

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent of: Yojiro Matsueda et al. Attorney Docket No. 57874-0038PS1
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Title: DISPLAY DEVICE AND COMPUTER READABLE MEDIA

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**PETITION FOR POST GRANT REVIEW OF UNITED STATES PATENT
NO. 12,293,691 PURSUANT TO 35 U.S.C. §§ 311–319, 37 C.F.R. § 42**

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LIST OF EXHIBITS

EX1001	U.S. Patent No. 12,293,691 (“the ’691 patent”)
EX1002	Excerpts from the Prosecution History of the ’691 patent (“the Prosecution History”)
EX1003	Declaration and Curriculum Vitae of Dr. Bretschneider
EX1004	Complaint, <i>Tianma Microelectronics Co., Ltd. et al v. LG Display Co., Ltd. et al.</i> , 1-25-cv-02021 (WDTX), filed December 9, 2025
EX1005	U.S. Patent Application Publication No. 2015/0207094 to Hwang (“Hwang”)
EX1006	U.S. Patent Application Publication No. 2014/0292622 to Lee (“Lee”)
EX1007	U.S. Patent Application Publication No. 2012/0056531 to Park et al., (“Park’531”)
EX1008	U.S. Patent Application Publication No. 2016/0225834 to Kim (“Kim’834”)
EX1009	U.S. Patent Application Publication No. 2016/0260792 to Kim (“Kim’792”)
EX1010	U.S. Patent Application Publication No. 2015/0129856 to Kim (“Kim’856”)
EX1011	U.S. Patent Application Publication No. 2015/0364526 to Peng (“Peng”)
EX1012	U.S. Patent Application Publication No. 2012/0307123 to Cok (“Cok’123”)
EX1013	U.S. Patent Application Publication No. 2012/0098415 to Song (“Song”)

EX1014	U.S. Patent Application Publication No. 2009/0121983 to Sung (“Sung”)
EX1015	U.S. Patent Application Publication No. 2004/0217694 to Cok (“Cok’694”)
EX1016	U.S. Patent Application Publication No. 2011/0291550 to Kim, et al. (“Kim’550”)
EX1017	U.S. Patent No. 7,623,141 to Brown Elliott et al. (“Elliott”)
EX1018	U.S. Patent No. 4,853,592 to Strathman (“Strathman”)
EX1019	U.S. Patent No. 7,948,170 to Striakhilev et al. (“Striakhilev”)
EX1020	U.S. Patent No. 8,456,496 Credelle (“Credelle”)
EX1021	Sarma <i>et al.</i> , “Flat Panel Displays for Portable Systems,” 13 Journal of VLSI Signal Processing Systems 165-190, 1996 (“Sarma”)
EX1022	Fang, <i>et al.</i> , “Increasing image resolution on portable displays by subpixel rendering – a systematic overview,” APSIPA Transactions on Signal and Information Processing, vol. 1, p. E1, 2012 (“Fang”)

LISTING OF CHALLENGED CLAIMS

Claim 1	
[1.pre]	A display device comprising:
[1.1]	a display unit where a plurality of first pixels each including subpixels of three colors and a plurality of second pixels each including subpixels of three colors arranged differently from the subpixels in one of the first pixels are alternately arrayed in a row direction and a column direction, the subpixels of the three colors including a subpixel of a first color, a subpixel of a second color and a subpixel of a third color;
[1.2]	a thin film transistor (TFT) circuit disposed below each of the subpixels to control the subpixels; and
[1.3]	at least one connection part that connects the TFT circuit and one of the subpixels;
[1.4]	wherein in the first pixel and the second pixel adjacent to each other in the column direction, the subpixel of the second color and the subpixel of the third color are arrayed alternately in the column direction,
[1.5]	a column where the subpixel of the first color in the first pixel and the subpixel of the first color in the second pixel are arrayed in parallel with a column where the subpixel of the second color and the subpixel of the third color are alternately arrayed, the columns being arrayed alternately in the row direction,
[1.6]	the subpixel of the first color in one of the first pixels has a biased arrangement and is positioned toward a side of the subpixel of the second color in an array direction of the subpixel of the second color and the subpixel of the third color that are arrayed alternately,
[1.7]	the subpixel of the first color in one of the second pixels has a biased arrangement and is positioned toward a side of the subpixel of the third color in the array direction of the subpixel of the second color and the subpixel of the third color that are arrayed alternately,
[1.8]	the subpixel of the first color in one of the first pixels has a rectangle or rounded rectangle shape whose long axis is parallel with the direction in which the subpixel of the second color and the subpixel of the third color are arrayed alternately,
[1.9]	the subpixel of the first color in one of the second pixels has the rectangle or rounded rectangle shape whose long axis is parallel with

	the direction in which the subpixel of the second color and the subpixel of the third color are arrayed alternately,
[1.10]	the at least one connection part of the subpixel of the first color in one of the first pixels is one connection part and is biased from a middle of a long axis of the subpixel of the first color toward an end of the long axis when viewed from the row direction,
[1.11]	the at least one connection part of the subpixel of the first color in one of the second pixels is one connection part and is biased from a middle of a long axis of the subpixel of the first color toward an end of the long axis when viewed from the row direction,
[1.12]	a biased position where the connection part of the subpixel of the first color in the first pixel is disposed with respect to the middle of the long axis of the subpixel of the first color in the first pixel when viewed from the row direction is relatively different from a biased position where the connection part of the subpixel of the first color in the second pixel is disposed with respect to the middle of the long axis of the subpixel of the first color in the second pixel when viewed from the row direction,
[1.13]	a position where the connection part is disposed with respect to the subpixel of the second color, a position where the connection part is disposed with respect to the subpixel of the third color and a position where the connection part is disposed with respect to the subpixel of the first color in the first pixel are relatively same as a position where the connection part [is disposed] ¹ with respect to the subpixel of the second color, a position where the connection part is disposed with respect to the subpixel of the third color and a position where the connection part is disposed with respect to the subpixel of the first color in the second pixel, and
[1.14]	in a pixel array including the first pixel and the second pixel arrayed in the column direction, the connection part of the subpixel of the first color is disposed between a column where the subpixel of the

¹ Limitation [1.13] is presented here with a correction of an apparent typographical error that appears in the '691 patent.

	second color and the subpixel of the third color are alternately arrayed and a column where the subpixel of the first color arranged in parallel with the column where the subpixel of the second color and the subpixel of the third color are alternately arrayed.
Claim 2	
[2.pre]	The display device according to claim 1, wherein
[2.1]	the subpixel includes an anode electrode, and the at least one connection part is a portion that connects an output of the TFT circuit and the anode electrode.
Claim 3	
[3.pre]	The display device according to claim 2, wherein
[3.1]	a position where the at least one connection part is disposed overlaps with the anode electrode in a plan view.
Claim 4	
[4.pre]	The display device according to claim 1, wherein
[4.1]	the TFT circuit includes an identical circuit arrangement pattern for the subpixels of the first to third colors.
Claim 5	
[5.pre]	The display device according to claim 1, wherein
[5.1]	in one of the first pixels and one of the second pixels that are adjacent to each other in the row direction, a distance between a first connection part of the at least one connection part for the subpixel of the first color in the one of the first pixels and a second connection part of the at least one connection part for the subpixel of the first color in the one of the second pixels are consistent in the display unit independent of the biased arrangements of the subpixels.
Claim 6	
[6.pre]	The display device according to claim 1, wherein
[6.1]	a first square not crossing the subpixels encloses a region including the subpixels of three colors included in one of the first pixels and excluding other subpixels,

[6.2]	a second square not crossing the subpixels encloses a region including the subpixels of three colors included in one of the second pixels and excluding other subpixels, and
[6.3]	the first square and the second square are arranged without overlapping each other.
Claim 7	
[7.pre]	The display device according to claim 1, wherein
[7.1]	the OLED layer is disposed above the at least one connection part, and
[7.2]	a position where the at least one connection part is disposed overlaps with the OLED layer in a plan view.
Claim 8	
[8.pre]	The display device according to claim 1, wherein
[8.1]	the TFT circuit and one of the subpixels are connected by only one of the at least one connection part.

LG Display Co., Ltd. petitions for *Post Grant* Review of claims 1-8 (“the Challenged Claims”) of U.S. Patent No. 12,293,691 (“the ’691 patent”).

I. REQUIREMENTS FOR PGR

A. Grounds for Standing

Petitioner certifies that the ’691 patent is available for PGR. This petition is being filed within 9 months of the issue date of the ’691 patent. The ’691 patent also is subject to the first-inventor-to-file provisions of the AIA since its earliest priority claim is after March 16, 2013. Thus, the ’691 patent is available for PGR.

This petition is being filed within one year of service of a complaint against LG Display. LG Display is not barred or estopped from requesting review of the Challenged Claims on the below-identified grounds.

B. Challenge and Relief Requested

LG Display requests PGR of the Challenged Claims on the grounds noted below. Dr. Bretschneider provides supporting testimony. EX1003.

Ground	Claim(s)	35 U.S.C. § 102/103/112
1	1-8	§112: Indefinite
2	1-8	§112: Lack of Written Description
3	1-8	§112: Not Enabled
4	1-6 and 8	§103: Hwang and Lee
5	7	§103: Hwang, Lee, and Park’531

The '691 patent's earliest priority claim is September 2, 2015 ("Critical Date"), which Petitioner does not concede. EX1001, 1:17-21. Each prior art reference in Grounds 4 and 5 pre-dates the Critical Date.

Reference	Date	Section
Hwang	5/20/2014 (filed)	§102(a)(2)
Lee	8/9/2013 (filed)	§102(a)(2)
	10/2/2014 (published)	§102(a)(1)
Park'531	9/7/2011 (filed)	§102(a)(2)
	3/8/2012 (published)	§102(a)(1)

Hwang, Lee, and Park'531 are analogous art to the '691 patent because, like the '691 patent, each is directed to a display device, such as an organic light emitting diode (OLED) display device, that displays images by combining at least three colors emitted from an arrangement of pixels. EX1005, Abstract, [0005], [0007]; EX1006, Abstract, [0006],[0007], [0048]; EX1007, Abstract, [0003],[0005], [0009]; EX1001, Abstract, 1:21-36; EX1003, 108, 115.

C. Claim Construction

No formal claim constructions are necessary because “claim terms need only be construed to the extent necessary to resolve the controversy.” *Wellman, Inc. v. Eastman Chem. Co.*, 642 F.3d 1355, 1361 (Fed. Cir. 2011).

D. Level of Ordinary Skill in the Art

A person of ordinary skill in the art (“POSITA”) relating to the subject matter of the ’691 patent as of the Critical Date would have had a four-year undergraduate degree in electrical engineering or physics or a closely-related field and four years of experience in the design and implementation of flat panel display devices or components thereof as of the Critical Date. EX1003, 50. Additional graduate education could substitute for professional experience, and *vice versa*. *Id.*

II. THE ’691 PATENT

A. Brief Description

The ’691 patent is directed to “a display device” that “includes pixels having different arrangements of subpixels and reducing a color edge.” EX1001, Abstract; EX1003, 99.

The ’691 patent explains, in its Background, “to secure an opening ratio (aperture ratio) at a high resolution in an OLED display device, a pixel array where columns including alternately-arranged subpixels of red and green and columns including subpixels of blue are alternately arranged has been proposed” (citing JP

2011-249334, English transl. EX1016). EX1001, 1:21-36. The Background also describes the prior art as “a pixel array including two types of pixels having different arrangements of subpixels of blue in the pixels,” and contends such pixel array has a problem referred to as “color edge.” EX1001, 2:21-26; EX1003, 100.

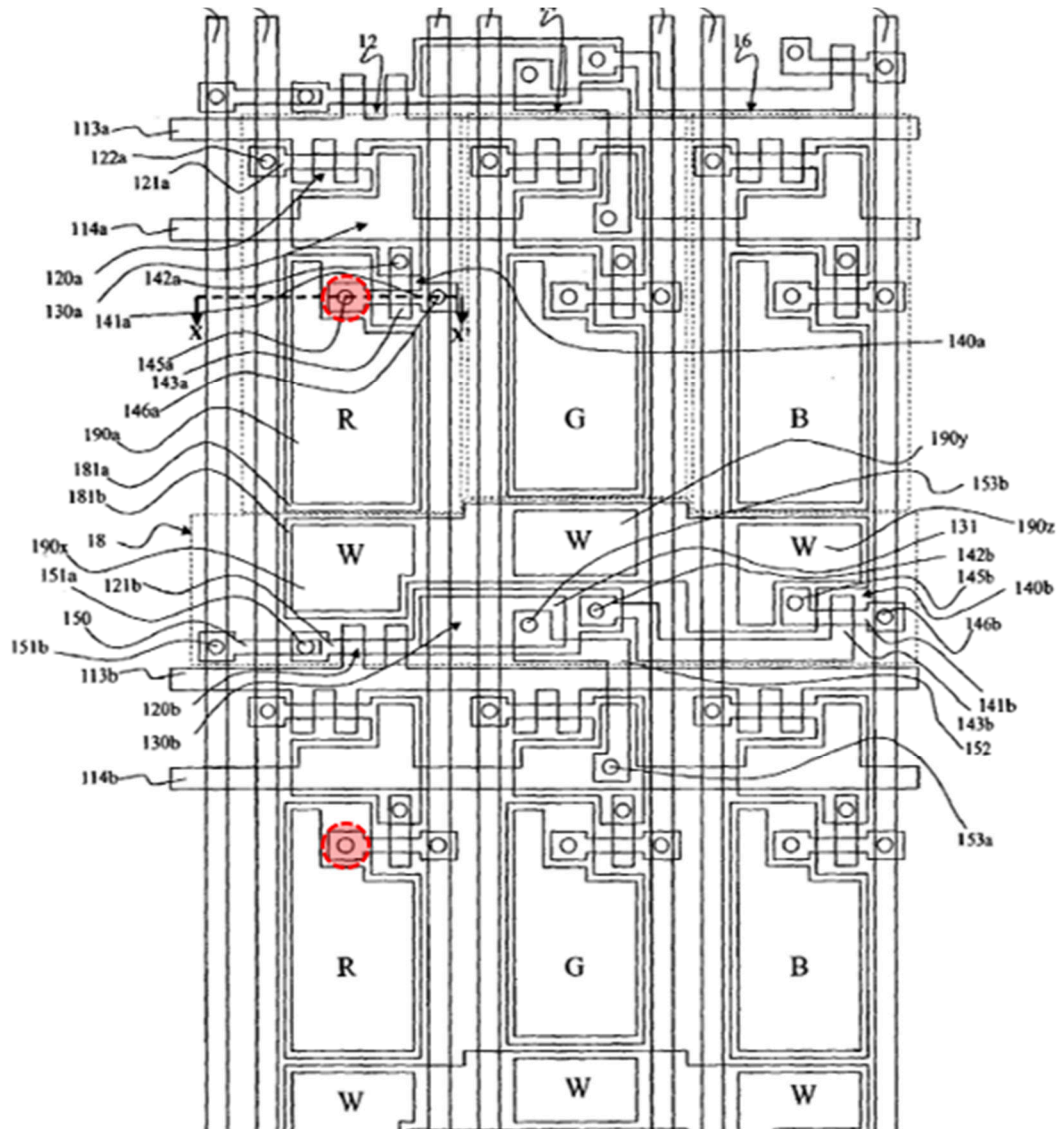
To address this problem, the ’691 patent proposes a “luminance allocation unit” that allocates “luminance” to different subpixels according to a “predetermined ratio.” EX1001, Abstract; EX1003, 101.

However, the allegedly novel feature of controlling “luminance” is nowhere recited in the claims. Instead, the claims recite the structure of “alternately arranged” subpixels, which the ’691 patent’s Background acknowledges as being prior art, and additional features of subpixel circuitry that are unrelated to the alleged novelty, and which were well-known in the art. EX1003, 102.

B. Prosecution History

During prosecution, the claims were amended extensively to overcome rejections in seven different Office Actions. *See generally*, EX1002; EX1003, 103. Ultimately, the Examiner identified limitation [1.12], which was newly added to the claims in the last amendment, as allowable. EX1002, Notice of Allowance dated January 7, 2025, p. 7. The Examiner noted that Cok’694 (EX1015) does not disclose the “*relatively different*” positioning of connection parts in first and second pixels, because Cok’694 instead discloses “the connection part 145a for the

blue subpixel is placed at relatively the same position with respect to the middle of the long axis of the subpixel.” EX1002, Notice of Allowance, p. 7; EX1015, FIG. 12 (below); EX1003, 103.



EX1015, FIG. 12 (annotated)

However, limitation [1.12] and its “*relatively different*” positioning of connection parts in different pixels was well-known, as demonstrated in Hwang

(EX1005) as well as other references such as Kim’792 (EX1009). EX1003, 104.

There is no indication that the Examiner considered Hwang (EX1005) during prosecution. EX1002; EX1003, 105. Lee (EX1006) was cited in an office action as being “relevant” but was not relied upon in a rejection. EX1002, Advisory Action dated July 27, 2022, p. 2. Park’531 (EX1007) was cited in an Office Action for “its disclosure of the arrangement of subpixels in different pixels” (citing FIG. 3), and was relied upon by the Examiner to reject features now recited in claim 7, which Applicant cancelled from the independent claims without overcoming the rejection over Park’531. EX1002, Office Action dated Oct. 26, 2021 and Office Action dated March 10, 2023; EX1003, 105.

As explained below, Hwang and Lee render obvious claims 1-6 and 8, and, in view of Park’531, render obvious claim 7. EX1003, 106-107.

III. THE CHALLENGED CLAIMS ARE UNPATENTABLE

A. [GROUND 1] – Claims 1-8 Are Indefinite

A claim is indefinite when, viewed in light of the specification and prosecution history, the claim fails to inform those skilled in the art about “the scope of the invention with reasonable certainty.” *Nautilus, Inc. v. Biosig Instruments, Inc.*, 572 U.S. 898, 901, 910 (2014). Claim 1 includes several limitations that are indefinite. EX1003, 152.

**1. Inconsistent Use of “relatively different” and
“relatively same”**

Limitation [1.12] recites a “relatively different” position, whereas limitation [1.13] recites a “relatively same” position. EX1001, 32:46-55.

As an initial matter, the '691 patent lacks clarity on the scope of what is required when modifying “different” and “same” with “relatively.” EX1003, 155. “Claim language employing terms of degree has long been found definite where it provided enough certainty to one of skill in the art when read in the context of the invention.” *Berkheimer v. HP Inc.*, 881 F.3d 1360, 1363 (Fed. Cir. 2018). The specification, however, does not use the term “relative” or “relatively” and it fails to otherwise provide guidance on a degree of difference (or sameness) required for positions to be considered relatively different (or relatively the same). EX1003, 155. As Dr. Bretschneider explains, manufacturing processes are not perfect and result in some variation between subpixel/pixel elements across a display. EX1003, 156. Thus, some degree of difference is expected and without clear guidance or even discussion, a POSITA would not be reasonably certain as to the amount of difference acceptable within the terms “relatively different” or “relatively same.” *Id.*

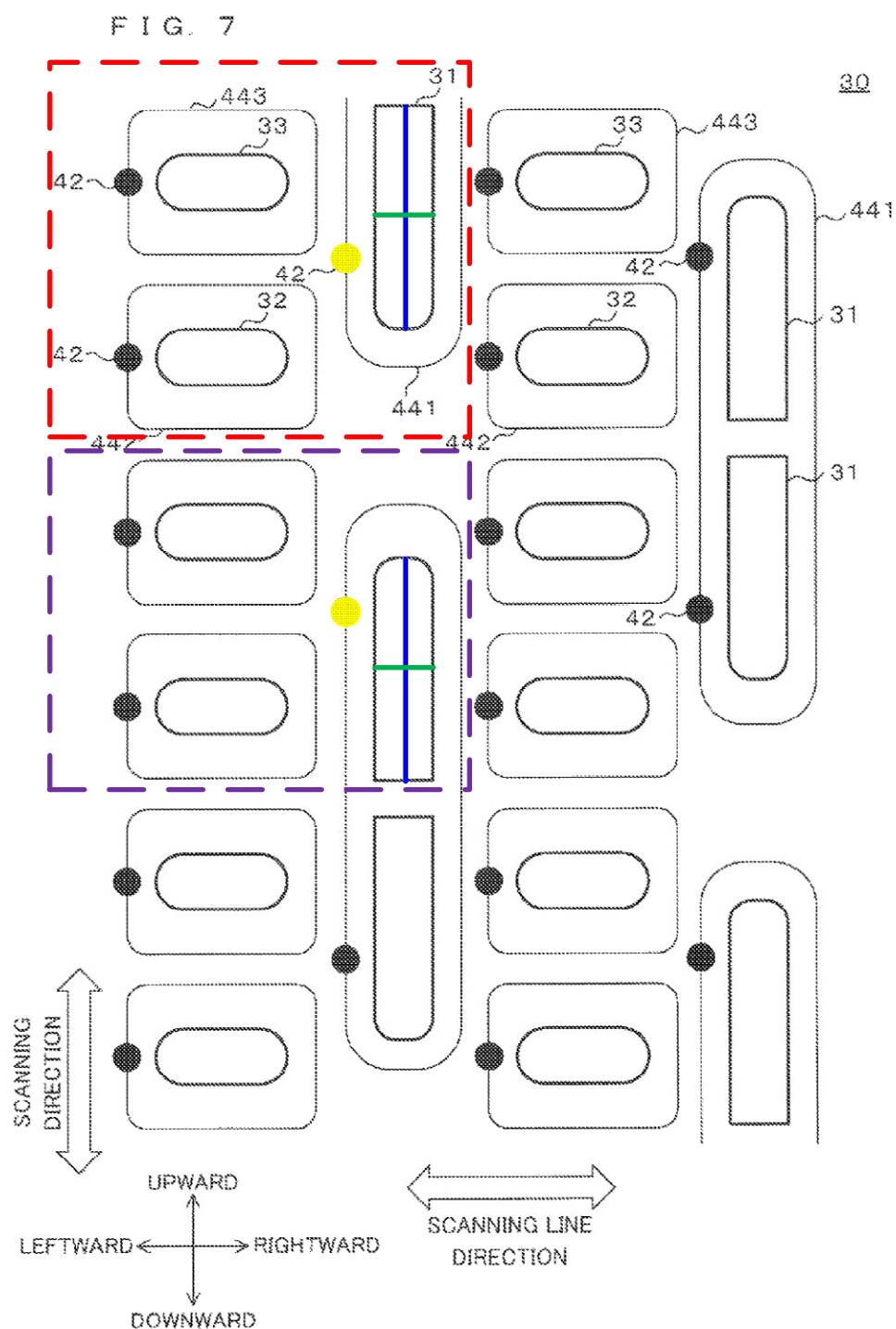
The specification does not offer description of the positional relationship of connection portions relative to subpixels or explain how positions are “relatively

different” or “relatively same.” EX1003, 157. Instead, limitations [1.12] and [1.13] appear to draw support solely from FIG. 7. *Id.* But FIG. 7 is merely an example arrangement² and does not give clear guidance on the scope of “relatively different” and “relatively same.” *Id.* Without sufficient guidance, the ’691 patent fails to provide reasonable clarity on the outer bounds of what it means for the positions of connection parts and subpixels to be “relatively different” or “relatively same.” *Id.*

Further, neither claim 1 nor the specification clarifies how “the biased position” in limitation [1.12] is relatively different while “the position” in limitation [1.13] is relatively the same. EX1003, 158. Limitation [1.12] recites “a biased position where the connection part of the subpixel of the first color in the first pixel is disposed with respect to the middle of the long axis of the subpixel of the first color in the first pixel when viewed from the row direction.” *Id.* Initially, the specification fails to explain what “when viewed from the row direction” adds and how the biased position with respect to the middle of the long axis might be different when viewed from a different direction. *Id.*

² The ’691 patent confirms that it is not limited to its description/figures. EX1001, 2:52-55; 16:8-10; 31:51-57.

Also, as shown in the annotated version of FIG. 7 below, the middle of the long axis of the subpixel of the first color lacks clarity in terms of whether it refers to the middle in the upward/downward direction (i.e., green line added to first subpixels below), the leftward/rightward direction (i.e., blue line added to first subpixels below), or even the depth direction (i.e., into/out of the page). EX1003, 159. This breadth adds to the confusion because it creates uncertainty as to which aspect of “the subpixel of the first color” is the reference point for evaluating the positional requirements in limitation [1.12]. *Id.*



As shown, the connection part of the subpixel of the first color (highlighted in yellow) of the first pixel (dashed red rectangle) and the second pixel (dashed

purple rectangle) appears to be positioned the same relative to the middle of the long axis in the leftward/rightward direction (i.e., blue line added to first subpixels). EX1003, 160. The highlighted connection parts also appear to be positioned the same distance from the middle of the long axis in the upward/downward direction (i.e., green line added to first subpixels). *Id.* The highlighted connection parts further appear to be positioned the same relative to the rounded end of the first subpixel. *Id.*

A difference appears to be that the connection part in the first pixel (dashed red rectangle) is downward from the middle of the long axis in the upward/downward direction (i.e., green line added to first subpixels), but upward in the second pixel (dashed purple rectangle). EX1003, 160. But it is far from clear that is the relative difference specified in limitation [1.12] and the claim does not provide reasonable certainty as to what differences might fall within the scope of “relatively different.” EX1003, 160, 162.

Also, if the position upward or downward from the middle of the long axis in the upward/downward direction (i.e., green line added to first subpixels) is the difference in limitation [1.12], that difference would be the same in limitation [1.13] and the specification fails to clarify how the position in limitation [1.13] could be relatively the same. EX1003, 163. Specifically, limitation [1.13] recites that “a position where the connection part is disposed with respect to the subpixel

of the first color in the first pixel [is] relatively same as ... a position where the connection part is disposed with respect to the subpixel of the first color in the second pixel.” *Id.* Notably, limitation [1.13] recites its positional requirement (“with respect to the subpixel of the first color”) more broadly than limitation [1.12] (“the middle of the long axis of the subpixel of the first color”). *Id.* But this breadth makes limitation [1.13] even less clear because it does not provide guidance as to which part of the subpixel of the first color should be judged in assessing whether the position of the connection part is the same or different in the first and second pixels. Indeed, if judged from the middle of the subpixel of the first color (i.e., the middle of the long axis of the subpixel of the first color), the position would have the same relative difference as discussed for limitation [1.12]. *Id.* How can a position of a connection part be relatively different with respect to the middle of the long axis of the subpixel of the first color, but also relatively the same with respect to the subpixel of the first color? *Id.* How can it be simultaneously both different and the same? *Id.* It cannot, and the Federal Circuit has routinely found claims with inconsistent/impossible limitations like those in limitations [1.12] and [1.13] to be indefinite. *Competitive Techs., Inc. v. Fujitsu Ltd.*, 185 F. App’x 958, 965-66 (Fed. Cir. 2006); EX1003, 163.

In addition to “the subpixel of the first color,” limitation [1.13] also specifies a “relatively same” position for “the subpixel of the second color” and “the

subpixel of the third color.” EX1003, 164. If you overlaid the first pixel (dashed red rectangle in annotated version of FIG. 7 above) on top of the second pixel (dashed purple rectangle in annotated version of FIG. 7 above), the subpixels of the second color and the subpixels of the third color would overlap identically, but the subpixels of the first color would not. *Id.* The specification does not clarify how identical overlap/positioning satisfies the “relatively same” limitation while non-identical overlap/positioning also satisfies the “relatively same” limitation. *Id.* In fact, the specification fails to provide guidance on how much non-identical overlap/positioning is allowed (“relatively same”) or required (“relatively different”), thereby leaving a POSITA uncertain as to the scope of the claims. *Id.*

For these reasons, the ’691 patent does not provide reasonable clarity as to the scope of “relatively different” and “relatively same,” much less explain how these inconsistent/impossible limitations could both be met. EX1003, 165. Thus, a POSITA would not be reasonably certain of the scope of limitations [1.12] and [1.13] in claim 1 and it is indefinite. *Id.*

2. Claim 1 Does Not Clarify Which “one” of the First Pixels is Referenced by “the first pixel” Throughout the Claim

Claim 1 introduces confusion by its use of the terms “a plurality of first pixels,” “one of the first pixels,” and “the first pixel.” EX1003, 166-167. As shown below in yellow, claim 1 starts off in limitation [1.1] by reciting “a plurality of first

pixels” and “one of the first pixels.” EX1001, 31:60-67.

1. A display device comprising:

- [1.1] a display unit where a plurality of first pixels each including subpixels of three colors and a plurality of second pixels each including subpixels of three colors arranged differently from the subpixels in one of the first pixels are alternately arrayed in a row direction and a column direction, the subpixels of the three colors including a subpixel of a first color, a subpixel of a second color and a subpixel of a third color;

After introducing these concepts and as shown below in yellow, claim 1 then twice refers to “the first pixel” in limitations [1.4] and [1.5]. EX1001, 32:6-15.

- [1.4] in the first pixel and the second pixel adjacent to each other in the column direction, the subpixel of the second color and the subpixel of the third color are arrayed alternately in the column direction,
- [1.5] a column where the subpixel of the first color in the first pixel and the subpixel of the first color in the second pixel are arrayed in parallel with a column where the subpixel of the second color and the subpixel of the third color are alternately arrayed, the columns being arrayed alternately in the row direction,

Although claim 1 does not have explicit antecedent basis for “the first pixel” in limitations [1.4] and [1.5] because it does not previously recite “a first pixel,” the references to “the first pixel” in limitations [1.4] and [1.5] presumably refer back to the “one of the first pixels” recited in limitation [1.1]. EX1003, 168. Specifically, “the first pixel” is singular and the previous recitation of “one of the first pixels” specifies “one” (singular) of “the first pixels.” *Id.* Indeed, when claim 1 intends to refer to multiple pixels, it does. EX1001, 31:60 (“plurality of first pixels”), 31:63-64 (“the first pixels”), 32:16 (“the first pixels”); EX1003, 168. And when claim 1

intends to modify “each” of a group of pixels or subpixels in the claim, it also does. EX1001, 31:60-61 (“plurality of first pixels each including subpixels”), 31:61-62 (“plurality of second pixels each including subpixels”), 32:1-2 (“disposed below each of the subpixels”); EX1003, 168. Accordingly, when limitations [1.4] and [1.5] recite “the first pixel,” these limitations refer to a single pixel within “the plurality of first pixels” and presumably the “one” first pixel introduced in limitation [1.1] because that first pixel is the only singular pixel introduced at this point of the claim. *Id.*

Claim 1, however, does not stop there. As shown below in blue, green, and orange highlighting, limitations [1.6], [1.8], and [1.10] each introduce an additional instance of “one of the first pixels.” EX1001, 32:16-40.

