

EXHIBIT 1003

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

TCL Electronics Holdings Ltd. (f/k/a TCL Multimedia Technology Holdings, Ltd.
TCL Industries Holdings Co., Ltd.
TCL Industries Holdings (H.K.) Limited
TTE Technology, Inc. (d/b/a TCL North America)
TTE Corporation
TCL Moka International Limited
TCL Moka Manufacturing S.A. de C.V.
TCL King Electrical Appliances (Huizhou) Co. Ltd.
Manufacturas Avanzadas S.A. de C.V.
TCL Smart Device (Vietnam) Co., Ltd
Shenzhen TCL New Technology Co., Ltd.
TCL Optoelectronics Technology (Huizhou) Co., Ltd.
TCL Overseas Marketing Ltd.
TCL Technology Group Corporation (f/k/a TCL Corp.),
Petitioners

v.

LG Electronics Inc.,
Patent Owner.

Case No. IPR2023-00239

U.S. Patent No. 9,080,740

DECLARATION OF THOMAS CREDELLE IN SUPPORT OF PETITION FOR
INTER PARTES REVIEW OF U.S. PATENT NO. 9,080,740

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EXHIBITS CONSIDERED

Exhibit No.	Description
1001	U.S. Patent No. 9,080,740 to Kim et al.
1002	INTENTIONALLY LEFT BLANK
1003	Declaration of Thomas Credelle in Support of Petition for Inter Partes Review
1004	U.S. Patent Publication 2012-0069248 to Yokota
1005	U.S. Patent Publication 2012-0277347 to Matsumoto
1006	U.S. Patent Publication 2011-0013119 to Ha et al.
1007	Curriculum Vitae of Thomas Credelle
1008	U.S. Patent 7,275,852 to Kim et al.
1009	INTENTIONALLY LEFT BLANK
1010	<u>Order setting scheduling conference and interim dates</u>
1011	<u>Average Time to Trial</u>
1012	<u>LGE v. TCL - Complaint for Patent Infringement</u>
1013	<u>Infringement Contentions</u>

I, Thomas Credelle, hereby declare under penalty of perjury:

I. BACKGROUND AND QUALIFICATIONS

1. I have been retained by Petitioners, TCL Industries Holdings Co., Ltd., TCL Industries Holdings (H.K.) Limited, TCL Electronics Holdings Ltd., TTE Corporation, TTE Technology Inc., TCL Overseas Marketing Limited, Manufacturas Avanzadas S.A. de C.V. TTE Technology Inc., TCL Overseas Marketing Limited, Manufacturas Avanzadas, TCL King Electrical Appliances (Huizhou) Co. Ltd., Shenzhen TCL New Technology Co., Ltd., TCL Smart Device (Vietnam) Co., Ltd., and TCL Optoelectronics Technology (Huizhou) Co., Ltd., (hereinafter “TCL” or “Petitioners”) to provide my opinions regarding claims 1-31 of U.S. Patent No. 9,080,740 (Ex. 1001, “the ’740 patent”).

2. Ex. 1007 is a copy of my current curriculum vitae, which provides further details about my academic and professional background and qualifications.

3. I am being compensated for my services and reimbursed for reasonable expenses that I may incur while working on this matter. I have no financial interest in the outcome of this matter or any other matter that may exist between Petitioners and LG Electronics. This compensation does not depend in any way on the conclusions I reach.

4. I have extensive experience in the field of flat panel displays, including touch panels, LCDs, LEDs, LED displays, backlight assemblies, optics, display electronics, and electro-optics.

5. I received my M.S. in Electrical Engineering from MIT in 1970 with an emphasis on electro-optics and solid-state physics. I received a B.S. in electrical engineering from Drexel University in 1969.

6. I am currently the president of TLC Display Consulting where I provide technical consulting in the field of flat panel displays, LEDs, and display electronics. I have been president of TCL Display Consulting since 2008.

7. I have over 50 years of experience working in the display industry that began at RCA Sarnoff Labs in Princeton, New Jersey. I worked at RCA Sarnoff Labs from 1970-1986 where I led development of some of the first polysilicon TFT LCDs.

8. From 1986 to 1991, I worked at the GE R&D Center in Schenectady, New York. At GE I managed R&D in thin film transistor and LCD technology for avionics equipment and led the team that built the first 1-million-pixel LCD.

9. From 1991-1994, I worked at Apple Computer in Cupertino, California. At Apple I was responsible for all LCD engineering and qualification for the first PowerBook notebook computers.

10. From 1994 to 1996, I worked at Allied Signal in Los Gatos, California. At Allied Signal I was responsible for establishing product marketing direction for newly developed optical films for viewing angle enhancement for LCDs.

11. From 1996 to 1999, I worked at Motorola in the Flat Panel Display Division in Tempe, Arizona. At Motorola I was responsible for establishing market direction and initial sales approach for new Field Emission Displays (FED) and I contributed to product development and specification generation, including display screens for mobile phones

12. From 1999 to 2001, I worked at Alien Technology Corporation in Morgan Hill, California. At Alien, where I worked as VP of Operations, I was a key contributor to the display-related use of Alien manufacturing processes.

13. From 2001 to 2007, I worked at Clairvoyante, Inc. in Cupertino, California. I was responsible for engineering, product development, product roadmap, and marketing of technology that improved resolution and reduced power of color flat panel displays. We collaborated extensively with several OLED developers to integrate a new pixel architecture for high-pixel-density OLEDs. Samsung eventually acquired the company.

14. From 2007 to 2008, I worked at Puredeth, Inc. in Redwood City, California and Auckland, New Zealand. At Puredeth I was a Senior VP of Engineering and was recruited to establish the first senior management leadership position for hardware and software engineering related to Puredeth's Multi Layer Display (MLD) technology.

15. From 2008 to 2018, I worked at Display Engineering, Inc. in San Jose, California. At Display Engineering I designed and tested high-brightness LED backlights, designed circuits and performed thermal analysis of LED light bars, and developed new methods for passive cooling of LED light sources.

16. From 2021 to 2016, I worked as a VP of Application Engineering and Device Performance where I performed testing and qualifications of all their products.

17. From 2016 to 2018, I was the acting CEO of RealD. At RealD I was a business and technical advisor to the RealD Intelligent Backlight business unit. technology, LED technology, LCD technology and TFT technology.

II. MATERIALS CONSIDERED

18. In developing my opinions below relating to the '740 patent, I have considered the materials cited herein, including those itemized in the table of "Exhibits Considered" preceding this declaration.

III. LEVEL OF ORDINARY SKILL IN THE ART

19. In my opinion a person of ordinary skill in the art (“POSITA”) of the ’740 patent at the time of the alleged invention would have had a bachelor’s level degree in mechanical engineering, physics, optics, or a similar field and at least two years of industry experience designing LCD modules with direct backlights. Work or research experience can substitute for less or different education, and vice-versa.

20. I have considered the level of ordinary skill in the art relevant to the ’740 patent. I understand that factors such as the education level of those working in the field, the sophistication of the technology, the types of problems encountered in the art, the prior art solutions to those problems, and the speed at which innovations are made may help establish the level of skill in the art.

21. I am of skill in the relevant art, of a level at least as high as ordinarily skilled persons, and I am able to provide insight and opinions into the understandings of such persons prior to, and at the time that the invention of the ’740 patent was made and at all other relevant times by virtue of my education, training, and experience.

IV. DIRECT LED BACKLIGHT FUNDAMENTALS

22. The technology of the '740 patent and the prior art discussed herein relates to LCDs, and more specifically, to direct backlight assemblies using an array of light emitting diodes (LEDs) as the light sources for the LCD.

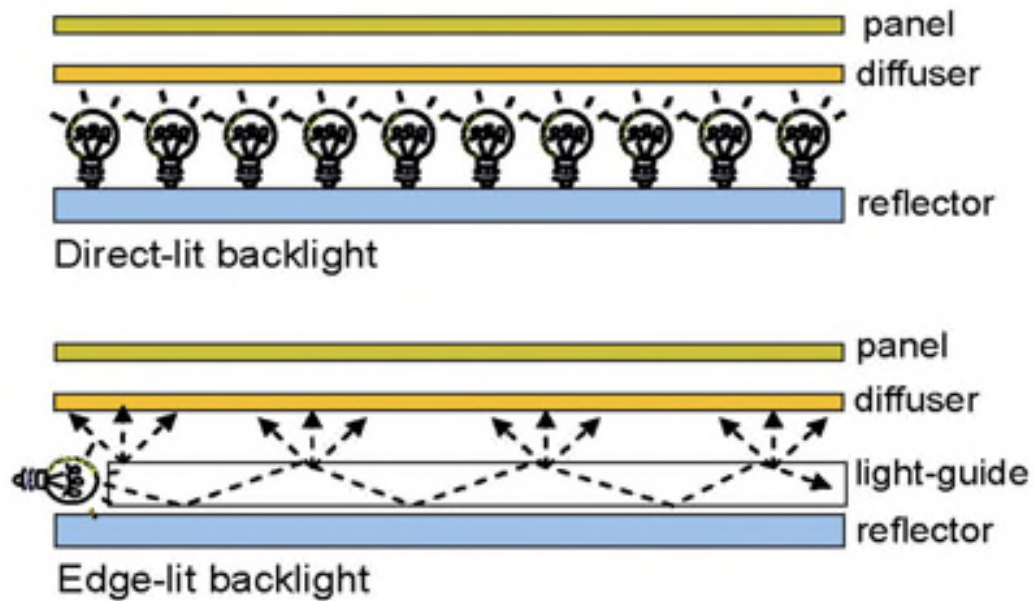
23. Liquid crystal displays (LCDs) are the most common form of flat panel displays and their use is widespread. An LCD does not *emit* light but *modulates*, i.e., selectively and locally blocks or permits transmission of light from a light source, e.g., LEDs. For smaller displays such as mobile phones and tablets, the light sources are placed along one or more edges of the display and a “light guide,” which is an optical element, is used to direct the light over the display area. As illustrated below (lower fig.) light from a row of LEDs along the edge enters the light guide and is confined by total internal reflection. If the light hits a scattering element on the front or rear surface of the light guide, light can be deflected towards the LCD module. A reflector is added below the light guide and one or more diffuser sheets are added above the light guide to randomize the light coming from the scattering elements. The positioning of the scattering dots are designed to create uniform luminance; for example, scattering dots are more sparsely spaced near the LEDs and dot position near the edges of the light guide are adjusted to accommodate edge effects. A key advantage of edge-lit backlights is thinness.

24. A second type of backlight, shown in upper fig. below is a direct-lit backlight. In this design, which is commonly used in larger LCDs such as TVs, a two-dimensional array of LEDs is placed behind the LCD. A reflector sheet is added behind the LED array and one or more diffuser sheets or plates are added to create a uniform light source for the LCD (not shown).

25. A key advantage of the direct backlight is higher luminance because more LEDs can be used for the backlight than would fit along the edges. However, there are three key disadvantages: thickness, cost, and edge uniformity.

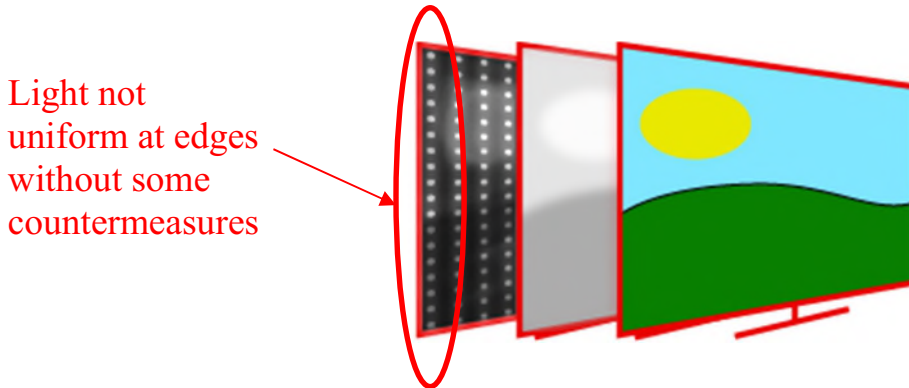
26. The backlight is thicker since there needs to be room to spread out the light from the discrete LEDs. Even with specially designed lenses for the LEDs that spread the light laterally, some distance is required to “fill” the space.

27. Another challenge is cost; at the time of the invention, LEDs were relatively expensive, so manufacturers used as few as possible while still achieving the brightness goals. For example, the LEDs may be spaced apart by several centimeters. Due to the sparse spacing, more diffusion was typically required to create a uniform light source for the LCD.



Source: P. de Greef et al, "Adaptive Backlight dimming for LCD Systems," **SID Information Display**, Nov. 2009.

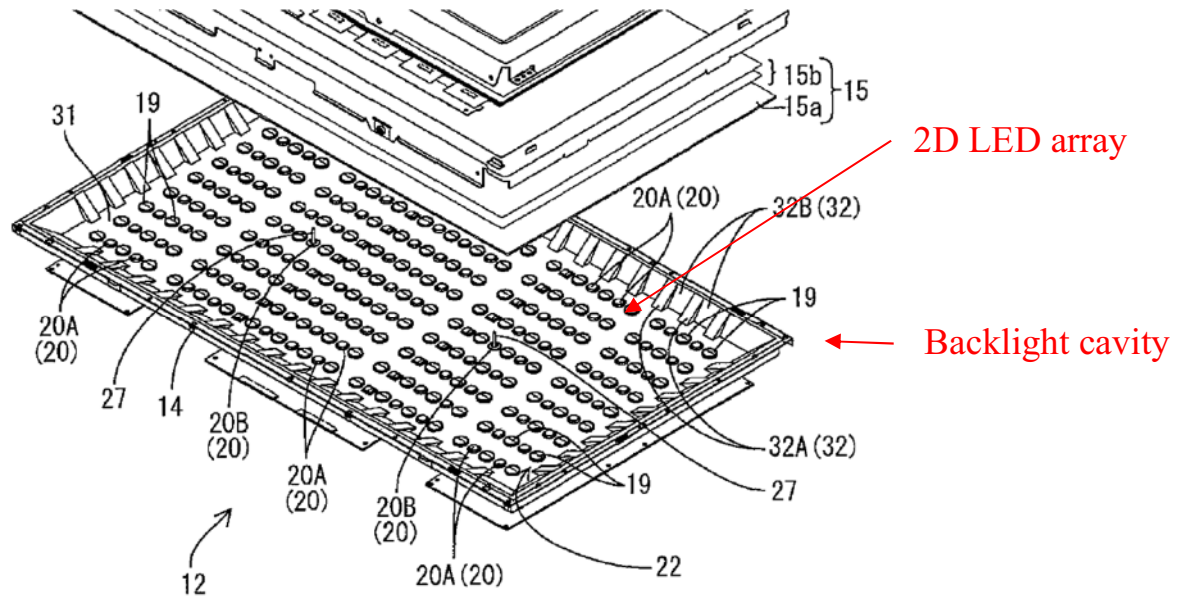
28. The third issue that affects performance is edge uniformity. Away from the edges, the 2D array of LEDs creates similar overlapping light patterns causing the light to be uniform and the central portion to have uniform luminance. This is not the case at the edges of the LED array. As can be expected, if nothing is changed at the edge of a direct-lit LED backlight, there will be brightness nonuniformities at the edges. Depending on the design of the cavity holding the LEDs, the luminance at the edges can be dimmer or brighter.



Source: <https://www.rtings.com/tv/tests/picture-quality/local-dimming>

29. For example, in the prior art below, various methods to adjust edge-related luminance were taught. Typically, the backlight cavity has side walls to define the cavity and to prevent light from escaping; this is done so that light is not wasted and so light does not create a “haze” around the edges of the TV.

30. Matsumoto Fig. 2 shows a typical backlight cavity. The LED array is on the interior side of the cavity, or housing, and the edges are bent upward at an angle.

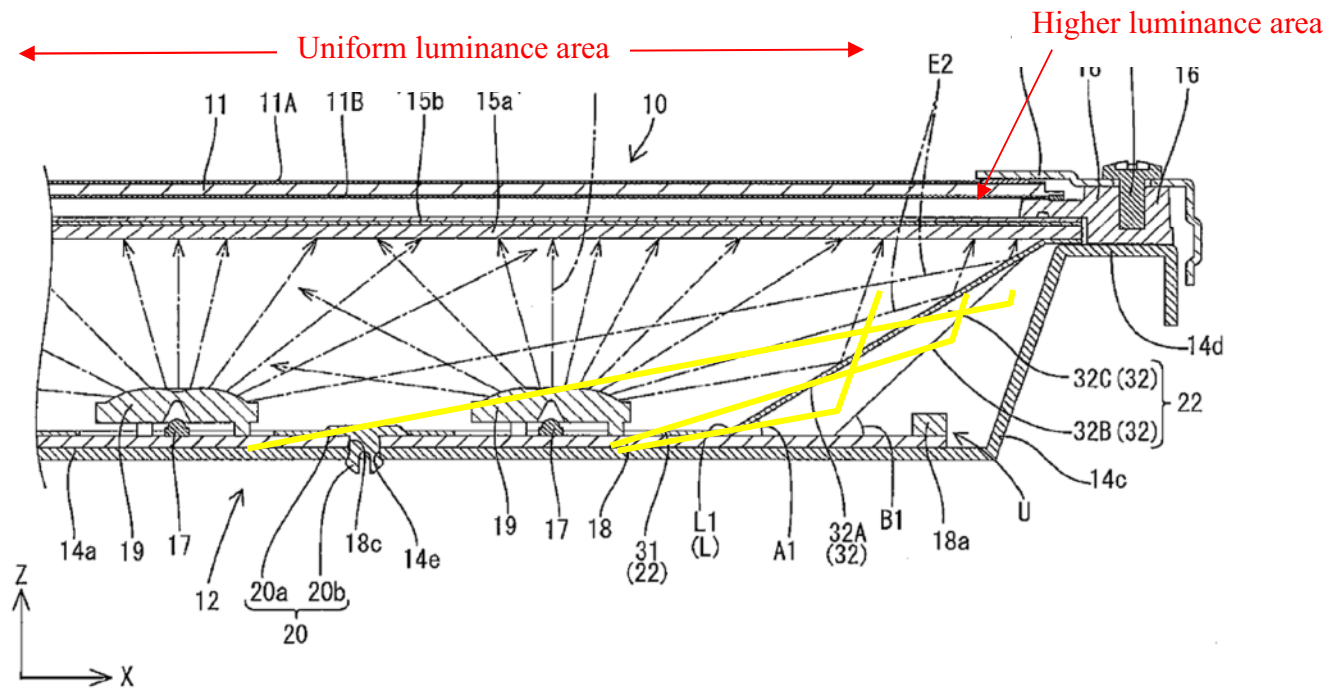


Matsumoto Ex 1005, excerpt from Fig. 2, annotated

31. As further shown in Matsumoto, the light from the edge LEDs will create additional edge luminance if no countermeasures are applied. As shown in Fig. 7, the light from edge-located LEDs will reflect on the side walls and create unwanted additional luminance.

32. Backlight manufacturers used various measures to create a more uniform light source, including adding regions on the side walls with reduced reflectance, adjusting the spacing of the LEDs, or adjusting the brightness of LEDs. The latter two methods created additional costs and complexity in manufacturing, so the preferred method was to adjust the reflectance of the side walls of the cavity.

33. An example of the light paths from two LEDs near the edge is shown in Matsumoto Fig. 7, below. The highlighted light rays illustrate how higher luminance is achieved with a reflective sidewall. As detailed below, all the prior art references illustrate designs to reduce higher or uneven luminance at the sidewalls.



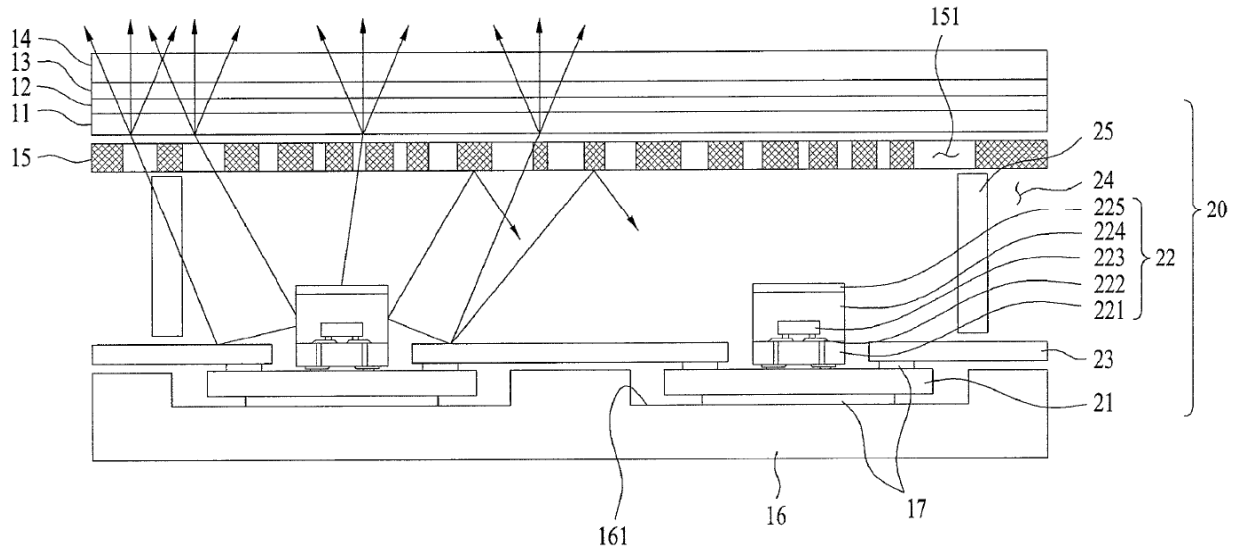
Matsumoto, Ex. 1005 at Fig. 7, annotated

V. SUMMARY OF THE '740 PATENT

34. I have been informed that the earliest application to which the '740 patent claims priority is Korean Application No. 10-2013-0007294 filed on January 23, 2013; I have assumed this date for the purposes of my analysis. Ex. 1001 at field (30).

