

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

MIANYANG BOE OPTOELECTRONICS TECHNOLOGY CO., LTD.,
WUHAN CHINA STAR OPTOELECTRONICS SEMICONDUCTOR
DISPLAY TECHNOLOGY CO., LTD., TIANMA MICROELECTRONICS
CO. LTD., and VISIONOX TECHNOLOGY, INC.,
Petitioner,

v.

SAMSUNG DISPLAY CO., LTD.,
Patent Owner.

IPR2023-00988
Patent 10,854,683 B2

Before JAMESON LEE, TERRENCE W. McMILLIN, and
JOHN A. HUDALLA, *Administrative Patent Judges*.

HUDALLA, *Administrative Patent Judge*.

DECISION
Granting Institution of *Inter Partes* Review
35 U.S.C. § 314

Mianyang BOE Optoelectronics Technology Co., Ltd.; Wuhan China Star Optoelectronics Semiconductor Display Technology Co., Ltd.; Tianma Microelectronics Co. Ltd.; and Visionox Technology, Inc. (collectively, “Petitioner”) filed a Petition (Paper 1, “Pet.”) requesting an *inter partes* review of claims 1, 2, 4–10, 13, and 15 (“the challenged claims”) of U.S. Patent No. 10,854,683 B2 (Ex. 1001, “the ’683 patent”). Petitioner filed a Declaration of P. Morgan Pattison, Ph.D. (Ex. 1003) with its Petition. Samsung Display Co., Ltd. (“Patent Owner”) filed a Preliminary Response (Paper 9, “Prelim. Resp.”).

We have authority to determine whether to institute an *inter partes* review. *See* 35 U.S.C. § 314 (2018); 37 C.F.R. § 42.4(a) (2023). Under 35 U.S.C. § 314(a), we may not authorize an *inter partes* review unless the information in the petition and the preliminary response “shows that there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition.” For the reasons that follow, we institute an *inter partes* review as to claims 1, 2, 4–10, 13, and 15 of the ’683 patent on all grounds of unpatentability presented.

I. BACKGROUND

A. *Real Parties-in-Interest*

Petitioner identifies Mianyang BOE Optoelectronics Technology Co., Ltd.; Wuhan China Star Optoelectronics Semiconductor Display Technology Co., Ltd.; Tianma Microelectronics Co. Ltd.; and Visionox Technology, Inc. and their subsidiaries as the real parties-in-interest. Pet. 3. Patent Owner identifies Samsung Display Co., Ltd., as the real party-in-interest. Paper 6, 2.

B. Related Matters

The parties identify the following proceedings related to the '683 patent (Pet. 3; Paper 6, 2):

Certain Active Matrix Organic Light-Emitting Diode Display Panels And Modules For Mobile Devices, And Components Thereof, Inv.

No. 337-TA-1351 (USITC); and

Samsung Display Co., Ltd. v. BOE Technology Co., Ltd., Case No. 2-23-cv-00309 (E.D. Tex.).

C. The '683 Patent

The '683 patent is directed to “a pixel arrangement structure of an organic light emitting diode (OLED) display.” Ex. 1001, 1:20–21. The '683 patent indicates that “[a]n organic emission layer included in the pixel of an OLED display may be deposited and formed by using a mask such as a fine metal mask (FMM).” *Id.* at 1:43–45. The '683 patent notes that “[w]hen reducing a gap between the neighboring pixels to obtain a high aperture ratio of the pixel, deposition reliability may be deteriorated,” but “[o]n the other hand, when increasing the gap between the pixels to improve the deposition reliability, the aperture ratio of the pixel may be deteriorated.” *Id.* at 1:45–50. The '683 patent also indicates that pixels of certain colors may have different lifespans from other pixels, and that the pixel arrangement structure of the OLED display may provide improved life span. *Id.* at 7:29–36.

The '683 patent indicates that an exemplary embodiment “provides a pixel arrangement structure for an OLED display having an improved

aperture ratio of a pixel while efficiently setting up a gap between the pixels.” Ex. 1001, 1:62–67.

Figure 1 of the '683 patent is reproduced below.

FIG.1

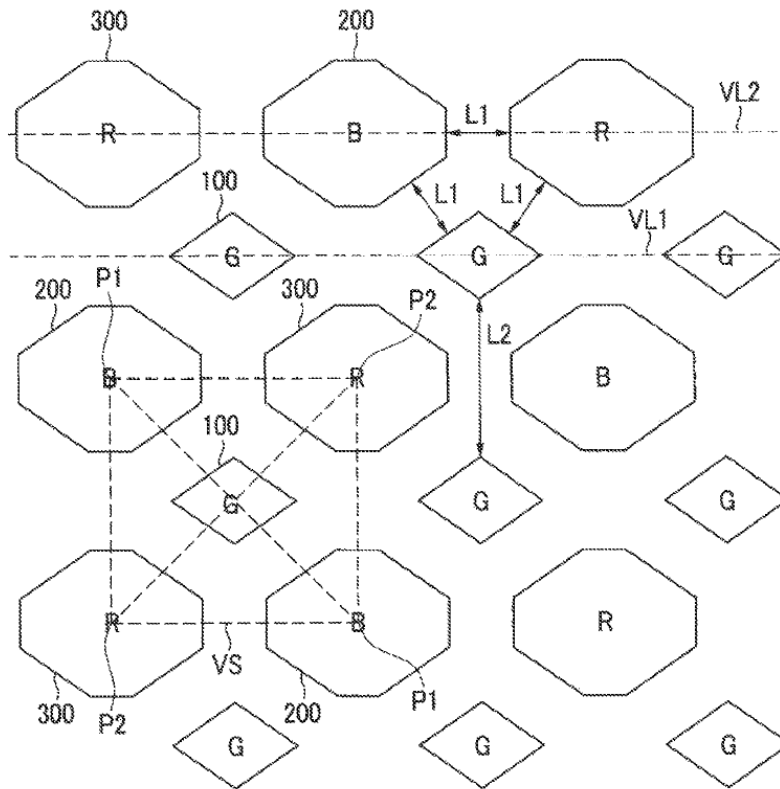


Figure 1 is “a view of a pixel arrangement structure of an OLED display.” Ex. 1001, 3:3–4. “[T]he pixel arrangement structure of the OLED display includes a plurality of first pixels 100, a plurality of second pixels 200, and a plurality of third pixels 300,” which emit green, blue, and red light, respectively. *Id.* at 3:56–59, 4:16–17, 4:34–35, 4:47–48.

According to the '683 patent, “each of the first pixels 100 has a smaller area than neighboring second pixels 200 and third pixels 300, and

has a quadrilateral (i.e., four-sided) shape.” Ex. 1001, 4:8–11. “The second pixels 200 are arranged diagonally with respect to the first pixels 100, such as at first vertices P1 along one diagonal of a virtual square VS having one of the first pixels 100 as a center point (or center) of the virtual square VS.” *Id.* at 4:18–22. “In a similar fashion, the third pixels 300 are arranged diagonally with respect to the first pixels 100, such as at second vertices P2 along the other diagonal of the virtual square VS.” *Id.* at 4:22–25.

According to the ’683 patent, “[e]ach of the third pixels 300 has a larger area than the neighboring first pixel 100 and the same area as each of the second pixels 200.” Ex. 1001, 4:40–42. The ’683 patent indicates that “by enclosing each of the first pixels 100 by a pair of the second pixels 200 and a pair of the third pixels 300, the aperture ratio of the first pixels 100, the second pixels 200, and the third pixels 300 may be improved.” *Id.* at 5:24–27.

The ’683 patent further states that

the gap of the first length L1 is formed between adjacent pairs of the first pixels 100 and the second pixels 200, between adjacent pairs of the first pixels 100 and the third pixels 300, and between adjacent pairs of the second pixels 200 and the third pixels 300. In addition, the gap of the second length L2 that is longer than the first length L1 is formed between the neighboring ones of the first pixels 100. This results in improved deposition reliability when using a fine metal mask to form the green, blue, and red organic emission layers respectively included in the first pixels 100, the second pixels 200, and the third pixels 300.

Ex. 1001, 5:13–23.

Figure 2 of the '683 patent is reproduced below.

FIG.2

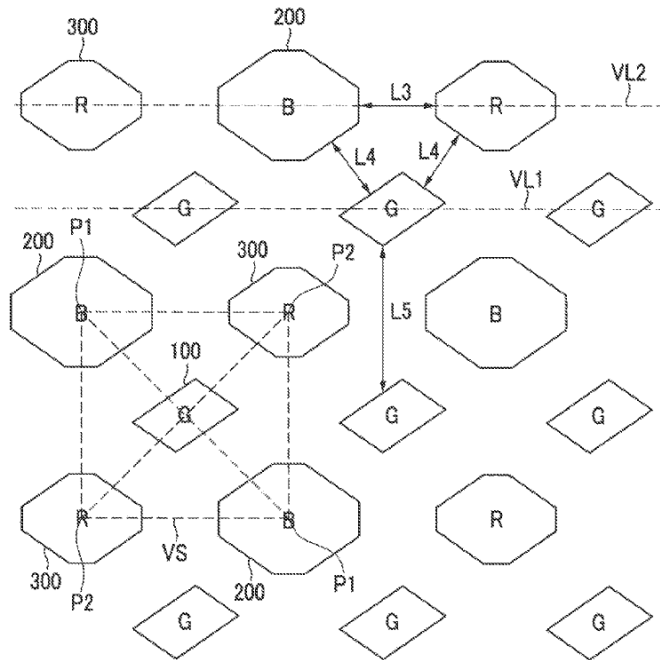


Figure 2 is “a view of a pixel arrangement structure of an OLED display.” Ex. 1001, 3:5–6. In Figure 2, “[t]he plurality of first pixels 100 have the same quadrilateral shape (e.g., a parallelogram)” and “the second pixels 200 have a larger area than the third pixels 300.” *Id.* at 6:4–6. According to the '683 patent, because “the second pixels 200 that emit blue have the shortest life span,” “the second pixels 200 have a larger area than the third pixels 300, thereby suppressing the deterioration of the life span of the OLED display.” *Id.* at 6:47–52.

Figure 5 of the '683 patent is reproduced below.

