

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Hisense USA Corporation
Petitioner

v.

Brightplus Ventures LLC
Patent Ownerfa

Patent No. 8,294,075
Filing Date: August 5, 2010
Issue Date: October 23, 2012
Title: SOLID-STATE LUMINAIRES FOR GENERAL ILLUMINATION

Inter Partes Review No. IPR2023-01410

Ex. 1003 – Declaration of P. Morgan Pattison, Ph.D.

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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* Reviews of U.S. Patent No. 8,294,075(“the ’075 Patent”).

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 claims 1-7 and 9-12 of the ’075 Patent 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.

II. Qualifications

6. My curriculum vitae (“CV”) is attached hereto as Exhibit 1004 and provides an accurate identification of my background and experience.

7. I have over (25) years of experience in the areas of light emitting diodes (LEDs), organic light emitting diodes (OLEDs), lighting, solid state lighting (SSL), displays, lasers, and optoelectronic materials and devices

8. I am the Founder and President of Solid State Lighting Services, Inc. In that capacity, I am responsible for, among other things, providing technical, strategic, and market expertise in the areas of LEDs, OLEDs, lighting, SSL, displays, and optoelectronic materials and devices. I am also involved in connecting optical device technical performance with application requirements for displays, general illumination, color discrimination applications (medical, retail), and various novel lighting applications enabled by SSL technology.

9. From January 2006 through November 2007, I worked as a Project Manager at the U.S. Department of Energy (DOE). In that capacity, I was responsible for managing DOE funded research and development projects in SSL, including LED and OLED lighting technologies. My duties included managing the solicitation and selection of R&D projects with the objective of saving energy. As part of the solicitation and selection process, I evaluated and identified priority

areas of research necessary for advancement of SSL in terms of efficiency, lighting performance, and cost.

10. From September 2000 through January 2006, I was a Graduate Student Researcher at University of California Santa Barbara (UCSB). I performed my Doctoral thesis research under Professor Shuji Nakamura (Nobel Prize in Physics 2014) on gallium-nitride (GaN) based micro-cavity light emitting diodes. The research included: epitaxial structure design and growth by MOCVD, semiconductor process development, materials characterization, and electro-optical device characterization. While at UCSB, I participated in additional areas of research, including research and development of UV LEDs, vertical cavity surface emitting lasers (VCSEL), and edge emitting laser diodes.

11. From November 1996 through May 2000, I worked as a Laser Test Engineer at Cymer Laser. I was responsible for testing and developing test methodology for production and prototype KrF and ArF excimer lasers used in deep UV photolithography for manufacturing of advanced semiconductor products. Testing included optical characterization and full system troubleshooting. I also developed new electrical and optical test methodologies to improve test cycle times, automated test procedures, and developed test documentation.

12. I earned a Ph.D. in Materials Science, Electronic and Photonic Materials from the USCBA in 2006. As stated above, my graduate work focused on

fabrication and characterization of gallium nitride based micro-cavity LEDs. I obtained a Bachelor's Degree in Electrical Engineering, Electronic Devices and Materials from UC San Diego in 1996, and I obtained a Master's Degree in Electrical Engineering, Electronics and Photonics from UCSB in 2003.

13. I am listed as an inventor on at least 11 issued patents, including multiple patents in the field of LED materials and device design, LED lighting product design, and home automation and controls for lighting.

14. I have authored numerous peer reviewed journal articles and publications on the topics of LED materials and device design.

15. Since 2008, I have also authored annually updated R&D and technology and manufacturing roadmaps used by the DOE to guide federal lighting R&D efforts. I frequently give presentations and talks on the topic of LED technology, SSL status and R&D opportunities, and application advancements enabled by LED technology.

III. Summary of Legal Issues

16. I am not a lawyer. Thus, in expressing my opinions and considering the subject matter of the claims of the '075 Patent, I am relying upon certain legal principles that counsel has explained to me.

A. Obviousness

17. First, I understand that for an invention claimed in a patent to be found patentable, it must be, among other things, new and not obvious from what was known before the invention was made.

18. I understand the information that is used to evaluate whether an invention is new and not obvious is generally referred to as “prior art” and generally includes patents and printed publications (e.g., books, articles, product manuals, company publications, etc.).

19. I understand that in this proceeding the Petitioner, Hisense has the burden of proving that the claims of the patents-at-issue are obvious in view of the prior art by a preponderance of the evidence. I understand that “a preponderance of the evidence” is evidence sufficient to show that a fact is more likely true than it is not true.

20. I understand that in this proceeding, the information that may be evaluated is limited to patents and printed publications. My analysis below compares the claims to patents and printed publications that I understand are prior art to the patents-at-issue.

21. I have been informed and understand that a claim is obvious in light of the prior art if the difference or differences between the claimed subject matter and the prior art are such that the subject matter as a whole would have been

obvious, at the time the invention was made, to a person having ordinary skill in the art. I have been informed and understand that the Supreme Court provided an outline for analyzing obviousness in which it rejected an earlier test in favor of an “expansive and flexible approach” using “common sense.” I have also been informed and understand that the Supreme Court explained that under the correct analysis, any need or problem known in the field of endeavor at the time of invention and addressed by the patent can provide a reason for combining the elements in the manner claimed. I have also been informed and understand that the Supreme Court explained that “[t]he combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results.” I further have been informed and understand that the Court pointed to other factors that may show obviousness. These factors included the following principles:

- a. combination that unites old elements with no change in their respective functions is unpatentable. As a result, the combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results,
- b. a predictable variation of a work in the same or a different field of endeavor is likely obvious if a person of ordinary skill would be able to implement the variation,

- c. an invention is obvious if it is the use of a known technique to improve a similar device in the same way, unless the actual application of the technique would have been beyond the skill of the person of ordinary skill in the art. In this case, a key inquiry is whether the improvement is more than the predictable use of prior art elements according to their established functions,
- d. an invention is obvious if there existed at the time of invention a known problem for which there was an obvious solution encompassed by the patent's claims,
- e. inventions that were “obvious to try” — chosen from a finite number of identified, predictable solutions, with a reasonable expectation of success — are likely obvious,
- f. known work in one field of endeavor may prompt variations of it for use in either the same field or a different one based on design incentives or other market forces if the variations would have been predictable to one of ordinary skill in the art, and
- g. an explicit teaching, suggestion, or motivation in the art to combine references, while not a requirement for a finding of obviousness, remains “a helpful insight” in determining upon which a finding of obviousness may be based.

B. Claim Construction

22. I have been informed and understand that in an *inter partes* review claim terms are construed according to their ordinary and customary meaning as understood by one of ordinary skill in the art in view of the specification and the prosecution history of the patent.

C. Level of Skill in the Art

23. I am informed and understand that a person of ordinary skill in the art is a hypothetical person who is presumed to have known the relevant art at the time of the alleged invention. I am informed and understand that factors that may be considered in determining the level of ordinary skill in the art may include: (A) the type of problems encountered in the art; (B) prior art solutions to those problems; (C) the rapidity with which innovations are made; (D) the sophistication of the technology; and (E) the educational level of active workers in the field

IV. The '075 Patent

24. The '075 Patent is entitled "Solid-state luminaires for general illumination" and claims priority as a continuation an earlier application. I am informed that the earliest claimed priority date of the '075 Patent is April 21, 2006. Each of the prior art references I address herein was available prior to April 21, 2006, thus I have not analyzed whether each claim of the '075 Patent is entitled to that priority date.

A. Person of Ordinary Skill in the Art of the '075 Patent

25. It is my opinion that the field of the '075 Patent is back-lighting panels and filters for adjusting the light output of solid-state lighting, e.g., Light Emitting Diodes (LEDs). *See* '075 Patent, 1:14-16.

26. I am informed and understand that in a corresponding litigation, the Petitioner, Hisense has argued that as of April 21, 2006, a person of ordinary skill in the art “would have had at least a graduate degree in mechanical engineering, physics, materials science, electrical engineering, or a related discipline, coupled with at least four years’ experience in designing backlighting systems for displays; the level of ordinary skill in the art is approximate and additional education could make up for a lack of experience or vice-versa.”

27. I am informed and understand that in a corresponding litigation, the Patent Owner, Brightplus has argued that as of April 21, 2006, a person of ordinary skill in the art “would possess the following qualifications: (a) A Bachelor of Science degree in a technical field and at least four years of experience in the field of design and/or manufacture of display systems; (b) a Master of Science degree in a technical field and at least two years of experience in the field of design and/or manufacture of display systems; or (c) a PhD in a technical field relating to the design and/or manufacture of display systems.”

28. In my opinion, a person with any of these levels of skill in the art would find the claims of the '075 Patent to be obvious in view of the prior art discussed here. Further, as I explain above, I have the relevant educational background and I have worked in the technical area of the '075 Patent for many years. As of April 21, 2006, which I understand to be the time of the alleged invention, I was a person of ordinary skill in the art under either level.

B. Construction of Claim Terms of the '075 Patent

29. As explained in further detail below, under any reasonable construction, the claims are obvious in view of the prior art I address herein. Thus, I do not separately offer an opinion with respect to the proper construction of the terms of the claims of the '075 Patent.

V. Materials Considered

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
1001	U.S. Patent No. 8,294,075 (“the '075 Patent”)
1002	Prosecution History of U.S. Patent No. 8,294,075
1005	US 2006/0227545 to Mok <i>et al.</i> (“Mok”)
1006	WO 03/056876 to Holman <i>et al.</i> (“Holman”)
1007	US 2005/0135115 to Lamb <i>et al.</i> (“Lamb”)
1008	US 2005/0265029 to Epstein <i>et al.</i> (“Epstein”)
1014	US 2006/0082698 to Ko <i>et al.</i> (“Ko”)

1015	Han-Ping D. Shieh, et al., <i>Micro-Optics for Liquid Cristal Displays Applications</i> , IEEE/OSA Journal of Display Tech., Vol. 1, No. 10, Sep. 2005.
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31. 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).

VI. State of the Art as of April 21, 2006.

A. General Display Technology Background

32. By 2006 liquid crystal display (LCD) technology and the supporting backlighting technology was well understood. Liquid crystal displays require a light to illuminate color filters within liquid crystal shutters that create an image. Most LCD developments in this time frame were focused on using an internal light source but some displays used ambient light to illuminate the liquid crystals. In this timeframe the backlight light source technology was transitioning from mostly cold cathode fluorescent to Light Emitting Diode (“LED”) technology. Edge emitting arrangements and direct backlighting arrangements of the light source technologies were both described in publicly available references, exemplified by the references described below. The different lighting arrangements and light source technologies had similar general challenges that differed in the details of the solution, but the optical concepts and techniques to solve the challenges were

similar. For example, both CCFL and LED light sources would require diffusers and reflectors to make their emission into the LCD layers more uniform, removing lines of bright emission from the CCFL sources or spots of high intensity from the LED sources.

33. Within the backlighting module various optical components were combined to condition the light from the light source to light suitable for optimized backlighting of the liquid crystals to achieve desired display performance. As described in the following references, backlight modules (or units) could have multiple diffusers, collimators (referred to as brightness enhancing films), and reflective elements and components. These various components were often off-the-shelf components and the optical features in these components consisted of well understood techniques to provide the desired performance. Conventional optical understanding was used to determine the relationships between the various components because, within the backlighting module, each optical interface would induce reflection and refraction according to basic principles of optics. Optical elements and components could be combined, similar to combining multiple simple lenses to create a compound lens with performance based on the relationship of the two simple lenses. Standard optical engineering understanding was necessary to integrate the various optical elements to achieve desired performance.

34. Within the backlight module desired performance would be a combination of efficiency, cost, thickness, and display performance aspects which include brightness, color gamut, viewing angle, and uniformity. So, display engineers made various combinations of known optical elements to achieve the balance of these performance aspects.

B. Mok

35. I am informed that Mok is prior art to the '075 Patent. Mok describes a light emitting panel including “a plurality of light emitting elements” and that “[o]ne or more light conditioners ... receive and condition light produced by the light emitting elements.” [Mok, Abstract] to achieve display performance with “substantially uniform intensity that extends over a radiation angle of at least about 60°” [0007]. As described by Mok, “[t]he 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.” Mok, [0015].

