

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

PETITION FOR *INTER PARTES* REVIEW

TABLE OF CONTENTS¹

I.	PRELIMINARY STATEMENT	1
II.	THE '394 PATENT	2
	A. Overview	2
	B. Prosecution History	6
	C. Claim Construction	9
III.	ORDINARY SKILL	9
IV.	PRIOR ART	10
	A. Kwon224 (Ex-1005)	10
	B. Kim524 (Ex-1006)	10
	C. Kim481 (Ex-1007)	10
	D. Zhu837 (Ex-1008)	10
	E. Jang513 (Ex-1009)	11
V.	RELIEF REQUESTED	11
VI.	THE CHALLENGED CLAIMS ARE UNPATENTABLE	11
	A. Ground 1: Kwon224-Kim524 Combination Renders Obvious Claims 1-4 and 6-8	11
	1. Kwon224 Overview	11
	2. Kim524 Overview	16
	3. Kwon224 and Kim524 are Analogous Art	19

¹ All color annotations added unless otherwise indicated.

4. Independent Claim 1	21
a. 1[pre]: “An organic light emitting display comprising;” ..	21
b. 1[a]: “light emitting elements disposed on a substrate;” ..	23
c. 1[b]: “an encapsulation unit disposed on the light emitting elements;”	27
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”	29
e. 1[d]: “first conductive lines connected to the touch sensors;”	37
f. 1[e]: “second conductive lines connected to the first conductive lines;”	38
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”	53
h. 1[g]: “a bank configured to expose anodes of the light emitting elements,”	56
i. 1[h]: “wherein at least one of the first bridges or the second bridges overlaps the bank.”	60
5. Dependent Claims	67
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.”	67

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.”	69
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.”	73
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.”	73
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.”	78
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.”	79
B.	Ground 2: Kwon224-Kim524-Zhu837 Combination Renders Obvious Claims 9-16, 18.	81
1.	Zhu837 Overview.....	81
2.	Kwon224, Kim524, and Zhu837 are Analogous Art.....	83
3.	Dependent Claims	84
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.” 84
- 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.” 90
- 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.” 92
- 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.” 94
- 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.” 95
- 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.” 97
- 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.” 98
- 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.”	103
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.”	103
C.	Ground 3: Kwon224-Kim524-Jang513 Combination Renders Obvious Claim 5.	105
	1. Jang513 Overview	105
	2. Kwon224, Kim524, and Jang513 are Analogous Art	107
	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.”	108
D.	Ground 4: Kwon224-Kim524-Kim481 Combination Renders Obvious Claim 17.	117
	1. Kim481 Overview	117
	2. Kwon224, Kim524 and Kim481 are Analogous Art	120
	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.”	121
E.	Ground 5: Kim481-Kim524 Combination Renders Obvious Claim 19.	126
	1. Kim481 and Kim524 are Analogous Art	126
	2. Independent Claim 19	127
	a. 19[pre]: “An organic light emitting display comprising:”	127

b.	19[a]: “light emitting elements disposed on a substrate;”	127
c.	19[b]: “an encapsulation unit disposed on the light emitting elements;”	129
d.	19[c]: “touch sensors disposed on the encapsulation unit;”	130
e.	19[d]: “first conductive lines connected to the touch sensors;”	133
f.	19[e]: “second conductive lines connected to the first conductive lines; and”	134
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,”	143
h.	19[g]: “wherein the second conductive lines are disposed along a side surface of the encapsulation unit.”	143
VII.	MANDATORY NOTICES	145
A.	Real Parties-in-Interest	145
B.	Related Matters	145
C.	Lead and Back-Up Counsel, and Service Information	146
VIII.	GROUND FOR STANDING	147
IX.	CONCLUSION	148

TABLE OF AUTHORITIES

Page(s)

Cases

<i>Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.</i> , 868 F.3d 1013 (Fed. Cir. 2017)	9
---	---

Statutes

35 U.S.C. §102(a)(1).....	10, 11
35 U.S.C. §102(a)(2).....	10, 11

TABLE OF EXHIBITS

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.
Ex-1003	Declaration of Richard A. Flask
Ex-1004	Curriculum Vitae of Richard A. Flask
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”)

***NOTE: All citations herein to page numbers identify the stamped page numbers of the cited exhibit, not the page numbers of the original reference.**

LIST OF CHALLENGED CLAIMS

Claim 1	
1[pre]	An organic light emitting display comprising:
1[a]	light emitting elements disposed on a substrate;
1[b]	an encapsulation unit disposed on the light emitting elements;
1[c]	touch sensors disposed on the encapsulation unit, the touch sensors including:
1[d]	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;
1[e]	first conductive lines connected to the touch sensors:
1[f]	second conductive lines connected to the first conductive lines;
1[g]	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
1[h]	a bank configured to expose anodes of the light emitting elements,
1[i]	wherein at least one of the first bridges or the second bridges overlaps the bank.
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.	

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.	
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.	
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.	
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	
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.	
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.	
Claim 9	
9[pre]	The organic light emitting display according to claim 1, wherein:

9[a]	the encapsulation unit comprises at least one inorganic encapsulation layer and at least one organic encapsulation layer; and
9[b]	the at least one insulating film is one of the at least one inorganic encapsulation layer and the at least one organic encapsulation layer.
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.	
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.	
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.	
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.	
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.	

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.	
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.	
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.	
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.	
Claim 19	
19[pre]	An organic light emitting display comprising:
19[a]	light emitting elements disposed on a substrate;
19[b]	an encapsulation unit disposed on the light emitting elements;
19[c]	touch sensors disposed on the encapsulation unit;
19[d]	first conductive lines connected to the touch sensors;
19[e]	second conductive lines connected to the first conductive lines; and

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,
19[g]	wherein the second conductive lines are disposed along a side surface of the encapsulation unit.

I. PRELIMINARY STATEMENT

The '394 patent should never have issued. The patent's claims cover an OLED display with a built-in touch screen, a concept well-known before the patent's earliest alleged priority date in 2016. Unlike designs where a touch screen is separate from a display panel, this design eliminates the need for an additional attachment process, reduces weight and slims the device by placing touch sensor components directly on or in the display's top encapsulation layer. Prior art cited in this petition and not considered by the Examiner demonstrates there was nothing inventive about this or anything else in the claims at the time of the alleged invention.

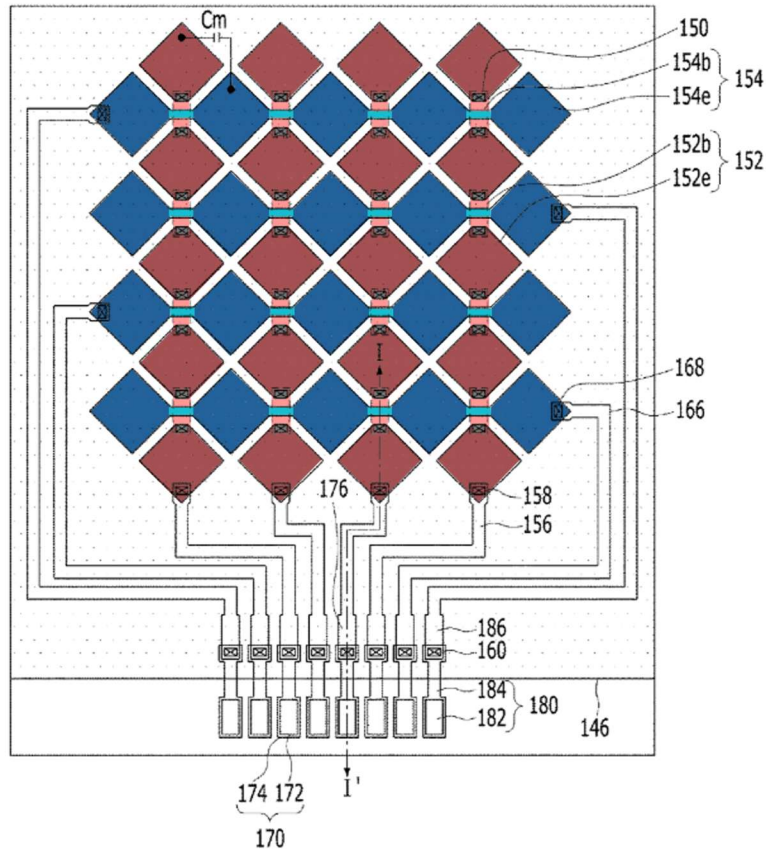
Indeed, the USPTO found virtually all elements of the independent claims anticipated by a single reference during prosecution. The '394 patent only issued after two minor features originally found only in dependent claims were added to the independent claims: (i) "bridges" (or connecting lines) that vertically overlap with a "bank" (or an area defining the light-emitting region) and (ii) connection wiring disposed on the side surface of an encapsulation unit. Not only are these features unrelated to the alleged novelty of the patent, but, as demonstrated below, they were also well-known before the earliest alleged priority date in 2016. This IPR should be instituted and all claims of the '394 patent should be cancelled.

II. THE '394 PATENT

A. Overview

The '394 patent claims an “organic light emitting display” with touch sensors that 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**). Ex-1001, Fig. 1, 2:26-30, 4:31-49; Ex-1003, ¶¶43-46.

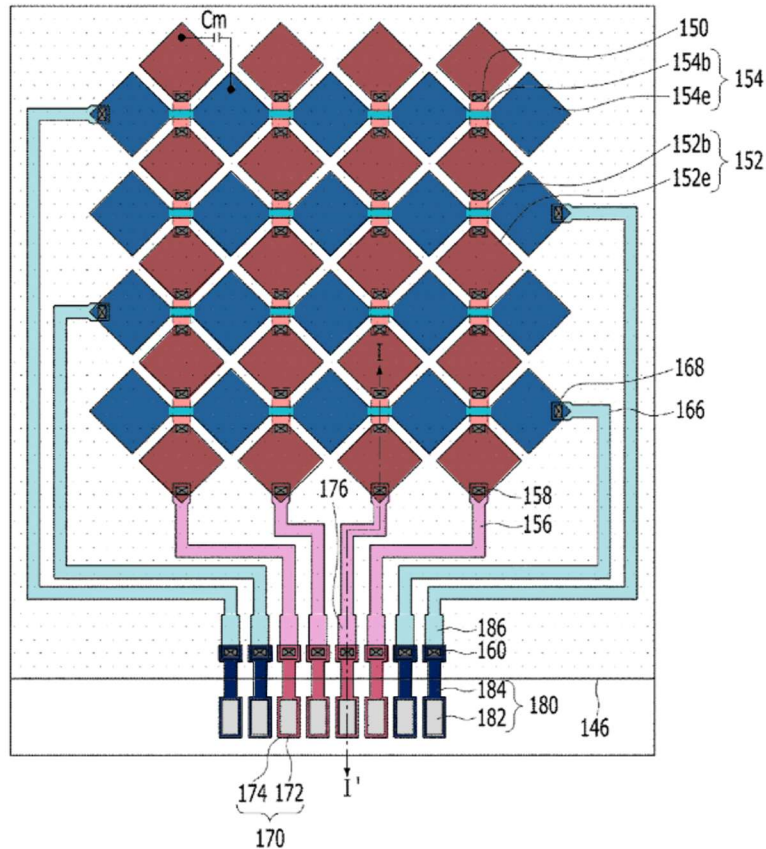
FIG.1



Ex-1001, FIG. 1

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 connected to **pad connection electrodes 174/184 (magenta/navy blue)** (collectively, the claimed “second conductive lines”). *Id.*, 5:13-20, 5:66-6:10. The pad connection electrodes are connected to the **pad electrodes 172/182 (light gray)** (collectively, the claimed “touch pads”). *Id.*, 5:47-50.

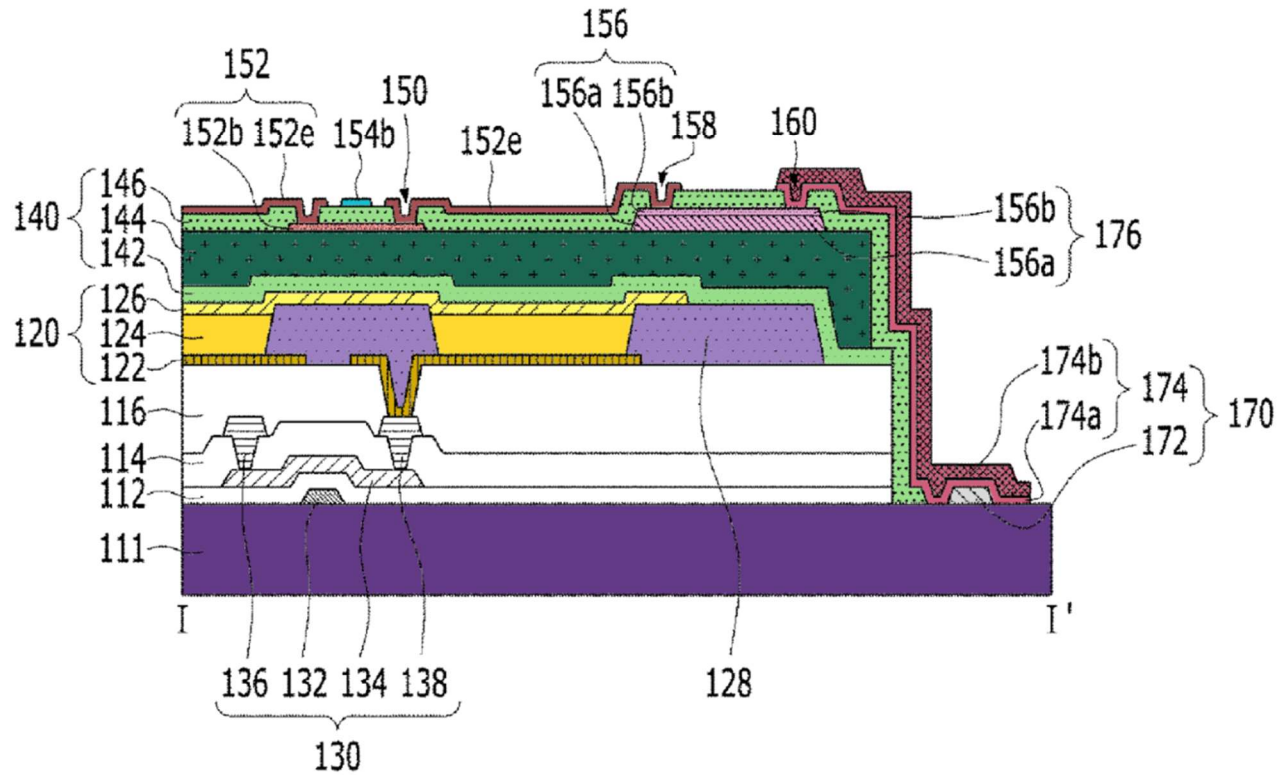
FIG.1



Ex-1001, FIG. 1

Figure 2 provides a cross-sectional view along line I-I' of FIG. 1, showing 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/154b** (**salmon/cyan**), as well as **first routing lines 156** (**pink**), **pad connection 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

It further shows an encapsulation unit 140 comprising inorganic (**lime green**) and organic (**dark green**) layers, with inorganic layer 146 disposed between the first and second conductive lines (**pink** and **magenta** respectively). *Id.*, 3:34-47, 5:55-60. The second conductive lines (**magenta**) are disposed on the uppermost inorganic layer and along the side surface of the encapsulation unit. *Id.*, 5:55-60. Below the encapsulation unit are light emitting elements 120 (**all shades of yellow**) that include anode 122, light emitting layer 124, and cathode 126. *Id.*,

3:19-22. Banks 128 (light purple) overlap the bridges 152b/154b (salmon/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

During prosecution, the Examiner found that Kang651 anticipated all claims except two dependent claims. Ex-1002, 148; Ex-1003, ¶¶47-54.

The Examiner found Kang651 expressly discloses the core features of the '394 patent, including the **first/second touch electrodes 142a/143a (brick red/deep blue)**, **first/second bridges 142b/143b (salmon/cyan)**, **first/second conductive lines 148a/148b (pink/magenta)**, **touch pads 423 (light gray)**, **encapsulation unit 140 (green)**, **an inorganic insulating film 155 (lime green)** between the conductive lines, and **touch pads (light gray)**. *Id.*, 148-149; Kang651, Figs. 1, 4, ¶[0043].

FIG. 1

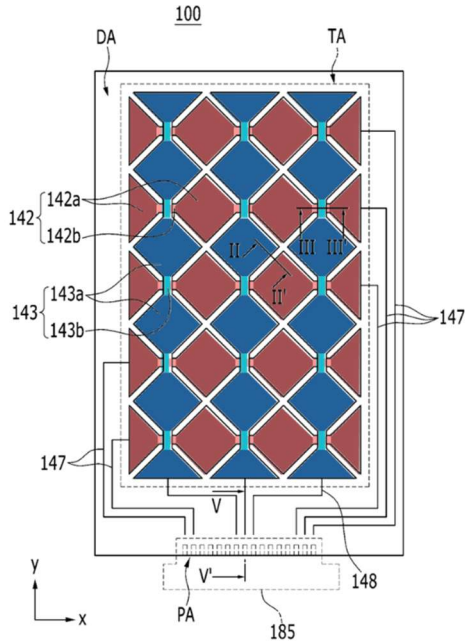
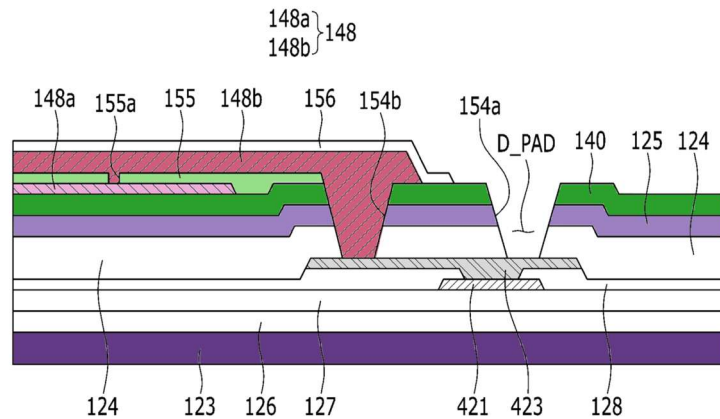
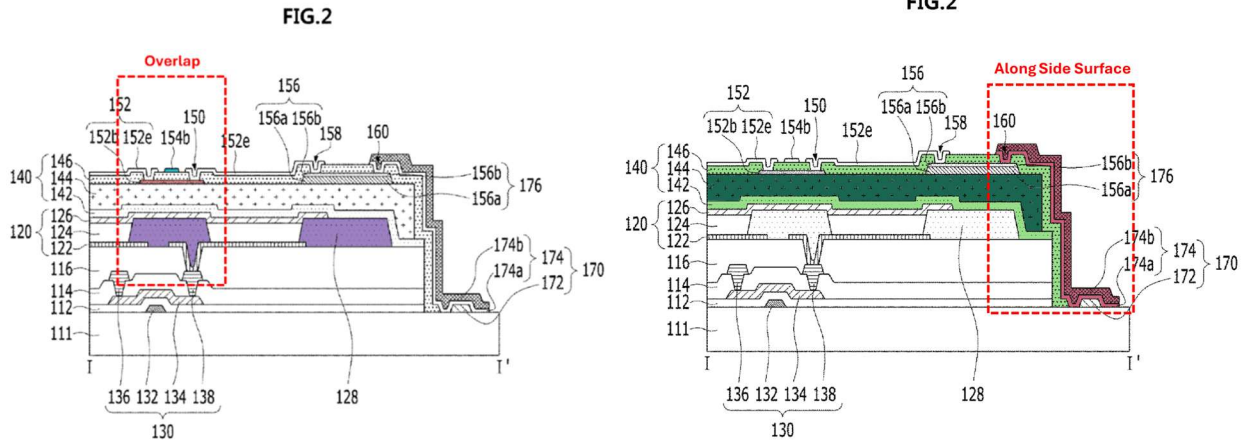


FIG. 5



Kang651, FIGS. 1, 5

Below the encapsulation unit 140, which has both **inorganic (lime green)** and/or **organic (dark green)** layers, are “**light emitting elements (LD,) [(all shades of yellow)]** disposed on a **substrate (123) [(dark purple)]**,” *Id.*, 148, and **pixel defining layers 125 (i.e., banks) (light purple)** that expose the anode 160 in an emission region. Kang651, ¶[0059], Figs. 4-5.



Ex-1001, FIG. 2

Rewriting these claims into independent form led to allowance. Ex-1002, 251-258, 262-269. But these added features were well-known in the prior art.

C. Claim Construction

Claims must be construed only to the extent necessary to resolve a controversy. *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017). Here, no terms need construction to resolve the controversy in this forum.² Ex-1003, ¶¶58-59.

III. ORDINARY SKILL

A person of ordinary skill in the art (“POSITA”) would have had a four-year undergraduate degree in electrical engineering or physics or a closely-related field

² Petitioner reserves the right to argue indefiniteness in an appropriate forum.

and four years of experience in the design and implementation of flat panel display devices or components thereof as of the priority date. Ex-1003, ¶¶55-57, 1-19.

Additional relevant education could substitute for professional experience, and significant work experience could substitute for formal education. *Id.*

IV. PRIOR ART

The Examiner failed to consider the following references, which render obvious all claims.

A. Kwon224 (Ex-1005)

Kwon224 (filed May 12, 2016, published December 29, 2016) is prior art under at least 35 U.S.C. §102(a)(2).

B. Kim524 (Ex-1006)

Kim524 (filed June 5, 2015, published June 16, 2016) is prior art under at least 35 U.S.C. §§102(a)(1)-102(a)(2).

C. Kim481 (Ex-1007)

Kim481 (filed February 4, 2011, published March 15, 2012) is prior art under at least 35 U.S.C. §§102(a)(1)-102(a)(2).

D. Zhu837 (Ex-1008)

Zhu837 (filed December 25, 2014, published October 27, 2016) is prior art under at least 35 U.S.C. §102(a)(2).

E. Jang513 (Ex-1009)

Jang513 (filed August 14, 2012, published October 24, 2013) is prior art under at least 35 U.S.C. §§102(a)(1)-102(a)(2).

V. RELIEF REQUESTED

Petitioner requests *inter partes* review and cancellation of claims 1-19 based on the following grounds. Ex-1003, ¶¶60-61.

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
4	17	103	Kwon224, Kim524, Kim481
5	19	103	Kim481, Kim524

VI. THE CHALLENGED CLAIMS ARE UNPATENTABLE

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

1. Kwon224 Overview

Kwon224 describes an “organic light emitting display having” two conductive layers of touch sensors. Ex-1003, ¶¶62-66. The first conductive layer, shown in Figure 9A and deposited first, includes “sensing parts SP1” of the “first touch electrodes TE1” (brick red), “connected parts CP1” (salmon), first touch

signal lines SL1 (pink). The second conductive layer, shown in Figure 9B and deposited second, includes “sensing parts SP2” of the “second touch electrodes TE2” (deep blue), “connected parts CP2” (cyan), and second touch signal lines SL2 (sky blue). Kwon224, ¶¶[0143], [0145], [0147], [0149].

FIG. 9A

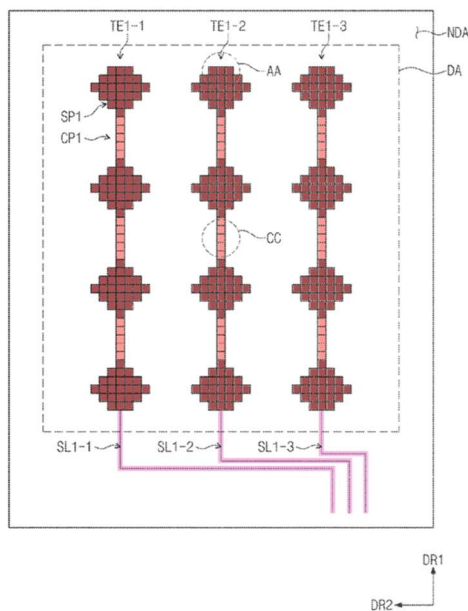
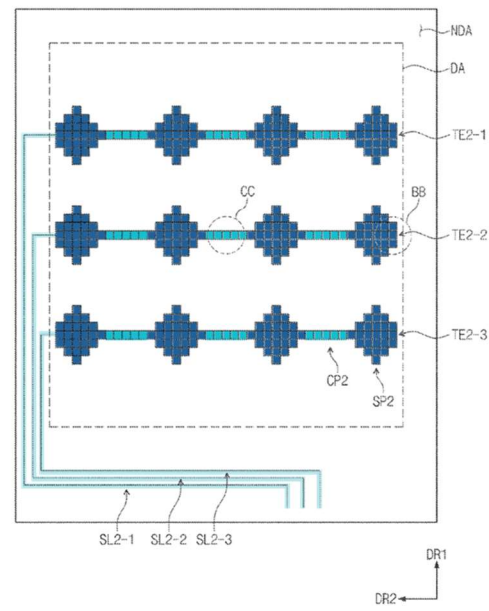


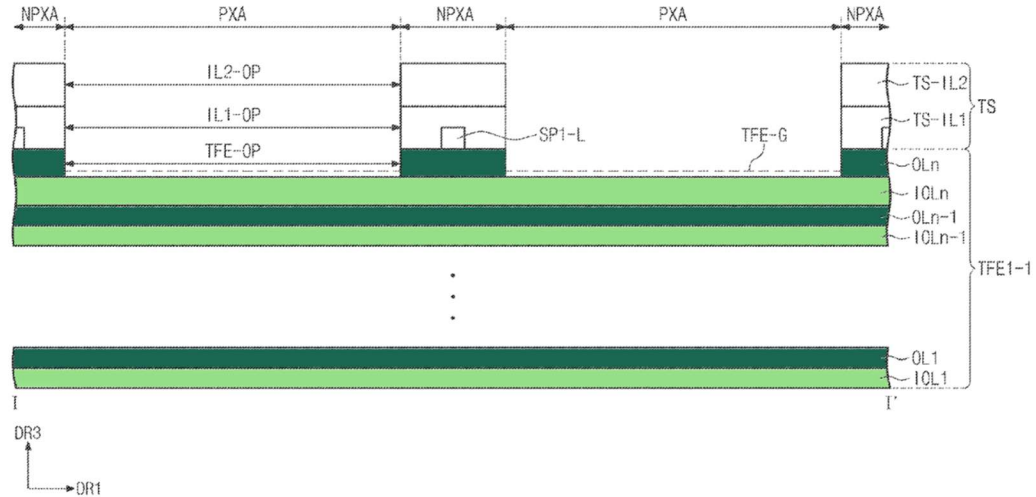
FIG. 9B



Kwon224, FIGS. 9A, 9B

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. Kwon224, ¶¶[0112], [0126], [0132], [0138].

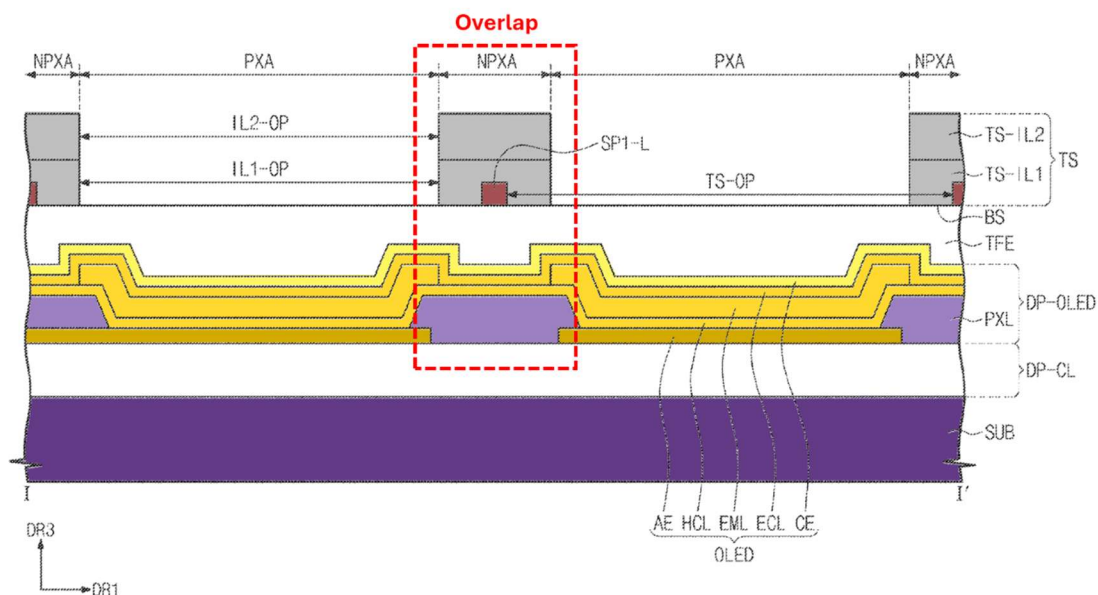
FIG. 13A



Kwon224, FIGS. 13A (showing exemplary configuration)

The “first insulating layer TS-IL1” covers the first conductive layer, including the first lines SL1. Kwon224, ¶¶[0010], [0155]. The second conductive layer, including the **touch electrodes (deep blue)**, is deposited on top of TS-IL1 and above the **TFE (green)**. *Id.*, ¶[0010].

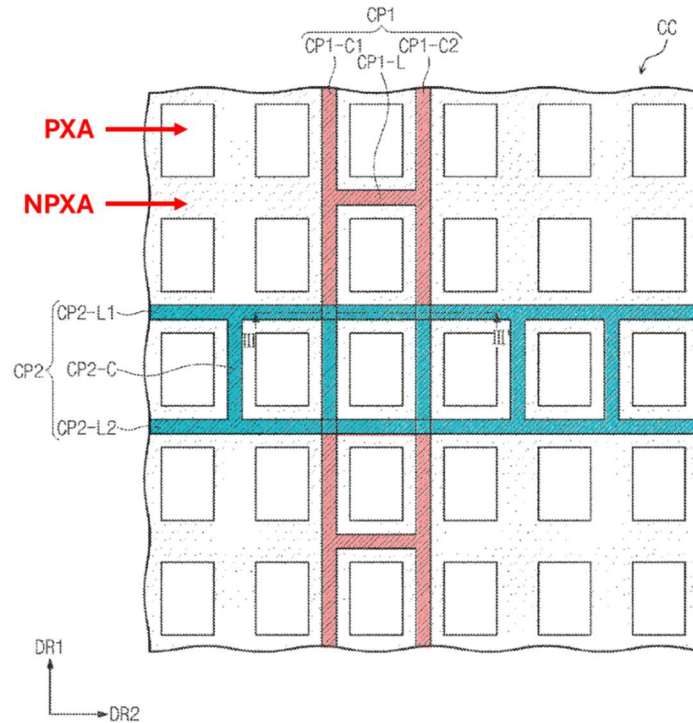
FIG. 10B



Kwon224, FIGS. 10B

Because **connected parts CP1/CP2 (salmon/cyan)** are entirely within the NPXA region, the PXL layers overlap these parts.