FIG.5

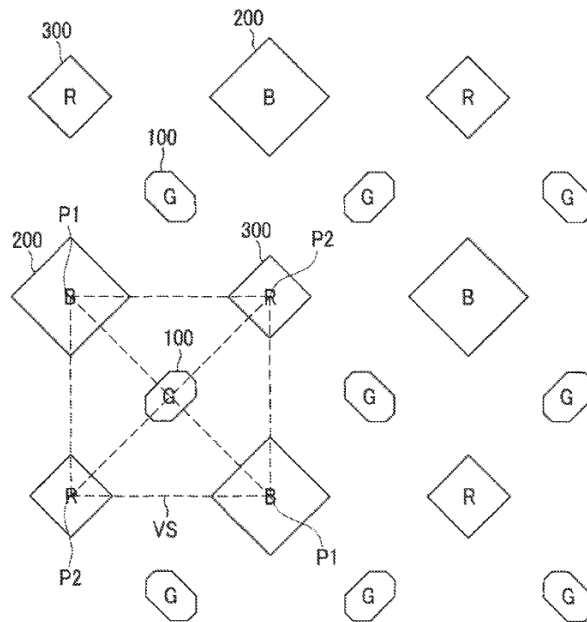
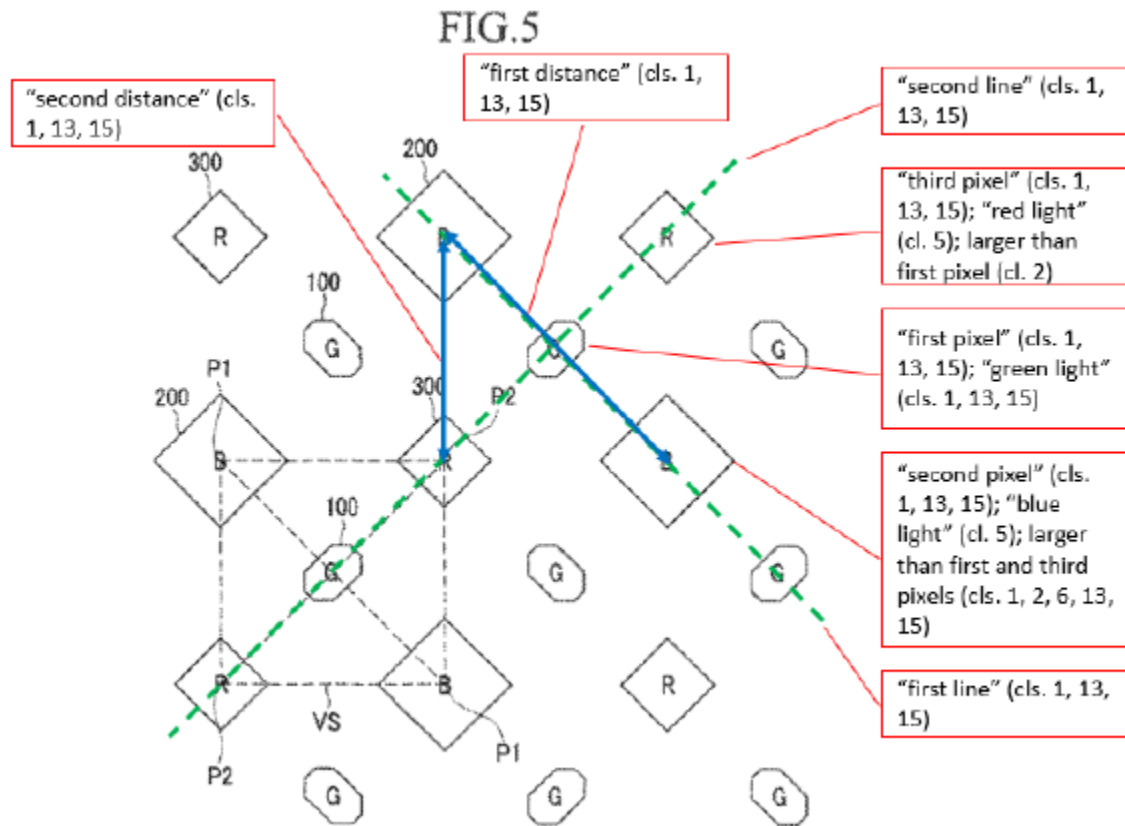


Figure 5 is “a view of a pixel arrangement structure of an OLED display.” Ex. 1001, 3:13–14. According to the '683 patent, “the neighboring first pixels 100 have a octagonal shape and are symmetrical to each other, while the second pixels 200 have a larger area than the third pixels 300.” *Id.* at 8:35–38. The '683 patent states that “[t]his results in improved deposition reliability in the deposition process using the fine metal mask to form the green, blue, and red organic emission layers respectively included in the first pixels 100, the second pixels 200, and the third pixels 300.” *Id.* at 8:38–42.

Patent Owner provides an annotated version of Figure 5, reproduced below, in which it annotates “key claim limitations.”



Prelim. Resp. 9. In this annotated version of Figure 5 from the '683 patent, Patent Owner has indicated with red callout boxes its mapping of various claim limitations, including “first pixel,” “second pixel,” and “third pixel.” *Id.* Patent Owner also has applied green dashed lines and further red callout boxes indicating the recited “first line” and “second line.” *Id.* Patent Owner additionally has applied solid blue lines and further red callout boxes indicating the recited “first distance” and “second distance.” *Id.*

The application that led to the '683 patent was filed on November 13, 2017, and claims priority to, *inter alia*, a Korean application that was filed on March 6, 2012 (i.e., the earliest possible effective filing date). Ex. 1001, codes (22), (30). For purposes of this Decision, we apply the March 6, 2012, date for qualifying the asserted references as prior art.

D. Illustrative Claim

Of the challenged claims, claims 1, 13, and 15 are independent. Claims 2 and 4–10 depend directly or indirectly from claim 1. Claim 1 is illustrative of the challenged claims and recites:

1. A pixel arrangement structure of an organic light emitting diode (OLED) display comprising:
 - a plurality of pixels for displaying an image on the OLED display and comprising:
 - a first pixel;
 - a pair of second pixels separated from the first pixel, the second pixels being located at opposite sides of the first pixel along a first line on which the first pixel, the second pixels, and another first pixel are consecutively arranged such that the first line passes through respective centers of the first pixel, the second pixels, and the other first pixel; and
 - a pair of third pixels separated from the first pixel and the second pixels, the third pixels being located at opposite sides of the first pixel along a second line on which the first pixel, the third pixels, and an additional first pixel are consecutively arranged such that the second line passes through respective centers of the first pixel, the third pixels, and the additional first pixel, the second line crossing the first line at a location of the first pixel,
 - wherein a first distance between the second pixels is greater than a second distance between one of the second pixels and a neighboring one of the third pixels,
 - wherein the first pixels are configured to emit green light, which is a color that is different from light emitted by the second pixels and the third pixels,
 - wherein the first pixels are smaller than at least one of the second pixels or the third pixels, and

wherein each of the second pixels has a larger area than each of the third pixels.

Ex. 1001, 8:63–9:26.

E. Prior Art

Petitioner relies on the following prior art:

U.S. Patent No. 6,897,855 B1, filed Feb. 16, 1999, issued May 24, 2005 (Ex. 1004, “Matthies”);

U.S. Patent No. 7,091,986 B2, filed Dec. 5, 2003, issued Aug. 15, 2006 (Ex. 1005, “Phan”);

Japanese Patent No. 4496852 B2, filed June 10, 2004, issued July 7, 2010 (Exs. 1006, 1007, “Murai”);¹ and

U.S. Patent No. 6,366,025 B1, filed Feb. 24, 2000, issued Apr. 2, 2002 (Ex. 1008, “Yamada”).

F. The Asserted Grounds

Petitioner challenges claims 1, 2, 4–10, 13, and 15 of the ’683 patent based on the following grounds (Pet. 5):

Claims Challenged	35 U.S.C. §	References
1, 2, 4–10, 13, 15	103(a) ²	Matthies, Yamada
1, 4–10, 13, 15	103(a)	Phan
2	103(a)	Phan, Yamada
1, 2, 4–10, 13, 15	103(a)	Murai, Yamada

¹ Murai is a Japanese-language publication (Ex. 1006) that was filed with an English-language translation (Ex. 1007, 1–15) and a declaration attesting to the accuracy of the translation (*id.* at 16). Our citations to Murai herein refer to the translation at Exhibit 1007.

² The Leahy-Smith America Invents Act (“AIA”), Pub. L. No. 112-29, 125 Stat. 284, 287–88 (2011), amended 35 U.S.C. §§ 102 and 103. Because the ’683 patent claims priority to an application filed before March 16, 2013 (the

II. ANALYSIS

We now consider Petitioner’s asserted grounds and Patent Owner’s arguments to determine whether Petitioner has met the “reasonable likelihood” standard for institution under 35 U.S.C. § 314(a).

A. *Legal Standards*

A claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. *See KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007).

The question of obviousness is resolved on the basis of underlying factual determinations, including (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of skill in the art; and (4) where in evidence, so-called secondary considerations.³ *See Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). We also recognize that prior art references must be “considered together with the knowledge of one of ordinary skill in the pertinent art.” *In re Paulsen*, 30 F.3d 1475, 1480 (Fed. Cir. 1994) (citing *In re Samour*, 571 F.2d 559, 562 (CCPA 1978)).

effective date of the relevant amendments), the pre-AIA versions of §§ 102 and 103 apply.

³ The present record does not include any evidence of secondary considerations of nonobviousness.

B. Level of Ordinary Skill in the Art

Citing testimony from Dr. Pattison, Petitioner contends a person of ordinary skill in the art “would have had a degree in electrical engineering, materials science, physics, or a similar discipline, along with 2 years of professional experience working with display design, including OLED displays, or an equivalent level of skill, knowledge, and experience.” Pet. 10 (citing Ex. 1003 ¶¶ 37–39). Petitioner further notes that such a person of ordinary skill in the art “would have been aware of and generally knowledgeable about OLED materials, and display pixel design, layout, and operation.” *Id.* (citing Ex. 1003 ¶ 39). Patent Owner does not dispute Petitioner’s proposed level of ordinary skill in the art at this time, noting that “[f]or purposes of this Preliminary Response, Patent Owner does not believe it is necessary to define the level of ordinary skill in the art.” Prelim. Resp. 10.

For purposes of this Decision, we adopt Petitioner’s definition of the level of ordinary skill in the art. On the present record, we are satisfied that this definition is consistent with the ’683 patent and the asserted prior art.

C. Claim Interpretation

In an *inter partes* review, we construe each claim using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. [§] 282(b), including construing the claim in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent.

37 C.F.R. § 42.100(b) (2023). Accordingly, our claim construction standard is the same as that of a district court. *See id.* Under the standard applied by

district courts, claim terms are generally given their plain and ordinary meaning, as would have been understood by a person of ordinary skill in the art at the time of the invention and in the context of the entire patent disclosure. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1313 (Fed. Cir. 2005) (en banc). “There are only two exceptions to this general rule: 1) when a patentee sets out a definition and acts as his own lexicographer, or 2) when the patentee disavows the full scope of a claim term either in the specification or during prosecution.” *Thorner v. Sony Comput. Entm’t Am. LLC*, 669 F.3d 1362, 1365 (Fed. Cir. 2012).

Petitioner states that “[f]or purposes of this petition . . . the terms of the ’683 patent’s claims do not require further construction and can be afforded their plain and ordinary meaning.” Pet. 10. Patent Owner points out that “the Administrative Law Judge in the related ITC Investigation No. 337-TA-1351 issued a claim construction order” which “did not construe any claim terms of the ’683 patent.” Prelim. Resp. 10 (citing Ex. 2001). Patent Owner further states that “the parties in the ITC Investigation submitted a list of claim constructions to which the parties agreed, which included certain claim terms of the ’683 patent.” *Id.* (citing Exs. 2001, 2002). Notwithstanding, Patent Owner indicates that it “does not believe that any specialized constructions are necessary,” and that “[t]he Petition fails to establish a reasonable likelihood of prevailing under any claim interpretation.” *Id.*

For purposes of this Decision, we determine that no aspects of the challenged claims require explicit construction. *See, e.g., Realtime Data, LLC v. Iancu*, 912 F.3d 1368, 1375 (Fed. Cir. 2019) (“The Board is required to construe ‘only those terms . . . that are in controversy, and only to the

extent necessary to resolve the controversy.’” (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999))).

D. Obviousness Ground Based on Phan

Petitioner contends that the subject matter of claims 1, 4–10, 13, and 15 would have been obvious over Phan. Pet. 41–55. Patent Owner disputes Petitioner’s contentions. Prelim. Resp. 40–48.

1. Phan

Phan is a U.S. patent directed to a “display comprising pixels and dots.” Ex. 1005, 1:18–19. Phan indicates that such a display may be one of a number of display technologies including an OLED display. *Id.* at 1:19–29. According to Phan, “[t]he pixels generally consist of so-called dots representing the three basic colours red, green and blue.” *Id.* at 1:59–61. Phan discloses displays in which “each dot has a receiver of its own . . . to convert digital information transmitted through [a] network . . . into luminous intensity levels for [the] dots.” *Id.* at 5:16–19. Phan discloses “dynamic generation of pixels wherein a one-pixel logical unit is formed by grouping adjacent dots, with adjacent pixels being physically superimposed and the dynamic pixels being generated by sequential addressing at a rate such that said generation is not perceivable by the human eye.” *Id.* at 2:66–3:4.