C. Epstein

36. I am informed that Epstein is prior art to the '075 Patent. Epstein describes “an optical assembly for emitting light comprises an array of light emitting diodes (LEDs) mounted to a substrate. The LEDs emit light in a direction

generally perpendicular to the substrate.” Epstein, [0005]. Epstein describes an intermediate layer 422 (and related embodiment 622 of FIG. 6) that may be a reflector for light at the wavelength emitted by the LED 420 (or LED 620). *See* Epstein, [0048] & [0067]. Epstein further discloses that the intermediate layer 422 (and related embodiment layer 622) may be bonded to the substrate 408 (and related embodiment substrate 608).

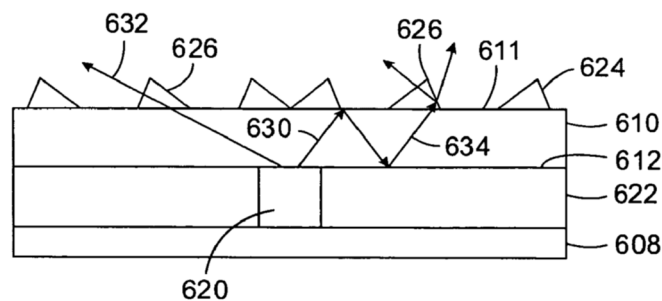


FIG. 6

Epstein, Fig. 6. Epstein also describes the use of a brightness enhancing film (BEF) 662 and 664, stating that “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.” Epstein, [0074].

D. Lamb

37. I am informed that Lamb is prior art to the '075 Patent. Lamb relates to backlighting systems to be used with liquid crystal displays and provides explicit disclosures related to the refraction and recycling of light by brightness enhancement films. Lamb, [0035] (“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.”).

E. Holman

38. I am informed that Holman is prior art to the '075 Patent. Holman describes and shows a BEF on a reflector sheet without an intervening air gap. Holman discloses the use of orthogonal, elevated prism sheets 58 and 60. *See, e.g.*, Holman, pp. 10-11, Prism sheets 58 and 60 are BEF. Holman, pp. 8-9 (explicitly disclosing that the prism sheet “may be one of the 90-degree offerings manufactured by the Minnesota Mining & Manufacturing Company (3M) under the trade name BEF, as in brightness enhancement film.”).

VII. The Prior Art Renders Every Element of Claims 1-7 and 9-12 Obvious.

39. In the analysis below I break down the elements of claims 1-7 and 9-12 and demonstrate that each of these elements were known in the art before the April 21, 2006, priority date of the '075 Patent.

A. Planar Backlighting Panels Including Substrates and Multiple LEDs were Known in the Art. (Claims 1A and 1B)

40. The claims of the '075 Patent all relate to backlighting panels for Liquid Crystal (LCD) displays that use multiple solid-state lighting devices (e.g., Light Emitting Diodes (LEDs)) to provide light for the backlight. Such backlighting systems for displays were known in the art.

41. As one example, Mok discloses “a light emitting panel.” Mok, Abstract. Mok describes that “Light emitting panels are commonly used as back lights for display systems (e.g. liquid crystal displays).” Mok, [0001].

42. Mok describes a base panel that “provides a convenient mounting location for the various light emitting elements” and one that is a “generally rectangular shaped, plate-like member . . . commensurate with the intended size of the [light emitting] panel.” Mok, [0019]. In Figure 1, the base panel 12 is shown as parallel to principal plane of lighting panel 10.

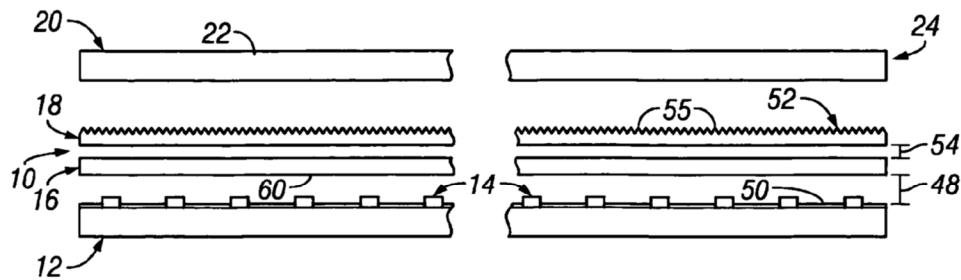


FIG. 1

Mok, Fig. 1. The various lighting emitting elements described in Mok are LEDs, which are “sold state lighting devices.” *See e.g.*, Mok, [0029].

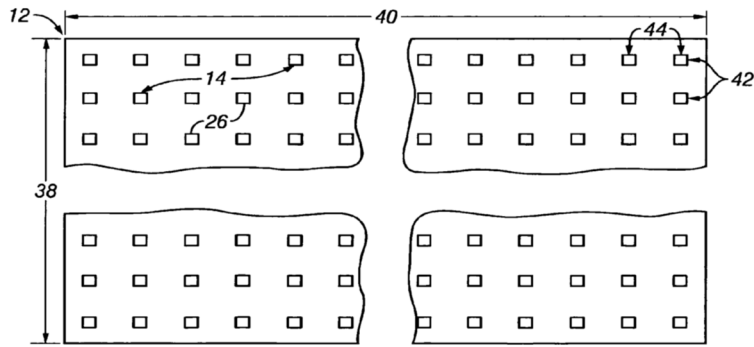
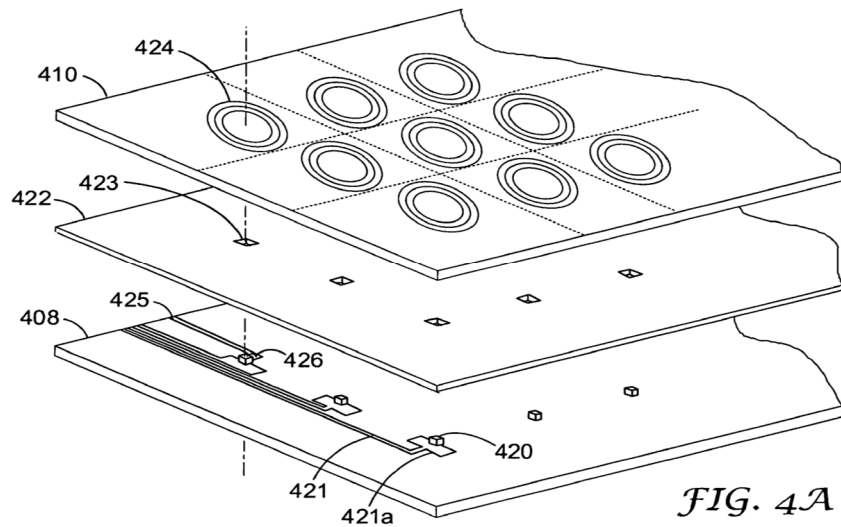


FIG. 2

Mok, Fig. 2.

43. As another example, Epstein discloses “backlighting of liquid crystal displays.” Epstein Abstract. Epstein Figure 4A shows that the “lighting unit 400 comprises a substrate 408 on which are arrayed a number of LEDs 420.” Epstein, [0046]. In my opinion, a person of ordinary skill in the art reviewing Figure 4A would understand that Epstein discloses a substrate that has a first side parallel to the principal plane of the lighting panel.



Epstein, Fig. 4A.

44. Epstein describes a lighting unit 400 that comprises a number of LEDs 420 that emit light and are arrayed on a first side of a substrate 408. Epstein, [0046]. A person of ordinary skill in the art would recognize that LEDs are solid state lighting devices.

B. Reflectors Used in Backlighting Panels were Known in the Art, and It Was Known that Reflectors Could Comprise Coatings or Reflector Sheets that Reflect and Scatter Light (Claims 1C and 2)

45. The claims of the '075 Patent also require a reflector mounted to the panel including the LEDs. Both reflector sheets and reflective coatings used in connection with backlighting panels for LED displays were known in the art. Similarly, it was known that such reflectors could comprise either coatings or reflective sheets. A person of ordinary skill in the art would recognize that such reflector sheets reflect and scatter light.

46. Mok describes a reflective surface 50 used in connection with the backlighting panel, describing that “[t]he reflective surface 50 may comprise a separate component (e.g., a sheet-like material) that is affixed to the base panel 12.” Mok, [0021]. Mok also describes that “[t]he reflective surface 50 may comprise a separate component (e.g., a sheet-like material) that is affixed to the base panel 12.” Mok, [0021]. Mok Figure 1 further demonstrates how the reflective surface 50 is on the first side of the base panel or substrate.

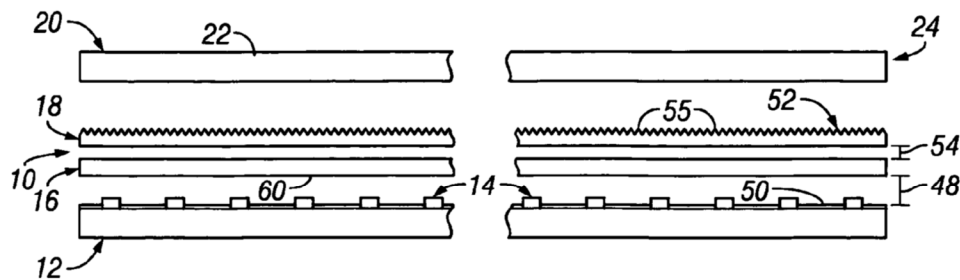


FIG. 1

Mok, Fig. 1.

47. Mok also describes diffuse reflectors. Mok, claim 12 (“The light emitting panel of claim 10, wherein said reflective surface comprises a diffuse reflective surface.”). As one example, Mok discloses that white paint is a diffuse reflector, and person of ordinary skill in the art would recognize that a “diffuse reflector” reflects and scatters light incident thereon. Mok, [0021] (“The reflective surface 50 may comprise a specular reflective surface (e.g., aluminum), or a diffuse reflective surface (e.g., white paint). . . . the reflective surface 50 may be deposited

directly on the base panel 12 by any of a wide range of processes suitable for depositing the particular type of reflective material that is to be used.”).

48. With respect to a reflector sheet, Mok describes that “[t]he reflective surface 50 may comprise a separate component (e.g., a sheet-like material) that is affixed to the base panel 12.” Mok, [0021]. Mok also describes reflective surfaces, including one made of aluminum, and another comprising white paint. A person of ordinary skill in the art would understand that a reflective surface, as described in Mok, reflects and scatters light. This is confirming by Mok’s description of white paint as a “diffuse reflector,” as discussed above. Mok, [0021].

49. Similarly, Epstein describes an intermediate layer 422 (and related embodiment 622 of FIG. 6) that may be a reflector for light at the wavelength emitted by the LED 420 (or LED 620). *See* Epstein, [0048] & [0067]. Epstein further discloses that the intermediate layer 422 (and related embodiment layer 622) may be bonded to the substrate 408 (and related embodiment substrate 608). Epstein, [0048] & [0067].

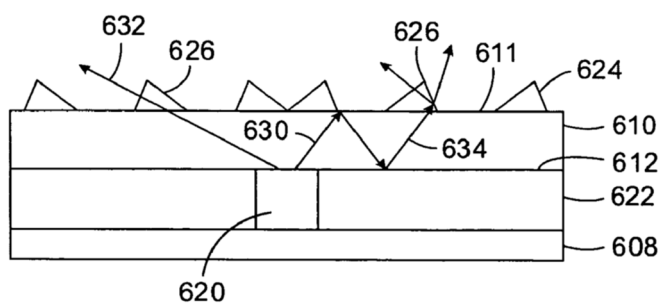


FIG. 6

Epstein, Fig. 6.

50. Epstein discloses a reflector that may comprise a “multilayer dielectric coating.” Epstein [0048] (“intermediate layer 422 may also include some other type of reflector, such as a metalized layer or multilayer dielectric coating.”). Epstein further describes including white paint, i.e., “white pigmented material” as a “diffusively reflective light extraction material.” *See* Epstein, [0081] (“Another example is schematically illustrated in FIG. 15B, in which the upper surface of the reflective intermediate layer 622, and/or the lower surface of the guiding layer 610, is provided with patches 695 of diffusely reflective light extraction material, such as a white pigmented material.”). Further, Epstein discloses that “different types of reflector may be used on the lower surface 612. For example, the lower surface 612 may be coated with a reflecting film.” Epstein [0079].

