

Mianyang BOE Optoelectronics Technology Co., Ltd. (“BOE”); Wuhan China Star Optoelectronics Semiconductor Display Technology Co., Ltd.; Tianma Microelectronics Co. Ltd.; and Visionox Technology, Inc.
v.
Samsung Display Co., Ltd.

Case Nos. IPR2023-00987, -00988, -01075
U.S. Patent Nos. 9,818,803, 10,854,683, 11,594,578

Patent Owner’s Demonstratives

October 9, 2024 Oral Hearing

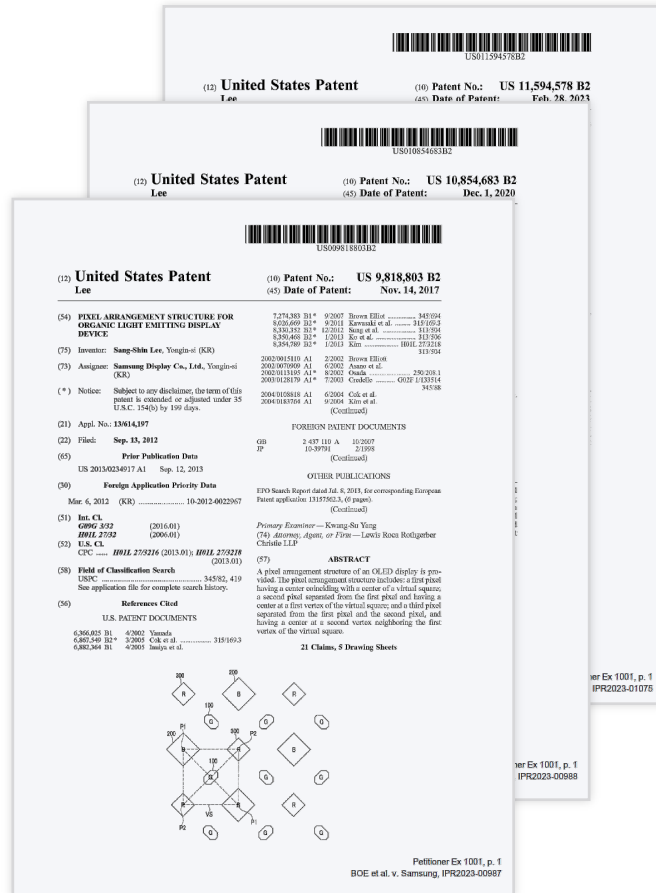
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Ex. 2087

The Challenged Diamond Pixel Patents



- U.S. Patent Nos. 9,818,803, 10,854,683, 11,594,578
- Overcame fundamental manufacturing challenges for OLED displays and improved image quality
- Enabled high-resolution AMOLED displays and widespread adoption of OLED displays for mobile devices
- Overcame skepticism and became pixel arrangement structure of choice in flagship mobile devices

The Inventions Overcame Specific Problems in Manufacturing OLEDs

An organic emission layer included in the pixel of an OLED display may be deposited and formed by using a mask such as a fine metal mask (FMM). When reducing a gap between the neighboring pixels to obtain a high aperture ratio of the pixel, deposition reliability may be deteriorated. On the other hand, when increasing the gap between the pixels to improve the deposition reliability, the aperture ratio of the pixel may be deteriorated.

'803 Patent at 1:38-45

'683 Patent at 1:43-50

'578 Patent at 1:46-53

simply formed placed on top of each pixel region. But in OLEDs, the organic emissive materials that form each pixel conduct electricity, so the organic material must be sufficiently separated from each other to prevent defects. Further, when organic materials for emitting different colors are deposited too close to each other, overlap of the material can result in color mixing, compromising the color of the display. Thus, in contrast to LCDs, OLED displays have large gaps between pixels.

46. The locations, shapes, and sizes of the FMM mask openings correspond to the locations, shapes, and sizes of the red, blue, and green organic light-emitting materials deposited on the display substrate. Accordingly, FMM design and evaporation process considerations are closely related to the design for the red, green, and blue pixels of an OLED. Thus, the choice of OLED pixel arrangements has a significant impact on the manufacturability of the OLED display.

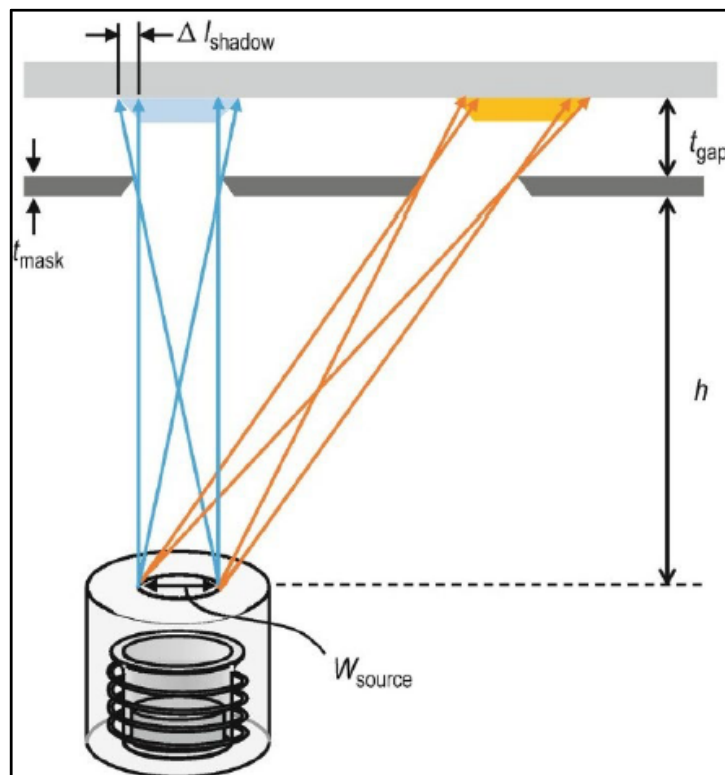
-00987 Ex. 2009 (Kymissis Declaration) at ¶43, 46

-00988 Ex. 2009 (Kymissis Declaration) at ¶43, 46

-01075 Ex. 2009 (Kymissis Declaration) at ¶43, 46

The Inventions Improved Resolution And Manufacturability

Illustration of Organic Material Deposition
Using Fine Metal Mask



-00987 Ex. 2009 (Kymissis Declaration) at ¶206-208

-00988 Ex. 2009 (Kymissis Declaration) at ¶206-208

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

In addition, by enclosing each of the first pixels **100** by a pair of the second pixels **200** and a pair of the third pixels **300**, the aperture ratio of the first pixels **100**, the second pixels **200**, and the third pixels **300** may be improved. Accordingly, a manufacturing time and manufacturing cost of the entire OLED display may be reduced and the display quality of the image of the OLED display may be improved.

'803 Patent at 5:9-26

'683 Patent at 5:13-30

'578 Patent at 5:19-36

Petitioner's Asserted Grounds

Ground	35 U.S.C. §	Claims
Matthies + Yamada	103(a)	'803 claims 1-5, 19-21 '683 claims 1-2, 4-10, 13, 15 '578 claims 1-6, 10, 12, 17-19, 21-23, 41-42, 44-47, 52
Matthies + Yamada + Hong	103(a)	'578 claims 40, 43, 45-47, 51-52
Phan	103(a)	'803 claims 1-4, 19-21 '683 claims 1, 4-10, 13, 15
Phan + Yamada	103(a)	'803 claim 5 '683 claim 2
Murai + Yamada	103(a)	'803 claims 1-5, 19-21 '683 claims 1-2, 4-10, 13, 15

Primary Disputes – '578 Patent Ground 1 (Matthies+Yamada)

- A POSITA would not have been motivated to combine Matthies and Yamada
 - Matthies' passive-matrix, tiled displays would not be modified based on Yamada's disclosures for active-matrix, single-substrate displays
 - Petitioner's modifications are incompatible with Matthies' teachings, and Petitioner fails to explain how the modification could even be implemented
 - Petitioner's modifications would reduce the lifetime and quality of Matthies' display
 - Prior art showed Yamada's approach is flawed and discouraged following it
- Even if combined, would not yield a structure that meets the claims
 - No pixel defining layer (all challenged claims)
 - Petitioner fails to correctly apply Yamada and to consider relevant factors
 - Petition disregards that Matthies addressed lower blue efficiency by using two blue sub-pixels in quad pixel
 - Petitioner's modifications violate Matthies' design requirements for quad pixels
 - A POSITA would, at most, combine with Matthies' triple-pixel structure
 - No elongated pixels (claims 41, 44, 52) and no structure satisfying all elements of claim 5 (including blue=red)

Primary Disputes – '578 Patent Ground 2 (Matthies+Yamada+Hong)

- A POSITA would not have been motivated to further combine Matthies and Yamada with Hong
 - Incompatibility of the references' pixel arrangement structures
 - Incompatibility of Petitioner's modifications with Matthies
 - Petitioner's modifications are contrary to Hong's teachings, reducing aperture ratio and pixel spacing
- Even if combined, would not yield a structure that meets the claims
 - Petitioner's alleged pixel shape is not taught or suggested by Hong
 - A POSITA would not truncate pixel corners in Matthies' arrangement
- Petitioner applies its alleged structure only to elements of dependent claims, and fails to analyze the elements of the independent claims

Primary Disputes – '803 Patent Ground 1 (Matthies+Yamada)

- A POSITA would not have been motivated to combine Matthies and Yamada
 - Matthies' passive-matrix, tiled displays would not be modified based on Yamada's disclosures for active-matrix, single-substrate displays
 - Petitioner's modifications are incompatible with Matthies' teachings, and Petitioner fails to explain how the modification could even be implemented
 - Petitioner's modifications would reduce the lifetime and quality of Matthies' display
 - Prior art showed Yamada's approach is flawed and discouraged following it
- Even if combined, would not yield a structure that meets the claims
 - No "virtual square" ('803 Patent, all challenged claims)
 - Would not meet relative pixel size requirements of any challenged claim
 - Petitioner fails to correctly apply Yamada and to consider relevant factors
 - Petition disregards that Matthies addressed lower blue efficiency by using two blue sub-pixels in quad pixel
 - Petitioner's modifications violate Matthies' design requirements for quad pixels
 - A POSITA would, at most, combine with Matthies' triple-pixel structure

Primary Disputes – '803 Patent Ground 2 (Phan)

- Phan does not teach or suggest OLED pixels or pixel arrangement structures for OLEDs
- A POSITA would not have been motivated to modify Phan as Petitioner argues
 - Petitioner's modifications are incompatible with Phan's teachings, and Petitioner fails to explain how the modification could even be implemented
 - Petitioner inappropriately removes spacing from Phan's drawings
 - Petitioner's modifications would reduce the lifetime and quality of displays according to Phan
- Even if combined, would not yield a structure that meets the claims
 - No “virtual square” ('803 Patent, all challenged claims) or OLED display

Primary Disputes – '803 Patent Ground 3 (Phan+Yamada)

- Phan does not teach or suggest OLED pixels or pixel arrangement structures for OLEDs
- A POSITA would not have been motivated to combine Phan with Yamada
 - Phan's passive-matrix displays would not be modified based on Yamada's disclosures for active-matrix, single-substrate OLED displays
 - Petitioner's modifications would reduce the lifetime and quality of displays according to Phan
- Even if combined, would not yield a structure that meets claim 5's requirements
 - Prior art showed Yamada's approach is flawed and discouraged following it
 - Petitioner fails to correctly apply Yamada and to consider relevant factors
 - Would not meet relative pixel size requirements of claim 5
 - Petition's theory conflicts with Phan's re-sizing of pixels using a cross-point
 - Petition disregards Phan's disclosure of using two blue sub-pixels in quad pixel
 - A POSITA would, at most, combine with Phan's triple-pixel structure

Primary Disputes – '803 Patent Ground 4 (Murai+Yamada)

- Murai does not teach or suggest OLED pixels or pixel arrangement structures for OLEDs
- A POSITA would not have been motivated to combine Murai with Yamada
 - Murai's pixel arrangements for LCD displays would not be modified based on Yamada's disclosures for OLED displays
 - Petitioner's modifications conflict with Murai's teachings
 - Petitioner's modifications would reduce the lifetime and quality of displays according to Murai
- Even if combined, would not yield a structure that meets the requirements of the challenged claims
 - No "virtual square"
 - Petitioner inappropriately draws lines that are not at the centers of pixels as the claims require
 - Not an OLED display, and would not meet relative pixel size requirements of claim 5
 - Prior art showed Yamada's approach is flawed and discouraged following it
 - Petitioner fails to correctly apply Yamada and to consider relevant factors
 - Petition disregards Murai's disclosure of using two blue sub-pixels in quad pixel
 - A POSITA would, at most, combine with Murai's triple-pixel structure

Primary Disputes –'683 Patent Ground 1 (Matthies+Yamada)

- A POSITA would not have been motivated to combine Matthies and Yamada
 - Matthies' passive-matrix, tiled displays would not be modified based on Yamada's disclosures for active-matrix, single-substrate displays
 - Petitioner's modifications are incompatible with Matthies' teachings, and Petitioner fails to explain how the modification could even be implemented
 - Petitioner's modifications would reduce the lifetime and quality of Matthies' display
 - Prior art showed Yamada's approach is flawed and discouraged following it
- Even if combined, would not yield a structure that meets the claims
 - Would not meet relative pixel size requirements of any challenged claim
 - No "substantially equidistant" pixels ('683 Patent, claim 7)
 - Petitioner fails to correctly apply Yamada and to consider relevant factors
 - Petition disregards that Matthies addressed lower blue efficiency by using two blue sub-pixels in quad pixel
 - Petitioner's modifications violate Matthies' design requirements for quad pixels
 - A POSITA would, at most, combine with Matthies' triple-pixel structure

Primary Disputes – '683 Patent Ground 2 (Phan)

- Phan does not teach or suggest OLED pixels or pixel arrangement structures for OLEDs
- A POSITA would not have been motivated to modify Phan as Petitioner argues
 - Petitioner's modifications are incompatible with Phan's teachings, and Petitioner fails to explain how the modification could even be implemented
 - Petitioner inappropriately removes spacing from Phan's drawings
 - Petitioner's modifications would reduce the lifetime and quality of displays according to Phan
- Even if combined, would not yield a structure that has an OLED display (all challenged claims) or “substantially equidistant” pixels ('683 Patent, claim 7)

Primary Disputes – '683 Patent Ground 3 (Phan+Yamada)

- Phan does not teach or suggest OLED pixels or pixel arrangement structures for OLEDs
- A POSITA would not have been motivated to combine Phan with Yamada
 - Phan's passive-matrix displays would not be modified based on Yamada's disclosures for active-matrix, single-substrate OLED displays
 - Petitioner inappropriately removes spacing from Phan's drawings
 - Petitioner's modifications would reduce the lifetime and quality of displays according to Phan
- Even if combined, would not yield a structure that meets claim 2's requirements
 - Prior art showed Yamada's approach is flawed and discouraged following it
 - Petitioner fails to correctly apply Yamada and to consider relevant factors
 - Would not meet relative pixel size requirements of claim 2
 - Petition's theory conflicts with Phan's re-sizing of pixels using a cross-point
 - Petition disregards Phan's disclosure of using two blue sub-pixels in quad pixel
 - A POSITA would, at most, combine with Phan's triple-pixel structure

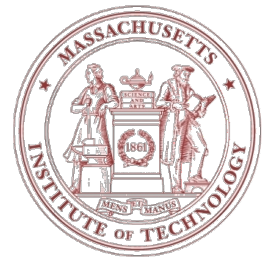
Primary Disputes – '683 Patent Ground 4 (Murai+Yamada)

- Murai does not teach or suggest OLED pixels or pixel arrangement structures for OLEDs
- A POSITA would not have been motivated to combine Murai with Yamada
 - Murai's pixel arrangements for LCD displays would not be modified based on Yamada's disclosures for OLED displays
 - Petitioner's modifications conflict with Murai's teachings
 - Petitioner's modifications would reduce the lifetime and quality of displays according to Murai
- Even if combined, would not yield a structure that meets the requirements of the challenged claims
 - Would not meet relative pixel size requirements, and not an OLED display
 - Prior art showed Yamada's approach is flawed and discouraged following it
 - Petitioner fails to correctly apply Yamada and to consider relevant factors
 - Petition disregards Murai's disclosure of using two blue sub-pixels in quad pixel
 - A POSITA would, at most, combine with Murai's triple-pixel structure

Technical Explanations of Dr. Ioannis (John) Kymissis



- Kenneth Brayer Professor in Electrical Engineering and Vice Dean of Infrastructure and Innovation of the School of Engineering and Applied Science, Columbia University
- President, Society for Information Display (SID)
- Practical experience with multiple display startup companies
- 150+ Peer-reviewed Journal Papers, 100+ Presentations, 50+ Patents
- Inventor on 38 U.S. patents in displays, organic materials, and semiconductors
- Fellow of SID, Optica, IEEE for work on displays and thin film electronics
- Ph.D., Electrical Engineering and Computer Science, MIT (2003)
- M.Eng./S.B., Electrical Engineering and Computer Science, MIT (1999)



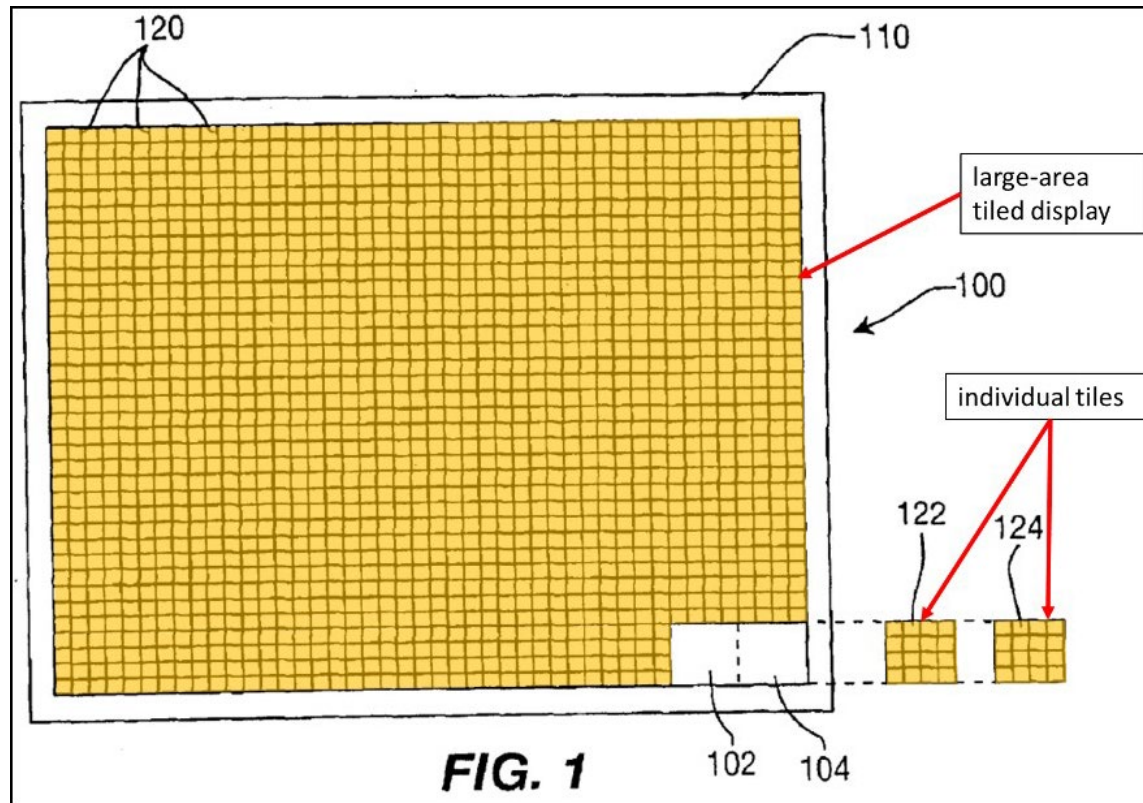
Matthies in view of Yamada

IPR2023-00987 Ground 1 ('803 Patent claims 1-5, 19-21)

IPR2023-00988 Ground 1 ('683 Patent claims 1-2, 4-10, 13, 15)

IPR2023-01075 Ground 1 ('578 claims 1-6, 10, 12, 17-19, 21-23, 41-42, 44-47, 52)

Matthies: Large-Area Tiled Displays

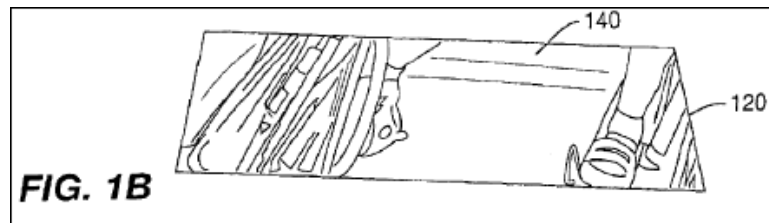
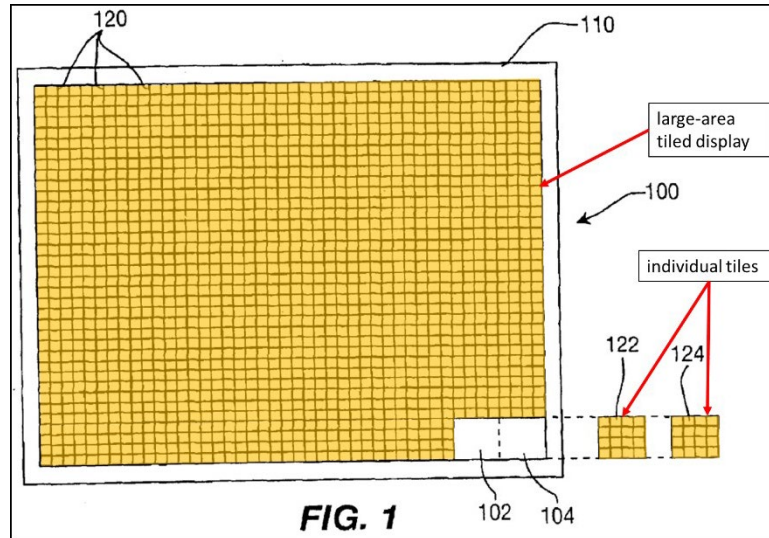


-00987 Ex. 2009 (Kymissis Declaration) at ¶103
-00988 Ex. 2009 (Kymissis Declaration) at ¶103
-01075 Ex. 2009 (Kymissis Declaration) at ¶92

No practical tiled display system has yet been developed (video walls formed by abutting conventional CRT displays are not considered tiled because of their wide separations between adjacent displays). What has been missing is a fabrication technology that allows a display to be constructed so that pixels can be brought up to the very edge (actually, with in $\frac{1}{2}$ pixel spacing period of the edge), while at the same time allowing for electronics to address each tile, even those tiles completely surrounded by other tiles. Two barriers to implementing the tiled approach have been: 1) eliminating the visibility of the seams between tiles, and 2) providing electrical access to the pixels.

Matthies at 1:66-2:10

Matthies: Large-Area Tiled Displays



The edges of the tiles are desirably carefully formed to ensure that the tiled display has no visible seams between the tiles. One criterion for the tiles is that the spacing between the pixels separated by the tile seam is the same as the spacing of pixels on the tile. To satisfy this criterion, the tile

Matthies at 8:37-41

The tiles are constructed with pixel forming elements evenly spaced up to the edges of the tiles. As described

Matthies at 5:47-48

-00987 Ex. 2009 (Kymissis Declaration) at ¶103
-00988 Ex. 2009 (Kymissis Declaration) at ¶103
-01075 Ex. 2009 (Kymissis Declaration) at ¶92

Matthies Is Directed to Passive-Matrix Displays

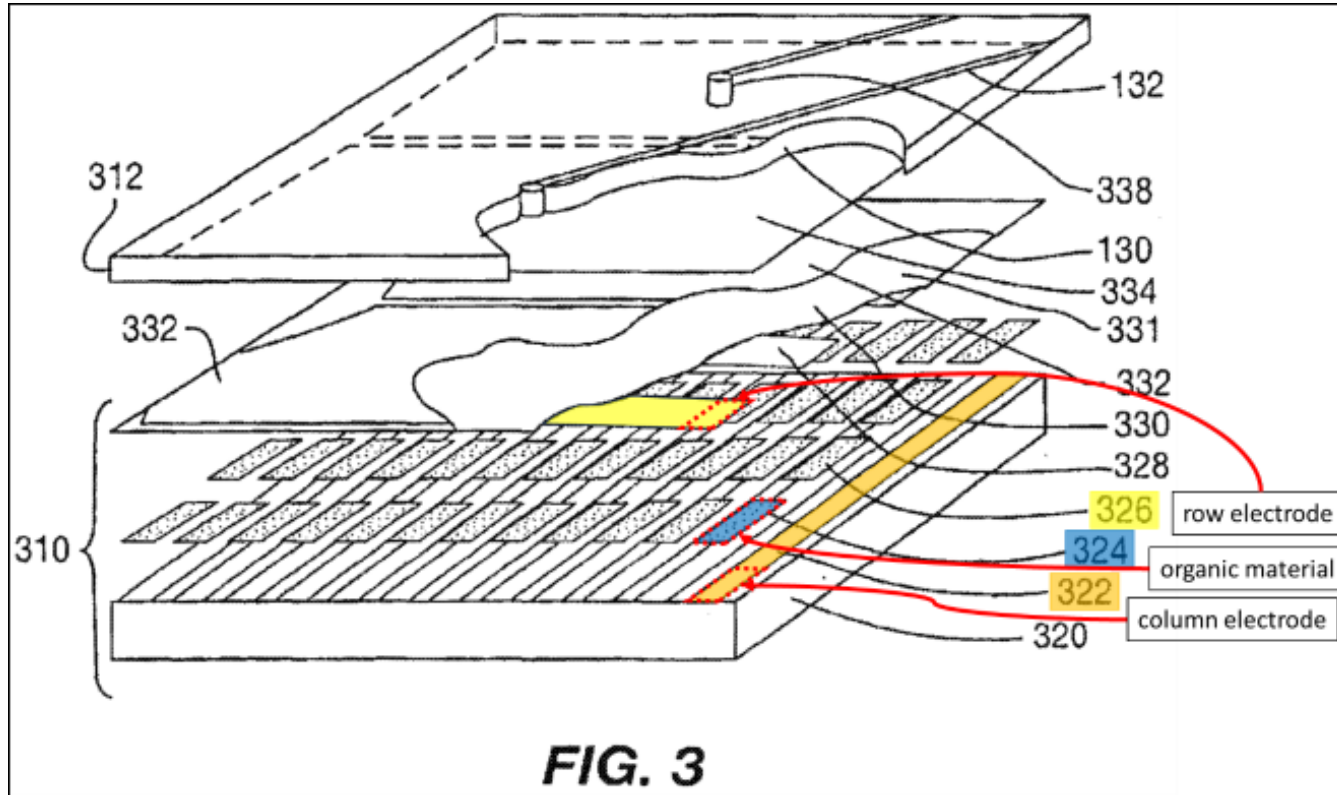


FIG. 3

-00987 Ex. 2009 (Kymissis Declaration) at ¶107
-00988 Ex. 2009 (Kymissis Declaration) at ¶107
-01075 Ex. 2009 (Kymissis Declaration) at ¶96

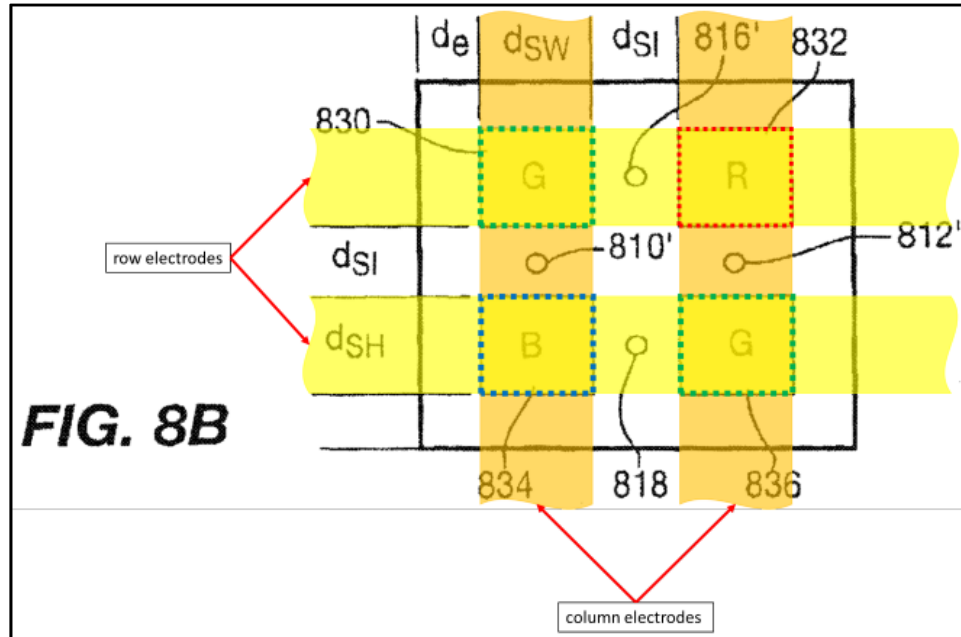
108. As Matthies explains, “[c]urrent flowing from one electrode to the other electrode” causes the organic material to emit light. Matthies, 6:22-23. Consequently, the emissive area of a pixel is defined by the area where a column electrode and a row electrode cross (i.e., the region of overlap of the vertical and horizontal electrodes), with the organic emissive material sandwiched in between. Matthies, 13:1-5. Thus, Matthies describes a passive-matrix display.

-00987 Ex. 2009 (Kymissis Declaration) at ¶108
-00988 Ex. 2009 (Kymissis Declaration) at ¶108
-01075 Ex. 2009 (Kymissis Declaration) at ¶97

The exemplary embodiment of the invention employs a passive addressing technique within a block in which only one row of pixels is illuminated at any time. The scanning circuitry steps through each row on the tile and illuminates that row for a predetermined interval. Because each tile is

Matthies at 10:31-35

Matthies' Figure 8B Is Passive-Matrix



-00987 Ex. 2009 (Kymissis Declaration) at ¶109
-00988 Ex. 2009 (Kymissis Declaration) at ¶109
-01075 Ex. 2009 (Kymissis Declaration) at ¶98

would improve the overall brightness of the display. The pixel structure shown in FIG. 8B employs two row electrodes (not shown) and two column electrodes (not shown).

Matthies at 17:10-12

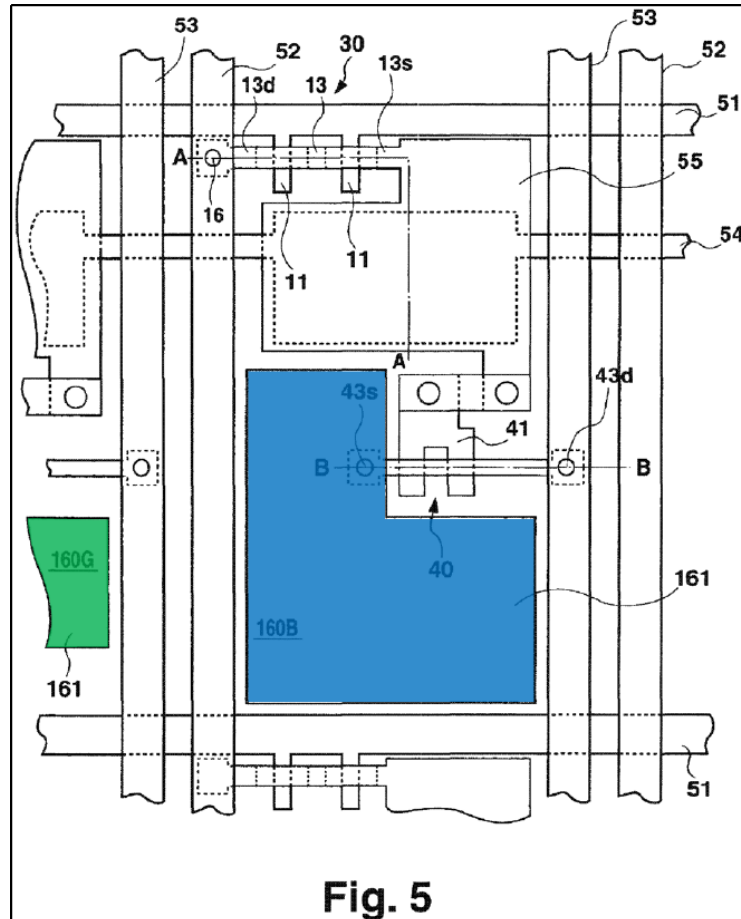
109. The quad sub-pixel structure of Figure 8B that Dr. Pattison relies on is similarly a passive-matrix structure, and has “two row electrodes ... and two column electrodes” creating the four sub-pixel regions where the electrodes cross as shown below in an annotated version of Figure 8B. Matthies, 17:10-12.

-00987 Ex. 2009 (Kymissis Declaration) at ¶109
-00988 Ex. 2009 (Kymissis Declaration) at ¶109
-01075 Ex. 2009 (Kymissis Declaration) at ¶98

6 Q. I'm just asking about Figure 8B. And Matthies
7 says the pixel structure shown employs two row electrodes,
8 not shown, and two column electrodes, not shown, correct?
9 A. Correct.
10 Q. And that's describing passive-matrix display for
11 Figure 8B, correct?
12 A. Yes.

-00987 Ex. 2083 (Pattison Testimony) at 304:6-12
-00988 Ex. 2083 (Pattison Testimony) at 304:6-12
-01075 Ex. 2083 (Pattison Testimony) at 304:6-12

Yamada Concerns Monolithic, Active-Matrix Displays



-00987 Ex. 2009 (Kymissis Declaration) at ¶113
-00988 Ex. 2009 (Kymissis Declaration) at ¶113
-01075 Ex. 2009 (Kymissis Declaration) at ¶102

As shown in FIGS. 2A and 2B, the organic EL display apparatus is formed by laminating in sequence the TFT and the organic EL element onto a substrate 10, such as a substrate formed from glass or synthetic resin, a conductive substrate, or a semiconductor substrate. However, when a

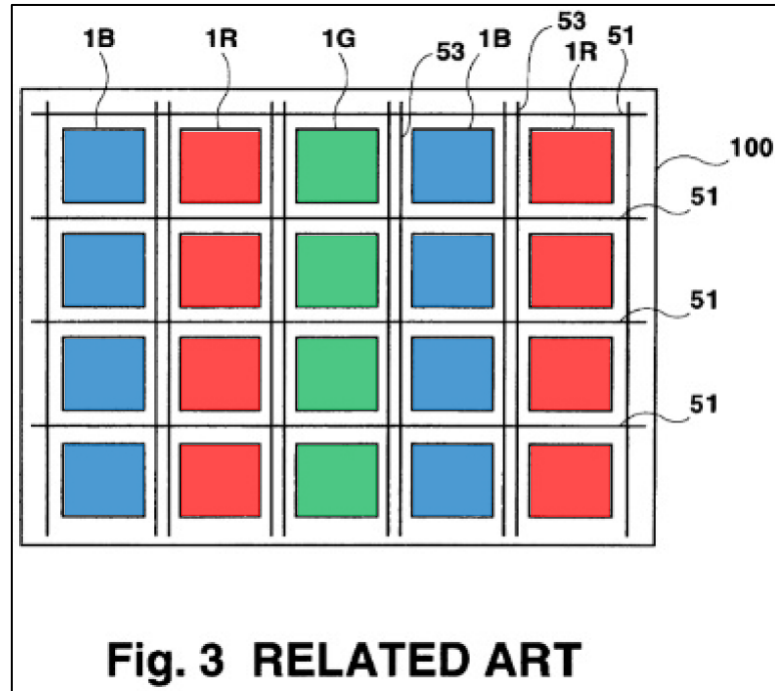
Yamada at 1:46-50

111. On the other hand, Yamada is directed to active-matrix OLEDs (“AMOLEDs”). Yamada, 1:6-9, 1:18-3:8. And Yamada is directed to what are called monolithic displays—unitary OLED displays having many pixels built on a single substrate. Yamada, 1:12-14.

of row or column electrodes. But as shown above, and as discussed in the technical background section, Yamada’s pixels are still constrained by the pixel driving circuit (including transistors and a capacitor) and power and signal lines.

-00987 Ex. 2009 (Kymissis Declaration) at ¶111, 114
-00988 Ex. 2009 (Kymissis Declaration) at ¶111, 114
-01075 Ex. 2009 (Kymissis Declaration) at ¶100, 103

Yamada Is Directed to Triple-Pixel (RGB) Structures



Yamada at Fig. 3

149. Yamada only contemplates R/G/B triplet structures, as evidenced by its reference to only “stripe,” “delta,” and “diagonal” layouts. Yamada, 12:37-43. These

-00987 Ex. 2009 (Kymissis Declaration) at ¶149

-00988 Ex. 2009 (Kymissis Declaration) at ¶149

-01075 Ex. 2009 (Kymissis Declaration) at ¶138

Incompatible Display Architectures

Passive-Matrix vs. Active-Matrix Addressing

Passive-Matrix and Active-Matrix Are Fundamentally Different

SOCIETY FOR INFORMATION DISPLAY



SOCIETY FOR INFORMATION DISPLAY

SHORT COURSE S-1:

Fundamentals of OLEDs

Amal Ghosh
Eastman Kodak Co.
Rochester, NY

Michael Hack
Universal Display Corporation
Ewing, NJ

SUNDAY, MAY 23, 2004
WASHINGTON STATE CONVENTION
AND TRADE CENTER
SEATTLE, WASHINGTON

SID EX. 2073 - 1/20

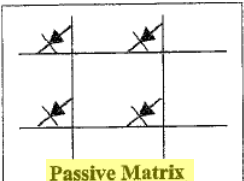
OLED Display Technology

- Introduction
- Passive matrix vs Active matrix
- Backplanes for AMOLEDs
- Top Emission AMOLED
- AMOLED Power Consumption

Fundamentals of OLEDs

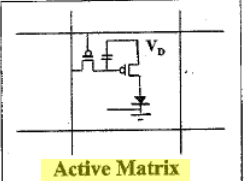
SID May 04

Addressing architectures



Passive Matrix

1 scan (row) line
1 column line



Active Matrix

1 select line
1 data line
1 common power line
1 ground

Fundamentals of OLEDs

SID May 04

Driving Architectures		
	AMOLED	PMOLED
Ease of fabrication	OLED deposited on backplane – isolated pixels, no cathode separator	OLED requires cathode separator
Module cost	Higher because of backplane – lower voltage driver IC Drive electronics integration ?	No backplane – higher voltage drive IC
Yield	Pixels isolated	Pixel shorts create line defects
Array size/resolution	Backplane limited, especially if top emission	Limited to <100 rows or < 3"
Power Consumption	Low	Higher – line losses and lower OLED efficiency
Lifetime	Higher – OLEDs driven dc	Lower – OLEDs pulsed
Uniformity	Very dependent on drive TFT threshold voltage	Direct current drive

Fundamentals of OLEDs

SID May 04

OLED Driving Requirements		
	AMOLED	PMOLED
Data	Voltage or current driven – depends on pixel circuit	Current driven and higher voltage to drive OLED at peak brightness
Scan	Pulse select TFT	Pulse OLED
Line resistance	Low resistance lines	Very low resistance row lines – all current instantaneously flows down a single line
Grey scale	Generally analog	PWM or analog

Fundamentals of OLEDs

SID May 04

-00987 Ex. 2073 (SID Course) at 11-15
-00988 Ex. 2073 (SID Course) at 11-15
-01075 Ex. 2073 (SID Course) at 11-15

PMOLEDs and AMOLEDs Have Different Primary Modes and Rates of Pixel Degradation

- Unrebutted, detailed technical testimony from Dr. Kymissis

fundamentally different ways. The different driving methods result in differences in the degradation profile of the OLED pixels that make up the display.

-00987 Ex. 2009 (Kymissis Declaration) at ¶116

-00988 Ex. 2009 (Kymissis Declaration) at ¶116

-01075 Ex. 2009 (Kymissis Declaration) at ¶105

12-15. As a result, OLEDs in active-matrix displays undergo lower rates of degradation, and different primary modes of degradation, than OLEDs in passive-matrix displays.

-00987 Ex. 2009 (Kymissis Declaration) at ¶118

-00988 Ex. 2009 (Kymissis Declaration) at ¶118

-01075 Ex. 2009 (Kymissis Declaration) at ¶107

“lower[] the OLED power conversion efficiency” Ex. 2074 (Gu) at 6. Further, the high voltages required for driving pixels in a passive matrix display also promotes more rapid degradation of the OLED pixels due to several different mechanisms. Heat generation is one major mechanism. When an OLED is biased, heat is generated due to potential drops at the interfaces between the different layers of the OLED device stack. The electrical resistances at the different interfaces of the stack, as well as the high resistance of the organic layer, all contribute to heating. Heat generation in an OLED can result in crystallization of the organic material, which reduces the luminance and efficiency of the OLED. Ex. 2078 (Tyagi) at 1-4. This effect will be more pronounced at the higher voltages and current densities required to drive a PMOLED display.

-00987 Ex. 2009 (Kymissis Declaration) at ¶117

-00988 Ex. 2009 (Kymissis Declaration) at ¶117

-01075 Ex. 2009 (Kymissis Declaration) at ¶106

PMOLED and AMOLED Displays Have Different Lifetime and Design Considerations

- Unrebutted, detailed technical testimony from Dr. Kymissis

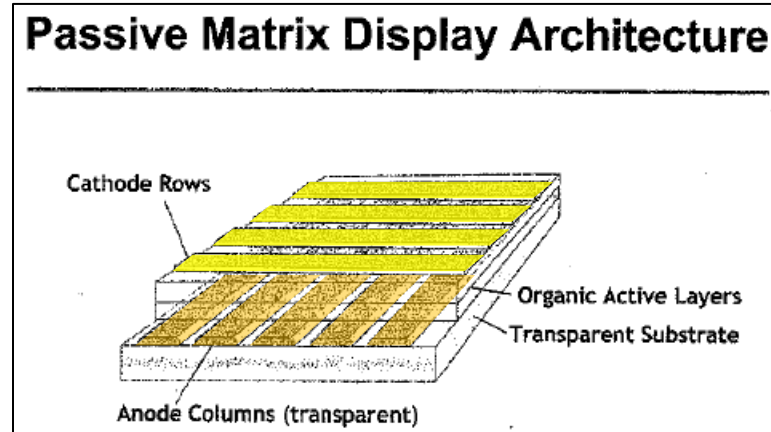
117. To recap, in passive-matrix OLEDs, the rows of OLED pixels are selected sequentially, one row at a time for only a small fraction of a frame. The light pulses must be extremely bright because of the short time within which each row is addressed, and this requires the pixels to be driven with very high voltage and current density. This “high-instantaneous luminance requirement” was known to “lower[] the OLED power conversion efficiency” Ex. 2074 (Gu) at 6. Further, the

118. On the other hand, in active-matrix OLED displays, the capacitors allow the voltages on particular OLED pixels to be held constant for the duration of a frame, even when the row(s) associated with those particular OLED pixels are not selected. Thus, pixels can remain on while other rows of pixels are selected. This allows the OLEDs to be driven at a significantly lower voltage and driving current as compared to the OLEDs in passive-matrix OLED displays. Ex. 2073 (Ghosh) at 12-15. As a result, OLEDs in active-matrix displays undergo lower rates of

-00987 Ex. 2009 (Kymissis Declaration) at ¶¶117-118
-00988 Ex. 2009 (Kymissis Declaration) at ¶¶117-118
-01075 Ex. 2009 (Kymissis Declaration) at ¶¶106-107

PMOLED and AMOLED Displays Have Different Constraints for Pixel Structures

Passive-matrix:



-00987, -00988, -01075 Ex. 2073 (SID Short Course) at 13 (annotated)

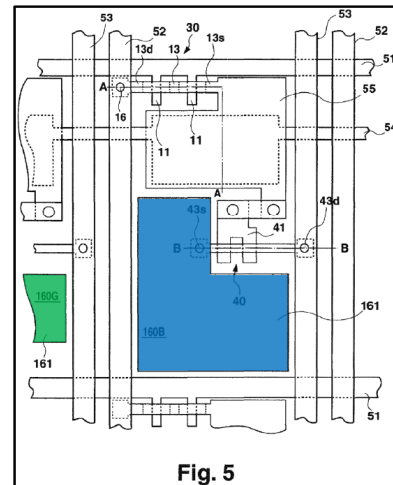
49. In a passive-matrix display, pixels are formed where column electrodes and row electrodes overlap. Ex. 2074 (Gu) at 6. Thus, the intersection of column electrodes and row electrodes defines the OLED pixel size. An individual pixel is

-00987 Ex. 2009 (Kymissis Declaration) at ¶49

-00988 Ex. 2009 (Kymissis Declaration) at ¶49

-01075 Ex. 2009 (Kymissis Declaration) at ¶49

Active-matrix:



55. The additional pixel driving circuitry associated with each pixel in an active-matrix OLED, in conjunction with the power and signal lines necessary to control this circuitry, also impose different constraints on the size and locations of pixels. Ex. 2073 (Ghosh) at 12-15. For example, in Yamada's bottom-emission type

-00987 Ex. 2009 (Kymissis Declaration) at ¶55, 113

-00988 Ex. 2009 (Kymissis Declaration) at ¶55, 113

-01075 Ex. 2009 (Kymissis Declaration) at ¶55, 102

PMOLED and AMOLED Display Designs Are Not Readily Applicable to Each Other

matrix driving and passive-matrix driving. At a high level, active-matrix and passive-matrix driving refers to different ways in how the individual display elements are addressed for controlling the operation of each pixel (*i.e.*, how the light emitting material is controlled to change the brightness of each pixel). The two different approaches require fundamental differences in the physical structure of the display as well. As a result, the technologies and design methods used for one are not readily transferable to the other.

