

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Tianma Microelectronics Co., Ltd.,

Petitioner,

v.

LG Display Co., Ltd.,

Patent Owner.

Patent No. 11,251,394 B2

Filing Date: June 22, 2020

Issue Date: February 15, 2022

Title: ORGANIC LIGHT EMITTING DISPLAY AND METHOD OF
FABRICATING THE SAME

Inter Partes Review No. IPR2025-01579

**DECLARATION OF RICHARD FLASCK
IN SUPPORT OF PETITION FOR *INTER PARTES* REVIEW OF
U.S. PATENT NO. 11,251,394**

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I. INTRODUCTION

1. I, Mr. Richard Flasck, submit this declaration to state my opinions on the matter described below.

2. I have been retained by Petitioner Tianma Microelectronics Co. Ltd., (“Tianma” or “Petitioner”), as an independent expert in this proceeding before the United States Patent and Trademark Office. Although I am being compensated at my usual and customary rate of \$495.00 per hour, no part of my compensation depends on the outcome of this proceeding, and I have no other interest in this proceeding.

3. I understand that this proceeding involves U.S. Patent No. 11,251,394 (the “’394 patent”), and I have been asked to provide my opinions as to the patentability of the claims of the ’394 patent. I understand that the application for the ’394 patent was filed on June 22, 2020, and claims priority to a foreign application having a filing date of June 30, 2016.

4. I have been asked to consider the validity of certain claims of the ’394 patent based on certain prior art references. I have also been asked to consider the state of the art and prior art available as of June 30, 2016. Based on the prior art discussed in this declaration, it is my opinion that claims 1-19 of the ’394 patent are unpatentable for the reasons provided below.

[Introduction]

II. QUALIFICATIONS AND BACKGROUND

5. My qualifications for forming the opinions set forth in this Declaration are summarized here and explained in more detail in my curriculum vitae, which is attached as Exhibit 1004. I believe that I am well qualified to serve as a technical expert in this matter based upon my educational and work experience, and specifically, flat panel display devices, including liquid crystal displays (“LCDs”) and organic light emitting diode (“OLED”) displays.

6. I received a Bachelor of Science degree in Physics from the University of Michigan, Ann Arbor, in 1970. I thereafter received a Master of Science degree in Physics from Oakland University in Rochester, Michigan, in 1976. I am the founder and CEO of RAF Electronics Corp., where I developed and patented Liquid Crystal on Silicon (LCOS) microdisplay projection technology as well as developed proprietary LED-based Solid State Lighting (SSL) products.

7. After receiving my Bachelor’s degree, I was employed as a scientist and a manager by Energy Conversion Devices, Inc., from 1970 through 1982. My work at Energy Conversion Devices concerned the development of thin film photovoltaics, ablative imaging films, non-volatile memory, multi-chip modules, and superconducting materials. After leaving Energy Conversion Devices, I founded and served as CEO of Alphasil, Inc., where I developed amorphous silicon thin film transistor (TFT) active matrix liquid crystal displays (AMLCDs). My work at [Qualifications and Background]

Alphasil included thin film transistor array substrate process and circuit design, data driver and gate driver design, scalers, video circuits, gamma correction circuits, back light units (BLUs), and inverter/converter design. At Alphasil, I established one of the world's first TFT AMLCD pilot production lines in 1985. It was a 2000 square foot class 10 cleanroom AMLCD pilot production line. I also designed and incorporated touch panel screens into active matrix display devices. The touch panel technologies included resistive and capacitive sensing. My work at Alphasil included TFT process and circuit design, data driver and gate driver design, scalers, video circuits, gamma correction circuits, backlighting, and inverter design. I worked at Alphasil from 1982 through 1989.

8. After leaving Alphasil, I founded RAF Electronics Corp., described above. I have served as CEO of RAF Electronics since that time. At RAF, I was engaged in display consulting and developed HDTV projection technology for liquid crystal on silicon (LCOS) devices and the associated optical systems. My activities at RAF have included developments in lighting systems using both traditional LED and OLED (Organic Light Emitting Diode) technologies. In 2016 I was granted US Patent 9,328,898 which includes OLED and LED technology and lighting systems. In 2019 RAF received a CalSEED grant from the California Energy Commission to develop ultra-efficient lighting products and explore establishing a Central Valley manufacturing facility.

[Qualifications and Background]

9. In 1997, I took the position of President and COO at Alien Technology Corporation, where I was responsible for completing a Defense Advanced Research Projects Agency (DARPA) contract, and for implementing MEM fluidic self-assembly (FSA) technology. I left the position in 1999.

10. In 2002, I co-founded and served as COO of Diablo Optics, Inc., where I developed, produced, and commercialized key optical components for HDTV projectors, such as polarization optics, condenser lenses, projection lenses, and ultra-high performance optical interference filters using thin film stacks in conjunction with LCD and LED arrays and devices. I left Diablo in 2007.

11. Regarding LED devices specifically, my experience is as follows: In the early 1970s, I designed and developed test equipment using LED arrays. This work resulted in the 1973 conference publication: H. Rockstad, and R. Flasck, "Photo-thermopower in Amorphous Chalcogenide Films," Proceedings of the Fifth International Conference on Amorphous and Liquid Semiconductors, Garmisch-Partenkirchen, Germany, 1311-1315 (1973). Starting in the mid 1970s, I was involved in the design and fabrication of LED displays which comprised X-Y arrays of LEDs mounted on circuit boards.

12. Beginning around 2000, I developed several LED based products including: LED panels for LCD backlighting units (BLUs), including dynamic contrast control; LED railroad warning signage for outdoor use; LED panels for [Qualifications and Background]

therapeutic medical devices addressing seasonal affective disorder (SAD); LED structures for medical diagnostic devices; LED panels for backlighting units, including dynamic contrasts control; LED based light engines for HDTV projectors; and LED panels and instruments for theatrical and stage use. These activities resulted in my US Patent 9,328,898. In 2019 I was awarded a State of California CalSEED Concept Award Grant for this technology with successful completion of the project in the summer of 2020.

13. I am listed as an inventor on twenty-six patents issued in the United States and foreign countries, including one United States design patent. My inventions concern technologies including LCD, LED devices, semiconductor materials, glass materials, non-volatile memory cells, thin film transistors, flat panel backplanes and displays, and wafer based active matrices.

14. I have authored or co-authored twenty-five articles or conference presentations, including numerous papers and presentations concerning lighting and display technologies. My curriculum vitae (Ex. 1004) lists these articles and conference presentations.

15. I am also a member of the several professional organizations, including the OSA, SPIE, AES, SID, and the IEEE.

[Qualifications and Background]

16. In summary, I have 55 years of experience in the field of high-tech product development including Liquid crystal displays (LCDs), transistor array substrates, touch panels, LED displays and devices, and OLED displays and devices.

17. I have been an expert witness in over 70 patent cases, have written scores of expert reports and declarations, and have testified in district court or before the International Trade Commission (ITC) eight times. About half of those cases have involved liquid crystal displays (LCDs). In addition, many of the cases have involved organic light emitting displays (OLEDs) and touch panels as shown below.

18. Since 2019, I have served as an expert witness for patent infringement litigation (or arbitrations) or PTAB proceedings in the following cases involving OLED displays:

Solas v Samsung (Case No. 2:19-cv-00152-JRG)
Solas v LG / Sony (Case No. 6:19-cv-00236-ADA)
Solas v Samsung (Case No. 2:19-cv-00152-JRG)
Solas v Dell (Case No. 6:19-cv-00514-ADA)
Solas v Google (Case No. No. 6:19-cv-00515-ADA)
Solas v Apple (Case No. 6:19-cv-00537-ADA)
Solas v HP (Case No. 6:19-cv-00631-ADA)
LGD v Solas OLED (Case No. IPR2020-00177)
Samsung v Solas Case (Case No. IPR2020-00320)
Solas v BOE/Samsung (Case No. ITC 337-TA-1243)
Solas v Samsung (Case No. 2:21-cv-000104-JRG)
BOE v Paneltouch (Case No. IPR2025-01483)
BOE v Paneltouch (Case No. IPR2025-01482)
BOE v Samsung (Case No. IPR2025-01481)

19. Since 2019, I have served as an expert witness for patent infringement litigation (or arbitrations) or PTAB proceedings in the following cases involving touch panel screens:

Neodron v Lenovo / Motorola (Case No. 3:19-cv-05644-SI)
Neodron v Dell (Case No. 1:19-cv-00819-ADA)
Neodron v Microsoft (Case No. 1:19-cv-00874-ADA)
Neodron v Amazon (Case No. 1:19-cv-00898-ADA)
Samsung v Neodron (Case No. IPR2020-00192)
Samsung v Neodron (Case No. IPR2020-00234)
Samsung v Neodron (Case No. IPR2020-00225)
Samsung v Neodron (Case No. IPR2020-00406)
Samsung v Neodron (Case No. IPR2020-00267)
Samsung v Neodron (Case No. IPR2020-00267)
Samsung v Neodron (Case No. IPR2020-00515)
Dell, Lenovo, HP v Neodron (Case No. IPR2020-00731)
Samsung v Neodron (Case No. IPR2020-00308)
BOE v Paneltouch (IPR2025-01483)
BOE v Paneltouch (IPR2025-01482)
BOE v Samsung (IPR2025-01481)
BOE v Paneltouch (IPR2025-01267)
BOE v Paneltouch (IPR2025-01482)
BOE v Paneltouch (IPR2025-01483)
BOE v Paneltouch (IPR2025-01481)

III. MATERIALS CONSIDERED

20. In forming my opinions, I have reviewed the following documents and all others cited in this declaration:

Exhibit	Description
Ex-1001	U.S. Patent No. 11,251,394 B2 to Oh (“’394 patent”).
Ex-1002	Prosecution File History of the ’394 patent.

[Materials Considered]

Exhibit	Description
Ex-1005	U.S. Pat. Pub. No. 2016/0378224 A1 to Kwon et al. (“Kwon224”)
Ex-1006	U.S. Pat. Pub. No. 2016/0170524 A1 to Kim et al. (“Kim524”)
Ex-1007	U.S. Pat. Pub. No. 2012/0062481 A1 to Kim et al. (“Kim481”)
Ex-1008	U.S. Pat. Pub. No. 2016/0313837 A1 to Zhu et al. (“Zhu837”)
Ex-1009	U.S. Pat. Pub. No. 2013/0278513 A1 to Jang (“Jang513”)
Ex-1010	U.S. Pat. Pub. No. 2017/0090651 A1 to Kang et al. (“Kang651”)

IV. LEGAL STANDARDS

21. I am not a lawyer. My understanding of the legal standards to apply in reaching the conclusions in this declaration is based on discussions with counsel for Petitioner, my experience applying similar standards in other patent-related matters, and my reading of the documents submitted in this proceeding. In preparing this declaration, I have tried to faithfully apply these legal standards to the challenged claims.

22. I have been informed that there are two ways in which prior art may render a patent claim unpatentable. First, I have been informed that the prior art can “anticipate” a claim. Second, I have been informed that the prior art can render a claim “obvious” to a person of ordinary skill in the art. I understand that a claim is

[Legal Standards]

patentable if it was not anticipated and would not have been obvious by the prior art at the effective filing date of the patent.

23. I have been informed that a dependent claim is a patent claim that refers back to another patent claim. I have been informed that a dependent claim includes all of the limitations of the claim to which it refers.

24. I have been asked to provide my opinions as to whether the cited prior art teaches or renders obvious claims 1-19 of the '394 Patent from the perspective of a person of ordinary skill in the art at the '394 Patent's earliest claimed priority date of June 30, 2016, as described in more detail below. I have been informed that in inter partes review proceedings, such as this one, the party challenging the patent bears the burden of proving unpatentability by a preponderance of the evidence. I understand that a preponderance of the evidence means "more likely than not."

25. For purposes of this declaration, I have been asked to provide my opinions on issues regarding unpatentability. I have been informed of the following legal standards, which I have applied in forming my opinions.

A. Level of Ordinary Skill

26. I have been informed a person of ordinary skill in the art is determined by considering several factors, including the (i) type of problems encountered in the art; (ii) prior art solutions to those problems; (iii) rapidity with which innovations are made; (iv) sophistication of the technology; and (v) educational level of active
[Legal Standards]

workers in the field. I have been instructed to assume a person of ordinary skill in the art is not a specific real individual, but rather a hypothetical individual having the qualities reflected by the factors discussed above.

B. Prior Art

27. I have been advised and understand the information used to evaluate whether an invention was new and not obvious when made is generally referred to as “prior art.” I understand that prior art includes patents and printed publications that existed before the earliest claimed priority date or the earliest filing date of the patent (which I have been informed is also called the “effective filing date”). I have been informed and understand that a patent or published patent application is prior art if it was filed before the earliest filing date of the claimed invention and that a printed publication is prior art if it was publicly available before the earliest filing date.

C. Claim Construction

28. I understand that the United States Patent and Trademark Office interprets claim terms in an *inter-partes* review proceeding under the same claim construction standard that is used in a United States federal court. I understand that under this standard, the meaning of claim terms is considered from the viewpoint of one of ordinary skill in the art at the time of the alleged invention.

29. I have been informed that claim terms are generally given their ordinary and customary meaning as understood by one of ordinary skill in the art in light of the specification and the prosecution history pertaining to the patent. I understand, however, that claim terms are generally not limited by the embodiments described in the specification.

30. I understand that in addition to the claims, specification, and prosecution history, other evidence may be considered to ascertain the meaning of claim terms, including textbooks, encyclopedias, articles, and dictionaries. I have been informed that this other evidence is often less significant and less reliable than the claims, specification, and prosecution history.

D. Anticipation

31. I have been informed that under 35 U.S.C. § 102, a patent claim is unpatentable for anticipation if it is not novel, including if the claimed subject matter was patented or described in a printed publication before the effective filing date of the claimed invention. I have been informed that this is referred to as unpatentability by anticipation. I have been informed that a patent claim is anticipated under § 102 if a single prior art reference discloses all limitations of the claimed invention.

E. Obviousness Under 35 U.S.C. § 103

32. I have been informed that under 35 U.S.C. § 103, a patent claim is unpatentable if the differences between the subject matter sought to be patented and [Legal Standards]

the prior art are such that the subject matter as a whole would have been obvious to a person having ordinary skill in the art to which said subject matter pertains at the time the invention was made. This means that even if all of the elements of the claim cannot be found in a single prior art reference that would anticipate the claim, a person of ordinary skill in the field who knew about all the prior art would have come up with the claimed invention. I have been informed that this is referred to as unpatentability by obviousness.

33. I have been informed that a proper obviousness analysis includes the following: (a) determining the scope and content of the prior art; (b) ascertaining the differences between the prior art and the claims at issue; (c) resolving the level of ordinary skill in the pertinent art; and (d) considering evidence of secondary indicia of non-obviousness (if available). I am not aware of any evidence of secondary considerations that would support a determination of non-obviousness of the claimed subject matter in the '394 patent. I understand that any assertion of secondary considerations of non-obviousness must be accompanied by a nexus between the merits of the invention and the evidence offered.

34. I have been informed that the relevant time for considering whether a claim would have been obvious to a person of ordinary skill in the art is the time of invention. For my obviousness analysis, counsel for Petitioner instructed me to

[Legal Standards]

assume that the date of invention for the Challenged Claims is June 30, 2016. My opinions would not change if I assumed a later date of invention.

35. I have been informed that a reference may be modified or combined with other references or with a person of ordinary skill in the art's own knowledge if the person would have found the modification or combination obvious. I have also been informed that a person of ordinary skill in the art is presumed to know all the relevant prior art, and the obviousness analysis may take into account the inferences and creative steps that a person of ordinary skill in the art would employ.

36. I have been informed that whether a prior art reference renders a patent claim obvious is determined from the perspective of a person of ordinary skill in the art. I have also been informed that, while there is no requirement that the prior art contain an express suggestion to combine known elements to achieve the claimed invention, and while a suggestion to combine known elements to achieve the claimed invention may come from the prior art as a whole or individually and may consider the inferences and creative steps a person of ordinary skill in the art would employ, as filtered through the knowledge of one skilled in the art, obviousness grounds cannot be sustained by mere conclusory statements and must include some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.

[Legal Standards]

37. In determining whether a prior art reference could have been combined with another prior art reference or other information known to a person having ordinary skill in the art, I have been informed that the following principles may be considered:

- a. A combination of familiar elements according to known methods is likely to be obvious if it yields predictable results;
- b. The substitution of one known element for another is likely to be obvious if it yields predictable results;
- c. The use of a known technique to improve similar items or methods in the same way is likely to be obvious if it yields predictable results;
- d. The application of a known technique to a prior art reference that is ready for improvement to yield predictable results;
- e. Any need or problem known in the field and addressed by the reference can provide a reason for combining the elements in the manner claimed;
- f. A person of ordinary skill often will be able to fit the teachings of multiple references together like a puzzle; and
- g. the proper analysis of obviousness requires a determination of whether a person of ordinary skill in the art would have a “reasonable

expectation of success”—but not “absolute predictability” of success—
in achieving the claimed invention by combining prior art references.

38. I have been informed that, when a work is available in one field, design alternatives and other market forces can prompt variations of it, either in the same field or in another. I have been informed that if a person of ordinary skill in the art could have implemented a predictable variation and would have seen the benefit of doing so, that variation is likely to have been obvious. I have been informed that, in many fields, there may be little discussion of obvious combinations, and in these fields market demand—not scientific literature—may drive design trends. I have been informed that, when there was a design need or market pressure and there are a finite number of predictable solutions, a person of ordinary skill in the art would have had a good reason to pursue those known options.

39. I have been informed that the law permits the application of “common sense” in examining whether a claimed invention would have been obvious to a person skilled in the art. For example, I have been informed that combining familiar elements according to known methods and in a predictable way may suggest obviousness when such a combination would yield nothing more than predictable results. I understand, however, that a claim is not obvious merely because every claim element is disclosed in the prior art and that a party asserting obviousness must still provide a specific motivation to combine or modify the references as recited in [Legal Standards]

the claims and explain why one skilled in the art would have reasonably expected to succeed in doing so.

40. I have been informed that there is no rigid rule that a reference or combination of references must contain a “teaching, suggestion, or motivation” to combine references. But I also understand that the “teaching, suggestion, or motivation” test can be a useful guide in establishing a rationale for combining elements of the prior art. I have been informed that this test poses the question as to whether there is an express or implied teaching, suggestion, or motivation to combine prior art elements in a way that realizes the claimed invention, and that it seeks to counter impermissible hindsight analysis.

41. I have been informed that, in an obviousness analysis, prior art must be analogous prior art to the patent being considered. I have been informed that a prior art reference is considered to be analogous, or in the same field of art, if the reference is either (1) in the same field of endeavor as the challenged patent, regardless of the problems the challenged patent and the prior art address, or (2) reasonably pertinent to the particular problem being solved by the challenged patent.

42. In evaluating whether such a claim would have been obvious, one may consider whether a reason has been identified that would have prompted a person of ordinary skill in the art to combine the elements or concepts from the prior art in the same way as in the claimed invention. There is no single way to define the line
[Legal Standards]

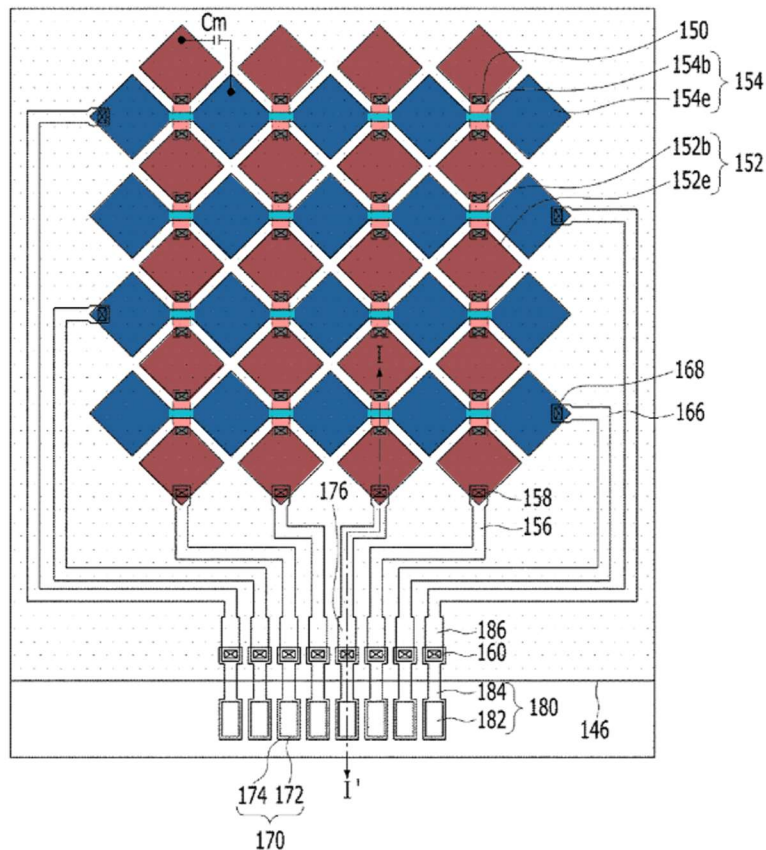
between true inventiveness on the one hand (which is patentable) and the application of common sense and ordinary skill to solve a problem on the other hand (which is not patentable).

V. THE '394 PATENT

A. Overview of the '394 patent

43. The '394 patent describes and claims an “organic light emitting display” with touch sensors, like the ones in FIG. 1 below. Ex-1001, 2:26-30. As shown in annotated Figure 1 below, the touch sensors include “touch driving lines 152” with “first bridges 152b” (**salmon**) connected to “first touch electrodes 152e” (**brick red**) and “touch sensing lines 154” with “second bridges 154b” (**cyan**) connected to “second touch electrodes 154e” (**deep blue**). *Id.*, 4:31-49.

FIG.1



Ex-1001, FIG. 1

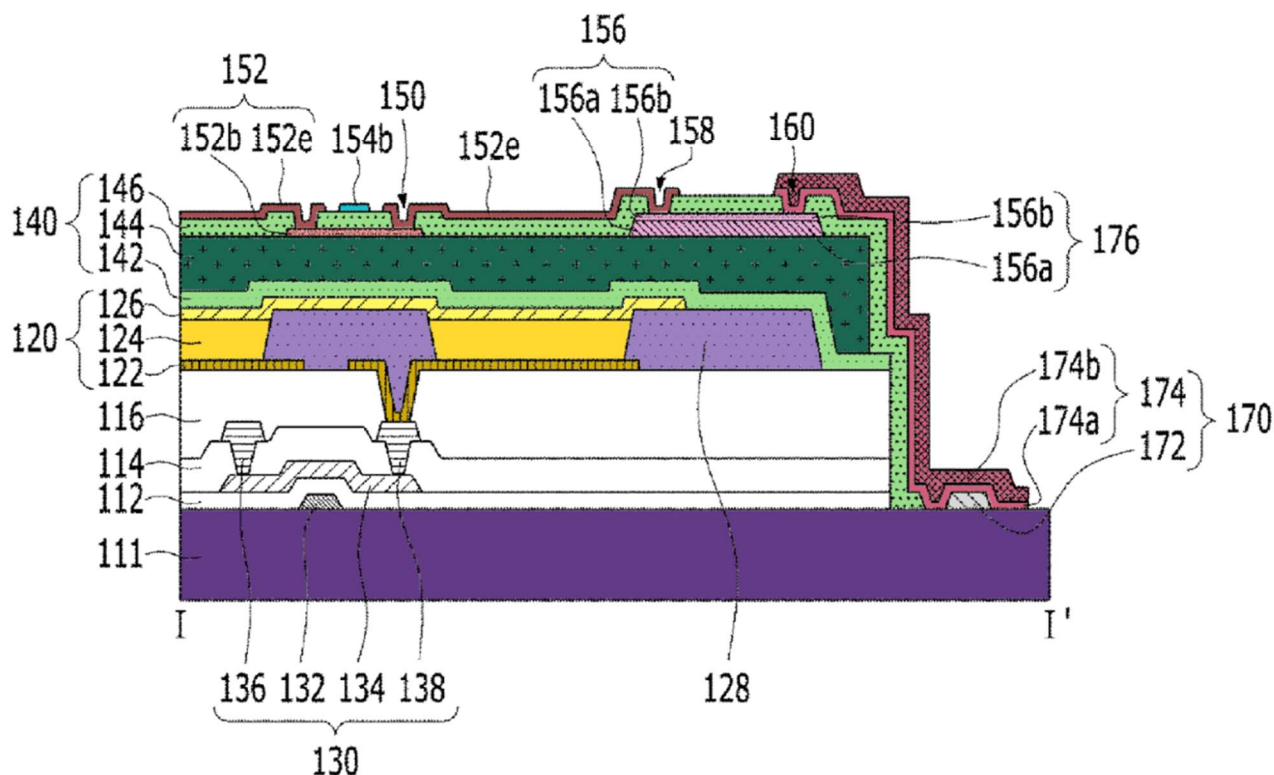
44. As shown in the additional annotations of Figure 1 below, the touch sensors are connected to **first routing lines 156 (pink)** and **second routing lines 166 (sky blue)** (collectively, the claimed “first conductive lines”) which are in turn connected to **pad connection electrodes 174 and 184 (magenta and navy blue)** (collectively, the claimed “second conductive lines”). *Id.*, 5:13-20, 5:66-6:10. Further, the annotations show that the pad connection electrodes are connected to

45. Annotated Figure 2 below provides further context. Specifically, Figure 2 provides a cross-sectional view along line I-I' of FIG. 1, which only shows the layer structure across one portion of two touch driving lines. *Id.*, 2:29-30. It shows “**first touch electrodes 152e**” (**brick red**) and both **bridges 152b and 154b** (**salmon** and **cyan**), as well as **first routing lines 156** (**pink**), **pad connection**

[The '394 Patent]

electrode 174 (magenta), and pad electrode 172 (light gray). *Id.*, 4:31-34, 4:47-49, 5:6-9, 5:66-6:10.

FIG.2



Ex-1001, FIG. 2

46. As shown by the annotations above, Figure 2 further shows an encapsulation unit 140 comprising inorganic (lime green) and organic (dark green) layers, with one inorganic layer 146 disposed between the first and second conductive lines (pink and magenta respectively). *Id.*, 3:34-47, 5:55-60, 6:11-19. Annotated Figure 2 above also shows that the second conductive lines (magenta) [The '394 Patent]

are disposed on the uppermost inorganic layer (**lime green**) and along the side surface of the encapsulation unit. *Id.*, 5:55-60. Below the encapsulation unit 140 are light emitting elements 120 (**all shades of yellow**) that include anode 122, light emitting layer 124, and cathode 126, as also shown by the annotations above. *Id.*, 3:19-22. Banks 128 (**light purple**) overlap the bridges 152b and 154b (**salmon and cyan**) and are positioned to expose anodes of the light emitting element and provide an emission region. *Id.*, 3:26-28, 4:44-46, 4:60-63. At the bottom is substrate 111 (**dark purple**). *Id.*, 3:6-8.

B. Prosecution History of the '394 patent

47. I have reviewed the prosecution history of the application that led to the '394 patent. Ex. 1002. I understand that the Examiner applied Kang651 during prosecution of the '394 patent. Specifically, during prosecution, the Examiner found that a single reference, Kang651, anticipated all claims except two dependent claims. Ex-1002, 148.

48. The Examiner found that Kang651 expressly discloses the core features of the '394 patent's allegedly inventive "organic light emitting display having touch sensors." For example, as annotated Figures 1 and 4 show, Kang651 discloses "touch sensors (142, 143)" with a plurality of "**first touch electrodes (142a)**" (**brick red**) and "**second touch electrodes (143a)**" (**deep blue**) and "**first bridges (142b)**"

[The '394 Patent]

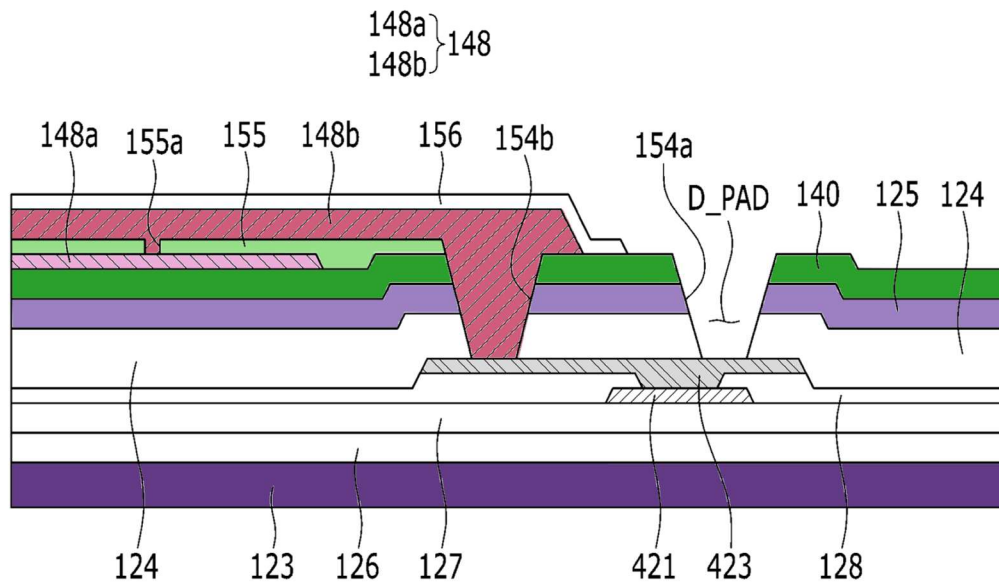
[illegible]

49. As shown in annotated Figure 5 below, Kang651 further discloses “**first conductive lines (148a) [(pink)]** connected to the touch sensors,” “**second conductive lines (148b) [(magenta)]** connected to the first conductive lines,” and second lines connected to “touch pads (423)” (**light gray**). *Id.*, 148-149. The annotated Figure 5 also shows that Kang651 discloses “an encapsulation unit (140)”

25

(green) with inorganic (lime green) and/or organic (dark green) layers, including layer 155 disposed between the conductive lines (pink and magenta). *Id.*, 148; Kang651, ¶[0043]. Kang651 further discloses “interlayer inorganic layer (140d),” as shown in Figure 4. Ex-1002, 150.

FIG. 5



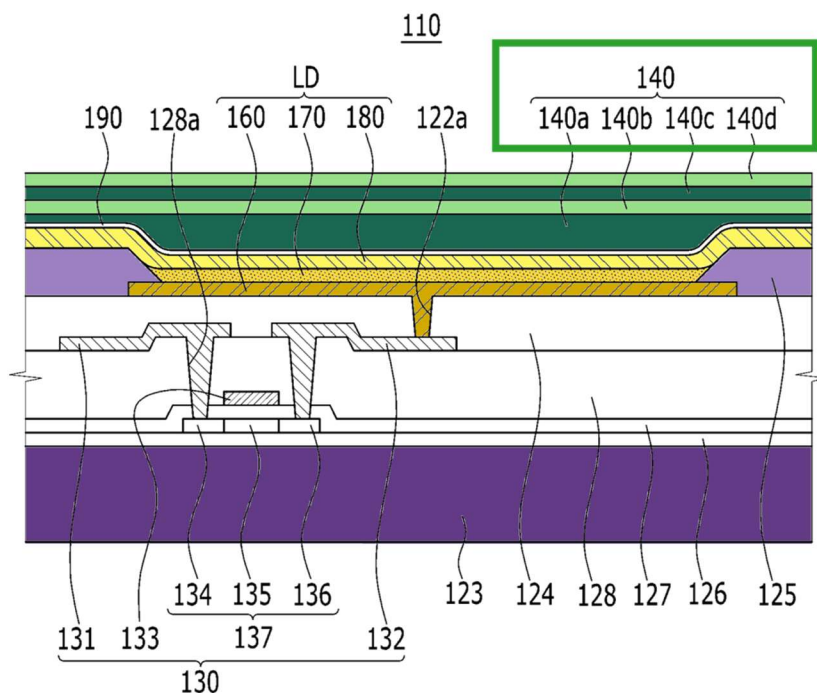
Kang651, FIG. 5

50. Below the encapsulation unit 140 are “light emitting elements (LD, Fig. 4) [(all shades of yellow)] disposed on a substrate (123) [(dark purple)]” *Id.*, 148. Kang651 also discloses pixel defining layer 125 (i.e., banks) (light purple) that

exposes the pixel electrode 160, which is an anode, in an emission region. Kang651,

¶[0059], Fig. 4.

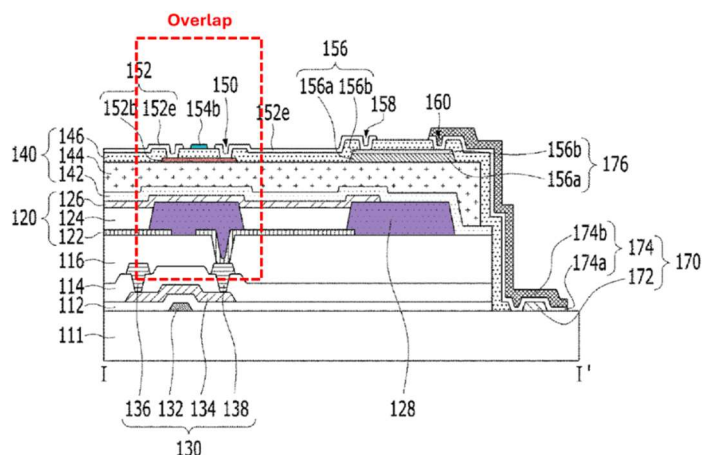
FIG. 4



Kang651, FIG. 4

51. The Examiner did not find prosecution claims 10 and 19 anticipated. Ex-1002, 148-152. Prosecution claim 10 added that “at least one of the first bridges or the second bridges overlaps the bank.” Ex-1002, 44.

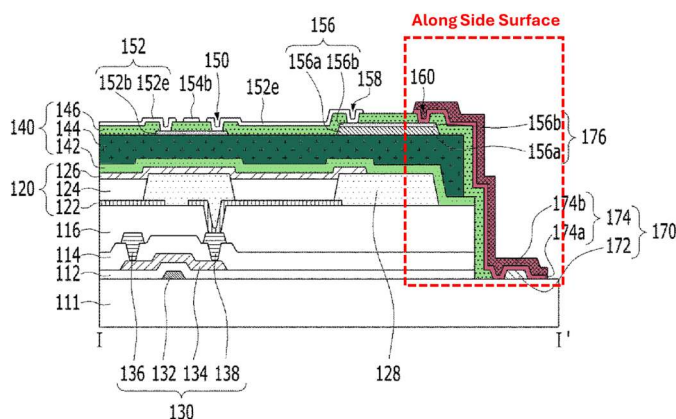
FIG.2



Ex-1001, FIG. 2

52. Prosecution claim 19 added that “the second conductive lines are disposed along a side surface of the encapsulation unit.” Ex-1002, 46.

FIG.2



Ex-1001, FIG. 2

53. The rewriting of these claims into independent form led to allowance. Ex-1002, 251-258, 262-269. However, in my opinion, the Examiner failed to

[The '394 Patent]

appreciate that even the features from the dependent claims added to secure allowance were known in the prior art, as I explain in detail below.

54. Nothing in the prosecution history changes my opinions expressed in this declaration.

C. Person of Ordinary Skill in the Art

55. As discussed above, I have been informed that patentability must be analyzed from the perspective of “one of ordinary skill in the art” in the same field as the ’394 patent at the time of the invention.

56. In my opinion, a person of ordinary skill in the art pertinent to the ’394 patent as of its earliest priority date would have had at least a four-year undergraduate degree in electrical engineering or physics or a closely related field and four years of experience in the design and implementation of flat panel display devices or components thereof. Additional education could substitute for professional experience and significant work experience could substitute for formal education. Although I surpass this definition of one of ordinary skill in the art now and at the priority date of the ’394 patent, my analysis regarding the ’394 patent has been based on the perspective of one ordinary skill in the art as of the priority date of the ’394 patent.

57. I am also familiar with the knowledge of the person of ordinary skill in the art as of the priority date of the ’394 patent. I am able to opine on how the person [The ’394 Patent]

of ordinary skill in the art would have understood the disclosure and claims of the '394 patent, the disclosures of the prior art, the motivation to combine the prior art, and what combinations would have been obvious to one of ordinary skill in the art.

VI. CLAIM CONSTRUCTION OF TERMS OF THE '394 PATENT

58. As I discussed above, I have been informed that for purposes of *inter-partes* reviews, the standard for claim construction of terms within the claims of the patent is the same as that applied in federal district court litigation.

59. I have been asked for purposes of this declaration to assume that the preamble of independent claims 1 and 19 are limiting. I have been asked to assume that the claims terms otherwise have their plain and ordinary meaning to a person skilled in the art in light of the specification and the prosecution history.

VII. SUMMARY OF OPINIONS ON UNPATENTABILITY

60. In my opinion, the challenged claims are unpatentable based on combinations of prior art.

61. In the analysis that follows, I identify the following combinations of prior art that, in my opinion, render obvious the '394 patent claims:

Ground	Claim(s) Challenged	35 U.S.C. §	Reference(s)
1	1-4, 6-8	103	Kwon224, Kim524
2	9-16, 18	103	Kwon224, Kim524, Zhu837
3	5	103	Kwon224, Kim524, Jang513

[Claim Construction of Terms of the '394 patent]

Ground	Claim(s) Challenged	35 U.S.C. §	Reference(s)
4	17	103	Kwon224, Kim524, Kim481
5	19	103	Kim481, Kim524

VIII. THE CHALLENGED CLAIMS ARE UNPATENTABLE

A. Ground 1: The Combination of Kwon224 and Kim524 Renders Obvious Claims 1-4, 6-8 and 18.

1. Kwon224 Overview

62. Like the '394 patent, Kwon224 also describes an “organic light emitting display having” two conductive layers of touch sensors. The first conductive layer is shown in Figure 9A, which is annotated below. This shows that the first conductive layer is deposited first and includes “**sensing parts SP1**” of the “first touch electrodes TE1” (**brick red**), “**connecting parts CP1**” (**salmon**), and **first touch signal lines SL1** (**pink**). The second conductive layer is shown in Figure 9B, which is also annotated below. This shows that the second conductive layer is deposited second and includes “**sensing parts SP2**” of the “second touch electrodes TE2” (**deep blue**), “**connecting parts CP2**” (**cyan**), and **second touch signal lines SL2** (**sky blue**). Kwon224, ¶¶[0143], [0145], [0147], [0149].

FIG. 9A

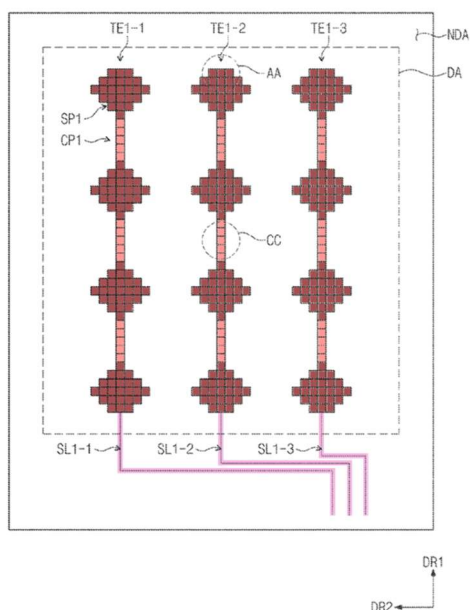
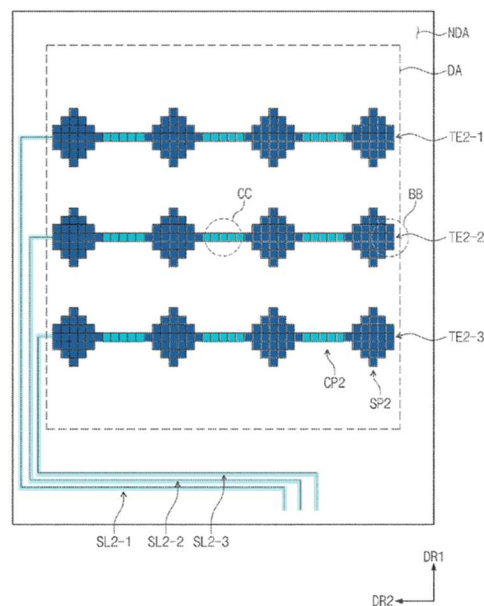


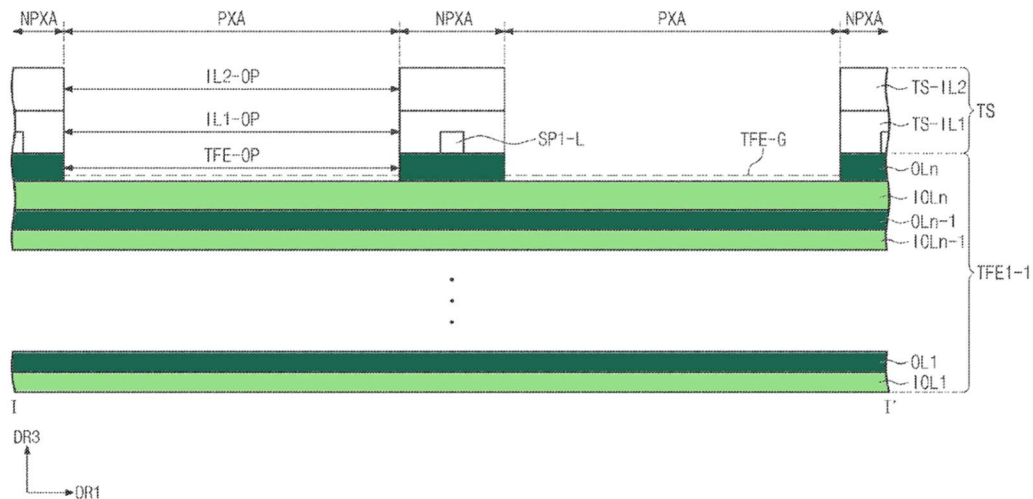
FIG. 9B



Kwon224, FIGS. 9A, 9B

63. As shown in annotated Figure 13A below, Kwon224 further discloses a thin film encapsulation layer (TFE), which includes **inorganic (lime green)** and **organic (dark green)** layers that help protect the OLEDs from moisture and foreign substances, which is a key feature of any encapsulation unit. Kwon224, ¶¶[0112], [0126], [0132], [0138]. Figure 13A shows one configuration of these layers:

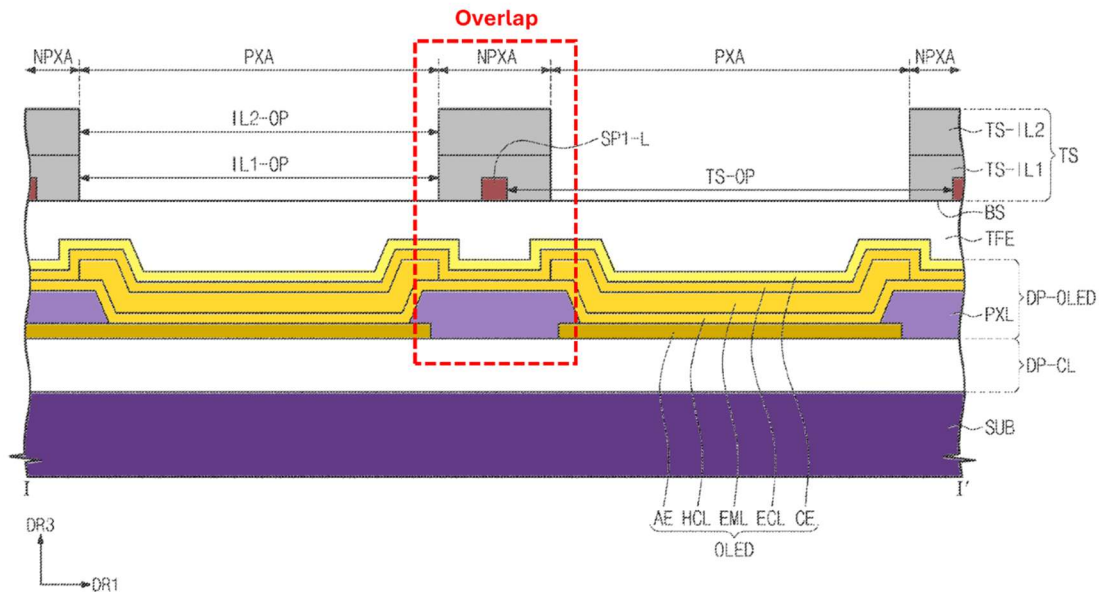
FIG. 13A



Kwon224, FIGS. 13A

64. The “first insulating layer TS-IL1” covers the first conductive layer, which includes covering the first touch signal lines SL1. Kwon224, ¶¶[0010], [0155] (“Although not shown in figures, the first insulating layer TS-IL1 may cover the first connecting part CP1 and the first touch signal lines SL1-1, SL1-2, and SL1-3.”). As shown in the annotated figure below, the second conductive layer, including the **second touch electrodes TE2 (deep blue)** and any touch signal lines in this layer, are deposited on top of TS-IL1 layer and above the **TFE layer (green)**.