51. Epstein discloses that “[t]he intermediate layer 422 may comprise, for example, a multi-layer polymer reflective film such as Vikuiti ESR film available from 3M Company, St. Paul, Minn. The intermediate layer 422 may also be a white diffuse reflector such as a matrix containing diffusely reflecting particles, for example titanium dioxide particles.” Epstein, [0048]. As discussed above, a person of ordinary skill in the art would know that a “diffuse reflector” such as that disclosed by Epstein reflects and disperses light incident thereon.

C. Reflector Sheets Comprising Plastic Foam were Known in the Art. (Claim 4)

52. Holman discloses a reflector that may be composed of a plastic material. Holman, p. 8. Similarly, Epstein similarly describes that its reflector sheet may be plastic, in particular, “a multi-layer polymer reflective film such as Vikuiti™ ESR film available from 3M Company, St. Paul, Minn,” Epstein, [0048]. Plastic is a generic term, and plastic foams were well known in the art as optical materials as shown by Ko, which discloses that “[p]olymer foams may also be used” to form the substrate. Ko, [0056]. As explained, a person of ordinary skill in the art would understand that polymer foam is a plastic foam. In my opinion, using a plastic foam as the plastic described in Holman in the backlighting panels of either Mok or Epstein would have been an obvious variation to a person of ordinary skill in the art.

53. For example, Ko describes the use of a foam plastic material as a material to achieve optical diffusion. In my opinion, a person of skill in the art would understand that by deploying a foam plastic material on an opaque substrate a similar effect could be achieved but rather than diffusing transmitted light, the reflected light would be diffused. In fact, such an optical material is generally referred to as a diffuse reflector, meaning that the light is reflected at different angles than the incoming light which results in a generally matte white type of finish. The foam plastic material contains random bubbles which will serve to

create optical interfaces at random locations with random angles thereby reflecting light at random angles, serving to diffuse the reflected light.

54. A person of ordinary skill in the art would be motivated to consider the total reflectance, diffusion properties, cost, and manufacturability of candidate reflector materials. Plastic foams are lightweight, thin, and inexpensive, and thus a person of ordinary skill in the art would be motivated to consider plastic foam as a reflector sheet. As a transparent diffuser option, the use of plastic foam as a diffuse reflector would have similar and predictable reflective performance. The reflectance and diffusion properties would be a function of the specific plastic foam properties, thickness, and substrate material. A person of ordinary skill in the art would have been motivated to use a plastic foam based on its price, relative thickness, and reflective properties. A person of skill in the art would have further recognized that the selection of a plastic foam to act as the reflector is simply a design-choice that a person of ordinary skill in the art would have made based on the desired thickness and reflectance of the foam optical material.

D. It was Known in the Art to Include Apertures in a Reflector to Enable LEDs to Pass-Through the Reflector. (Claim 3)

55. Claim 3 of the '075 Patent further requires that the reflector sheet includes apertures or vias through which the LEDs pass, in particular, “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.” This configuration was known in the art.

56. As one example, Mok describes that the “reflecting surface 50” may be a separate sheet. Mok, [0021] (“The reflective surface 50 may comprise a separate component (e.g., a sheet-like material) that is affixed to the base panel 12.”). Similarly, Mok Figures 1 and 2 show a reflective surface 50 with apertures for solid state lighting devices. *See, e.g.*, Mok, [0021] “The reflective surface 50 may comprise a separate component (e.g., a sheet-like material) that is affixed to the base panel 12.” Mok, [0021]. As Mok explains, the solid state lighting devices are mounted to the substrate or base panel. *See, e.g.*, Mok, [0019] (“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.

57. As shown in Figures 1 and 2 below, the reflective surface or sheet (50) has apertures that are aligned with and correspond to the plurality of solid state lighting devices. *See* Mok.

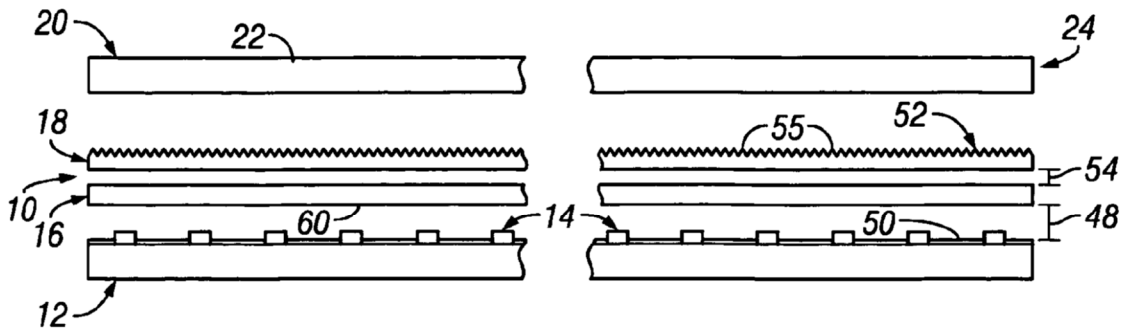


FIG. 1

Mok Figure 1. The reflector sheet 50 of FIG. 1 contains apertures through which LEDs 14 align and correspond with.

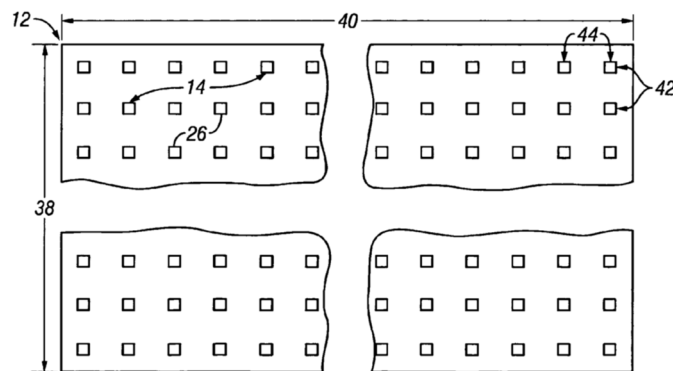
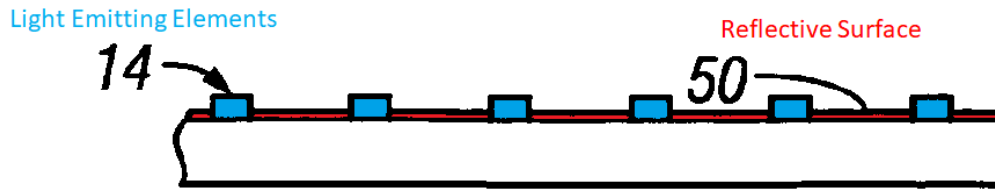


FIG. 2

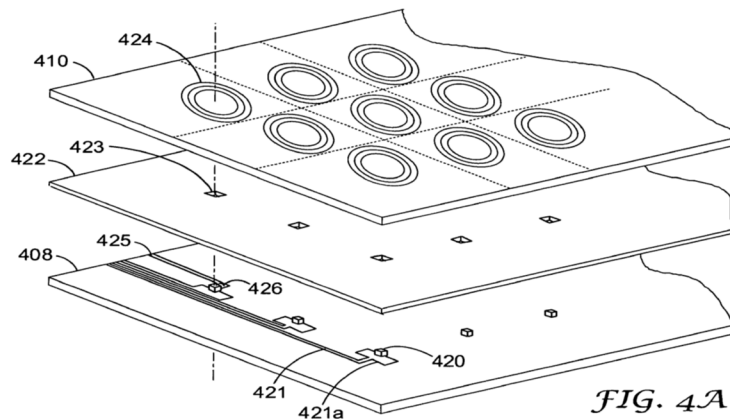
Mok Figure 2.

58. An enlarged and annotated view of the relevant portion Mok Figure 1, as shown below, further demonstrates how Mok discloses a base panel 12 covered with a reflective surface 50.



Mok, Figure 1 (annotated).

59. Similarly, Epstein describes a reflector 422 with a guiding layer 410, stating that “the guiding layer 410 may include an array of light extraction elements 424 associated with each LED 420. The intermediate layer 422 includes apertures 423, also referred to as vias, that are registered to the LEDs 420 disposed on the substrate 408.” Epstein, [0048].



Epstein, Fig. 4A.

E. Brightness Enhancing Films (BEFs) were Known in the Art, and It was Known that BEFs Preferentially Emit Light in a First Orientation and Reflect Light Having a Second Different Orientation (Claims 1D and 1F)

60. The claims of the '075 Patent further require a Brightness Enhancing Film (“BEF”). Such films were known in the art, and the claims recite

functionality performed by these BEFs. It was known that BEFs performed functionality like “preferentially emit[ing] 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.”

61. As to the positioning of the Brightness enhancing film, the claims of the '075 patent state “a brightness enhancement film on the reflector sheet.” As the '075 patent explains, “on” means directly on or with intervening elements in between. *See* '075 Patent, 6:47-51 (“It will be understood that when an element such as a layer, region or substrate is referred to as being ‘on’ or extending ‘onto’ another element, it can be directly on or extend directly onto the other element or intervening elements may also be present.”). Either interpretation of “on,” i.e., “directly on” or “with intervening elements in between,” was known in the prior art.

62. For example, Mok describes a brightness enhancer 18 that is a brightness enhancement film. Mok, [0024] (“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.”). Mok describes that the brightness enhancer collects light from the diffuser 16 and directs it out the front surface 52 of the brightness enhancer 18, thereby maximizing the on-axis brightness of the panel. Mock, [0024].

63. Mok, discloses that the BEF preferentially emits light having a first orientation and preferentially reflects light having a second orientation, which is different from the first orientation. First, BEFs are designed and configured to work in this manner. Mok reinforces this point when it describes the use of “light conditioners” to, on the one hand, diffuse light to create uniform lighting within the panel and on the other hand to use a “brightness enhancer” to collect diffused light and direct it out of a front surface to “maximize the on-axis brightness of the light emitting panel.” Mok, [0015]. Mok similarly describes the concept of recycling light, although in relation to light reflected by the diffuser. Mok, [0024]. The same phenomenon occurs with brightness enhancement films, including the specific brightness enhancement film referenced by Mok. *See* Mok, [0024] (referencing 3M’s BEF sold under the tradename Vikuiti®).

64. Similarly, Lamb relates to backlighting systems to be used with liquid crystal displays and provides explicit disclosures related to the refraction and recycling of light by brightness enhancement films. Lamb, [0035] (“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.”)

65. Lamb discloses the same structures disclosed in Mok, such as LEDs, a reflector, a brightness enhancement film, and a diffuser. Lamb, [0010], [0035],

[0039]. Mok and Lamb also both teach that the brightness enhancement film may be Vikuiti Brightness Enhancement Film (BEF), available from 3M Company. *See* Mok, [0024]; Lamb, [0035]. Lamb discloses that an “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.” Lamb, [0035].

66. Mok further discloses that the BEF is on the reflector. For example, Figure 1 shows that the BEF 18 is on diffuser 16 with an intervening area of air, while the diffuser 16 is on the reflector 12 with an intervening area of air. Mok shows the diffuser and air gaps as intervening elements such that the BEF is on the reflector. *See* Mok, Fig. 1.