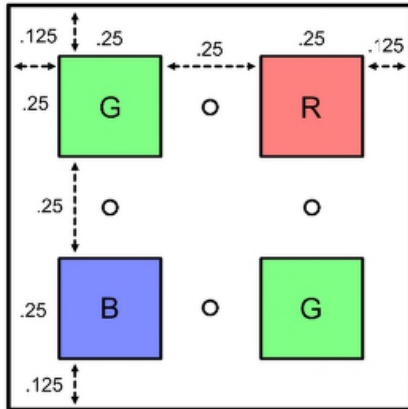
-00987 Ex. 2009 (Kymissis Declaration) at ¶47

-00988 Ex. 2009 (Kymissis Declaration) at ¶47

-01075 Ex. 2009 (Kymissis Declaration) at ¶47

The Petitions Propose Modifying Matthies' Figure 8B

As can be seen, both the sub-pixel dimensions and spacing are “equal in the horizontal and vertical directions.” (*Id.*, 17:31-33.) This results in square sub-pixels arranged in an evenly spaced, square matrix. The below demonstrative is a scale drawing of the Figure 8B’s “quad sub-pixel structure” generated using the example dimensions of Table 2:

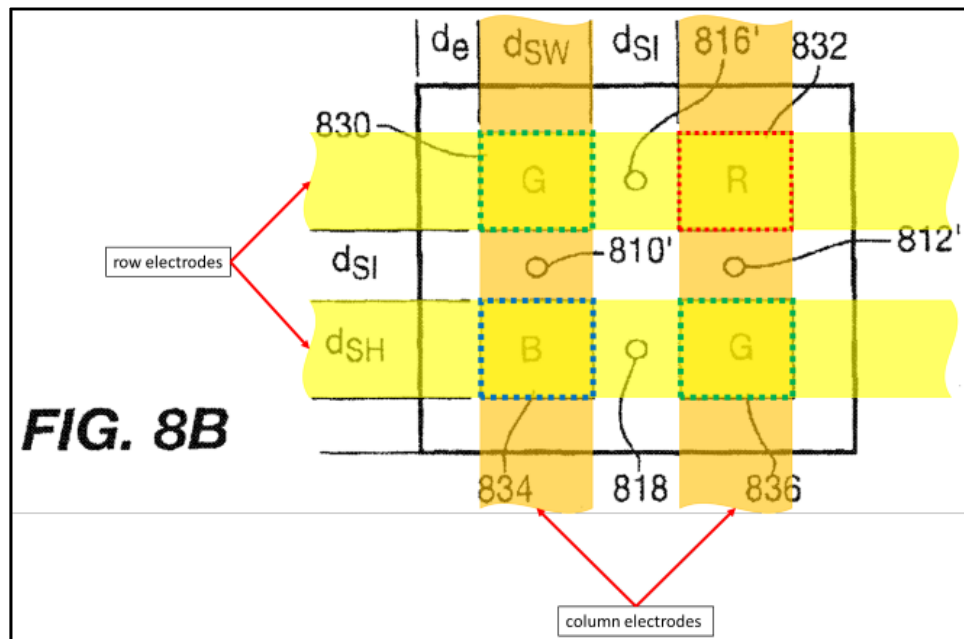


-00987 Pet. at 24
-00988 Pet. at 22-23
-01075 Pet. at 29-30

Matthies also teaches how this “quad sub-pixel structure” should be integrated into a display. “[D]isplay 100” can be “formed from tiles having 16 pixel forming elements in a four by four array.” (Ex. 1004, 5:56-61.) To obtain such a larger tile, the pixel geometry shown in Figure 8B and the above demonstrative is simply repeated. (See, e.g., *id.*, Fig. 7 (showing a 16 pixel tile with equal pixel spacing); see also *id.*, 5:38-55 (“[t]he tiles are constructed with pixel forming elements evenly spaced”).)

-00987 Pet. at 25
-00988 Pet. at 23
-01075 Pet. at 30

The Experts Agree Matthies' Figure 8B Is Passive-Matrix



-00987 Ex. 2009 (Kymissis Declaration) at ¶109
-00988 Ex. 2009 (Kymissis Declaration) at ¶109
-01075 Ex. 2009 (Kymissis Declaration) at ¶98

106. Matthies' tiled displays—including the specific embodiment of the tiled display shown in Figure 8B that Dr. Pattison relies on—are PMOLED displays. Matthies, 10:31-33.

-00987 Ex. 2009 (Kymissis Declaration) at ¶106
 -00988 Ex. 2009 (Kymissis Declaration) at ¶106
 -01075 Ex. 2009 (Kymissis Declaration) at ¶95

6 Q. I'm just asking about Figure 8B. And Matthies
7 says the pixel structure shown employs two row electrodes,
8 not shown, and two column electrodes, not shown, correct?
9 A. Correct.

10 Q. And that's describing passive-matrix display for
11 Figure 8B, correct?
12 A. Yes.

-00987 Ex. 2083 (Pattison Testimony) at 304:6-12
-00988 Ex. 2083 (Pattison Testimony) at 304:6-12
-01075 Ex. 2083 (Pattison Testimony) at 304:6-12

Matthies' Figure 8B Is Passive-Matrix

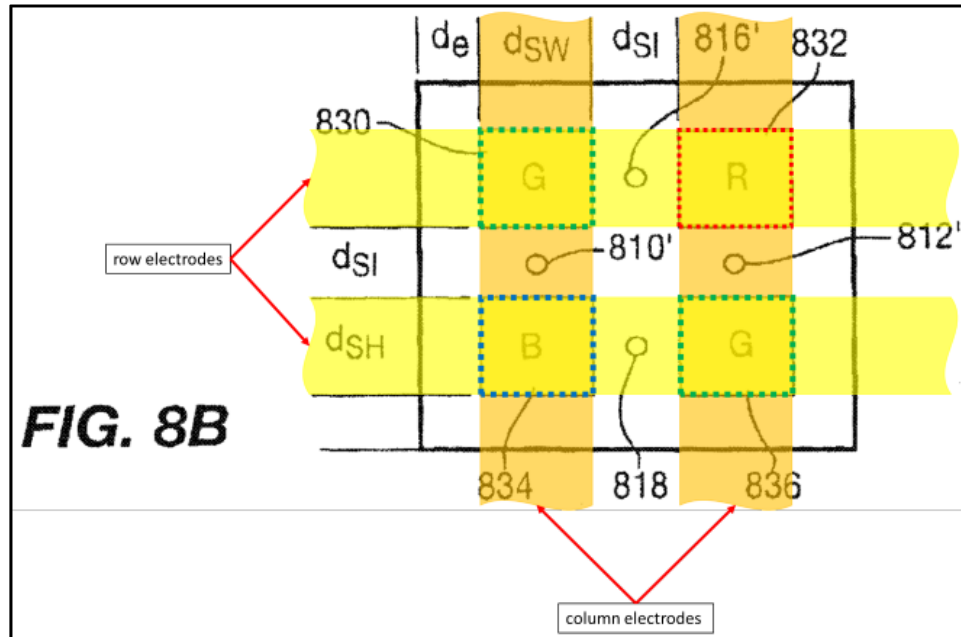


FIG. 8B

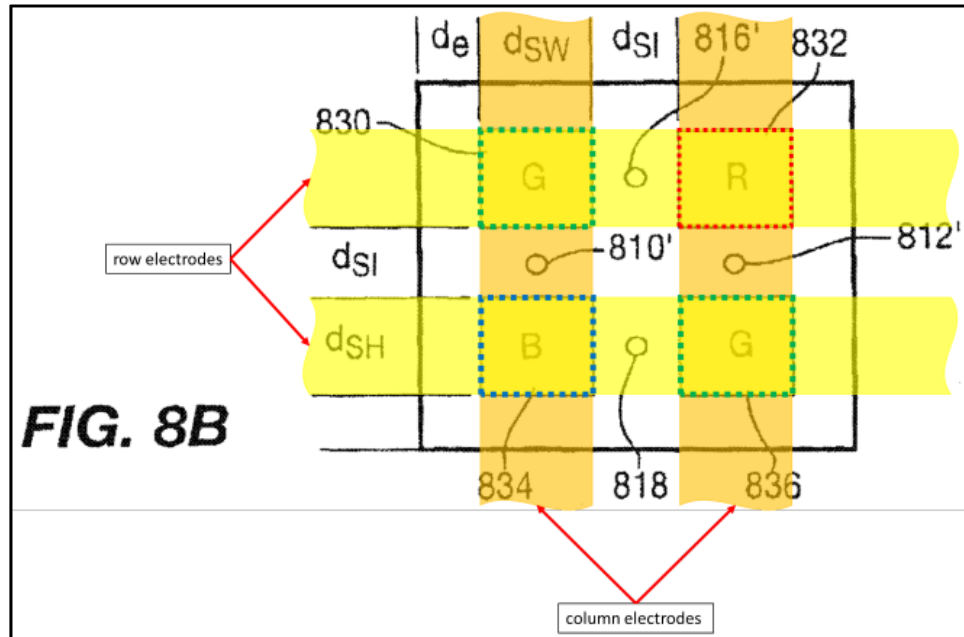
-00987 Ex. 2009 (Kymissis Declaration) at ¶109
-00988 Ex. 2009 (Kymissis Declaration) at ¶109
-01075 Ex. 2009 (Kymissis Declaration) at ¶98

109. The quad sub-pixel structure of Figure 8B that Dr. Pattison relies on is similarly a passive-matrix structure, and has “two row electrodes ... and two column electrodes” creating the four sub-pixel regions where the electrodes cross as shown below in an annotated version of Figure 8B. Matthies, 17:10-12.

110. In this embodiment of Matthies, consistent with a PMOLED structure, “[t]he geometry of the quad sub-pixel structure is defined by the dimensions d_{SH} the height of the sub-pixel, d_{SW} , the width of the sub-pixel, d_e , the distance from the active sub-pixel areas to the edge of the pixel area, and d_{SL} , the distance between adjacent sub-pixels.” Matthies, 17:16-20. So in the quad sub-pixel structure, the width of the row electrode and the width of the column electrode define the pixel areas. The result is that in the quad sub-pixel structure of Matthies, each of the green,

-00987 Ex. 2009 (Kymissis Declaration) at ¶109-110
-00988 Ex. 2009 (Kymissis Declaration) at ¶109-110
-01075 Ex. 2009 (Kymissis Declaration) at ¶98-99

Matthies' Figure 8B Is Passive-Matrix



-00987 Ex. 2009 (Kymissis Declaration) at ¶109
-00988 Ex. 2009 (Kymissis Declaration) at ¶109
-01075 Ex. 2009 (Kymissis Declaration) at ¶98

The exemplary embodiment of the invention employs a passive addressing technique within a block in which only one row of pixels is illuminated at any time. The scanning

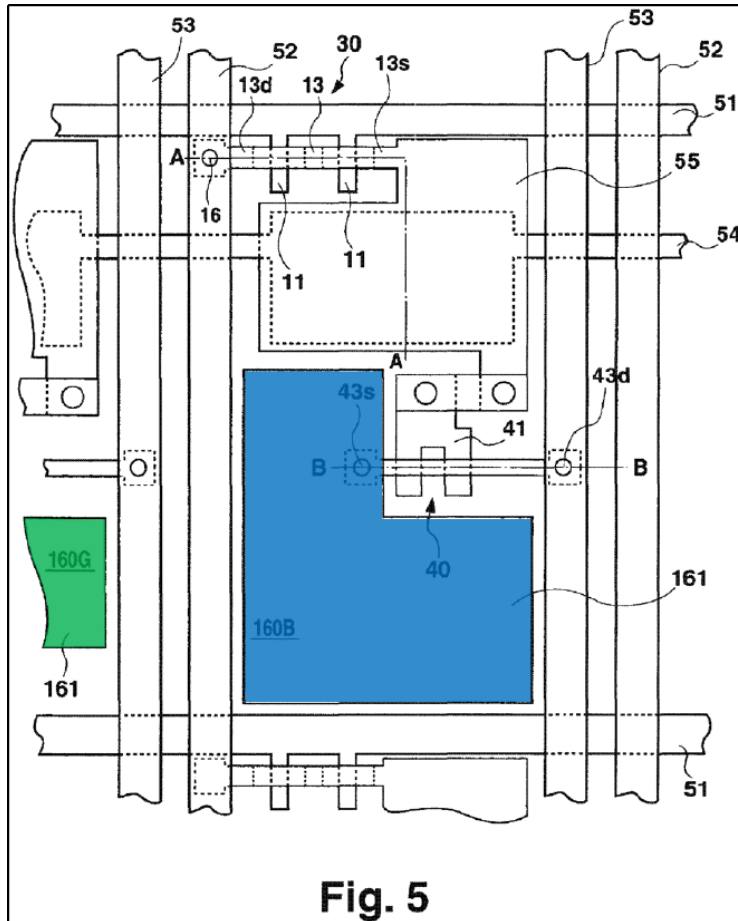
Matthies at 10:31-33

49. In a passive-matrix display, pixels are formed where column electrodes and row electrodes overlap. Ex. 2074 (Gu) at 6. Thus, the intersection of column electrodes and row electrodes defines the OLED pixel size. An individual pixel is illuminated when appropriate voltages are applied to the row and column electrodes that overlap at the location of that pixel. Note that in this configuration, a row of pixels shares one row electrode and a column of pixels shares one column electrode.

When operating the display, one row of pixels is illuminated at a time by applying a

-00987 Ex. 2009 (Kymissis Declaration) at ¶49
-00988 Ex. 2009 (Kymissis Declaration) at ¶49
-01075 Ex. 2009 (Kymissis Declaration) at ¶49

Yamada Is Directed to Active-Matrix Displays



-00987 Ex. 2009 (Kymissis Declaration) at ¶113
-00988 Ex. 2009 (Kymissis Declaration) at ¶113
-01075 Ex. 2009 (Kymissis Declaration) at ¶102

As shown in FIGS. 2A and 2B, the organic EL display apparatus is formed by laminating in sequence the TFT and the organic EL element onto a substrate 10, such as a substrate formed from glass or synthetic resin, a conductive substrate, or a semiconductor substrate. However, when a

Yamada at 1:46-50

111. On the other hand, Yamada is directed to active-matrix OLEDs (“AMOLEDs”). Yamada, 1:6-9, 1:18-3:8. And Yamada is directed to what are called

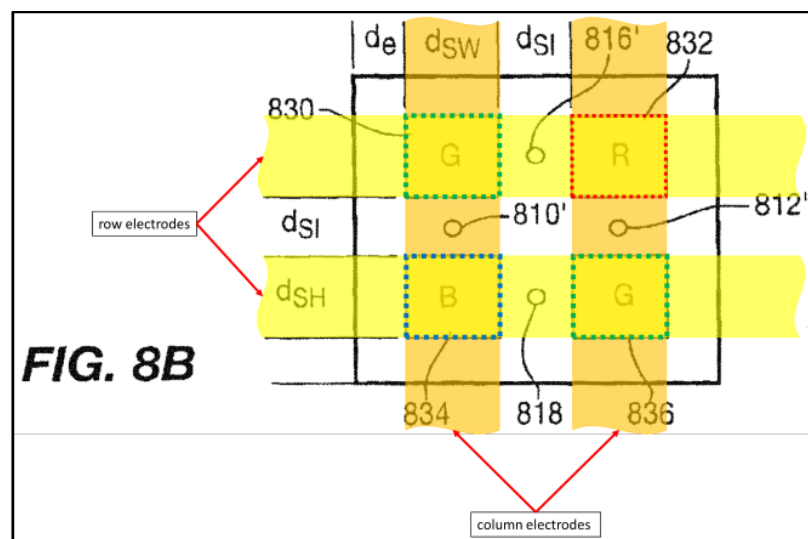
114. Thus, Yamada’s AMOLED display does not use row and column electrodes, and Yamada’s pixel shapes and sizes are not dictated by the dimensions of row or column electrodes. But as shown above, and as discussed in the technical background section, Yamada’s pixels are still constrained by the pixel driving circuit (including transistors and a capacitor) and power and signal lines.

-00987 Ex. 2009 (Kymissis Declaration) at ¶111, 114
-00988 Ex. 2009 (Kymissis Declaration) at ¶111, 114
-01075 Ex. 2009 (Kymissis Declaration) at ¶100, 103

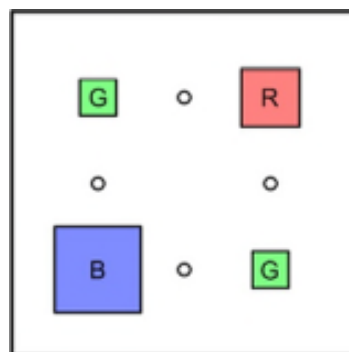
Petitioner's Proposal Is Inconsistent with the Passive-Matrix Structure

- Unrebutted technical testimony from Dr. Kymissis

Matthies' Structure



Petitioner's Proposal



123. And as I just explained, in the PMOLED of Matthies, the light-emitting area is defined by the overlap of the row and column electrodes. As a result, as shown

834 in the left column) have the same width (d_{SW}). If a POSITA were to try to change the size of a pixel in the PMOLED shown in Figure 8B, that would require changing the size of a row and/or column electrode, but doing so would also change the size of all of the other pixels defined by that row and/or column electrode. Dr. Pattison does not give any explanation of how the pixel sizes could be individually arbitrarily changed into the proportions that he suggests should be used, and it is not clear how such a display could be made.

-00987 Ex. 2009 (Kymissis Declaration) at ¶123
-00988 Ex. 2009 (Kymissis Declaration) at ¶123
-01075 Ex. 2009 (Kymissis Declaration) at ¶112

Petitioner's New Argument in Reply

- Petitioner does not dispute Matthies Fig. 8B is a passive matrix display
- Petitioner only argues Matthies “also” teaches active matrix displays

Matthies does explain that “exemplary embodiment[s]” “employ[] a passive addressing technique.” (Matthies, 10:31-33.) But it also teaches “active matrix” displays. Petition, 13 (quoting Matthies, 8:21-26). In fact, Matthies repeatedly

-00987 Reply at 2-3

-00988 Reply at 2-3

-01075 Reply at 2-3

Matthies' Displays Are Not Active-Matrix Displays

- Matthies discusses active and passive “electronics” or “devices,” not active-matrix addressing

One exemplary tile structure consists of a multilayer ceramic circuit board 132 that serves as a substrate upon which: the display material is mounted on the viewer side while the electronics 134 (active and passive) for drive or other functions are mounted mostly on the back side. Con-

Matthies at 7:15-19

rials. The multiple layers together with the connectors and vias provide the basic function of a circuit board upon which active and passive electrical devices and circuits can be placed.

Matthies at 7:42-45

Matthies' Displays Are Not Active-Matrix Displays

- Petitioner relies on culled quotations taking the word “active” out of context

displays. Petition, 13 (quoting Matthies, 8:21-26). In fact, Matthies repeatedly states that it is equally applicable to both actively and passively driven OLEDs. (*Id.*, 7:15-19 (“display” can be “active and passive”); 7:42-45 (“active” or “passive ... circuits” can be employed); 8:21-23 (“electronics,” such as “pixel driving circuitry[.]” can be “both active and passive”); 8:20-26 (referencing “active matrix circuits” particularly with “high temperature” substrates); 8:30-33 (use of either “active or passive devices” is contemplated).)

-00987 Reply at 3
-00988 Reply at 3
-01075 Reply at 3

One exemplary tile structure consists of a multilayer ceramic circuit board **132** that serves as a substrate upon which: the display material is mounted on the viewer side while **the electronics 134 (active and passive)** for drive or other functions are mounted mostly on the back side. Con-

Matthies at 7:15-19

The electronics which form the image processing and **pixel driving circuitry** are mounted on the layers. **Electronics** are used in the broadest sense to include both active and passive, and both discrete devices mounted on the layers and devices formed in place by processes such as those now used to make active matrix circuits for displays on various high temperature substrates. While these electronics can be

Matthies at 8:20-26

Matthies' Displays Are Not Active-Matrix Displays

- Dr. Pattison admits his reply declaration misquotes Matthies

9. For example, according to Matthies, its "display" can be either "active or passive" (Matthies, 7:15-19) and may employ either "active" or "passive ... circuits" (*id.*, 7:42-45).

-00987 Ex. 1017 (Pattison Reply Declaration) at ¶9
-00988 Ex. 1018 (Pattison Reply Declaration) at ¶9
-01075 Ex. 1017 (Pattison Reply Declaration) at ¶9

One exemplary tile structure consists of a multilayer ceramic circuit board 132 that serves as a substrate upon which: the display material is mounted on the viewer side while the electronics 134 (active and passive) for drive or other functions are mounted mostly on the back side. Con-

Matthies at 7:15-19

17	In Paragraph 9 of your declaration you
18	have a quotation, active or passive.
19	Do you see that?
20	A I do.
21	MR. HERMAN: Objection to form.
22	Q My simple question is, the words "active"
1	or "passive" that you have quoted here do not
2	appear in Matthies Column 7, Lines 15 to 19.
3	Isn't that correct, yes or no?
4	A Yes.

-00987 Ex. 2086 (Pattison Deposition) at 31:17-32:4
-00988 Ex. 2086 (Pattison Deposition) at 31:17-32:4
-01075 Ex. 2086 (Pattison Deposition) at 31:17-32:4

Matthies' Displays Are Not Active-Matrix Displays

- Both experts agree active circuits are different from active matrix displays

4 Q. So Figure 6 is meant to show a display in which the
5 individual pixels are completely actively driven.
6 Correct?
7 A. So, again, I think we're mixing two terms here. So
8 the individual pixels are actively driven; however,
9 they are individually addressed.

22 So, yes, each pixel is actively driven, but
1 I would disagree that it is an active matrix because
2 we're not driving it using that matrix architecture.

-00987 Ex. 1018 (Kymissis Deposition) at 101:4-9, 101:22-102:2

-00988 Ex. 1019 (Kymissis Deposition) at 101:4-9, 101:22-102:2

-01075 Ex. 1018 (Kymissis Deposition) at 101:4-9, 101:22-102:2

5 Q Now, an active matrix is not a single
6 circuit. Correct?
7 A Well, it has single circuits going to the
8 subpixels. It has -- yeah. So it's a matrix of
9 single circuits that drive the subpixels.

17 Q And so the active matrix itself is not a
18 single circuit. Right?
19 A Like I said, it's comprised in single
20 circuits, so it's a -- it's a general description
21 of a drive scheme.
22 Q Active matrix OLEDs require a pixel
1 circuit for each and every pixel. Correct?
2 MR. HERMAN: Objection. Form.
3 A Yeah. Yeah, that would be my
4 understanding.

-00987 Ex. 2086 (Pattison Deposition) at 41:5-9, 41:17-42:4

-00988 Ex. 2086 (Pattison Deposition) at 41:5-9, 41:17-42:4

-01075 Ex. 2086 (Pattison Deposition) at 41:5-9, 41:17-42:4

Matthies' Displays Are Not Active-Matrix Displays

- Dr. Pattison admits Matthies does not refer to active matrix addressing

9	Q	Matthies doesn't use the term "active
10		matrix addressing." Correct?
11	A	I don't think so. That's kind of a --
12		yeah. I don't think so.

-00987 Ex. 2086 (Pattison Deposition) at 81:9-12

-00988 Ex. 2086 (Pattison Deposition) at 81:9-12

-01075 Ex. 2086 (Pattison Deposition) at 81:9-12

Matthies' Displays Are Not Active-Matrix Displays

- Dr. Pattison admits Matthies only mentions “active matrix circuits” in referring to processes for forming electronic elements, namely, manufacturing steps used to make active matrix circuits

The electronics which form the image processing and pixel driving circuitry are mounted on the layers. Electronics are used in the broadest sense to include both active and passive, and both discrete devices mounted on the layers and devices formed in place by processes such as those now used to make active matrix circuits for displays on various high temperature substrates. While these electronics can be placed anywhere, the most convenient location is the back surface. This permits standard assembly and attachment equipment and processes to be used. In addition, the placing of active or passive devices on the intervening layers or viewer surface permits greater flexibility in the system design.

Matthies at 8:20-33 (cited in Pattison Reply Declaration at ¶11)

4	Q And then Matthies says that's one option,
5	and the other is devices formed in place by
6	processes such as those now used to make active
7	matrix circuits for displays on various
8	high-temperature substrates. Correct?
9	A Yes.
10	Q And there are processes like chemical
11	vapor deposition and etching that are used to form
12	electronic components on a tile or other substrate
13	that are also used to make active matrix circuits.
14	Correct?
15	A Yeah, there's a whole field of making
16	transistors and passive components that are
17	integrated into electronics, that's -- that's --
18	it's kind of like he's talking about making an
19	integrated circuit on these tiles.

-00987 Ex. 2086 (Pattison Deposition) at 47:4-19

-00988 Ex. 2086 (Pattison Deposition) at 47:4-19

-01075 Ex. 2086 (Pattison Deposition) at 47:4-19

Matthies Teaches No Active-Matrix Implementation

- Matthies' disclosures convey it is directed to passive-matrix displays

The exemplary embodiment of the invention employs a passive addressing technique within a block in which only one row of pixels is illuminated at any time. The scanning

Matthies at 10:31-33

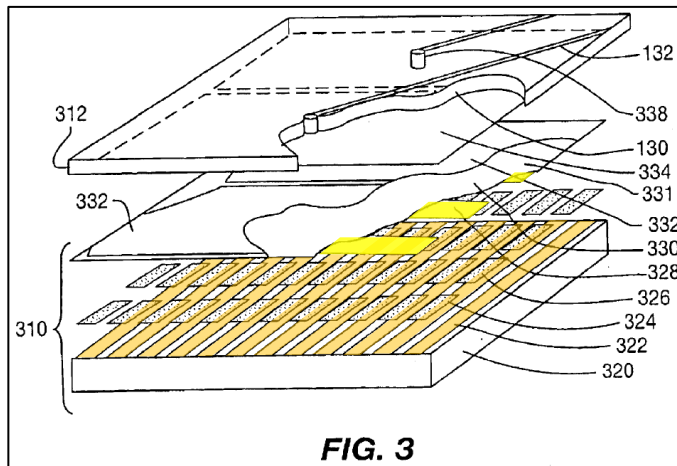
3.5 Passive matrix and active matrix driving schemes

To drive an LCD or OLED display, passive matrix (PM) and active matrix (AM) driving techniques are commonly used.^{14, 15} For a PM LCD, due to the capacitor characteristics of the liquid crystal (LC) layer, a voltage applied to a selected pixel inevitably affects the neighboring pixels and degrades the contrast of the display, which is called crosstalk.¹⁶ Each row of a PM LCD or OLED display is sequentially active with a high frequency, and the human eye regards it as a planar frame rather than line scanning due to the persistence of vision. Since only one row can be selected and displayed at a time, the display time for a single row decreases with increasing number of rows, which limits the display size and resolution. In contrast, by using TFTs in an LCD or OLED pixel, the turn-on/turn-off and different grayscales can be controlled independently: this is called AM driving.

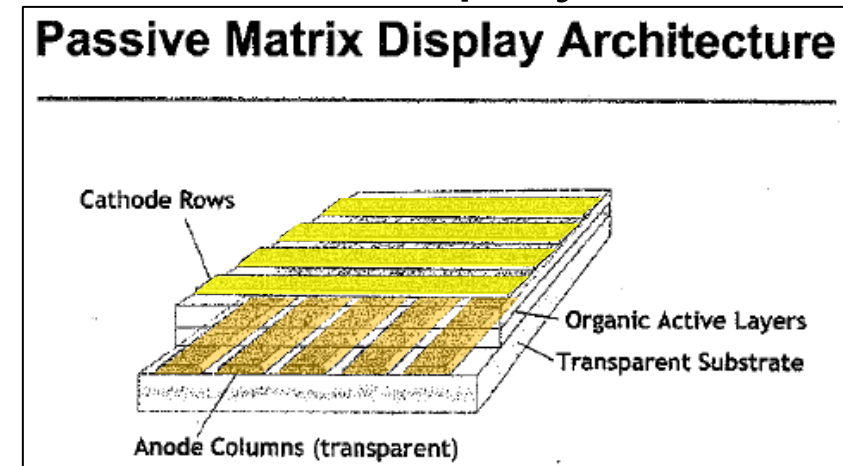
- 00987 Ex. 2080 (Introduction to Flat Panel Displays) at 5
- 00988 Ex. 2080 (Introduction to Flat Panel Displays) at 5
- 01075 Ex. 2080 (Introduction to Flat Panel Displays) at 5

Matthies Teaches No Active-Matrix Implementation

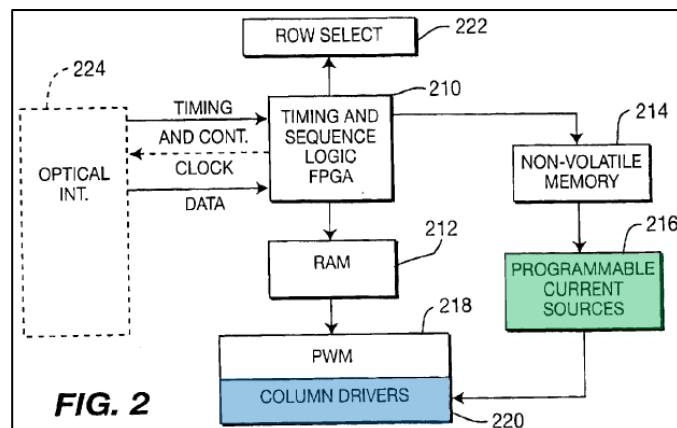
■ Matthies' disclosures concern passive-matrix displays



Matthies at Fig. 3 (annotated)



-00987, -00988, -01075 Ex. 2073 (SID Short Course) at 13



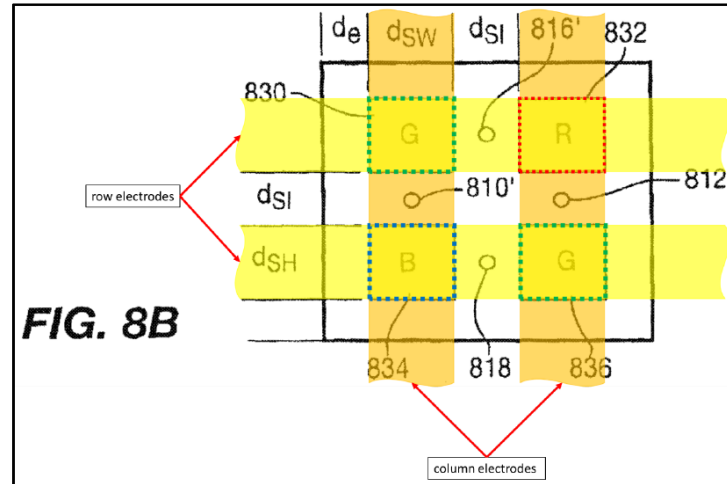
Matthies at Fig. 2 (annotated)

A passive matrix OLED (PM OLED) array consists of two sets of electrically isolated leads (rows and columns) arranged orthogonally with an OLED at each intersection, as shown in Fig. 6(a). An electronic switch is employed to address each of the rows. To achieve gray levels, the column drivers must be current sources since the pixel luminance is proportional to the drive current, and the I - V characteristics of the OLED's are highly nonlinear as discussed in Section II.

-00987, -00988, -01075 Ex. 2074 (Gu Paper) at 6

Display Addressing Scheme Impacts Pixel Arrangements

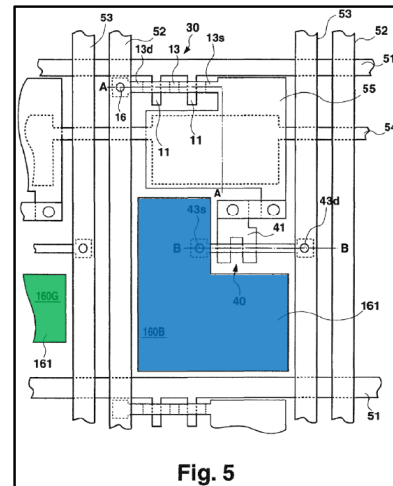
Passive-matrix:



49. In a passive-matrix display, pixels are formed where column electrodes and row electrodes overlap. Ex. 2074 (Gu) at 6. Thus, the intersection of column electrodes and row electrodes defines the OLED pixel size. An individual pixel is

-00987 Ex. 2009 (Kymissis Declaration) at ¶49
-00988 Ex. 2009 (Kymissis Declaration) at ¶49
-01075 Ex. 2009 (Kymissis Declaration) at ¶49

Active-matrix:



55. The additional pixel driving circuitry associated with each pixel in an active-matrix OLED, in conjunction with the power and signal lines necessary to control this circuitry, also impose different constraints on the size and locations of pixels. Ex. 2073 (Ghosh) at 12-15. For example, in Yamada's bottom-emission type

-00987 Ex. 2009 (Kymissis Declaration) at ¶55
-00988 Ex. 2009 (Kymissis Declaration) at ¶55
-01075 Ex. 2009 (Kymissis Declaration) at ¶55

Display Addressing Scheme Impacts Pixel Arrangements

21 Q. All right. So the reference does not say that the
22 pixel arrangements it depicts are suitable only for
1 active matrix displays or only for passive matrix
2 displays, does it?
3 MR. KUDZIN: Objection.
4 A. So that paragraph says that pixel arrangements are
5 useful in different displays. Again, the details of
6 what will or will not be useful for a passive versus
7 active matrix depends on details of the system
8 design.

-00987 Ex. 1018 (Kymissis Deposition) at 68:21-69:8
-00988 Ex. 1019 (Kymissis Deposition) at 68:21-69:8
-01075 Ex. 1018 (Kymissis Deposition) at 68:21-69:8

[0025] If the material of the sub-electrodes is of a low enough conductivity so as to make lateral conduction negligible, then no gap need be provided between the sub-electrodes. For example, sub-electrodes could be made of a thin layer of material in order to increase lateral resistance and reduce lateral conduction thus negating the requirement for a gap between the sub-electrodes. However, in this case, additional conductive connecting lines will usually be required, particularly for a passive matrix display, as otherwise the resistance across the display will generally be too high. This is not such a problem for active matrix displays in which each discrete light-emissive region will have its own driver.

-00987 Ex. 1011 (Smith) at [0025]
-00988 Ex. 1012 (Smith) at [0025]
-01075 Ex. 1006 (Smith) at [0025]

Incompatible Display Architectures

Conflicts with Requirements of Matthies' Tiled Display

Petitioner's Theory Violates Matthies' Spacing and Regularity Requirements

131. Matthies repeatedly stresses the importance of ensuring that pixels are spaced such that the distance from each pixel to the edge of the tile is the same, and the distance between pixels within a tile is the same as the distance between pixels across adjacent tile. *See, e.g.,* Matthies, 5:47-53, 8:37-41, 15:59-63, 16:5-9. As I've explained further below in Section X.D.3, this is important to Matthies' tiled display to avoid optical effects at the tile edges. *See, e.g.,* Matthies, 8:37-41, 21:22-27, 22:53-56. Matthies also places constraints on its pixel arrangements to accommodate vias and connectors. *See, e.g.,* Matthies, 15:61-63, 16:5-9, 16:22-26, 24:39-42. These constraints important to Matthies' tiled display would be incompatible with Dr. Pattison's proposed resizing of Matthies' pixels based on Yamada.

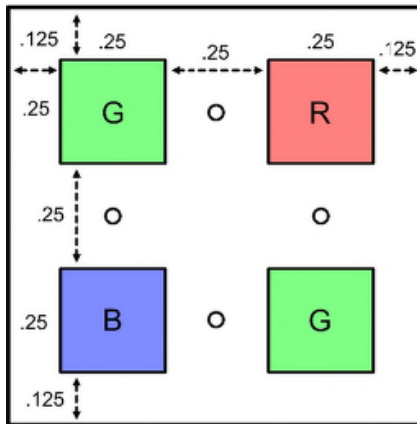
-00987 Ex. 2009 (Kymissis Declaration) at ¶¶131, 178

-00988 Ex. 2009 (Kymissis Declaration) at ¶¶131, 178

-01075 Ex. 2009 (Kymissis Declaration) at ¶¶120, 167

Matthies' Requirement of Equal Spacing between Pixels

- Undisputed that Matthies requires the same spacing between pixels within a tile and across adjacent tiles



The edges of the tiles are desirably carefully formed to ensure that the tiled display has no visible seams between the tiles. One criterion for the tiles is that the spacing between the pixels separated by the tile seam is the same as the spacing of pixels on the tile. To satisfy this criterion, the tile

Matthies at 8:37-41

arranged in a “matrix.” (Ex. 1004, 5:56-62.) The sub-pixels are arranged “such that ... the inter-pixel distance between the edge pixels of two adjacent tiles is the same as the inter-pixel distance of adjacent pixels in the interior of a tile.” (*Id.*, 5:49-53; see also *id.*, 8:48-50 (explaining that the display is “tile[d]” “such that there is a continuity in the pixel spacing over the display”).) Each sub-pixel can be “centered

-00987 Pet. at 22

-00988 Pet. at 21

-01075 Pet. at 27

a sub-pixel and tile edge always be exactly the same. Instead, merely requires that “distance between ... pixels of two adjacent tiles” be “the same as the ... distance of adjacent pixels in the interior of a tile.” (*Id.*, 5:49-53; see also 8:39-41.) This is how

-00987 Reply at 11-12

-00988 Reply at 11-12

-01075 Reply at 11-12

Matthies' Requirement of Equal Spacing between Pixels

- Matthies requires equal pixel spacing within a tile and across adjacent tiles, as Petitioner's expert admits

187. Further, Matthies teaches having the same spacing between the pixels, both within each tile and across adjacent tiles, as illustrated by Dr. Pattison's "scale drawing" of Matthies' quad sub-pixel structure shown in Figure 8B using the example values listed in Table 2, reproduced below. *See* Ex. 1003, ¶174.

-00987 Ex. 2009 (Kymissis Declaration) at ¶187

-00988 Ex. 2009 (Kymissis Declaration) at ¶187

-01075 Ex. 2009 (Kymissis Declaration) at ¶176

149. "[T]he tiles are formed such that, when they are joined, the inter-pixel distance between the edge pixels of two adjacent tiles is the same as the inter-pixel distance of adjacent pixels in the interior of a tile." (*Id.*, 5:49-53.)

-00987 Ex. 1003 (Pattison Declaration) at ¶149

-00988 Ex. 1003 (Pattison Declaration) at ¶144

-01075 Ex. 1003 (Pattison Declaration) at ¶136

Petitioner's Proposal Violates Matthies' Equal Pixel Spacing Requirement

- Petitioner's modification violates Matthies' requirement of equal pixel spacing within a tile and across adjacent tiles

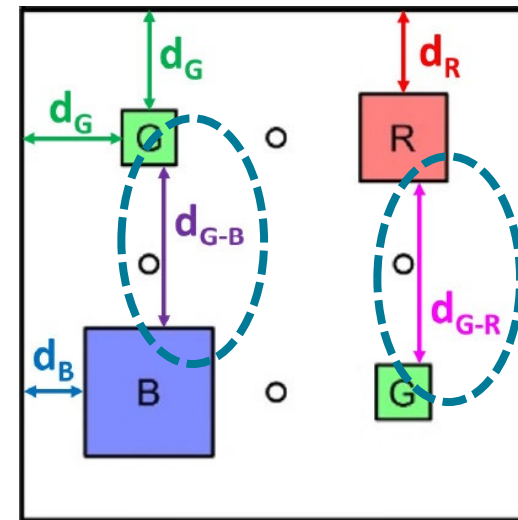
190. Dr. Pattison's proposed combination with Yamada would require a POSITA to disregard Matthies' teachings and violate its design requirements for its quad sub-pixel structures. For red, green, and blue pixels to all have different sizes with respect to each other as proposed by Dr. Pattison, the distance between adjacent pixels cannot be constant, and the distance between pixels and the edges of the tile would need to be different for each color pixel. As illustrated below in an annotation

the red pixels (Ex. 1003, ¶229), the space between a green pixel and an adjacent red pixel would be *greater* than the space between a green pixel and an adjacent blue pixel. Similarly, there would be *different* distances between the edges of each adjacent color pixel and the edge of the tile:

-00987 Ex. 2009 (Kymissis Declaration) at ¶190

-00988 Ex. 2009 (Kymissis Declaration) at ¶190

-01075 Ex. 2009 (Kymissis Declaration) at ¶179



$$d_{G-B} \neq d_{G-R}$$

Matthies' Requirement of Even Spacing to Tile Edges

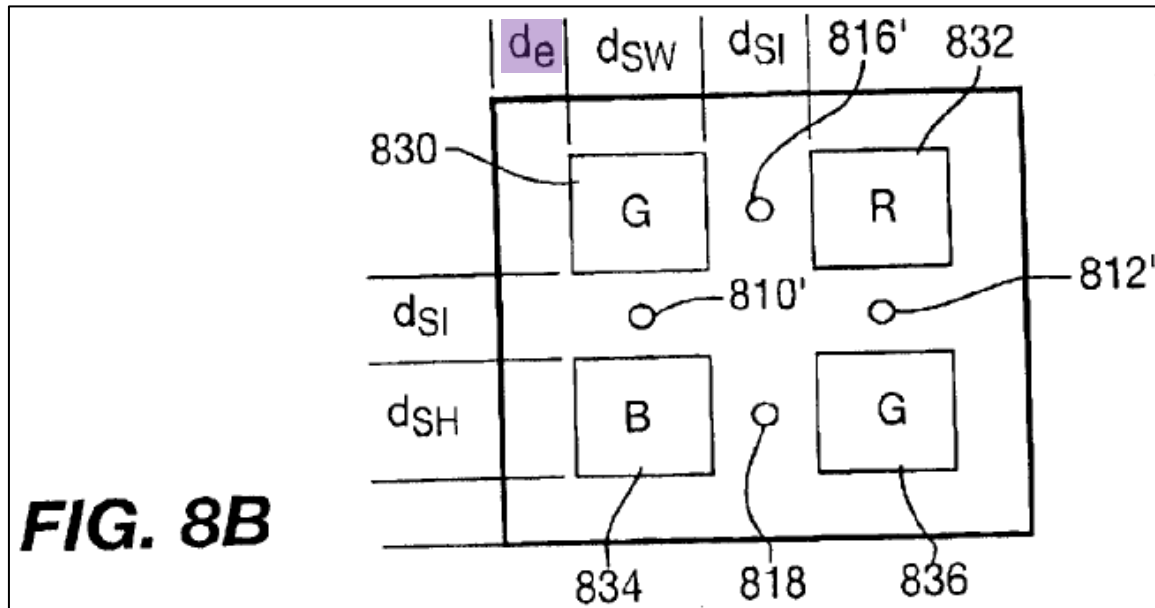


FIG. 8B

Matthies at Fig. 8B

The tiles are constructed with pixel forming elements evenly spaced up to the edges of the tiles. As described

Matthies at 5:47-48

810' and 812'. The geometry of the quad sub-pixel structure is defined by the dimensions d_{SH} the height of the sub-pixel, d_{SW} , the width of the sub-pixel, d_e , the distance from the active sub-pixel areas to the edge of the pixel area, and d_{SI} , the distance between adjacent sub-pixels. These values are

Matthies at 17:16-20

Matthies' Requirement of Even Spacing to Tile Edges

- Matthies requires pixels evenly spaced to tile edges, as Petitioner's expert admits

179. One of Matthies' main concerns is to "eliminat[e] the visibility of the seams between tiles" in its tiled displays. Matthies, 2:7-10; *see id.* 22:17-22. To ensure that the seams are not visible, and to allow space for materials that join adjacent tiles while ensuring that no useful light emission is blocked, Matthies teaches that the edges of pixels should be evenly spaced from the edges of the tile.

-00987 Ex. 2009 (Kymissis Declaration) at ¶179

-00988 Ex. 2009 (Kymissis Declaration) at ¶179

-01075 Ex. 2009 (Kymissis Declaration) at ¶168

148. In particular, Matthies explains that its display includes "tiles ... constructed with pixel forming elements evenly spaced up to the edge of the tiles." (*Id.*, 5:47-48.)