35. FIG. 1 of the '740 patent is a sectional view illustrating an example of a planar lighting device. Ex. 1001 at 3:5-6.

FIG. 1

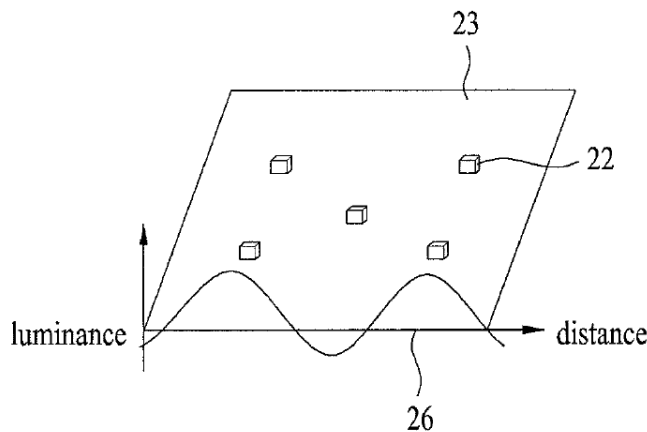


36. The planar lighting device 20 includes a lower cover 16 and a liquid crystal panel (not shown) may be disposed on the planar lighting device 20. The planar lighting device 20 includes a plurality of light sources 22 such as light emitting diodes (LEDs) disposed in one line or a zigzag form. The light sources 22 protrude from an upper surface of a reflection layer 23. Ex. 1001 at 4:19-27.

37. The intensity of light varies inversely with the distance from light sources 22 such as the LEDs. In a direct-type planar lighting device, the aggregate luminance of light emitted from the light sources 22 in the central portion of the

planar lighting device 20 is evenly distributed and the luminance will be uniform after passing through optical sheets 11, 12, 13 and 14. However, as shown in FIG. 2, along the edges 26 of the planar lighting device luminance varies significantly based upon the distance of locations on the edge 26 from a light source. Ex. 1001 at 6:1-27.

FIG. 2



38. Consequently, in a direct-type lighting device, at an edge 26 luminance is higher at positions close to the light sources 22 and lower at positions more distant from light sources 22. Ex. 1001 at 6:26-29. These areas of high luminance and low luminance cause uneven brightness because the optical sheets

11, 12, 13 and 14 are not uniformly illuminated across their planar surfaces. This degrades the image produced by the LCD.

39. As stated in the '740 patent

[D]ifferences in luminance between areas close to the light source 22 and areas far from the light source 22 may be generated at an edge 26 in which distribution of the light source 22 is completed. For example, as can be seen from FIGS. 2 and 3, as the disposition of the light source 22 is changed, luminance difference may be generated according to the distance from the light source 22 at the edge 26 of the light source 22. That is, in a direct-type lighting device, luminance is high at the position close to the light source 22 and luminance is low at the position far from the light source 22 at an edge 26 of the upper surface of the reflection layer 23.

Ex. 1001 at 6:17-30.

40. The '740 patent addresses this issue by providing “a light regulator 300 for regulating luminance difference caused by distance difference between the light source 22 and the edge 26 may be provided.” *Id.*

41. The U.S. filing date of the application that matured into the '740 patent is August 8, 2014. Ex. 1001. Face of Patent, field (22). A Notice of Allowance was issued about ten weeks later on October 22, 2014. No Office Action on the merits was issued before the Notice of Allowance.

VI. CLAIM CONSTRUCTION

42. I understand that the claims of the '740 patent should, for the most part, be interpreted according to the plain and ordinary meaning as they would have been understood by a person of ordinary skill of the art at the time of the purported invention of the '740 patent in light of the claim language, the specification, and the prosecution history.

VII. LEGAL STANDARDS FOR OBVIOUSNESS

43. I understand that a claim may be invalid under § 103(a) if the subject matter described by the claim as a whole would have been obvious to a hypothetical POSITA in view of a prior art reference, or in view of a combination of references at the time the claimed invention was made. I understand that the date the invention was made is often referred to as the priority or critical date. I understand that the prior art includes references that were known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the date the invention was allegedly made by the patent holder. For a printed publication to qualify as prior art, I understand that the Petitioners must demonstrate that the publication was disseminated or otherwise sufficiently accessible to the public.

44. I understand that the asserted claims of the patent should be read from the point of view of such a person at the time the claimed invention was made. I

further understand that a hypothetical POSITA is assumed to know and to have all relevant prior art in the field of endeavor covered by the patent in suit and all analogous prior art. I understand that the standard for obviousness in an *inter partes* review proceeding is by a preponderance of the evidence, which means “more likely than not.” I understand this is the Petitioners’ burden to show.

45. I understand the preponderance of the evidence standard requires that a reasonable factfinder could find a material fact is more probable than the non-existence of that fact. It does not allow for speculation regarding specific facts and is instead focused on whether the evidence more likely than not demonstrates the existence or non-existence of specific material facts.

46. For TCL’s Petition, I understand that TCL has argued that the claims are obvious in view of certain prior art references.

47. I also understand that an analysis of whether a claimed invention would have been obvious should be considered in light of the scope and content of the prior art, the differences (if any) between the prior art and the claimed invention, and the level of ordinary skill in the pertinent art involved. I understand as well that a prior art reference should be viewed as a whole. I understand that in considering whether an invention for a claimed combination would have been obvious, I may assess whether there are apparent reasons to combine known

elements in the prior art in the manner claimed in view of interrelated teachings of multiple prior art references, the effects of demands known to the design community or present in the market place, and/or the background knowledge possessed by a POSITA.

48. It is my understanding that a patent claim is unpatentable as being obvious in view of prior art if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious, at the time the alleged invention was made, to a POSITA to which said subject matter pertains. I further understand that an obviousness analysis takes into consideration factual inquiries such as the level of ordinary skill in the art, the scope and content of the prior art, and the differences between the prior art and the patent claim.

49. I understand that the U.S. Supreme Court has recognized several rationales for combining references and for modifying a reference as part of an obviousness analysis. These rationales include combining prior art elements according to known methods to yield predictable results, simple substitution of a known element for another to obtain predictable results, a predictable use of prior art elements in accordance with their established functions, applying a known technique to improve a known device (or process) and yield predictable results,

and choosing from a finite number of known predictable solutions with a reasonable expectation of success. It is further my understanding that an obviousness analysis takes into consideration whether the prior art provides a teaching, suggestion, or motivation to combine teachings of multiple prior art references to arrive at the patent claim.

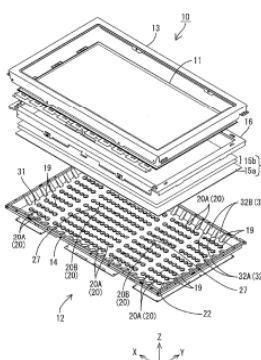
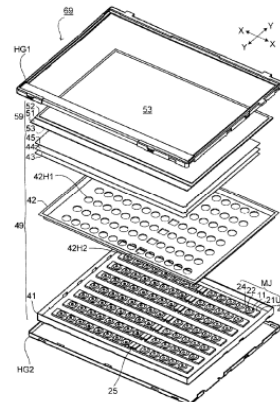
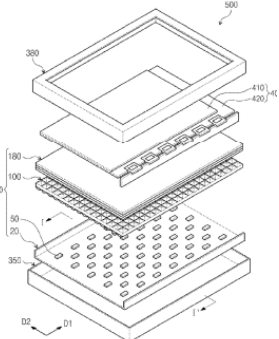
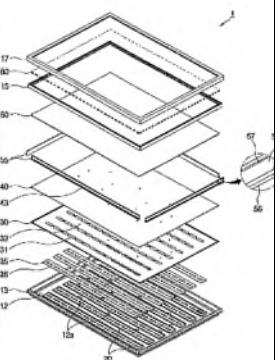
50. I have also been informed that the claimed invention must be considered as a whole in analyzing obviousness or non-obviousness. In determining the differences between the prior art and the claims, the question under the obviousness inquiry is not whether the differences themselves would have been obvious, but whether the claimed invention as a whole would have been obvious.

51. Relatedly, I understand that it may be appropriate to consider whether there is evidence of a “teaching, suggestion, or motivation” to combine the prior art teachings in the prior art, the nature of the problem or the knowledge of a POSITA.

52. I understand that the claims of a patent are normally interpreted according to the plain and ordinary meaning as they would have been understood by a person of ordinary skill of the art in light of the claim language, the specification, and the prosecution history.

VIII. THE PRIOR ART

53. Yokota, Matsumoto, Ha et al., and Kim et al. all disclose technology in the same technical field of liquid crystal displays having direct-type, planar lighting backlight assemblies. A POSITA would understand the devices depicted in the drawings in the table to have many common components, such as covers for enclosing a display, direct-type backlights having light sources, circuit/wiring boards, reflection sheets, LED light sources, diffuser sheets, color filters and other optical sheets, and liquid crystal display modules.

Matsumoto	Yokota	Ha et al.	Kim et al.
			
“FIG. 2 is an exploded perspective view illustrating a general configuration of a liquid crystal display device.” Ex. 1005 at [0027].	“FIG. 1 is an exploded perspective view of a display device incorporating an illumination device” Ex. 1004 at [0040].	“FIG. 1 is an exploded perspective view showing a display apparatus” Ex. 1006 at [0016].	“FIG. 1 is an exploded perspective view of a backlight unit according to an embodiment” Ex. 1008 at 2:49-51.

54. In addition to being in the same technical field, the references also: (1) focus on improving the uniformity of the illumination of the liquid crystal display, (2) disclose a host of common elements, e.g., LCD modules, optical sheets,

diffuser sheets, LED light sources, LED circuit boards, reflective sheets with inclined portions having reflection reduction treatments such as holes, and dots and sheets of reflection-reducing material, where the elements are applied in selected locations to overcome uneven illumination caused by the backlight assembly, and (3) teach the interchangeability of reflection-reduction treatments such as holes and dots of light absorbent material which can be applied to reduce areas of unevenly high illumination in the backlight assembly.

55. The teachings in Yokota, Matsumoto, Ha et al., and Kim et al. would have provided POSITA all of the tools and instructions necessary to attain without undue experimentation the stated object of the '740 patent invention of improving luminance uniformity in a backlight assembly, including at its edge portions. Ex. 1001 at 1:62-64.

A. **Yokota**

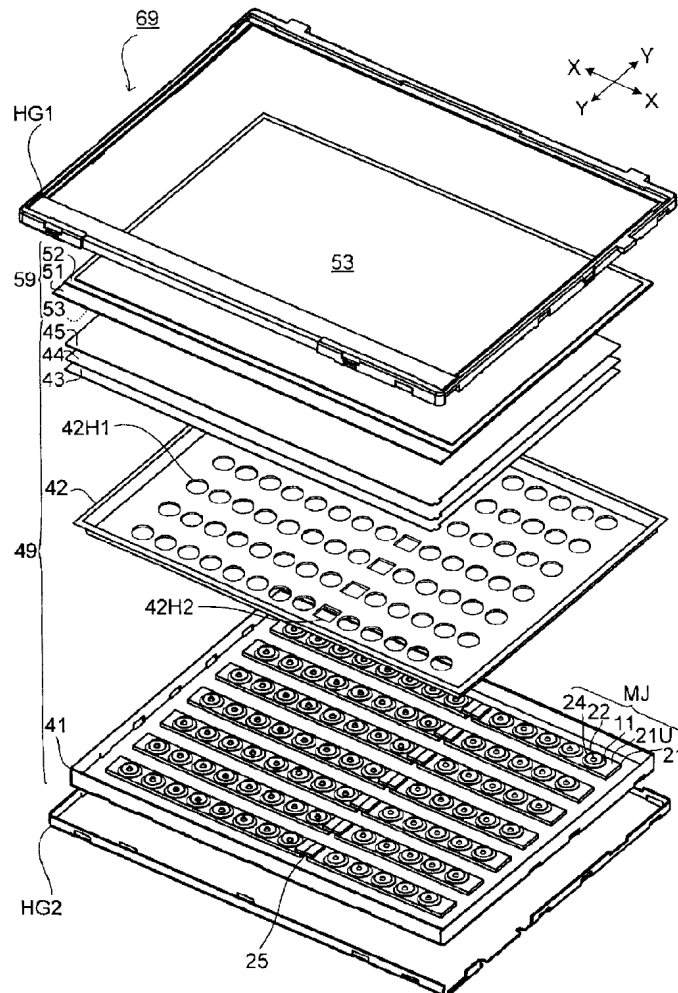
56. United States Patent Publication 2012-0069248 [Ex. 1004, “Yokota”] entitled “Illumination Device, Display Device, and Television Receiver” was published on March 21, 2012, and is prior art against the '740 patent under AIA U.S.C. §102(a)(1).

57. A purpose of the invention of Yokota is to provide uniform luminance of a backlight assembly. *Id.* at [0012]. This is the same object as disclosed in the

'740 patent, Ex. 1001 at 2:62-64, and, as discussed below, in Matsumoto Ex 1005 at [0009].

58. Yokota Fig. 1 is an exploded view of a display device 69.

FIG.1



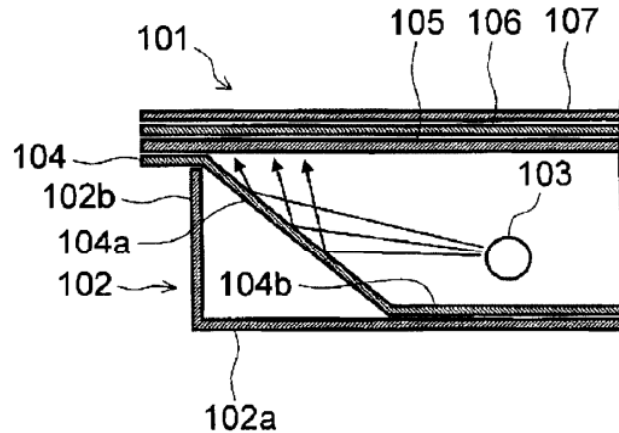
59. The display device 69 includes a liquid crystal display panel 59, backlight unit 49, front housing HG1 and rear housing HG2. Ex. 1004 at [0056].
In the backlight assembly, mounting boards (substrates) 21 have mounted thereon

modules MJ including either five or eight LEDs 22. *Id.* at [0073]. The mounting boards 21 with the LEDs are coupled together in their lengthwise direction by connectors 25 attached to adjacent edges. *Id.* The mounting boards 21 have a mounting surface 21U with electrodes (not shown) formed at predetermined intervals in the lengthwise direction. *Id.* at [0068]. The LEDs 22 are individually mounted on the electrodes. *Id.* As shown in FIG. 1, a plurality of sets of an LED 22, a diffusive lens 24, and a built-in reflective sheet 11 combined together are arranged on each mounting board 21, at predetermined intervals in its lengthwise direction. *Id.* The mounting boards are arranged parallel to one another on chassis 41. *Id.* at [0074]. As a result, individual LEDs 22 are arranged in a matrix.

60. Light emanating from the LEDs 22 shines on the diffusive plate 43 from behind. *Id.* at [0078]. A reflective sheet 42 is provided on the chassis 41 to reflect light from the LEDs 22 toward the rear surface of the diffusive plate 43. *Id.* The reflective sheet 42 has inclined surfaces 42a as its peripheral portions. The lower end of the inclined surface 42a is contiguous with a main plane 42b of the reflective sheet 42. *Id.* at [0077].

61. Referring to FIG. 12, Yokota discusses a problem of uneven illumination of the diffusion sheet when a reflective sheet having inclined peripheral portions is used in a backlight assembly.

FIG.12



62. Yokota states:

An inclined surface of a reflective sheet, like that seen in the exemplary structure shown in FIG. 12, on one hand has the advantage that no light source needs to be arranged right under a peripheral part of a diffusive plate, but on the other hand has the disadvantage that, as a result of light emanating from a number of light sources concentrating in the peripheral part, an amount of light larger than is necessary may be reflected toward the diffusive plate. This may result in, as shown in FIG. 13, higher luminance only in a peripheral part of a diffusive plate. Since an illumination device to be combined with a display device is required to offer even luminance all across a diffusive plate, such uneven luminance needs to be overcome.

Id. at [0011].

63. Yokota provides a solution for this problem of uneven illumination:

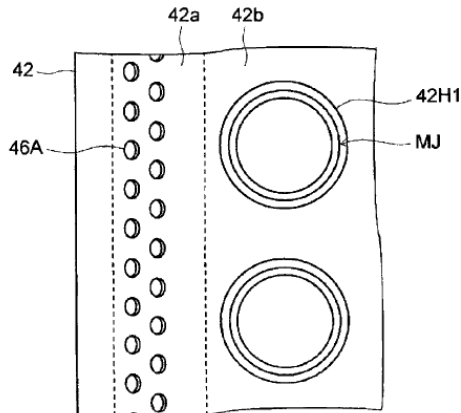
According to a preferred embodiment of the invention, an illumination device is provided with a diffusive plate; a chassis supporting the diffusive plate; a light source arranged on the chassis and shining light on the diffusive plate; and a reflective sheet covering the chassis entirely and reflecting light from the light source toward the diffusive plate. Here, in a peripheral part of the reflective sheet, an inclined surface is formed, which reflects light emanating sideways from the light source toward the diffusive plate, and is treated with reflection reduction treatment.

With this structure, no light source needs to be arranged right under the peripheral part of the diffusive plate. On the other hand, the reflection reduction treatment applied to the inclined surface of the reflective sheet reduces the amount of light reflected on it to travel toward the diffusive plate, and this prevents disproportionately higher luminance in the peripheral part, than elsewhere, of the diffusive plate. According to another preferred embodiment of the invention, in the illumination device structured as described above, the reflection reduction treatment is achieved by forming a number of small apertures in the inclined surface.

Id. at [0013] - [0015].

64. This is illustrated in FIG. 3, which shows holes 46A on inclined surface 42A. *Id.* at [0080].

FIG.3



Id. at FIG. 3.

65. Yokota discloses a further embodiment where instead of forming the reflection-reduction elements as small apertures in the inclined portions of the reflection sheet, patterns of small dots of light absorbing ink (elements 46D in FIGs. 8 and 9) may be printed on the inclined surface 42a to provide a reflection-reduction treatment.

FIG.8

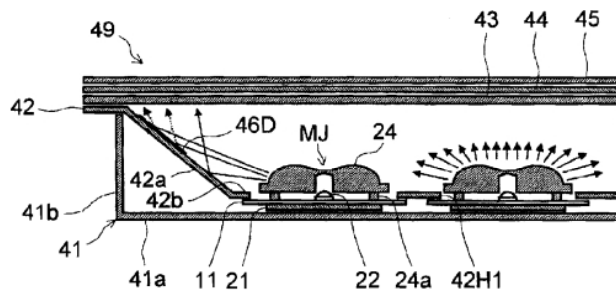
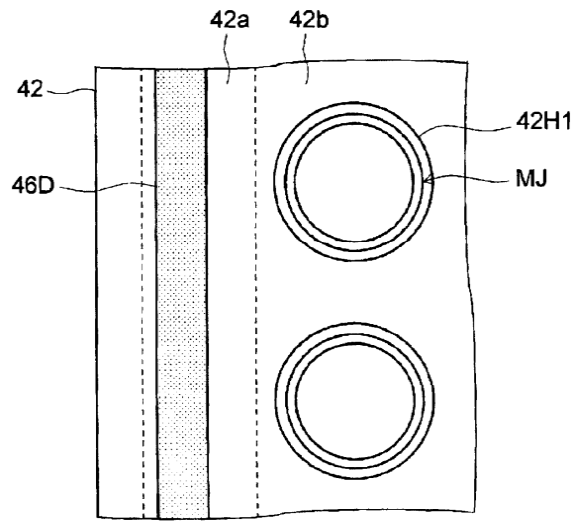


FIG.9



The printed portion 46D with increased light absorptance reflects less light than the non-printed portion, and this reduces the overall amount of light reflected on the inclined surface 42a so as to travel toward the diffusive plate 43. This prevents disproportionately higher luminosity in a peripheral part, than elsewhere, of the diffusive plate 43.

Id. at [0089] – [0091].

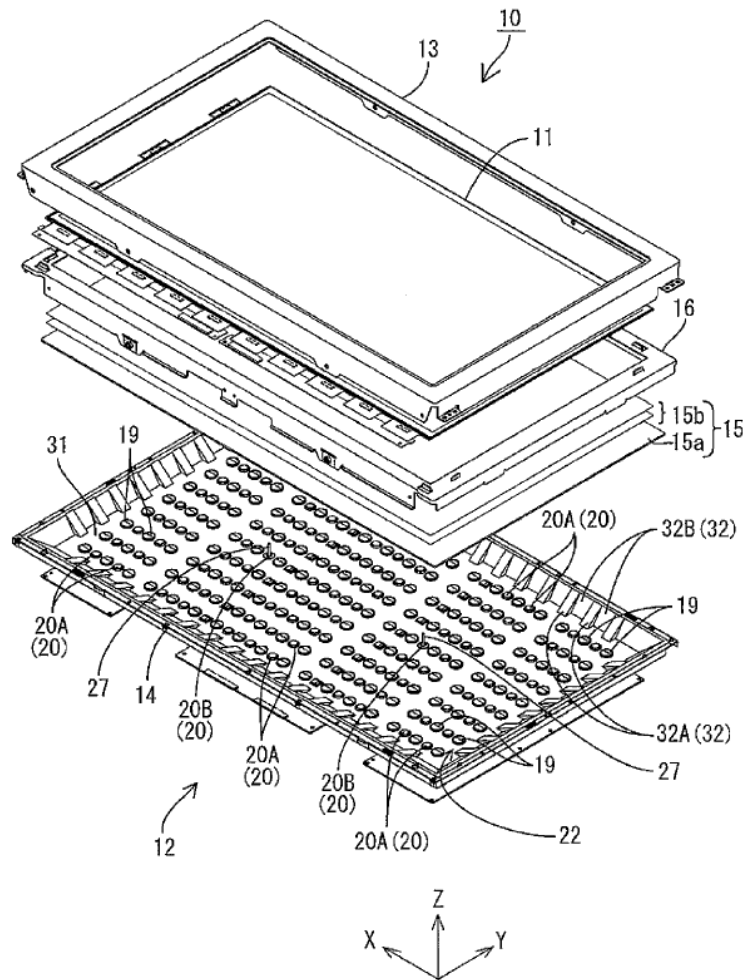
66. Yokota's clear description that instead of holes in the inclined surface 42a, dots of light absorbent material may be printed on the inclined surface 42a as a light reflection reduction treatment (*Id.* at [0083], [0088]) teaches the interchangeability of holes and light-absorbent dots as reflection reduction-treatments.