Figures 11a and 11b of Phan are reproduced below.

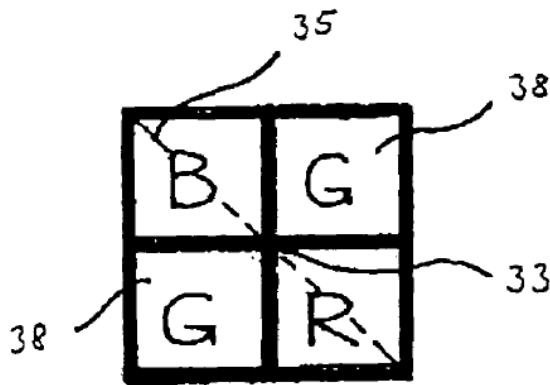


FIG. 11a

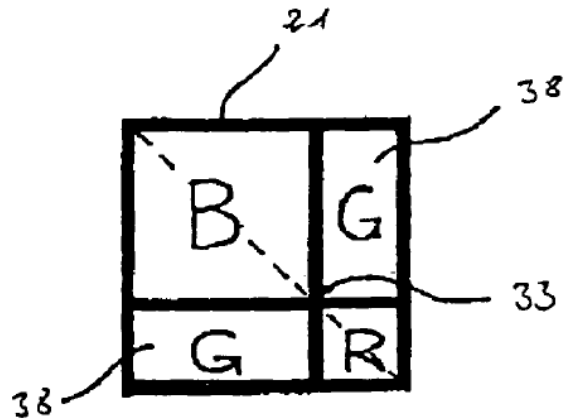


FIG 11b

Figure 11a “shows a square quad pixel where the crosspoint 33 is in the centre of the four dots (individual elements) of equal light emitting area and space, contoured by black mask or black barrier ribs 21 with the same structure.” Ex. 1005, 5:47–50. Figure 11b “shows a typical square quad pixel where the crosspoint 33 moving along the diagonal line 35 forms two dots (individual elements) of equal light emitting area and space 38 of green color (G).” *Id.* at 5:51–54.

Figure 12 of Phan is reproduced below.

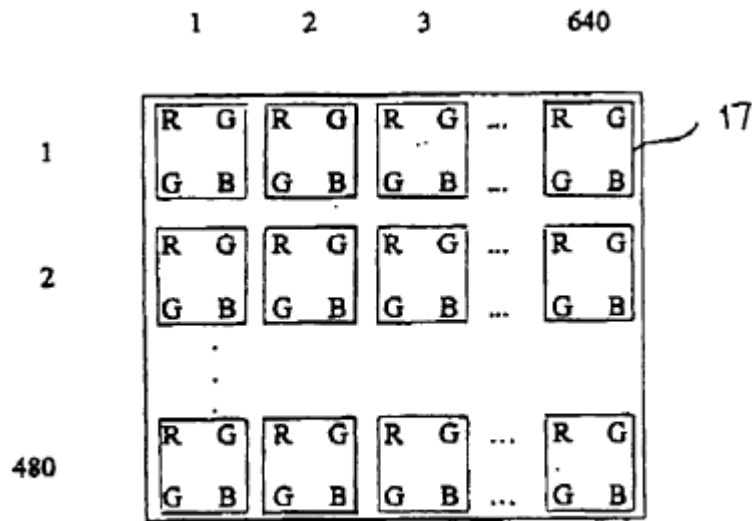


FIG. 12

Figure 12 “shows a quad pixels display with a resolution of 480x640 static pixels 17.” Ex. 1005, 4:5–6, 5:55–56.

Petitioner notes that Phan issued August 15, 2006, and contends that Phan qualifies as prior art under 35 U.S.C. § 102(b). Pet. 14. Patent Owner does not contest the prior art status of Phan at this juncture. For purposes of this Decision, we determine that Phan qualifies as prior art under 35 U.S.C. § 102(b) because Phan’s issue date of August 15, 2006, is more than one year before the earliest effective filing date of the challenged claims, which is March 6, 2012. Ex. 1001, code (30); Ex. 1005, code (45).

2. *Claim 1*

The preamble of claim 1 recites “[a] pixel arrangement structure of an organic light emitting diode (OLED) display.” Ex. 1001, 8:63–64.

Petitioner cites Phan’s teaching of a “display comprising pixels and dots.” Pet. 42 (quoting Ex. 1005, 1:18–19) (citing Ex. 1005, 2:51–53). Petitioner contends that “Phan’s teachings can be employed with various ‘display

technologies,’ including ‘Organic Light Emitting Diode (OLED)’ displays.” *Id.* (quoting Ex. 1005, 1:18–29) (citing Ex. 1003 ¶¶ 325–328). Petitioner also notes that “Phan includes two sets of example pixel designs,” including the “quad pixel” designs of Figure 11a and 11b. *Id.* at 54 (citing Ex. 1005, 5:47–54). Petitioner contends that an ordinarily skilled artisan would have been motivated to use these pixel designs with the displays referenced elsewhere in Phan with “every reason to believe that those pixel designs can be successfully employed.” *Id.* at 54–55 (citing Ex. 1003 ¶¶ 412–414).

Patent Owner argues that “Petitioner fails to show that the embodiments of Phan on which it relies even disclose an OLED display.” Prelim. Resp. 40–41. In particular, Patent Owner argues that Phan’s mention of OLED displays appears only in Phan’s field of the invention, which is merely a “listing of every conceivable display technology.” *Id.* at 41. Patent Owner explains that this “does not show that any embodiments in Phan are OLED displays.” *Id.* Patent Owner additionally cites Phan’s teaching that “each color dot has a receiver of its own to convert digital information transmitted through a network and that the network preferably is an optical fiber network” is evidence that Phan’s embodiments pertain to “something other than an OLED.” *Id.* (citing Ex. 1005, 5:16–20). Patent Owner further argues that “neither Phan nor Petitioner explains how Phan’s embodiments can be combined with an OLED display.” *Id.* at 41–42.

At this stage, we find Petitioner’s showing regarding the preamble sufficient for institution.⁴ Phan expressly states that its “invention relates to

⁴ Neither party addresses whether the preamble is limiting. Because Petitioner shows sufficiently that Phan teaches the preamble, we need not

a display comprising pixels and dots, including but not limited to the following display technologies: . . . Organic Light Emitting Diode (OLED), . . . as well as a method for controlling the (said) display.” Ex. 1005, 1:18–29. Although Patent Owner disputes that this mention of OLED displays establishes that Phan’s teachings are applicable to OLED displays (*see* Prelim. Resp. 41), we find this disclosure sufficient for institution because we must consider Phan “for everything it *teaches* by way of technology,” which is “not limited to the particular *invention* it is describing.” *EWP Corp. v. Reliance Universal Inc.*, 755 F.2d 898, 907 (Fed. Cir. 1985). Petitioner also has put forth unrebutted testimony from Dr. Pattison that an ordinarily skilled artisan would have expected success implementing Phan’s pixel designs in the display types referenced elsewhere in Phan (e.g., OLED) (*see, e.g.*, Ex. 1003 ¶¶ 328, 412–414), whereas Patent Owner has only put forth attorney argument at this stage. Thus, based on the present record, we find that Phan teaches, or at least fairly suggests, that its disclosed display technologies may be implemented as an OLED display.

We also have considered Patent Owner’s argument that Phan’s mention of a preferred embodiment—where each color dot has a receiver of its own to convert digital information transmitted through an optical fiber network—suggests something other than an OLED display. Prelim. Resp. 41 (citing Ex. 1005, 5:16–20). Even if we were to agree with the premise of Patent Owner’s argument, however, we do not agree on the present record that this preferred embodiment necessarily limits other teachings in Phan. We also note that this argument amounts to an attorney’s

determine whether the preamble is limiting. *See Realtime Data*, 912 F.3d at 1375.

interpretation of Phan that is unsupported by other evidence or testimony. Patent Owner will have an opportunity to further develop its argument at trial.

Claim 1 further recites “a plurality of pixels for displaying an image on the OLED display.” Ex. 1001, 8:65–66. Petitioner cites Phan’s teaching of a display including “so-called pixels” that “consist of so-called dots representing the three basic colours of red, green and blue.” Pet. 42 (quoting Ex. 1005, 1:57–61). Petitioner maps the recited “plurality of pixels” to Phan’s dots, which Petitioner calls Phan’s display’s “minimum display unit.” *Id.* at 43 (citing Ex. 1003 ¶¶ 329–336). Petitioner also cites the same teachings discussed above from the preamble for teaching the “OLED display” and contends that the display is “intended to allow for generation of a high resolution image.” *Id.* (internal quotation and alteration omitted) (citing Ex. 1003 ¶¶ 337–339; Ex. 1005, 2:51–3:25, 4:19–24).

Patent Owner does not dispute this limitation apart from its arguments discussed above with respect to the preamble. We are persuaded preliminarily that Phan’s dots teach the recited “pixels.” *See, e.g.*, Ex. 1005, 1:57–61. We also are persuaded preliminarily that Phan teaches OLED displays and the use of displays for generating images. *See, e.g.*, Ex. 1003 ¶¶ 337–339; Ex. 1005, 1:18–29, 2:51–3:25, 4:19–24.

Claim 1 further recites “a first pixel.” Ex. 1001, 8:67. A later limitation recites that the first pixels “are configured to emit green light.” *Id.* at 9:20. Petitioner cites Phan’s teaching of pixels that “comprise regularly disposed dots 11 radiating the basic colours red (red dot 13), green (green dot 14) and blue (blue dot 15).” Pet. 44 (quoting Ex. 1005, 4:29–32). As such, Petitioner maps the recited “first pixel” to Phan’s green dots. *Id.*

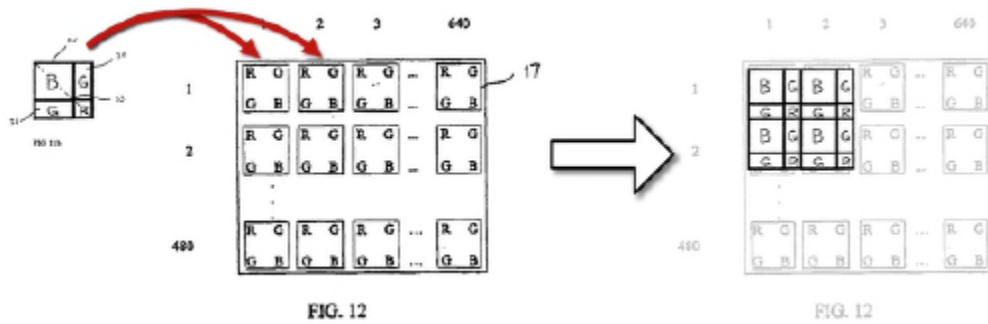
(citing Ex. 1003 ¶¶ 340–343); *see also id.* at 50 (similar mapping). Patent Owner does not dispute this limitation apart from its arguments discussed above with respect to the preamble. We are persuaded preliminarily that Phan’s green dots teach “a first pixel” that is “configured to emit green light.” *See, e.g.*, Ex. 1005, 4:29–32.

Claim 1 further recites

a pair of second pixels separated from the first pixel, the second pixels being located at opposite sides of the first pixel along a first line on which the first pixel, the second pixels, and another first pixel are consecutively arranged such that the first line passes through respective centers of the first pixel, the second pixels, and the other first pixel.