[1.6] the subpixel of the first color in one of the first pixels has a biased arrangement and is positioned toward a side of the subpixel of the second color in an array direction of the subpixel of the second color and the subpixel of the third color that are arrayed alternately,

⋮

[1.8] the subpixel of the first color in one of the first pixels has a rectangle or rounded rectangle shape whose long axis is parallel with the direction in which the subpixel of the second color and the subpixel of the third color are arrayed alternately,

⋮

[1.10] the at least one connection part of the subpixel of the first color in one of the first pixels is one connection part and is biased from a middle of a long axis of the subpixel of the first color toward an end of the long axis when viewed from the row direction,

Each of these limitations has the same wording as limitation [1.1] and, in the

same way, reference any pixel in the plurality of first pixels. EX1003, 170. It must be “one” pixel, but like limitation [1.1], these limitations do not specify any particular pixel in the plurality. *Id.* Notably, these limitations do not refer back to “the first pixel” used in limitations [1.4] and [1.5]. *Id.* With this structure, limitations [1.6], [1.8], and [1.10] could cover different pixels from the plurality of first pixels than “the first pixel” referenced in limitations [1.1], [1.4], and [1.5]. *Id.*

At this point, claim 1 has now introduced four, potentially different first pixels:

- (1) First Pixel One with the limitations of [1.1], [1.4], and [1.5] (yellow above);
- (2) First Pixel Two with the limitations of [1.6] (blue above);
- (3) First Pixel Three with the limitations of [1.8] (green above); and
- (4) First Pixel Four with the limitations of [1.10] (orange above).

And, problematically, after introducing these four potentially different first pixels, claim 1 then again refers to “the first pixel.” EX1003, 172-176. As shown below in red highlighting, limitation [1.14] in claim 1 refers to “the first pixel.” EX1001, 33:1-9; EX1003, 176.

in a pixel array including the first pixel and the second pixel arrayed in the column direction, the connection part of the subpixel of the first color is disposed between a column where the subpixel of the second color and the subpixel of the third color are alternately arrayed and a column where the subpixel of the first color arranged in parallel with the column where the subpixel of the second color and the subpixel of the third color are alternately arrayed.

At this point, the claim does not provide certainty as to which “one” of the first pixels is referenced by “the first pixel” in limitation [1.14].³ EX1003, 177. Is it First Pixel One (yellow), First Pixel Two (blue), First Pixel Three (green), and/or First Pixel Four (orange)? With this claim structure, a POSITA cannot be reasonably certain what “the first pixel” in limitation [1.14] requires. Does it require the limitations of [1.1], [1.4], [1.5], [1.6], [1.8], and [1.10]? Or can it exclude any of them? Can the claim be satisfied if the limitations of [1.14] are met in First Pixel Four with the limitations of [1.10], but without the limitations of [1.1], [1.4], [1.5], [1.6], and [1.8]? The claim does not specify and a POSITA cannot reasonably discern the scope of what “the first pixel” in limitation [1.14]

³ Limitations [1.12] and [1.13] also recite “the first pixel,” which adds additional confusion.

requires.⁴ *Id.*

Limitation [1.12] adds to the confusion. EX1003, 178. Specifically, limitation [1.12] recites “*the connection part* of the subpixel of the first color *in the first pixel*.” The only prior limitation in the claim that refers to a connection part and a first pixel is limitation [1.10]—“the at least one *connection part* of the subpixel of the first color in *one of the first pixels*.” EX1001, 32:46-47. So, “the first pixel” in limitation [1.12] must refer to First Pixel Four (orange highlighted in limitation [1.10] above). But limitation [1.10] clearly refers to “one of the first pixels;” not First Pixel One (yellow highlighted in limitations [1.1], [1.4], and [1.5] above). Thus, the phrase “the first pixel” is used inconsistently throughout claim 1 and a POSITA cannot reasonably discern its scope, particularly in limitation [1.14] after “one of the first pixels” has been recited four separate times in limitations [1.1], [1.6], [1.8], and [1.10] and “the first pixel” has been recited in limitations [1.3], [1.4], [1.12], and [1.13]. *Id.*

The specification does not help. EX1003, 179. Although the specification

⁴ Claim 1 also recites “the second pixel” in limitation [1.14]. Because claim 1 includes similar limitations for second pixels as it does for first pixels, the same indefiniteness issues exist for “the second pixel” in limitation [1.14].

provides an example pixel arrangement in FIGS. 4 and 7, the specification makes clear that “[t]he arrangement and shapes of the first subpixel 31, the second subpixel 32, and the third subpixel 33 are not limited to FIG. 4.” EX1001, 16:8-10. The specification also confirms that “both the foregoing general description and the following detailed description are exemplary and explanatory and are not restrictive of this disclosure.” EX1001, 2:52-55. And it confirms that:

the disclosed embodiment is illustrative and not restrictive in all aspects. The scope of the present invention is defined by the appended claims rather than by the description. EX1001, 31:51-57.

With this disclosure, the ’691 patent specification does not provide clarity and, instead, embraces the confusion of its claims. EX1003, 180.

For these reasons, claim 1 aligns precisely with the textbook example of indefiniteness set forth in the MPEP. EX1003, 181. As explained in the MPEP, “if two different levers are recited earlier in the claim, the recitation of ‘said lever’ in the same or subsequent claim would be unclear where it is uncertain which of the two levers was intended.” MPEP § 2173.05(e). Claim 1 is even worse; it recites four different first pixels before limitation [1.14]’s reference to “the first pixel.”

The Federal Circuit endorses the MPEP in this regard, as it also has found this type of claim structure indefinite. In *Bushnell Hawthorne, LLC v. Cisco Sys.*

Inc., for example, the Federal Circuit considered a claim that recited “said different IP Address” following recitation of “one or more IP Addresses,” “one or more second IP Addresses,” and “one or more third IP Addresses.” 813 F. App’x 522, 526-27 (Fed. Cir. 2020). In assessing this language, the Federal Circuit found that, “[w]ith three different IP addresses to choose from, a POSA faced with the ‘said different IP Address’ limitation is left to wonder which of the different IP addresses is ‘said’ different one.” *Id.* The Federal Circuit also explained that, “[w]here, as here, a singular/plural mismatch further confuses an already confused claim, it is proper to consider the mismatch in discerning whether a POSA could understand the claim with reasonable certainty.” *Id.*

Claim 1 is similar to the claim found indefinite in *Bushnell*. Like the claim in *Bushnell*, with four different first pixels to choose from, a POSA faced with “the first pixel” in limitation [1.14] is left to wonder which of the different first pixels is “the first pixel.” And, similar to the claim in *Bushnell*, the different singular and plural uses and mismatches in claim 1 further confuses an already confused claim.

Finally, claim 1 introduces even more confusion by reciting “subpixels,” “a subpixel of a first color,” “a subpixel of a second color,” and “a subpixel of a third color” for each of the first and second pixels. EX1001, 31:60-33:9; EX1003, 183. For example, when limitation [1.14] recites “the subpixel of the first color” the claim does not indicate to which “subpixel” the limitation refers. EX1001, 33:1-9;

EX1003, 183. Indeed, limitation [1.14] does not specify whether “the subpixel of the first color” is a subpixel of a first pixel or a second pixel, nor does it specify to which of the various subpixels of the first color recited earlier in claim 1 it refers. Thus, the recitations of “subpixels,” “the subpixel of the first color,” “the subpixel of the second color,” and “the subpixel of the third color” further confuse an already confusing claim. *Id.*

For these reasons, a POSITA would not be reasonably certain of the scope of claim 1 and it is indefinite. EX1003, 184.

3. Inconsistent and Indefinite Use of “at least one connection part” and “the connection part”

Limitation [1.3] recites “at least one connection part that connects the TFT circuit and one of the subpixels.” EX1001, 32:3-4. Notably, the “at least one connection part” connects the TFT circuit and “one of” the subpixels. *Id.* Similar to the use of “one of” discussed for the first pixel limitations, limitation [1.3] refers to “one” subpixel in the singular form. Again, similar the above analysis, the “one of” language contrasts with the language in the TFT circuit limitation in [1.2], which states that the TFT circuit is “disposed below each of the subpixels to control the subpixels.” EX1001, 32:1-2. Accordingly, limitation [1.3] confirms that the “at least one connection part” connects to “one” subpixel. EX1003, 185.

Limitations [1.10] and [1.11] refer back to the “at least one connection part”

in limitation [1.3]. Limitation [1.10] recites that:

the at least one connection part of the subpixel of the first color in one of the first pixels **is one connection part**. EX1001, 32:36-40.

Limitation [1.11] similarly recites that:

the at least one connection part of the subpixel of the first color in one of the second pixels **is one connection part**. EX1001, 32:41-45.

These limitations are unclear. EX1003, 188. How can “the at least one connection part” be “**one** connection part” for each of the different subpixel arrangements claimed? If it is only “**one**” connection part, which the ’691 patent consistently uses to refer to a singular component, how can “the at least one connection part” be multiple, “**one**” (singular) connection parts? Is it one connection part for both subpixels? Claim 1 does not offer clarification on these points and fails to provide reasonable certainty as to the requirements of “the at least one connection part.” *Id.*

Also, claim 1 does not indicate how the subpixel arrangements specified in limitations [1.10] and [1.11] relate to the “one” subpixel specified in limitation [1.3]. EX1003, 189. Is the subpixel in limitation [1.3] the same as “the subpixel of the first color in one of the first pixels” in limitation [1.10], the same as “the

subpixel of the first color in one of the second pixels” in limitation [1.11], or another subpixel entirely? Claim 1 does not say. *Id.*

It also does not say how the “one connection part” in limitation [1.10] and the “one connection part” in limitation [1.11] connect to the “one” subpixel in limitation [1.3]. EX1003, 190. The “one connection part” in limitation [1.10] and the “one connection part” in limitation [1.11] are both referenced as “the at least one connection part” and limitation [1.3] clearly states that the “at least one connection part” connects to “one” of the subpixels. *Id.* But the claim does not specify how both the “one connection part” in limitation [1.10] and the “one connection part” in limitation [1.11] connect to “one” subpixel, particularly when limitations [1.10] and [1.11] refer to specific subpixels that are different. *Id.*

The confusion over the “at least one connection part” multiplies at limitation [1.13], which uses the term “the connection part” six times. EX1001, 32:56-67; EX1003, 191. Prior to limitation [1.13], claim 1 makes five references to connection part:

- (1) “at least one connection part” in limitation [1.3];
- (2) “one connection part” in limitation [1.10];
- (3) “one connection part” in limitation [1.11];
- (4) “the connection part of the subpixel of the first color in the first pixel” in limitation [1.12]; and

(5) “the connection part of the subpixel of the first color in the second pixel” in limitation [1.12].

When limitation [1.13] makes six references to “the connection part,” it does not clarify to which connection part the claim refers. EX1003, 197. For example, limitation [1.13] refers to “a position where **the connection part** is disposed with respect to the subpixel of the second color.” EX1001, 32:56-57. But to which connection part does this refer? Is it “the connection part of the subpixel of the first color in the first pixel,” “the connection part of the subpixel of the first color in the second pixel,” or some other unrecited connection part associated with the subpixel of the second color? Claim 1 does not specify or provide a POSITA reasonable certainty as to which connection part(s) must meet the positional requirements set forth in limitation [1.13]. *Id.*

Limitation [1.14] continues the confusion by reciting “the connection part of the subpixel of the first color.” EX1001, 33:2-3; EX1003, 198. Limitation [1.14] does not specify if the connection part is for a subpixel of a first pixel or a second pixel, much less provide clarity as to which of the six uses of “the connection part” in limitation [1.13] it refers. *Id.*

Finally, claim 1 does not specify how the seven uses of “the connection part” in limitations [1.13] and [1.14] relate to the “one” subpixel in limitation [1.3]. EX1003, 199. As discussed above, limitation [1.3] clearly states that the “at least

one connection part” connects to “one” of the subpixels. But the claim does not convey how the seven uses of “the connection part” in limitations [1.13] and [1.14] connect to the “one” subpixel in limitation [1.3], particularly when limitations [1.13] and [1.14] refer to various subpixels of three, different colors. *Id.*

Similar to the first pixel limitations discussed above, the specification does not help. EX1003, 200. The specification does not use the term “connection part” and, instead, refers to a “connection portion.” EX1001, 9:6-7. The specification, however, does not explain the difference between the described “connection portion,” and the claimed “connection part.” *Id.* Also, FIG. 6 (below) shows the “TFT circuit output connection portion 42” as a single connection and the corresponding portion of the specification describes “[a] TFT circuit output **connection portion 42** and electronic circuits which **connect** the demultiplexer 15 and the scan driver 16 with **the subpixels**.” EX1001, 9:6-10; EX1003, 200.

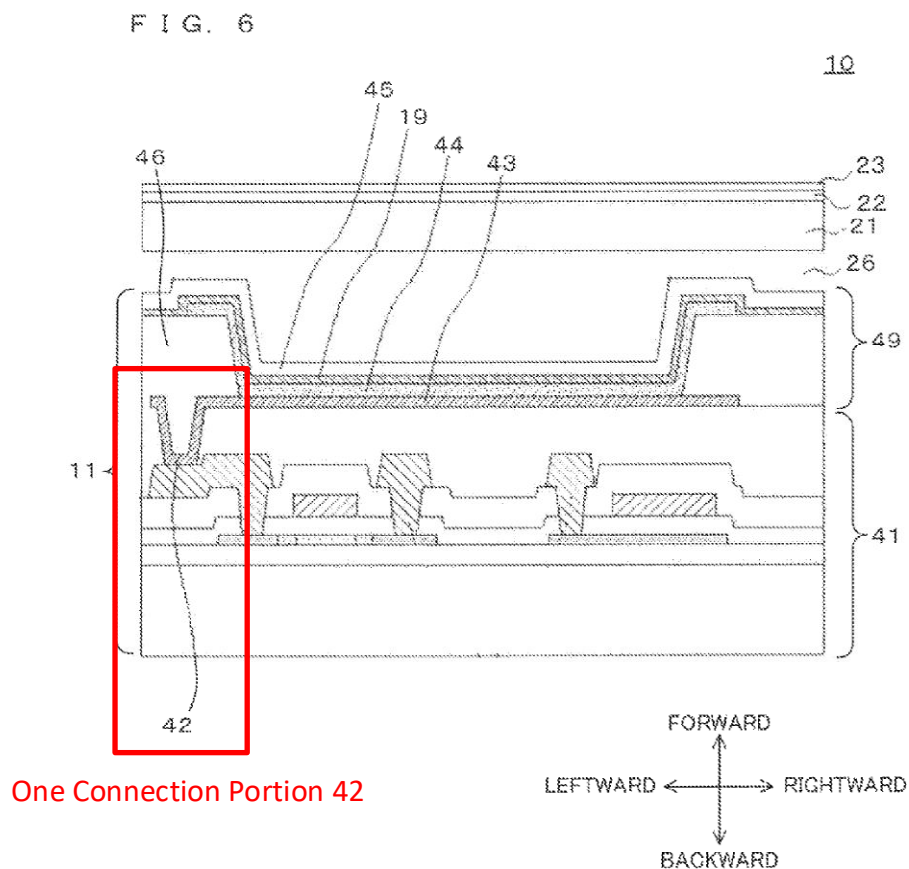
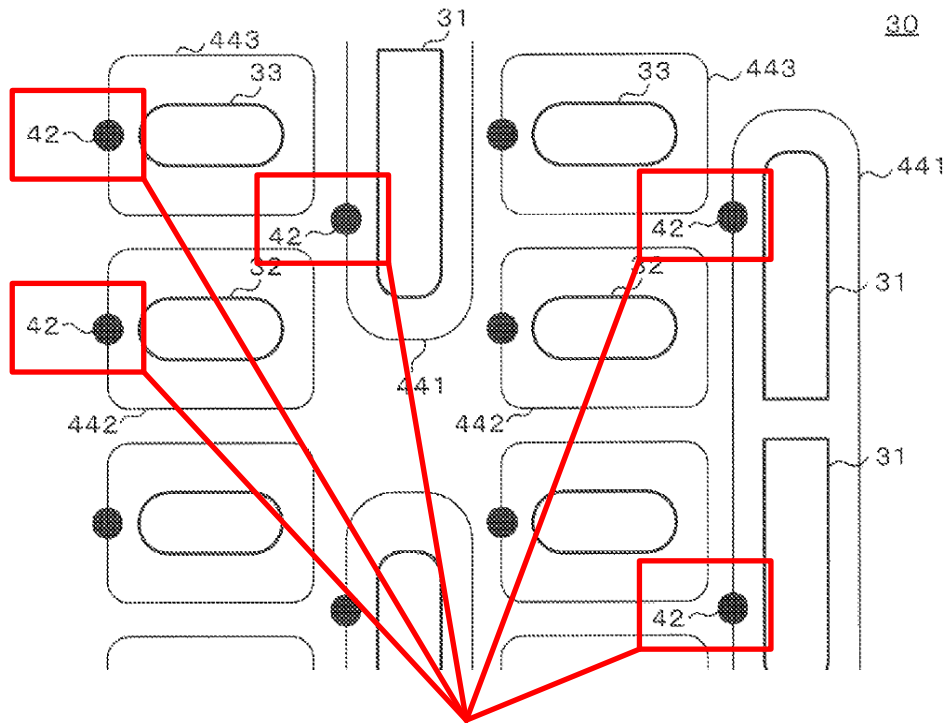


FIG. 7 (excerpt, below) then shows multiple instances of “TFT circuit output connection portion 42” and the specification describes that “[o]ne TFT circuit output connection portion 42 is arranged in the vicinity of each subpixel.” EX1001, 10:23-24; EX1003, 201.

FIG. 7



Multiple Uses of Connection Portion 42

The '691 patent fails to explain how a TFT circuit output connection portion 42 connects with multiple subpixels per the description of FIG. 6 and how one TFT circuit output connection portion 42 is arranged in the vicinity of each subpixel per the description of FIG. 7. EX1003, 202. Accordingly, the specification does not resolve the confusion over the connection part limitations discussed above. *Id.* This is particularly true because the specification embraces the confusion of its claims. EX1001, 2:52-55; 16:8-10; 31:51-57.

For these reasons and reasons similar to those discussed for the first pixel limitations, a POSITA would not be reasonably certain of the scope of the “at least

one connection part” and “the connection part” limitations in claim 1 and it is indefinite. EX1003, 203.

Further, claim 7 includes additional features that are indefinite. EX1003, 204. Claim 7 recites that “the OLED layer is disposed above the at least one connection part, and a position where the at least one connection part is disposed overlaps with the OLED layer in a plan view.” EX1001, 34:16-20. As an initial matter, “the OLED layer” in claim 7 lacks antecedent basis in claim 1 and the ’691 patent does not clarify the layer in claim 1 that claim 7 is modifying. EX1003, 204.

Beyond this confusion, claim 7 refers to “the at least one connection part” and its overlap with “the OLED layer.” But as discussed above, limitations [1.10] and [1.11] each separately require the at least one connection part to be “one connection part.” EX1003, 205. And limitations [1.13] and [1.14] thereafter refer to “the connection part” seven more times. Accordingly, when claim 7 refers to “the at least one connection part,” the ’691 patent does not provide reasonably clarity as to which connection part the claim refers and whether the overlap with the OLED layer needs to be met for all previously-recited connection parts or not. EX1003, 253. For these reasons, claim 7 is indefinite. *Id.*

Claim 3, which recites “a position where the at least one connection part is disposed overlaps with the anode electrode in a plan view,” suffers from similar deficiencies as claim 7. EX1003, 206.

4. The “TFT” and “subpixel” Limitations Are Misaligned with the Specification and the General Understanding of Display Technology at the time of the ’691 Patent

The claimed relationship between a “subpixel” and a “TFT circuit” is inconsistent with the specification and a POSITA’s general understanding of display technology. EX1003, 207. Specifically, limitation [1.2] requires a TFT circuit to be “disposed below each of the subpixels to control the subpixels.” EX1001, 32:1-2. The specification does not use the term “below” or otherwise describe a TFT circuit disposed below each of the subpixels to control the subpixels (*see* written description, Section III.B.3). EX1003, 207.

FIG. 6 is a “cross sectional” diagram illustrating arrangement of components of a subpixel in a display device.” EX1001, 3:3-5; 8:60-66 (“a cross-sectional diagram obtained by cutting one subpixel”). Thus, per the ’691 patent, FIG. 6 shows components included in a subpixel. EX1003, 208. One component shown in FIG. 6 as part of a subpixel is the TFT substrate 11. EX1001, 8:64-9:6. And although TFT substrate 11 includes wiring portion 41 disposed below pixel array portion 49, the ’691 patent does not describe pixel array portion 49 as including a subpixel. *Id.*, 9:5-17; FIG. 6. Rather, as the description of FIG. 6 clearly states, pixel array portion 49 and wiring portion 41 are “components of a subpixel.” *Id.*, 3:3-5; 8:60-66; EX1003, 208.

Indeed, the description of FIG. 6 states that “[e]ach of the subpixels includes a pixel circuit, an organic light emitting element which includes the anode electrode 43, the cathode electrode 19 and an organic light emitting layer (OLED layer) disposed between the anode electrode 43 and the cathode electrode 19.” EX1001, 9:20-25. The ’691 patent subsequently (and repeatedly) confirms that the pixel circuit of the subpixel includes the TFT components. *Id.*, 13:46-47 (“The pixel circuit includes a switching TFT, a driving TFT”); 29:21-23; FIGS. 12, 30, 33. FIG. 12 “illustrat[es] a pixel circuit” and clearly shows the TFT components as part of the pixel circuit. *Id.*, 13:38-64; EX1003, 209.

Because each subpixel includes a pixel circuit and the pixel circuit includes the TFT circuit, the TFT circuit is part of a subpixel. EX1001, 9:20-25; 13:38-64; 29:21-23; FIGS. 12, 30, 33. The ’691 patent is consistent on this point, which aligns with FIG. 6’s depiction of the TFT circuit as a component of a subpixel. *Id.*, 3:3-5; 8:60-9:17; EX1003, 210. Thus, in the ’691 patent, the TFT circuit is part of a subpixel. *Id.* As Dr. Bretschneider explains, the description in the ’691 patent aligns with a POSITA’s general knowledge that TFTs are part of subpixels, not below them. EX1003, 203.

However, claim 1 introduces confusion by, for the first time, reciting that the TFT circuit is “disposed below each of the subpixels to control the subpixels.” EX1001, 32:1-2; EX1003, 211. But how can the TFT circuit be disposed below

the subpixels when the TFT circuit is part of each subpixel? It cannot. Claim 1, thus, is internally inconsistent with the specification in a manner that renders the scope of the claim uncertain, specifically whether a “subpixel” includes a “TFT circuit” or not and whether it requires the impossible condition of a component being below itself. MPEP 2173.03 (“indefinite when a conflict or inconsistency between the claimed subject matter and the specification disclosure renders the scope of the claim uncertain”). For these reasons, a POSITA would not be reasonably certain of the scope of limitation [1.2] in claim 1 and it is indefinite. EX1003, 211.

5. Indefinite Use of “array direction”

Limitation [1.6] introduces the concept of “an array direction.” EX1001, 32:16-20. This follows the introduction of “a row direction” and “a column direction” in limitation [1.1]. *Id.*, 31:64-65.

While the specification references at least eleven directions, it nowhere defines or uses the term “array direction.” EX1003, 213. Specifically, the ’691 patent describes “row and column directions” (EX1001, Abstract), “various directions of forward, backward, leftward, rightward, upward, and downward” (*id.*, 4:5-8), “the longitudinal directions of each subpixel” (*id.*, 7:17-18), “the diagonal direction of the pixel” (*id.*, 17:35), and “the scan line direction” (*id.*, 21:6-7). The cannons of claim construction seeks to honor the choice of a patent owner to recite

different terms, by presuming that those different terms (in this case, the “array direction” in limitation [1.6], the eleven directions described in the ’691 patent, and the other directions recited in claim 1) have somehow different meanings. *Karlin Tech. Inc. v. Surgical Dynamics, Inc.*, 177 F.3d 968, 971-72 (Fed. Cir. 1999). But these same canons leave to the patent owner the task of defining distinct terms in its patent disclosure and, here, the ’691 patent disclosure fails to explain which if any of these directions is being referred to by the “array direction” or whether the “array direction” is instead some other direction not described in the specification. EX1003, 213.

The ’691 patent also describes that “FIG. 7 is a diagram illustrating an array of subpixels.” EX1001, 10:5-6. But the lower portion of FIG. 7 lists six other directions and fails to provide clarity as to which direction is the “array direction” or the “array” shown in FIG. 7. EX1003, 214.

In addition, after introducing the array direction in limitation [1.6], limitation [1.8] refers to “the direction in which the subpixel of the second color and the subpixel of the third color are arrayed alternately.” EX1001, 32:26-30. Although not explicit, presumably, “the direction” in limitation [1.8] refers to the column direction because limitation [1.4] recites that “the subpixel of the second color and the subpixel of the third color are arrayed alternately in the column direction,” which aligns with the language in limitation [1.8]. EX1003, 215.

Notably, limitation [1.6] uses different language when referring to the array direction—“an array direction *of the subpixel of the second color and the subpixel of the third color* that are arrayed alternately.” EX1001, 32:18-20. Yet, the ’691 patent provides no explanation for how a direction “*in which* the subpixel of the second color and the subpixel of the third color are arrayed alternately” is different from a direction “*of the* subpixel of the second color and the subpixel of the third color.” *Id.*, 32:18-30; EX1003, 216.

By introducing a new direction that is different from all directions described in the specification and by using different language to describe that direction, the ’691 patent fails to provide clarity as to which direction is required to meet the “array direction” recited in limitation [1.6]. EX1003, 217. Thus, a POSITA would not be reasonably certain of the scope of claim 1 and it is indefinite. *Id.*

B. [GROUNDS 2 and 3] – Claims 1-8 Lack Written Description Support and Are Not Enabled

To satisfy written description under 35 U.S.C. § 112(a), an application must “reasonably convey[] to those skilled in the art that the inventor had possession of” and “actually invented” the claimed subject matter. *Ariad Pharms., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1351 (Fed. Cir. 2010) (en banc). This requirement ensures that the claims do “not overreach the scope of the inventor’s contribution.” *Reiffin v. Microsoft Corp.*, 214 F.3d 1342, 1345 (Fed. Cir. 2000).

35 U.S.C. § 112(a) also requires that the patent enable a POSITA to make and use the claimed invention. “The scope of the claims must be less than or equal to the scope of the enablement.” *Nat’l Recovery Techs., Inc. v. Magnetic Separation Sys., Inc.*, 166 F.3d 1190, 1196 (Fed. Cir. 1999).

**1. The ’691 Patent Does Not Describe or Enable the
“relatively different” and “relatively same”
Limitations**

As discussed at Section III.A.1 (incorporated here), the specification does not use the term “relative” or “relatively” and does not provide text-based descriptions of the “relatively different” and “relatively same” limitations. These are terms of relational degree, and yet, the specification fails to disclose what is required contextually by these terms. EX1003, 218.

Instead, the ’691 patent appears to attempt to find support for the “relatively different” and “relatively same” limitations based solely on FIG. 7. EX1003, 219. Yet, as discussed at Section III.A.1, FIG. 7 does not reasonably convey the positioning requirements of the “relatively different” and “relatively same” limitations. *Id.* In fact, as discussed at Section III.A.1, the positioning requirements of the “relatively different” and “relatively same” limitations are impossible—the position of the connection part relative to the subpixel of the first color cannot be both different and the same. *Id.*

Because FIG. 7 does not reasonably convey the “relatively different” and

“relatively same” limitations, which have impossible requirements, FIG. 7 does not provide a written description, much less enable a POSITA to make and use the “relatively different” and “relatively same” limitations. EX1003, 220. Thus, claims 1-8 lack written description support and are not enabled.

2. The '691 Patent Does Not Describe or Enable the “connection part” Limitations

As discussed at Section III.A.3 (incorporated here), limitation [1.3] recites “at least one connection part that connects the TFT circuit and one of the subpixels.” EX1001, 32:3-4. Claim 1 then, in limitations [1.10] through [1.14], references multiple connection parts as being part of the at least one connection part. The specification, however, does not describe multiple connection parts connecting to “one” pixel as required. EX1003, 221.

Specifically, the specification describes “[a] TFT circuit output connection portion 42 and electronic circuits which connect the demultiplexer 15 and the scan driver 16 with the subpixels.” EX1001, 9:6-10. And it describes that “[o]ne TFT circuit output connection portion 42 is arranged in the vicinity of each subpixel.” *Id.*, 10:23-24. But it never describes multiple connection parts connected to “one” subpixel and does not reasonably convey to a POSITA that the inventors possessed an invention where multiple connection parts connect to “one” subpixel. EX1003, 222. Thus, claims 1-8 lack written description support. *Id.*

Further, if multiple connection parts connect to “one” subpixel, the display device would not work. EX1003, 232. This is because the multiple connection parts would send different and incorrect/inconsistent signals to the “one” subpixel and the “one” subpixel would not be separately controllable by “one” TFT circuit as is customary in display technology. *Id.* Also, if multiple connection parts connect different subpixels together, the subpixels would not be individually controllable and, instead, would respond to signals from various connection parts. *Id.* Without the ability to separately and individually control subpixels, the display device would not properly display images. *Id.* For these reasons, claims 1-8 are not enabled.

Further, as discussed in Section III.A.3 (incorporated here), claim 7 requires that a position where *the at least one connection part* is disposed *overlaps with the OLED layer* in a plan view. EX1003, 224. Yet, the specification does not describe all of the connection parts that potentially fall within the scope of the at least one connection part as overlapping with an OLED layer, much less a layer recited in claim 1. *Id.* Thus, claim 7 fails to meet the written description and enablement requirements.

Claim 3, which recites “a position where *the at least one connection part* is disposed *overlaps with the anode electrode* in a plan view,” suffers from similar deficiencies to those discussed for claim 7. EX1003, 225. In addition, the

specification describes that “[o]ne anode electrode 43 **is connected to** one TFT circuit output connection portion 42.” EX1001, 9:28-29. FIG. 6 shows the connection portion 42 and the anode electrode 43 where the opening of the connection portion 42 does not overlap with the anode electrode (unless the connection portion 42 extends beyond the illustrated opening to overlap with the anode electrode 43). EX1003, 225. For these reasons, unless the connection portion 42 extends beyond its opening to a point where it connects to the anode electrode 43, claim 3 lacks written description support. *Id.*

3. The ’691 Patent Does Not Describe or Enable a TFT circuit “disposed below each of the subpixels to control the subpixels”

As discussed at Section III.A.4 (incorporated here), the specification does not use the term “below” and does not describe a TFT circuit disposed below each of the subpixels to control the subpixels. EX1003, 226. The only support for this limitation is FIG. 6. *Id.* But, as discussed at Section III.A.4 (incorporated here), FIG. 6 shows components of a subpixel, including the TFT circuit. EX1001, 3:3-5; 8:60-9:17; EX1003, 226. Thus, FIG. 6 shows a TFT circuit as part of a subpixel; not a TFT circuit below a subpixel. *Id.* The ’691 patent also repeatedly confirms that “[e]ach subpixel includes a pixel circuit” and the pixel circuit of the subpixel includes the TFT components. EX1001, 9:20-25; 13:38-64; 29:21-23; FIGS. 12, 30, 33. For these reasons, the ’691 patent does not provide a written description of

a TFT circuit “disposed below each of the subpixels to control the subpixels,” as required by limitation [1.2]. EX1003, 226.