B. Matsumoto

67. United States Published Patent Application 2012/0287347 [Ex. 1005, “Matsumoto”] entitled “Lighting Device, Display Device and Television Receiver” was published on November 15, 2012, and is prior art against the ’740 patent under AIA 35 U.S.C. §102(a)(1). The invention of Matsumoto is directed to remedying uneven illumination in a backlighting device for a display such as an LCD. *Id* at [0009],

68. FIG. 2 is an exploded perspective view illustrating a general configuration of a liquid crystal display device and FIG. 4 is a cross-sectional view of the liquid crystal display device of FIG. 2. *Id.* at [0027], [0029].

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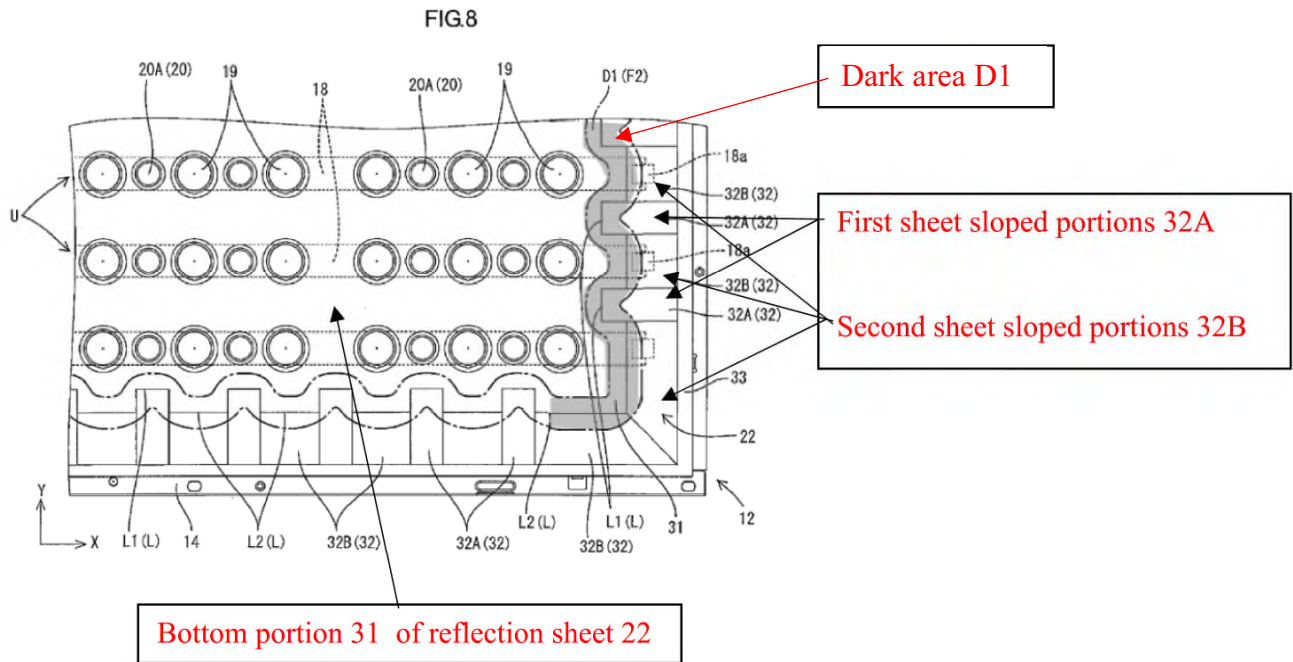
Id. at FIG. 2.

69. In FIG. 2, the backlight device 12 includes chassis 14, optical sheet set 15 (a diffuser 15a, and a plurality of optical sheets 15b between diffuser 15a and liquid crystal panel 11), frame 16, and chassis reflection sheet 22. *Id.* at [0040].

70. According to Matsumoto, in “such a backlight unit, if the light sources are arranged on the bottom plate such that a light axis of light from the light source is directed toward the liquid crystal panel ...a portion of the reflection sheet that is adjacent to [borderline L] a border between the sheet bottom portion and the sheet sloped portion (a peripheral end portion of the sheet bottom portion and a basal end portion of the sheet sloped portion) is likely to be a dark portion compared to other portions.” *Id.* at [0004].

71. The backlight has a chassis reflection sheet 22 that comprises a sheet bottom portion 31 and sheet sloped portions 32 shown as including first sheet sloped portions 32A and second sheet sloped portions 32B. *Id.* at [0065], [0071]. The sheet sloped portions are inclined areas of the reflection sheet 21 and rise as they extend toward the edges of the reflection sheet 22. *Id.* First sheet sloped portions 32A begin closer to borderline L and have a longer inclined surface than second sheet sloped portion 32B. *Id.*

72. This is shown in FIG. 8, which has been highlighted to identify the dark area D1 and to highlight the first and second sheet sloped portions.



Id., Fig. 8, annotated.

73. According to Matsumoto, the dark area D1 results from two factors.

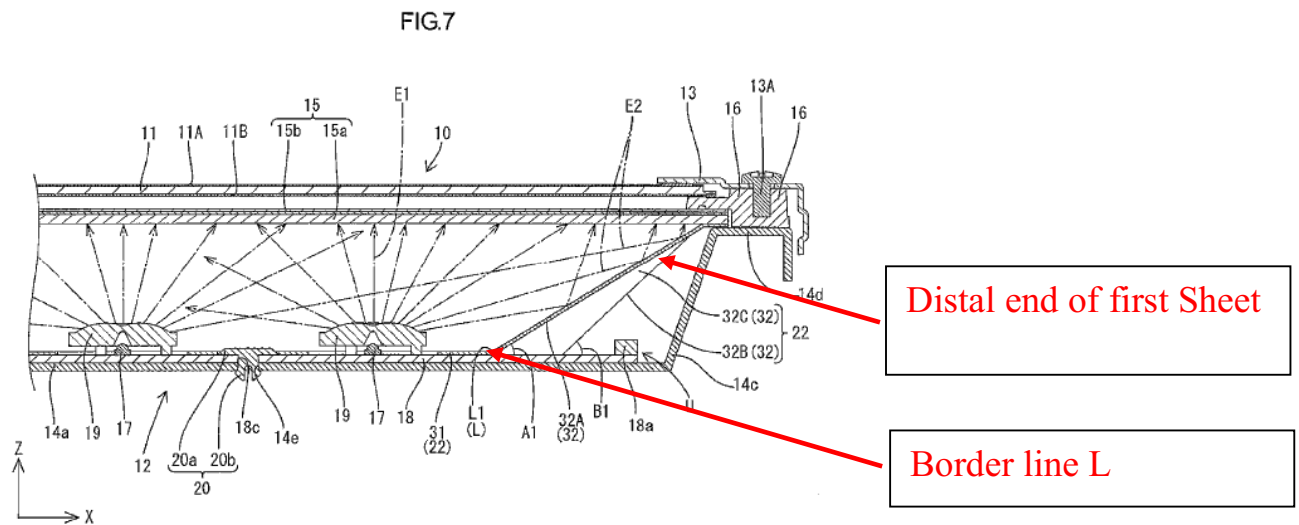
A first reason is as follows. The portion of the reflection sheet adjacent to the border corresponds to the peripheral end portion of the sheet bottom portion. Therefore, a distance from the light source to the portion adjacent to the border is greater than that from the light source to the middle portion of the sheet bottom portion. Accordingly, the amount of light reaching from the light source is relatively small in the portion adjacent to the border compared to that in the middle portion of the sheet bottom portion.

A second reason is as follows. Generally, in a light source having strong directivity, an amount of light exiting therefrom varies according to an inclination angle of a direction in which the light exits with respect to a light axis and the amount of exiting light decreases

as the inclination angle increases. Specifically, in the above example, comparing the amount of light in the basal end portion of the sheet sloped portion and that in the distal end portion of the sheet sloped portion, the inclination angle with respect to the light axis of the light from the light source increases as is closer to the basal end portion of the sheet sloped portion. Accordingly, the amount of light reaching the basal end portion is relatively small.

Id. at [0006], [0007].

74. Matsumoto refers to FIG. 7 to further describe the problem of uneven illumination of a diffuser 15A which causes a display to have uneven brightness.

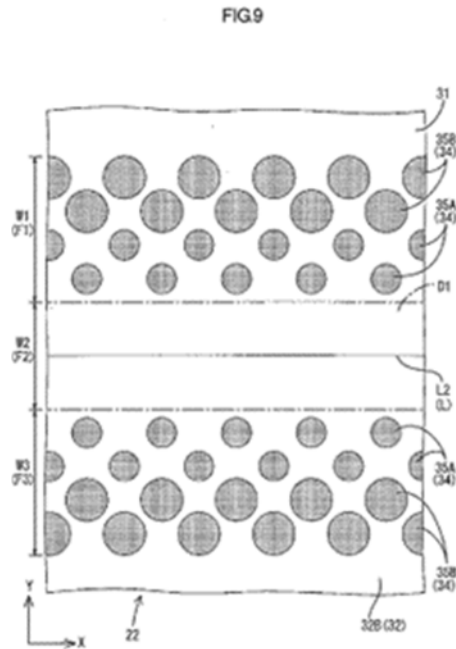


Id. FIG. 7, annotated.

75. The emission intensity of the LED 17 is greater along the light axis E1 represented by arrow E1 in FIG. 7 and sharply decreases as the angle of a light ray to the light axis E1 increases. *Id.* at [0083]. Light rays E2 from the LED 17

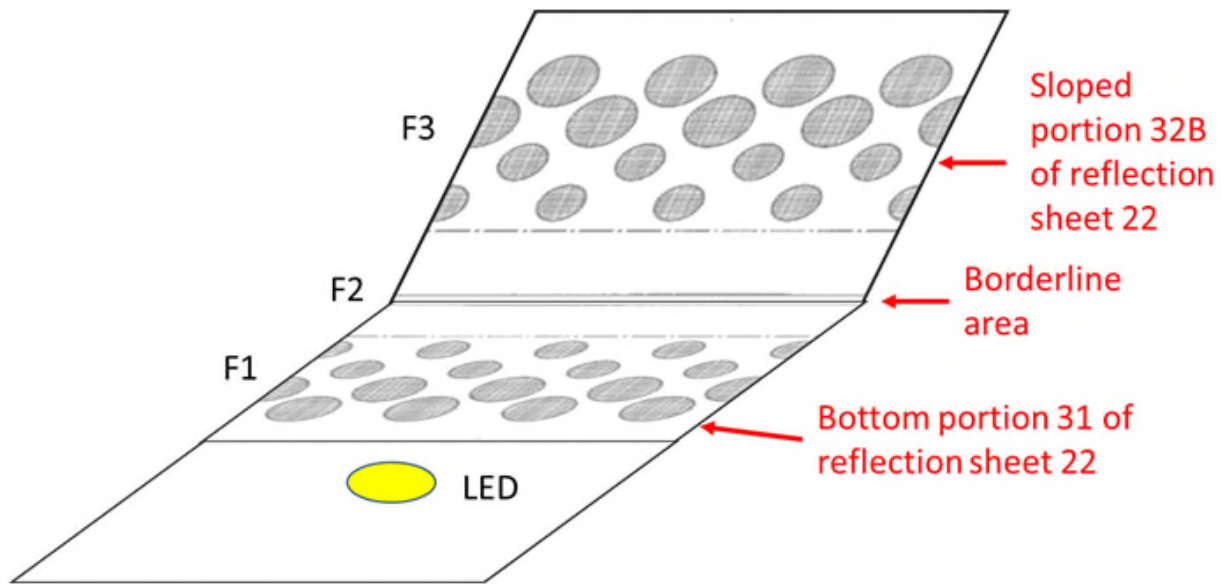
reaching the distal ends of the sheet sloped portions 32 have a relatively small angle with respect to light axis E1 compared to light reaching a portion adjacent to the borderline L which is at an angle of approximately 90 degrees with respect to the light axis E1. *Id.* Thus, the number of light rays reaching the portion adjacent to the borderline L is smaller than the number of light rays reaching the distal end of the sheet sloped portion 32. *Id.* at [0083], [0084]. Accordingly, fewer light rays reach a border portion F2 of the chassis reflection sheet 22, which is a portion encompassing the border line L, appear as dark portions, i.e., lower illumination than adjacent portions F1, F3 (shown below in FIG. 9 and in schematic combination of FIGs. 8 and 9, below.). *Id.* at [0084]. This causes uneven brightness. *Id.*

76. Matsumoto eliminates “dark portions” in the border portion by applying a reflectance reduction treatment to the reflective surfaces of first sheet sloped portions 32A and the second sheet sloped portions 32B. FIG 9 and the schematic combination thereof illustrate how this is accomplished using a second sheet sloped portion 32B as an example.



Id. at FIG. 9.

77. The following is a schematic combination of FIGs. 8 and 9 showing the relationships of areas F1-F3 of the bottom portion 31 and the second sheet sloped portion 32B of the reflection sheet 22.



34

78. The area F2 is the fold region of reflection sheet 22 at the location of the borderline L, i.e., the intersection between the bottom portion 31 of reflection sheet 22 and the sheet sloped portion 32B of the reflection sheet 22. The area F2 includes the dark portion D1 highlighted in FIG. 8, above.

79. The areas F1 in the bottom portion 31 and F3 in the sheet sloped portion 32B have a reflection reduction treatment in the form of a pattern of reduced-reflection dots 35A and 35B formed on the reflection sheet 22. *Id.* Area F3 corresponds to the distal end of inclined sheet sloped portion 32B. *Id.* at FIGs. 8 and 9.

80. The dots 35A (small) and 35B (large) of the portion 34 are disclosed to reflect light less effectively than untreated areas of the chassis reflection sheet 22. As seen in FIG. 9 and in the schematic diagram, smaller dots 35A are located adjacent the dark area at the borderline L and larger dots 35B are located more distant from the borderline L. There are no reduced-reflection dots in the border line area F2 of the reflection sheet 22. In this arrangement, the reflectance from the reflection sheet 22 in the area F2 where there are no reduced-reflection dots is

higher than in the areas of reflection sheet 22 having reduced-reflection dots.

Moreover, in the area of the small dots 35A the reflectance of the reflection sheet 22 will be reduced less than in the area of the larger dots 35A. A POSITA would understand from FIG. 9 that by providing reflection reduction dots of different sizes on a reflection sheet, the degree of reflection from bright areas can be reduced and controlled.

81. As discussed above with regard to FIG. 7, fewer light rays from the LEDs reach the border line portion F2 than reach area F3 on second sheet sloped portion 32B. Thus, without applying a reflection-reduction treatment, the area F1 would appear to be dark compared to the area F3 of the second sheet sloped portion 32B which causes non-uniform illumination of the diffusion sheet. However, Matsumoto teaches that by applying reflection-reduction elements (dots 35A and 35B) in area F3 the resultant reduction in reflection in that area ensures that the brightness does not abruptly change between the borderline L in area F2 and the area F3. Consequently, “dark portions” and uneven brightness will not occur. *Id.* at [0086], [0088-0089].

82. Matsumoto instructs that the area of each dot 35A, 35B and the arrangement intervals of the dots can be varied to control the degree of light reflectance in the locations of the dots. *Id.* at [0077], [0081], [0089]. Thus, from

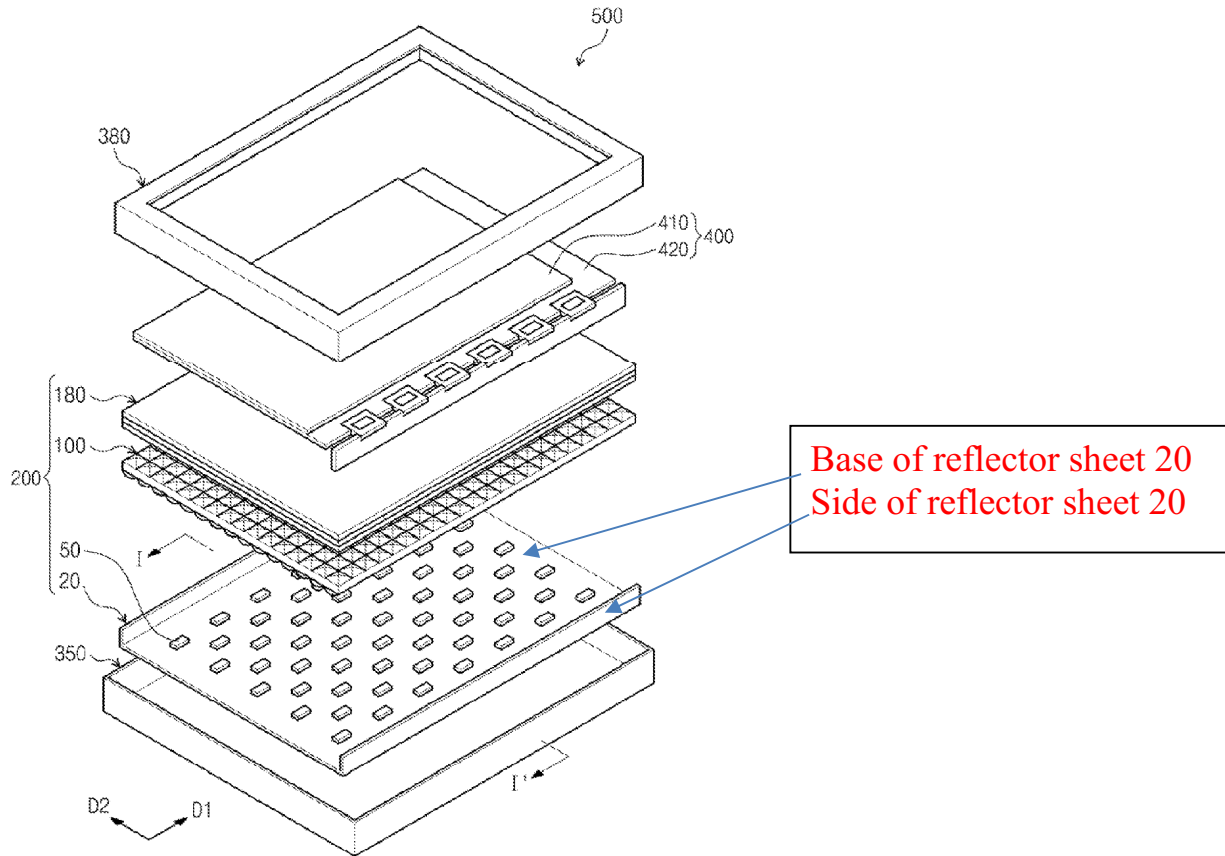
the teachings of Matsumoto, a POSITA would have readily understood that by selectively applying different sized dots of reduced reflection material to relatively bright areas of a reflection sheet to reduce the reflectance therefrom, uniformity of illumination in a direct-type backlight assembly can be attained.

C. **Ha et al.**

83. United States Patent Publication 2011/0013119 [Ex. 1006, “Ha et al.”] entitled “Backlight Assembly and Display Apparatus Having the Same” was published on January 20, 2011, and is prior art regarding the ’740 patent under AIA 35 U.S.C. §102(a)(1). In the manner of the ’740 patent, Matsumoto, and Yokota, the Ha et al. disclosure is directed to a backlight assembly capable of providing substantially uniform light. *Id.* at [0003].

84. FIG. 1 is an exploded view of a display apparatus having a backlight. *Id.* at [0016].

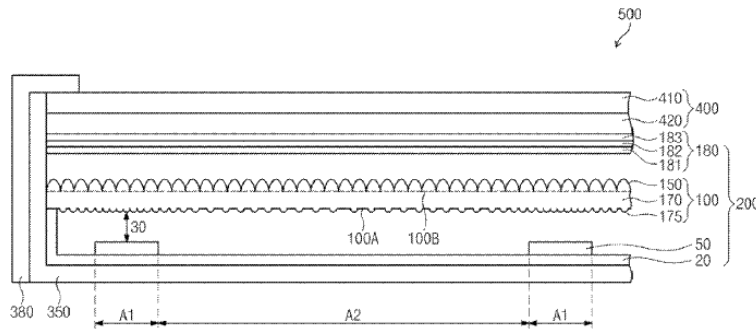
Fig. 1



Id. at Fig. 1 (annotated).

85. FIG. 2 is a sectional view taken along line I-I' of FIG. 1. *Id.* at [0017].

Fig. 2



Id. at Fig. 2.