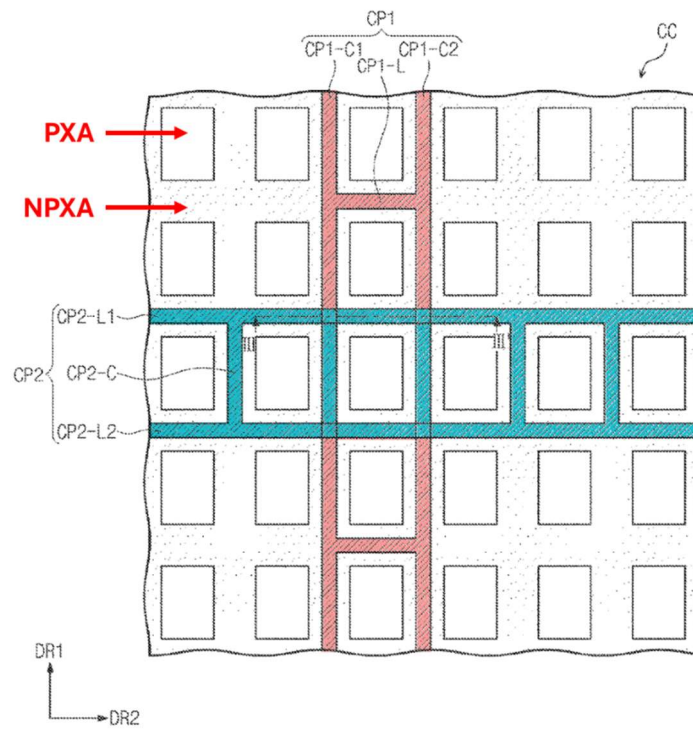
FIG. 10B



Kwon224, FIGS. 10B

66. Annotated Figure 12A below provides additional context regarding the positional relationship between the PXL layers and the connecting parts. Specifically, as shown in the Figure 12A below, because **connected parts CP1 (salmon)** and **connected parts CP2 (cyan)** are entirely within the NPXA region, the PXL layers overlap these connected parts.

FIG. 12A



Kwon224, FIGS. 12A

2. Kim524 Overview

67. Like the '394 patent and Kwon224, Kim524 also discloses an “organic light emitting display having touch sensors.” Specifically Kim524 describes an “organic light emitting diode display” with two conductive “touch active” layers of touch sensors. As shown in Figure 6, the touch active layer includes touch sensors comprising lower and upper layers. Below is a comparison of the original Figure 6 and an annotated version that identifies specific elements. For example, the annotated version shows that the lower layer includes first set of **touch electrodes 411 (brick red)**, connecting portions **412 (salmon)**, first lower **touch signal lines** [The Challenged Claims Are Unpatentable]

415 (pink), and second lower **touch signal lines 416 (navy blue)**. The figure further shows that the upper layer includes second set of **touch electrodes 421 (deep blue)**, **connecting portions 422 (cyan)**, **second upper touch signal lines 426 (sky blue)**, and first upper **touch signal lines 425 (magenta)**. Kim524, ¶¶[0078-80]. In between both layers—including the upper and lower signal lines—is **an insulating layer 430 that is made of inorganic material (lime green)**. *Id.*, ¶¶[0078] (“Touch electrode layer 400 includes first touch electrode layer 410 and second touch electrode layer 420, with insulating layer 430 formed therebetween ... The insulating layer may be made of silicon oxide (SiO_x), silicon nitride (SiN_x), silicon oxynitride (SiO_xN_y), etc.”), [0074] (“In exemplary embodiments, the inorganic layer may include any one of silicon nitride (SiN_x), aluminum oxide (AlO_x), silicon oxide (SiO_x), and titanium oxide (TiO_x)”).

FIG. 6

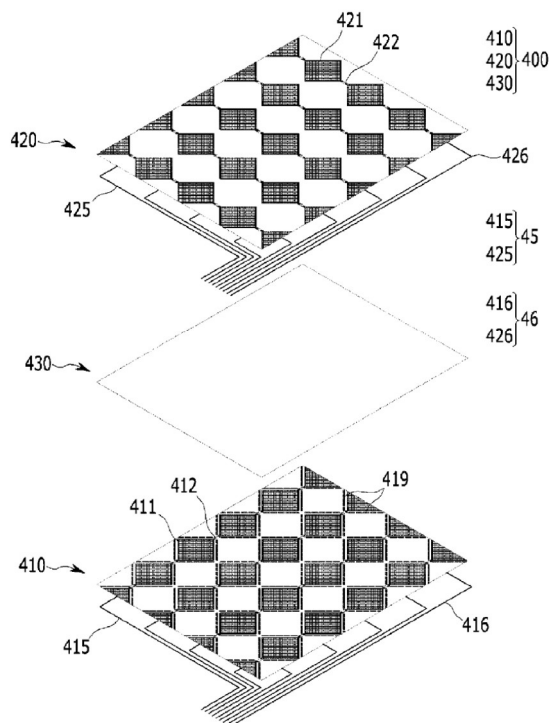
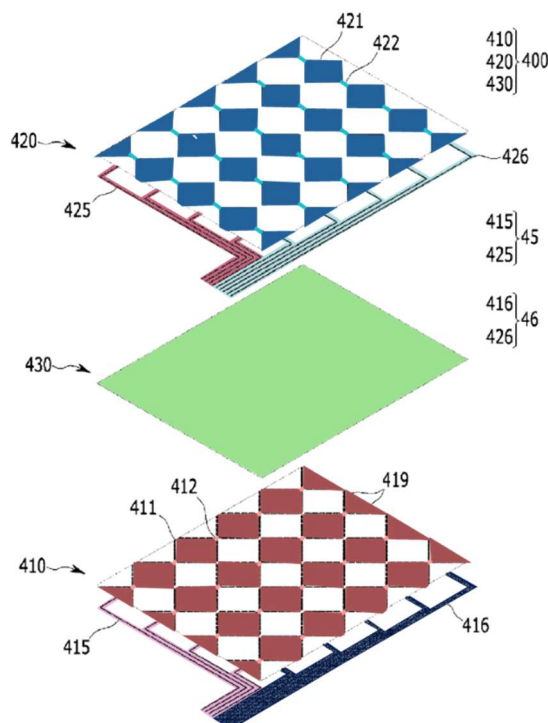


FIG. 6



Kim524, FIG. 6 (Unannotated Left)

68. Figure 10 provides additional context regarding the conductive lines. Specifically, as shown in the annotated version of Figure 10 below on the left, the stacked signal line configuration, which discloses the upper signal lines connecting to the lower signal lines through contact holes 435 created in the inorganic insulating layer 430. *Id.*, ¶[0084]. Figure 10 shows one set of conductive lines—specifically lines 416 and 426. However, the same applies to the other set of conductive lines. *Id.* (“First lower touch signal lines 415 are connected with first upper touch signal lines 425 formed to overlap with first lower touch signal lines 415 to form respective first touch signal lines 45, and second upper touch signal lines 426 are connected [The Challenged Claims Are Unpatentable]

with second lower touch signal lines 416 to form respective second touch signal lines 46. Connection of upper touch signal lines 425 and 426 to lower touch signal lines 415 and 416 may be, performed by contacting upper touch signal lines 425 and 426 and lower touch signal lines 415 and 416 through contact holes 435 in insulating layer 430 as illustrated in FIG. 10.”). Thus, the modified, annotated version of Figure 10 show below to the right is an accurate representation of lines 415 and 425, which have the same stacked configuration.

FIG. 10

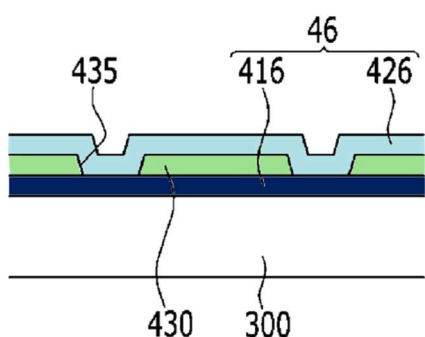
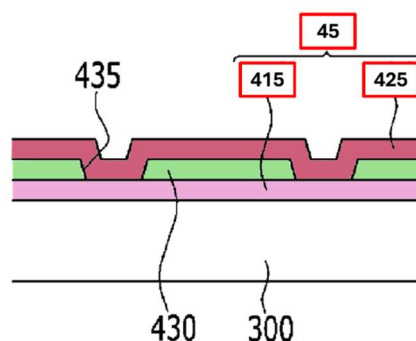


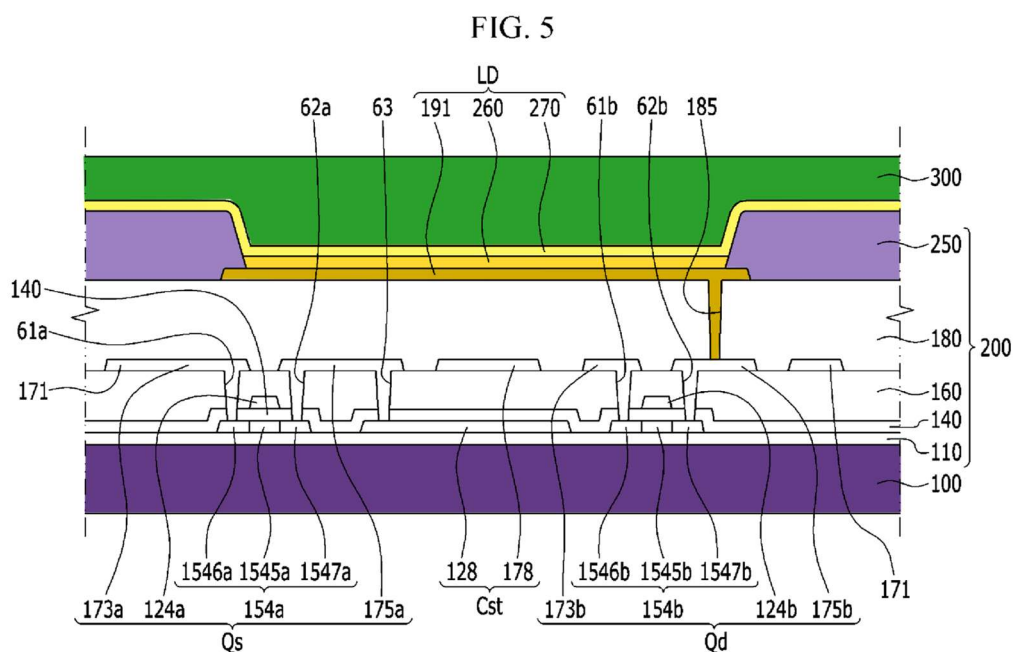
FIG. 10



Kim524, FIG. 10 (modified right)

69. Figure 5 provides additional context. As the annotated version of this figure below shows, underneath the touch active layer, the device includes a display layer 200 comprising an **encapsulation layer 300 (green)** including inorganic and organic layers, **light emitting devices LD (all shades of yellow)**, a **substrate 100 (dark purple)**, and a touch active layer 400. *Id.*, ¶¶[0050], [0067], [0073-74]. The [The Challenged Claims Are Unpatentable]

display layer further includes **pixel defining layer 250 (light purple)** that exposes anodes and provides an emission region, just like the claimed bank. *Id.*, ¶¶[0069-70] (“Pixel defining layer 250 has an opening exposing pixel electrode 191. In a plan view, a region where pixel defining layer 250 is formed corresponds to a non-pixel area, and the opening by which pixel electrode 191 is exposed may correspond to a pixel area ... In the opening of pixel defining layer 250, organic emission layer 260 is disposed on pixel electrode 191.”).



Kim524, FIG. 5

70. Kim524 discloses a stacked signal line configuration, as shown in Figure 10.

[The Challenged Claims Are Unpatentable]

3. Kwon224 and Kim524 are Analogous Art

71. In my opinion, a person of ordinary skill in the art would have found it obvious to combine Kwon224 and Kim524. As I explain below, these references disclose complementary systems/methods in the field for fabricating OLED touchscreens, analogous to the '394 patent and each other. *Compare* Sections V.A, VIII.A.1-2. All three similarly disclose touch sensors and display panel layers, that work together to provide OLED touch screens. *Id.* For example, the '394 patent, Kwon224, and Kim524 all have light emitting elements above a substrate, with an encapsulation unit on the light emitting elements, and touch sensor components above the encapsulation unit. *Id.*

72. Further, all three address similar problems. The '394 patent explains that conventional touchscreens, when attached to the front surface of a display panel, increase the overall thickness, complicate the manufacturing process, and make it difficult to achieve flexibility and high transmittance. Ex-1001, 1:41-48. The '394 patent addresses these problems by a specific fabrication process: integrating touch sensors with the display layer, thereby achieving weight reduction, slimming, improved flexibility, and process simplification without the need for a separate dedicated insulating layer between the display panel and touch sensor layer or an attachment process. *Id.*, 2:1-17.

[The Challenged Claims Are Unpatentable]

73. In my opinion, Kwon224 and Kim524 address similar problems directed toward integrating touch sensor layers with the display panel. For example, Kwon224 addresses the same class of integration challenges as the '394 patent, noting that conventional display devices with touch sensors can suffer from increased thickness, reduced flexibility, and electrode cracking. Kwon224, ¶¶[0006], [0010] (explaining that the display device includes the touch screen), [0139]-[0140], [0162] (explaining the touch electrode configuration helps reduce cracking issues), Figs. 9A-11B. These disclosures show that Kwon224 provides a solution by integrating mesh-structured touch electrodes directly onto the display panel, which improves flexibility, reduces mechanical stress, and prevents electrode cracking during bending. *Id.*

74. Likewise, Kim524, addresses a closely related aspect of the integration problem: the increase in parasitic capacitance and reduction in touch sensitivity that can occur when touch electrodes are placed close to display electrodes in a compact, integrated structure. Kim524, ¶¶[0006-7] (However, due to the parasitic capacitance generated between the touch electrode and the electrode of the display panel, sensitivity of the sensor may deteriorate. Parasitic capacitance also becomes a problem as the distance between the touch electrode and the electrode in the display panel is decreased.”), [0090]. Kim524 provides a fabrication solution—forming the touch electrodes with a mesh pattern of varying density, which reduces parasitic

[The Challenged Claims Are Unpatentable]

capacitance while maintaining mutual capacitance and touch sensitivity. *Id.*, ¶¶[0033] (“According to exemplary embodiments, since parasitic capacitance may be reduced without influencing the mutual capacitance between the touch electrodes, it is possible to improve sensitivity performance of the touch sensor.”), [0088], [0091-93] (“Since the capacitance is proportional to the area of the electrode, the area occupied by the metal line (that is, the density of the mesh pattern) is reduced even while the size of first and second touch electrodes 411 and 421 is maintained, thereby reducing parasitic capacitance. On the other hand, when the area of first and second touch electrodes 411 and 421 is decreased, the mutual capacitance between first and second touch electrodes 411 and 421 may be decreased.”). This approach also supports mechanical flexibility and reliability, as the mesh structure is less prone to cracking than conventional transparent electrodes. *Id.*, ¶[0088] (“In a transparent electrode such as indium tin oxide (ITO) and indium zinc oxide (IZO), a defect such as a crack may occur when a flexible display device is implemented. In the case of the metal mesh, since the flexibility may be better than a transparent electrode, it is advantageous for use in a flexible display device.”).

75. Thus, it is my opinion that, given that Kwon²²⁴ and Kim⁵²⁴ disclose similar systems that operate in a similar manner and are directed to similar problems, a person of ordinary skill in the art would have been motivated to consider their

combined teachings. Additional rationale for the combination is provided below for specific claim elements.

4. Independent Claim 1

a. 1[pre]: “An organic light emitting display comprising:”

76. If the preamble is limiting, it is my opinion that Kwon224 discloses 1[pre].

77. For example, Kwon224 discloses a “flexible display device [that] include[es] a display panel [DP]” and “touch screen.” Kwon224, ¶[0010]. “The display panel DP [is] an organic light emitting display panel.” *Id.*, ¶[0095]. Thus, it is my opinion that a person of ordinary skill in the art would have understood Kwon224’s flexible display device with an organic light emitting display panel constitutes an organic light emitting display.

78. Kwon224 describes the display device in Figures 9A-9B, which provide plan views from the top “showing conductive layers of a touch screen.” Kwon224, ¶¶[0003], [0027], Figs. 9A-9B; *see also id.*, ¶¶[0162-163].

FIG. 9A

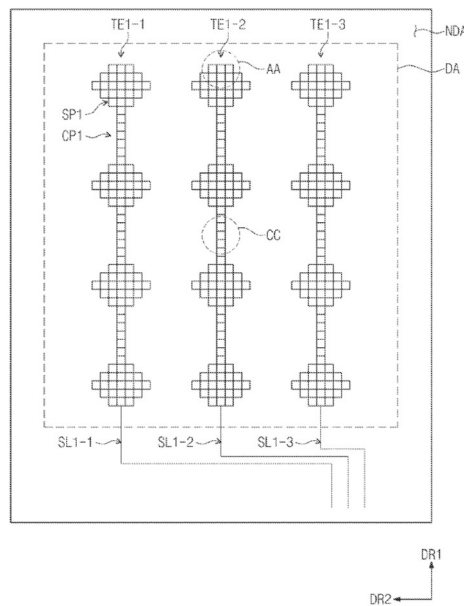
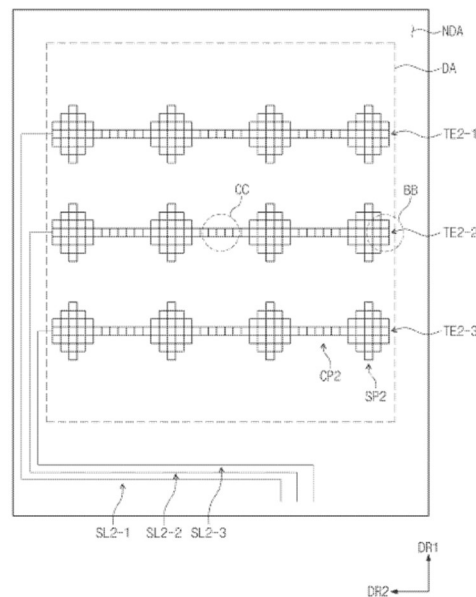


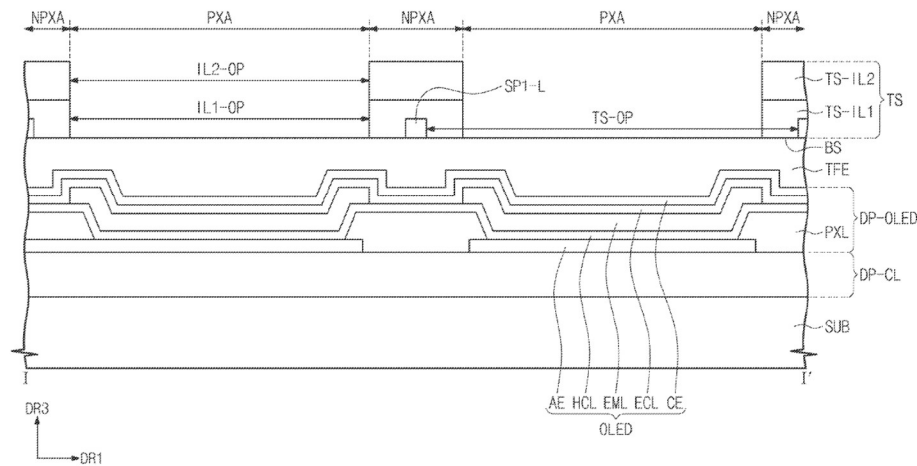
FIG. 9B



Kwon224, FIGS. 9A, 9B (Plan View)

79. Figure 10B shows another view of the device in Figures 9A-9B, specifically depicting various layers of the device. Kwon224, Fig. 10B (showing a cross-sectional view showing a portion of Fig. 9A within the area designated “AA.”), ¶[0029]; *see id.*, ¶[0028], Fig. 10A. Specifically, Figure 10B shows that the device includes the following layers: the touch screen layer (TS), a thin film encapsulation layer (TFE), an organic light emitting device layer (DP-OLED), a circuit layer (DP-CL), and a substrate (SUB). *See id.*, ¶¶ [0141], [0155]; *see id.*, ¶[0112].

FIG. 10B



Kwon224, FIG. 10B (Cross-Section)

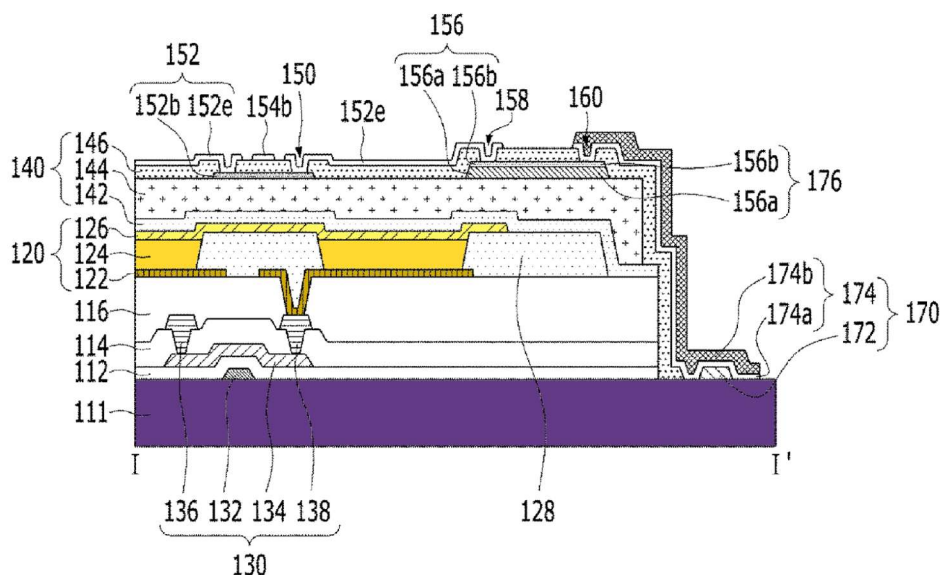
80. Therefore, in my opinion, Kwon224 discloses 1[pre] because it discloses an organic light emitting display (i.e., Kwon224's display device with an organic light emitting display panel).

b. 1[a]: “light emitting elements disposed on a substrate;”

81. In my opinion, Kwon224 discloses 1[a].

82. For example, Kwon224's Figure 10B, which is annotated below, discloses **organic light emitting devices (OLEDs)** (all shades of yellow) that are part of the organic light emitting device layer (DP-OLED) and disposed on a **substrate** (dark purple). Kwon224, Fig. 10B, ¶¶[0122-123], [0112-113]; *see id.*, ¶[0106].

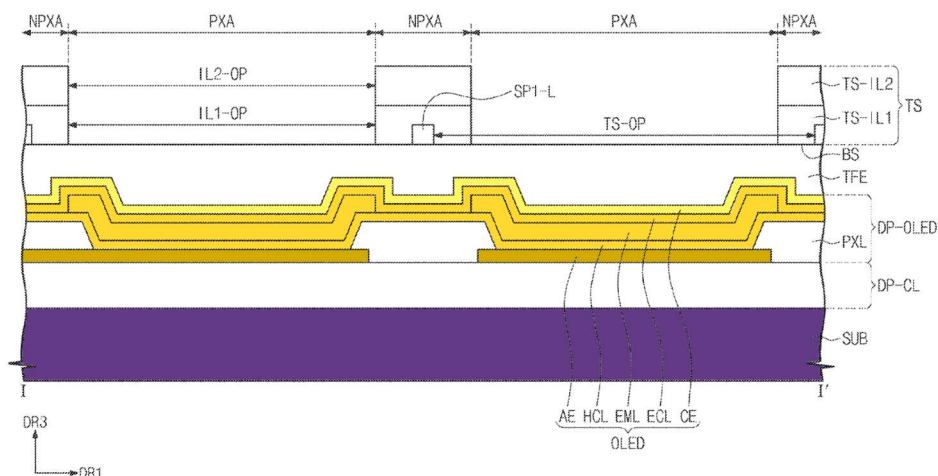
FIG.2



'394 Patent, FIG. 2

85. Kwon224's OLEDs (all shades of yellow) are similarly disposed on substrate SUB (dark purple):

FIG. 10B

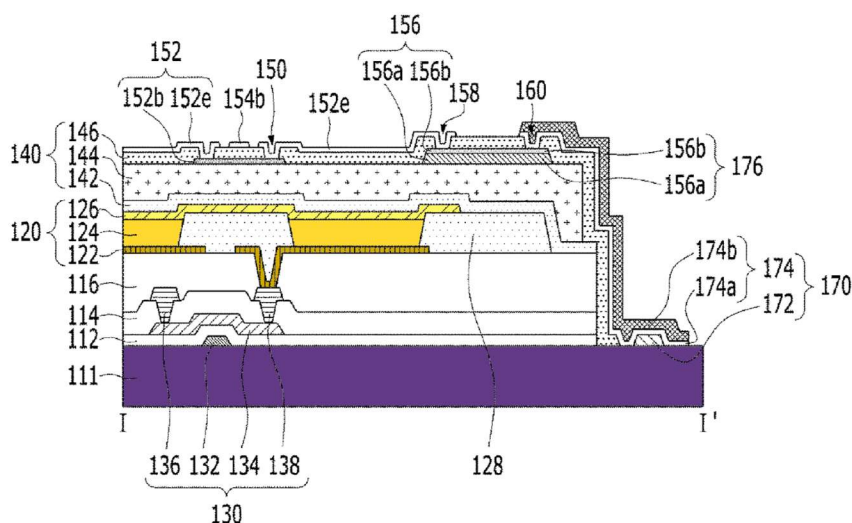


Kwon224, FIG. 10B

[The Challenged Claims Are Unpatentable]

86. In the '394 patent, each time the positional relationship between the light emitting elements and the substrate is described, there are intervening elements and layers in between. *See* EX-1001, 3:1-33; *see also* Ex-1001, 6:44-52, 8:14-28, 9:23-33, 11:9-21, 12:23-33 (explaining that the subsequent figures are “the same” as Figs. 1 and 2 except where noted, and that the transistors are present even if omitted as unnecessarily repetitious):

FIG. 2



'394 Patent, FIG. 2

87. Therefore, in my opinion, Kwon224 discloses 1[a] because it discloses light emitting elements (i.e., OLEDs) disposed on a substrate (i.e., substrate SUB).

c. 1[b]: “an encapsulation unit disposed on the light emitting elements;”

88. In my opinion, Kwon224 discloses 1[b].

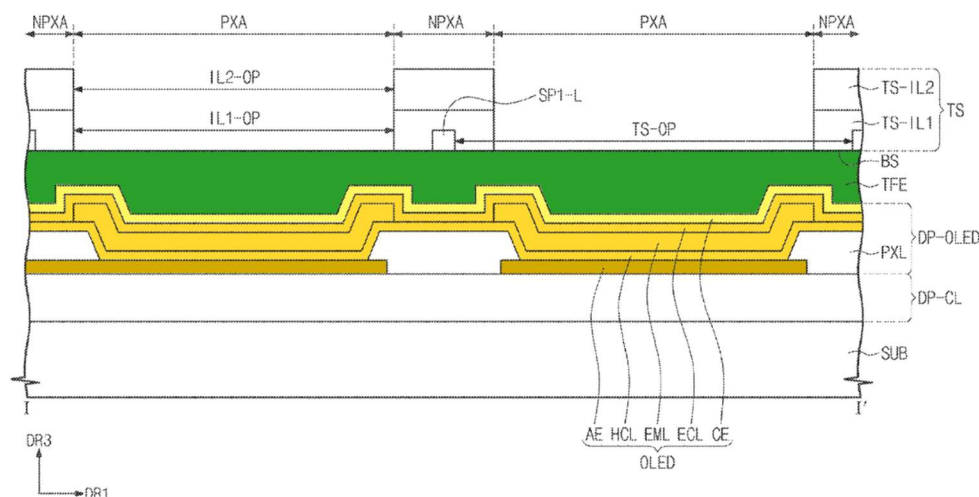
[The Challenged Claims Are Unpatentable]

89. Kwon224 discloses a thin film encapsulation layer (TFE). It is my opinion that a person of ordinary skill in the art would have understood the TFE layer as the claimed encapsulation unit, as detailed below. Kwon224, ¶¶[0123] (“The thin film encapsulation layer TFE may protect the organic light emitting device OLED from moisture and foreign substance.”), [0155], Fig. 10B.

90. The thin film encapsulation layer (TFE) is disposed on Kwon224’s OLEDs, thus satisfying 1[b]. *Id.*, ¶[0123].

91. As shown in the annotated Figure 10B below, Kwon224 shows a **thin film encapsulation layer (TFE) (green)** disposed on **OLEDs (all shades of yellow)**. Kwon224, ¶[0155], Fig. 10B; *see* Section VIII.A.4.b (explaining that the OLEDs are the claimed light emitting elements).

FIG. 10B



Kwon224, FIG. 10B

[The Challenged Claims Are Unpatentable]

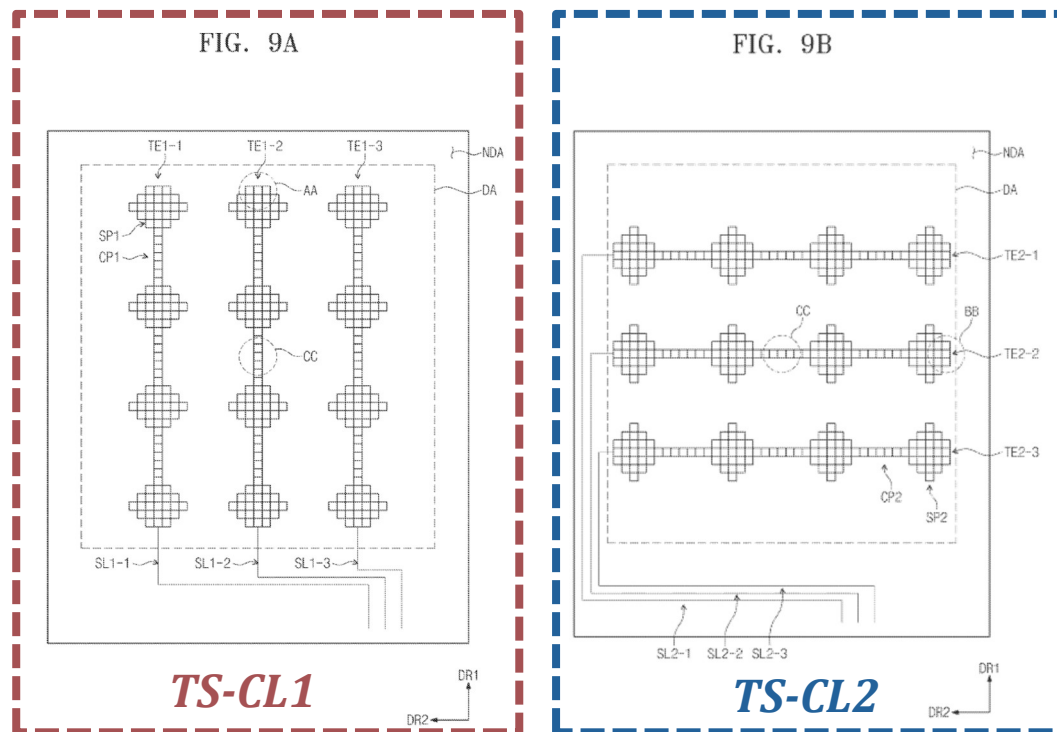
92. The thin film encapsulation layer (TFE) is the claimed encapsulation unit. The '394 patent provides helpful context. Specifically, it explains that the encapsulation unit 140 “prevents external moisture or oxygen from penetrating through the light emitting element 120” and in a preferred embodiment includes at least two inorganic encapsulation layers and at least one organic encapsulation layer. Ex-1001, 3:34-44, Fig. 2. Kwon224’s thin film encapsulation layer (TFE) serves the same purpose: to “protect the organic light emitting device OLED from moisture and foreign substance.” Kwon224, ¶¶[0112], [0126], [0123].

93. Thus, in my opinion, a person of ordinary skill in the art would have understood that the thin film encapsulation layer (TFE) is the claimed encapsulation unit. Therefore, in my opinion, Kwon224 discloses 1[b] because it discloses an encapsulation unit (i.e., the TFE layer) disposed on the light emitting elements (i.e., the OLEDs).

- d. **1[c]: “touch sensors disposed on the encapsulation unit, the touch sensors including: a plurality of first touch electrodes and a plurality of second touch electrodes, first bridges configured to connect the first touch electrodes, and second bridges configured to connect the second touch electrodes”**

94. In my opinion, Kwon224 discloses 1[c]. Kwon224, ¶¶[0139], [0142], [0151].

95. For example, Kwon224 discloses a “first conductive layer TS-CL1” and “second conductive layer TS-CL2” and a skilled artisan would have understood that these layers constitute the claimed touch sensors. Kwon224, ¶¶[0136-137]. Figures 9A-9B below show these conductive layers. Kwon224, ¶[0142] (“the first conductive patterns of FIG. 9A may correspond to the first conductive layer TS-CL1 ... the second conductive patterns of FIG. 9B may correspond to the second conductive layer TS-CL2”).



Kwon224, FIGS. 9A, 9B

96. As shown below, annotated Figure 9A illustrates “sensing parts SP1” of the “first touch electrodes TE1-1, TE1-2, and TE1-3” (brick red) and annotated Figure 9B illustrates the “sensing parts SP2” of the “second touch electrodes TE2-1, TE2-2, and TE2-3” (blue). [The Challenged Claims Are Unpatentable]

1, TE2-2, and TE2-3” (deep blue). Kwon224, ¶¶[0143], [0147]. The sensing parts SP1 are connected together by “connected parts CP1” (salmon) and the sensing parts SP2 are connected together by “connected parts CP2” (cyan). Kwon224, ¶¶[0145] (“Each of the first connecting parts CP1 may connect two first sensing parts SP1 adjacent to each other among the first sensing parts SP1.”), [0149] (“Each of the second connecting parts CP2 may connect two second sensing parts SP2 adjacent to each other among the second sensing parts SP2”).

FIG. 9A

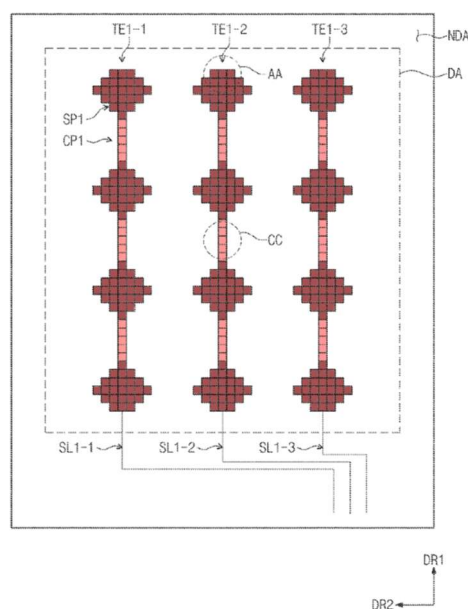
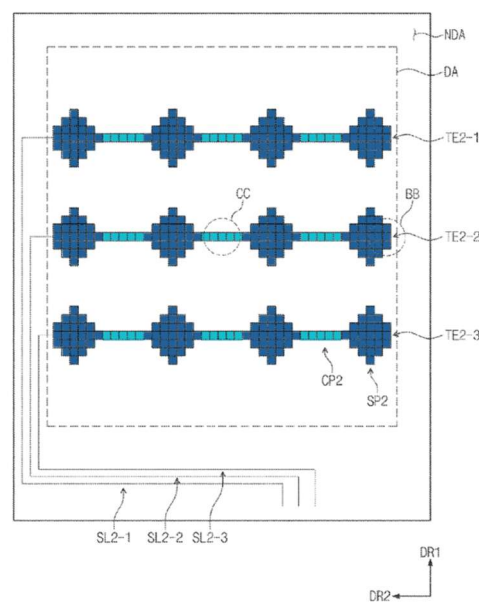


FIG. 9B



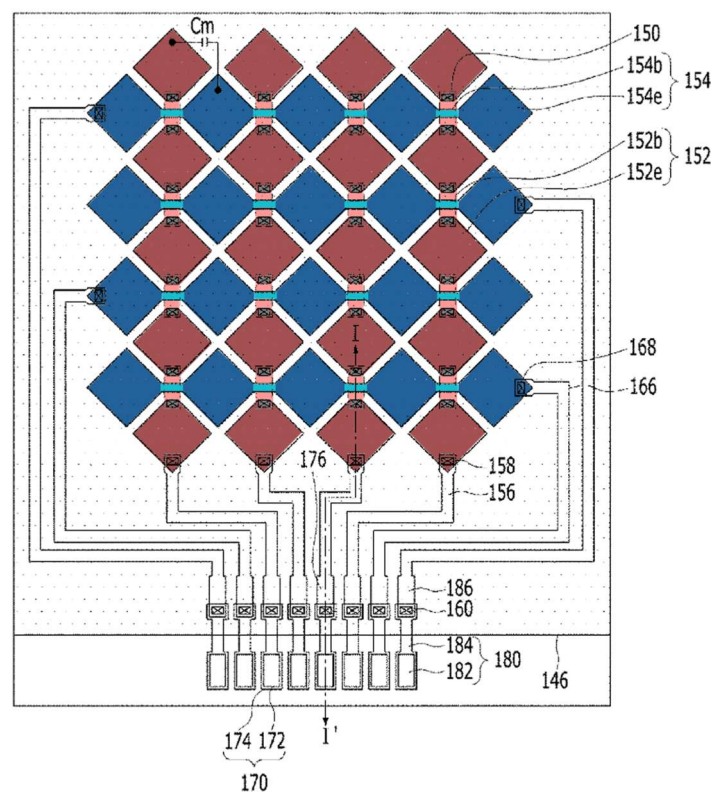
Kwon224, FIGS. 9A, 9B

97. Consequently, it is my opinion that a person of ordinary skill in the art would have understood that Kwon224 discloses the claimed touch sensors.

[The Challenged Claims Are Unpatentable]

98. The '394 patent confirms this point. It explains that Kwon224 discloses the claimed touch sensors for two reasons. First, Kwon224's disclosure of touch sensors in Figures 9A-9B is consistent with the '394 patent's disclosure in Figure 1, which is reproduced and annotated below. Figure 1 shows the touch driving lines 152e (i.e., **first touch electrodes**) (**brick red**), touch sensing lines 154e (i.e., **second touch electrodes**) (**deep blue**), first bridges 152b (**salmon**) connecting the first touch electrodes, and **second bridges 154b (cyan)** connecting the second touch electrodes. Ex-1001, 4:31-33, 4:47-49, 4:64-5:5.

FIG.1



'394 Patent, FIG. 1

[The Challenged Claims Are Unpatentable]

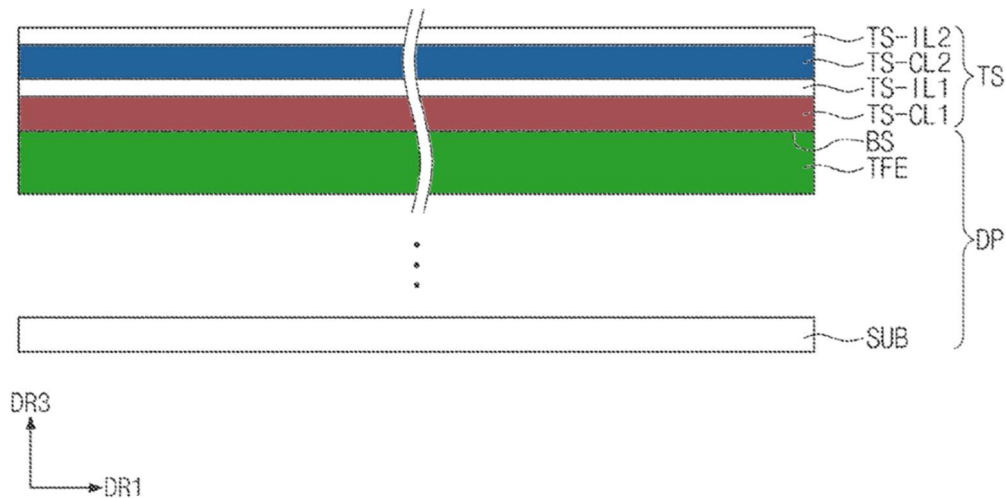
99. Second, the '394 patent describes a touch sensor based on mutual capacitance. Specifically, it explains that mutual capacitance (C_m) is established between a touch driving line 152 and a touch sensing line 154. Ex-1001, 4:64-5:5 (“Since the touch sensing lines 154 and the touch driving lines 152 intersect each other with the organic encapsulation layer 144 interposed therebetween, mutual capacitances C_m are formed at the intersections between the touch sensing lines 154 and the touch driving lines 152.”). It further explain that a touch driving pulse charges the driving line 152, and the resulting change in capacitance is transferred to the sensing line 154, allowing the system to detect the presence and location of a touch. *Id.* (“Therefore, the mutual capacitance C_m is charged with charges by a touch driving pulse supplied to the touch driving line 152 and discharges the charges to the touch sensing line 154, thus serving as a touch sensor.”).

100. Kwon224, in my opinion, similarly discloses a capacitive touch sensor architecture. Specifically, Figures 9A–9B illustrate a “two-layer electrostatic capacitive touch screen” capable of detecting touch events using either self-capacitance or mutual capacitance modes. Kwon224, ¶[0142]. In particular, Kwon224 explains that the first touch electrodes are “capacitively coupled to the second touch electrodes,” and that “when sensing signals are applied to the first touch electrodes, capacitors may be formed between the first sensing parts and the second sensing parts.” *Id.*, ¶[0151], [0278]. Kwon224 further reads out the resulting [The Challenged Claims Are Unpatentable]

touch signals from the second electrodes (*id.*, ¶[0220])—and a skilled artisan would have understood that this functionally mirrors the charge/discharge behavior described in the '394 patent. Thus, a skilled artisan would have understand that Kwon224's capacitive coupling mechanism aligns with the mutual capacitance principle described in the '394 patent, indicating that both disclosures rely on similar touch sensing methodologies—one that forms mutual capacitances C_m at the intersections between the touch electrodes

101. Lastly, as shown in annotated Figure 8 below, Kwon224's first conductive layer (TS-CL1) and second conductive layer (TS-CL2) are disposed on the thin film encapsulation layer (TFE). Kwon224, ¶[0139]; *see* Section VIII.A.4.c (explaining in that the TFE layer is the claimed encapsulation unit), Section VII.A.4.b.