-00987 Ex. 1003 (Pattison Declaration) at ¶148

-00988 Ex. 1003 (Pattison Declaration) at ¶143

-01075 Ex. 1003 (Pattison Declaration) at ¶135

Matthies' Requirement of Even Spacing to Tile Edges

- Dr. Pattison agreed Matthies requires pixels evenly spaced to tile edges

24 Q. And one thing that Matthies discusses is the
25 importance of having uniform spacing from the edges of its
1 tiles, correct?
2 A. Yes.
3 Q. And Matthies is describing a certain symmetry
4 with pixels of the same size and equal spacing from the
5 edges of the tiles, correct?
6 A. Yeah. He is.

13 And you agree that Matthies explains that its
14 display tiles include tiles constructed with pixel-forming
15 elements evenly spaced up to the edge of the tiles, right?
16 A. Yes.

-00987 Ex. 2083 (Pattison Testimony) at 307:24-308:6, 308:13-16

-00988 Ex. 2083 (Pattison Testimony) at 307:24-308:6, 308:13-16

-01075 Ex. 2083 (Pattison Testimony) at 307:24-308:6, 308:13-16

4 Q If we can turn to Paragraph 148 of your
5 declaration. You say, In particular, Matthies
6 explains that its display includes, quote,
7 tiles ... constructed with pixel forming elements
8 evenly spaced up to the edge of the tiles.
9 Do you see that?
10 A Yes. I would say that's relative. If we
11 go back to that Figure 8, you could see the
12 subpixels don't go right up to the edge of the
13 tile. There is a space still.
14 Q Sure. But the space is even across all
15 the subpixels. Correct?
16 MR. HERMAN: Objection. Form.
17 A Yeah. Let's see.
18 Uh-huh. Yes.

-00987 Ex. 2062 (Pattison Deposition) at 128:4-18

-00988 Ex. 2062 (Pattison Deposition) at 128:4-18

-01075 Ex. 2062 (Pattison Deposition) at 128:4-18

Uneven Spacing Causes Undesired Light-Scattering Effects

- Unrebutted, detailed technical testimony from Dr. Kymissis

180. As Matthies explains, in tiled displays, if light scatters at the edge of a tile such that the light refracts differently than at the center, the edge may appear visibly different, for example as “a band of reduced brightness in the displayed image.” Matthies, 22:53–56. Thus, for example, for tiled displays using mullions,

themselves. Pixels that are smaller or larger, and pixels that are closer or farther from the tile edge, will result in their emitted light scattering differently at the tile edges than away from the edges, and for the reasons discussed below, differently relative to each other. Matthies explains that, to ensure the edge is not visible to a viewer, “[t]he tiles are constructed with pixel forming elements *evenly spaced up to the edges of the tiles.*” *Id.* at 5:47–48. Matthies also defines a value “ d_e ” to represent the

-00987 Ex. 2009 (Kymissis Declaration) at ¶180

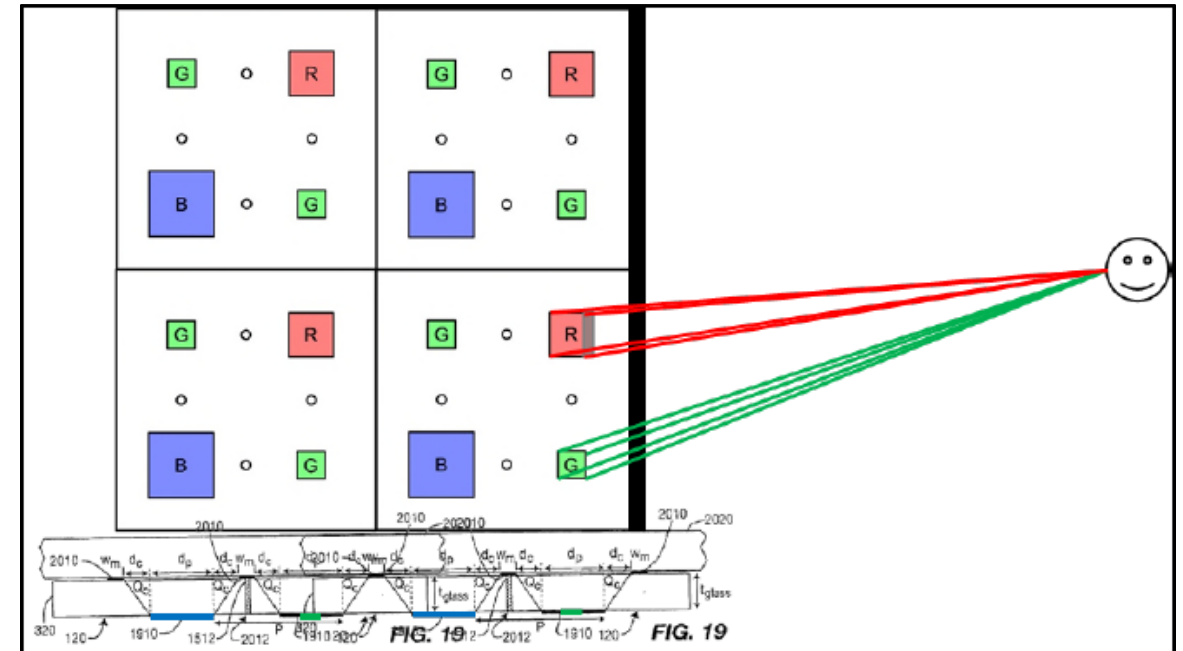
-00988 Ex. 2009 (Kymissis Declaration) at ¶180

-01075 Ex. 2009 (Kymissis Declaration) at ¶169

Uneven Spacing Causes Undesired Shadowing Effects

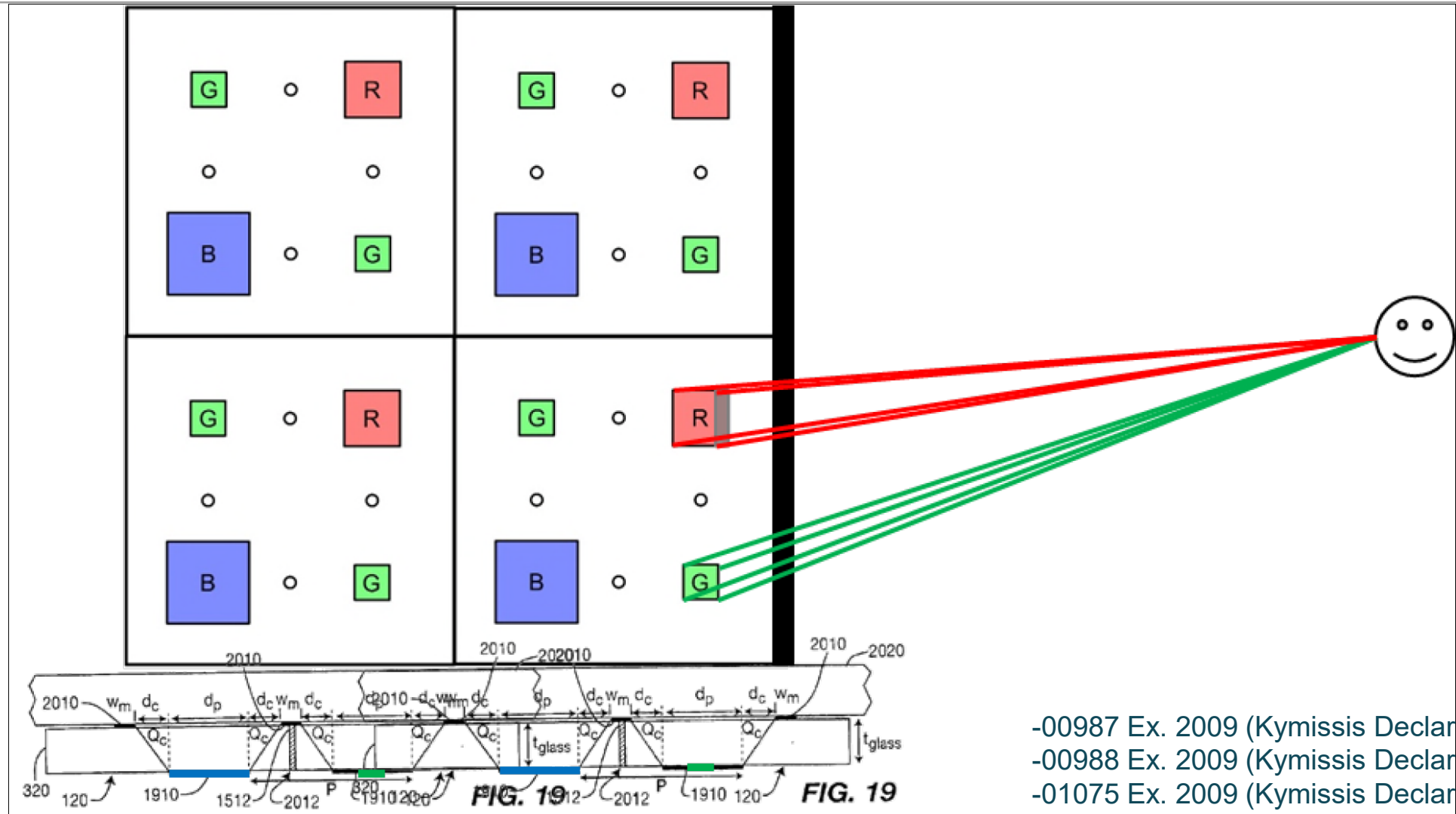
- Unrebutted, detailed technical testimony from Dr. Kymissis

the modification would introduce *uneven* pixel size and spacing from the edge. In particular, the larger pixels would have more of their light emission blocked by the black stripes or mullions (called “shadowing”) than the smaller pixels. The different degree of shadowing for different colors would also cause the display to exhibit an undesirable color shift, contrary to the goals of both Matthies and Yamada. Further, the degree of shadowing and color shift would vary by viewing angle, resulting in an inconsistent white balance throughout the viewing space. This is particularly problematic because Matthies is directed to large displays for, for example, “[a]pplications that require multiple viewers,” and “[a]pplications in which the user needs to move about in an area,” in which the display must have a wide viewing angle. *See* Matthies, 1:14-25.



-00987 Ex. 2009 (Kymissis Declaration) at ¶¶181-182
-00988 Ex. 2009 (Kymissis Declaration) at ¶¶181-182
-01075 Ex. 2009 (Kymissis Declaration) at ¶¶170-171

Uneven Spacing Causes Undesired Shadowing Effects



-00987 Ex. 2009 (Kymissis Declaration) at ¶¶181-182
 -00988 Ex. 2009 (Kymissis Declaration) at ¶¶181-182
 -01075 Ex. 2009 (Kymissis Declaration) at ¶¶170-171

Matthies Fig. 19
(annotated)

IPR2023-00987 PO Response at 24-27; PO Sur-reply at 10-11
IPR2023-00988 PO Response at 24-26; PO Sur-reply at 10-11
IPR2023-01075 PO Response at 24-26; PO Sur-reply at 10-11

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Demonstrative Exhibit – Not Evidence 57

Petitioner's Proposal Violates Matthies' Even Edge Spacing Requirement

- Petitioner's modification violates Matthies' requirement of pixels evenly spaced to tile edges

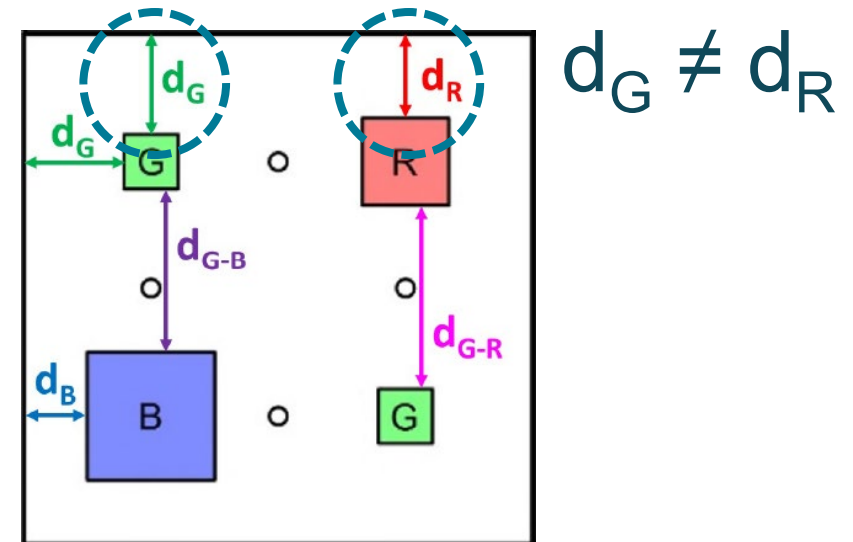
190. Dr. Pattison's proposed combination with Yamada would require a POSITA to disregard Matthies' teachings and violate its design requirements for its quad sub-pixel structures. For red, green, and blue pixels to all have different sizes with respect to each other as proposed by Dr. Pattison, the distance between adjacent pixels cannot be constant, and the distance between pixels and the edges of the tile would need to be different for each color pixel. As illustrated below in an annotation

the red pixels (Ex. 1003, ¶229), the space between a green pixel and an adjacent red pixel would be *greater* than the space between a green pixel and an adjacent blue pixel. Similarly, there would be *different* distances between the edges of each adjacent color pixel and the edge of the tile:

-00987 Ex. 2009 (Kymissis Declaration) at ¶190

-00988 Ex. 2009 (Kymissis Declaration) at ¶190

-01075 Ex. 2009 (Kymissis Declaration) at ¶179



Petitioner's Alleged Motivations to Combine Fail

Petitions Argued Improved “Lifetime” Motivates Combination

- Petitioner argued a POSITA’s motivation would be to “increas[e] the display’s life”

shorter lives than others shortening the display’s life. (*Id.*, ¶ 281.) Applying Yamada’s teachings and re-sizing the pixels in accordance with their emission efficiencies—the blue pixels would be largest, the red would have an intermediate size, and the green the smallest—would allow each pixel to be supplied with a similar current increasing the display’s life. (*Id.*, ¶ 282.)

-00987 Pet. at 40-41

-00988 Pet. at 37

-01075 Pet. at 71

Petitioner's Proposed Modification Reduces Lifetime

- Petitioner's proposed modification keeps blue pixels the same size and shrinks the red and green pixels

Figures 3 and 4 of Yamada exemplify how a pixel array/matrix is to be modified using this relative sizing. The blue pixel's size remains the same, while sizes of the red and green pixels are reduced. The same pixel spacing continues to

The below demonstrative—again drawn to scale—applies Yamada's example green:red:blue pixel area ratio of 1:2.6:5.6 to Matthies' "quad sub-pixel structure." Per Yamada, the blue pixel has kept its original size. The other pixels have been reduced in size in accordance with Yamada's example ratio. The same regular sub-

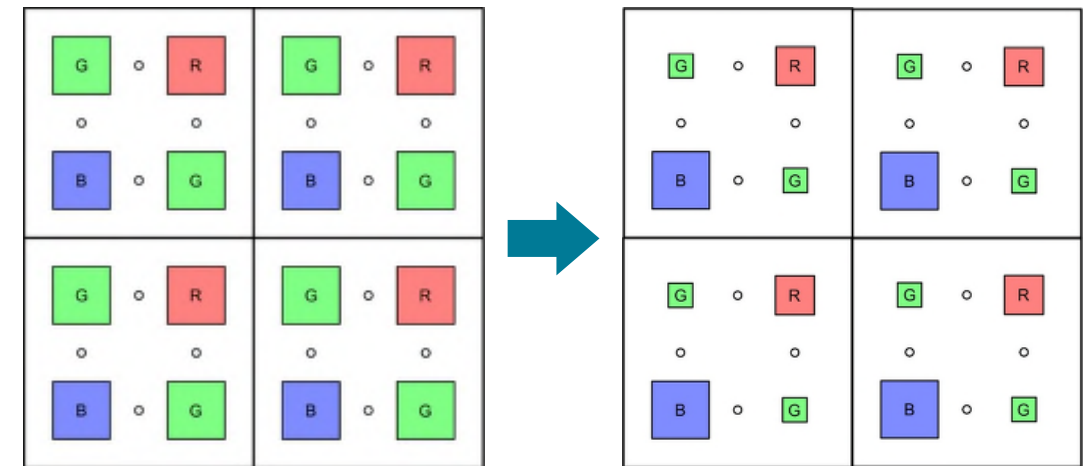
-00987 Pet. at 31-32; -00988 Pet. at 29-30; -01075 Pet. at 37-39

227. Per Yamada, the blue pixel has kept its original size. The other pixels have been reduced in size in accordance with Yamada's example ratio.

-00987 Ex. 1003 (Pattison Declaration) at ¶227

-00988 Ex. 1003 (Pattison Declaration) at ¶231

-01075 Ex. 1003 (Pattison Declaration) at ¶246



-00987 Pet. at 26, 33; -00988 Pet. at 24, 30; -01075 Pet. at 31, 39

Petitioner's Proposed Modification Reduces Lifetime

- Dr. Kymissis explained Petitioner's proposed modification would reduce lifetime

136. But Dr. Pattison's proposed combination of Matthies and Yamada would not extend the life of the display under his own theory of OLED lifetime. By keeping the blue pixels the same size, the life of the blue pixels would not be extended. And by reducing the sizes of the red and green pixels, the life of the red and green pixels would be *reduced*. In a color display, where (for example) the red,

-00987 Ex. 2009 (Kymissis Declaration) at ¶136

-00988 Ex. 2009 (Kymissis Declaration) at ¶136

-01075 Ex. 2009 (Kymissis Declaration) at ¶125

- Dr. Pattison has no rebuttal

Petitioner's Proposed Modification Reduces Lifetime

- Unrebutted, detailed technical testimony from Dr. Kymissis

green-pixels. Yamada, 2:60-67; 10:61-11:3, 11:11-15. The lifetime of OLED pixels is indeed a function of current density—the amount of current applied to the pixel divided by the area of the pixel (though the relationship is not as simple as Dr. Pattison and Yamada assume, given the other degradation modes and differences in degradation profiles between passive matrix and active matrix structures). But generally speaking, if the same current is applied to two OLED pixels with different sizes, then all else being equal, the smaller OLED pixel will tend to have a shorter life than a larger OLED pixel. So absent any countervailing considerations, the preference for an OLED display designer is to have larger pixel areas when possible, to extend the lifetime of the display.

-00987 Ex. 2009 (Kymissis Declaration) at ¶135

-00988 Ex. 2009 (Kymissis Declaration) at ¶135

-01075 Ex. 2009 (Kymissis Declaration) at ¶124

137. Additionally, Dr. Pattison's proposed combination would increase the risk of the catastrophic failure and dark spot modes of degradation. As I've explained

electromigration of cathode metal to the ITO and formation of dark spots. Both phenomena can result in significantly decreased luminance. And if the driving voltage and current density is increased to maintain the desired luminance, even faster degradation of the OLED would occur. By reducing the sizes of the red and green pixels, Dr. Pattison's proposed modification would require a significantly higher current density to be supplied to the red and green pixels to maintain the same brightness as before. This would increase the risks of catastrophic failure of the OLEDs and dark spot formation, and thus reduce the useful life of the display.

-00987 Ex. 2009 (Kymissis Declaration) at ¶137

-00988 Ex. 2009 (Kymissis Declaration) at ¶137

-01075 Ex. 2009 (Kymissis Declaration) at ¶126

Petitioner Shifts to a New “Useful Lifetime” Theory in Reply

- Petitioner cites only Dr. Pattison’s ***Reply*** Declaration
- Petitioner takes the notion of “useful lifetime” from Arnold
- Arnold was not cited in the Petition, and it criticizes Yamada’s approach

2011, 1:50-56.) Once again, this improves the display’s “useful lifetime” by “maximiz[ing] the time that the relative luminance of the three-color elements can be maintained....” (*Id.*, 2:1-4.)

themselves have a longer life. But the useful life of an OLED display is dictated not only by the lifetimes of the individual pixels, but also by how long proper color and white balance can be maintained. (Ex. 1017, ¶¶ 34-48.) By applying Yamada’s teachings, a POSITA would have understood that Matthies’ pixels would all age at or near the same rate. (*Id.*, ¶ 46.) This would in turn prevent the color/white balance from drifting apart over time. (*Id.*, ¶ 47.) It follows that applying Matthies’ teachings

-00987 Reply at 5-7

-00988 Reply at 5-7

-01075 Reply at 5-7

Petitioner's New "Useful Lifetime" Theory Is Unsupported

- Petitioner's partial quotation leaves out Arnold's teachings that contradict Petitioner's proposed combination
- E.g., Arnold specifically discourages reducing the luminance of red and green pixels

Petitioner's quotation

2011, 1:50-56.) Once again, this improves the display's "useful lifetime" by "maximiz[ing] the time that the relative luminance of the three-color elements can be maintained..." (Id., 2:1-4.)

-00987 Reply at 7
-00988 Reply at 7
-01075 Reply at 7

Arnold's text

three colors. To maximize the useful lifetime of the display, it is important to maximize the time that the relative luminance of the three-color elements can be maintained while minimizing the loss of absolute luminance.

-00987 Ex. 2011 (Arnold) at 2:1-4
-00988 Ex. 2011 (Arnold) at 2:1-4
-01075 Ex. 2011 (Arnold) at 2:1-4

Arnold's text

Alternatively, one may reduce the luminance of the red and green to balance the blue, but this lowers the overall brightness of the display. Once the display becomes too dim, the user may also consider the display to be at the end of its useful lifetime, regardless of the relative luminance of the three colors. To maximize the useful lifetime of the display,

-00987 Ex. 2011 (Arnold) at 1:63-2:1
-00988 Ex. 2011 (Arnold) at 1:63-2:1
-01075 Ex. 2011 (Arnold) at 1:63-2:1

Petitioner's New "Useful Lifetime" Theory Is Unsupported

- Petitioner's proposed combination results in a significant loss of absolute luminance

vias and other circuitry." Ex. 1003 at ¶ 295-298. But that is not a benefit at all. Taking away this "additional space" from the pixels would lower the aperture ratio of the display. To maintain the same brightness with smaller emissive area, the OLEDs would have to be driven harder at a higher current density to maintain the same brightness as before, resulting in lower lifetime; alternatively, if the OLEDs were driven at the same current density with a reduced area, the display would be dimmer than before. Dr. Pattison's modification would remove light-emitting area, thus lowering the aperture ratio and resulting in either worse lifetime or reduced brightness, when Matthies sought to improve the overall brightness of the display.

-00987 Ex. 2009 (Kymissis Declaration) at ¶144

-00988 Ex. 2009 (Kymissis Declaration) at ¶144

-01075 Ex. 2009 (Kymissis Declaration) at ¶133

Petitioner's New "Useful Lifetime" Theory Is Unsupported

- Petitioner's new theory rests on the incorrect assumption that resizing pixels causes different colored pixels to "age at or near the same rate"
- Dr. Kymissis explained this assumption is incorrect

175. Yamada assumes that the organic materials for emitting each color would decay (1) linearly, and (2) at the same rate. Both are incorrect. First, the lifetime of any given OLED material decays non-linearly over time at constant current density. Ex. 2077 (Park) at 8-10, Figs. 4-6. Second, the lifetime and rate of decay of different materials varies. Ex. 2011 (Arnold) at Fig. 10. Thus, adjusting the pixel sizes for different colors according to the emission efficiency of each material as Yamada suggests would fail to maintain the same ratio of red, green, and blue light in the display over an extended period of operation. This ratio, which is also

-00987 Ex. 2009 (Kymissis Declaration) at ¶175

-00988 Ex. 2009 (Kymissis Declaration) at ¶175

-01075 Ex. 2009 (Kymissis Declaration) at ¶164

Petitioner's Modification Eliminates Circuitry Needed for Matthies' Display

- Unrebutted, detailed technical testimony from Dr. Kymissis

The circuitry Dr. Pattison proposes eliminating is *necessary* for Matthies' display to function because it both provides display data to each pixel, Matthies, 10:1-5, and ensures uniformity in brightness and color across different pixels and across different tiles—a critical requirement for Matthies' tiled display, Matthies, 10:6-9.

-00987 Ex. 2009 (Kymissis Declaration) at ¶140

-00988 Ex. 2009 (Kymissis Declaration) at ¶140

-01075 Ex. 2009 (Kymissis Declaration) at ¶129

141. The “non-volatile memory 214” and “programmable current sources 216” are necessary to send the image data to the display because the memory stores the value for the pixel cell corresponding to the image data to be displayed, and the current source provides the electrical current to the pixel cell to cause it to emit the light corresponding to the image data to be displayed. Matthies, 10:58-11:21. It is unclear how Dr. Pattison’s display would display any images without them. And Matthies explicitly acknowledges that each OLED pixel can have different characteristics due to manufacturing variations, and thus contemplates that individual OLEDs would be tuned during the manufacturing process, with necessary adjustments saved in the “non-volatile memory 214.” Matthies, 11:36-46. Eliminating this memory as Dr. Pattison proposes would result in a non-uniform display (if the display could operate at all) with poor image quality that cannot be fixed by just re-sizing the pixels.

-00987 Ex. 2009 (Kymissis Declaration) at ¶141

-00988 Ex. 2009 (Kymissis Declaration) at ¶141

-01075 Ex. 2009 (Kymissis Declaration) at ¶130

Resized Pixels Cannot Substitute for Matthies' Pixel Compensation Circuitry

- Unrebutted, detailed technical testimony from Dr. Kymissis

The circuitry Dr. Pattison proposes eliminating is *necessary* for Matthies' display to function because it both provides display data to each pixel, Matthies, 10:1-5, and ensures uniformity in brightness and color across different pixels and across different tiles—a critical requirement for Matthies' tiled display, Matthies, 10:6-9.

-00987 Ex. 2009 (Kymissis Declaration) at ¶140

-00988 Ex. 2009 (Kymissis Declaration) at ¶140

-01075 Ex. 2009 (Kymissis Declaration) at ¶129

142. Removing the additional compensation circuitry such as Matthies' optional "light sensor" or "circuitry 134" as Dr. Pattison suggests would also eliminate another key functionality. Matthies' circuitry "continually adjusts" the brightness of individual pixels to compensate for aging throughout the life of the display as it is used—something Yamada's static re-sized pixels cannot do. Matthies, 11:61-12:41. Further, POSITAs in the field understood that the decay slope for each color pixel is different (owing to differences in the light-emitting materials) and non-linear, and Yamada's static re-sizing of pixels would fail to account for the resulting differential aging of the OLED pixels as they are used over time, resulting in color shift through the life of the display, and some pixels dying off faster than others. Ex. 2077 (Park) at 8-10, Figs. 4-6; Ex. 2011 (Arnold) at Fig. 10.

143. Thus, without Matthies' circuitry, the display's color would shift over time, rendering the display defective.

-00987 Ex. 2009 (Kymissis Declaration) at ¶142-143

-00988 Ex. 2009 (Kymissis Declaration) at ¶142-143

-01075 Ex. 2009 (Kymissis Declaration) at ¶131-132

Petitioner's Flawed Reliance on Yamada

Petitioner Selectively Reads Yamada

- Petitioner asserts emission efficiency determines pixel size

2:53-54.) To improve the display's life and avoid premature deterioration, Yamada teaches that the pixels should be re-sized "in accordance with the emission efficiency of" each color's "emissive element." (*Id.*, 2:55-3:6, 3:16-27, 4:4-14, 10:61-11:3.) The "emissive element of a color with the highest emission efficiency" (green) is made "smaller," while the "emissive element of a color with the lowest emission efficiency" (blue) is made "larger." (*Id.*, 3:38-44, 3:51-57; 7:3-12, 8:19-28; 8:47-

-00987 Pet. at 19

-00988 Pet. at 17

-01075 Pet. at 18

Petitioner Selectively Reads Yamada

- Yamada requires consideration of more than emission efficiency, contrary to Petitioner's theory

display pixel of another color. Furthermore, the element emissive areas in the display pixels for R, G, and B are designed to take into consideration not only the emission efficiency of the emissive elements of the display pixels but also the luminance ratio of red to green to blue in accordance with the chromaticity of the target display white of the display device and with the chromaticity of each red, green, and blue color emitted by the emissive elements of the respective display pixels. This prevents the organic EL

Yamada at Abstract

Petitioner Selectively Reads Yamada

- Yamada requires consideration of more than emission efficiency, contrary to Petitioner's theory

7	Q	You have the chromaticity of each of the
8		color -- each color emitted by the respective
9		emissive elements?
10	A	Well, he actually says both the
11		chromaticity of each color and the chromaticity of
12		the target white display. So those would all be
13		considerations for how you size the different
14		subpixels in any pixel arrangement, whether it's a
15		quad or a stripe or something else. That's --
16		that would be obvious to a person of skill in the
17		art.

-00987 Ex. 2062 (Pattison Deposition) at 92:7-17

-00988 Ex. 2062 (Pattison Deposition) at 92:7-17

-01075 Ex. 2062 (Pattison Deposition) at 92:7-17

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Petitioner Misapplies Yamada

- Petitioner fails to consider the factors Yamada teaches should be considered

6	Q	Have you done those calculations for the
7		combination -- for Matthies?
8	MR. HERMAN:	Objection. Form.
9	A	No, I did not. Because the note -- the

-00987 Ex. 2062 (Pattison Deposition) at 105:6-9

-00988 Ex. 2062 (Pattison Deposition) at 105:6-9

-01075 Ex. 2062 (Pattison Deposition) at 105:6-9

Petitioner Misapplies Yamada

- Others in the field, when applying Yamada correctly, arrived at red pixels larger than blue pixels

EXAMPLE 3 (COMPARATIVE)

In this example, the method of Yamada in U.S. Pat. No. 6,366,025 is used to determine the relative red, green, and blue areas. Yamada discusses the selection of individual

0.0369:0.0142:0.0231. Normalizing these values to provide a green value of 1, the relative areas of the red, green, and blue light emitting elements is R:G:B=2.6:1.0:1.6, indicating that the red light emitting element should be 2.6 times the size of the green light emitting element, and the blue light emitting element should be 1.6 times the size of the green light emitting element.

-00987 Ex. 2011 (Arnold) at 15:58-16:36

-00988 Ex. 2011 (Arnold) at 15:58-16:36

-01075 Ex. 2011 (Arnold) at 15:58-16:36

Petitioner Selectively Reads Yamada

- Yamada itself contemplates different size ratios could result when all relevant factors are properly considered

In the above-mentioned embodiment, when the emission efficiency is green>red>blue, an example was described where the emissive area of the display pixels was green<red<blue so that the size of the emissive area for the various colors differed in this order. However, an embodiment need not be limited to this example. For example, with the emission efficiency at the same green>red>blue, the emissive areas may be set to green=red<blue or to green<red=blue.

Yamada at 10:52-60

Petitioner Selectively Reads Yamada

- Instead of performing the requisite analysis, Dr. Pattison selectively disagrees with Yamada

Furthermore, when the emission efficiency ratio of the various colors of the organic EL elements is 10:3.8:1.8 for green, red, and blue as described above, the emissive area ratio becomes $G:R:B=1/10:0.54/3.8:0.63/1.8=1:14.2:35$ to achieve a G, R, and B luminance ratio of $G:R:B=1:0.54:0.63$.

Yamada at 11:34-39

14	So, yeah, I think if I was going to try
15	to make the green one-35th the size of the blue, I
16	would actually have a lot of other problems with
17	my device, including luminance issues being too
18	bright in that absolute space because the color
19	emission over area would be too bright. I'd have
20	other issues.

7	not an absolute light output number. So you've
8	really jacked up the luminance levels in a way
9	that would not be I think conducive for display.

-00987 Ex. 2062 (Pattison Deposition) at 196:14-20, 197:1-9

-00988 Ex. 2062 (Pattison Deposition) at 196:14-20, 197:1-9

-01075 Ex. 2062 (Pattison Deposition) at 196:14-20, 197:1-9

Petitioner Selectively Reads Yamada

- Instead of performing the requisite analysis, Dr. Pattison selectively disagrees with Yamada

In the above-mentioned embodiment, when the emission efficiency is green>red>blue, an example was described where the emissive area of the display pixels was green<red<blue so that the size of the emissive area for the various colors differed in this order. However, an embodiment need not be limited to this example. For example, with the emission efficiency at the same green>red>blue, the emissive areas may be set to green=red<blue or to green<red=blue.

Yamada at 10:52-60

11 But in your opinion, a person of ordinary skill
12 in the art would recognize it would not be a good idea to
13 make blue the same size as red, correct?
14 A. Correct. Just like I said, it's well known in
15 the art, and this is something I've been working on for
16 decades, managing projects to improve blue OLED materials
17 since 2006, projects at UDC and other places that DOE
18 funded. Blue has always been the weak point with -- among
19 OLED emitters.

5 Q. Okay. But you, yourself, struggle to see a
6 reason why someone would make green the same size as red,
7 which is one of the options that Yamada says might be used?
8 A. Yes.

-00987 Ex. 2083 (Pattison Testimony) at 279:11-19, 280:5-8

-00988 Ex. 2083 (Pattison Testimony) at 279:11-19, 280:5-8

-01075 Ex. 2083 (Pattison Testimony) at 279:11-19, 280:5-8

Petitioner Misreads Yamada

- Yamada teaches nothing about “typical” pixel size ratios

169. While Dr. Pattison claims that “[a]ccording to Yamada, in a typical OLED display, the ‘green pixel’ has the highest efficiency and is thus made smallest, while the ‘blue pixel’ has the lowest efficiency and is made largest,” Ex. 1003, ¶ 219, Yamada says nothing about the “typical” OLED display or “typical” efficiencies. The portions of Yamada that Dr. Pattison cites for this assertion make clear that Yamada concludes that green has the lowest efficiency and blue has the largest efficiency based on its specific embodiment with its set of specific materials selected as the emissive elements. *See Yamada*, 8:19-22, 10:52-56.

-00987 Ex. 2009 (Kymissis Declaration) at ¶169
-00988 Ex. 2009 (Kymissis Declaration) at ¶169
-01075 Ex. 2009 (Kymissis Declaration) at ¶158

The Prior Art Criticized Yamada's Teachings

- Yamada was directly criticized by other prior art for inadequacies in the very teachings Petitioner relies on

Arnold (2004)

areas. However, Yamada fails to discuss other important characteristics of OLED materials that will affect device lifetime, such as the differences in the inherent luminance stability over time of different materials. Yamada further does not consider important optical characteristics of the target display design, each of which will influence the overall lifetime of OLED materials.

-00987 Ex. 2011 (Arnold) at 2:34-41

-00988 Ex. 2011 (Arnold) at 2:34-41

-01075 Ex. 2011 (Arnold) at 2:34-41

Cok (2005)

the lifetime of the OLED display. While Yamada discloses light emitting elements having different sizes for optimizing the lifetime of the display, the display is not optimized with respect to the response of the human visual system.

-00987 Ex. 1015 (Cok) at 2:5-8

-00988 Ex. 1017 (Cok) at 2:5-8

-01075 Ex. 2004 (Cok) at 2:5-8

The Prior Art Criticized Yamada's Teachings

- Prior art explained that applying Yamada's approach results in ***shorter*** useful lifetime

Conventional Display

Using a conventional display of the prior art, one third of the total available display fill factor would be allocated to the red, green, and blue light emitting element. Using this

emit red, green, and blue light. Using the data in these tables and the equations shown within this disclosure, the time required for the red, green, and blue light emitting elements to produce half their initial luminance under the current drive conditions would be 16523, 17941, and 4115 hours, respectively. Notice that within this prior art configuration, the lifetime of the display is 4115 hours when lifetime is defined as the time for any of the three color subpixels to decay to produce 50% of their initial luminance.

Yamada-resized Display

The lifetime of a display with these pixel sizes may then be calculated using the method provided herein. Assuming

calculated using the method of this invention. In this example, the time required for the three subpixels to produce half their initial luminance under the current drive conditions are 29972, 7140, and 3714 hours for the red, green, and blue subpixels, respectively. Notice that within this prior art configuration, the lifetime of the display is 3714 hours when lifetime is defined as the time for any of the three color subpixels to decay to produce 50% of their initial luminance.

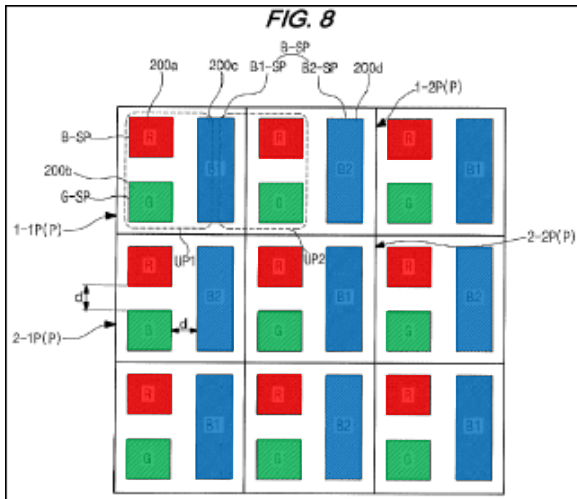
-00987 Ex. 2011 (Arnold) at 15:42-57, 16:22-36

-00988 Ex. 2011 (Arnold) at 15:42-57, 16:22-36

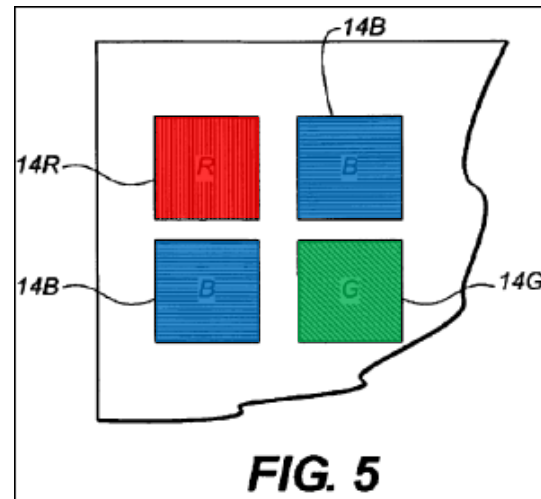
-01075 Ex. 2011 (Arnold) at 15:42-57, 16:22-36

The Prior Art Diverged from Petitioner's Modifications

- Other prior art explicitly considering Yamada did not resize pixels the way Petitioner suggests



-00987 Ex. 2012 (Yoo) at Fig. 8
-00988 Ex. 2012 (Yoo) at Fig. 8
-01075 Ex. 2012 (Yoo) at Fig. 8



-00987 Ex. 2011 (Arnold) at Fig. 5
-00988 Ex. 2011 (Arnold) at Fig. 5
-01075 Ex. 2011 (Arnold) at Fig. 5

16 MR. LERNER: Okay. So if we could go
17 back to the Arnold reference, Figure 5.
18 Q This is a quad-pixel structure with two
19 blue subpixels, one red and one green subpixel.
20 Correct?
21 A That's correct.
22 Q And the subpixels are each equally sized.
1 Correct?
2 A Correct.
3 Q So in Arnold the red subpixel, the blue
4 subpixel, and the green subpixel are each the same
5 size and there's two blue subpixels. Correct?
6 A Yeah.

-00987 Ex. 2086 (Pattison Reply Deposition) at 22:16-23:6
-00988 Ex. 2086 (Pattison Reply Deposition) at 22:16-23:6
-01075 Ex. 2086 (Pattison Reply Deposition) at 22:16-23:6

Petitioner Selectively Reads Prior Art

- Dr. Pattison selectively disagrees with other prior art explicitly considering Yamada

areas. However, Yamada fails to discuss other important characteristics of OLED materials that will affect device lifetime, such as the differences in the inherent luminance stability over time of different materials. Yamada further does not consider important optical characteristics of the target display design, each of which will influence the overall lifetime of OLED materials.