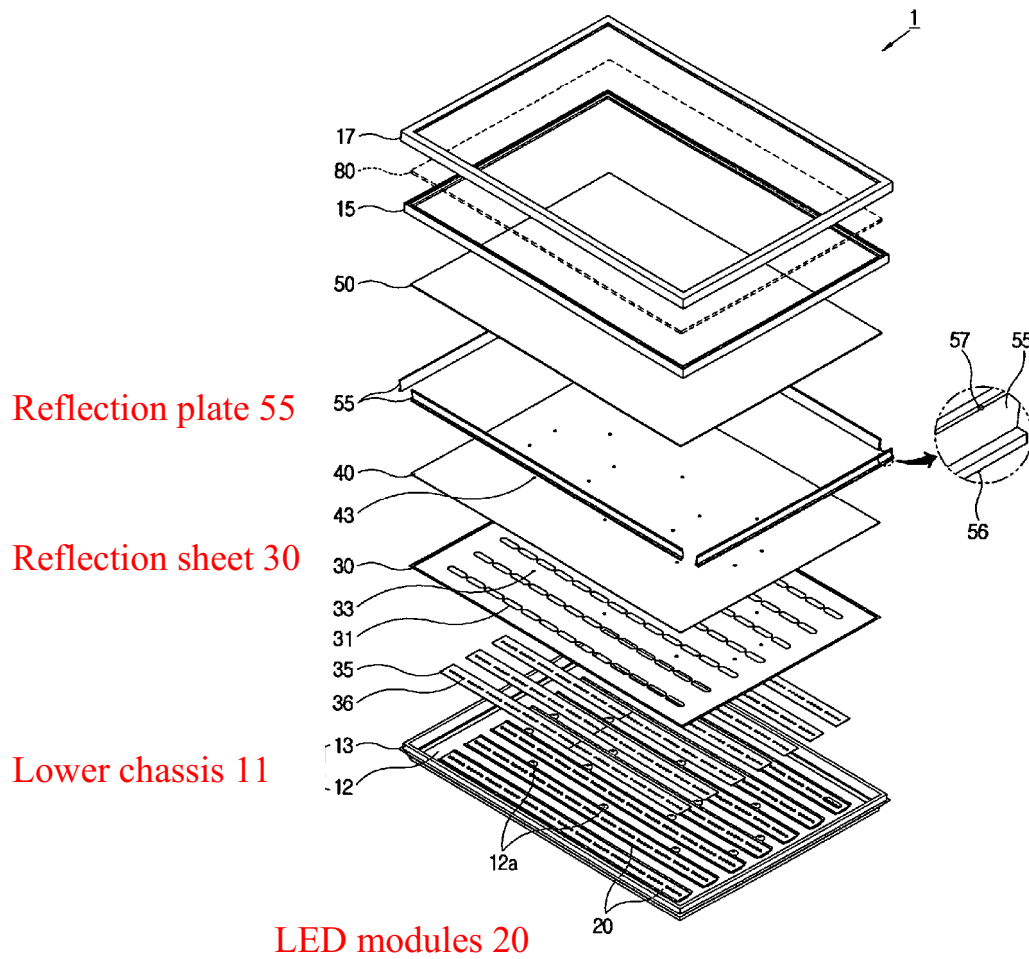
86. Referring to FIGs. 1 and 2, a display apparatus 500 includes backlight assembly 200, display panel 400, top chassis 380, and bottom chassis 350. *Id.* at [0033]. Backlight assembly 200 includes a reflection plate 20, a plurality of LED light sources 50, a first optical member 100, and a second optical member 180. *Id.* at [0034]. First optical member 100 is a diffusion sheet that diffuses the light from light sources 50. *Id.* at [0038]. As shown in FIG. 1, the sides of the reflection plate 20 are inclined at a right angle with respect to the bottom surface of the reflection plate 20.

D. Kim et al.

87. U.S. Patent No. 7,275,852 [Ex. 1008, “Kim et al.”], entitled, “Backlight Unit and LCD Display Apparatus Having the Same,” was originally filed on Nov. 17, 2004, as KR 10-2004-0093880 and was filed Dec. 29, 2004, in the U.S. The patent issued Oct. 2, 2007, and is prior art regarding the ’740 patent under AIA 35 U.S.C. §102(a)(1).

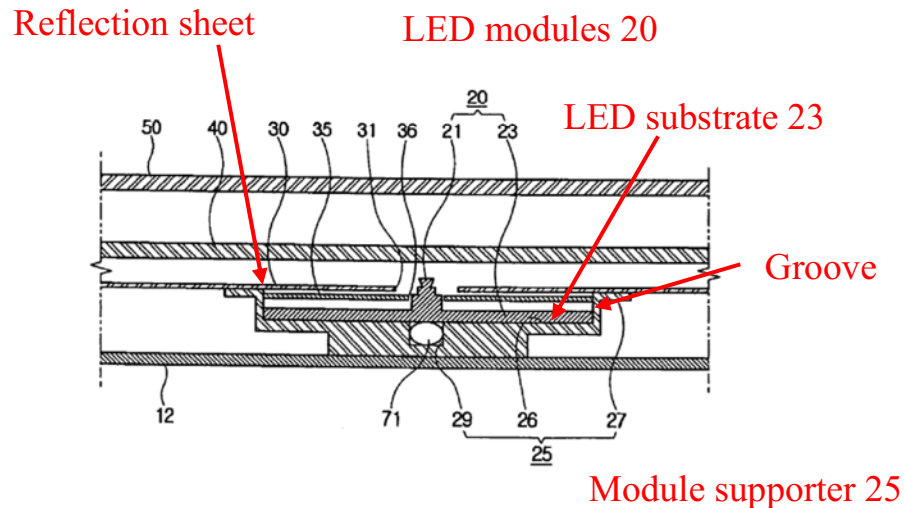
88. Kim et al., like Yokota, Matsumoto, and Ha et al., is directed to an LED backlight module. Kim et al. discloses “a plurality of LEDs emitting light, and an LED substrate supporting and driving the plurality of LEDs, a diffusion sheet placed over the LED module and diffusing light emitted from the LED module, an optical sheet placed over the diffusion sheet, a module supporter placed on a back of the LED module and supporting the LED module.” *Id.* at Abstract. Further, and as shown in FIG. 1, “the LED modules 20 may be plurally provided, *e.g.*, seven LED modules 20 are illustrated as being transversely arranged with respect to a lower chassis 11 of the chassis assembly 10.” *Id.* at 3:34-37. The LED modules are mounted to a lower chassis assembly 11 comprising a base portion 12 to which module supporters 25 are mounted. *Id.* at 5:48-61. The module supporters include grooves to mount the LED modules 20. *Id.* at 4:43-58, Fig. 2. The module supporters 25 include module accommodator 26, which includes a groove to accommodate the LED substrate 23. *Id.*

FIG. 1



Id. at Fig. 1 (annotated).

FIG. 2



Id. at Fig. 2 (annotated).

IX. GROUND 1: CLAIMS 1-3, 7-29, AND 31 ARE OBVIOUS OVER YOKOTA IN VIEW OF MATSUMOTO

89. It is my opinion that Claims 1-3, 7-29, and 31 of the '740 patent would have been obvious over the combination of Yokota modified in view of Masumoto. I discuss below how each limitation is disclosed in the combination of these two references.

90. The '740 patent includes independent claims 1, 22, and 31. The table below shows that there are eleven individual claim elements and of these eleven claim elements seven (shaded in the table) are identically recited in each of the independent claims.

USP 9,080,740 INDEPENDENT CLAIMS		
1. A planar lighting device comprising:	22. A display device comprising: a lighting device including: a lower cover;	31. A direct-type lighting device comprising: a lower cover;
a circuit substrate;	a circuit substrate disposed on the lower cover;	a plurality of circuit substrates disposed on the lower cover and spaced apart by a predetermined distance;
a plurality of light sources disposed on the circuit substrate	a plurality of light sources disposed on the circuit substrate;	a plurality of light sources mounted on each of the circuit substrates such that the light sources are spaced apart by a predetermined distance;
a reflection layer disposed on the circuit substrate, the reflection layer comprising	a reflection layer disposed on the circuit substrate, the reflection layer comprising	a reflection layer disposed on the circuit substrates, the reflection layer comprising

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a first surface having a plurality of openings where the respective light sources are located,	a first surface having a plurality of openings where the respective light sources are located,	a first surface having a plurality of openings where the respective light sources are located,
a second surface connected to the first surface, wherein the second surface has an inclination with respect to the first surface, and	a second surface connected to the first surface, wherein the second surface has an inclination with respect to the first surface, and	a second surface connected to the first surface, wherein the second surface has an inclination with respect to the first surface, and
a hole pattern having a plurality of through holes provided in the second surface of the reflection layer,	a hole pattern having a plurality of through holes provided in the second surface of the reflection layer,	a hole pattern having a plurality of through holes provided in the second surface of the reflection layer,
wherein at least two through holes of the hole pattern are different in size; and	wherein at least two through holes of the hole pattern are different in size;	wherein at least two through holes of the hole pattern are different in size;
an optical sheet disposed on the light sources.	an optical sheet disposed on the light sources; and	an optical sheet disposed on the light sources; and
2. The planar lighting device of claim 1, further comprising		

a spacer disposed between the reflection layer and the optical sheet.	a spacer disposed between the lower cover and the optical sheet; and	a spacer disposed between the lower cover and the optical sheet.
	a liquid crystal panel on the lighting device.	

91. My analysis below will show the presence of each element of each asserted claim in prior art references describing known backlight assemblies. I will explain that a POSITA would have been motivated to combine the references in the manner in which I propose. Moreover, a POSITA would have recognized a reasonable probability of success from the combinations that I propose and discuss.

92. Of the eleven claim limitations in the above table of independent claims eight limitations are identical.¹ The remaining three limitations are either minor variations of each other, e.g., circuit substrates and light sources, or a conventional structure, such as a cover, included in every backlight assembly.

¹ Dependent claim 2 is included in this table because it adds to the combination of independent claim 1 the same claim limitation present in independent claims 22 and 31.

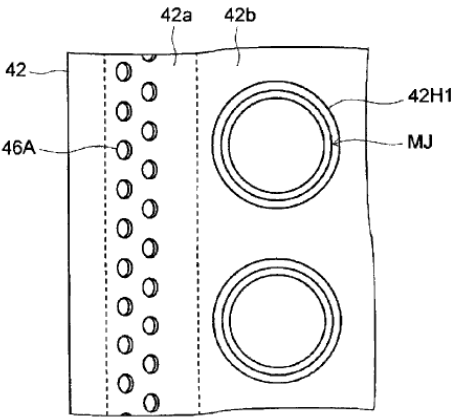
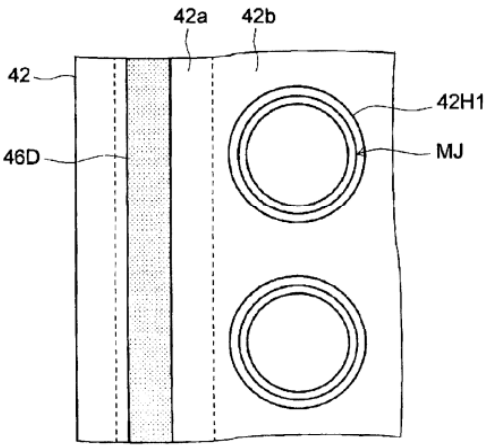
93. Many of the common claim elements of the independent claims are similarly ubiquitous in prior art direct-type backlight assemblies. These include a reflection sheet with a central portion in which there are regularly spaced openings for receiving LED light sources and inclined peripheral portions, spacers, and optical sheets. Backlight assemblies are used as the light source for direct-type liquid crystal panels so the recitation of a liquid crystal panel in independent claim 22 is of no patentable significance. Moreover, the prior art applied in my analysis shows such a panel.

94. I focus on each claim limitation in the claims challenged in the Petition, and in this introduction would like to preview two elements in particular. These limitations, which are identically recited in each independent claim, are:

Limitation 1. “a hole pattern having a plurality of through holes provided in the second surface of the reflection layer,” and

Limitation 2. “wherein at least two through holes of the hole pattern are different in size.”

95. Yokota unquestionably meets limitation 1.

YOKOTA HOLE EMBODIMENT	YOKOTA DOT EMBODIMENT
FIG.3 	FIG.9 
“According to another preferred embodiment of the invention, in the illumination device structured as described above, the reflection reduction treatment is achieved by <u>forming a number of small apertures in the inclined surface.</u>” Ex. 1004 at [0015], emphasis added.	“The printed portion 46D with increased light absorptance reflects less light than the non-printed portion, and this reduces the overall amount of light reflected on the inclined surface 42a so as to travel toward the diffusive plate 43. This prevents disproportionately higher luminosity in a peripheral part, than elsewhere, of the diffusive plate 43. Ex. 1004 at [0089] – [0091].

96. It is my opinion that the hole embodiment of Yokota fully meets limitation 1, and fails to meet limitation 2 only because claims require that the holes must be at least two sizes. However, Yokota also teaches alternatives to holes for reducing light reflectance from the inclined surfaces 42a of the reflection sheet. Specifically, Yokota teaches:

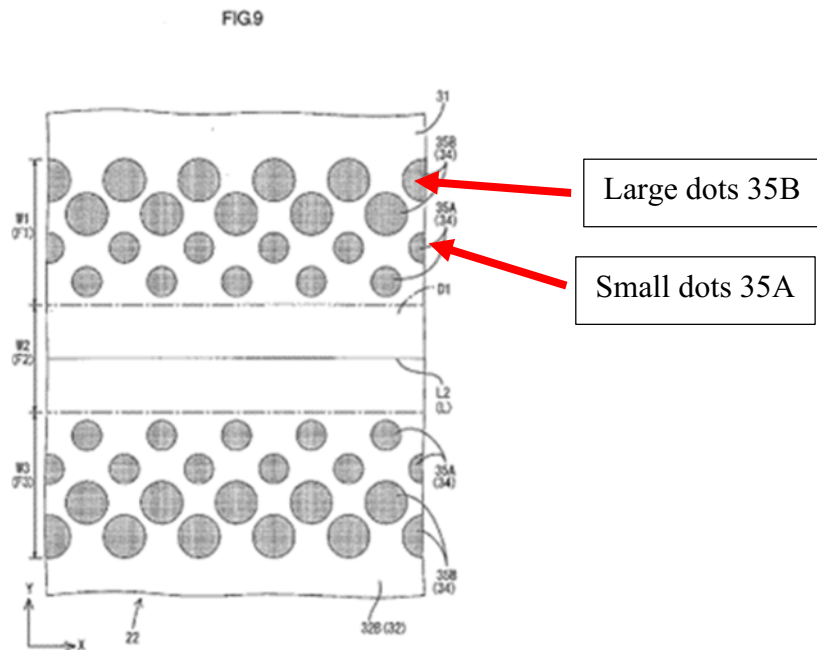
In the backlight unit 49 according to a fourth embodiment of the invention shown in FIGS. 8 and 9, applying printing with higher light absorptance than the inclined surface itself to the inclined surface 42a constitutes reflection reduction treatment.

In the printed portion 46D, dark-color ink is applied in a dotted pattern composed of a large number of dots ...to obtain higher light absorptance.

Ex. 1005 at [0089], [0090].

97. This teaching of the interchangeability of holes and printed dots as effective reflection-reduction elements is important because Matsumoto provides the teaching of using different sizes of dots of reflection-reducing material as reflection-reduction elements. Specifically, in Matsumoto's effort to obtain uniform luminance for a backlight by eliminating "dark portions" in the border portion Matsumoto applies a reflectance-reduction treatment to the reflective

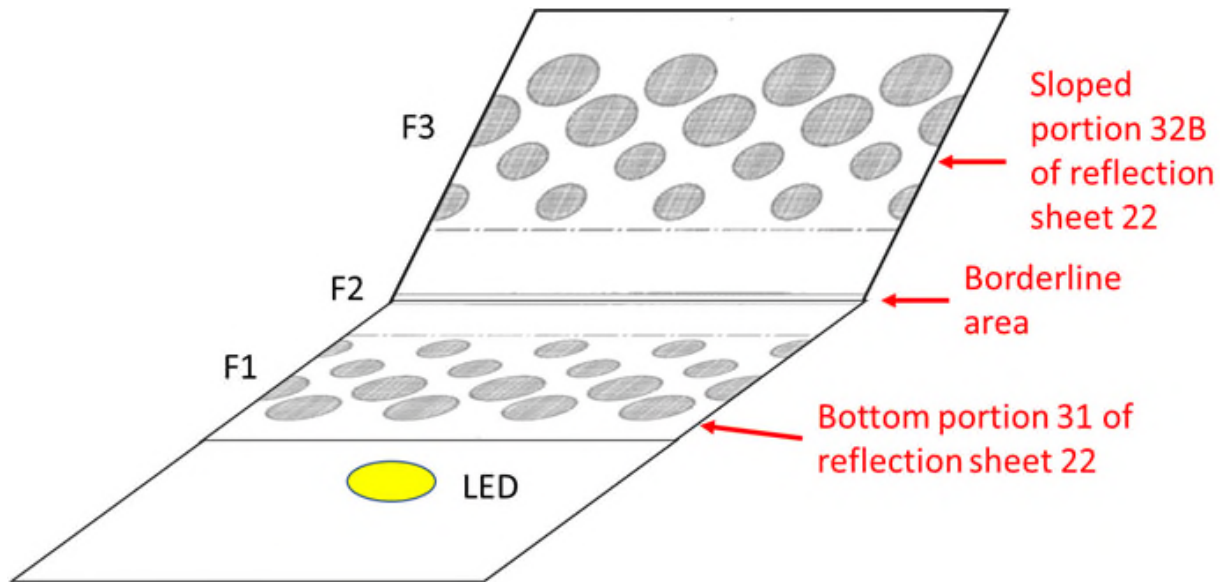
surfaces of first sheet sloped (inclined) portions 32A and second sheet sloped (inclined) portions 32B of a reflection sheet 22. I have made the schematic drawing below from the teachings in FIGs. 7, 8 and 9 of Matsumoto to illustrate how this is accomplished using a second sheet sloped portion 32B as an example.



Ex. 1001, FIG. 9.

98. The following schematic combination of FIGs. 7, 8 and 9 of Matsumoto shows the pattern of dots printed on a reflection sheet 22, including on

the inclined, second sheet sloped portion 32B of the reflection sheet 22.



99. The areas F1 in the bottom portion 31 and F3 in the sheet sloped portion 32B have a reflection-reduction treatment in the form of a pattern of reduced-reflection dots 35A and 35B formed on the interior surface of the reflection sheet 22. Area F3 corresponds to the of inclined sheet sloped portion 32B of the reflection sheet 22. Ex. 1005 at FIGs. 8 and 9.

100. Specifically, in FIG. 9, the dots 35A (small) and 35B (large) of the portion 34 reflect light less effectively than untreated areas of the chassis reflection sheet 22. It is my opinion that given Yokota's teaching of the interchangeability of holes and printed dots as reflection-reduction elements and the teaching of Matsumoto of using dots of different size to provide different degrees of reflection

reduction, it would have been obvious to a POSITA to modify the holes of Yokota to have different sizes to meet the scope of limitation 2.

101. From the above discussion, it is clear that Yokota discloses a backlight assembly and states a specific goal is to prevent the inclined surface 42a from causing unnecessarily high luminance of edge portions of the diffusive sheet compared with the central section of the diffusive sheet. Ex. 1004 at [0012]. Yokota achieves this goal by applying a reflection-reduction treatment to the inclined surface 42a. *Id.* at [0013]. One embodiment of the reflection-reduction treatment is to provide holes 42a in the inclined portions of the reflection sheet. *Id.* at FIG. 3. Yokota explains that the size, intervals, and positions in inclined surface 42a of the apertures 46A are optimized through experiments. *Id.* at [0081]. Yokota further teaches that printing reflection-reducing dots of, for example, light absorbing material, is another type of reflection-reduction treatment. *Id.* at FIG. 9; [0090].

102. A purpose of Matsumoto is to eliminate noticeable “dark portions” in the border of a diffusion sheet caused by non-uniform illumination by the backlight. Matsumoto at [0004], [0008-0009]. A reduced light reflecting portion 34, which is embodied as a pattern of reduced reflection dots (35A) and (35B), is formed in portions of a front surface of reflection sheet 22, including inclined sheet

sloped portion 32B at the periphery of the reflection sheet. *Id.* at [0080-0081], Fig.

9. The dots 35A and 35B are illustrated as being of two different sizes and each dot reflects less light than the remainder of the reflection sheet 22. *Id.*

103. A POSITA working in the field of backlight assemblies would look to the teachings of Yokota and Matsumoto regarding backlight assemblies having non-uniform brightness. From these highly compatible teachings I conclude that it would have been a matter of routine design for a POSITA to modify Yokota in view of Matsumoto to provide holes of different sizes in the inclined portion of a reflection sheet.

104. Moreover, this combination would also be obvious to try and a POSITA would have a reasonable expectation of success in combining Yokota and Matsumoto because of the teaching in Yokota of the interchangeability of holes and printed dots as reflection reduction elements,

A. Claim 1

- a. Limitation 1a: Preambles: “A planar lighting device comprising/A display device comprising: a lighting device including/A direct-type lighting device comprising”

105. The preamble of claim 1 recites “[a] planar lighting device comprising.” The preamble of claim 22 recites a “display device comprising: a

lighting device.” The preamble of claim 31 recites a “direct-type lighting device.”

To the extent the preambles are limiting, they are disclosed in Yokota.

