0045]. Thus, one of skill in the art would understand that Saccamanno's teachings of extended and angled reflector which form optical cavities around the LEDs, in conjunction with its teachings

regarding the management of recycled light reflected from light management films, including diffusers and BEFs, could be used in combination with the designs taught by the prior art in Ground I.

58. Chang is directed to improving panel design to reduce heat and increase brightness. And Chang specifically discusses the use of angled reflectors to “enhance the reflection effect” in an effort to increase brightness. Chang also teaches the use of diffusers and optical films to increase light uniformity and brightness. Finally, Chang discloses the relative position of these components and shows the reflector in contact with the diffuser, which in turn is in contact with the optical film or BEF. Thus, it would have been obvious to use Chang’s angled reflector surface and stacked sheet design to improve light output, brightness, and efficiency in the lighting panel designs disclosed by the prior art in Ground I

59. A person of ordinary skill in the art reviewing the teachings of Ayabe, Roth, Saccamanno, and Chang would recognize that incorporating the elements discussed above of any one of Ayabe, Roth, Saccamanno, and Chang into the combination of Mok, Holman, and Lamb would improve efficiency as well as the quality and uniformity of light output by the backlight system. Thus, a person of ordinary skill in the art would be motivated to make this modification to improve the quality of light output. Accordingly, it would have been obvious to one of skill

in the art to employ the teachings of Ayabe, Roth, Saccamanno, and Chang with each of the prior art in Ground I.

B. It Would Have Been Obvious to Incorporate the Teachings of Ayabe, Roth, or Saccamanno with the Prior Art of Ground II.

60. For similar reasons expressed in my original declaration for combining the prior art of Ground II, it would have been obvious to combine any of Ayabe, Roth, or Saccamanno with the prior art of Ground II (Epstein, Holman, and Lamb).

61. As discussed above, Ayabe, Roth, Saccamanno, and Chang all relate to the same field of endeavor as Epstein, Holman, and Lamb, i.e., LED based lighting devices to provide backlighting for display elements and are directed to common issues across the art of lighting panel design including light uniformity and diffusion, increasing on axis-brightness, reducing “hot-spots” and other deleterious lighting effects, and reducing panel thickness.

62. Moreover, each of Ayabe, Roth, Saccamanno, and Chang employ similar structures and components, including LEDs, substrates, reflector sheets or reflective substrates, diffusers, and brightness enhancement films.

63. Similarly, it would have been obvious to one of skill in the art to employ the teachings of Ayabe, Roth, Saccamanno, and Chang with each of the prior art in Ground II. The reasoning and analysis I provide above applies to the prior art in Ground II as well and is incorporated herein in this section. Each of

Epstein, Lamb, and Holman relate to the same field of endeavor, utilize similar light panel designs and light panel constructions, and have similar goals of increasing light output, maximizing efficiency, and improving light uniformity. A person of ordinary skill in the art reviewing the teachings of Ayabe, Roth, Saccamanno, and Chang would recognize that incorporating the elements discussed above of any one of Ayabe, Roth, Saccamanno, and Chang into the combination of Epstein, Holman, and Lamb would improve efficiency as well as the quality and uniformity of light output by the backlight system. Thus, a person of ordinary skill in the art would be motivated to make this modification to improve the quality of light output.

I hereby declare that statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true. Should further information become available to me as this matter proceeds, I may revise my opinions accordingly as necessary. I declare under penalty of perjury that the foregoing Declaration is true and correct.

July 16, 2024

Date



Dr. P. Morgan Pattison