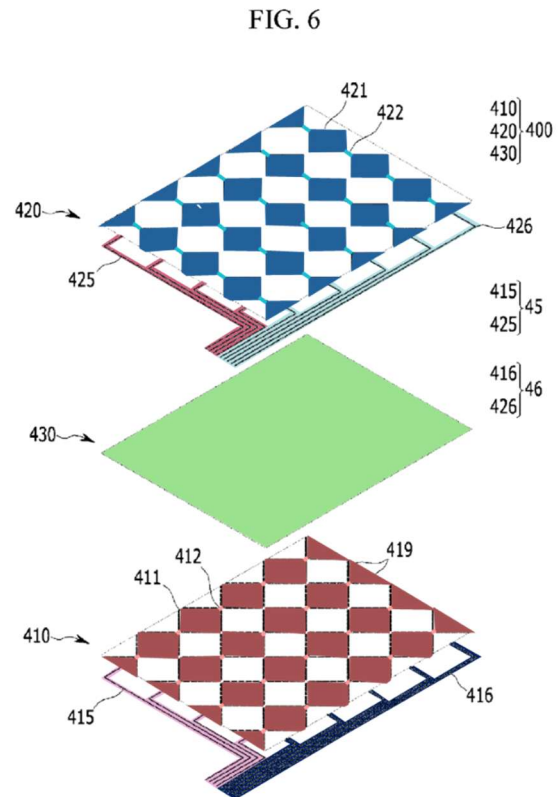
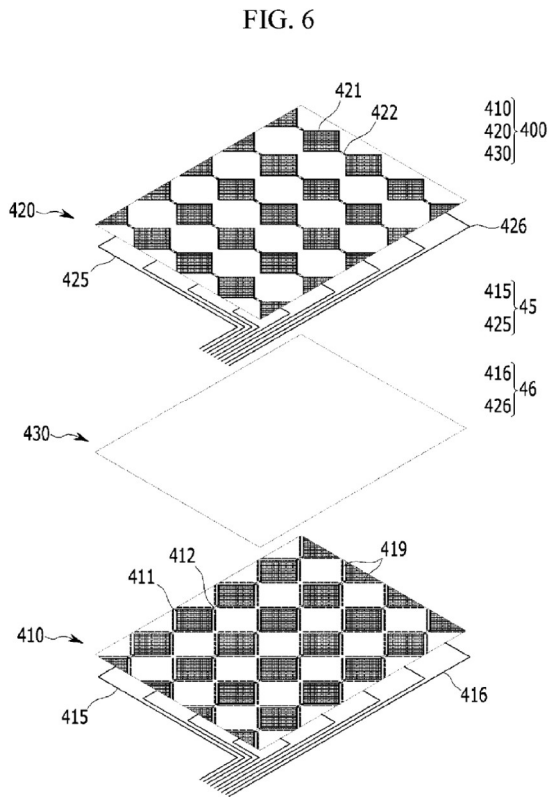
FIG. 12A



Kwon224, FIGS. 12A

2. Kim524 Overview

Kim524 discloses an “organic light emitting diode display” with upper and lower “touch active” layers of touch sensors. Ex-1003, ¶¶67-70. Each layer includes touch electrodes 411/421 (**brick red/deep blue**), connecting portions 412/422 (**salmon/cyan**), first touch signal lines 415/426 (**pink/sky blue**), and second touch signal lines 416/425 (**navy blue/ magenta**). Kim524, ¶¶[0078-80]. In between both layers is an **inorganic, insulating layer 430 (lime green)**. *Id.*, ¶¶[0078], [0074].



Kim524, FIG. 6 (Unannotated Left)

Figure 10 details the stacked signal line configuration, showing the upper signal lines connecting to the lower ones through contact holes 435 in layer 430.

Id., ¶[0084].

FIG. 10

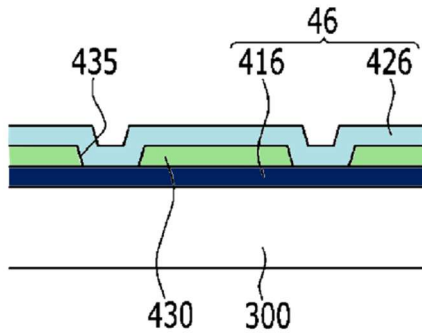
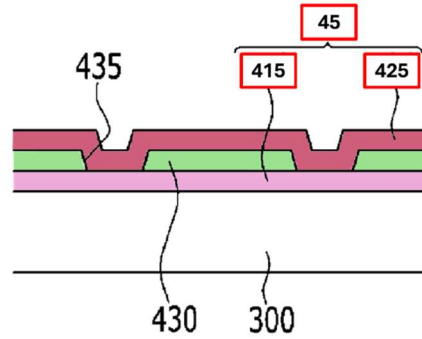
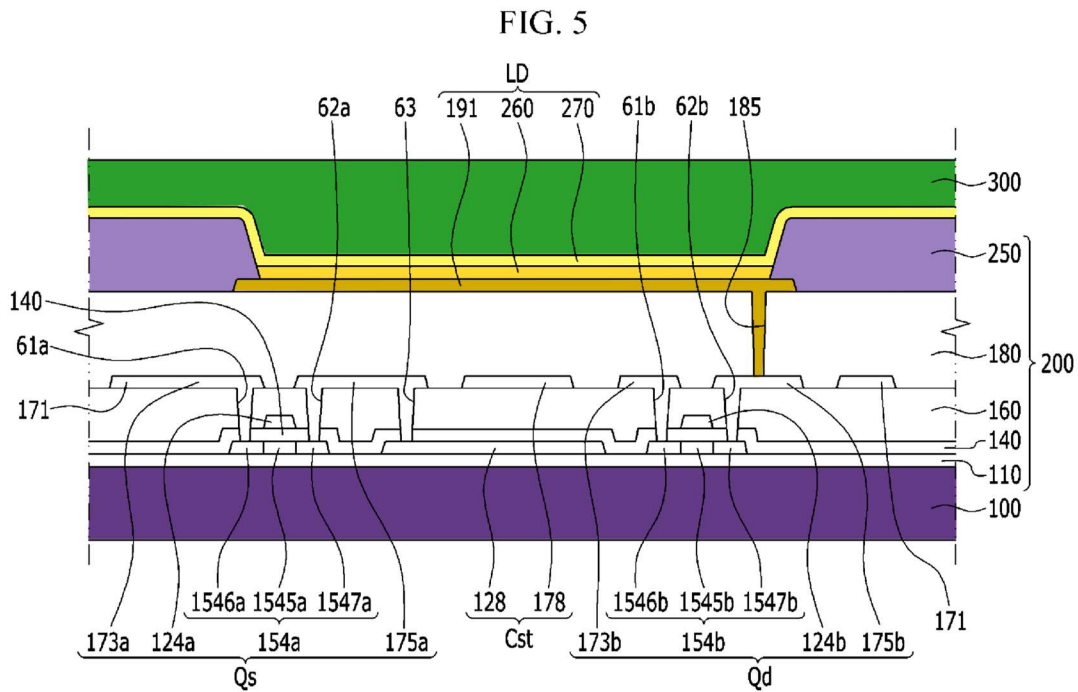


FIG. 10



Kim524, FIG. 10 (modified right)

Underneath the touch active layer is a display layer 200 comprising an encapsulation layer 300 (green) including inorganic and organic layers, light emitting devices LD (all shades of yellow), pixel defining layer 250 (light purple) (i.e., the claimed bank) that exposes anodes and provides an emission region, and a substrate 100 (dark purple). *Id.*, ¶¶[0050], [0067], [0069-70], [0073-74].



Kim524, FIG. 5

3. Kwon224 and Kim524 are Analogous Art

A POSITA would have found it obvious to combine Kwon224 and Kim524, which disclose complementary systems/methods in the field for fabricating OLED touchscreens, analogous to the '394 patent and each other. *Compare* Sections II., VI.A.1, VI.A.2; Ex-1003, ¶¶71-75.

All three address similar problems. The '394 patent states that attaching touchscreens to the display panel's front increases thickness, complicates manufacturing, and hinders flexibility and transmittance. Ex-1001, 1:41-48. The patent's solution integrates the touch layer and display layer, reducing weight and

thickness, improving flexibility, and simplifying the process without needing a separate insulating layer or attachment step. *Id.*, 2:1-17; Ex-1003, ¶72.

Kwon224 and Kim524 both address similar integration-related problems. Kwon224 highlights that conventional devices with separate touch sensor attachments can suffer from increased thickness, reduced flexibility, and electrode cracking. Kwon224, ¶¶[0006], [0010], [0139]-[0140], [0162]. Kwon224's solution integrates touch electrodes directly onto the display panel, improving flexibility, reducing mechanical stress, and preventing electrode cracking during bending. *Id.*; Ex-1003, ¶73.

Likewise, Kim524, addresses an integration problem: when integrating touch electrodes with display electrodes in a compact, integrated structure, an increase in parasitic capacitance and reduction in touch sensitivity can occur. Kim524, ¶¶[0006-7], [0090]; Ex-1003, ¶74. Kim524's solution forms touch electrodes with a density-varying mesh pattern—reducing parasitic capacitance while maintaining mutual capacitance, touch sensitivity, and mechanical flexibility and reliability. *Id.*, ¶¶[0033], [0088], [0091-93]; Ex-1003, ¶74.

Because Kwon224 and Kim524 disclose similar systems that operate similarly and are directed to similar problems, a POSITA would have been motivated to

consider their combined teachings. Ex-1003, ¶¶75. Additional claim element rationales are provided below.

4. Independent Claim 1

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

To the extent the preamble is limiting, Kwon224 discloses 1[pre]. Ex-1003, ¶76.

Kwon224 discloses a “flexible display device” that includes a “organic light emitting display panel.” Kwon224, ¶¶[0010], [0095]; Ex-1003, ¶77 (explaining that Kwon224’s device constitutes an organic light emitting display).

Kwon224’s Figures 9A-9B show a plan view of the device’s “conductive layers of a touch screen.” Kwon224, ¶¶[0003], [0027], Figs. 9A-9B; Ex-1003, ¶¶78-80.

FIG. 9A

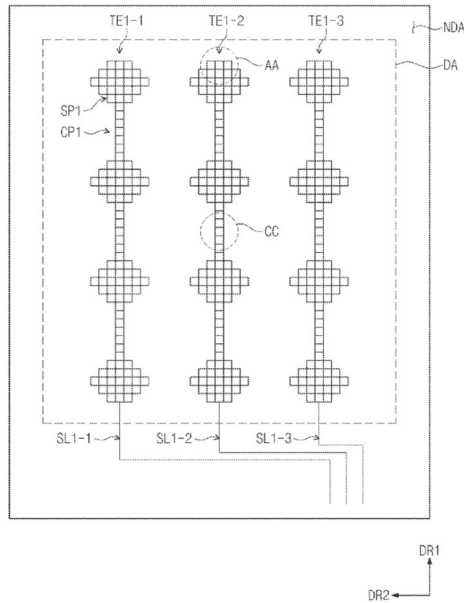
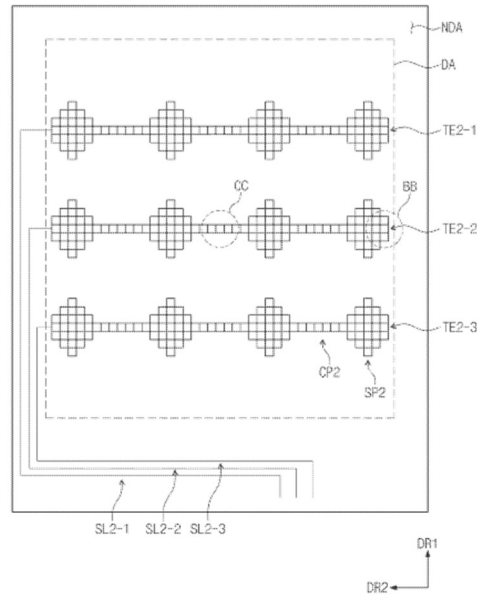


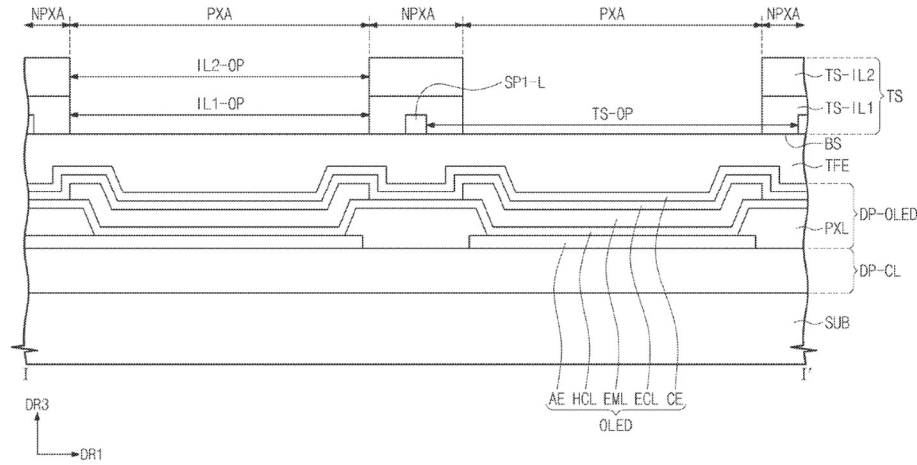
FIG. 9B



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

Figure 10B's cross-sectional view of the device in Figures 9A-9B depicts various layers, including 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). Kwon224, Figs. 10A-10B, ¶¶[0029], [0141], [0155].

FIG. 10B



Kwon224, FIG. 10B (Cross-Section)

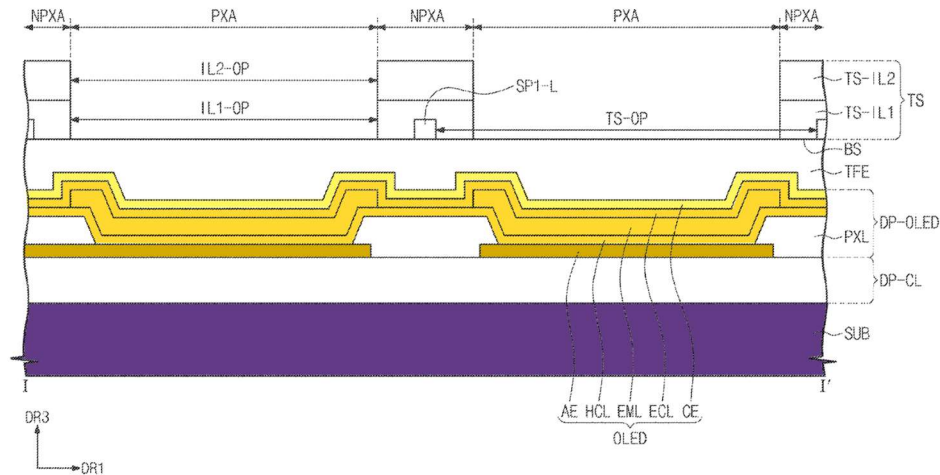
Therefore, Kwon224 discloses 1[pre] because it discloses an organic light emitting display (i.e., Kwon224's display device with an organic light emitting display panel).

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

Kwon224 discloses 1[a]. Ex-1003, ¶¶81-87.

Kwon224's Figure 10B discloses **organic light emitting devices (OLEDs)** (all shades of yellow) that are disposed on a **substrate** (dark purple). Kwon224, Fig. 10B, ¶¶[0122-123], [0112-113].

FIG. 10B

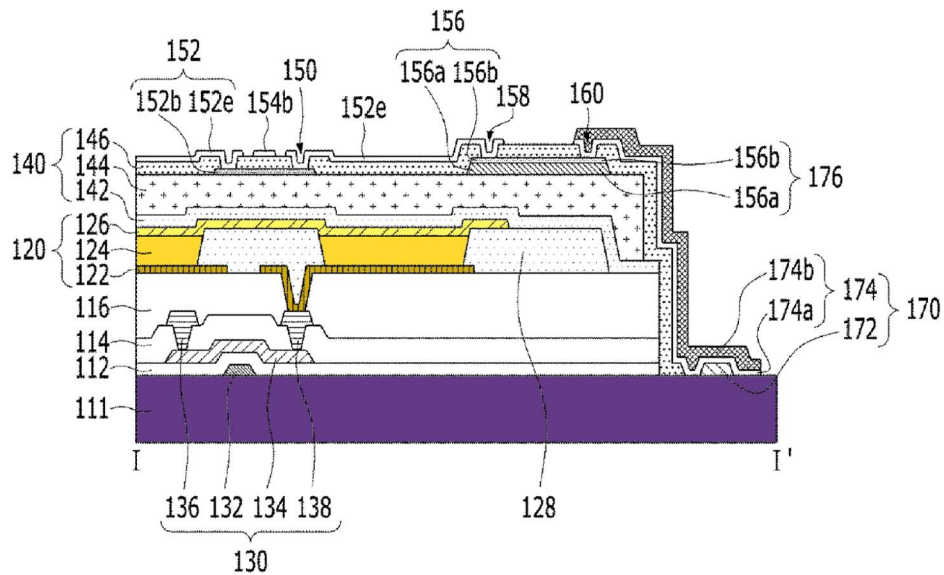


Kwon224, FIG. 10B

The '394 patent confirms that Kwon224's **OLEDs** are the claimed "light emitting elements" for two reasons. Ex-1003, ¶¶82-87. First, the '394 patent's "light emitting elements" include an anode, a hole-related layer, a light-emitting layer, an electron-related layer, and a cathode. Ex-1001, 3:19-22, 3:28-31, Fig. 2; Ex-1003, ¶83. Similarly, Kwon224's **OLEDs** include an AE (anode), HCL (hole control layer), EML (organic light-emitting layer), ECL (electron control layer), and CE (cathode). Kwon224, Fig. 10B, ¶[0122]; Ex-1003, ¶83.

Second, both the '394 patent and Kwon224 depict light emitting elements positioned on a substrate. Ex-1003, ¶¶84-85. The '394 patent's Figure 2 shows **light emitting elements 120 (all shades of yellow)** on a **substrate 111 (dark purple)**.

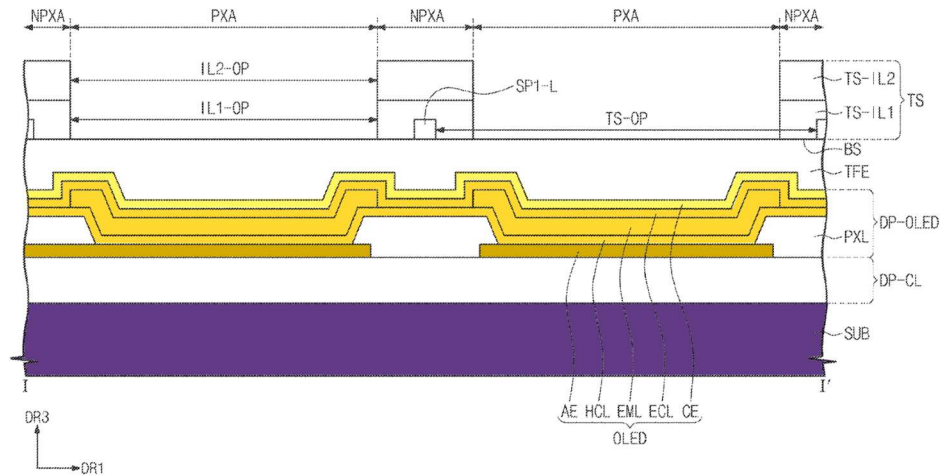
FIG. 2



'394 Patent, FIG. 2

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

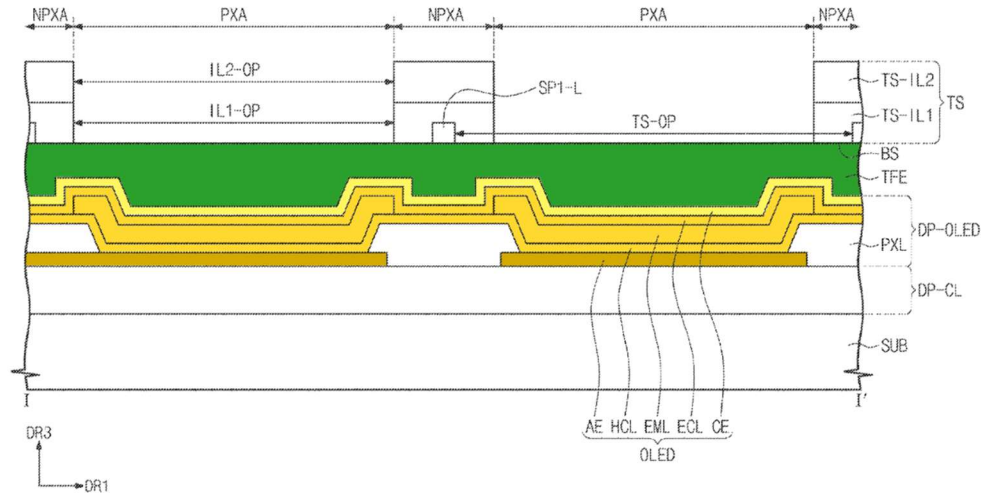
FIG. 10B



Kwon224, FIG. 10B

The '394 patent's description of the position between the light emitting elements and substrate includes intervening layers. Ex-1003, ¶86; *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:

FIG. 10B



Kwon224, FIG. 10B

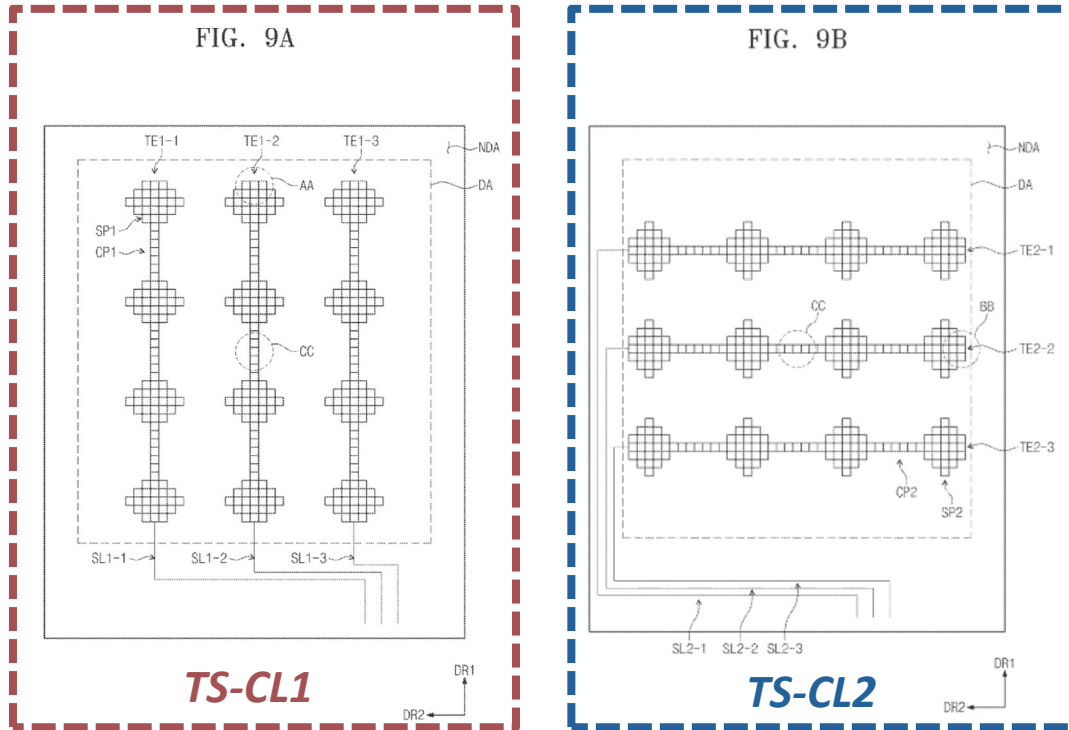
This TFE is the claimed encapsulation unit. Ex-1003, ¶¶89-91. The '394 patent explains that the encapsulation unit protects light emitting elements from “external moisture or oxygen.” Ex-1001, 3:34-44, Fig. 2. Kwon224’s TFE serves the same purpose: to “protect the organic light emitting device OLED from moisture and foreign substance.” Kwon224, ¶¶[0112], [0126], [0123]; Ex-1003, ¶¶89-92.

Therefore, Kwon224 discloses 1[b] because it discloses an encapsulation unit (i.e., the thin film encapsulation layer (TFE)) 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”**

Kwon224 discloses 1[c]. Kwon224, ¶¶[0139], [0142], [0151]; Ex-1003, ¶¶94-104.

Kwon224 discloses a “first conductive layer TS-CL1” and “second conductive layer TS-CL2,” constituting the claimed touch sensors. Kwon224, ¶¶[0136-137]; Ex-1003, ¶95. 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

As shown below, Figure 9A shows the “sensing parts SP1” of the “first touch electrodes TE1-1, TE1-2, and TE1-3” (**brick red**) and Figure 9B shows the “sensing parts SP2” of the “second touch electrodes TE2-1, TE2-2, and TE2-3” (**deep blue**). Kwon224, ¶¶[0143], [0147]. The sensing parts SP1 are connected together by “connecting parts CP1” (**salmon**) and the sensing parts SP2 are connected together by “connecting parts CP2” (**cyan**). Kwon224, ¶¶[0145], [0149].

FIG. 9A

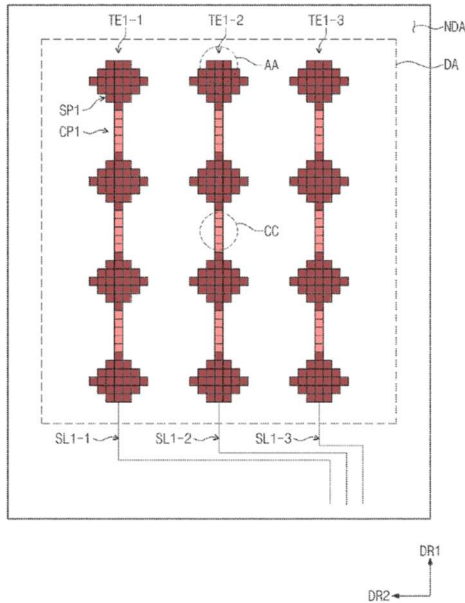
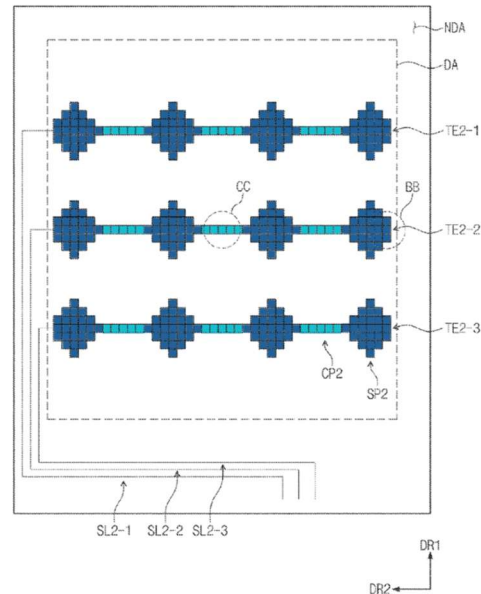


FIG. 9B

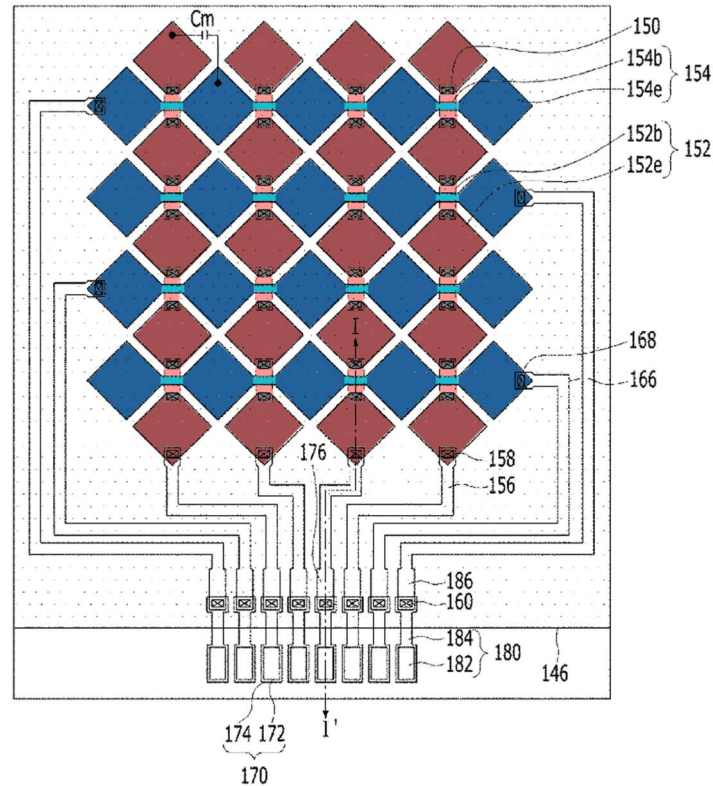


Kwon224, FIGS. 9A, 9B

Consequently, a POSITA would have understood that Kwon224 discloses the claimed touch sensors. Ex-1003, ¶97.

The '394 patent confirms that Kwon224 discloses the claimed touch sensors for two reasons. Ex-1003, ¶98. First, Kwon224's disclosure of touch sensors in Figures 9A-9B is consistent with the '394 patent's disclosure in Figure 1, reproduced below, which 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; Ex-1003, ¶99.

FIG.1



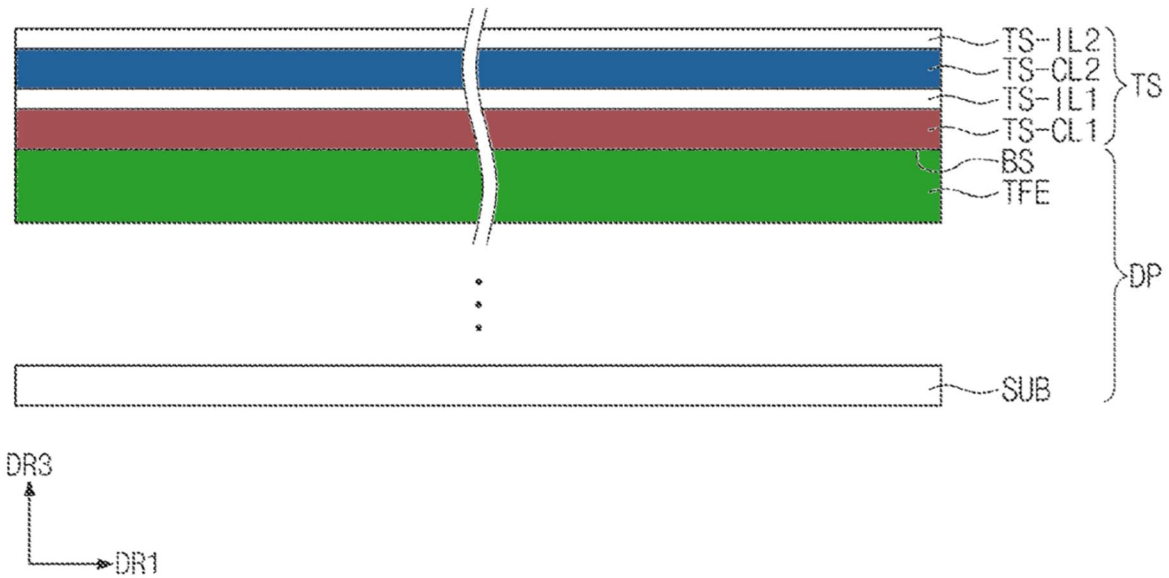
'394 Patent, FIG. 1

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; Ex-1003, ¶99. 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.* Kwon224 similarly discloses a capacitive touch sensor architecture. Ex-1003, ¶100. 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 SP1 and the second sensing parts SP2.” *Id.*, ¶¶[0151], [0220], [0278]. This capacitive coupling mechanism aligns with the mutual capacitance principle described in the ’394 patent, indicating that both disclosures rely on similar touch sensing methodologies. *Id.*; Ex-1003, ¶100.