106. Yokota discloses a “display device 69” with a “backlight unit (49).” Ex. 1004 at Abstract and FIG. 1. The backlight unit (49) is a planar, direct-type backlight device because the light sources are provided in a planar array beneath a diffuser sheet that covers an open side of the backlight device. Ex. 1004 at [0059]. The light sources are oriented to directly illuminate the diffuser sheet. *Id.*

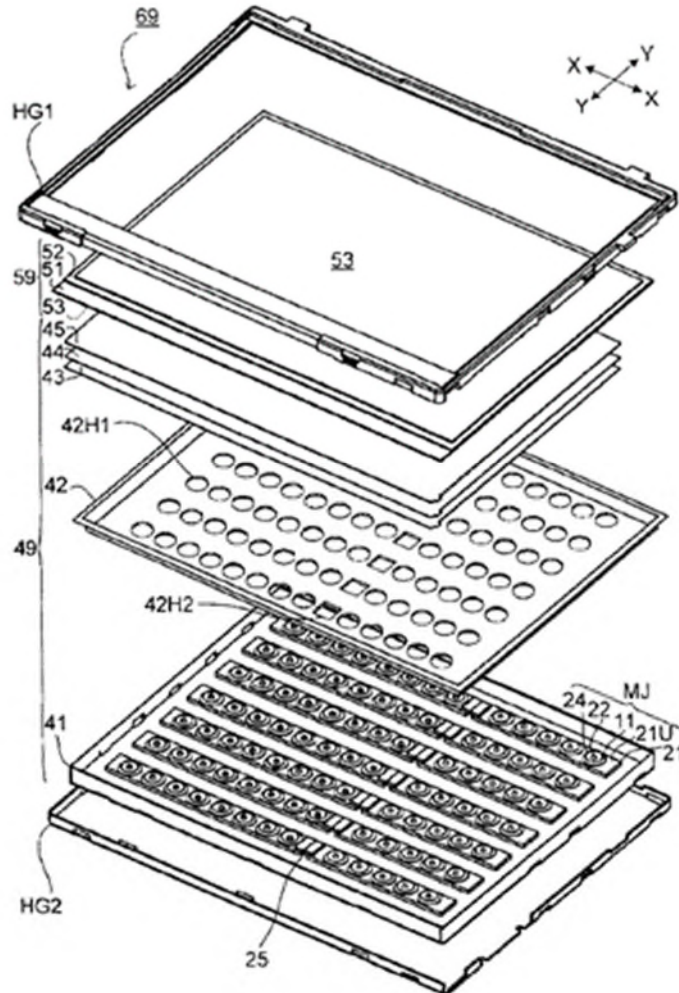
- b. Limitation 1b: “lower cover/circuit substrate/circuit substrate disposed on the lower cover/a plurality of circuit substrates disposed on the lower cover and spaced apart by a predetermined distance, “a receiving part configured to receive at least one of digital image data and analog image data;”

107. A “lower cover” is recited in claims 22 and 31, but not claim 1. Yokota discloses a chassis 41 serving as a lower cover. Ex. 1004 at [0074], FIGs. 1 and 2.

108. Claim 1 recites “a circuit substrate.” Claims 22 and 31 associates “circuit substrates” with respect to the lower cover. That is, claim 22 recites a “circuit substrate disposed on the lower cover.” Claim 31 recites a “plurality of circuit substrates disposed on the lower cover and spaced apart by a predetermined distance.” I will address “circuit substrates” and “circuit substrates disposed on a cover” together because Yokota discloses each of these similar limitations.

109. FIG. 1 of Yokota is reproduced below.

FIG. 1



Ex. 1004 at Fig. 1.

110. In FIG. 1, substrates formed by mounting boards 21 have either five or eight light emitting modules MJ arranged thereon. The mounting boards 21 are coupled together lengthwise by connectors 25. *Id.* at [0073]. The mounting boards 21 have a mounting surface 21U, on which electrodes (not shown) are formed at

predetermined intervals in the lengthwise direction. *Id.* at [0068]. LEDs 22 are mounted on the electrodes. Each mounting board 21 is common to a plurality of LEDs 22. *Id.* That is, as shown in FIG. 1, a plurality of sets of light emitting modules MJ, including an LED 22, a diffusive lens 24, and a built-in reflective sheet 11 combined together, are arranged on each mounting board 21, at predetermined intervals in its lengthwise direction. *Id.* As shown in FIG. 1 multiple rows of mounting boards 21 are spaced apart by a predetermined distance and are disposed on rear housing HG2. *Id.* at [0056] and FIG. 1 In construing “predetermined” I use my understanding of the plain and ordinary mean of that term such as “decided or arranged at an earlier time.” A POSITA would have understood that the depictions of the mounting boards in FIG. 1 to be in parallel rows spaced by what is depicted to be a uniform distance indicates that the placement of the mounting boards on the lower cover was decided at the design phase. Further, a POSITA would have understood that uniformly spaced rows of LEDs would yield the desired uniform illumination of the diffuser sheet.

- c. Limitation 1c]: “plurality of light sources disposed on the circuit substrate/plurality of light sources disposed on the circuit substrate such that the light sources are spaced apart by a predetermined distance”

111. Claims 1 and 22 identically recite a “plurality of light sources disposed on the circuit substrate.” Claim 31 similarly recites a “plurality of light

sources disposed on the circuit substrate such that the light sources are spaced apart by a predetermined distance.” Yokota meets each of these limitations.

112. Yokota discloses that “[o]ne mounting board 21 is common to a plurality of LEDs 22. That is, as shown in FIG. 1, a plurality of sets of an LED 22, a diffusive lens 24, and a built-in reflective sheet 11 combined together are arranged on each mounting board 21, at predetermined intervals in its lengthwise direction.” Ex. 1004 at [0068]. In addition to stating that the LEDs 22 are “arranged ... at predetermined intervals,” FIG. 1 of Yokota shows that the LEDs 22 are spaced apart by “a predetermined distance” as further recited in claim 31. Ex. 1004 at FIG. 1, [0068]. Therefore, Yokota discloses a plurality of light sources (e.g., LEDs 22) disposed on circuit substrate (mounting boards 21) such that the light sources are spaced apart by a predetermined distance.

d. Limitation 1d: “a reflection layer disposed on the circuit substrate”

113. This element is identically recited in claims 1, 22, and 31; it is clearly shown in Yokota.

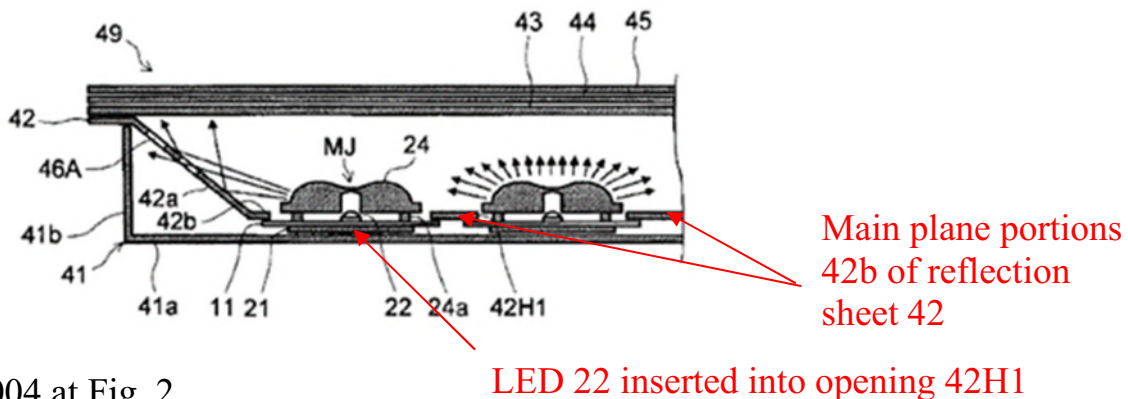
114. Yokota discloses a reflective sheet 42 disposed on the substrate mounting boards 21 on which the LEDs 22, are mounted. Ex. 1004 at [0076], FIGs. 1 and 2. Therefore, Yokota discloses a reflection layer (e.g., reflective sheet 42) disposed on the circuit substrate (e.g., mounting boards 21).

- e. Limitation 1e: “a first surface having a plurality of openings where the respective light sources are located”

115. This element is identically recited in claims 1, 22, and 31; it is clearly shown in Yokota.

116. Yokota discloses that a main plane 42b of the reflective sheet 42. The main plane 42b includes circular clearance openings 42H1 in which the light sources LEDs 22, are inserted. Ex. 1004 at [0077], FIGs. 1 and 2.

FIG.2



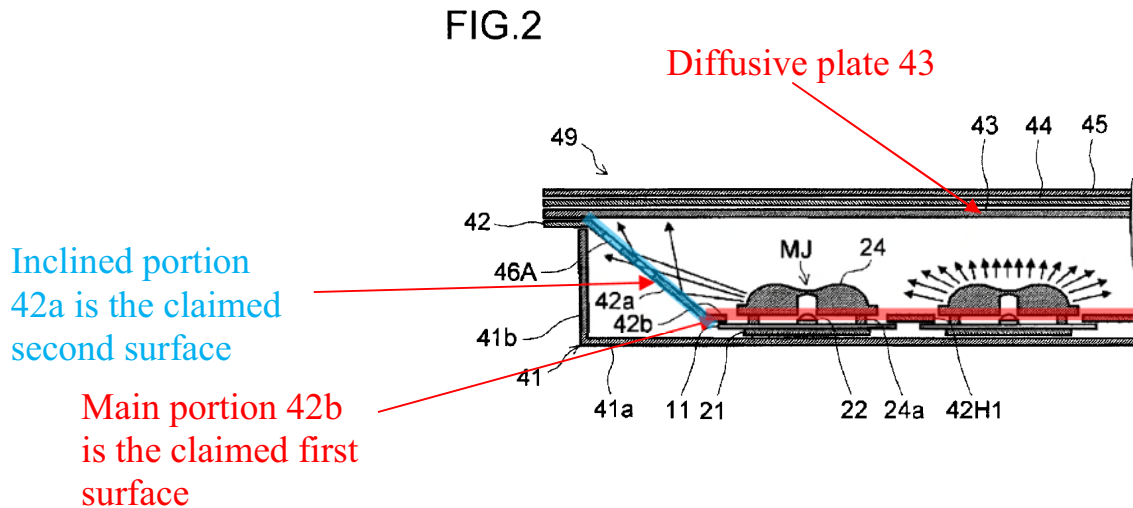
Ex. 1004 at Fig. 2.

Therefore, Yokota discloses a first surface (e.g., a main plane 42b) having a plurality of openings (e.g., circular clearance openings 42H1) where the respective light sources are located (e.g., LEDs 22).

- f. Limitation 1f: “a second surface connected to the first surface, wherein the second surface has an inclination with respect to the first surface”

117. This element is identically recited in claims 1, 22, and 31; it is disclosed in Yokota and is met by inclined portions 42a of the reflection sheet 42..

118. As shown in FIG. 2 and discussed in Yokota, an inclined surface 42a (turquoise) is contiguous at its lowest end with a main plane 42b (red) of the reflective sheet 42. Ex. 1004 at [0075], [0076], [0079].



Ex. 1004 at Fig. 2.

Light emanating from LEDs 22 illuminates diffusive plate 43 from behind. Light not traveling directly toward diffusive plate 43 or light reflecting off of diffusive plate 43 is reflected by reflective sheet 42 toward diffusive plate 43. Light emanating sideways from LEDs 22 strikes inclined surface 42a of reflective sheet 42 and is reflected toward diffusive plate 43. Ex. 1004 at [0078].

Therefore, Yokota discloses a second surface (e.g., inclined surface 42a) connected to the first surface (e.g., main plane 42b) wherein the second surface has an inclination with respect to the first surface (e.g., inclined surface 42a is inclined when compared to first surface main plane 42b).

- g. Limitation 1g: “a hole pattern having a plurality of through holes provided in the second surface of the reflection layer, wherein at least two through holes of the hole pattern are different in size”

119. This element is identically recited in claims 1, 22, and 31, and is obvious in view of the teachings of Yokota in view of Matsumoto which are illustrated with reference to the table and discussion below.

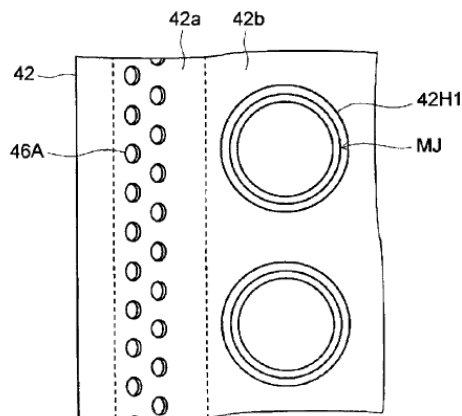
Matsumoto Fig. 9	Yokota Fig. 3
Light reflecting portions 34 may be formed as a pattern of dots of different size (35A and 35B) of light absorbing material on the second (inclined) surface 32 of the	An inclined surface 42a forming a number of small apertures 46A in the inclined surface 42a. Ex. 1004 at [0076] and [0079], FIGs. 2 and 3.

of the chassis reflection sheet 22. Ex. 1005 at [0077] and FIG. 9.	“[T]he size, intervals, positions in the inclined surface 42a, etc. of the small apertures 46A are preferably <u>optimized through experiments</u> ,” Ex. 1004 at [0081, FIG. 2.], emphasis added. Yokota further teaches that instead of small apertures 46a a pattern of dots of dark colored ink serving as light absorbent material can be provided on the inclined surfaces 42a. Ex. 1004 at [0089], [0090].
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120. Yokota discloses a reflective sheet 42 with an inclined portion 42a around its periphery. Ex. 1004 at [0076], [0014]. A specific goal of Yokota is to prevent the inclined surface 42a from causing unnecessarily high luminance of edge portions of the diffusive sheet. *Id.* at [0012]. This goal is achieved by applying a reflection-reduction treatment to the inclined surface 42a. *Id.* at [0013]. The reflection-reduction treatment applied to the inclined surface 42a of the reflective sheet reduces the amount of light reflected from it to prevent disproportionately higher luminance in the peripheral part of the diffusive plate compared to illumination elsewhere on the diffusive plate. *Id.* at [0014].

121. Yokota teaches multiple structures for the reflection-reduction treatment. Compare Ex. 1004 at ¶¶[0079-0080] and [0090-0091]. One treatment is to form an arrangement of holes (apertures) 46A in the inclined surfaces 42a of reflective sheet 42. *Id.* at [0015], FIGs. 2 and 3.

FIG.3

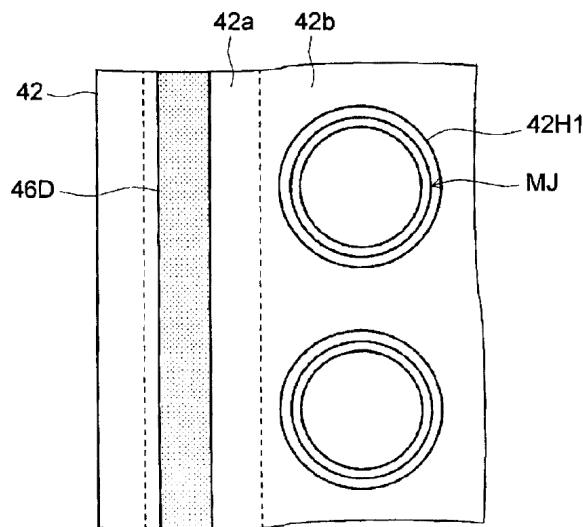


122. The holes 46A can be punched during the molding process of the reflective sheet 42. *Id.* at [0016]. The area with the holes has reduced light reflectance such that the total light reflected from the inclined portion 42a will be reduced compared to an inclined portion 42a without holes. *Id.* at [0024]. Yokota explains that the size, intervals, and positions in inclined surface 42a of the apertures 46A are optimized through experiments. *Id.* at [0081]. As a consequence of providing apertures 46A (holes) in the inclined areas 42a of the reflective sheet

42 the edge portions of the diffusive plate 43 will not be noticeably brighter than other areas of the diffusive plate and illumination will be more uniform.

123. Yokota further teaches that reflection reducing dots of, for example, light absorbing material are another type of reflection reduction treatment.

FIG.9



Ex. 1004 at Fig. 9.

124. As shown in FIG. 9, “[i]n the printed portion 46D, dark-color ink is applied in a dotted pattern composed of a large number of dots . . . to obtain higher light absorptance.” Ex. 1004 at [0090]. The printed portion 46D with increased light absorptance due to the dark-color ink reflects less light than the non-printed portion, and this reduces the overall amount of light reflected from the inclined surface 42a to the edge portions of the diffusive plate 43 and prevents

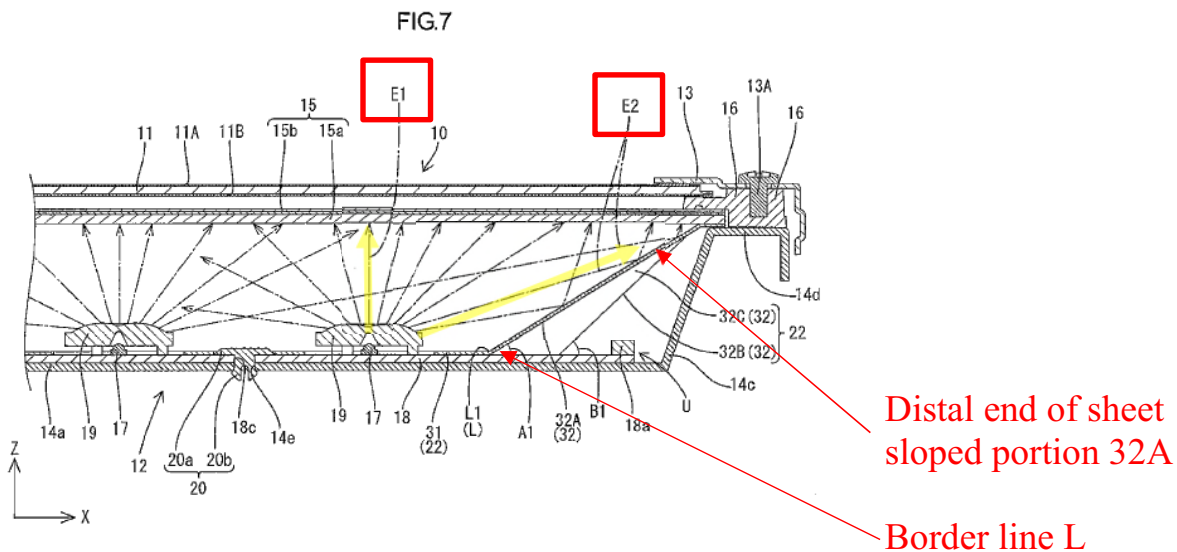
disproportionately higher luminosity in the edge portions of the diffusive plate 43 than elsewhere in the diffusive plate. Ex. 1004 at [0091].

125. Yokota provides guidance that the size, spacing, pattern, and positions of the small holes 46A on the inclined surface 42a, and the degree of light absorptance, area (size), pattern, and position of the light absorbent dots 46D on the inclined surface 42a are preferably optimized through experiments to obtain the proper reflectance. Ex. 1004 at [0081], [0092].

126. A POSITA would have readily understood that Yokota teaches the interchangeability of dots of reflection-reduction material, such as dots of light-absorbent ink, and holes to attain the desired result of selectively reducing light reflectance in selected areas of an inclined reflective surface to eliminate uneven luminance of a diffuser sheet. Moreover, from Yokota a POSITA would have understood that the sizes, patterns, intervals, and locations of such elements depend on the location, degree, and size of the unwanted areas of higher luminance as caused by the specific design of the backlight.

127. Yokota teaches the entirety of this claim limitation except that “at least two through holes of the hole pattern are different in size.” This is easily found in Matsumoto, which like Yokota discloses a direct-type backlight assembly.

128. A purpose of Matsumoto is to eliminate noticeable “dark portions” in the border of a diffusion sheet caused by non-uniform illumination by the backlight. Ex. 1005 at [0004], [0008-0009]. Specifically, Matsumoto refers to FIG. 7 to describe a problem of a backlight not uniformly illuminating a diffuser causing a display to have uneven brightness. Ex. 1005 at [0082].

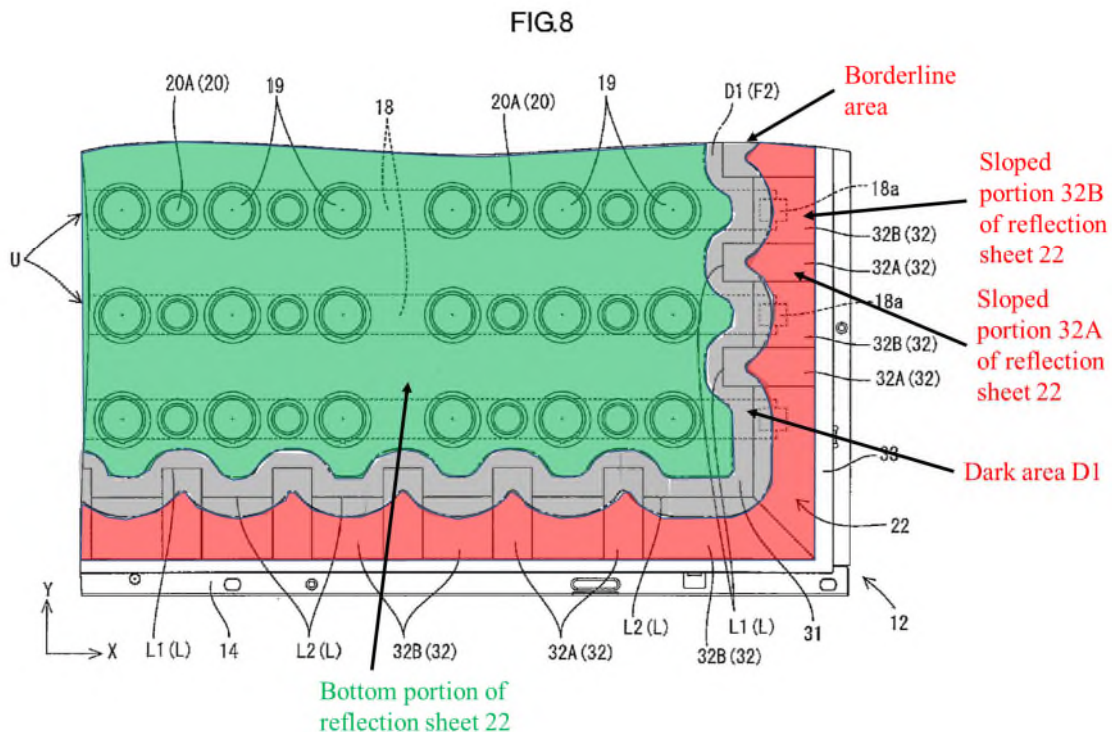


Ex. 1005, FIG. 7 (annotated).