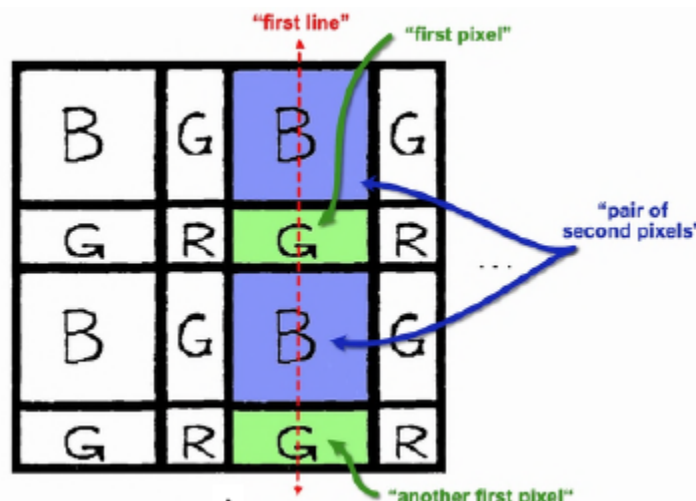
Ex. 1001, 9:1–7. Petitioner cites the same teaching of dots from Phan and maps the “pair of second pixels” to the blue dots in particular. Pet. 44 (citing Ex. 1005, 4:29–32, Fig. 11b). Petitioner contends that adjacent dots are “separated” based on Phan’s teaching that dots are “surrounded by a black mask or black barrier ribs 21 to obtain a higher contrast.” *Id.* (citing Ex. 1005, 4:33–37, Figs. 1a–c, 10a–11b).

For the recited arrangement of pixels, Petitioner cites the “quad pixel” arrangement disclosed in Figure 11b of Phan and contends it can be implemented in the “quad pixel display” of Figure 12 from Phan. Pet. 45–46 (citing Ex. 1005, 5:47–60, Figs. 11–12). Petitioner depicts this concept in the following illustration from the Petition, which includes annotated versions of Phan’s Figure 11b and 12, as reproduced below.



Id. at 46. In this illustration, Petitioner indicates how “the dot/pixel structure shown in Fig. 11b in a repeating grid or matrix [as shown in Figure 12] results in what this limitation requires.” Pet. 46 (citing Ex. 1005, 4:29–32, 4:41–43, 5:47–54, Figs. 11b, 12). Petitioner contends that, “[d]ue to the use of a square pixel shape that is regularly arranged on lines in an identically repeating matrix, Phan’s blue and green dots have ‘*respective centers*’ that are located ‘*along a first line.*’” Pet. 46–47. Petitioner further contends that, “because there are twice as many green dots as there are red and blue dots in Phan’s ‘quad pixel,’ the blue and green dots alternate with each other and are ‘*consecutively arranged*’ with blue pixels on ‘*opposite sides*’ of the green pixels.” *Id.* at 47 (citing Ex. 1003 ¶¶ 347–363).

To summarize these contentions, Petitioner provides the following illustration in the Petition.



Id. In this illustration from the Petition, Petitioner indicates the recited “first pixel” and “another first pixel” in green, the recited “pair of second pixels” in blue, and the recited “first line” in red. *Id.*

Patent Owner does not dispute this limitation apart from its arguments discussed above with respect to the preamble. We are persuaded preliminarily that Phan’s blue dots teach the recited “pair of second pixels.” *See, e.g.*, Ex. 1005, 4:29–32, Fig. 11b. We also are persuaded preliminarily that Phan’s black mask or black barrier ribs “separate[s]” the dots. *See, e.g.*, Ex. 1005, 4:33–37, Figs. 1a–c, 10a–11b. Petitioner has also shown sufficiently that the dot/pixel structure of Phan’s Figure 11b implemented in the repeating grid pattern of Phan’s Figure 12 results in the arrangement recited in this limitation, including the recited “first line.” *See, e.g.*, Ex. 1003 ¶¶ 347–363; Ex. 1005, 4:29–32, 4:41–43, 5:47–60, Figs. 11–12.

Claim 1 further recites

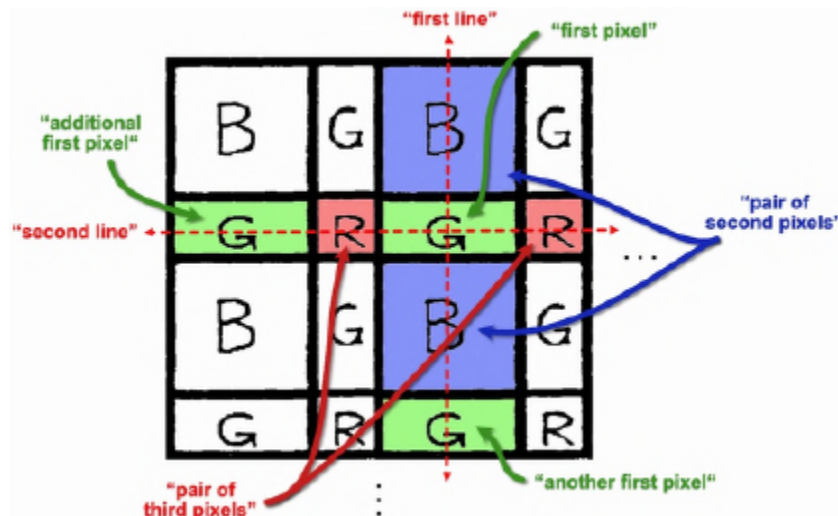
a pair of third pixels separated from the first pixel and the second pixels, the third pixels being located at opposite sides of the first pixel along a second line on which the first pixel, the third pixels, and an additional first pixel are consecutively arranged such that the second line passes through respective centers of the first pixel, the third pixels, and the additional first pixel, the second line crossing the first line at a location of the first pixel.

Ex. 1001, 9:8–6. Petitioner cites the same teaching of dots from Phan and maps the “pair of third pixels” to the red dots in particular. Pet. 47 (citing Ex. 1005, 4:29–32, Fig. 11b). Petitioner again contends that adjacent dots are “separated” based on Phan’s teaching that dots are surrounded by a black mask or black barrier ribs. *Id.* (citing Ex. 1005, 4:33–37, Figs. 1a–c, 10a–11b).

Regarding the recited arrangement of pixels, Petitioner cites Phan's teachings that its pixels and dots are identical, regularly disposed, and arranged in a "square quad shape." Pet. 48 (citing Ex. 1005, 4:29–32, 5:47–54, Fig. 11b). As such, Petitioner contends that

the red dots have their "*centers*" on a "*second line*" that runs through the red dots, the green "*first pixel*" and "*an additional*" green "*first pixel*." The "*second line*" "*cross[es] the first line*" at a green pixel as required. And, the pixels are "*consecutively arranged*," with "*third pixels*" (red dots) on "*opposite sides*" of the "*first pixel[s]*" (green dots).

Id. (citing Ex. 1003 ¶¶ 367–369). To summarize these contentions, Petitioner provides the following illustration in the Petition.

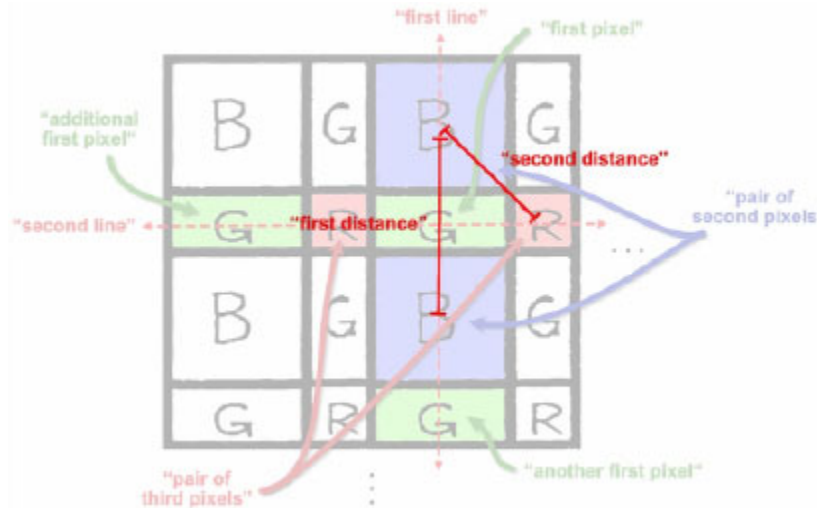


Id. In this illustration from the Petition, Petitioner indicates the recited "first pixel," "another first pixel," and "additional first pixel" in green, the recited "pair of second pixels" in blue, and the recited "pair of third pixels," "first line," and "second line" in red. *Id.*

Patent Owner does not dispute this limitation apart from its arguments discussed above with respect to the preamble. We are persuaded preliminarily that Phan's red dots teach the recited "pair of third pixels." *See, e.g.*, Ex. 1005, 4:29–32, Fig. 11b. We also are persuaded preliminarily

that Phan’s black mask or black barrier ribs “separate[s]” the dots. *See, e.g.*, Ex. 1005, 4:33–37, Figs. 1a–c, 10a–11b. Petitioner has also shown sufficiently that the dot/pixel structure of Phan’s Figure 11b implemented in the repeating grid pattern of Phan’s Figure 12 results in the arrangement recited in this limitation, including the recited “second line crossing the first line at a location of the first pixel.” *See, e.g.*, Ex. 1003 ¶¶ 367–369; Ex. 1005, 4:29–32, 5:47–54, Figs. 11–12.

Claim 1 further recites that “a first distance between the second pixels is greater than a second distance between one of the second pixels and a neighboring one of the third pixels.” Ex. 1001, 9:17–19. Petitioner notes that “Phan’s ‘square quad pixels’ include twice as many green dots as blue or red dots,” so “there are green dots located between all of Phan’s ‘second pixels’ (the blue dots).” Pet. 48–49 (citing Ex. 1005, 5:47–54, Figs. 11a–b, 12). Petitioner further notes that “the ‘second pixels’ (the blue dots) and the ‘third pixels’ (the red dots) are arranged diagonally with no intervening pixels.” *Id.* at 49 (citing Ex. 1005, Figs. 11a–b). Based on these teachings, Petitioner contends the “‘*first distance*’ between Phan’s blue dots will always be ‘*greater*’ than a ‘*second distance*’ between adjacent blue and red dots.” *Id.* (citing Ex. 1003 ¶¶ 370–374). To summarize these contentions, Petitioner provides the following illustration in the Petition.



Id. In this illustration from the Petition, Petitioner indicates the recited “first distance” between blue dots with a longer red line and the recited “second distance” between a blue dot and a red dot with a shorter red line. *Id.*

Patent Owner does not dispute this limitation apart from its arguments discussed above with respect to the preamble. We are persuaded preliminarily that the dot/pixel structure of Phan’s Figure 11b implemented in the repeating grid pattern of Phan’s Figure 12 results in the arrangement recited in this limitation with a “first distance” between blue dots (i.e., “second pixels”) being greater than a “second distance” between a blue dot (i.e., “one of the second pixels”) and a red dot (i.e., “a neighboring one of the third pixels”). *See, e.g.*, Ex. 1003 ¶¶ 370–374; Ex. 1005, 5:47–54, Figs. 11a–b, 12.

Claim 1 further recites that “the first pixels are configured to emit green light, which is a color that is different from light emitted by the second pixels and the third pixels.” Ex. 1001, 9:20–22. Petitioner relies on the same analysis discussed above mapping the “first pixels” to Phan’s green dots. Pet. 50 (citing Ex. 1005, 4:29–32, Fig. 11b). Patent Owner does not dispute this limitation apart from its arguments discussed above with respect

to the preamble. For the same reasons discussed above, this analysis is sufficient for institution.