The ’691 patent also fails to enable a POSITA to make and use a TFT circuit “disposed below each of the subpixels to control the subpixels.” EX1003, 227.

Because the ’691 patent repeatedly and consistently describes the TFT circuit as part of a subpixel, it fails to provide a POSITA with guidance on how to construct a TFT circuit that is “disposed below each of the subpixels to control the subpixels.” EX1001, 3:3-5; 8:60-9:17; 9:20-25; 13:38-64; 29:21-23; FIGS. 12, 30, 33. As Dr. Bretschneider explains, the description in the ’691 patent aligns with a POSITA’s general knowledge that TFTs are constructed as parts of subpixels, not below them. EX1003, 227. For these reasons, the ’691 patent fails to teach a POSITA how to make and use a TFT circuit “disposed below each of the subpixels to control the subpixels.” *Id.*

4. The ’691 Patent Does Not Describe the “array direction” Limitations

As discussed at Section III.A.5 (incorporated here), the specification does not use the term “array direction.” It, instead, references at least eleven other directions. EX1001, Abstract, 4:5-8, 7:17-18, 17:35, 21:6-7. But the ’691 patent does not explain which of these directions is an “array direction” or otherwise describe an “array direction.” EX1003, 229.

The '691 patent also describes that “FIG. 7 is a diagram illustrating an array of subpixels.” EX1001, 10:5-6. But the lower portion of FIG. 7 lists six other directions and fails to describe which direction is the “array direction.” EX1003, 230.

Limitation [1.6] also refers to “an array direction of the subpixel of the second color and the subpixel of the third color that are arrayed alternately.” EX1001, 32:18-20. Yet, the '691 patent provides no description of a direction “of the subpixel of the second color and the subpixel of the third color.” *Id.*, 32:18-30; EX1003, 231.

Because the specification does not reasonably convey an array direction of the subpixel of the second color and the subpixel of the third color that are arrayed alternately, the '691 patent does not provide a sufficient written description. EX1003, 232.

C. [GROUND 4] – Claims 1-6 and 8 Are Rendered Obvious By Hwang and Lee

Below, the Petition relies on the disclosure of Hwang and Lee and explains why this disclosure, when interpreted in view of the general knowledge of a POSITA, renders obvious claims 1-6 and 8. EX1003, 233. As discussed in Grounds 1-3, the scope of various limitations lacks clarity and the specification fails to provide an enabling disclosure of several features. To the extent the '691

patent provides an enabling disclosure of claims with sufficient definiteness, the diagrams shown in FIGS. 4, 6, and 7 (which were cited repeatedly by Applicant during prosecution as providing support for the claims) must fall within the scope of such claims. Accordingly, in the analysis below and applicable to each limitation where the Petition raises §112 grounds, the Petition maps prior art to the claims in a manner consistent with FIGS. 4, 6, and 7. Hwang and Lee provide prior art disclosure that is commensurate with the disclosure that the '691 patent relies on for support of claims 1-6 and 8 (i.e., the disclosure of FIGS. 4, 6, and 7), and thus render obvious claims 1-6 and 8. EX1003, 233.

Specifically, Hwang discloses a pixel arrangement and pixel emission structure that are nearly identical to those disclosed in the '691 patent specification. EX1003, 234. Lee provides implementation details of features already disclosed in Hwang, such as details of grouping sub-pixels into pixels and aspects of pixel circuitry. *Id.*

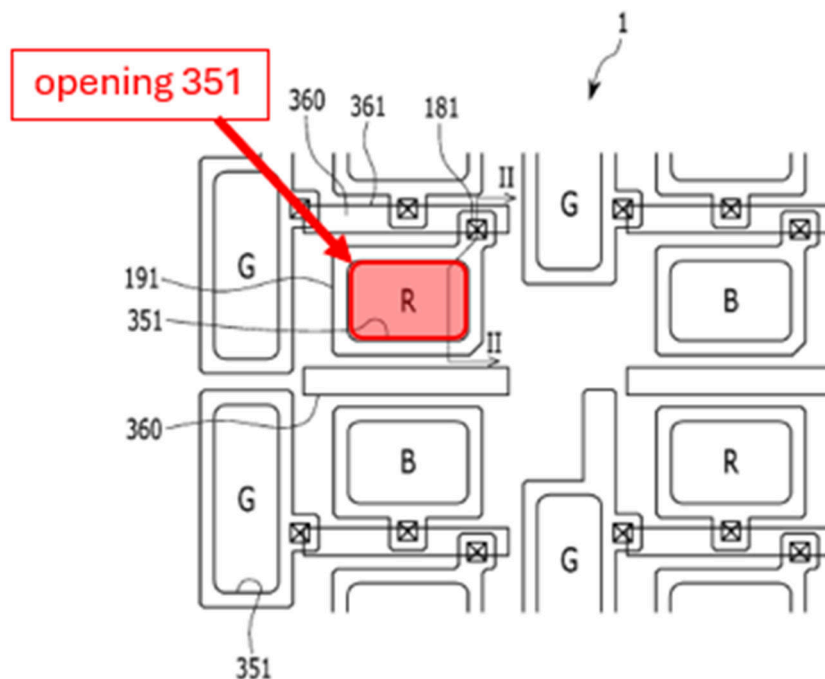
1. Overview of Hwang

Hwang describes a “display device” (e.g., an “OLED display device”) implementing a “display panel 1.” EX1005, [0005], FIG. 7; EX1003, 109. Hwang’s display panel includes an arrangement of “organic light emitting elements 70” each connected to respective circuitry to emit different colors, such as red, green, and blue. EX1005, [0007], [0008], [0040], [0041]; EX1003, 109.

Each of Hwang's light emitting elements emits light through an "opening 351" in an upper layer of the display panel, defining a "pixel area" which is a light-emitting region of each pixel. EX1005, [0046], FIGS. 1, 2; EX1003, 110.

Hwang

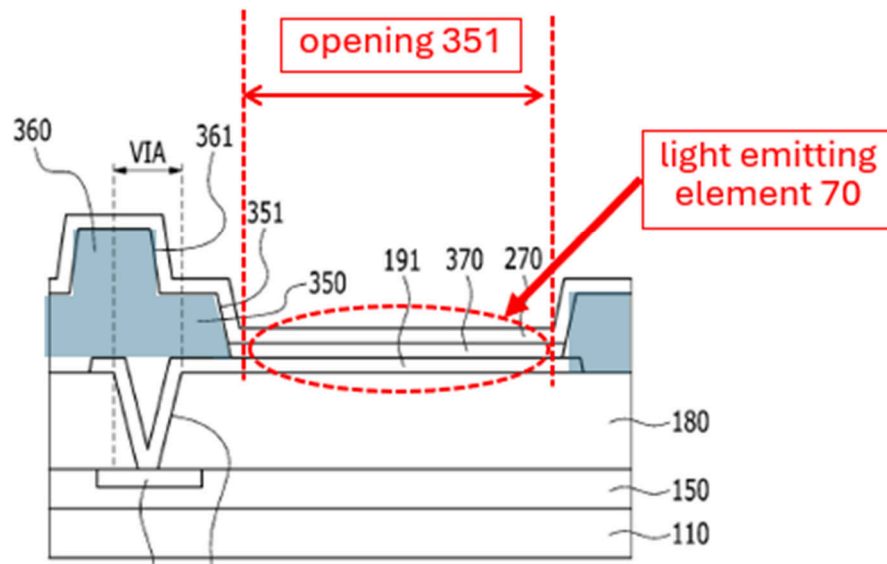
FIG. 1



EX1005, FIG. 1 (annotated)

Hwang

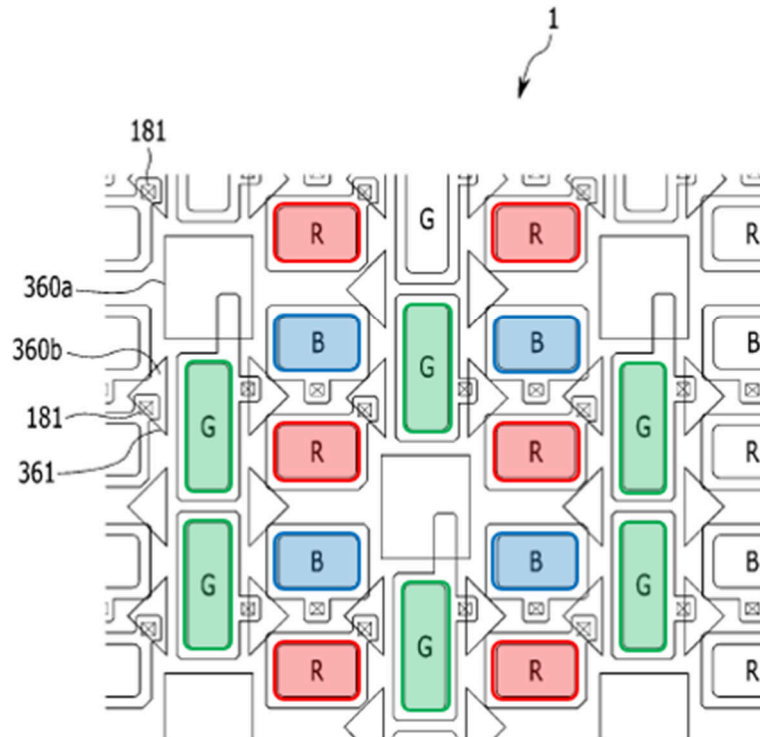
FIG. 2



EX1005, FIG. 2 (annotated)

Three pixels of different colors (red, green, blue) are “regularly arranged” in an alternating manner in vertical and horizontal directions. EX1005, [0057]-[0059], FIG. 7; EX1003, 111.

Hwang
FIG. 7



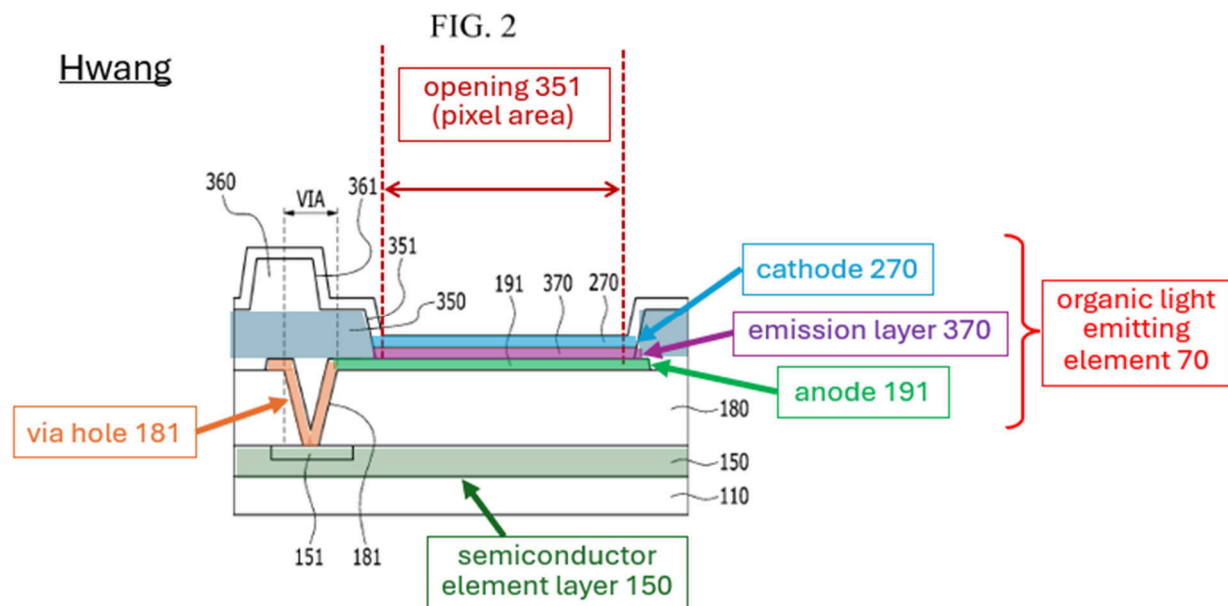
EX1005, FIG. 7 (annotated)

Specifically, red and blue pixels (R, B) are “alternately arranged in a vertical direction” and green pixel (G) is “arranged at one side” of red and blue pixels R, B. EX1005, [0058], [0059], [0074], FIG. 7; EX1003, 112. Green pixel G is “continuously arranged in the vertical direction” and “a column of the green pixel G and a column where the red pixel R and the blue pixel B are arranged may be alternately arranged.” *Id.* Green pixel G is “longer” in the vertical direction than red and blue pixels R, B. *Id.*

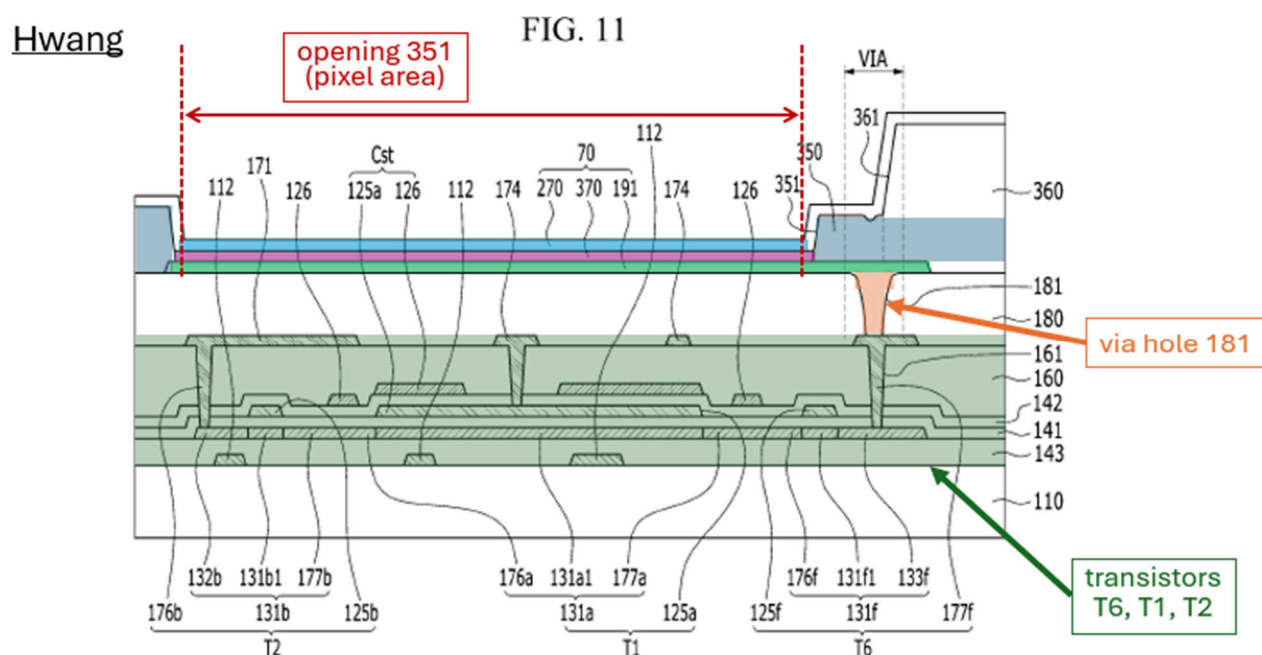
Each of Hwang’s light emitting elements is driven by “semiconductor element layer 150” disposed under and connected to anode 191 of the light

emitting element through “via hole 181.” EX1005, [0040], [0043], FIG. 2;

EX1003, 113.



EX1005, FIG. 2 (annotated)



EX1005, FIG. 11 (annotated)

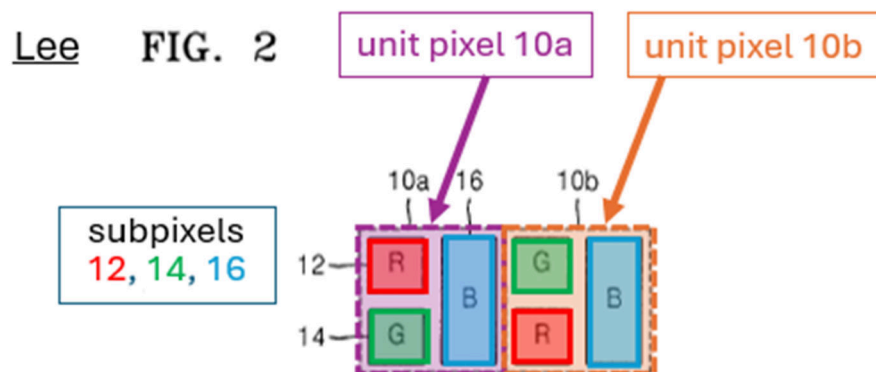
Hwang’s semiconductor element layer 150 includes interconnected

transistors, such as driving transistor T1 and switching transistor T2, that provide various signals to the pixel. EX1005, [0121], [0081], [0083], FIG. 11; EX1003, 114.

2. Overview of Lee

Lee describes a display device, such as an organic light emitting diode (OLED) display device, that displays images by combining at least three colors emitted from an arrangement of pixels. EX1006, Abstract, [0006],[0007], [0048]; EX1003, 115.

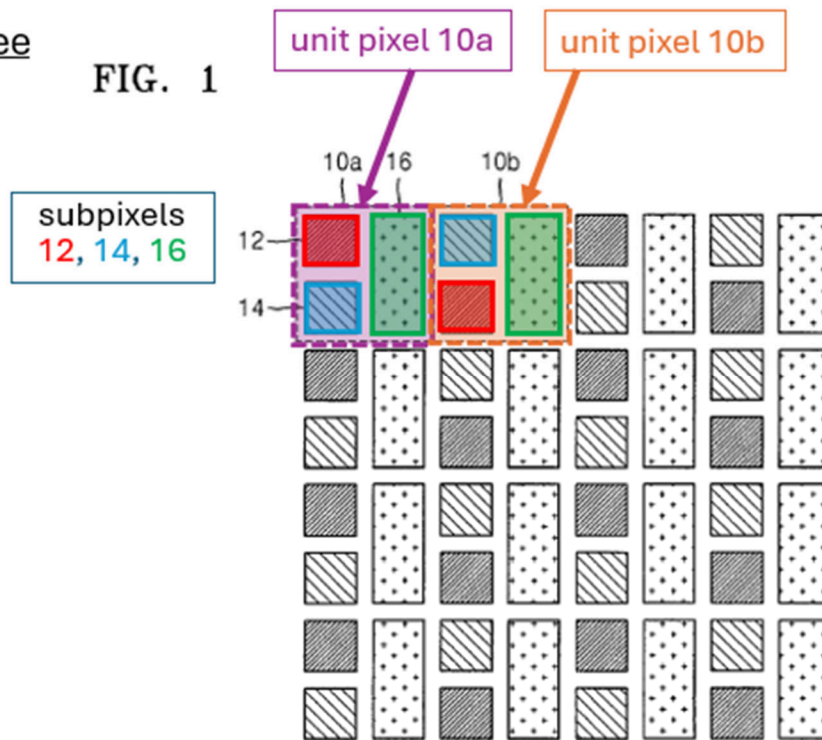
Lee's display device includes a "pixel arrangement" with two types of unit pixels, "unit pixels 10a and 10b." EX1006, [0049], FIGS. 1, 2; EX1003, 116. Each unit pixel is formed of three sub-pixels 12, 14, and 16 that emit different colors (e.g., red, blue, green) and are "alternately and repeatedly arranged in a row direction." EX1006, [0049]-[0053], FIGS. 1-4; EX1003, 116.



EX1006, FIG. 2 (annotated)

Lee

FIG. 1

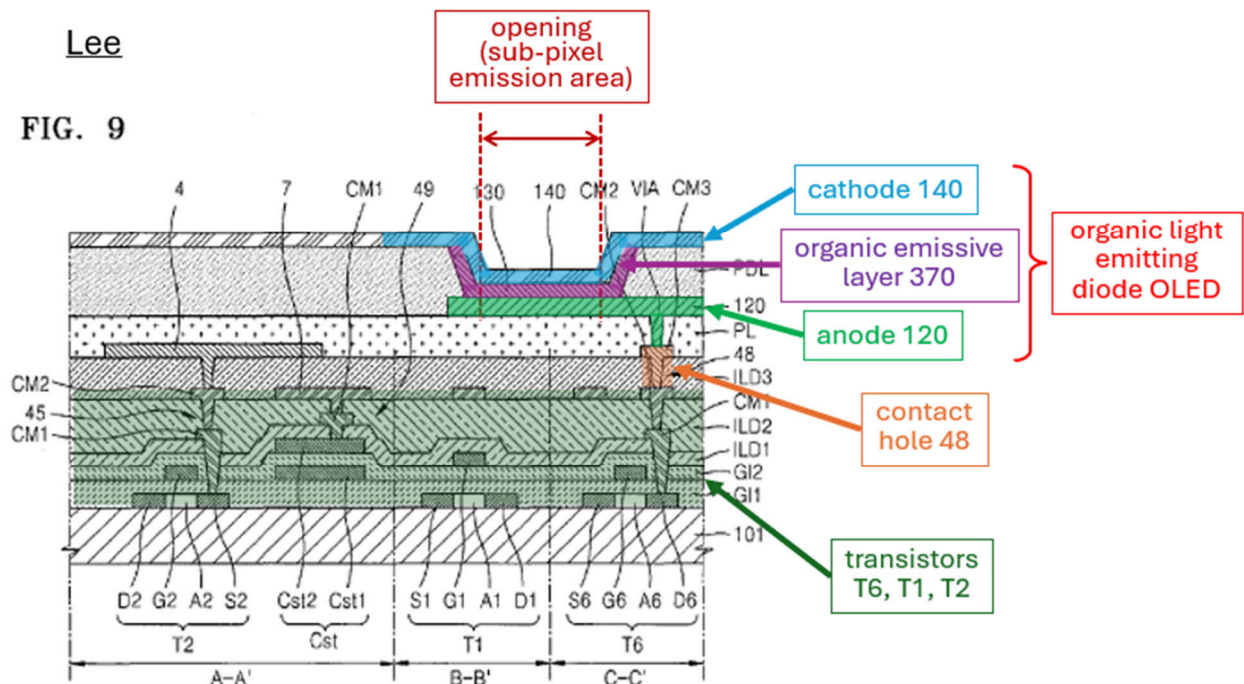


EX1006, FIG. 1 (annotated)

Lee's unit pixels 10a and 10b are distinguished by the arrangement of three sub-pixels (12, 14, 16) in each unit pixel. EX1006, [0050]-[0051], FIG. 1; EX1003, 117. In particular, "positions of the first and second sub-pixels 12 and 14 of the first unit pixel 10a are opposite to those of the first and second sub-pixels 12 and 14 of the second unit pixel 10b." *Id.* First and second sub-pixels 12 and 14 "have the same size" and can be arranged in either "a left column or a right column" of each of unit pixel 10a, 10b. *Id.* Third sub-pixel 16 "has a height that is more than two times" that of first or second sub-pixel 12, 14 in the column direction, and can be arranged in the other of the "right column or a left column" of each unit pixel 10a, 10b. *Id.*

Each of Lee's sub-pixels (12, 14, 16) emits light through an "opening" in an upper layer of the display device, defining an "emission portion" of each sub-pixel.

EX1006, [0112], FIG. 9; EX1003, 118.



EX1006, FIG. 9 (annotated)

Each of Lee's sub-pixels (12, 14, 16) includes an organic light emitting diode (OLED) driven by a "pixel circuit" including various transistors (T6, T1, T2) disposed under and connected to anode 120 of the OLED through "contact hole 48." EX1006, [0110]-[0111], FIG. 9; EX1003, 119.

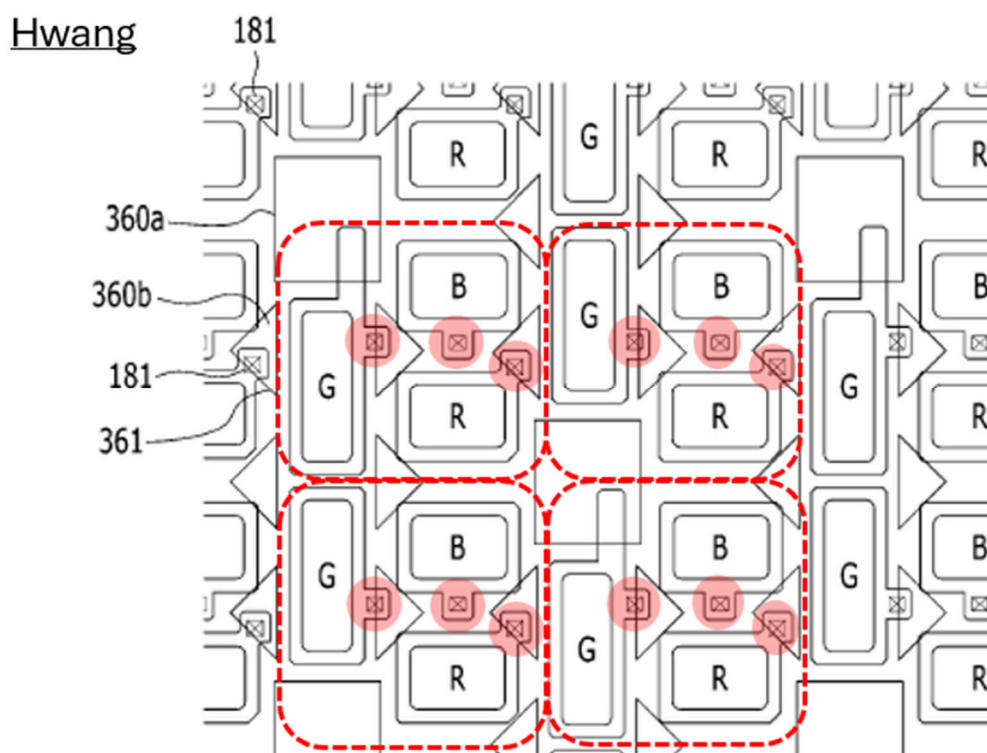
3. Combination of Hwang and Lee

Lee provides details of features disclosed in Hwang, such as details of grouping of sub-pixels into pixels and aspects of pixel circuitry. EX1003, 120.

As discussed above, Hwang provides a foundational teaching of the well-

known concept that display devices, including OLED devices, display images by combining pixels of three “primary colors” (red, blue, green) to display full-color images. EX1005, [0007], [0040]; EX1003, 121. Hwang’s three-colored pixels are alternately arranged in a regular repeating pattern. EX1005, [0058], [0059], [0074], FIG. 7; EX1003, 121.

Moreover, Hwang suggests a pixel arrangement with groups of three adjacent pixels (R, G, B), each having a respective “pixel electrode 191” that is “protruded toward a space between” the three pixels, “thereby being connected to electrode 151 of semiconductor element through the via hole 181.” EX1005, [0038], [0039], [0043], [0044], FIG 7 (below); EX1003, 122.



EX1005, FIG. 7 (annotated)

Based on these teachings of Hwang, a POSITA would have understood and found obvious that every three adjacent Hwang pixels are grouped according to their pixel electrodes 191 protruding into a space between the three pixels for connecting to electrode 151. EX1003, 123. As Dr. Bretschneider explains, it was common to group R, G, B color emission components into a pixel in display technology by the Critical Date. *Id.* The background of the '691 patent itself recognizes that “[d]isplay devices displaying a color image by using pixels configured by combining subpixels of three colors that are red, green, and blue have been used.” EX1001, 1:21-23; 1:33-36; EX1003, 124. With this background and a POSITA’s knowledge of the well-known technique of grouping R, G, B light emitting elements into pixels in a display by the Critical Date, a POSITA reviewing Hwang would have understood or found obvious that Hwang’s display includes pixels of R, G, B groupings as shown above in the annotated version of FIG. 7. EX1003, 124.

Lee provides details for implementing such a grouping. EX1003, 125. A POSITA would have turned to Lee and its teaching of combining subpixels into “unit pixels” for further details of grouping Hwang’s pixels into groups of three R, G, B elements. *Id.* As discussed above, Lee teaches a “pixel arrangement” that groups subpixels of three primary colors (red, blue, green) into “unit pixels” 10a and 10b. The two types of unit pixels 10a, 10b are distinguished by the

arrangement of the three primary-colored sub-pixels in each unit pixel. EX1006, [0050]-[0051], FIG. 1; EX1003, 125.

As explained below, combining Hwang and Lee would have been obvious. Such a combination would have merely involved (1) combining prior art elements according to known methods to yield predictable results; and the (2) use of known techniques to improve similar devices in the same way. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 415-421, (2007); MPEP 2143; EX1003, 126.

Given the extensive similarities between Hwang and Lee, a POSITA would have understood that Hwang and Lee are compatible. Sections III.C.1 and III.C.2, *supra*, EX1003, 127. Lee merely provides explicit teachings and further details for what Hwang would have already conveyed to a POSITA, namely that Hwang's pixels of three primary colors (R, G, B) should be grouped. *Id.*

The resulting Hwang-Lee combination is shown below. EX1003, 128.

Hwang-Lee

FIG. 7

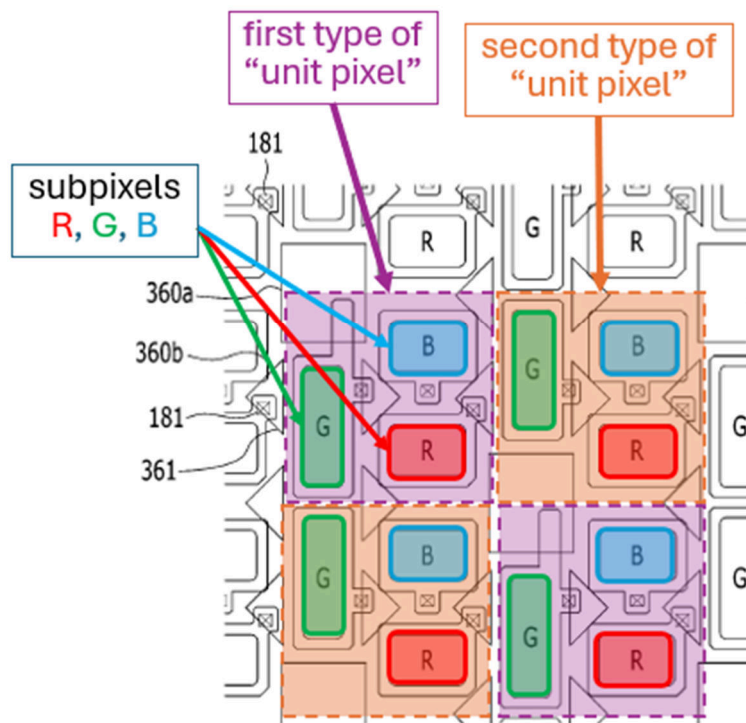


Diagram A (the Hwang-Lee combination)

Lee explains a benefit of this two-dimensional pixel grouping arrangement (compared to a linear "stripe arrangement") is to reduce the size of a "black matrix" and achieve higher "aperture ratio" for improved display resolution. EX1006, [0052], [0082], [0134], [0135], [0006]-[0008]; EX1003, 129. This is aligned with, and would ensure, Hwang's stated goal of achieving "a high resolution organic light emitting device" and "improving display quality." EX1005, [0103], [0109]; EX1003, 129.