129. As described previously, the emission intensity of an LED 17 is greatest along the light axis E1 represented by arrow E1 in FIG. 7 and sharply decreases as the angle of a light ray to the light axis E1 increases. Ex. 1005 at [00083] Light rays E2 from the LED 17 reaching the distal end of the sheet sloped portions 32 have a relatively small angle with respect to light axis E1 compared to light reaching a portion adjacent to the borderline L which is at an angle of

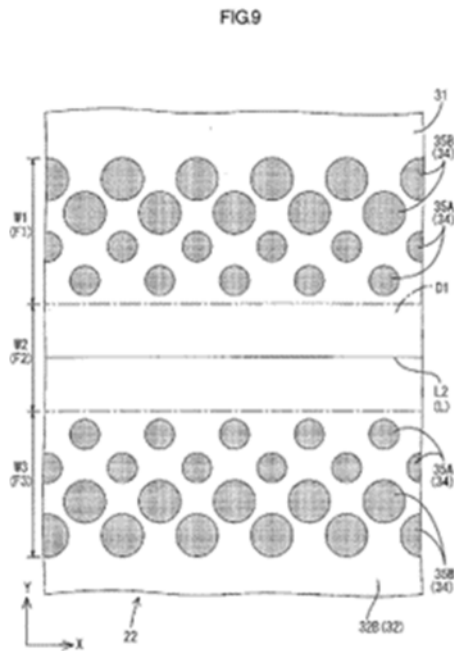
approximately 90 degrees with respect to the light axis E1. Thus, the number of light rays reaching the portion adjacent to the borderline L is smaller than the number of light rays reaching the distal end of the sheet sloped portion 32. *Id.* Accordingly, fewer light rays reach a border portion F2 of the chassis reflection sheet 22 resulting in a portion encompassing the border line L appearing as dark portions, i.e., lower illumination than adjacent portions F1, F3 (shown below in FIG. 9 and in schematic combination of FIGs. 8 and 9, below.). *Id.* This causes uneven brightness. Ex. 1005 at [0083], [0084].

130. FIG. 8 of Matsumoto has been highlighted to locate the dark portions on the reflective sheet 22.



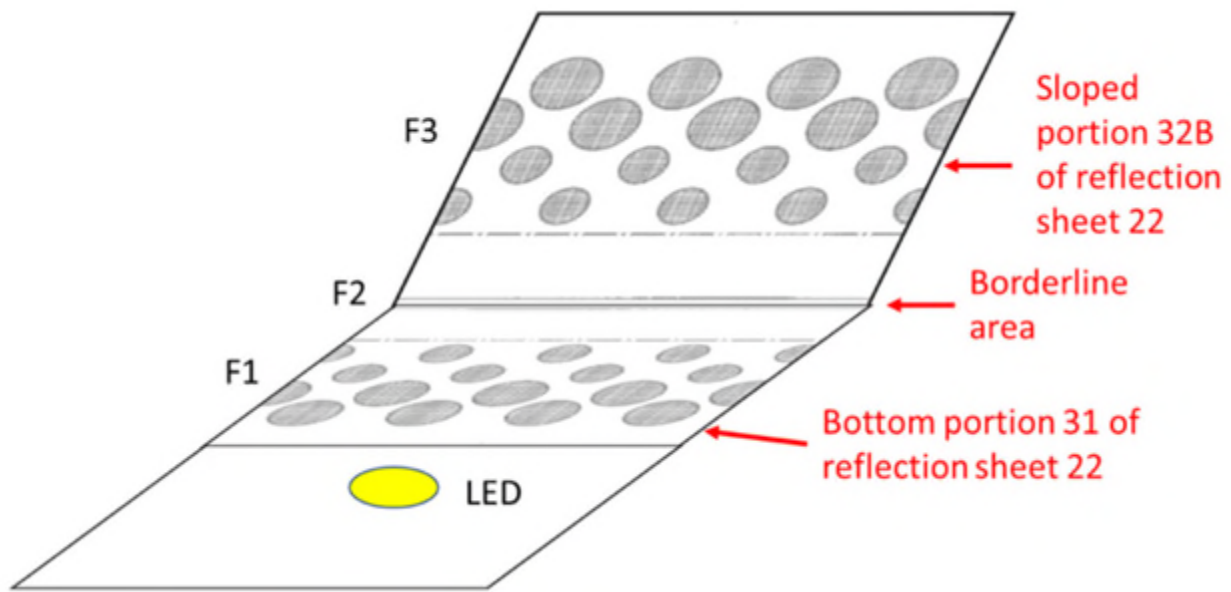
Ex. 1005, Fig. 8 (annotated).

Fig. 9 illustrates a pattern of reflectance reduction elements incorporated into the structure of Fig. 8 to eliminate noticeable dark portions.



Ex. 1005 at Fig. 9.

131. The illustration below is a schematic diagram produced by combining portions of FIGs 7, 8 and 9 in view of their corresponding description of each drawing in the Matsumoto specification. The diagram shows the relationships of areas F1-F3 of the bottom portion 31 and the inclined, sheet sloped portion 32B of the reflection sheet 22.



Ex. 1005 at Figs. 7, 8 and 9 (annotated).

132. The area F2 is the fold region of reflection sheet 22 at the borderline L. Area F1 is an area of the bottom portion 31 of reflection sheet 22 and area F3 is the surface of the inclined, sheet sloped portion 32B of the reflection sheet 22. The area F2 is the location of the dark portion D1 highlighted in FIG. 8, above.

133. Referring to FIG. 8, a light reflecting portion 34, which is embodied as a pattern of dots (35A) and (35B) formed in portions F1, F3 on a front surface of reflection sheet 22. The areas covered by dots have a reduced reflection compared with the other areas of the reflection sheet 22.. *Id.* at [0088-0089], Fig. 9. F3 corresponds to the inclined sheet sloped portion 32B. *Id.* at FIGs. 8 and 9. The dots 35A and 35B reflect less light than the remainder of the reflection sheet 22. *Id.* at

[0080-0081]. Since there are no reduced-reflection dots in the border portion F2 of the reflection sheet 22 light reflection in area F2 is not reduced and will be higher than the light reflectance of the reflection sheet 22 in areas F1 and F3 because those areas are treated with reduced-reflection dots 35A and 35B). *Id.* at [0078].

134. As discussed with reference to FIG. 7, fewer light rays reach the border portion F2 than reach areas F1 and F3. This would normally cause light reflectance from area F2 to be lower than reflectance of light from areas F1 and F2 because for the same reflecting surface fewer incident light rays means lower light reflectance. Consequently, the area F2 will produce a noticeable darker portion in the display. *Id.* at [0083], [0084]. However, by applying the dots 35A and 35B to reduce reflectance in portions F1 and F3 the brightness of light reflected from areas F1 and F3 will be reduced such that the brightness does not abruptly change in the area of the borderline L in area F2 when compared to areas F1 and F3. Consequently, noticeable “dark portions” and uneven brightness do not appear. *Id.* at [0086], [0088].

135. Matsumoto clearly shows that the areas of dots 35A (small), 35B (large) are different and Matsumoto shows in FIG. 9 a pattern of dots provided at predetermined intervals. Matsumoto further instructs that in addition to the dots differing in size, the dots can be applied in different patterns to control the degree

of light reflectance from the area of a reflective sheet in which the dots are located. *Id.* at [0077], [0081], [0089]. Thus, from the teachings of Matsumoto a POSITA would have readily understood to apply patterns of different sized dots of reduced reflection material to areas of a reflection sheet to reduce the reflectance therefrom, and hence to lower the illumination from areas of a reflection sheet in order to attain uniformity of illumination in a direct-type backlight assembly.

136. Yokota teaches that dots of reflection reducing material applied to peripheral, inclined surfaces of a reflective sheet and holes punched in the sheet can be used interchangeably as elements of a reflection-reduction treatment to provide localized reduction of light reflectance in a backlight assembly. Moreover, Yokota instructs that the “size, intervals, positions in the inclined surface 42a, etc. of the small apertures 46A are preferably optimized through experiments.” Ex. 1004 at [0081], emphasis added. That is, the size, location, pattern, and spacing of such elements are selected according to the design of the backlight. Ex. 1004 at [0081], [0084], [0090], [0092] Thus, from this disclosure in Yokota a POSITA would have been motivated to use different size holes in the inclined portions of the reflection sheet to optimize the uniformity of illumination by the backlight. Moreover, this teaching of Yokota to change the size of the holes is directly addressed by Matsumoto, which adds to the teachings of Yokota the use of

multiple sizes of reflectance reduction elements included in a pattern of such elements. A POSITA would understand from the prior art teachings of Yokota in view of Matsumoto that multiple sizes of holes when provided in inclined portions of a reflection sheet according to the design of the backlight assembly will assist in providing uniformity of illumination of a diffuser sheet in a backlight assembly.

137. The combination of Yokota in view of Matsumoto would have instructed a POSITA to adopt a reflection-reduction treatment comprising a pattern of holes of at least two different sizes in peripheral, inclined portions of a reflective sheet, which fully meets this claim element.

138. Moreover, a POSITA would have been motivated to combine the teachings of Yokota and Matsumoto. The prior art solutions of Yokota and Matsumoto are used in the same environment (direct-type backlights), on the same element (reflection sheets), in the same area (inclined portions of the reflection sheets) for the same purpose (the localized reduction of reflectance to achieve uniform luminance in the backlight). Yokota teaches the interchangeability of holes and dots of reflection reducing material to embody the reflection reduction treatment. Both references teach that the size, pattern, and location of the elements is selected based upon experimentation according to the design of the backlight assembly. Consequently, a POSITA would have been motivated to apply the

combined teachings of Yokota and Matsumoto to provide a pattern of holes of two different sizes in inclined portions of a reflective sheet to optimize uniformity of illumination. The combination of Yokota and Matsumoto teaches this claim element.

h. Limitation 1h: “an optical sheet disposed on the light sources”

139. The optical sheet is present in Yokota.

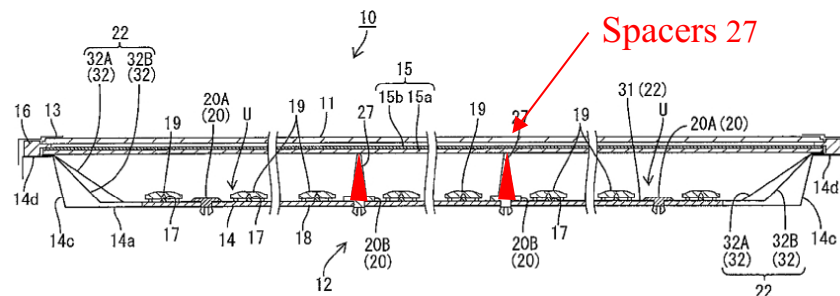
140. Yokota discloses a diffusive sheet 43, a prism sheet 44, and a microlens sheet 45 disposed on the light emitting modules MJ, which includes the light sources, i.e., LEDs 22. Ex.1004 at [0059], FIGs. 1 and 2. Claim 18 of the '740 patent which depends upon independent claim 1 recites: “The planar lighting device of claim 1, wherein the optical sheet comprises at least one of a diffusion layer, a lower polarizing plate, a color filter substrate and an upper polarizing plate. Ex. 1001, 11:26-29. Yokota teaches the same types of optical sheets as claimed in the '740 patent. Yokota also discloses that these optical sheets are disposed on the light emitting modules MJ which contain the LEDs. Ex. 1004 at [0073-0074], Fig. 1.

- i. Limitation 1i: “a spacer disposed between the lower cover and the optical sheet; a spacer disposed between the lower cover and the optical sheet”

141. Claim 22 further recites “a spacer disposed between the lower cover and the optical sheet.” Claim 31 recites “a spacer disposed between the lower cover and the optical sheet.” Claim 1 does not recite a spacer limitation, but claim 2, which depends from claim 1, recites as its only limitation that the planar lighting device of claim 1 further comprises “a spacer disposed between the reflection layer and the optical sheet.” This recitation in claim 2 is the same as the spacer limitation of claim 22.

142. Matsumoto discloses a supporting pin 27 that projects from supporting member 20B and is located between the chassis 14 (lower cover) and the diffuser 15a such that the diffuser 15a is supported from the lower side by the support pins 27. Ex. 1005 at [0064]; Fig. 4.

FIG.4



Ex. 1005 at Fig. 4, annotated.

143. As shown in FIG. 4, a stopper portion 20b secures the support pins 27 to the bottom plate 14a of the chassis 14, which forms the bottom cover of the backlight assembly. *Id.* at [0042], [0063]. The support pins 27 ensures that the proper spacing is maintained between the diffuser 15a and the reflective sheet 22 so that uneven brightness is less likely to result from warping of the diffuser 15a. *Id.* at [0064].

144. As stated above, a POSITA would have looked to a combination of Yokota and Matsumoto in designing a backlight assembly with uniform luminance. ¶¶95-103,135-137, *supra*. Moreover, Matsumoto teaches the value of the support pins 27, which are connected to the chassis 14 (the back cover) to maintain a uniform distance between the reflective sheet and diffuser to prevent uneven brightness due to warping of the diffuser. *Id.* Consequently, a POSITA would have been motivated to include the support pins 27 in the backlight assembly of Yokota to support the diffuser from the chassis 14 and to maintain a uniform space between the reflective sheet 42 and the diffuser 15a to avoid uneven brightness due to warping of the diffusive plate. Therefore, the combination of Yokota and Matsumoto discloses a spacer (e.g., support pins 27) disposed between a lower cover (chassis 14) and an optical sheet (diffuser 15a) in a manner that meets the “spacer” limitations in each of claims 2, 22, and 31. It would have been obvious to

a POSITA in light of the teachings of Matsumoto to implement such spacers in Yokota. The implementation would yield predictable results with a reasonable expectation of success without undue experimentation.

j. Limitation 1j): “a liquid crystal panel on the lighting device”

145. This limitation is in independent claim 22 and is not present in independent claims 1 and 31. Not surprisingly all of the applied references, which disclose backlight assemblies for use with liquid crystal panels, also disclose a liquid crystal panel. For example, Yokota discloses a liquid crystal panel 59 which meets this limitation. Ex. 1004 at [0057].

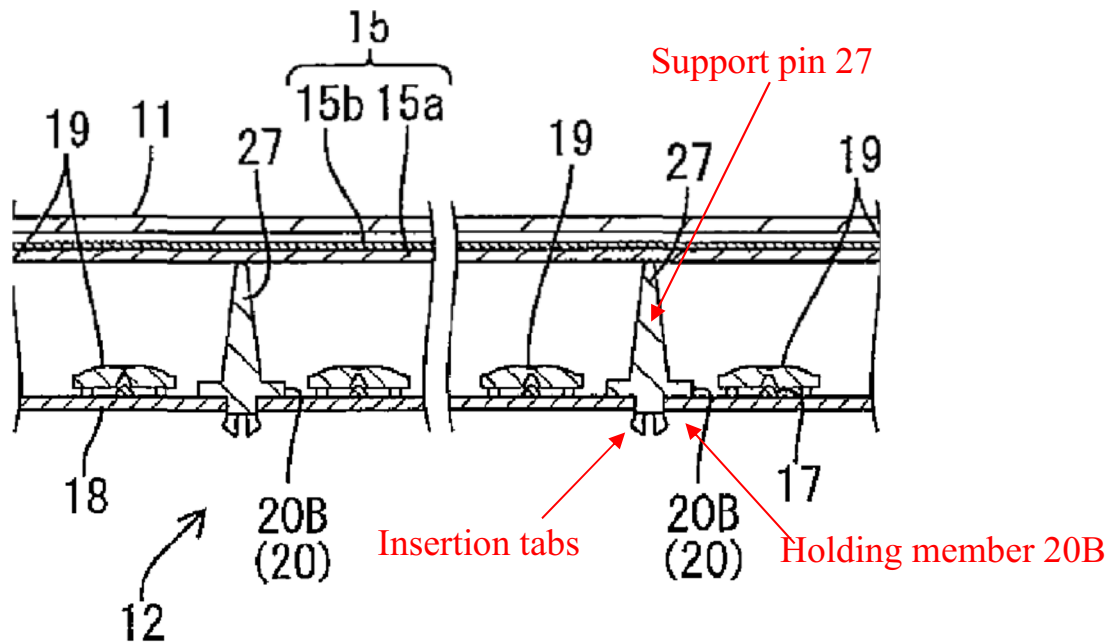
146. The foregoing discussion of the elements a-j found in claims 1, 2, 22, and 31 establishes the combination of those elements as recited in those claims would have been obvious to a POSITA at the time the alleged invention of the '740 patent was made.

B. Claim 3: “The planar lighting device of claim 2, wherein the spacer is formed of at least one material selected from polycarbonate (PC), polymethyl methacrylate (PMMA), glass, a resin, phenyl propanol amine (PPA) or aluminum (Al) and thus exhibits light transmission, refraction or reflection.”

147. A POSITA would have understood that the spacer pin disclosed in Matsumoto is formed of at least one material selected from polycarbonate (PC), polymethyl methacrylate (PMMA), glass, a resin, phenyl propanol amine (PPA) or

aluminum (Al) and thus exhibits light transmission, refraction or reflection.

Matsumoto teaches that the LED board 18 is fixed to the bottom plate by a holding member 20. “The holding member 20B includes a disk-like shaped pressing portion **20a** and a stopper portion **20b** extending downwardly from the pressing portion **20a**.” ... “A distal end portion of the stopper portion 20b of the holding member 20 is formed to be an **elastically deformable** wide portion.” Ex. 1004 at [0063], emphasis added. An enlarged view of the holding member 20B from Matsumoto Fig. 4 is shown below. The holding member is inserted into a hole in the LED board 18 with “tabs” to lock the member in place; these tabs would necessarily be deformable. Further, holding members 20B arranged in the middle portion of the bottom plate 14a have supporting pins 27. Ex. 1004 at [0064].



Ex. 1004, Fig. 4 excerpt, annotated

148. With such teaching of a holding member with supporting pin, i.e. a spacer, which is elastically deformable, a POSITA would understand that the spacer is made of a plastic material such as polycarbonate (PC), polymethyl methacrylate (PMMA), glass, a resin, phenyl propanol amine (PPA) as these were among the common choices for moldable plastic materials. All of these materials exhibit light transmission, refraction, or reflection owing to their index of refraction of approximately 1.5. A POSITA would know that reflection or refraction would take place at the boundary between air and the plastic material. The plastic spacers could exhibit light transmission depending on the additives to the plastic material. A POSITA's selection of the material would have been a conventional consideration based upon factors such as cost, weight, rigidity, and ease of molding or shaping. Therefore, the limitations of claim 3 would have been obvious in view of the combination of Matsumoto and Yokota and teach this element.

- C. Claim 7 – “The planar lighting device of claim 1, wherein the light sources are mounted on the circuit substrate such that the light sources are spaced apart by a predetermined distance.”

149. As shown in FIG. 1 of Yokota, a plurality of sets of LEDs 22 on the mounting boards 21 are arranged at predetermined intervals in both the X and Y directions. Ex. 1004 at [0068].

150. Therefore, Yokota teaches the light sources (e.g., LEDs 22) are mounted on the circuit substrate (e.g., mounting board 21) such that the light sources are spaced apart by a predetermined distance applying the plain meaning of “predetermined” as discussed with regard to claim element 1b. This disclosure meets the limitation of claim 7.

D. Claim 8 - “The planar lighting device of claim 1, wherein the light sources further comprise an optical layer.”

151. In Yokota, diffusive lenses 24 are provided on the light sources (LEDs 22). Ex. 1004 at [0063], [0064], [0068], FIG. 1. These diffuser lenses comprise an optical layer and meet the limitation of claim 8.

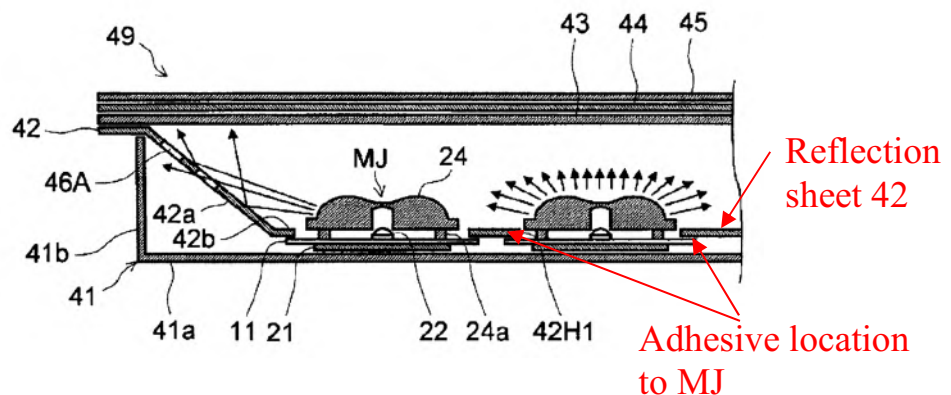
E. Claim 10 – “The planar lighting device of claim 1, wherein the reflection layer is fixed to the circuit substrate by an adhesive.”

152. Yokota states that the light absorption surfaces may be bonded to the inclined surface 42a. Ex. 1004 at [0093]. This is a teaching of the use of bonding to secure optical elements, such as a reflective sheet. Yokota also discloses that a reflection sheet “combined together . . . with a plurality of sets of an LED 22, a diffusive lens 24, and a built-in reflective sheet 11 . . . are arranged on each

mounting board 21.” Ex. 1004 at [0068]. The built-in reflective sheet 11 is “fixed on the mounting surface 21U.” *Id.* at [0075]. Further, Yokota teaches the use of adhesives to bond diffusive lens 24 to the mounting board. *Id.*, at [0069]. Thus, Yokota teaches a reflection sheet fixed to the circuit substrate and a POSITA would understand that “fixing” could be accomplished with an adhesive.

153. Yokota is directed to providing a backlight assembly with uniform illumination and an unbonded reflection sheet 42 may become uneven due to heat generated by the LEDs, thus reducing the uniformity of light on the diffusion sheet. Thus, a POSITA would have been motivated from Yokota to attach the reflective sheet to the light emitting module MJ by using well-known adhesive bonding techniques which would have been applied to the opposite surface of the reflection sheet 42 than the side used to reflect light to illuminate a diffusion sheet. *See* annotated FIG. 2 below.

FIG.2



Ex. 1004, Fig. 2, annotated.

154. To the extent that Yokota does not explicitly state that adhesive bonding is used to secure a reflection layer to the circuit substrate, A POSITA considering FIG. 2 would have found it obvious to use adhesive bonding.