Claim 1 further recites that “the first pixels are smaller than at least one of the second pixels or the third pixels” and “each of the second pixels has a larger area than each of the third pixels.” Ex. 1001, 9:23–26. Petitioner cites the embodiment in Figure 11b of Phan (reproduced above) where “the central ‘crosspoint’ of the pixel has been shifted ‘along diagonal line 35’ resulting in dots with non-equal areas.” Pet. 50–51 (citing Ex. 1003 ¶¶ 378–382; Ex. 1005, 5:47–54, Fig. 11b). Patent Owner does not dispute this limitation apart from its arguments discussed above with respect to the preamble. Based on Phan’s Figure 11b embodiment, we are persuaded preliminarily that Phan’s green dots (i.e., “first pixels”) are smaller than the blue dots (i.e., “second pixels”) and that Phan’s blue dots (i.e., “second pixels” have a larger area than the red dots (i.e., “third pixels”). *See, e.g.*, Ex. 1003 ¶¶ 378–382; Ex. 1005, 5:47–54, Fig. 11b.

Petitioner has shown sufficiently that Phan teaches or suggests all limitations of claim 1 in light of the knowledge of a person of ordinary skill in the art. Based on the present record, we determine that Petitioner has established a reasonable likelihood that it would prevail in showing that the subject matter of claim 1 would have been obvious over Phan.

3. *Claims 4–6, 8–10, 13, and 15*

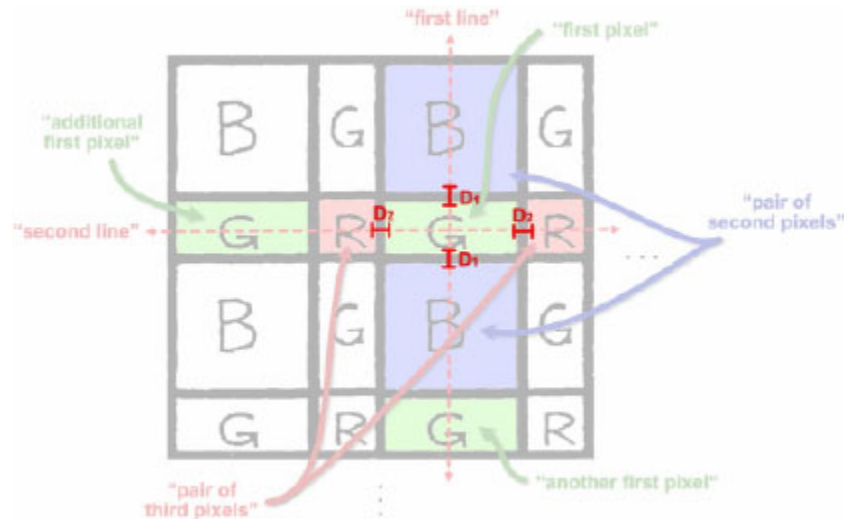
We have reviewed Petitioner’s analysis for claims 4–6, 8–10, 13, and 15. Pet. 42–55. Patent Owner does not dispute Petitioner’s showing for these claims apart from its arguments discussed above with respect to claim 1. Based on the present record, Petitioner has established a reasonable

likelihood that it would prevail in showing that the subject matter of claims 4–6, 8–10, 13, and 15 would have been obvious over Phan.

4. *Claim 7*

We have already determined that Petitioner has established a reasonable likelihood of success that it would prevail in showing that claims 1, 4–6, 8–10, 13, and 15 would have been obvious over Phan, and we will be instituting review on all challenged claims and all challenged grounds in the Petition. *See SAS Inst. Inc. v. Iancu*, 138 S. Ct. 1348 (2018) (holding that the Board may not institute review on fewer than all claims challenged in the petition); 37 C.F.R. § 42.108(a) (“When instituting *inter partes* review, the Board will authorize the review to proceed on all of the challenged claims and on all grounds of unpatentability asserted for each claim.”). Nevertheless, we include the following discussion regarding Petitioner’s obviousness contentions for claim 7.

Claim 7 depends from claim 1 and recites “the second pixels are substantially equidistant from the first pixel interposed between the second pixels, and the third pixels are substantially equidistant from the first pixel interposed between the third pixels.” Ex. 1001, 9:43–47. For the “substantially equidistant” limitations, Petitioner provides the following illustration in the Petition.



Pet. 52–53. In this illustration from the Petition, Petitioner indicates distances D_1 and D_2 in red. Petitioner contends that “a ‘first pixel’ will be ‘substantially equidistant’ to two surrounding ‘second pixels’ (label D_1). Likewise, the ‘first pixel’ will also be ‘substantially equidistant’ to two surrounding ‘second pixels’ (label D_2).” *Id.* (citing Ex. 1003 ¶¶ 393–398).

Patent Owner disputes Petitioner’s interpretation of its illustration, which is based on Petitioner’s conception of how Phan’s quad pixel arrangement from Figure 11b would be implemented in the display of Figure 12. Prelim. Resp. 42–48. In particular, Patent Owner criticizes how “Petitioner offers no justification for changing Phan to remove the gaps between adjacent quad pixels.” *Id.* at 45–46 (citing Ex. 1003 ¶ 356). Patent Owner argues that, in an OLED display, “there would need to be space for circuitry such as signal lines and power lines.” *Id.* at 43–44 (citing Ex. 1001, 3:62–65; Ex. 1008, 1:23–33, 6:55–60, Figs. 4, 5). Patent Owner notes testimony from Dr. Pattison that allegedly supports Patent Owner’s argument. *Id.* at 46 (quoting Ex. 1003 ¶ 346) (Dr. Pattison testifying that an ordinarily skilled artisan “would have understood that when implemented in a display, there would be at least some physical space between to [sic] the

dots so as to allow for the required signal lines passing between the dots”). According to Patent Owner, had Petitioner maintained the necessary space in Phan’s Figure 12, then Petitioner’s proposed pixel arrangement would not meet the “substantially equidistant” limitations of claim 7. *Id.* at 46–47.

Patent Owner’s arguments call into question whether Petitioner has taken too much liberty in its interpretation of how Phan’s quad pixel arrangement from Figure 11b would be implemented in the display of Figure 12.⁵ At trial, the parties should further address whether it would have been obvious or even possible to maintain the distances Petitioner posits in the illustration at page 53 of the Petition for an OLED display implementation.

E. Obviousness Ground Based on Phan and Yamada

Petitioner contends that the subject matter of claim 2 would have been obvious over the combination of Phan and Yamada. Pet. 55–60. Patent Owner disputes Petitioner’s contentions. Prelim. Resp. 48–57.

1. Yamada

Yamada is a U.S. patent related to an “electroluminescence (EL) display apparatus.” Ex. 1008, 1:6–7. Yamada discusses an “EL display apparatus” including “emissive regions 1B [blue], 1R [red], and 1G [green] for the display pixel of the respective color . . . arranged in a matrix configuration.” *Id.* at 2:55–60; *see also id.* at 7:6–12 (discussing colors for

⁵ Based on the present record, we do not believe that this potential problem, even if true, detracts from Petitioner’s obviousness contentions for the other claims in this ground. Nor does Patent Owner argue such at this stage.

the various emissive regions). Yamada indicates that “the emission efficiency of the emissive layer for emitting light of various colors differs with each color.” *Id.* at 2:53–54. According to Yamada, when the pixels all have identically sized emissive areas, “a current larger than that supplied to the other display pixels having a high emission efficiency must be supplied” to obtain the same luminance at display pixels having a low emission efficiency. *Id.* at 2:55–64. Yamada teaches that “[t]his causes the life of those display pixels having a low emission efficiency, in particular, to shorten, and also possibly causes the life of the EL display apparatus to shorten.” *Id.* at 2:64–67.

Yamada purports to improve upon these aspects of EL displays by way of “a color display device, in which a display pixel having an emissive element is provided for every color, wherein the emissive area of the display pixel of any one color, among the display pixels of various colors, is different in size from the emissive area of the display pixel of another color.” Ex. 1008, 3:17–22. According to Yamada,

[b]y setting the emissive area of the display pixel, namely, the emissive area of the emissive element, in accordance with the emission efficiency of the emissive element as in the foregoing, and by supplying, for example, the same power to the emissive elements of colors having different emission efficiencies, it becomes possible to have the same emission luminance at the various display pixels.

Id. at 3:65–4:5. Therefore, Yamada states “it is possible to prevent the deterioration from accelerating when a load is selectively placed on the emissive element having low emission efficiency and extend the life of the display device.” *Id.* at 4:11–14.

Figure 4 of Yamada is reproduced below.

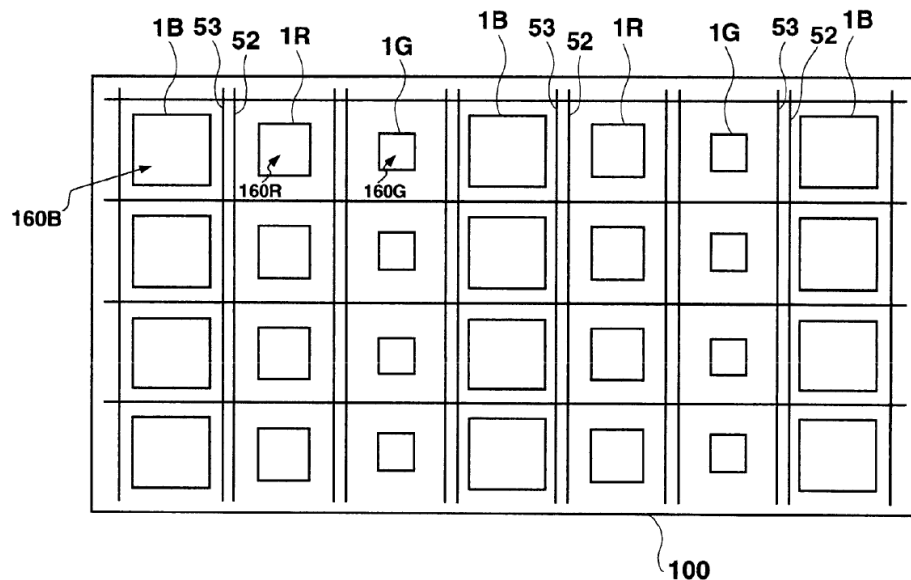


Fig. 4

Figure 4 is a “conceptual diagram showing emissive region areas of the EL display apparatus.” Ex. 1008, 6:24–25. According to Yamada, Figure 4 “is a top plan view of an EL display apparatus 100” representing “a case where the respective display pixels emit red (R), green (G), and blue (B) light.” *Id.* at 6:49–52. “[I]n the case of FIG. 4, the emissive area of the green display pixel 1G is provided as the smallest,” while “[e]missive regions 1R and 1B of the other colors are formed with a larger area than that of emissive region 1G.” *Id.* at 7:6–10. Yamada indicates that while in Figure 4 the “[a]rea of green emissive region 1G<area of red emissive region 1R<area of blue emissive region 1B,” “the order in size of the emission region areas is not fixed at the above-mentioned green<red<blue, but is determined by the emission efficiency of the emissive materials that are used.” *Id.* at 7:10–19.

Petitioner notes that Yamada issued April 2, 2002, and contends that Yamada qualifies as prior art under 35 U.S.C. § 102(b). Pet. 17. Patent Owner does not contest the prior art status of Yamada at this juncture. For

purposes of this Decision, we determine that Yamada qualifies as prior art under 35 U.S.C. § 102(b) because Yamada’s issue date of April 2, 2002, is more than one year before the earliest effective filing date of the challenged claims, which is March 6, 2012. Ex. 1001, code (30); Ex. 1008, code (45).