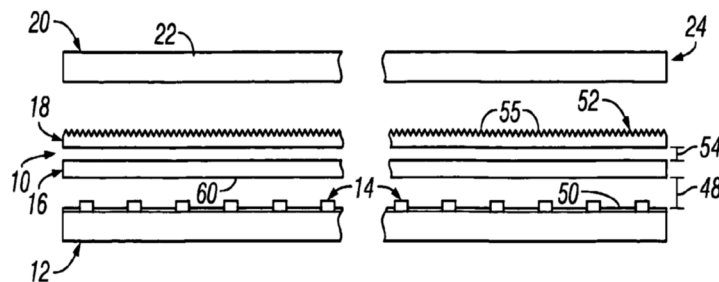


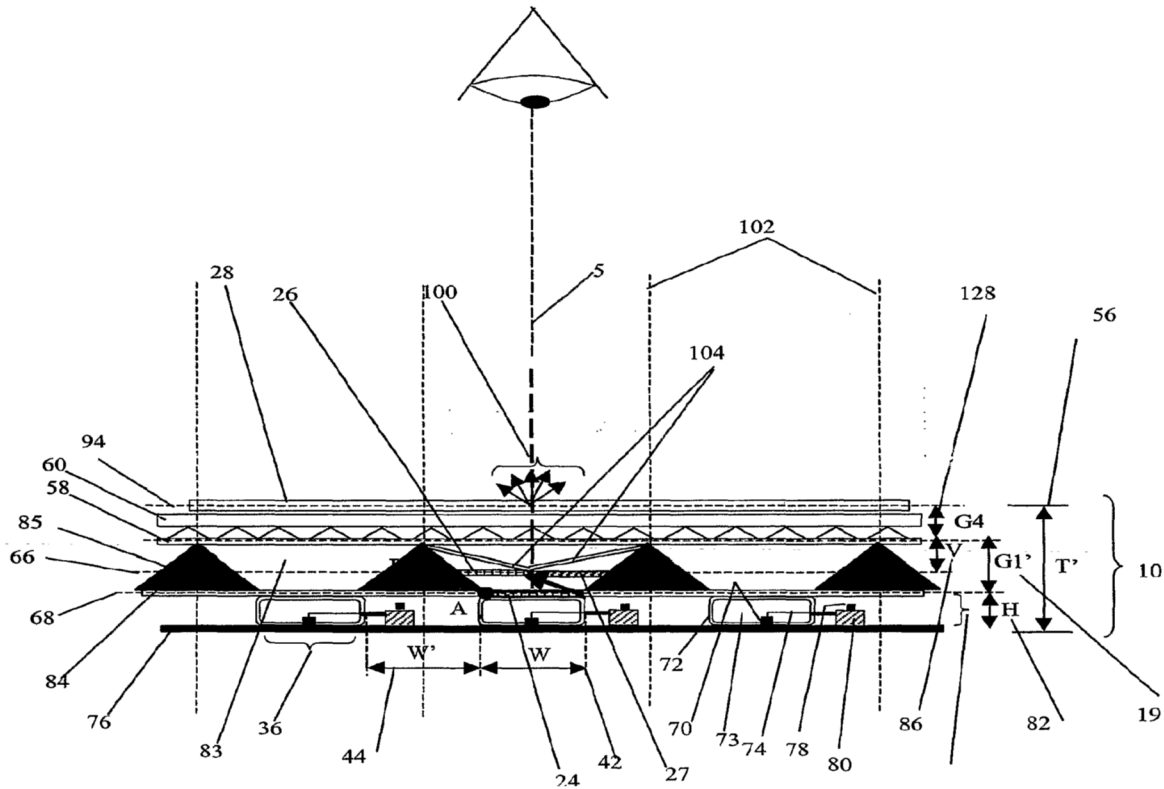
FIG. 1

67. To the extent that an air gap is not an intervening element, various other configurations and arrangements of films, sheets, and surfaces were known. For example, Holman describes and shows a brightness enhancement film on a reflector sheet without an intervening air gap. First, Holman discloses the use of

orthogonal, elevated prism sheets 58 and 60. *See, e.g.*, Holman, pp. 9-10, Prism sheets 58 and 60 are brightness enhancement films. Holman, pp. 9-10; *see also*, pp. 7-8 (explicitly disclosing that the prism sheet “may be one of the 90-degree offerings manufactured by the Minnesota Mining & Manufacturing Company (3M) under the trade name BEF, as in brightness enhancement film.”). Holman also explains that the prism sheets perform the same function as 3M’s trademarked BEFs. Holman, p. 121.

68. As to the physical arrangement of the prism sheets, Holman discloses that prism sheets 58 and 60 are on the reflector (i.e., “reflecting layer 76”) via intervening elements that include “confining structure 72” (*see* Holman., pp. 36-37), “diffusely scattering layer 68” (Holman, p. 43), “compartmentalized spacer layer 84” and “sidewalls 85” (Holman., p. 15). Holman’s Figures 7 also shows a “stacked” arrangement where the brightness enhancement films (58) is “on” the reflector (76):

FIG. 7



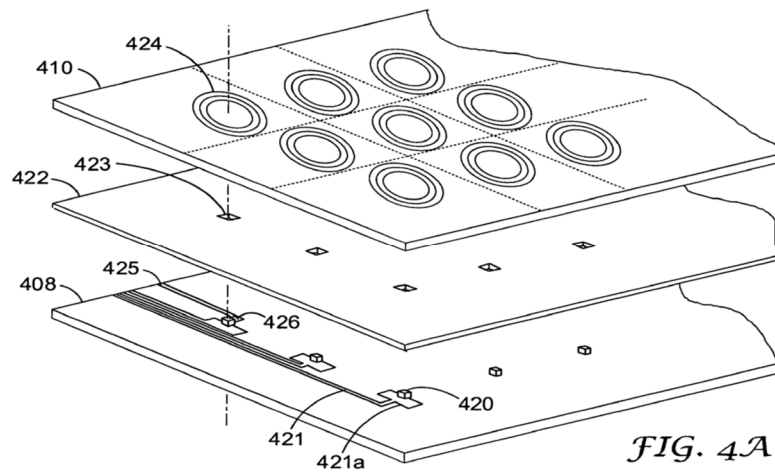
Holman, Figure 7.

69. Holman also describes another stacked arrangement whereby the brightness enhancement film is on the reflector. *See* Holman, Figure 8. For example, Holman discloses a brightness enhancement film 131 that rests on a transparent dielectric material 144. The transparent dielectric material rests on diffusely scattering layer 68, which in turn rests on confining structure 72. Confining structure 72 abuts reflector 76. *See* Holman, FIG. 8:

70. Similarly, Epstein discloses a BEF. With respect to Figure 6, Epstein describes the use of a brightness enhancing film (BEF) 662 and 664, stating that “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.” Epstein, [0074].

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422 is on one side of the substrate (408), followed by a guiding layer 410 that also includes an array of light extraction elements 424 associated with each LED 420.



Epstein, Fig. 4A

72. Epstein's Figure 6 shows the physical relationship between these various layers as the reflective layer 622 is on the substrate 608, which the reflector 622 is bonded to, with the guiding layer 610 above the reflective layer 622. *See, e.g.,* Epstein Figures 6, 10A, 12 (*see also* similar disclosures in FIG. 4A). Because the '075 patent explains that "on" means directly on or with intervening elements in between (*See* '075 Patent, 6:47-51), Epstein's BEF 662 is on the reflector 622 with intervening element 610 in between.

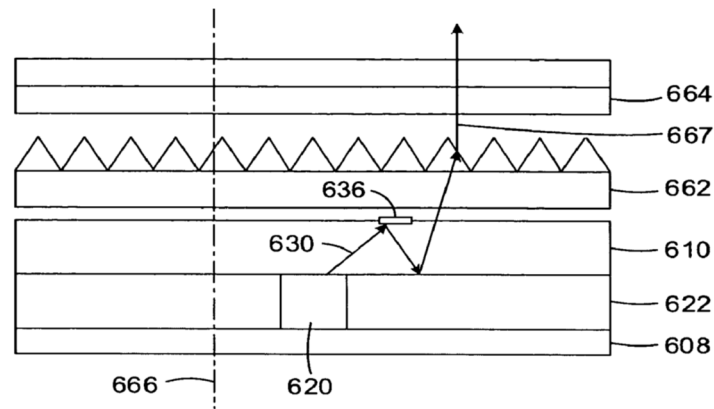


FIG. 11

Epstein, Fig. 11.

73. Epstein, as shown in Figure 11 above, discloses that “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.” Epstein, [0074]. Epstein further discloses that the intermediate layer 622 may be a reflector that causes some depolarization so that the light reflected may be recycled and passed through a reflective polarizer, in addition to stating that “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.” Epstein, [0074] & [0076].

F. BEFs Comprising 3D Light Extraction Features that Bend Light Rays Toward the Directional Normal to the Principal Plane of the Lighting Panel were Known in the Art. (Claim 5)

74. Claim 5 of the '075 Patent states that “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.” Such three-dimensional light extraction features used on a BEF were known in the art.

75. For example, Mok describes that a “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.” Mok, [0021]. Prisms are three dimensional structures, and a person of skill in the art would understand that maximizing “on-axis brightness” includes bending at least some light rays toward the direction normal to the principal plane of the lighting panel.

76. Similarly, Lamb discloses the use of brightness enhancement film or another suitable prismatic film or structure in combination with a reflective polarizer as part of a recycling enhancement structure 112 and 114. Lamb, [0044]-[0046]. Lamb teaches that the prismatic structures prismatic structures, such as BEF, “redirect and recycle light to increase on-axis output brightness of the

backlighting system 200 by refracting toward the viewer light within a certain angle and reflecting back light outside that angle.” Lamb, [0052]. A person of ordinary skill in the art would understand that this disclosure teaches bending at least some light rays toward the direction normal to the principal plane of the lighting panel.

77. Epstein describes a BEF, which “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.” Epstein, [0074]. Figure 11 shows “a diffractive light extraction element 636 [that] 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.” Epstein, [0074]. Accordingly, Epstein discloses three dimensional structures, i.e. prismatic elements, as part of the BEF that will bend light in a direction normal to the principal pane of the lighting panel.

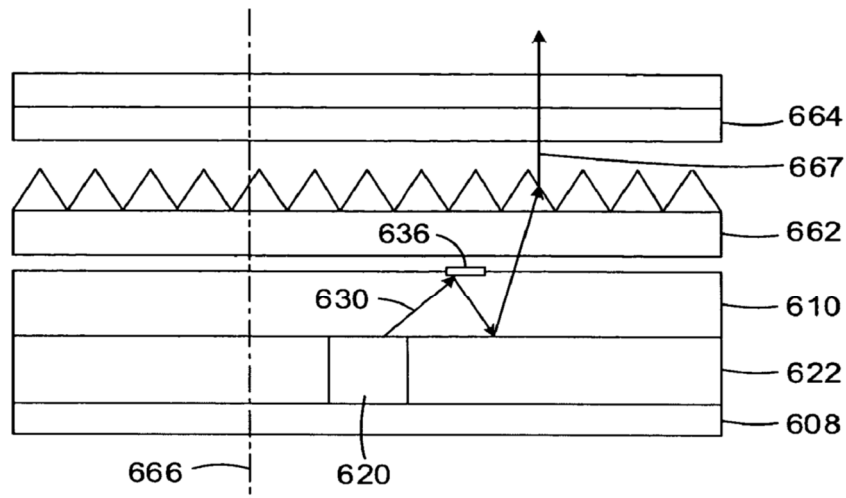


FIG. 11

Epstein, Figure 1.

G. BEFs Comprising Random 3D Light Extraction Features were Known in the Art. (Claim 9)

78. Claim 9 of the '075 Patent further requires that “the light extraction features are random features.” As discussed above, BEFs including surface features were known in the art. A of ordinary skill in the art would further understand that Random 3D Light Extraction Features were known in the art and would have incorporated them into the disclosures of Mok or Epstein.

79. For example, Lamb describes the “randomization” of the polarization and direction of light. Lamb [0042]. This further shows that it would have been obvious to a person of ordinary skill in the art to modify the shown invention to include a plurality of other, random light extraction features.

80. Additional related prior art in peer reviewed academic literature describes the use of a random 3-d grating structure to improve brightness and uniformity of light emitted from a LCD display. The use of randomly patterned optical components was well understood to avoid the creation of moire patterns which are optical interference patterns resulting from regular optical elements acting on the light from a display. *See, e.g.*, Ex. 1015 at 6 (“By optimizing the grating pitches and orientations of RG-LCF [Random Grating Light Control Film], the reflective light distribution can be well controlled and results in high brightness, wide viewing angle, and high uniformity images.”); at 9 (“RG-LCF [Random Grating Light Control Film], as shown in Fig. 18, which can direct light incident from multiple directions collectively for viewing, can achieve much enhanced brightness of reflective image. The grating pitches and orientations were designed properly to improve the brightness and uniformity. Additionally, the size of each grating is $25 \times 25 \mu\text{m}^2$ and the arrangement in a single pixel is randomized in order to avoid the moiré patterns and dispersion.”). Such patterns would be undesirable for display applications.

81. A person of ordinary skill in the art would further recognize that the LEDs in a backlight are positioned in uniform locations. Thus, including random features on a BEF helps avoid interference effects. This provides a motivation to use randomized patterns on the surface of the BEF. Further, randomized optical

patterns also help to minimize optical dispersion which is the separation of colors, such as with a prism, where in a display the objective is to combine colors. This provides an additional motivation for a person of ordinary skill in the art to apply random patterns to the surface of the BEF.