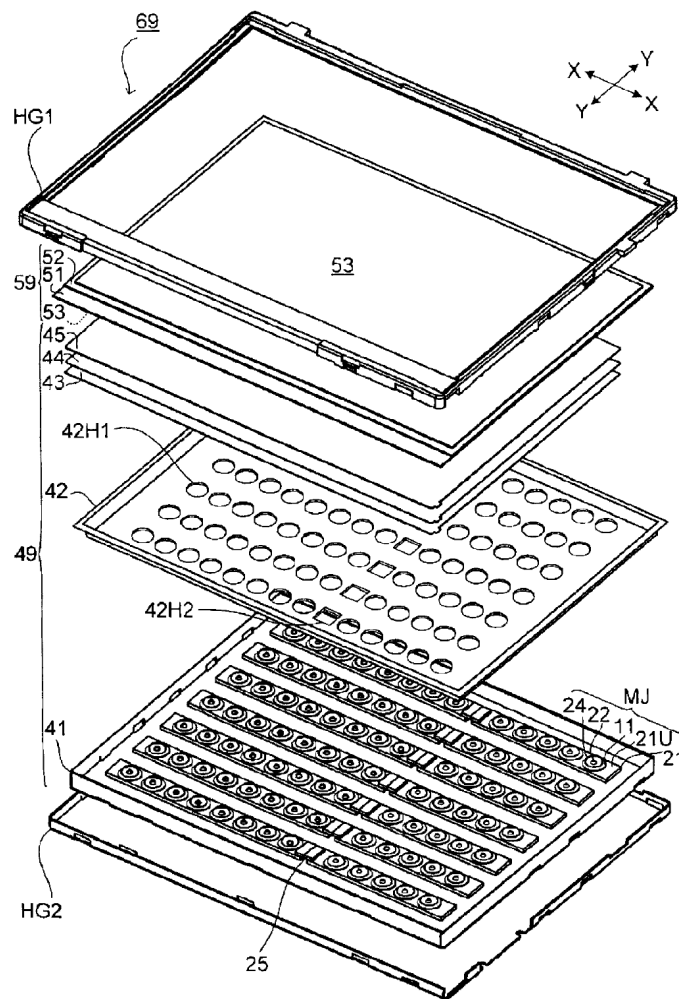
155. FIG. 2 shows the reflection sheet 42 attached to built-in reflector sheets 11 to cover gaps between the built-in reflector sheets to ensure the integrity of a reflective surface below the LEDs 22 and throughout the interior surface of the base of the backlight assembly. No mechanical coupling is illustrated in FIG. 2 to couple the edges of the reflector sheet 42 to the edges of the built-in reflector sheet or to couple the built-in reflector sheet 11 to circuit substrates 21.

156. A POSITA would have understood that to maintain uniformity of reflectance of the reflector sheet 41 and the built-in reflector sheets 11, those reflector sheets would be joined at points of overlap as shown in FIG. 2 and the means for joining them at those overlapped areas would be applied to the underside of the reflector sheet 41 and the top side of the built-in reflector sheets 11 at the points of overlap. This would ensure uniform reflectance even at the areas of overlap. Given the references to the use of adhesive elsewhere in Yokota, a POSITA would have readily and naturally turned to adhesive to join the overlapped edges of the reflector sheets to form a continuous reflection sheet in the

- G. Claim 12 - The planar lighting device of claim 1, wherein the openings are disposed in the first surface and spaced apart by a predetermined distance.

160. FIG. 1 of Yokota discloses that holes 42H in the reflective 42 are disposed on the first surface of the reflection sheet 42 and arranged in an array in the central portion of reflective sheet 42 and are spaced apart by a predetermined distance in the manner of the LEDs 22.

FIG.1



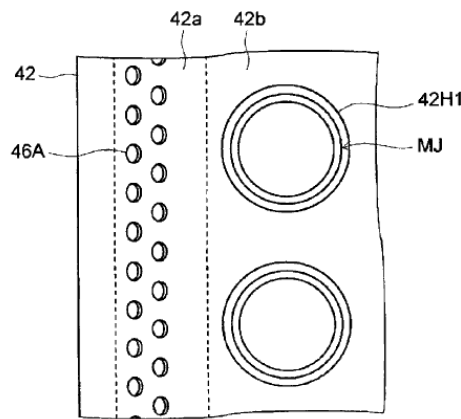
Ex. 1004, FIG. 1.

161. Thus, Yokota teaches the limitation of claim 12.

H. Claims 13 and 23 – “The planar lighting device of claim 1/claim 22, wherein the hole pattern is located at a position where corresponding light sources are located.”

162. As shown in FIG. 3 of Yokota, the pattern of holes 42H is located proximate to, and at a position corresponding to, LEDs in light sources MJ.

FIG.3



Ex. 1004 at FIG. 3

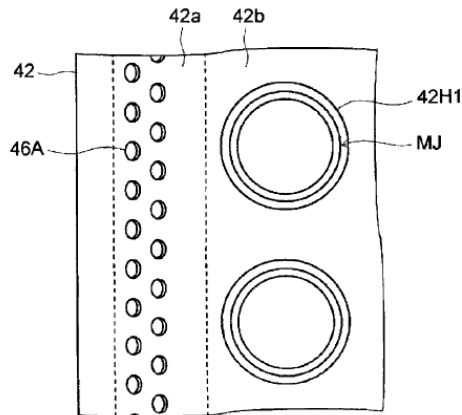
163. Yokota teaches the additional limitation of claims 13 and 23.

I. Claims 14 and 24 – “The planar lighting device of claim 1/claim 22, wherein a plurality of hole patterns is provided in the second surface, and wherein the hole patterns repeat in the second surface.”

164. Yokota shows in FIG. 3 a repeating pattern of holes 46A in the inclined portion 42a (second surface) of reflective sheet 42b and teaches that the

use of holes or dots of light absorbent material are interchangeable. Ex. 1004 at [0079], [0081], [0090].

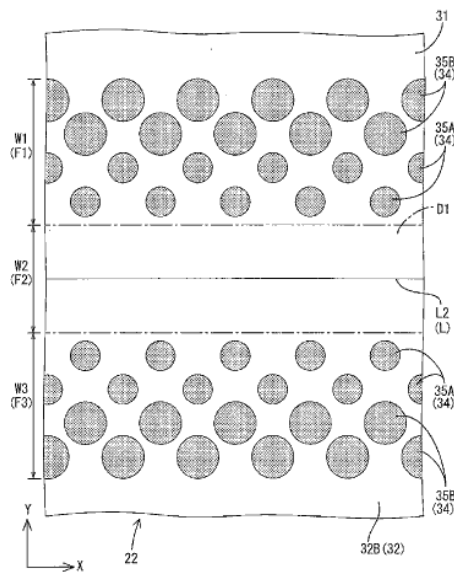
FIG.3



Ex. 1004 at Fig. 3.

165. Matsumoto shows a repeating dot pattern of light-absorbent material where the pattern includes two different sizes of dots. Ex. 1005 at [0077], [0080]; Fig. 9.

FIG.9



Ex. 1005 at Fig. 9.

166. As explained in in Ground 1, claim 1, limitation 1g, Section VII.A.1.g, *supra*, one of skill in the art world have been motivated to modify the pattern of holes in Yokota in view of Matsumoto to provide patterns of holes of different sizes with the patterns repeating in the inclined surface 42a (second portion) of the reflective sheet 42.

167. The additional limitation of claims 14 and 24 would have been obvious from Yokota modified in view of Matsumoto.

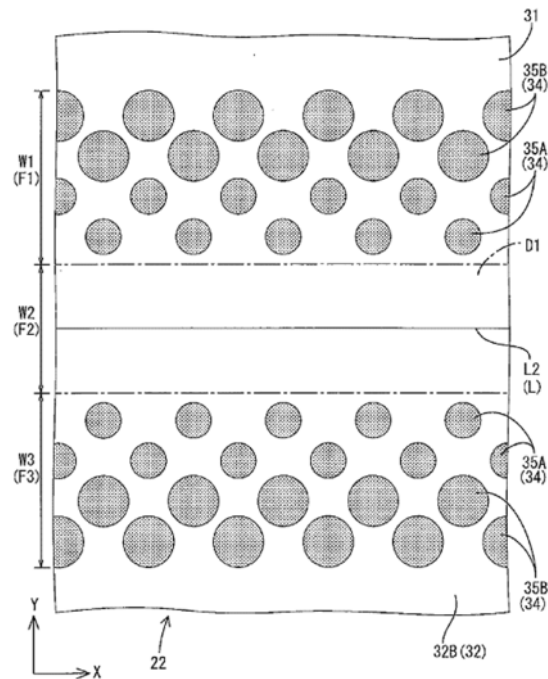
J. Claims 15 and 25 – “The planar lighting device of claim 14/claim 24, wherein the hole patterns are spaced apart by a predetermined distance.”

168. The hole pattern resulting from modification of Yokota in view of Matsumoto provides holes of two different sizes in a pattern shown in FIG. 9 of Matsumoto. The holes in the pattern are spaced apart by a predetermined distance. This limitation is met by the modification of Yokota in view of Matsumoto as discussed at Ground 1, claim 1, limitation 1g, Section VII.A.1.g, *supra*.

K. Claim 16 and 26 – “The planar lighting device of claim 1/claim 22, wherein the through holes of the hole pattern increase and decrease in size repeatedly.”

169. Matsumoto shows that the pattern of dots of light absorbent material in at least the two middle rows of dots repeatedly increase and decrease in size (area). Ex. 1005 at FIG. 9.

FIG. 9



Ex. 1005 at Fig. 9.

170. When Yokota is modified in view of Matsumoto, holes of two different sizes are provided in such patterns in the inclined portions 42a of reflection sheet 42. This modification of Yokota in view of Matsumoto meets the limitations of claims 16 and 26 because each small hole 35a is adjacent to a large hole 35b. Moreover, it would have been a matter of simple design choice to select the locations and other patterns where the holes increase and decrease in size repeatedly according to the change of reflectance required to provide uniform illumination of the diffusion sheet. Ex. 1004 at [0081], [0092].

171. The subject matter of claims 16 and 26 would have been obvious from Yokota in view of the Matsumoto at the time the invention of the '740 patent was made.

- L. Claims 17 and 27 – “The planar lighting device of claim 1/claim 22, wherein neighboring through holes of the hole pattern are different in size.”

172. In the pattern of dots of reflectance reducing material shown in FIG. 9 of Matsumoto (see reproduction of FIG. 9 in the above discussion of claims 16 and 26) vertically neighboring dots and diagonally neighboring dots in the middle two rows differ in size (area). [Ex. 1005 at FIG. 9]. Yokota teaches that dots of light absorbent material and holes are interchangeable as reflection-reduction elements to reduce light reflectance in selected areas of a reflection sheet in order to uniformly illuminate a diffusion sheet in a backlight assembly. Ex. 1004 at [0089], [0090]. Thus, Yokota modified in view of Matsumoto to have a pattern of through holes in the pattern of dots shown in Matsumoto provides patterns of through holes wherein neighboring through holes differ in size. Ex. 1004 at [0081], [0092].

173. The additional limitation of claims 15 and 25 would have been obvious from the modification of Yokota in view of Matsumoto.

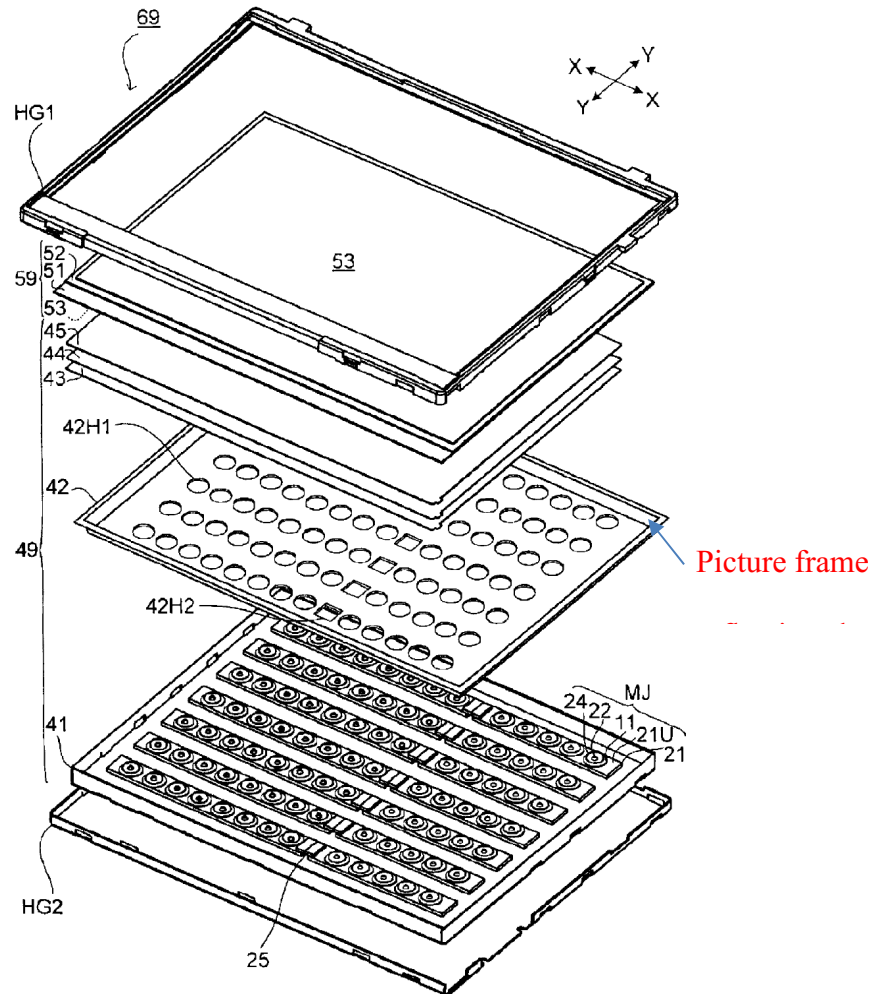
- M. Claim 18 – “The planar lighting device of claim 1, wherein the optical sheet comprises at least one of a diffusion layer, a lower polarizing plate, a color filter substrate and an upper polarizing plate.”

174. Yokota discloses a diffusive sheet 43, a prism sheet 44, a microlens sheet 45, and a polarizing film 53 disposed on the light emitting modules MJ, which includes the light sources, i.e., LEDs 22. Ex.1004 at [0055], [0059], FIGs. 1 and 2. These are optical sheets. Therefore, Yokota teaches an optical sheet which comprises a diffusion layer meeting this claim.

N. Claim 19 – “The planar lighting device of claim 1, wherein the second surface is connected at four side edges of the first surface.”

175. As described earlier, Yokota discloses (1) that second surfaces (the inclined surfaces 42a) are provided like a picture frame to surround the main plane 42b of the reflection sheet 42, and (2) are contiguous with the main plane 42b (first surface). Ex. 1004 at [0076], [0079], Fig. 1. As can be seen below, the second surface (inclined surfaces of 42) meet at all four side edges of the flat surface of the first surface (flat surface of 42).

FIG. 1



Ex. 1004, FIG. 1 (annotated).

176. Therefore, Yokota teaches the additional limitation of claim 19.

- O. Claim 20 – “The planar lighting device of claim 19, wherein the hole pattern is provided in the second surface connected at two side edges of the first surface.”

177. Since Yokota teaches that the surfaces 42a are contiguous with the main plane 42b on four side edges, Yokota meets this claim limitation that the surfaces 42a are contiguous with the main plane 42b on two side edges.

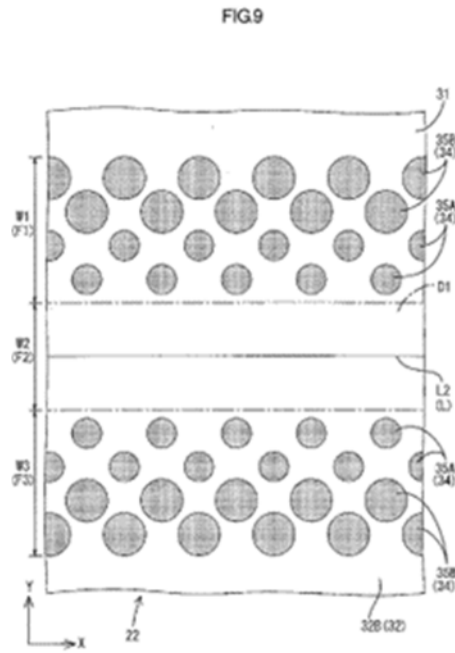
178. The additional limitation of claim 20 is fully met by Yokota.

P. Claims 21 and 28 – “The planar lighting device of claim 1/22, wherein a largest through hole is disposed in a location close to a corresponding light source.”

179. As noted in Section VII.A.1.g, *supra*, Yokota applies a reflection reduction treatment, i.e., holes in the inclined area 42a of a reflective sheet 42, to change the reflectance of the inclined surface 42a is to avoid over illuminating the peripheral areas of a diffusive plate 45. Ex. 1004 at [0013]-[0015].

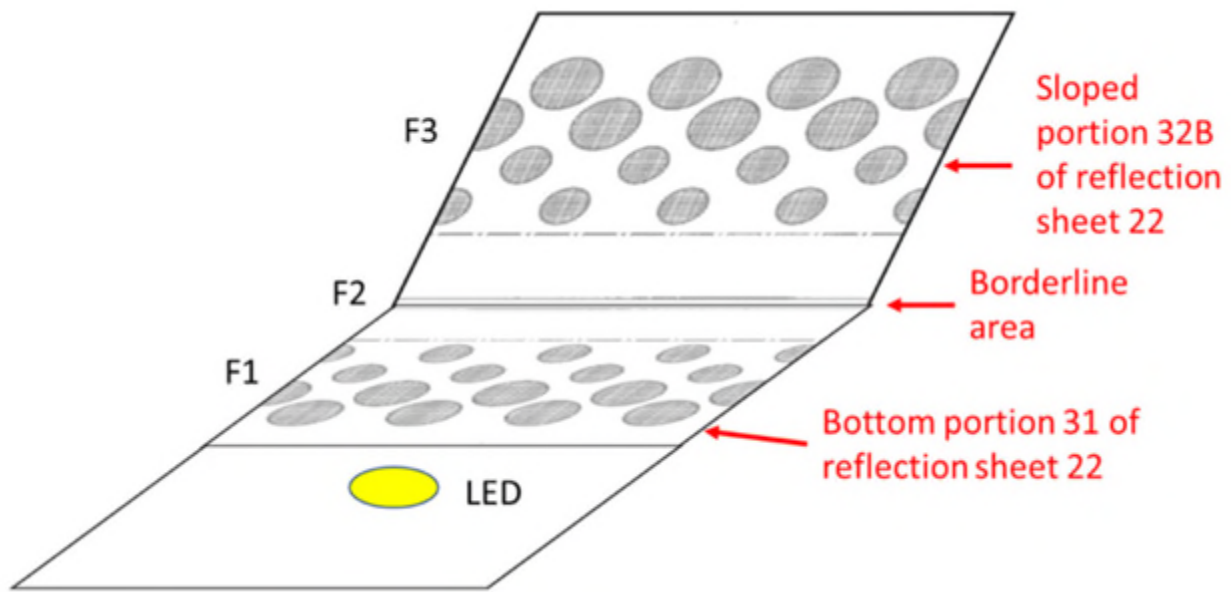
180. Matsumoto uses a reflection-reduction treatment to eliminate dark areas D1 causing non-uniform illumination near the borderline L of the reflective sheet in the backlight assembly. Ex. 1004 at [0088],[0089]. As shown in FIG. 9 and in the below diagram schematically combining portions of FIGs 7, 8 and 9, Matsumoto solves this problem by applying a pattern of smaller light absorbent dots 35A near basal (bottom) portions of the sheet sloped portions 32A and a pattern of larger light absorbent dots 35B near distal (top) portions of the sheet sloped portions 32A. FIG. 9 is illustrating a pattern of reflectance -reduction

elements incorporated into the structure of FIG. 8 to eliminate noticeable dark portions.



Ex. 1005, FIG. 9.

181. The schematic combination of portions of FIGs. 7, 8 and 9 shows the relationships of areas F1-F3 of the bottom portion 31 and the inclined, sheet sloped portion 32B of the reflection sheet 22.



Ex. 1005, FIGs. 7, 8 and 9 (annotated).

182. A result of applying the reflection-reducing spots to the reflection sheet in area F3, light absorption will be less at the basal portions of sheet sloped portions 32B which are illuminated less brightly and greater at the peripheral portions of the sheet sloped portions 32B which are illuminated more brightly. The result is to make the light reflected from the entirety of the sheet sloped portions more uniform to eliminate the dark portions, which are artifacts of the design of the backlight assembly.

183. Stepping back, in the context of a direct, planar backlight assembly, Yokota modified in view of Matsumoto instructs a POSITA to use larger reflection reduction elements, e.g., large holes, in areas that are brightest or where the greatest reduction in light reflection is desired. Smaller reflection reduction

elements (smaller holes) are located in areas less bright or where light reflectance is to be suppressed to a lesser degree. Equipped with this knowledge, and the teachings of Yokota and Matsumoto of examples of the practical application of these principles in backlight assemblies, a POSITA faced with unwanted high illumination in a planar, direct backlight assembly would have easily understood to use holes of selected sizes in selected patterns and locations to suppress reflectance of a reflection sheet and attain uniform illumination. Placing the largest holes in the area of highest brightness, such as locations nearest to light sources, was a routine design choice readily apparent to a POSITA from the combined teachings of Yokota and Matsumoto. The recitation of claims 21 and 29 that the “largest through hole is disposed in a location close to a corresponding light source” applies the principals readily apparent from Yokota modified in view of Matsumoto in a routine manner to provide the greatest suppression of reflectance at a location closest to the light source. A POSITA would have had a reasonable expectation of success in making this combination because it would amount to no more than the combination of known elements to yield predictable results.