-00987 Ex. 2011 (Arnold) at 2:34-41

-00988 Ex. 2011 (Arnold) at 2:34-41

-01075 Ex. 2011 (Arnold) at 2:34-41

2 A. I see that, but I don't agree that --

3 Q. Okay. You don't agree with it?

4 A. -- with that analysis. No.

-00987 Ex. 2083 (Pattison Testimony) at 285:2-4

-00988 Ex. 2083 (Pattison Testimony) at 285:2-4

-01075 Ex. 2083 (Pattison Testimony) at 285:2-4

A POSITA Would Not Have Combined the References in the Way the Petitions Assert

Yamada Is Directed to Triplet Pixel Structures

149. Yamada only contemplates R/G/B triplet structures, as evidenced by its reference to only “stripe,” “delta,” and “diagonal” layouts. Yamada, 12:37-43. These

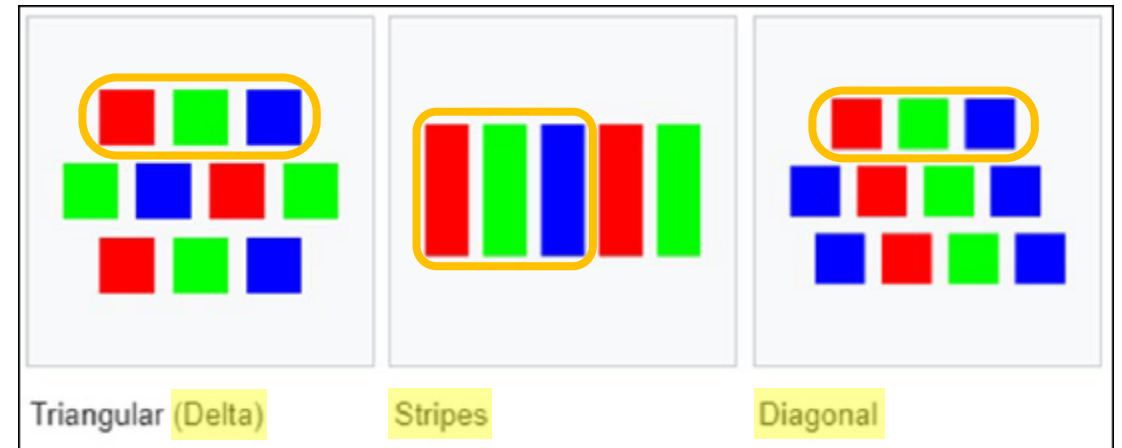
-00987 Ex. 2009 (Kymissis Declaration) at ¶149

-00988 Ex. 2009 (Kymissis Declaration) at ¶149

-01075 Ex. 2009 (Kymissis Declaration) at ¶138

Furthermore, although the arrangement of the display pixels of various colors in the embodiment was shown in a stripe layout, the same effect is also obtained in a delta layout and a diagonal layout. Still furthermore, although the

Yamada at 12:37-40



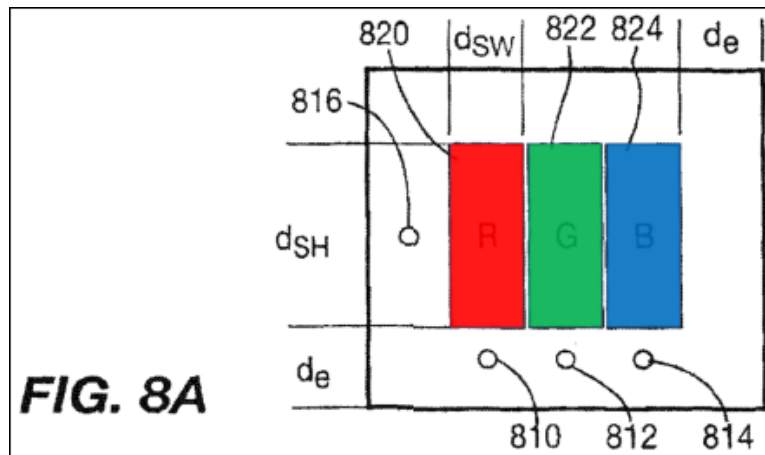
-00987 Ex. 2009 (Kymissis Declaration) at ¶149

-00988 Ex. 2009 (Kymissis Declaration) at ¶149

-01075 Ex. 2009 (Kymissis Declaration) at ¶138

Triplet and Quad Pixel Structures Have Different Constraints

- Relative emissive area in triplet pixel structures adjusted by changing pixel size
- Relative emissive area in quad pixel structures adjusted using extra color pixel



-00987 Ex. 2009 (Kymissis Declaration) at ¶148
-00988 Ex. 2009 (Kymissis Declaration) at ¶148
-01075 Ex. 2009 (Kymissis Declaration) at ¶137

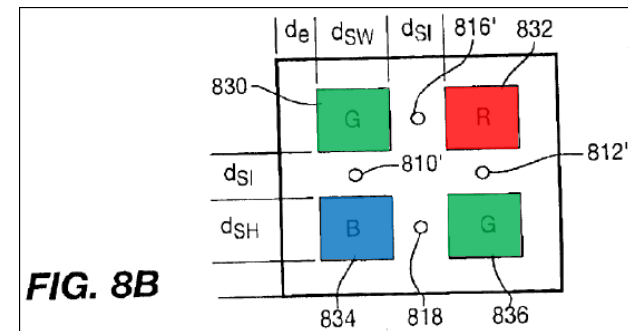


FIG. 8B

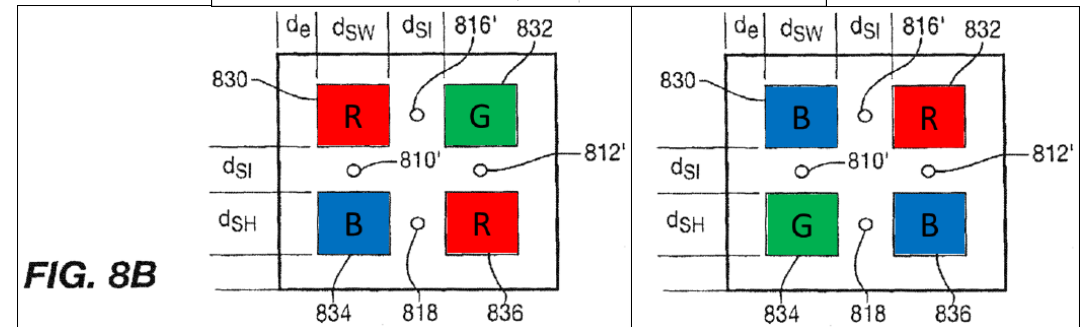


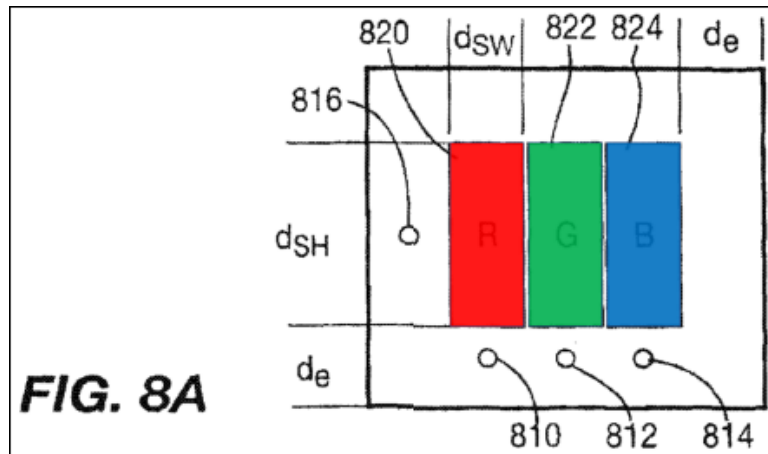
FIG. 8B

Matthies at Fig. 8B

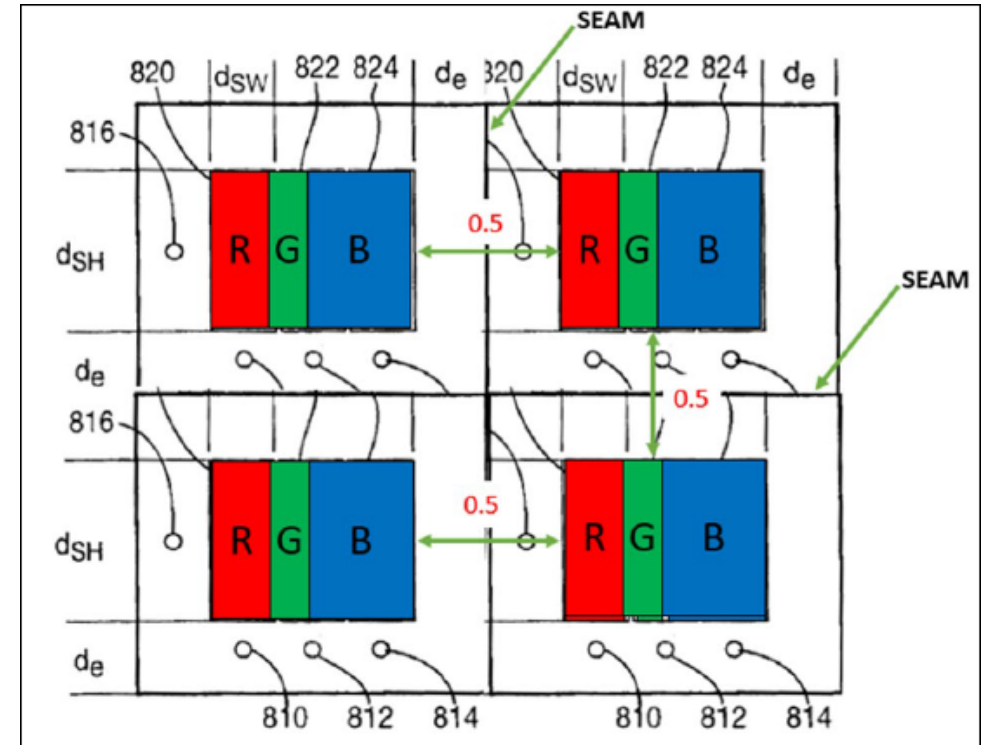
-00987 Ex. 2009 (Kymissis Declaration) at ¶160
-00988 Ex. 2009 (Kymissis Declaration) at ¶160
-01075 Ex. 2009 (Kymissis Declaration) at ¶149

No Motivation to Try to Resize Matthies' Quad-Pixel Structure

- Yamada is directed to triplet pixel structures
- Matthies' triplet structure has fewer incompatibilities if one tried to resize subpixels than Matthies' separate quad-pixel structure



-00987 Ex. 2009 (Kymissis Declaration) at ¶148
-00988 Ex. 2009 (Kymissis Declaration) at ¶148
-01075 Ex. 2009 (Kymissis Declaration) at ¶137



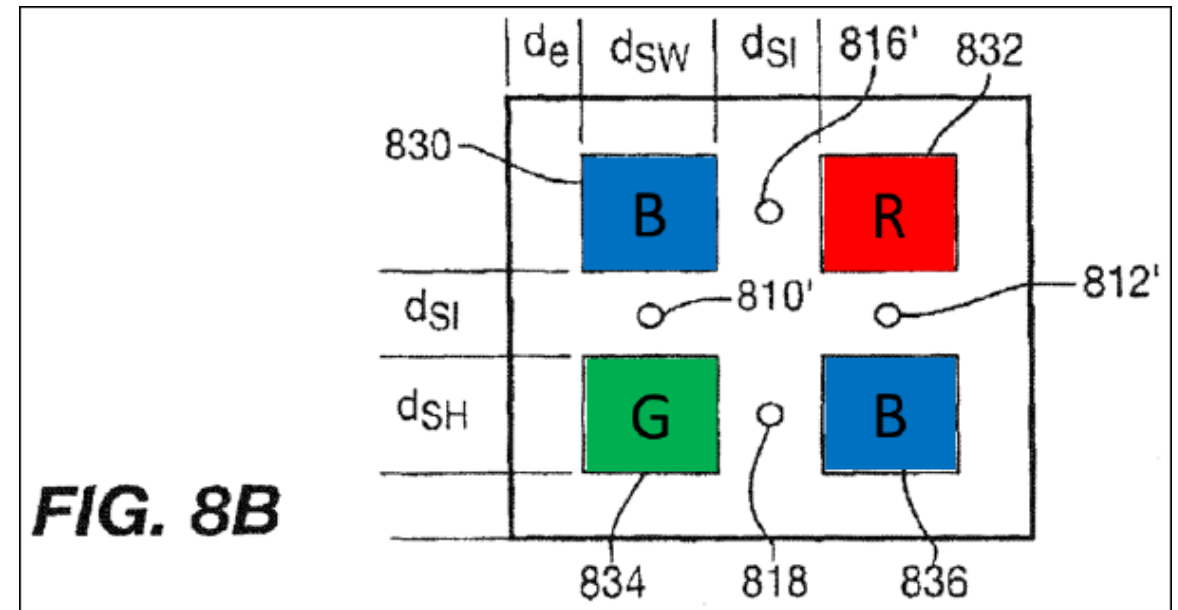
-00987 Ex. 2009 (Kymissis Declaration) at ¶152
-00988 Ex. 2009 (Kymissis Declaration) at ¶152
-01075 Ex. 2009 (Kymissis Declaration) at ¶141

No Motivation to Try to Resize Matthies' Quad-Pixel Structure

- Matthies teaches that if blue material has lower emission efficiency, then two blue sub-pixels are used in the quad pixel
 - Solution specific to its quad-pixel structure

pixels. In some display technologies, the amount of light emitted by the red or blue pixel material may be less than the amount of light emitted by the green pixels. In this instance, making the pixels **830** and **836** both be red or blue pixels would improve the overall brightness of the display. The

Matthies at 17:6-10



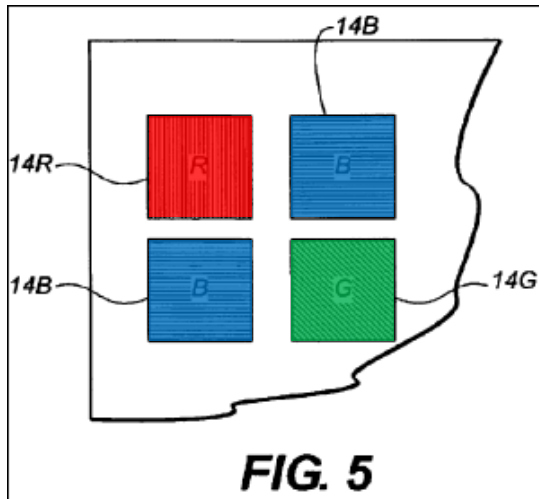
-00987 Ex. 2009 (Kymissis Declaration) at ¶160

-00988 Ex. 2009 (Kymissis Declaration) at ¶160

-01075 Ex. 2009 (Kymissis Declaration) at ¶149

No Reason to Try to Resize Matthies' Quad-Pixel Structure

- Arnold, aware of and criticizing Yamada, teaches the same solution of using two blue pixels in a quad-pixel structure

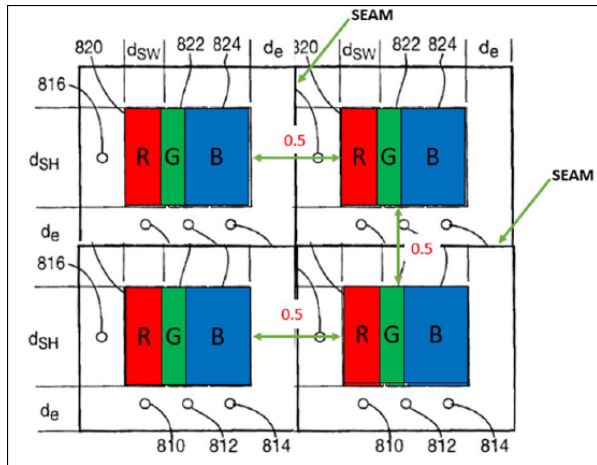


-00987 Ex. 2011 (Arnold) at Fig. 5
-00988 Ex. 2011 (Arnold) at Fig. 5
-01075 Ex. 2011 (Arnold) at Fig. 5

177. Further, many other prior art references also illustrate that a POSITA would not have combined Matthies and Yamada in the manner proposed by Dr. Pattison. Several references authored by other workers in the field, including those who explicitly considered Yamada's teachings, show pixel arrangement structures that deviate from the arrangement proposed by Dr. Pattison. For example, Yoo (below, left) arrived at a triple-pixel (RGB) structure. See Ex. 2012, Fig. 8. And Arnold (below, right) arrived at a quad-pixel structure with two *blue* pixels, in a similar way as done by Matthies as described above. See Ex. 2011, Fig. 5.

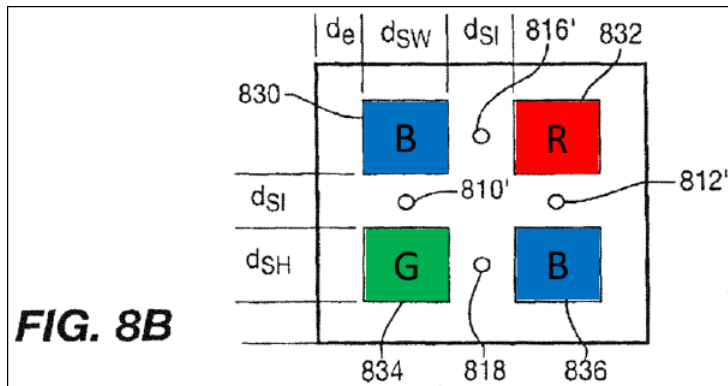
-00987 Ex. 2009 (Kymissis Declaration) at ¶177
-00988 Ex. 2009 (Kymissis Declaration) at ¶177
-01075 Ex. 2009 (Kymissis Declaration) at ¶166

Even a Combination of Matthies and Yamada Would Not Meet Any Claim



157. If a POSITA were to make any combination, a POSITA would have modified Matthies' RGB stripe structure. Such a combination, however, when tiled, would result in a structure that fails to meet any of the challenged claims of the '803 Patent. There is no "first pixel" (green) that has a center coinciding with a center of a virtual square as required by claim 1. Specifically, this structure fails to meet at

'803 Patent, limitations [1-a(1)], [1-a(2)], [1-a(3)], [1-a(4)], [2-a], [3-a], [4-a]

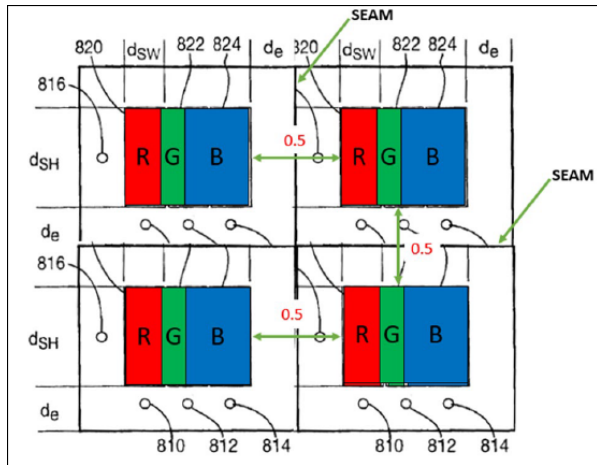


163. This RBGB pixel structure, when tiled, would result in a structure that fails to meet any of the challenged claims of the '803 Patent. There is no "first pixel" (green) that has a center coinciding with a center of a virtual square as required by claim 1. Additionally, there is no "second pixel" that has a larger area than a "third pixel" as required by claim 1. Additionally, there are no "second pixels" and "third pixels" that each have larger areas than the "first pixel" as required by claim 5.

'803 Patent, limitations [1-a(1)], [1-a(2)], [1-a(3)], [1-a(4)], [1-b], [2-a], [3-a], [4-a], [5-b]

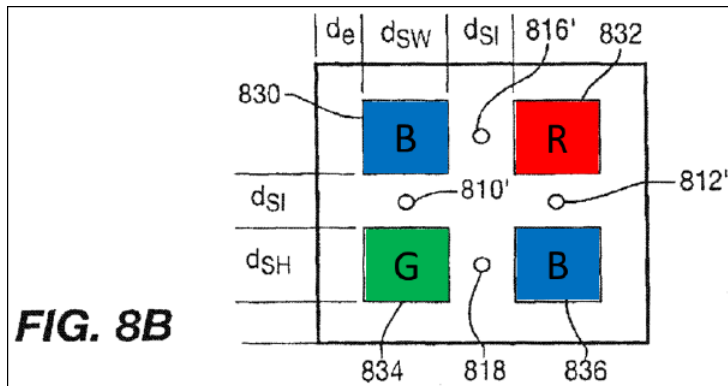
-00987 Ex. 2009 (Kymissis Declaration) at ¶157, 163

Even a Combination of Matthies and Yamada Would Not Meet Any Claim



157. If a POSITA were to make any combination, a POSITA would have modified Matthies' RGB stripe structure. Such a combination, however, when tiled, would result in a structure that fails to meet any of the challenged claims of the '683 Patent. Specifically, this structure fails to meet at least the following limitations:

'683 Patent, limitations [1-a(2)]/[13-a(2)]/[15-a(2)], [1-a(3)]/[13-a(3)]/[15-a(3)], 7, 9

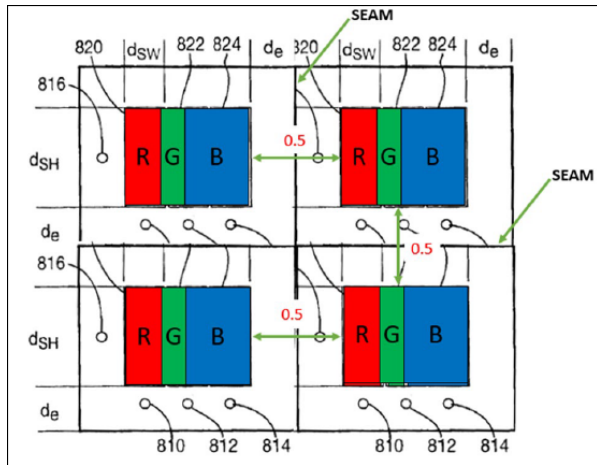


163. This RBGB pixel structure, when tiled, would result in a structure that fails to meet any of the challenged claims of the '683 Patent. Specifically, this

'683 Patent, limitations [1-d]/[13-d]/[15-d], [1-e]/[13-e]/[15-e], [2-b], 6

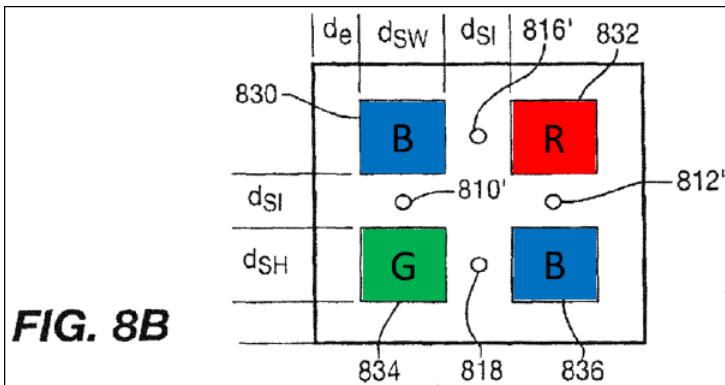
-00988 Ex. 2009 (Kymissis Declaration) at ¶157, 163

Even a Combination of Matthies and Yamada Would Not Meet Any Claim



146. If a POSITA were to make any combination, a POSITA would have modified Matthies' RGB stripe structure. Such a combination, however, when tiled, would result in a structure that fails to meet any of the challenged claims of the '578 Patent. Specifically, this structure fails to meet at least the following limitations:

'578 Patent, limitations [1-4]/[42-4], [1-5]/[42-5], [1-6], [1-8]/[42-7], [1-9]/[42-8], [1-12], [1-13]/[42-15], [45-4], [45-5]



152. This RBGB pixel structure, when tiled, would result in a structure that fails to meet any of the challenged claims of the '578 Patent. There are no "first sets," "second sets," "third sets," or "fourth sets" of pixels. Additionally, the pixel structure would not have the recited region "overlapping a row of the first pixels" and "entirely offset" from the second or third pixels. Specifically, this structure fails to

'578 Patent, limitations [1-4]/[42-4], [1-5]/[42-5], [1-6], [1-8]/[42-7], [1-9]/[42-8], [1-12], [1-13]/[42-15], [45-5]

-01075 Ex. 2009 (Kymissis Declaration) at ¶146, 152

'803 Patent Claims 4, 5

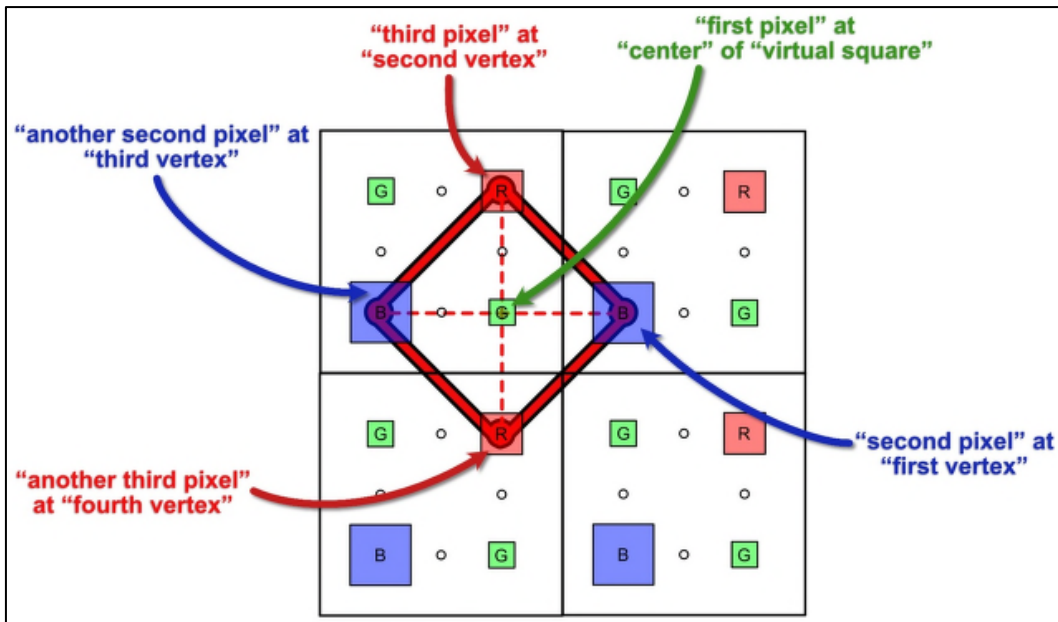
'803 Patent Claims 4, 5

4. The pixel arrangement structure of claim 3, wherein the second pixels and the third pixels enclose the first pixel in the virtual square.

5. The pixel arrangement structure of claim 4, wherein the first pixel, the second pixels, and the third pixels have polygonal shapes, and each of the second pixels and each of the third pixels has a larger area than the first pixel.

'803 Patent at 9:24-31 (claims 4, 5)

Dr. Pattison Disavowed His Theory for Claim 4



-00987 Ex. 1003 (Pattison Declaration) at ¶251

15 Q. And you argued to the PTAB that the arrangement
16 drawn in that figure meets the requirements of the
17 "enclosed" limitation of claim 4, correct?
18 A. Yes.
19 Q. Now, yesterday you testified that personally you
20 don't think this encloses, correct?
21 A. Yes. I mean, my -- I did this, I believe, before
22 this report was put in, prior to my next report. So I'd say
23 my thoughts on this have changed, yes.

-00987 Ex. 2083 (Pattison Testimony) at 237:15-23

Matthies in view of Yamada ('578 Patent)

IPR2023-01075 Ground 1 ('578 claims 1-6, 10, 12, 17-19, 21-23, 41-42, 44-47, 52)

No Pixel Defining Layer

Each Challenged Claim Requires a Pixel Defining Layer

wherein the OLED display comprises a pixel defining layer defining areas of the first pixels, the second pixels, and the third pixels,

'578 Patent at 9:11-13 (claim 1)

wherein the OLED display comprises a pixel defining layer defining areas of the first pixels, the second pixels, and the third pixels,

'578 Patent at 13:48-50 (claim 42)

wherein the OLED display comprises a pixel defining layer defining areas of the first pixels, the second pixels, and the third pixels,

'578 Patent at 14:45-47 (claim 45)

the first pixels, the second pixels, and the third pixels”). The '578 Patent states that “there may be an insulation layer such as a pixel definition layer to define an area and a shape of each pixel.” '578 Patent, 1:42-44. The '578 Patent uses the term consistent with how it is used in the industry. In particular, a POSITA would have understood that a “pixel defining layer” is an actual layer that is physically present in an OLED display.

-01075 Ex. 2009 (Kymissis Declaration) at ¶186

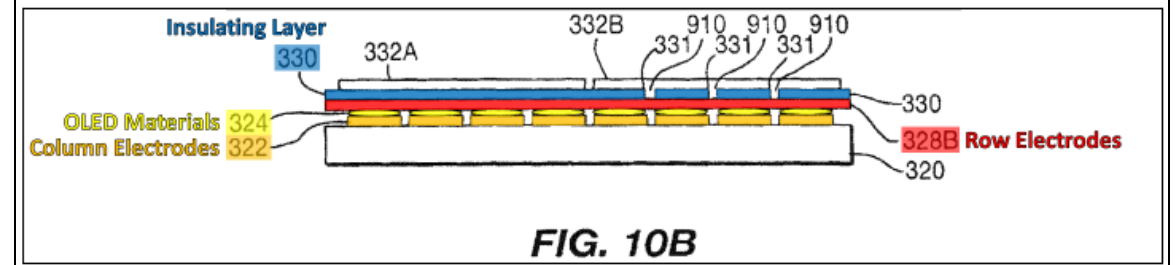
Matthies Does Not Disclose or Teach a Pixel Defining Layer

- Matthies' displays do not have, and do not need, a pixel defining layer

187. There is no teaching or suggestion in Matthies relating to a “pixel defining layer.” Matthies’ specification and figures do not ever teach or suggest the presence of a pixel defining layer in Matthies’ display nor do they teach or suggest any manufacturing steps that would lead to the deposition of a pixel defining layer.

-01075 Ex. 2009 (Kymissis Declaration) at ¶187

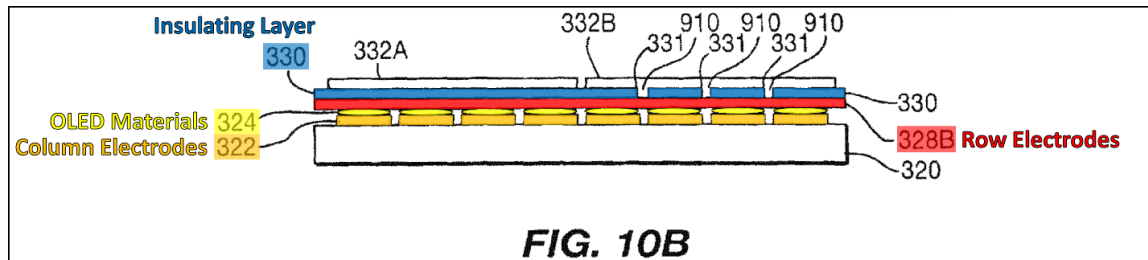
increased energy consumption. As shown in the cross-section of Matthies’ display shown in Figure 10B (annotated version below), Matthies does not use any layer between the row and column electrodes for shaping the organic material, because there is no need for such a layer in the PMOLED where the electrode overlap regions define the emissive area. *See also* Matthies, 12:58-13:26.



-01075 Ex. 2009 (Kymissis Declaration) at ¶117

Matthies Does Not Teach a Pixel Defining Layer

- Matthies' manufacturing steps do not include depositing or forming a PDL



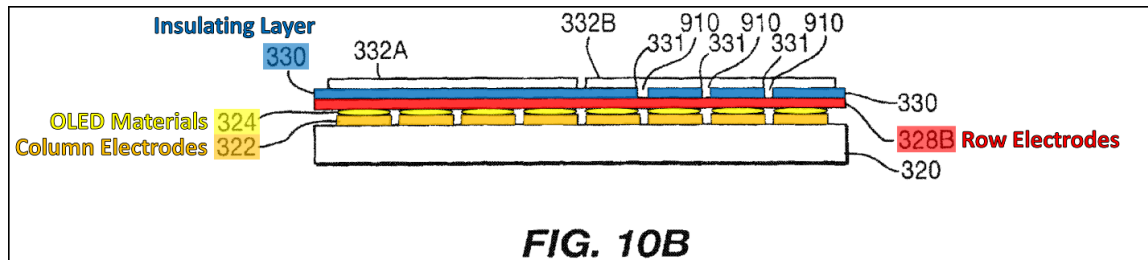
-01075 Ex. 2009 (Kymissis Declaration) at ¶117

The display section includes a transparent front plate which may be, for example, a float glass plate. Transparent column electrodes 322 are formed on the front plate 320 by forming thin bands of a transparent conductor, such as indium-tin oxide, using well known processes. This may be done, for example, by depositing a film of ITO over the surface of the float glass plate and selectively etching the ITO to form the electrodes. The display materials, red, green and blue OLED materials 324 and 326, including a hole transport layer, a light emitting layer and an electron injecting layer, are deposited on top of the column electrodes to define the active area of the pixel. The hole transport layer is electrically coupled to the column electrodes, and the light emitting layer is electrically coupled to the hole transport layer. The electron injecting layer which may, for example, be formed from metallic calcium is formed on top of the light emitting layer. The row electrodes 328 are formed on

Matthies at 12:61-13:26

Matthies Does Not Teach a Pixel Defining Layer

- Matthies' manufacturing steps do not include depositing or forming a PDL



-01075 Ex. 2009 (Kymissis Declaration) at ¶117

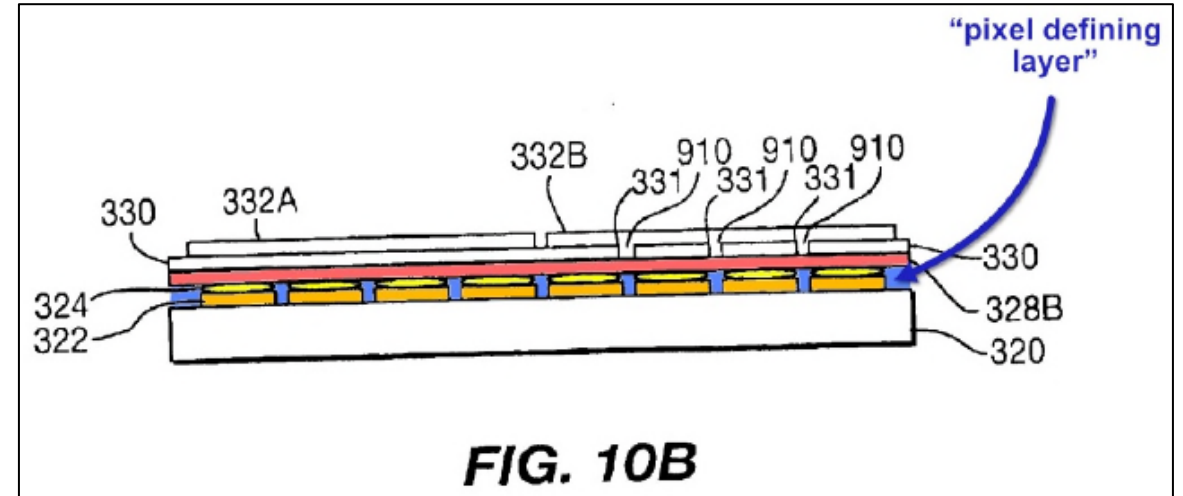
light emitting layer. The row electrodes 328 are formed on top of the electron injecting layer. As described below with reference to FIGS. 6A and 7, it is desirable for the display materials 324 and 326 to occupy only a portion (e.g. about 25 percent) of the pixel area. The row electrodes may be formed, for example, from polysilicon or from a metal such as aluminum using standard deposition techniques. An insulating layer 330 is formed on top of the row electrodes. The exemplary insulating layer 330 may be formed from any of a number of insulating materials. To protect the display materials, the insulating layer 330 is desirably formed using low-temperature processes. Exemplary materials include Polyimide or other low-temperature inorganic materials. The insulating layer 330 may be applied using thick film or thin film deposition techniques. The insulating layer 330 includes a plurality of openings 331 aligned with the row electrodes 328 or column electrodes 322.

Matthies at 12:61-13:26

Matthies Does Not Teach a Pixel Defining Layer

- Petitioner misleadingly labels a “pixel defining layer” in Figure 10B
- Dr. Kymissis explains Figure 10B does not show, and nothing in Matthies teaches or suggests, the presence of a PDL
- Dr. Pattison admits a PDL is not labeled or shown Figure 10B

Petitioner's Annotation to Matthies Fig. 10B



-01075 Pet. at 25

187. There is no teaching or suggestion in Matthies relating to a “pixel defining layer.” Matthies’ specification and figures do not ever teach or suggest the presence of a pixel defining layer in Matthies’ display nor do they teach or suggest any manufacturing steps that would lead to the deposition of a pixel defining layer.

-01075 Ex. 2009 (Kymissis Declaration) at ¶187

171. While not labeled or shown in Figure 10B, Matthies also explains that various other “layers” “may be present to improve the function or life of the display layers.” (*Id.*, 6:37-38.)

-01075 Ex. 1003 (Pattison Declaration) at ¶171

A POSITA Would Not Have Added a PDL to Matthies

- The Petition fails to identify any motivation to add a pixel defining layer to Matthies, let alone to Matthies' Figure 8B
- A POSITA would not have attempted to add a pixel defining layer

188. A POSITA would not have understood Matthies to “obviously” include a pixel defining layer in its display. Matthies does not identify any benefits or advantages to including a pixel defining layer in its display. Matthies does not explain that the lack of a pixel defining layer would pose any problems with its display. A POSITA would instead have understood that adding a pixel defining layer would introduce additional manufacturing steps, which would add costs.

-01075 Ex. 2009 (Kymissis Declaration) at ¶188

regions define the emissive areas. A POSITA would not have attempted to add such an additional layer, which would undesirably increase thickness and require additional process steps of deposition and patterning that would increase cost and reduce yield, and result in increased power consumption due to charge accumulation that does not contribute to the operation of the OLED, as discussed above in Section X.A.3.

-01075 Ex. 2009 (Kymissis Declaration) at ¶182

A POSITA Would Not Have Added a PDL to Matthies

- Petitioner's attorney argument in reply is unsound

layer. Additional layers such as blocking or passivation layers may be present to improve the function or life of the display layers. The transparent electrode is preferably the

Matthies at 6:37-39 (cited at -01075 Reply at 13)

defining layer when it does not. Matthies says that “[a]dditional layers *such as blocking or passivation layers* may be present,” neither of which is a PDL. Matthies, 6:37 (emphasis added).

-01075 Sur-reply at 16

Petitioner Does Not Propose Combining a Layer in Yamada with Matthies

- Yamada does not use a planarization insulating film in various embodiments
- Petitioner also never argued that film would be incorporated into Matthies

POSITA would be motivated to try to do so. In fact, while Dr. Pattison points to Yamada's figure 6B, which shows a "planarization insulating film 167," Yamada's figure 6A does *not* include the same layer, suggesting that a planarization insulating film is not a key feature of Yamada's display that a POSITA would have been motivated to implement into Matthies (assuming a POSITA would have been

-01075 Ex. 2009 (Kymissis Declaration) at ¶189

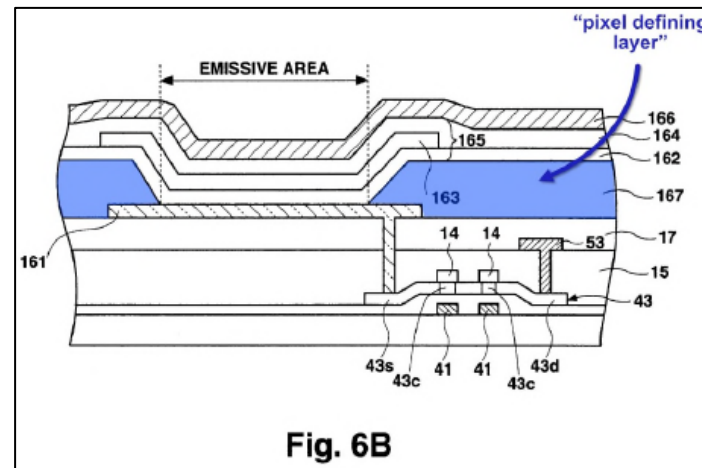


Fig. 6B

Pet. at 26

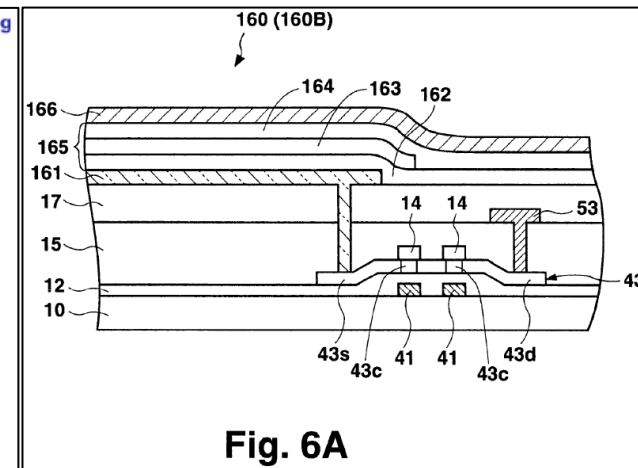


Fig. 6A

Yamada at Fig. 6A

Claim 5

'578 Patent Claim 5

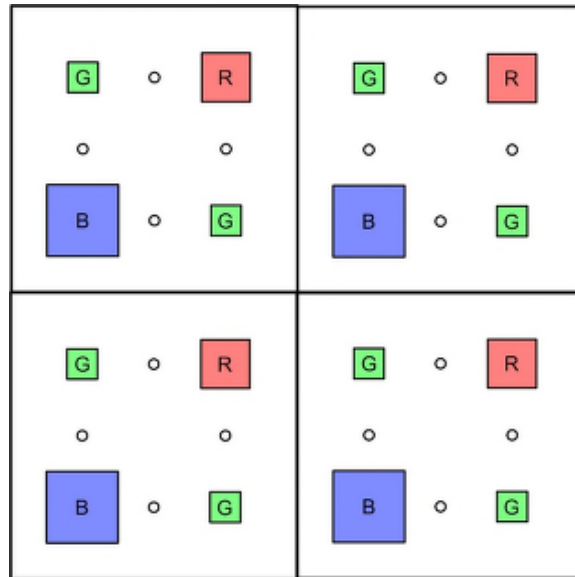
5. The pixel arrangement structure of claim 1, wherein a shortest distance between the first pixels and the second pixels, and a shortest distance between the first pixels and the third pixels, are a same first length.

'578 Patent at 9:66-10:2 (claim 5)

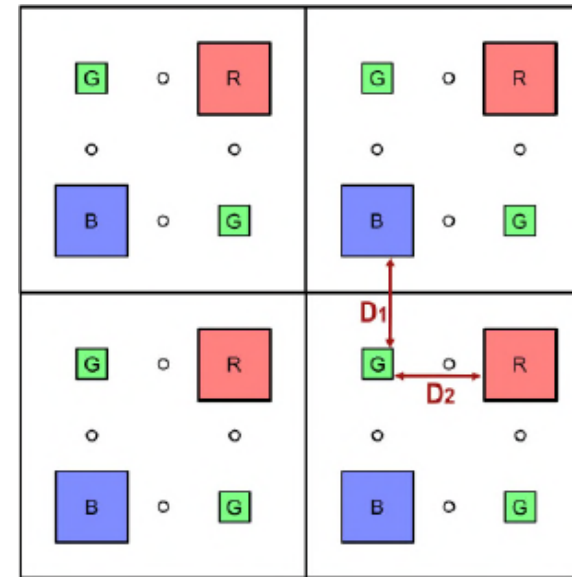
The Petition's Theory for Dependent Claim 5

- Only for the additional limitation of claim 5, Petitioner argues Matthies' pixels would be resized per Yamada to make green pixels smaller and red and blue pixels equally sized

Alleged Combination for Claim 1



Alleged Combination for Dependent Claim 5



-01075 Pet. at 39, 45

Petitioner's Theory Is Internally Inconsistent

- Petitioner's theory for claim 5's additional limitation is inconsistent with its theory for independent claim 1, from which claim 5 depends

Petitioner's theory for Claim 1

Following these teachings, rather than making all the sub-pixels all the same size, a POSITA would have understood that Matthies' sub-pixels should be re-sized in accordance with their emission efficiencies such that the "*first pixels*" (the green sub-pixels) are smallest, the "*second pixels*" (the blue sub-pixels) are largest, and the "*third pixels*" (the red sub-pixels) have an intermediate size. The same "quad

-01075 Pet. at 38

Petitioner's theory for Claim 5

While re-sizing the red, green, and blue sub-pixels following Yamada's teachings would change these distances, a POSITA would have considered it obvious to keep the green-to-blue and green-to-red distance the same. (*Id.*, ¶¶ 269-270.) This would have been accomplished by, for instance, making the green sub-pixels smaller and the red and blue pixels equally sized as shown below. (*Id.*, ¶ 271.)

-01075 Pet. at 46

Petitioner Offers No Motivation to Modify Figure 8B This Way

- Dr. Pattison contends a POSITA would have been motivated to make blue pixels ***larger*** than red pixels to improve OLED display lifetime

306. And, as explained in connection with limitations [1-12] to [1-13], Yamada teaches that to improve the life of an OLED display, the blue sub-pixels should be made largest, the red sub-pixels intermediately sized, and the green sub-pixels smallest.

would have further motivated its application to Matthies. Because OLED displays were routinely designed with larger blue pixels, intermediately sized red pixels, and smaller green pixels, a POSITA would not only have been aware of this design, but would have been motivated to employ it with Matthies to obtain the benefits of this relative pixel sizing known and discussed in the prior art.

-01075 Ex. 1003 (Pattison Declaration) at ¶306, 436

Petitioner Offers No Motivation to Modify Figure 8B This Way

- Dr. Pattison admitted a POSITA would not think making blue and red pixels the same size would be a good idea

11 But in your opinion, a person of ordinary skill
12 in the art would recognize it would not be a good idea to
13 make blue the same size as red, correct?
14 A. Correct. Just like I said, it's well known in
15 the art, and this is something I've been working on for
16 decades, managing projects to improve blue OLED materials
17 since 2006, projects at UDC and other places that DOE
18 funded. Blue has always been the weak point with -- among
19 OLED emitters.

-01075 Ex. 2083 (Pattison Testimony) at 279:11-19

Petitioner Offers No Motivation to Modify Figure 8B This Way

- Petitioner alleges “design choice” but articulates no reason why a POSITA would choose the design



Merely stating that a particular placement of an element is a design choice does not make it obvious. The Board must offer a reason for why a person of ordinary skill in the art would have made the specific design choice

Cutsforth, Inc. v. MotivePower, Inc.,
636 F. App'x 575, 578 (Fed. Cir. 2016)

Claims 41, 44, and 52

Petitioner Fails to Meet Its Burden

- The Petition fails to articulate or show what structure the resulting modification allegedly has
 - Not even a drawing showing alleged structure
- The Petition fails to show all limitations are met by the alleged modification, e.g.,
 - “region” limitation [1-12]
 - “shortest distance” limitation [41/44/52]

Petitioner Fails to Meet Its Burden

41. The pixel arrangement structure of claim 1, wherein a shortest distance between two elongated sides of one of the first pixels is less than a shortest distance between the one of the first pixels and a nearest one of the second pixels in the third direction or a fourth direction crossing the third direction.

'578 Patent at 13:36-41 (claim 41)

44. The pixel arrangement structure of claim 42, wherein a shortest distance between two elongated sides of one of the first pixels is less than a shortest distance between the one of the first pixels and a nearest one of the second pixels in the third direction or a fourth direction crossing the third direction.

'578 Patent at 14:32-37 (claim 44)

52. The pixel arrangement structure of claim 45, wherein a shortest distance between two parallel edges that are elongated in a first direction or a second direction crossing the first direction from among the edges of one of the group of four neighboring ones of the plurality of first pixels is less than a shortest distance between the one of the group of four neighboring ones of the plurality of first pixels and the only one of the second pixels and the third pixels included in the virtual quadrangle.

'578 Patent at 15:27-35 (claim 52)

No Motivation to Use Elongated Pixels

- Petition sets forth no reason why a POSITA would have elongated pixel shapes in Matthies' quad-pixel display
- Petitioner alleges “design choice” but articulates no reason why a POSITA would have chosen the design



Merely stating that a particular placement of an element is a design choice does not make it obvious. The Board must offer a reason for why a person of ordinary skill in the art would have made the specific design choice

Cutsforth, Inc. v. MotivePower, Inc.,
636 F. App'x 575, 578 (Fed. Cir. 2016)

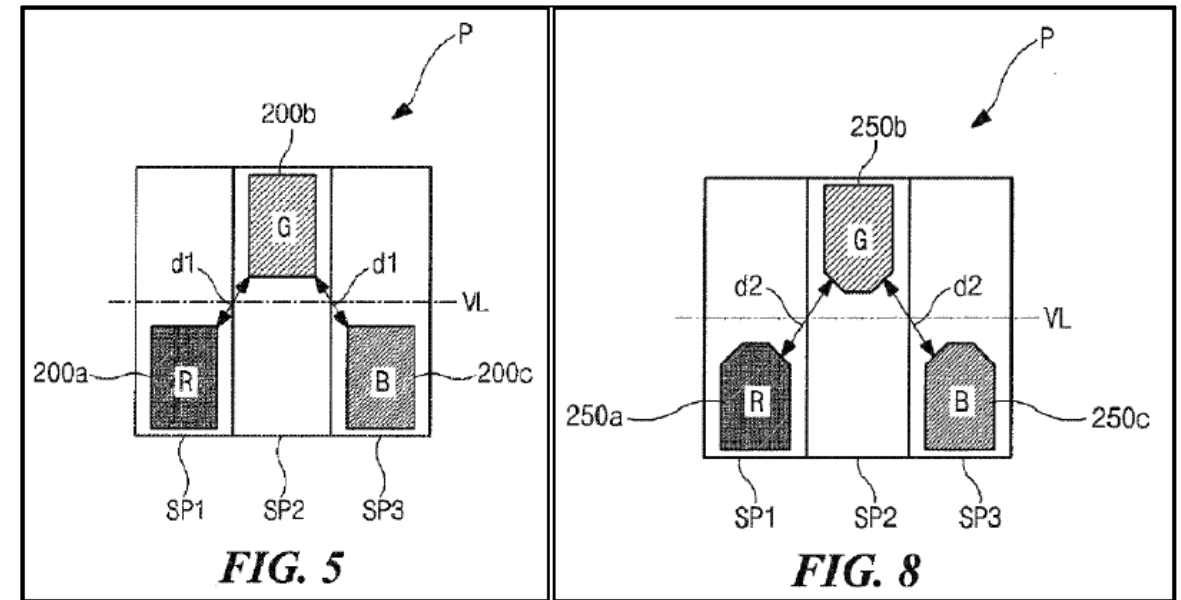
Matthies in view of Yamada and Hong ('578 Patent)

IPR2023-01075 Ground 2 ('578 claims 40, 43, 45-47, 51-52)

Hong Is Directed to a Zig-Zag RGB Triple Pixel Arrangement

- Hong uses truncation to increase aperture ratio because in its zig-zag arrangement shortest distances are diagonal

85. Hong is directed to an OLED display device that uses a particular arrangement of organic patterns in sub-pixel regions. Hong, ¶[0003]. Specifically, Hong is directed to a specific variant of the RGB stripe-type structure, where the red, green, and blue pixels are arranged in a “zigzag” pattern, instead of being arranged in a regular rectilinear grid. Hong, Abstract, ¶¶[0015]-[0016], [0043], [0052], [0067], Figures 4, 6, 9. The zigzag pattern is an important aspect of Hong’s invention because it is what allows for greater separation between adjacent pixels of different colors to result in improved aperture ratio and resolution while reducing the shadowing effect. Hong, ¶¶[0036], [0043]-[0044], [0048]-[0049], [0052].