2. *Claim 2*

We include the following discussion even though we will be instituting on all challenged claims and all grounds in the Petition. Claim 2 depends from claim 1 and recites, *inter alia*, that “each of the second pixels and the third pixels has a larger area than the first pixel.” Ex. 1001, 9:30–31. Petitioner concedes that “Phan does not . . . provide an example where its ‘third pixel’ (red dots) is also larger than its ‘first pixel’ (green dots).” Pet. 56. Thus, building upon its obviousness contentions based on Phan alone, Petitioner cites Yamada’s teaching of “an OLED display with red, green, and blue pixels re-sized in accordance with the emission efficiency of each color’s emissive element.” *Id.* (internal quotations omitted) (citing Ex. 1008, 2:55–60, 3:16–27). Applying this teaching to Phan’s Figure 11a embodiment, Petitioner contends that the result would be such that “the blue dot maintains its original size (making it relatively larger), the green dots have been made smallest and the red dot an intermediate size.” *Id.* at 57 (citing Ex. 1003 ¶¶ 433–441). Petitioner contends an ordinarily skilled artisan would have made this combination because “it was well-known that adjusting pixel size—and making pixels with lower emission efficiencies (blue) larger and pixels with higher emission efficiencies (green) smaller—reduces deterioration and improves display life.” *Id.* at 58 (citing Ex. 1003 ¶¶ 444–454).

Patent Owner disputes Petitioner's reasons for combining Yamada with Phan as being inconsistent with Phan's disclosures of moving the crosspoint of its quad pixel arrangement along a diagonal line. Prelim. Resp. 49–50 (citing Ex. 1005, 5:51–54, Figs. 11a, 11b). In particular, Patent Owner argues that “Petitioner ignores Phan's teaching about resizing pixels along the diagonal line and breaks up the pixels into an arbitrary structure that can be explained only as a hindsight-based attempt to meet the claims of the '683 patent without any support in Phan or Yamada.”⁶ *Id.* at 50.

At this stage, Petitioner's contentions are supported by Dr. Pattison's testimony, whereas Patent Owner's positions amount to attorney argument. Notwithstanding, we feel that evaluating Petitioner's application of Yamada's resizing of pixels based on emission efficiency to Phan's quad pixel arrangement would be best accomplished in the context of a fully developed trial record. In particular, the parties should address the compatibility of Yamada's teaching of pixel resizing with Phan's teaching of moving the crosspoint of a quad pixel group along a diagonal line.

F. Obviousness Ground Based on Matthies and Yamada

Petitioner contends that the subject matter of claims 1, 2, 4–10, 13, and 15 would have been obvious over the combination of Matthies and Yamada. Pet. 18–41. Patent Owner disputes Petitioner's contentions. Prelim. Resp. 11–40.

⁶ Patent Owner also relies on other arguments it makes against the Matthies–Yamada ground. See Prelim. Resp. 50–52. We discuss those arguments below. See *infra* § II.F.2.

1. *Matthies*

Matthies is a U.S. patent directed to “large-area display devices which are formed as an array of tiled display devices.” Ex. 1004, 1:8–10. Matthies states that “[b]uilding a large-area display out of smaller tiles has been recognized as a desirable solution,” because “the basic unit of manufacture is relatively small,” which “reduces manufacturing costs.” *Id.* at 1:56–65. Matthies explains that “[n]o practical tiled display system has yet been developed” because “[w]hat has been missing is a fabrication technology that allows a display to be constructed so that pixels can be brought up to the very edge . . . while at the same time allowing for electronics to address each tile, even those tiles completely surrounded by other tiles.” *Id.* at 1:66–2:7.

Figure 1 of Matthies is reproduced below.

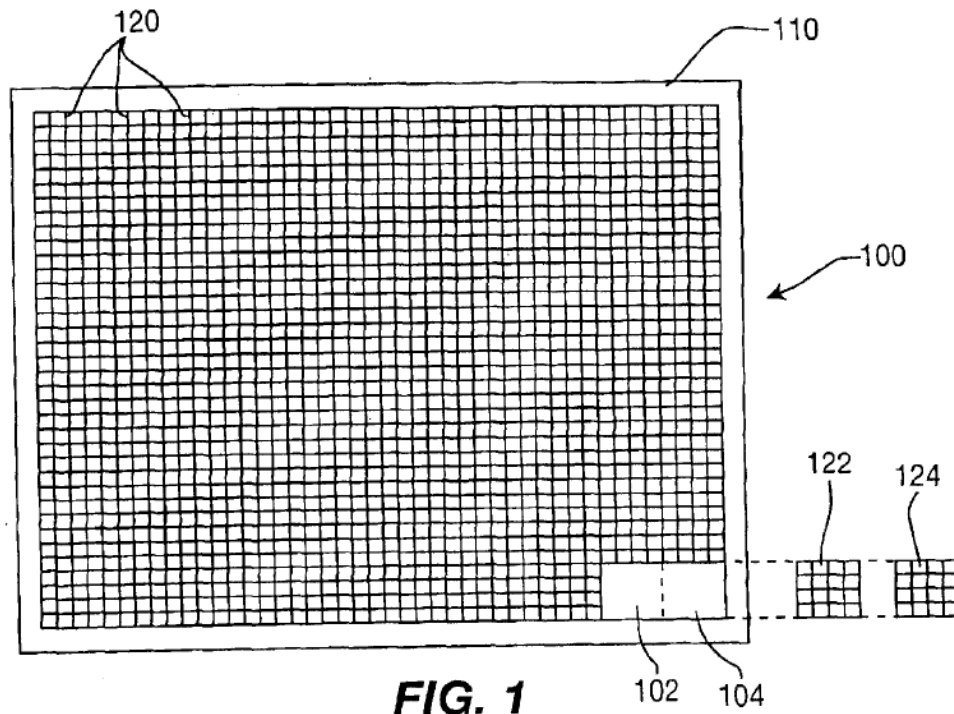


Figure 1 “is a front plan drawing of a large area display device from which two tiles have been removed.” Ex. 1004, 3:49–50. According to Matthies,

“display 100 is a tiled display in which emissive or reflective elements, on which the image pixels are formed, are built as relatively small arrays on tiles 120 and assembled into a frame to produce the large-area display having a large number of pixel forming elements.” *Id.* at 5:38–42. Matthies indicates that “[a]lthough the display 100 is shown as being formed from tiles having 16 pixel forming elements in a four by four array, it is contemplated that each tile may include many more pixels.” *Id.* at 5:56–59.

Matthies states that in an exemplary embodiment, “the pixel forming elements are made from an organic light emitting diode (OLED) material.” Ex. 1004, 6:17–19. According to Matthies, “[t]he active portion . . . of the pixels occupies only about 1/4 of the total pixel area.” *Id.* at 15:67–16:1. Matthies indicates that “this spacing of the pixels leaves room along the edges of the display for the vias . . . to connect to the row and column electrodes of the pixel without interfering with the regular spacing of the pixels across tile boundaries.” *Id.* at 16:5–9.

Figure 7 of Matthies is reproduced below.

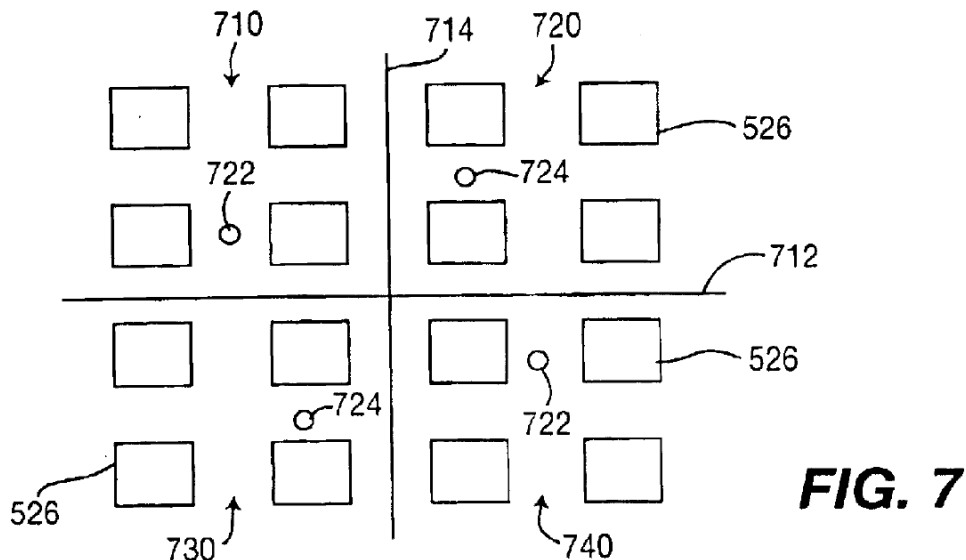


Figure 7 “is a pixel diagram which shows an exemplary pixel layout for portions of four tiles.” Ex. 1004, 4:6–7. “In the layout shown in FIG. 7, the active portions 526 of the pixels are centered in their respective pixel regions and the vias which connect the row and column electrodes of the display to the electronics are formed between respective pixel elements.” *Id.*

at 16:22–26. “The distance between the edge of an active region 526 and the edge 712 of the display is equal on all sides of the tile.” *Id.* at 16:26–28.

Figure 8B of Matthies is reproduced below.

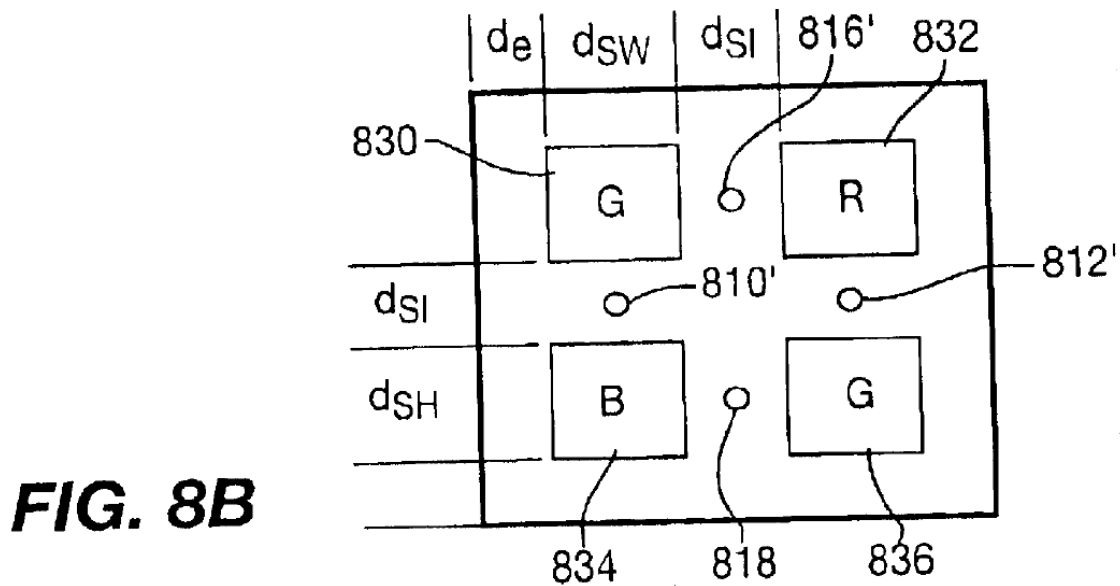


Figure 8B is “a front-plan view of an alternative single color pixel structure which includes separate sub-pixels.” Ex. 1004, 4:12–13. According to Matthies, Figure 8B illustrates a “color pixel structure” that “includes four sub-pixel elements, 830, 832, 834 and 836.” *Id.* at 16:62–64. “Two of these sub-pixel elements, 830 and 836 emit green light when stimulated while the other two pixel elements, 832 and 834 emit red and blue light, respectively.” *Id.* at 16:64–66. Matthies indicates that “[t]his structure is known as a quad sub-pixel structure.” *Id.* at 16:67. According to Matthies, “[t]he geometry of the quad sub-pixel structure is defined by the dimensions d_{SH} , the height

of the sub-pixel, d_{sw} , the width of the sub-pixel, d_e , the distance from the active sub-pixel areas to the edge of the pixel area, and d_{sl} , the distance between adjacent sub-pixels.” *Id.* at 17:16–20.