The resulting Hwang-Lee combination would not require any structural or functional modifications to Hwang's display device. EX1003, 130. Instead, the

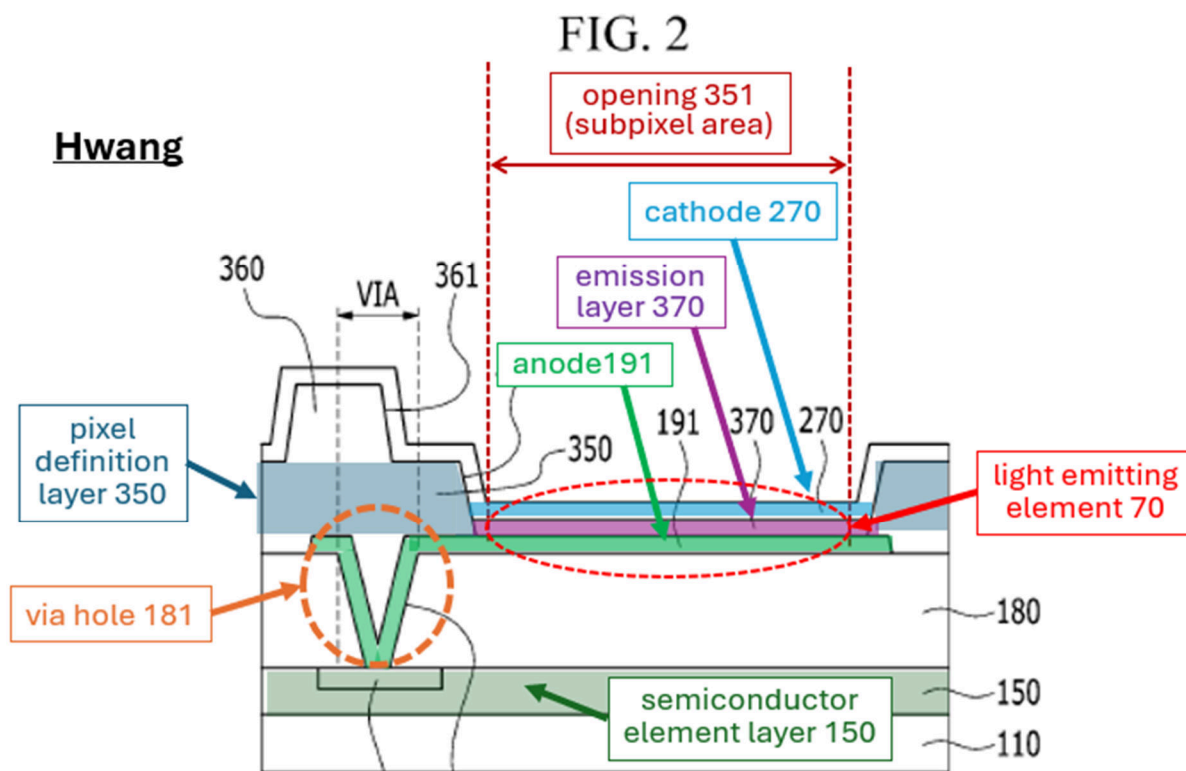
Hwang-Lee combination merely makes explicit to a POSITA what would have already been understood to be implicitly disclosed or rendered obvious by Hwang, namely that Hwang's pixels of three colors (R, G, B) would have been grouped together based on their electrode connectivity and arrangement. *Id.*

Furthermore, although Hwang and Lee use different terminology when referring to the same light-emitting structure, namely Hwang's terminology "pixel" and Lee's terminology "subpixel," as Dr. Bretschneider explains, a POSITA would have understood that it was common in the art to interchangeably use the terms "pixel" and "subpixel" when referring to the structure above a smallest light-emitting unit of a display device. EX1003, 131 (citing EX1012, [0003] as explaining that pixels and sub-pixels "are **not distinguished** herein" and that "**all light-emitting elements** are called **pixels**," EX1009, [0036], EX1013, [0040]-[0041], [0045]).

Both Hwang and Lee are directed to OLED devices that implement an arrangement of pixels with alternating and repeating patterns of differently-colored light emitting elements. EX1003, 132. The combination would have simply involved incorporating teachings of Lee into the compatible teachings of Hwang, thereby making the Hwang-Lee combination predictable and foreseeable with a reasonable expectation of success. *Id.*

4. Analysis

Before a claim-by-claim analysis, first, a detailed comparison is presented, in Diagram B below, showing cross-section views of Hwang's TFT and subpixel structure with that of the '691 patent and their extensive similarities. EX1005, FIG. 2; EX1001, FIG. 6; EX1003, 235. This discussion is incorporated by reference into each of the claim limitation analyses below.



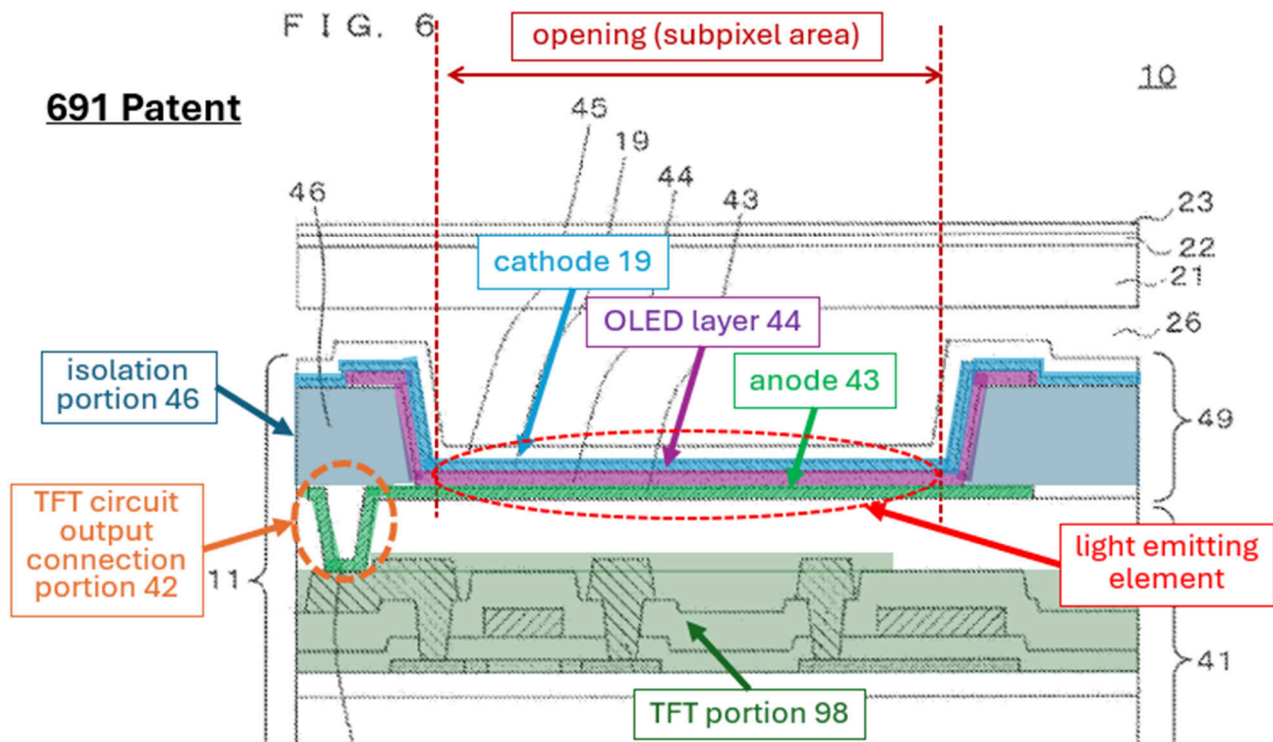


Diagram B (comparing EX1005, FIG. 2 with EX1001, FIG. 6)

Hwang, like the '691 patent, discloses organic light emitting element 70 including opposed electrode 270 (functioning as a cathode), pixel electrode 191 (functioning as an anode), and organic emission layer 370. EX1005, [0040], FIG. 2; EX1001, 9:18-25; EX1003, 236. Like the '691 patent, Hwang's organic light emitting element 70 emits light through an opening 351 to emit one of three possible colors. EX1005, [0007], [0008], [0041]; EX1001, 9:33-67; EX1003, 236.

Like the '691 patent, Hwang's display device includes semiconductor element layer 150 with various TFTs (e.g., T1, T2, T6) connected to anode 191 of Hwang's organic light emitting element 70 through via hole 181. EX1005, [0043]; EX1001, FIGS. 6, 11; 9:5-29; 13:3-8 ('691 patent describing "TFT portion 98"

(included in wiring portion 41) which is connected to anode 43 of the light emitting element through “TFT circuit output connection portion 42”); EX1003, 237.

For ease of reference throughout the subsequent analysis, Diagram C below summarizes how Hwang-Lee discloses the claimed “*first pixel*” and “*second pixel*” each with different arrangements of green subpixel G (“*subpixel of a first color*”), red subpixel R (“*subpixel of a second color*”), and blue subpixel B (“*subpixel of a third color*”). EX1003, 238.

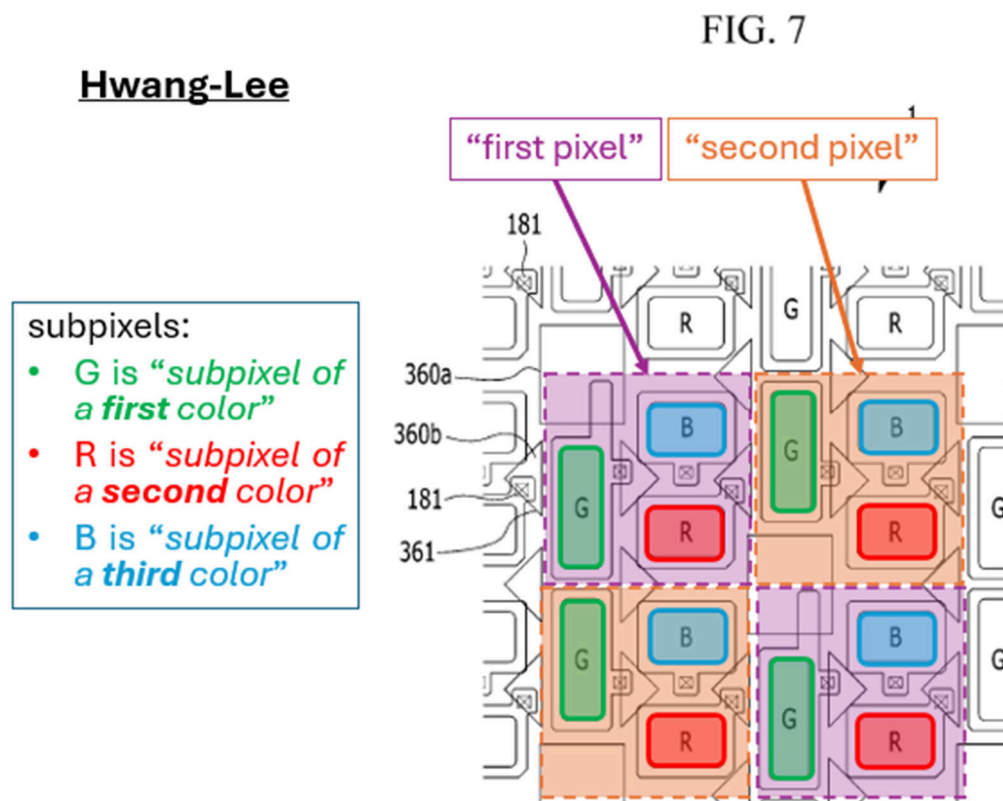


Diagram C (based on EX1005, FIG 7, mapped to claimed elements)

[1.pre]

Hwang discloses a “display device” such as a “liquid crystal display (LCD), an organic light emitting diode (OLED) display, and an electrophoretic display.”

EX1005, Title, Abstract, [0005]; EX1003, 239.

[1.1]

As discussed in Section III.C.3, the Hwang-Lee display device implements (i) unit pixels of a first type (“*a plurality of first pixels*”) each including subpixels of three colors and (ii) unit pixels of a second type (“*a plurality of second pixels*”) each including *subpixels of three colors* that are *arranged differently* from the subpixels in one of the first pixels. EX1005, [0058]-[0059], [0074]-[0076], FIG. 7; EX1006, [0050]-[0051], FIGS. 1-2; EX1003, 241.

Moreover, as discussed in Section III.C.3, Hwang-Lee’s first pixels and second pixels are *alternately arrayed in a row direction and a column direction*. EX1005, [0058]-[0059], [0074]-[0076], FIG. 7; EX1006, [0049]-[0051], [0059], FIGS. 1-2; EX1003, 242.

Like the ’691 patent, the Hwang-Lee subpixels of three colors include green subpixel “G” (“*subpixel of a first color*”), red subpixel “R” (“*subpixel of a second color*”), and blue subpixel B (“*subpixel of a third color*”). EX1005, [0058]-[0059], [0074]-[0076], FIG. 7; EX1006, [0050]-[0051], [0054], FIGS. 1-2; EX1003, 243.

A comparison of the Hwang-Lee pixel structure with that of the '691 patent is shown in Diagram D, below. EX1005, FIG. 7; EX1001, FIG. 4; EX1003, 244.

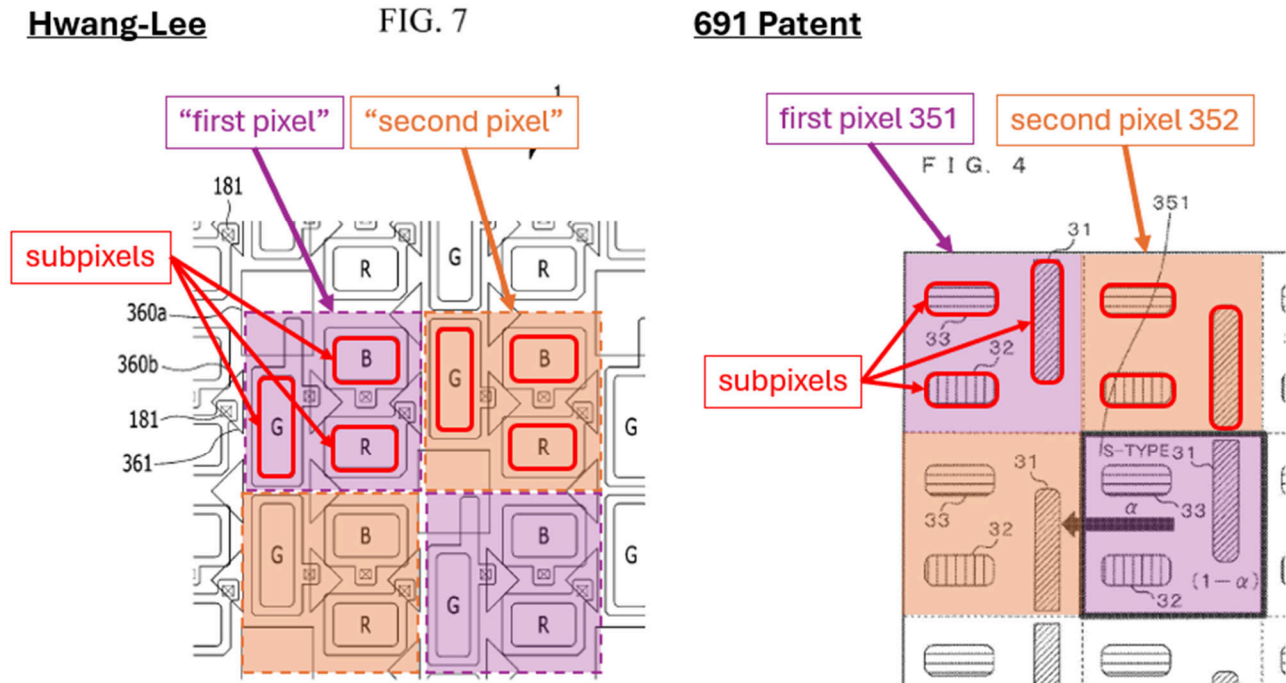


Diagram D (comparing pixel structures of Hwang-Lee and the '691 patent)

Therefore, a POSITA would have understood Hwang-Lee to render obvious [1.1]. EX1003, 245.

[1.2]

Hwang discloses a thin film transistor (TFT) circuit disposed below each of the sub-pixels to control the subpixels, as recited in [1.2], in a manner commensurate with the disclosure in the '691 patent. EX1003, 246.

The '691 patent describes "TFT portion 98" (included in wiring portion 41) which is connected to anode 43 of the light emitting element (through TFT circuit output connection portion 42). EX1001, FIGS. 6, 11; 9:5-29; 13:3-8; EX1003, 247.

Hwang discloses a similar if not an analogous structure. As seen in Diagram B above, Hwang's display device includes semiconductor element layer 150 with transistors T1, T2, T6 ("**TFT circuit**") connected to pixel electrode 191 of Hwang's organic light emitting element 70 through via hole 181. EX1005, [0043], [0146], [0039]-[0041]; EX1003, 238.

As in the '691 patent, Hwang's transistors T1, T2, T6 in semiconductor element layer 150 ("**TFT circuit**") are disposed below Hwang's light emitting element 70. EX1005, FIGS. 2, 11; EX1003, 249. Hwang explains that its transistors T2, T2, T6 function as "driving transistor T1" and "switching transistor T2," which are components included in the pixel circuitry of a subpixel. EX1005, [0082], [0121], FIGS. 8, 11; EX1003, 249.

Moreover, as in the '691 patent, Hwang's driving transistor T1 and switching transistor T2 control the subpixel. EX1005, [0084]; EX1001, 13:59-63; EX1003, 250.

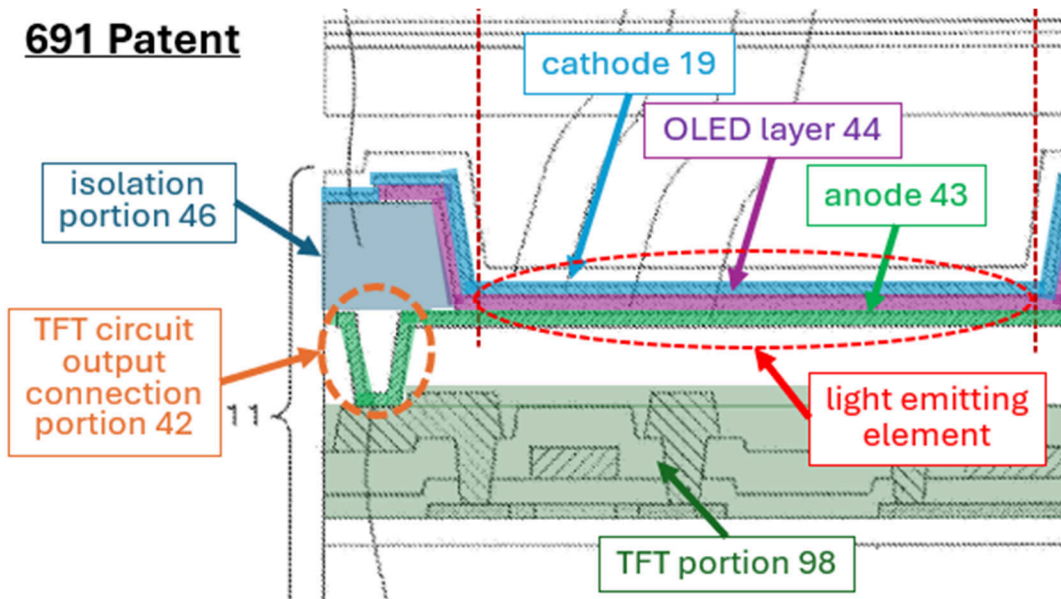
Therefore, Hwang-Lee renders obvious [1.2].

[1.3]

The '691 patent specification does not use the term "**connection part**." EX1001; EX1003, 252-253. Instead, the specification describes "TFT circuit output connection portion 42" that connects "one anode electrode 43 to one TFT circuit." EX1001, 9:28-29; EX1003, 253. The '691 patent describes TFT circuit

output connection portion 42 as receiving “output of a TFT circuit” and “applying the output to the anode electrode 43.” EX1001, 10:25-28, 9:55-58; EX1003, 253.

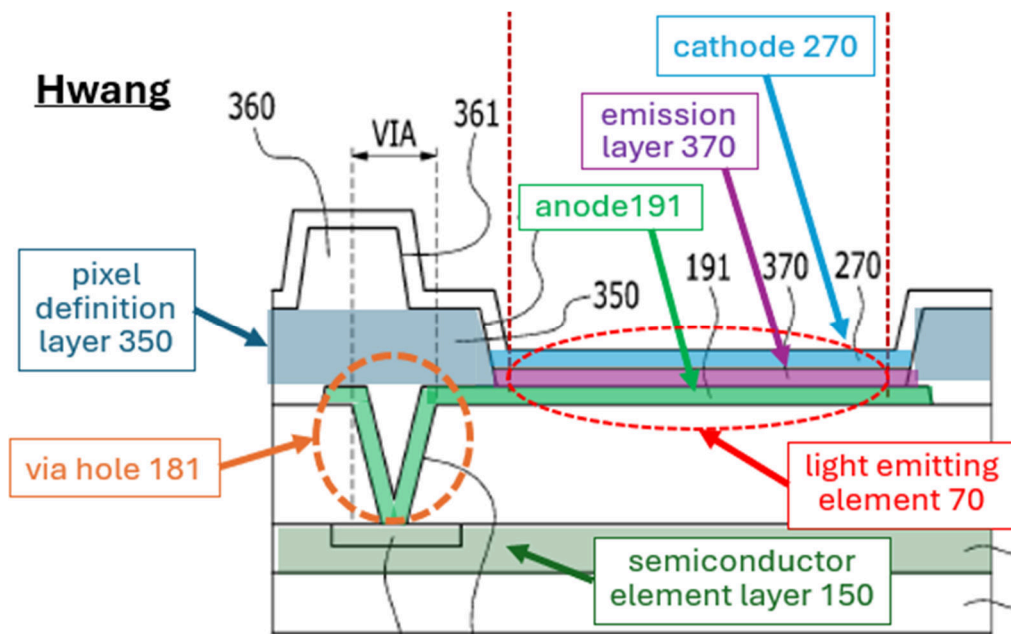
The '691 patent shows, in FIG. 6 (below), anode electrode 43 extending toward “TFT circuit output connection portion 42” to connect to underlying TFT portion 98. EX1001, FIG. 6; EX1003, 254.



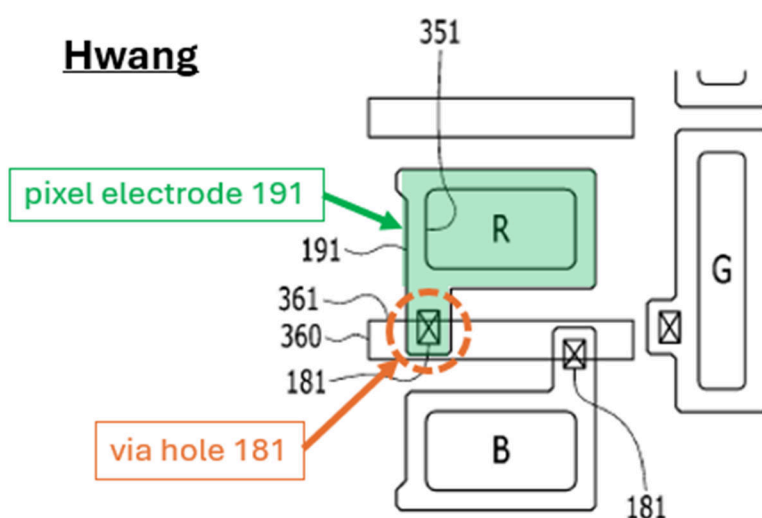
EX1001, FIG. 6 (annotated)

The '691 patent explains that TFT circuit output connection portion 42 and anode electrode 43 are formed of the same material and manufactured in one step (“step S502” of FIG. 8). EX1001, 10:59-61, FIG. 8; EX1003, 255. Specifically, “after a vapor deposition apparatus forms a metal film, ...an etching apparatus removes unnecessary portions of the metal film, so that the TFT circuit output connection portion 42 and the anode electrode 43 are formed.” EX1001, 10:62-67; EX1003, 255.

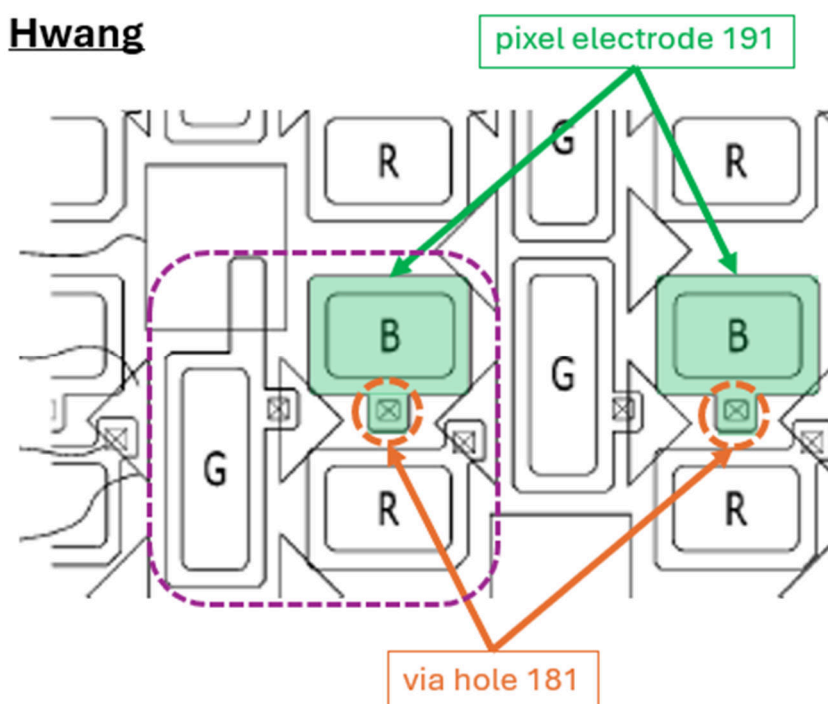
Hwang discloses a similar if not analogous structure. As explained above, Hwang's pixel electrode 191 (part of which functions as an anode for light emitting element 70 of a Hwang-Lee subpixel) is "protruded toward" and extends through "via hole 181" to connect to semiconductor element layer 150, which includes TFTs such as T1, T2, T6. EX1005, [0043], [0146], [0039]-[0041], FIGS. 2, 11; EX1003, 256.



EX1005, FIG. 2 (annotated)



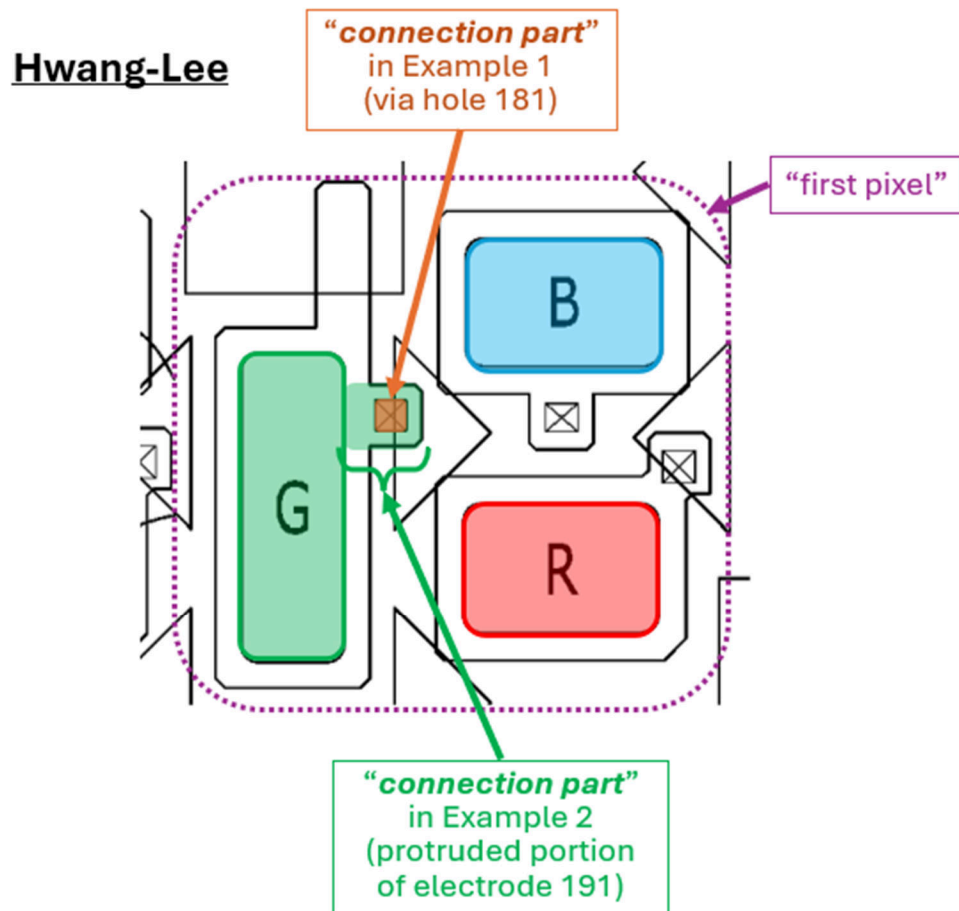
EX1005, FIG. 6 (annotated)



EX1005, FIG. 7 (annotated)

Based on Hwang's teachings, a POSITA would have understood that the claimed "*at least one connection part*" is rendered obvious by at least two different structures in Hwang. EX1003, 257. For example, a POSITA would have

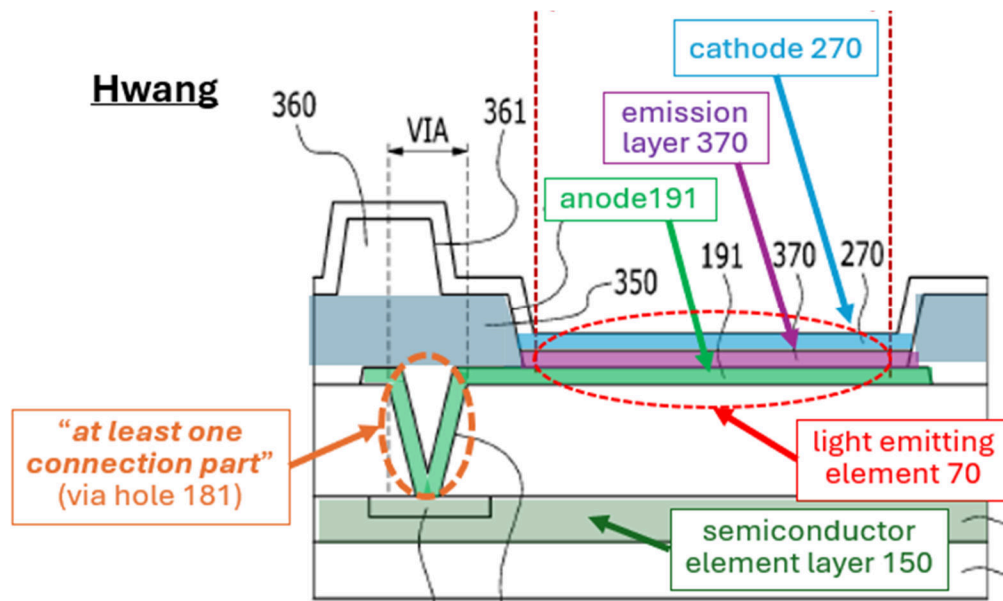
understood that the claimed “*at least one connection part*” is rendered obvious by Hwang’s **via hole 181** into which Hwang’s electrode 191 protrudes (hereinafter “Example 1”) and also by Hwang’s **protruded portion of pixel electrode 191** which protrudes into via hole 181 (hereinafter “Example 2”). *Id.* A comparison of the two is shown below, with reference to Hwang’s FIG. 7. *Id.* In both examples, a POSITA would have found Hwang-Lee to render obvious [1.10] and [1.11]. *Id.*



EX1005, FIG. 7 (annotated)

In Example 1, a POSITA would have understood that Hwang’s **via hole 181** (into which Hwang’s electrode 191 protrudes) renders obvious the claimed “*at*

least one connection part.” EX1003, 258. As seen in Hwang’s FIG. 2, below, Hwang’s via hole 181 (“*at least one connection part*” in Example 1) connects Hwang’s semiconductor layer 150 including TFTs (“*TFT circuit*”) and the anode electrode 191 of one of Hwang-Lee’s subpixels (“*one of the subpixels*”). EX1005, FIG. 2; *see also* analysis of claim 3 below; EX1003, 258.