H. BEFs in which Light Extraction Features Comprise Fresnel-Type Lenses were Known in the Art. (Claim 11)

82. The use of fresnel-type lenses as light extraction features in BEFs was known in the art. Epstein discloses that “the lenses are formed on a lens sheet 1852 as prismatic lenses, for example Fresnel lenses.” Epstein, [0110]. Further, Epstein discloses that “the light extraction prisms are arranged on the second side of the optical sheet as one or more Fresnel lenses.” Epstein, Claim 4. Similarly, Holman discloses that the “lens 356 may be a Fresnel or a pair of Fresnel lens elements.” Holman, pp. 69. A person of ordinary skill in the art would understand that lenses are light extraction features and that Fresnel type lens advantageously allow for thinner optical components and help collimate light. Both of these features are features that would have been compatible with and advance Mok’s goals of creating efficient, thin lighting displays.

83. Thus, Fresnel type lenses were known in the art and a person of skill in the art would have been motivated to apply these features to the disclosures of Mok. By definition, Fresnel lenses have the functionality of a conventional lens but are much thinner since they compress the optical features of the lens into an

almost flat element. Figure 6 of Epstein shows the cross section of a Fresnel lens placed over an LED emitter. Epstein describes that the light going through the Fresnel lens “is directed in forwards direction toward the viewer by the prismatic structures” [Epstein 0067]. This is the same desired functionality for any type of brightness enhancing film – to direct more light toward the viewer. The Fresnel lens type of prismatic structure is another option for achieving this result while maintaining a thin form factor to keep the total display as thin as possible.

I. BEFs that Would “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” were Known in the Art. (Claim 10)

84. Brightness enhancement films are designed to maximize the light directed toward the viewer, in other words increase the amount of light within a solid angle and per area directed toward the viewer. It was well known that BEFs could be configured to encourage light recycling and diffusion of light outside of the desired emission angle. Light not within the desired forward directed angle would be redirected and reflected so that it could have another chance to be within the desired forward angle, and thereby “recycled”. This would increase the efficiency of the display optical system and could serve to diffuse the light as the reflected light would be reflected back at a different angle. A person of skill in the art would recognize that this is the functionality commonly performed by a BEF, i.e., light recycling and diffusion.

85. Lamb expressly discloses recycling enhancement structures 112 and 114, which are brightness enhancement films. Lamb, [0042] and [0044]. As Lamb describes, these “the second recycling enhancement structure 114 includes prismatic structures, e.g., prismatic Structured film, that would aid in redirecting and recycling light to increase on-axis brightness of the backlight 100 by refracting toward the viewer light within a certain angle and reflecting back light outside that angle.” Lamb, [0045]. Thus, Lamb discloses recycling light and thereby limiting direct emission from the lighting panel.

86. Similarly, Epstein describes the use of “one or more brightness enhancing films, available from 3M Company, St. Paul, Minn., under the trade name BEF.” Epstein, [0074]. A BEF limits direct emission as Epstein explicitly teaches that its brightness enhancement film may reflect light, including when a reflective polarizer is used. *See* Epstein, [0074]-[0075].

J. BEFs that are “Configured to Substantially Collimate Light Emitted by the Lighting panel” were Known in the Art. (Claim 12)

87. A person of ordinary skill in the art would recognize that “substantially collimate light” means to substantially align light. This was known in the art.

88. For example, Mok describes that “[t]he 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.” Mok, [0015].

89. Epstein describes that “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.” Epstein, [0074]. Epstein Figure 11 further demonstrates that the light 667 is gathered together in parallel by the BEF, which a person of ordinary skill in the art would understand to be aligning light.

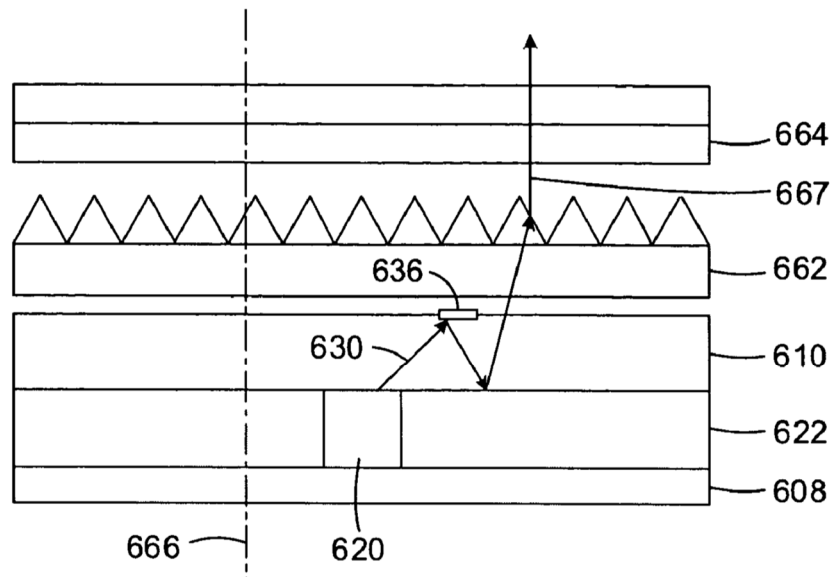


FIG. 11

Epstein, Fig. 11.

K. It was Known in the Art to Position a Reflector Between a Substrate of a Lighting Panel and a BEF (Claim 1E)

90. With respect to the positioning and the reflector, the claims of the '075 Patent further require that “the reflector sheet is arranged between the at least

91. In Mok, the reflector is arranged between the substrate and the BEF.

For example, Mok describes and shows a reflector (reflective surface 50) as between a substrate, which is the base panel 12, and BEF (brightness enhancer 18).

See Mok Figure 1 below.



FIGURE 5B

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92. Holman also shows a reflector arranged between the substrate and brightness enhancement film. *See* Holman, Figure 8.

93. Epstein, as shown in Figure 11, describes a reflector 622 positioned between the substrate and the BEF. *See* Figure 11. As shown, reflector 622 is positioned between the BEFs 662 and 664 and the substrate 608. Epstein, Figure 11.

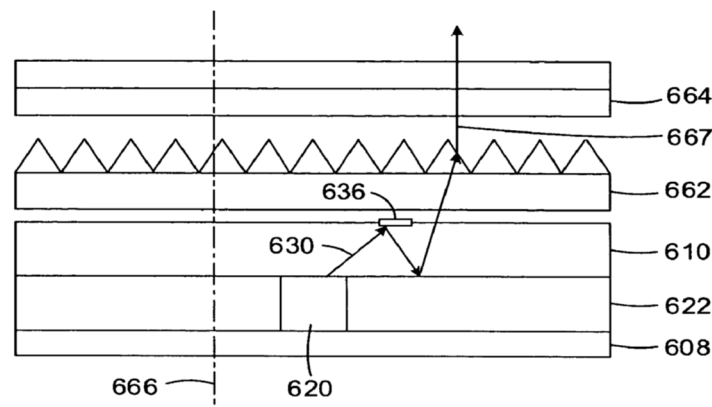


FIG. 11

Epstein, Fig. 11.

L. It was Known in the Art to Use Planar Diffuser Sheets Positioned Between a Reflector and a BEF (Claims 1G and 7)

94. The claims of the '075 Patent further require “a diffuser sheet between the reflector sheet and the brightness enhancement film, wherein the reflector sheet, the diffuser sheet and brightness enhancement film extend and are arranged parallel to the principal plane of the lighting panel” (claim 1G) and “the diffuser sheet is in direct contact with the reflector sheet and the brightness enhancement film.” (claim 7). Such a diffuser sheet was known in the art.

95. As a first example, Mok describes and shows a diffuser sheet (diffuser 16) that is between a reflector (reflective surface 50) and BEF (brightness enhancer 18). *See, e.g.,* Mok, [0022] (describing a “diffuser 16 is positioned in spaced-apart relation to the base panel 12 so that it receives and diffuses light produced by the light emitting elements 14 as well as light that maybe reflected by the reflective surface 50 provided on base panel 12.”). Mok Figure 1 shows those components as extending and being arranged in parallel to the principal plane of the lighting panel.

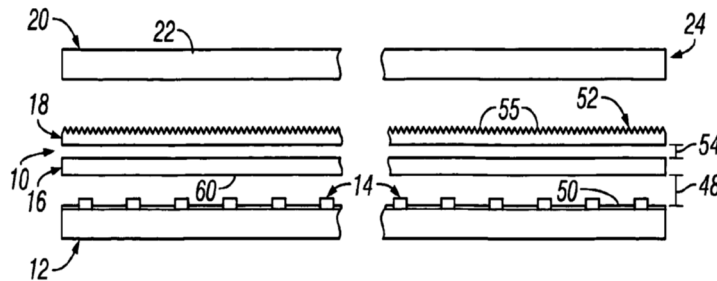


FIG. 1

Mok, Fig. 1.

96. Mok explicitly discloses a diffuser sheet in direct contact with a BEF. *See* Mok, [0025] (“the brightness enhancer 18 is preferably stacked directly on (or applied to) the diffuser 16, thereby minimizing or eliminating the distance 54.”).

97. With respect to direct contact between the reflector sheet and the diffuser sheet, as discussed above, Mok describes a diffuser 16 and a reflective surface 50. Mok describes that the “reflecting surface 50” may be a separate sheet

mounted to base panel 12. Mok, [0021] (“The reflective surface 50 may comprise a separate component (e.g., a sheet-like material) that is affixed to the base panel 12.”). Mok also describes that the reflective surface 50 may be mounted *less than* 50 mm from the base panel. Mok [0023] (“The diffuser 16 may be mounted in front of the base panel 12 and separated therefrom by a spaced-distance 48... 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*.”).

98. A person of ordinary skill in the art would recognize that the distance between diffuser 16 and base panel 12 on which the reflective surface is mounted is already less than 50 mm. Mok [0023]. Further, a person of ordinary skill in the art would recognize that the thickness of the reflective surface 50 is something more than 0 mm. Thus, a person of ordinary skill in the art would recognize that Mok expressly discloses that the distance between the reflective surface 50 and the diffuser 16 is significantly less than 50 mm.

99. Mok further teaches that larger spaces between the diffuser and base panel are “at the expense of panel thickness and some loss of efficiency.” Mok, [0023]. Based on this teaching, and the desire to create a thinner and more efficient display, coupled with Mok’s teaching of reflective surface 50 as a separate sheet like component mounted on the surface of base panel 12 (Mok, [0021]), a person of ordinary skill in the art would recognize that the distance between the reflective

surface 50 in Mok and the diffuser 16 could be reduced so that the diffuser 16 directly contacts the reflective surface 50. A person of ordinary skill in the art would be motivated to make this modification in order to create a thinner and more efficient display, as Mok expressly teaches. Mok, [0023].

100. Similarly, Epstein discloses a diffuser sheet between the reflector sheet and the brightness enhancement film. In particular, Epstein discloses a guiding layer and is explicit that this guiding layer functions as a diffuser, explaining that the guiding layer “spreads” light. *See, e.g.*, Epstein, [0066] (“the guiding layer 510 may be said to guide the light from the LED. Laterally guiding the light away from the LED, also referred to as ***spreading the light***, before directing the light to the viewer may help to reduce the amount of dark space between adjacent light emitting elements of the lighting unit.”). Epstein describes guiding layer 610, which “spreads” light from the LEDs Epstein, [0084] (“Another approach to ***spreading the light from the LED*** 620 within the guiding layer 610 is now discussed with reference to FIG. 19A.”).

101. Epstein describes that guiding layer 610 may include a diffuser. Epstein, [0084] (“A diffuser 1902, such as a volume diffuser, is positioned on the far side of the guiding layer 610 from the LED 620. Where the diffuser 1902 is a volume diffuser, the volume diffuser may be located within the guiding layer 610.... The diffuser 1902 spreads some of the light 1904 laterally so that it can be extracted

from the guiding layer [610].”). Thus, it is my opinion that a person of ordinary skill in the art would recognize that the guiding layer 610 functions as a diffuser.