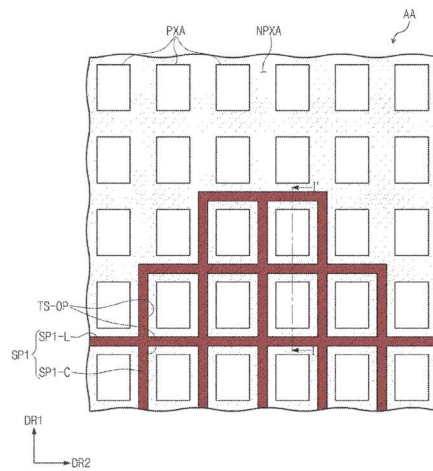
FIG. 8A



Kwon224, FIG. 8A

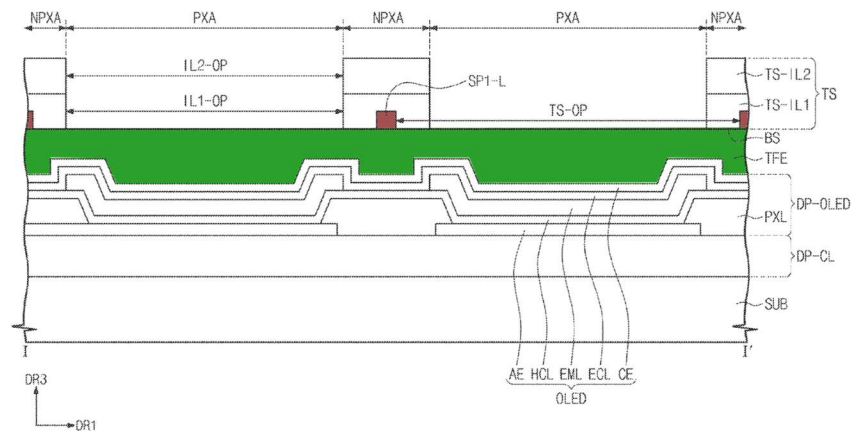
102. Additional Kwon224 figures further show the touch sensors disposed on the TFE layer. For example, annotated Figures 10A-10B provided below show that sensing parts SP1, which are part of the first touch electrodes, are disposed on the TFE. Kwon224, ¶[0145].

FIG. 10A



Kwon224, FIG. 10A

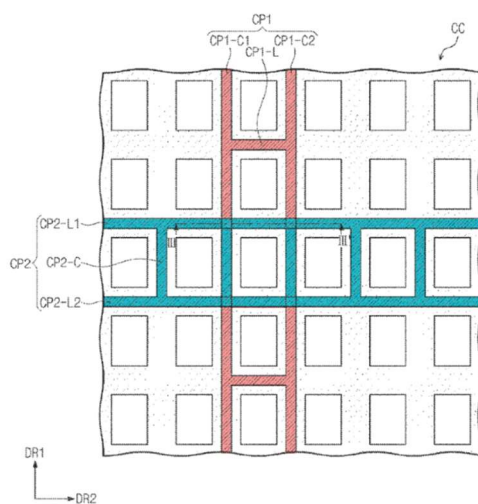
FIG. 10B



Kwon224, FIG. 10B

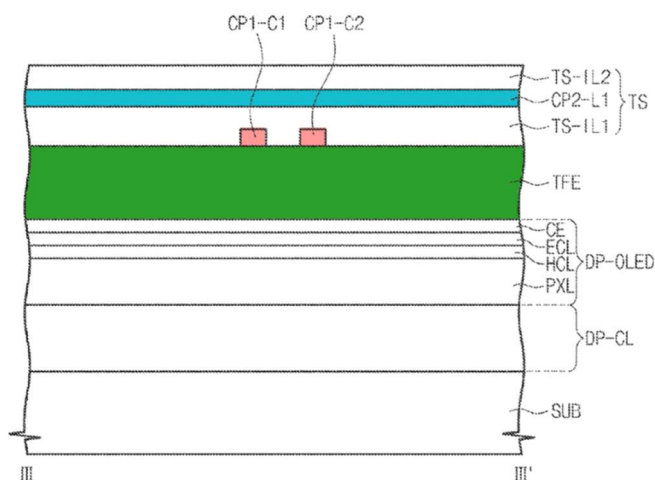
103. Additionally, Figures 12A-12B below show that connecting parts CP1 are disposed on the TFE.

FIG. 12A



Kwon224, FIG. 12A

FIG. 12B



Kwon224, FIG. 12B

104. Therefore, in my opinion, Kwon224 discloses 1[c] because it discloses touch sensors (i.e., “first conductive layer TS-CL1” and “second conductive layer TS-CL2”) disposed on the encapsulation unit (i.e., TFE layer), and the touch sensors [The Challenged Claims Are Unpatentable]

include a plurality of first touch electrodes (i.e., sensing parts SP1 of the first touch electrodes TE1) and a plurality of second touch electrodes (i.e., sensing parts SP2 of the second touch electrodes TE2), first bridges (i.e., connected parts CP1) configured to connect the first touch electrodes, and second bridges (i.e., connected parts CP2) configured to connect the second touch electrodes.

e. 1[d]: “first conductive lines connected to the touch sensors:”

105. In my opinion, Kwon224 discloses 1[d].

106. For example, Kwon224 discloses **first touch signal lines SL1-1, SL-2, and SL1-3 (pink)** as shown in annotated Figure 9A below, and **second touch signal lines SL2-1, SL2-2, and SL2-3 (sky blue)** as shown in annotated Figure 9B below. Kwon224, ¶[0143], [0147]. A skilled artisan would have understood that either set of touch signal lines constitute the claimed “first conductive lines.”

FIG. 9A

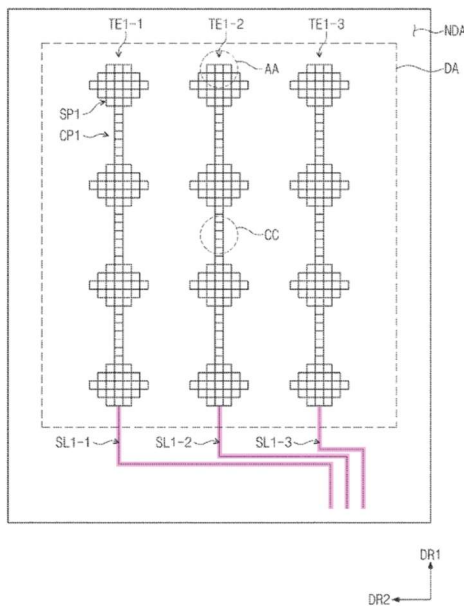
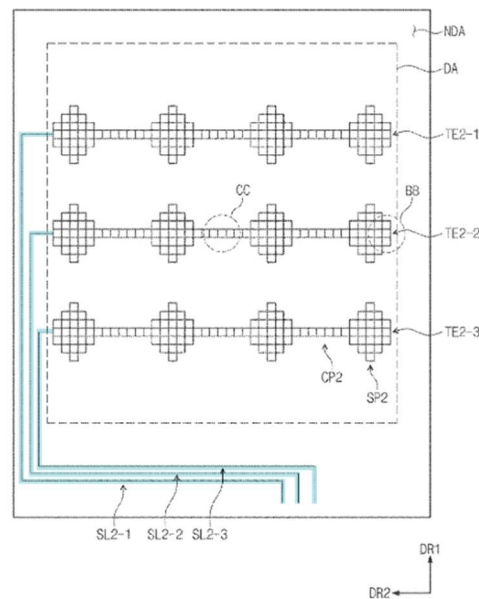


FIG. 9B



Kwon224, FIGS. 9A, 9B

107. Further, as shown by the figures above, the first and second touch signal lines are connected to the touch sensors. Kwon224 also explains that the first and second touch signal lines are connected to the first and second touch electrodes, respectively. Kwon224, ¶¶[0143] (“FIG. 9A shows an example of three first touch electrodes TE1-1, TE1-2, and TE1-3 connected to first touch signal lines SL1-1, SL-2, and SL1-3.”), [0147] (“FIG. 9B shows an example of three second touch electrodes TE2-1, TE2-2, and TE2-3 connected to second touch signal lines SL2-1, SL2-2, and SL2-3.”); *see* Section VIII.A.4.d (explaining the touch sensors include the touch electrodes).

[The Challenged Claims Are Unpatentable]

108. Therefore, in my opinion, Kwon224 discloses 1[d] because it discloses first conductive lines (i.e., first and/or second touch signal lines SL1 and SL2) connected to the touch sensors (i.e., the first and second touch electrodes TE1 and TE2 portion of Kwon224's touch sensors).

f. 1[e]: “second conductive lines connected to the first conductive lines;”

109. In my opinion, Kwon224 and Kim524 render obvious 1[e].

110. For example, as annotated Figures 9A-9B show, Kwon224 discloses first conductive lines (i.e., first touch signal lines SL1 (pink) and second touch signal lines SL2 (sky blue)). See Section VIII.A.4.e (describing how Kwon224 discloses these conductive lines).

FIG. 9A

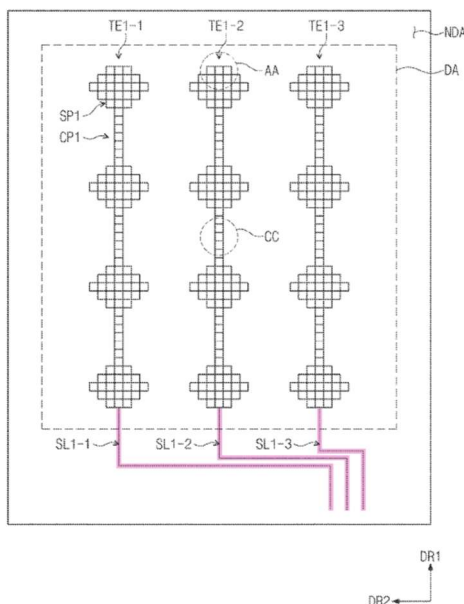
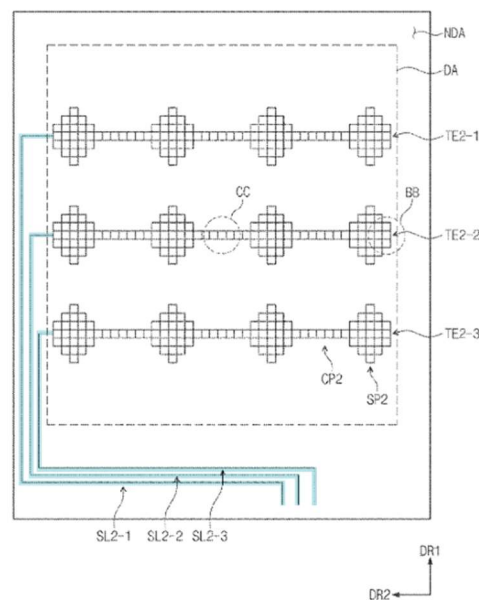


FIG. 9B



Kwon224, FIGS. 9A, 9B

[The Challenged Claims Are Unpatentable]

111. In reviewing Kwon224, a skilled artisan would appreciate that the reference provides limited details on the vertical structure of the touch signal lines and never provides a cross-sectional view showing this structure. The detail Kwon224 provides is that the “first insulating layer TS-IL1” covers the “first touch signal lines SL1-1, SL1-2, and SL1-3.” Kwon224, ¶[0155]. A person of ordinary skill in the art would have been encouraged to investigate touch signal structures that take advantage of this design to improve Kwon224’s device, such as those disclosed in Kim524. *Id.* Such investigation is reasonable because touch signal structures are important aspect of a touchscreen design because they serve as the communication pathways that carry the electrical signals generated by touch interactions from the sensor surface to the external device. Without these signal lines, the system would not be able to relay touch data for processing, rendering the touch screen non-functional. Thus, a skilled artisan would appreciate the importance of designing these lines and Kwon224’s lack of focus on these lines provides a prime opportunity to improve Kwon224’s device design.

112. Kim524 provides an example of an improved touch signal line design. Specifically, Kim524’s OLED touchscreen is similar to Kwon224’s and, as explained below, Kim524 details touch signal lines, showing a vertical arrangement that reveals second conductive lines in parallel with and connected to the first conductive lines. This provides numerous benefits, as also detailed below.

[The Challenged Claims Are Unpatentable]

113. Kim524's figures show that its device includes similar layers and elements as Kwon224's device. Annotated Figure 2 below illustrates that Kim524's device includes a display layer 200 comprising **light emitting devices LD (all shades of yellow)** that are disposed on a **substrate 100 (dark purple)**, an **encapsulation layer 300 (green)** disposed on the light emitting devices, and a touch active layer 400 that includes touch electrodes, connecting portions, and touch signal lines. Kim524, ¶¶[0039], [0052], [0073], [0078-80].

FIG. 2

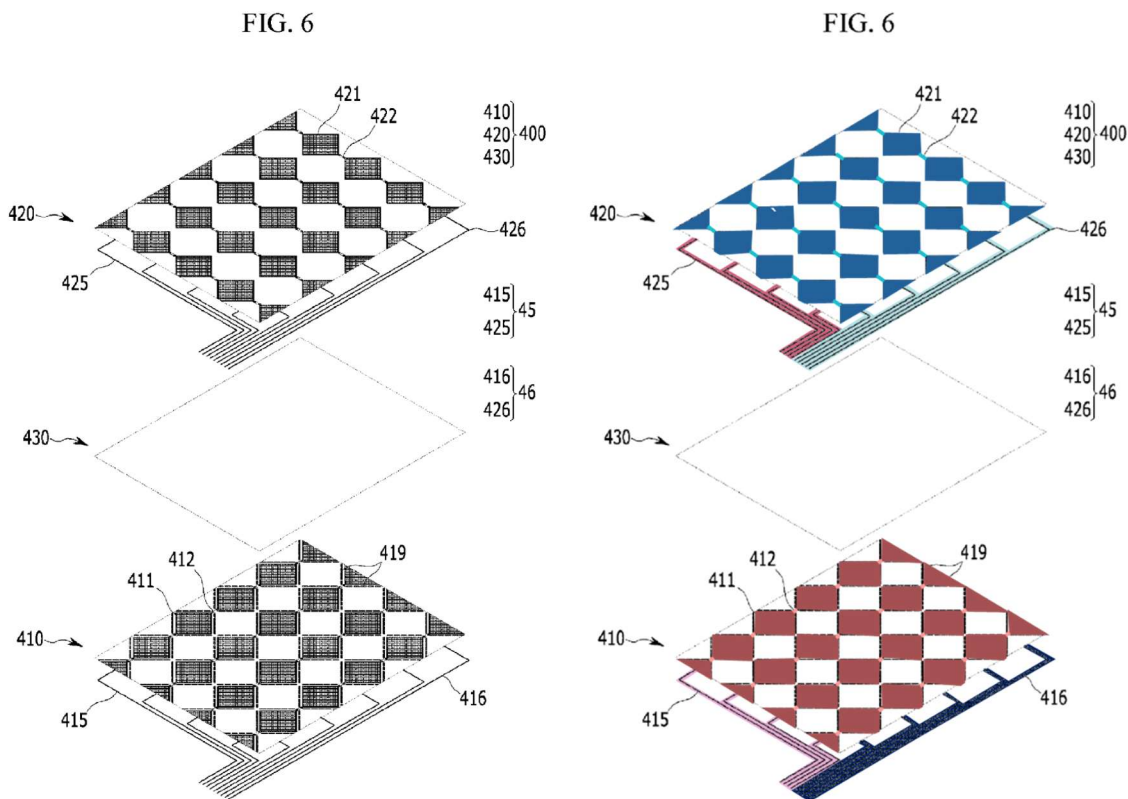


Kim524, FIG. 2

114. Kim524's Figure 6, annotated below, details the various areas of metallization in the touch active layer 400, showing a first set of touch electrodes 411 (**brick red**) connected by connecting portions 412 (**salmon**) and a second set of

[The Challenged Claims Are Unpatentable]

touch electrodes 421 (**deep blue**) connected by connecting portions 422 (**cyan**). Kim524, ¶¶[0078-80]. It further shows “first and second touch signal lines 45 and 46.” Kim524, ¶[0085]. The touch signal lines 45 include “**first lower touch signal lines 415**” (**pink**) and “**first upper touch signal lines 425**” (**magenta**) and touch signal lines 46 including “**second lower touch signal lines 416**” (**navy blue**) and “**second upper touch signal lines 426**” (**sky blue**). Kim524, ¶¶[0079-80].



Kim524, FIG. 6 (Unannotated Left)

115. As I explained above, Kwon224 also discloses these areas of metallization in its device. *See* Section VIII.A.4.d-VIII.A.4.e. It is my opinion that, given the similarities of the references, a person of ordinary skill in the art would [The Challenged Claims Are Unpatentable]

have considered Kim524's teachings to improve Kwon224's device. Skilled artisans in this industry regularly look at similar devices to craft modifications that would create an improved device.

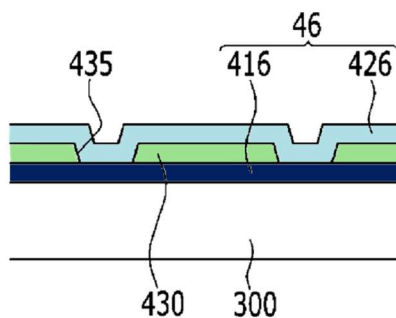
116. It is also my opinion that Kim524 discloses second conductive lines connected to first conductive lines.

117. For example, Kim524's **lower touch signal lines 415 (pink)** and/or **upper touch signal lines 426 (sky blue)** constitute the claimed first conductive lines because these lines are connected to the touch electrodes 411 and 421. This is consistent with how the '394 patent describes the first conductive lines in Figure 1, specifically showing the first conductive lines connecting to the touch electrodes. Ex-1001, Fig. 1. Accordingly, it is also my opinion that Kim524's **upper touch signal lines 425 (magenta)** and/or **lower touch signal lines 416 (navy blue)** constitute the claimed second conductive lines.

118. Kim524's Figure 10 also provides helpful context. Specifically, it shows that Kim524's first and second conductive lines are connected. Figure 10, which is annotated below, provides an exemplary cross-sectional view of touch signal lines 46, showing a connection of the **first conductive lines 426 (sky blue)** connected to **second conductive lines 416 (navy blue)** through contact holes 435 in the intermediate insulating layer 430 made of inorganic material. Kim524, ¶¶[0084] ("First lower touch signal lines 415 are connected with first upper touch signal lines [The Challenged Claims Are Unpatentable]

425 formed to overlap with first lower touch signal lines 415 to form respective first touch signal lines 45, and second upper touch signal lines 426 are connected with second lower touch signal lines 416 to form respective second touch signal lines 46”). Thus, Kim524 discloses that both upper lines are connected to the lower lines.
Id.

FIG. 10

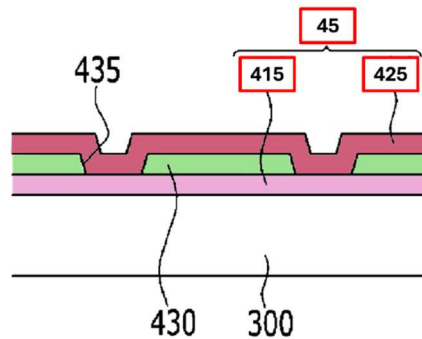


Kim524, FIG. 10

119. Furthermore, with respect to insulating layer 430, Kim524 explains that this layer is made of “silicon oxide (SiOx), silicon nitride (SiNx), silicon oxynitride (SiOxNy).” Kim524, ¶[0078]. Kim524 further explains that “an organic layer may include any one of silicon nitride (SiNx), aluminum oxide (AlOx), silicon oxide (SiOx), and titanium oxide (TiOx).” *Id.*, ¶[0074]. Thus, a skilled artisan would have understood that the insulating layer 430 is an inorganic layer.

120. While Figure 10 shows an example using one set of lower and upper lines, it explains that the other set of conductive lines have the same vertical structure. *Id.*, ¶[0084] (“First lower touch signal lines 415 are connected with first upper touch signal lines 425 formed to overlap with first lower touch signal lines 415 to form respective first touch signal lines 45, and second upper touch signal lines 426 are connected with second lower touch signal lines 416 to form respective second touch signal lines 46. Connection of upper touch signal lines 425 and 426 to lower touch signal lines 415 and 416 may be, performed by contacting upper touch signal lines 425 and 426 and lower touch signal lines 415 and 416 through contact holes 435 in insulating layer 430 as illustrated in FIG. 10”). Specifically, for the **lower touch signal lines 415 (pink)** and **upper touch signal lines 425 (magenta)**, the order of first and second conductive lines flipped, as shown in the modified and annotated version of Figure 10 below. *Id.*

FIG. 10



Kim524, FIG. 10 (modified)

121. In my opinion, a person of ordinary skill in the art would have found it obvious to implement Kim524's stacked touch signal line configuration in Kwon224's device, including for the general motivations to combine the references as described in Section VIII.A.3. As described in Sections VIII.A.1-VII.A.3 and above in this section, Kwon224 and Kim524 provide similar device architecture. One similarity is that both references disclose touch signal lines (i.e., Kwon224's touch signal lines SL1 and SL2 and Kim524's touch signal lines 415 and 426) and an inorganic insulating layer (i.e., Kwon224's inorganic insulating layer TS-IL1 and Kim524's inorganic insulating layer 430). Thus, a person of ordinary skill in the art would have considered the teachings of Kwon224 and Kim524 in the ordinary course because Kwon224 provided limited details regarding the touch signal lines

[The Challenged Claims Are Unpatentable]

and Kim524 discloses a vertical touch signal structure that provides specific benefits, as detailed below.

122. There are numerous reasons why a skilled artisan would have been motivated to combine Kwon224 and Kim524. For example, a person of ordinary skill in the art would have been motivated to combine the references because it achieves Kwon224's goal of reduced resistance and improved touch sensitivity. Specifically, Kwon224 states that lowering the resistance at touch electrodes enhances touch sensitivity, an important characteristic of OLED touchscreens. Kwon224, ¶[0177]. Reduced resistance ensures that electrical signals are transmitted efficiently across the device, which minimizes data loss and delay and improves the device's touch response accuracy and speed. Improved touch sensitivity allows the device to detect subtle changes in capacitance caused by user interaction. Thus, reducing resistance and improving touch sensitivity helps improve ability of the device to serve its critical function of reliably registering touches.

123. A person of ordinary skill in the art would have understood that implementing Kim524's stacked conductive line achieves these benefits. Specifically, the stacked conductive line configuration allows signal transmission across different layers and helps distribute electrical resistance over a larger cross-sectional area, both of which help reduce resistance in the touch signal line paths. For example, due to the first and second conductive lines connected and positioned [The Challenged Claims Are Unpatentable]

on different layers, the signal is transmitted across multiple layers. Further, the stacked configuration provides a more vertical—wider—routing path. The use of different materials for the different layers allows using both transparent conductive oxides like ITO and metallic materials. The transparent conductive oxide improve touch screen transparency, while the metallic materials lowers resistivity in the touch signal path and improves conductivity. Thus, the stacked configuration enables segregating functional roles for different layers and optimizes electrical performance without compromising display quality.

124. In my opinion, a person of ordinary skill in the art would have also understood that reducing resistance in the touch signal lines directly reduces the overall resistance of the touch electrodes. This is especially true in architectures like Kwon224 where the signal lines and electrodes are part of a continuous, integrated conductive pattern. Kwon224, Figs. 9A-9B; ¶¶[0137] (“Each of the first conductive layer TS-CL1 and the second conductive layer TS-CL2 may include a plurality of patterns”), [0143], [0146-147], [0150]. Thus, because these elements are electrically and physically connected within the same layer stack, improvements in signal line conductivity translate predictably to enhanced touch sensitivity across the entire touch panel. Therefore, the reduced resistance provided by Kim524’s stacked conductive lines also reduces the overall resistance of the touch electrodes because the conductive lines are part of the same pattern as the touch electrodes. In fact, this [The Challenged Claims Are Unpatentable]

structural interdependence would have made the benefit of lower resistance from a stacked line configuration both apparent and desirable to a person of ordinary skill in the art.

125. Further, it is also my opinion that a person of ordinary skill in the art would have further understood that incorporating Kim524's vertical interconnect strategy into Kwon224's architecture would enhance signal integrity and reduce layout complexity, particularly in modern high-resolution displays with narrow bezels, where routing space is limited due to the increased number of lines and the smaller area. Signal integrity refers to the quality and reliability of electrical signals as they travel through conductive paths. Signal integrity is enhanced because the vertical configuration reduces line resistance, as I explained above. Further, vertical stacking allows for shortens horizontal signal paths because signals can be split across layers. Additionally, the stacked conductive line structure helps suppress display-generated noise from, for example, capacitive coupling between touch electrodes and display elements, by using a insulating layer between the upper and lower conductive lines, which reduces coupling between the two layers.

126. In my opinion, the combination would have been predictable and within the capabilities of a person of ordinary skill in the art. For example, Kwon224 discloses depositing touch signal lines, and the modification merely deposits additional signal lines during the manufacturing process at a point where lines are

[The Challenged Claims Are Unpatentable]

already being deposited for the other sensor line. This is a simple design choice—choosing where to deposit lines.

127. Further, the use of contact holes to connect conductive lines through insulating layers is a well-established technique in display and semiconductor fabrication. Kim524's implementation of this technique in the context of OLED touchscreens would have provided a clear blueprint for enhancing Kwon224's design—which itself uses creating holes in insulating layers, as discussed above. The resulting device would maintain the structural benefits of Kwon224 while incorporating the electrical connectivity advantages of Kim524, including the benefits I discussed above.

128. It is also my opinion that the modification involves straightforward adjustments. Indeed, although not pictured, Kwon224 explicitly *contemplates* stacked multi-layer conductive lines, as “[e]ach of the first conductive layer TS-CL1 and the second conductive layer TS-CL2 may have a single-layer structure **or a multi-layer structure** of layers stacked along the third directional axis DR3.” Kwon224, ¶[0136]. As discussed before and shown in the annotated figure below, TS-CL1 includes the lower first and second conductive lines and TS-CL2 includes the upper first and second conductive lines. As such, Kwon224 already teaches adding the Kim524 stacked structure, with Kim524 merely providing specific implementation details.

[The Challenged Claims Are Unpatentable]

FIG. 9A

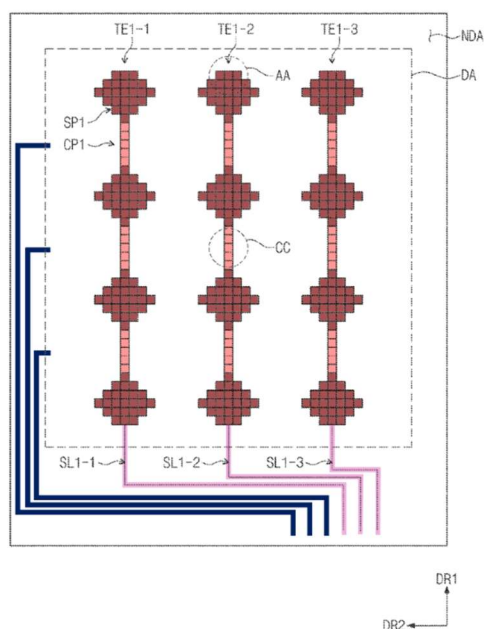
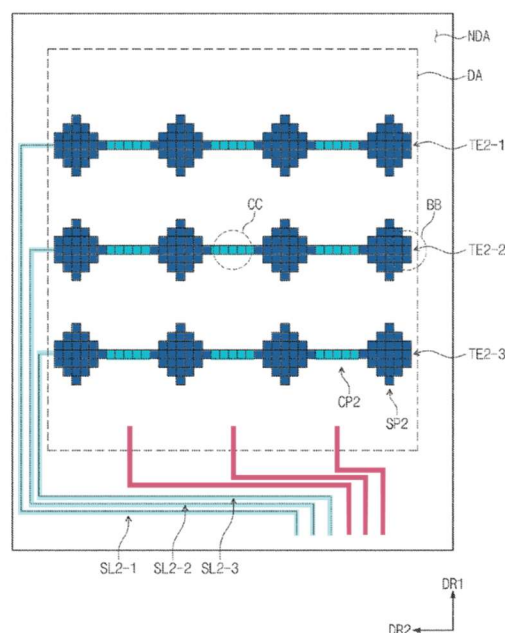


FIG. 9B



Representation of Kwon224-Kim524

129. For example, as shown in the annotated figures below, Kwon224 originally discloses first depositing a first conductive layer, which includes both the sensing parts SP1 of the first touch electrodes TE1 (**brick red**) and touch signal lines SL1 (**pink**), and then an inorganic insulating layer TS-IL1 (**lime green**). Kwon224, ¶¶[0135-137], [0143-152], [0155].

FIG. 9A

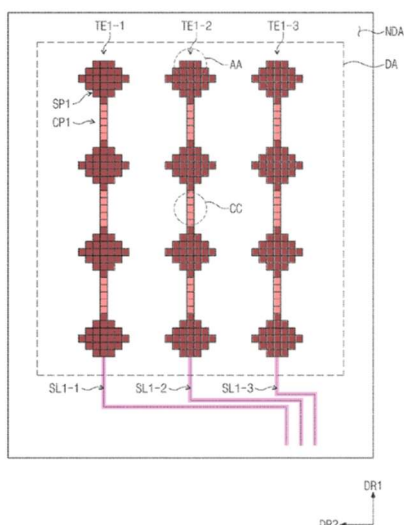
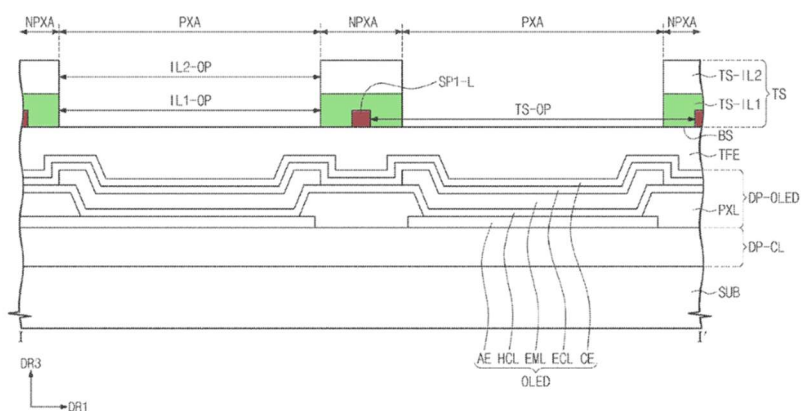


FIG. 10B



Kwon224, FIGS. 9A and 10B

130. Then, as shown in additional annotated figures below, Kwon224 deposits the second conductive layer, which includes both the sensing parts SP2 of the second touch electrodes TE2 (**deep blue**) and touch signal lines SL2 (**cyan**). *Id.*

FIG. 9B

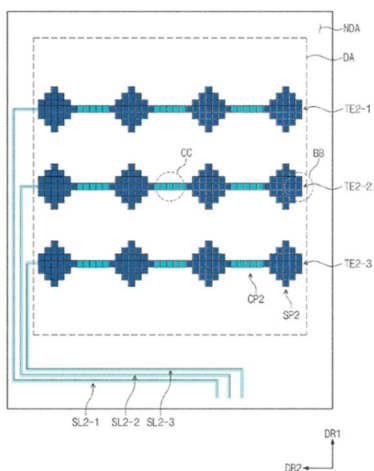
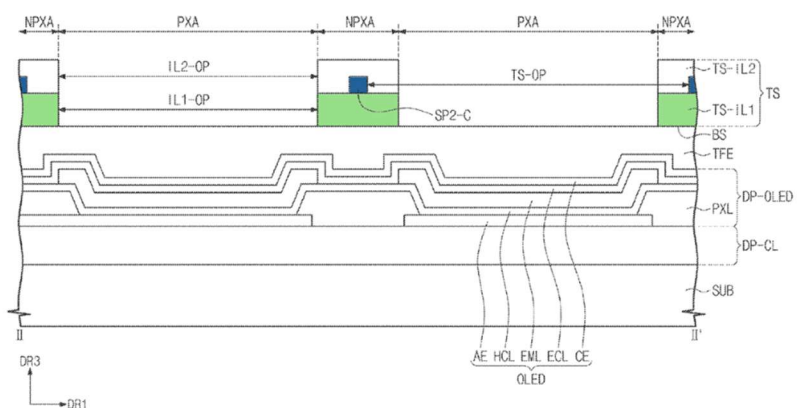


FIG. 11B



Kwon224, FIGS. 9B and 11B

[The Challenged Claims Are Unpatentable]

131. In my opinion, the Kwon224-Kim524 modification involves two simple steps. First, it adds extra touch signal lines (i.e., the second conductive lines in **magenta** and **navy blue**) during deposition of each conductive layer. As I mentioned before, these additional lines are deposited at the same time as Kwon224 deposits the conductive lines SL1 and SL2. Further, these additional lines are deposited in the same plane as existing first conductive lines, in **sky blue** and **pink**, and thus further shows that they would be deposited in the same step, as in Kim524. Kim524, ¶¶[0079]-[0080].

FIG. 9A

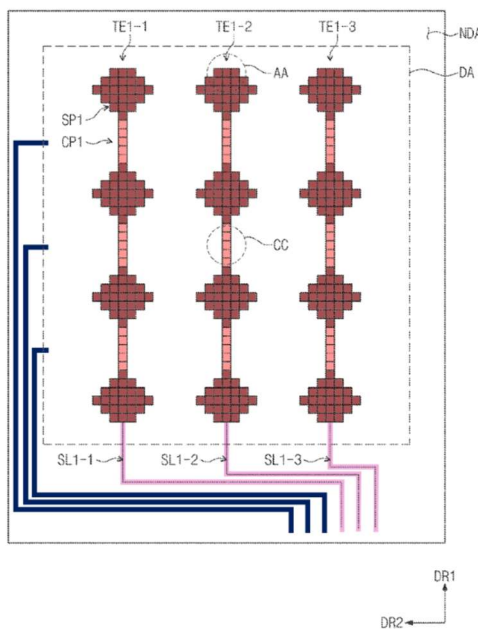
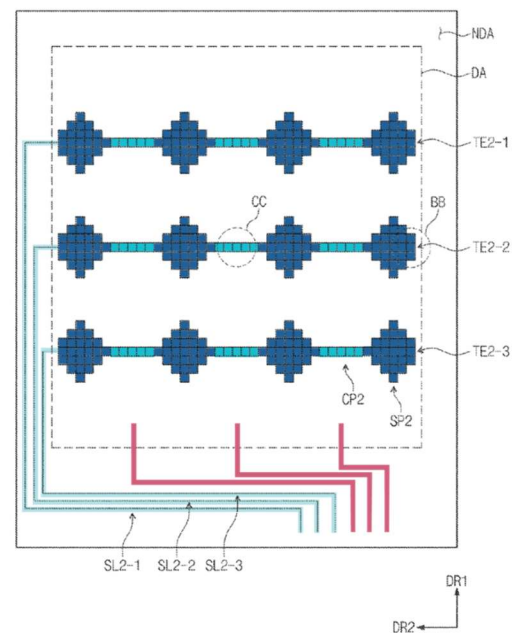


FIG. 9B



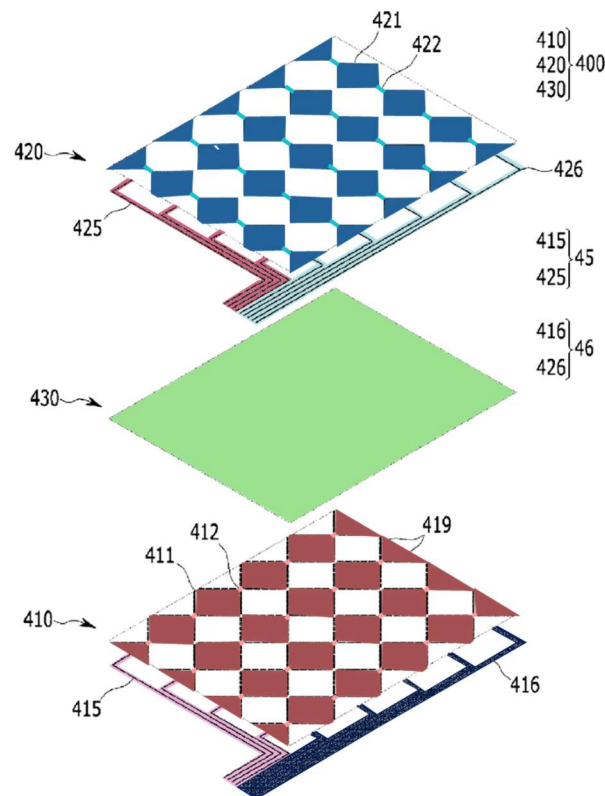
Representation of Kwon224-Kim524

[The Challenged Claims Are Unpatentable]

132. In the combination, the touch signal lines would run in parallel and overlap, as disclosed in Kim524's Figure 10, from the connection at the touch electrodes (**brick red** and **deep blue**) to the other connection point.

133. In fact, this is consistent with how Kim524 discloses the second conductive lines (**magenta** and **navy blue**), as shown in the annotated figures below. Specifically, Kim524 shows two sets of conductive lines deposited in both the lower and upper layers.

FIG. 6



Kim524, Fig. 6

[The Challenged Claims Are Unpatentable]

134. Second, the modification requires the TS-IL1 layer to include contact holes to enable connection between the first and second conductive lines. Kwon224 already discloses including openings (or holes) in the TS-IL1 layer to enable underneath layers to achieve certain purposes (Kwon224, ¶¶[0155-156]), and, in my opinion, a person of ordinary skill in the art would have found it straightforward to create similar holes to enable contact between first and second conductive lines to achieve the benefits described below. As I noted above, creating contact holes in insulating layers is well-established in the industry.

135. It is also my opinion that this combination integrates prior art elements—namely, Kwon224’s touchscreen device architecture utilizing layer touch signal lines and Kim524’s architecture employing a stacked touch signal line configuration—by applying established methods such as controlled deposition of layers in touchscreen devices. The result is a predictable outcome: a touchscreen device as described in Kwon224, now featuring a stacked touch signal line configuration, which was already known as Kim524 shows us. This combination simply substitutes Kim524’s stacked touch signal line design for Kwon224’s touch signal layer configuration (which Kwon224 specifically teaches could be used), producing predictable touchscreen device results as outlined in Kwon224, but with stacked signal lines. The combination employs Kim524’s stacked touch signal line technique to enhance Kwon224’s similar touchscreen architecture, reducing

[The Challenged Claims Are Unpatentable]

resistance and increasing touch sensitivity, and also providing additional benefits noted above.

136. Finally, in my opinion, there would have been a reasonable expectation of success in combining these references. Both Kwon224 and Kim524 are directed to similar device architectures and use compatible materials and fabrication techniques, including for the reasons I noted in Section VIII.A.3. Their combination would have addressed known challenges in OLED touchscreen integration—namely, achieving reliable electrical connections across multiple layers without compromising display performance, as Kwon224 itself contemplates. Kwon224, ¶[0136] (describing multi-layer structures, as described above).

137. Therefore, in my opinion, Kwon224 and Kim524 render obvious 1[d] because it would have been obvious to combine the references and the combined system includes second conductive lines (i.e., Kim524’s upper touch signal lines 425 and lower touch signal lines 416 incorporated into Kwon224’s architecture, with either upper or lower touch signal lines constituting the claimed second conductive lines in the combination) connected to the first conductive lines (Kwon224’s first touch signal lines SL1 and/or second touch signal lines SL2).

g. 1[f]: “at least one insulating film formed of at least one of an inorganic film or an organic film and

disposed between the first and second conductive lines; and”

138. Kwon224 and Kim524 renders 1[f] obvious.

139. For example, the combined Kwon224-Kim524 system includes an insulating layer TS-IL1 that is an inorganic film and disposed between the first and second conductive lines.

140. First, the TS-IL1 layer can be either an inorganic or organic layer. Kwon224, ¶[0138] (“Each of the first insulating layer TS-IL1 and the second insulating layer TS-IL2 may include an inorganic material or an organic material.”).

141. Second, the deposition process, as detailed in Kwon224, shows that the TS-IL1 layer is disposed between the first and second conductive lines.

142. As Kwon224 explains, the first conductive layer is deposited before the insulating layer TS-IL1. Kwon224, ¶¶[0138-139]. In the combined system, the first conductive layer, shown in Figure 9A, includes sensing parts SP1 of the first touch electrodes TE1 (**brick red**), touch signal lines SL1 (i.e., first conductive lines) (**pink**), and Kim524’s lower touch signal lines (i.e., second conductive lines) (**navy blue**). *See* Section VIII.A.4.f.

FIG. 9A

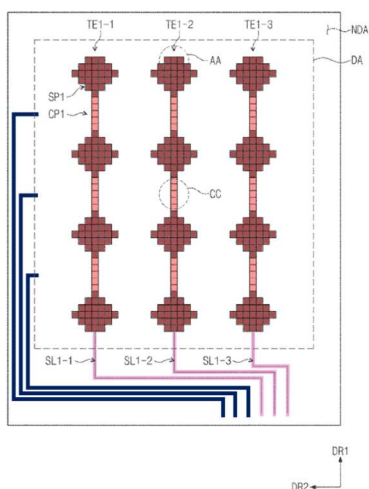
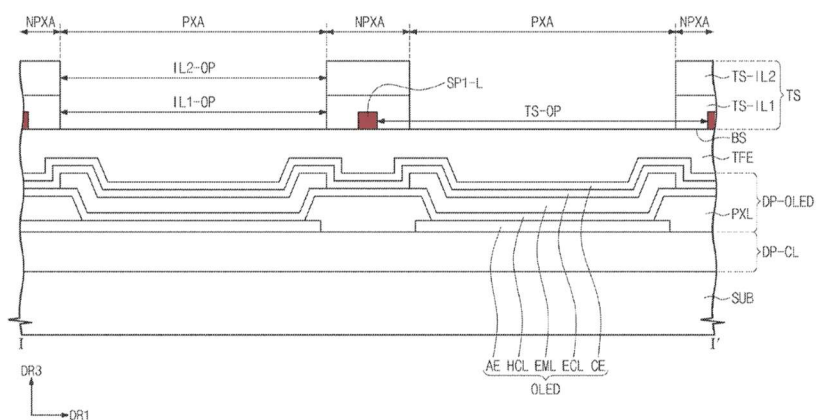


FIG. 10B

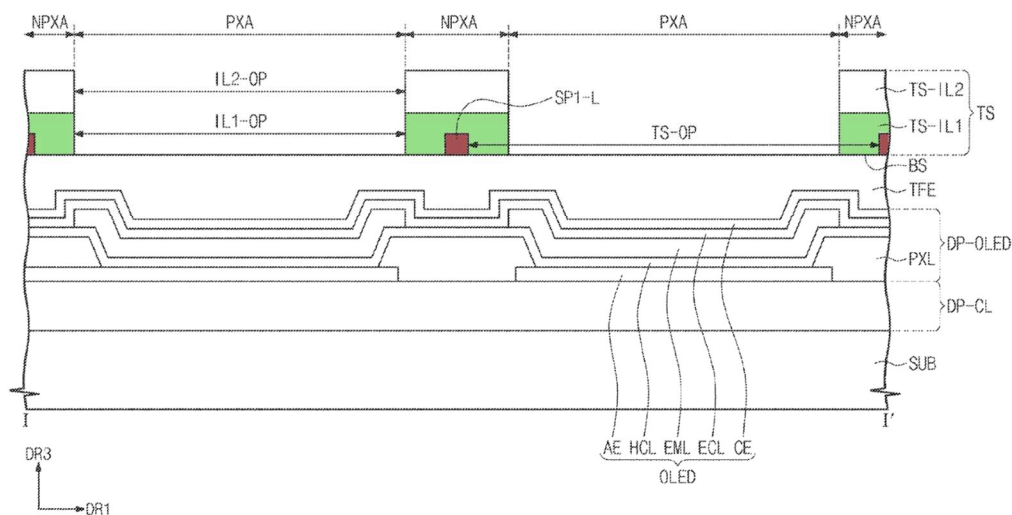


Representation of Kwon224-Kim524

143. Afterward, the TS-IL1 layer is deposited to cover these components.

Kwon224, ¶[0155].

FIG. 10B



Kwon224, FIGS. 10B

[The Challenged Claims Are Unpatentable]

144. Next, the second conductive layer is deposited. Kwon224, ¶¶[0147-150], [0158-159]. In the combined system, the second conductive layer, shown in Figure 9B, includes sensing parts SP2 of the second touch electrodes TE2 (**deep blue**) and touch signal lines SL2 (i.e., first conductive lines) (**cyan**), and Kim524's upper touch signal lines (i.e., second conductive lines) (**magenta**). See Section VIII.A.4.f.