Lastly, Kwon224’s first conductive layer (TS-CL1) and second conductive layer (TS-CL2) are disposed on the thin film encapsulation layer (TFE). Ex-1003, ¶¶101-103; Kwon224, ¶[0139]; *see* §VI.A.4.c (explaining that the TFE layer is the claimed encapsulation unit), §VI.A.4.b.

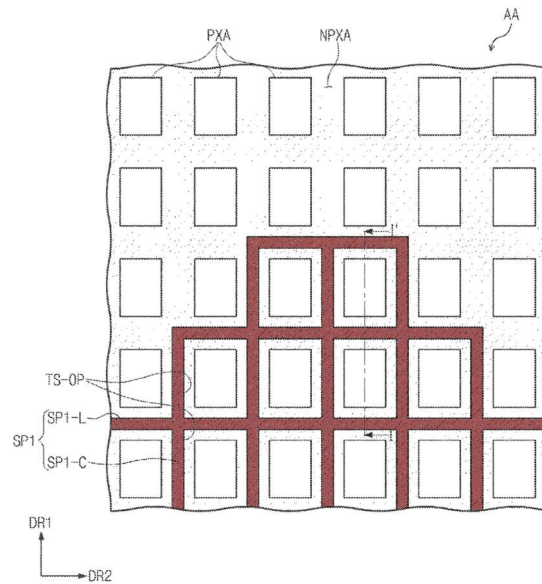
FIG. 8A



Kwon224, FIG. 8A

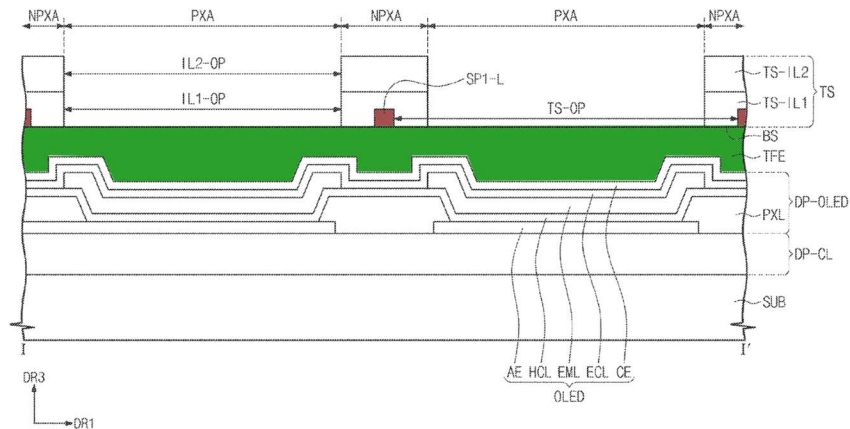
Additional Kwon224 figures further show the touch sensors disposed on the TFE layer. Figures 10A-10B show that sensing parts SP1, which are part of the first touch electrodes, are disposed on the TFE. Kwon224, ¶[0145].

FIG. 10A



Kwon224, FIG. 10A

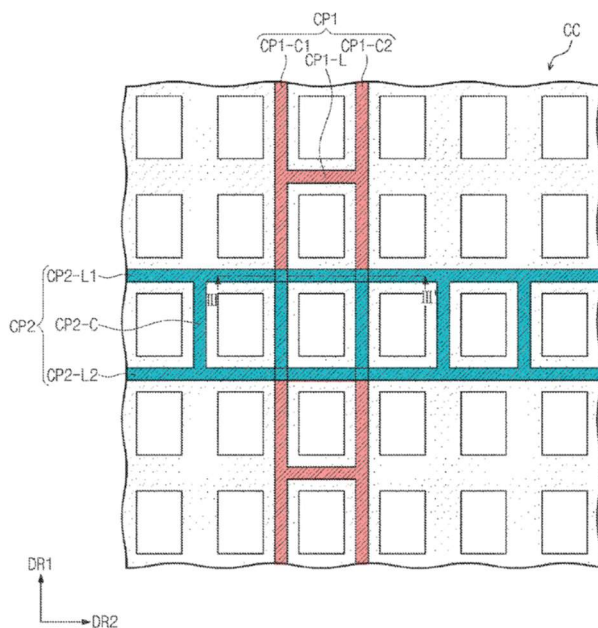
FIG. 10B



Kwon224, FIG. 10B

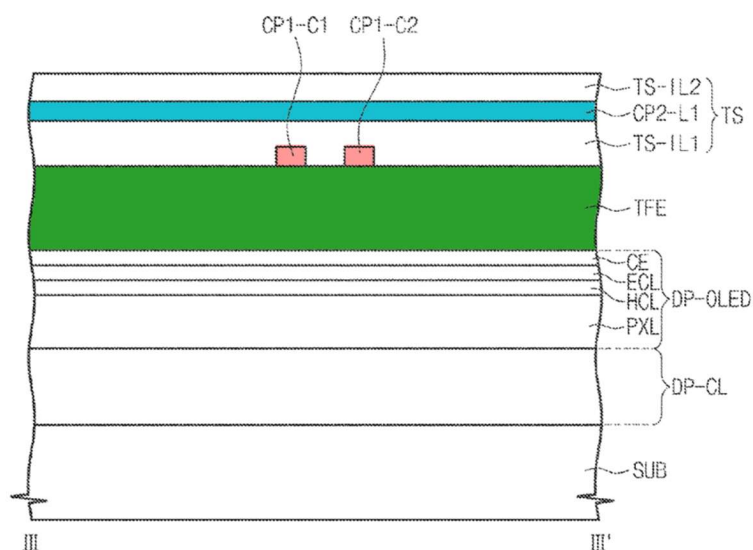
Additionally, Figures 12A-12B below show that connecting parts CP1 are disposed on the TFE.

FIG. 12A



Kwon224, FIG. 12A

FIG. 12B



Kwon224, FIG. 12B

Therefore, Kwon224 discloses 1[c] because it discloses touch sensors (i.e., first/second conductive layer TS-CL1/TS-CL2) disposed on the encapsulation unit (i.e., TFE layer), and the touch sensors 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:”

Kwon224 discloses 1[d]. Ex-1003, ¶¶105-108.

Kwon224 discloses **first touch signal lines SL1 (pink)** and **second touch signal lines SL2 (sky blue)**—either of which constitute the claimed first conductive lines. Kwon224, ¶¶[0143], [0147]; Ex-1003, ¶106.

FIG. 9A

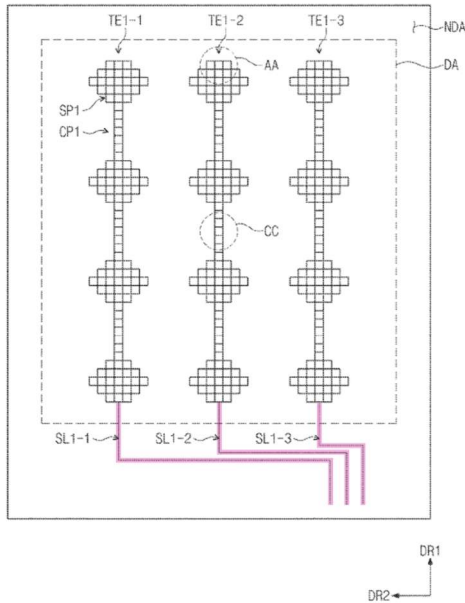
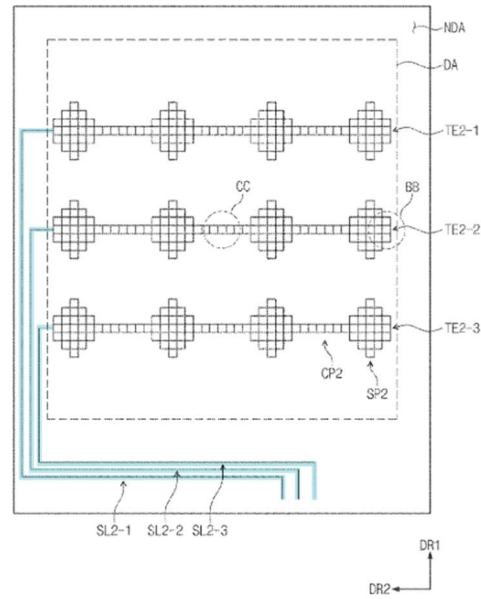


FIG. 9B



Kwon224, FIGS. 9A, 9B

SL1 and SL2 are connected to touch electrodes TE1 and TE2, respectively. Kwon224, ¶[0143], [0147]; §VI.A.4.d (explaining the touch sensors include the touch electrodes). Ex-1003, ¶107.

Therefore, 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;”

Kwon224 and Kim524 render obvious 1[e]. Ex-1003, ¶¶109-137.

Kwon224 discloses first conductive lines (i.e., first touch signal lines SL1 (pink) and/or second touch signal lines SL2 (sky blue)). See §VI.A.4.e.

FIG. 9A

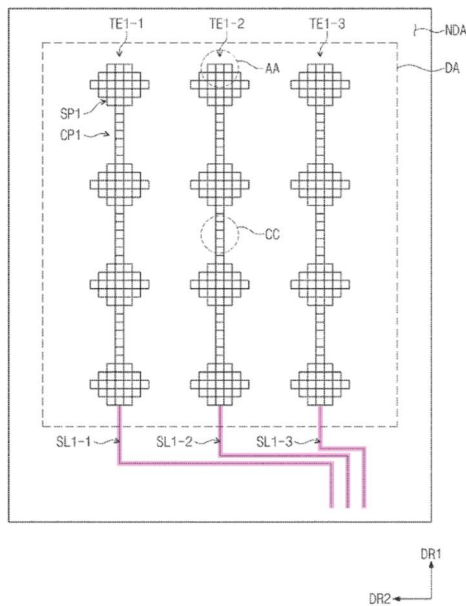
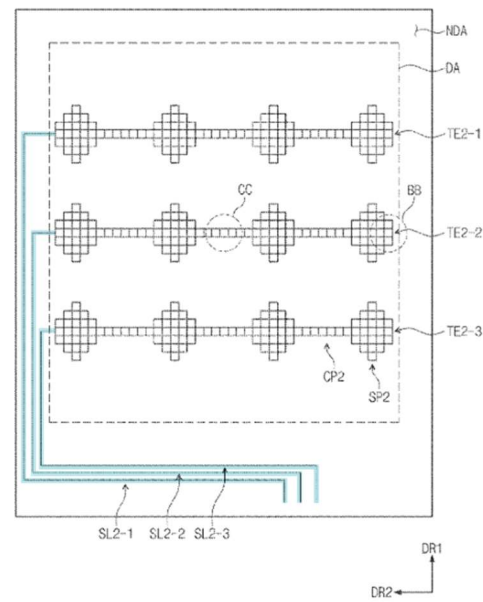


FIG. 9B



Kwon224, FIGS. 9A, 9B

Kwon224 provides limited details on the vertical structure of the touch signal lines and never provides a cross-sectional view showing this structure. Ex-1003, ¶¶110-111. Kwon224 only states that the “first insulating layer TS-IL1” covers the “first touch signal lines SL1.” Kwon224, ¶[0155]; Ex-1003, ¶111. Thus, a POSITA would have been encouraged to investigate touch signal structures, such as those disclosed in Kim524, to improve Kwon224’s device. *Id.*

Kim524's OLED touchscreen is similar to Kwon224's and Kim524 details touch signal lines, showing a vertical arrangement that reveals second conductive lines in parallel with and connected to the first conductive lines. *See* §VI.A.3; Ex-1003, ¶112.

Kim524's figures show it includes similar layers and elements as Kwon224, including a substrate, light emitting elements, an encapsulation layer, and a touch active layer with touch electrodes, connecting portions, and touch signal lines. *See* §VI.A.1-VI.A.3; Kim524, ¶¶[0039], [0052], [0073], [0078-80]; Ex-1003, ¶113.

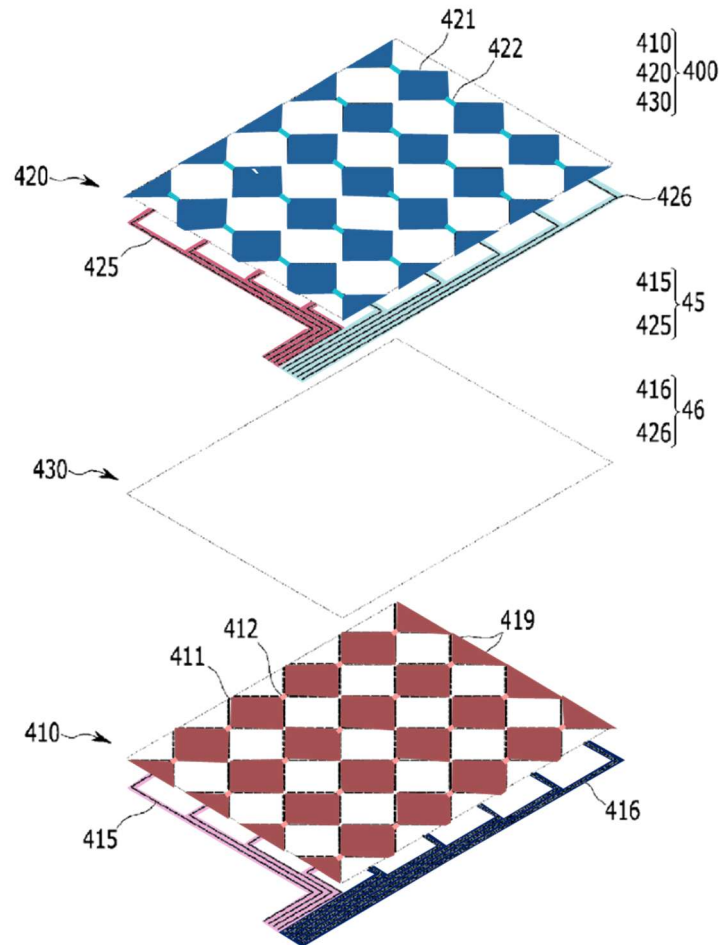
FIG. 2



Kim524, FIG. 2

Figure 6 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 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].

FIG. 6



Kim524, FIG. 6

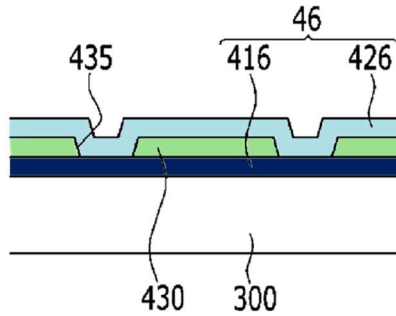
Kwon224 also discloses these areas of metallization in its device. *See* §VI.A.4.d-VI.A.4.e; Ex-1003, ¶¶114-115. Given the similarities of the references, a POSITA would have considered Kim524's teachings to improve Kwon224's device. Ex-1003, ¶115.

Kim524 discloses limitation [1e]—second conductive lines connected to first conductive lines. Kim524's **lower touch signal lines 415 (pink)** and **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. Ex-1003, ¶¶116-117; *see* Ex-1001, Fig. 1 (showing the first conductive lines connecting to the touch electrodes). Accordingly, Kim524's **upper touch signal lines 425 (magenta)** and/or **lower touch signal lines 416 (navy blue)** constitute the claimed second conductive lines.

Figure 10 shows that Kim524's first and second conductive lines are connected. It 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, inorganic **insulating layer 430 (lime green)**. Kim524, ¶¶[0084], [0078], [0074]; Ex-1003, ¶¶118-119 (explaining that insulating layer 430 is an inorganic layer).

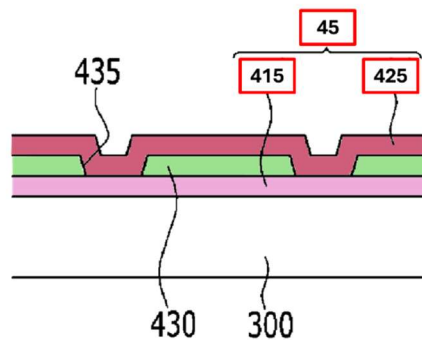
FIG. 10



Kim524, FIG. 10

For the **lower touch signal lines 415 (pink)** and **upper touch signal lines 425 (magenta)**, the same structure is used, with the order flipped. Kim524, ¶[0084]; Ex-1003, ¶120.

FIG. 10



Kim524, FIG. 10 (modified)

A POSITA 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 §VI.A.3. Ex-1003, ¶121.

A POSITA would have been motivated to combine Kwon224 and Kim524 because it achieves Kwon224's goal of reduced resistance and improved touch sensitivity, which would improve ability of the device to serve its function of reliably registering touches. Ex-1003, ¶122. Kwon224 states that lowering the resistance at touch electrodes enhances touch sensitivity, an important characteristic of OLED touchscreens. Kwon224, ¶[0177]; Ex-1003, ¶122. A POSITA would have understood that Kim524's stacked conductive line configuration allows signal transmission across different layers and wider routing paths in the vertical direction, both of which help reduce resistance in the touch signal line paths. Ex-1003, ¶123. Additionally, the stacked configuration beneficially permits use of different materials for the different layers, allowing use of transparent conductive oxides like ITO that improve touch screen transparency and visibility and metallic materials in the upper lines, which lowers resistivity in the touch signal path and improves conductivity. *Id.* Thus, the stacked configuration enables segregating functional roles for different layers and optimizes electrical performance without compromising display quality. *Id.*

A POSITA would have also understood that reducing resistance in the touch signal lines directly reduces the overall resistance of the touch electrodes, particularly in architectures like Kwon224 where the signal lines and electrodes are part of a continuous, integrated conductive pattern. Ex-1003, ¶124; Kwon224, ¶¶[0137], [0143], [0146-147], [0150]. 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. Ex-1003, ¶124. This structural interdependence would have made the benefit of lower resistance from a stacked line configuration both apparent and desirable to a POSITA. *Id.*

A POSITA 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. Ex-1003, ¶125.

The combination would have been predictable and within the capabilities of a POSITA. Ex-1003, ¶126. Kwon224 discloses depositing touch signal lines, and the modification merely deposits additional signal lines during the manufacturing process at a point where lines are *already* being deposited for the other sensor line.

Id. Further, the use of contact holes to connect conductive lines through insulating layers is a well-established technique in display and semiconductor fabrication. Ex-1003, ¶127. 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. *Id.* The resulting device would maintain the structural benefits of Kwon224 while incorporating the electrical connectivity advantages of Kim524. *Id.*

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 [including the lower first and second conductive lines] and the second conductive layer TS-CL2 [including the upper first and second conductive lines] may have a single-layer structure **or a multi-layer structure** of layers stacked along the third directional axis DR3.” Kwon224, ¶[0136]. So Kwon224 already teaches adding the stacked structure, with Kim524 merely providing implementation details. Ex-1003, ¶128.

The specific deposition steps are straightforward. 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]; Ex-1003, ¶129.

FIG. 9A

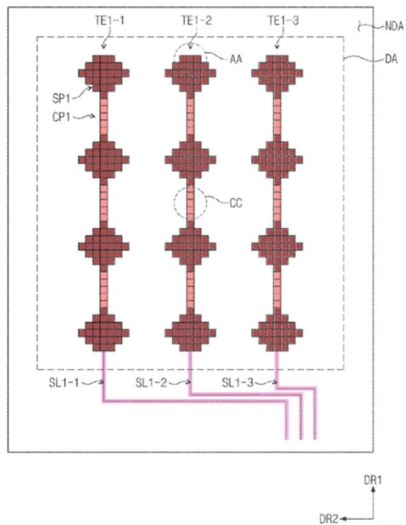
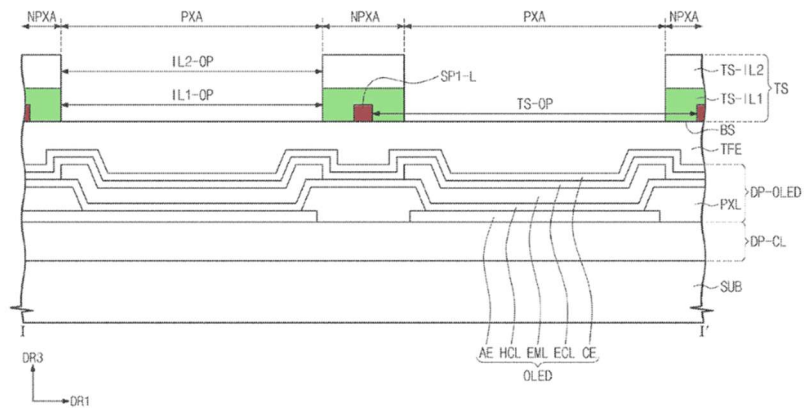


FIG. 10B



Kwon224, FIGS. 9A and 10B

Then it 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.*, Ex-1003, ¶130.

FIG. 9B

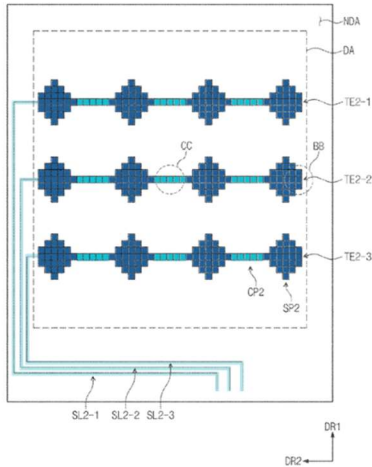
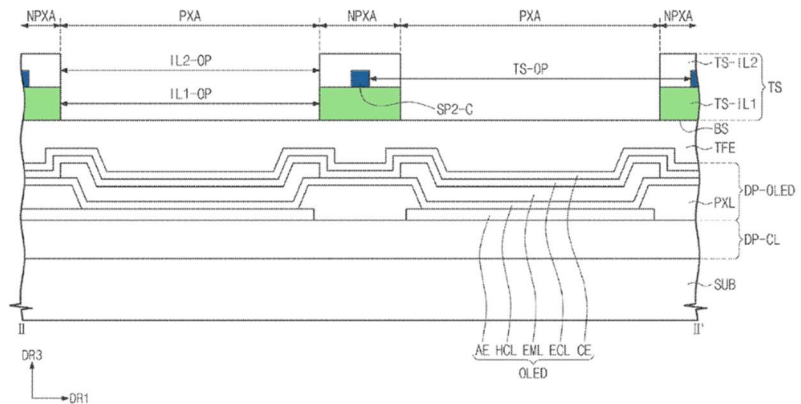


FIG. 11B



Kwon224, FIGS. 9B and 11B

The modification involves two simple steps. Ex-1003, ¶131. First, it adds extra touch signal lines (i.e., the second conductive lines in **magenta** and **navy blue**) during deposition of each conductive layer. Ex-1003, ¶¶131-133. Note that these are deposited in the same plane as existing first conductive lines, in **sky blue** and **pink**, and thus would be deposited in the same steps, as in Kim524. Kim524, ¶¶[0079]-[0080]:

FIG. 9A

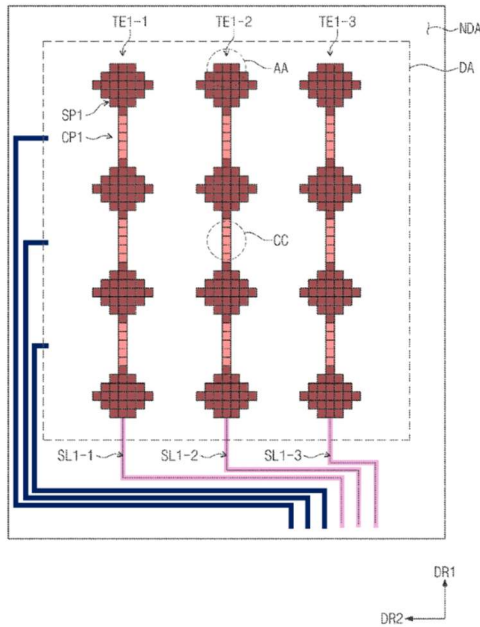
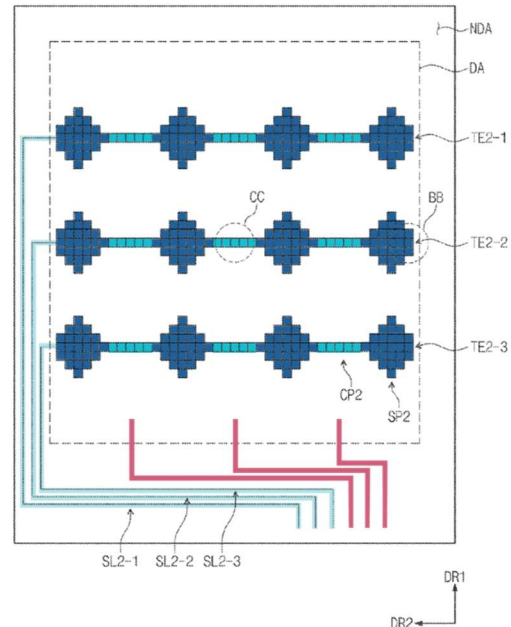


FIG. 9B

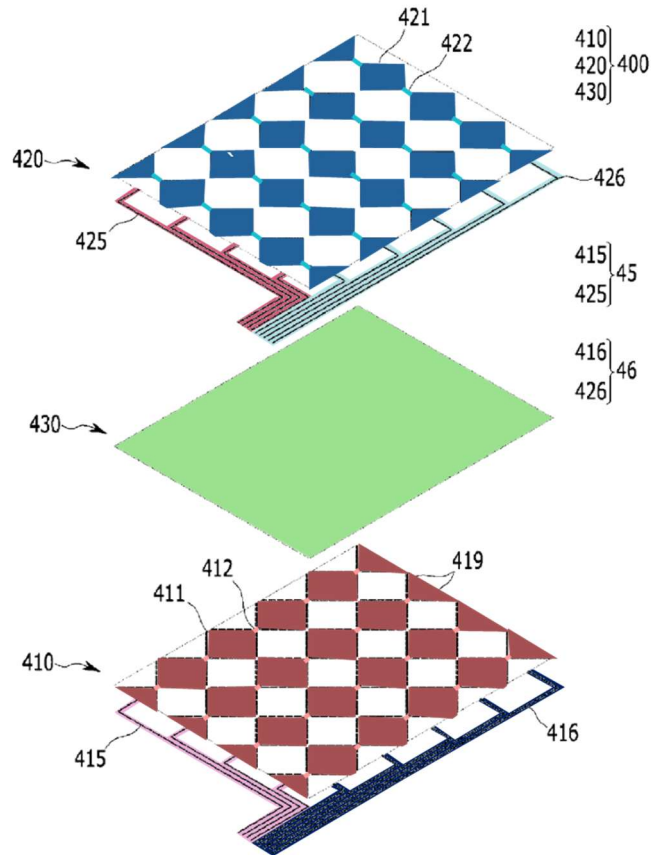


Ex-1003, ¶131 (Representation of Kwon224-Kim524)

In the combination, the upper and lower 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/deep blue**) to the other connection point. Ex-1003, ¶132.

This is consistent with how Kim524 discloses the second conductive lines (**magenta/navy blue**). Ex-1003, ¶133.

FIG. 6



Kim524, Fig. 6

Second, the modification requires the TS-IL1 layer to include contact holes to enable connection between the first and second conductive lines. Ex-1003, ¶134. Kwon224 already discloses including openings (or holes) in the TS-IL1 layer to enable underneath layers to achieve certain purposes (Kwon224, ¶¶[0155-156]), and a POSITA would have found it straightforward to create similar holes to enable contact between first and second conductive lines to achieve the benefits described below. Ex-1003, ¶134.

Additional reasons support the combination. This combination integrates prior art elements—namely, Kwon224’s touchscreen device architecture utilizing 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. Ex-1003, ¶135. 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. *Id.* The combination employs Kim524’s stacked touch signal line technique to enhance Kwon224’s similar touchscreen architecture, reducing resistance and increasing touch sensitivity, and providing additional benefits noted above. *Id.*

Finally, 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. Ex-1003, ¶136. 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. *Id.*

Therefore, 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”

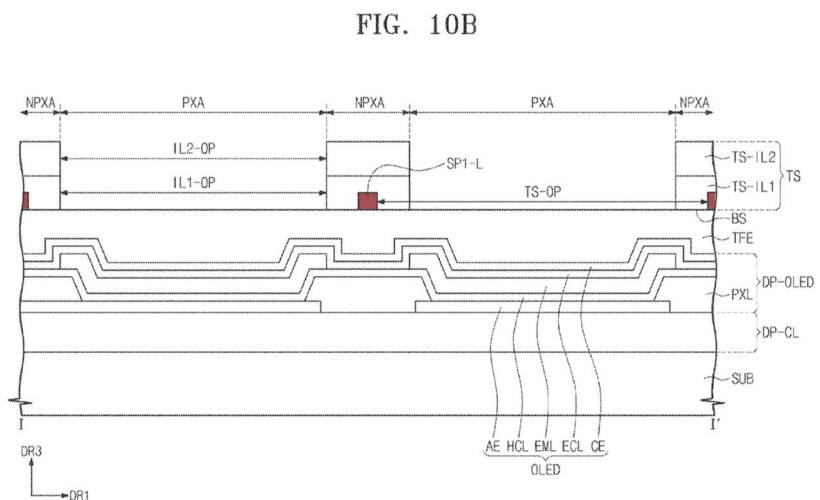
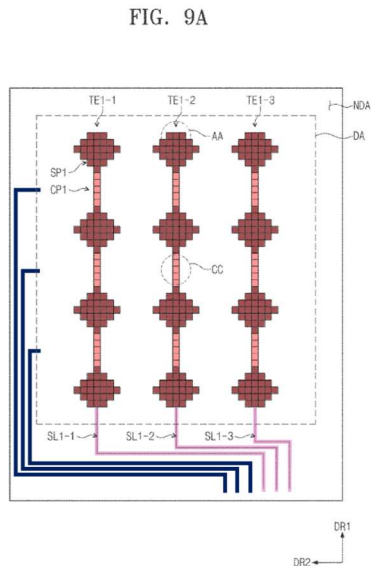
Kwon224 and Kim524 renders 1[f] obvious. Ex-1003, ¶¶138-146.

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 film or an organic film (i.e., Kwon224's inorganic or organic TS-IL1 layer) and disposed between the first and second conductive lines. *Id.*, ¶139

First, the TS-IL1 layer can be either an inorganic or organic layer. Kwon224, ¶[0138]. *Id.*, ¶140.

Second, the deposition process, as detailed in Kwon224, shows that the TS-IL1 layer is disposed between the first and second conductive lines. *See* §VI.A.4.f (explaining that the deposition involves depositing the first conductive layer, then the TS-IL1 layer, and then the second conductive layer). Kwon224, ¶¶[0138-139]; Ex-1003, ¶141.