102. As shown in Epstein Figure 11, the guiding layer 610 (i.e., the diffuser) is positioned between the reflector sheet 622 and the BEFs 662 and 664.

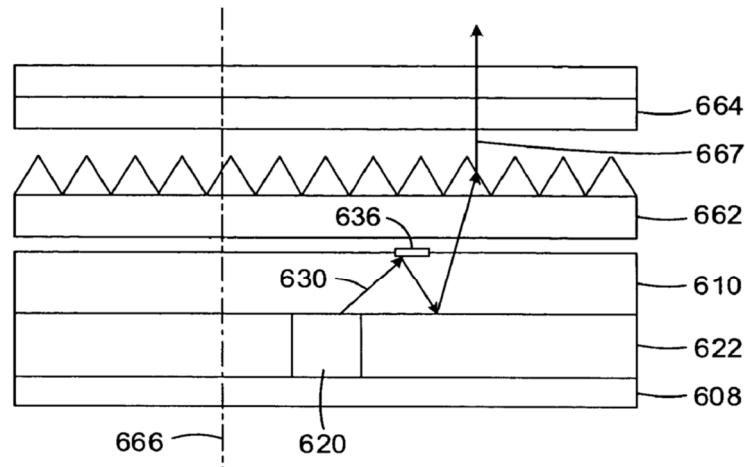


FIG. 11

Epstein, Fig. 11. *See, e.g.* Epstein [0067] (“LED 620 is disposed on a substrate 608 and is surrounded by an intermediate layer 622, which may be a reflecting film”); [0068] (“the light may be reflected back into the guiding layer 610 by the intermediate layer 622”); [0074] (“the combination of the two layers 662 and 664 of brightness enhancing film redirects the light towards the axis 666 in two dimensions.”).

103. Epstein Figure 11 further shows the BEF layers 662 and 664, the reflector 622, and the guiding layer 610 (i.e., a diffuser) arranged in parallel to the principal plane of the lighting panel.

104. Further, Epstein describes and shows a diffuser sheet (guiding layer 610) is in direct contact with the reflector sheet (intermediate layer 622). *See* Epstein Fig. 11 and [0074]-[0075]. Epstein also shows that the BEF 662 is directly on top of the diffuser sheet (guiding layer 610). To the extent that there is any intervening space between the two, in my opinion a person of ordinary skill in the art would have been motivated to modify the arrangement of the layers such that there was no such space, especially given the fact that Epstein recognizes a challenge with prior art systems is that they were “thick and bulky.” Epstein [0003]; Epstein [0123] (“The present invention should not be considered limited to the particular examples described above, but rather should be understood to cover all aspects of the invention as fairly set out in the attached claims. Various modifications, equivalent processes, as well as numerous structures to which the present invention may be applicable will be readily apparent to those of skill in the art to which the present invention is directed upon review of the present specification.”)

M. It was Known in the Art to Include on a Backlight a Heatsink Panel Configured to Draw Heat Away from the Panel in a Direction Opposite to the Direction of Light Emission (Claim 6)

105. Claim 6 of the '075 Patent requires “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.” Such heatsink panels were known in the art and would have been obvious to include in any of these systems.

106. Mok identifies and recognizes the issue of heat generation and dissipation. Mok, [0004] and [0006]. Mok further discloses the use of printed circuit board for a base panel. Mok, [0019]. It was well known at the time, and a person of skill in the art would have recognized that a printed circuit board is a heat sink, as heat is dissipated through electrical connections and the metal base of the printed circuit board.

107. Heat sinks were well known in the art, as demonstrated by Holman. Holman, like Mok, recognizes the need for heat extraction from LEDs which emit light. *See, e.g.*, Holman, pp. 7, 32, and 38. To solve this issue, Holman mentions a need for “adequate heat sinking.” Holman, p. 30. Holman describes a base layer 220 that functions as part of a heat sink. Holman, p. 39. In Holman, the LEDs 70 are mounted to the base layer 220. *See* Holman, Figs. 7 and 13. Light is emitted from the LEDs 70 in a direction away from the base layer 220 and the base layer draws heat away from the LEDs 70 in the direction opposite the direction of light emission. A person of ordinary skill in the art would understand that a base layer that is a heat sink could be easily modified so that a heat sink panel was on one side of the base layer as the purpose of a heat sink is to draw heat away from heat sensitive components, such as light emitting devices.

108. Similarly, Epstein discloses that “[t]he 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 421a to aid in spreading the heat generated by the LEDs 420.” Epstein, [0054]. A person of skill in the art would have understood and recognized that a metallic layer for extracting heat is a heatsink panel. The metallic layer for extracting heat is on the opposite side of the substrate as the LEDs, and thus draws heat away from the direction opposite to the direction of light emission.

VIII. Combination of Mok, Holman, and Lamb

109. As described above, each element of claims 1-7 and 9-12 was known in the art. Further, in my opinion, a person of ordinary skill in the art would have been motivated to modify Mok based on the disclosures of Holman and Lamb discussed above.

110. As of April 21, 2006 a person of ordinary skill in the art would have had the capability to, and would have been motivated to modify the light emitting panel described in Mok to include both (1) features such as the brightness enhancement film and arrangement thereof, fresnel-type lenses, and heatsink panel described in Holman, and (2) features such as the brightness enhancement film with a plurality of three dimensional light extraction features, and a diffuser sheet between the reflector and the brightness enhancement film described in Lamb.

111. A person of ordinary skill in the art would recognize that each of Mok, Holman, and Lamb are in the same field of endeavor, i.e., LED-based lighting devices to provide backlighting for display elements. Consequently, a person of ordinary skill in the art addressing Mok's system would have looked to improvements in similar systems like Holman and Lamb. Further, given the similarities of these references and that each teaches the use of known components according to their well-known function, a person of ordinary skill in the art would have had an expectation of success in combining these references.

112. Mok recognizes certain challenges with lighting panels, such as efficiency. Mok [0006]. Those same challenges are recognized in both Holman and Lamb as well. Holman p. 2, Lamb [0006]. A primary motivation of one of ordinary skill in the art would have been to create a more efficient lighting panel. A person of ordinary skill in the art would have recognized that combining features within Holman would have provided a more efficient lighting panel. For example, Holman states numerous times that an "object of the invention to provide an improved system and a method for homogenizing ... uneven light distribution," which creates a more "efficient and homogenous" illumination system. Holman p. 3-5. Holman aims to do so by using components such as a reflector, diffuser, and brightness enhancement film in various configurations. *See, e.g.*, Holman, pp. 119, 159-160. Those same components are used in various configurations in Mok as

well. *See, e.g.*, Mok [0021], [0024], [0028]. Lamb further states that “there remains a need in the field of backlights for large high-performance LCDS for backlighting systems that... are more efficient” and does so by using components described in Mok, such as a reflector, diffuser, and brightness enhancement film to create a more efficient backlighting system. *See, e.g.*, Lamb [0010], [0017], [0035], [0048].

113. Modifying Mok to include Holman’s specific BEF configuration, wherein the BEF is positioned on a reflector sheet without an intervening air gap would beneficially allow for a thinner panel while maintaining light uniformity. *See, e.g.*, Holman p. 16. A person of ordinary skill in the art would thus be motivated to make this combination. Similarly, incorporating Holman’s plastic diffuse reflector in Mok would provide uniform lighting quality at a lower cost and weight than traditional metal reflectors, and thus a person of ordinary skill in the art would be motivated to make this combination. *See, e.g.*, Holman p. 8. Further, a person of ordinary skill in the art would be motivated to use Holman’s lens array 62 of Fresnel-lenses to increase light diffusion, which improves light uniformity, hence quality for the viewer. In addition, applying Holman’s heatsink panel to Mok to improve cooling and efficient operation of LEDs. A person of ordinary skill in the art would make this modification to maintain operating temperature of the LEDs and their control circuit and thereby enhance longevity.

114. A person of ordinary skill in the art would further have been motivated to apply Lamb's BEF to Mok to eliminate thick diffuser plates, provide increased brightness by recycling light, and increase the exit light's spatial uniformity. Lamb [0008], [0035], [0048]. Further including Lamb's BEF would both increase on axis light, a desirable feature recognized by Lamb and Mok, and increase efficiency by recycling light, another desirable feature of lighting panels.

115. A person of ordinary skill in the art would recognize that each of Mok, Holman, and Lamb describes known methods for improving the lighting quality and efficiency of similar LED-based backlighting systems. Thus, in my opinion a person of ordinary skill in the art would have been motivated to use the improvements described within Holman and Lamb to improve the quality of backlighting provided by the backlighting system described in Mok.

116. As one example of an improvement of this combination, a person of ordinary skill in the art would recognize that the combination of Mok, Holman, and Lamb would provide better light diffusion and thus a better display quality as well as improved efficiency, and this would have provided a motivation to make the combination.

117. Further, because each of these references is in a similar field of endeavor, a person of ordinary skill in the art would have recognized that the combination of these references is nothing more than the combination of known

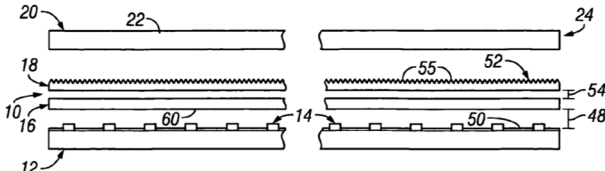
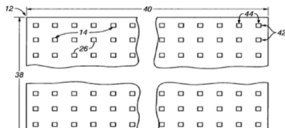
elements in the same field. Thus, combining these three references—Mok, Holman, and Lamb—that all use the same components to achieve the same goal would have been obvious to a person of ordinary skill in the art.

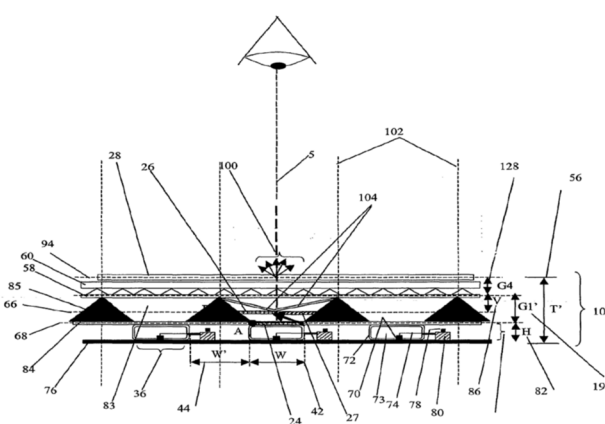
118. With the development of LED backlit LCD technology there were various technical challenges similar to the challenges with CCFL backlit LCDs. The challenges involve trade-offs between efficiency, optical uniformity, display performance, cost, and thickness of the backlit system. Engineers would use well known components and optical understanding to adjust the technology for use with LEDs and to achieve optimal performance among the known trade-offs.

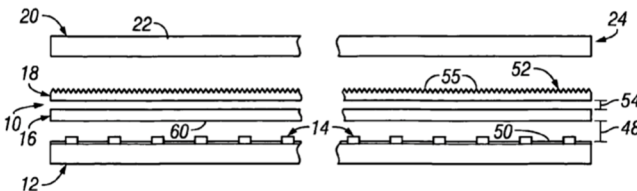
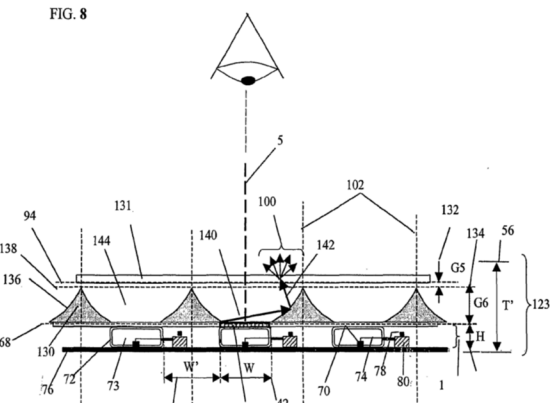
119. Mok describes the basic elements of a LED backlight system including a diffuser and brightness enhancing film located adjacent to the LEDs deployed on a substrate with a reflective coating. While Mok's embodiment does describe recycling of light that is back reflected from the various optical interfaces, Holman and Lamb provide further guidance as to how light outside of the desired emission angle could be recycled, thereby improving efficiency and display performance of the system. Lamb and Holman further describe the use of a diffuser to randomize the light output. As discussed above, the use of random optical features was well understood at the time to reduce interference effects and optical dispersion effects caused by resonant coupling of the light with regular patterns within the optical elements, and thus a person of ordinary skill in the art

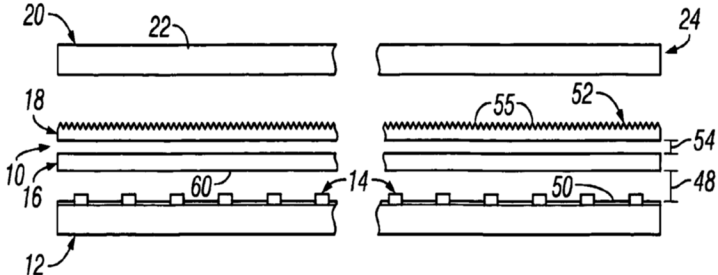
would have been motivated to use these random optical features in the BEF described in Mok.