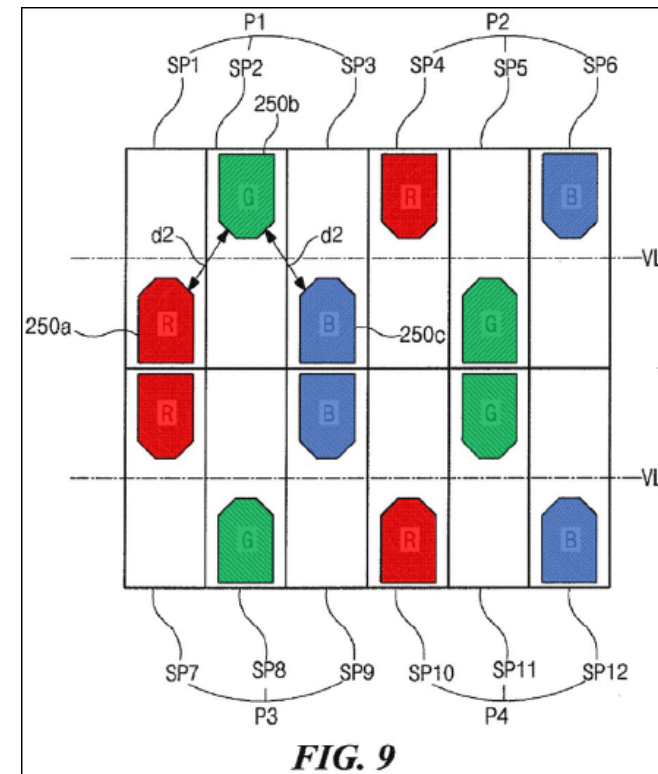
-01075 Ex. 2009 (Kymissis Declaration) at ¶85, 248

Hong Does Not Teach Octagonal Pixel Shapes

- Hong shows pairs of adjacent hexagonal shapes corresponding to two separate pixel regions, not octagons

239. Hong does not teach, suggest, or use octagonal pixels. There does not appear to a dispute between myself and Dr. Pattison on this point, as Dr. Pattison seems to state that what Hong actually discloses is pairs of two same-color, but different, pixels that are situated adjacent to each other in the vertical direction. See Ex. 1003, ¶469 (“Thus, only two corners are truncated on each part (the other two corners do not need to be truncated as they are directly next to a same-color pixel).”)

-01075 Ex. 2009 (Kymissis Declaration) at ¶239



-01075 Ex. 2009 (Kymissis Declaration) at ¶229

Hong Does Not Teach Octagonal Pixel Shapes

- Adjacent pairs of shapes of the same color correspond to separate and independent pixel regions

octagonal shaped pixel could be used instead. Ex. 1003, ¶¶468-469. I disagree. These pairs of hexagon-shaped regions are for two separate pixels in two separate pixel regions, individually driven by two separate sets of driving circuitry, and there is a clear separation in where the organic emissive material is deposited for each pixel.

-01075 Ex. 2009 (Kymissis Declaration) at ¶241

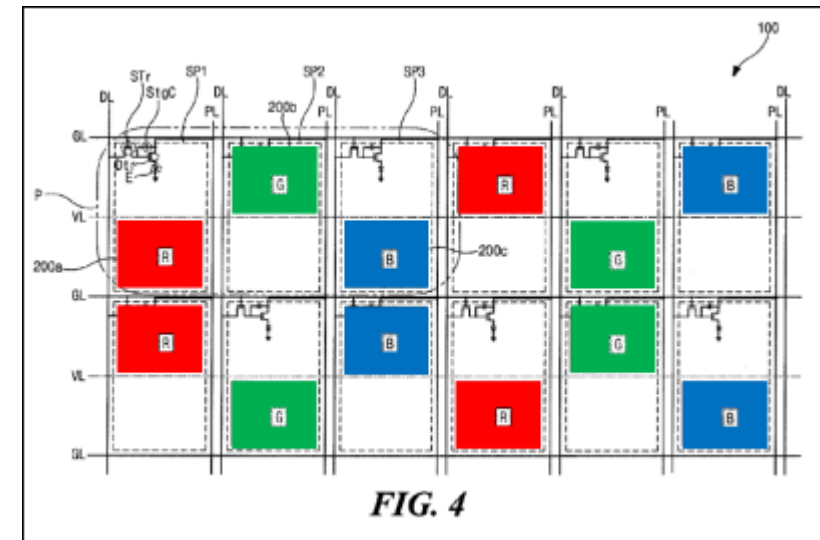


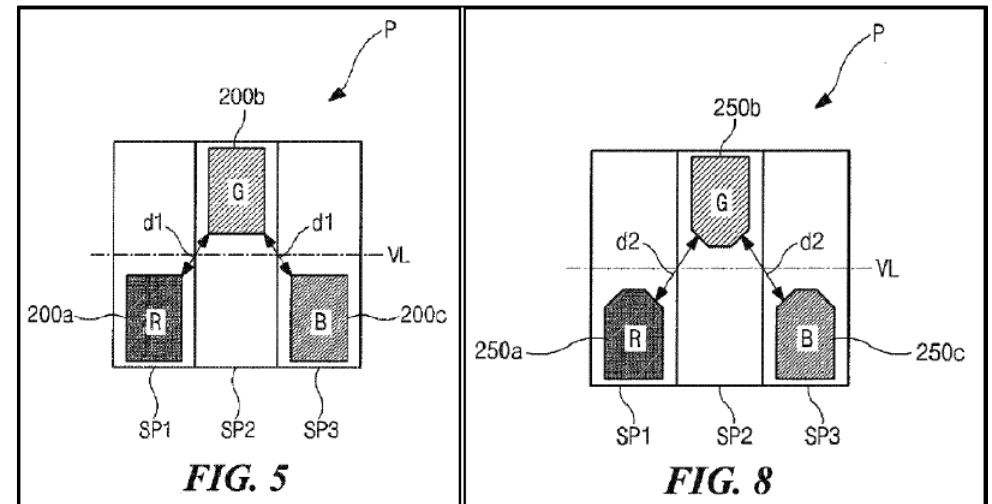
FIG. 4

-01075 Ex. 2009 (Kymissis Declaration) at ¶227

Hong Does Not Teach the Petition's Elongated Octagonal Pixels

238. But this oblong octagonal pixel shape does not appear anywhere in Hong. It also does not appear anywhere in Matthies, Yamada, or any other reference cited by Dr. Pattison. The illustrated elongated octagonal shape, including the relative dimensions and sizing, all appear to be entirely a creation of Dr. Pattison, created without explanation of how it was created, and with no basis in any of the cited references.

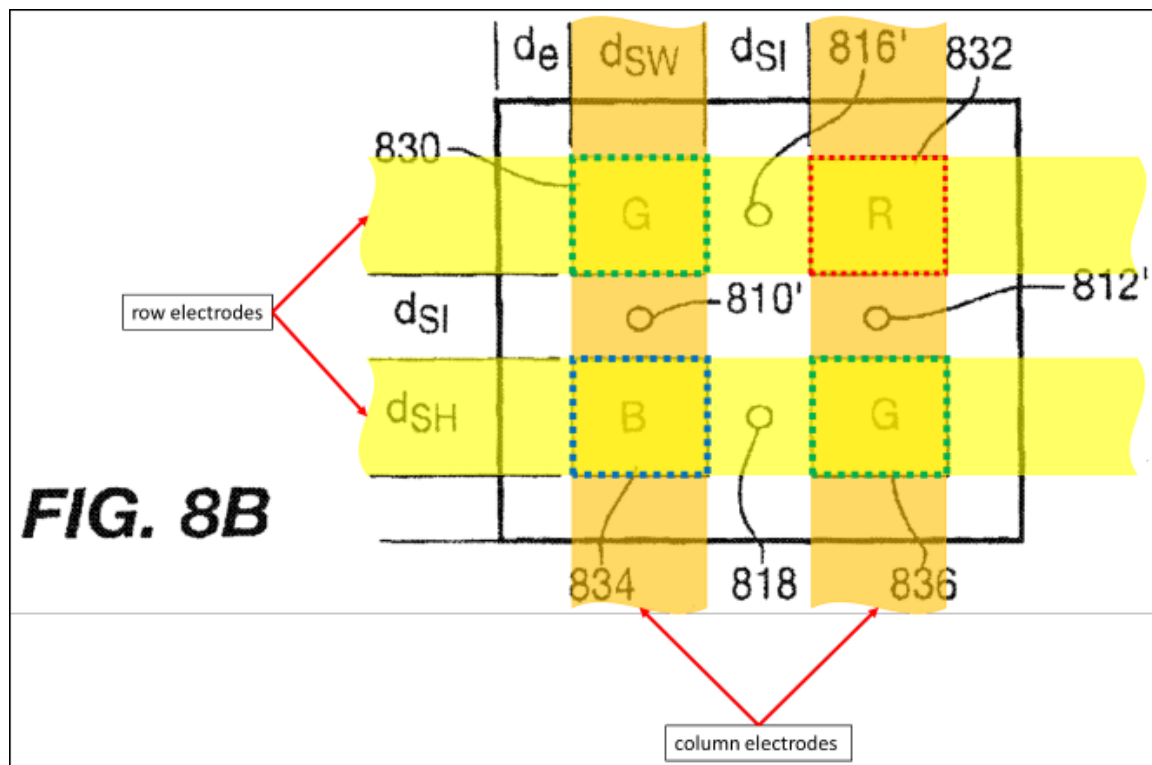
-01075 Ex. 2009 (Kymissis Declaration) at ¶238



-01075 Ex. 2009 (Kymissis Declaration) at ¶248

Petitioner's Theory Is Incompatible with Matthies

- Matthies' pixel arrangement structures are not amenable to octagonal pixel shapes



matrix display. *See* Section VIII.A. And in a passive-matrix display, the pixels are defined by the overlap of the row and column electrodes, as shown in the annotated

expectation of success. As I've explained above, attempting to change the shapes of the pixels in a passive-matrix display would introduce several complex electrical effects that would negatively impact the operation and quality of the display and would require adding process steps that would reduce yield and increase manufacturing costs. *See* Section V. What's more, even if Dr. Pattison is correct that a POSITA would have "considered" other non-rectangular shaped pixels for use in Matthies' passive-matrix display, he has not offered any explanation at all why a POSITA would have chosen the particular octagonal shape that he relies on.

-01075 Ex. 2009 (Kymissis Declaration) at ¶218

The Petition Ignores Constraints on Pixel Shape and Spacing

incorrect. Again Dr. Pattison oversimplifies the design of pixels that can operate as part of actual, functioning displays. As I just explained above, the choices of pixel shapes are not arbitrary. In the real world, the designer of pixel shapes for displays must take into account myriad considerations, such as manufacturability, aperture ratio, and image quality. Further, pixel shapes may be further constrained by the area necessary for power and signal lines, and driving circuitry, as I have already explained in relation to Hong and Yamada. A POSITA thus would not have considered it a matter of “mere design choice” or otherwise obvious to use any pixel shapes, let alone elongated octagonal pixel shapes. Dr. Pattison points to no evidence that octagonal pixels were widely used or that the choice of octagonal pixels or other pixel shapes was a matter of routine design choice.

-01075 Ex. 2009 (Kymissis Declaration) at ¶217

Not An Obvious Design Choice



Merely stating that a particular placement of an element is a design choice does not make it obvious. The Board must offer a reason for why a person of ordinary skill in the art would have made the specific design choice

Cutsforth, Inc. v. MotivePower, Inc.,
636 F. App'x 575, 578 (Fed. Cir. 2016)



The obviousness inquiry does not merely ask whether a skilled artisan could combine the references, but instead asks whether “they would have been motivated to do so.” Fundamental differences between the references are central to this motivation to combine inquiry.

Adidas AG v. Nike, Inc.,
963 F.3d 1355, 1359 (Fed. Cir. 2020)

No Generalized Benefit of Manufacturing Octagonal Pixels

- Smith (Ex. 1006) is describing benefits specific to its own embodiments using a particular manufacturing method not used in Hong or Yamada

[0064] FIG. 7 shows a similar arrangement to that of FIG. 5 which utilizes hexagonal discrete colour-forming regions rather than square. This arrangement provides a good aperture ratio while having corners that have a greater angle than in the square arrangement such that ink can readily wet the whole of each discrete colour-forming region.

-01075 Ex. 1006 (Smith) at ¶[0064]

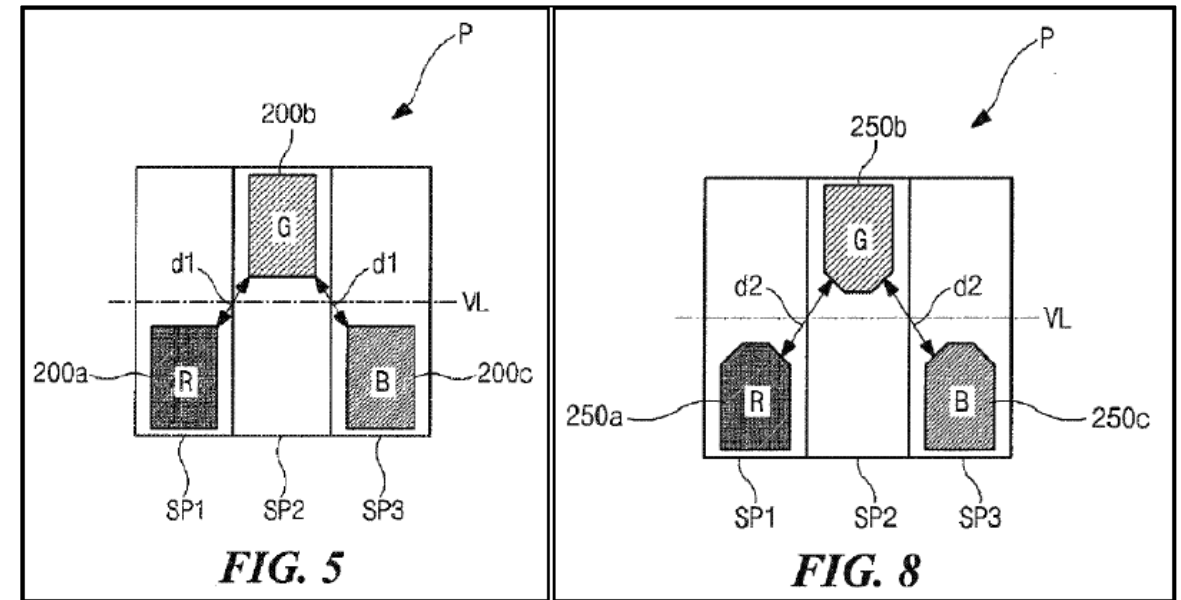
and “easier . . . manufactur[ability].” Ex. 1003, ¶¶486. Smith is merely describing how one embodiment of its disclosure is better than another embodiment of its disclosure, and does not support a generalized understanding that any OLED pixel would be easier to manufacture in an octagonal shape. Further, Smith’s discussion of these benefits of one of its embodiments is clearly limited to its particular manufacturing method, which is inkjet printing. There is no generalized understanding that octagonal OLED pixels are easier to manufacture than square pixels, or provide a “good aperture ratio” (whatever “good” is even supposed to mean, given no basis for comparison).

-01075 Ex. 2009 (Kymissis Declaration) at ¶221

Proposed Modification Does Not Have Hong's Benefits

- Hong's truncation results in reduced shadowing effect due to its zig-zag arrangement, and would not occur in Matthies' quad pixel arrangement

87. As shown below in Figures 5 and 8 of Hong, the shortest distance between adjacent organic patterns in the zigzag arrangement is in the diagonal direction (d1). Hong seeks to increase the aperture ratio by using this zigzag pattern to avoid a "shadowing effect" that the proximity of organic patterns in such an arrangement can cause. Hong, ¶¶[0011], [0044]. Hong explains that the arrangement in Figure 8 further addresses the potential shadowing effect by truncating the corners of the organic patterns to increase the shortest distance from d1 to d2. Hong, ¶¶[0047]-[0048], [0060]-[0061]. This allows the patterns 250a, 250b, and 250c to have "a further enlarged area" and results in an increase in the total light-emitting area. Hong, ¶¶[0057], [0061]. This is consistent with Hong's teaching that pixel



-01075 Ex. 2009 (Kymissis Declaration) at ¶87, 248

Proposed Modification Is Inconsistent with Hong

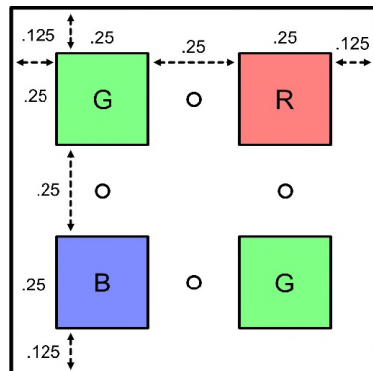
- Hong truncates to increase aperture ratio while maintaining adequate separation due to its zigzag arrangement
- Petitioner's proposal would reduce aperture ratio and decrease separation

truncated corners of pixels. Hong is instead very clear that the higher aperture ratio is due to its zigzag pattern, which allows for the organic patterns to be larger in size and to be deposited using Hong's manufacturing method. Hong, ¶¶[0003] ("aperture [0049], [0061]-[0062]. Hong does state that aperture ratio is improved in the embodiment where corners of organic patterns are cut off or truncated, but this is not because the corners were cut off, but because the cut-off corners result in a greater distance between pixels, which can then be taken advantage of by "further enlarg[ing]" the area of the organic patterns for each pixel. Hong, ¶¶[0061]-[0062]. Thus, it is enlarging the pixel, not cutting off its corners, that results in the increased aperture ratio. Of course, this makes perfect sense; merely cutting the corners of the

-01075 Ex. 2009 (Kymissis Declaration) at ¶220

Proposed Modification Is Inconsistent with Hong

- Shortest distances between pixels in Matthies' quad-pixel structure are *not* in the diagonal directions
- Truncating pixel corners would not increase aperture ratio or reduce shadowing, but instead reduce aperture ratio and lifetime



-01075 Pet. at 30

have expected success in doing so. In the quad sub-pixel structure of Matthies (and in Dr. Pattison's combination of Matthies with Yamada), the shortest distances between different color pixels are in the horizontal and vertical directions, rather than the diagonal directions. Thus, truncating the corners of the sub-pixels would not increase the shortest distance between pixels, and thus would not help with achieving increased aperture ratio or resolution. In fact it would just result in the opposite effect: it would reduce the useful area of the pixels and reduce the aperture ratio of the display, for no benefit and no reason. Note that this would also further reduce the lifetime of the display because a greater current density would have to be applied to the pixels with truncated corners to achieve the same level of brightness as before.

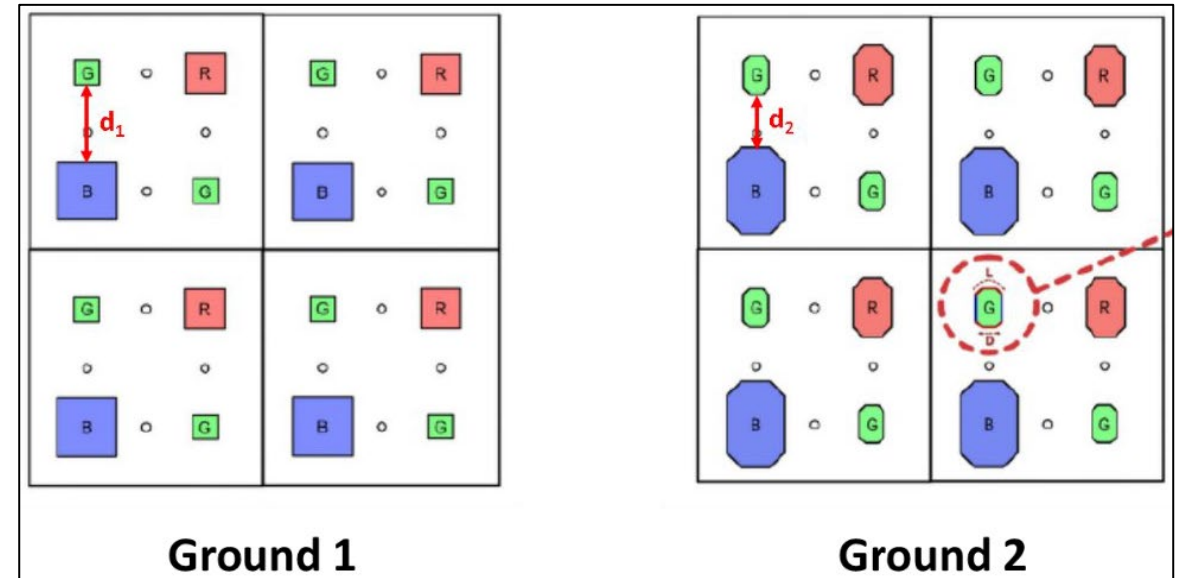
-01075 Ex. 2009 (Kymissis Declaration) at ¶249

Proposed Modification Reduces Aperture and Lifetime

- Elongating pixels in Matthies' arrangement would exacerbate shadowing effect and increase manufacturing complexities

pixels. The distance d_2 is actually *smaller* than the distance d_1 . Thus, by further modifying his proposed combination of Matthies and Yamada by using an oblong, octagonal pixel, allegedly based on Hong, Dr. Pattison arrives at a pixel arrangement structure where adjacent pixels are *closer together*. Dr. Pattison's proposal is thus contrary to Hong's teaching to increase the distance between organic patterns (thus increasing the distance between the light emitting regions for each pixel), and would exacerbate the "shadowing effect" and make the display more difficult to manufacture, contrary to Hong's goals.

-01075 Ex. 2009 (Kymissis Declaration) at ¶251



-01075 Ex. 2009 (Kymissis Declaration) at ¶250

Petitioner Fails to Meet Its Burden

- Each independent claim (claims 1, 42, 45) recites limitations specifying certain “shortest distances” between pairs of pixels
- Claim 1 further requires a specified “region” that is “entirely offset” from certain pixels
- Petitioner fails to show how any of these limitations are met by its proposed combination in Ground 2

Dr. Pattison fails to show that any of these limitations are satisfied by his proposed combination of Matthies, Yamada, and Hong. In fact, Dr. Pattison fails to show how any one of the limitations in independent claims 1, 42, and 45 are met by his proposed combination.

-01075 Ex. 2009 (Kymissis Declaration) at ¶254

structure. Dr. Pattison states only that he “[a]ppl[ies] Hong’s elongated pixel shape to Matthies.” Ex. 1003, ¶469. But Dr. Pattison’s illustration of his proposed combination cannot be drawn to scale, because there is simply nothing in any of the references relied on by Dr. Pattison that indicate to a POSITA how much the pixels should be elongated and how, or what the dimensions of the pixels and distances between pixels should be. He does not even attempt to explain why a POSITA making the combination would end up with the sizes and shapes in the drawings as he has drawn them. Thus, none of Dr. Pattison’s opinions that simply rely on annotations of his drawings have support in the references he cites. Dr. Pattison’s drawings of his proposed combination of Matthies, Yamada, and Hong are thus arbitrary.

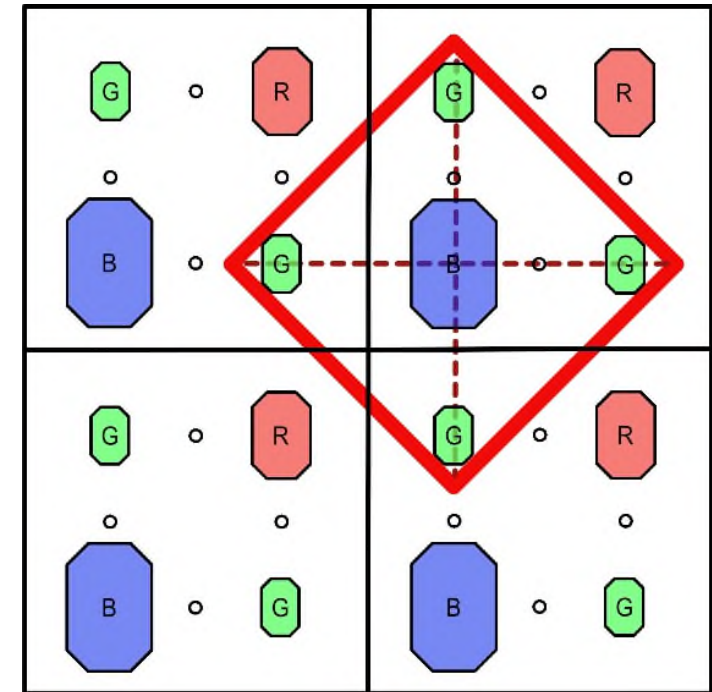
-01075 Ex. 2009 (Kymissis Declaration) at ¶259

Petitioner Fails to Meet Its Burden

- Petitioner addresses only one limitation in claim 45 relating to “a virtual quadrangle containing outer edges comprising some of the edges of a group of four neighboring ones of the plurality of first pixels”
- Even this analysis is deficient

four adjacent green pixels “cooperate to form the quadrangle.” However, if the green pixels are all to have the *same* size and shape (as Dr. Pattison appears to assume), the sides formed by the truncated corners of adjacent green pixels could only “cooperate to form” a side of the virtual quadrangle if the corners of the green pixels were truncated at 45 degree angles. Dr. Pattison has not even alleged that the green pixels are so truncated. And there is no teaching in Hong that the pixels must be truncated at 45 degree angles. On the contrary, a POSITA would understand that the optimum angle of truncation would be one that would maximize the distance between pixels while maximizing the available pixel area. (And for the reasons

-01075 Ex. 2009 (Kymissis Declaration) at ¶257



-01075 Pet. at 81

Phan

IPR2023-00987 Ground 2 ('803 Patent claims 1-4, 19-21)

IPR2023-00988 Ground 2 ('683 Patent claims 1, 4-10, 13, 15)

Phan Does Not Teach OLED Pixel Arrangements

The Challenged Claims Are OLED Pixel Arrangement Structures

- Every challenged claim requires an OLED display and a pixel arrangement structure of an OLED display

1. A pixel arrangement structure of an organic light emitting diode (OLED) display, comprising:
a plurality of pixels for displaying an image on the OLED display and comprising:

'803 Patent at 8:58-61 (claim 1)

1. A pixel arrangement structure of an organic light emitting diode (OLED) display comprising:
a plurality of pixels for displaying an image on the OLED display and comprising:

'683 Patent at 8:63-66 (claim 1)

Phan Does Not Teach OLED Pixel Arrangement Structures

- Phan's sole reference to OLED is in passing in a laundry list

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to a display comprising pixels and dots, including but not limited to the following display technologies: Cathode Ray Tube (CRT), Field Emission Display (FED), Vacuum Florescent Display (VFD), Plasma Display Panel (PDP), Liquid Crystal Display (LCD), Light Emitting Diode (LED), Organic Light Emitting Diode (OLED), Polymer Light Emitting Diode (PLED), Electroluminescence (EL), Electronic inks, Surface Emitting Display (SED), Digital Light Processing (DLP), Electro-mechanics, Phototronics, Biotronics and any light sources known or invented in the future as well as a method for controlling the (said) display.

Phan at 1:15-29

Phan Does Not Teach OLED Pixel Arrangement Structures

- Phan's laundry list includes numerous "technologies"
Petitioner's expert never heard of

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Phan at 1:15-29

4	Q	What's meant by electronic inks?
5	A	Electronic inks? I'm not entirely sure,
6		but maybe 20 years ago there was some prospect
7		for, I don't know, some -- some ink. It kind of
8		sounds like a polymer OLED. But, yeah, I'm not --
9		I'm not certain what he -- what he was intending
10		or thinking of.

-00987 Ex. 2062 (Pattison Deposition) at 160:4-10

-00988 Ex. 2062 (Pattison Deposition) at 160:4-10

11	Q	What's a surface emitting display, SED?
12	A	Yeah, I don't -- I don't know what that
13		one is either. I'd have to look it up. I mean,

-00987 Ex. 2062 (Pattison Deposition) at 160:11-13

-00988 Ex. 2062 (Pattison Deposition) at 160:11-13

Phan Does Not Teach OLED Pixel Arrangement Structures

- Phan's laundry list includes numerous "technologies" Petitioner's expert never heard of

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The invention relates to a display comprising pixels and dots, including but not limited to the following display technologies: Cathode Ray Tube (CRT), Field Emission Display (FED), Vacuum Florescent Display (VFD), Plasma Display Panel (PDP), Liquid Crystal Display (LCD), Light Emitting Diode (LED), Organic Light Emitting Diode (OLED), Polymer Light Emitting Diode (PLED), Electroluminescence (EL), Electronic inks, Surface Emitting Display (SED), Digital Light Processing (DLP), Electro-mechanics, Phototronics, Biotronics and any light sources known or invented in the future as well as a method for controlling the (said) display.

Phan at 1:15-29

11 Q. So at the time of your deposition after rendering
12 your opinions, you didn't know what Phan meant by digital
13 light processing display, correct?
14 A. Correct.

-00987 Ex. 2083 (Pattison Testimony) at 292:11-14

-00988 Ex. 2083 (Pattison Testimony) at 292:11-14

17 Q. And you're not sure what Phan means by
18 electromechanics, correct?
19 A. No.
20 Q. No, you're not sure?
21 A. No, I'm not sure what he means by that.

-00987 Ex. 2083 (Pattison Testimony) at 292:17-21

-00988 Ex. 2083 (Pattison Testimony) at 292:17-21

Phan Does Not Teach OLED Pixel Arrangement Structures

- Phan's laundry list includes numerous "technologies" Petitioner's expert never heard of

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22 Q. And next is phototronics. And outside of Phan,
23 you've never seen the term "phototronics" before, correct?
24 A. Yeah, I have not seen that term before.

-00987 Ex. 2083 (Pattison Testimony) at 292:22-24

-00988 Ex. 2083 (Pattison Testimony) at 292:22-24

25 Q. And next is biotronics, and you don't know what
1 Phan means by biotronics.
2 A. Not exactly. I'm assuming it's some sort of
3 biological based optoelectronic system, but I'm not familiar
4 with that term.

-00987 Ex. 2083 (Pattison Testimony) at 292:25-293:4

-00988 Ex. 2083 (Pattison Testimony) at 292:25-293:4

Phan at 1:15-29

Phan Does Not Teach OLED Pixel Arrangement Structures

- Phan's laundry list includes numerous "technologies" Petitioner's expert never heard of

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The invention relates to a display comprising pixels and dots, including but not limited to the following display technologies: Cathode Ray Tube (CRT), Field Emission Display (FED), Vacuum Florescent Display (VFD), Plasma Display Panel (PDP), Liquid Crystal Display (LCD), Light Emitting Diode (LED), Organic Light Emitting Diode (OLED), Polymer Light Emitting Diode (PLED), Electroluminescence (EL), Electronic inks, Surface Emitting Display (SED), Digital Light Processing (DLP), Electro-mechanics, Phototronics, Biotronics and any light sources known or invented in the future as well as a method for controlling the (said) display.

18	So I don't -- I don't know, you know, some of
19	these exotic biotronics, phototronics, exactly
20	what he was thinking. Except like you suggested,
21	he was maybe future-proofing this -- this concept.

-00987 Ex. 2062 (Pattison Deposition) at 160:18-21

-00988 Ex. 2062 (Pattison Deposition) at 160:18-21

Phan at 1:15-29

Phan Does Not Teach OLED Pixel Arrangement Structures

- Phan's laundry list includes technologies that do not exist

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to a display comprising pixels and dots, including but not limited to the following display technologies: Cathode Ray Tube (CRT), Field Emission Display (FED), Vacuum Florescent Display (VFD), Plasma Display Panel (PDP), Liquid Crystal Display (LCD), Light Emitting Diode (LED), Organic Light Emitting Diode (OLED), Polymer Light Emitting Diode (PLED), Electroluminescence (EL), Electronic inks, Surface Emitting Display (SED), Digital Light Processing (DLP), **Electro-mechanics**, **Phototronics**, **Biotronics** and any light sources known or invented in the future as well as a method for controlling the (said) display.

202. Further, Phan lists several “technologies” that appear not to exist. For example, I do not know what Phan is referring to when it mentions **Electro-mechanics displays**. I have also never heard of **Phototronics** or **Biotronics displays**.

Based on Phan's inclusion of several “display technologies” that do not appear to exist, and even “any light sources known or invented in the future,” a POSITA would not have thought that Phan contemplated real displays or pixel arrangements for each of these “display technologies.” A POSITA would understand that different display

-00987 Ex. 2009 (Kymissis Declaration) at ¶¶202
-00988 Ex. 2009 (Kymissis Declaration) at ¶¶202

Phan at 1:15-29

Phan Does Not Teach OLED Pixel Arrangement Structures

- By Dr. Pattison's logic, Phan would disclose pixel arrangements for non-existent display technologies

5 Q. And you're not aware of any phototronics or
6 biotronics displays that existed at the time of this patent
7 by Phan?

8 A. Yeah. Like we just said, I don't -- I don't even
9 know what those terms really mean, so, yeah. I wouldn't be
10 aware of any displays.

11 Q. In your opinion -- and you don't know what pixels
12 for phototronics or biotronics would look like, correct?

13 A. No.

14 Q. But it's your opinion that Phan discloses pixel
15 arrangements for phototronics and biotronics displays?

16 A. Yeah, and for OLEDs and polymer light-emitting
17 diodes, which are also OLEDs. Yeah.

-00987 Ex. 2083 (Pattison Testimony) at 293:5-17

-00988 Ex. 2083 (Pattison Testimony) at 293:5-17

COVINGTON

Phan Does Not Teach OLED Pixel Arrangement Structures



[O]ne of ordinary skill in the art would not have understood the '416 patent's "laundry list" of potential central nervous system controlling effects to mean that every carbostyryl derivative disclosed in the '416 patent is a potential antipsychotic.

Otsuka Pharm. Co. v. Sandoz, Inc.,
678 F.3d 1280, 1294 (Fed. Cir. 2012)

Phan Does Not Teach OLED Pixel Arrangement Structures

- Dr. Pattison admits nothing in Phan describes any of Phan's figures as OLED pixel arrangements

16	Q.	Okay. And there's nothing in the description of
17		any figure of Phan that says it's describing or purporting
18		to describe OLED pixel arrangements, correct?
19	A.	No.

-00987 Ex. 2083 (Pattison Testimony) at 300:16-19

-00988 Ex. 2083 (Pattison Testimony) at 300:16-19

Phan Does Not Teach OLED Pixel Arrangement Structures

- Pixel layouts would differ according to the limitations of the underlying technology

2	Q	Do the different tradeoffs that needed to
3		be managed affect the pixel layout?
4	MR. HERMAN:	Objection. Form.
5	A	Yeah, I mean, that's -- pixel layout is a
6		design consideration that can be adjusted based
7		on -- you know, based on the limitations or the
8		facts of the underlying light-emitting technology.

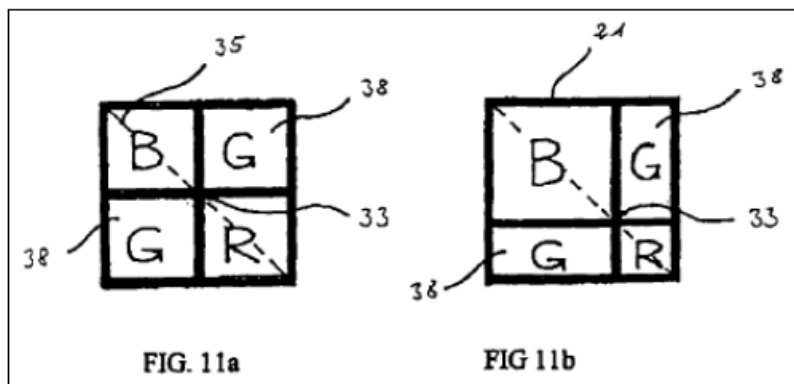
-00987 Ex. 2062 (Pattison Deposition) at 42:2-8

-00988 Ex. 2062 (Pattison Deposition) at 42:2-8

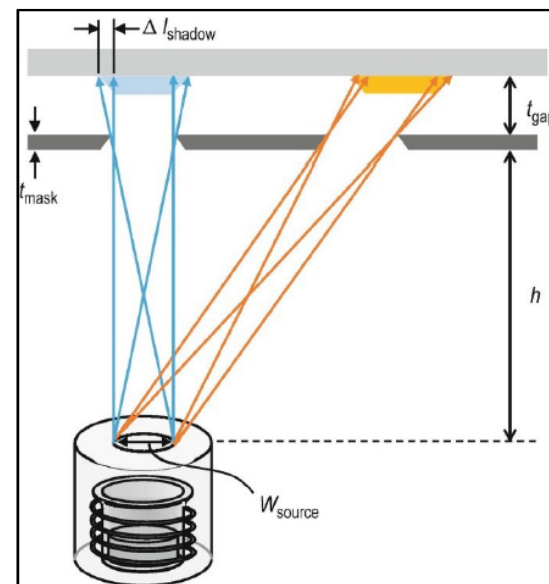
Phan's Disclosure Reinforces that It Does Not Teach OLED Displays

- Unrebutted that Phan depicts pixel arrangements that would not be feasible to implement in an OLED display

206. Phan's figures depicting its pixel arrangements show essentially no spacing between adjacent dots. For example, shown below are Phan's quad pixel structures illustrated in Figures 11a and 11b:



207. A POSITA would have understood that such pixel arrangements were not feasible to implement in an OLED display. Due to physical limitations in the manufacturing process and a degree of randomness and variability always involved, OLED manufacturing process margins would have required large gaps between adjacent pixels. As one example, the illustration below shows how organic material



-00987 Ex. 2009 (Kymissis Declaration) at ¶¶206-208
-00988 Ex. 2009 (Kymissis Declaration) at ¶¶206-208

Phan's Disclosure Reinforces that It Does Not Teach OLED Displays

- Unrebutted that Phan describes components for forming pixels indicative of LCD or plasma, but not OLED displays

205. Phan also describes “contour[ing]” the individual pixel elements “by black mask or barrier ribs,” which are methods mainly used for LCD and plasma displays, instead of OLEDs. Phan, 1:30-34. A POSITA would understand that “black mask” is typically used in LCD displays. A POSITA would understand that “black barrier ribs” are typically used in plasma displays. Neither were used in OLED displays at the time, because barrier ribs are structural elements that keep plasma displays from collapsing, and most OLEDs used a circular polarizer for contrast enhancement, and did not need a black mask to contour the individual OLED pixels.

-00987 Ex. 2009 (Kymissis Declaration) at ¶205

-00988 Ex. 2009 (Kymissis Declaration) at ¶205

Phan's Disclosure Reinforces that It Does Not Teach OLED Displays

- Unrebutted that Phan describes components of its displays, such as “optical fiber network[s]” and “receivers,” not used in OLED displays

embodiments are not OLED displays. Instead of an OLED display, Phan describes a distinct type of display that is connected to a “control circuitry” through “preferably . . . an optical fiber network” that addresses individual pixels’ “receivers” that convert “digital information transmitted through [the] network . . . into luminous intensity levels” for the pixels. Phan, 5:9-24. Phan’s use of “optical fiber network[s]” and “receivers” to control the display indicates that Phan does not concern OLED displays. OLED displays do not use optical fiber networks or receivers.

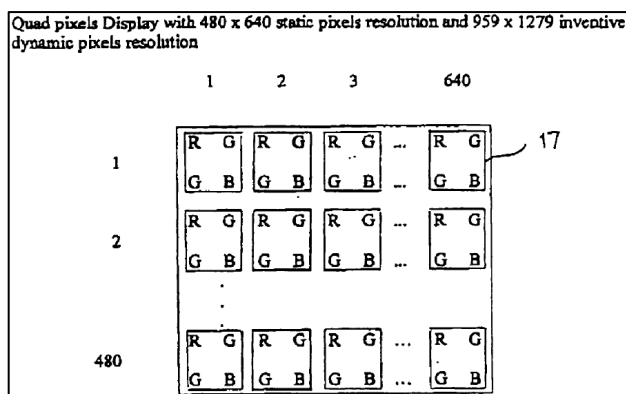
-00987 Ex. 2009 (Kymissis Declaration) at ¶203

-00988 Ex. 2009 (Kymissis Declaration) at ¶203

Phan's Invention Not Practicable with an OLED Display

- Phan's invention of "dynamic pixels" is impractical to implement with an OLED display

212. But Phan's algorithm requires scanning through the rows of a full display at such high frequency and high brightness (requiring such high voltage and current density for an OLED), that it would be impractical to implement with a passive-matrix OLED display. As explained in the background of the technology



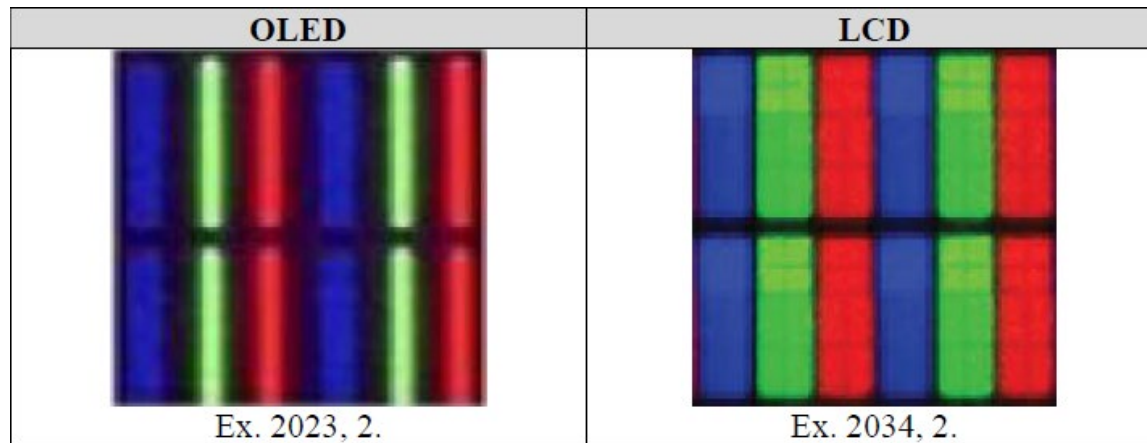
213. To take an example, Phan contemplates a display having a resolution of 480 x 640 static pixels shown in Figure 12, which Dr. Pattison relies on. Each static pixel here is a quad pixel with four dots, meaning a resolution of 960 x 1280 individual dots. To run through 960 rows of dots, one row at a time, to display a single image frame, and to run the display at 100 Hz as Phan suggests would require driving each pixel at 960 times the intensity, every 1/96,000 seconds, or about once every 0.01 milliseconds. That is already impractical for a PMOLED display. Add to that the fact that to drive this display using Phan's dynamic pixel driving method (which would display four virtual pixels for each static pixel, see Phan, Figs. 12a-d, 4:5-11), the display must be run at 4 times the frequency that the display would be driven at normally. This is simply not practical for a PMOLED display. Further note

-00987 Ex. 2009 (Kymissis Declaration) at ¶212-213

-00988 Ex. 2009 (Kymissis Declaration) at ¶212-213

Technology Differences Impact Pixel Arrangement Structures

- Different display technologies employ different structures
- Petitioner's attorney argument to the contrary is unsupported



43. In LCDs, a single layer of liquid crystal material could be deposited on the entire display, with red, green, and blue color filters made of insulating material simply formed placed on top of each pixel region. But in OLEDs, the organic emissive materials that form each pixel conduct electricity, so the organic material must be sufficiently separated from each other to prevent defects. Further, when organic materials for emitting different colors are deposited too close to each other, overlap of the material can result in color mixing, compromising the color of the display. Thus, in contrast to LCDs, OLED displays have large gaps between pixels.