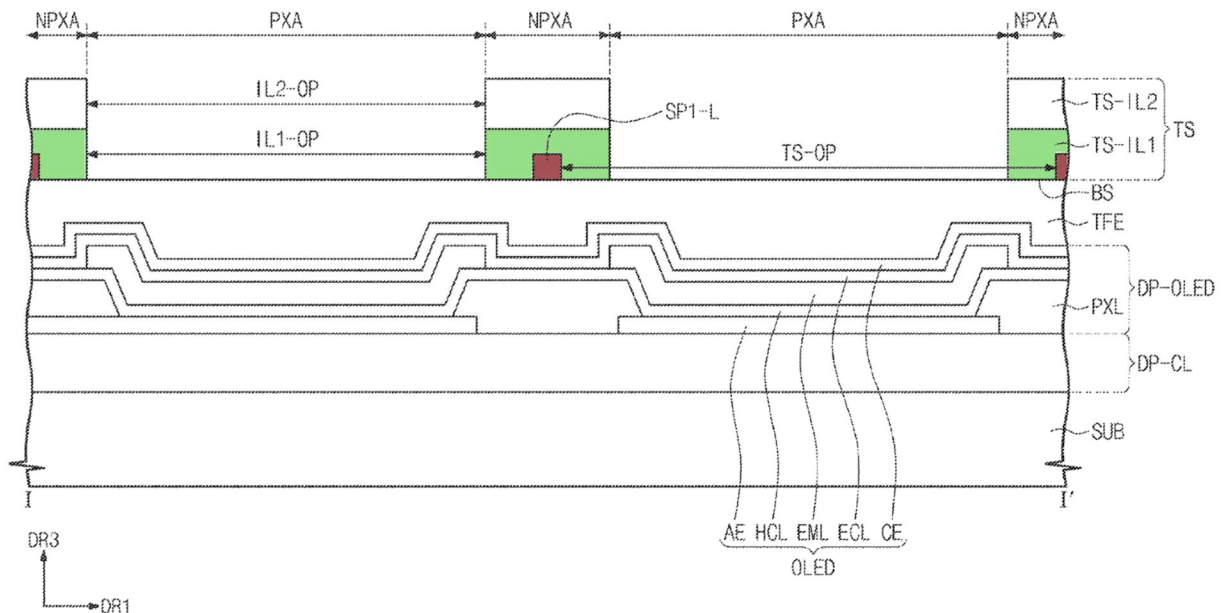
In the combined system, the first conductive layer includes the sensing parts SP1 of the first touch electrodes TE1 (**brick red**) and the lower touch signal lines—i.e., touch signal lines SL1 (i.e., first conductive lines) (**pink**) and Kim524's lower touch signal lines (i.e., second conductive lines) (**navy blue**). Ex-1003, ¶142; *see* §VI.A.4.f.



Ex-1003, ¶142 (Representation of Kwon224-Kim524)

The **TS-IL1 layer (lime green)** is deposited on the first conductive layer to cover these components. Kwon224, ¶[0155]; Ex-1003, ¶143.

FIG. 10B



Kwon224, FIGS. 10B

Next, the second conductive layer is deposited and includes sensing parts SP2 of the second touch electrodes TE2 (**deep blue**) and upper touch signal lines—i.e., touch signal lines SL2 (i.e., first conductive lines) (**cyan**) and Kim524's upper touch signal lines (i.e., second conductive lines) (**magenta**). See §VI.A.4.f; Kwon224, ¶[0147-150], [0158-159]; Ex-1003, ¶¶144-145.

FIG. 9B

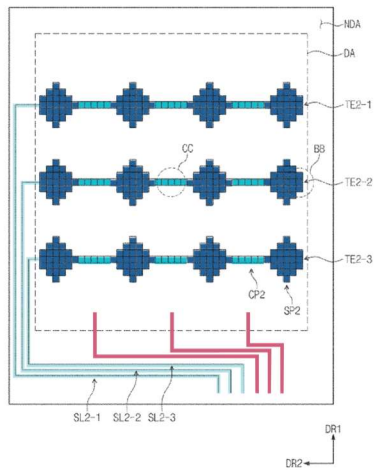
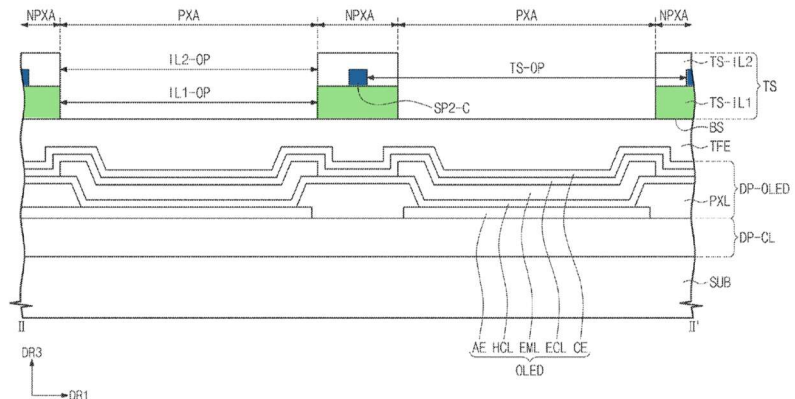


FIG. 11B



Kwon224, FIGS. 9B, 11B

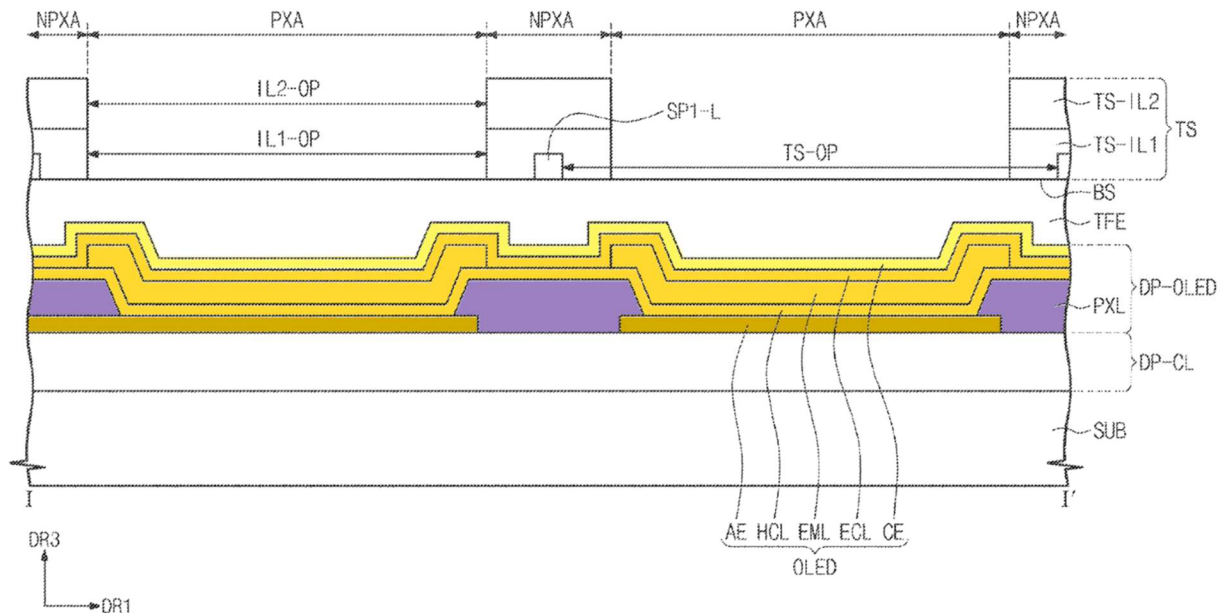
Thus, the insulating layer TS-IL1 is disposed between the first and second conductive lines.

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

Kwon224 discloses 1[g]. Ex-1003, ¶¶147-153.

Kwon224 discloses a “**pixel definition layer PXL**” (light purple) (i.e., the claimed bank) that “exposes ... anode AE” (gold), which are part of Kwon224’s **light emitting elements** (all shades of yellow). Kwon224, ¶¶[0121-122], Fig. 10B; Ex-1003, ¶148; *see* §VI.A.4.b.

FIG. 10B

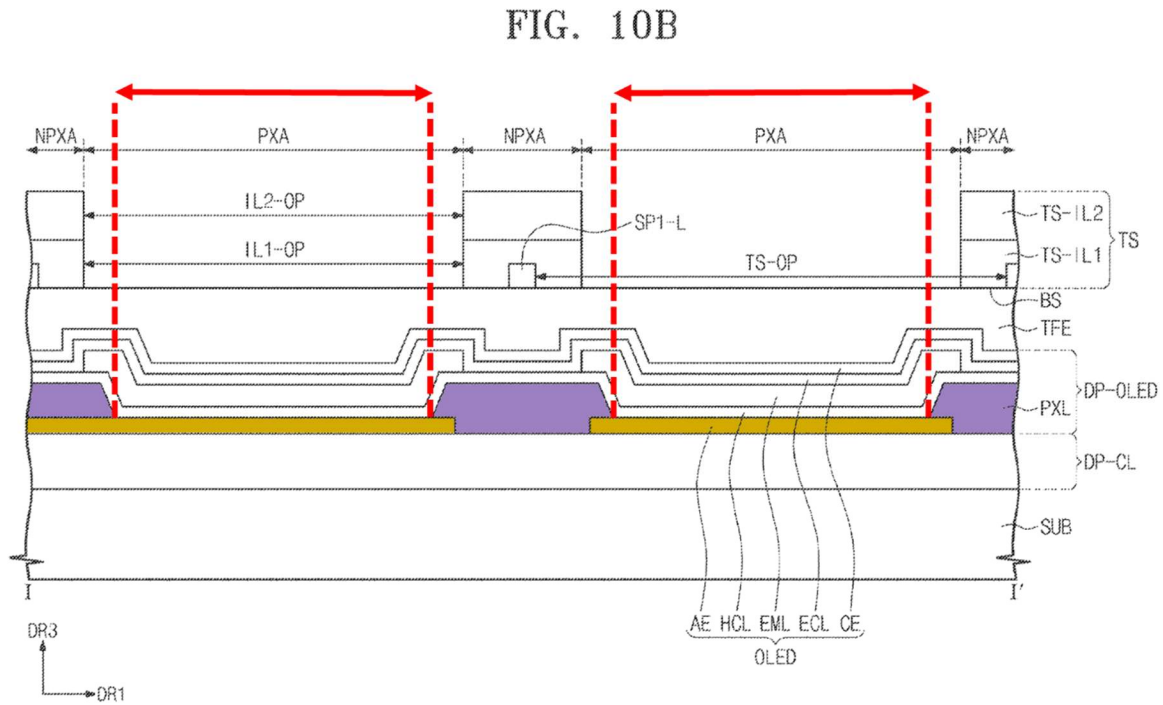


Kwon224, FIG. 10B

The '394 patent confirms that Kwon224's PXL is the claimed "bank." Ex-1003, ¶149. 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 Figure 10B shows that the **PXL layers (light purple)** similarly provide an emission region, with the layers creating opening regions that are within the light emitting areas PXA. Kwon224, ¶¶[0122], [0124]. A POSITA would have understood that these light emitting areas correspond to the emission region

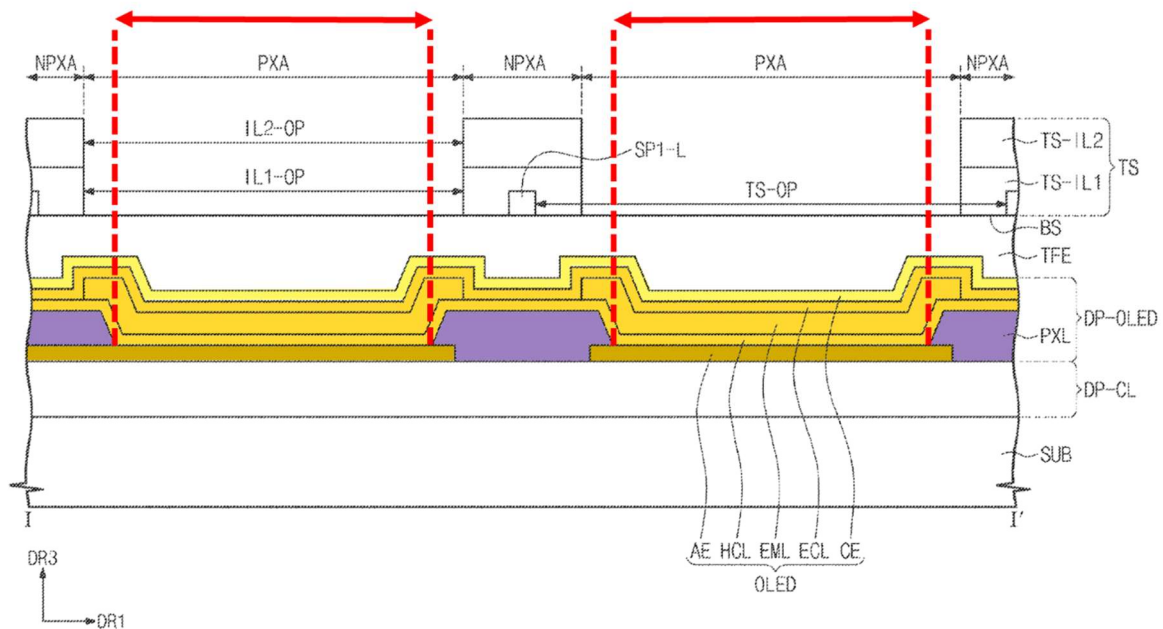
described in the '394 patent because these areas are where light emits from. Ex-1003, ¶149.



Kwon224, FIG. 10B

Just as in the '394 patent, Kwon224's emission region is filled with the **organic light emitting layer EML, hole control layer HCL, and electron control layer ECL (bright yellow)**. Kwon224, ¶[0122]; Ex-1003, ¶150; *see* Ex-1001, 3:28-31.

FIG. 10B



Kwon224, FIG. 10B

Second, the figures in the '394 patent and Kwon224 similarly depict the bank and PXL. Figure 2 from the '394 patent provides a representative example of how the figures depict the bank. Ex-1003, ¶151.

and that the NXPA region covers all of the connected parts, CP1 and CP2. Ex-1003, ¶155. Consequently, CP1 and CP2 also overlap with the PXL. *Id.*

First, Kwon224 explains that the entire non-light emitting area NPXA overlaps the **PXL (light purple)**. Ex-1003, ¶156. Figure 10A shows a close-up view of region AA from Figure 9A, including the NPXA and light emitting areas PXA.

FIG. 9A

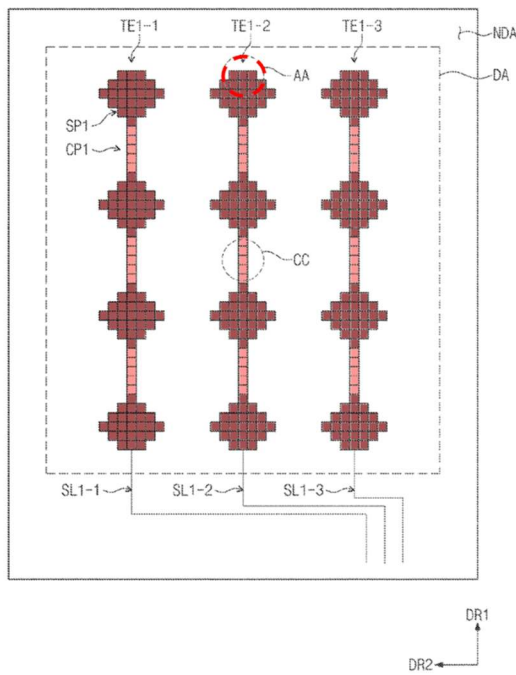
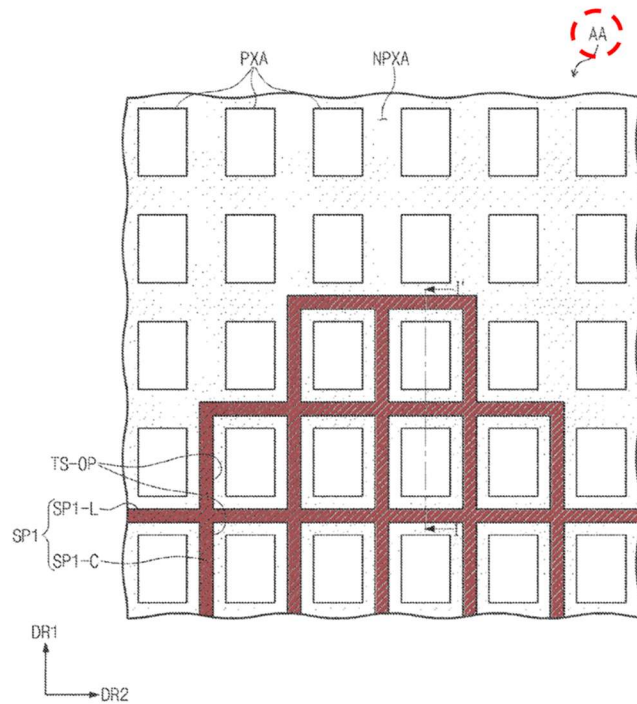


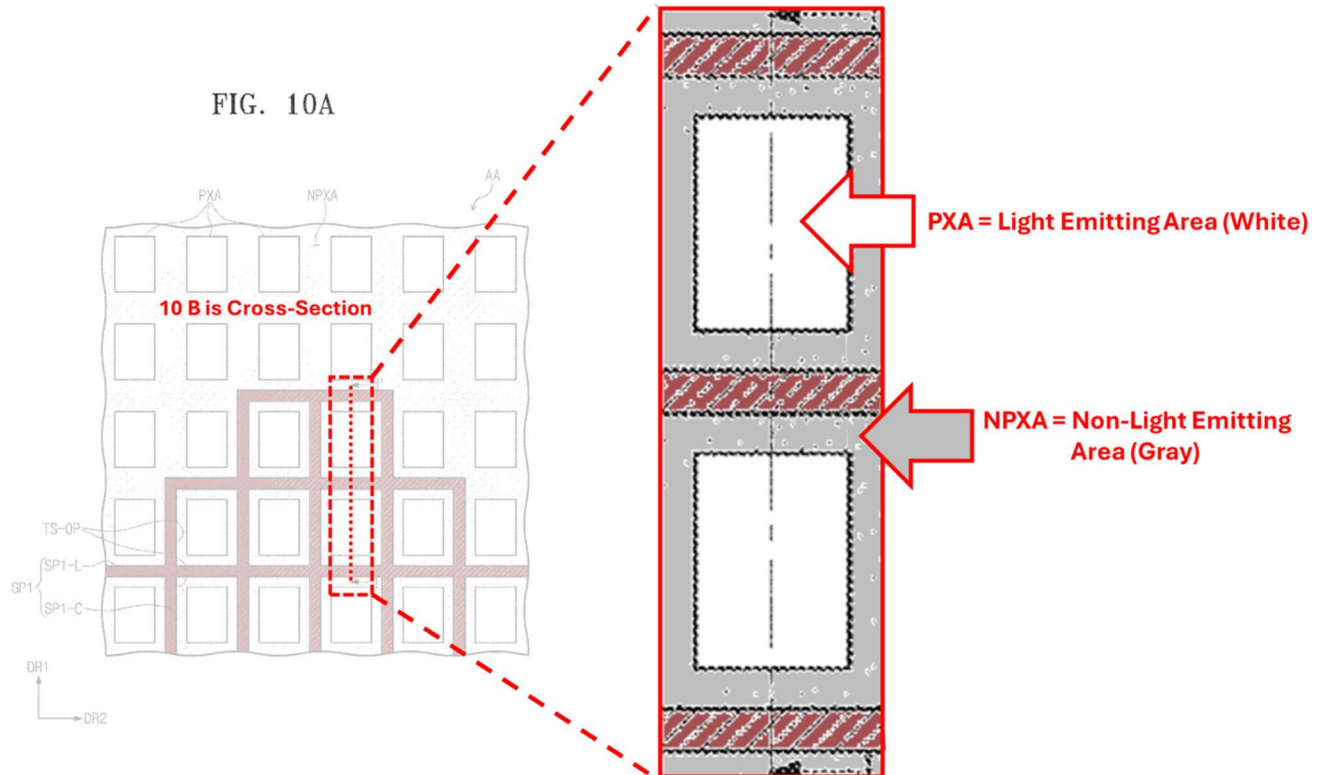
FIG. 10A



Kwon224, FIGS. 9A, 10A

As shown in the close-up image below, Figure 10A depicts the non-light emitting area NPXA (**gray**) surrounding the light emitting areas PXA (white

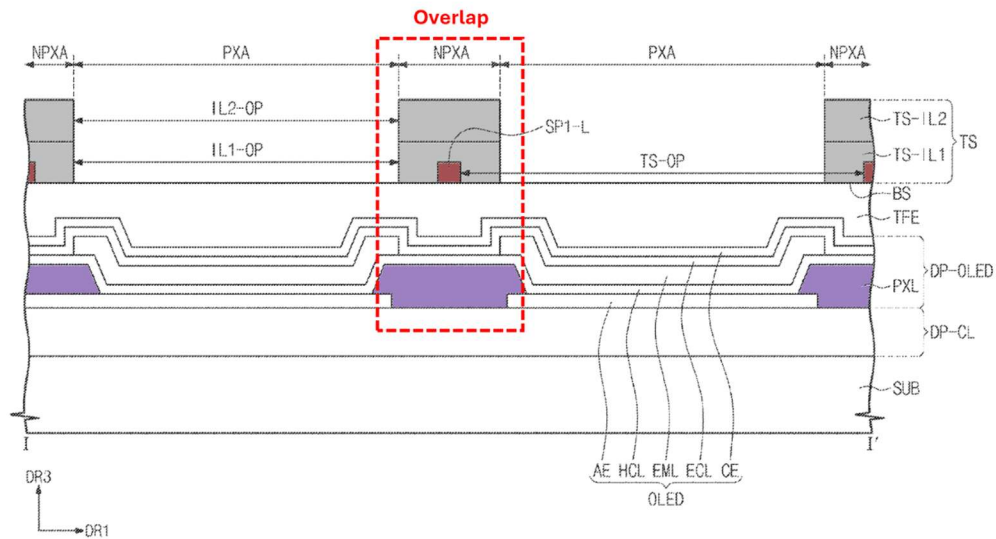
boxes) and that the sensing parts SP1 of the first touch electrode (**brick red**) are completely within the NPXA region (**gray**). *See* Kwon224, ¶[0153]; Ex-1003, ¶157.



Kwon224, FIG. 10A

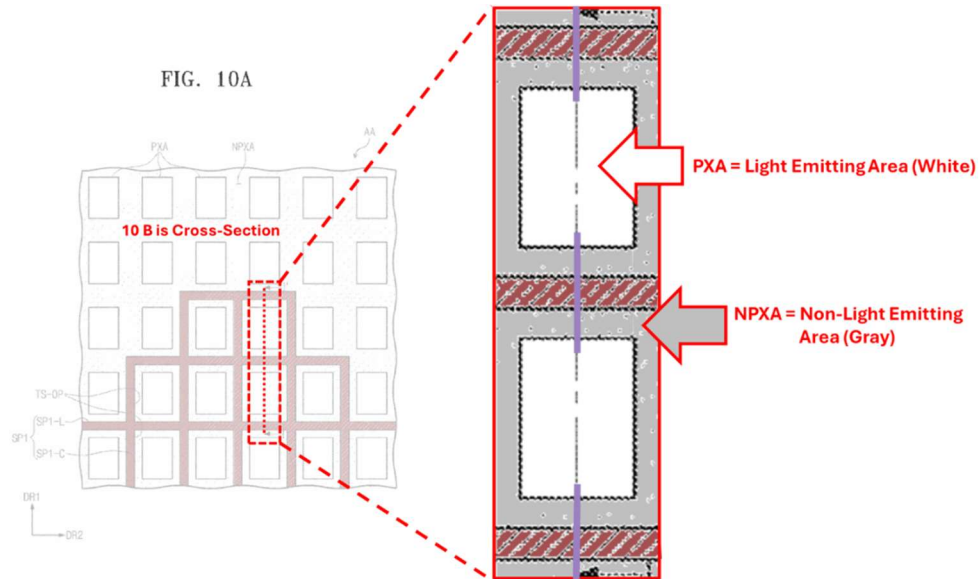
Figure 10B shows a cross-sectional view detailing the NPXA region. The entire NPXA region is within the width of the **PXL layer (light purple)**:

FIG. 10B



Kwon224, FIG. 10B

A POSITA would have thus understood that the **PXL** (light purple) approximately spans the length shown below by the purple lines below. Ex-1003, ¶¶158-159.



Kwon224, FIG. 10A

Second, Kwon224 shows that the connected parts CP1 and CP2 are entirely within the non-light emitting area NXPA. Ex-1003, ¶160. Figure 12A shows a close-up view of region CC from Figures 9A-9B, including the NPXA and light emitting areas PXA previously identified in Figure 10A, as well as the **CP1 (salmon)** and **CP2 (cyan)**.

FIG. 9A

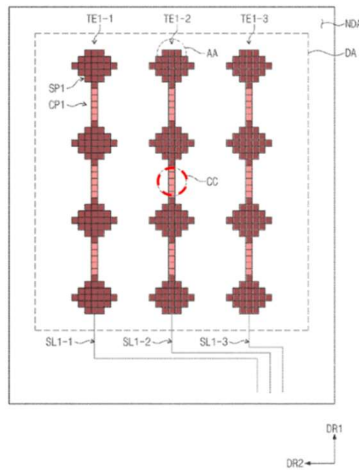


FIG. 9B

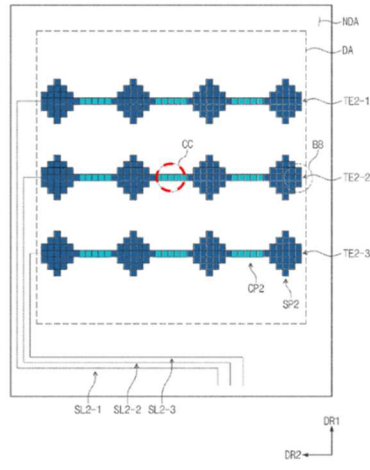
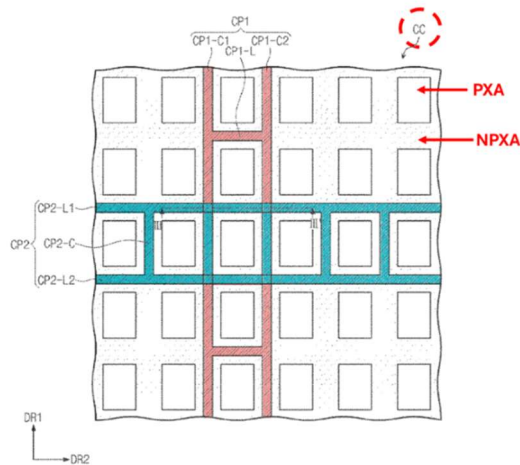


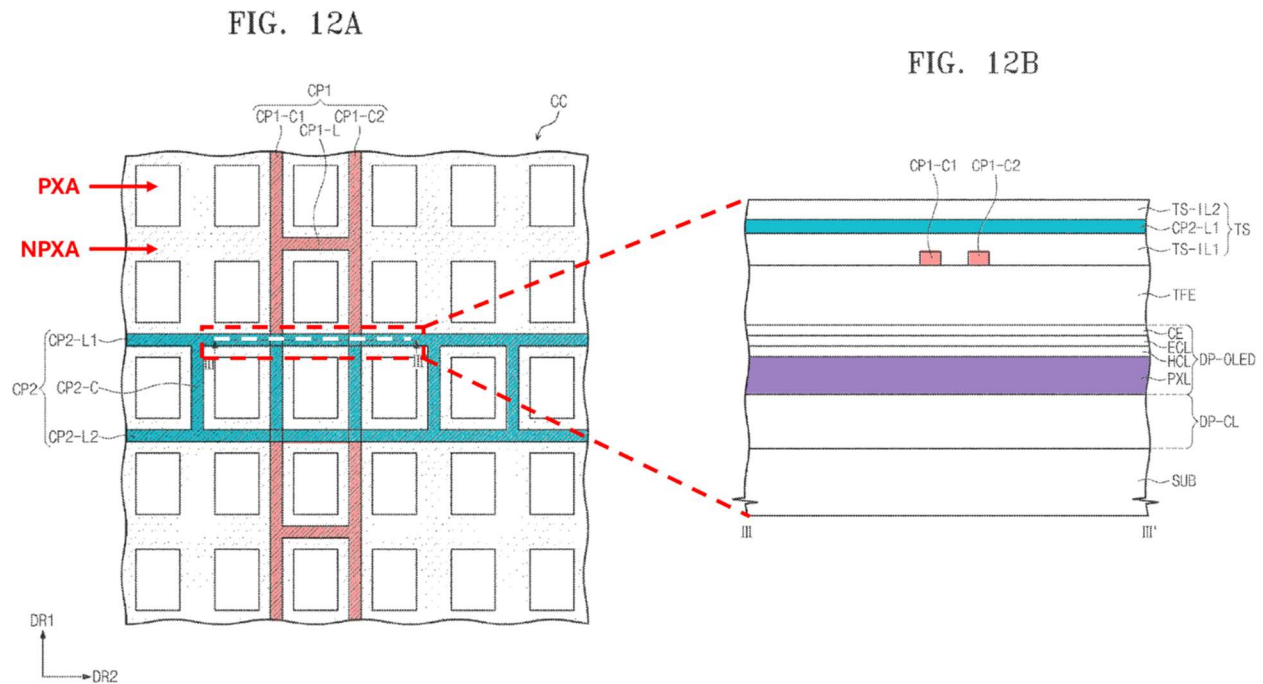
FIG. 12A



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

Figure 12A confirms that the **CP1 (salmon)** and **CP2 (cyan)** are entirely within the NPXA region. Ex-1003, ¶161. Because the NPXA region entirely overlaps the PXL layer, a POSITA would have understood that the **CP1 (salmon)** and **CP2 (cyan)** are also entirely overlapping the PXL. *Id.*

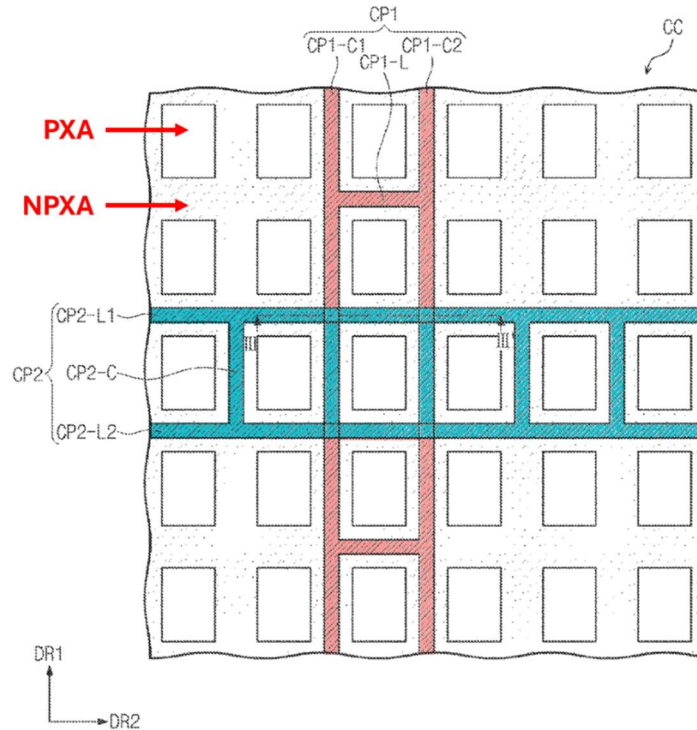
Figure 12B further confirms this, showing that the **CP1 (salmon)** completely overlaps the **PXL (light purple)** and spans the entire length of the **connected parts CP2 (cyan)**. *Id.*, ¶162.