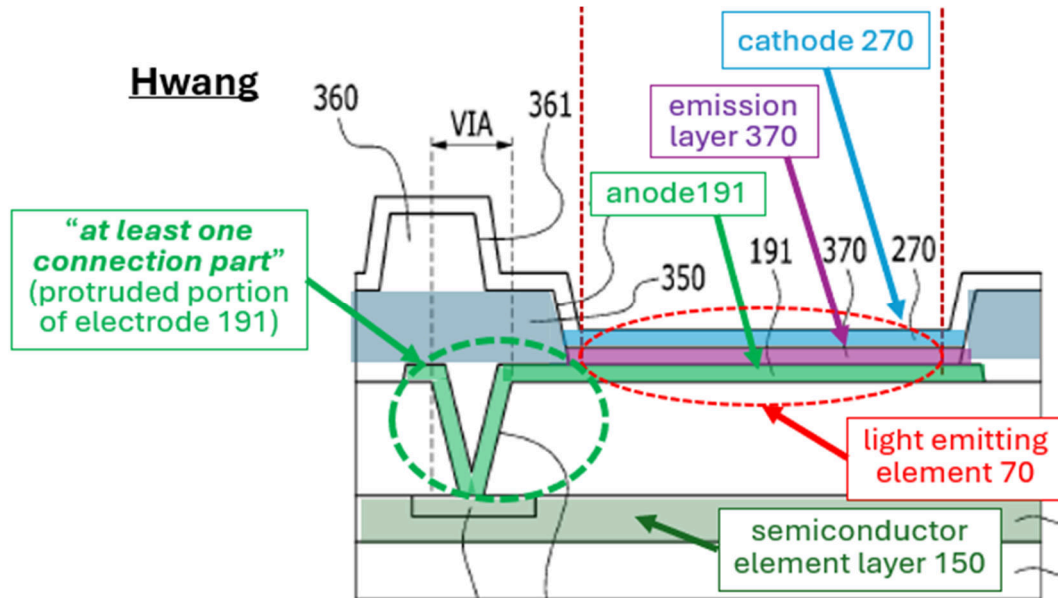
EX1005, FIG. 2 (annotated, Example 1)

As Dr. Bretschneider explains, it was known in the art to implement a via hole, as disclosed in Hwang-Lee, to provide a connection part. EX1003, 259. Such knowledge is evidenced, for example, in the prosecution history of the '691 patent itself, in which the Examiner rejected the claimed "*at least one connection part*" by citing "via hole VIA" disclosed in Kim'834, a mapping which Applicant did not contest. EX1002, 3rd office action; EX1003, 259.

In Example 2, a POSITA would have understood that Hwang’s **protruded**

portion of pixel electrode 191 (protruding toward and into Hwang's via hole 181)

also renders obvious the claimed “*at least one connection part.*” EX1003, 260.



EX1005, FIG. 2 (annotated, Example 2)

Hwang's protruded portion of pixel electrode 191 (“*at least one connection part*” in Example 2) connects Hwang's semiconductor layer 150 including TFTs (“*TFT circuit*”) and the remaining non-protruded portion of Hwang's pixel electrode 191 functioning as an anode under emission layer 370 in light emitting element 70 in one of Hwang-Lee's subpixels (“*one of the subpixels*”). EX1005, FIG. 2, [0040], [0044]; *see also* analysis of claim 7 below; EX1003, 261.

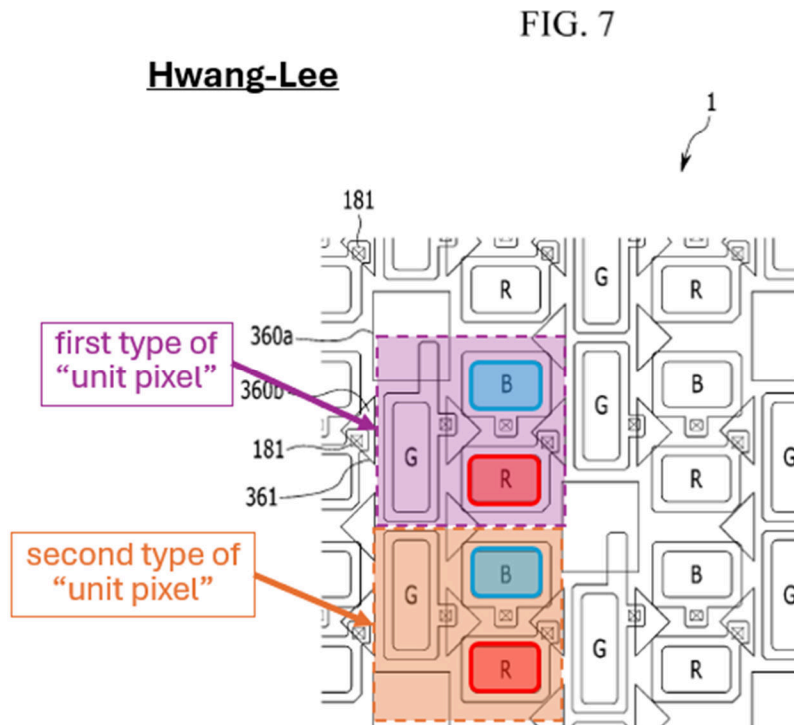
For these reasons, Hwang-Lee renders obvious [1.3]. EX1003, 262, 263.

[1.4]

As discussed in Section III.A.2, the “first pixel” in [1.4] refers to a single pixel within “the plurality of first pixels” and presumably the “one” first pixel

introduced in [1.1]. Moreover, the “second pixel” in [1.4] lacks antecedent basis and could potentially refer to either of two second pixels that are adjacent to the first pixel in the column direction. Regardless of which interpretation is taken, Hwang-Lee discloses “first pixels” and “second pixels” each of which render obvious [1.4]. EX1003, 264.

Also, as discussed in Section III.C.3, Hwang-Lee implements a first pixel and a second pixel adjacent to each other in the column direction. In these adjacent pixels, red subpixel R and blue subpixel B are arrayed alternatively in the column direction. EX1005, [0058]; EX1003, 265.



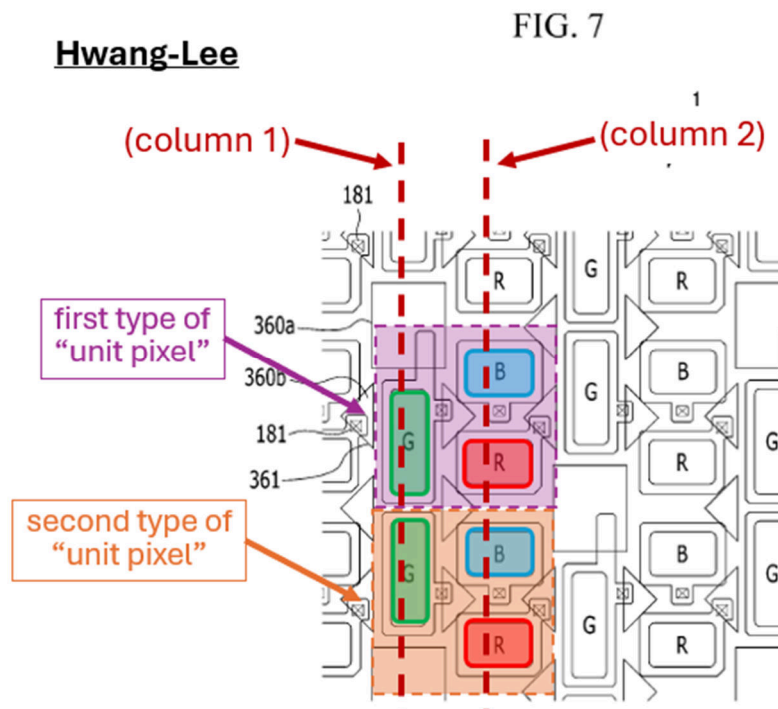
EX1005, FIG. 7 (annotated)

Therefore, Hwang-Lee renders obvious [1.4]. EX1003, 266.

[1.5]

As discussed in [1.4], Hwang-Lee discloses a “first pixel” and a “second pixel” that are adjacent to each other in the column direction. EX1003, 267.

As shown in annotated FIG. 7 of Hwang, below, Hwang-Lee discloses a column (labeled “column 1”) where green subpixel G in the first pixel and green subpixel G in the second pixel are arrayed. EX1005, [0058], FIG. 7; EX1003, 268. This column 1 is parallel with another column (labeled “column 2”) where red subpixel R and blue subpixel B are alternately arrayed. *Id.* Furthermore, these two columns are arrayed alternately in the row direction. EX1005, [0059]; EX1003, 268.



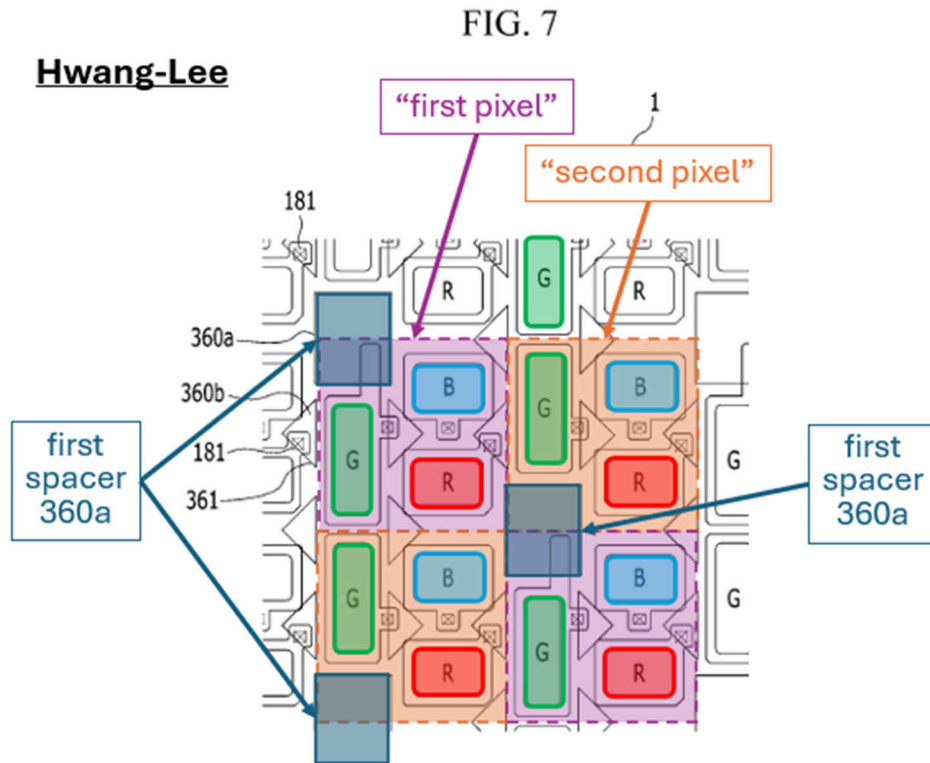
Therefore, Hwang-Lee renders obvious [1.5]. EX1003, 269.

[1.6] and [1.7]

Limitations [1.6] and [1.7] describe mirror-image arrangements of subpixels in the first pixel and second pixel and are thus analyzed together. EX1003, 270.

Hwang-Lee renders obvious [1.6], based on all of Hwang-Lee's "first pixels" being identical and possessing the claimed features. EX1003, 271. Hwang-Lee renders obvious [1.7], based on all of Hwang-Lee's "second pixels" being identical and possess the claimed features. EX1003, 272.

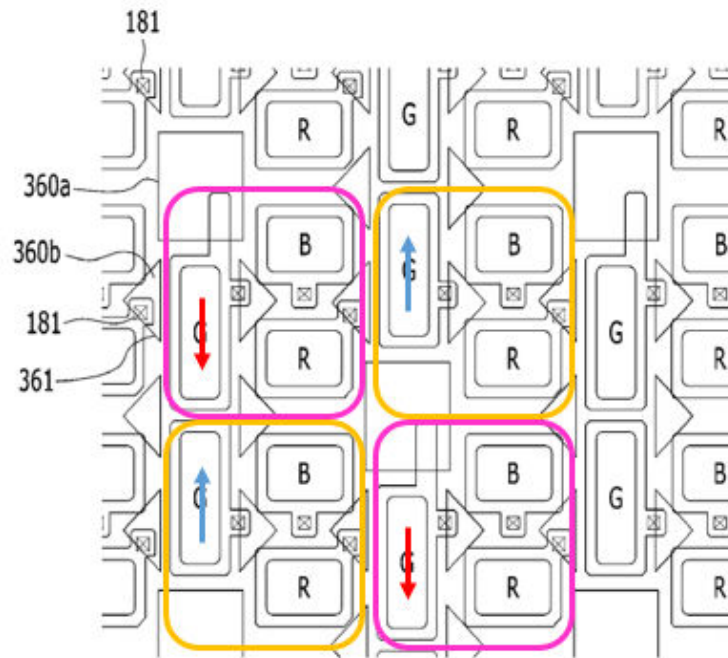
Specifically, a POSITA would have recognized that the same "biased arrangement" described in the '691 patent is also disclosed in Hwang, due to a specific structural feature in Hwang's pixel arrangement, namely "spacers" 360 that "maintain an interval of space" between adjacent subpixels. EX1005, [0047]; EX1003, 274. As shown in FIG. 7, Hwang discloses a first spacer 360a "disposed between the green pixels G that are arranged in one line" along a column, and in particular between every "two green pixels G" along the column. EX1005, [0075], FIG. 7; EX1003, 274.



EX1005, FIG. 7 (annotated)

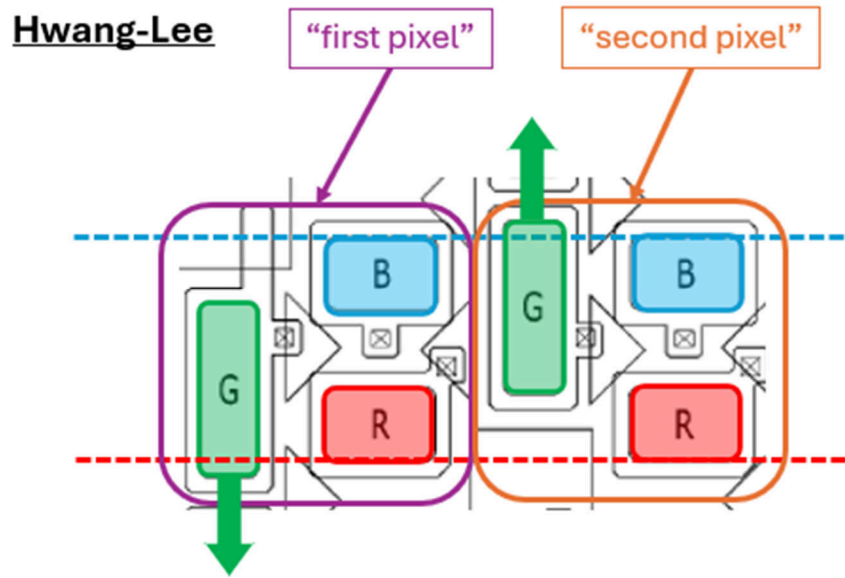
By contrast, in the column where red and blue subpixels (R, B) are arranged, “the spacer may not be disposed” in that column (instead, a second spacer 360a may be disposed “between” the column of green subpixels G and the column of red and blue subpixels R, B). EX1005, [0076], FIG. 7. EX1003, 275.

Accordingly, the green subpixels G are spaced every “two” apart by first spacers 360a along a column, while the red and blue subpixels R, B do not have any spacers in the column, resulting in a non-uniform clustered arrangement shown in FIG. 7 (below). As explained below, POSITA would have determined that, in this arrangement, every green subpixel G is positioned either closer toward a side of red subpixel R or closer toward a side of blue subpixel B. EX1003, 276.



EX1005, FIG. 7 (annotated)

More precisely, to determine this, a POSITA would have found it obvious to compare the distances between the top and bottom edges of green subpixel G with respective top and bottom edges of red and blue subpixels R, B in the same pixel, as shown below. EX1003, 277.



EX1005, FIG. 7 (annotated)

Furthermore, a POSITA would have understood or found obvious that first spacers 360a all have uniform sizes and shapes. EX1003, 278. For example, Hwang explains that spacers 360 are formed using “one photomask” including a “halftone region.” EX1005, [0054], [0134], [0143]; EX1003, 278. A POSITA would have understood that when using a photomask to fabricate repetitive features such as spacers, and to ensure Hwang’s desire for first spacers 360a “larger than” second spacers 360b (EX1005, 0076), first spacers 360a would have uniform sizes and shapes. EX1003, 278.

Therefore, in [1.6], a POSITA would have found Hwang-Lee to render obvious that green subpixel G in one of the first type of unit pixels has a biased arrangement and is positioned toward a side of red subpixel R in an array direction of red subpixel R and blue subpixel B that are arrayed alternately. EX1003, 279.

Furthermore, in [1.7], a POSITA would have found Hwang-Lee to render obvious that green pixel G in one of the second type of unit pixels has a biased arrangement and is positioned toward a side of blue pixel B in the array direction of red pixel R and blue pixel B that are arrayed alternately. EX1003, 280.

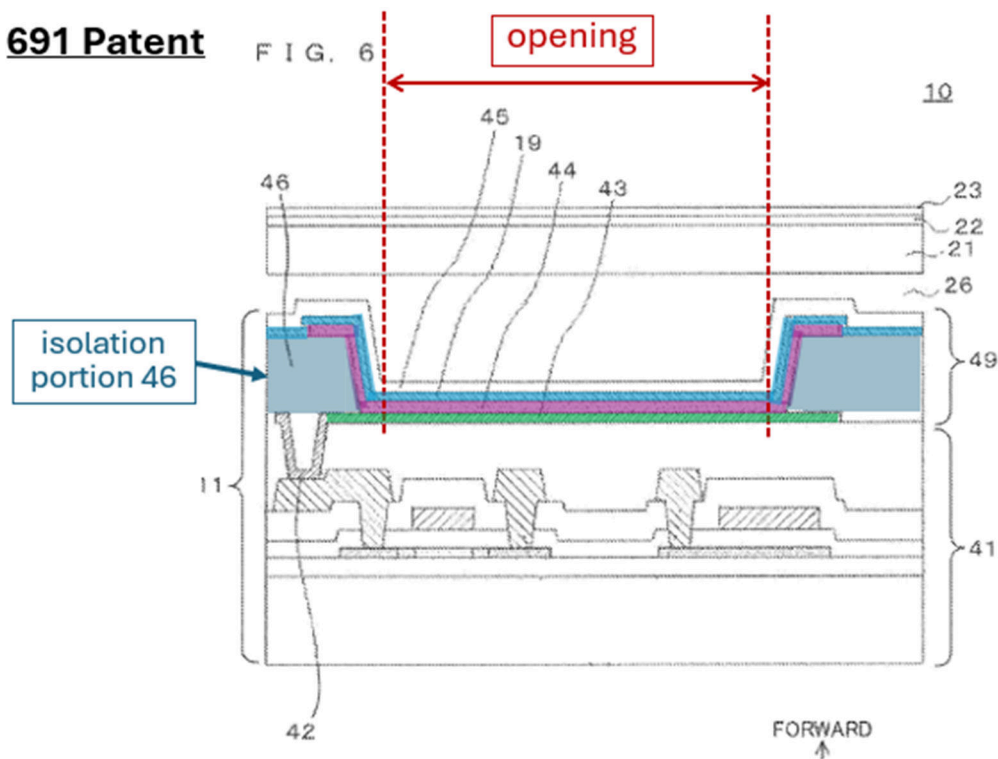
Therefore, Hwang-Lee renders obvious [1.6] and [1.7]. EX1003, 281.

[1.8] and [1.9]

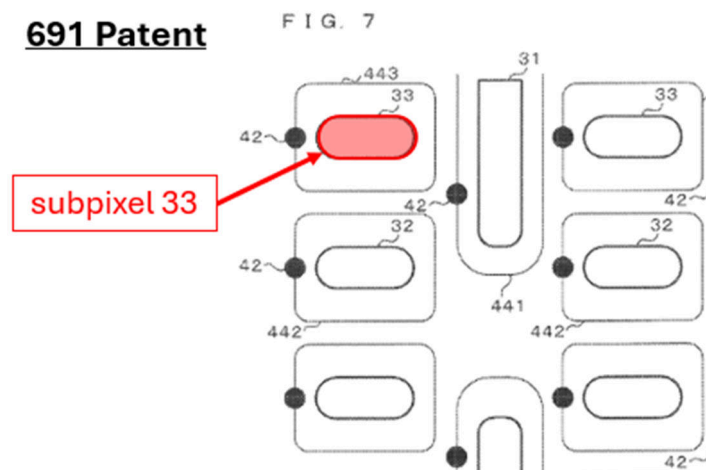
Hwang-Lee renders obvious [1.8], based on all of Hwang-Lee's "first pixels" being identical and possessing the claimed features. EX1003, 283. Hwang-Lee renders obvious [1.9], based on all of Hwang-Lee's "second pixels" being identical and possessing the claimed features. EX1003, 284.

The '691 patent explains, in describing the "shape" of a subpixel, that "isolation portion 46 is an insulating layer having **openings corresponding to the shapes** of the first subpixel 31, the second subpixel 32, and the third subpixel 33 illustrated in FIG. 4." EX1001, 9:33-36; FIG. 4; EX1003, 285. As such, the "shape" of each subpixel in the '691 patent corresponds to the "openings" in the isolation portion 46. EX1003, 286.

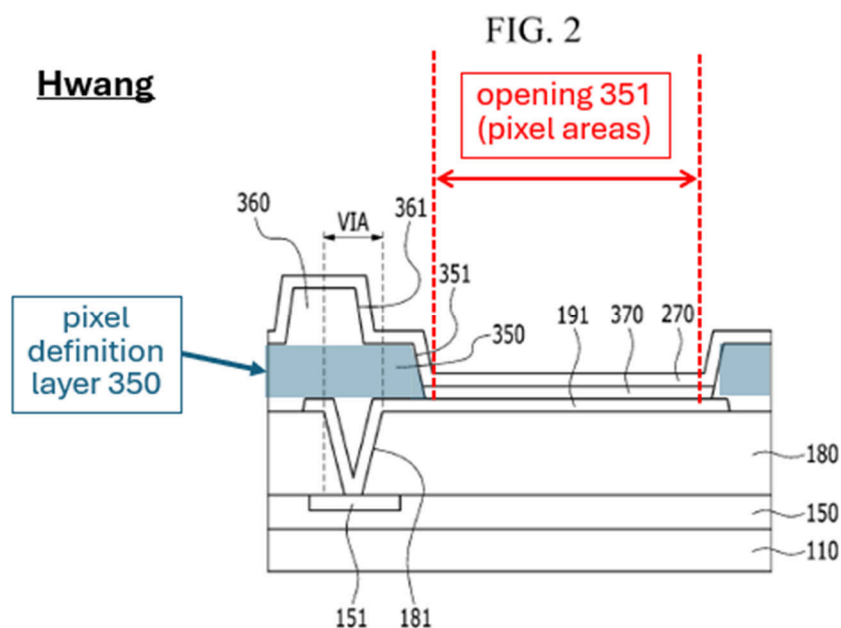
691 Patent



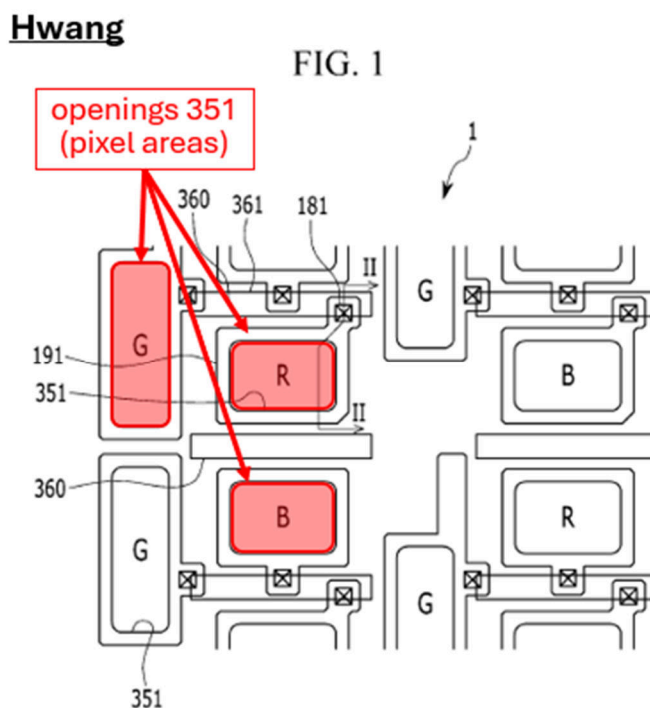
691 Patent



Similarly, Hwang defines an “opening 351” in a pixel definition layer 350 through which each of Hwang’s light emitting elements 70 emits light, thus defining a “pixel area” which is a “light-emitting region of each pixel.” EX1005, [0046], FIGS. 1, 2; EX1003, 286.



EX1005, FIG. 2 (annotated)



EX1005, FIG. 1 (annotated)

The “opening 351” in all of Hwang’s plan-view diagrams are consistently illustrated as having a rectangular shape with rounded corners, as seen in FIG. 1.

EX1005, FIGS. 1, 3, 5, 6, 7; EX1003, 287. Hwang expresses a deliberate choice in the shape of openings 351 illustrated in FIG. 1. EX1003, 287. In particular, when Hwang describes FIG. 7 as compared to FIG. 1, Hwang explains that “the **shape** and the arrangement of the red pixel R, the **green pixel G**, and the blue pixel B ... may be different.” EX1005, [0074]; EX1003, 287. Furthermore, in comparing the three subpixels (R, G, B), Hwang only compares two dimensions, “a length of a horizontal direction” and “a length of the vertical direction” of each subpixel. EX1005, [0058]; EX1003, 287. As Dr. Bretschneider explains, it was well known in the art that light-emitting regions of pixels were typically rectangular in shape. EX1003, 287 (citing EX1007, [0010], [0043], [0046], [0087]).

Hwang also explains that “a length of the vertical direction of the green pixel G” is “longer than the length of the vertical direction of either of the red pixel R or the blue pixel B.” EX1005, [0058]; EX1003, 288.

Furthermore, Hwang discloses that red subpixel R and blue subpixel B are “arranged in a vertical direction” (EX1005, [0058]) and that green subpixels G are “continuously arranged in the vertical direction” EX1005, [0059]; EX1003, 289. Hwang further explains that “a column of the green pixel G and a column where the red pixel R and the blue pixel B are arranged may be alternately arranged.” EX1005, [0059]; EX1003, 289.

Therefore, in [1.8], a POSITA would have found Hwang-Lee to render

obvious that green subpixel G in one of the first type of unit pixels has a rectangle or rounded rectangle shape whose length along the vertical direction is parallel with the direction in which red subpixel R and blue subpixel B are arrayed alternately. EX1003, 290.

Moreover, in [1.9], a POSITA would have found Hwang-Lee to render obvious that green subpixel G in one of the second type of unit pixels has a rectangle or rounded rectangle shape whose length along the vertical direction is parallel with the direction in which red subpixel R and blue subpixel B are arrayed alternately. EX1003, 291.

Therefore, Hwang-Lee renders obvious [1.8] and [1.9]. EX1003, 292.

[1.10] and [1.11]

Hwang-Lee renders obvious [1.10], based on all of Hwang-Lee's "first pixels" being identical and possessing the claimed features. EX1003, 294. Hwang-Lee renders obvious [1.11], based on all of Hwang-Lee's "second pixels" being identical and possessing the claimed features. EX1003, 295.