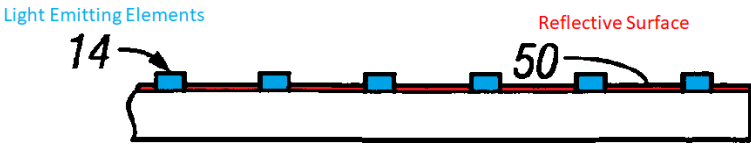
120. The claim chart below further demonstrates that the combination of Mok, Holman, and Lamb discloses or render obvious to a person of ordinary skill in the art each element of claims 1-7 and 9-12 of the '075 Patent.

Claims of the '075 Patent	Mok, Holman, and Lamb
[’075 Claim 1 Preamble] A lighting panel, comprising:	“a light emitting panel.” Mok, Abstract
[’075 Claim 1A] at least one substrate having a first side parallel to a principal plane of the lighting panel;	a base panel 12 that “provides a convenient mounting location for the various light emitting elements” Mok, [0019]. Mok, Fig. 1  FIG. 1
[’075 Claim 1B] a plurality of solid state lighting devices arranged on the first side of the at least one substrate and configured to emit light;	“[t]he 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.” Mok, [0019]. Mok describes the use of a “plurality of LEDs arranged in a two-dimensional array” [0005]. LEDs are a type of solid state lighting devices. Mok, Fig. 2  FIG. 2

Claims of the '075 Patent	Mok, Holman, and Lamb
['075 Claim 1C] a reflector sheet on the first side of the at least one substrate;	“[t]he reflective surface 50 may comprise a separate component (e.g., a sheet-like material) that is affixed to the base panel 12.” Mok, [0021]. Mok, Fig. 1
['075 Claim 1D] a brightness enhancement film on the reflector sheet,	“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.” Mok, [0024]. Mok, Fig. 1 the prism sheet “may be one of the 90-degree offerings manufactured by the Minnesota Mining & Manufacturing Company (3M) under the trade name BEF, as in brightness enhancement film.” Holman, pp.7-8. Holman, Figs. 7, 8 FIG. 7 
['075 Claim 1E] wherein the reflector sheet is arranged between the at least one substrate and the brightness enhancement film and	Mok, Figs. 1. Reflector is element 50, substrate is element 12 (referred to as a base panel) which has a plurality of light emitting elements, and a brightness enhancing film is element 18. Mok [0015]

Claims of the '075 Patent	Mok, Holman, and Lamb
	 FIG. 1 Holman, Fig. 8  FIG. 8
[’075 Claim 1F] 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	Mok, [0015] (Mok describes the use of “light conditioners” to, on the one hand, diffuse light to create uniform lighting within the panel and on the other hand to use a “brightness enhancer” to collect diffused light and direct it out of a front surface to “maximize the on-axis brightness of the light emitting panel.”) Mok, [0024]. (“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.”) According to basic optical principles, light beyond the critical angle based on Snell’s law corresponds to a second orientation that will be reflected back from the back surface of the BEF.

Claims of the '075 Patent	Mok, Holman, and Lamb
	Lamb, [0035] (“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.”)
[’075 Claim 1G] a diffuser sheet between the reflector sheet and the brightness enhancement film, wherein the reflector sheet, the diffuser sheet and brightness enhancement film extend and are arranged parallel to the principal plane of the lighting panel.	“diffuser 16 is positioned in spaced-apart relation to the base panel 12 so that it receives and diffuses light produced by the light emitting elements 14 as well as light that maybe reflected by the reflective surface 50 provided on base panel 12.” Mok, [0022]. Mok, Fig. 1  FIG. 1
[’075 Claim 2] The lighting panel of claim 1, wherein the reflector sheet is configured to reflect and disperse light incident thereon.	“The reflective surface 50 may comprise a specular reflective Surface (e.g., aluminum), or a diffuse reflective surface (e.g., white paint).... the reflective surface 50 may be deposited directly on the base panel 12 by any of a wide range of processes suitable for depositing the particular type of reflective material that is to be used.” Mok, [0021] Mok, [0021] (“The reflective surface 50 may comprise a separate component (e.g., a sheet-like material) that is affixed to the base panel 12.”)

Claims of the '075 Patent	Mok, Holman, and Lamb
	Mok, claim 12 (“The light emitting panel of claim 10, wherein said reflective surface comprises a diffuse reflective surface.”) By definition, a diffuse reflective surface will reflect and disperse incident light.
[’075 Claim 3] The lighting panel of claim 1, 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.	“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.” Mok, [0019] Mok, [0021] (“The reflective surface 50 may comprise a separate component (e.g., a sheet-like material) that is affixed to the base panel 12.”). Mok, Figs. 1, 2.  Mok, Figure 1 (annotated);
[’075 Claim 4] The lighting panel of claim 1, wherein the reflector sheet comprises a plastic foam.	Holman discloses a reflector that may be composed of a plastic material. Holman, p. 8. Plastic is a generic term, and plastic foams were well known in the art as shown by Ko (Ko, [0056] (“[p]olymer foams may also be used” to form the substrate)) such that using a plastic foam as the plastic described in Holman in the backlighting panels of Mok.
[’075 Claim 5] The lighting panel of claim 1, wherein the brightness enhancement film	“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

Claims of the '075 Patent	Mok, Holman, and Lamb
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.	front surface 52 of the brightness enhancer 18. The brightness enhancer 18 thereby maximizes the on-axis brightness of the panel 10.” Mok, [0021]. Prismatic structures “redirect and recycle light to increase on-axis output brightness of the backlighting system 200 by refracting toward the viewer light within a certain angle and reflecting back light outside that angle.” Lamb, [0052] Lamb, [0044]-[0046].
[’075 Claim 6] 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.	Mok, [0004], [0006] discuss heat generation and dissipation. Holman, pp. 7, 32, and 38 discusses heat extraction from LEDs. Holman discusses a base layer 220 that functions as part of a heat sink. Holman, p. 39
[’075 Claim 7] The lighting panel of claim 1, wherein the diffuser sheet is in direct contact with the reflector sheet and the brightness enhancement film.	Mok, [0025] (“the brightness enhancer 18 is preferably stacked directly on (or applied to) the diffuser 16”). Mok, [0021] (“The reflective surface 50 may comprise a separate component (e.g., a sheet-like material) that is affixed to the base panel 12.”). Mok, [0023] (“The diffuser 16 may be mounted in front of the base panel 12 and separated therefrom by a spaced-distance 48... By way of example, in one

Claims of the '075 Patent	Mok, Holman, and Lamb
	embodiment, the diffuser 16 is separated from the base panel 12 by a distance 48 of about 50 millimeters (mm) or less.”).
[’075 Claim 9] The lighting panel of claim 5, wherein the light extraction features are random features.	Lamb, [0042] discusses randomization of light direction. Random optical extraction features were a known optical concept to reduce dispersion and interference effects caused by regular patterns.
[’075 Claim 10] The lighting panel of claim 5, 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.	Mok discloses a BEF. Mock, [0024] (“the brightness enhancer 18 comprises a brightness enhance film (BEF).”). Lamb discloses recycling enhancement structures 112 and 114, which are BEFs. Lamb, [0042] and [0044]. “the second recycling enhancement structure 114 includes prismatic structures, e.g., prismatic structured film, that would aid in redirecting and recycling light to increase on-axis brightness of the backlight 100 by refracting toward the viewer light within a certain angle and reflecting back light outside that angle.” Lamb, [0045].
[’075 Claim 11] The lighting panel of claim 5, wherein the light extraction features comprise fresnel-type lenses.	“lens 356 may be a Fresnel or a pair of Fresnel lens elements.” Holman, p. 69.
[’075 Claim 12] The lighting panel of claim 5, wherein the brightness	“[t]he 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

Claims of the '075 Patent	Mok, Holman, and Lamb
enhancement film is configured to substantially collimate light emitted by the lighting panel.	the on-axis brightness of the light emitting panel 10.” Mok, [0015].

IX. Combination of Epstein, Holman, and Lamb

121. As described above, each element of claims 1-7 and 9-12 was known in the art. Further, in my opinion, a person of ordinary skill in the art would have been motivated to modify Epstein based on the disclosures of Holman and Lamb discussed above.

122. As of April 21, 2006 a person of ordinary skill in the art would have had the capability to, and would have been motivated to modify the light emitting panel described in Epstein to include both (1) features such as the brightness enhancement film on a reflector as described in Holman, and (2) the express functionality for a brightness enhancement film described by Lamb.

123. A person of ordinary skill in the art would recognize that each of Epstein, Holman, and Lamb are in the same field of endeavor, i.e., LED-based lighting devices to provide backlighting for display elements. Consequently, a person of ordinary skill would have had a reasonable expectation of success in combining their various disclosures to produce a lighting panel. Furthermore, it was well within the technical ability of a person of ordinary skill at the time to

incorporate the improvements to backlighting systems described in Holman and Lamb into the lighting device disclosed by Epstein.

124. Epstein, Holman, and Lamb are all aimed at the same goal—increasing the efficiency of lighting systems. Epstein [0121]; Holman p. 2, Lamb [0006]. Epstein and Holman describe accomplishing those similar functions by using the same components—LED light sources, reflectors, diffusers, and brightness enhancement films—in a variety of configurations. The same is true for Epstein and Lamb, which also both describe improved backlighting systems using similar components like a reflector, a diffuser, and a brightness enhancement film. *See, e.g.*, Lamb [0035], [0048]. The three references similarly discuss ways to improve light output and manage light uniformity by using a variety of films, layers, and structures and by modifying and arranging these structures in a variety of physical configurations.

125. A person of ordinary skill in the art would have recognized that each of Epstein, Holman, and Lamb describes known methods for improving the lighting quality and efficiency of similar LED-based backlighting systems. A person of ordinary skill in the art would have been motivated to use the improvements described within Holman and Lamb to improve the quality of backlighting provided by the backlighting system described in Epstein. A person of ordinary skill would have recognized that the combination would have provided

better light diffusion and thus a better display quality as well as improved efficiency, and this would have provided a motivation to make the combination. This combination is nothing more than the combination of known elements from similar references in a similar area.

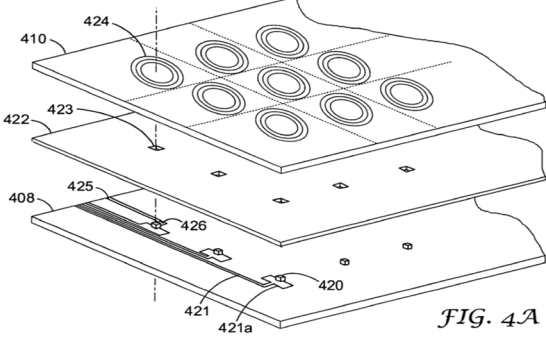
126. Epstein, Lamb, Holman describe similar approaches of using known optical principles and elements to balance efficiency, display performance, thickness, and cost factors. To the extent a specific optical element is not explicitly described in one of these references, it would be obvious to use known optical elements which are described in the other references and were generally known at the time. As discussed above, the use of random optical features was well understood at the time to reduce interference effects and optical dispersion effects caused by resonant coupling of the light with regular patterns within the optical elements, and thus a person of ordinary skill in the art would have been motivated to use these random optical features in the BEF described in Epstein.