Matthies teaches that a “tile may also include circuitry which automatically adjusts the pixel brightness to compensate for aging of the display material,” such as a “small light sensor over one or more pixel positions which continually monitors the brightness of that pixel and adjusts the current level applied to that pixel—and the current levels applied to all of the other pixels on the display—to compensate for variations in pixel brightness due to aging of the display.” Ex. 1004, 11:47–58. Matthies also teaches “that the decay in the brightness of an OLED pixel that occurs with aging can be predicted” by, for example, “measuring the current and time for a particular pixel, and integrating the product of current and time” or by “monitor[ing] the voltage that is applied to the pixel.” *Id.* at 11:61–12:16. Matthies indicates that the “methods for adjusting the current applied to a pixel in order to maintain a predetermined brightness level may be combined with any other method either as a check or to augment the performance of the other method.” *Id.* at 12:41–46.

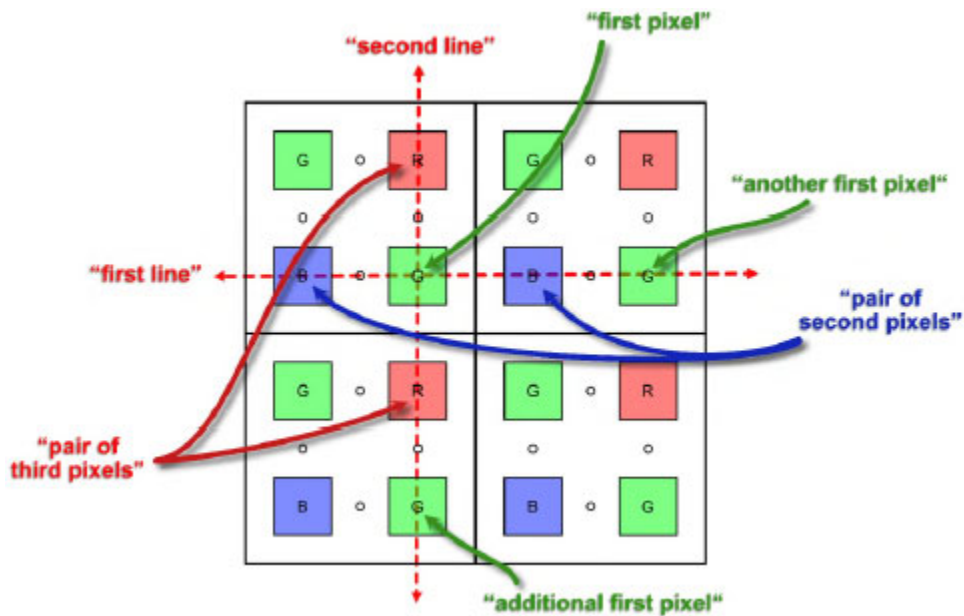
Petitioner notes Matthies’s issue date,⁷ and contends that Matthies qualifies as prior art under 35 U.S.C. § 102(b). Pet. 11. Patent Owner does not contest the prior art status of Matthies at this juncture. For purposes of this Decision, we determine that Matthies qualifies as prior art under 35 U.S.C. § 102(b) because Matthies’s issue date of May 24, 2005, is more

⁷ Petitioner states that Matthies issued on May 23, 2005, when it actually issued one day later on May 24, 2005. Pet. 11; Ex. 1004, code (45). This harmless error does not affect whether Matthies qualifies as prior art.

than one year before the earliest effective filing date of the challenged claims, which is March 6, 2012. Ex. 1001, code (30); Ex. 1004, code (45).

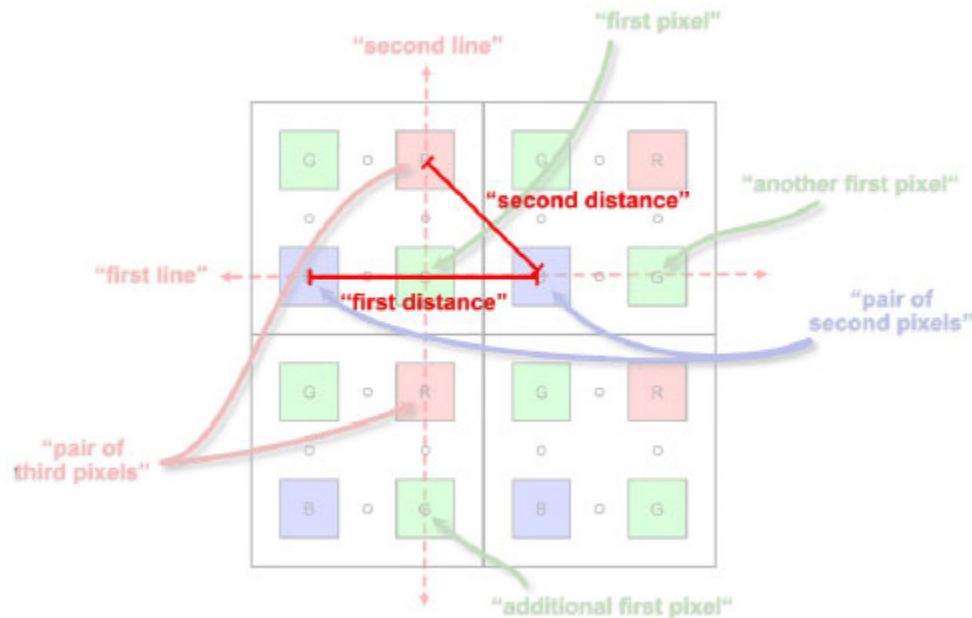
2. Discussion

We include the following discussion even though we will be instituting on all challenged claims and all grounds in the Petition. Petitioner's obviousness contentions for this ground are based on the "quad sub-pixel structure" in Matthies's Figure 8B implemented with the dimensions in Matthies's Table 2. Petitioner provides the following demonstrative of several such quad sub-pixel structures in a tiled arrangement to support its analysis of various limitations in independent claims 1, 13, and 15.



Pet. 24. In this demonstrative from the Petition, Petitioner has indicated the "first pixel[s]" in green, the "second pixels" in blue, and the "third pixels" in red. *Id.* Petitioner has also indicated the "first line" and "second line" with red dashed lines. *Id.* Petitioner provides another version of the same

demonstrative, reproduced below, to show the recited “first distance” and “second distance.”



Id. at 27. In this demonstrative from the Petition, Petitioner has indicated the recited “first distance” and “second distance” with red lines. *Id.*

Petitioner additionally cites Yamada’s teaching that, in order to overcome the problem of OLED pixel colors having different emission efficiencies, “pixels with lower emission efficiencies (blue) should be made larger than pixels with higher emission efficiencies (green).” Pet. 35–36 (citing Ex. 1008, 2:55–3:6, 3:38–44, 3:51–57, 7:3–12, 8:19–28, 8:47–52, Figs. 4, 9). Petitioner contends it would have been obvious to apply these teachings from Yamada to Matthies’s OLED display with a “quad sub-pixel structure.” *Id.* at 36–37 (citing Ex. 1003 ¶¶ 274–282; Ex. 1004, code (57), 3:6–7, 10:14–18, 10:24–27, 16:21–34, 16:62–17:31, Figs. 1, 7, 8B).

Patent Owner disputes Petitioner’s rationale for combining Matthies with Yamada. In particular, Patent Owner notes that Yamada uses an active matrix OLED (AMOLED) display, which is different than Matthies’s

passive matrix OLED (PMOLED) display. Prelim. Resp. 14, 17–18 (citing Ex. 1004, 10:31–33; Ex. 1008, 1:6–9). In light of these differences, Patent Owner argues that Petitioner has not established a reasonable expectation of success in making the combination. Prelim. Resp. 19–26. Patent Owner also criticizes Dr. Pattison’s testimony that “it was well-known and routine in the art to resize OLED pixels to improve display lifetime” because he “says nothing about how the OLED pixels *in the passive matrix display tiles of Matthies* could be sized differently from one another.” *Id.* at 21 (citing Ex. 1003 ¶¶ 306–307, 310). Patent Owner additionally notes that Matthies teaches “pixel forming elements evenly spaced up to the edges of the tiles,” whereas Yamada teaches differently-sized pixels. *Id.* at 26 (citing Ex. 1004, 5:47–48); *see also id.* at 24–25 (discussing irregularly shaped pixels in Yamada’s Figure 5). In light of this, Patent Owner argues that “Petitioner does not even attempt to explain how differently sized pixels could be used with Matthies’ pixel geometry.” *Id.* at 26–29.

At this stage, Petitioner’s contentions are supported by Dr. Pattison’s testimony, and Patent Owner’s positions, though extensively supported with citations to the underlying record, amount to attorney argument.

Notwithstanding, we look forward to the parties further developing the record at trial on the potential incompatibilities in Petitioner’s combination, including the differences between PMOLED and AMOLED technologies and any differences in pixel geometry between Matthies and Yamada. We will be better able to decide these issues with a fully developed record.

Patent Owner also asserts that an ordinarily skilled artisan would have taken other avenues in making the combination even if the references are combinable. In particular, Patent Owner argues that an ordinarily skilled

artisan (1) would have started with Matthies’s embodiments using an RGB triple subpixel structure arranged in a stripe pattern (Prelim. Resp. 30–32); (2) would have modified Matthies’s quad subpixel structure so that it has two blue pixels instead of two green subpixels (*id.* at 33–36); and/or (3) would not have reduced the area of the green pixels (*id.* at 36–40). We feel that these issues involving alternative design pathways would be best decided in the context of a fully developed record.

G. Obviousness Ground Based on Murai and Yamada

Petitioner contends that the subject matter of claims 1, 2, 4–10, 13, and 15 would have been obvious over the combination of Murai and Yamada. Pet. 60–78. Patent Owner disputes Petitioner’s contentions. Prelim. Resp. 57–66.

1. Murai

Murai is a Japanese patent directed to “a color image display device.” Ex. 1007 ¶ 1. Murai indicates that the display device may be an “organic EL display device[.]” *Id.* ¶ 58. Murai discloses a color image display device that “has unit pixels . . . made up of four dots disposed as a grid in the

vertical and horizontal direction.” *Id.* ¶ 28. Figure 3 of Murai is reproduced below.