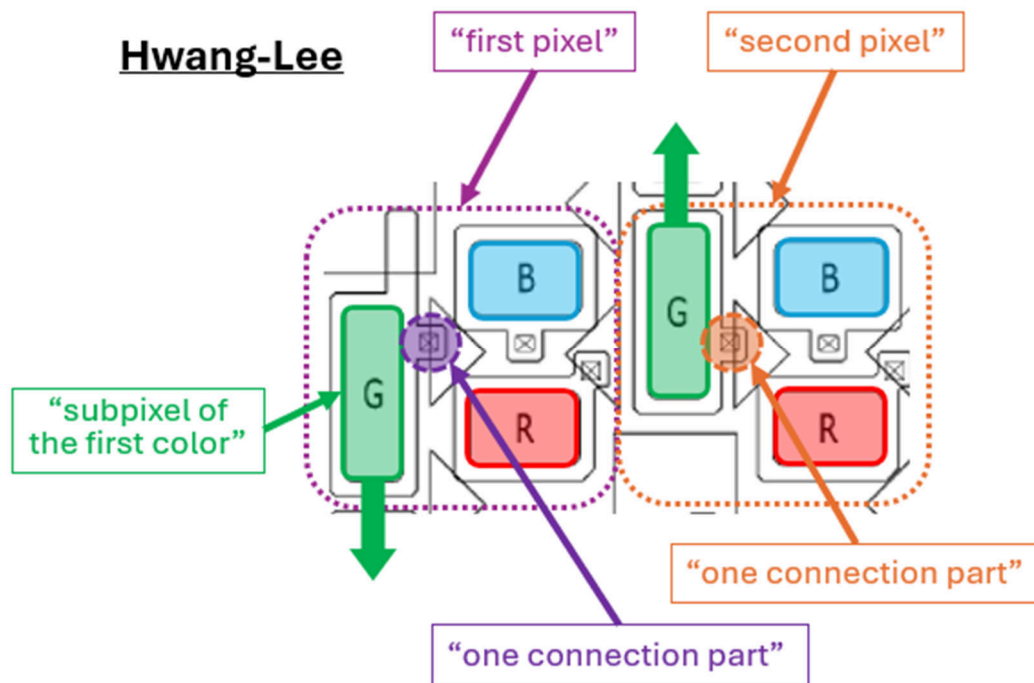
As explained for [1.3], a POSITA would have understood that the claimed "***at least one connection part***" is rendered obvious by at least two example structures in Hwang, namely Hwang's **via hole 181** into which Hwang's electrode 191 protrudes (Example 1) and Hwang's **protruded portion of pixel electrode 191** which protrudes into via hole 181 (Example 2). EX1003, 297. In both

examples, a POSITA would have found Hwang-Lee to render obvious [1.10] and [1.11]. *Id.*

Example 1

A POSITA would have recognized that in Hwang-Lee's first type of unit pixel ("***one of the first pixels***"), there is only one via hole 181 ("***one connection part***" in Example 1) for Hwang-Lee's green subpixel G ("***the subpixel of the first color***"). EX1003, 299.

Moreover, a POSITA would have found obvious that in Hwang-Lee's first type of unit pixel ("***first pixel***"), Hwang's via hole 181 ("***one connection part***" in Example 1) is biased from a middle of a long axis of Hwang's green subpixel G ("***subpixel of the first color***") toward an **upper end** of the long axis when viewed from the row direction, as shown in Hwang's FIG. 7 below, rendering obvious [1.10]. EX1003, 300.

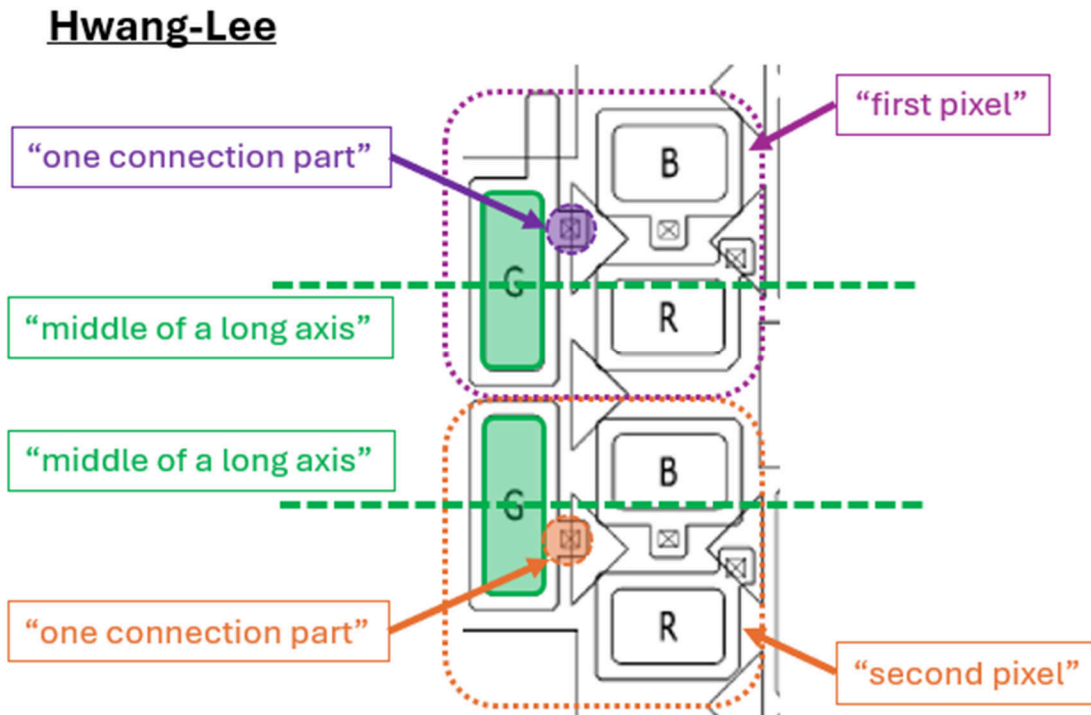


EX1005, FIG. 7 (annotated)

Specifically, as discussed for [1.6], a POSITA would have understood Hwang-Lee to render obvious that, in the first pixel, the green subpixel G (“*subpixel of the first color*”) has a biased arrangement and is positioned toward a side of the red subpixel R (“*subpixel of the second color*”). EX1003, 301. As such, a POSITA would have understood that Hwang-Lee’s green subpixel G (“*subpixel of the first color*”) would have its via hole 181 (“*one connection part*” in Example 1) positioned toward an upper end of subpixel G to ensure that the via hole 181 is positioned in a space between the adjacent red and blue subpixels, as shown in annotated FIG. 7 below. *Id.*

To determine this, a POSITA would have found it obvious to compare the vertical position of Hwang’s via hole 181 (“*one connection part*” in Example 1)

with respect to a mid-point of the green subpixel G, as shown below. EX1003, 302.



EX1005, FIG. 7 (annotated)

In doing so, a POSITA would have found Hwang-Lee to render obvious that the via hole 181 (*"at least one connection part"* in Example 1) of the green subpixel G (*"subpixel of the first color"*) in one of the first type of unit pixels (*"one of the first pixels"*) is only one via hole 181 (*"one connection part"* in Example 1) and is biased from a middle of a long axis of the green subpixel G (*"subpixel of the first color"*) toward an end of the long axis when viewed from the row direction, thus rendering obvious [1.10]. EX1003, 303.

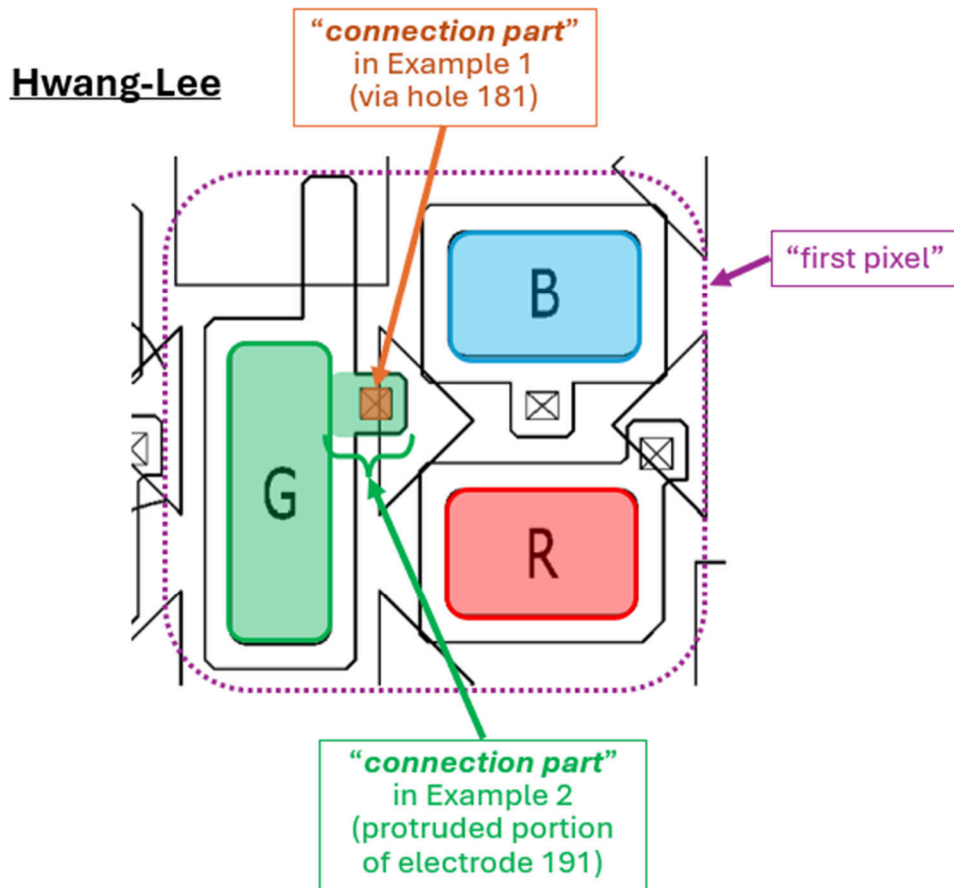
Analogously, for [1.11], the arrangements of Hwang-Lee's green subpixel G and its via hole 181 in the first pixel and second pixel are mirror images, and a

POSITA would have found Hwang-Lee to render obvious that the via hole 181 (“*at least one connection part*” in Example 1) of the green subpixel G (“*subpixel of the first color*”) in one of the second type of unit pixels (“*one of the second pixels*”) is only one via hole 181 (“*one connection part*” in Example 1) and is biased from a middle of a long axis of the green subpixel G (“*subpixel of the first color*”) toward an end of the long axis when viewed from the row direction, thus rendering obvious [1.11]. EX1003, 304.

Therefore, a POSITA would have found Hwang-Lee to render obvious [1.10] and [1.11] in Example 1. EX1003, 305.

Example 2

As explained for [1.3], in Example 2, Hwang’s protruded portion of pixel electrode 191 also renders obvious the claimed “*at least one connection part*”. EX1003, 307. Moreover, a POSITA would have recognized that Hwang’s protruded portion of pixel electrode 191 (“*at least one connection part*” in Example 1) is arranged at **the same position** as Hwang’s via hole 181 into which Hwang’s protruded portion of electrode 191 extends (“*at least one connection part*” in Example 2). EX1005, FIG. 7; EX1003, 307.



EX1005, FIG. 7 (annotated)

Therefore, for reasons similar to those discussed in regard to Example 1, a POSITA would have found Hwang-Lee to render obvious [1.10] and [1.11] in Example 2. EX1003, 308.

[1.12]

As discussed for [1.3], [1.10], [1.11], a POSITA would have understood that the claimed **"connection part"** is rendered obvious by at least two example structures in Hwang, namely Hwang's **via hole 181** into which Hwang's electrode 191 protrudes (Example 1) and Hwang's **protruded portion of pixel electrode**

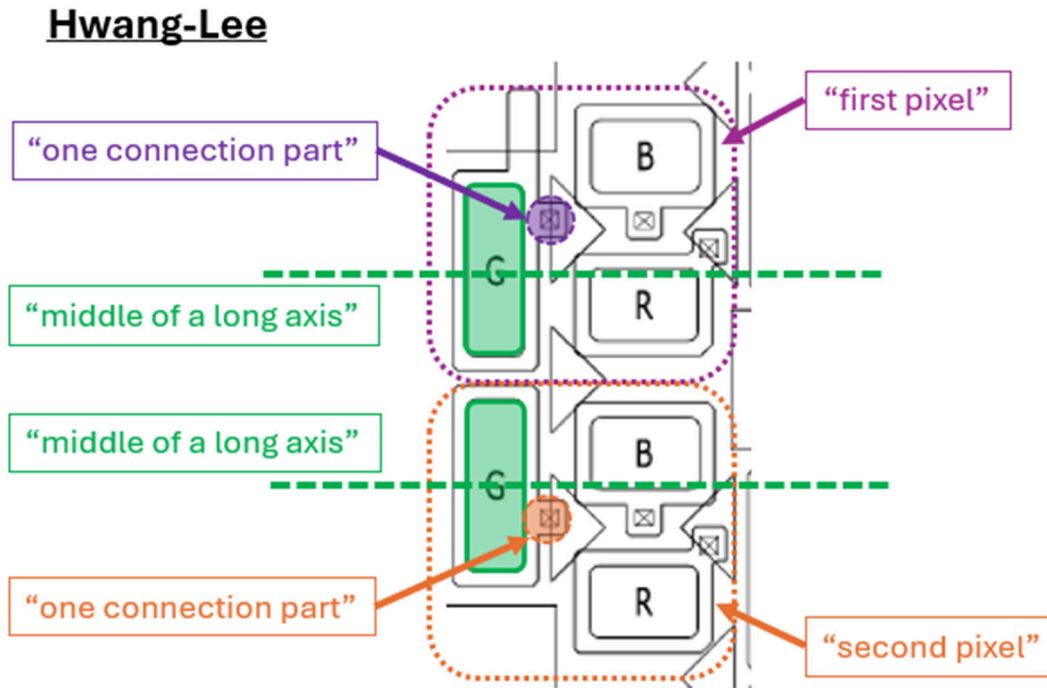
191 which protrudes into via hole 181 (Example 2). In both examples, a POSITA would have found Hwang-Lee to render obvious [1.12]. EX1003, 309-311.

As discussed for [1.10] and [1.11], in Hwang-Lee's first and second pixels, each of Hwang's via 181 ("***connection part***" in Example 1) and Hwang's protruded portion of electrode 191 ("***connection part***" in Example 2) is biased from a middle of a long axis of Hwang-Lee's green subpixel G ("***subpixel of the first color***") in opposite directions, i.e., biased toward an **upper end** of the long axis in the **first pixel** and biased toward a **lower end** of the long axis in the **second pixel**. EX1003, 312.

Therefore, in Example 1, a POSITA would have found Hwang-Lee to render obvious that a biased position where Hwang's via 181 ("***connection part***" in Example 1) of green subpixel G ("***subpixel of the first color***") in the first pixel is disposed with respect to the middle of the long axis of green subpixel G ("***subpixel of the first color***") in the first pixel when viewed from the row direction is **relatively different** from a biased position where Hwang's **via 181** ("***connection part***" in Example 1) of green subpixel G ("***subpixel of the first color***") in the second pixel is disposed with respect to the middle of the long axis of green subpixel G ("***subpixel of the first color***") in the second pixel when viewed from the row direction. EX1003, 313.

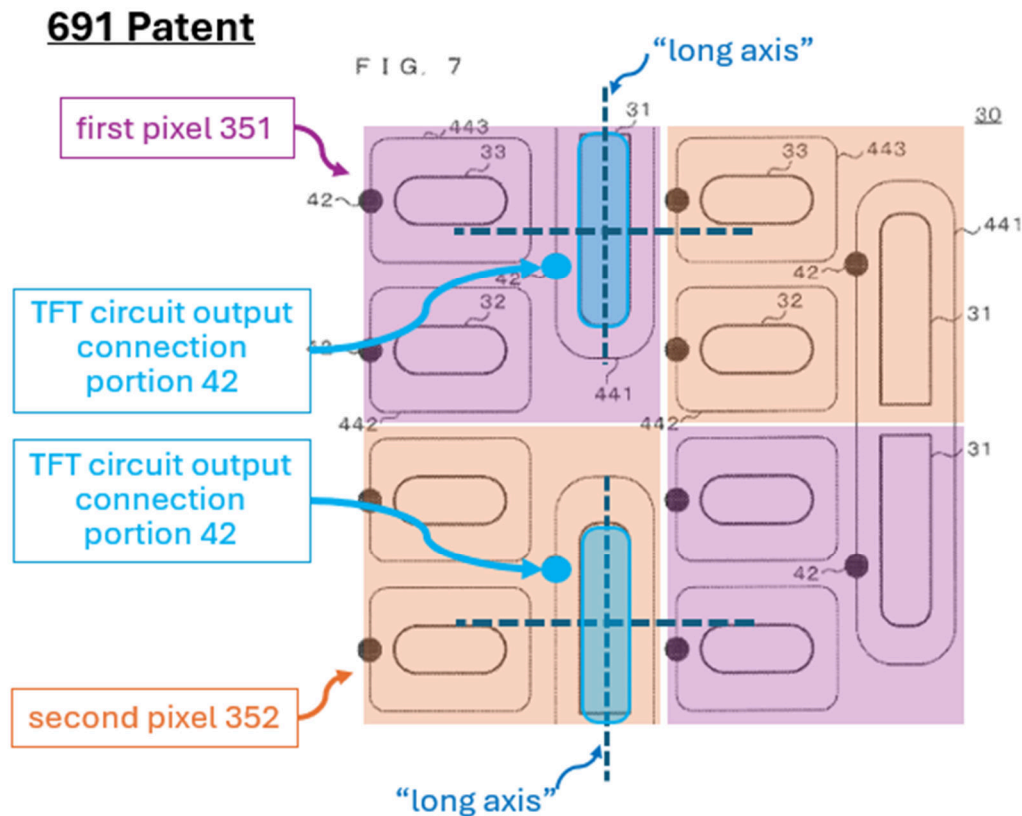
Similarly, in Example 2, a POSITA would have understood that applying the

same analysis as above with Hwang's protruded portion of pixel electrode 191 ("connection part" in Example 2) instead of Hwang's via hole 181 ("connection part" in Example 1) would yield the same result. EX1003, 314.



EX1005, FIG. 7 (annotated)

This is consistent with how the '691 patent describes [1.12], as illustrated in FIG. 7 (below) which shows "TFT circuit output connection portion 42" (in first and second pixels) arranged in *relatively different* (mirror image) positions with respect to the middle of a long axis of the respective subpixels of the first color (31). EX1001, FIG. 7; EX1003, 315.



EX1001, FIG. 7 (annotated)

Therefore, a POSITA would have found Hwang-Lee to render obvious [1.12]. EX1003, 316.

[1.13]

As discussed for [1.3], [1.10], [1.11], a POSITA would have understood that the claimed “*connection part*” is rendered obvious by at least two example structures in Hwang, namely Hwang’s **via hole 181** into which Hwang’s electrode 191 protrudes (Example 1) and Hwang’s **protruded portion of pixel electrode 191** which protrudes into via hole 181 (Example 2). EX1003, 317-320. In both examples, a POSITA would have found Hwang-Lee to render obvious [1.13].

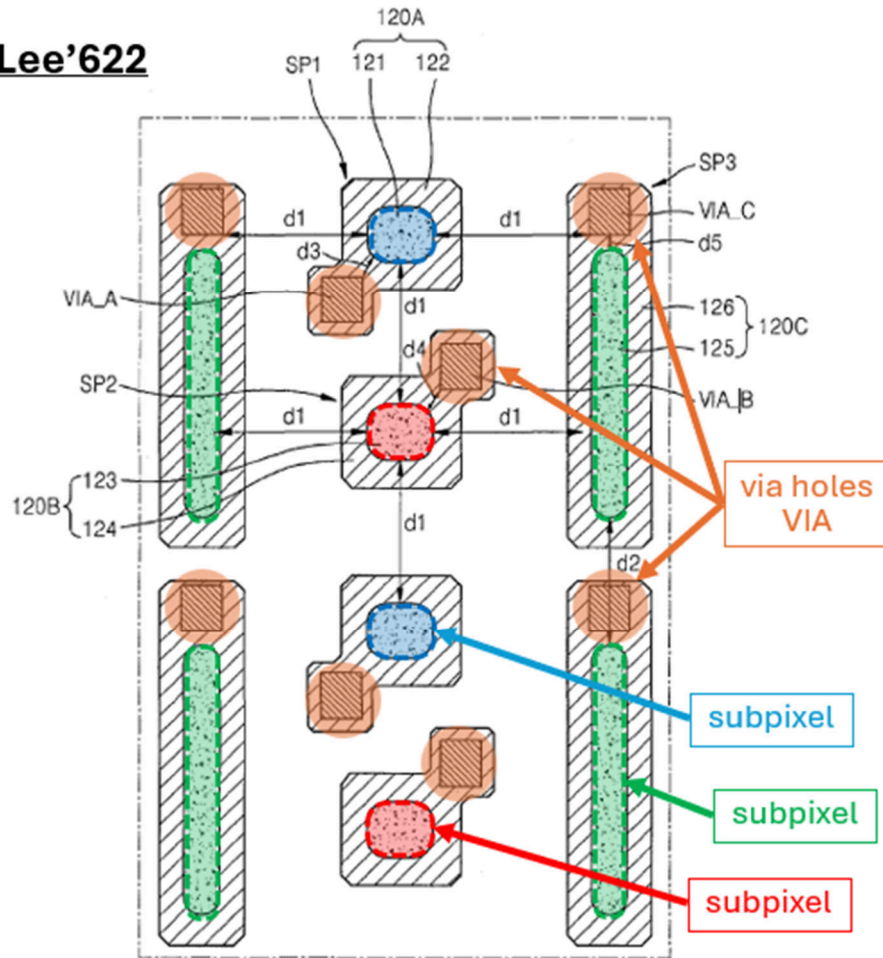
EX1003, 320.

As discussed for [1.10] and [1.11], each Hwang-Lee subpixel has a “pixel electrode 191” that is “protruded toward a space between” the subpixels, thereby being connected to electrode 151 of semiconductor element through the via hole 181.” EX.1005, [0038], [0039], [0043], [0044], FIG. 7; EX1003, 321. As disclosed in Hwang, this is true for “each” of Hwang-Lee’s subpixels regardless of its specific positioning arrangement. EX1005, [0044]; EX1003, 321.

Furthermore, Lee provides further details of the well-known feature of implementing “via holes” to be in relatively same positions with respect to subpixels, in each unit pixel. EX1006, [0116], [0120]-[0126], FIGS. 6, 10-13; EX1003, 322.

FIG. 10

Lee'622



EX1006, FIG. 10 (annotated)

For example, Lee provides details of specific distances of spacing between via holes and corresponding sub-pixels. EX1006, FIGS. 10-11, [0120]-[0122]; EX1003, 323. A POSITA would have understood, based on the disclosure in Lee, that the dimensions shown and described in FIG. 10 are applicable to both pixels (first pixel and second pixel) shown in FIG. 10. *Id.*

As Dr. Bretschneider explains, a POSITA would have understood that it was well known in the art to have a specific and consistent arrangement of via holes

(also referred to as “contact holes” in the art) for different pixels, rather than having them differ across different pixels. EX1003, 324 (citing EX1010, [0014]).

Therefore, in Example 1, a POSITA would have found Hwang-Lee to render obvious that a position where Hwang’s via 181 (“*connection part*” in Example 1) is disposed with respect to Hwang-Lee’s red subpixel R (“*subpixel of the second color*”), a position where Hwang’s via 181 (“*connection part*” in Example 1) is disposed with respect to Hwang-Lee’s blue subpixel B (“*subpixel of the third color*”) and a position where Hwang’s via 181 (“*connection part*” in Example 1) is disposed with respect to Hwang-Lee’s green subpixel G (“*subpixel of the first color*”) in the first pixel are relatively same as a position where Hwang’s via 181 (“*connection part*” in Example 1) [is disposed] with respect to Hwang-Lee’s red subpixel R (“*subpixel of the second color*”), a position where Hwang’s via 181 (“*connection part*” in Example 1) is disposed with respect to Hwang-Lee’s blue subpixel B (“*subpixel of the third color*”) and a position where Hwang-Lee’s via 181 (“*connection part*” in Example 1) is disposed with respect to Hwang-Lee’s Green subpixel G (“*subpixel of the first color*”) in the second pixel. EX1003, 325.

Similarly, in Example 2, a POSITA would have understood that applying the same analysis as above with Hwang’s protruded portion of pixel electrode 191 (“*connection part*” in Example 2) instead of Hwang’s via hole 181 (“*connection part*” in Example 1) would yield the same result. EX1003, 326.

For these reasons, a POSITA would have found Hwang-Lee to render obvious [1.13]. EX1003, 327.

[1.14]

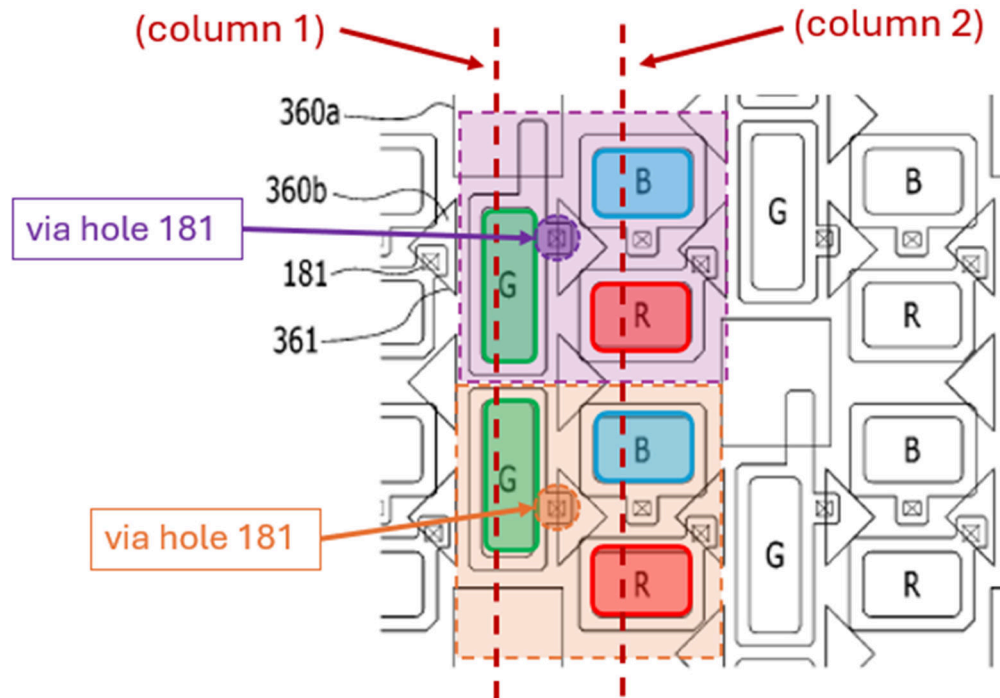
As discussed for [1.1], Hwang-Lee discloses a pixel array including a first type of unit pixel (“**first pixel**”) and a second type of unit pixel (“**second pixel**”) that are arrayed in the column direction. EX1003, 328-329.

In addition, as discussed for [1.3], [1.10], [1.11], a POSITA would have understood that the claimed “**connection part**” is rendered obvious by at least two example structures in Hwang, namely Hwang’s **via hole 181** into which Hwang’s electrode 191 protrudes (Example 1) and Hwang’s **protruded portion of pixel electrode 191** which protrudes into via hole 181 (Example 2). EX1003, 330. In both examples, a POSITA would have found Hwang-Lee to render obvious [1.14]. *Id.*

In Example 1, as seen in FIG. 7, Hwang’s via 181 (“**connection part**” in Example 1) of Hwang-Lee’s green subpixel G (“**subpixel of the first color**”) is **disposed between**: (A) a column where red subpixel R (“**subpixel of the second color**”) and blue subpixel B (“**subpixel of the third color**”) are alternately arrayed and (B) a column where green subpixels G (“**subpixel of the first color**”) are arranged in parallel with the column where red subpixel R and blue subpixel B are alternately arrayed. EX1005, [0039], [0041], [0049], [0058], FIG. 7; EX1003,

331.

Hwang-Lee



EX1005, FIG. 7 (annotated)

Similarly, in Example 2, a POSITA would have understood that applying the same analysis as above with Hwang's protruded portion of pixel electrode 191 ("**connection part**" in Example 2) instead of Hwang's via hole 181 ("**connection part**" in Example 1) would yield the same result. EX1003, 332.

Therefore, Hwang-Lee renders obvious [1.14].

[2.pre]

Hwang-Lee renders obvious the display device of claim 1. See [1.pre]-[1.14].

[2.1]

As discussed for [1.3], [1.10], [1.11], a POSITA would have understood that the claimed “***at least one connection part***” is rendered obvious by at least two example structures in Hwang, namely Hwang’s **via hole 181** into which Hwang’s electrode 191 protrudes (Example 1) and Hwang’s **protruded portion of pixel electrode 191** which protrudes into via hole 181 (Example 2). EX1003, 334. In both examples, a POSITA would have found Hwang-Lee to render obvious [2.1]. *Id.*

In Example 1, Hwang explains that “pixel electrode 191” of light emitting element 70 “may function as an **anode** and is electrically connected through a via hole (181)” (“***at least one connection part***” in Example 1) which “enables current or voltage applied from the thin-film transistor (TFT) circuit to be transmitted to the pixel electrode.” EX1005, [0039]-[0044]; EX1003, 335.

Furthermore, Hwang discloses with regard to FIG. 11 that the “drain electrode of the driving transistor T6 is electrically connected to the anode 191 of the organic light-emitting diode (OLED) through the via hole 181” (“***at least one connection part***” in Example 1). EX1005, [0084]; EX1003, 336.

Similarly, in Example 2, a POSITA would have understood that applying the same analysis as above with Hwang’s protruded portion of pixel electrode 191 (“***at least one connection part***” in Example 2) instead of Hwang’s via hole 181 (“***at***

least one connection part” in Example 1) would yield the same result, at least because Hwang’s protruded portion of pixel electrode 191 extends into Hwang’s via hole 181. EX1005, FIGS. 2, 11; EX1003, 337.

Therefore, a POSITA would have understood Hwang-Lee to render obvious [2.1]. EX1003, 338.