Kwon224, FIGS. 12A, 12B

A POSITA 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 **CP2 (cyan)**. *Id.*, ¶¶163-164.

FIG. 12A



Kwon224, FIGS. 12A

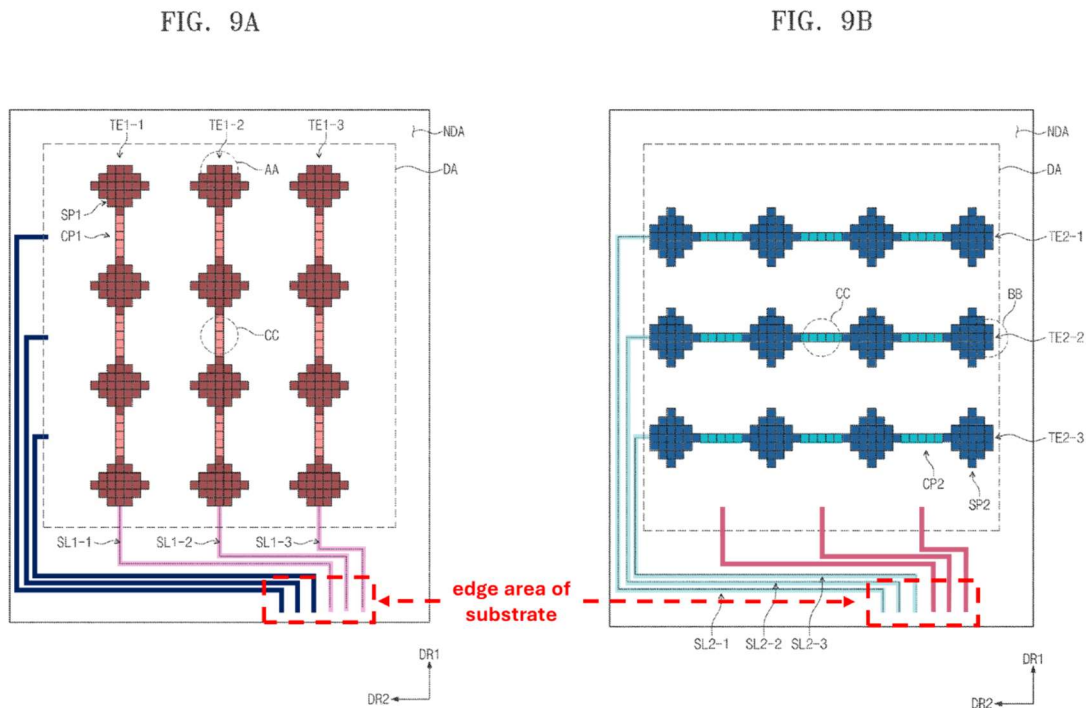
5. Dependent Claims

- 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.”

Kwon224 and Kim524 render obvious claims 1 (*see* §VI.A.4) and 2. Ex-1003, ¶¶165-170.

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 at least parts of the lines overlap each other from the touch electrodes to an edge area of

the substrate (i.e., substrate SUB). Ex-1003, ¶¶166-168; *see* §VI.A.4.f; §VI.A.4.b). Kwon224's Figures 9A-9B show the conductive lines at an edge area of the non-display area NDA and a POSITA would have understood that a substrate covers the entire display area DA and non-display area NDA. Kwon224, ¶¶[0112-114]; Ex-1003, ¶¶166-170.



Kwon224, FIG. 9A, 9B

- 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.”**

Kwon224 and Kim524 render obvious claim 1 (*see* §VI.A.4) and 3. Ex-1003, ¶¶171-179.

The combined system includes first and second conductive lines that run parallel and overlap each other. *See* §VI.A.4.f; Ex-1003, ¶172. Further, the first and second conductive lines are on the encapsulation unit. *See* §VI.A.4.d-VI.A.4.f; Kwon224, ¶¶ [0139], [0141]; Ex-1003, ¶173.

As explained in §VI.A.4.c, Kwon224’s thin film encapsulation layer (TFE) is the claimed encapsulation unit. Ex-1003, ¶174.

FIG. 9A

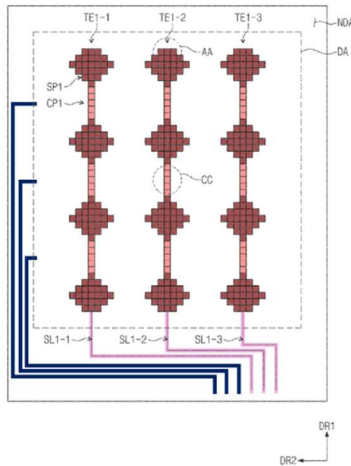
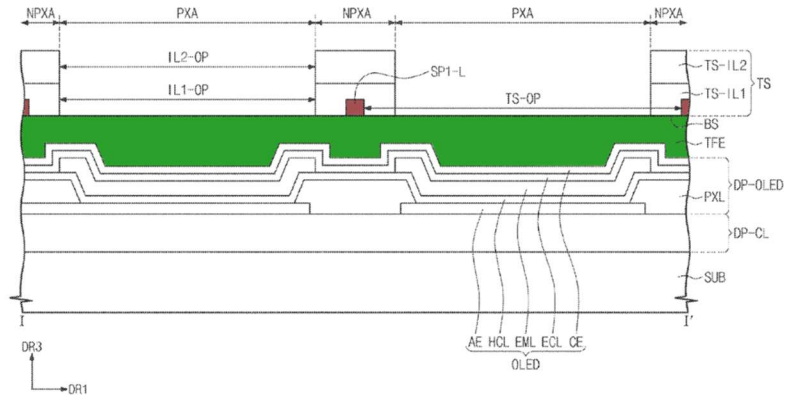


FIG. 10B



Kwon224, FIG. 9A, 10B

After, a second conductive layer is deposited and includes the first conductive lines SL1 (sky blue) and second conductive lines (magenta). Ex-1003, ¶176.

FIG. 9B

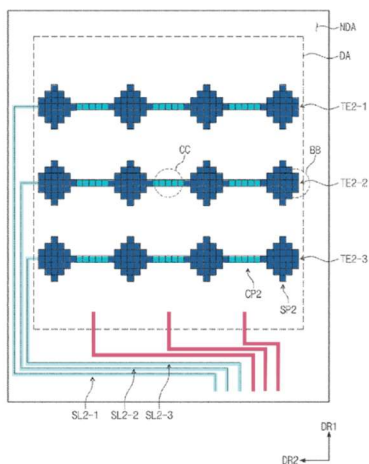
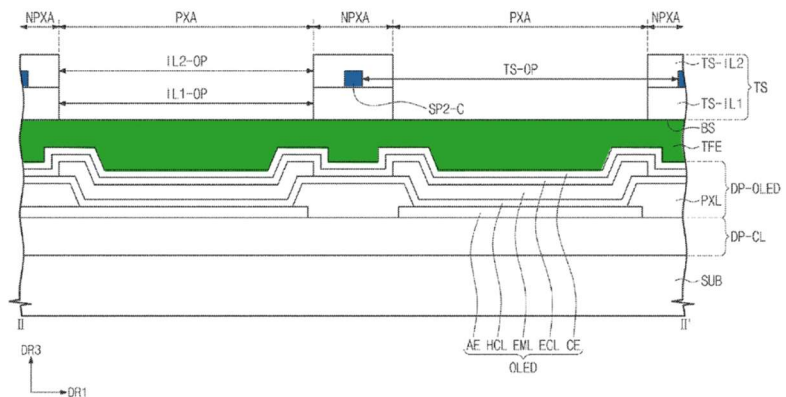


FIG. 11B



Kwon224, FIG. 9B, 11B

Thus, a POSITA would have understood that Kwon224's disclosures to show that the conductive lines are on the encapsulation unit, and this is also well-known design in the industry. Ex-1003, ¶¶177; Kim481, Fig. 3. 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)**. Ex-1003, ¶¶177-78; Kim524, ¶¶[0073], [0078], [0084].

FIG. 10

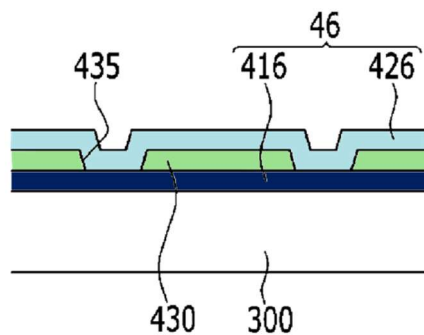
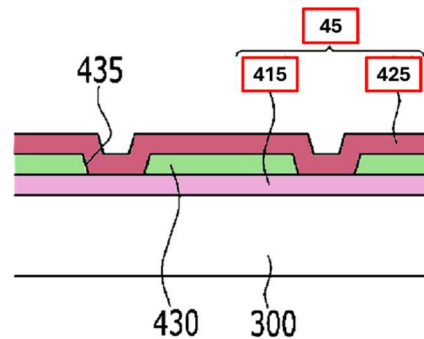


FIG. 10



Kim524, FIG. 10 (modified right)

Therefore, 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.”**

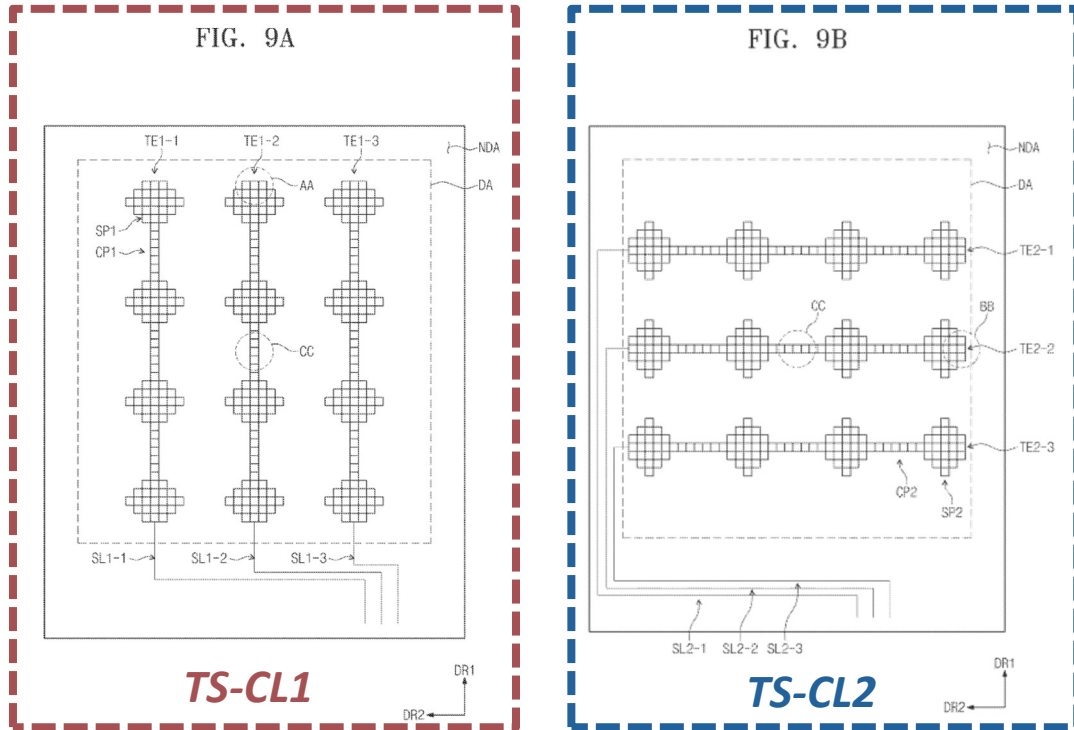
Kwon224 and Kim524 render obvious claims 1 (§VI.A.4) and 4 for the reasons stated for limitations 1[e] and 1[f]. *See* §VI.A.4.f (explaining that the modification includes a TS-IL1 layer with contact holes to enable connection between the first and second conductive lines); §VI.A.4.g (explaining the TS-IL1 layer is the claimed insulating film); Ex-1003, ¶180.

- 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.”**

Kwon224 and Kim524 render obvious claim 1 (*see* §VI.A.4) and 6. Ex-1003, ¶¶181-191.

In the Kwon224-Kim524 combination, the first conductive lines (Kwon224’s touch signal lines SL1 and SL2) are on the same plane as the first bridges and/or second bridges (i.e., Kwon224’s connected parts CP1 and CP2). *Id.*, ¶¶182-183.

Figs. 9A-9B each show a plan view of the first and second conductive layers TS-CL1 and TS-CL2, respectively. Kwon224, ¶[0142].



Kwon224, FIGS. 9A, 9B

The first conductive lines share the same plane as the sensing parts of the touch electrodes. Ex-1003, ¶184. Lines SL1 (pink) and SL2 (sky blue) (i.e., first conductive lines) are connected to the sensing parts SP1 (brick red) and sensing parts SP2 (deep blue), respectively, and thus at least a portion of each the lines are on the same plane as the sensing parts they connect to. Kwon224, ¶¶[0143], [0147]; Ex-1003, ¶184; *see* §VI.A.4.e.

FIG. 9A

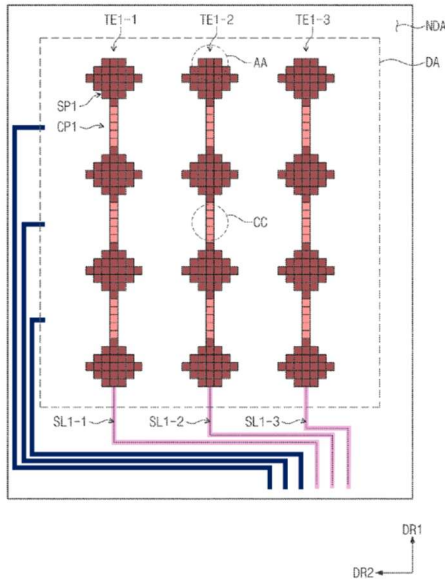
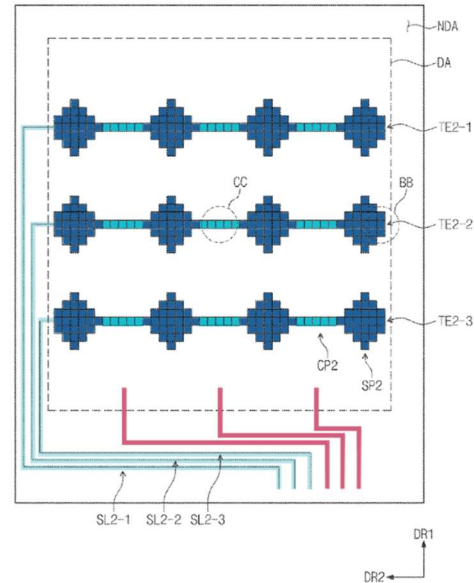


FIG. 9B



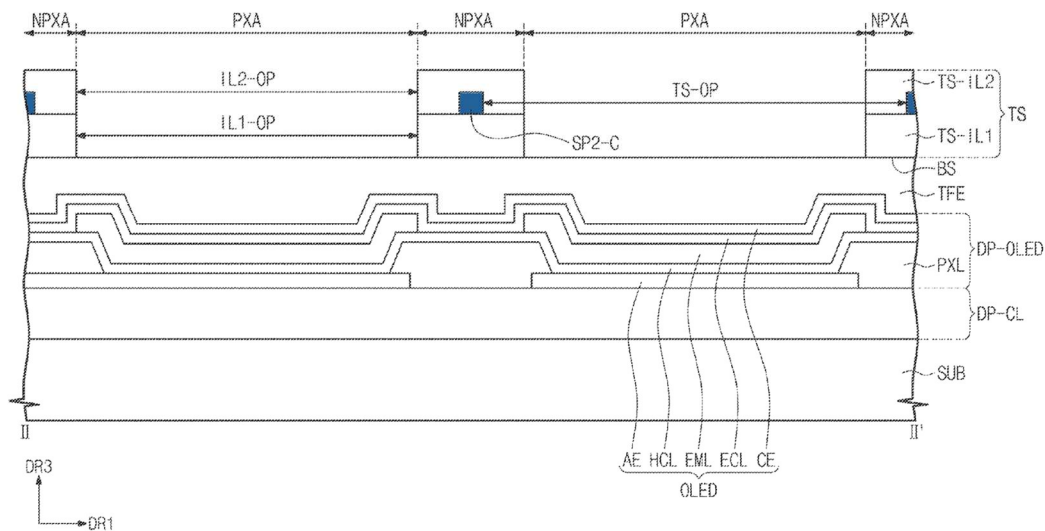
Kwon224, FIGS. 9A-9B

The sensing parts SP1 and SP2 share the same plane as the connected parts CP1 and CP2 (i.e., the first and second bridges), respectively. Consequently, the first conductive lines also share the same plane with the connected parts. Ex-1003, ¶185; *see* §VI.A.4.d. Sensing parts SP1 are disposed on “base surface” created by the thin film encapsulation layer TFE. Kwon224, ¶¶[0138-139], [0096], Figs. 8A-8B, 10B-11B, 13B; Ex-1003, ¶185.

Thus, touch signal lines SL1 (i.e., first conductive lines) (pink) are on the same plane as CP1 (salmon). Ex-1003, ¶187.

Sensing parts SP2 (deep blue) are disposed on the TS-IL1 layer. Kwon224, ¶[0158]; Ex-1003, ¶188.

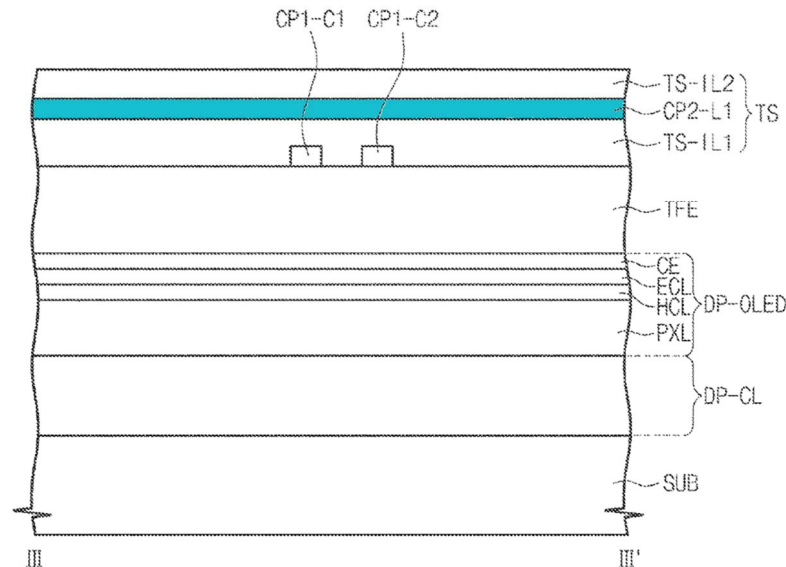
FIG. 11B



Kwon224, FIG. 11B

Connected parts CP2 (cyan) are similarly disposed on the TS-IL1 layer and, thus, on the same plane as SP2. Ex-1003, ¶¶189-190.

FIG. 12B



Kwon224, FIG. 12B

Thus, touch signal lines SL2 (i.e., first conductive lines) (sky blue) are on the same plane as CP2.

- 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.”**

Kwon224 and Kim524 render obvious claim 1 (*see* §VI.A.4) and 7. Ex-1003, ¶¶192-194.

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 §§VI.A.4.d-VI.A.4.f, TS-CL1 includes the first bridges, first touch electrodes, and first and second conductive lines; and TS-CL2 includes the second bridges, second touch electrodes, first conductive lines, and second conductive lines.

Therefore, the Kwon224-Kim524 combination discloses claim 7 because Kwon224 discloses the claimed multilayer structure.

- 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.”**

Kwon224 and Kim524 render obvious claim 1 (*see* §VI.A.4) and 8. Ex-1003, ¶195-201.

Kwon224 discloses that the first and second conductive layers TS-CL1 and TS-CL2 may have multi-layer structures. Kwon224, ¶[0136]. It further explains each conductive layer comprises a metal layer including “at least one of” “molybdenum,” “titanium,” and/or “aluminum.” *Id.* A POSITA 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. Ex-1003, ¶¶196-197.

A POSITA would have modified the Kwon224-Kim524 combination to implement Kwon224's teachings in a specific manner: using Ti/Al/Ti and Mo/Al/Mo metal stacks for the first and/or second conductive layers, which include the sets of bridges, touch electrodes, and conductive lines, as explained in the last section. *Id.*

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. Ex-1003, ¶198. 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.

Using these stacks provides benefits, including improved adhesion because titanium or molybdenum are adhesion layers, reduced contact resistance because aluminum is the main conductor and has a low electrical resistivity, and prevention of diffusion and electromigration because the top titanium or molybdenum layer acts as a cap or barrier. Ex-1003, ¶199.

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. Ex-1003, ¶200.

Therefore, the modified Kwon224-Kim524 combination discloses claim 8 because it discloses forming the conductive layer elements using Ti/Al/Ti or Mo/Al/Mo. *Id.*, ¶201.

B. Ground 2: Kwon224-Kim524-Zhu837 Combination Renders Obvious Claims 9-16, 18.

1. Zhu837 Overview

Zhu837 discloses “a touch control display device” with “organic light-emitting diodes” (OLEDs). Zhu837, Abstract, ¶[0004]; Ex-1003, ¶202. The “touch control device is integrated within the display panel” and includes touch sensors comprising first and second conductive units 105 (**brick red**) and 107 (**deep blue**) and “conductive bands” connecting each set of conductive units. Zhu837, ¶¶[0043-45], [0073]; Ex-1003, ¶203.

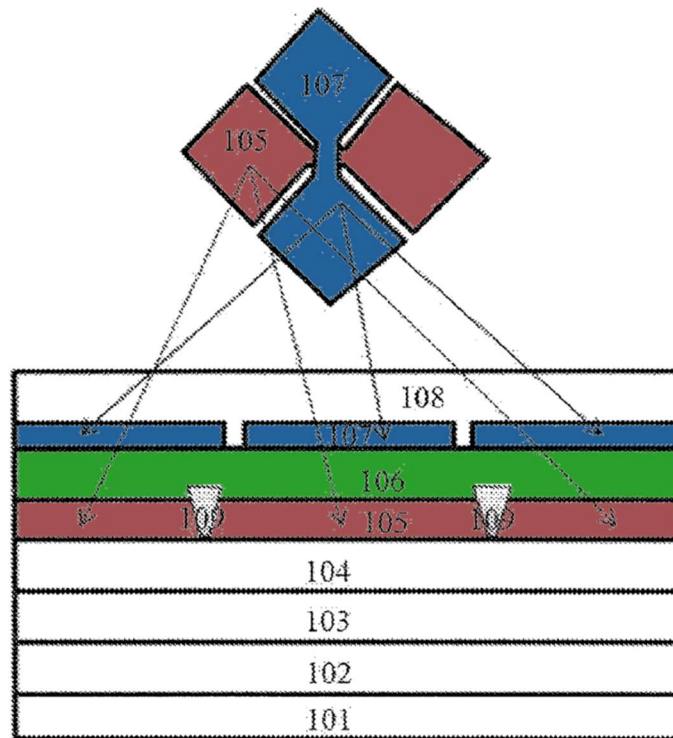


FIG. 2

Zhu837, Fig. 2

Figure 2 shows an “**encapsulation layer 106**” (**green**) between the first and second conductive units made of “organic films and/or inorganic films” and single or multi-layered. Zhu837, ¶¶[0043], [0056], [0058], [0066-67]; Ex-1003, ¶204.

The device includes a substrate 101 and organic light emitting layer 104. Zhu837, ¶¶[0043], [0046], [0049]; Ex-1003, ¶205.

2. Kwon224, Kim524, and Zhu837 are Analogous Art

A POSITA 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 II, VI.A.1-VI.A.3, VI.B.1; Ex-1003, ¶206.

Zhu837, like Kwon224 and Kim524, addresses similar problems as the '394 patent. Zhu837 notes issues with traditional touch displays, like added thickness, complex manufacturing, and limited flexibility from separate sensing and protective layers. Zhu837, ¶¶[0006-7]. Zhu837's solution embeds the touch control structure with the OLED stack, simplifying the fabrication process, reducing device thickness, improving light-emitting efficiency, and enabling flexibility. *Id.*, ¶¶[0008], [0010-14], [0033-35], [0044-46]; Ex-1003, ¶207.

Because Kwon224, Kim524, and Zhu837 disclose similar systems operating similarly and directed to similar problems, a POSITA would have been motivated to consider their combined teachings. Ex-1003, ¶208. Additional claim element rationales are provided below.

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.”**

Kwon224 and Kim524 render obvious claim 1 (*see* §VI.A.4). Further, Kwon224, Kim524, and Zhu837 render claim 9 obvious. Ex-1003, ¶¶209-225.

Zhu837 discloses a single-layered or multi-layered encapsulation layer 106 with “organic films and/or inorganic films” that is disposed between the first conductive units 105 (i.e., the first touch electrodes) and the second conductive units 107 (i.e., the second touch electrodes). *Id.*, ¶¶[0056], [0064], [0066], [0068-69]; Ex-1003, ¶210. 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 POSITA would have found beneficial. *Id.*, ¶[0056]; Ex-1003, ¶¶211-212 (also explaining that the layer would have a total thickness of 6.2 um which a POSITA would have generally considered to be thin).

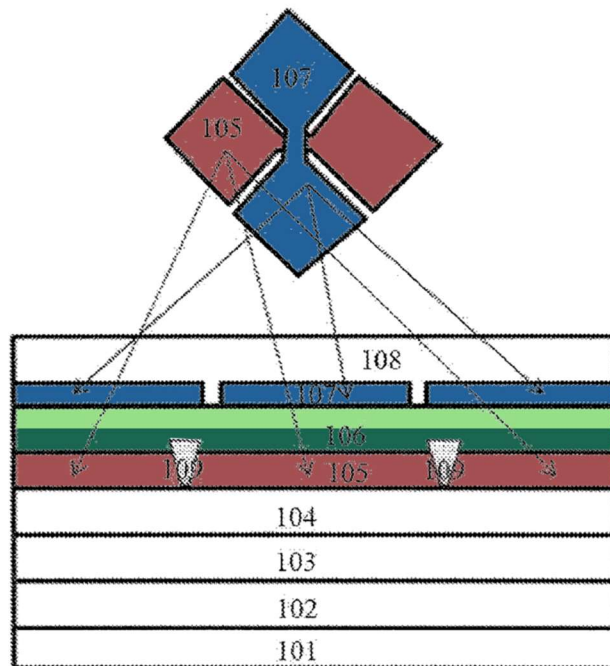


FIG. 2

Zhu837, FIG. 2

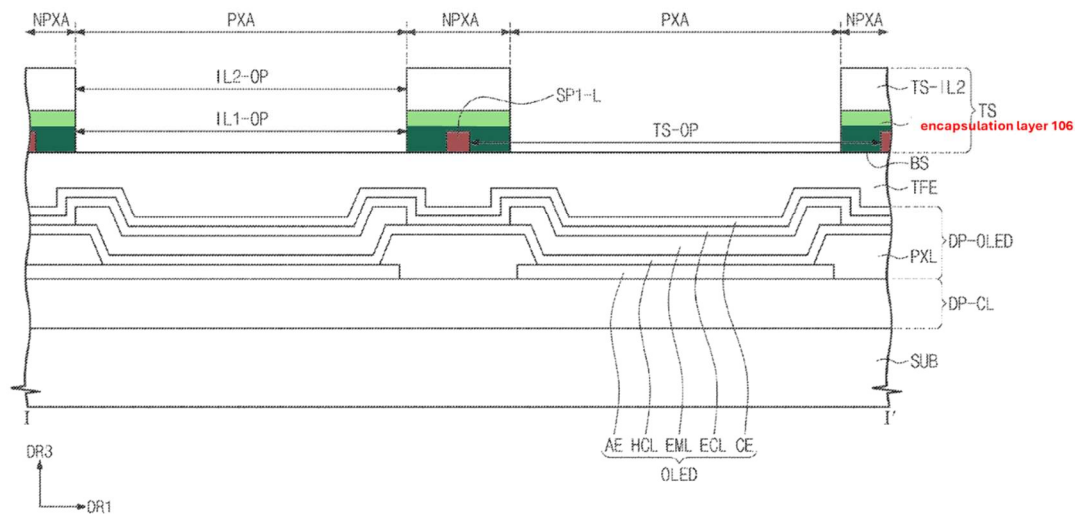
Compared to Kwon224's single-layered, inorganic TS-IL1 structure, Zhu837's encapsulation layer provides additional flexibility by enabling both organic and inorganic layers between the conductive units. Zhu837, ¶¶[0056-57]; Ex-1003, ¶213. A POSITA would have understood that this flexibility would help designers build a device based on their specific preferences, such as thinner encapsulation units or specific materials for certain protection. Ex-1003, ¶213; Zhu837, ¶¶[0056-57]; *see also* Kwon224, ¶[0126] (explaining that inorganic and organic layers provide different types of protection).

Claim 9 is rendered obvious in view of Kwon224, Kim524, and Zhu837 because a POSITA would have been motivated to replace the TS-IL1 layer with Zhu837's encapsulation layer. Ex-1003, ¶¶214-215. 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* §VI.A.4.c. Further, Zhu837's encapsulation layer 106 is the claimed insulting film that is between the first and second conductive lines. *See* §VI.A.4.g.

The encapsulation layer 106 includes openings or contact holes similar to the openings in Kwon224's TS-IL1 layer, which help expose the light emitting areas and enable connection between the first and second conductive lines—two purposes of the TS-IL1 layer. Kwon224, ¶[0154], Fig. 10B; Ex-1003, ¶215; *see* §VI.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 is a routine thin-film OLED practice well known in the industry, and a POSITA would treat implementing such openings in layer 106 as an ordinary manufacturing choice rather than a design departure. Ex-1003, ¶¶216. Kwon224 discloses creating openings in encapsulation layers. Kwon224, ¶[0165], Fig. 13B.

The combination is illustrated in the modified figure below:

FIG. 10B



Ex-1003, ¶217 (Representation of Kwon224-Kim524-Zhu837)

A POSITA 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 §VI.B.2. Ex-1003, ¶218. Specifically, a POSITA would have found it obvious to replace the 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. *Id.*; see §VI.A.4.g. The TS-IL1 layer in Kwon224 also matches the placement of

encapsulation layer 106 in Zhu837—between the touch sensors (**brick red** and **deep blue**). Ex-1003, ¶218; §VI.A.4.f.