FIG. 9B

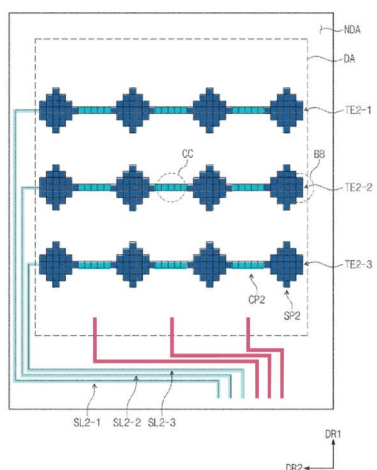
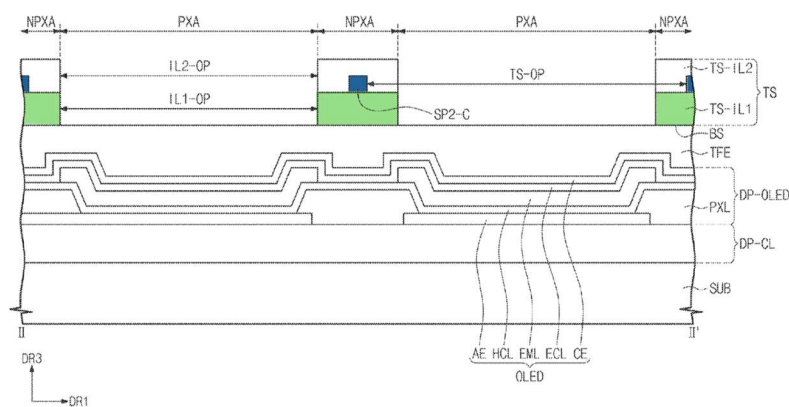


FIG. 11B



Kwon224, FIGS. 9B, 11B

145. Thus, the insulating layer TS-IL1 is disposed between the first and second conductive lines.

146. Therefore, in my opinion, Kwon224 and Kim524 render obvious 1[f] because it would have been obvious to combine the references and the combined system includes at least one insulating film formed of at least one of an inorganic

[The Challenged Claims Are Unpatentable]

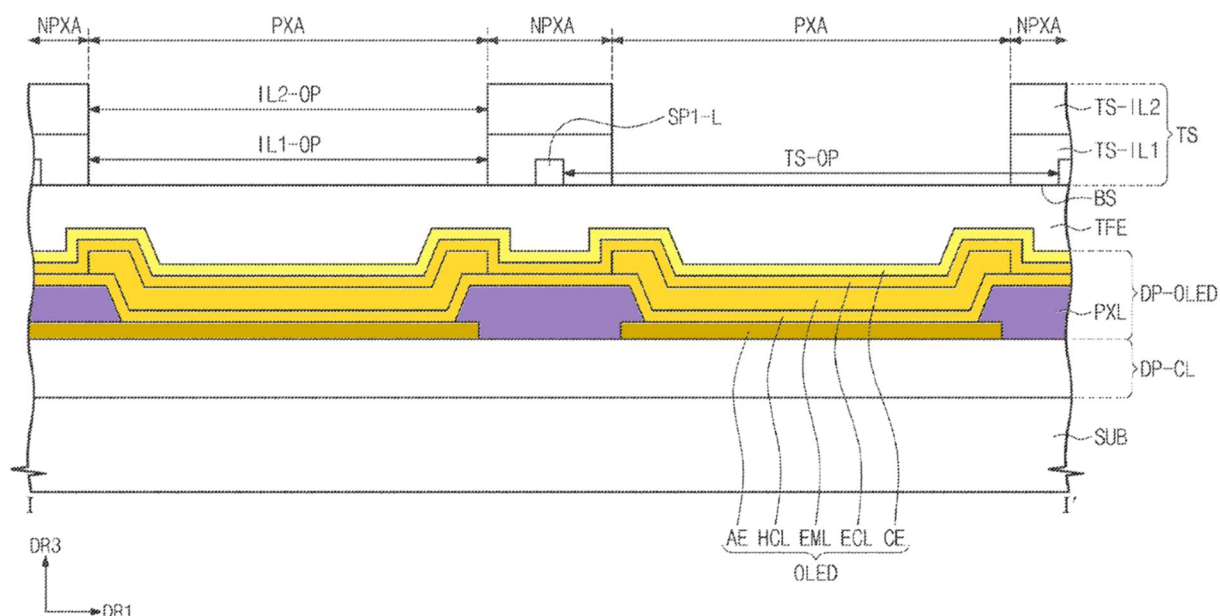
film or an organic film (i.e., Kwon224's TS-IL1 layer) and disposed between the first and second conductive lines.

h. 1[g]: “a bank configured to expose anodes of the light emitting elements,”

147. In my opinion, Kwon224 discloses 1[g].

148. For example, Kwon224 discloses a “**pixel definition layer PXL**” (**light purple**) (i.e., the claimed bank) that “exposes ... anode AE” (**gold**). Kwon224, ¶¶[0121-122]. As Figure 10B shows, **anodes AE (gold)** are part of the **OLEDs (all shades of yellow)**. Kwon224, ¶¶[0122], [0124] (“The light emitting area PXA may be defined to correspond to the anode AE or the light emitting layer EML of the organic light emitting device OLED.”), Fig. 10B; *see* Section VIII.A.4.b (explaining that the OLEDs are the claimed light emitting elements).

FIG. 10B



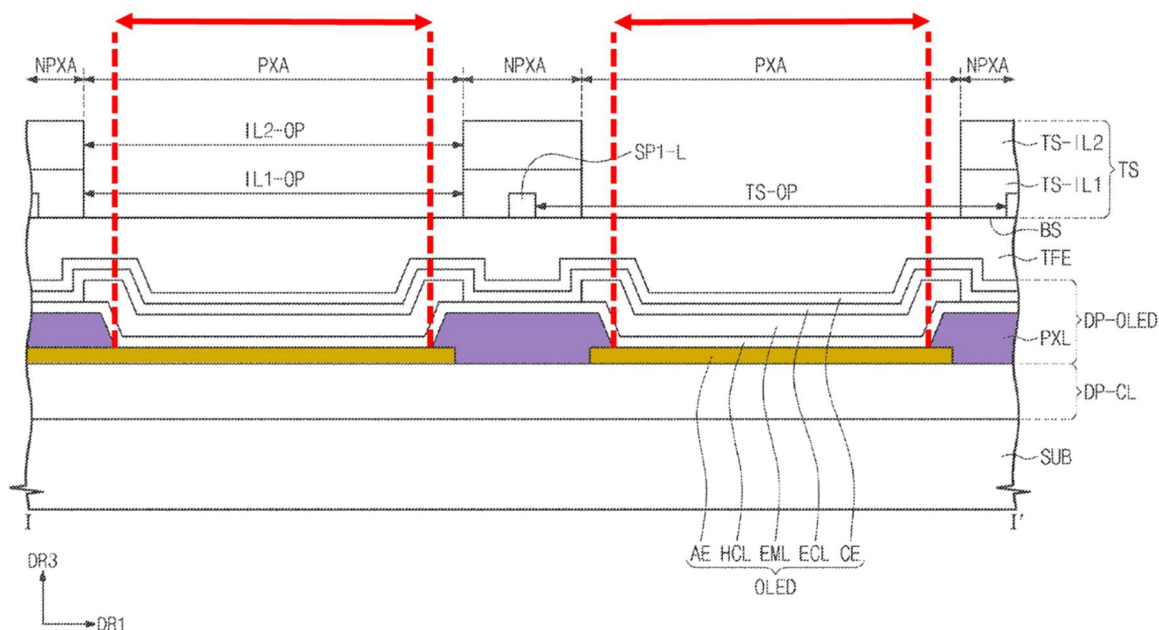
Kwon224, FIG. 10B

149. Additionally, the '394 patent confirms that Kwon224's pixel definition layer PXL is the claimed "bank." The '394 patent provides little detail about the bank, only describing it as providing an emission region where the "organic light emitting layer 124 is formed on the anode 122." Ex-1001, 3:26-28; *see id.*, 3:19-21, 3:28-33. Kwon224's **PXL layers (light purple)** similarly provide an emission region. Figure 10B, below, shows how the PXL layer creates opening regions that are within the light emitting areas PXA. Kwon224, ¶¶[0122] ("the opening OP of the pixel definition layer PXL may expose at least a portion of the anode AE"), [0124]. It is my opinion that a person of ordinary skill in the art would have

[The Challenged Claims Are Unpatentable]

understood that these light emitting areas correspond to the emission region described in the '394 patent because these areas are where light emits from.

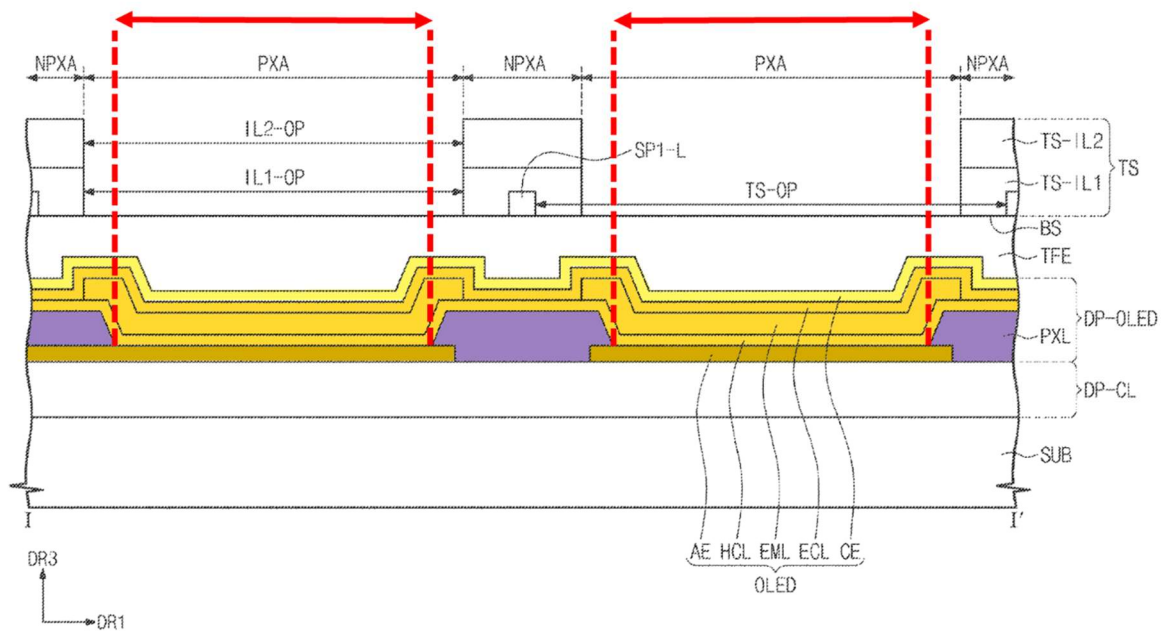
FIG. 10B



Kwon224, FIG. 10B

150. Further, just as in the '394 patent, the emission region in Kwon224 is filled with the **organic light emitting layer EML**, **hole control layer HCL**, and **electron control layer ECL (bright yellow)**. Kwon224, ¶[0122]; see Ex-1001, 3:28-31 (explaining that the organic light emitting layer 124 comprises “a hole-related layer, a light emitting layer and an electron-related layer on the anode 122”).

FIG. 10B



Kwon224, FIG. 10B

151. Second, the figures in the '394 patent and Kwon224 similarly depict the bank and pixel definition layer PXL. Figure 2 from the '394 patent provides a representative example of how the figures depict the bank 128.

155. For example, Kwon224's connected parts CP1 and connected parts CP2 (i.e., the first and second bridges) overlap the pixel definition layer PXL (i.e., the claimed bank). *See* Section VIII.A.4.D (explaining CP1 and CP2 are the first and second bridges, respectively); Section VIII.A.4.h (explaining the PXL is the bank). Specifically, Kwon224 indicates that the pixel definition layer (PXL) covers the entire non-light emitting area (NPXA), and that the NXPA region covers all of the connected parts, CP1 and CP2. Consequently, in my opinion, the connected parts CP1 and connected parts CP2 also overlap with the pixel definition layer PXL. *Id.*

156. This can be shown through the Kwon224's figures. First, Kwon224 explains that the entire non-light emitting area NPXA overlaps the **pixel definition layer PXL (light purple)**. Annotated Figure 10A shows a close-up view of region AA from Figure 9A, including the non-light emitting area NPXA and light emitting areas PXA.

FIG. 9A

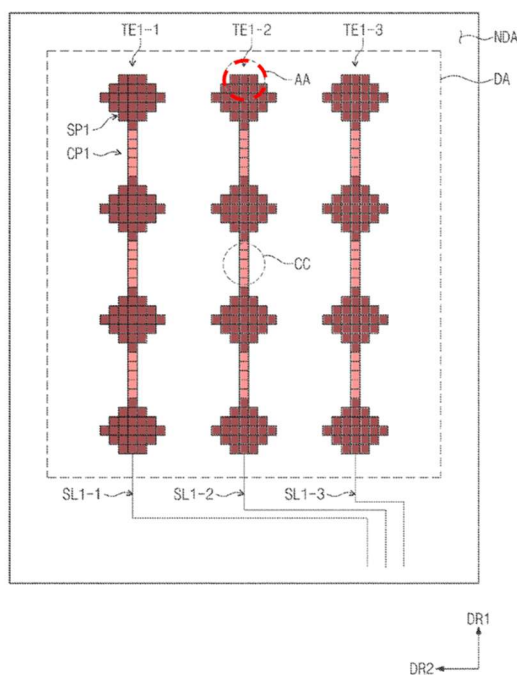
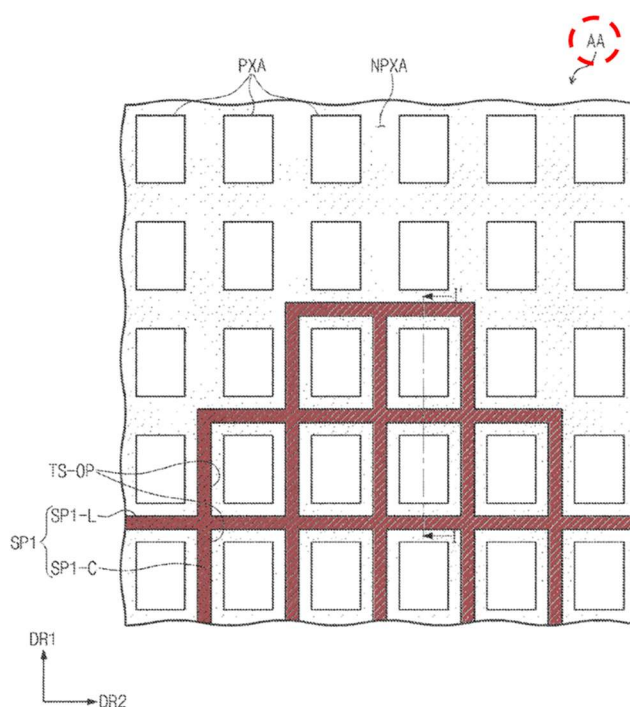
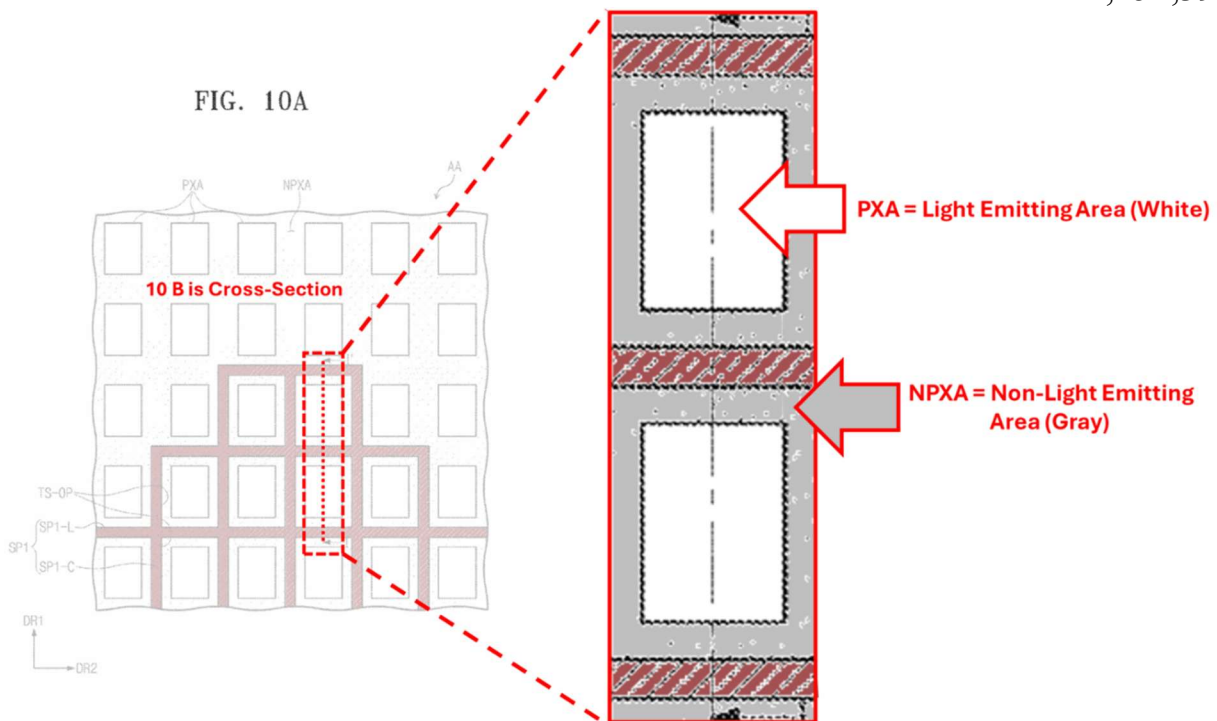


FIG. 10A



Kwon224, FIGS. 9A, 10A

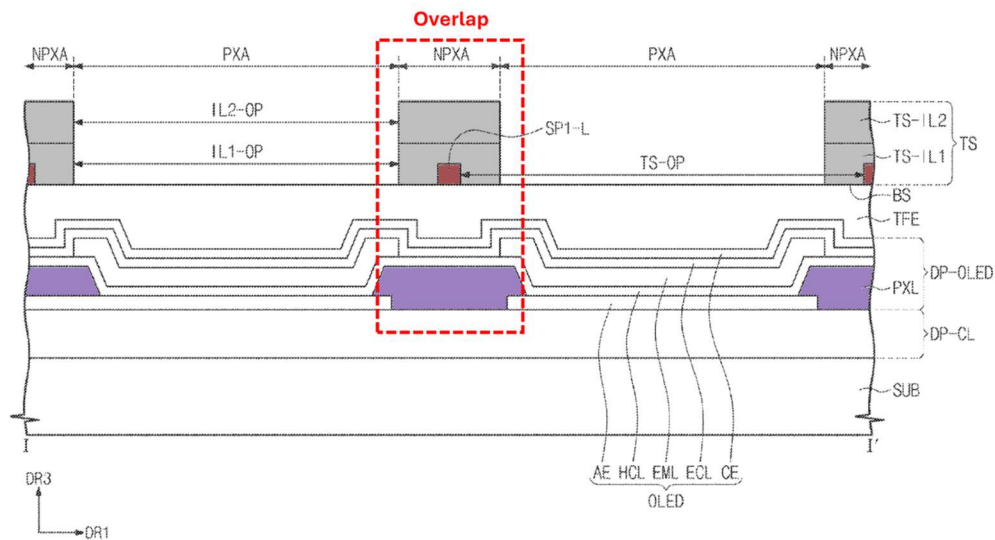
157. As shown in the close-up annotated image below, Figure 10A depicts the non-light emitting area NPXA (**gray**) surrounding the light emitting areas PXA (white boxes) and that the sensing parts SP1 of the first touch electrode (**brick red**) are completely within the NPXA region (**gray**). See Kwon224, ¶[0153] (explaining SP1 “overlap[s] with the non-light emitting area NPXA.”).



Kwon224, FIG. 10A

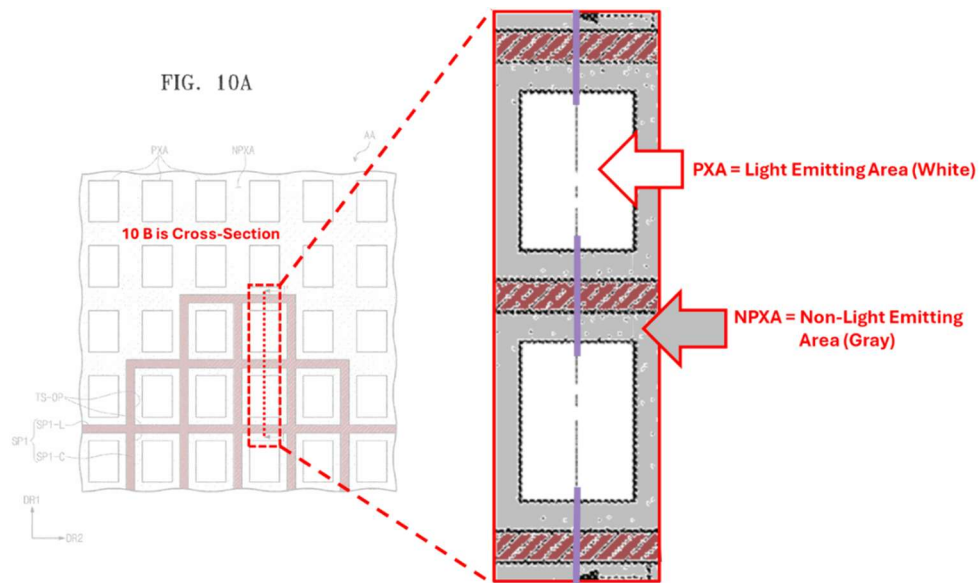
158. Further, annotated Figure 10B shows a cross-sectional view detailing the NPXA region. Specifically, the entire NPXA region is within the width of the **PXL layer (light purple)**:

FIG. 10B



Kwon224, FIG. 10B

159. It is my opinion that a person of ordinary skill in the art would have thus understood that the **PXL layer (light purple)** approximately spans the length shown below by the purple lines below. This is based on the cross-sectional figures described above, which show the PXL layer being wider than the SP1 elements.



Kwon224, FIG. 10A

160. Second, Kwon224 shows that the connected parts CP1 and connected parts CP2 are entirely within the NXPA region. Annotated Figure 12A shows a close-up view of region CC from Figures 9A-9B, including the non-light emitting area NPXA and light emitting areas PXA previously identified in Figure 10A, as well as the **connected parts CP1 (salmon)** and **connected parts CP2 (cyan)**.

FIG. 9A

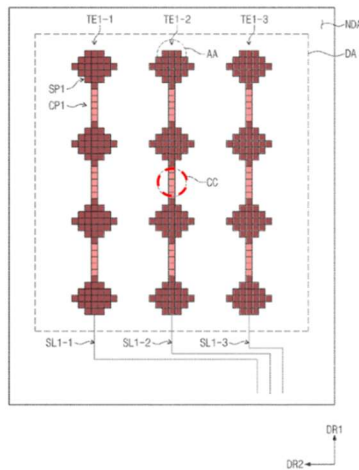


FIG. 9B

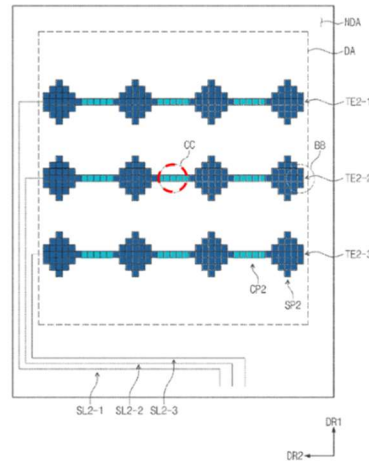
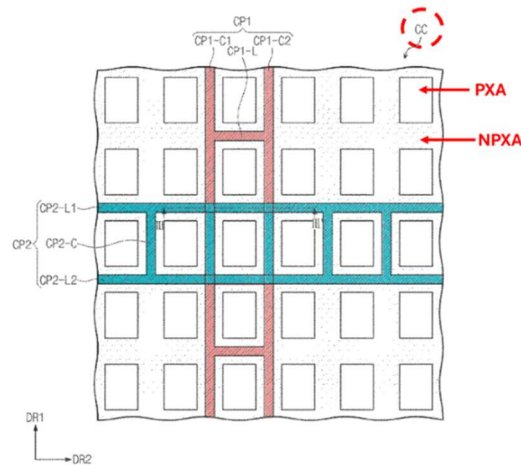


FIG. 12A



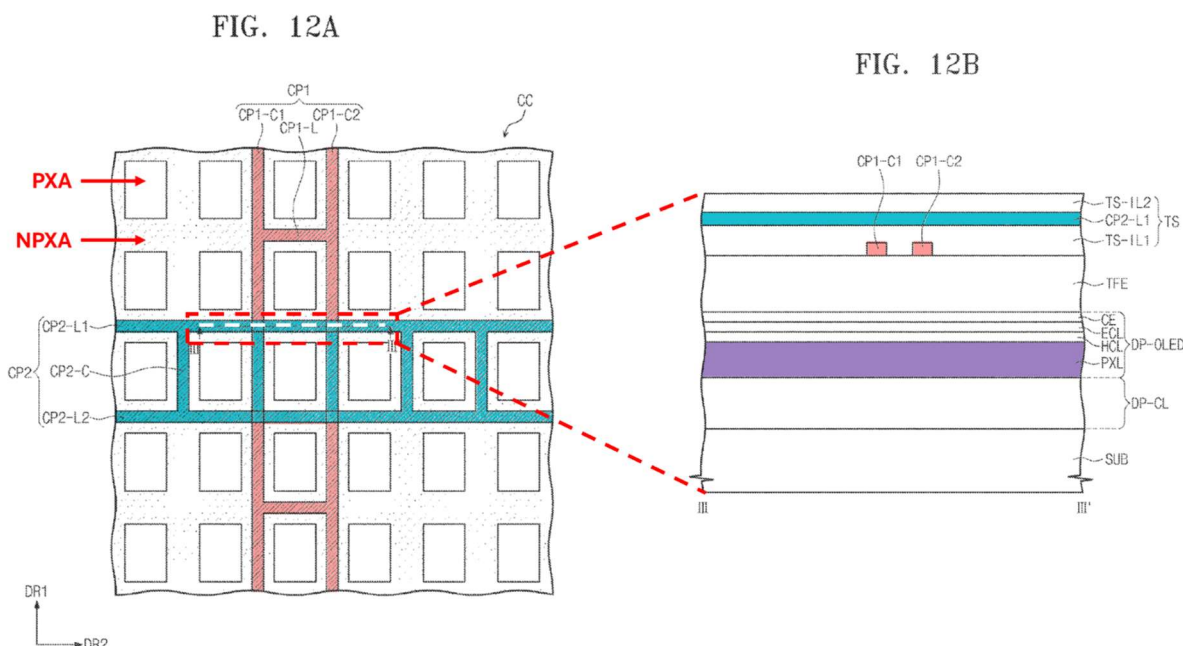
Kwon224, FIGS. 9A, 9B, 12A

161. Annotated Figure 12A confirms that the **connected parts CP1 (salmon)** and **connected parts CP2 (cyan)** are entirely within the NPXA region. Thus, because the NPXA region entirely overlaps the pixel definition layer PXL, a person of ordinary skill in the art would have understood that the **connected parts**

[The Challenged Claims Are Unpatentable]

CP1 (salmon) and **connected parts CP2 (cyan)** are also entirely overlapping the pixel definition layer PXL.

162. Annotated Figure 12B below further confirms this understanding. It shows that the **connected parts CP1 (salmon)** are completely overlapping the **pixel definition layer PXL (light purple)** and spanning the entire length of the **connected parts CP2 (cyan)**.

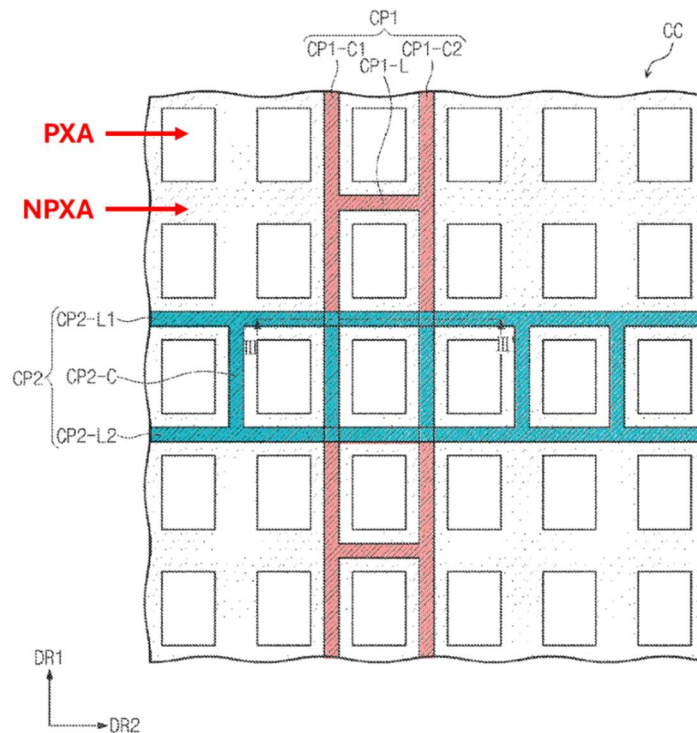


Kwon224, FIGS. 12A, 12B

163. Specifically, it is my opinion that a person of ordinary skill in the art would have understood that the **PXL layer (light purple)** covering the entire NXPA region means it also entirely spans the **connected parts CP1 (salmon)** and **connected parts CP2 (cyan)** as shown below.

[The Challenged Claims Are Unpatentable]

FIG. 12A



Kwon224, FIGS. 12A

164. Therefore, in my opinion, Kwon224 discloses 1[h] because it discloses at least one of the first bridges (i.e., connected parts CP1) or the second bridges (i.e., connected parts CP2) overlaps the bank (i.e., pixel definition layer PXL).

5. Dependent Claims

- a. **Claim 2: “The organic light emitting display according to claim 1, wherein at least parts of the first and second conductive lines overlap each other in an edge area of the substrate.”**

165. In my opinion, Kwon224 and Kim524 render obvious the display of claim 1 (*see* §VIII.A.4). Further, in my opinion, Kwon224 and Kim524 render obvious the limitation of claim 2.

166. For example, in the combined system, the **first conductive lines** (**pink** and/or **sky blue**) and **second conductive lines** (**magenta** and/or **navy blue**) run parallel and overlap each other from the touch electrodes to an edge area of the substrate. *See* Section VIII.A.4.f (explaining how the combined system discloses overlapping conductive lines); *see* Section VIII.A.4.b (explaining Kwon224’s substrate SUB). Specifically, Kwon224’s Figures 9A-9B show the conductive lines at an edge area of the non-display area NDA of the device and, in my opinion, a person of ordinary skill in the art would have understood that a substrate covers the entire display area DA and non-display area NDA. Kwon224, ¶¶[0112-114].

FIG. 9A

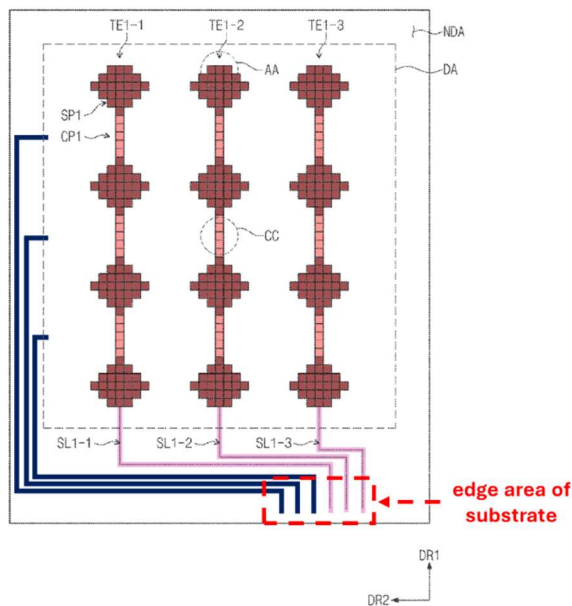
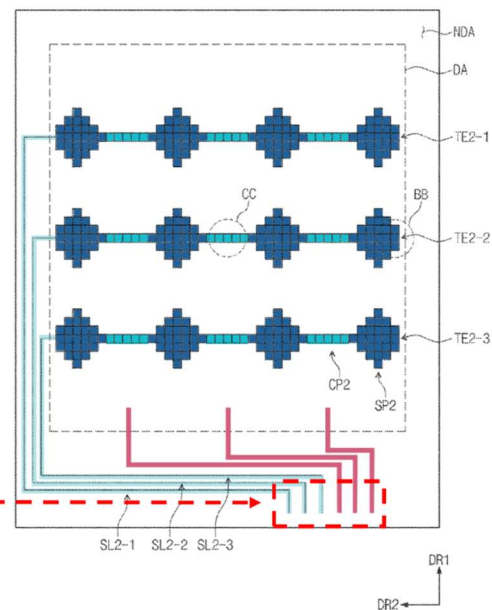


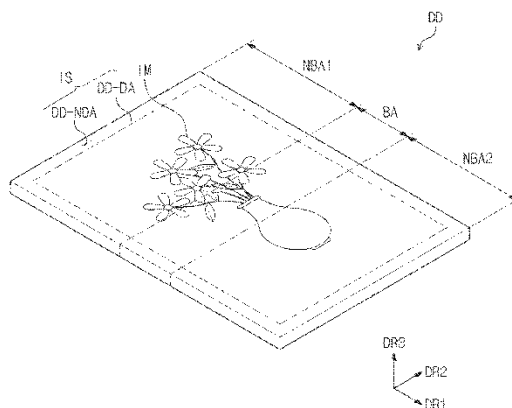
FIG. 9B



Kwon224, FIG. 9A, 9B

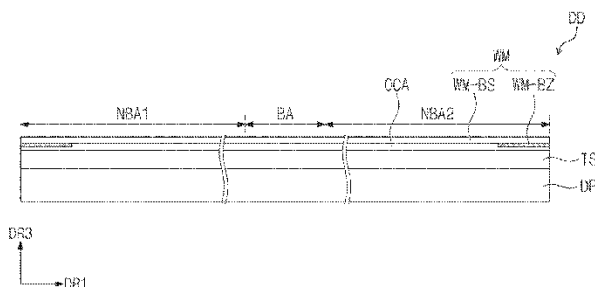
167. For example, Figure 1A shows flexible display device DD with a display area DD-DA and non-display area DD-NDA, and Figure 2A shows a cross section of this device. Figure 2A further shows that the display panel DP spans the entire device. Kwon224 confirms that the lower layer of the display panel DP is the substrate.

FIG. 1A



Kwon224, FIGS. 1A

FIG. 2A



Kwon224, FIGS. 2A

168. A skilled artisan would have understood these disclosures to mean that the display panel DP includes a substrate SUB that spans the entire display area DA and non-display area DD.

169. Further, it is also my opinion that it was well understood at the time that a substrate in a device such as the one described in Kwon²²⁴ is continuous and extends across the entire panel, including both the display area (DA) and the non-[The Challenged Claims Are Unpatentable]

display area (NDA). This is necessary for mechanical integrity and for supporting the deposition and patterning of all other layers. For example, the substrate must extend across both regions to provide mechanical support and to allow for the routing of electrical connections and integration of peripheral circuitry. Using a single substrate provides structural continuity, which allows for controlled bending, and ensures that all components on the DA and NDA are supported by a stable base for deposition and operation.

170. Therefore, in my opinion, Kwon224-Kim524 combined system discloses claim 2 because it includes at least parts of the first and second conductive lines overlapping each other in an edge area of the substrate (i.e., substrate SUB).

b. Claim 3: “The organic light emitting display according to claim 1, wherein the first and second conductive lines overlap each other on the encapsulation unit.”

171. In my opinion, Kwon224 and Kim524 render obvious the display of claim 1 (*see* §VIII.A.4). Further, in my opinion, Kwon224 and Kim524 render obvious the limitation of claim 3.

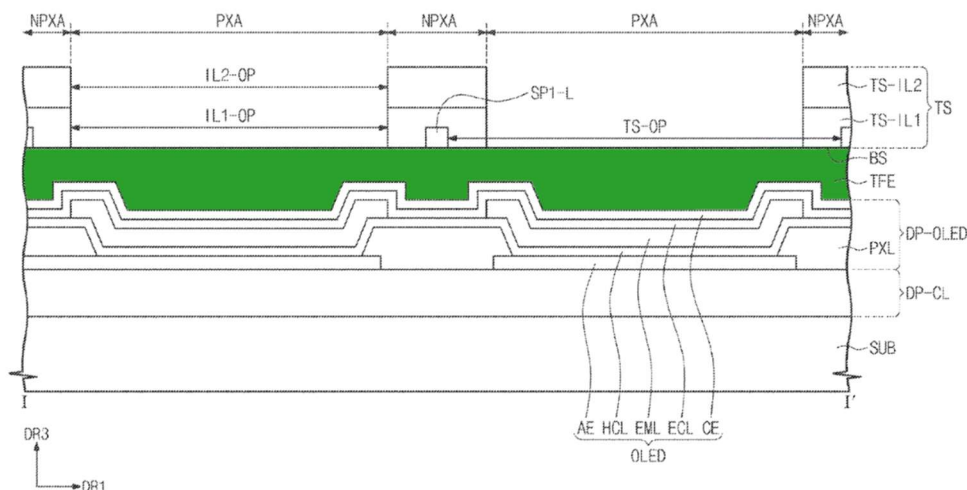
172. For example, the combined system includes first and second conductive lines that run parallel and overlap each other. *See* Section VIII.A.4.f. Specifically, the combination implemented Kim524’s stacked conductive line configuration, as shown in Kim524’s Figure 10, which include vertically stacked conductive lines that

are formed on the encapsulation unit. *See id.*; Kim524, Figs. 6, 7 (showing a plan view with region B that includes vertically stacked conductive lines), 10 (showing conductive lines are electrically connected, vertically stacked and located on encapsulation layer 300).

173. Further, the first and second conductive lines are on the encapsulation unit. *See* Sections VIII.A.4.d-VIII.a.4.f; Kwon224, ¶¶ [0139], [0141] (explaining that Figure 9A illustrates the first conductive layer TS-CLI1, which includes the touch signal lines SL1, and that this entire layer is “disposed on the thin film encapsulation layer TFE”).

174. As explained in Section VIII.A.4.c, Kwon224 discloses a thin film encapsulation layer (TFE), which is the claimed encapsulation unit.

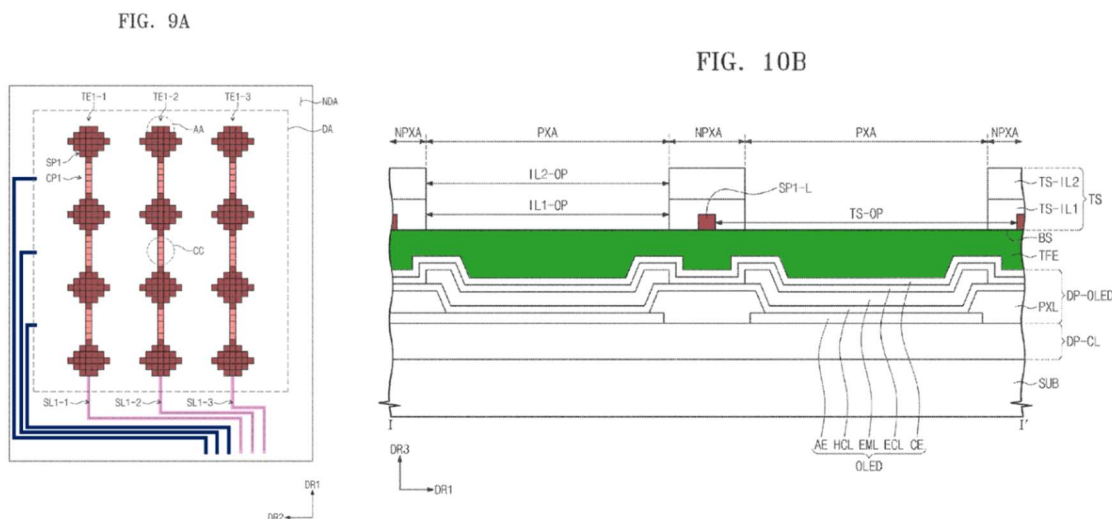
FIG. 10B



Kwon224, FIG. 10B

175. The first and second conductive lines are deposited on the TFE layer.

Kwon224, ¶¶[0135], [0139], [0141], Figs. 8A-8B. As explained in Section VIII.A.4.f, the first conductive layer is first deposited, and includes the first conductive lines SL1 (pink) and second conductive lines (navy blue).



Kwon224, FIG. 9A, 10B

176. After, a second conductive layer is deposited and includes the first conductive lines SL1 (sky blue) and second conductive lines (magenta).

FIG. 9B

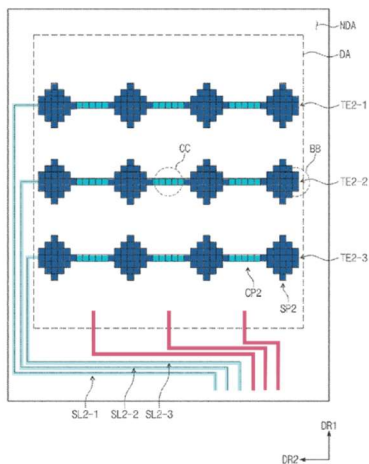
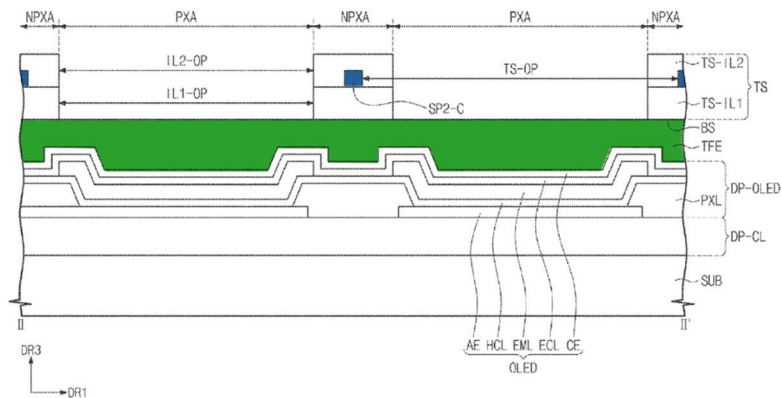


FIG. 11B



Kwon224, FIG. 9B, 11B

177. A skilled artisan would have understood that Kwon224's disclosures describe the conductive lines are on the encapsulation unit, and this was also well known design in the industry. Many OLED displays use thin-film encapsulation (TFE) followed by deposition of the touch sensor layer, which includes the conductive lines, above the TFE layer. This sequence is widely adopted for flexible displays, smartphones, and wearables. This direct stacking of the touch layer above the encapsulation layer provides design efficiency as it allows for compact stacking, reduces the number of substrates, and supports flexible form factors.

178. In fact, Kim524 itself discloses that the **first conductive lines** (sky blue and/or pink) and **second conductive lines** (navy blue and/or magenta) overlap on the **encapsulation unit 300** (green). *Id.*; Kim524, ¶¶[0073], [0078], [0084].

[The Challenged Claims Are Unpatentable]

FIG. 10

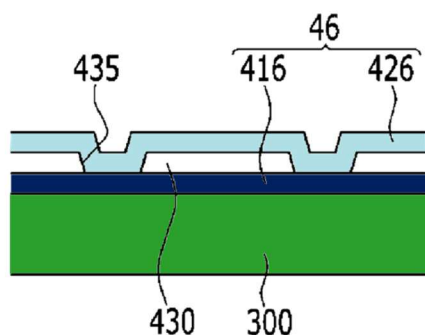
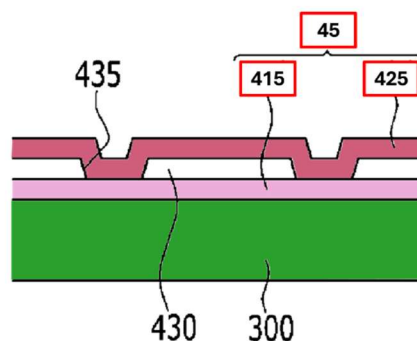


FIG. 10



Kim524, FIG. 10 (modified right)

179. Therefore, in my opinion, the Kwon224-Kim524 combination discloses claim 3 because it discloses the first and second conductive lines (touch signal lines in pink, sky blue, magenta, navy blue) overlap each other on the encapsulation unit (i.e., the TFE layer).