-00987 Ex. 2009 (Kymissis Declaration) at ¶43

-00988 Ex. 2009 (Kymissis Declaration) at ¶43

Technology Differences Impact Pixel Arrangement Structures

1 Q And the pixel layout that you would use
2 for an inorganic LED display would not be the same
3 one that you would design for an organic LED
4 display, correct, because of those differences?
5 MR. HERMAN: Objection to form.
6 A Yeah, they would be different; but they
7 would be developed in the same way, by considering
8 the efficiency and the growth parameters that --
9 fabrication of the technology. So the same

13 The fabrication process, that would be
14 another factor that you would need to consider in
15 designing a pixel layout for a display. Correct?
16 A Yeah, the -- I mean, the fabrication
17 process and the limitations of the fabrication
18 process are of course a consideration when
19 making -- when making any kind of device.

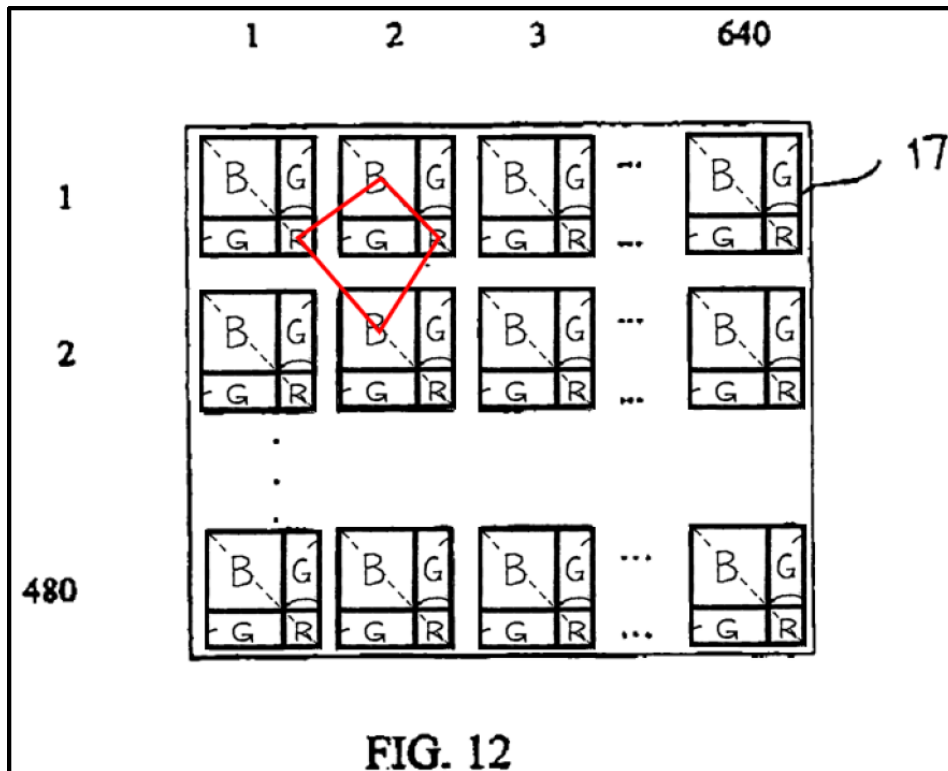
-00987 Ex. 2062 (Pattison Deposition) at 45:1-19

-00988 Ex. 2062 (Pattison Deposition) at 45:1-19

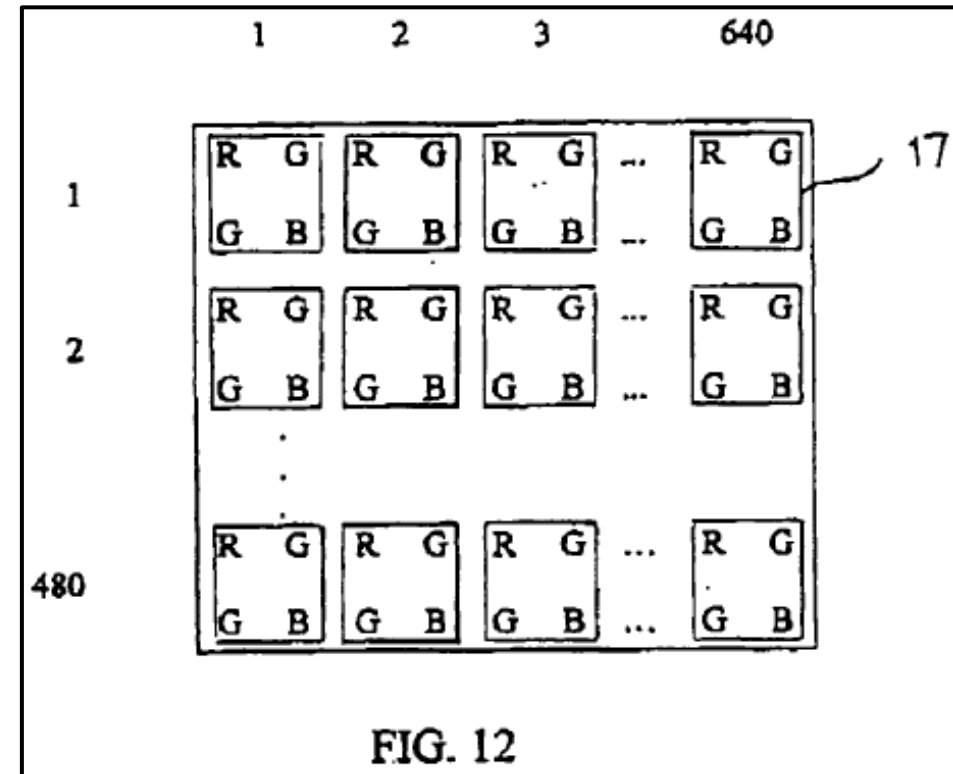
Phan Has No “Virtual Square”

Phan Does Not Teach or Suggest a Virtual Square

- Petitioner's proposal of combining the structure of Fig. 11b with the display of Fig. 12 results in no virtual square



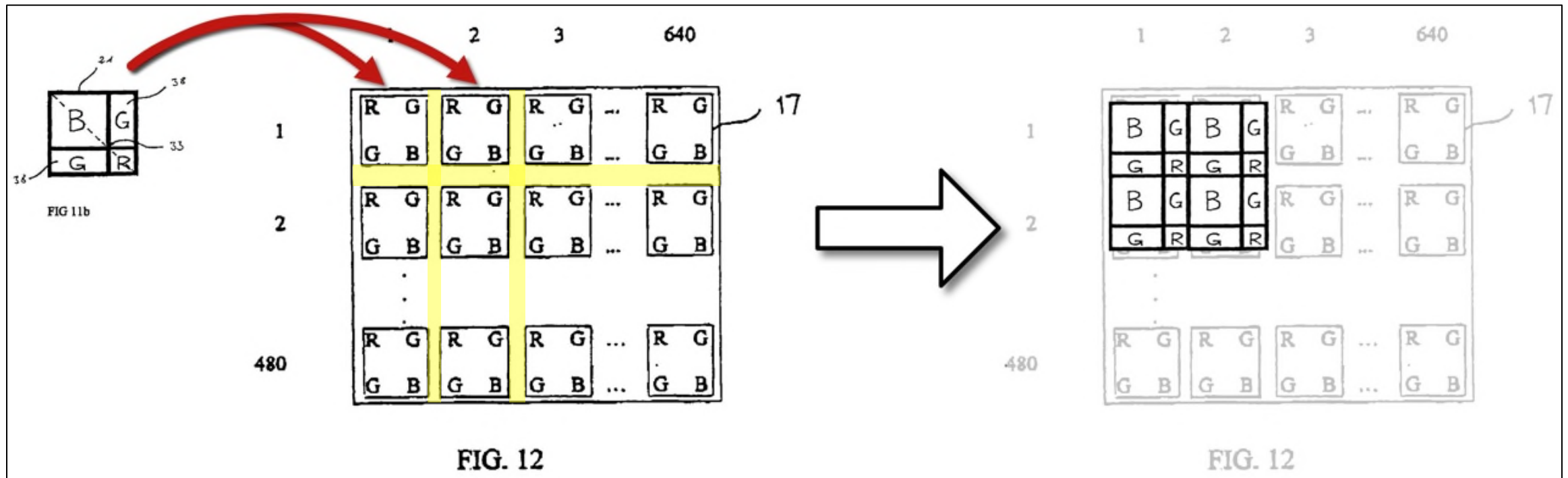
-00987 Ex. 2009 (Kymissis Declaration) at ¶219



Phan at Fig. 12

Phan Does Not Teach or Suggest a Virtual Square

- Petitioner improperly removes spacings between quad-pixel units in Phan's Fig. 12



-00987 Pet. at 49

Phan Does Not Teach or Suggest a Virtual Square

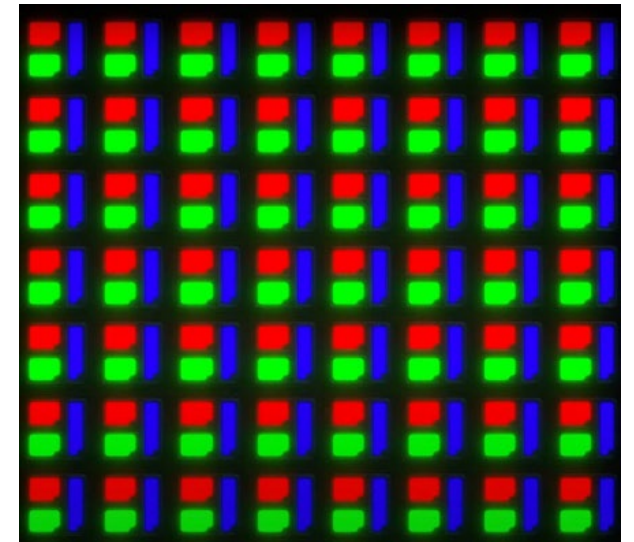
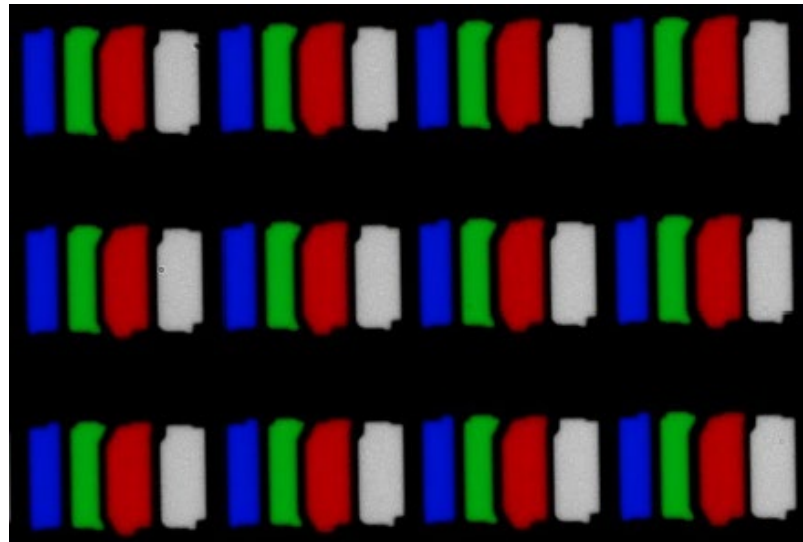
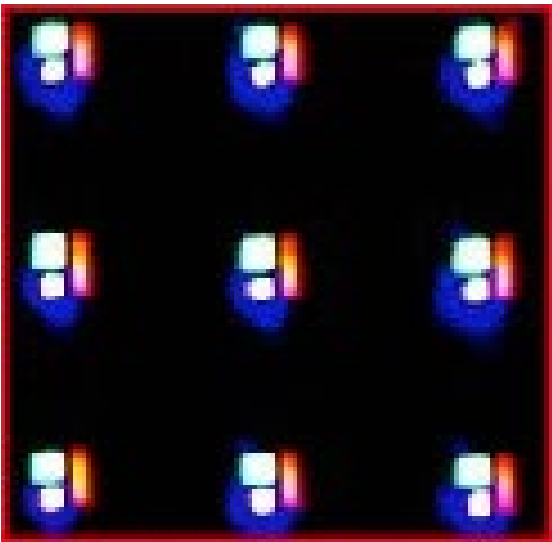
- Petitioner ignores reasons in Phan for having spacing between quad-pixels

223. First, a POSITA would have understood that there were reasons for separating the quad pixels in the display of Figure 12. Phan teaches, for example, that the display requires “[c]ontrol circuitry” that “combines adjacent dots 11 to form a dynamic pixel 18 in order to then address these as a logical unit.” Phan, 5:20-22. A POSITA would understand that space would be required to place and route such circuitry. Indeed, even Dr. Pattison acknowledges that “a POSITA would have understood that there already is space (even if not depicted) between the pixels to allow for the intermediate signal lines.” Ex. 1003, ¶ 428. Phan’s spacings could also be for placement of wiring for Phan’s “optical fiber network.” Phan, 5:20-24, Fig. 5.

-00987 Ex. 2009 (Kymissis Declaration) at ¶223

Phan Does Not Teach or Suggest a Virtual Square

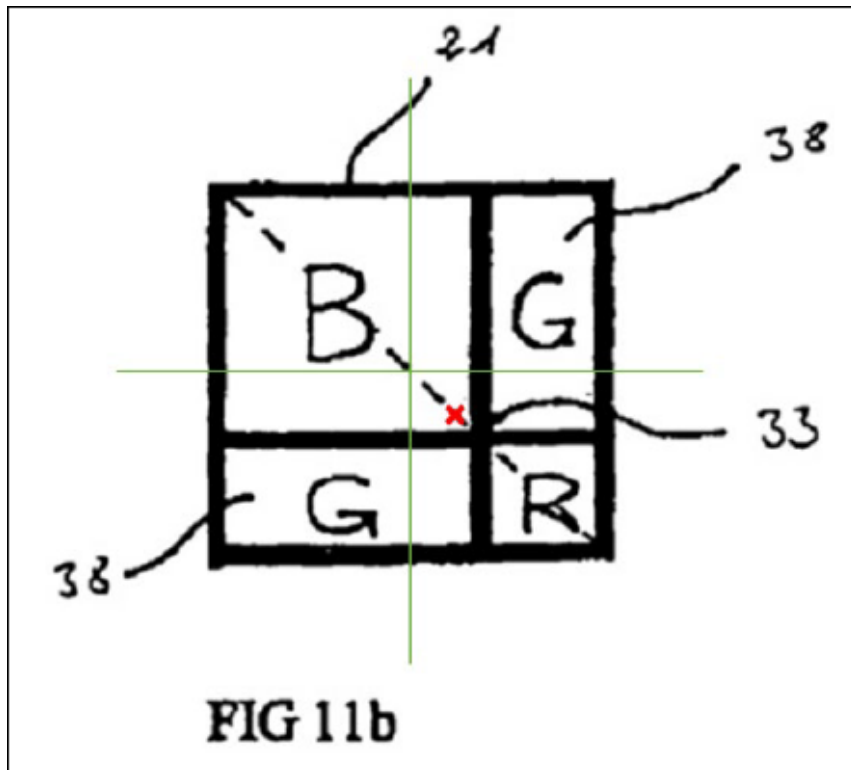
- Spacing between unit pixels was common in display devices



-00987 Ex. 2009 (Kymissis Declaration) at ¶224

Petitioner's Theory Is Inconsistent with Phan

- Petitioner's changes are incompatible with Phan's dynamic pixel approach



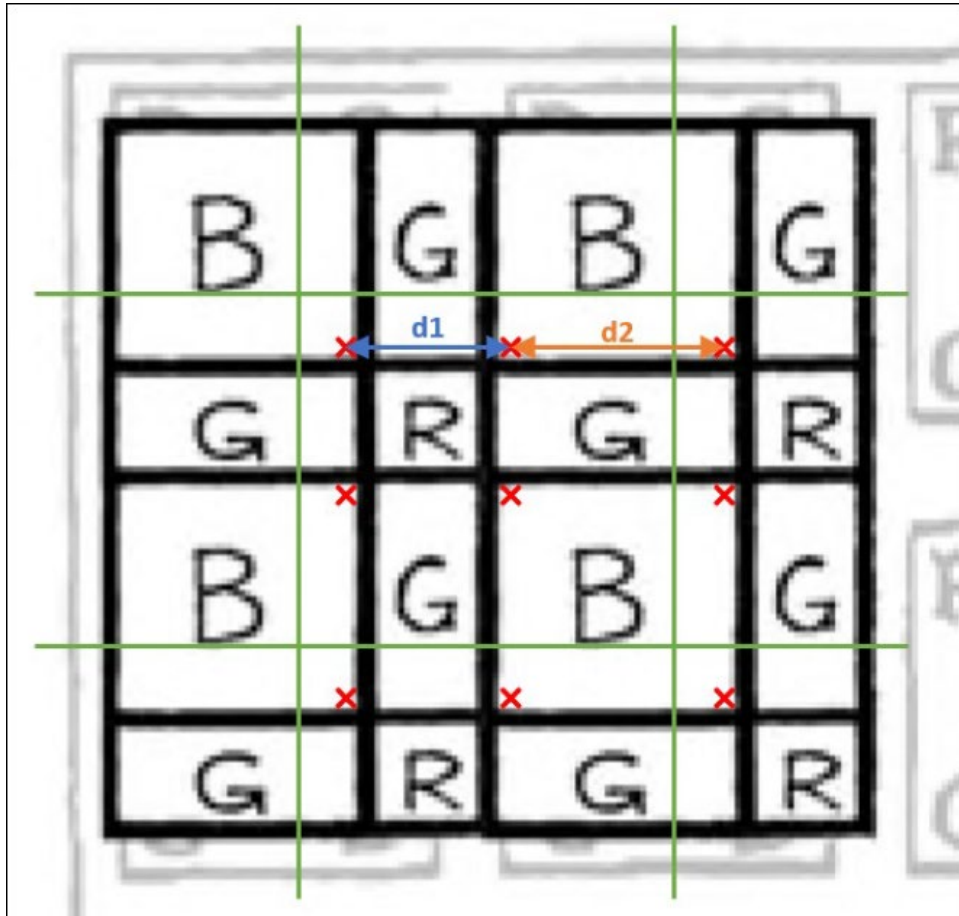
227. If a display's static quad pixels have differently sized red, blue, and green dots, such as in the structure shown in Figure 11b, then the visual locus of the dynamic quad pixels will be perceived by the viewer to be shifted away from the center of the static quad-pixels. For example, below is an annotated version of Figure 11b of Phan, where the red cross represents the visual locus of the quad pixel:

228. The "visual locus" of a unit pixel consisting of the different color dots that constitute the unit pixel refers to the location where the user perceives the color-mixed pixel to lie. This is a function of color, area, and relative location. The human visual system is more sensitive to green light than red or blue light, and so the green dots have an outsized effect on the perceived visual locus of a unit pixel.

-00987 Ex. 2009 (Kymissis Declaration) at ¶¶227-228

Petitioner's Theory Is Inconsistent with Phan

- Petitioner's changes are incompatible with Phan's dynamic pixel approach



If this quad pixel structure is combined with Figure 12 of Phan without any spacing between adjacent quad pixels and Phan's dynamic pixel driving method is used, the result would be that the visual locus of the overlapping dynamic quad-pixels will not lie on a regular grid. Instead, as shown below in a further annotated version of Dr. Pattison's proposed combination of Figures 11b and 12 of Phan (Ex. 1003, ¶ 350), the visual locus of the dynamic quad pixel in the middle of the top row will be offset by a distance d1 from the visual locus of the dynamic quad pixel at top left, but offset by a distance d2 from the visual locus of the dynamic quad pixel at top right. (Note that the same offsets would occur among adjacent dynamic quad pixels in the column direction as well.) The result is that the user would perceive a distortion in the dynamic pixel display.

-00987 Ex. 2009 (Kymissis Declaration) at ¶227

Phan Does Not Teach a Virtual Square

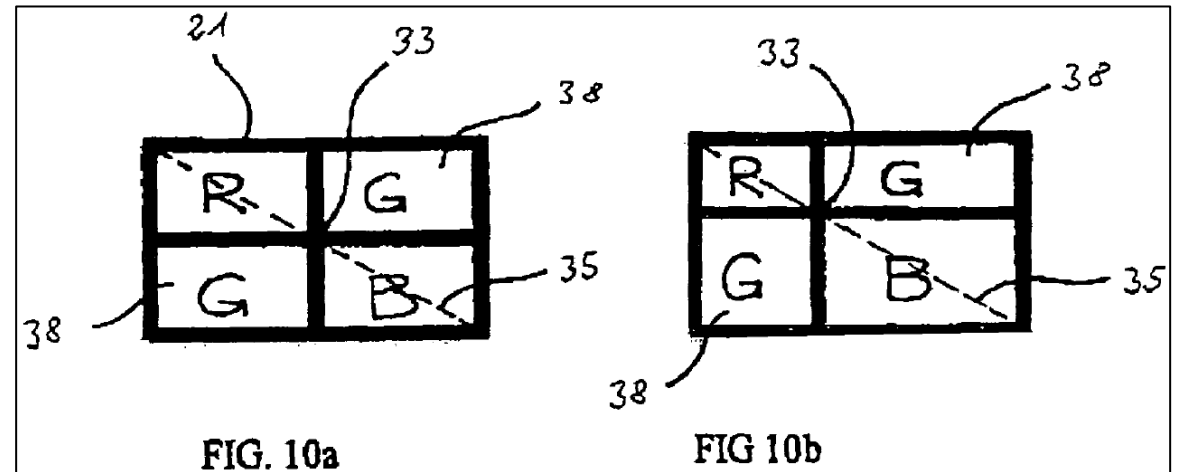
- The Petition incorrectly assumed Phan requires equal distances between centers of dots in horizontal and vertical directions
- Petitioner's expert admits that is not the case

wherein the light emitting area and space of each quad pixel group as well as of its individual elements are preferable in the form of rectangle or square, and

Phan at 7:63-65

4	Q	In Figures 10A and 10B the horizontal
5		distance between centers of dots is different than
6		the vertical distance between the centers of dots.
7		Correct?
8	MR. HERMAN:	Objection. Form.
9	A	So the horizontal -- yes.

-00987 Ex. 2086 (Pattison Reply Deposition) at 61:4-9



Phan at Figs. 10a, 10b

Phan Does Not Teach a Virtual Square

- Petitioner's reply conjures hypothetical problems that its expert does not support

dynamic pixels—as Patent Owner does—presents numerous issues. Perceived brightness would vary from pixel-to-pixel, and the added space would reduce blending and increase the risk that sub-pixels would be separately visible. (*Id.*, ¶¶ 73-79.) This would all be contrary to Phan's teaching that its dynamic pixels are

-00987 Reply at 15

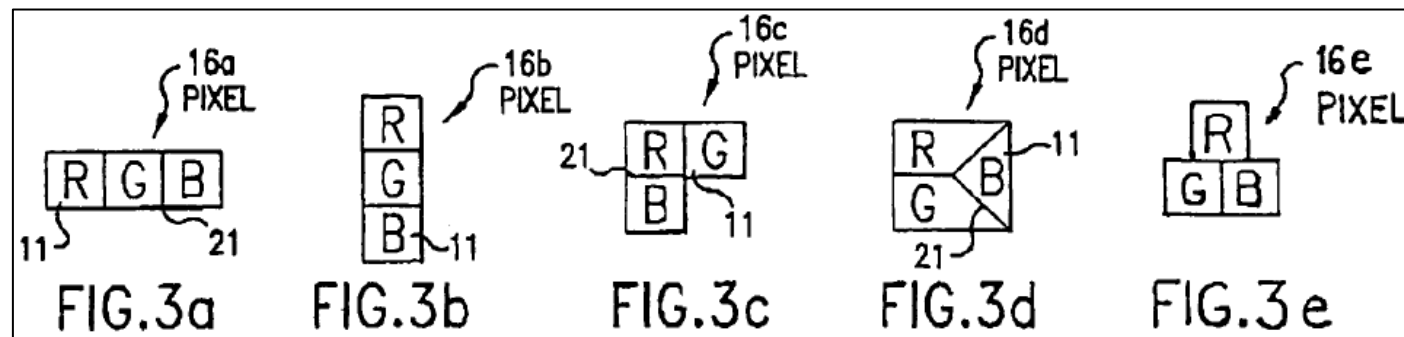
15 Q Phan's RGB dynamic pixels that is using
16 the structures like those in 3A through 3E don't
17 have reduced visual blending of the dots.

18 Correct?

19 MR. HERMAN: Objection. Form.

20 A I'm not sure what you mean by "reduced
21 visual blending."

-00987 Ex. 2086 (Pattison Reply Deposition) at 68:15-21



Phan at Figs. 3a-3e

Phan Does Not Teach a Virtual Square

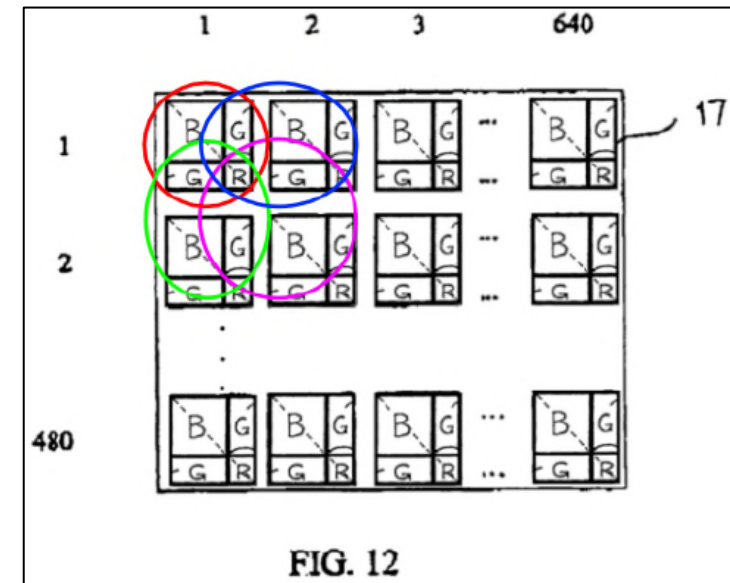
- Petitioner's drawing of virtual pixels inappropriately circles more than four dots

18 Q For a four-dot pixel, you wouldn't want
19 to draw a circle that covered more than four dots
20 to show the dynamic or virtual pixels, according
21 to Phan. Correct?
22 A Yeah, for Phan's objective of this whole
1 virtual pixel concept, you would -- I think you
2 would maintain -- you would maintain -- or he
3 shows maintaining the underlying pixel kind of
4 quantity, let's say.

-00987 Ex. 2086 (Pattison Reply Deposition) at 71:18-72:4

-00988 Ex. 2086 (Pattison Reply Deposition) at 71:18-72:4

Petitioner's annotation of dynamic pixels in reply

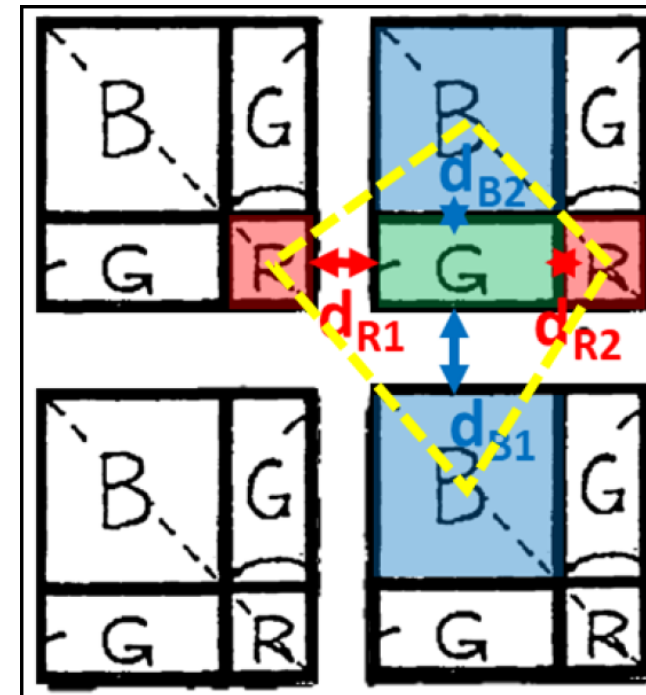
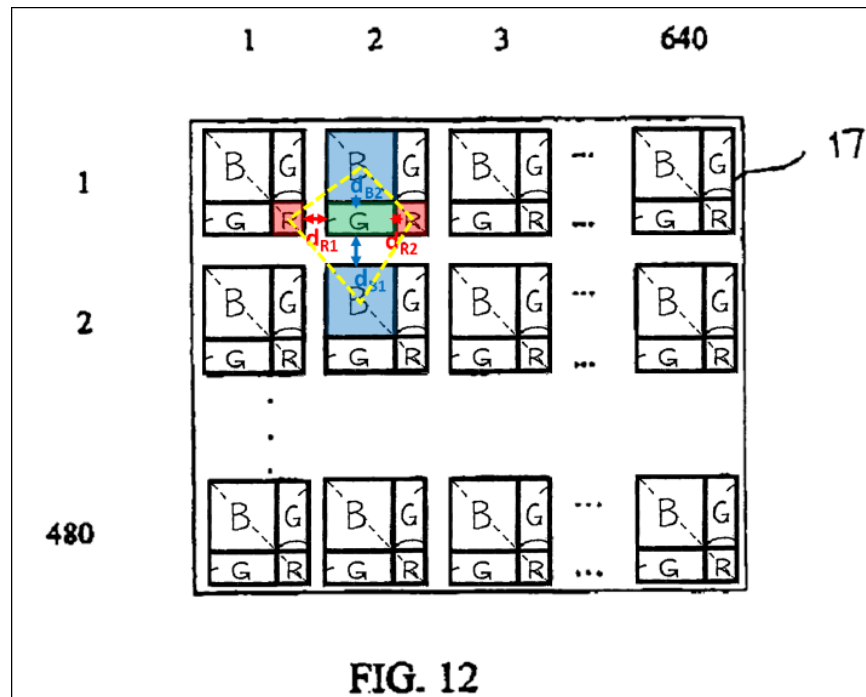


-00987 Reply at 15

-00988 Reply at 15

Phan Does Not Teach “Substantially Equidistant” Pixels

- For the same reasons as “virtual square,” Phan does not meet the “substantially equidistant” limitations of claim 7 of the '683 patent



Phan in view of Yamada

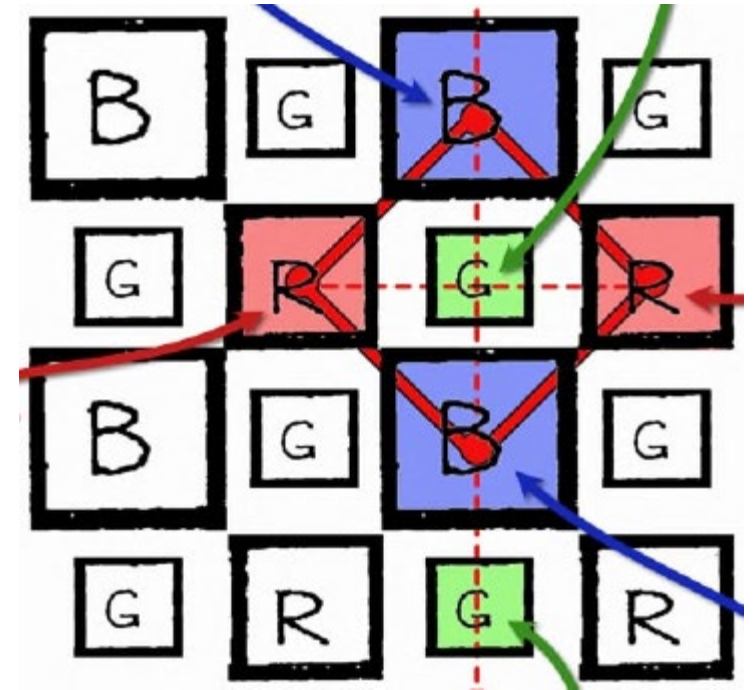
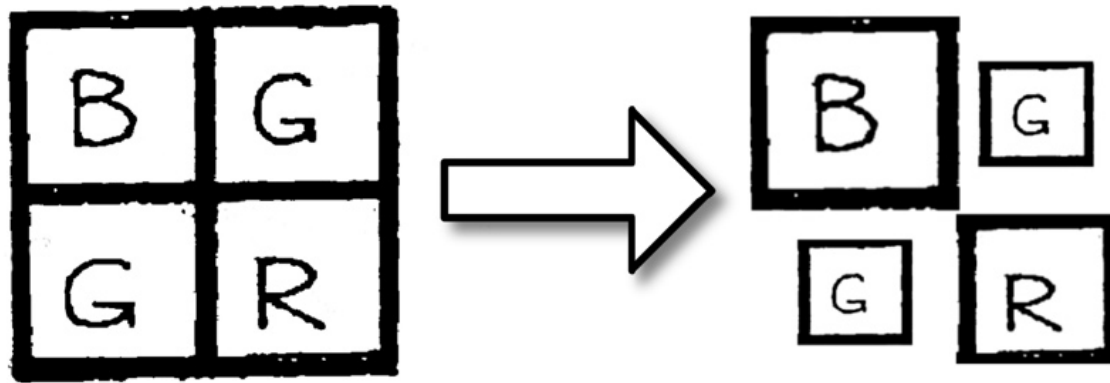
IPR2023-00987 Ground 3 ('803 Patent claim 5)

IPR2023-00988 Ground 3 ('683 Patent claim 2)

Incompatible Display Architectures

The Petitions' Theory

- Petitioner proposes resizing Phan's quad-pixel structure in Fig. 11a, then using it in Phan's display shown in Fig. 12



-00987 Pet. at 61-62
-00988 Pet. at 57-58

Petitioner's Resizing Is Incompatible with Phan's Passive-Matrix Display

- Phan teaches a passive-matrix display
- Phan discourages using active-matrix displays

referred to as TFT) element.”). As also discussed above, Phan is explicitly directed to a passive-matrix display for implementing its dynamic pixel driving method. Phan, 5:23-24 (“Addressing involves high-frequency repetition, preferably at a rate of minimum 100 Hz for passive driving display”).

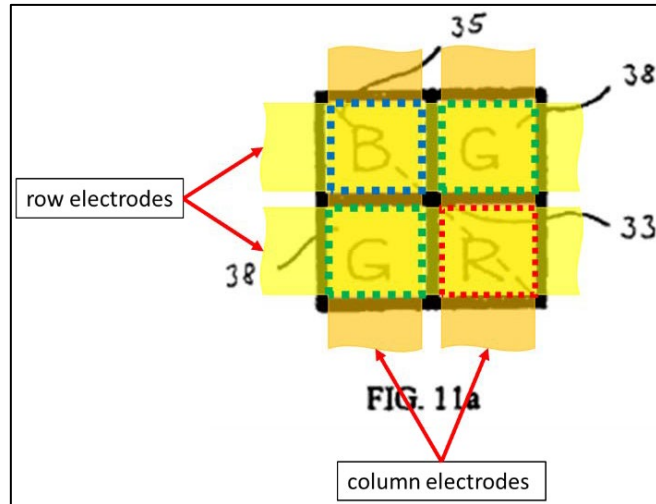
236. What’s more, Phan describes its approach as an alternative to active-matrix displays, and discourages using active-matrix displays. Phan criticizes active-matrix LCDs because they require TFTs for individually controlling pixels and TFTs are expensive and prone to manufacturing failure. Phan, 2:14-43. A POSITA would have understood that active-matrix OLEDs would require more TFTs more complex pixel circuits than active-matrix LCDs: active-matrix LCDs only require one TFT per pixel because they are voltage controlled, while OLED displays are current-driven and require at least two TFTs per pixel for an active-matrix implementation. So a POSITA would not have read Phan as contemplating an active matrix display, and especially not an active-matrix OLED display.

-00987 Ex. 2009 (Kymissis Declaration) at ¶¶235-236

-00988 Ex. 2009 (Kymissis Declaration) at ¶¶235-236

Display Addressing Scheme Impacts Pixel Arrangements

Passive-matrix:

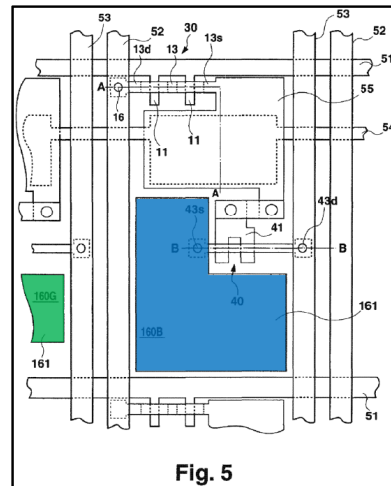


49. In a passive-matrix display, pixels are formed where column electrodes and row electrodes overlap. Ex. 2074 (Gu) at 6. Thus, the intersection of column electrodes and row electrodes defines the OLED pixel size. An individual pixel is

-00987 Ex. 2009 (Kymissis Declaration) at ¶49

-00988 Ex. 2009 (Kymissis Declaration) at ¶49

Active-matrix:



55. The additional pixel driving circuitry associated with each pixel in an active-matrix OLED, in conjunction with the power and signal lines necessary to control this circuitry, also impose different constraints on the size and locations of pixels. Ex. 2073 (Ghosh) at 12-15. For example, in Yamada's bottom-emission type

-00987 Ex. 2009 (Kymissis Declaration) at ¶55

-00988 Ex. 2009 (Kymissis Declaration) at ¶55

Petitioner's Resizing Is Incompatible with Phan's Passive-Matrix Display

- Phan is particularly unsuitable for modification based on Yamada's teachings directed to active-matrix displays

237. As I explained above, a POSITA would have understood that the design considerations for a pixel arrangement of a passive-matrix OLED are significantly different from the design considerations for a pixel arrangement of an active-matrix OLED. The rate and modes of degradation of OLED pixels are materially different between PMOLEDs and AMOLEDs, and this would particularly be the case with Phan's requirement for "high-frequency repetition" to implement its dynamic pixel driving display. Phan, 5:23-24.

-00987 Ex. 2009 (Kymissis Declaration) at ¶237
-00988 Ex. 2009 (Kymissis Declaration) at ¶237

238. As I also explained above, since Figure 12 of Phan discloses a display having 480 rows of quad pixels (and thus 960 rows of dots), a POSITA would have understood this would require that significantly higher driving voltages (and thus significantly higher current densities) be applied to each row due to the shorter "on" times for each row, compared to an AMOLED display like in Yamada. Thus, the pixel aging rate and profile for Phan's display would be significantly different from that for Yamada's display. A POSITA would thus have had no reason to look to Yamada and its teachings about pixel aging in AMOLED displays to modify a pixel arrangement in Phan, and would not have any reasonable expectation of doing so successfully.

-00987 Ex. 2009 (Kymissis Declaration) at ¶238
-00988 Ex. 2009 (Kymissis Declaration) at ¶238

Petitioner's Resizing Is Incompatible with Phan's Passive-Matrix Display

- Petitioner relies on inapposite comparisons to other prior art references, which also do not support Petitioner

15	A. Ah, okay. So the statement in column 2 says that
16	generally the present invention is useful for passive
17	or active matrix devices. I'm sorry, it just doesn't
18	speak specifically about Figure 1.

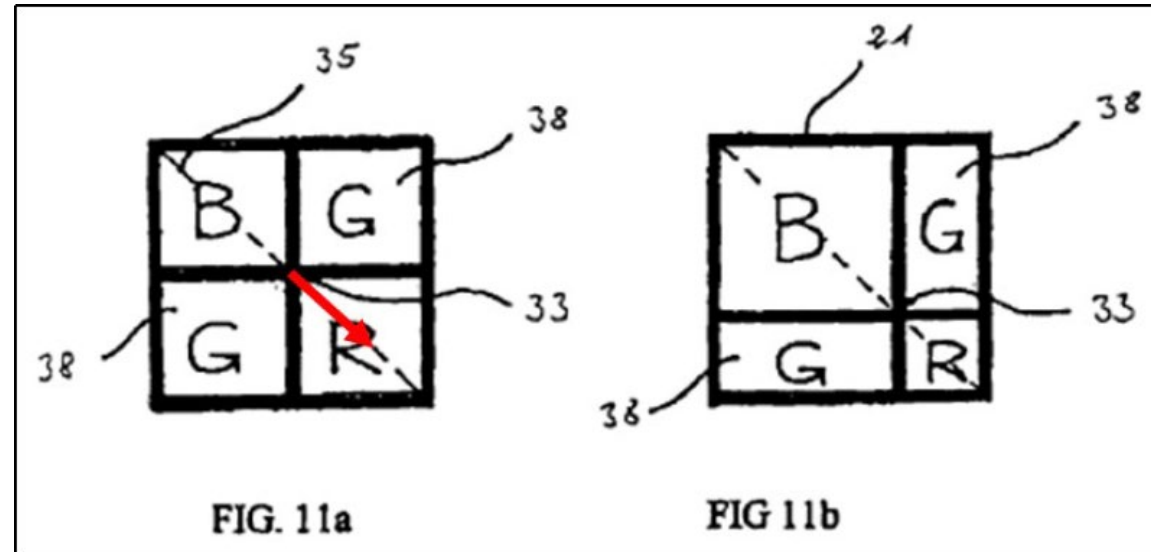
13	Q. Now, besides being rotated 180 degrees, Figure 1 and
14	Figure 11b have the same basic shape, don't they?
15	MR. KUDZIN: Objection.
16	A. So they have some similarities, but they also have
17	some differences. For example, Phan explicitly calls
18	out a number of features such as the barrier ribs and
19	black mask, which are not discussed in Cok.

-00987 Ex. 1018 (Kymissis Deposition) at 70:15-18, 72:13-19

-00988 Ex. 1019 (Kymissis Deposition) at 70:15-18, 72:13-19

Petitioner's Resizing Is Incompatible with Phan's Resizing Along a Cross-point

- Phan teaches how dots within quad pixel structures should be resized

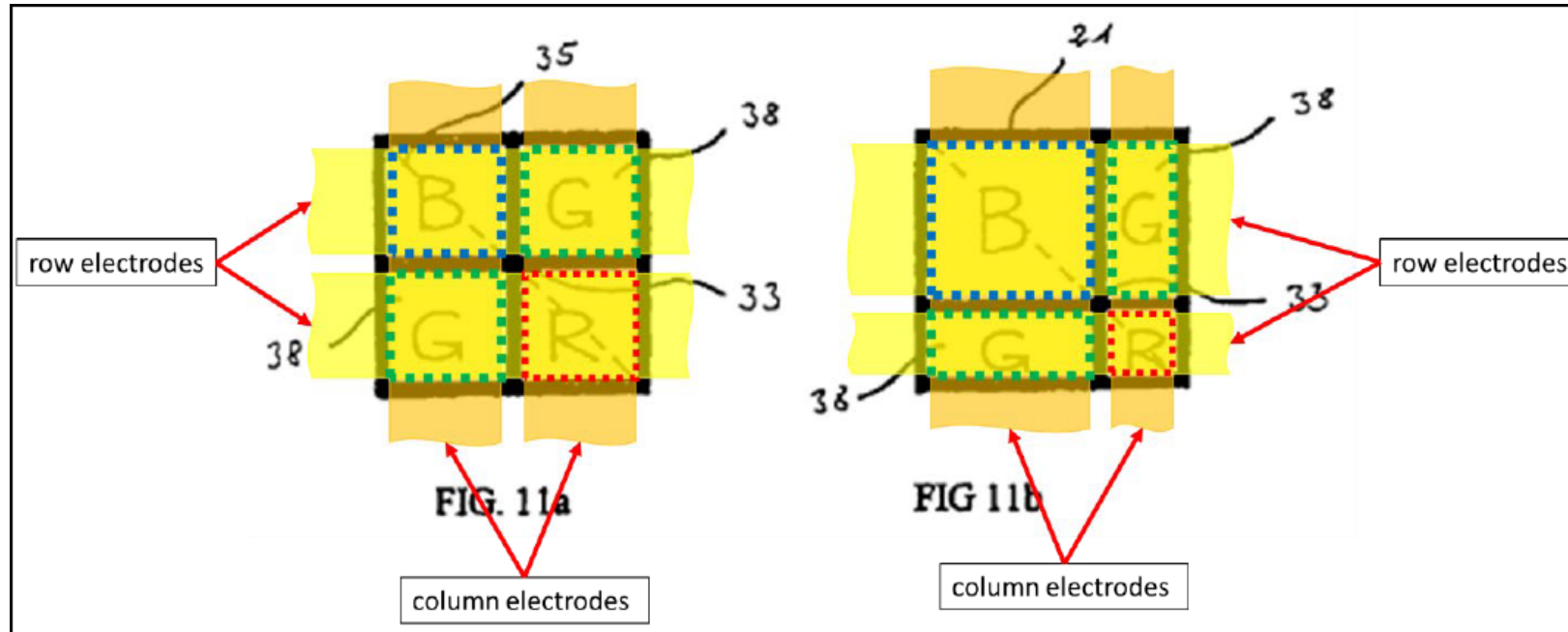


-00987 Ex. 2009 (Kymissis Declaration) at ¶247

-00988 Ex. 2009 (Kymissis Declaration) at ¶247

Petitioner's Resizing Is Incompatible with Phan's Resizing Along a Cross-point

- Phan's dot resizing methodology is a natural result of Phan's passive-matrix architecture



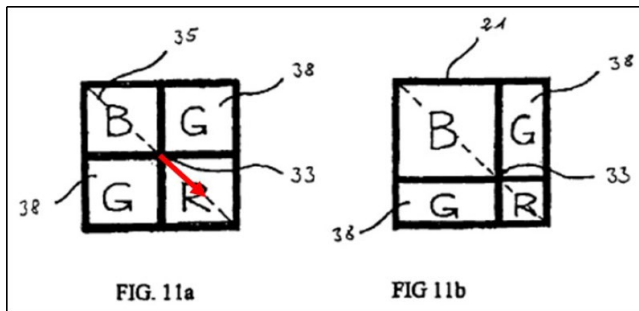
-00987 Ex. 2009 (Kymissis Declaration) at ¶242

-00988 Ex. 2009 (Kymissis Declaration) at ¶242

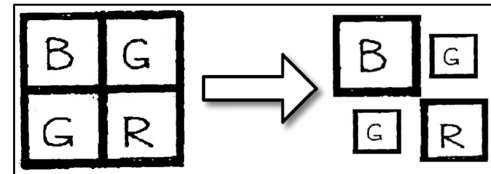
Petitioner's Resizing Is Incompatible with Phan's Resizing Along a Cross-point

- Petitioner's resizing of dots is incompatible with Phan's teaching and passive-matrix structure

Phan's teaching



Petitioner's modification



been ignored. Moving a crosspoint along the diagonal has a direct relationship to Phan's passive-matrix structure. As I explained above, in a passive matrix display, each row of pixels shares the same row electrode and each column of pixels shares the same column electrode. Phan, by constraining resizing of pixels by moving the crosspoint along a diagonal, ensures that the pixels that share a row electrode have the same height and the pixels that share a column electrode have the same width. This is illustrated below. A POSITA would understand that this makes good sense because it is a natural way to resize pixels consistent with the passive matrix architecture. Dr. Pattison's proposed re-sizing of Phan's quad pixel structure, on the other hand, is incompatible with Phan's passive matrix structure.