FIG. 10B

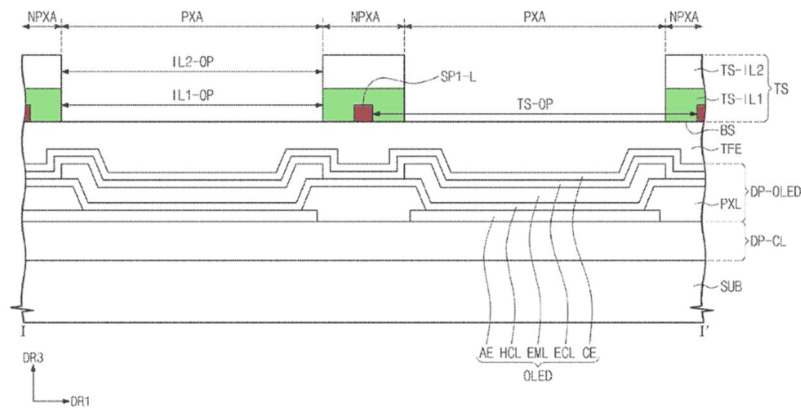
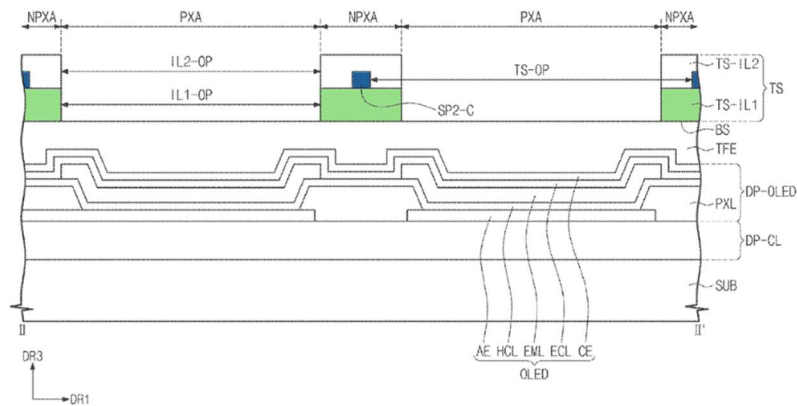


FIG. 11B



Kwon224, FIGS. 10B, 11B

Swapping the TS-IL1 layer with Zhu837's encapsulation layer—both insulating layers—was a standard industry practice and an ordinary material choice

with a predictable outcome, enabling engineers to meet reliability targets without changing circuit geometry through selecting the specific type of layer to deposit. Ex-1003, ¶219. Thus, a POSITA would have viewed this as a like-for-like layer swap that yields the predictable result of maintained insulation and overall layer structure. *Id.*

The modification provides numerous benefits including enhanced protection and device sensitivity. Ex-1003, ¶¶220-222. The encapsulation layer provides both environmental protection and electrical isolation between conductor sets—allowing close spacing without shorting to improve touch sensitivity by minimizing vertical separation between touch electrode layers. *Id.*

Because the substitution preserves the layer's (a) isolation function and (b) physical placement, and because both references operate in the same fabrication technology for flexible OLED/touch devices, a POSITA would reasonably expect the modified stack to work without adverse effects. Ex-1003, ¶¶223-224.

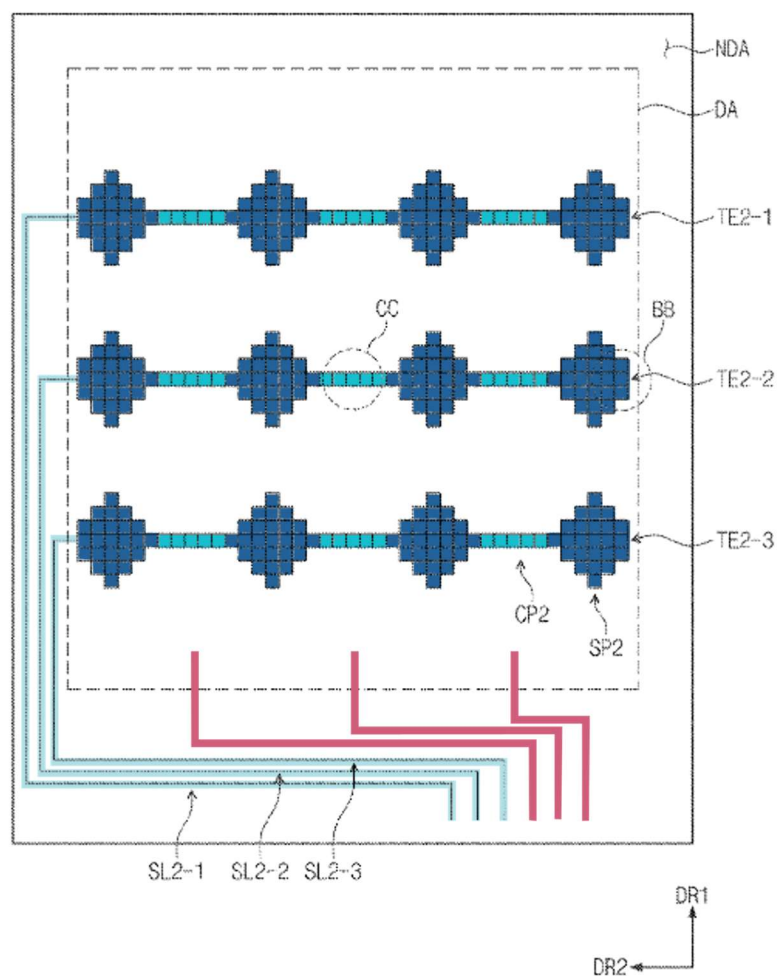
Therefore, the Kwon224-Kim524-Zhu837 combination discloses claim 9.

- 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.”**

Kwon224 and Kim524 render obvious claim 1 (*see* §VI.A.4), and Kwon224, Kim524, and Zhu837 render obvious claims 9 (*see* §VI.B.3.a) and 10. Ex-1003, ¶226-232.

The combination includes second conductive layer with second conductive lines (**magenta**), and this layer is disposed on the encapsulation layer 106 with the uppermost inorganic layer. *See* Sections VI.A.4.f; VI.B.3.a; Ex-1003, ¶¶227-228.

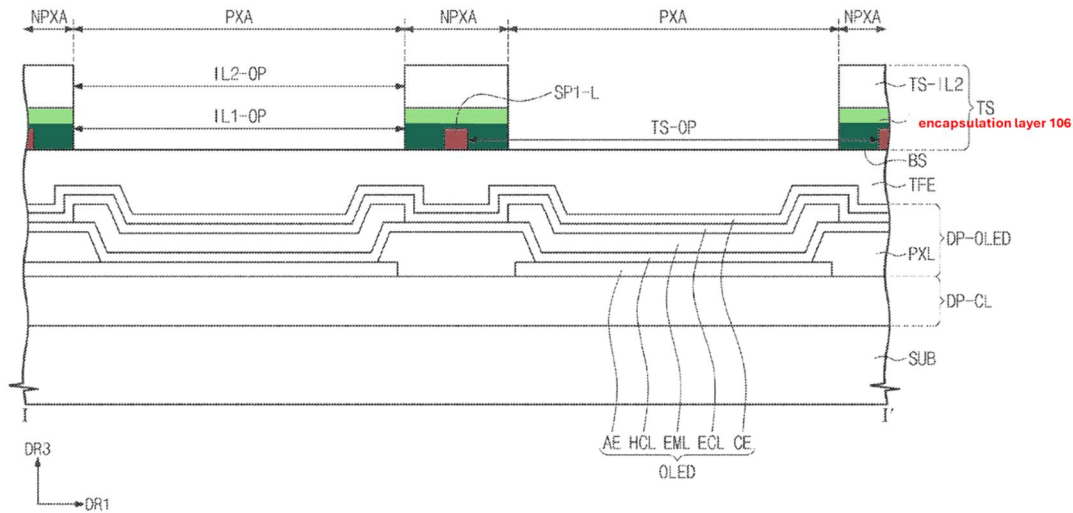
FIG. 9B



Kwon224, FIG. 9B

The encapsulation layer 106 is either (i) an inorganic, single-layer or (ii) a multi-layer configuration with an inorganic top layer—with the uppermost layer being inorganic in both instances. *See* Sections VI.B.3.a; Ex-1003, ¶¶229-231. The multi-layer configuration is shown below:

FIG. 10B



Ex-1003, ¶229 (Representation of Kwon224-Kim524-Zhu837)

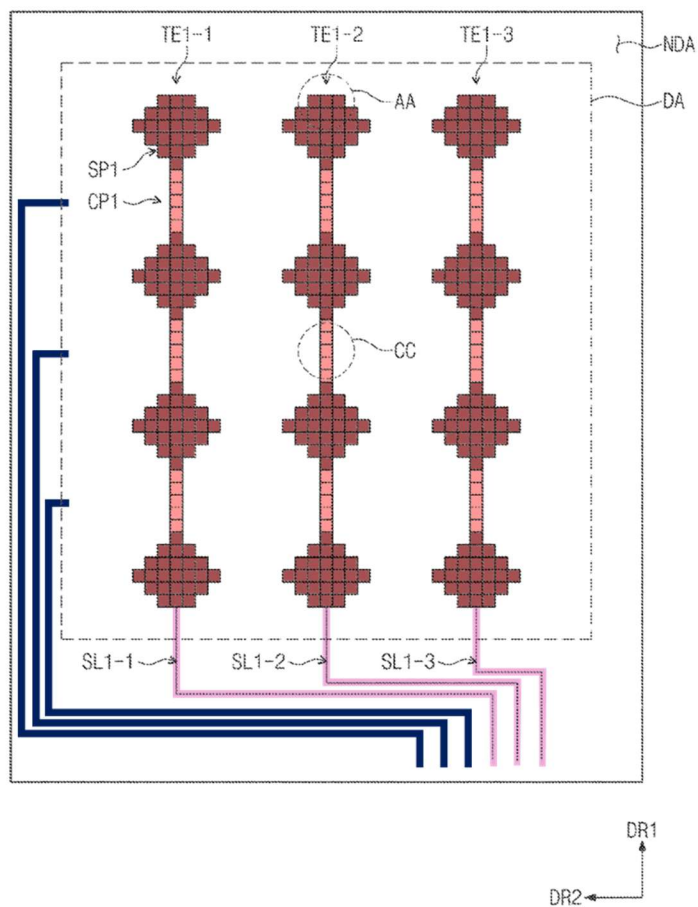
Therefore, the Kwon224-Kim524-Zhu837 combination discloses claim 10.

- 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.”**

Kwon224 and Kim524 render obvious claim 1 (*see* §VI.A.4), and Kwon224, Kim524, and Zhu837 render obvious claims 10 (*see* §§VI.B.3.a-VI.B.3.b) and 11. Ex-1003, ¶¶233-237.

The Kwon224-Kim524 combination includes the first conductive layer with first conductive lines (pink), and these lines are disposed on the upper layer of the thin film encapsulation layer (TFE), which can be an organic encapsulation layer. *See* §VI.A.4.e; VI.A.4.f; Ex-1003, ¶234.

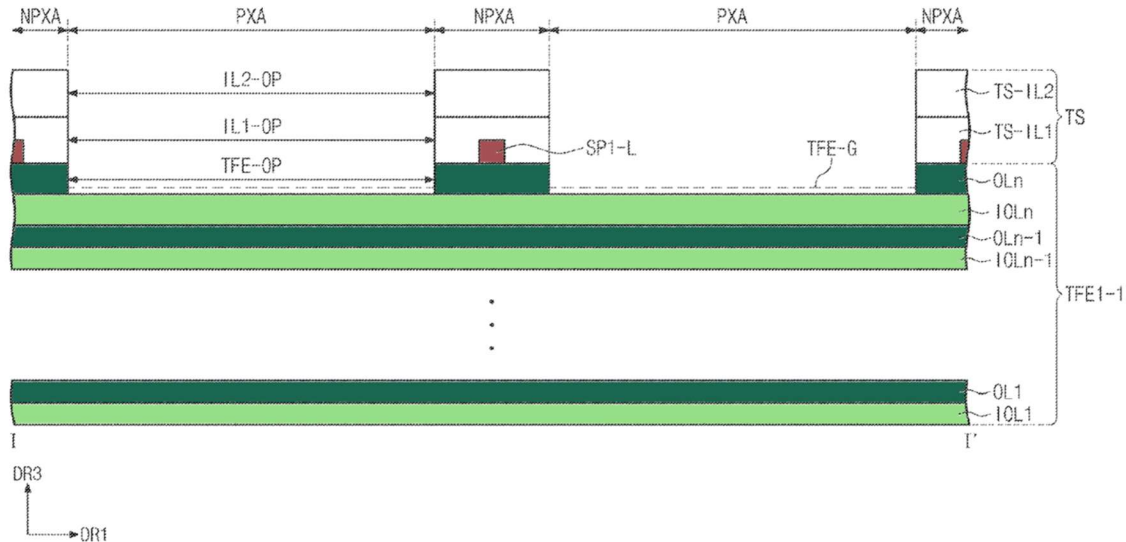
FIG. 9A



Kwon224, FIG. 9A

The TFE includes inorganic and/or organic thin film layers, and Kwon224's Figure 13A shows one implementation of the TFE with an organic top layer. Kwon224, ¶¶[0112], [0126], [0123], [0164-165], Fig. 13A; Ex-1003, ¶¶235-236

FIG. 13A



Kwon224, FIG. 13A

Therefore, 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.”**

Kwon224 and Kim524 render obvious claim 1 (*see* §VI.A.4) and Kwon224, Kim524, and Zhu837 render obvious claims 11 (*see* §VI.B.3.a-VI.B.3.c) and 12. Ex-1003, ¶¶238-241.

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. *See* §§VI.A.4.f

(explaining the first and second conductive lines are connected via contact holes through the TS-IL1 layer); VI.B.3.a-b (explaining the TS-IL1 layer is replaced by Zhu837's encapsulation layer 106); Ex-1003, ¶¶239-240. This is illustrated in Kim524's Figure 10, which shows the structure incorporated into the combination.

FIG. 10

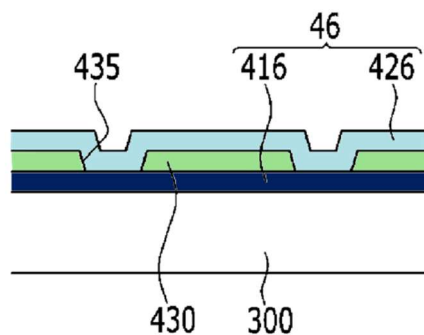
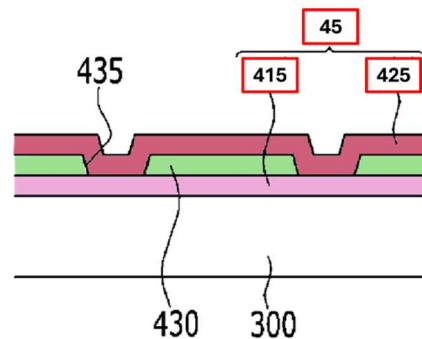


FIG. 10



Kim524, FIG. 10 (modified right)

Therefore, the Kwon224-Kim524-Zhu837 combination discloses claim 12.

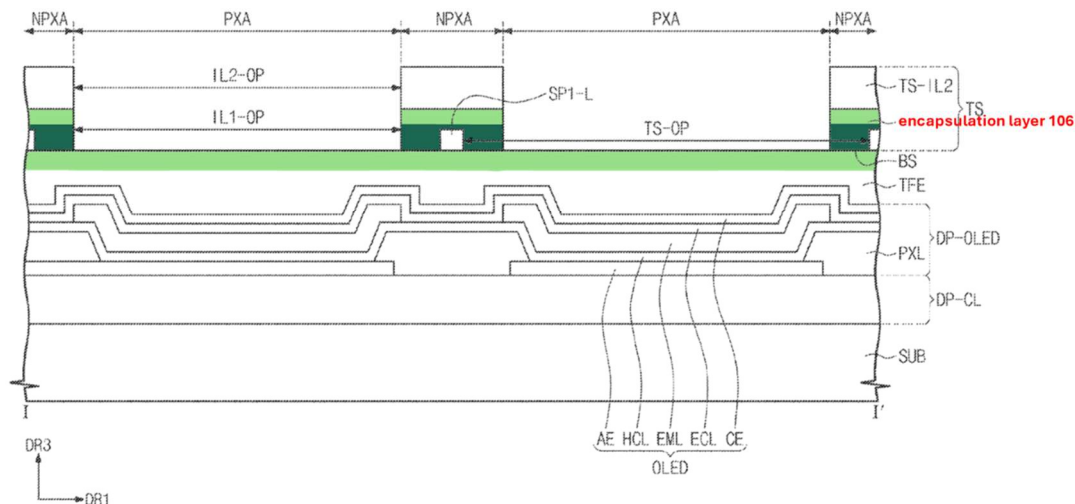
- e. **Claim 13: “The organic light emitting display according to claim 10, wherein the first conductive lines are disposed on one of the at least one inorganic encapsulation layer, disposed under the at least one organic encapsulation layer.”**

Kwon224 and Kim524 render obvious claim 1 (*see* §VI.A.4), and Kwon224, Kim524, and Zhu837 render obvious claims 10 (*see* §§VI.B.3.a-VI.B.3.b) and 13. Ex-1003, ¶¶242-247.

The first conductive lines are disposed on the TFE layer (*see* VI.A.5.b), which has a top inorganic encapsulation layer disposed under an organic encapsulation layer. Ex-1003, ¶243. Kwon224's TFE includes inorganic and organic layers, and expressly discloses two examples that include a top inorganic layer. Kwon224, ¶¶[0112], [0125-126], [0123], Figs. 7B-7C, 13A. Further, Zhu837's encapsulation layer's multi-layered arrangement can have a top inorganic film with an organic film underneath. Zhu837, ¶[0056]; *see* §VI.B.3.a; Ex-1003, ¶244-246. Thus, a POSITA would have understood that the combination discloses a TFE layer with a top inorganic layer that is underneath an organic layer.

Id.

FIG. 10B



Kwon224, FIGS. 10B

Therefore, the Kwon224-Kim524-Zhu837 combination discloses claim 13 because the first conductive lines disposed on the TFE layer are disposed on an inorganic encapsulation layer underneath an organic encapsulation layer.

- 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.”**

Kwon224 and Kim524 render obvious claim 1 (*see* §VI.A.4), and Kwon224, Kim524, and Zhu837 render obvious claims 13 (*see* §§VI.B.3.a-VI.B.3.b, VI.B.3.e) and 14. Ex-1003, ¶¶248-250.

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* VI.B.3.d; VI.B.3.a; Ex-1003, ¶249.

Therefore, the Kwon224-Kim524-Zhu837 combination discloses claim 14.

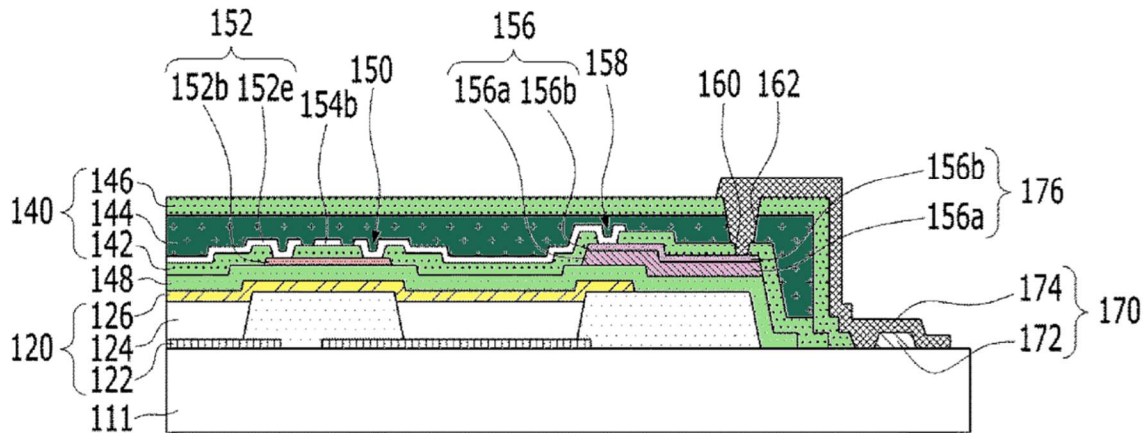
- g. **Claim 15: “The organic light emitting display according to claim 10, further comprising an interlayer inorganic layer disposed on cathodes of the light emitting elements, wherein the first conductive lines are disposed on the interlayer inorganic layer.”**

Kwon224 and Kim524 render obvious claim 1 (*see* §VI.A.4), and Kwon224, Kim524, and Zhu837 render obvious claims 10 (*see* §§VI.B.3.a-VI.B.3.b) and 15. Ex-1003, ¶¶251-264.

The Kwon224-Kim524-Zhu837 combination discloses the claimed interlayer inorganic layer (i.e., Kwon224’s TFE layer) and first conductive lines (Kwon224’s touch signal lines *see* §VI.A.4.e) disposed thereon. Ex-1003, ¶252.

The ’394 patent illustrates the interlayer inorganic layer in Figure 7—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-1003, ¶253.

FIG. 7

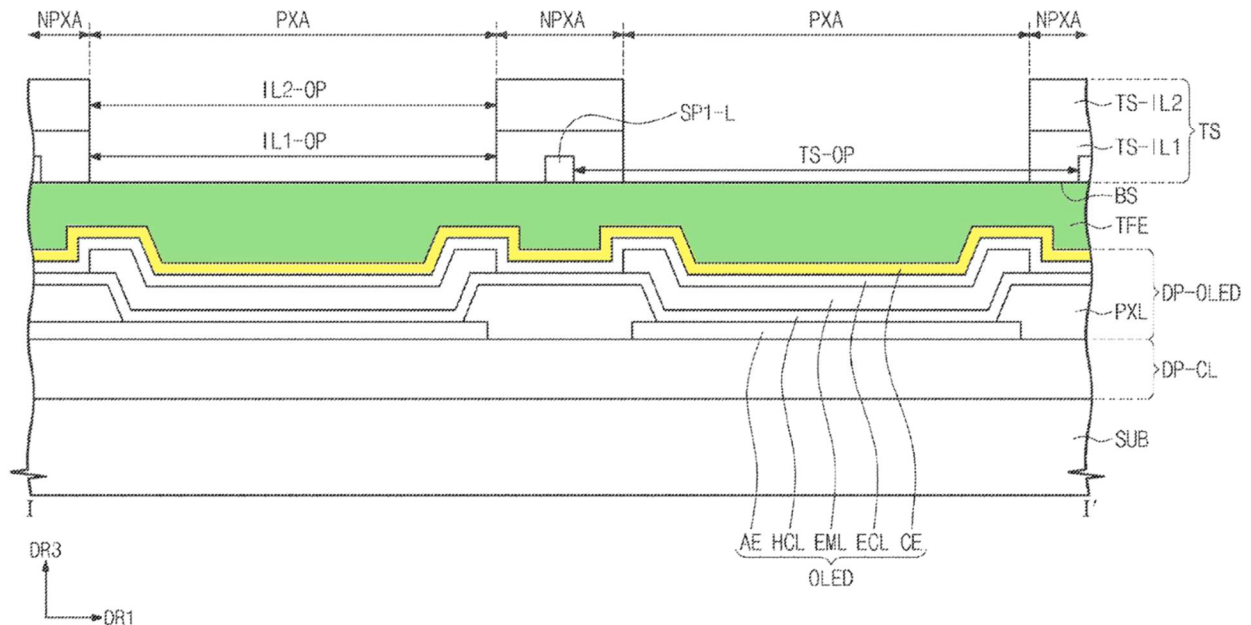


Ex-1001, FIG. 7

The Kwon224-Kim524-Zhu837 combination discloses this configuration.

First, the combination discloses an inorganic TFE layer—the **interlayer inorganic layer film (lime green)**. *Id.* The TFE layer (lime green) is disposed on the **cathodes (light yellow)** of the light emitting elements and the first conductive lines and bridges are disposed on the TFE layer. *See* §§VI.A.5.b, VI.A.5.d; Ex-1003, ¶¶254-255; Kwon224, ¶[0123]. Thus, a POSITA would have understood that this TFE layer would have constituted the claimed interlayer inorganic layer film, including because the TFE layer’s positioning and composition is consistent with the interlayer film described in the ’394 patent. Ex-1003, ¶¶255-256.

FIG. 10B



Kwon224, FIGS. 10B

Second, the combination replaces TS-IL1 layer with Zhu837's encapsulation layer 106 that can be multi-layered with "alternately arranged layers of organic films and/or inorganic films." Zhu837, ¶[0056]; *see* §VI.B.3.a. Thus, one example of the multi-layered configuration is an inorganic film (lime green) on top, an organic film (dark green) in the middle, and another inorganic film (lime green) on the bottom. Ex-1003, ¶257; *see* §VI.B.3.e-VI.B.3.f.

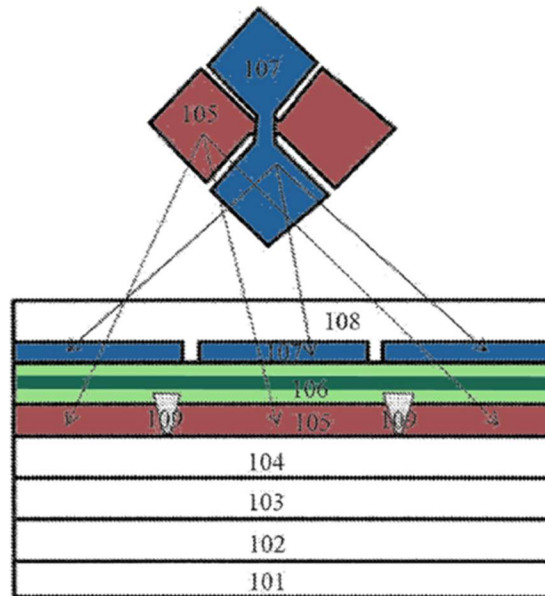
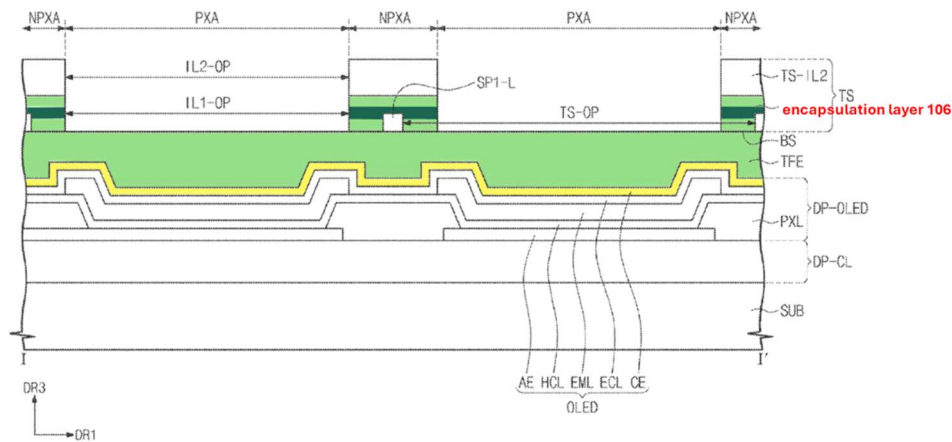


FIG. 2

Zhu837, FIG. 2

The encapsulation unit includes both the TFE layer and the encapsulation layer 106, with the TFE layer (**lime green, bottom layer**) being the fourth layer from the top. Ex-1003, ¶258.

FIG. 10B



Ex-1003, ¶258 (Representation of Kwon224-Kim524-Zhu837)

Third, the TFE layer is implemented as a single inorganic layer. Kwon224 explains that TFE may constitute only inorganic layers and one implementation involves a single inorganic layer with two inorganic sublayers. Kwon224, ¶¶[0112], [0132], [0134], [0114]; Ex-1003, ¶259. This is consistent with industry understanding that multiple inorganic layers without an intermediary element deposited in between would constitute a single inorganic encapsulation layer. Ex-1003, ¶¶260-261. The '394 patent also confirms this point, noting that an encapsulation layer may be a “multilayer structure[s].” Ex-1001, 3:53-58, 4:15-19; *see id.*, 4:2-6; Ex-1003, ¶¶262-263; *see also* Zhu837, ¶¶[0020] (showing that an encapsulation layer with a single layer was well known in the art), [0050], claim 7.

- 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.”**

Kwon224 and Kim524 render obvious claim 1 (*see* §VI.A.4), and Kwon224, Kim524, and Zhu837 render obvious claim 15 (*see* §§VI.B.3.a-VI.B.3.b, VI.B.3.g) and 16. Ex-1003, ¶¶265-267.

The Kwon224-Kim524-Zhu837 combination discloses this claim for the reasons explained for claims 12 and 14 in the Kwon224-Kim524-Zhu837 combination. *See* §§VI.B.3.d; VI.B.3.f; Ex-1003, ¶266. As explained in §VI.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.

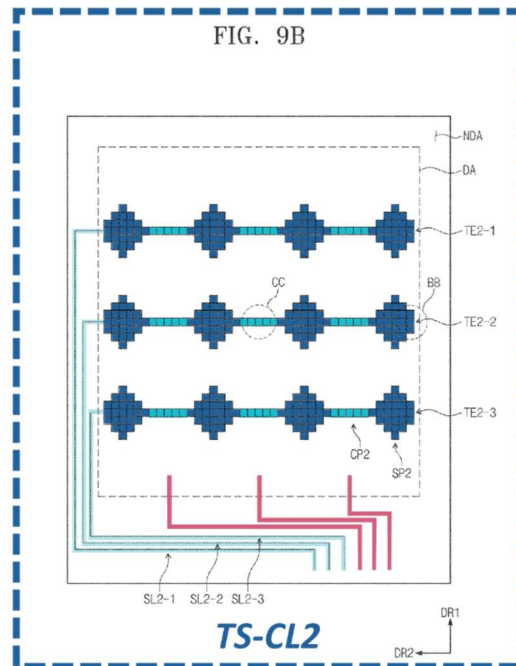
Therefore, the Kwon224-Kim524-Zhu837 combination discloses claim 16.

- 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.”**

Kwon224 and Kim524 render obvious claim 1 (*see* §VI.A.4) and Kwon224, Kim524, and Zhu837 render obvious claims 9 (*see* §VI.B.3.a) and 18. Ex-1003, ¶¶268-272.