- c. **Claim 4: “The organic light emitting display according to claim 1, wherein the first and second conductive lines are connected through contact holes formed through the at least one insulating film.”**

180. In my opinion, Kwon224 and Kim524 render obvious the display of claim 1 (*supra* Section VIII.A.4). Further, in my opinion, Kwon224 and Kim524 render obvious the limitation of claim 4 for the reasons stated for limitations 1[e] and 1[f]. See Section VIII.A.4.f (explaining that the modification includes a TS-IL1 layer with contact holes to enable connection between the first and second

[The Challenged Claims Are Unpatentable]

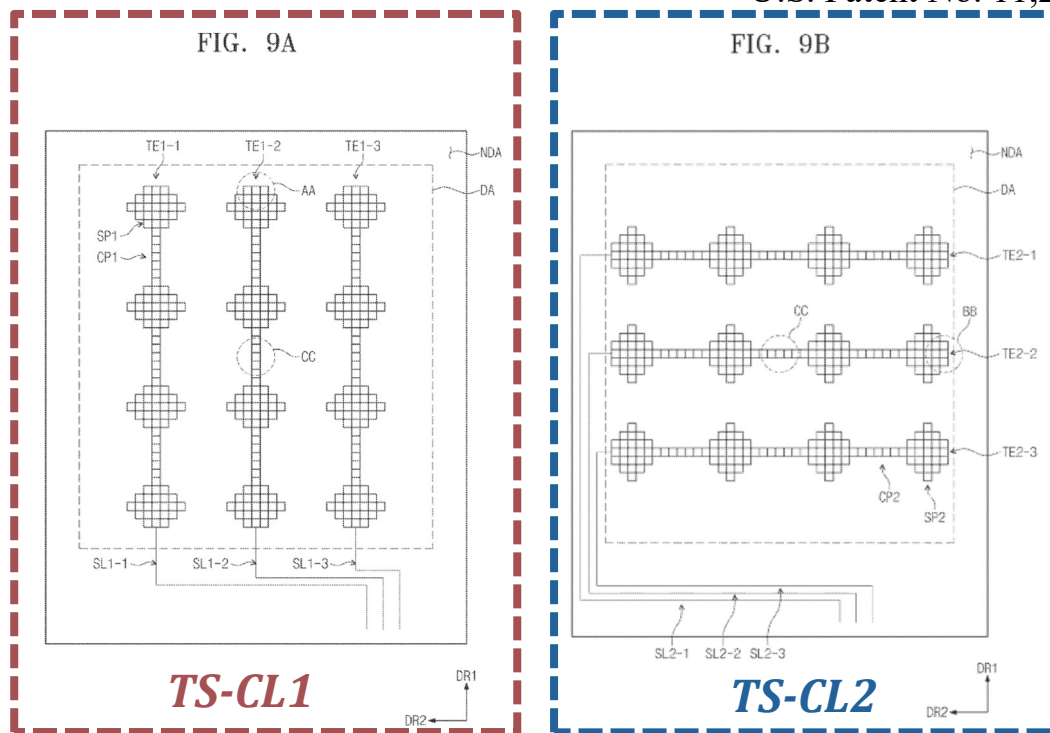
conductive lines); Section VIII.A.4.g (explaining the TS-IL1 layer is the claimed insulating film).

d. Claim 6: “The organic light emitting display according to claim 1, wherein one of the first and the second bridges is disposed on a same plane as one of the first and second conductive lines.”

181. In my opinion, Kwon224 and Kim524 render obvious the display of claim 1 (*see* §VIII.A.4). Further, in my opinion, Kwon224 and Kim524 render obvious the limitation of claim 6.

182. For example, in the Kwon224-Kim524 combination, the first conductive lines are on the same plane as the first bridges and/or second bridges.

183. As shown in the annotated figures below, each of Figs. 9A and 9B show a horizontal cross sectional plane for the first conductive layer TS-CL1 and second conductive layer TS-CL2, respectively. Kwon224, ¶[0142].



Kwon224, FIGS. 9A, 9B

184. First, in the combination, the first conductive lines share the same plane as the sensing parts of the touch electrodes. Specifically, touch signal lines SL1 (i.e., first conductive lines) (pink) are connected to the sensing parts SP1 of the first touch electrodes TE1 (brick red), and thus at least a portion of the lines are on the same plane as the sensing parts given that the two elements are connected. Kwon224, ¶[0143]; see Section VII.A.4.e (explaining Kwon224's disclosure of first conductive lines). Similarly, touch signal lines SL2 (i.e., first conductive lines) (sky blue) are connected to the sensing parts SP2 of the second touch electrodes TE2 (deep blue), and thus at least a portion of the lines are on the same plane as the sensing parts for the same reasons. Kwon224, ¶[0147]; see Section VII.A.4.e.

[The Challenged Claims Are Unpatentable]

FIG. 9A

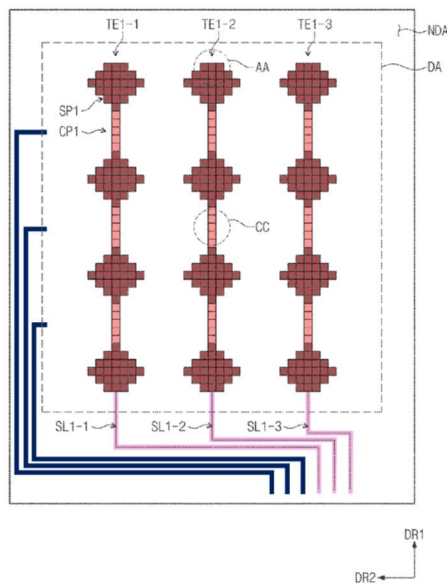
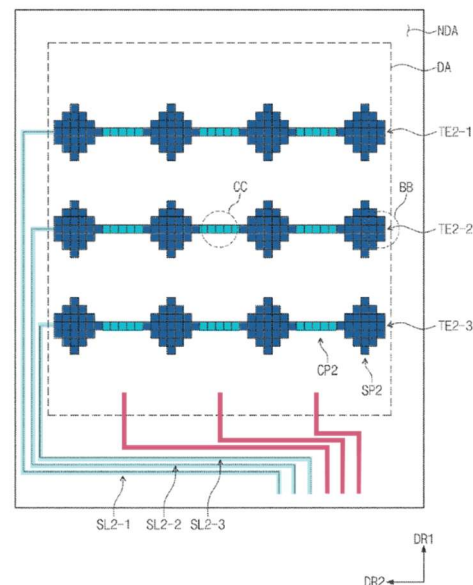


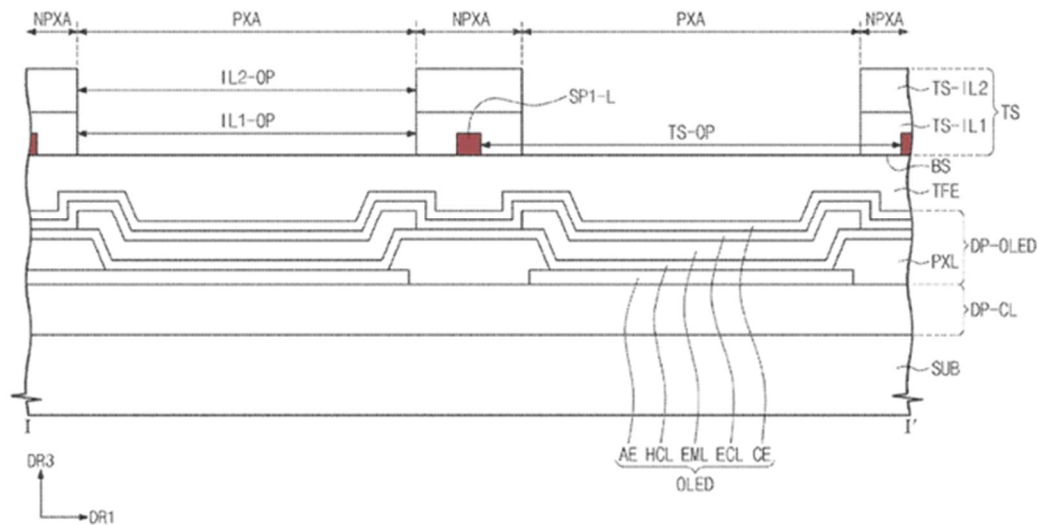
FIG. 9B



Kwon224, FIGS. 9A-9B

185. Second, the sensing parts share the same plane as the connected parts CP1 and CP2 (i.e., the claimed bridges) and, consequently, the first conductive lines also share the same plane with the connected parts (i.e., the claimed bridges); *See* Section VIII.A.4.d (explaining that connected parts CP1 and CP2 are the claimed first and second bridges, respectively). As shown in annotated Figure 10B below, **sensing parts SP1 (brick red)** are disposed on “base surface” created by the thin film encapsulation layer TFE, which is uniformly shown to be a flat surface. Kwon224, ¶¶[0138-139], [0096], Figs. 8A-8B, 10B-11B, 13B.

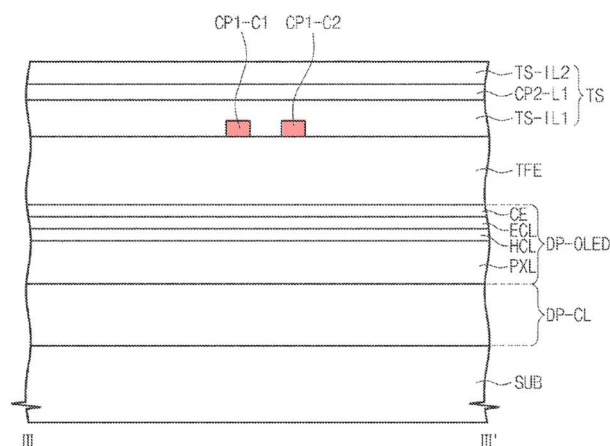
FIG. 10B



Kwon224, FIG. 10B

186. As shown in annotated Figure 12B below, **connected parts CP1** (**salmon**) are similarly disposed on the base surface created by the TFE and, thus, on the same plane as the sensing parts SP1.

FIG. 12B

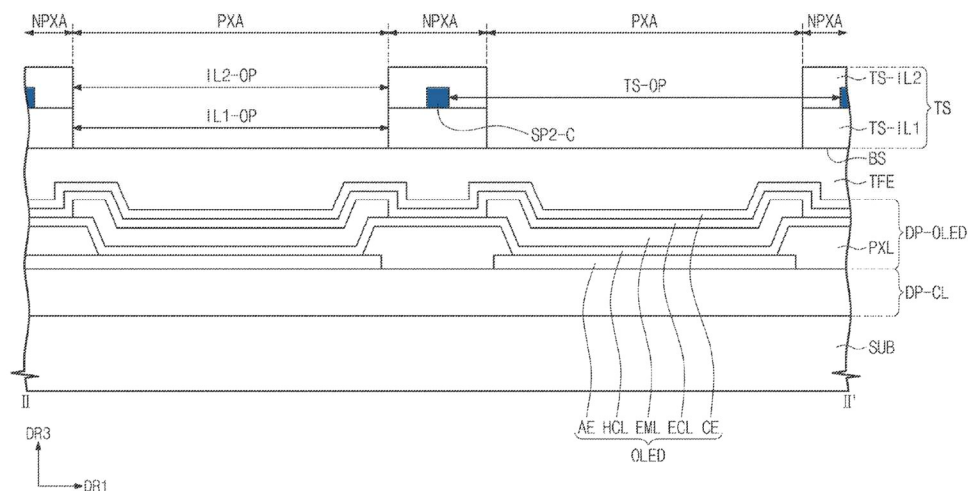


Kwon224, FIG. 12B

187. Thus, it is my opinion that, the touch signal lines SL1 (i.e., first conductive lines) (pink) are also on the same plane as connected parts CP1 (salmon).

188. Kwon224 discloses an alternative ground that meets this limitation. First, as shown in annotated Figure 11B below, sensing parts SP2 (deep blue) are disposed on the TS-IL1 layer. Kwon224, ¶[0158].

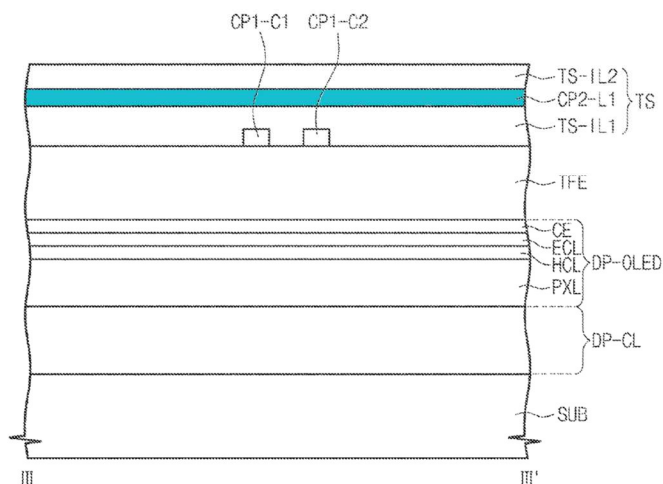
FIG. 11B



Kwon224, FIG. 11B

189. Connected parts CP2 (cyan) are similarly disposed on the TS-IL1 layer and, thus, on the same plane as the sensing parts SP2 (deep blue).

FIG. 12B



Kwon224, FIG. 12B

[The Challenged Claims Are Unpatentable]

190. Thus, in my opinion, the **touch signal lines SL2 (i.e., first conductive lines) (sky blue)** are also on the same plane as connected parts CP2 (**cyan**).

191. Therefore, in my opinion the Kwon224-Kim524 combination discloses claim 6 because Kwon224 discloses one of the first and the second bridges (i.e., Kwon224's connected parts CP1 and CP2) is disposed on a same plane as one of the first and second conductive lines (i.e., Kwon224's touch signal lines SL1 and SL2).

- e. **Claim 7: “The organic light emitting display according to claim 1, wherein at least one of the first bridges, the second bridges, the first touch electrodes, the second touch electrodes, the first conductive lines or the second conductive lines is formed in a multilayer structure comprising Al, Ti, Cu, Mo, ITO or MO.”**

192. In my opinion, Kwon224 and Kim524 render obvious the display of claim 1 (*see* Section VIII.A.4). Further, in my opinion, Kwon224 and Kim524 render obvious the limitation of claim 7.

193. For example, Kwon224 discloses that “[e]ach of the first conductive layer TS-CL1 and the second conductive layer TS-CL2 may have a ... multi-layer structure of layers” including a “indium tin oxide (ITO),” “molybdenum,” “titanium,” “copper,” and/or “aluminum.” Kwon224, ¶[0136]. As explained in Sections VIII.A.4.d, VIII.A.4.e, VIII.A.4.f, the first conductive layer TS-CL1 includes the first bridges, first touch electrodes, first conductive lines, and second conductive lines. Further, as explained in those sections, the second conductive layer [The Challenged Claims Are Unpatentable]

TS-CL2 includes the second bridges, second touch electrodes, first conductive lines, and second conductive lines.

194. Therefore, in my opinion, the Kwon224-Kim524 combination discloses claim 7.

- f. **Claim 8: “The organic light emitting display according to claim 1, wherein at least one of the first bridges, the second bridges, the first touch electrodes, the second touch electrodes, the first conductive lines or the second conductive lines is formed of Ti/Al/Ti or Mo/Al/Mo.”**

195. In my opinion, Kwon224 and Kim524 render obvious the display of claim 1 (*see* §VIII.A.4). Further, in my opinion, Kwon224 and Kim524 render obvious the limitation of claim 8.

196. For example, Kwon224 discloses that the first conductive layer TS-CL1 and second conductive layer TS-CL2 may have multi-layer structures. Kwon224, ¶[0136]. It further explains each conductive layer comprising a metal layer and that metal layer including “at least one of” “molybdenum,” “titanium,” and/or “aluminum.” *Id.* It is my opinion that a person of ordinary skill in the art would have thus understood Kwon224 to teach using multiple metals in the metal layer, including stacks of metals using titanium and aluminum or molybdenum and aluminum. Kim524 expressly discloses using “titanium/aluminum/titanium (Ti/Al/Ti)” or “molybdenum/aluminum/molybdenum (Mo/Al/Mo)” for the touch

electrodes. Kim524, ¶[0087] (“First touch electrode 411 and second touch electrode 421 are formed by mesh patterns formed by crossing the metal lines. The mesh pattern may be formed by metals such as molybdenum (Mo), silver (Ag), titanium (Ti), copper (Cu), aluminum (Ti), titanium/aluminum/titanium (Ti/Al/Ti), molybdenum/aluminum/molybdenum (Mo/Al/Mo), or the like.”).

197. A person of ordinary skill in the art would have modified the Kwon224-Kim524 combination to implement Kwon224’s teachings in a specific manner that is disclosed in Kim524. Specifically, the modification would use Ti/Al/Ti and Mo/Al/Mo metal stacks for Kwon224’s touch electrodes or, alternatively, the entire first and/or second conductive layers, which include the sets of bridges, touch electrodes, and conductive lines, as explained in the last section.

198. In the field of thin-film electronics and touch panels, it is well-known that Ti/Al/Ti and Mo/Al/Mo stacks are standard multilayer metallization schemes, including for signal lines, electrodes, and interconnects in display and touch sensor fabrication. This is because Ti/Al/Ti and Mo/Al/Mo stacks offer a well-balanced combination of properties—titanium and molybdenum serve as excellent adhesion and barrier layers, while aluminum provides low resistivity for efficient signal transmission. These stacks are widely adopted in thin-film processing due to their thermal stability, etch selectivity, and compatibility with photolithographic patterning, making them ideal for forming reliable interconnects and signal lines in

[The Challenged Claims Are Unpatentable]

high-density display and touch sensor architectures. In fact, Kim524 teaches forming first and second touch electrodes using Ti/Al/Ti or Mo/Al/Mo. Kim524, ¶[0087]. And Kwon224 itself contemplates using metal stacks with these elements, as noted above.

199. Using these stacks provides numerous benefits. First, improved adhesion is achieved because titanium and molybdenum are commonly used as base adhesion layers that bond well to underlying substrates such as glass or oxide films, ensuring mechanical stability and preventing delamination during thermal cycling or flexing. Second, reduced contact resistance results from aluminum's role as the central conductive layer, since aluminum has low electrical resistivity and provides efficient signal transmission across the touch panel. Third, prevention of diffusion and electromigration is accomplished by the top titanium or molybdenum layer, which acts as a cap or barrier that inhibits aluminum atoms from migrating into adjacent layers or interconnects, thereby preserving long-term electrical reliability and preventing signal degradation

200. Using Ti/Al/Ti or Mo/Al/Mo would not change the function of the conductive layers in Kwon224, but would improve manufacturability, reliability, and electrical performance. First, Kwon224 already disclose combining these metals, and the modification simply implements Kwon224's teaching in a specific stack of metals that were well known in the industry. Second, manufacturability is [The Challenged Claims Are Unpatentable]

improved because these metal stacks are widely compatible with standard thin-film deposition and etching processes, allowing for high-yield fabrication using well-established tooling and process controls. Third, reliability is enhanced due to the layered structure's ability to resist electromigration and thermal degradation, which helps maintain long-term electrical stability even under repeated touch interactions and environmental stress. Fourth, electrical performance is optimized because aluminum provides low resistivity for efficient signal transmission, while titanium or molybdenum layers serve as barriers that prevent diffusion and maintain clean interfaces between layers, reducing contact resistance and signal loss.

201. Therefore, in my opinion, the Kwon224-Kim524 combination discloses claim 8.

B. Ground 2: The Combination of Kwon224, Kim524, and Zhu837 Renders Obvious Claims 9-16.

1. Zhu837 Overview

202. Like the '394 patent, Kwon224, and Kim524, Zhu837 discloses “a touch control display device” with organic light-emitting diodes” (OLEDs), specifically describing a “touch control device is integrated within the display panel.” Zhu837, Abstract, ¶[0004] (“however, the in-cell technology can make the display panel lighter and thinner, with higher light transmittance and lower power consumption, as well as achievable flexibility, and therefore the in-cell technology

[The Challenged Claims Are Unpatentable]

is considered to be an ultimate solution for touch control display, especially for touch control of organic electro-luminescent display, which will gradually become a development mainstream of touch control technology in organic electro-luminescent display devices.”). While the specification generally describes a “touch control display device,” a skilled artisan would readily appreciate that Zhu837’s disclosure apply to OLED displays, especially given the benefits Zhu837 touts of these types of devices. *Id.*, ¶¶[0008-11], [0037-39].

203. Zhu837’s device includes touch sensors comprising first and second conductive units 105 and 107 (**brick red** and **deep blue**) and “conductive bands” connecting each set of conductive units. Zhu837, ¶¶[0043-45] (“The touch control layer comprises a plurality of second conductive units 107 arranged in parallel in a second direction, the first conductive units 105 and the second conductive units 107 are configured to be insulated from each other and to form a cross network.”), [0073]. The connective bands overlap each other creating a “cross network” while maintaining insulation between the conductive units. *Id.*, ¶[0028].

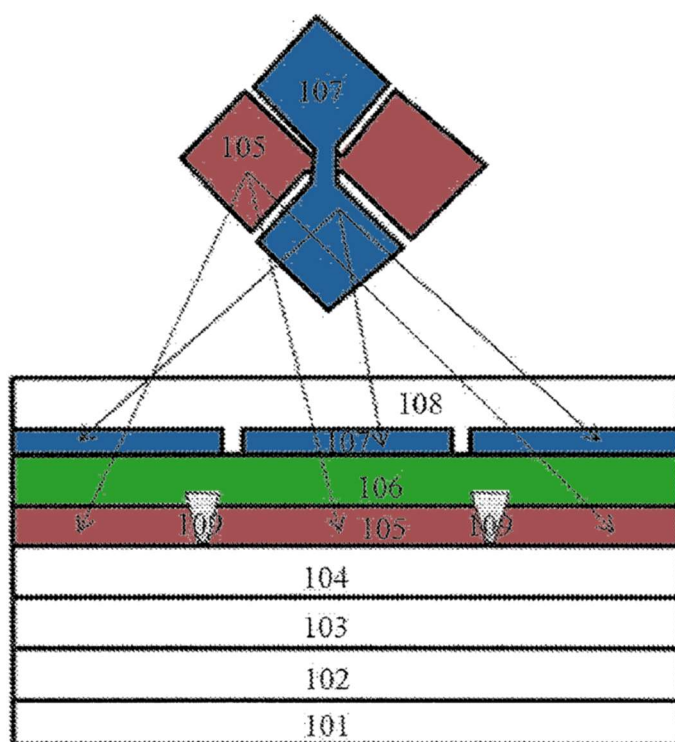


FIG. 2

Zhu837, Fig. 2

204. As annotated Figure 2 above shows, the device includes an “**encapsulation layer 106**” (green) between the first and second conductive units 105 and 107 (brick red and deep blue). *Id.*, ¶¶[0043], [0066-67]. This layer includes either a “a single layer of or multiple alternately arranged layers of organic films and/or inorganic films.” *Id.*, ¶¶[0056], [0058]. The encapsulation layer also provides “insulation between the [conductive units]. *Id.*, ¶[0045].

205. The device also includes a substrate 101 and organic light emitting layer 104. *Id.*, ¶¶[0043], [0046], [0049]. Sometimes the reference notes “substrate 100” but this is referring to substrate 101 in the figures. *See e.g.*, ¶[0043].

[The Challenged Claims Are Unpatentable]

2. Kwon224, Kim524, and Zhu837 are Analogous Art

206. It is my opinion that a person of ordinary skill in the art would have found it obvious to combine Kwon224, Kim524, and Zhu837, which disclose complementary systems/methods in the field for fabricating OLED with integrated touchscreens, analogous to the '394 patent and each other. *Compare* Sections VIII.A.1-VIII.A.3, VIII.B.1. All four similarly disclose touch sensors and display panel layers, that work together to provide OLED touch screens. *Id.* For example, the '394 patent, Kwon224, Kim524, and Zhu837 all have a vertical stack configuration that includes the following layers: a substrate, light emitting elements, an encapsulation unit, and a touch sensor layer. *Id.*

207. Zhu837, like Kwon224 and Kim524, addresses similar problems as the '394 patent. Specifically, Zhu837 identifies the challenges of conventional touch control display devices, including excessive thickness, complex fabrication processes, and limited flexibility due to the use of separate touch sensing layers and protective structures. Zhu837, ¶¶[0006-7]. Zhu837 solves these problems by embedding the touch control structure directly within the OLED stack—forming a cross-network of conductive units using the OLED's second electrodes and a patterned touch control layer, insulated by an encapsulation layer. *Id.*, ¶¶[0008], [0010-14], [0044-45]. A skilled artisan would have understood that this integration

simplifies the fabrication process, reduces device thickness, improves light-emitting efficiency, and enables flexibility. *Id.*, ¶¶[0008], [0033-35], [0046].

208. Given that Kwon224, Kim524, and Zhu837 disclose similar systems that operate in a similar manner and are directed to similar problems, a person of ordinary skill in the art would have been motivated to consider their combined teachings. Additional rationale for the combination is provided below for specific claim elements.

3. Dependent Claims

- a. **Claim 9: “The organic light emitting display according to claim 1, wherein the encapsulation unit comprises at least one inorganic encapsulation layer and at least one organic encapsulation layer; and the at least one insulating film is one of the at least one inorganic encapsulation layer and the at least one organic encapsulation layer.”**

209. In my opinion, Kwon224 and Kim524 render obvious the display of claim 1 (*see* Section VIII.A.4). Further, in my opinion, Kwon224, Kim524, and Zhu837 also render claim 9 obvious.

210. For example, Zhu837 discloses an encapsulation layer 106 that comprises either “a single layer of or multiple alternately arranged layers of organic films and/or inorganic films.” Zhu837, ¶[0056]. As shown in annotated Figure 2 below, the encapsulation layer 106 may have a multi-layer configuration and is disposed between the first conductive units 105 (i.e., the first touch electrodes) and

[The Challenged Claims Are Unpatentable]

the second conductive units 107 (i.e., the second touch electrodes). *Id.*, ¶¶[0064], [0066], [0068-69]. The encapsulation layer 106 includes alternately-arranged inorganic (**lime green**) and organic (**dark green**) films, and Zhu837 contemplates placing the inorganic film on top as one implementation of layer 106, which a skilled artisan would have found beneficial. *Id.*, ¶[0056]. Specifically, Zhu837 simply notes that the inorganic and organic films are alternatively arranged and leaves open which layer is placed on top, as a design choice for the manufacturer. *Id.* Thus, a skilled artisan would have understood that either the inorganic or organic layer can be the topmost layer of the encapsulation layer 106. In fact, this was well-known in the industry—Kwon224 itself discloses either placing the inorganic or organic layer on top. *See* Kwon224, Figs. 7A-7C, 13A.

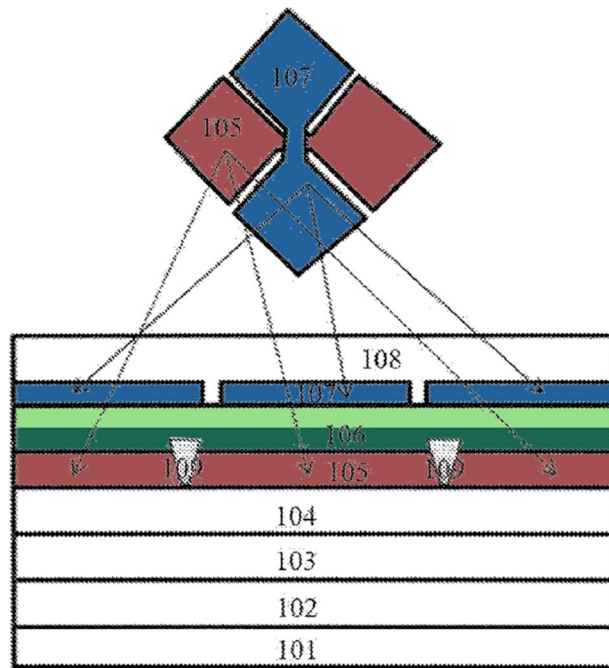


FIG. 2

Zhu837, FIG. 2

211. Further, a skilled artisan would have understood that placing the inorganic film on top provides numerous benefits, including (i) providing a first line of defense against environmental degradation, which is critical for sensitive organic materials underneath, because inorganic materials are highly effective at blocking moisture and oxygen; (ii) enhancing mechanical protection, as inorganic layers are generally harder and more resistant to scratches and abrasion than organic layers, thereby shielding the device from physical damage; (iii) improving chemical stability, since inorganic films are less reactive to atmospheric contaminants, UV light, and chemicals, which helps preserve the integrity of the encapsulation stack; and (iv) offering compatibility with further processing, as inorganic surfaces can [The Challenged Claims Are Unpatentable]

withstand harsher fabrication conditions, including photolithography and etching, compared to organic layers.

212. Zhu837 explains that the encapsulation layer 106 is thin—with the organic layer having a thickness as small as 1.5 μm and the inorganic layer having a thickness of 50 nm. *Id.*, ¶¶[0057-58] (explaining the encapsulation layer may include a polyacrylic ester layer, which a skilled artisan would have understood to be an organic film, and an aluminum oxide layer, which a skilled artisan would have understood to be an inorganic film). A skilled artisan would have also regarded this total thickness as thin, including thinner than Kwon224's TS-IL1 layer. For example, Kwon224 explains that a color filter CF “may have a thickness that is the same as a sum of a thickness of the first insulating layer TS-IL1 and a thickness of the second insulating layer TS-IL2.” Kwon224, ¶[0190]. Typical color filter stacks in OLED displays range from 5 to 10 μm in total thickness. Thus, a skilled artisan would have reasonably estimated a TS-IL1 layer to be approximately 2.5 μm (if TS-IL1 is 1/3rd the thickness the TS-IL2 layer) to 5 μm (if the TS-IL1 layer is of the same thickness as the TS-IL2 layer). Kwon224's figures indicate that the two layers have similar or the same thicknesses. *See id.*, Figs. 10B, 11B, 13A-13B.

213. The combination is an improvement over Kwon224's structure, which only provides a singular, inorganic or organic TS-IL1 layer in between the conductive units. Kwon224, ¶[0138]. Zhu837, however, includes an encapsulation

[The Challenged Claims Are Unpatentable]

layer between the conductive units that provides additional flexibility by enabling either a singular layer or multi-layer structure with both organic and inorganic layers between the conductive units. Zhu837, ¶¶[0056-57], [0067] (explaining that the material of the encapsulation layer 106 can be selected, which provides additional flexibility of what can be used in between the conductive units). A skilled artisan would have understood that this flexibility would help designers build a device based on their specific preferences, such as using a single layer for a thinner encapsulation unit or using specific materials to achieve specific protection. Zhu837, ¶¶[0056-57] (providing specific material and layer stack options). For example, inorganic layers provide protection from moisture and organic layers provide protection from foreign substances such as dust particles, and using both types of layers provides additional protection. Kwon224, ¶[0126] (explaining that inorganic and organic layers provide different types of protection).

214. In my opinion, Claim 9 is rendered obvious in view of Kwon224, Kim524, and Zhu837 because a person of ordinary skill in the art would have been motivated to replace the TS-IL1 layer with Zhu837's encapsulation layer. Consequently, in the Kwon224-Kim524-Zhu837 combination, the encapsulation unit comprises Kwon224's thin film encapsulation layer (TFE) and Zhu837's encapsulation layer 106, which comprises inorganic and organic layers. *See* Section VIII.A.4.c (explaining that the TFE layer could include inorganic and organic [The Challenged Claims Are Unpatentable]

layers). Further, in this combination, Zhu837's encapsulation layer 106 is the claimed insulting film that is between the first and second conductive lines. *See* Section VIII.A.4.g. As explained in Section VIII.B.1, the encapsulation layer 106 is between the first and second conductive units 105 and 107. Zhu837, ¶¶[0043], [0045], [0066-67].

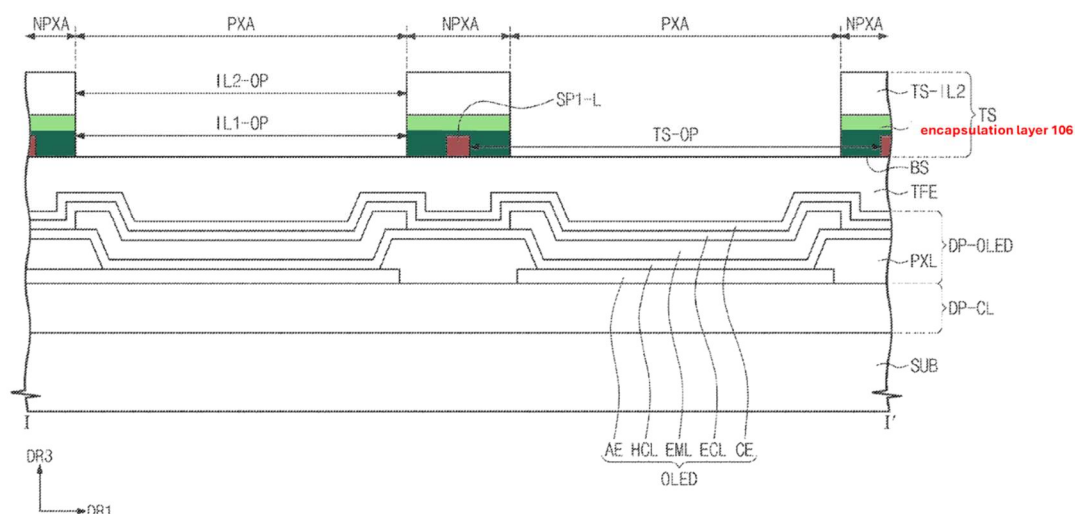
215. Zhu837's encapsulation layer fulfills the purposes of Kwon224's TS-IL1 layer. In the combination, the encapsulation layer 106 includes openings or contact holes similar to the openings in Kwon224's TS-IL1 layer. Kwon224 discloses creating openings in encapsulation layers. Kwon224, ¶[0165], Fig. 13B. Further, in my opinion, these openings help enable the encapsulation layer 106 to fulfil the same purposes as the TS-IL1 layer. First, the TS-IL1 layer includes openings to expose the light emitting areas. Kwon224, ¶[0154], Fig. 10B.

216. Further, contact holes are required to enable connection between the first and second conductive lines. *See* Section VIII.A.4.f (explaining the benefits achieved from stacked conductive lines, which requires contact holes to connect the lines). Creating contact holes and openings in encapsulation layers achieves these purposes and is a routine thin-film OLED practice well known in the industry, and a person of ordinary skill in the art would treat implementing such openings in encapsulation layer 106 as an ordinary manufacturing choice rather than a design departure.

[The Challenged Claims Are Unpatentable]

217. The combination is illustrated in the modified figure below:

FIG. 10B



Representation of Kwon224-Kim524-Zhu837

218. Further, it is my opinion that a person of ordinary skill in the art would have found it obvious to implement Zhu837's encapsulation layer 106 in the Kwon224-Kim524 combination including for the general motivations to combine the references as described in Section VIII.B.2. Specifically, a person of ordinary skill in the art would have found it obvious to replace the touch insulating layer TS-IL1 layer, with Zhu837's encapsulation layer because both are inorganic or organic layers providing insulating properties—thus achieving TS-IL1's functional role. *See* Section VIII.A.4.g (explaining that the TS-IL1 layer is the insulating layer between the first conductive layer and second conductive layer); Zhu837, ¶[0045] ("first encapsulation layer 106 is used for insulation between the first conductive units 105 [The Challenged Claims Are Unpatentable]

The diagram illustrates the structure of the proposed device. It is divided into three main horizontal sections. The top section shows the layout with regions labeled NPXA, PXA, and TS-OP. The middle section shows the layers: TS, IL2-OP, IL1-OP, SP2-C, BS, TFE, DP-OLED, PXL, DP-CL, and SUB. The bottom section shows the electrical connections: DR3, AE, HOL, EMI, EOL, OE, and QLED.

219. In my opinion, swapping the TS-IL1 layer with Zhu837's encapsulation layer was a standard industry practice, enabling engineers to meet reliability targets without changing circuit geometry through selecting the specific type of layer to deposit. For example, if engineers desired extra protection between the conductive layers, then Zhu837's encapsulation layer can be modified to include both inorganic

Tianma Exhibit 1003, Page 125 of 206

and organic layers providing protection against moisture and foreign substances, respectively. However, if thinness and foreign substance protection was prioritized, a single organic layer implementation of Zhu837's encapsulation layer could be used. Kwon224's TS-IL1 layer would not provide such flexibility.

220. Specifically, a person of ordinary skill in the art would have considered selecting Zhu's encapsulation layer 106 in place of TS-IL1 as reflecting ordinary material choice with a predictable outcome, not inventive restructuring, especially because both are able to achieve touch insulating layer TS-IL1's purpose: providing electrical isolation between the conductive layers. *See* Zhu837, ¶[0045] ("first encapsulation layer 106 is used for insulation between the first conductive units 105 and the second conductive units 107"). As explained earlier in this section, encapsulation layer 106 is a thin film that physically insulates the OLED electrode network from the touch network. Thus, a person of ordinary skill in the art would have viewed this as a like-for-like layer swap and one that yields the predictable result of maintained insulation and overall layer structure.

221. It is also my opinion that the modification provides numerous benefits, as replacing the TS-IL1 layer with Zhu837's encapsulation layer enhances protection and device sensitivity. For example, the encapsulation layer is taught as a physical insulating/encapsulation film separating the OLED electrode network from the touch network—i.e., it provides environmental protection (thin-film encapsulation) while

[The Challenged Claims Are Unpatentable]

also acting as an electrical isolator between conductor sets. In the combination, the encapsulation layer 106 covers the sensing parts SP1 and connecting parts CP1, which are located in the non-light emitting area and exposed to more environmental stress than the light-emitting area because the NPXA lacks the shielding provided by color filters and black matrices, and is situated closer to external interfaces where moisture, oxygen, and contaminants are more likely to penetrate. These elements have fine geometry and electrical sensitivity, rendering them vulnerable to (i) moisture ingress that can cause corrosion or leakage currents, (ii) containments like dust and oxygen that can degrade signal fidelity or cause dielectric breakdown, and (iii) mechanical stress during layer stacking. Thus, the encapsulation layer, with both organic and inorganic layers, provides additional helpful protection over the SP1 and CP1 elements, shielding them from environmental exposure and ensuring long-term reliability of the touch sensing function.

222. Further, Zhu837's encapsulation layer expressly provides a physical insulating layer between the two electrode networks to allow close spacing without shorting—thereby improving touch sensitivity by minimizing vertical separation between touch electrode layers.

223. A skilled artisan would have also recognized an additional benefit from this combination: Zhu837's alternating-film encapsulation layer 106 would have provided a well-known major reliability benefit, as disclosed in Kim481. Kim481, [The Challenged Claims Are Unpatentable]

¶¶[0050] (“The first and second organic films 202 and 206 of the sealing thin film 200 prevent nano-crack and micro-crack defects formed in the first and second inorganic layers 204 and 208 from being continuously formed, so that it is possible to decrease a moisture transmission rate by preventing an infiltration path of moisture and oxygen and to reduce stress left in the first and second organic layers 204 and 208.”), [0054-55]. Accordingly, a skilled artisan would have been highly motivated to use a Zhu837’s encapsulation layer containing both an inorganic film (as a superior contaminant barrier) in conjunction with an organic film (to prevent cracking of the inorganic film).

224. Further, a skilled artisan would have understood that, because the substitution preserves (a) the layer’s function (electrical isolation) and (b) its physical placement (between the same conductor levels), and because both references operate in the same fabrication technology for flexible OLED/touch devices, a person of ordinary skill in the art would reasonably expect the modified stack to work without adverse effects.

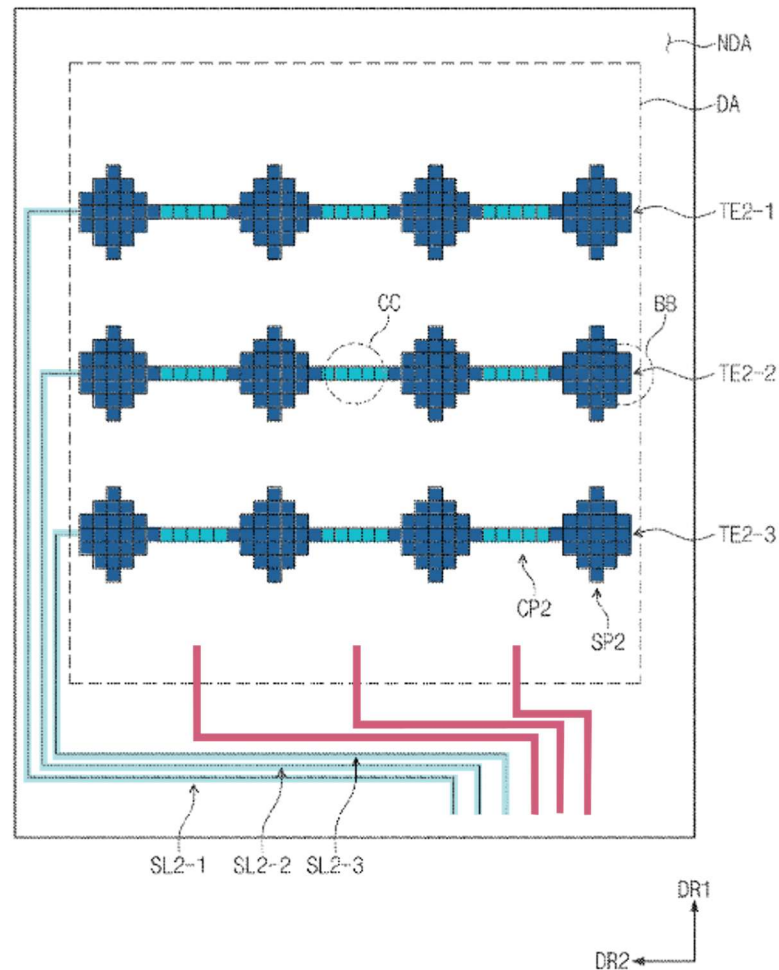
225. Therefore, it is my opinion that the Kwon224-Kim524-Zhu837 combination discloses claim 9.

b. Claim 10: “The organic light emitting display according to claim 9, wherein the second conductive lines are disposed on an uppermost one of the at least one inorganic encapsulation layer.”

226. In my opinion, Kwon224 and Kim524 render obvious the display of claim 1 (*see* Section VIII.A.4), and Kwon224, Kim524, and Zhu837 render obvious claim 9 (*see* Section VIII.B.3.a). It is also my opinion that Kwon224, Kim524, and Zhu837 render claim 10 obvious.

227. For example, the Kwon224-Kim524-Zhu837 combination includes second conductive lines (**magenta**) that are part of the second conductive layer, as shown in annotated Figure 9B below. *See* Section VIII.A.4.f (explaining the second conductive lines (**magenta**) are deposited as part of the second conductive layer). As I explained in Section VIII.B.3.a, this layer (and lines) are disposed on the encapsulation layer 106 (i.e., the uppermost one of the at least one inorganic encapsulation layer).

FIG. 9B



Kwon224, FIG. 9B

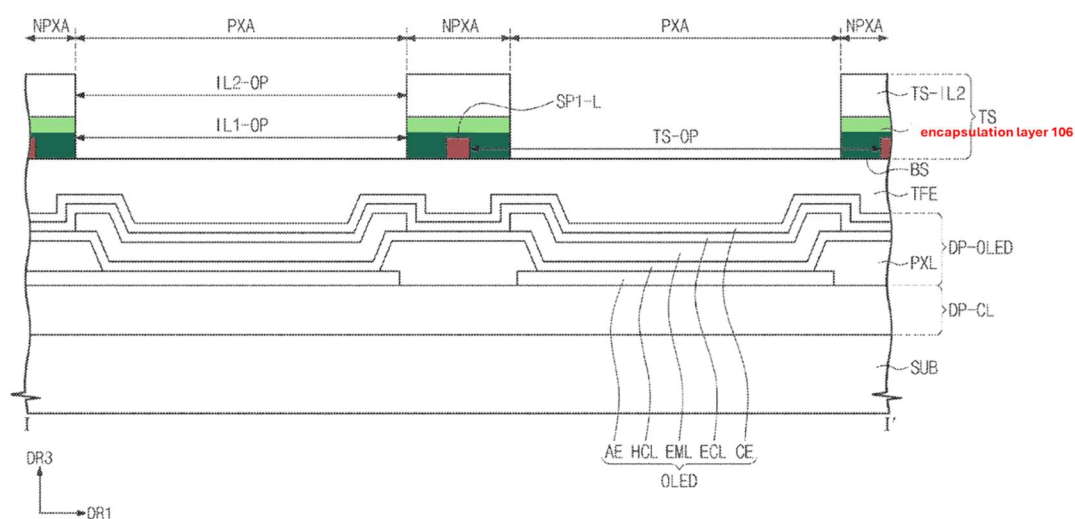
228. Further, in the combination, this second conductive layer shown in Figure 9B, including the second conductive lines (**magenta**), is deposited on top of the encapsulation layer 106. *See* Sections VIII.A.4.f (explaining Kwon224 discloses depositing the first conductive layer first, the TS-IL1 layer next, and then the second

[The Challenged Claims Are Unpatentable]

conductive layer on top); VIII.B.3.a (explaining the encapsulation layer 106 replaces TS-IL1 layer in the combination).