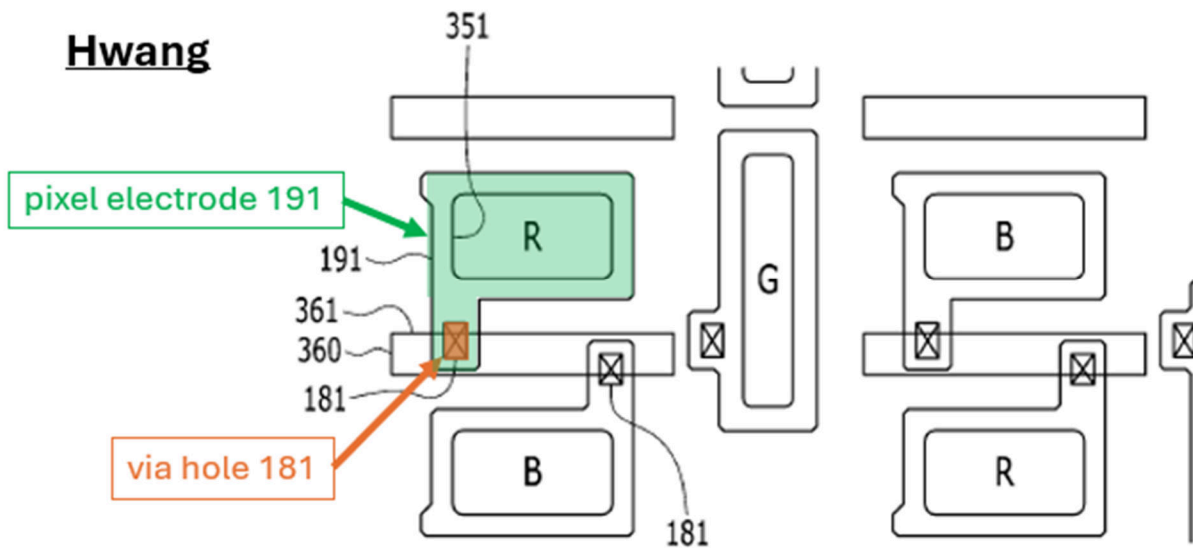
[3.pre]

Hwang-Lee renders obvious the display device of claim 2. *See* [2.pre]-[2.1].

[3.1]

As discussed for [1.3], [1.10], [1.11], a POSITA would have understood that the claimed “*at least one connection part*” is rendered obvious by Hwang’s **via hole 181** into which Hwang’s electrode 191 protrudes (Example 1). EX1003, 339.

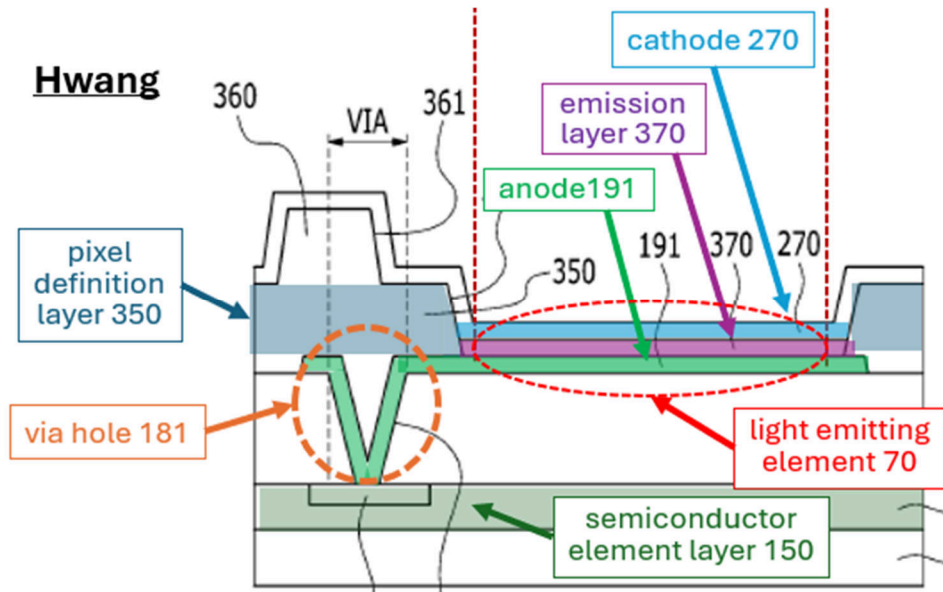
As shown in FIGS. 1, 6, and 7, a position where Hwang’s via hole 181 (“*at least one connection part*” in Example 1) is disposed overlaps Hwang’s pixel electrode 191 (“*anode electrode*”) in a plan view. EX1003, 340.



EX1005, FIG. 6 (annotated)

Hwang explains that “pixel electrode 191” is “protruded toward a space between the pixels, thereby being connected to the electrode 151 of the semiconductor element through the via hole 181.” EX1005, [0043], FIGS. 1, 6, 7; EX1003, 341.

A POSITA would have understood that this overlap in the plan view is due to Hwang’s anode electrode 191 extending into Hwang’s via hole 181 as shown in the cross-section view of FIG 6. EX1005, FIG. 2; EX1003, 342.



EX1005, FIG. 2 (annotated)

Therefore, a POSITA would have understood Hwang-Lee to render obvious [3.1]. EX1003, 343.

[4.pre]

Hwang-Lee renders obvious the display device of claim 1. See [1.pre]-[1.14].

[4.1]

Hwang discloses an “equivalent circuit diagram” in FIG. 8 for a subpixel, and further discloses in FIGS. 9-10 a “layout view of a plurality of transistors and capacitors” for a subpixel. EX1005, [0080], [0081], [0099], EX1003, 345. Hwang also discloses in FIGS. 11-15 a cross-sectional view of driving transistor T6 of a subpixel. EX1005, [0120]; EX1003, 345.

A skilled artisan would have understood that Hwang’s disclosures above are

applicable to each of Hwang-Lee's subpixels. EX1003, 346.

Furthermore, Lee describes an identical circuit arrangement pattern for the subpixels of the first to third colors, e.g., by providing a plan view of a pixel circuit and explains the pixel circuit arrangement is "equally applied" to any of red, green, and blue sub-pixels. EX1006, [0083], FIG. 7; EX1003, 347.

FIG. 7

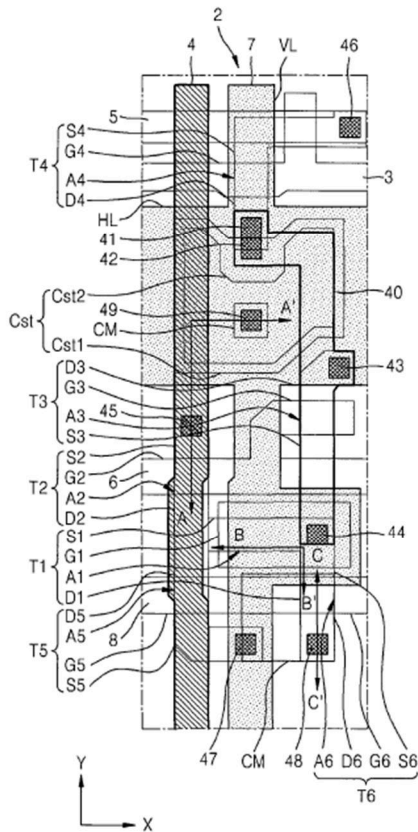
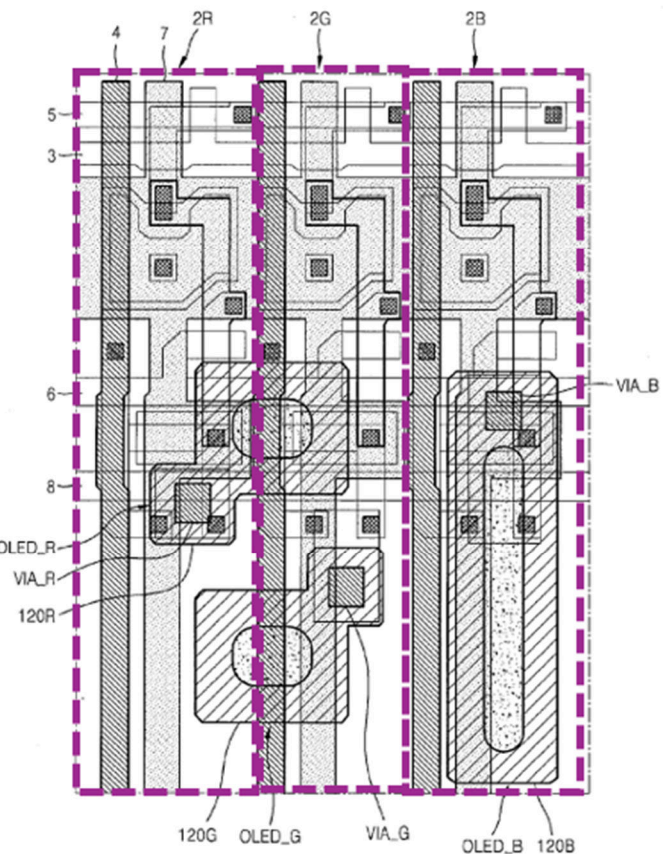


FIG. 6



EX1006, FIGS. 6, 7 (annotated)

Therefore, a POSITA would have understood Hwang-Lee to render obvious [4.1]. EX1003, 348.

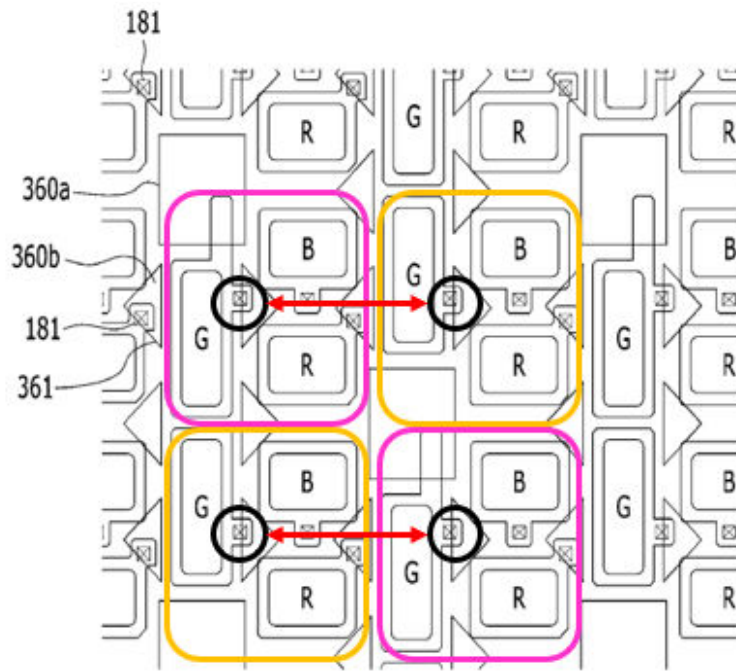
[5.pre]

Hwang-Lee renders obvious the display device of claim 1. *See* [1.pre]-[1.14].

[5.1]

Based on the discussion for [1.3], [1.10], [1.11], a POSITA would have understood that each of the claimed “***first connection part***” and “***second connection part***” in [5.1] is rendered obvious by at least two example structures in Hwang, namely Hwang’s **via hole 181** into which Hwang’s electrode 191 protrudes (Example 1) and Hwang’s **protruded portion of pixel electrode 191** which protrudes into via hole 181 (Example 2). EX1003, 351. Each of Hwang-Lee’s unit pixels implements these structures, and in both examples, a POSITA would have found Hwang-Lee to render obvious [5.1]. *Id.*

In Example 1, a POSITA would have understood Hwang-Lee to render obvious that, in one of the first pixels and one of the second pixels that are adjacent in the row direction, a distance between (A) Hwang’s **via 181** (“***first connection part***” in Example 1) for green subpixel G (“***subpixel of the first color***”) in one of Hwang-Lee’s first pixels and (B) Hwang’s **via 181** (“***second connection part***”) for green subpixel G (“***subpixel of the first color***”) in one of Hwang-Lee’s second pixels are consistent in the display unit, independent of the biased arrangements of the subpixels. EX1003, 352.



EX1005, FIG. 7 (annotated)

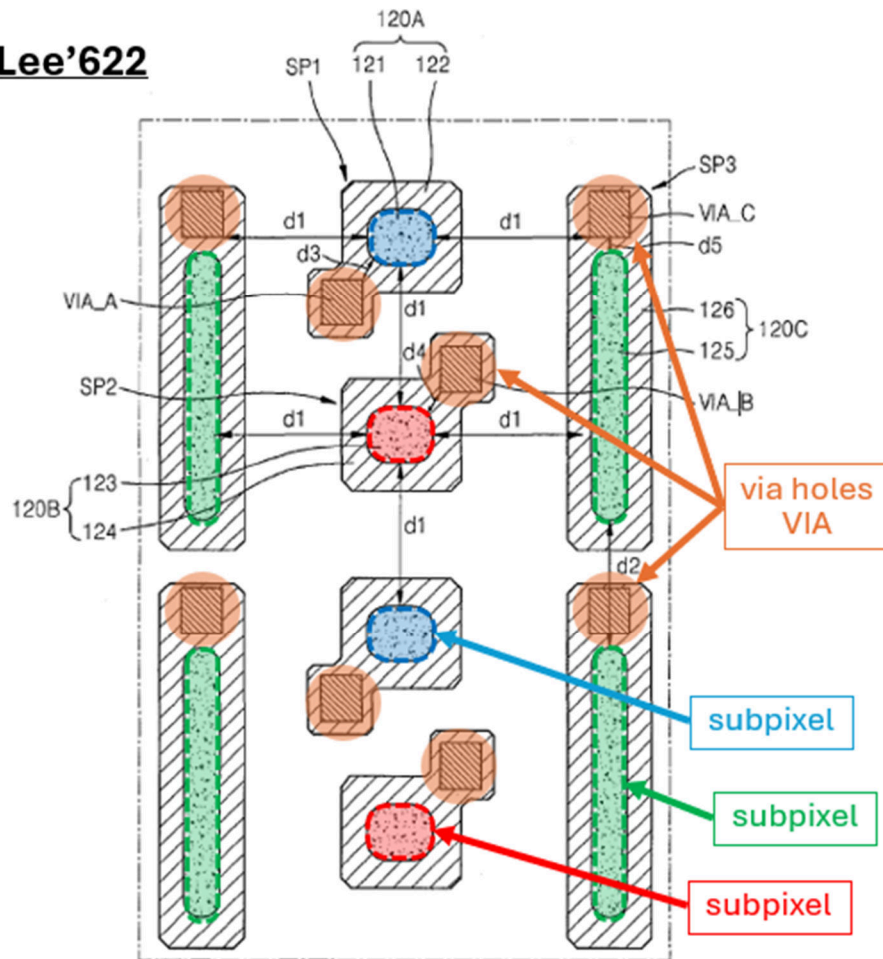
In particular, a POSITA would have understood that Hwang's pixel arrangement follows a repetitive pattern, and that Hwang's **via 181** ("*first/second connection part*" in Example 1) of same-color subpixels between adjacent pixels in the row direction follow the same pattern. EX1003, 353.

As such, a POSITA would have found obvious that regardless of how different subpixels are specifically positioned in a pixel, the distance between Hwang's **via 181** ("*first/second connection part*" in Example 1) of same-color subpixels in adjacent pixels is consistently maintained. EX1005, [0099], [0120], [0139]; EX1003, 354.

Explicit evidence of this is found in Lee, which discloses specific distances between via holes of same-colored subpixels in row-adjacent pixels. EX1003, 355.

For example, Lee specifies, in FIG. 10, the same distance “d1” between via holes of the longer subpixel in row-adjacent pixels. EX1006, [0117]-[0119], [0129]. [0135]; EX1003, 355.

FIG. 10
Lee’622



EX1006, FIG. 10 (annotated)

Lee emphasizes that “**the first distance d1** ... between each of subpixels of different colors **may be maintained**” and explains a benefit that “by maintaining the substantially constant distance between each of the subpixels, a shadowing effect in which a boundary between each of adjacent organic layers becomes vague

during processes of forming the sub-pixels may be reduced.” EX1006, [0135]; EX1003, 356.

Similarly, in Example 2, a POSITA would have understood that applying the same analysis as above with Hwang’s protruded portion of pixel electrode 191 (“**connection part**” in Example 2) instead of Hwang’s via hole 181 (“**connection part**” in Example 1) would yield the same result, at least because Hwang’s protruded portion of pixel electrode 191 extends into Hwang’s via hole 181 and is therefore arranged at the same position. EX1005, FIGS. 2, 11; EX1003, 357.

Therefore, a POSITA would have understood Hwang-Lee to render obvious [5.1]. EX1003, 358.

[6.pre]

Hwang-Lee renders obvious the display device of claim 1. *See* [1.pre]-[1.14].

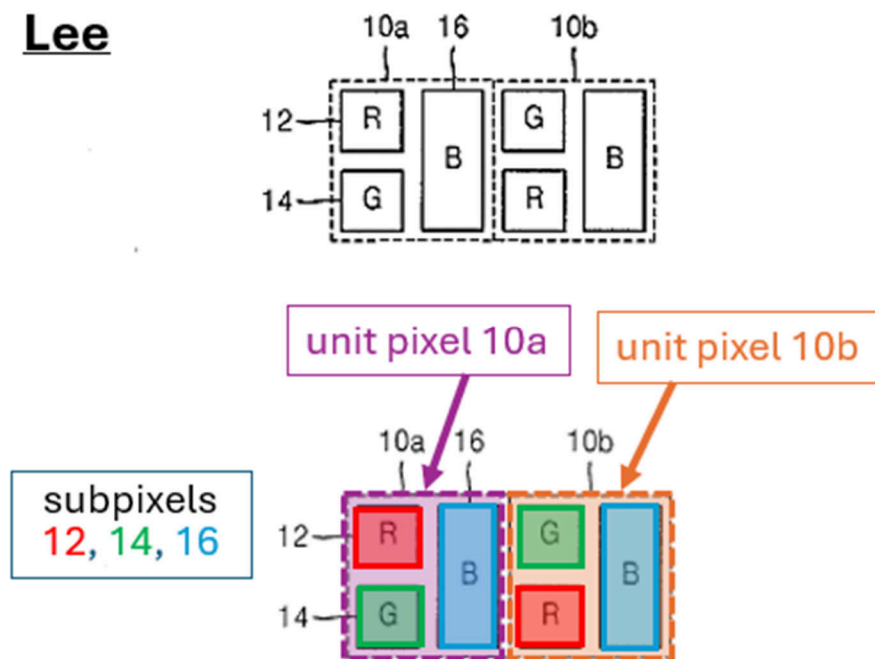
[6.1], [6.2], and [6.3]

Regarding the claimed “*first square*” and “*second square*,” the ’691 patent explains that a “boundary line” of a pixel is merely “virtual” and is not an actual “member” that exists in reality. EX1001, 7:27-38; EX1003, 360.

Lee discloses and delineates boundaries of unit pixels 10a (“**first pixels**”) and unit pixels 10b (“**second pixels**”) formed of first through third sub-pixels 12, 14, 16 (“**subpixels of three colors**”). EX1006, [0049]-[0053], FIGS. 2, 6; EX1003,

361.

Specifically, the boundaries of Lee's first and second unit pixels (10a, 10b) do not cross any of subpixels (12, 14, 16). EX1006, FIGS. 2, 6; EX1003, 362. Moreover, the boundaries of Lee's first and second unit pixels (10a, 10b) each enclose a respective region including respective subpixels (12, 14, 16) included in the unit pixel, while excluding other subpixels. *Id.* And, the boundaries of Lee's first and second unit pixels (10a, 10b) do not overlap each other. *Id.*



EX1006, FIG. 2 (annotated and un-annotated versions)

Therefore, a POSITA would have understood Hwang-Lee to render obvious [6.1], [6.2], and [6.3]. EX1003, 363-364.

[8.pre]

Hwang-Lee renders obvious the display device of claim 1. *See* [1.pre]-

[1.14].

[8.1]

As discussed in [1.3], [1.10], [1.11], a POSITA would have understood that the claimed “***at least one connection part***” in [8.1] is rendered obvious by at least two example structures in Hwang, namely Hwang’s **via hole 181** into which Hwang’s electrode 191 protrudes (Example 1) and Hwang’s **protruded portion of pixel electrode 191** which protrudes into via hole 181 (Example 2). EX1003, 365. In both examples, a POSITA would have found Hwang-Lee to render obvious [8.1]. *Id.*

In Example 1, as explained for [1.4], Hwang describes “via 181” (“***at least one connection part***” in Example 1) that connects “pixel electrode 191” of one subpixel to “electrode 151 of the semiconductor element.” EX1005, [0043], FIGS. 2, 11; EX1003, 366.

Hwang’s FIGS. 2, 7, and 11 show **only one** “via 181” that connects each subpixel to the semiconductor element (TFT T6). EX1005, FIGS. 2-7; EX1003, 367.

As Dr. Bretschneider explains, a POSITA would have understood that display devices typically implemented only one connection between a subpixel and its pixel circuitry. EX1003, 368. As Dr. Bretschneider explains, POSITA would have been motivated to simplify and reduce the number of steps involved in

manufacturing a display device. *Id.* With this understanding and motivation, Dr. Bretschneider explains that a POSITA would have understood that including additional via holes, in addition to “via 181,” for the purpose of connecting a subpixel to the semiconductor element (TFT T6) would have been unnecessary and inefficient. *Id.* For these reasons, a POSITA would have understood and found obvious that, in Hwang-Lee, the TFT circuit and one of the subpixels are connected by only one of the at least one connection part, as shown in Hwang’s FIGS. 2, 7, and 11. *Id.*

Similarly, in Example 2, a POSITA would have understood that applying the same analysis as above with Hwang’s protruded portion of pixel electrode 191 (“*connection part*” in Example 2) instead of Hwang’s via hole 181 (“*connection part*” in Example 1) would yield the same result, at least because Hwang’s protruded portion of pixel electrode 191 extends into Hwang’s via hole 181 and contacts Hwang’s semiconductor element layer 150 (“*the TFT circuit*”). EX1005, FIGS. 2, 11; EX1003, 369.

Therefore, a POSITA would have understood Hwang-Lee to render obvious [8.1]. EX1003, 370.

D. [GROUND 5] – Claim 7 Is Rendered Obvious By Hwang, Lee, and Park’531

Below, the Petition relies on Park’531 for the limited feature that an OLED

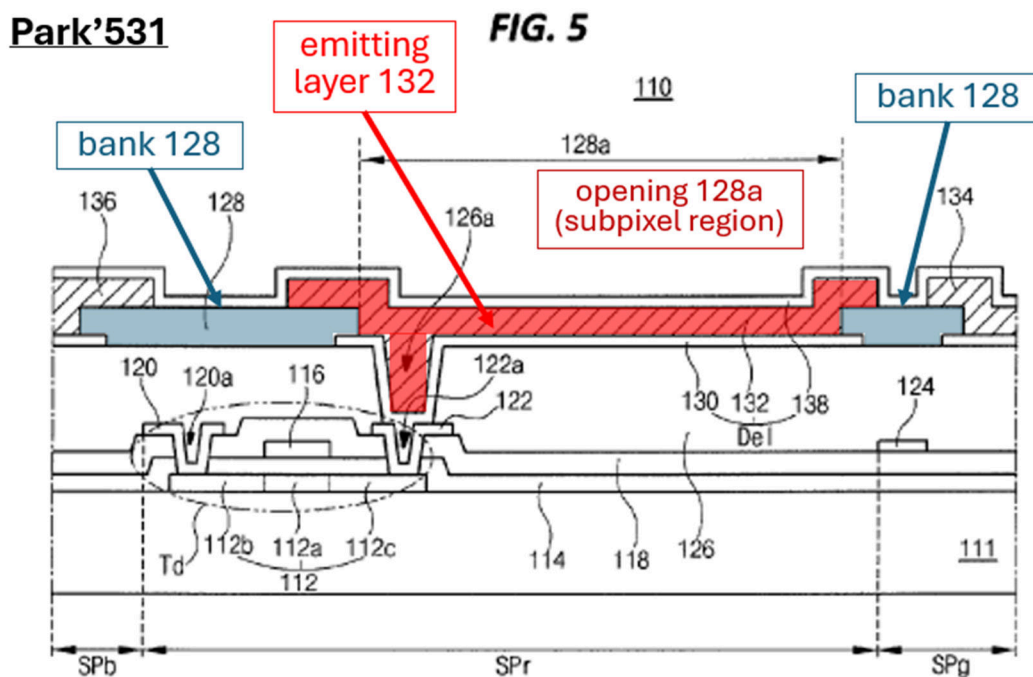
layer of a subpixel can be disposed above and overlap a connection part that connects the subpixel to a TFT circuit. EX1003, 371. While this feature of Park'531 relates only to the structure of a single subpixel, Park'531 also discloses an arrangement of multiple sub-pixels that shares numerous similarities with Hwang and Lee. *Id.* As such, a POSITA would have naturally turned to the disclosure of Park'531 for additional details that would be applicable to the Hwang-Lee combination. *Id.*

1. Overview of Park'531

Park'531 is directed to an organic electroluminescent display (OLED) device that displays images by combining three primary colors emitted from an arrangement of pixels. EX1007, Abstract, [0003],[0005], [0009]; EX1003, 133.

Park'531 discloses fabricating an “emitting layer” of an individual “sub-pixel” in an OLED display device. EX1007, [0005], [0012], [0015], [0048], [0070], [0074]-[0079], [0080]-[0082]; EX1003, 134. In particular, Park'531 explains a well-known technique of “thermal deposition using a shadow mask.” EX1007, [0012]; EX1003, 134. The metal shadow mask has numerous “opening portions” through which an “emitting material” is deposited onto a sub-pixel region. EX1007, [0012], [0047], [0080]-[0082], [0094]; EX1003, 134. In particular, the emitting material is deposited into an “opening” of a “bank,” where the sub-pixel is to be formed. EX1007, [0047]-[0049]; EX1003, 134. As a result,

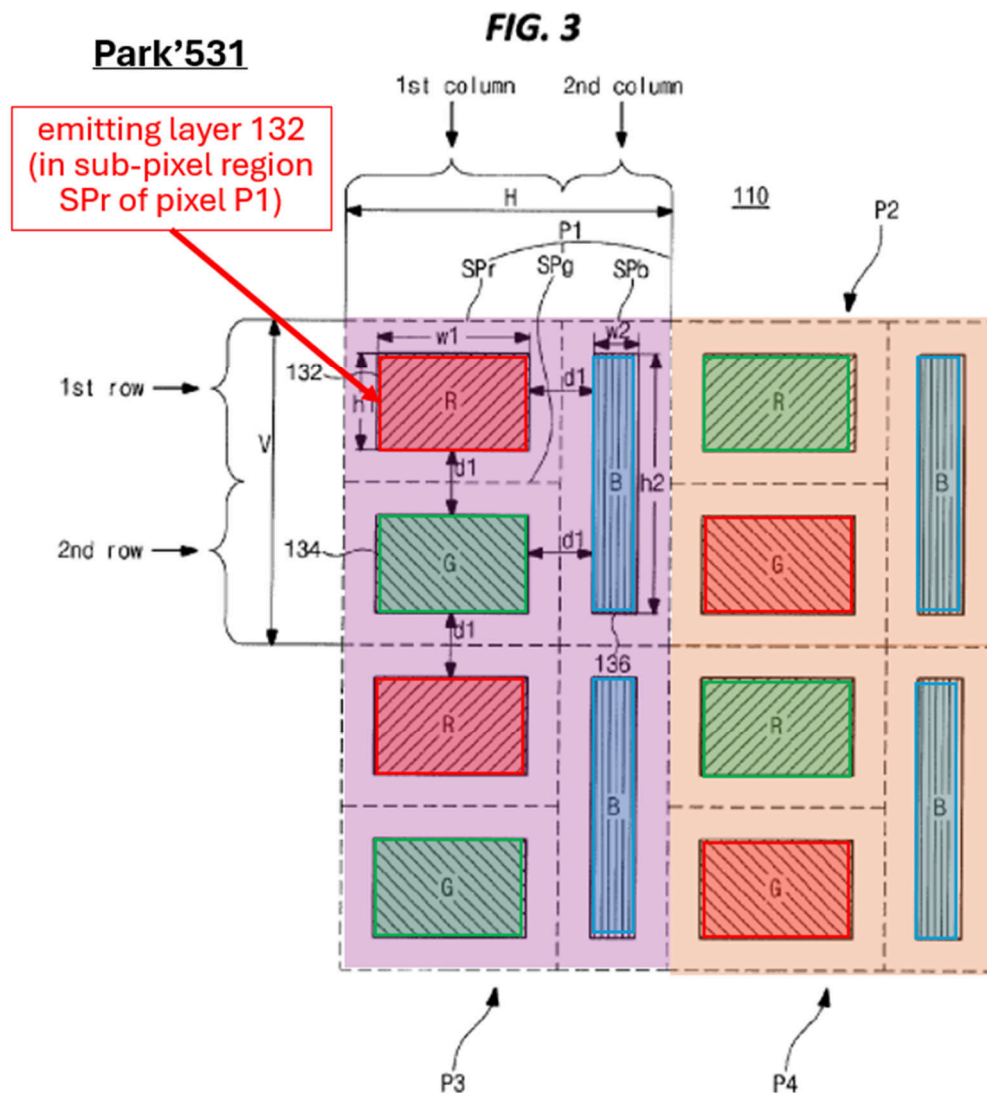
by using a metal shadow mask and thermal deposition, an emitting layer can be formed for a sub-pixel. *Id.* Park'531 provides an example of the resulting emitting layer of a sub-pixel, in FIG. 5 (cross section of single sub-pixel region), which illustrates a result of emitting layer 132 deposited onto opening 128a of bank 128. EX1007, FIG. 5; EX1003, 134.



EX1007, FIG. 5 (annotated)

By repeating this thermal deposition process for different sub-pixel regions, Park'531 discloses a resulting matrix of “pixel regions” (e.g., P1, P2, P3, P4 in FIGS. 3 and 8) where each pixel region includes “red, green and blue sub-pixel regions” (SPr, SPg, SPb). EX1007, [0041]-[0043], [0057], [0086]-[0091], FIGS. 3, 8; EX1003, 135. Each pixel region has a “rectangular shape” in which red and

green sub-pixels (SPr, SPg) are “alternately arranged with each other in a first column” and blue sub-pixel (SPb) is “arranged in a second column.” EX1007, [0043], [0087], FIGS. 3, 8; EX1003, 135.