-00987 Ex. 2009 (Kymissis Declaration) at ¶242

-00988 Ex. 2009 (Kymissis Declaration) at ¶242

-00987 Ex. 2009 (Kymissis Declaration) at ¶247

-00987 Pet. at 61-62

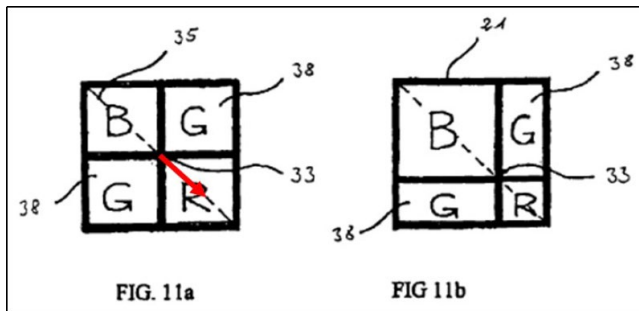
-00988 Ex. 2009 (Kymissis Declaration) at ¶247

-00988 Pet. at 57-58

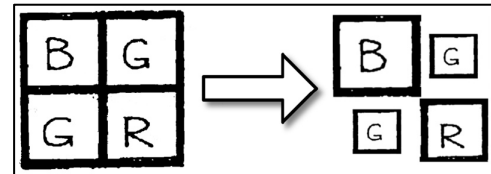
Petitioner's Resizing Is Incompatible with Phan's Resizing Along a Cross-point

- Petitioner draws arbitrary spacing between dots inconsistent with Phan, and creates a worse display

Phan's teaching



Petitioner's modification



teachings regarding the sizing of dots in its quad pixel structure. By resizing dots by moving the crosspoint along a diagonal line of the quad pixel structure, Phan is able to resize its dots without adding any additional dead space that does not have useful light output—and thus keeps the total aperture ratio constant. Phan, 5:43-46, 5:51-54. On the other hand, Dr. Pattison's proposed combination breaks apart Phan's quad pixel structure and introduces arbitrary spacing between subpixels for no good reason, and with no support for doing so in Phan. Ex. 1003, ¶ 426.

252. Not only is the additional spacing added by Dr. Pattison unwarranted, it would undesirably reduce the aperture ratio of the display. It would require higher current density to be supplied to the green and red dot to maintain the same brightness they had before, causing those dots to degrade more quickly and reducing the life of the display. This would be contrary to Yamada's teachings.

-00987 Ex. 2009 (Kymissis Declaration) at ¶247
-00988 Ex. 2009 (Kymissis Declaration) at ¶247

-00987 Pet. at 61-62
-00988 Pet. at 57-58

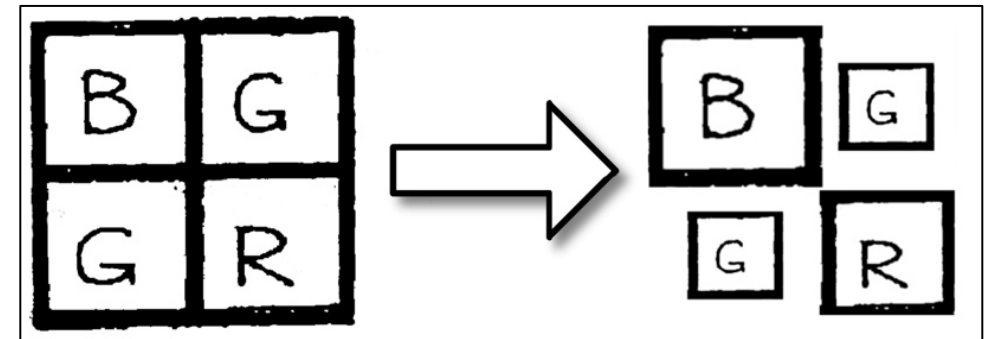
-00987 Ex. 2009 (Kymissis Declaration) at ¶249, 252
-00988 Ex. 2009 (Kymissis Declaration) at ¶249, 252

Petitioner's Proposed Modification Reduces Lifetime

- Petitioner's proposed modification keeps blue pixels the same size and shrinks the red and green pixels

Each pixel includes two green, one blue, and one red dot. (*See id.*) Following Yamada's teachings, while maintaining the square pixel shape and matrix geometry Phan already employs, results in the following. The figure on the left is derived from Figure 11a of Phan. The modified figure on the right employs the same overall square pixel size and shape as Figure 11a. But, while the blue dot maintains its original size (making it relatively larger), the green dots have been made smallest and the red dot an intermediate size as Yamada instructs:

-00987 Pet. at 61
-00988 Pet. at 57



-00987 Pet. at 61
-00988 Pet. at 57

Petitioner's Proposed Modification Reduces Lifetime

- Dr. Kymissis explained Petitioner's proposed modification would reduce lifetime

245. Dr. Pattison's proposed combination would actually have *reduced* the lifetime of an OLED display, and also had other negative effects. As I explained above in Section X.B regarding Dr. Pattison's proposed combination of Matthies and Yamada, a POSITA would have understood that Dr. Pattison's proposed re-sizing of the pixels to keep the blue pixels the same size and reduce the sizes of the red and green pixels would not extend the overall life of the display. Dr. Pattison's

-00987 Ex. 2009 (Kymissis Declaration) at ¶245

-00988 Ex. 2009 (Kymissis Declaration) at ¶245

- Dr. Pattison has no rebuttal

Petitioner's Proposed Modification Reduces Lifetime

- Unrebutted, detailed technical testimony from Dr. Kymissis

red and green pixels would not extend the overall life of the display. Dr. Pattison's proposed combination would not increase the blue light-emitting area, and would not lower the current density. Additionally, by reducing the red and green light-emitting areas, Dr. Pattison's combination would require a *higher* current density to be applied to the red and green pixels to drive them at the same amount of brightness as before, thus accelerating aging of the red and green pixels and reducing display lifetime. In Phan's passive-matrix displays, the aging and lifetime effects of higher driving voltages and current densities would be further exacerbated. And as also

-00987 Ex. 2009 (Kymissis Declaration) at ¶245

-00988 Ex. 2009 (Kymissis Declaration) at ¶245

A POSITA Would Not Have Combined the References in the Way the Petitions Assert

Yamada Is Directed to Triplet Pixel Structures

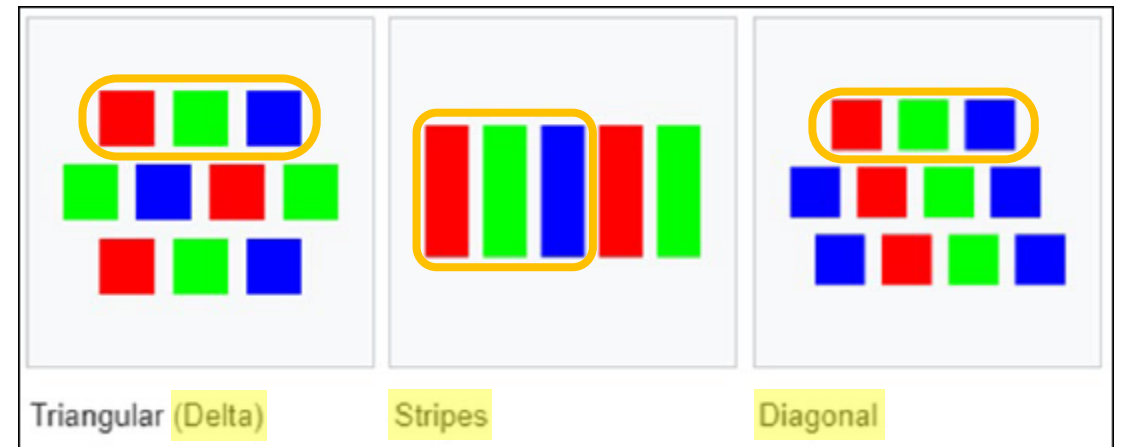
149. Yamada only contemplates R/G/B triplet structures, as evidenced by its reference to only “stripe,” “delta,” and “diagonal” layouts. Yamada, 12:37-43. These

-00987 Ex. 2009 (Kymissis Declaration) at ¶149, 257

-00988 Ex. 2009 (Kymissis Declaration) at ¶149, 257

Furthermore, although the arrangement of the display pixels of various colors in the embodiment was shown in a stripe layout, the same effect is also obtained in a delta layout and a diagonal layout. Still furthermore, although the

Yamada at 12:37-40

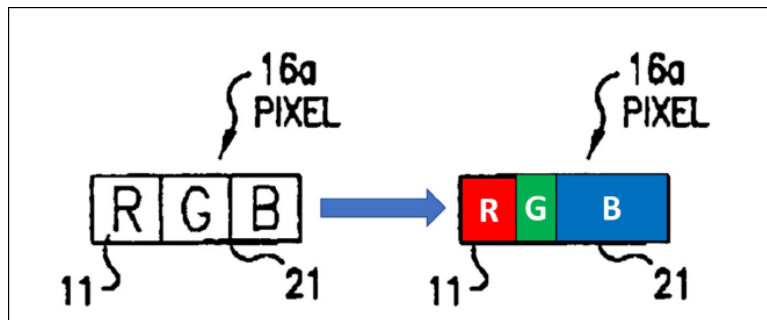


-00987 Ex. 2009 (Kymissis Declaration) at ¶149, 257

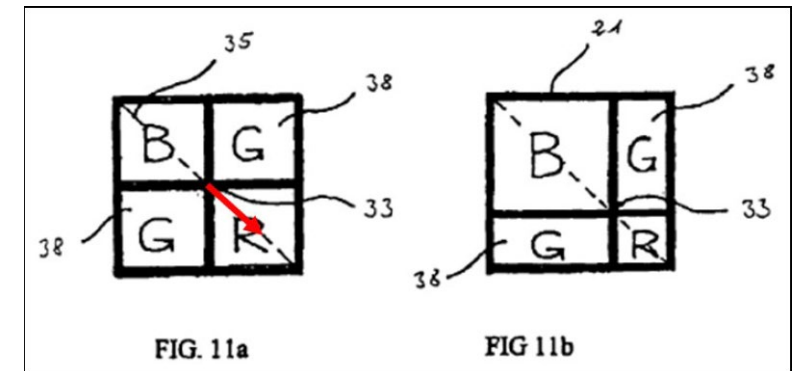
-00988 Ex. 2009 (Kymissis Declaration) at ¶149, 257

Triplet and Quad Pixel Structures Have Different Constraints

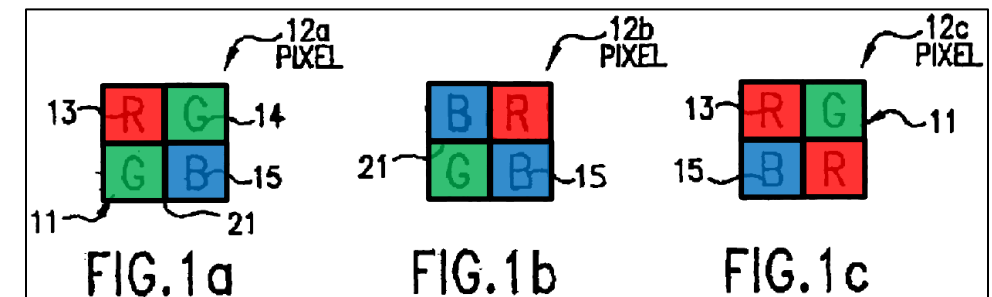
- Relative emissive area in triplet pixel structures adjusted by changing pixel size
- Relative emissive area in quad pixel structures adjusted using extra color pixel



-00987 Ex. 2009 (Kymissis Declaration) at ¶259
-00988 Ex. 2009 (Kymissis Declaration) at ¶259



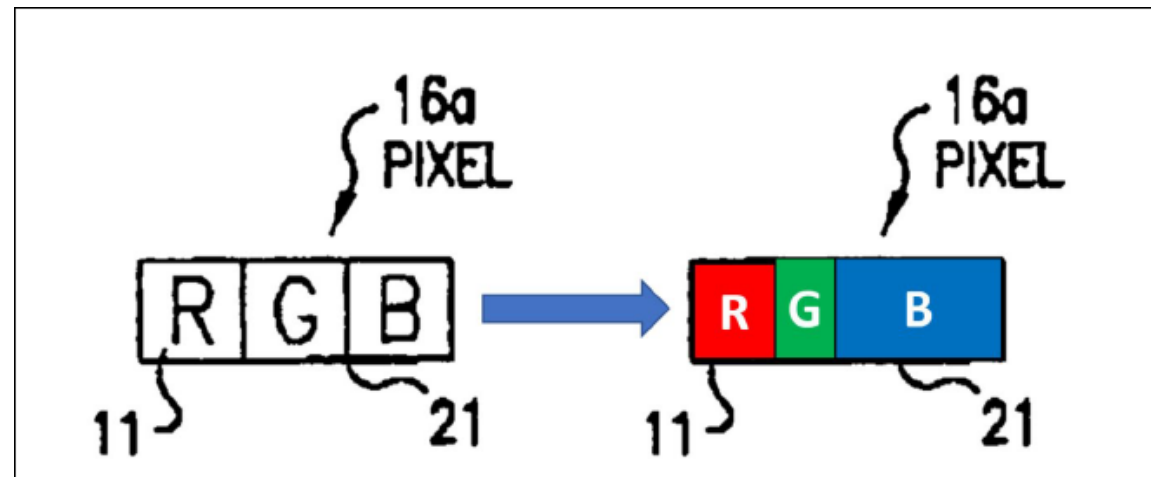
-00987 Ex. 2009 (Kymissis Declaration) at ¶247
-00988 Ex. 2009 (Kymissis Declaration) at ¶247



Phan at Figs. 1a-1c (annotated)

No Motivation to Try to Resize Phan's Quad-Pixel Structure

- Yamada is directed to triplet pixel structures
- Phan's triplet structure has fewer incompatibilities if one tried to resize subpixels than Phan's separate quad-pixel structure

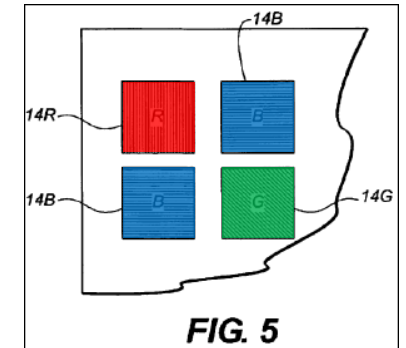


-00987 Ex. 2009 (Kymissis Declaration) at ¶259

-00988 Ex. 2009 (Kymissis Declaration) at ¶259

No Motivation to Try to Resize Phan's Quad-Pixel Structure

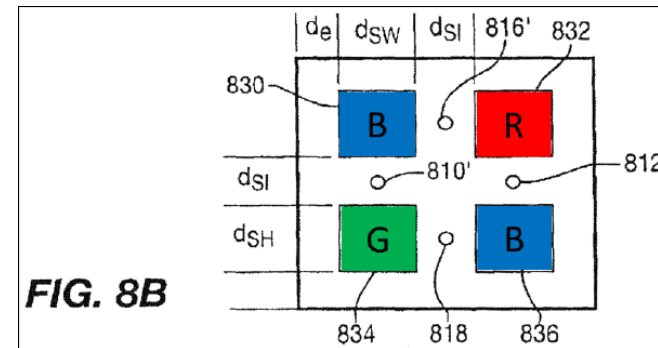
- The art teaches that if blue material has lower emission efficiency, then two blue sub-pixels are used in the quad pixel
 - Solution specific to quad-pixel structure
- And Phan itself disclosed a similar structure for its quad-pixel arrangement



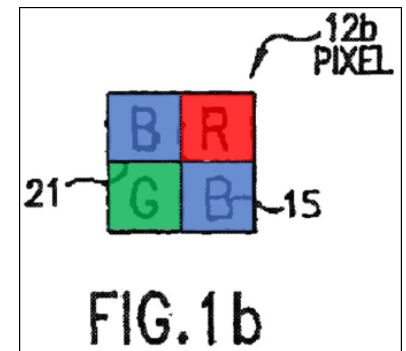
-00987 Ex. 2011 (Arnold) at Fig. 5 (annotated)
-00988 Ex. 2011 (Arnold) at Fig. 5 (annotated)

pixels. In some display technologies, the amount of light emitted by the red or blue pixel material may be less than the amount of light emitted by the green pixels. In this instance, making the pixels **830** and **836** both be red or blue pixels would improve the overall brightness of the display. The

Matthies at 17:6-10

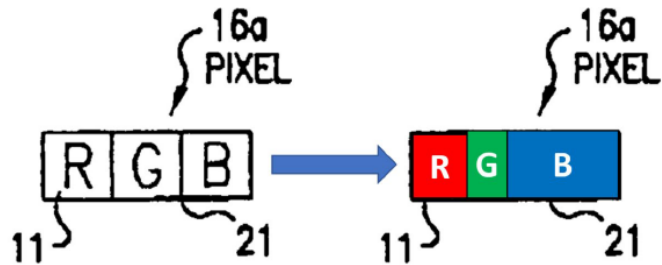


-00987 Ex. 2009 (Kymissis Declaration) at ¶160
-00988 Ex. 2009 (Kymissis Declaration) at ¶160



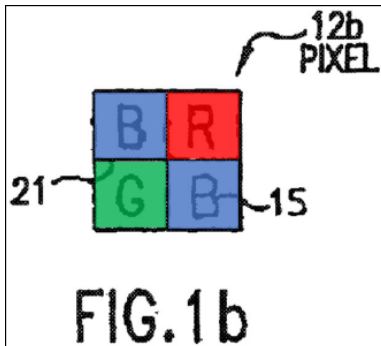
-00987 Ex. 2009 (Kymissis Declaration) at ¶263
-00988 Ex. 2009 (Kymissis Declaration) at ¶263

Even a Combination of Phan and Yamada Would Not Meet Any Claim



261. If a POSITA were to make any combination, a POSITA would have modified Phan's RGB stripe structure. Such a combination, however, even when tiled without spacing as Dr. Pattison would, would result in a structure that fails to meet any of the challenged claims of the '803 Patent. There is no "first pixel" (green) that has a center coinciding with a center of a virtual square as required by claim 1.

'803 Patent, limitations [1-a(1)], [1-a(2)], [1-a(3)], [1-a(4)], [2-a], [3-a], [4-a]

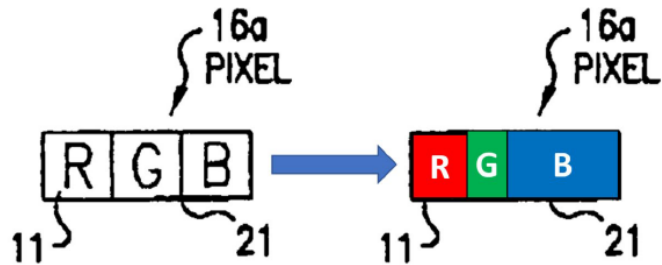


265. Dr. Pattison never alleges—nor could he—that a quad pixel structure with two blue dots would meet any of the challenged claims of the '803 Patent. This RBGB pixel structure, when tiled without spacing as Dr. Pattison would, would result in a structure that fails to meet any of the challenged claims of the '803 Patent. There is no "first pixel" (green) that has a center coinciding with a center of a virtual square as required by claim 1. Additionally, there is no "second pixel" that has a

'803 Patent, limitations [1-a(1)], [1-a(2)], [1-a(3)], [1-a(4)], [1-b], [2-a], [3-a], [4-a], [5-b]

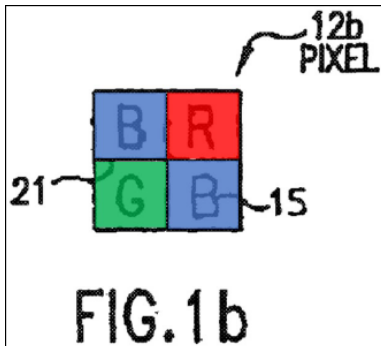
-00987 Ex. 2009 (Kymissis Declaration) at ¶261, 265

Even a Combination of Phan and Yamada Would Not Meet Any Claim



261. If a POSITA were to make any combination, a POSITA would have modified Phan's RGB stripe structure. Such a combination, however, even when tiled without spacing as Dr. Pattison would, would result in a structure that fails to meet any of the challenged claims of the '683 Patent. Specifically, this structure fails

'683 Patent, limitations [1-a(2)], [1-a(3)]



265. Dr. Pattison never alleges—nor could he—that a quad pixel structure with two blue dots would meet any of the challenged claims of the '683 Patent. This RBGB pixel structure, when tiled without spacing as Dr. Pattison would, would result in a structure that fails to meet any of the challenged claims of the '683 Patent.

'683 Patent, limitations [1-d], [1-e], [2-b]

-00988 Ex. 2009 (Kymissis Declaration) at ¶261, 265

Petitioner's Flawed Reliance on Yamada

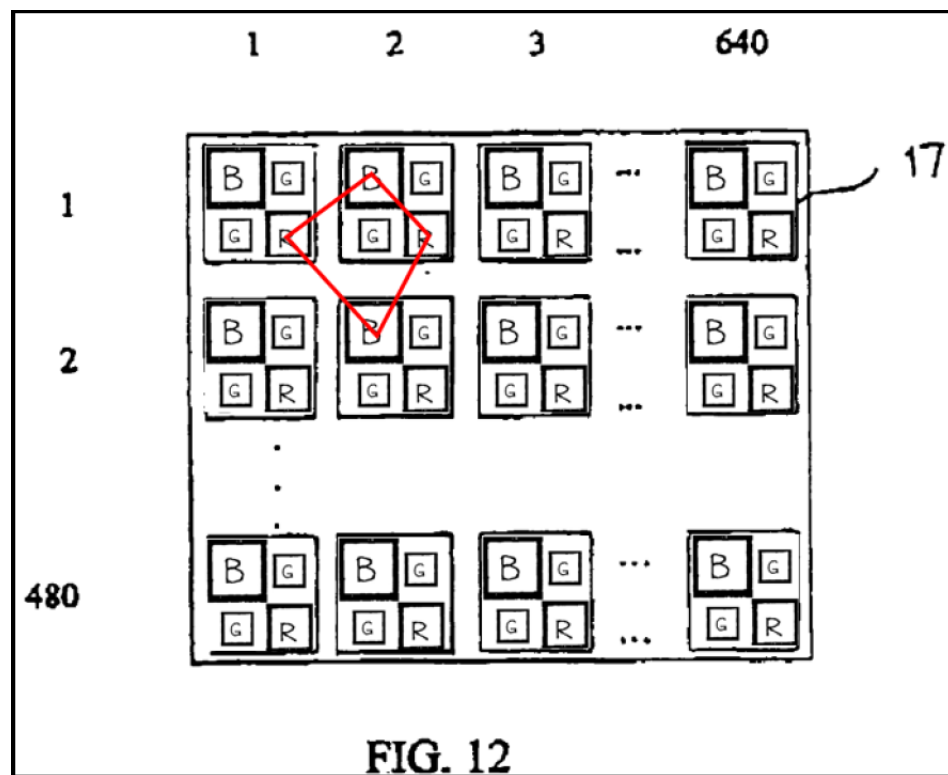
Petitioner's Flawed Reliance on Yamada

- Petitioner alleges the same reasons for resizing Matthies' pixels according to Yamada apply to resizing Phan's pixels
- These rationales fail for the same reasons they fail in Petitioner's combination of Matthies and Yamada

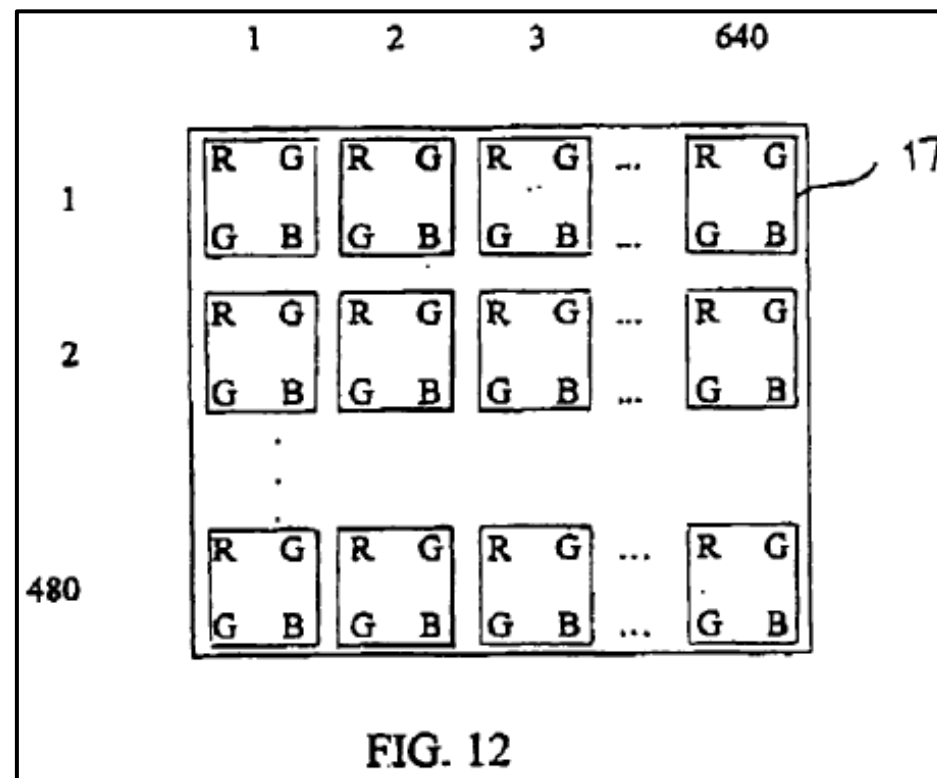
No “Virtual Square”

Phan in Combination with Yamada Does Not Teach a Virtual Square

- Combining the structure of Fig. 11a with the display of Fig. 12 results in no virtual square



-00987 Ex. 2009 (Kymissis Declaration) at ¶270



Phan at Fig. 12

Murai in view of Yamada

IPR2023-00987 Ground 4 ('803 Patent claims 1-5, 19-21)

IPR2023-00988 Ground 4 ('683 Patent claims 1-2, 4-10, 13, 15)

Murai Does Not Teach OLED Pixel Arrangements

Murai Describes LCD displays

- Murai's background section describes only LCDs

[0002]

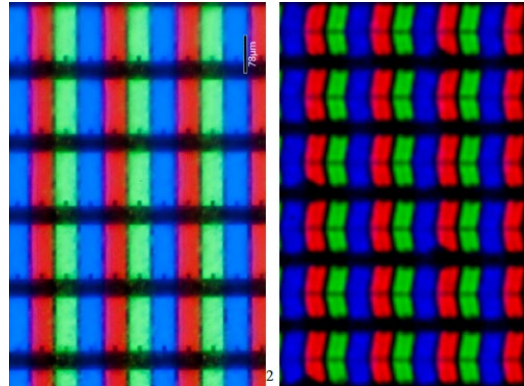
Some color image display devices that express color images create various colors by mixing the three primary colors: red (R: red), green (G: green), and blue (B: blue). Furthermore, conventionally, some devices display a color image using four colors, a neutral color (white) in addition to RGB (for example, see Patent Document 1). Moreover, conventionally, there are color liquid crystal display devices wherein the planar shape of the dots that are components of the pixels (unit pixels) is a shape wherein two corner portions on one diagonal line of a rectangle are cut off (for example, see Patent Document 2).

Murai at ¶[0002]

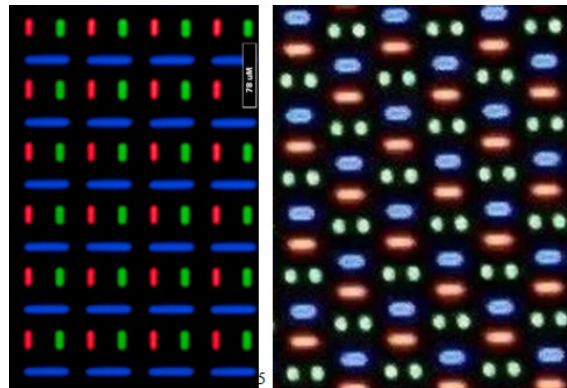
Murai Describes LCD displays

- The problem to be solved by Murai's invention is directed to a problem arising in LCDs, but not in OLED displays

LCD:



OLED:



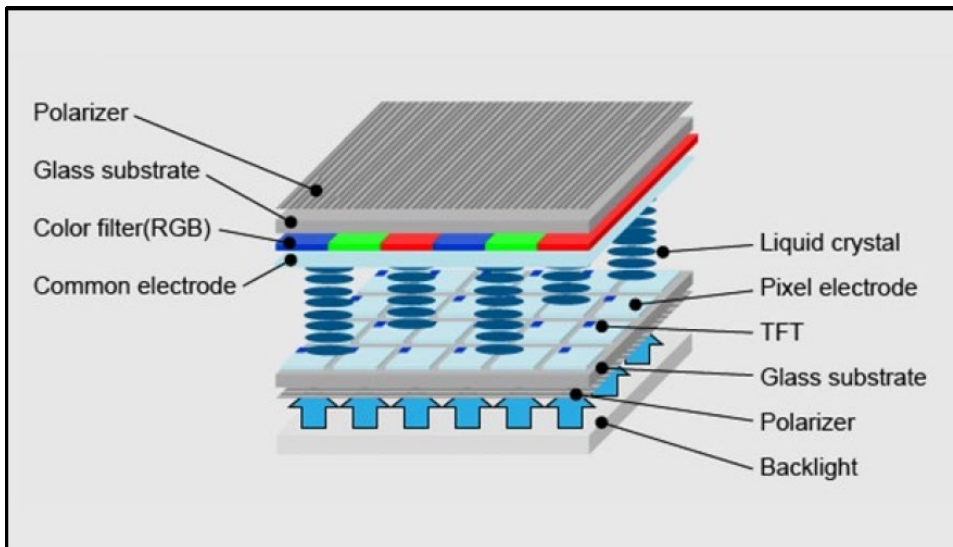
[0040]-[0043]. The “Problem to Be Solved by Invention” section explains that the problem to be solved is “streaking” due to dots of the same color being adjacent and too close to each other—a problem that would only occur in displays using tightly-packed pixel arrangements, such as color LCDs. Murai, ¶¶ [0003]-[0005]. A POSITA would have understood this would not be a problem in other types of displays with substantial gaps between pixels, such as OLED displays. As discussed above in Sections V, XI.A, OLED displays have large gaps between adjacent pixels due to limitations in deposition techniques.

-00987 Ex. 2009 (Kymissis Declaration) at ¶¶39, 43, 276

-00988 Ex. 2009 (Kymissis Declaration) at ¶¶39, 43, 270

Murai Describes LCD displays

- The only technical description of the display structure in Murai describes components of LCDs, not OLED displays



-00987 Ex. 2009 (Kymissis Declaration) at ¶34
-00988 Ex. 2009 (Kymissis Declaration) at ¶34

Murai's displays describes a single thin-film transistor (TFT) for driving each dot. Murai, ¶¶ [0041]-[0043]. A POSITA would have understood that an LCD pixel can be driven with a single TFT, but that an OLED pixel requires at least two TFTs (a switching TFT and a driving TFT), because LCDs are voltage driven and OLEDs are current driven. Murai's further descriptions of the pixel electrode, holding capacitor electrode, and color filters are all further indicative of LCDs. Murai, ¶¶ [0040]-[0043]. The "Problem to Be Solved by Invention" section explains that the

-00987 Ex. 2009 (Kymissis Declaration) at ¶276
-00988 Ex. 2009 (Kymissis Declaration) at ¶270

Murai Does Not Teach OLED Pixel Arrangement Structures

- One passing reference to “organic EL display devices” in a list is not a teaching that an identical pixel arrangement could be used in an OLED display

[0058]

The color image display device according to the present invention can be applied to liquid crystal display devices, organic EL display devices, plasma display devices, projectors, and the like.

Murai at ¶[0058]

Murai does not explain how its LCD display solutions can be applied to an OLED display. Murai does not disclose or suggest that any of its figures, let alone Figure 3, represent how an OLED display (or any other display other than LCD) could or would be implemented.

-00987 Ex. 2009 (Kymissis Declaration) at ¶277

-00988 Ex. 2009 (Kymissis Declaration) at ¶271

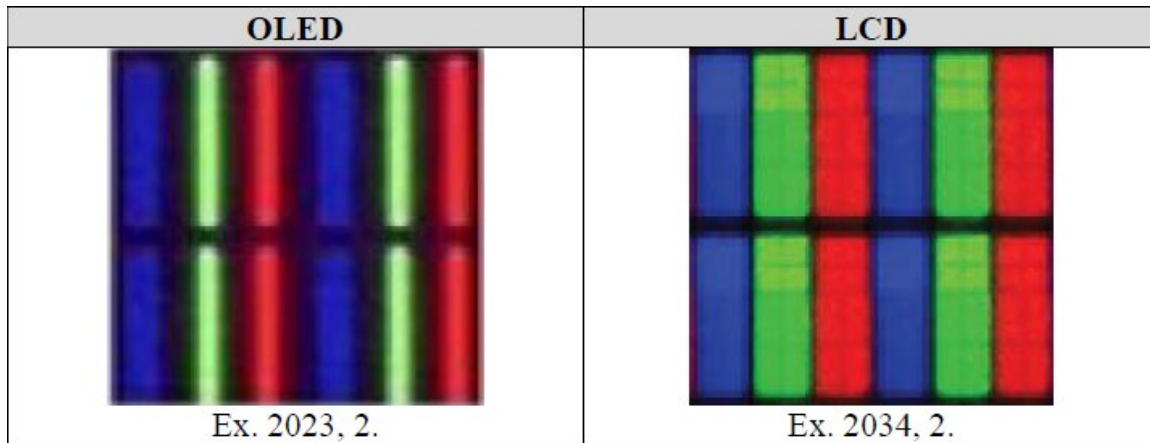
Murai Does Not Teach OLED Pixel Arrangement Structures

278. As I explained in the background of the technology section, LCDs and OLED displays operate on fundamentally different principles, and these result in different structures and different manufacturing methods. See Section V. For example, LCD displays have a single layer of liquid crystal shared by multiple pixels, with pixel boundaries being defined by the locations of pixel electrodes and color filters. Adjacent pixels in an LCD thus run right up against each other, bounded only by thin black masks that demark boundaries of pixels by virtue of simply blocking the light from being seen by the user in that part of the display. On the other hand, organic materials for OLED displays are individually deposited due to their conductive nature, and due to limitations in deposition techniques, there must be significant gaps between adjacent pixels in an OLED display.

-00987 Ex. 2009 (Kymissis Declaration) at ¶278

-00988 Ex. 2009 (Kymissis Declaration) at ¶272

LCDs and OLEDs Require Different Pixel Arrangements



-00987 Ex. 2009 (Kymissis Declaration) at ¶43

-00988 Ex. 2009 (Kymissis Declaration) at ¶43

43. In LCDs, a single layer of liquid crystal material could be deposited on the entire display, with red, green, and blue color filters made of insulating material simply formed placed on top of each pixel region. But in OLEDs, the organic emissive materials that form each pixel conduct electricity, so the organic material must be sufficiently separated from each other to prevent defects. Further, when organic materials for emitting different colors are deposited too close to each other, overlap of the material can result in color mixing, compromising the color of the display. Thus, in contrast to LCDs, OLED displays have large gaps between pixels.

-00987 Ex. 2009 (Kymissis Declaration) at ¶43

-00988 Ex. 2009 (Kymissis Declaration) at ¶43

“TFT” does not mean “OLED”

- Petitioner’s attorney argument that the presence of a TFT implies a display is OLED is incorrect

computer monitors were in widespread use. Starting in the 1980s and 1990s, liquid crystal displays (“LCDs”) and plasma displays started being commercialized, with LCDs becoming more widespread in the 1990s and 2000s with the introduction of TFT-LCDs, which used thin-film-transistor (“TFT”) technology to drive the LCDs.

-00987 Ex. 2009 (Kymissis Declaration) at ¶30

-00988 Ex. 2009 (Kymissis Declaration) at ¶30

2	Q	And then in the next paragraph he goes on
3		to talk about LCD displays. "Likewise, in LCD
4		displays, the integration of a great number of
5		thin film transistors (TFT) is extremely expensive
6		and very prone to produce major amounts of
7		rejects."
8		Do you see that?
9	A	Yes.
10	Q	When he's talking about the great number
11		of thin film transistors, he's talking about
12		problems with active matrix displays. Correct?
13	A	Active matrix LCD in this case, but yeah.

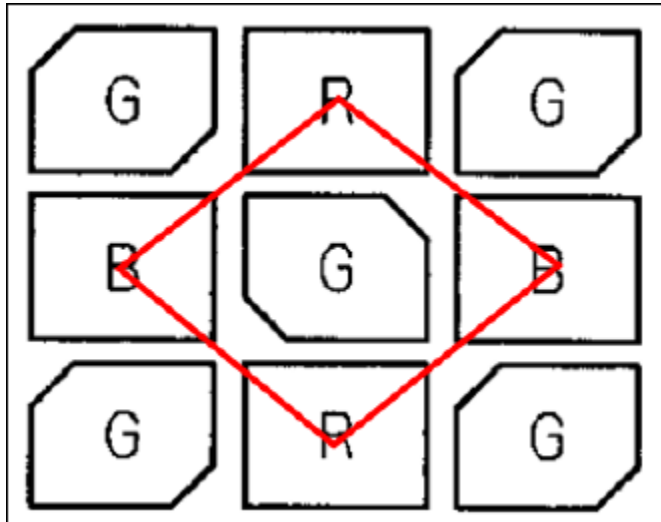
-00987 Ex. 2062 (Pattison Deposition) at 163:2-13

-00988 Ex. 2062 (Pattison Deposition) at 163:2-13

No “Virtual Square”

No Virtual Square

- Figure 3 does not teach a virtual square



-00987 Ex. 2009 (Kymissis Declaration) at ¶285

285. When a quadrilateral centered at the center of a green dot is drawn with vertices of the quadrilateral located at the *centers* of second and third pixels as required by the challenged claims, it is clear that the quadrilateral is not a square, so no virtual square is formed. This is illustrated in the annotated version of claim 3,

-00987 Ex. 2009 (Kymissis Declaration) at ¶285

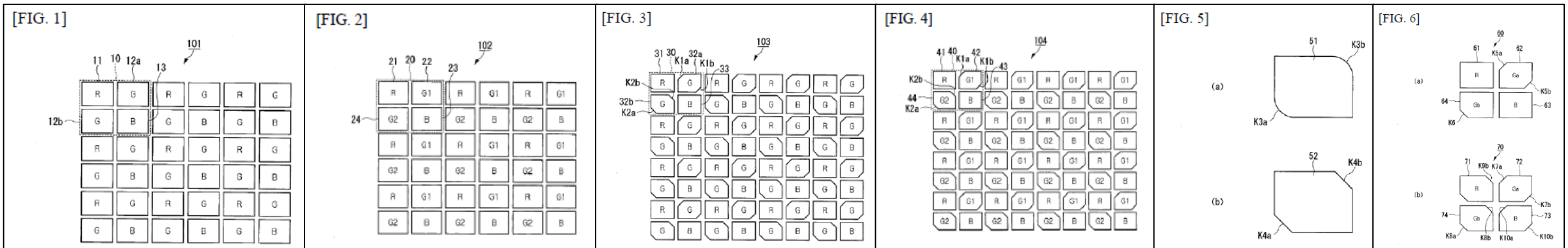
287. In fact, Dr. Pattison admits that Figure 3 shows “slightly rectangular dots (which have a length somewhat greater than their height),” and that it is only with the use of “square dots” that the claimed “virtual square” shape results. Ex. 1003 at ¶¶ 476-478. But Dr. Pattison fails to explain why or how a POSITA would have modified what are clearly oblong rectangle shaped dots into square shaped dots.

-00987 Ex. 2009 (Kymissis Declaration) at ¶287

Every Figure in Murai Uses Rectangular Dots

286. Figure 3 uses a rectangular dot shape and dots arranged in a rectilinear grid. As shown in the examples below, every figure shown in Murai uses rectangular dots, including Murai's "stripe" and "delta" embodiments (Figs. 7-8).

-00987 Ex. 2009 (Kymissis Declaration) at ¶286



Murai at Figs. 1-6

“Unit Pixels” Are Not “Dots”

292. Dr. Pattison’s assertion that Figure 3 does disclose the claimed virtual square relies on a misreading of Murai. First, Dr. Pattison states that:

According to Murai, all of the dots are “accurately” and “regularly disposed” for purposes of “improv[ing]” “the aperture ratio.” (*Id.*, ¶ [0010].) In my opinion, a POSITA would understand this reference to “regularly disposed” dots to mean that the dots are equally spaced from each other. This is what is shown in all of Murai’s figures. (*See id.*, Figs. 1, 3.)

Ex. 1003 at ¶ 474. This is plainly not what Murai says. Murai *never* says that the *dots* are “regularly disposed.” Murai instead states that “*each unit pixel* can easily and accurately be regularly disposed.” Murai, ¶ [0010]. Thus, Dr. Pattison’s inference that all of the *dots* are “equally spaced from each other” is unfounded.

-00987 Ex. 2009 (Kymissis Declaration) at ¶292

“Unit Pixels” Are Not “Dots”

- Petitioner misreads Murai’s references to “unit pixels” as “dots”
- Petitioner misreads Murai’s references to “dots” being square as “unit pixels” being square

293. Second, Dr. Pattison states that:

Murai explains that its square dots are regularly spaced, surround one point, are disposed at diagonals from each other, and are arranged in groups of four forming a rectangular shape (which is preferably square). (*E.g., id.*, ¶ [0017]; *see also id.*, ¶¶ [0006], [0010], [0032].)

Ex. 1003 at ¶ 479. This is also plainly not what Murai says. As an initial matter, Murai says nothing specifically about the relationship between square dots; Murai’s descriptions of square dots are limited to the three sentences quoted above. Further, Murai *never* says that its dots, square or otherwise, “are arranged in groups of four forming a rectangular shape (which is *preferably square*).” Murai simply does not say the dots are arranged to together form a square. Murai only states that the dots within each unit pixel “make up a rectangle made up of four rectangles.” *See, e.g., Murai*, ¶¶ [0010], [0017], [0024], [0032].

-00987 Ex. 2009 (Kymissis Declaration) at ¶293

“Unit Pixels” Are Not “Dots”

- Petitioner incorrectly assumes unit pixels should be square when square dots are used

the quad-pixel structures. Notably, while Murai states that individual *color dots* can have a square shape, it never states, depicts, or suggests that the quad-pixel groupings can be square.