229. As I explained in Section VIII.B.3.a, the encapsulation layer 106 either has (i) a single, inorganic layer that would be the uppermost inorganic encapsulation layer or (ii) a multi-layer configuration with a top layer as the uppermost inorganic layer. *See* Sections VIII.B.3.a. Annotated Figure 10 shows the multi-layer configuration below:

FIG. 10B



Representation of Kwon224-Kim524-Zhu837

230. I note that this figure does not explicitly show the second conductive lines on top of Zhu837's encapsulation layer 106, as the cross section is from the area of the device where SP1 is present. However, considering the figure in light of the described combination, this limitation is met. As I describe above in Section [The Challenged Claims Are Unpatentable]



231. As also detailed in Section VIII.A.4.f, Kwon²²⁴ further explains that the second conductive layer, which includes the magenta second conductive lines, is deposited on top of the encapsulation layer. Therefore, in combination a POSITA would understand the magenta second conductive lines would be disposed on top of

132

the pictured TS-IL1 layer, which in the combination with Zhu837 would be a part of the encapsulation unit, and include in the uppermost layer an inorganic encapsulation layer.

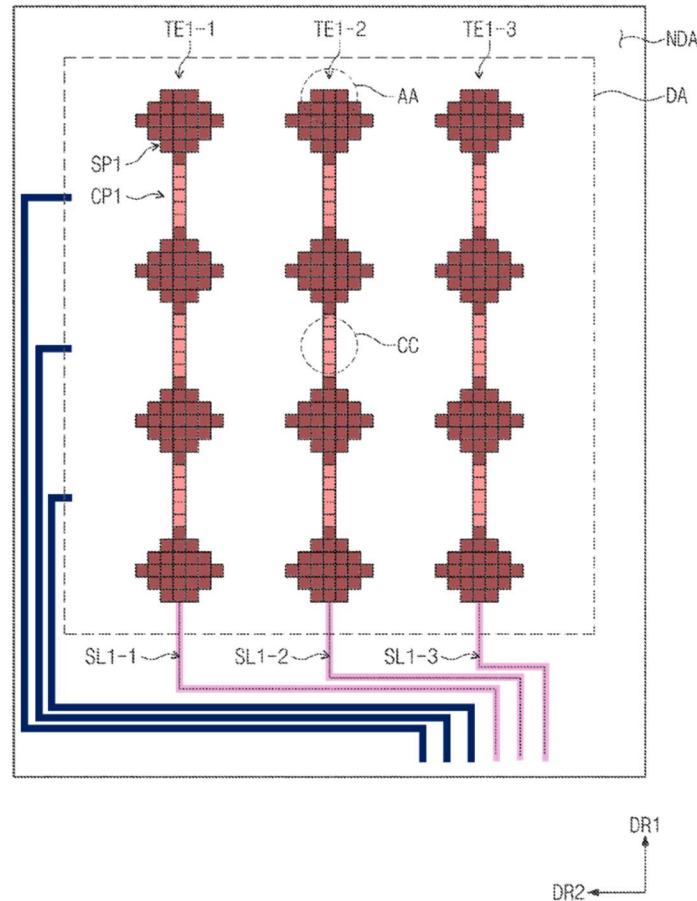
232. Therefore, in my opinion, the Kwon224-Kim524-Zhu837 combination discloses claim 10.

c. Claim 11: “The organic light emitting display according to claim 10, wherein the first conductive lines are disposed on the at least one organic encapsulation layer.”

233. Kwon224 and Kim524 render obvious the display of claim 1 (*see* Section VIII.A.4), and Kwon224, Kim524, and Zhu837 render obvious claim 10 (*see* Sections VIII-B.3.a-VIII.B.3.b). Further, Kwon224, Kim524, and Zhu837 also render claim 11 obvious.

234. For example, the Kwon224-Kim524 combination includes first conductive lines (pink) that are part of the first conductive layer, as shown in Figure 9A below. As I previously explained, these lines are disposed on the upper layer of the thin film encapsulation layer (TFE), and this upper layer can be an organic encapsulation layer. *See* Section VIII.A.4.e (explaining the first conductive lines (pink)); VIII.A.4.f (explaining the first conductive lines being deposited on top of the TFE layer).

FIG. 9A

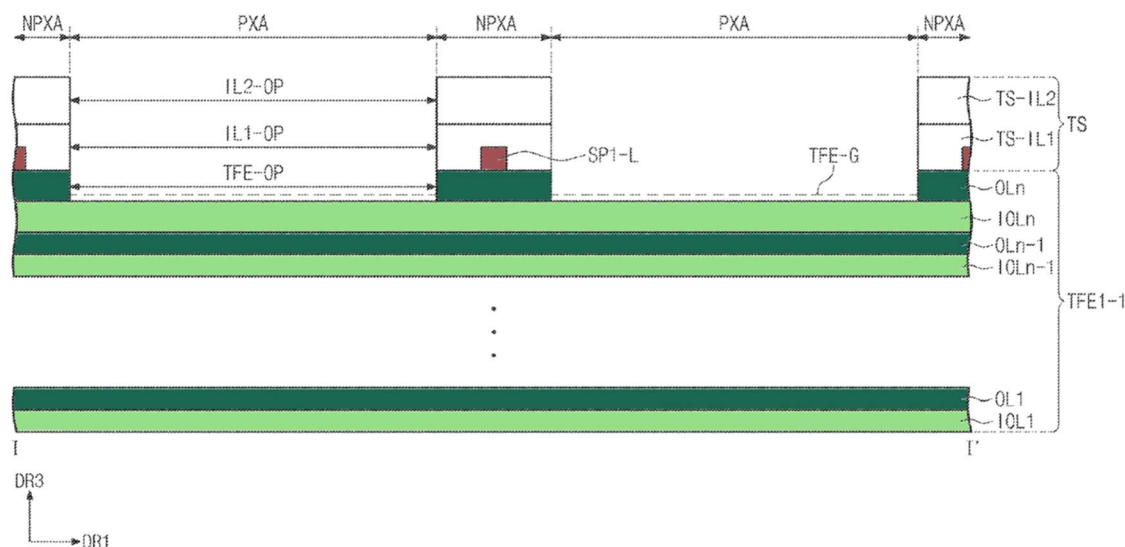


Kwon224, FIG. 9A

235. Specifically, the first conductive layer, including the first conductive lines (pink), is deposited on top of the thin film encapsulation layer (TFE). See Section VIII.A.4.f (explaining Kwon224 discloses depositing the first conductive layer first). The TFE includes inorganic and/or organic thin film layers, and Kwon224 discloses one implementation of the TFE includes an organic top layer. Kwon224, ¶¶[0112], [0126], [0123], [0164-165], Fig. 13A (showing a cross-
[The Challenged Claims Are Unpatentable]

sectional view of Fig. 10A, like Fig. 10B, and organic layers OL and inorganic layers IOL).

FIG. 13A



Kwon224, FIG. 13A

236. Similarly to claim 10, I note that this figure does not explicitly show SL1-N, or the first conductive lines (pink), on top of thin film encapsulation layer (TFE), as Kwon224 does not include a cross-sectional view of touch signal lines SL1-N specifically. However, considering the figure in light of the described combination, this limitation is met. As I describe above in Section VIII.A.4.e, the first conductive lines (SL1-N) are part of the first conductive layer, which also includes SP1. This layer, including both pictured SP1 and not pictured SL1-N, is deposited on top of the thin film encapsulation layer (TFE), as shown in Figure 13A,

[The Challenged Claims Are Unpatentable]

albeit for only the portion of the device where SP1 is present. So, SL1-N would be present on the same layer for the same reasons.

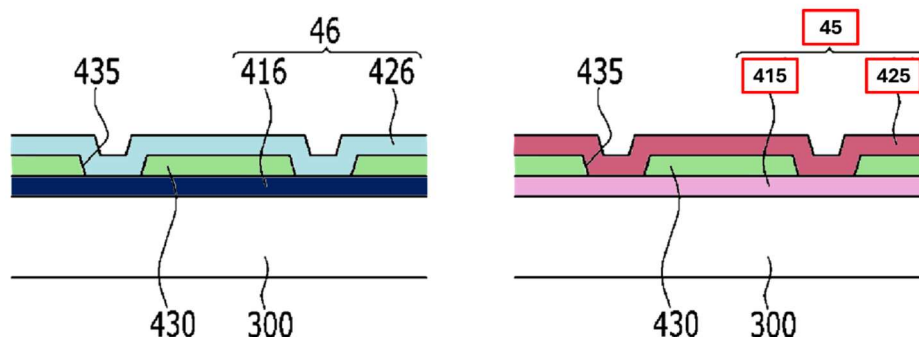
237. Therefore, in my opinion, the Kwon224-Kim524-Zhu837 combination discloses claim 11.

- d. Claim 12: “The organic light emitting display according to claim 11, wherein the first conductive lines are connected to the second conductive lines through contact holes formed through the uppermost one of the at least one inorganic encapsulation layer.”**

238. Kwon224 and Kim524 render obvious the display of claim 1 (*see* Section VIII.A.4) and Kwon224, Kim524, and Zhu837 render obvious claim 11 (*see* Sections VIII.B.3.a-VIII.B.3.c). Kwon224, Kim524, and Zhu837 also render claim 12 obvious.

239. For example, as I explained for the Kwon224-Kim524 combination, the first and second conductive lines are arranged in a parallel configuration with one positioned directly above the other, such that they are vertically stacked while maintaining parallel alignment. *See* Section VIII.A.4.f. Specifically, the combination implements Kim524’s stacked conductive line configuration, as shown in annotated Figure 10 below and to the left with conductive lines 416 and 426, into Kwon224’s device. *See* Section VIII.A.4.f. This expressly shows a connection via contact holes 435 through an upper, inorganic insulating layer 430. *Id.* The annotated

FIG. 10



Kim524, FIG. 10 (modified right)

240. In applying Kim524's vertical conductive line configuration to Kwon224's device, the first and second conductive lines in the combination are connected via contact holes through the TS-IL1 layer. *See* Section VIII.A.4.f (explaining the TS-IL1 layer is layer in between the conductive layers, which includes the lower and upper conductive lines). Further, in the Kwon224-Kim524-Zhu837 combination, the TS-IL1 layer is replaced by Zhu837's encapsulation layer 106, which includes the uppermost inorganic encapsulation layer. *See* Section VIII.B.3.a. As further explained in Section VIII.B.3.a, the Kwon224-Kim524-Zhu837 combination includes creating contact holes through the encapsulation layer

[The Challenged Claims Are Unpatentable]

106 between the first and second conductive lines to enable connection between the lines.

241. Therefore, in my opinion, the Kwon224-Kim524-Zhu837 combination discloses claim 12.

- e. **Claim 13: “The organic light emitting display according to claim 10, wherein the first conductive lines are disposed on one of the at least one inorganic encapsulation layer, disposed under the at least one organic encapsulation layer.”**

242. Kwon224 and Kim524 render obvious the display of claim 1 (*see* Section VIII.A.4), and Kwon224, Kim524, and Zhu837 render claim 10 obvious (*see* Sections VIII.B.3.a-VIII.B.3.b). Kwon224, Kim524, and Zhu837 also render claim 13 obvious.

243. For example, the first conductive lines are disposed on the TFE layer, which has a top inorganic encapsulation layer disposed under an organic encapsulation layer. *See* Section VIII.A.5.b (explaining that the first conductive lines are disposed on the TFE layer). Kwon224 explains that the TFE layer includes inorganic and organic layers, and expressly discloses examples that include a top inorganic layer. Kwon224, ¶¶[0112], [0126], [0123] (“Each thin film encapsulation layer may include at least two inorganic thin film layers and an organic thin film layer disposed between the two inorganic thin film layers”), [0125] (“FIGS. 7A, 7B, and 7C are cross-sectional views showing thin film encapsulation layers TFE1, [The Challenged Claims Are Unpatentable]

TFE2, and TFE3 according to an exemplary embodiment of the present disclosure.”)

Figs. 7B-7C.

244. Further, Zhu837’s encapsulation layer can have “multiple alternately arranged layers of organic films and/or inorganic films,” Zhu837, ¶[0056], with one example being a top inorganic film with an organic film underneath. *See* Section VIII.B.3.a.

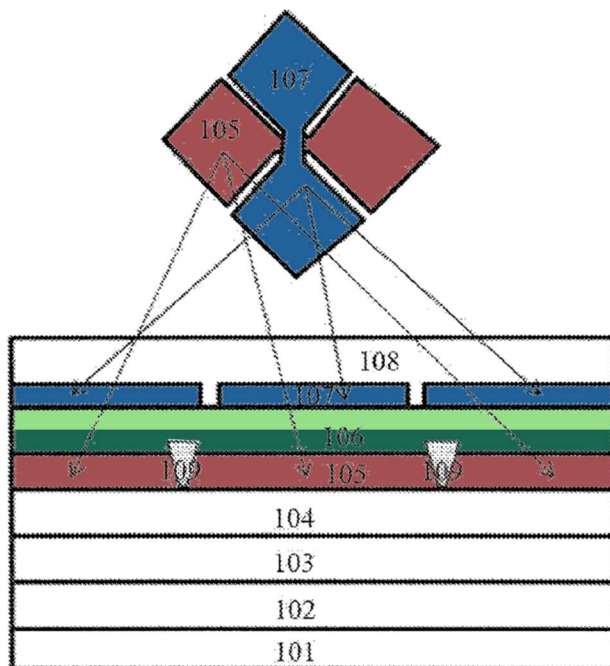


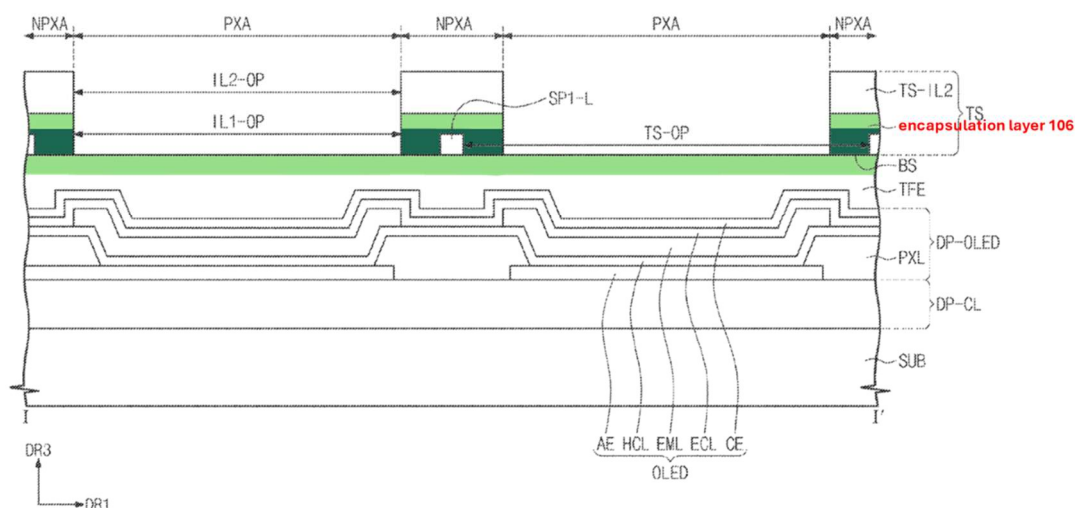
FIG. 2

Zhu837, FIG. 2

245. Thus, in my opinion, a person of ordinary skill in the art would have understood that the combination discloses a TFE layer with a top inorganic layer that is underneath the encapsulation layer 106’s organic layer, as illustrated below in annotated figure 10B below. *Id.*

[The Challenged Claims Are Unpatentable]

FIG. 10B



Kwon224, FIGS. 10B

246. In this configuration, the first conductive lines, which are disposed on the TFE layer, are disposed on an inorganic encapsulation layer underneath an organic encapsulation layer.

247. Therefore, in my opinion, the Kwon224-Kim524-Zhu837 combination discloses claim 13.

- f. **Claim 14: “The organic light emitting display according to claim 13, wherein the first conductive lines are connected to the second conductive lines through contact holes formed through the uppermost one of the at least one inorganic encapsulation layer and through the at least one organic encapsulation layer.”**

248. In my opinion, Kwon224 and Kim524 render obvious the display of claim 1 (*see* Section VIII.A.4), and Kwon224, Kim524, and Zhu837 render claim 13

[The Challenged Claims Are Unpatentable]

obvious (*see* Sections VIII.B.3.a-VIII.B.3.b, VIII.B.3.e). Kwon224, Kim524, and Zhu837, in my opinion, also render claim 14 obvious.

249. In the Kwon224-Kim524 combination, the first and second conductive lines are vertically stacked on top of each other and connected via contact holes through the encapsulation layer 106 with the uppermost inorganic layer and an organic layer underneath. *See* VIII.B.3.d; VIII.B.3.a.

250. Therefore, in my opinion, the Kwon224-Kim524-Zhu837 combination discloses claim 14.

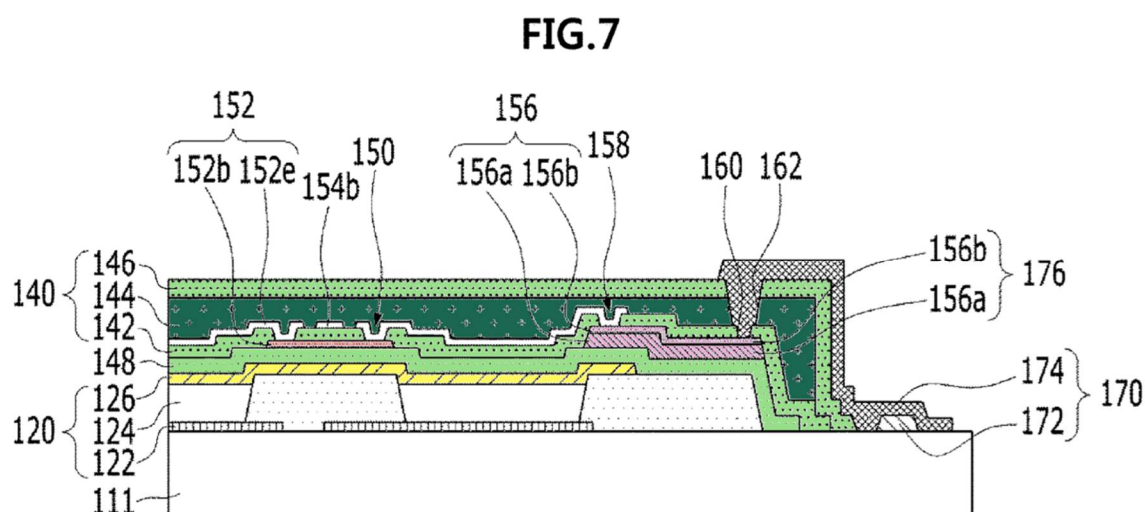
g. Claim 15: “The organic light emitting display according to claim 10, further comprising an interlayer inorganic layer disposed on cathodes of the light emitting elements, wherein the first conductive lines are disposed on the interlayer inorganic layer.”

251. In my opinion, Kwon224 and Kim524 render obvious the display of claim 1 (*see* Section VIII.A.4), and Kwon224, Kim524, and Zhu837 render claim 10 obvious (*see* Sections VIII.B.3.a-VIII.B.3.b). Kwon224, Kim524, and Zhu837, in my opinion, also render claim 15 obvious.

252. For example, in my opinion, the Kwon224-Kim524-Zhu837 combination discloses the claimed interlayer inorganic layer and first conductive lines disposed thereon.

253. The '394 patent provides helpful context that explains this claim. Specifically, the '394 patent illustrates the interlayer inorganic layer in Figure 7, [The Challenged Claims Are Unpatentable]

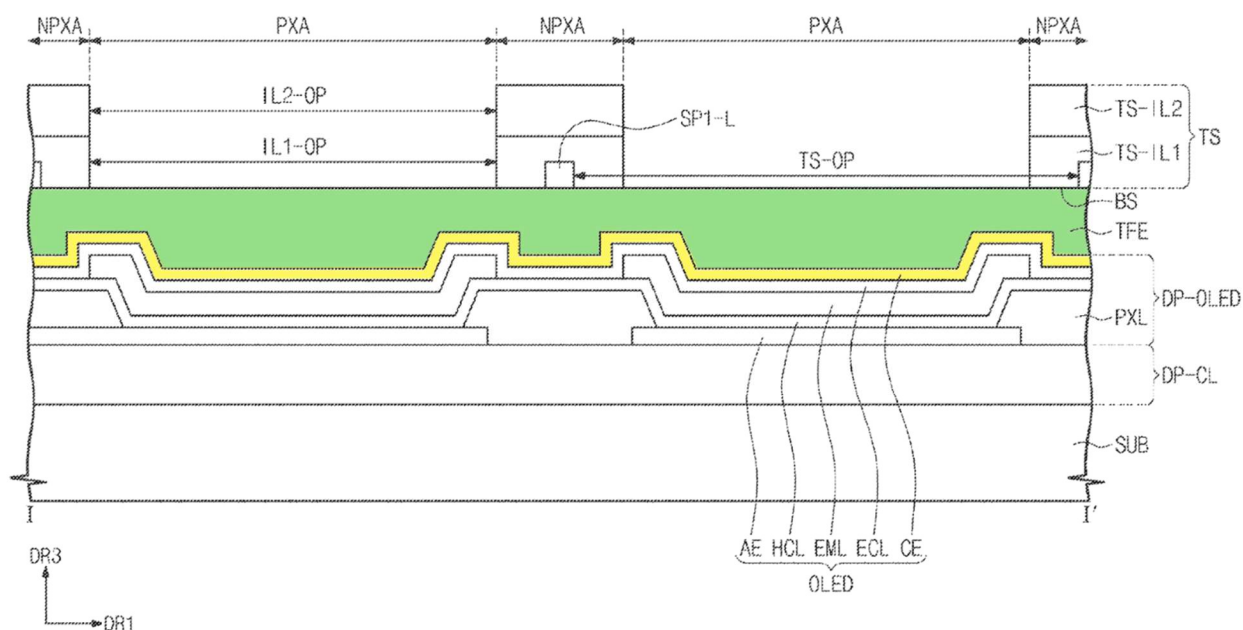
which is annotated below—showing it simply as an inorganic layer on the **cathodes** (light yellow) and underneath the **first conductive lines** (pink) and the **first bridges** 152b (salmon). Ex-1001, 11:22-34, 12:26-54.



Ex-1001, FIG. 7

254. It is my opinion that the Kwon224-Kim524-Zhu837 combination discloses this configuration. First, the combination discloses an inorganic TFE layer, which a skilled artisan would have understood as the claimed **interlayer inorganic layer film** (lime green), especially in view of the '394 patent disclosures describing this interlayer film that I discussed above. Further, Kwon224 explains that the **TFE layer** (lime green) is disposed on the **cathodes** (light yellow) of the light emitting elements. Kwon224, ¶[0123].

FIG. 10B



Kwon224, FIGS. 10B

255. As I explained in detail in Section VIII.A.5.b, the first conductive lines are disposed on the TFE layer. Further, as I explained in Section VIII.A.5.d, the first bridges are disposed on the TFE layer.

256. A skilled artisan would have understood that this TFE layer would have constituted the claimed interlayer inorganic layer film, including because the TFE layer's positioning (as noted above) and composition (being an inorganic film) is consistent with the interlayer film described in the '394 patent.

257. Second, as I explained in Section VIII.B.3.a, the combination replaces TS-IL1 layer with Zhu837's encapsulation layer 106, which includes "multiple

[The Challenged Claims Are Unpatentable]

alternately arranged layers of organic films and/or inorganic films.” Zhu837, ¶[0056]. Thus, in the combination, the encapsulation layer 106—which is positioned above the first conductive lines—can include an inorganic film (lime green) on top, an organic film (dark green) in the middle, and another inorganic film (lime green) on the bottom, as shown below. *See* Sections VIII.B.3.e-VIII.B.3.f (detailing encapsulation layer 106 with a three-layer structure).

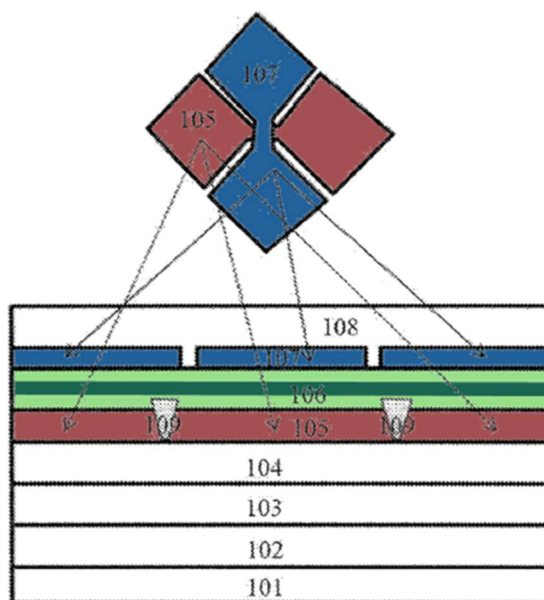


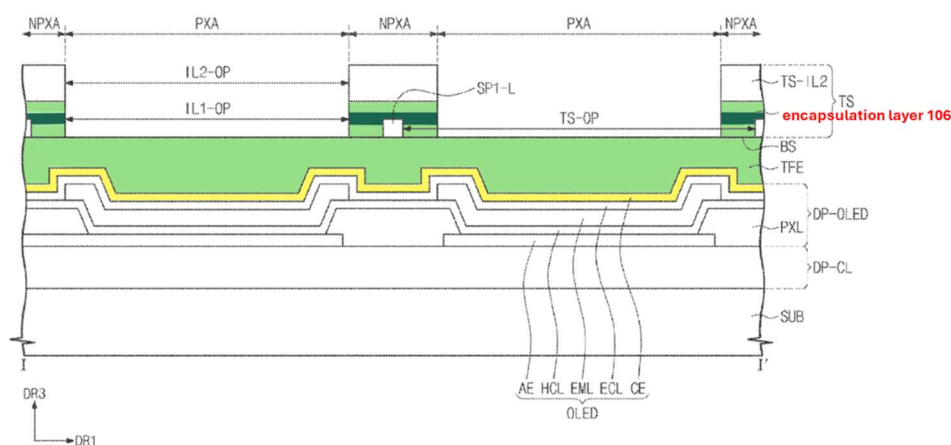
FIG. 2

Zhu837, FIG. 2

258. Putting this together, the Kwon224-Kim524-Zhu837 combination would include an encapsulation unit as illustrated below in annotated Figure 10B. Specifically, the encapsulation unit would include both the TFE layer and the encapsulation layer 106. Further, the TFE layer (lime green, bottom layer) is the fourth layer in the encapsulation unit.

[The Challenged Claims Are Unpatentable]

FIG. 10B



Representation of Kwon224-Kim524-Zhu837

259. Third, the TFE layer is implemented as a single inorganic layer. Kwon224 explains that TFE may constitute only inorganic layers and one implementation involves an inorganic layer with two inorganic sublayers. Kwon224, ¶¶[0112], [0132], [0134], [0114]. Thus, a person of ordinary skill in the art would have understood that Kwon224's TFE may only comprise a single inorganic film layer that includes two inorganic sublayers.

260. It is also my opinion that this is consistent with industry understanding that multiple inorganic layers without an intermediary element deposited in between would constitute a single inorganic encapsulation layer. In fact, the term "layer" in OLED/TFE practice often refers to a functional layer rather than a single deposition step. A functional layer can itself be a composite of multiple sub films (e.g., alternating inorganic sub layers) that together perform the barrier function.

[The Challenged Claims Are Unpatentable]

261. In my opinion, interpreting the TFE layer to include just a single inorganic layer also aligns with industry practice, where a single encapsulation layer is often implemented as a composite stack to achieve the required barrier performance.

262. In fact, the '394 patent also confirms this point. It notes that encapsulation layers may be “multilayer structure[s].” Ex-1001, 3:53-58 (“Such a first encapsulation layer 142 is formed to have a monolayer or multilayer structure using an inorganic insulating material which can be deposited at a low temperature, such as silicon nitride (SiNx), silicon oxide (SiOx), silicon oxynitride (SiON) or aluminum oxide (Al₂O₃). Therefore, damage to the organic light emitting layer 124 by a high-temperature atmosphere during a deposition process of the first encapsulation layer 142 can be prevented.”), 4:15-19; *see id.*, 4:2-6.

263. Zhu837 also confirms that this interpretation is correct. Specifically, it shows an encapsulation layer with a single layer was well known in the art. Zhu837, ¶¶[0020] (“Preferably, the first encapsulation layer and the second encapsulation layer each comprises a single layer of or alternately arranged multiple layers of organic films and/or inorganic films.”), [0050], claim 7.

264. Therefore, in my opinion, the Kwon224-Kim524-Zhu837 combination discloses claim 15.

- h. Claim 16: “The organic light emitting display according to claim 15, wherein the first conductive lines are connected to the second conductive lines through contact holes formed through the at least one inorganic encapsulation layer and the at least one organic encapsulation layer.”**

265. Kwon224 and Kim524 render obvious the display of claim 1 (*see* Section VIII.A.4), and Kwon224, Kim524, and Zhu837 render claim 15 obvious (*see* Sections VIII.B.3.a-VIII.B.3.b, VIII.B.3.g). Kwon224, Kim524, and Zhu837 also render claim 16 obvious.

266. For example, the Kwon224-Kim524-Zhu837 combination discloses this claim for the reasons explained for claim 12 in the Kwon224-Kim524-Zhu837 combination. *See* Section VIII.B.3.d. As explained in Section VIII.B.3.a, the modification includes creating contact holes in the encapsulation layer 106 between the first and second conductive lines to enable connection between the lines.

267. Therefore, in my opinion, the Kwon224-Kim524-Zhu837 combination discloses claim 16.

- i. Claim 18: “The organic light emitting display according to claim 9, wherein the second conductive lines contact an uppermost one of the at least one inorganic encapsulation layer.”**

268. In my opinion, Kwon224 and Kim524 render obvious the display of claim 1 (*see* Section VIII.A.4) and Kwon224, Kim524, and Zhu837 render obvious

claim 9 (*see* Section VIII.B.3.a). Further, in my opinion, Kwon224, Kim524, and Zhu837 also render claim 18 obvious.

269. For example, in the Kwon224-Kim524-Zhu837 combination, the TS-CL2 layer, which includes **SP2 (deep blue)** and **second conductive lines (magenta)**, is deposited on top of (and thus contacts) the **top layer of Zhu837's encapsulation layer 106, which is the uppermost inorganic layer (lime green)**. Kwon224, ¶[0138] (“The first insulating layer TS-IL1 may have a variety of shapes as long as the first insulating layer TS-IL1 insulates the first conductive layer TS-CL1 from the second conductive layer TS-CL2.”); *see* Sections VIII.A.4.f (explaining the second conductive lines in the combination); VIII.B.3.a (explaining that the combination incorporates Zhu837's encapsulation layer 106 with an uppermost inorganic layer in the encapsulation unit, replacing the TS-IL1 layer).

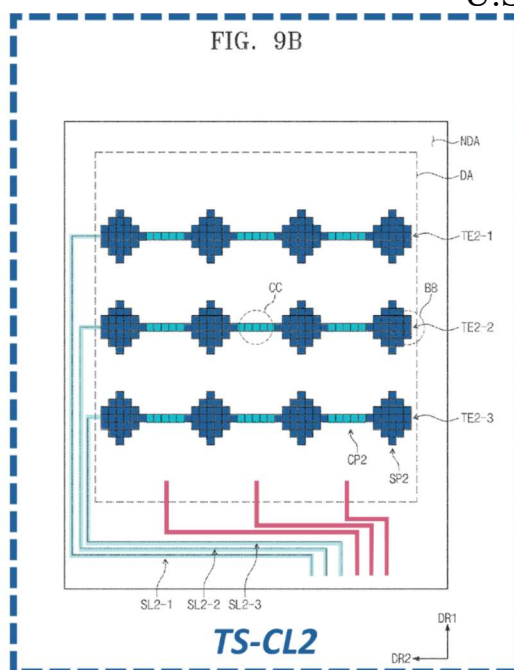
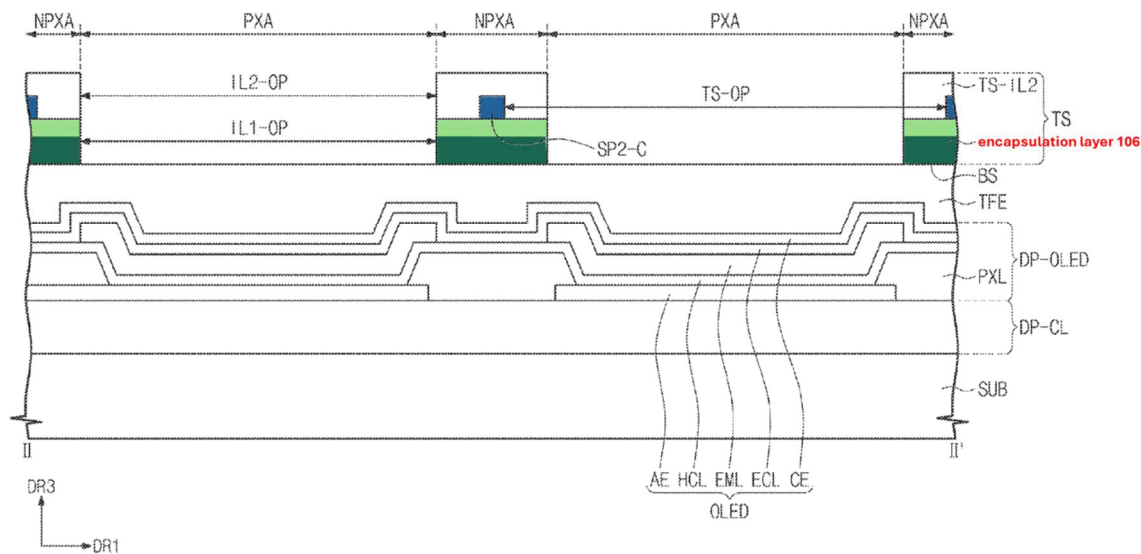


FIG. 11B



Representation of Kwon224-Kim524-Zhu837

270. The second conductive layer (i.e., the upper conductive layer) includes the second conductive lines in **magenta** (as shown in Kwon224's Figure 9B above)

[The Challenged Claims Are Unpatentable]

and is deposited after and on top of the encapsulation layer 106. *See* Section VIII.A.4.f (detailing deposition of the TS-IL1 layer, which the encapsulation layer 106 replaces). Thus, the second conductive lines (magenta) would contact the topmost layer of the encapsulation layer 106, which is the uppermost inorganic layer in the encapsulation unit, as Figure 11B above shows. Figure 11B above also shows that the sensing parts SP1—which are a part of the second conductive layer TS-CL2—are on top of and contact the encapsulation layer 106. This is also true of other elements of the TS-CL2 layer, including the connecting parts CP2 (as shown in Figure 12B) and the second conductive lines in **magenta** described above.

271. As explained when describing the Kwon224-Kim524 combination, both the first and second conductive lines, on the first and second conductive layers TS-CL1 and TS-CL2, are arranged in a parallel configuration, with one positioned directly above the other, with the encapsulation layer 106 in between. *Id*; *see* Section VIII.A.4.f (explaining implementation of Kim524's stacked conductive line configuration, as shown in Figure 10). This is also shown in Kim524, Figure 10B:

FIG. 10

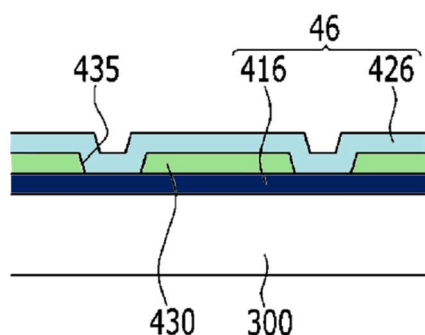
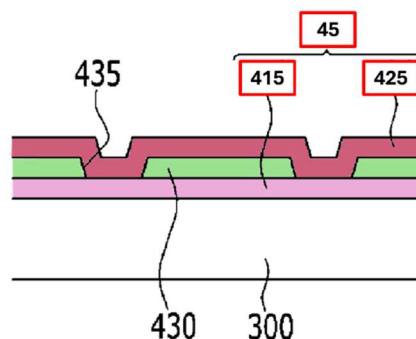


FIG. 10



Kim524, FIG. 10 (modified right)

272. Therefore, in my opinion, the Kwon224-Kim524-Zhu837 combination discloses claim 18.

C. Ground 3: The Combination of Kwon224, Kim524, and Jang513 Renders Obvious Claim 5.

1. Jang513 Overview

273. Like the '394 patent, Kwon224, and Kim524, Jang513 discloses a “touch screen panel” that includes self-emissive pixels, a sealing thin film, and sensing electrodes. Jang513, Abstract, ¶¶[0056-57], [0068-69]. A person of ordinary skill in the art would have understood that Jang513’s device is an OLED device or, at the very least, Jang513’s disclosures apply to OLED devices because of the technical details disclosed in Jang514, including that the pixels themselves emit light. not simply filter it. A person of ordinary skill in the art would have understood

[The Challenged Claims Are Unpatentable]

that pixels that are self-emissive would indicate an OLED device, because, in such devices, each pixel emits light and can be independently controlled. This contrasts with other devices in which a uniform backlight emits light through the pixels, which filter the light received from the backlight.

274. For example, Jang513 explains that “light emitted from the pixels 20 is not blocked by the first and second sensing electrodes 50 and 60” (¶[0068]) and that “the pixels 20 may be exposed through the plurality of openings 70, such that the light emitted from the pixels 20 may be transmitted outside through the openings 70 without being blocked by the metal wires 100 of the first and second sensing electrodes 50 and 60.” This shows how the reference repeatedly describes “light emitted from the pixels” and emphasizes the need to avoid blocking that light with sensing electrodes—a concern that arises specifically in displays with self-emissive pixels, like OLEDs, where each pixel generates its own light.

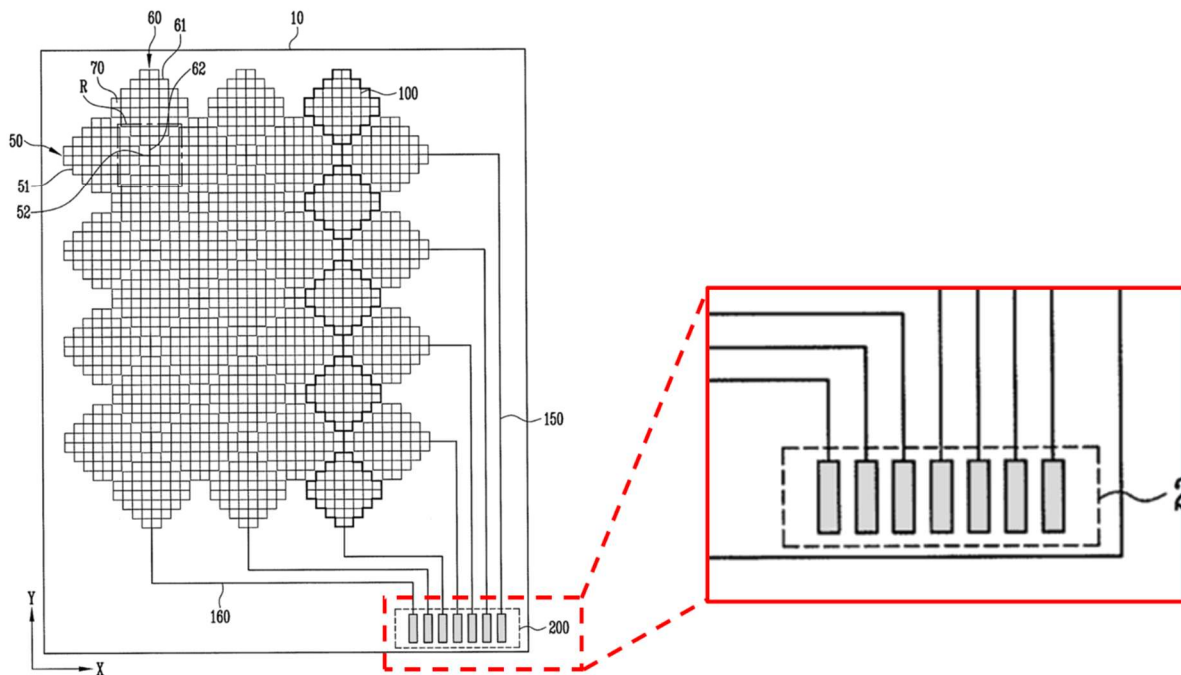
275. Additional technical details also indicate that Jang513’s device is an OLED device. Jang513 discloses the use of low-temperature sintered opaque metal electrodes to prevent pixel damage, which aligns with OLED fabrication requirements, as OLED materials are sensitive to high temperatures. The document also describes mesh-shaped sensing electrodes that expose pixels through openings, and the use of flexible substrates such as PET, PC, and PI—materials commonly

used in flexible OLED panels. Taken together, these features strongly indicate that the disclosed touch screen panel is designed for use with OLED displays.

276. Thus, a skilled artisan would have recognized that Jang513's device is an OLED device. At the very least, a skilled artisan would have recognized that Jang513's teachings are agnostic as to the specific type of OLED device, apply to OLED devices, are highly compatible with OLED technology.

277. For example, annotated Figure 1 below shows touch sensors comprising first and second sensing electrodes 50 and 60 that include sensing cells and connection patterns connecting adjacent cells. Jang513, ¶¶[0051], [0060]. The device also includes first and second position detecting lines 150 and 160 that terminate at **touch pad unit 200 (light gray)**. *Id.*, ¶¶[0063-64].

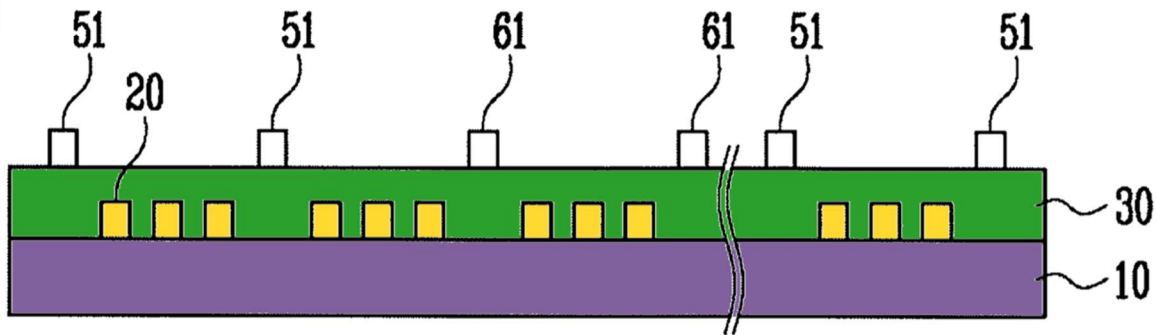
FIG. 1



Jang513, FIG. 1

278. Further, annotated Figure 3 below shows a cross-sectional view of the device, illustrating pixels 20 (i.e., light emitting elements) (yellow) on top of a substrate 10 (dark purple), as well a sealing film 30 (green).