184. The subject matter of claims 21 and 29 would have been obvious from Yokota in view of Matsumoto.

Q. Claim 9 and 29 – “The planar lighting device of claim 1, wherein the second surface is bent at a periphery of the first surface./The display

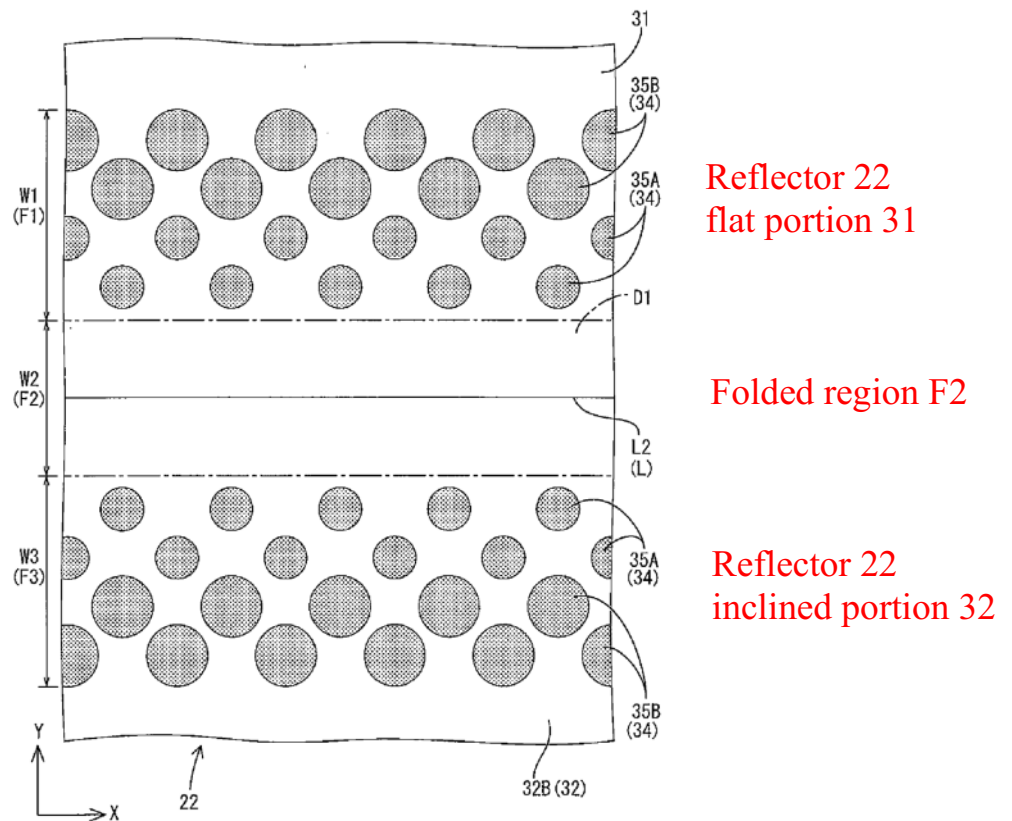
device of claim 22, wherein the inclination is formed by bending a portion of the reflection layer.”

185. Claim 9 depends from claim 1 and recites that “the second surface is bent at a periphery of the first surface.” Claim 29 depends from claim 22 and recites that “the inclination is formed by bending a portion of the reflection layer.” These claims are directed to the inclined second surface of the reflection layer.

186. Yokota teaches that inclined surface 42a is contiguous with a main plane 42b of the reflective sheet 42. Ex. 1004 at [0076] and [0079], FIGs. 2 and 3. Since the peripheral portion 42a is both inclined with respect to, and contiguous with, the main plane 42b it must be bent (formed by bending) at the juncture of the inclined portion 42a and the reflective sheet 42.

187. Furthermore, Matsumoto teaches a folded reflection sheet 22 formed by bending at borderline shown in FIG. 9. Ex. 1005 at [0074]-[0076], FIG. 9.

FIG.9



Ex. 1005, FIG. 9 (annotated).

188. The additional limitations of claims 9 and 29 would have been obvious over Yokota modified in view of Matsumoto.

X. GROUND 2: CLAIM 30 WOULD HAVE BEEN OBVIOUS OVER YOKOTA IN VIEW OF MATSUMOTO AND HA ET AL.

189. Claim 30 recites “The display device of claim 22, wherein the inclination is about a right angle with respect to the first surface.” As shown in the discussion of independent claim 22 in Ground 1 the combination of Yokota

modified in view of Matsumoto renders claim 22 invalid as obvious. Claim 22 recites “a second surface connected to the first surface, wherein the second surface has an inclination with respect to the first surface.” Yokota meets this limitation by disclosing that surfaces 42a of reflection sheet 42 are contiguous with, and inclined with respect to, the main plane 42b of reflection sheet 42. See discussion in Petition, Section VII.A.1.f, relating to Ground 1, claim 1, limitation 1f; and ¶117, *supra*.

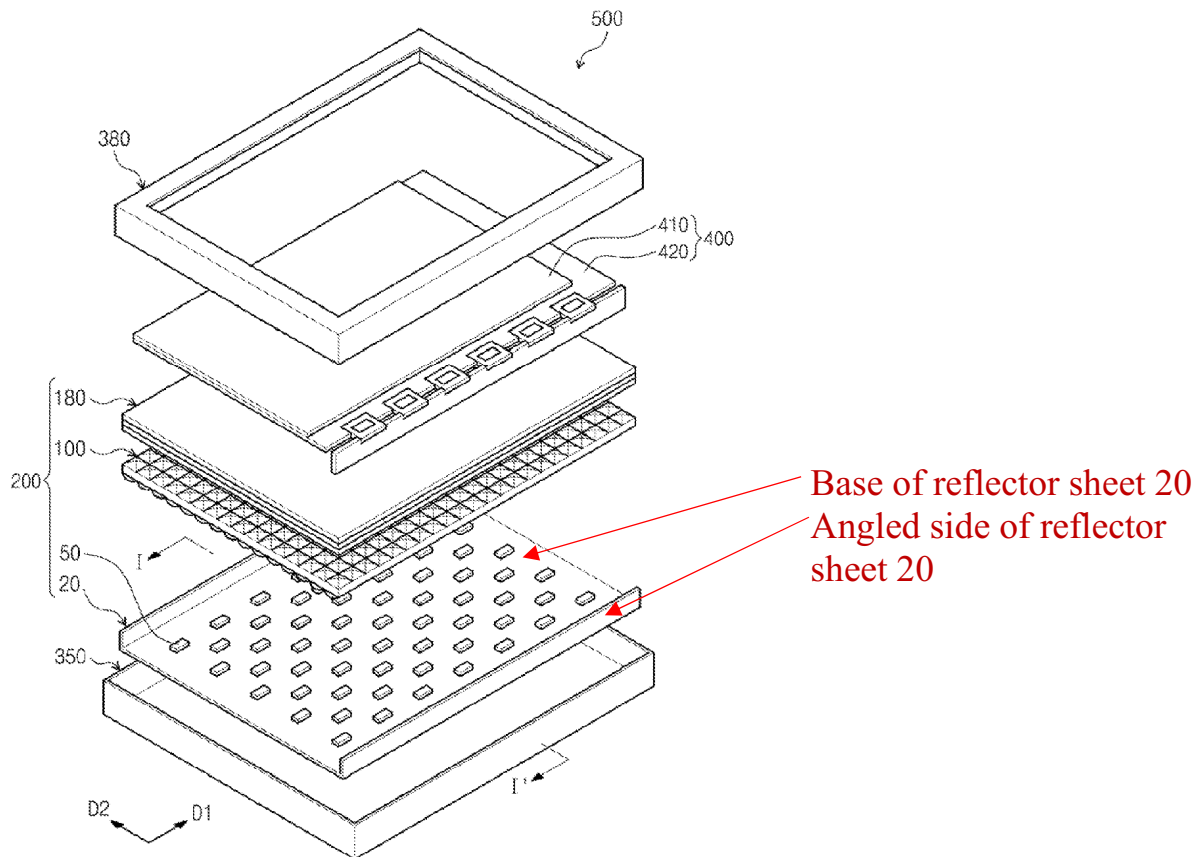
190. Claim 30 further narrows the scope of independent claim 22 by requiring that the “inclination [of the second surface] is about a right angle with respect to the first surface.” In other words, the peripheral portion of the reflection sheet is inclined at about a right angle with respect to the main body of the reflection sheet. Ha et al. shows this structure and Yokota modified in view of Matsumoto and Ha et al. renders the subject matter of claim 30 invalid for obviousness.

191. Like Yokota and Matsumoto, Ha et al. is directed to a backlight assembly as evident by its title “Backlight Assembly and Display Apparatus Having the Same.” Ex. 1006 at Title. FIG. 1 shows a direct type of backlight assembly 200.

192. FIG. 1 is an exploded view of a display apparatus having a backlight.

Ex. 1006 at [0016].

Fig. 1



Ex. 1006 at Fig. 1 (annotated).

193. Fig. 1 includes a reflection plate 20 and a plurality of light sources 50 arranged on the reflection plate 20. Ex. 1006 at [0034]. The reflection plate 20 includes peripheral portions inclined at a right angle with respect to the central

portion of the plate 20, i.e., “about a right angle” as required by claim 30. Ex.

1006 at Fig. 1.

194. Yokota modified in view of Matsumoto instructs a POSITA to provide the structure of independent claim 22. Ha et al. is in the same technical field of those references and includes a reflection plate 20 to reflect light from the light sources 50 to illuminate a diffusion plate in the manner of Yokota and Matsumoto, Ex. 1006 at Fig. 1, for the same purpose as similar elements provided in Yokota and Matsumoto. From Yokota modified in view of Matsumoto, a POSITA would know to apply a reflection-reduction treatment, including an array of holes or light absorbent dots of more than one size, to inclined, peripheral portions of a reflection sheet to reduce reflection from locations of high illumination compared to locations of lower illumination in order to uniformly illuminate a diffuser sheet. Ha et al. teaches in Fig. 1 that the peripheral inclined portions of the reflection sheet 20 may be inclined at “about a right angle.” To apply the solution evident from Yokota modified in view of Matsumoto to the “about a right angle” portions of the reflection sheet 20 of Ha et al. facilitates the same result of uniform illumination of a diffuser sheet by selectively reducing high areas of reflectance. The principles are identical whether the inclination is “about a right angle” or a smaller angle. A POSITA would further have been motivated to

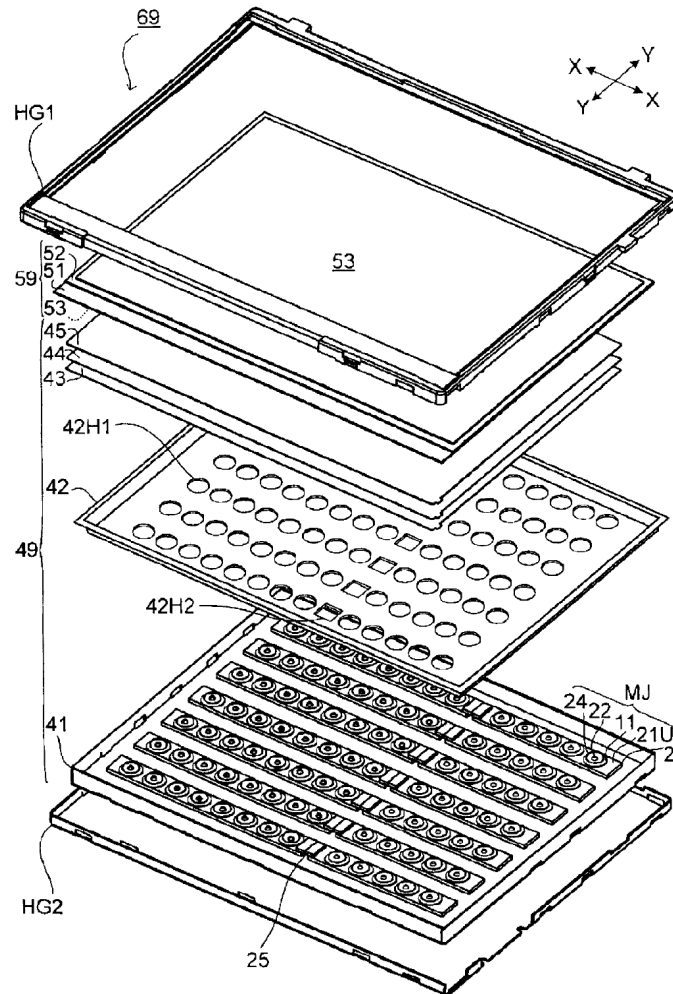
make this change because Ha et al. describes the reflection plate 20 as “reflect[ing] the light provided from the light sources 50 to enhance the amount of light used in the display panel.” Thus, Yokota modified in view of Matsumoto and further modified to have an inclination at about a right angle as shown in Ha et al. renders obvious the additional limitations of claim 30.

XI. GROUND 3: CLAIMS 4-6 WOULD HAVE BEEN OBVIOUS OVER YOKOTA IN VIEW OF MATSUMOTO AND KIM ET AL.

- A. Claim 4 – “The planar lighting device of claim 1, further comprising a lower cover having grooves, wherein the circuit substrate is located in one of the grooves.”

195. In FIG. 1, Yokota shows a plurality of sets of mounting boards 21 arranged parallel to one another on a chassis 41 of the backlight assembly. Ex. 1004 at [0061], [0068], FIG. 1. The mounting boards are circuit substrates for the lighting sources (LEDs).

FIG. 1

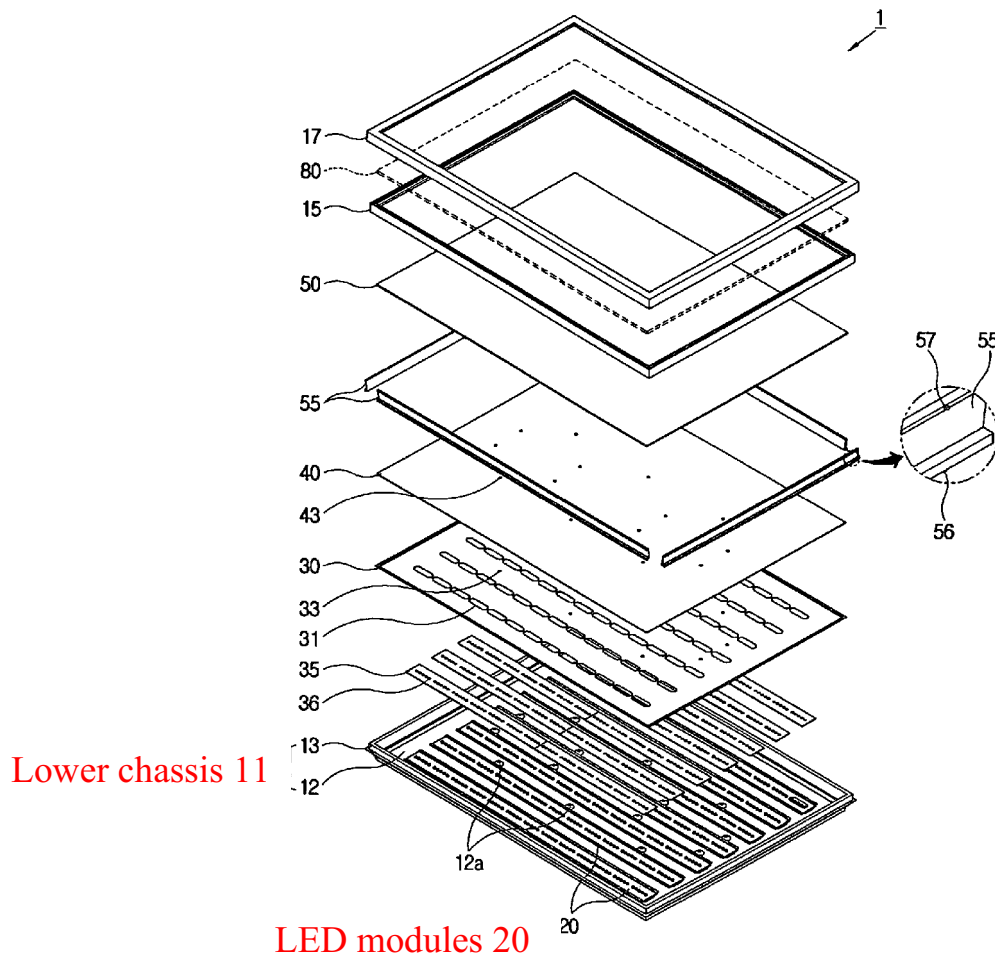


Ex. 1004, FIG. 1

196. Kim et al. similarly teaches an array of LED modules 20 comprising a plurality of LEDs 21 formed on LCD substrates 23. Ex. 1008, 4:8-26. As shown in FIG. 1 of Kim et al. reproduced below, a plurality of the LED modules 20, each including a plurality of LEDs 21, are arranged on a base portion 12 of lower chassis 11, which serves as a lower cover assembly. Ex. 1008 at 3:34-40, 5:49-53.

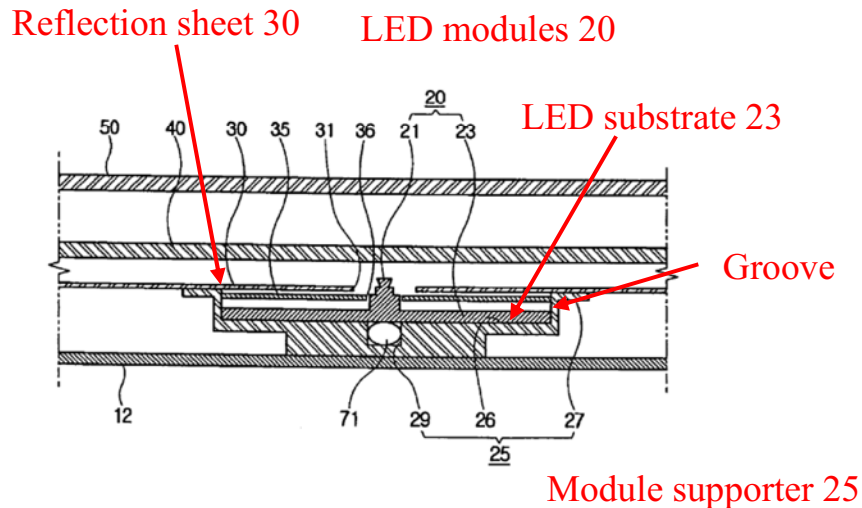
The base portion 12 is shaped like a rectangular plate and is compactly coupled with a module supporter 25. Ex. 1008 at 5:58-61. Referring to FIGs. 1 and 2, the module supporter 25 comprises a module accommodator 26 that receives and supports the elongated LED modules 20 in elongated recesses or grooves. Ex. 1008 at 3:34-64; 4:43-45. The lower cover assembly thus has recesses or grooves formed by the module accommodators 26 of the module supporters 25 in which the LED modules 20 are located.

FIG. 1



Ex. 1008, FIG. 1 (annotated).

FIG. 2



Ex. 1008, FIG. 2 (annotated).

197. A POSITA would have been motivated to look to Kim et al. to modify Yokota since the disclosures both relate to planar backlight units comprising strips of LEDs mounted on circuit substrates and that incorporate reflectors and diffusers to create a uniform light source. The use of recesses or grooves as proposed by Kim et al. would result in a more uniform illumination from the light source because the thickness of the circuit substrates would be below the principal surface of the reflector sheet 42 and the reflection sheet 42 would be a more uniform reflective surface, enhancing uniformity. The LED substrates would also be more

firmly attached to the lower cover, which enhances mechanical alignment of the LED substrates, improving uniformity.

198. Each of Yokota, Matsumoto, and Kim et al. discloses structures for mounting LED substrates in direct, planar backlight assemblies. A POSITA would have knowledge of such mounting structures and would have selected one of them or other known alternatives to mount LED substrates in the backlight assemblies according to routine design choice, well within the capabilities of a POSITA and would not have required undue experimentation. The modification of the combination of Yokota and Matsumoto to include the module accommodator 26 of Kim et al. incorporated into the lower cover assembly would have been one such routine design choice. The subject matter of claim 4 is obvious over such combination.

B. Claim 5 – “The planar lighting device of claim 4, wherein at least two circuit substrates are disposed on the lower cover/”

199. As shown in FIG. 1 of Kim et al. reproduced above, a plurality of LED modules 20, each including a plurality of LEDs 21 arranged on a circuit substrate, are provided on a lower chassis 11 of the chassis assembly 10, which serves as a lower cover assembly. Ex. 1008 at 3:34-40 (“the LED modules 20 may be plurally provided . . . as being transversely arranged with respect to a lower chassis 11 of the chassis assembly 10 (to be described later). Each LED module 20

comprises a plurality of LEDs 21 to emit light, and an LED substrate 23 supporting and driving the plurality of LEDs 21 (see FIG. 2).”). Therefore, a plurality of LED modules each with an LED substrate 23 means Kim et al. discloses at least two circuit substrates disposed on the lower cover. This meets the limitation of claim 5. *Id.*

- C. Claim 6 – “The planar lighting device of claim 5, wherein the at least two circuit substrates are disposed on the lower cover and spaced apart by a predetermined distance.”

200. As shown in FIG. 1 of Kim et al. reproduced above, a plurality of LED modules 20, each including a plurality of LEDs 21 arranged on a circuit substrate (LED substrate 23), are disposed on a lower chassis 11 of the chassis assembly 10, which serves as a lower cover assembly. Ex. 1008 at 3:34-40. The circuit substrates are shown in FIG. 1 to be spaced apart by a predetermined distance. This meets the limitation of claim 6. *Id.*

XII. DECLARATION IN LIEU OF OATH

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under § 1001 of Title 18 of the United States Code and that such willful false

Expert Declaration of Thomas Credelle in Support of
Inter Partes Review of U.S. Patent No. 9,080,740

statements may jeopardize the validity of the application, or any patent issued thereon. If called to testify as to the truth of the matters stated herein, I could and would testify competently.

I declare under penalty of perjury that the foregoing is true and correct.

November 21, 2022



Thomas L. Credelle