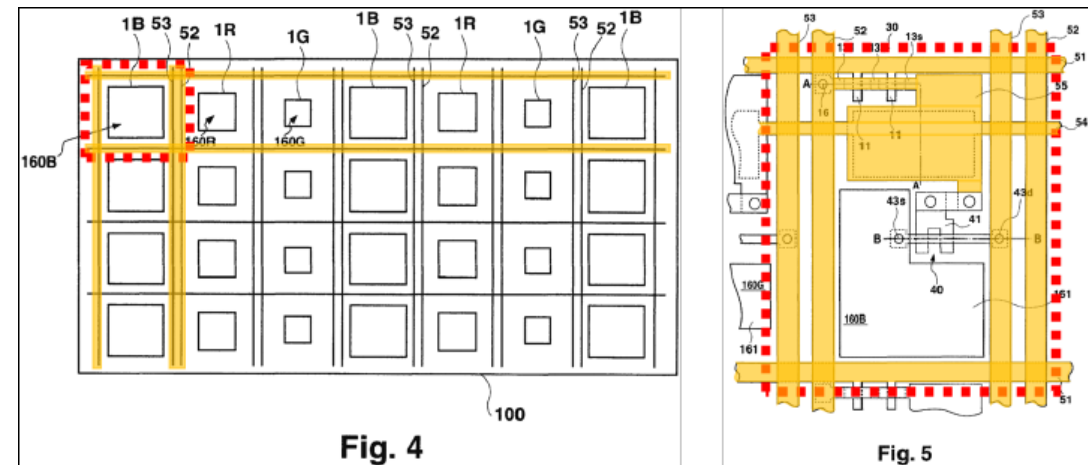
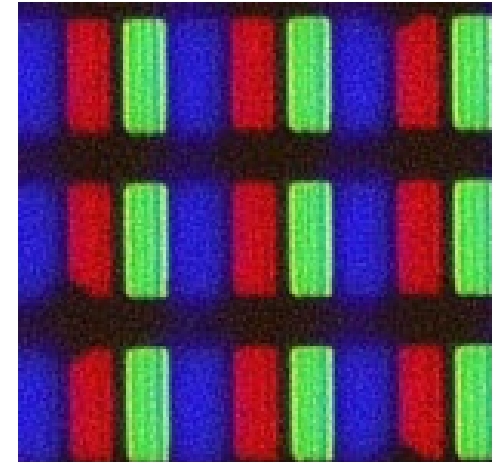
-00987 Ex. 2009 (Kymissis Declaration) at ¶289

Petitioner Misreads Murai

- Petitioner incorrectly assumes individual dots are equally spaced from each other

challenged claims. To form the virtual square, the edge-to-edge spacing between dots horizontally and vertically would need to be the same, and no extra spacing between quad-pixel groupings could be included for power or signal lines. But Murai does not state or imply that the horizontal spaces and the vertical spaces between the dots are equally sized. Indeed, the prior art in LCD pixel arrangement structures is replete with examples of unequal horizontal and vertical spacing between sub-pixels.

-00987 Ex. 2009 (Kymissis Declaration) at ¶290-291



-00987 Ex. 2009 (Kymissis Declaration) at ¶290-291

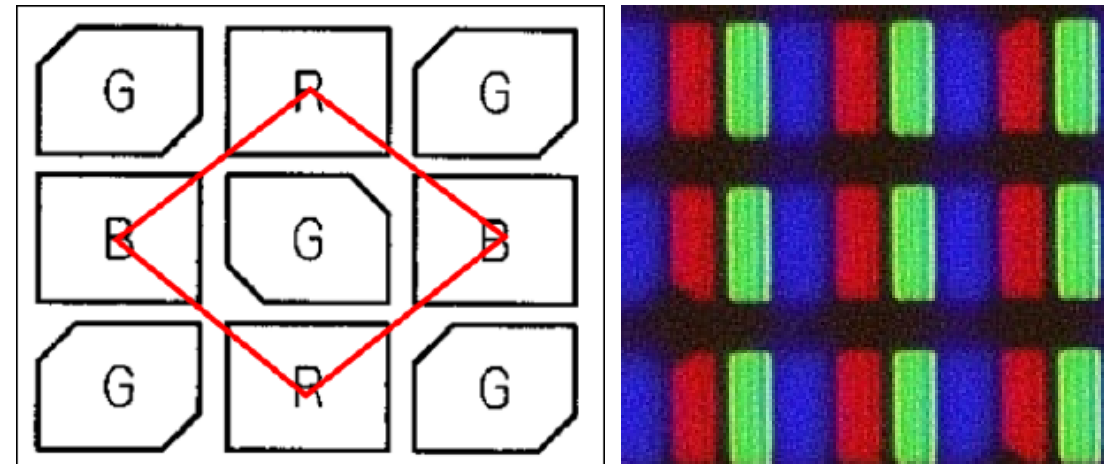
Petitioner Misreads Murai

- Petitioner incorrectly assumes all dots must be centered on a square grid

describe oblong rectangles. Dr. Pattison is wrong to read “regularly disposed” to require exclusively a *square* grid. A non-square rectangular grid of unit pixels is still “regularly spaced” because the distance between every pair of horizontally adjacent unit pixels is the same throughout the display, and the distance between every pair of vertically adjacent unit pixels is the same throughout the display. (And even if

throughout.) There is no reason that a POSITA would assume that “regularly disposed” means “equally spaced” both in the horizontal and vertical directions. That is contrary to the understanding of a POSITA as well as Murai’s explicit disclosures.

-00987 Ex. 2009 (Kymissis Declaration) at ¶292



-00987 Ex. 2009 (Kymissis Declaration) at ¶285, 290

No Motivation to Combine

No Motivation to Combine

- A POSITA had no reason to apply Yamada's teachings based on problems unique to organic materials to Murai's LCD

297. As discussed above, each of Murai's embodiments, including Figure 3, describe LCD devices. Yamada's teachings regarding the purported need to re-size the emissive areas of different color pixels because different materials for emitting different color light have different emission efficiencies is thus simply inapplicable to Murai's LCDs. As I explained above, LCDs do not contain organic emissive layers. The backlight unit of an LCD provides one uniform color of light, which is modulated by the liquid crystal layer, and then passed through color filters to control for color. Yamada's basic premise for the need to re-size pixels—the differential efficiency of organic emissive materials for different color light—does not exist in LCD, and has no relevance to LCDs. Thus, a POSITA would not have been motivated to modify Murai's pixel sizes based on Yamada.

-00987 Ex. 2009 (Kymissis Declaration) at ¶297

-00988 Ex. 2009 (Kymissis Declaration) at ¶275

No Motivation to Combine

- The rationale for Murai's cutouts does not apply to the resizing of OLED pixels
Petitioner suggests

Murai, in the context of LCD displays having packed dots placed closely together, observes that diagonal lines of green dots can create visible streaks. Murai, ¶¶ [0004]-[0005]. Thus, Murai's solution to avoid these unwanted streaks is to cut out alternating corners on adjacent green dots to increase their separation, while maximizing the light-emitting area. Murai, ¶¶ [0008], [0010], [0011], [0012], [0042]. Thus, every embodiment shows cut-off corners on the green dots, Murai, Figs. 3, 4,

300. But as I've explained above, due to manufacturing limitations of OLED displays, different color pixels in OLED displays must be spaced much farther apart than they could be in an LCD, and a POSITA would not have viewed Murai's cut-off corners as necessary in an OLED display to reduce a streaking effect: the pixels would simply not be so close that they could have a streaking effect. Indeed, because the OLED pixels would be so far apart, the OLED display may in fact have the *opposite* problem: for example, it may be desirable to display a green diagonal line, but that line may not appear as one continuous line, but instead a series of discrete points. Nor would cut-off corners like in Murai's have been beneficial in an OLED

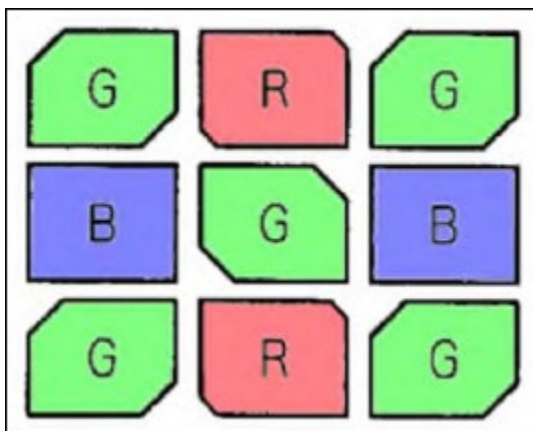
301. Further, Yamada's disclosed emissive area ratios of 1:2.6:5.6 between green, red, and blue pixels—which Dr. Pattison cites, Ex. 1003 at ¶ 508 (citing Yamada at 11:4-15), or the alternative ratio 1:14.2:35 Yamada at 11:34-39)—would result in such large cut-off corners and separations between green dots that it would nullify the reason for implementing Murai's cut-off corners. A POSITA would not

-00987 Ex. 2009 (Kymissis Declaration) at ¶¶299-301

-00988 Ex. 2009 (Kymissis Declaration) at ¶¶277-279

No Motivation to Combine

- Petitioner's proposed resizing is inconsistent with the purpose of Yamada's pixel resizing



-00987 Pet. at 74

-00988 Pet. at 71

demonstrative reproduced below. Ex. 1003 at ¶ 511. But in this proposed combination, the sizes of the emissive areas remain largely unchanged, contrary to Yamada's disclosure of achieving a balanced pixel luminance by adjusting the relative sizes of pixels according to emission efficiency of the organic light emitting material. Notably, Yamada's own calculations for pixel areas based on the organic materials it used in its embodiments resulted in significantly smaller green pixels in Dr. Pattison's other combinations with Matthies and Phan based on Yamada, than Dr. Pattison proposes would be made in the combination with Murai. Thus, Dr. Pattison's proposed modifications of Murai would reduce the aperture ratio and thus undercut Murai's purpose of improving the overall aperture ratio of the display, and simultaneously fail to adequately account for the differences in efficiency of the different organic light-emitting materials (assuming that the Murai display could somehow even be implemented as OLED pixels in the first place).

-00987 Ex. 2009 (Kymissis Declaration) at ¶303

-00988 Ex. 2009 (Kymissis Declaration) at ¶281

No Motivation to Combine

- Petitioner's proposed modification keeps blue pixels the same size and shrinks the red and green pixels
- Dr. Pattison argued that Yamada teaches keeping the blue pixel its original size

1003, ¶¶ 507-510.) The below demonstrative provides one example of how a POSITA would have obviously accomplished this. The green dots are made smallest via the inclusion of two larger cutouts. The red dots have an intermediate size with two smaller cutouts. The blue dots are largest because they include no cutouts:

-00987 Pet. at 74
-00988 Pet. at 71

511. The below demonstrative provides one example of how a POSITA would have obviously accomplished this. The green dots are made smallest via the inclusion of two larger cutouts. The red dots have an intermediate size with two smaller cutouts. The blue dots are largest because they include no cutouts. The

-00987 Ex. 1003 (Pattison Declaration) at ¶511
-00988 Ex. 1003 (Pattison Declaration) at ¶532

No Motivation to Combine

- Dr. Kymissis explained that, even if Murai were OLED, Petitioner's proposed modification would reduce lifetime

305. *Second*, again assuming that Murai's pixel structure could be applied to OLEDs, a POSITA would have understood that reducing the sizes of the green and red dots while keeping the blue dots the same size would not extend the overall lifetime of Murai's display, for the same reasons discussed above in Sections X.A.3, X.B. In brief, according to Dr. Pattison's theory underlying his proposed combination with Yamada, blue OLED materials have lower emission efficiency, requiring blue pixels to be driven at a higher current density which promotes degradation of the organic material, shortening its lifetime. Yamada, 2:60-67; 11:11-

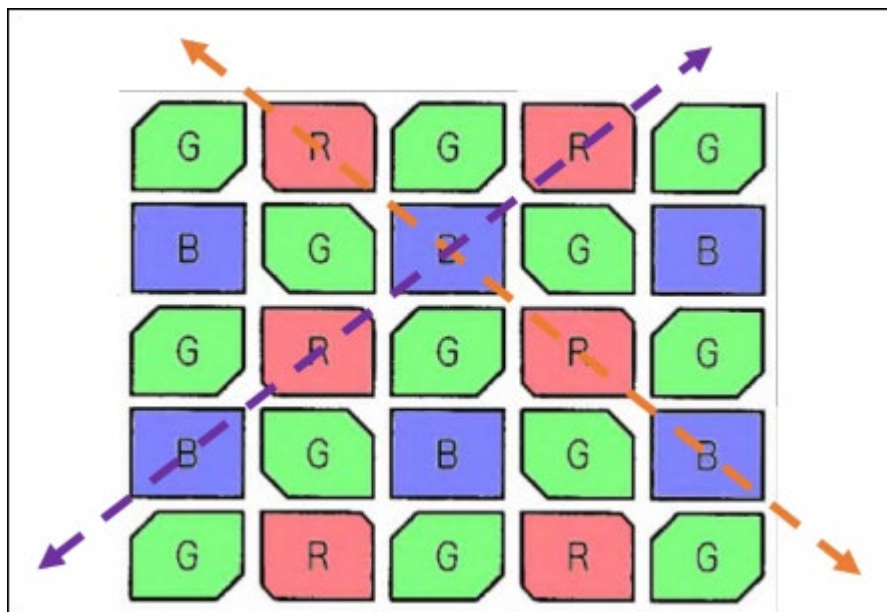
-00987 Ex. 2009 (Kymissis Declaration) at ¶305

-00988 Ex. 2009 (Kymissis Declaration) at ¶283

- Dr. Pattison offered no rebuttal

No Motivation to Combine

- Even if Murai were OLED, resizing pixels in the manner proposed by Petitioner would introduce unwanted visual artifacts



-00987 Ex. 2009 (Kymissis Deposition) at ¶306

-00988 Ex. 2009 (Kymissis Deposition) at ¶284

appearance. See, e.g., Murai, ¶¶ [0005]-[0014]. Specifically, by making Dr. Pattison's proposed combination, a diagonal of red and blue dots running from the top-left to the bottom-right of the display would exhibit a different degree of color mixing and streaking effects than a diagonal of red and blue dots running from the top-right to the bottom-left of the display, because a corner cut-offs of different sizes would be made in the corners for one diagonal than the other. For example, in the

it to form a 2 more rows and 2 more columns. When looking along the orange diagonal, there are 0 cut-off corners along that diagonal. On the other hand, when looking along the purple diagonal, there are 2 cut-off corners in each red pixel along that diagonal. This would result in an asymmetry in the degree of color mixing and streaking effects in images along the two diagonals. In contrast, none of Murai's embodiments suffer from this asymmetry introduced by Dr. Pattison's proposed combination because the blue and red dots are always equally sized in Murai's embodiments. A POSITA would have had no motivation to make Dr. Pattison's

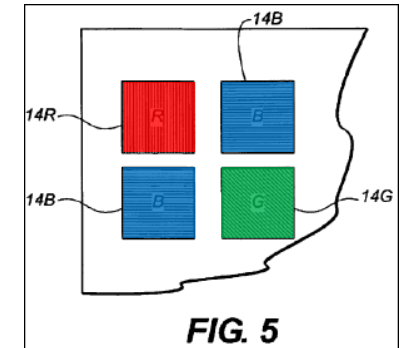
-00987 Ex. 2009 (Kymissis Deposition) at ¶306

-00988 Ex. 2009 (Kymissis Deposition) at ¶284

A POSITA Would Not Have Combined the References in the Way the Petitions Assert

No Motivation to Try to Resize Murai's Quad-Pixel Structure

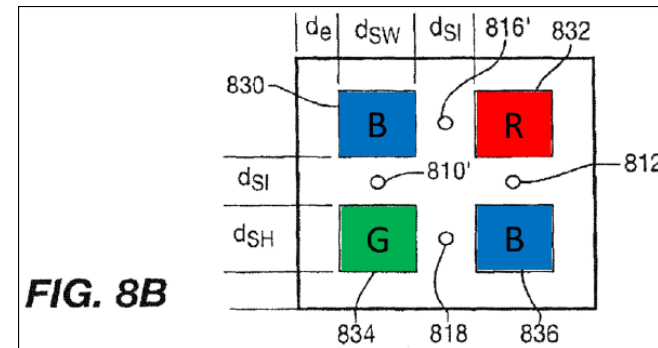
- The art teaches that if blue material has lower emission efficiency, then two blue sub-pixels are used in the quad pixel
- Solution specific to quad-pixel structure



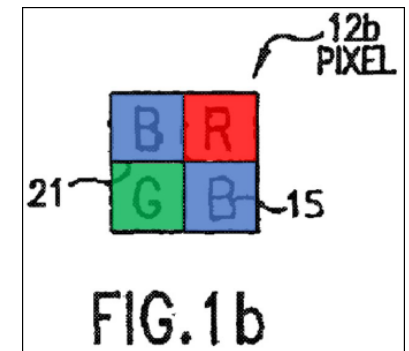
-00987 Ex. 2011 (Arnold) at Fig. 5 (annotated)
-00988 Ex. 2011 (Arnold) at Fig. 5 (annotated)

pixels. In some display technologies, the amount of light emitted by the red or blue pixel material may be less than the amount of light emitted by the green pixels. In this instance, making the pixels **830** and **836** both be red or blue pixels would improve the overall brightness of the display. The

Matthies at 17:6-10

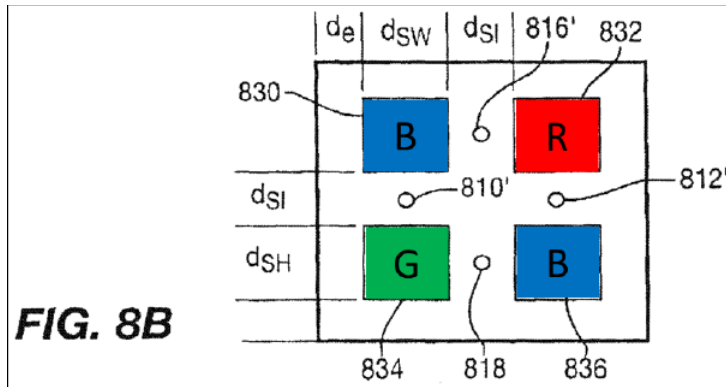


-00987 Ex. 2009 (Kymissis Declaration) at ¶160
-00988 Ex. 2009 (Kymissis Declaration) at ¶160



-00987 Ex. 2009 (Kymissis Declaration) at ¶263
-00988 Ex. 2009 (Kymissis Declaration) at ¶263

Even a Combination of Murai and Yamada Would Not Meet Any Claim



This RBGB pixel structure, when tiled, would result in a structure that fails to meet any of the challenged claims of the '803 Patent. There is no "first pixel" (green) that has a center coinciding with a center of a virtual square as required by claim 1. Additionally, there is no "second pixel" that has a larger area than a "third pixel" as required by claim 1. Additionally, there are no "second pixels" and "third pixels" that each have larger areas than the "first pixel" as required by claim 5. Specifically,

'803 Patent, limitations [1-a(1)], [1-a(2)], [1-a(3)], [1-a(4)], [1-b], [2-a], [3-a], [4-a], [5-b]

This RBGB pixel structure, when tiled, would result in a structure that fails to meet any of the challenged claims of the '683 Patent. Specifically, this structure fails to

'683 Patent, limitations [1-d]/[13-d]/[15-d], [1-e]/[13-e]/[15-e], [2-b], 6

-00987 Ex. 2009 (Kymissis Declaration) at ¶160
-00988 Ex. 2009 (Kymissis Declaration) at ¶160

-00987 Ex. 2009 (Kymissis Declaration) at ¶307
-00988 Ex. 2009 (Kymissis Declaration) at ¶285

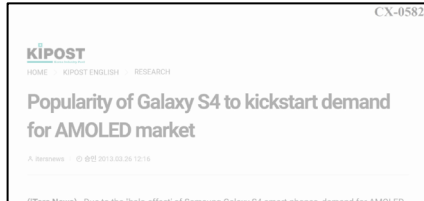
Petitioner's Flawed Reliance on Yamada

Petitioner's Flawed Reliance on Yamada

- Petitioner alleges the same reasons for resizing Matthies' and Phan's pixels according to Yamada apply to resizing Murai's pixels
- These rationales fail for the same reasons they fail in Petitioner's combinations of Matthies and Yamada and Phan and Yamada

Objective Evidence of Non-obviousness

Long-felt Need for Pixel Arrangements Enabling High-resolution Displays



Reaching the high-resolution point with true pixel densities greater than 300 pixels per inch (ppi) has been a challenge for AMOLED displays, as it is difficult to achieve dense pixel arrangements using the conventional Fine Metal Mask process while still securing enough display brightness and not compromising power consumption.

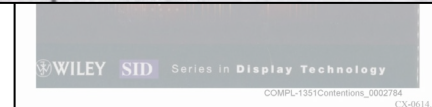


Ex. 2013 (News Service)

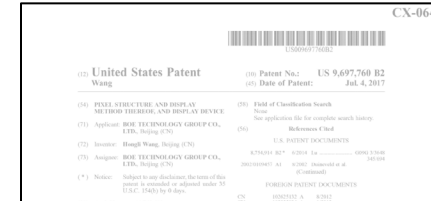


High NTSC ratio and high luminance efficiency can easily be achieved with the RGB side-by-side technology. However, as the resolution of the panel increases (>200 ppi), the fabrication of the fine metal mask and alignment control become tremendously difficult.

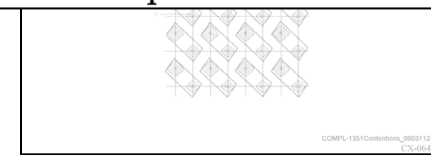
The merging of several multimedia applications such as DSC, cellular phones, and DMB into one mobile device will become a trend in the near future. It makes the development of high-resolution a critical factor in OLED displays. However, the limitations of FMM for high resolution will become a key issue when it comes to considering mass production.



Ex. 2019 (Textbook) COVINGTON



It can be seen that, how to implement the manufacture process for high-resolution pixels, to increase the aperture ratio of sub-pixels, to obtain good brightness level and to extend the lifetime in the meantime was always the urgent technical problems to be solved in the art.



Ex. 2015 (BOE Patent)



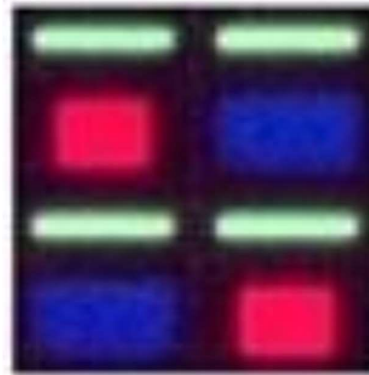
applications. However, AMOLEDs for mobile application still have several challenging issues to get competitiveness comparing with TFT-LCD in terms of performance and cost effectiveness.

As one of the key challenging issue, AMOLED display has difficulty caused by limitation on manufacturing R-G-B shadow metal mask in realizing a high resolution as compared with TFT-LCD even though the most common method for

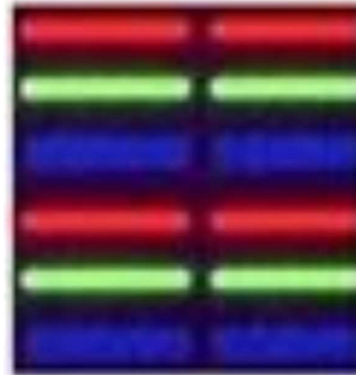
Ex. 2020 (Journal Paper)

Many Tried But Failed to Make Suitable Pixel Arrangements

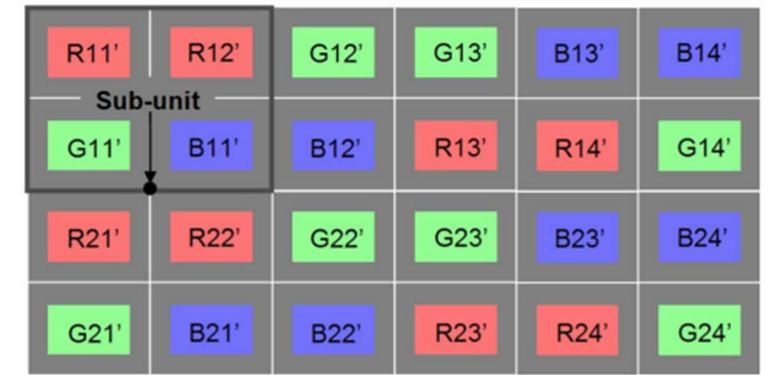
- Pre-invention pixel arrangements had low pixel density, well short of the full HD standard



233 PPI (Samsung Galaxy S, 2010)

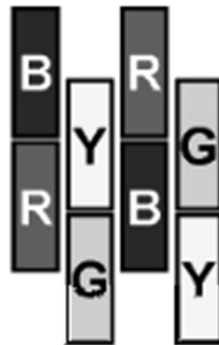


207 PPI (Samsung Galaxy S2, 2011)

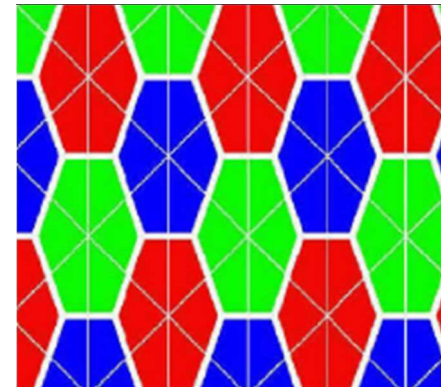


229 PPI (LG prototype, 2010)

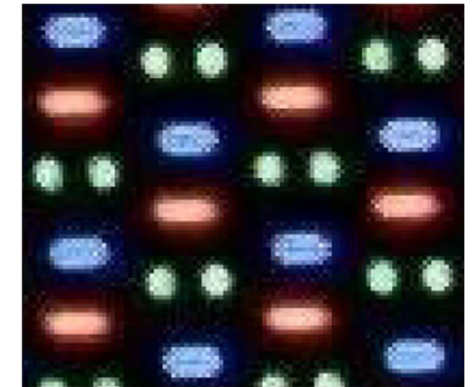
- Post-patent pixel arrangements were inferior, or not adopted for high-end applications



Not used in any flagship AMOLED device (2015)

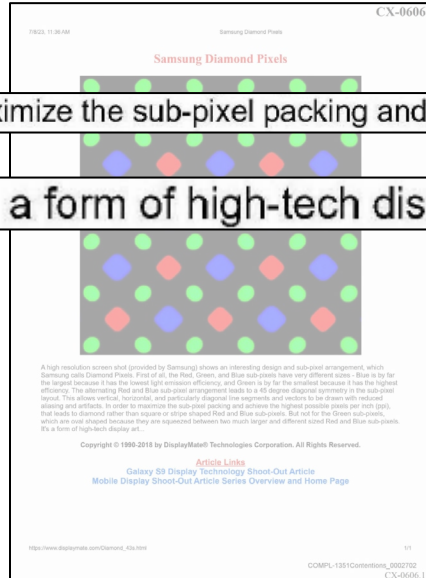


Not used in any flagship AMOLED device (2019)



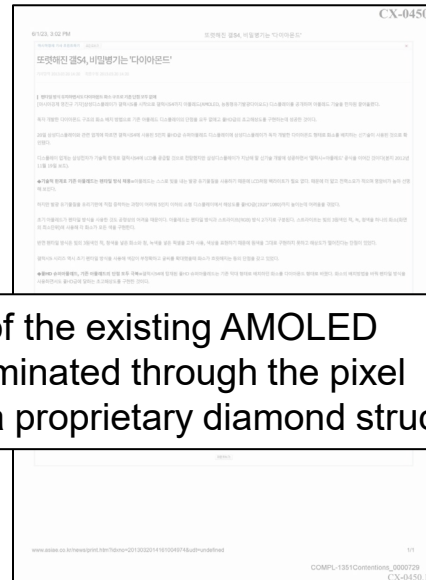
BOE Zhou Dongyu – criticized as inferior to patented design

Praise

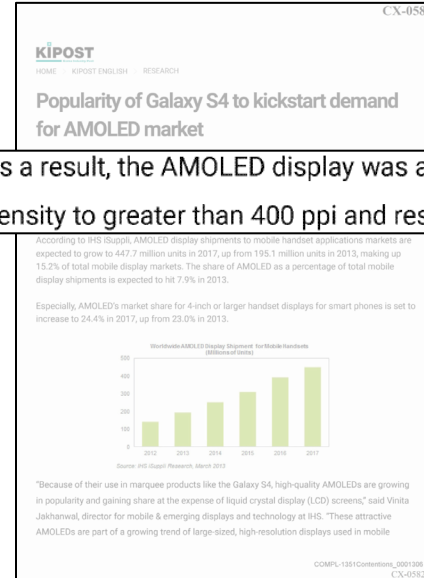


Ex. 2027 (DisplayMate)

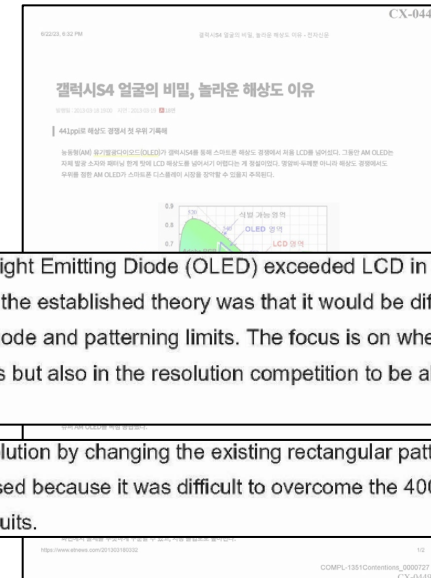
All weaknesses of the existing AMOLED displays were eliminated through the pixel array method in a proprietary diamond structure



Ex. 2026 (News Service)

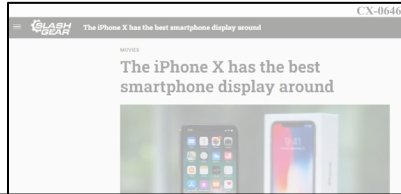


Ex. 2013 (News Service)

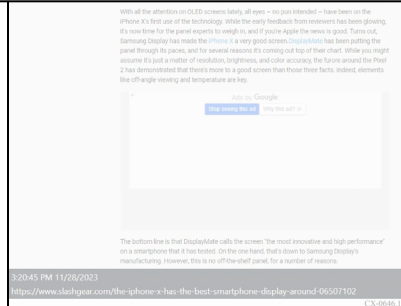


Ex. 2037 (News Service)

Praise



Apple and Samsung Display have used a diamond layout for the OLED screen's sub-pixels on the iPhone X. "On the iPhone X the resulting Sub-Pixel fill factor is much higher than other OLEDs,"



Ex. 2038 (Article)



• First we need to congratulate Samsung Display for developing and manufacturing the outstanding OLED display hardware in the iPhone X.

The display has Diamond Sub-Pixels



Ex. 2039 (DisplayMate)



A high resolution screen shot obtained with an optical microscope camera shows a Diamond shaped layout for the Sub-Pixels on the iPhone X. This Diamond Sub-Pixel layout is used on many OLED displays.

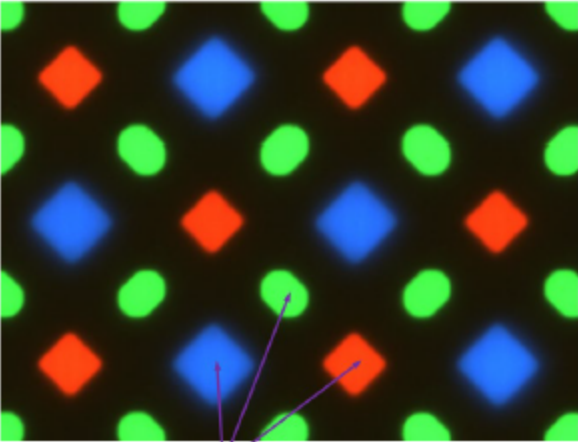
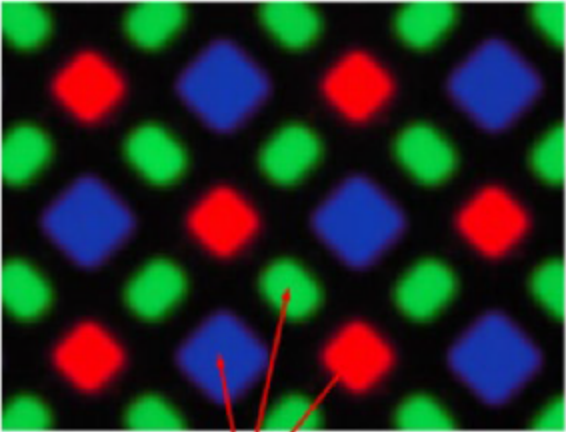
In order to maximize the sub-pixel packing and achieve the highest possible pixels per inch (ppi), that leads to a Diamond rather than Square or Striped arrangement of the Sub-Pixels. It's a form of high-tech display art...



Ex. 2069 (DisplayMate)

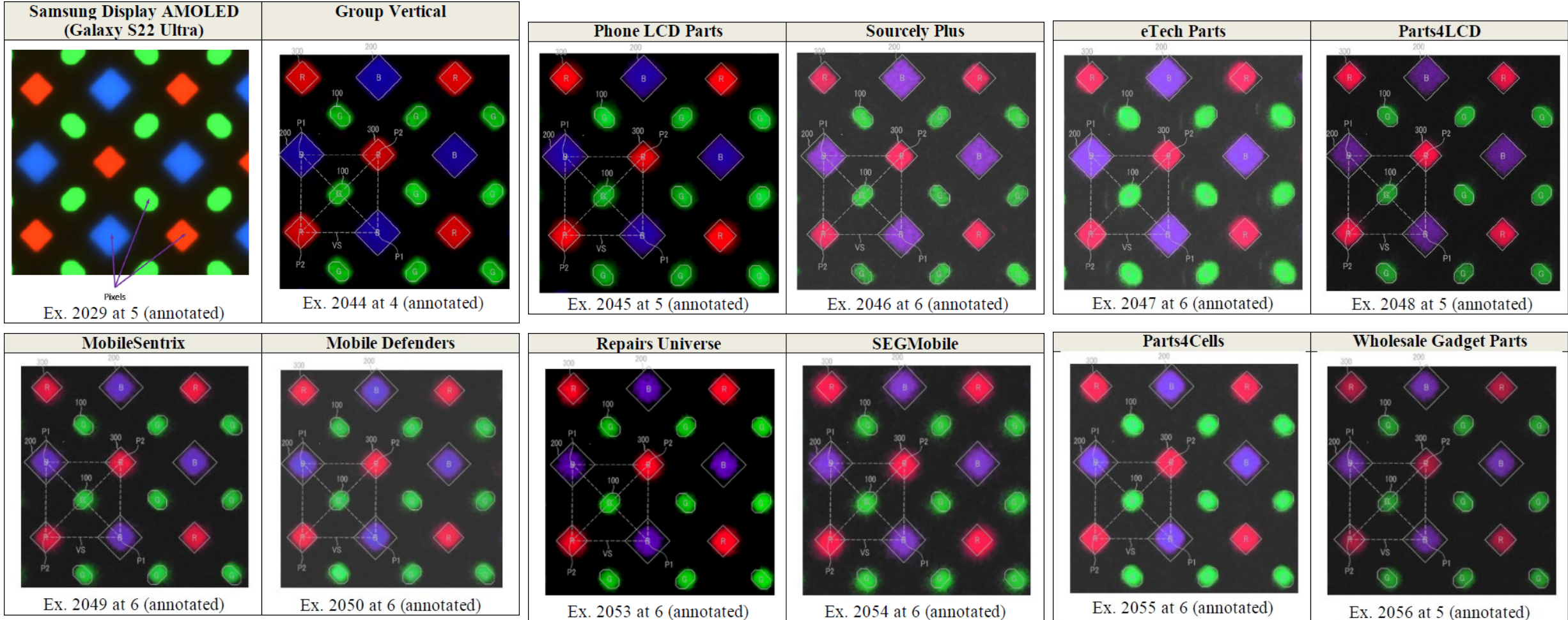


Copying by Petitioner

Samsung Display AMOLED (Galaxy S22 Ultra)	Mianyang BOE AMOLED (iPhone 12)
 Ex. 2029 at 5 (annotated)	 Ex. 2041 at ¶84

-00987 Ex. 2009 (Kymissis Deposition) at ¶341
-00988 Ex. 2009 (Kymissis Deposition) at ¶319
-01075 Ex. 2009 (Kymissis Deposition) at ¶292

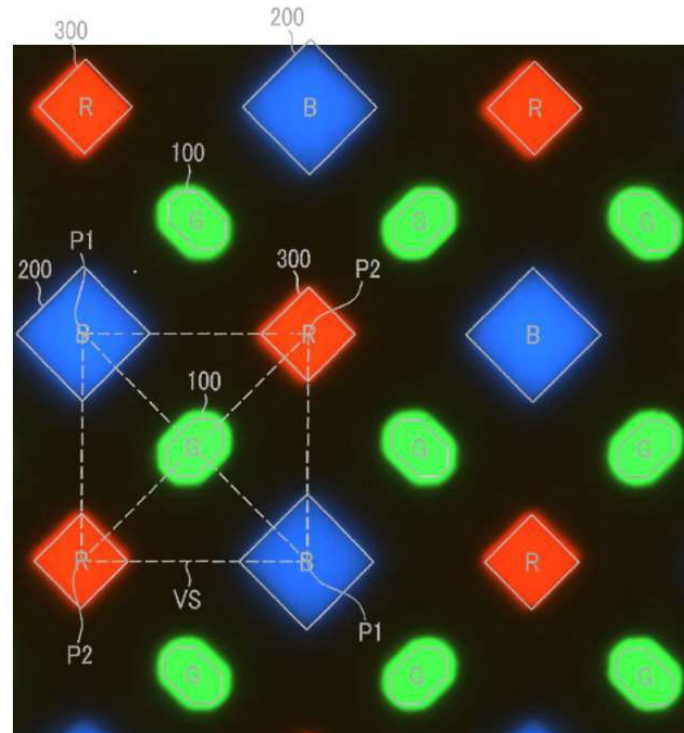
Industry Copying



-00987 Ex. 2009 (Kymissis Deposition) at ¶342-346
 -00988 Ex. 2009 (Kymissis Deposition) at ¶320-324
 -01075 Ex. 2009 (Kymissis Deposition) at ¶293-297

Nexus

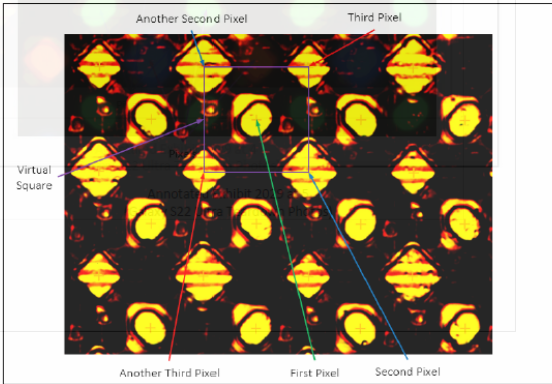
- The Samsung Galaxy S22 Ultra practices all challenged claims



Nexus

EXHIBIT 2028

CLAIM CHART: AMOLED DISPLAY IN SAMSUNG GALAXY S22 ULTRA

U.S. Pat. No. 9,818,803	Samsung Galaxy S22 Ultra
1[preamble] A pixel arrangement structure of an organic light emitting diode (OLED) display, comprising:	The Samsung Galaxy S22 Ultra product contains an organic light-emitting diode ("OLED") display. As shown in the annotated image below, the Samsung Galaxy S22 Ultra product contains a pixel arrangement structure of an OLED display.
U.S. Pat. No. 9,818,803	Samsung Galaxy S22 Ultra
1[preamble] A pixel arrangement structure of an organic light emitting diode (OLED) display, comprising:	
(cont'd)	
U.S. Pat. No. 9,818,803	Samsung Galaxy S22 Ultra
4. The pixel arrangement structure of claim 3, wherein the second pixels and the third pixels enclose the first pixel in the virtual square.	In the Samsung Galaxy S22 Ultra product, the second pixels and the third pixels enclose the first pixel in the virtual square. As shown in the annotated image below, the second pixels (blue arrows) and the third pixels (red arrows) enclose the first pixel (green arrow) in the virtual square (purple).
	
	Annotated Exhibit 2029 at 4 (Galaxy S22 Ultra Teardown Photos)

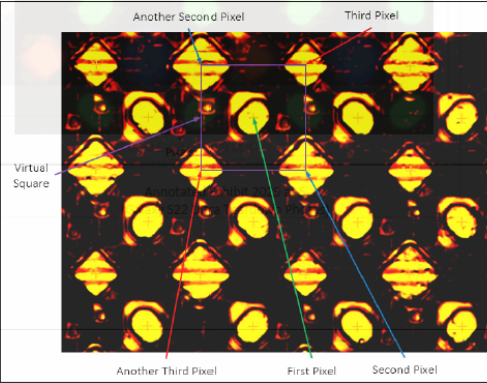
351. A software package called ImageJ was used to obtain certain information about the images of the Galaxy S22 Ultra's pixel arrangement structures, including data such as the areas of the sub-pixels and coordinates of the centers of the sub-pixels. ImageJ is a highly reliable image processing program developed at the National Institutes of Health and is a commonly used tool for microscope image processing, both in academia and commercially. For example, the "Analyze Particles" tool in ImageJ can extract, among other things, the area and center for each region of interest from the outline of the region.

-00987 Ex. 2009 (Kymissis Deposition) at ¶351
-00988 Ex. 2009 (Kymissis Deposition) at ¶329
-01075 Ex. 2009 (Kymissis Deposition) at ¶302

Nexus

EXHIBIT 2028

CLAIM CHART: AMOLED DISPLAY IN SAMSUNG GALAXY S22 ULTRA

U.S. Pat. No. 9,818,803	Samsung Galaxy S22 Ultra
1[preamble] A pixel arrangement structure of an organic light emitting diode (OLED) display, comprising:	The Samsung Galaxy S22 Ultra product contains an organic light-emitting diode ("OLED") display. As shown in the annotated image below, the Samsung Galaxy S22 Ultra product contains a pixel arrangement structure of an OLED display.
U.S. Pat. No. 9,818,803	Samsung Galaxy S22 Ultra
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(cont'd)	
U.S. Pat. No. 9,818,803	Samsung Galaxy S22 Ultra
4. The pixel arrangement structure of claim 3, wherein the second pixels and the third pixels enclose the first pixel in the virtual square.	In the Samsung Galaxy S22 Ultra product, the second pixels and the third pixels enclose the first pixel in the virtual square. As shown in the annotated image below, the second pixels (blue arrows) and the third pixels (red arrows) enclose the first pixel (green arrow) in the virtual square (purple).
	
	Annotated Exhibit 2029 at 4 (Galaxy S22 Ultra Teardown Photos)

352. Based on the teardown photos and corresponding ImageJ data, I prepared a claim chart demonstrating how the AMOLED display used in the Samsung Galaxy S22 Ultra product practices all challenged claims of the '803 Patent. Ex. 2028 (Galaxy S22 Ultra Claim Chart). As explained in the claim chart, the AMOLED display in the Galaxy S22 Ultra product practices the challenged claims of the '803 Patent.

-00987 Ex. 2009 (Kymissis Deposition) at ¶352

-00988 Ex. 2009 (Kymissis Deposition) at ¶330

-01075 Ex. 2009 (Kymissis Deposition) at ¶303

Nexus

- That other patents “claim different things” and allow for additional improvements is immaterial.
- Nexus can be satisfied even where a patented product’s success “was, in fact, based on two factors,” one “undisputedly covered” by the claims, and the other “undisputedly not covered by the claims.”



These statements make it clear that the commercial success of [patentee’s] product was, in fact, based on two factors: the improved filtration process, and the mobility of the commercial embodiment. . . . The success was due to both the mobility, undisputedly not covered by the claims, and to the improved filtration process, undisputedly covered by the claims. [Patent challenger] had the burden of disproving that the improved filtration process contributed to the success of the invention.

Ecolochem, Inc. v. S. Cal. Edison Co.,
227 F.3d 1361, 1378 (Fed. Cir. 2000)

Nexus



The challenged claims recite specific ways to group, shape, size, and lay out the red, green, and blue OLED sub-pixels

achieved a novel balance of improving the AMOLED display's aperture ratio (by enlarging the emissive areas) while *also* allowing for a more reliable deposition of the organic material (by ensuring sufficient gaps between pixels)

overcame the manufacturing and design challenges associated with the emissive layers of the OLED display ... which were long understood by POSITAs to be the bottleneck to full HD AMOLED displays for mobile devices

the “established theory” in the display industry had been that “it would be difficult for AMOLED[s] to exceed the resolution of LCD[s] due to their light emitting diode and patterning limits.” Ex. 2037 at 3. However, Samsung Display overcame industry skepticism and satisfied the longstanding need by “changing the existing rectangular patterning structure to a diamond structure . . . to overcome the 400ppi barrier,” delivering “the 5-inch 441ppi (pixels per inch) Full HD Super AMOLED to Galaxy S4.” Ex. 2037 at 3.

-00987 Ex. 2009 (Kymissis Declaration) at ¶¶354-356
-00988 Ex. 2009 (Kymissis Declaration) at ¶¶332-334
-01075 Ex. 2009 (Kymissis Declaration) at ¶¶305-307