FIG. 3



Jang513, FIG. 3

2. Kwon224, Kim524, and Jang513 are Analogous Art

279. It is my opinion that a person of ordinary skill in the art would have found it obvious to combine Kwon224, Kim524, and Jang513 which disclose complementary systems/methods in the field for fabricating OLEDs with integrated touchscreens, analogous to the '394 patent and each other. *Compare* Sections V.A, VIII.A.1-VIII.A.3, VIII.C.1 (explaining that all references disclose similar OLED device structures with integrated touch screens). All three similarly disclose touch sensors and display panel layers, that work together to provide touch screens. *Id.* For example, the '394 patent, Kwon224, Kim524, and Jang513 all have light emitting elements above a substrate, with an encapsulation unit on the light emitting elements, and touch sensor components above the encapsulation unit. *Id.*

[The Challenged Claims Are Unpatentable]

280. Jang513, like Kwon224 and Kim524, addresses integration challenges similar to those identified in the '394 patent. For example, Jang513 integrates the sensing electrodes directly onto the sealing thin film above the pixel array. Jang513, ¶¶[0016-17] (“The first sensing electrode and the second electrode may be formed directly on the sealing thin film, an insulating film being positioned between the first sensing electrodes and the second electrodes at least in an intersection region between the first and second sensing electrodes.”), [0070], [0074]. A skilled artisan would have recognized that this process eliminates the need for separate attachment steps—such as bonding or lamination of a distinct touch layer—and instead enables direct formation of the sensing structure within the display stack. This not only reduces structural complexity but also improves alignment precision because there is no need to align and bond a separate touch layer, thereby reducing registration errors. It also enhances overall device reliability by providing a simplified structure with fewer processing steps that reduces mechanical stress and potential failure points, improving long-term durability.

281. In Jang513, the electrodes are formed in a mesh structure with openings that expose the underlying pixels, thereby preserving light transmittance and image quality. Jang513, ¶¶[0056-57]. Jang513 also simplifies the fabrication process by using the same material and process for both the sensing electrodes and the position detecting lines. *Id.*, ¶[0064]. Further, Jang513 reduces pixel damage and enables

[The Challenged Claims Are Unpatentable]

flexible panel designs by teaching the use of opaque metal electrodes that can be sintered at low temperatures. *Id.*, ¶¶[0054], [0088], [0007-8]. Thus, a person of ordinary skill in the art would have understood that Jang513 addresses the same class of integration problems as the '394 patent, Kwon224, Kim524—thickness when using separate touch layers and display layers, flexibility, visibility, and process complexity.

282. Given that Kwon224, Kim524, and Jang513 disclose similar systems that operate in a similar manner and are directed to similar problems, it is my opinion that a person of ordinary skill in the art would have been motivated to consider their combined teachings. Additional rationale for the combination is provided below for specific claim elements.

3. Claim 5: “The organic light emitting display according to claim 1, further comprising touch pads connected to the second conductive lines and disposed on the substrate having the light emitting elements disposed thereon.”

283. In my opinion, Kwon224 and Kim524 render obvious the display of claim 1 (*see* Section VIII.A.4). Further, in my opinion, Kwon224, Kim524, and Jang513 render claim 5 obvious.

284. As I detailed in Section VIII.A.4, Kwon224 and Kim524 show all claimed elements of the touch screen, except that the connection lines are shown as terminating without being connected to anything else. A skilled artisan would

recognize that the Kwon224-Kim524 combination does not explicitly show how these lines would further connect to other devices, instead showing the lines simply terminating at the edge of the device, as shown in annotated Figures 9A-9B below. However, a skilled artisan would have recognized that these signal lines must be connected to a component so that signals can be transmitted from the touch sensors to said component.

FIG. 9A

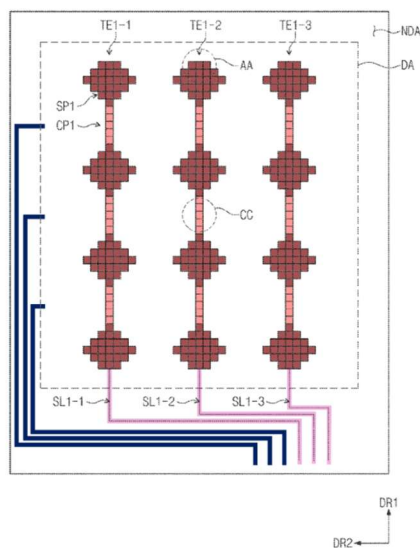
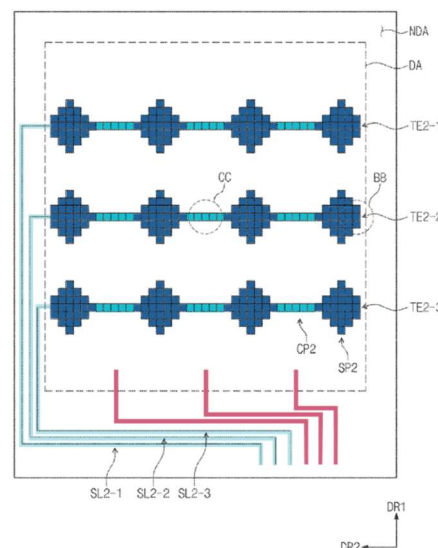


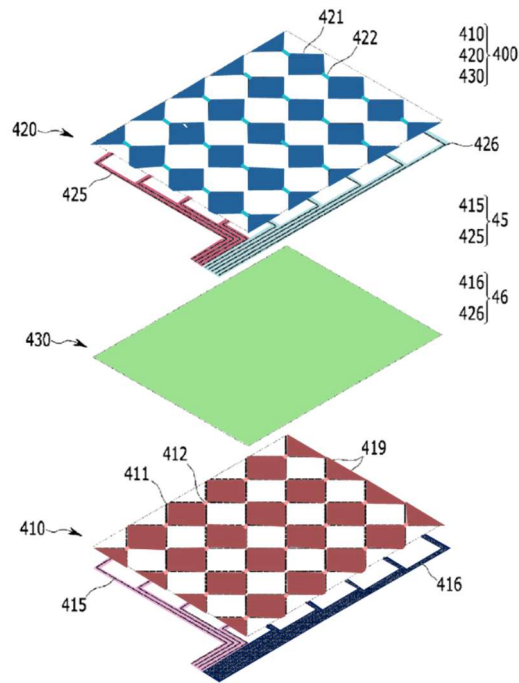
FIG. 9B



Representation of Kwon224-Kim524

[The Challenged Claims Are Unpatentable]

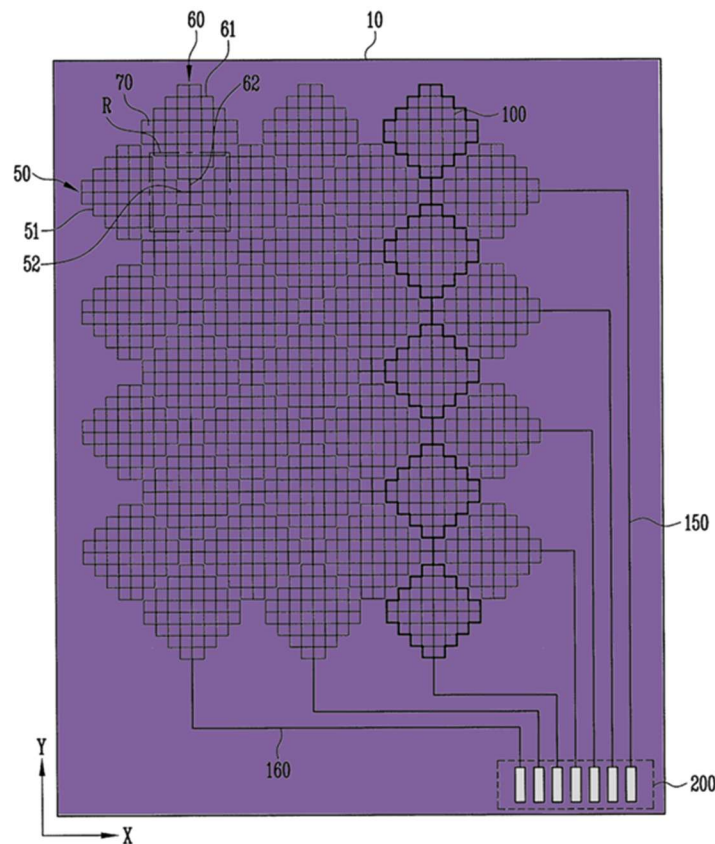
FIG. 6



Kim524, Fig. 10

285. Jang513, however, does show how these lines would connect. For example, Jang513 discloses **touch pad unit 200 with multiple touch pads (light gray)** connected to conductive lines 150 and 160 and disposed on a **substrate (dark purple)**. Jang513, ¶[0063].

FIG. 1



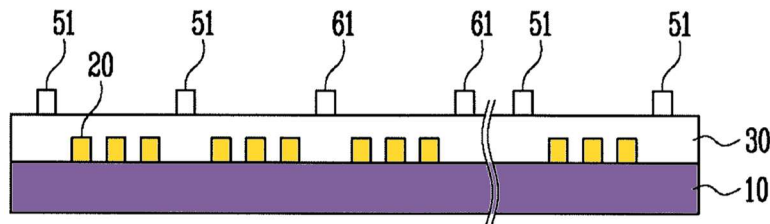
Jang513, FIG. 1

286. Specifically, Jang513 discloses a “plurality of first position detecting lines 150 and the second position detecting lines 160 [that] transfer signals detected from each first and second sensing electrodes 50 and 60, respectively, to an external touch driving circuit (not shown) through a pad unit 200. The touch driving circuit receiving the signals transferred through the first position detecting line 150 and the second position detecting line 160 may recognize a position touched by the user.” Jang513, ¶[0063].

[The Challenged Claims Are Unpatentable]

287. The substrate includes **pixels 20 (bright yellow)** (i.e., light emitting elements) disposed thereon. Jang513, ¶[0057] (“...pixels 20 may be exposed through the plurality of openings 70, such that the light emitted from the pixels 20...”).

FIG. 3



Jang513, FIG. 3

288. Thus, a skilled artisan would have been motivated to combine Kwon224, Kim524, and Jang513 to add Jang513’s touch pads to the conductive lines of the Kwon224-Kim524 combination. As illustrated below, a skilled artisan would have readily recognized that the Kwon224-Kim524 combination already includes conductive lines similar to Jang513 and that the combination leaves open what the lines connect to and how the device makes a connection to an external circuit. A person of ordinary skill in the art would have found it obvious to connect touch pads to second conductive lines of the Kwon224-Kim524 combination and dispose the touch pads on Kwon224’s substrate SUB, as Jang513 discloses. *See* Section VIII.A.4.f (explaining how the combined system discloses second conductive lines); [The Challenged Claims Are Unpatentable]

see Section VIII.A.4.b (explaining Kwon224's substrate SUB having light emitting elements disposed thereon). This modification would add touch pads in each conductive layer as shown below, consistent with Jang513's disclosures. Multi-layer touch pads were quite common in advanced display technologies, as such configuration allows for simultaneous detection of multiple touch points.

FIG. 9A

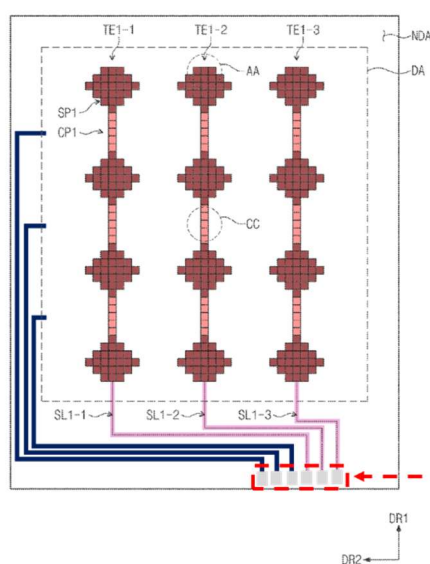
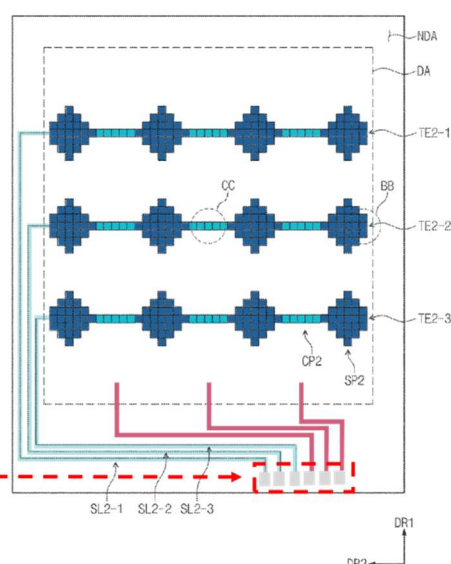


FIG. 9B



Representation of Kwon224-Kim524

289. In my opinion, a person of ordinary skill in the art would have been motivated to make this modification for numerous reasons. A person of ordinary skill in the art would have recognized that Kwon224 discloses touch signal lines that route touch signals from the sensor array to the periphery of the display but fails to

[The Challenged Claims Are Unpatentable]

provide details on how the signals are routed to an external component. This can be seen in Figures 9A-9B, that show the first and second conductive lines (pink, sky blue, magenta, navy blue) abruptly ending their path at the edge of the device without showing how the lines are connected to an external component. Thus, the combination adding Jang513's touch pads helps fill this gap with a specific implementation of what the touch signal lines connect to and how the signals are transmitted from the touch sensors to external components.

FIG. 9A

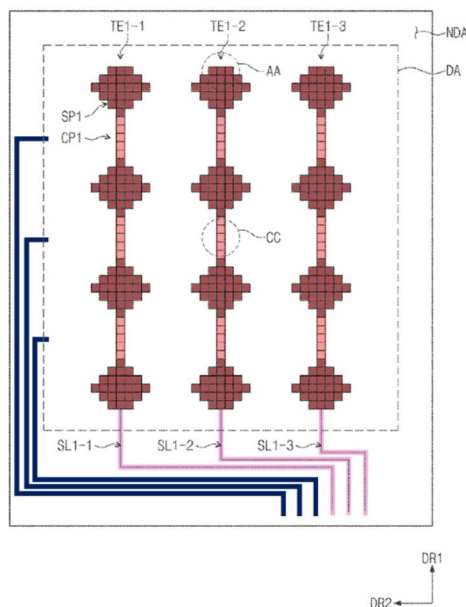
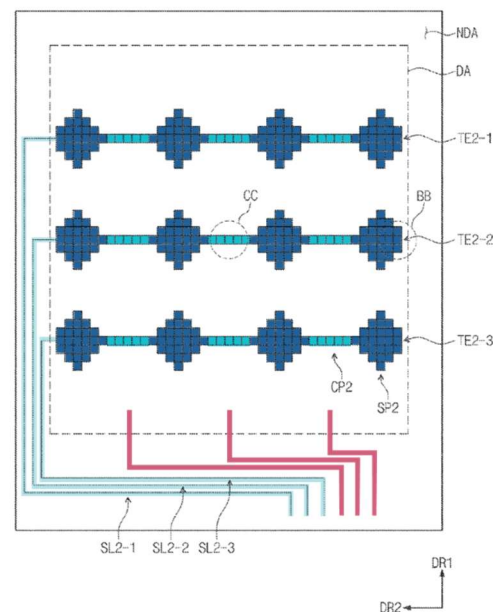


FIG. 9B

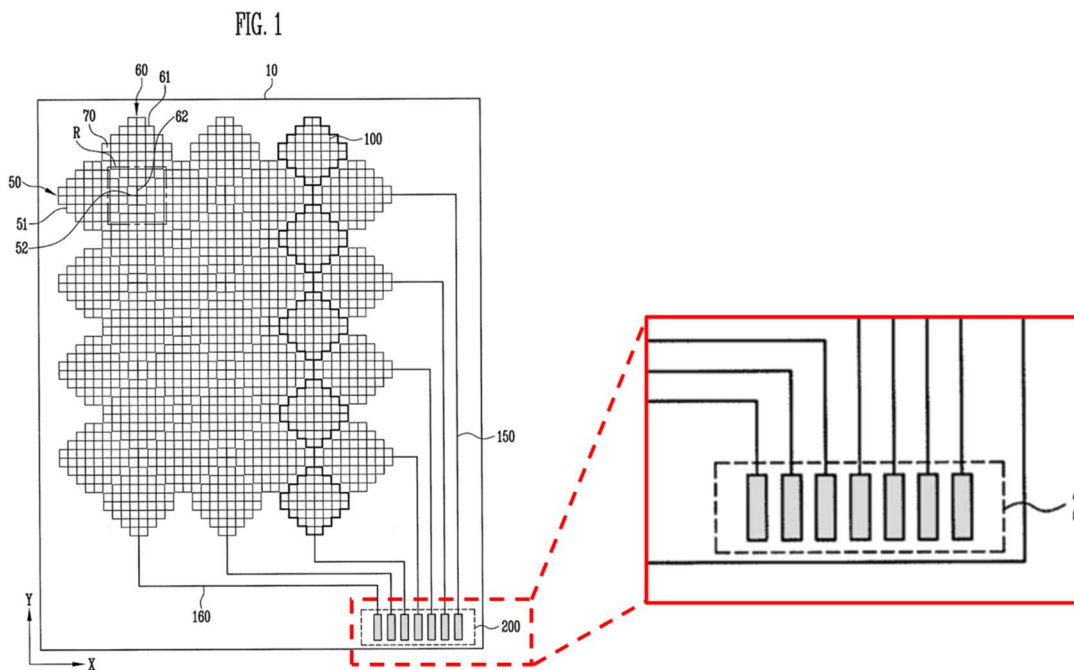


Kwon224, FIG. 9A-9B

290. Moreover, in practical touch display systems, it is necessary to connect these internal signal lines to external circuitry. For example, Kwon224's touch panel [The Challenged Claims Are Unpatentable]

can operate in the self-capacitance mode or the mutual-capacitance mode (Kwon224, ¶[0142]), and in either case, external electronic circuits must be electrically connected to Kwon224's touch panel to deliver and sense signals on the touch panel. This was a well-established and universally known technique.

291. It is also standard and well known in display and touch panel design to provide dedicated touch pads at the periphery for external electrical connection. *See also* Jang513, ¶[0063] (showing a plurality of signal lines 150 and 160 connecting “to an external touch driving circuit [] through a **pad unit 200** [(gray)].”), Fig. 1.



Jang513, FIG. 1

292. The modification is a straightforward extension of the existing design, requiring no inventive step and implementing a specific design that highly common

[The Challenged Claims Are Unpatentable]

at the time of the invention. Indeed, this is seen in LCDs, OLEDs, and touch panels across the industry. Thus, a person of ordinary skill in the art would have understood that touch signal lines in Kwon224 must ultimately be connected to external circuitry for the device to function. Providing a discrete touch pad at the end of each signal line is a routine, predictable solution. A person of ordinary skill in the art would have found this modification to provide predictable results because adding touch pads does not change the fundamental operation of the touch sensor and it enables a reliable electrical interface between the internal sensing circuitry and external components. It simply provides a more robust, reliable, and manufacturable interface for connecting the internal touch signal lines to external circuits because it (i) standardizes the connection point by defining a consistent physical and electrical interface for each signal line, (ii) reduces assembly complexity by enabling automated bonding processes such as Anisotropic Conductive Film (ACF) or Tape Automated Bonding (TAB) without requiring manual alignment, and (iii) ensures consistent electrical performance across production batches by minimizing variability in contact resistance and improving yield through repeatable fabrication techniques.

293. Moreover, it is also my opinion that it would be obvious to try connecting dedicated touch pads to the end of the touch signal lines in the Kwon224-Kim524 combination because it is one of a finite number of identified, predictable [The Challenged Claims Are Unpatentable]

solutions, with a reasonable expectation of success. Either the touch signal lines are connected directly to the external circuitry or they are connected using an intermediate component, such as dedicated touch pads. Given the longstanding use of touch pads, it is also my opinion that there would be a reasonable expectation of success in connecting these structures to the conductive lines of the Kwon224-Kim524 combination to facilitate external connection.

294. Further, is my opinion that a person of ordinary skill in the art would have been motivated to make this modification because it would provide numerous benefits, including mechanical robustness, electrical reliability, manufacturing yield, serviceability, and testing options. A touch pad provides a larger, reinforced area for wire bonding, soldering, or connection to a flex cable, reducing the risk of damage during assembly or use. It also ensures a low-resistance, stable electrical connection, minimizing signal loss or noise. Touch pads facilitate automated assembly and inspection, improving manufacturing yield and reducing defects. Additionally, touch pads allow for easier electrical testing during production and for diagnostics in the field.

295. There would have been a reasonable expectation of success in modifying the Kwon224-Kim524 combination to include touch pads, which were well known in the art and address known challenges in OLED touchscreen integration—namely, achieving reliable electrical connections, providing

[The Challenged Claims Are Unpatentable]

mechanical stability, and improved diagnostic testing. Using touch pad units is a universally accepted practice.

296. Therefore, in my opinion, the Kwon224-Kim524 combination discloses claim 5 because it discloses touch pads connected to the second conductive lines (touch signal lines in **magenta and navy blue**) and disposed on the substrate (i.e., Kwon224's substrate SUB) having the light emitting elements disposed thereon.

FIG. 9A

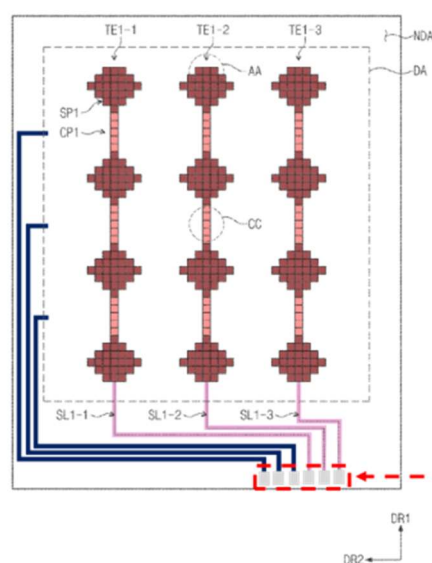
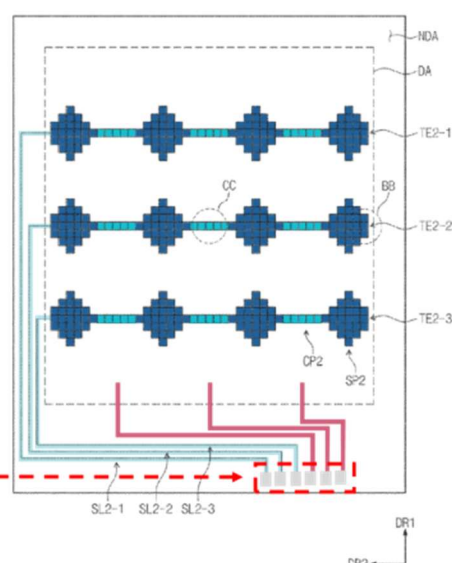


FIG. 9B



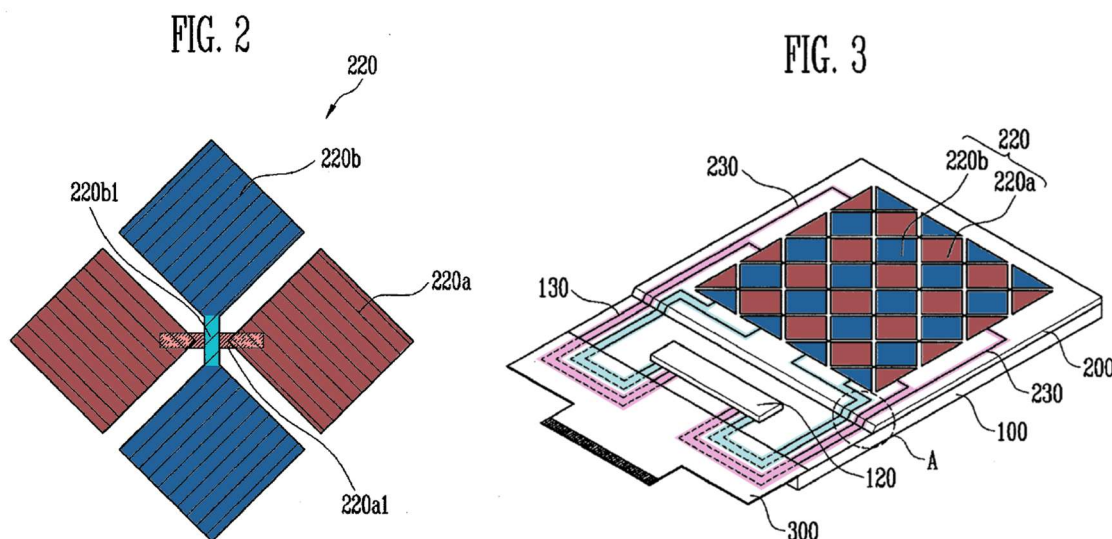
Representation of Kwon224-Kim524

297. Therefore, in my opinion, the Kwon224-Kim524-Jang513 combination discloses claim 5.

D. Ground 4: The Combination of Kwon224, Kim524, and Kim481 Renders Obvious Claim 17.

1. Kim481 Overview

298. Like the '394 patent, Kwon224, and Kim524, Kim481 describes an organic light emitting display having touch sensors, specifically describing an “organic light emitting display” with touch sensors comprising **sensing cells 220 (brick red and deep blue)** with **connection patterns 220a1 and 220b1 (salmon and cyan)** connecting adjacent cells and **sensing lines 230 (pink and sky blue)** providing a connection from the **sensing cells 220** to flexible printed circuit board (FPCB) 300. Kim481, ¶¶[0028-30] (“the sensing lines 230 extend to the substrate 100 of the display panel from an end of the sealing thin film 200 so as to be electrically connected to a flexible printed circuit board (FPCB) 300 attached to the substrate 100.”), [0034-35], [0040], [0042], [0044].



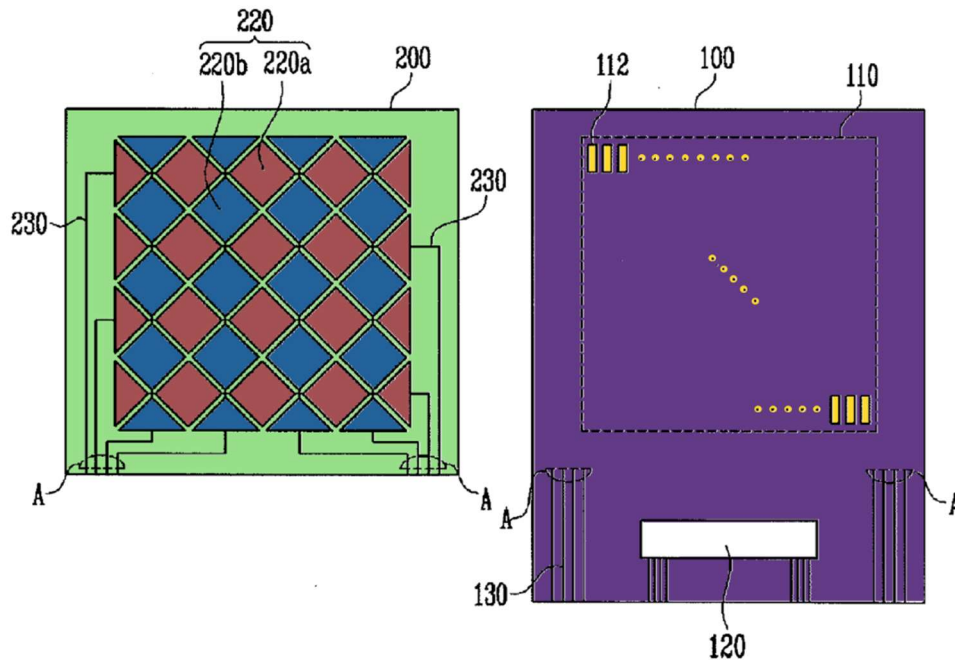
Kim481, FIGS. 2 and 3

[The Challenged Claims Are Unpatentable]

299. The device has an “integrated touch screen panel.” Kim481, Title, Abstract, ¶[0003]. Just as Kwon224 and Kim524 discloses, Kim481 also includes an insulating layer disposed between the first and second conductive lines. *Id.*, ¶[0033] (“In this instance, an insulating layer (not shown) for ensuring electrical isolation is interposed between the first connection patterns 220a1 and the second connection patterns 220b1.”).

300. The device further includes a **sealing film 200 (green)** “for sealing a plurality of **pixels 112 [(light emitting elements) (bright yellow)]** formed on a **substrate 100 [(dark purple)]**.” Kim481, ¶¶[0042], [0044], [0048]. Kim481 explains that the sealing film may include organic and inorganic layers. *Id.*, ¶[0048].

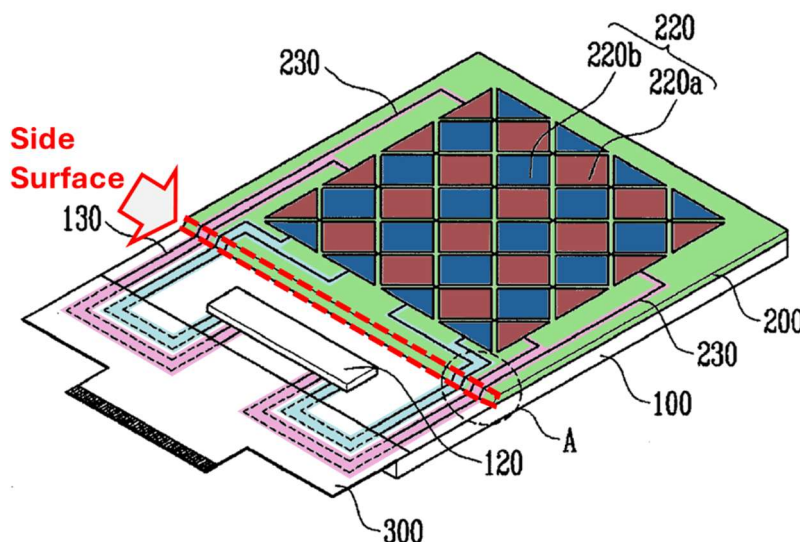
FIG. 5



Kim481, FIG. 5

301. As shown in Figure 3, the sensing lines 230 are disposed on top of and along a side surface of the **sealing film 200 (green)**. Kim481, ¶[0038] (“Particularly, an end portion A of the sealing thin film 200 is formed to be inclined (see FIG. 3), so that it is possible to prevent the sensing lines passing over the end portion from being broken.”).

FIG. 3



Kim481, FIG. 3

2. Kwon224, Kim524 and Kim481 are Analogous Art

302. A person of ordinary skill in the art would have found it obvious to combine Kwon224, Kim524, and Kim481 which disclose complementary systems/methods in the field for fabricating OLED with integrated touchscreens, analogous to the '394 patent and each other. *Compare* Sections V.A, VIII.A.1-VIII.A.3, VIII.D.1 (explaining that all references disclose similar OLED device structures with integrated touch screens). All three similarly disclose touch sensors and display panel layers, that work together to provide OLED touch screens. *Id.* For example, the '394 patent, Kwon224, Kim524, and Kim481 all have light emitting elements above a substrate, with an encapsulation unit on the light emitting elements, and touch sensor components above the encapsulation unit. *Id.*

[The Challenged Claims Are Unpatentable]

303. A skilled artisan would have recognized that Kim481, like Kwon224 and Kim524, addresses integration challenges similar to those identified in the '394 patent. For example, Kim481 notes that attaching a separately manufactured touch screen panel to a flat panel display increases product thickness and cost, and complicates the manufacturing process due to the need for separate driving ICs and flexible printed circuit boards. Kim481, ¶¶[0009-10] (“Such a touch screen panel is generally attached to an outer surface of a flat panel display such as a liquid crystal display or organic light emitting display. In a case where a separately manufactured touch screen panel is attached to a flat panel display, the entire thickness of a product is increased, and manufacturing cost is increased.”). To solve these problems, Kim481 teaches a flat panel display with an integrated touch screen panel formed directly on a sealing thin film, which replaces the conventional thick glass substrate. *Id.*, Title, Abstract, ¶¶[0003] (“The disclosed technology relates to a flat panel display, and more particularly, to a flat panel display with an integrated touch screen panel.”), [0021], [0024-25], [0042]. This integration minimizes thickness and enables the use of a single flexible printed circuit board for both the display and touch panel, thereby simplifying the bonding and testing process and reducing cost. *Id.*, ¶¶[0060] (“Thus, in this embodiment, the bonding and testing process of the FPCB 300 is simplified, so that it is possible to facilitate manufacturing processes and to decrease product cost, as compared with a case where FPCBs for respectively [The Challenged Claims Are Unpatentable]

driving the touch screen panel and the display panel are individually provided.”), [0025], [0010], [0037]. Thus, Kim481 provides a fabrication solution that supports mechanical flexibility, reduces structural complexity, and improves manufacturing efficiency—addressing the same class of problems as the ’394 patent.

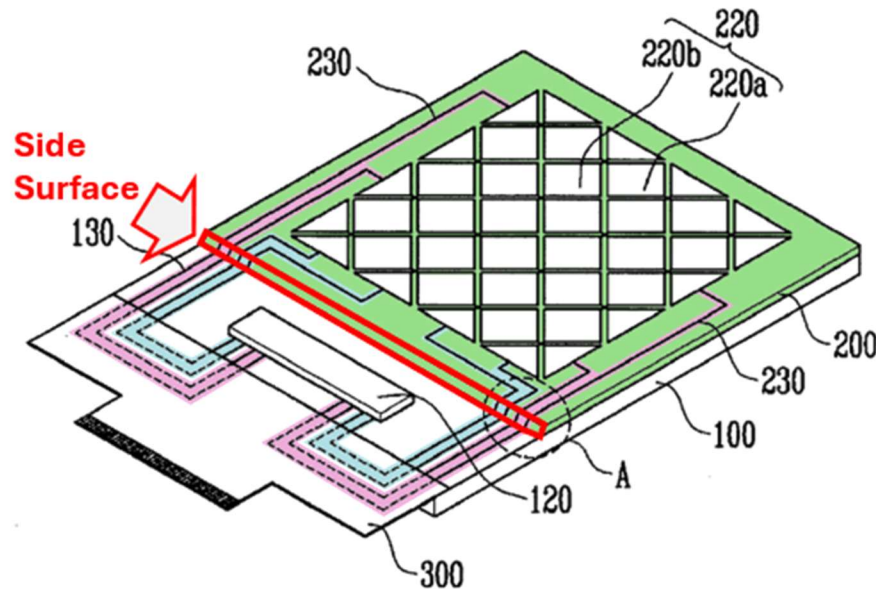
304. Given that Kwon224, Kim524, and Kim481 disclose similar systems that operate in a similar manner and are directed to similar problems, it is my opinion that a person of ordinary skill in the art would have been motivated to consider their combined teachings. Additional rationale for the combination is provided below for specific claim elements.

3. Claim 17: “The organic light emitting display according to claim 1, wherein the second conductive lines are disposed along a side surface of the encapsulation unit.”

305. It is my opinion that Kwon224 and Kim524 render obvious the display of claim 1 (*see* Section VIII.A.4). Further, it is my opinion that Kwon224, Kim524, and Kim481 render claim 17 obvious.

306. For example, as shown in annotated Figure 3 below, Kim481 discloses **conductive lines 230 (pink and sky blue)** that are disposed on top of and along a side surface of the **sealing film 200 (green)** (i.e., the encapsulation unit). Kim481, ¶¶[0021], [0038], [0046-47]; *see id.*, ¶¶[0041-42], [0044-45], [0049-53].

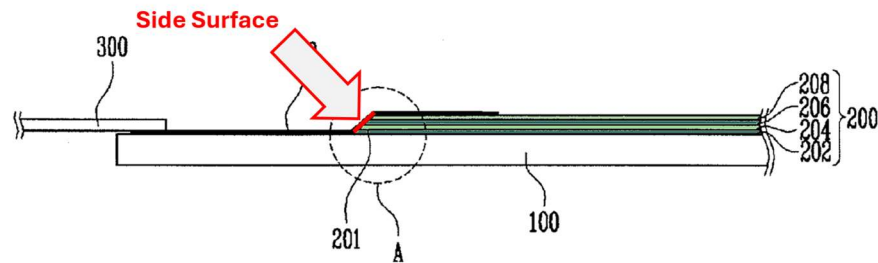
FIG. 3



Kim481, FIG. 3

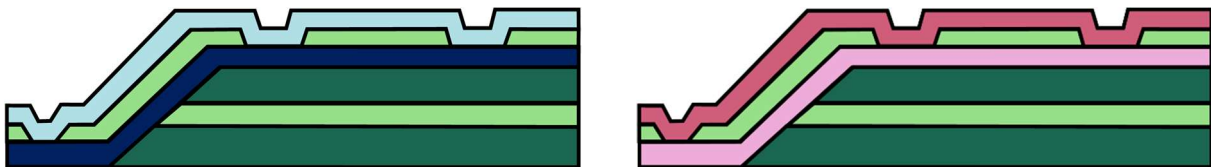
307. At the “end portion A” (shown by a dotted circle in annotated Figure 3 above), the sealing film 200 is inclined “to prevent the sensing lines passing over the end portion from being broken.” *Id.*, ¶¶[0038], [0054-55]. A skilled artisan would have understood that, without the incline, there would be a step difference—a sudden change in height or surface level—between the sealing film and the substrate, which could cause mechanical stress or discontinuity during photolithography or patterning, leading to fracture or breakage of the sensing lines. Figure 4 provides a side-view showing the conductive lines running along the side surface of the sealing film 200.

FIG. 4



Kim481, FIG. 4

308. In the Kwon224-Kim524-Kim481 combination, Kim481's conductive line path that runs down the inclined encapsulation unit edge is applied to Kwon224-Kim524's stacked touch signal line configuration, as illustrated in the modified figure below. Specifically, the combination is depicted below, showing the **first (sky blue and pink)** and **second (navy blue and magenta)** conductive lines in the stacked configuration and inclined down the sloped encapsulation unit. *See* Section VIII.A.4.f (describing the stacked signal lines of the Kwon224-Kim524 combination).



Representation of Kwon224-Kim524-Kim481

309. A skilled artisan would have readily recognized that the inclined portion of the encapsulation unit (i.e., sealing film) is the unit's side surface. For

[The Challenged Claims Are Unpatentable]

example, if there was no incline, the encapsulation unit would have a completely vertical side surface, similar to the one shown in Figure 2 of the '394 patent. Thus, Kim481's inclined surface of its encapsulation unit is the unit's side surface, as claimed and described in the '394 patent.

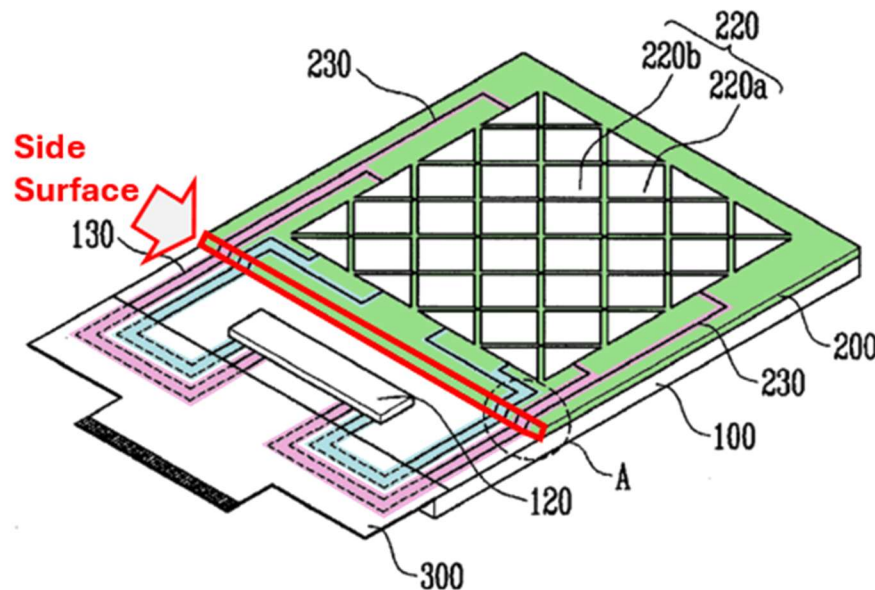
310. In my opinion, a person of ordinary skill in the art would have recognized that the encapsulation unit in the Kwon224-Kim524 combination has a side surface. As explained above in Section VIII.A.5.a, the substrate in Kwon224's device extends across the display area (DA) and non-display area (NDA) in Figures 9A-9B. Further, a person of ordinary skill in the art would have understood that Kwon224's encapsulation unit (i.e., TFE layer) does not extend across the entire substrate and has a side surface going vertically down to the substrate at the point where the unit terminates.

311. Kwon224 supports this understanding, explaining that the encapsulation unit is designed to encapsulate and protect the OLED device layers within the DA—not to cover the substrate's edge area. Kwon224, ¶¶[0123] (“The thin film encapsulation layer TFE may be disposed on the cathode CE to encapsulate the organic light emitting device layer DP-OLED”), [0126-127]. The OLED display area—which includes the anode AE, electron control layer ECL, organic light emitting layer EML, hole control layer HCL, and cathode CE—is within the display area. *See* Kwon224, ¶[0122], Fig. 10B.

[The Challenged Claims Are Unpatentable]

312. This is consistent with how devices like Kwon224's are designed and manufactured. In fact, Kim481 discloses this configuration. It shows the **sealing film 200 (green)** (i.e., the encapsulation unit) that terminates with an inclined side surface and a conductive line path that proceeds on the substrate until it connects to a circuit board 300. Kim481, ¶[0056].

FIG. 3



Kim481, FIG. 3

313. This is also consistent with industry practice. In production OLED/touch displays, the touch pads and/or external connection points are typically outside the encapsulation unit and bonded directly to the substrate. *See* Section VIII.C (discussing adding touch pads to the Kwon224-Kim524 combination). Bonding pads are placed directly on the substrate rather than over the encapsulation [The Challenged Claims Are Unpatentable]

unit to ensure high-integrity electrical contact. The substrate provides a flat, stable, and chemically compatible surface that supports low-resistance bonding and robust mechanical adhesion. In contrast, the encapsulation layer can introduce surface roughness and electrical interference, compromising bonding reliability. This design choice also facilitates probe access during testing and avoids stress-induced fracture in conductive lines. Thus, a skilled artisan would have concluded that the encapsulation unit in the Kwon224-Kim524 combination terminates before the connection point to the touch pad or external circuitry. This would also help save costs as less material is used for the encapsulation unit, lowering overall production costs.

314. It is also my opinion that a person of ordinary skill in the art would have found it obvious to adopt Kim481's edge/side surface routing of conductive lines into the integrated OLED touch architecture taught by Kwon224-Kim524 combination. *see* VIII.A.4.f (explaining the Kwon224-Kim524 combination uses stacked conductive lines). Further, a person of ordinary skill in the art would have recognized that Kwon224 discloses touch signal lines that route touch signals from the sensor array to the periphery of the display but fails to provide details the point where the touch signal lines make a connection to touch pads or an external device. *See* Section VIII.C.3. Kim481 provides these details, providing an inclined encapsulation unit edge that allows the signal lines a sloped path from the [The Challenged Claims Are Unpatentable]

encapsulation unit on to the substrate and to the next connection point. Kim481's addition simply shows that conductive lines can be extended **along the encapsulation edge/side** without disturbing device operation. *Id.* The Kwon224-Kim524-Kim481 combination leaves the electrical topology intact (first lines connect to the touch sensors; second lines extend from the first) and only optimizes their **path**. *Id.*

315. It is also my opinion that a person of ordinary skill in the art would have been motivated to make this modification because it provides device benefits. Kim481's touts the benefits of this configuration, explaining how the sloped line path on the edge of the encapsulation unit helps prevent breakage of the signal lines. Kim481, ¶¶[0054-55], Figs. 3-4. A vertical step at the edge of the sealing film would introduce mechanical stress, risking fracture of the thin conductive lines. By forming the end portion to be inclined, the design ensures a gradual transition, reducing stress concentration and preserving the integrity of the sensing lines as they pass from the sealing film to the substrate. This geometry also supports reliable electrical connection and robust device performance because the conductive lines transition smoothly from the sealing film to the substrate, allowing physical and electrical continuity of the lines, which is essential for consistent signal transmission.