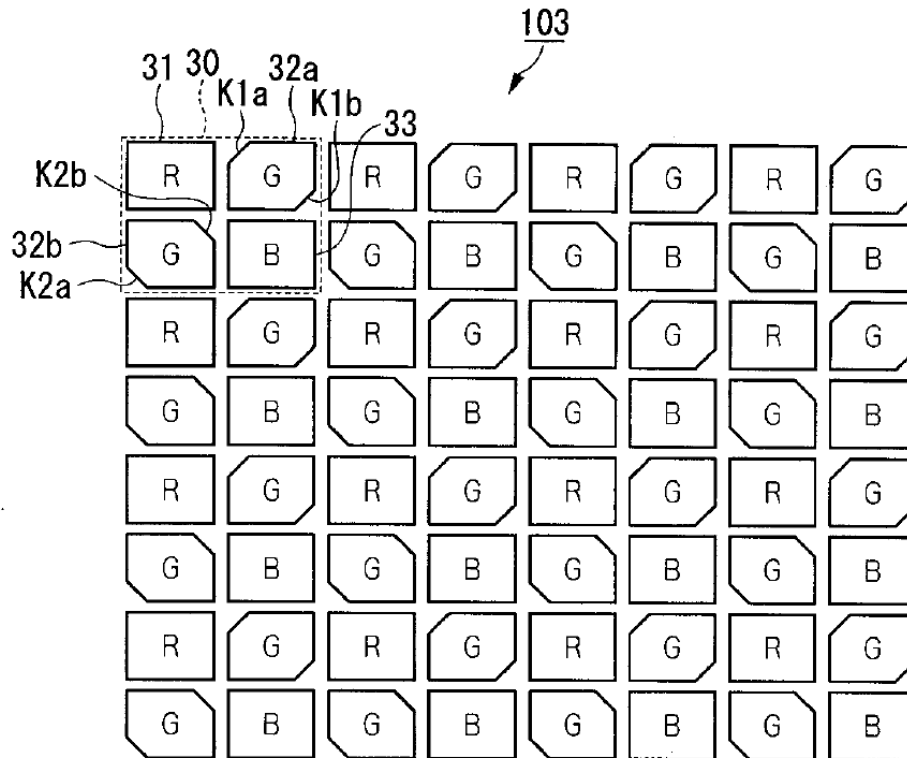


Figure 3 is “a plane view illustrating dot shape and dot arrangement in a color image display device.” Ex. 1007 ¶ 27. “The unit pixels 30 are configured by four dots: one first dot 31, two second dots (32a and 32b), and one third dot 33, as a combined display unit.” *Id.* ¶ 28. “[T]he second dots (32a and 32b) are configured by a first auxiliary dot 32a disposed on a top right corner of a rectangle made by the unit pixel 30 and a second auxiliary dot 32b disposed on a bottom left corner of the rectangle.” *Id.* That is, “the first auxiliary dot 32a and the second auxiliary dot 32b are disposed diagonally in the rectangle made by the unit pixel 30.” *Id.*

According to Murai, “the first auxiliary dot and the second auxiliary dot [may] be shaped having cut-off portions wherein at least one corner of the rectangular shape is cut off, and to be disposed so that there is a cut-off

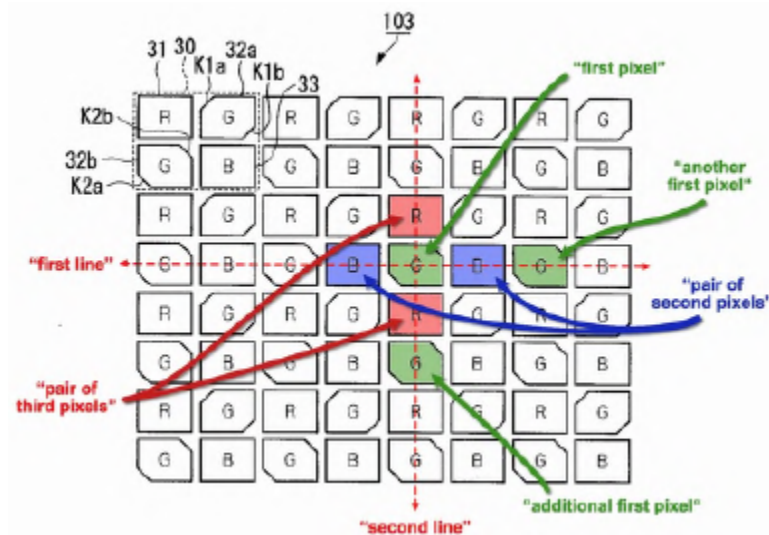
portion near a space between the first auxiliary dot and the second auxiliary dot.” Ex. 1007 ¶ 11.

Petitioner contends that Murai published April 23, 2010. Pet. 15. As such, Petitioner contends that Murai qualifies as prior art under 35 U.S.C. § 102(b). *Id.* Patent Owner does not contest the prior art status of Murai at this juncture.

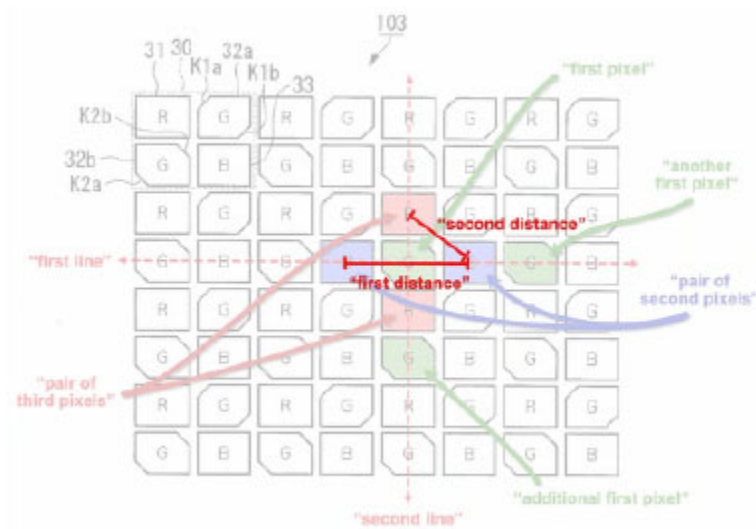
Petitioner appears to have cited Murai’s “Registration Date” of April 23, 2010, as being the publication date. *See* Pet. 15; Ex. 1007, code (24). It is unclear based on the present record whether this is the correct date for qualifying Murai as a “printed publication” under pre-AIA § 102(b). The parties should further address this issue at trial.

2. *Discussion*

We include the following discussion even though we will be instituting on all challenged claims and all grounds in the Petition. Petitioner’s obviousness contentions for this ground are based primarily on the embodiment in Murai’s Figure 3. Petitioner provides the following annotated version of Figure 3 to support its analysis of various limitations in independent claims 1, 13, and 15.



Pet. 66. In this annotated version of Murai’s Figure 3, Petitioner has indicated the “first pixel[s]” in green, the “second pixels” in blue, and the “third pixels” in red. *Id.* Petitioner has also indicated the “first line” and “second line” with red dashed lines. *Id.* Petitioner provides another annotated version of Murai’s Figure 3, reproduced below, to show the recited “first distance” and “second distance.”



Id. at 67. In this annotated version of Murai’s Figure 3, Petitioner has indicated the recited “first distance” and “second distance” with red lines. *Id.*

Petitioner notes Murai’s teachings of (1) different dot sizes; (2) differently shaped dots; and (3) dots with different numbers of cutouts. Pet. 68–70 (citing Ex. 1007 ¶¶ 6, 11, 13, 39, Figs. 3, 5(b), 6(a), 6(b)). Petitioner further cites Yamada’s teaching of “an OLED display with red, green, and blue pixels re-sized in accordance with the emission efficiency of each color’s emissive element.” *Id.* at 70 (internal quotations omitted) (citing Ex. 1008, 2:55–60, 3:16–27). Applying Yamada’s teachings to Murai, Petitioner contends “[t]he **‘first pixel’** (the green dot) would continue to be **‘smaller’** than the other pixels” but “the **‘area’** of the **‘second pixels’** (the blue dots) would also be made relatively **‘larger’** than that of the **‘third pixel’** (the red dots).” *Id.* at 71 (citing Ex. 1003 ¶¶ 529–531).

Petitioner contends that an ordinarily skilled artisan would have been motivated to apply Yamada’s teachings to Murai because “it was well-known that adjusting pixel size—and making pixels with lower emission efficiencies (like blue) larger and pixels with higher emission efficiencies (like green) smaller—reduces deterioration and improves display life.” Pet. 75–76 (citing Ex. 1003 ¶¶ 561–576). Although Petitioner acknowledges that Murai teaches differently sized dots/pixels for purposes of improving image quality by preventing continuous bands of color, Petitioner contends that an ordinarily skilled artisan “would have understood that this existing design feature could also be used to improve display life.” *Id.* at 76–77 (citing Ex. 1003 ¶¶ 570–572).

Patent Owner argues that “Murai discloses problems associated with liquid crystal display (LCD) devices and means for solving the problems.” Prelim. Resp. 57 (citing Ex. 1007 ¶¶ 2–14). Although Patent Owner acknowledges that Murai mentions OLED displays in paragraph 58, Patent

Owner argues that “Murai does not explain how its solutions for LCD devices could be used with OLED displays or the other display types listed.” *Id.* (citing Ex. 1007 ¶ 58). Thus, Patent Owner argues that “Yamada’s teachings regarding the efficiency and the life of organic emissive layers would not apply to LCD displays” and that an ordinarily skilled artisan “would not have been motivated to reduce pixel sizes in embodiments concerning LCD devices . . . based on Yamada.” *Id.* Patent Owner also disputes that Murai’s dots can have different sizes. Prelim. Resp. 58. Rather, Patent Owner argues that “Murai merely suggest[s] that the position of the cutoff portion of the dots can vary” in order to “prevent dots having the same color (or a similar color) from being spaced in the diagonal direction in a way that results in the visual appearance of streaks.” *Id.* (citing Ex. 1007 ¶¶ 11–12).

Patent Owner also argues that (1) Petitioner’s proposed combination would frustrate Murai’s objective to improve the overall aperture ratio (Prelim. Resp. 59, 61 (both citing Ex. 1007 ¶ 42)); (2) “Yamada’s technique of resizing the pixels would also create irregularly shaped pixels, rather than square or rectangular pixels, and may obviate the reason for Murai’s cutouts” (*id.* at 60); and (3) Petitioner’s proposal to add tiny cutouts to the red dots in Murai based on Yamada is contrary to “Yamada’s goal of achieving a balanced pixel luminance . . . because the sizes of the green and red emissive areas remain largely unchanged” (*id.*).

Patent Owner additionally argues that, even if an ordinarily skilled artisan “were to combine Murai’s quad subpixel structure with Yamada, there was no motivation to maintain two green subpixels in the structure.” Prelim. Resp. 64. Instead, Patent Owner contends that an ordinarily skilled

artisan would have included two blue pixels in the quad pixel structure given that blue pixels have the lowest emission efficiency. *Id.* at 64–66. Patent Owner also argues that, if an ordinarily skilled artisan would have made the combination, that artisan would not have started with Murai’s RGBG quad pixel structure and instead would have started with Yamada’s RGB structure arranged in a stripe pattern. *Id.* at 63–64 (citing Ex. 1007, Fig. 7).

As above, Petitioner’s contentions at this stage are supported by Dr. Pattison’s testimony, whereas Patent Owner’s positions amount to attorney argument. Notwithstanding, we look forward to the parties addressing at trial whether Murai’s teachings are applicable to OLED displays. The parties also should develop the record as to whether an ordinarily skilled artisan would have started the combination with Murai’s quad pixel arrangement in the first instance, reduced the sizes of the green and red pixels while keeping blue pixels the same size, and maintained two green pixels. We feel that these issues would be best decided in the context of a fully developed record.

III. CONCLUSION

After considering the evidence and arguments presented in the current record, we determine that Petitioner has demonstrated a reasonable likelihood that it would prevail with respect to at least one of the claims challenged in the Petition. Accordingly, we institute an *inter partes* review on all of the challenged claims and all grounds presented in the Petition. At this stage of the proceeding, we have not made a final determination as to the patentability of the challenged claims.

IV. ORDER

Accordingly, it is

ORDERED that pursuant to 35 U.S.C. § 314, *inter partes* review is instituted as to claims 1, 2, 4–10, 13, and 15 of the '683 patent with respect to all grounds of unpatentability presented in the Petition; and

FURTHER ORDERED that *inter partes* review is commenced on the entry date of this Order, and pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4, notice is hereby given of the institution of a trial.

IPR2023-00988
Patent 10,854,683 B2

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