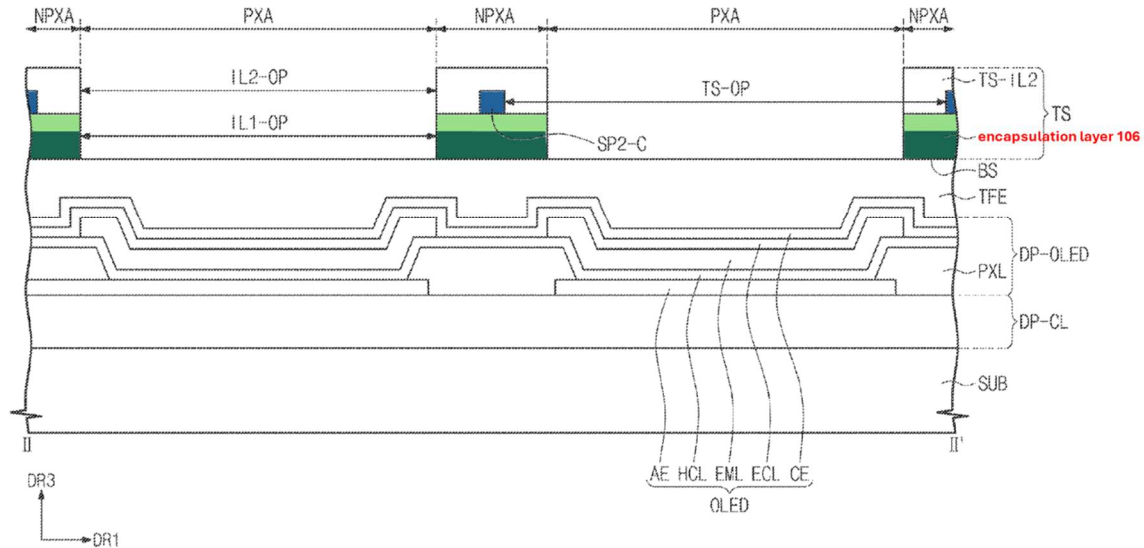
In the Kwon224-Kim524-Zhu837 combination, the TS-CL2 layer, which includes **SP2 (deep blue)** and **second conductive lines (magenta)**, is deposited on top of (and thus contacts) the **top layer of Zhu837's encapsulation layer 106**.

Kwon224, ¶[0138]; *see* §VI.A.4.f; VI.B.3.a; Ex-1003, ¶¶269-271.



Ex-1003, ¶269 (Representation of Kwon224-Kim524)

FIG. 11B



Ex-1003, ¶269 (Representation of Kwon224-Kim524-Zhu837)

The top layer of the encapsulation layer 106 is **the uppermost inorganic layer (lime green)**. *Id.*

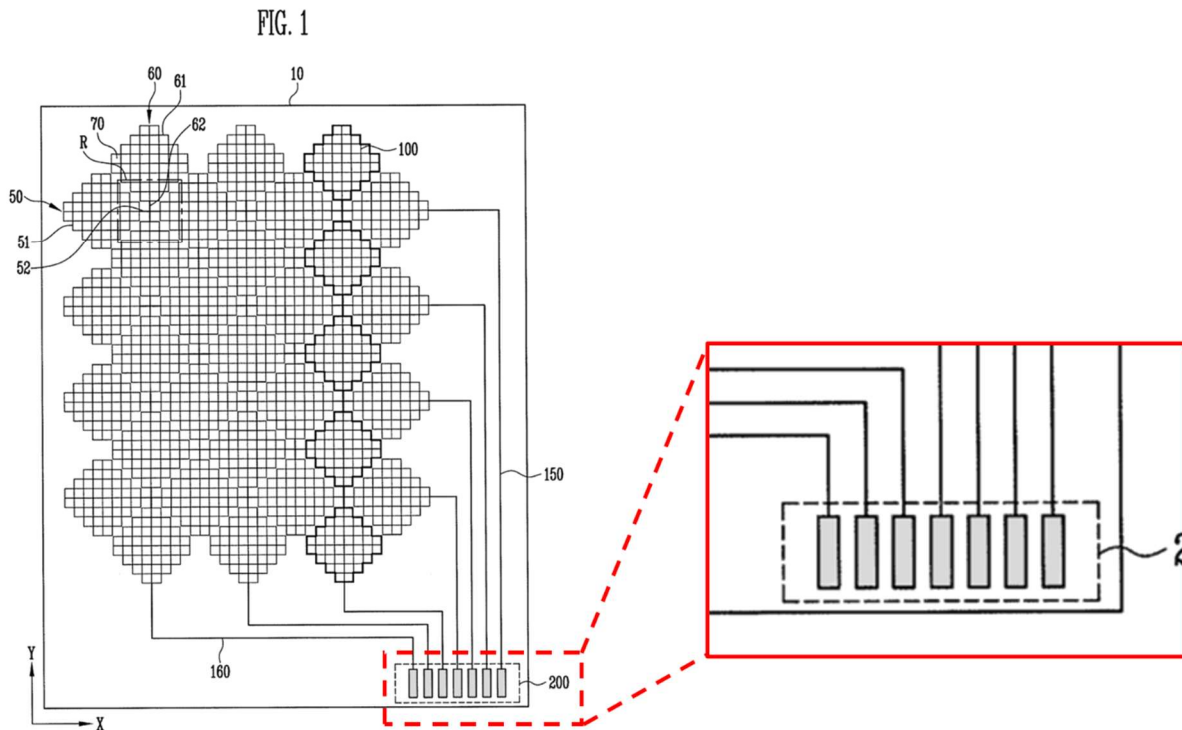
Therefore, the Kwon224-Kim524-Zhu837 combination discloses claim 18.

C. Ground 3: Kwon224-Kim524-Jang513 Combination Renders Obvious Claim 5.

1. Jang513 Overview

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 POSITA would have understood that Jang513’s device is an OLED device or, at the very least, Jang513’s disclosures apply to OLED devices. Ex-1003, ¶¶273-278.

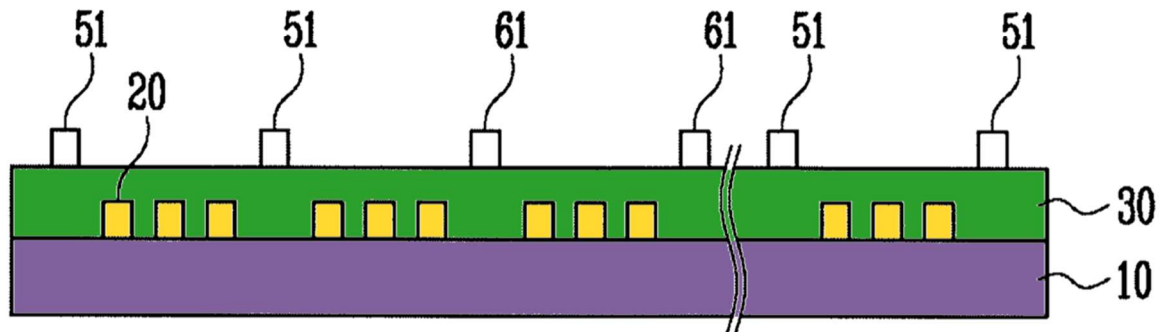
Figure 1 shows touch sensors comprising (i) first and second sensing electrodes 50 and 60 that include sensing cells and connection patterns connecting adjacent cells and (ii) position detecting lines 150 and 160 that terminate at **touch pad unit 200 (light gray)**. *Id.*, ¶¶[0051], [0060], [0063-64].



Jang513, FIG. 1

Figure 3 shows a cross-sectional view, 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

A POSITA 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 II, VI.A.1-VI.A.3, VI.C.1; Ex-1003, ¶279.

Jang513, like Kwon224, Kim524 and the '394 patent, addresses integration challenges. Ex-1003, ¶280. Jang513 integrates the sensing electrodes directly onto the sealing thin film above the pixel array, eliminating the need for separate attachment steps and reducing structural complexity. Jang513, ¶¶[0016-17], [0070], [0074]; Ex-1003, ¶281. Jang513's design helps preserve light transmittance and

image quality, streamlines fabrication through using shared materials, and reduces pixel damage. Jang513, ¶¶[0054-57], [0064], [0088], [0007-8]. A POSITA would have understood that Jang513 addresses the same class of integration problems as the '394 patent, Kwon224, Kim524—thickness, flexibility, visibility, and process complexity. Ex-1003, ¶¶280-281.

Because Kwon224, Kim524, and Jang513 disclose similar systems that operate similarly and are directed to similar problems, a POSITA would have been motivated to consider their combined teachings. Ex-1003, ¶282. Additional claim element rationales are provided below.

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.”

Kwon224 and Kim524 render obvious claim 1 (*see* §VI.A.4). Kwon224, Kim524, and Jang513 render claim 5 obvious. Ex-1003, ¶¶283-297.

Kwon224 and Kim524 disclose all claimed touch screen elements, except their connection lines end without showing any further connection to other devices:

FIG. 9A

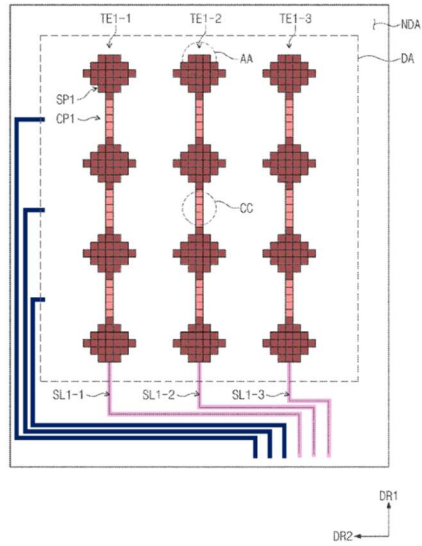
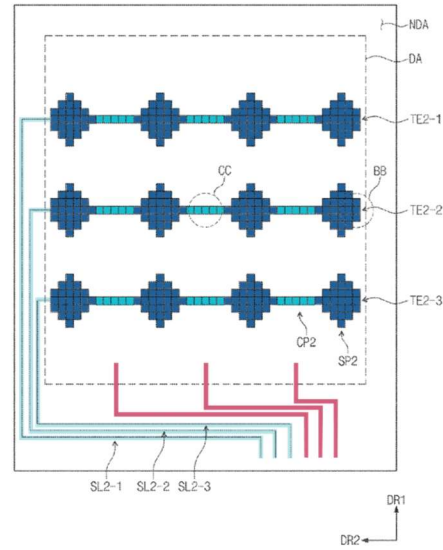
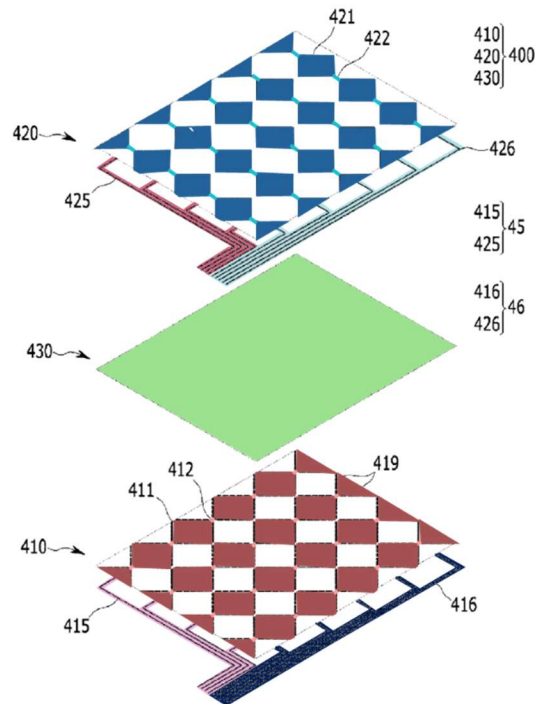


FIG. 9B



Ex-1003, ¶284 (Representation of Kwon224-Kim524)

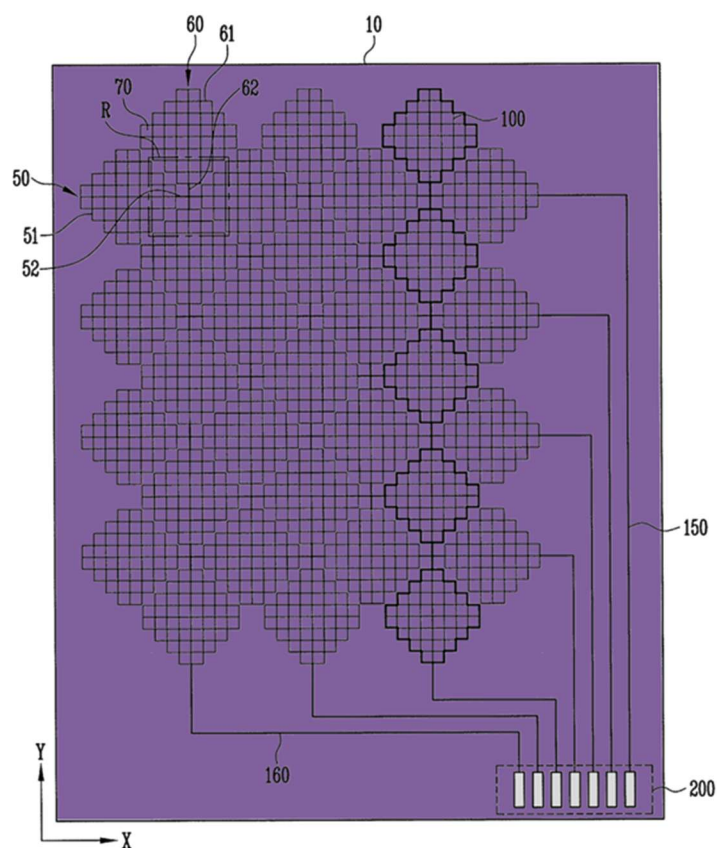
FIG. 6



Kim524, Fig. 10

Jang513 fills in the gap, showing that the conductive lines connect to a touch pad unit 200 with multiple touch pads (light gray) and disposed on a substrate (dark purple). Jang513, ¶[0063]; Ex-1003, ¶¶285-286.

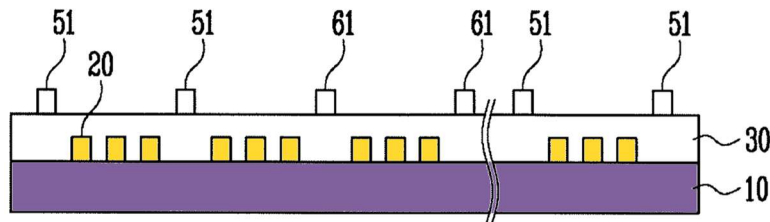
FIG. 1



Jang513, FIG. 1

The substrate includes **pixels 20 (bright yellow)** (i.e., light emitting elements) disposed thereon. Jang513, ¶[0057]; Ex-1003, ¶287.

FIG. 3



Jang513, FIG. 3

The Kwon224-Kim524-Jang513 combination adds Jang513's touch pads and connects them to the conductive lines. Ex-1003, ¶288. The Kwon224-Kim524 combination's conductive lines are similar to Jang513's lines 150/160. *Id.* A POSITA would have found it obvious to connect touch pads to the second conductive lines of the Kwon224-Kim524 combination and dispose the touch pads on Kwon224's substrate SUB. *See* §VI.A.4.f; *see* §VI.A.4.b. This modification would add touch pads in each conductive layer as shown below, consistent with Jang513:

FIG. 9A

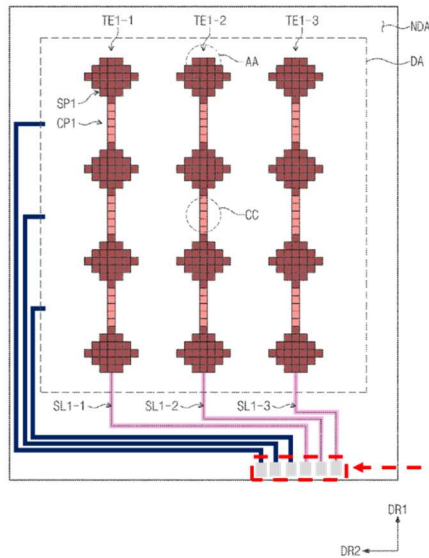
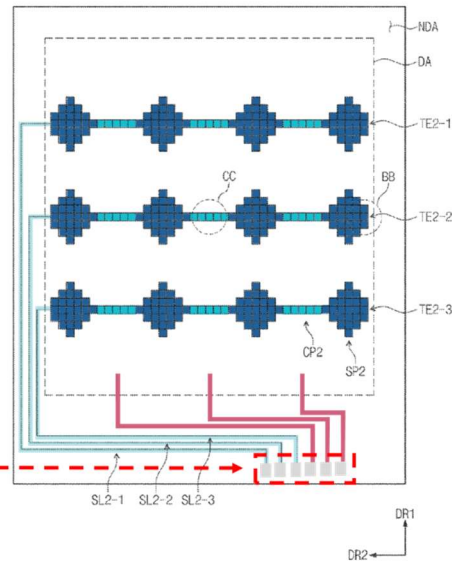


FIG. 9B



Ex-1003, ¶288 (Representation of Kwon224-Kim524)

A POSITA would have been motivated to make this modification for numerous reasons. A POSITA would have recognized that Kwon224-Kim524 discloses touch signal lines (pink, sky blue, magenta, navy blue) that route touch signals from the sensor array to the periphery of the display but fails to provide details on how the signals are routed to an external component. Ex-1003, ¶289.

FIG. 9A

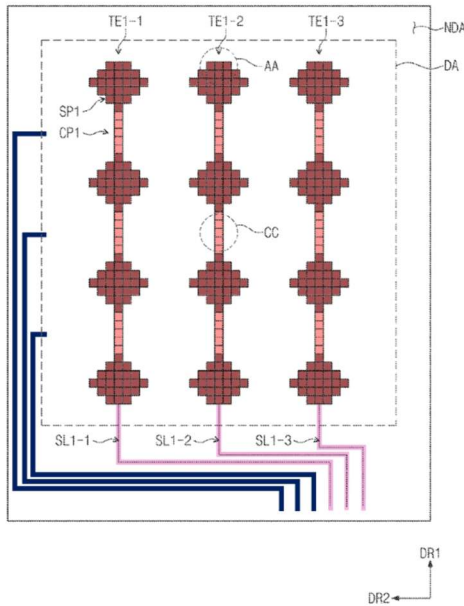
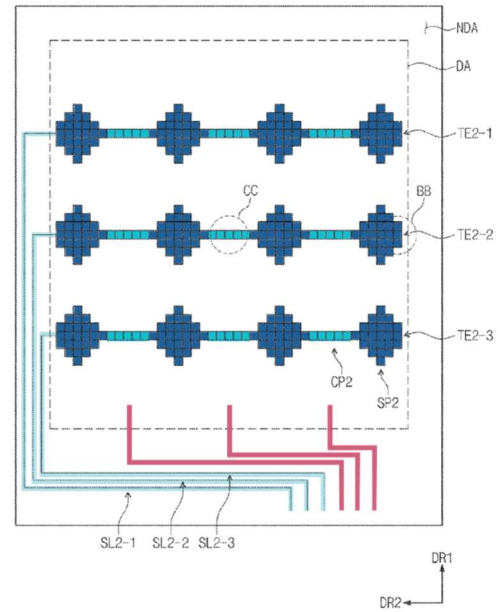
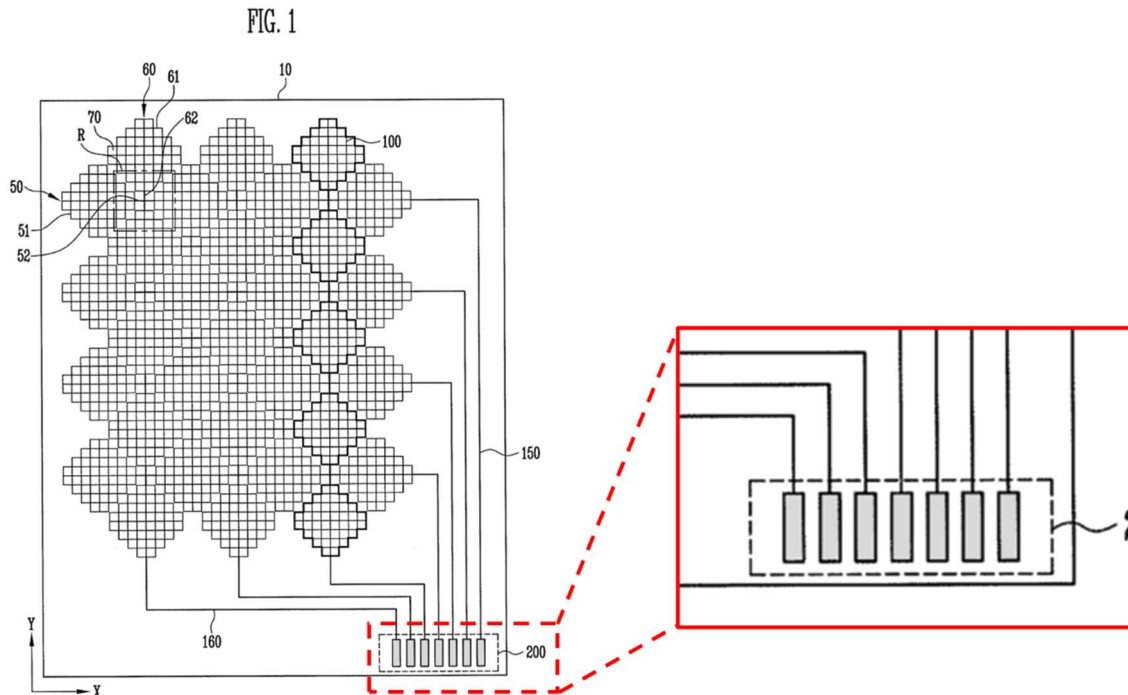


FIG. 9B



Kwon224, FIG. 9A-9B

In practical touch display systems, it is necessary to connect these internal signal lines to external circuitry and well known to provide dedicated touch pads at the periphery for external electrical connection. *Id.*; see Jang513, ¶[0063], Fig. 1.



Jang513, FIG. 1

The modification is a straightforward extension of the existing design, requiring no inventive step. Ex-1003, ¶¶290-293. Indeed, including touch pads this is seen in LCDs, OLEDs, and touch panels across the industry. Ex-1003, ¶292. Providing touch pads at the end of each signal line is a routine, predictable solution to enable touch signal lines to connect to external circuitry and function properly. *Id.* The modification would provide predictable results because adding touch pads does not change the fundamental operation of the touch sensor and provides a more robust, reliable, and manufacturable interface for connecting the internal touch signal lines to external circuits. *Id.*

Moreover, it would be obvious to try connecting dedicated touch pads to the end of the touch signal lines because it is one of a finite number of identified, predictable solutions, with a reasonable expectation of success. Ex-1003, ¶293. 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. *Id.* Given the longstanding use of touch pads, 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. *Id.*

A POSITA would have been motivated to make this modification because it would provide numerous benefits, including mechanical robustness by providing a reinforced area, electrical reliability, manufacturing yield by facilitating automated assembly, serviceability, and testing options during production and for diagnostics. Ex-1003, ¶294.

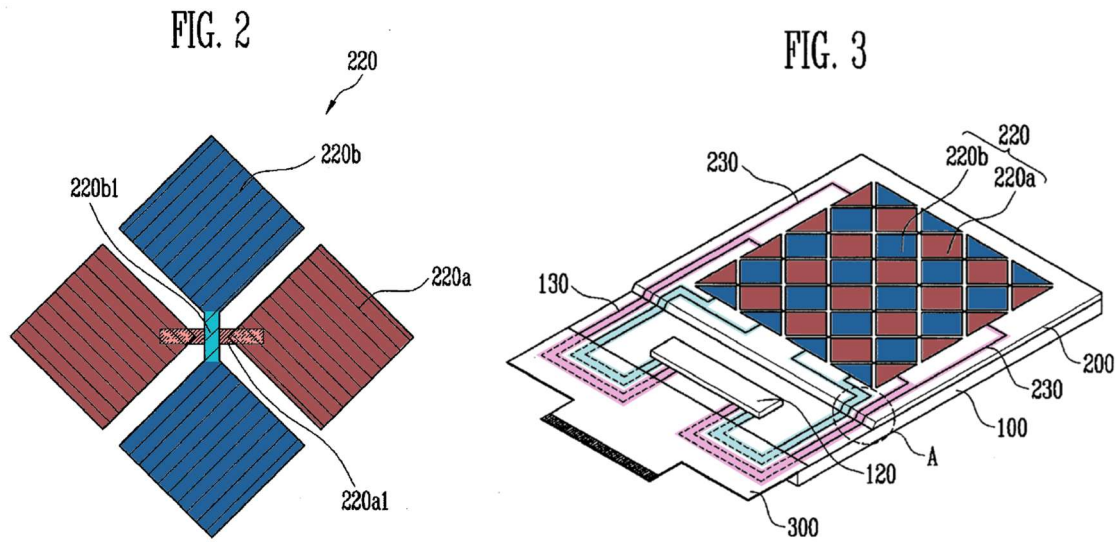
There would have been a reasonable expectation of success in modifying the Kwon224-Kim524 combination to include touch pads, which were well known in the art and address known challenges in OLED touchscreen integration—namely, achieving reliable electrical connections, providing mechanical stability, and improved diagnostic testing. Ex-1003, ¶¶295-296.

Therefore, 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.

D. Ground 4: Kwon224-Kim524-Kim481 Combination Renders Obvious Claim 17.

1. Kim481 Overview

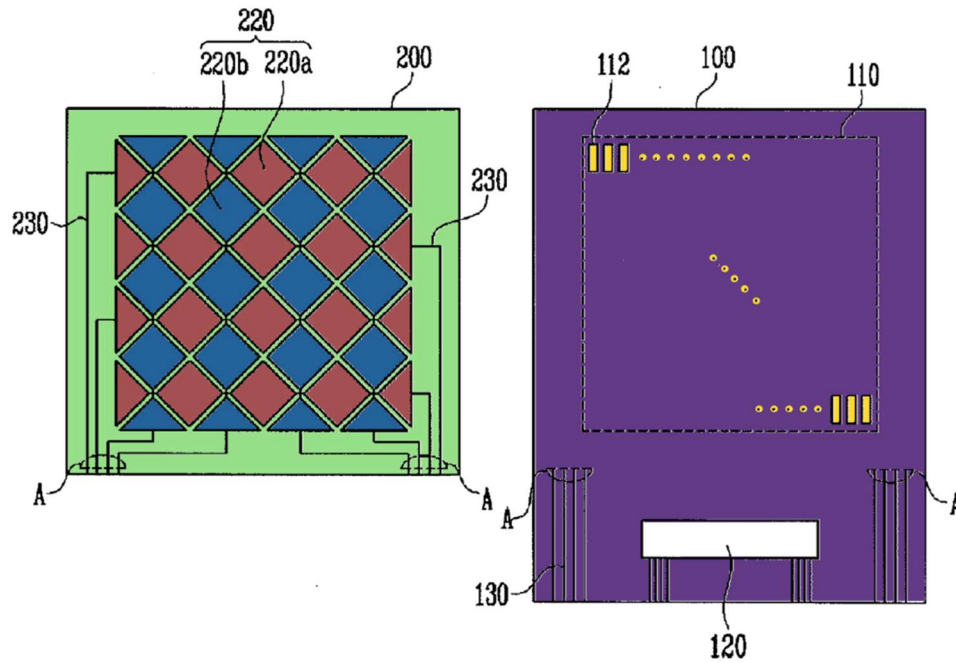
Kim481 describes an “organic light emitting display” with touch sensors comprising **sensing cells 220a/220b (brick red/deep blue)** with **connection patterns 220a1/220b1 (salmon/cyan)** connecting adjacent cells and **sensing lines 230 (pink/sky blue)** providing a connection from the cells to a flexible printed circuit board 300. Kim481, ¶¶[0028-30], [0034-37], [0040], [0042], [0044]; Ex-1003, ¶298. The device has an “integrated touch screen panel.” Kim481, Title, Abstract, ¶[0003]; Ex-1003, ¶299.



Kim481, FIGS. 2 and 3

The device further includes a **sealing film 200 (green)** made of inorganic and organic layers for sealing a plurality of **pixels 112 [(light emitting elements) (bright yellow)]** formed on a **substrate 100 [(dark purple)]**.” Kim481, ¶¶[0042], [0044], [0048]; Ex-1003, ¶300.

FIG. 5



Kim481, FIG. 5

The sensing lines 230 are disposed on top of and along a side surface of the sealing film 200 (green). Ex-1003, ¶301.

screen panel formed directly on a sealing thin film—minimizing thickness and simplifying the bonding and testing process and reducing cost by using a single flexible printed circuit board for both the display and touch panel. *Id.*, Title, Abstract, ¶¶[0003], [0060], [0021], [0024-25], [0042], [0010], [0037]. Thus, Kim481’s fabrication solution supports mechanical flexibility, reduces structural complexity, and improves manufacturing efficiency—addressing the same problems as the ’394 patent. *Id.*

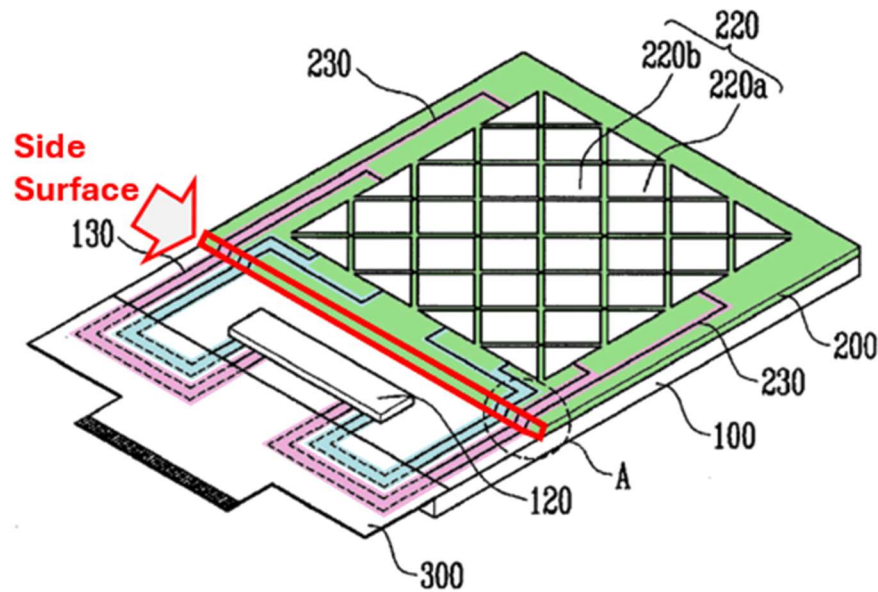
Because Kwon224, Kim524, and Kim481 disclose similar systems that operate similarly and are directed to similar problems, a POSITA would have been motivated to consider their combined teachings. Ex-1003, ¶304. Additional claim element rationales are provided below.

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.”

Kwon224 and Kim524 render obvious claim 1 (*see* §VI.A.4). Kwon224, Kim524, and Kim481 render claim 17 obvious. Ex-1003, ¶¶305-317.

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]; Ex-1003, ¶306; *see id.*, ¶¶[0041-42], [0044-45], [0049-53].

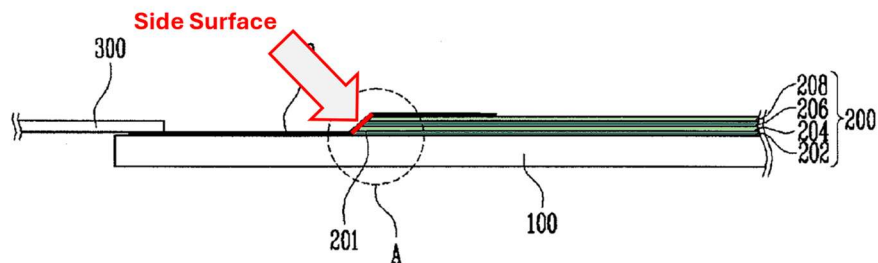
FIG. 3



Kim481, FIG. 3

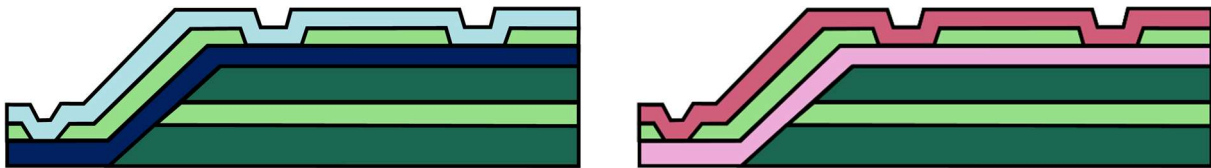
At the “end portion A,” the sealing film 200 is inclined to prevent sensing line breakage. *Id.*, ¶¶[0038], [0054-55]; Ex-1003, ¶ 307.