316. Implementing Kim481's routing in the Kwon224/Kim524 stack would have predictable outcomes because it relies on fabrication steps that are well [The Challenged Claims Are Unpatentable]

understood in the OLED industry. Specifically, it involves shaping the edge of the encapsulation unit to be sloped—an established method for managing step coverage—and uses the same conductive line deposition processes already employed in OLED and touch panel manufacturing. The outcomes would also be predictable because all three references share the same stack idiom: OLED elements encapsulated by an encapsulation unit, with touch electrodes and their lines formed above and led out to periphery. No new physics, materials, or control schemes are introduced—only a proven routing path applied to an otherwise conventional OLED-touch stack. Thus, it is my opinion that a person of ordinary skill in the art would have had a reasonable expectation of success in making the modification.

317. Therefore, in my opinion, the Kwon224-Kim524-Kim481 combination discloses claim 17.

E. Ground 5: The Combination of Kim481 and Kim524 Renders Obvious Claim 19.

1. Kim481 and Kim524 are Analogous Art

318. In my opinion, a person of ordinary skill in the art would have found it obvious to combine Kim481 and Kim524, which disclose complementary systems/methods in the field for organic light emitting display having touch sensors, analogous to the '394 patent and each other. *Compare* Sections V.A, VIII.D.1, VIII.A.2 (explaining that both references disclose similar OLED device structures

[The Challenged Claims Are Unpatentable]

with touch sensors); *see also* Section VIII.D.2. All three similarly disclose touch sensors and display panel layers, that work together to provide OLED touch screens. *Id.* For example, the '394 patent, Kim481, and Kim524 all have light emitting elements above a substrate, with an encapsulation unit on the light emitting elements, and touch sensor components above the encapsulation unit. *Id.*

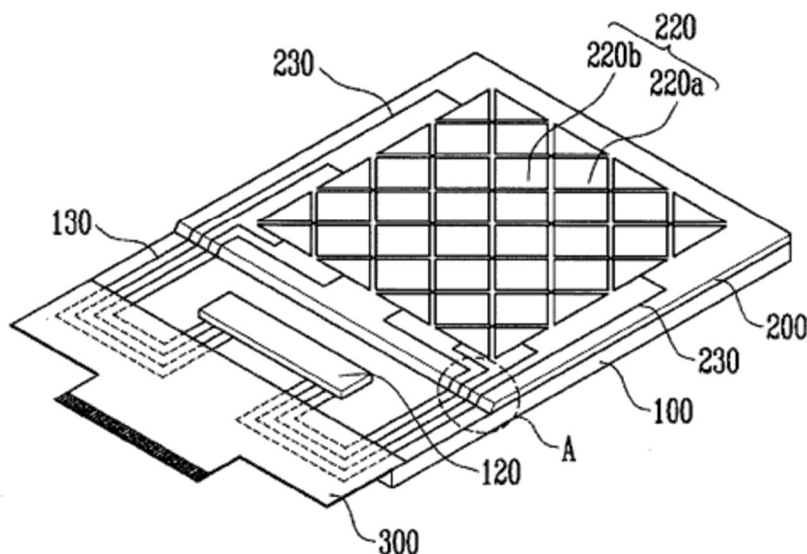
319. Given that Kim481 and Kim524 disclose similar systems that operate in a similar manner and are directed to similar problems, it is my opinion that a person of ordinary skill in the art would have been motivated to consider their combined teachings. Additional rationale for the combination is provided below for specific claim elements.

2. Independent Claim 19

a. 19[pre]: “An organic light emitting display comprising:”

320. To the extent the preamble is limiting, in my opinion, Kim481 discloses 19[pre].

321. For example, as illustrated in Figure 3 below, Kim481 discloses “an organic light emitting display.” Kim481, ¶¶[0042-43].



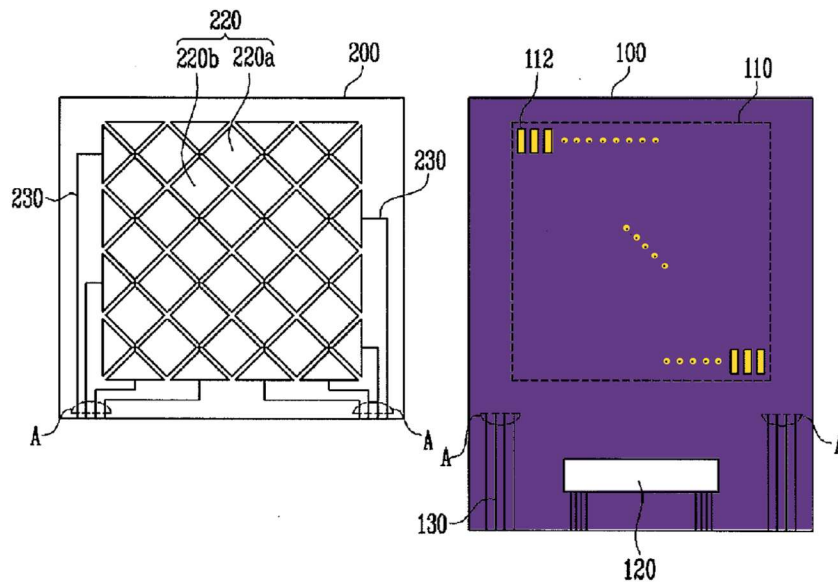
Kim481, FIG. 3

322. In my opinion, Kim481 discloses 19[a].

323. For example, Kim481 discloses “organic light emitting element[s],” which are “provided to each of the pixels 112.” Kim481, ¶[0042]; *see id.*, Abstract, ¶¶[0022-23], [0025]. A person of ordinary skill in the art, in my opinion, would have understood these disclosures to mean that each pixel 112 includes one or more organic light emitting elements (sub-pixels) that emit light when driven. As shown in annotated Figure 5 below, Kim481 discloses that “**pixels 112**” (and the light emitting elements) (**bright yellow**) are “formed on a **substrate 100**” (**dark purple**). Kim481, ¶[0042].

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FIG. 5



Kim481, FIG. 5

324. Therefore, in my opinion, Kim481 discloses 1[a] because it discloses light emitting elements (i.e., pixels 112 with light emitting elements) disposed on a substrate (i.e., substrate 100).

c. 19[b]: “an encapsulation unit disposed on the light emitting elements;”

325. In my opinion, Kim481 discloses 19[b].

326. For example, as annotated Figure 3 and 5 below show, Kim481 discloses **sealing film 200 (green)** “for sealing a plurality of pixels 112 formed on a substrate 100.” Kim481, ¶¶[0042], [0044], [0048]; *see* Section VIII.E.2.b (explaining that pixels 112 include light emitting elements).

FIG. 3

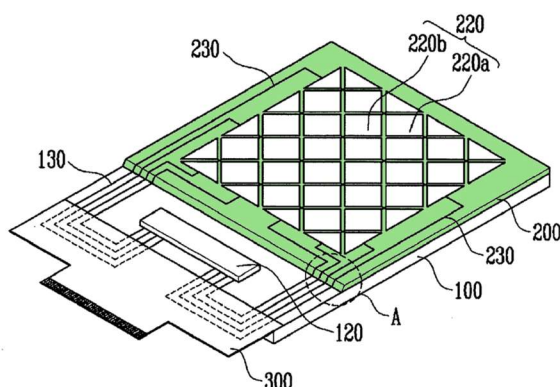
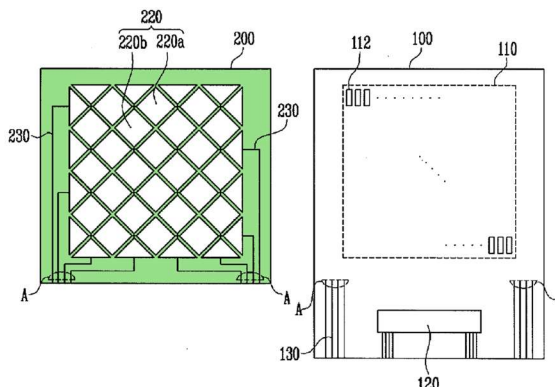


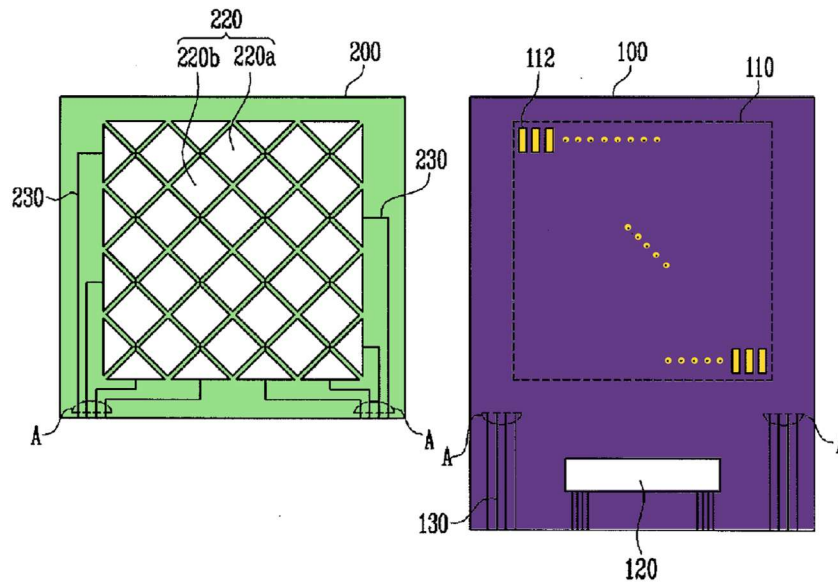
FIG. 5



Kim481, FIG. 3, FIG. 5

327. Specifically, Kim481 explains that the sealing film is “formed on the substrate 100 including a pixel area 110 so as to seal the pixel area 110 in which the pixels 112 are formed.” *Id.*, ¶[0044]. Annotated Figure 5 below illustrates this, showing the layer with the **sealing film 200 (green)** on the left that is disposed on the substrate with **pixels 112 (and the light emitting elements) (bright yellow)**.

FIG. 5

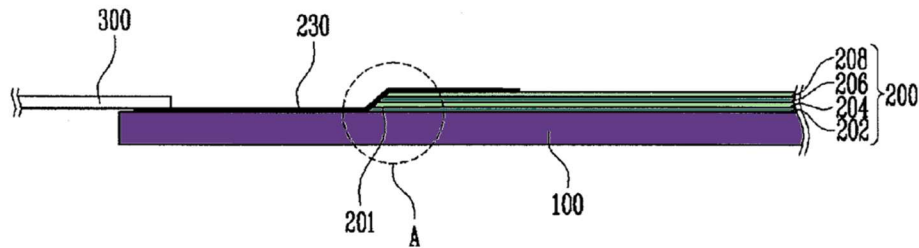


Kim481, FIG. 5

328. Note that in Figure 5, the sealing film is partially obscured by sensing cells 220, because “touch sensing patterns including the sensing cells 220 and the sensing lines 230 are formed **on the top surface of the sealing thin film 200.**” Kim481, ¶[0044]. However, as I note above the specification is clear that the sealing film 200 is “formed on the substrate 100 including a pixel area 110 so as to seal the pixel area 110 in which the pixels 112 are formed.” *Id.* And, “sealing thin film 200 is formed to protect the organic light emitting element provided to each of the pixels 112.” *Id.*, ¶[0048]. Figure 4 shows how the **sealing film (green)** is deposited across the substrate, and extended to the right would be disposed on the **pixels 112 (and the light emitting elements).**

[The Challenged Claims Are Unpatentable]

FIG. 4



Kim481, FIG. 4

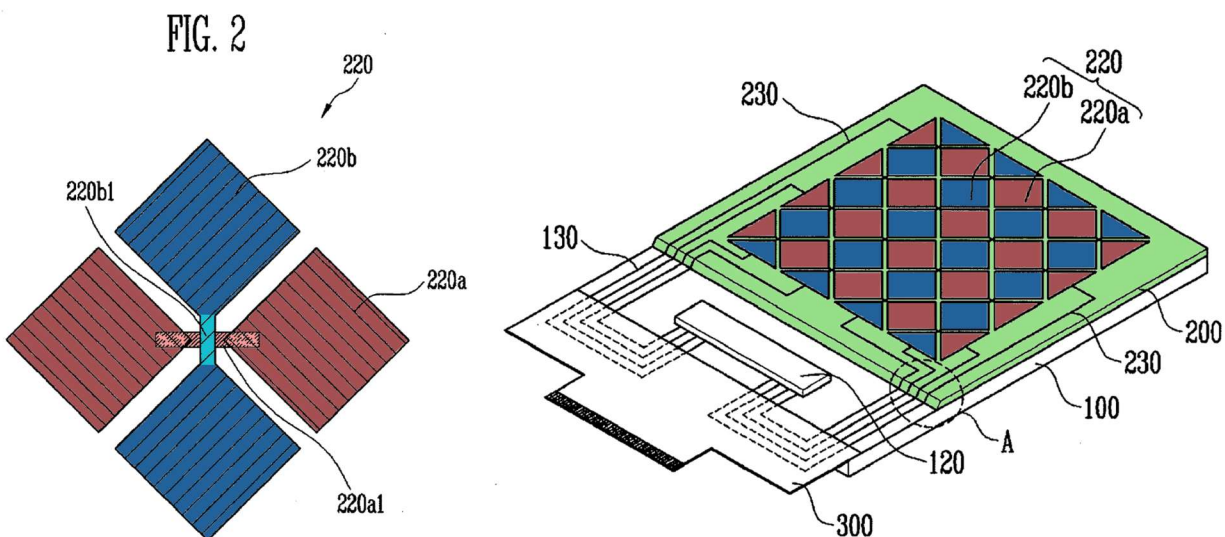
329. Therefore, in my opinion, Kim481 discloses 1[b] because it discloses an encapsulation unit (i.e., sealing film 200) disposed on the light emitting elements (i.e., pixels 112 with light emitting elements).

d. 19[c]: “touch sensors disposed on the encapsulation unit;”

330. In my opinion, Kim481 discloses 19[c].

331. For example, as shown in annotated Figures 2-3 below, Kim481 discloses sensing cells 220 (**brick red and deep blue**) for implementing the touch screen panel.” Kim481, ¶¶[0042], [0026]. The sensing cells are “formed on a **sealing thin film 200**” (**green**). *Id.*, ¶[0042]; see Section VIII.E.2.c (explaining the sensing thin film is the claimed encapsulation unit).

FIG. 3



Kim481, FIGS. 2 and 3

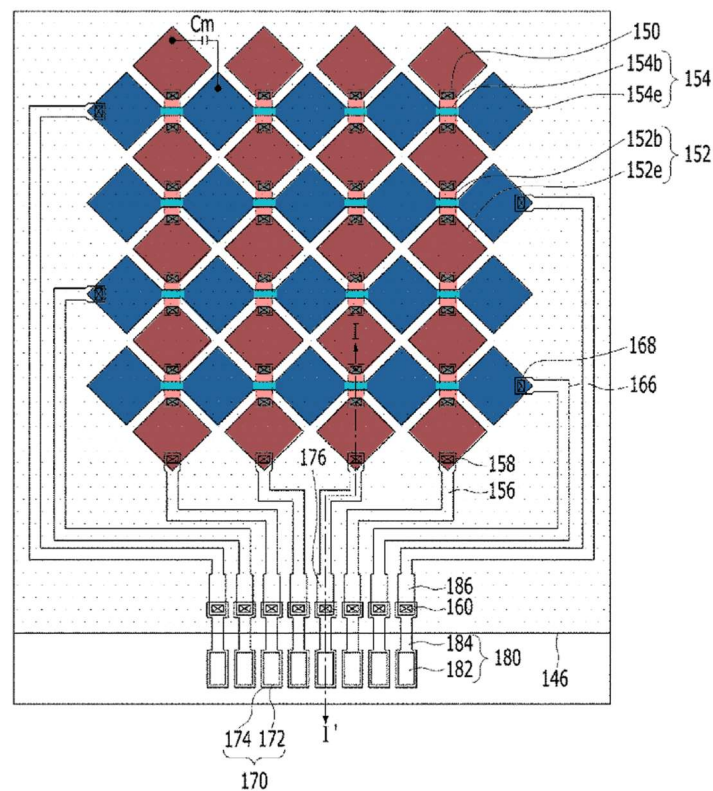
332. A person of ordinary skill in the art, in my opinion, would have understood that Kim481's sensing cells are touch sensors because the sensing cells 220 are explicitly described as part of a capacitive touch screen panel that detects contact positions via changes in capacitance, which are transferred from the sensing cells to a driving circuit. Kim481, ¶[0040]. Kim481 further confirms this, explaining that the cells are "touch sensing patterns," which a person of ordinary skill in the art would have understood to describe a touch sensor. *Id.*, ¶[0044].

333. Additionally, the '394 patent confirms that Kim481 discloses the claimed touch sensors for two reasons. First, Kim481's sensing cells meet the description of the touch sensors in the '394 patent. The '394 patent explains the "touch driving lines 152" and "touch sensing lines 154" (brick red and deep

[The Challenged Claims Are Unpatentable]

blue), illustrated below in annotated Figure 1, serve as the touch sensors. Ex-1001, 4:31-33, 4:47-49, 4:64-5:5. The touch driving lines are arranged horizontally and the touch sensing lines are arranged vertically. *Id.*, Fig. 1.

FIG.1



'394 Patent, FIG. 1

334. As explained above, this is how the sensing cells 220 are illustrated in Kim481. Further, Kim481 explains that sensing cells 220 include a lower layer of sensing cells 220a that are formed in a horizontal row and an upper layer of sensing cells 220b that are formed in a vertical row. Kim481, ¶¶[0035], [0026], [0030].

[The Challenged Claims Are Unpatentable]

335. Second, the '394 patent describes a touch sensor based on mutual capacitance. *See* Section VIII.A.4.d. Kim481 similarly explains that the touch screen functions based on a “change in capacitance caused by a contact position is transferred from the sensing cells 220.” Kim481, ¶¶[0040], [0008].

336. Therefore, in my opinion, Kim481 discloses 1[c] because it discloses touch sensors (i.e., sensing cells 220) disposed on the encapsulation unit (i.e., sealing film 200).

e. 19[d]: “first conductive lines connected to the touch sensors;”

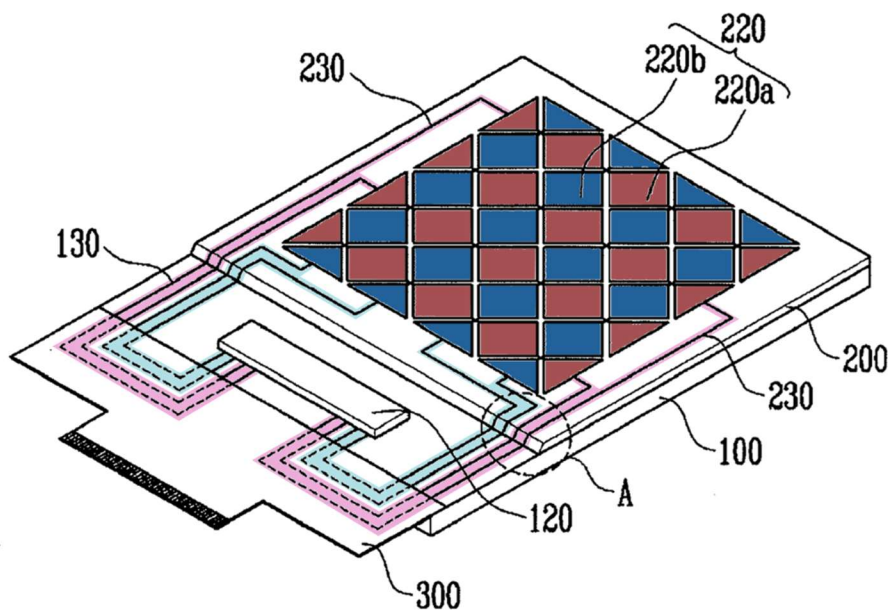
337. In my opinion, Kim481 discloses 19[d].

338. For example, Kim481 discloses a lower layer of **sensing lines 230 (pink and sky blue)** (i.e., **first conductive lines**) that are connected to the **sensing cells 220 (brick red and deep blue)**, as shown in annotated Figure 3 below. Kim481, ¶¶ [0030], 0034-35], [0040], [0042], [0044], Fig. 2; *see* Section VIII.E.2.d (explaining that sensing cells 220 are the claimed touch sensors). Sensing lines 230 are multi-layered, with one layer made of transparent electrode material and another layer made of metallic material. Kim481, ¶[0036] (“the sensing lines 230 may be formed of not only a transparent electrode material used to form the sensing cells 220 but also a low-resistance metallic material such as molybdenum (Mo), silver (Ag), titanium (Ti), copper (Cu), aluminum (Al) or Mo/Al/Mo.”). Specifically,

[The Challenged Claims Are Unpatentable]

sensing cells 220a (brick red) are connected to one set of sensing lines 230 (pink) and sensing cells 220b (deep blue) are connected to another set of sensing lines 230 (sky blue). *Id.* (“For example, the sensing lines 230 are electrically connected to row lines of the first sensing cells 220a and column lines of the second sensing cells 220b, respectively, so as to be connected to the driving circuit (not shown) of the touch panel, such as a position detecting circuit.”)

FIG. 3



Kim481, FIG. 3

339. A skilled artisan would have understood Kim481’s disclosures that the sensing lines 230 are “formed of not only a transparent electrode material ... but also ... a low-resistance metallic material” to mean that sensing lines have two stacked

[The Challenged Claims Are Unpatentable]

layers, each of different material. This interpretation is grounded in both the language of the patent and standard industry practice. In thin-film electronics, combining a transparent material (such as ITO) with a low-resistance metal (such as silver or copper) is typically achieved through vertical stacking, which preserves the optical clarity of the transparent layer while leveraging the superior conductivity of the metallic layer. In fact, as described in detail before, Kim524 explicitly discloses a stacked signal line configuration, reinforcing the technical feasibility and obviousness of such an approach. *See* Section VIII.A.4.f. Further, Kim481's reference to electrical connections at "an upper or lower portion" of the sensing cells further supports a layered architecture. A skilled artisan would recognize that blending these materials into a single layer would compromise their distinct advantages, whereas stacking enables optimal performance.

340. Therefore, in my opinion, Kim481 discloses 19[d] because it discloses first conductive lines (i.e., lower sensing lines 230) connected to the touch sensors (i.e., sensing cells 220).

f. 19[e]: "second conductive lines connected to the first conductive lines; and"

341. In my opinion, Kim481 and Kim524 render obvious 19[e].

342. Kim481 discloses multi-layered sensing lines 230 (*see* Section VIII.E.2.e) but never provides a cross-sectional view showing this structure. A

skilled artisan would have been encouraged to investigate touch signal structures that take advantage of this design to improve Kwon224's device, such as those disclosed in Kim524. Such investigation is reasonable because touch signal structures are important aspect of a touchscreen design because they serve as the communication pathways that carry the electrical signals generated by touch interactions from the sensor surface to the external device. Without these signal lines, the system would not be able to relay touch data for processing, rendering the touch screen non-functional. Thus, a skilled artisan would appreciate the importance of designing these lines and Kim481's lack of clarity on these lines provides a prime opportunity to improve Kim481's device design.

343. Kim524 provides an example of an improved touch signal line design. A person of ordinary skill in the art, in my opinion, would have found it obvious to modify Kim481 with Kim524's teachings of a stacked signal line structure that provides second conductive lines running in parallel with and connected to Kim481's first conductive lines, with an insulating inorganic layer in between the lines. As explained in Section VIII.A.4.f and shown in annotated Figures 6 and 10, Kim524 discloses a similar layer stack as Kim481, including a substrate, light emitting elements, encapsulation layer, and a touch sensor layer. It further discloses a stacked conductive line configuration with **first conductive lines 415 and 426 (sky blue and pink)** connected to **second conductive lines 416 and 425 (navy blue** [The Challenged Claims Are Unpatentable]

and magenta) using contact holes 435 through an inorganic insulating layer 430.

See Section VIII.A.4.f.

FIG. 6

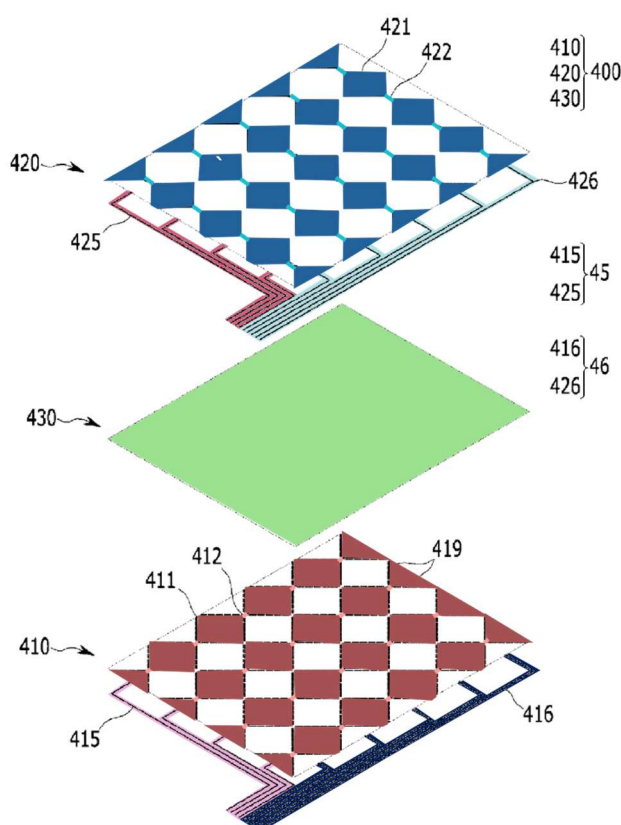
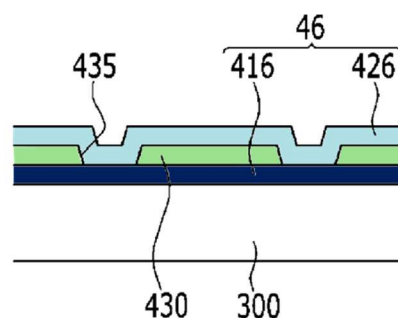


FIG. 10



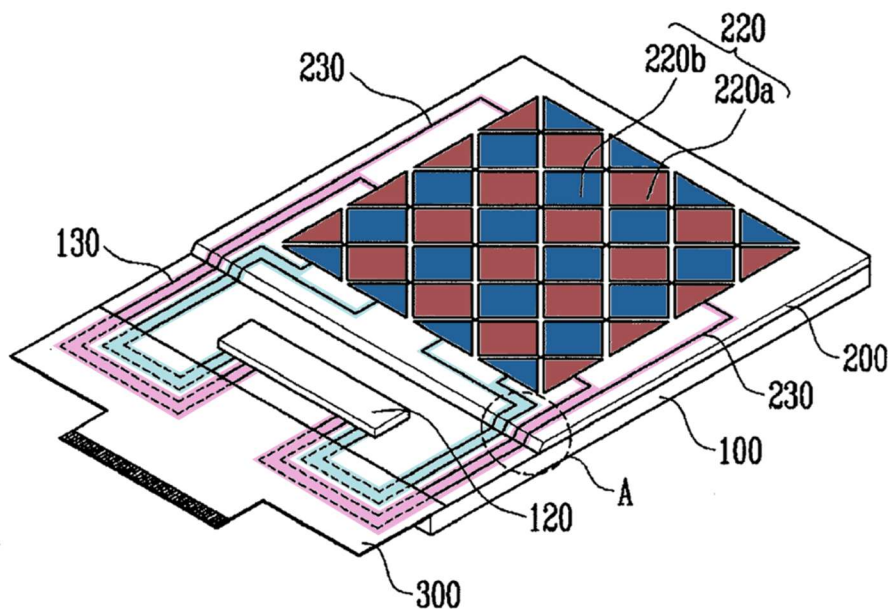
Kim524, FIGS. 6 and 10

344. Kim481 discloses a similar two-layered configuration, as shown in annotated Figure 3 below. As explained in Section VIII.E.2.d, Kim481's discloses sensing cells 220a (brick red) and sensing cells 220b (deep blue), with each having an upper and lower region for connections. Kim481, ¶[0030] ("The first connection patterns 220a1 connect the first sensing cells 220a to one another for each line along

[The Challenged Claims Are Unpatentable]

the first direction while being electrically connected to the first sensing cells 220a at an upper or lower portion of the first sensing cells 220 a.”).

FIG. 3

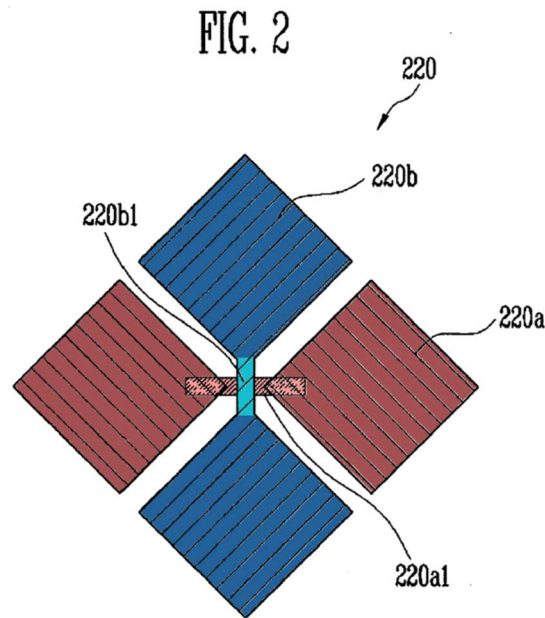


Kim481, FIG. 3

345. Kim481 also discloses an insulating layer between the two layers of sensing cell connection patterns. Specifically, sensing cells 220a and sensing cells 220b include integrally-formed connection patterns 220a1 (salmon) and 220b1 (cyan), respectively, as illustrated in annotated Figure 2 below—and Kim481 explains there is an insulating layer, not shown in the figures, on top of the lower layer to ensure electrical isolation. Kim481, ¶¶[0028-29], [0033] (explaining that Kim481’s disclosure that an insulating layer is between the connection patterns also

[The Challenged Claims Are Unpatentable]

means the insulating layer is between the sensing cells themselves since the cells are integrally formed with the connection patterns). Kim481 also discloses using a multi-layered conductive lines, noting that the "...sensing lines 230 may be formed of not only a transparent electrode material used to form the sensing cells 220 but also a low-resistance metallic material." Kim481, ¶[0036]. A skilled artisan would have understood that the multi-layered conductive lines would have connected to the upper and lower layers of sensing cells 220. *Id.*, ¶[0030].



346. Given the structural similarities of the references, a person of ordinary skill in the art, in my opinion, would have considered Kim524's teachings to improve Kim481's device. Skilled artisans in this industry regularly look at similar devices to craft modifications that would create an improved device.

[The Challenged Claims Are Unpatentable]

347. A person of ordinary skill in the art would have found it obvious to implement Kim524's stacked touch signal line configuration with an intermediate insulating layer in Kim481's device, including for the general motivations to combine Kim481 and Kim524 I previously discussed in Section VIII.E.1 and the motivations described in incorporating Kim524's stacked structure with Kwon224 (Sections VIII.A.3, VIII.A.4.f). As described above in this section, Kim481 and Kim524 provide similar device architecture, both disclosing touch signal lines and an insulating layer, and this similarity would have motivated a skilled artisan to incorporate helpful features from Kim524 into Kim481's device.

348. For example, a person of ordinary skill in the art, in my opinion, would have been motivated to combine Kim481 and Kim524 because it achieves Kim481's goal of reduced resistance and improved touch sensitivity. Specifically, a person of ordinary skill in the art would have understood that Kim481 aims to reduce electrical resistance, as shown by its preference for "low-resistance opaque metallic material[s]" for sensing lines and its layered connection patterns designed to optimize conductivity. Kim481, ¶¶[0030-31], [0036]. Additionally, given that lower resistance is a well-established goal in the touch display industry—essential for improving signal integrity by reducing signal attenuation along the conductive path to transmit a strong signal, responsiveness by allowing for faster charging and discharging of capacitive nodes to detect touches more rapidly, and power efficiency [The Challenged Claims Are Unpatentable]

by reducing the amount of energy lost due to heat—it is my opinion that a person of ordinary skill in the art would reasonably interpret Kim481 as pursuing reduced resistance in its device structure. *See also* Section VIII.A.4.f (discussing benefits of reduced resistance). Kim481 also uses transparent conductive materials like ITO for its sensing cells, which are known for high sensitivity—a widely sought-after feature in touch screen technology. Kim481, ¶[0027], [0031].

349. A person of ordinary skill in the art would have understood that implementing Kim524's stacked conductive line with an intermediate insulating layer achieves these benefits. Specifically, the stacked conductive line configuration allows signal transmission across different layers and helps distribute electrical resistance over a larger cross-sectional area, both of which help reduce resistance in the touch signal line paths. For example, due to the first and second conductive lines connected and positioned on different layers, the signal is transmitted across multiple layers. Further, the stacked configuration provides a more vertical—wider—routing path. The use of different materials for the different layers allows using both transparent conductive oxides like ITO and metallic materials. The transparent conductive oxide improve touch screen transparency, while the metallic materials lowers resistivity in the touch signal path and improves conductivity. Further, the use of an intermediate insulating layer enables selective electrical routing by preventing unintended electrical contact between overlapping conductive paths. [The Challenged Claims Are Unpatentable]

Instead, intentional electrical connections occur at the specific contact hole locations in the intermediate insulating layer. This is a common approach in multilayer touch sensor and display architectures, where contact holes are used to bridge layers while maintaining overall signal integrity and layout efficiency. Thus, the stacked configuration enables segregating functional roles for different layers and optimizes electrical performance without compromising display quality.

350. In my opinion, a person of ordinary skill in the art would have also understood that reducing resistance in the touch signal lines directly reduces the overall resistance of the touch electrodes. This is especially true in architectures like Kim481 where the signal lines and electrodes are part of a continuous, integrated conductive pattern. Kim481, Figs. 1-3, ¶¶[0029-31]. Thus, because these elements are electrically and physically connected within the same layer stack, improvements in signal line conductivity translate predictably to enhanced touch sensitivity across the entire touch panel. Therefore, the reduced resistance provided by Kim524's stacked conductive lines also reduces the overall resistance of the touch electrodes because the conductive lines are part of the same pattern as the touch electrodes. In fact, this structural interdependence would have made the benefit of lower resistance from a stacked line configuration both apparent and desirable to a person of ordinary skill in the art.

351. A person of ordinary skill in the art would have further understood that incorporating Kim524's vertical interconnect strategy into Kim481's architecture would enhance signal integrity and reduce layout complexity, particularly in modern high-resolution displays with narrow bezels, where routing space is limited due to the increased number of lines and the smaller area. Signal integrity refers to the quality and reliability of electrical signals as they travel through conductive paths. Signal integrity is enhanced because the vertical configuration reduces line resistance, as I explained above. Further, vertical stacking allows for shortens horizontal signal paths because signals can be split across layers. Additionally, the stacked conductive line structure helps suppress display-generated noise from, for example, capacitive coupling between touch electrodes and display elements, by using an insulating layer between the upper and lower conductive lines, which reduces coupling between the two layers.

352. In my opinion, the combination would have been predictable and within the capabilities of a person of ordinary skill in the art. Kim481 discloses depositing multi-layered touch sensing lines and insulating layers and the modification merely confirms the use of a vertical stacked structure and extends the use of the insulating layer during the manufacturing process. This is a simple design choice—choosing where to deposit the insulating layer.

353. Further, the use of contact holes to connect conductive lines through insulating layers is a well-established technique in display and semiconductor fabrication. Kim524's implementation of this technique in the context of OLED touchscreens would have provided a clear blueprint for enhancing Kim481's design. The resulting device would maintain the structural benefits of Kim481 while incorporating the electrical connectivity advantages of Kim524. *Id.*

354. It is also my opinion that the modification involves straightforward adjustments. Indeed, although not pictured, Kim481 explicitly *contemplates* stacked multi-layer conductive lines, as "... the sensing lines 230 may be formed of not only a transparent electrode material used to form the sensing cells 220 but also a low-resistance metallic material." Kim481, ¶[0036]. As such, Kim481 already teaches adding the Kim524 stacked structure, with Kim524 merely providing specific implementation details.

355. The specific changes required are also simple. Kim481 originally discloses first depositing multi-layered sensing lines. Kim481, ¶[0036], Fig. 2. The modification involves two simple steps. First, it extends the insulating layer during deposition so that is also located between the two layers of the sensing lines 430. In the combination, the sensing lines would run in parallel and overlap, as disclosed in Kim524's Figure 10. The line path extends from the connection point at the sensing cells (**brick red** and **deep blue**) to an external connection point.

[The Challenged Claims Are Unpatentable]

356. Second, the modification requires the insulating layer to include contact holes to enable connection between the first and second conductive lines. Kim481 discloses “patterning” the sensing cells 220 and sensing lines 230 (Kim481, ¶¶[0029], [0054]), which a person of ordinary skill in the art would have understood as the general fabrication process of defining specific shapes or regions on a layer, including creating contact holes. Moreover, a person of ordinary skill in the art, in my opinion, would have readily recognized the practicality of forming contact holes to facilitate electrical connection between the first and second conductive lines stacked on top of each other, thereby achieving the advantages detailed below—particularly by implementing Kim481’s “patterning” techniques in an established manner in the industry. As I noted above, creating contact holes in insulating layers is well-established in the industry.

357. It is also my opinion that this combination integrates prior art elements—namely, Kim481’s touchscreen device architecture utilizing sensing signal lines and Kim524’s architecture employing a stacked touch signal line configuration with an intermediate insulating layer—by applying established methods such as controlled deposition of layers in touchscreen devices. The result is a predictable outcome: a touchscreen device as described in Kim481, now featuring a stacked touch signal line configuration that has an intermediate insulating layer, which was already known as Kim524 shows us. This combination simply substitutes

[The Challenged Claims Are Unpatentable]

Kim524's stacked touch signal line design for Kim481's signal line configuration, producing predictable touchscreen device results as outlined in Kim481, but with Kim524's stacked signal lines. The combination employs Kim524's stacked touch signal line technique to enhance Kim481's similar touchscreen architecture, reducing resistance and increasing touch sensitivity.

358. Finally, in my opinion, there would have been a reasonable expectation of success in combining these references. Both Kim481's and Kim524 are directed to similar device architectures and use compatible materials and fabrication techniques, including for the reasons I noted in Section VIII.E.1. Their combination would have addressed known challenges in OLED touchscreen integration—namely, achieving reliable electrical connections across multiple layers without compromising display performance, as Kim481 itself contemplates.

359. Therefore, in my opinion, Kim481 and Kim524 render obvious 1[d] because it would have been obvious to combine the references and the combined system includes second conductive lines (i.e., Kim524's upper touch signal lines 425 and lower touch signal lines 416 with an intermediate insulating layer 430 incorporated into Kim481's architecture to replace the multi-layered sensing lines 230) connected to the first conductive lines (Kim481's stacked sensing signal lines that are connected via contact holes).

- g. 19[f]: “at least one insulating film formed of at least one of an inorganic film or an organic film and disposed between the first and second conductive lines,”**

360. In my opinion, Kim481 and Kim524 render obvious 19[f].

361. For example, the Kim481-Kim524 combination includes an Kim524’s intermediate insulating layer between the first and second conductive lines. *See* Section VIII.E.2.f (explaining that Kim524’s vertically-stacked conductive line configuration with an intermediate insulating layer is incorporated into Kim481’s device). The intermediate layer is an inorganic film. Layer 430 is “made of silicon oxide (SiOx)” or “silicon oxynitride (SiOxNy)” —both of which Kim524 explains as inorganic layers. Kim524, ¶¶[0078], [0074] (explaining these types of layers are inorganic layers). A person of ordinary skill in the art would have understood that an inorganic layer is an inorganic film.

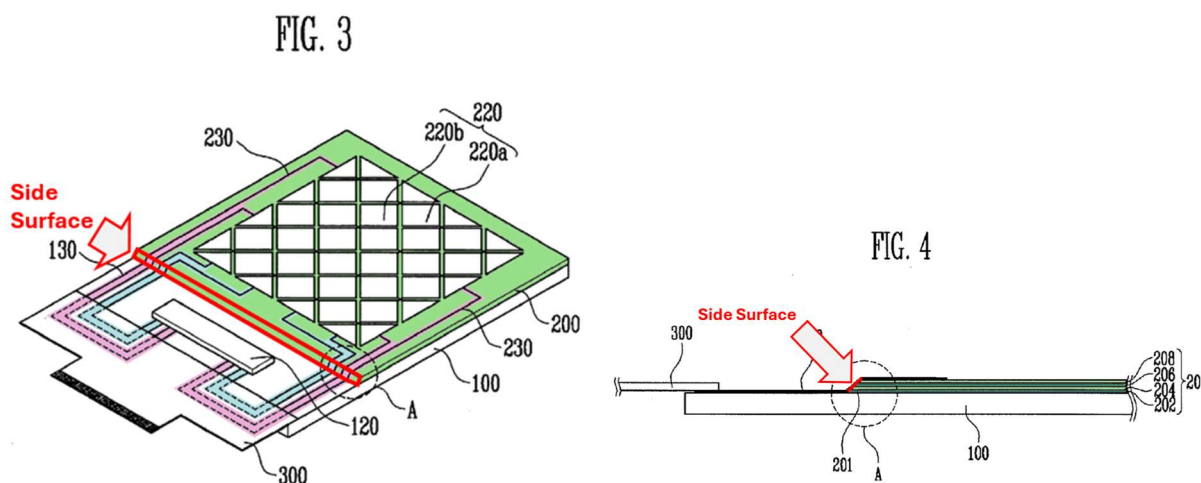
362. Therefore, in my opinion, Kim481 and Kim524 render obvious 19[f] because the combined system includes at least one insulating film formed of at least one of an inorganic film or an organic film (i.e., the inorganic intermediate insulating film, as Kim524 teaches) and disposed between the first and second conductive lines (i.e., the intermediate film between the multi-tiered sensing lines 430 in the Kim481-Kim524 combination).

h. 19[g]: “wherein the second conductive lines are disposed along a side surface of the encapsulation unit.”

363. In my opinion, Kim481 and Kim524 render 19[g] obvious.

364. For example, in my opinion, Kim481 discloses conductive lines along a side surface of the encapsulation unit and Kim481 and Kim524 render obvious the second conductive lines.

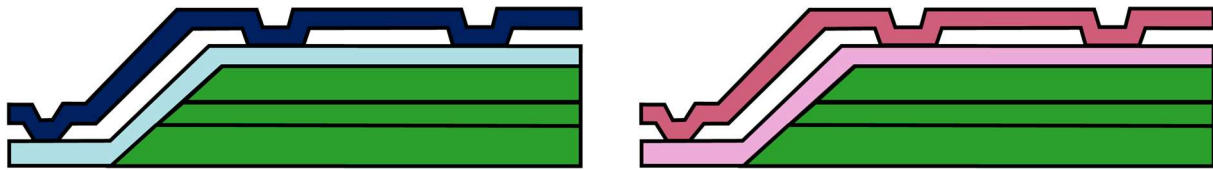
365. Specifically, as shown in annotated Figures 3 and 4 below, Kim481 discloses that the sensing lines 230 run along an inclined, side surface of Kim481’s **sealing film 200 (green)** (i.e., encapsulation unit). *See* Section VIII.D.3.



Kim481, FIG. 3

366. Further, in the Kim481-Kim524 combination, the sensing lines 230 are multi-layered with upper and lower lines, and the upper lines (i.e., second conductive lines) run in parallel to the lower lines (i.e., first conductive lines). *See* VIII.E.2.f. For example, the modified figure implements Kim524’s stacked conductive line [The Challenged Claims Are Unpatentable]

configuration from Figure 10 into Kim481's conductive lines running along the inclined side surface. As shown, the lower **sensing lines 230** (i.e., **first conductive lines**) (**sky blue** and **pink**) run parallel with the second conductive lines (**navy blue** and **magenta**) and the second conductive lines are disposed along a side surface of the **encapsulation unit (green)**.



Representation of Kim481-Kim425

IX. CONCLUSION

367. For the reasons set forth above, I believe claims 1-19 of the '394 patent are unpatentable in view of the prior art. In signing this declaration, I understand that the declaration will be filed as evidence in a contested case before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I acknowledge that I may be subject to cross-examination in this case and that cross-examination will take place within the United States. If cross-examination is required of me, I will appear for cross-examination within the United States during the time allotted for cross-examination.

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

Dated: October 15, 2025

By: 

Mr. Richard Flasck

[Conclusion]