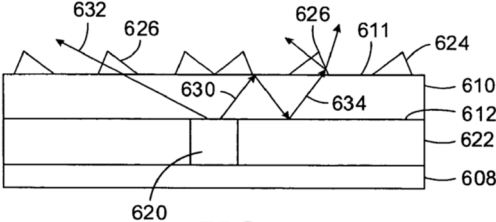
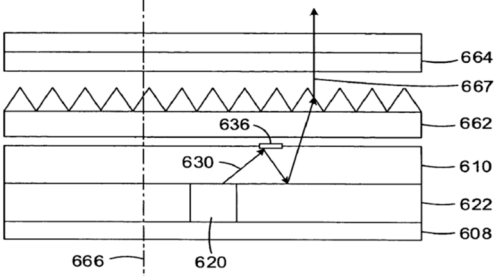
127. A person of ordinary skill in the art would be motivated to modify Epstein to include Holman's specific arrangement of BEF configuration, wherein the BEF is positioned on a reflector sheet without an intervening air gap. This positioning allows for a thinner panel while maintaining light uniformity. *See, e.g.,* Holman p. 16. A person of ordinary skill in the art would be motivated to make this combination in order to produce a thinner display panel. Further, a person of

ordinary skill in the art would be motivated to use Holman's plastic diffuse reflector in Epstein to provide uniform lighting quality at a lower cost and weight than traditional metal reflectors. *See e.g.*, Holman p. 8. A person of ordinary skill in the art would further have been motivated to apply Lamb's BEF to the Epstein-Holman combination to eliminate thick diffuser plates, provide increased brightness by recycling light, and increase the exit light's spatial uniformity. Lamb [0008], [0035], [0048].

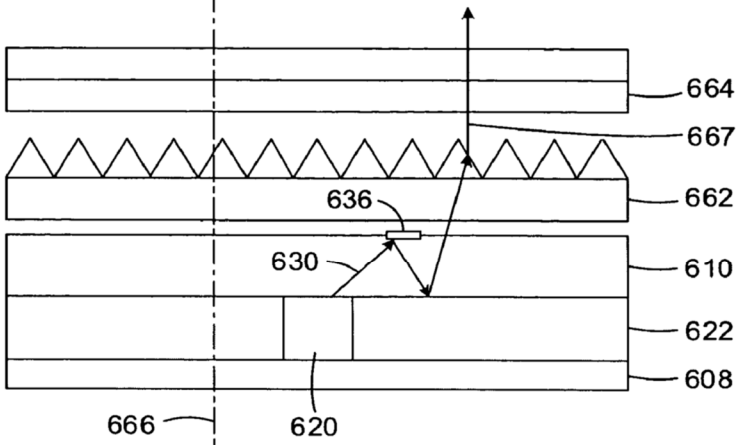
128. Further, a person of ordinary skill in the art would be motivated to use plastic foam as the reflector sheet. Plastic foams are lightweight, thin, and inexpensive, and thus a person of ordinary skill in the art would be motivated to use a plastic foam as a reflector sheet. As a transparent diffuser option, the use of plastic foam as a diffuse reflector would have similar and predictable reflective performance. The reflectance and diffusion properties would be a function of the specific plastic foam properties, thickness, and substrate material. A person of skill in the art would have further recognized that the selection of a plastic foam to act as the reflector is simply a design-choice that a person of ordinary skill in the art would have made based on the desired thickness and reflectance of the foam material.

129. The claim chart below further demonstrates that the combination of Epstein, Holman, and Lamb discloses or render obvious to a person of ordinary skill in the art each element of claims 1-7 and 9-12 of the '075 Patent.

Claims of the '075 Patent	Epstein, Holman, and Lamb
['075 Claim 1 Preamble] A lighting panel, comprising:	“backlighting of liquid crystal displays.” Epstein Abstract.
['075 Claim 1A] at least one substrate having a first side parallel to a principal plane of the lighting panel;	“lighting unit 400 comprises a substrate 408 on which are arrayed a number of LEDs 420.” Epstein, [0046]. Epstein, Fig. 4A  <i>FIG. 4A</i>
['075 Claim 1B] a plurality of solid state lighting devices arranged on the first side of the at least one substrate and configured to emit light;	Epstein, [0046] discusses LEDs in an array on substrate 408.
['075 Claim 1C] a reflector sheet on the first side of the at least one substrate;	Epstein, [0048] & [0067] discuss a reflector on a substrate Also figure 4D element 422, also 622 of figure 6 Epstein, Fig. 6

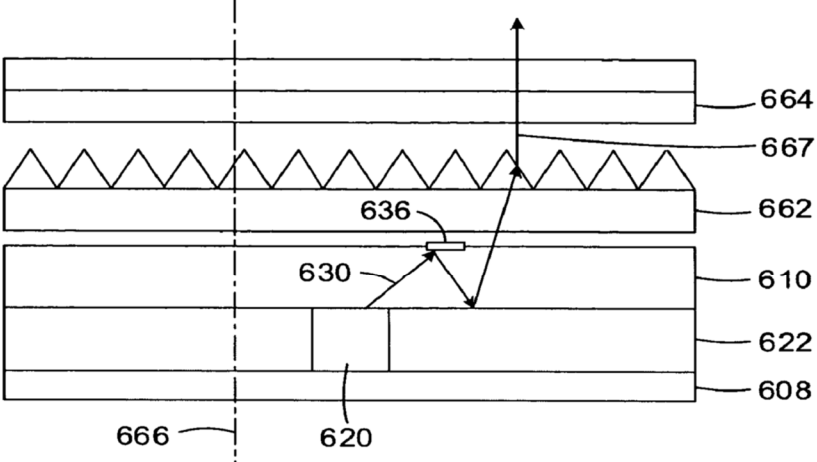
Claims of the '075 Patent	Epstein, Holman, and Lamb
	 <i>FIG. 6</i>
['075 Claim 1D] a brightness enhancement film on the reflector sheet,	Epstein, [0074] (“one or more brightness enhancing films, available from 3M Company, St. Paul, Minn., under the trade name BEF, may be used to direct the light more in a direction perpendicular to the substrate 608.”) Epstein, Figs. 4, 6, 10A, 11, 12  <i>FIG. 11</i> the prism sheet “may be one of the 90-degree offerings manufactured by the Minnesota Mining & Manufacturing Company (3M) under the trade name BEF, as in brightness enhancement film.” Holman, pp.7-8. Figs. 7, 8

Claims of the '075 Patent	Epstein, Holman, and Lamb
orientation, different from the first orientation, back into the lighting panel; and	
['075 Claim 1G] a diffuser sheet between the reflector sheet and the brightness enhancement film, wherein the reflector sheet, the diffuser sheet and brightness enhancement film extend and are arranged parallel to the principal plane of the lighting panel.	Epstein, [0066] (“the guiding layer 510 may be said to guide the light from the LED. Laterally guiding the light away from the LED, also referred to as spreading the light, before directing the light to the viewer may help to reduce the amount of dark space between adjacent light emitting elements of the lighting unit.”) Epstein, [0084] (“Another approach to spreading the light from the LED 620 within the guiding layer 610 is now discussed with reference to FIG. 19A.”). Epstein, [0084] (“A diffuser 1902, such as a volume diffuser, is positioned on the far side of the guiding layer 610 from the LED 620. Where the diffuser 1902 is a volume diffuser, the volume diffuser may be located within the guiding layer 610.... The diffuser 1902 spreads some of the light 1904 laterally so that it can be extracted from the guiding layer [610].”). Epstein [0067] (“LED 620 is disposed on a substrate 608 and is surrounded by an intermediate layer 622, which may be a reflecting film”) [0068] (“the light may be reflected back into the guiding layer 610 by the intermediate layer 622”) [0074] (“the combination of the two layers 662 and 664 of brightness enhancing film redirects the light towards the axis 666 in two dimensions.”).

Claims of the '075 Patent	Epstein, Holman, and Lamb
	 FIG. 11 Epstein, Fig. 11.
[’075 Claim 2] The lighting panel of claim 1, wherein the reflector sheet is configured to reflect and disperse light incident thereon.	Epstein discloses a reflector that may comprise a “multilayer dielectric coating.” Epstein [0048] (“a multi-layer polymer reflective film such as Vikuiti™ ESR film available from 3M Company, St. Paul, Minn,” “a white diffuse reflector such as a matrix containing diffusely reflecting particles,” or “some other type of reflector, such as a metalized layer or multilayer dielectric coating.”). Epstein, [0081] (“Another example is schematically illustrated in FIG. 15B, in which the upper surface of the reflective intermediate layer 622, and/or the lower surface of the guiding layer 610, is provided with patches 695 of diffusely reflective light extraction material, such as a white pigmented material.”) Further, “different types of reflector may be used on the lower surface 612. For example, the lower surface 612 may be coated with a reflecting film.” Epstein [0079].
[’075 Claim 3] The lighting panel of claim 1, wherein the	“the guiding layer 410 may include an array of light extraction elements 424 associated with each LED 420. The intermediate layer 422 includes apertures 423, also referred

Claims of the '075 Patent	Epstein, Holman, and Lamb
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.	to as vias, that are registered to the LEDs 420 disposed on the substrate 408.” Epstein, [0048]. Epstein, Fig. 4A
[’075 Claim 4] The lighting panel of claim 1, wherein the reflector sheet comprises a plastic foam.	Epstein, [0008] discusses a reflector sheet. Epstein, [0048] (“a multi-layer polymer reflective film such as Vikuiti™ ESR film available from 3M Company, St. Paul, Minn.”) Holman discusses a reflector may be composed of a plastic material. Holman, p. 8. Plastic is a generic term, and plastic foams were well known in the art as shown by Ko (“[p]olymer foams may also be used” to form the substrate. Ko, [0056]).
[’075 Claim 5] The lighting panel of claim 1, wherein the brightness enhancement film comprises a plurality of three dimensional light	BEF “typically comprise[s] 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.” Epstein, [0074]. Figure 11 shows “a diffractive light extraction element 636 [that] 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

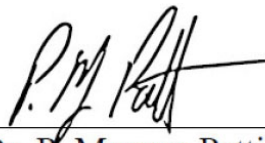
Claims of the '075 Patent	Epstein, Holman, and Lamb
extraction features configured to bend at least some light rays passing through the brightness enhancement film toward the direction normal to the principal plane of the lighting panel.	second direction that is closer to the axis 666 than the first direction.” Epstein, [0074]. Epstein, Fig. 11.
[’075 Claim 6] 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..	“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 421a to aid in spreading the heat generated by the LEDs 420.” Epstein, [0054].
[’075 Claim 7] The lighting panel of claim 1, wherein the diffuser sheet is in direct contact with	Epstein, [0048], [0074], [0084]; Figs. 11, 19A.

Claims of the '075 Patent	Epstein, Holman, and Lamb
the reflector sheet and the brightness enhancement film.	 FIG. 11 Epstein, Fig. 11
[’075 Claim 9] The lighting panel of claim 5, wherein the light extraction features are random features.	“[t]he present invention should not be considered limited to the particular examples described above, but rather should be understood to cover all aspects of the invention as fairly set out in the attached claims. Various modifications, equivalent processes, as well as numerous structures to which the present invention may be applicable will be readily apparent to those of skill in the art to which the present invention is directed upon review of the present specification. The claims are intended to cover such modifications and devices.” Epstein [0123]. Epstein, [0074], [0075]. Lamb, [0042] discusses randomization of light direction
[’075 Claim 10] The lighting panel of claim 5, wherein the brightness enhancement film	“one or more brightness enhancing films, available from 3M Company, St. Paul, Minn., under the trade name BEF.” Epstein, [0074]. Epstein, [0075]

Claims of the '075 Patent	Epstein, Holman, and Lamb
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.	Lamb, [0042], [0044], [0045] discuss light recycling
['075 Claim 11] The lighting panel of claim 5, wherein the light extraction features comprise fresnel-type lenses.	“the lenses are formed on a lens sheet 1852 as prismatic lenses, for example Fresnel lenses.” Epstein, [0110]. Epstein, claim 4.
['075 Claim 12] The lighting panel of claim 5, wherein the brightness enhancement film is configured to substantially collimate light emitted by the lighting panel.	that “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.” Epstein, [0074]. Epstein, Fig. 11.

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.

September 12, 2023
Date



Dr. F. Morgan Pattison