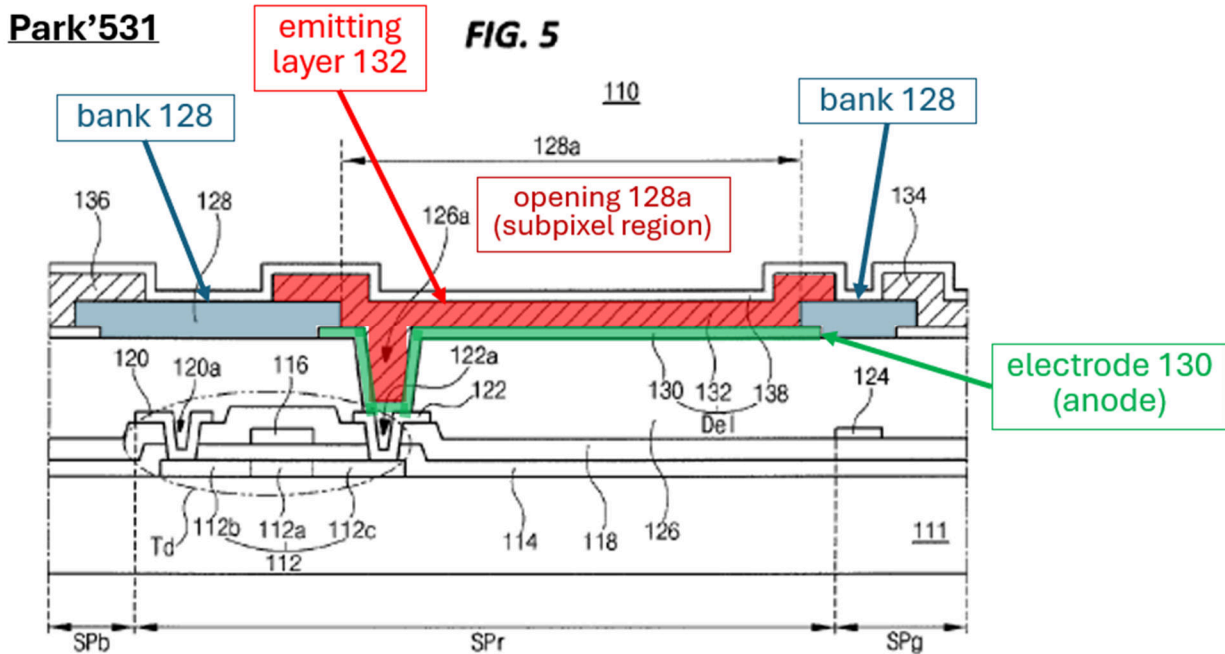


EX1007, FIG. 3 (annotated)

Notably, Park'531 provides insight into a distinction between the actual area of emitting layer 132 as compared to the area of emitting layer 132 shown in the plan view of FIG. 3. EX1007, [0012]-[0013], [0048], [0070], FIGS. 3, 8; EX1003,

136. In particular, Park'531 explains that “[a]n area of the red, green and blue emitting layers 132, 134 and 136 **may be larger** than that in FIG. 3.” EX1007, [0013], [0048], FIGS. 2, 3, 5; EX1003, 136. The reason for this distinction, Park'531 explains, is that FIG. 3 only shows “an area of the red, green and blue emitting layers 132, 134 and 136 corresponding to the **overlapped portions** of the first and second **electrodes 130 and 138.**” *Id.* Park'531 refers to this area of the emitting layers that overlaps the electrodes as the “**effective emitting portion**” and Park'531 clarifies that the “emitting layers 132, 134 and 136” that “**are shown**” in FIG. 3 are actually the “effective emitting portions.” EX1007, [0048], FIGS. 3, 5; [0013], FIG. 2; EX1003, 136.

Park'531 explains that there is only “a **portion** of each of the **emitting layers 132, 134 and 136**, which **contacts** the first **electrode 130**, such that **the portion** of the each of the **emitting layers 132, 134 and 136 emits light.**” EX1007, [0070]; EX1003, 138. Therefore, Park'531 explains the “important fact” that when determining measurements such as “an aperture ratio” of emitting layers (132, 134, 136), only the “**exposed area** of the first **electrode 130 through the opening 128a** of the bank 128” should be considered, and “[a]ccordingly, the red, green and blue **emitting layers 132, 134 and 136 corresponding** to the **opening 128a** of the bank 128 **are shown in FIG. 3.**” *Id.*



EX1007, FIG. 5 (annotated)

In view of these disclosures, a POSITA would have understood that the plan view illustrations of sub-pixel arrangements in Park'531 (e.g., FIGS. 3, 8) only illustrate a portion of emitting layer 132 which contacts electrode 130 which is exposed through opening 128a, and that the actual emitting layer 132 may be larger than this exposed portion. EX1003, 137, 139.

2. Combination of Hwang, Lee, and Park'531

A POSITA would have understood that Park'531 is highly relevant to Hwang-Lee's display device. EX1003, 140. As discussed in Sections III.C.1-3 and III.D.1, both Hwang-Lee and Park'531 are directed to OLED display devices that implement an arrangement of alternating pixels, each of which includes different arrangements of sub-pixels of three colors. *Id.*

As discussed in Section III.C.1-3, Hwang-Lee describes how to design and implement the overall arrangement of pixels and sub-pixels in an OLED display device, as well as the underlying pixel circuitry. EX1003, 141.

Park'531 supplements Hwang-Lee by providing details and design considerations for specifically fabricating the “emitting layer” (Hwang’s “emission layer 370”) of each individual sub-pixel, as discussed in Section III.D.1. EX1003, 142.

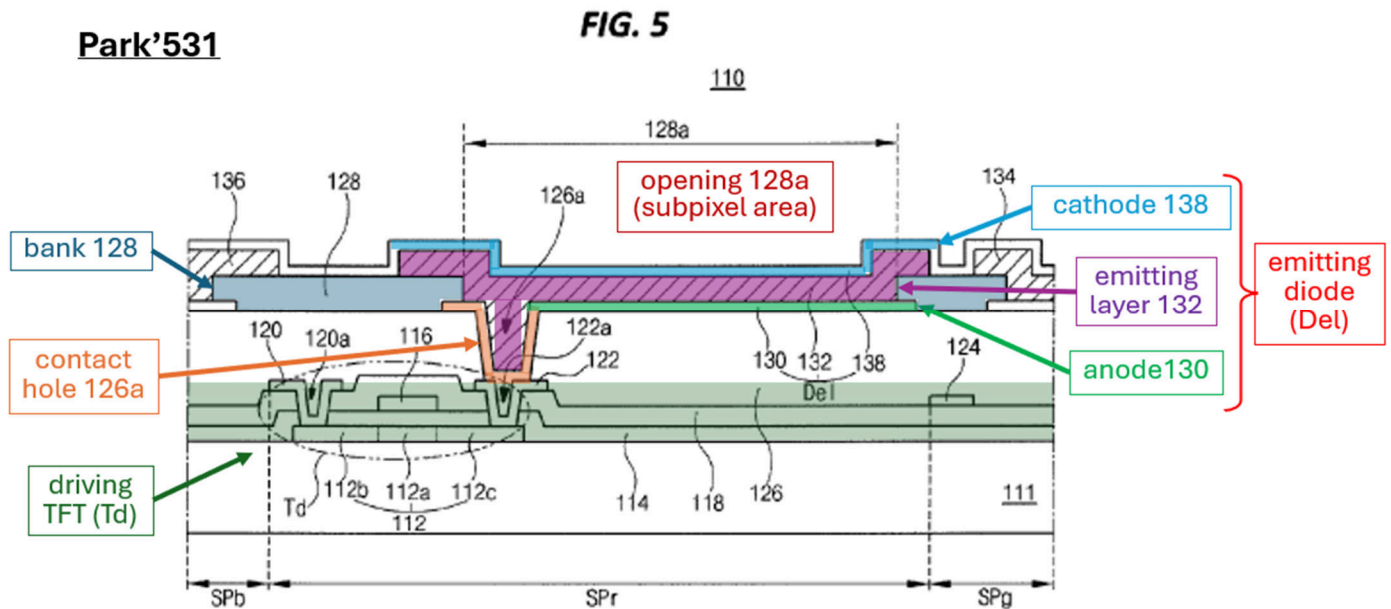
As explained below, combining Hwang-Lee and Park'531 would have been obvious because such a combination would have merely involved (1) combining prior art elements according to known methods to yield predictable results; and the (2) use of known techniques to improve similar devices in the same way.

KSR, 550 U.S. at 415-421 (2007); MPEP 2143; EX1003, 143.

Similar to Hwang-Lee, Park'531 discloses an alternating arrangement of pixels, where each pixel includes red and green sub-pixels (SP_r, SP_g) that are “alternately arranged with each other in a first column” and blue sub-pixel (SP_b) is “arranged in a second column.” EX1007, [0043], [0087], FIGS. 3, 8; EX1003, 144.

Furthermore, Park'531 provides details of the cross-sectional structure of each sub-pixel, in FIG. 5, which are similar to Hwang-Lee, such as a “substrate 111,” a “driving TFT T_d” over the substrate 111, and an “emitting diode D_{el}”

(including the emitting layer 132) that is “connected to the driving TFT.” EX1007, [0058], FIG. 5; EX1003, 145.



EX1007, FIG. 5 (annotated)

Similar to Hwang-Lee, Park’531 discloses “bank 128” formed with “opening 128a” that exposes a portion of an “emitting diode (Del)” which includes “first electrode 130” (anode), “second electrode 138” (cathode), and “emitting layer 132” therebetween. EX1007, [0066]-[0071], FIG. 5; EX1003, 146. First electrode 130 (anode) of the emitting diode Del is connected to “drain electrode 122” of a “driving TFT” (Td), which is disposed below the emitting diode Del, through “drain electrode contact hole 126a.” *Id.*

Based on Park’531, a POSITA would have understood that, in Hwang-Lee, the plan view illustrations of sub-pixels (e.g., in Hwang’s FIGS. 1-3, 5, 7) illustrate

only a **portion** of Hwang's emission layer 370 (namely, the "effective emitting portion" as taught in Park'531) which contacts electrode 191 exposed through opening 351. EX1003, 147. A POSITA would have understood that the actual emissive material forming emission layer 370 of Hwang (e.g., as formed through thermal deposition, taught in Park'531) may be "**larger**" than the exposed portion shown in the plan view figures of Hwang. *Id.* Alternatively, a POSITA would have found it obvious to extend Hwang's emission layer 370 by implementing the emissive material geometry of Park'531 based on the teachings of Park'531. *Id.* As Dr. Bretschneider explains, a POSITA would also have been motivated to extend Hwang's emission layer 370 beyond the boundaries of the opening 351 in the pixel definition layer to eliminate the possibility of an electrical short circuit between the anode and cathode. EX1003, 137, 148.

As a result, based on the combined teachings of Hwang-Lee and Park'531 ("Hwang-Lee-Park'531"), a POSITA would have understood that emission layer 370 of Hwang (i.e., the layer formed through thermal deposition of emissive material, as taught in Park'351) would be larger than Hwang's opening 351 through which light is emitted. EX1003, 149. For example, a POSITA would have understood that Hwang's emission layer 370 would have extended to cover Hwang's pixel definition layer 350, in accordance with the teachings of Park'531 (e.g., FIG. 5). *Id.* An example of the resulting Hwang-Lee-Park'531 combination,

in comparison with unmodified Hwang-Lee, is shown in Diagram E, below (which is based on FIG. 11 of Hwang). *Id.*

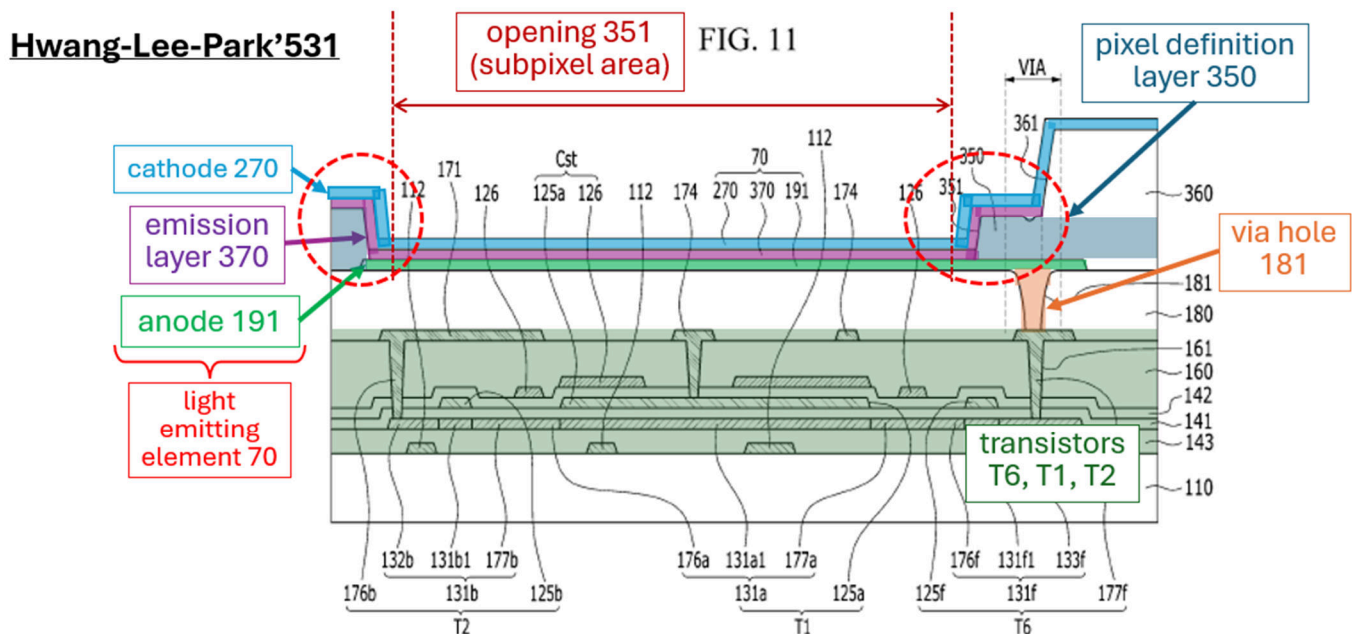
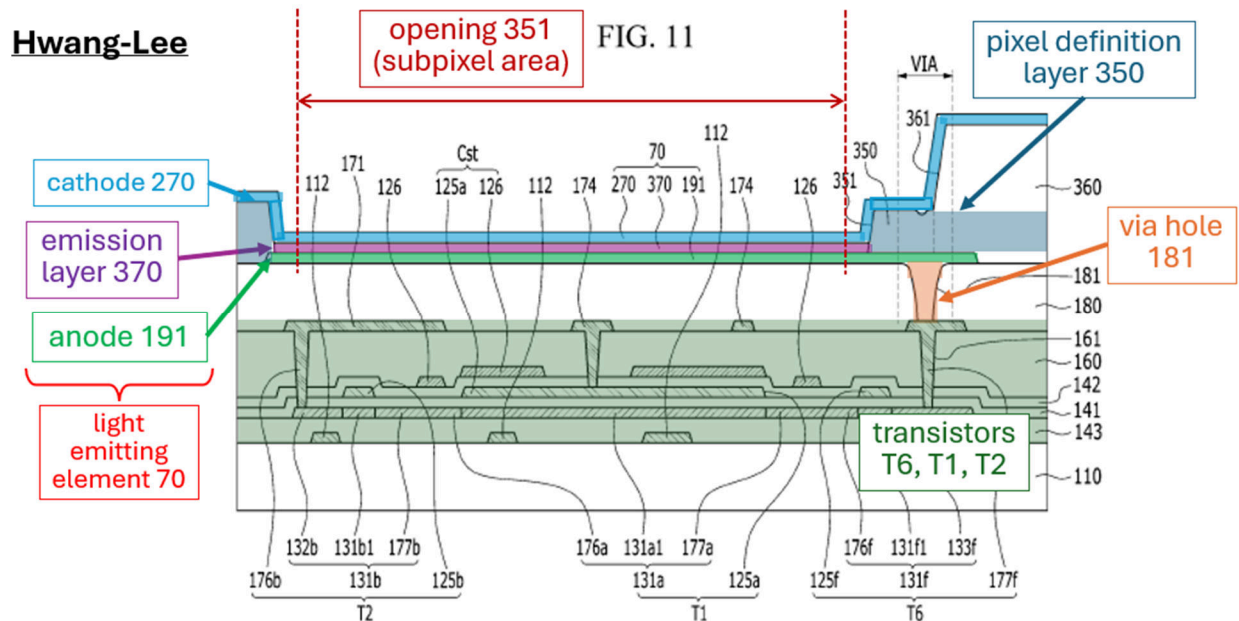


Diagram E (comparing Hwang-Lee with Hwang-Lee-Park'531)

As Dr. Bretschneider explains, a POSITA would have understood, by the

Critical Date, that it was known to fabricate a subpixel by depositing a layer of emissive material (e.g., through thermal deposition) to have a larger area than the opening of the subpixel. EX1003, 150. Dr. Bretschneider explains that one reason for this was to reduce the risk of direct contact between the anode and cathode of the sub-pixel, which would result in a short circuit that renders the subpixel non-functional. *Id.* To mitigate this risk, Dr. Bretschneider explains that it was well-known in the art to deposit the emissive material (e.g., the material deposited to form Hwang's emission layer 370) to be larger than the opening (e.g., Hwang's opening 351), thereby ensuring that the emissive material completely covers the bottom of the opening to avoid direct contact between the anode and electrode. *Id.*

Both Hwang-Lee and Park'531 are directed to OLED devices that implement an arrangement of pixels with alternating and repeating patterns of differently colored light emitting elements. EX1003, 151. The combination would have simply involved incorporating the teachings of Park'531 into the compatible teachings of Hwang-Lee, thereby making Hwang-Lee-Park'531 predictable and foreseeable with a reasonable expectation of success. *Id.*

3. Analysis

[7.pre]

Hwang-Lee renders obvious the display device of claim 1. *See* [1.pre]-[1.14].

[7.1] and [7.2]

The term “the OLED layer” in claim 7 lacks antecedent basis. To the extent the specification discloses an “***OLED layer***,” it describes “OLED layer 44” as part of a subpixel, and “disposed between the anode electrode 43 and the cathode electrode 19.” EX1001, 9:18-24, FIG. 6; EX1003, 373.

Hwang-Lee-Park’531 discloses a similar if not analogous structure. EX1003, 374. As discussed in Sections III.C.1 and III.C.2, Hwang’s “emission layer 370” is disposed between Hwang’s “pixel electrode 191 which is an anode” and “opposed electrode 270” which can “function as a cathode.” EX1005, [0040], [0138], FIG. 11; EX1003, 374.

Like the ’691 patent’s OLED layer 44, Hwang’s emission layer 370 includes “organic material” that can emit “three primary colors of red R, green G, and blue B” and is “made with multiple layers including an emission layer and at least one of a hole injection layer (HIL), a hole transport layer (HTL), an electron transport layer (ETL), and an electron injection layer (EIL).” EX1005, [0041], [0138]; EX1001, 9:37-42, 13:9-26; EX1003, 375.

Furthermore, in Hwang-Lee-Park’531, as discussed in Section III.D.2, a POSITA would have understood that the actual emissive material deposited to form Hwang’s emission layer 370 would have a larger area than pixel-defining opening 351, to allow manufacturing margin when depositing emission layer 370,

thus reducing the risk of a short circuit between the anode and cathode of emitting element 70. EX1003, 376. Indeed, this is the scenario shown in Park’531 (e.g., FIG. 5), where emitting layer 132 extends past opening 128a by covering a portion of bank 128, which defines the boundaries of opening 128a. EX1007, FIG. 5; EX1003, 376. An example of expanded emission layer 370 of Hwang-Lee-Park’531 is shown in Diagram F, below (based on FIG. 2 of Hwang).

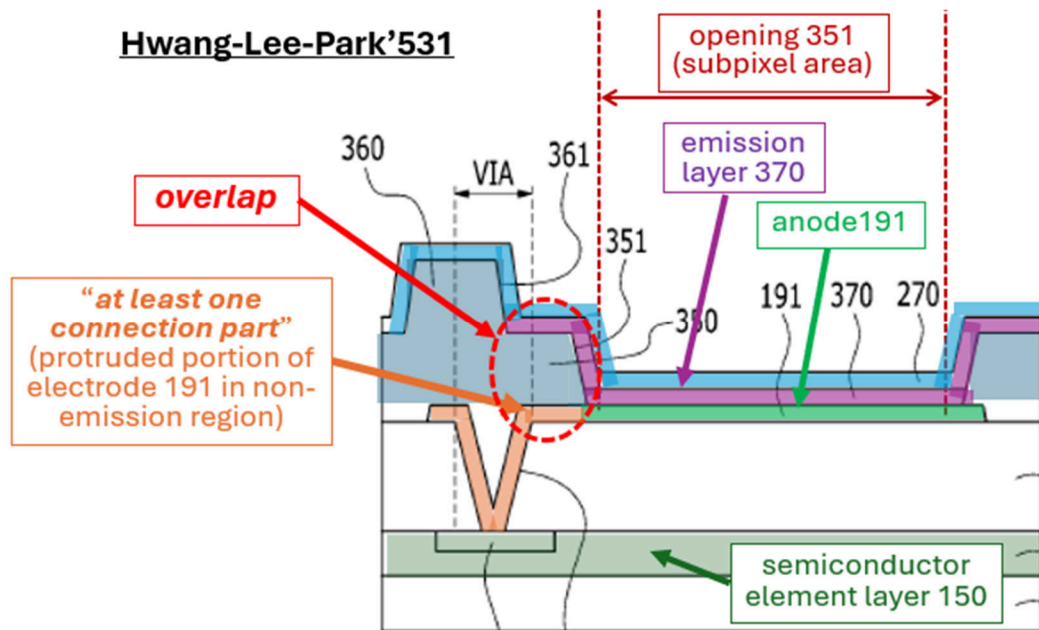
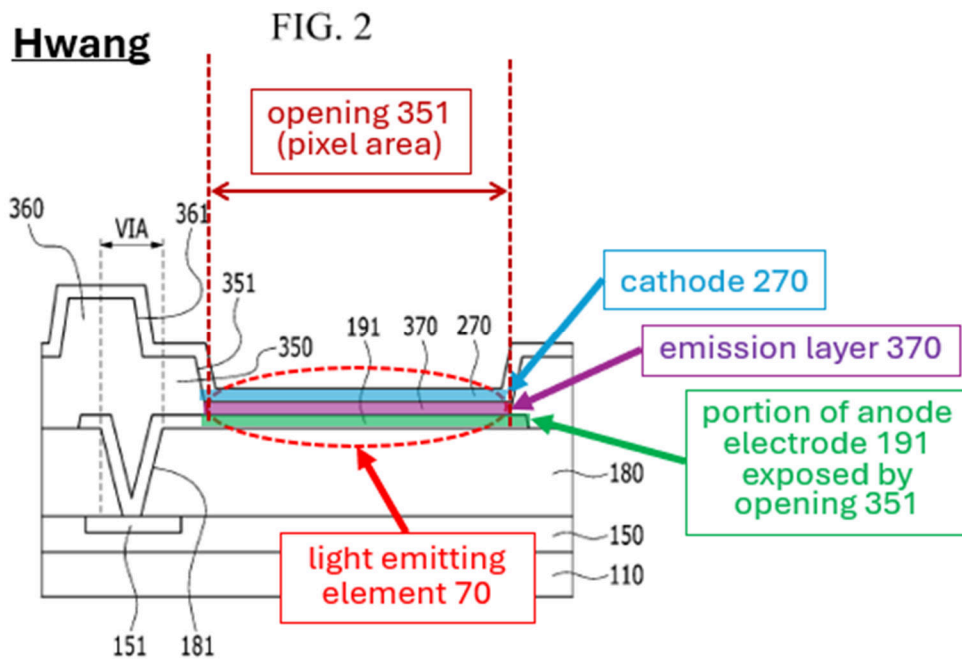


Diagram F (Hwang-Lee-Park’531)

Furthermore, as discussed in [1.3], [1.10], [1.11], a POSITA would have understood that the claimed “*at least one connection part*” in [7.1] and [7.2] is rendered obvious by Hwang’s **protruded portion of pixel electrode 191** which protrudes into via hole 181 (Example 2). EX1003, 377.

Specifically, Hwang’s protruded portion of pixel electrode 191 (which

protrudes into via hole 181) extends from the portion of Hwang's pixel electrode 191 that is exposed by Hwang's opening 351. EX1005, [0044], [0046], [0132], [0136], FIG. 2; EX1003, 378. Hwang explains that "opening 351 of pixel definition layer 350 may define a pixel area that is an emitting region of each pixel." EX1005, [0046], [0137], FIG. 2; EX1003, 378.



EX1005, FIG. 2 (annotated)

The portion of Hwang's pixel electrode 191 exposed by this opening 351 has, formed on it, "emission layer 370" and "opposed electrode 270." *Id.* Hwang refers to this structure as "light emitting element 70." EX1005, [0136], FIG. 2; EX1003, 379.

Hwang explains that, in light emitting element 70, pixel electrode 191 can "function as an anode" and opposed electrode 270 can "function as a cathode."

EX1005, [0040]; EX1003, 380. Specifically, Hwang explains that “[a]n electron injected from the cathode and a hole injected from the anode are coupled with each other in the light emitting layer to form an exciton, and the exciton emits light while discharging energy.” EX1005, [0008]; EX1003, 380.

In view of Hwang’s teachings, a POSITA would have understood that the “anode” property of pixel electrode 191 arises due to the electron-hole interactions between the “**portion of the pixel electrode 191 that is exposed at the opening 351**” (functioning as an anode), the emission layer 370, and the opposed electrode 270 (functioning as a cathode) resulting in emission of light. EX1005, [0008], [0040], [0136], FIG. 2; EX1003, 381. Consequently, a POSITA would have known that the portion of pixel electrode 191 **not** exposed by opening 351, and **not** in contact with emission layer 370, was typically **not** characterized as an “anode” for light emitting element 70. *Id.*

This understanding is evidenced in Lee. EX1003, 382. Like Hwang, Lee describes “an opening for exposing a part of the pixel electrode 120” (similar or analogous to Hwang’s pixel electrode 191) and Lee explains that “pixel electrode 120 includes an “**emission portion**” that is exposed by an opening, and a “**non-emission portion**” that is not exposed. EX1006, [0112]; EX1003, 382. Lee further discloses that “via hole VIA is disposed in the non-emission portion of the pixel electrode 120.” *Id.*

Park'531 provides evidence of these two distinct portions of a pixel electrode (emission and non-emission portions), in particular describing an **“effective emitting portion”** as **“corresponding to the overlapped portions of the first and second electrodes 130 and 138.”** EX1007, [0013]; EX1003, 383.

Park'531 explains the “important fact” that when determining measurements such as “an aperture ratio” of emitting layers, only the **“exposed area of the first electrode 130 through the opening 128a of the bank 128”** should be considered, and “[a]ccordingly, the red, green and blue **emitting layers 132, 134 and 136 corresponding to the opening 128a of the bank 128 are shown in FIG. 3.”** EX1007, [0070]; EX1003, 383.

Thus, a POSITA would have understood, based on the combined teachings of Hwang-Lee-Park'531, that Hwang's pixel electrode 191 includes an emission portion and non-emission portion, where (i) the emission portion of pixel electrode 191 is exposed by Hwang's opening 351 and contacts emission layer 370 to function as an anode in light emitting element 70 and (ii) the non-emission portion of pixel electrode 191 is not exposed by Hwang's opening 351 and does not function as an anode in light-emitting element 70, and instead covers Hwang's via hole 181. EX1003, 384.

A POSITA would have understood that the non-emission portion of Hwang's pixel electrode 191 can function as a connection part, connecting the

emission portion of Hwang's pixel electrode 191 (functioning as an anode electrode) with the underlying semiconductor element layer 150. EX1003, 385 (citing EX1010, FIG. 2, [0050]).

Therefore, in limitations [7.1] and [7.2], a POSITA would have understood that the claimed "*at least one connection part*" is rendered obvious by Hwang's **protruded portion of pixel electrode 191** (Example 2) which protrudes into via hole 181 to contact Hwang's semiconductor element layer 150. EX1003, 386. A POSITA would have understood that this protruded portion of pixel electrode 191 would correspond to what Lee describes as the "non-emission portion" of the pixel electrode. EX1006, [0112]; EX1003, 386.

In this Example 2, a POSITA would have found obvious that, as a result of the larger area of emission layer 370 in Hwang-Lee-Park's 531 extending outside opening 351, emission layer 370 would overlap the portion of Hwang's pixel electrode 191 that is outside opening 351, i.e., Hwang's protruded pixel electrode 191 ("*at least one connection part*" in Example 2) which protrudes into via hole 181, as shown in Diagram F. EX1003, 387.

Moreover, although Hwang discloses "spacer 360" that is "arranged between the pixel areas and **does not overlap the emission layer 370** (EX1005, [0048]), Hwang explains that "spacer 360 does not completely cover the via hole" and instead "only overlaps the portion" or "may not overlap" the via hole. EX1005,

[0073], [0078], [0133]-[0135]; EX1003, 388. As shown in the cross section view of Diagram G, Hwang's spacer 360 only extends to cover a portion of via hole 181. *Id.* Hwang also illustrates an example where the spacer does not overlap via hole 181 at all. EX1005, FIG. 7; EX1003, 389.

Therefore, a POSITA would have found obvious that the Hwang-Lee-Park's emission layer 370 ("*the OLED layer*") is disposed above Hwang's protruded portion of pixel electrode 191, i.e., non-emissive portion of pixel electrode 191 ("*the at least one connection part*" in Example 2) and that a position where this non-emissive portion of pixel electrode 191 is disposed overlaps with emission layer 370 in a plan view. EX1003, 390.

For these reasons, a POSITA would have understood Hwang-Lee-Park's 531 to render obvious [7.1] and [7.2]. EX1003, 391.

IV. CONCLUSION AND FEES

The Challenged Claims are unpatentable. Petitioner authorizes charge of fees to Deposit Account 06-1050.

V. MANDATORY NOTICES UNDER 37 C.F.R. § 42.8(a)(1)

A. Real Party-In-Interest Under 37 C.F.R. § 42.8(b)(1)

LG Display America, Inc. is a real party-in-interest with Petitioner, LG Display Co., Ltd.

B. Related Matters Under 37 C.F.R. § 42.8(b)(2)

The '691 Patent is the subject of civil action *Tianma Microelectronics Co., Ltd. et al v. LG Display Co., Ltd. et al.*, 1-25-cv-02021 (WDTX), filed December 9, 2025. Petitioner is not aware of any disclaimers, reexamination certificates, or PGR petitions addressing the '691 Patent.

C. Lead And Back-Up Counsel Under 37 C.F.R. § 42.8(b)(3)

Petitioner provides the following designation of counsel.

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D. Service Information

Please address all correspondence and service to the address listed above.

Petitioner consents to electronic service by email at PGR57874-0038PS1@fr.com.

Respectfully submitted,

Dated: February 6, 2026

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CERTIFICATION UNDER 37 CFR § 42.24

Under the provisions of 37 CFR § 42.24(d), the undersigned hereby certifies that the word count for the foregoing Petition for Post Grant Review totals 18,643 words, which is less than the 18,700 allowed under 37 CFR § 42.24.

Dated February 6, 2026

/W. Karl Renner/

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CERTIFICATE OF SERVICE

Pursuant to 37 CFR §§ 42.6(e)(4)(i) et seq. and 42.105(b), the undersigned certifies that on February 6, 2026, a complete and entire copy of this Petition for Post Grant Review and all supporting exhibits were provided by Federal Express, to the Patent Owner, by serving the correspondence address of record as follows:

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