FIG. 4



Kim481, FIG. 4

The Kwon224-Kim524-Kim481 combination applies Kim481's conductive line path down the inclined encapsulation unit edge to Kwon224-Kim524's stacked touch signal line configuration (i.e., **first (sky blue/pink) and second (navy blue/magenta) conductive lines**). Ex-1003, ¶308; *see* §VI.A.4.f. The sloped portion of the encapsulation unit is the unit's side surface. Ex-1003, ¶¶307-309.



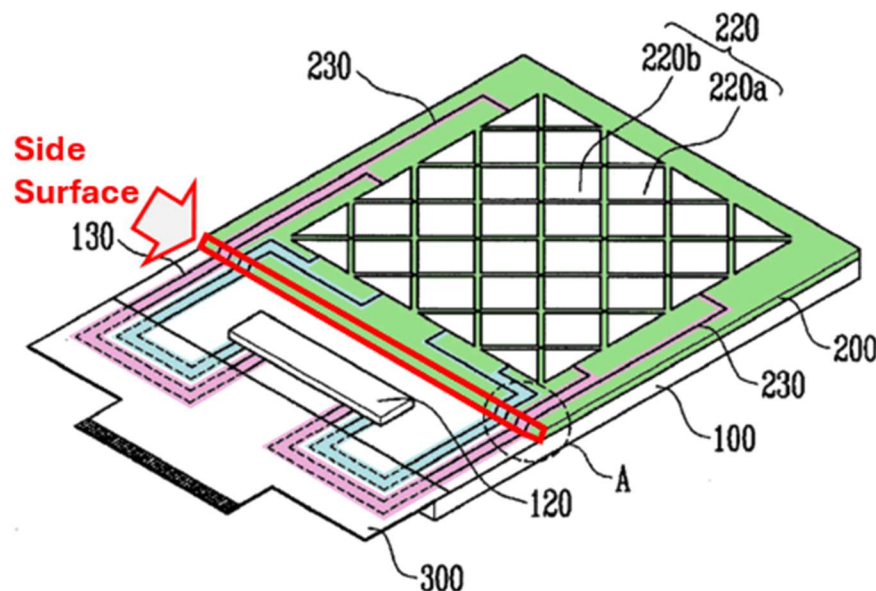
Ex-1003, ¶308 (Representation of Kwon224-Kim524-Kim481)

A POSITA would have recognized that the encapsulation unit in the Kwon224-Kim524 combination has a side surface. Ex-1003, ¶¶309-310. Kwon224's substrate extends across the display area (DA) and non-display area (NDA) in Figures 9A-9B. *See* §VI.A.5.a. Further, a POSITA would have understood that Kwon224's encapsulation unit (i.e., TFE layer) ends before reaching the edge of the substrate, with a vertical side surface at its termination point.

Kwon224 supports this, 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], [0126-127]; Ex-1003, ¶311.

This is consistent with how devices like Kwon224's are designed and manufactured. Ex-1003, ¶312. Kim481 discloses this configuration showing 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

The above interpretation of Kim224's encapsulation unit consistent with industry practice. Ex-1003, ¶313. 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, which provides a better bonding platform. Ex-

1003, ¶313; *see* §VI.C. Thus, a POSITA would have recognized that the encapsulation unit in the Kwon224-Kim524 combination terminates before the connection point to the touch pad or external circuitry, which provides cost and materials savings Ex-1003, ¶313.

A POSITA would have found it obvious to adopt Kim481's edge/side surface routing of conductive lines into Kwon224-Kim524's integrated OLED touch architecture. Ex-1003, ¶314; *see* VI.A.4.f. A POSITA would have recognized that Kwon224 discloses touch signal lines routing signals but leaves out details on how those signals are transmitted to touch pads or an external device. Ex-1003, ¶314; *see* §VI.C.3. Kim481 provides these details, providing an inclined encapsulation unit edge that allows the signal lines a sloped path from the encapsulation unit on to the substrate and to the next connection point, which would not disturb device operation. Ex-1003, ¶314. The 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.*

A POSITA would have been motivated to make this modification because it provides device benefits. Kim481's touts the benefits, explaining how the sloped line path on the edge of the encapsulation unit helps prevent signal line breakage.

Kim481, ¶¶[0054-55], Figs. 3-4. This configuration also supports reliable electrical connection and robust device performance. Ex-1003, ¶315.

Implementing Kim481's routing in the Kwon224/Kim524 stack would have predictable outcomes with a reasonable expectation of success because it relies on fabrication steps that are well understood in the OLED industry. Ex-1003, ¶316. 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. *Id.* No new physics, materials, or control schemes are introduced—only a proven routing path applied to an otherwise conventional OLED touch stack. *Id.*

Therefore, the Kwon224-Kim524-Kim481 combination discloses claim 17.

E. Ground 5: Kim481-Kim524 Combination Renders Obvious Claim 19.

1. Kim481 and Kim524 are Analogous Art

A POSITA 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* §§II, VI.D.1, VI.A.2; *see* §VI.D.2; Ex-1003, ¶¶318-319.

Because Kim481 and Kim524 disclose similar systems that operate in a similar manner and are directed to similar problems, a POSITA would have been

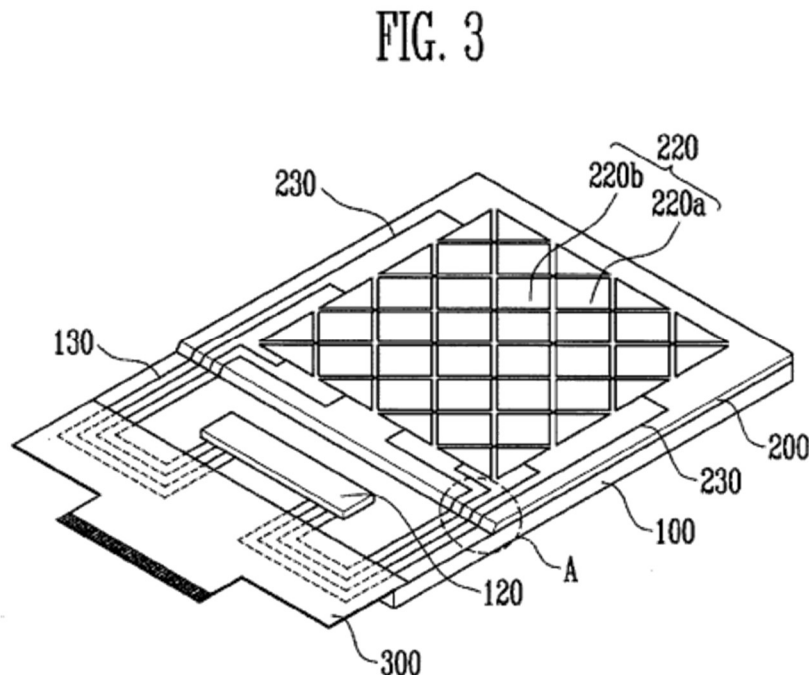
motivated to consider their combined teachings. Ex-1003, ¶319. Additional claim element rationales are provided below.

2. Independent Claim 19

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

To the extent the preamble is limiting, Kim481 discloses 19[pre]. Ex-1003, ¶320.

Kim481 discloses “an organic light emitting display.” Kim481, ¶¶[0042-43]; Ex-1003, ¶321.



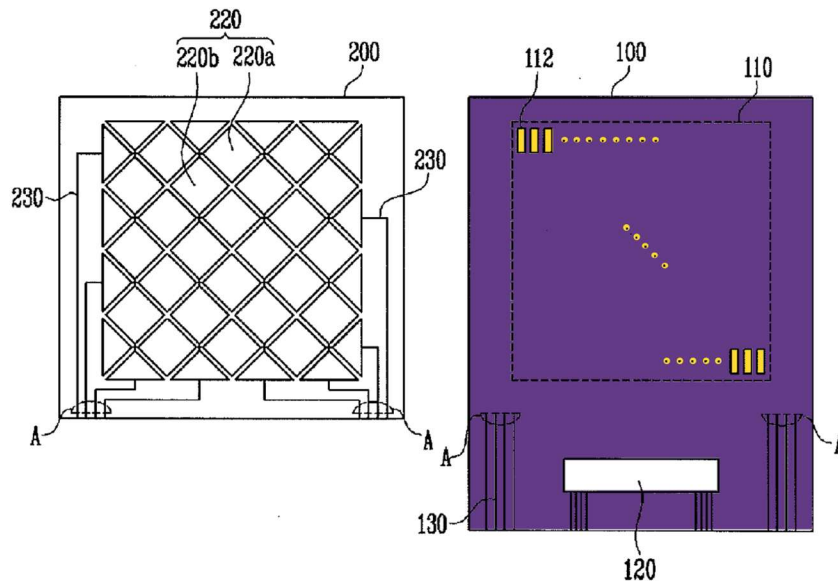
Kim481, FIG. 3

b. 19[a]: “light emitting elements disposed on a substrate;”

Kim481 discloses 19[a]. Ex-1003, ¶¶322-324.

Kim481 discloses “organic light emitting element[s],” which are “provided to each of the pixels 112.” Kim481, ¶[0042-43]; *see id.*, Abstract, ¶¶[0022-23], [0025]. A POSITA 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. Ex-1003, ¶323. Kim481 further explains that “**pixels 112**” (and the light emitting elements) (bright yellow) are “formed on a **substrate 100**” (dark purple). Kim481, ¶[0042].

FIG. 5



Kim481, FIG. 5

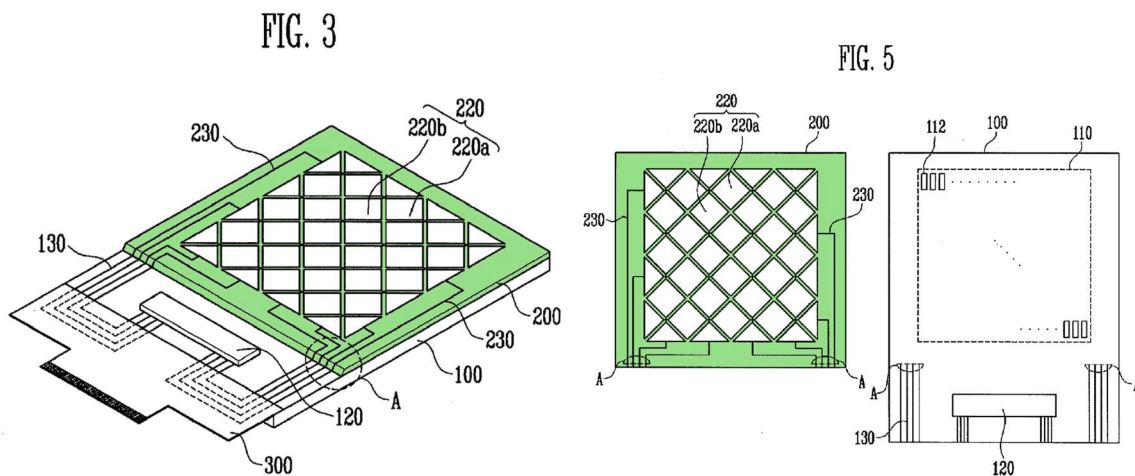
Therefore, Kim481 discloses 1[a] because it discloses light emitting elements (i.e., pixels 112 with light emitting elements) disposed on a substrate (i.e., substrate 100).

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

Kim481 discloses 19[b]. Ex-1003, ¶¶325-329.

Kim481 discloses **sealing film 200 (green)** “for sealing” the pixels 112.

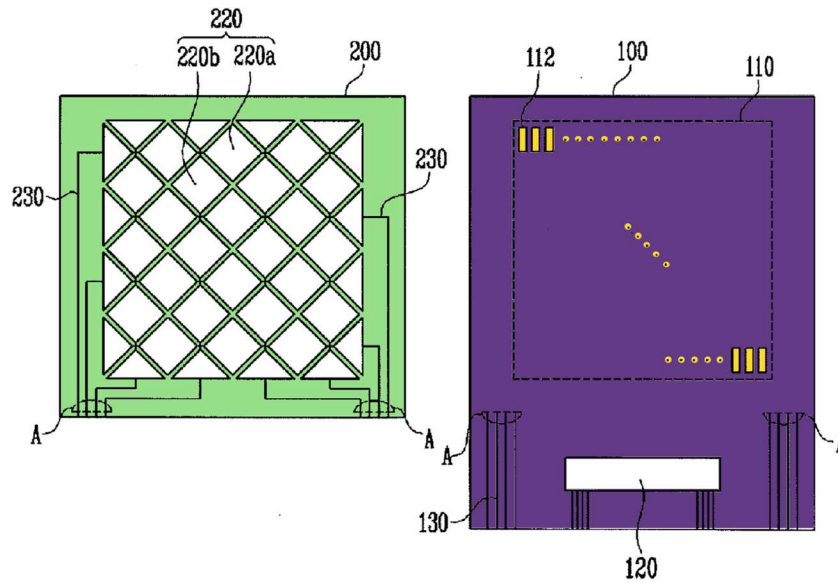
Kim481, ¶¶[0042], [0044], [0048]; Ex-1003, ¶326; *see* §VI.E.2.b.



Kim481, FIG. 3, FIG. 5

The sealing film is “formed on the substrate 100” where the pixels 112 are formed. *Id.*, ¶¶0044]; Ex-1003, ¶¶327-328. Figure 5 shows the **sealing film 200 (green)** disposed on the substrate with **pixels 112 (and light emitting elements) (yellow)**.

FIG. 5



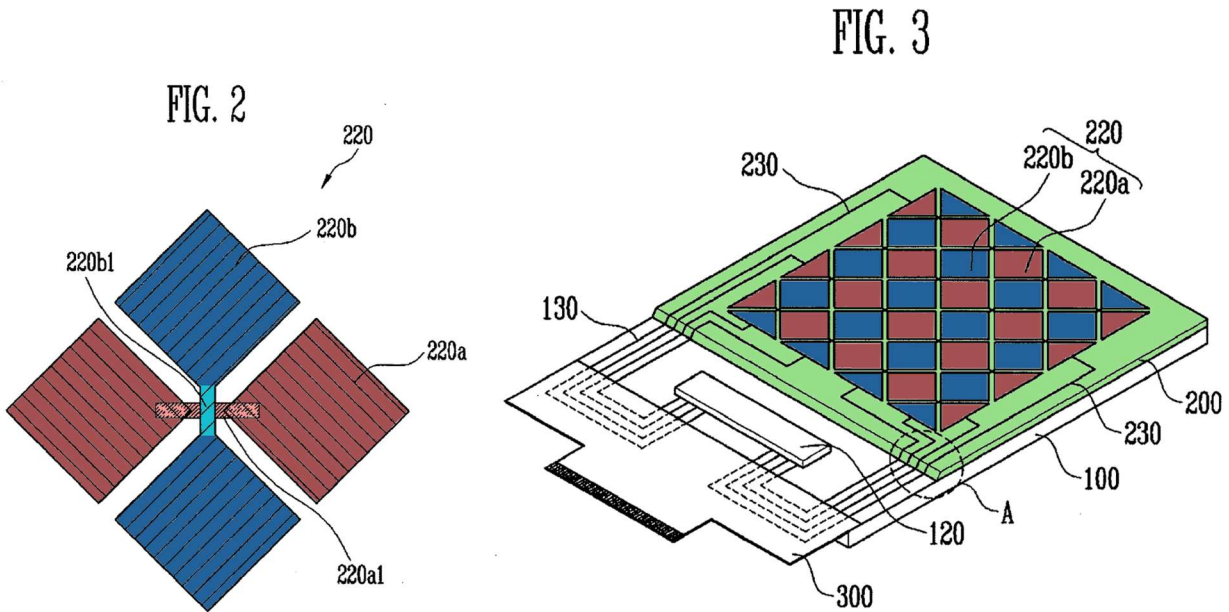
Kim481, FIG. 5

Therefore, 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;”

Kim481 discloses 19[c]. Ex-1003, ¶¶330-336.

Kim481 discloses **sensing cells 220 (brick red/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 §VI.E.2.c; Ex-1003, ¶331.

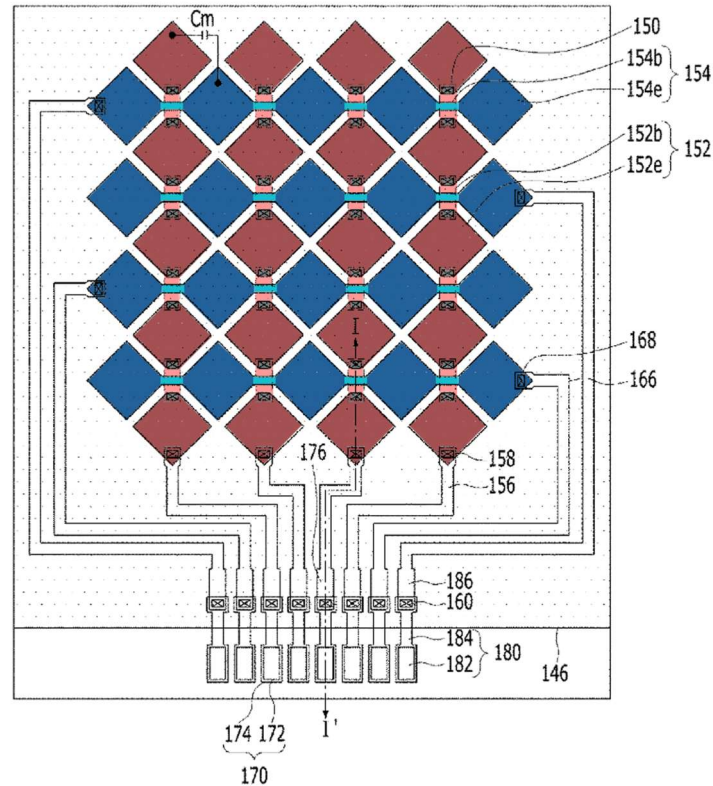


Kim481, FIGS. 2 and 3

Kim481 explains that the sensing cells are “touch sensing patterns,” which a POSITA would have understood to describe touch sensors. Kim481, ¶[0044]; Ex-1003, ¶332.

The '394 patent confirms that Kim481 discloses the claimed touch sensors. Ex-1003, ¶333. First, Kim481's sensing cells meet the description of the touch sensors in the '394 patent, which explain the horizontally-arranged “**touch driving lines 152**” and vertically-arranged “**touch sensing lines 154**” (**brick red/deep blue**) constitute the touch sensors. Ex-1001, 4:31-33, 4:47-49, 4:64-5:5; Ex-1003, ¶334.

FIG.1



'394 Patent, FIG. 1

This is how Kim481's sensing cells 220 are disclosed—with a horizontally-formed lower layer 220a and vertically-formed upper layer 220b. Kim481, Figs. 2-3, ¶¶[0035], [0026], [0030].

Second, the '394 patent describes a touch sensor based on mutual capacitance. Ex-1003, ¶335; see §VI.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].

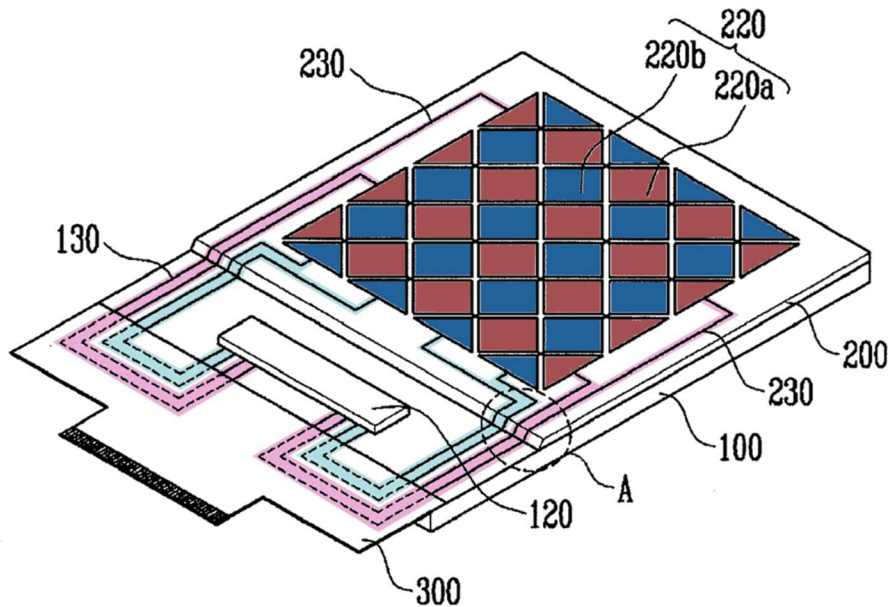
Therefore, Kim481 discloses 1[c] because it discloses touch sensors (i.e., sensing cells 220) disposed on the encapsulation unit (i.e., sealing film 200).

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

Kim481 discloses 19[d]. Ex-1003, ¶¶337-340.

Kim481 discloses a lower layer of **sensing lines 230 (pink/sky blue)** (i.e., **first conductive lines**) that are connected to the **sensing cells 220 (brick red/deep blue)**. Kim481, ¶¶ [0030], [0034-35], [0040], [0042], [0044], Fig. 2; Ex-1003, ¶338; *see* §VI.E.2.d. Sensing lines 230 are multi-layered—one made of transparent electrode material and another of metallic material. Kim481, ¶[0036]. **Sensing cells 220a (brick red)** and **sensing cells 220b (deep blue)** are connected to **sensing lines 230 (pink)** and **sensing lines 230 (sky blue)**, respectively. *Id.*, ¶[0035].

FIG. 3



Kim481, FIG. 3

A POSITA 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 layers, each of different material. Ex-1003, ¶339.

Therefore, Kim481 discloses 19[d] because it discloses first conductive lines (i.e., 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"

Kim481 and Kim524 render obvious 19[e]. Ex-1003, ¶¶341-359.

Kim481 discloses multi-layered sensing lines 230 (*see* §VI.E.2.e) but includes no cross-sectional view showing this structure. Ex-1003, ¶342. A POSITA would have found it obvious to modify Kim481 with Kim524's teachings of a vertically-stacked signal line structure that provides **first conductive lines 415/426** (sky blue/pink) connected to and running in parallel with **second conductive lines 416/425** (navy blue/magenta) using contact holes 435 through an inorganic insulating layer 430. Ex-1003, ¶343; *see* §VI.A.4.f. Kim524 discloses a similar layer stack as Kim481, including a substrate, light emitting elements, encapsulation layer, and a touch sensor layer. *See* §§VI.A.4.f, VI.D.1-VI.D.2.

FIG. 6

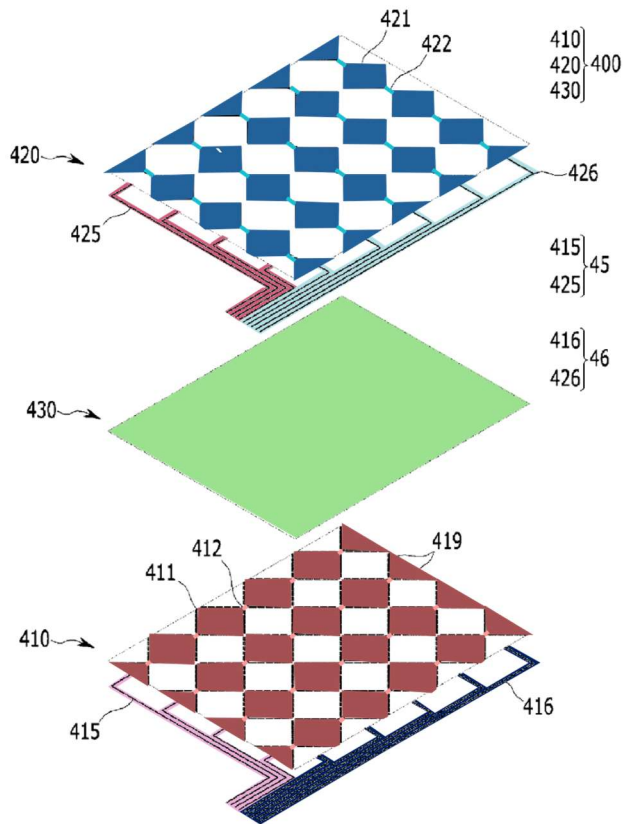
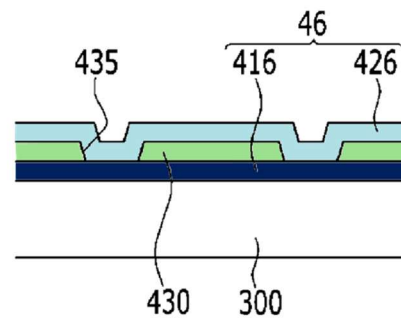
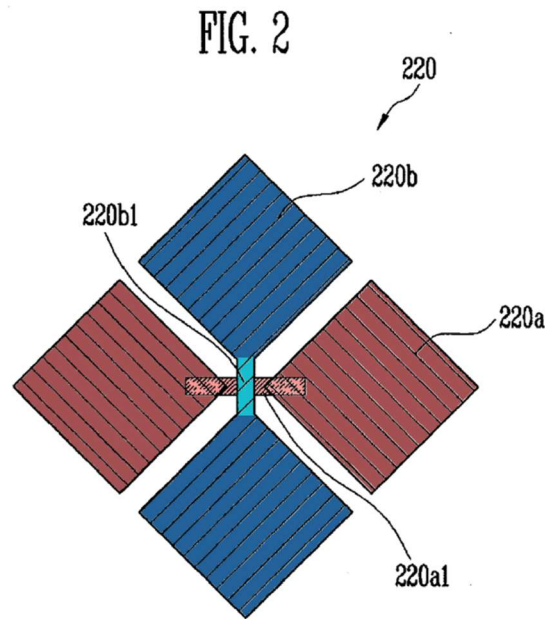


FIG. 10



Kim524, FIGS. 6 and 10

Kim481 discloses a similar two-layered configuration with **sensing cells 220a (brick red)** and **220b (deep blue)**, each having an upper and lower region for connections. See §VI.E.2.d; Kim481, ¶[0030]; Ex-1003, ¶344.



Kim481, FIG. 3

Given the structural similarities, a POSITA would have considered Kim524's teachings to improve Kim481's device. Ex-1003, ¶346.

A POSITA 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 (§VI.E.1) and the motivations described in incorporating Kim524's stacked structure with Kwon224 (§§VI.A.3, VI.A.4.f). Ex-1003, ¶347. As described above in this section, Kim481 and Kim524 provide similar device architecture, both disclosing touch signal lines and an insulating layer. Ex-1003, ¶347.

Combining Kim481 and Kim524 it achieves Kim481's goal of reduced resistance and improved touch sensitivity. Ex-1003, ¶348. 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]; Ex-1003, ¶348. Given that lower resistance is a well-established goal providing benefits in the touch display industry—a POSITA would reasonably interpret Kim481 as pursuing reduced resistance. Ex-1003, ¶349. 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]; Ex-1003, ¶¶348-349.

A POSITA would have understood that Kim524’s stacked conductive line configuration allows signal transmission across different layers and vertically wider routing paths, which helps reduce resistance in the signal line paths. Ex-1003, ¶349. The stacked configuration beneficially permits use of different materials for the different layers, allowing use of transparent conductive oxides like ITO that improve touch screen transparency and visibility and metallic materials in the upper lines that lowers resistivity and improves conductivity. *Id.* Further, using an intermediate insulating layer enables selective electrical routing by preventing unintended electrical contact between overlapping conductive paths and specifying where electrical connections occur. 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. *Id.*

Reduced resistance in the touch signal lines desirably reduces overall resistance of the touch electrodes, particularly for Kim481's continuous, integrated conductive pattern signal lines and electrodes. Ex-1003, ¶350; Kwon224, ¶¶[0137], [0143], [0146-147], [0150]. 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. *Id.*

Incorporating Kim524's vertical interconnect strategy into Kim481's architecture would enhance signal integrity and reduce layout complexity, particularly in high-resolution displays where routing space is limited. Ex-1003, ¶351.

The combination would have been predictable and within the capabilities of a POSITA. Ex-1003, ¶¶352-354. Kim481 discloses depositing multi-layered touch sensing lines and the modification merely confirms the use of a vertical stacked structure and extends the use of the insulating layer during the manufacturing process. Ex-1003, ¶352. Further, the use of contact holes to connect conductive lines through insulating layers is a well-established technique in display and semiconductor fabrication. Ex-1003, ¶353. Kim524's implementation of this

technique in the context of OLED touchscreens would have provided a clear blueprint for enhancing Kim481's design and maintain Kim481's structural benefits while incorporating Kim524's electrical connectivity advantages. *Id.*

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]' Ex-1003, ¶354. As such, Kim481 already teaches adding the Kim524 stacked structure, with Kim524 merely providing specific implementation details. *Id.*

The modification involves two simple steps after depositing multi-layered sensing lines. Kim481, ¶[0036]; Ex-1003, ¶¶355-356. First, the insulating layer extends to be between the two layers of the sensing lines 430. Ex-1003, ¶355. In the combination, the sensing lines would run in parallel and overlap, as disclosed in Kim524's Figure 10, from the connection at the sensing cells (**brick red** and **deep blue**) to an external connection point. *Id.*

Second, the insulating layer includes contact holes to enable connection between the first and second conductive lines. Ex-1003, 356. Kim481 discloses "patterning" the sensing cells 220 and 230—the general fabrication process of

defining specific shapes or regions on a layer like contact holes. *Id.* Moreover, a POSITA would have readily recognized the practicality of forming contact holes through “patterning” to facilitate electrical connection between the first and second conductive lines. *Id.* This combination integrates prior art elements—Kim481’s touchscreen architecture using sensing signal lines and Kim524’s architecture employing a stacked touch signal line configuration with an intermediate insulating layer—by applying the established method of controlled deposition of layers in touchscreen devices. Ex-1003, ¶357. The result is a predictable outcome: a touchscreen device as described in Kim481 featuring a stacked touch signal line configuration with an intermediate insulating layer—simply substituting Kim524’s stacked touch signal line design for Kim481’s signal line configuration for reducing resistance and increasing touch sensitivity. *Id.*

Finally, there would have been a reasonable expectation of success in combining these references. Ex-1003, ¶358. Both Kim481’s and Kim524 are directed to similar device architectures and use compatible materials and fabrication techniques. *Id.* 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. *Id.*

Therefore, Kim481-Kim524 combination renders obvious 1[d] because it 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,”**

Kim481 and Kim524 render obvious 19[f]. Ex-1003, ¶¶360-362.

The Kim481-Kim524 combination includes Kim524's intermediate insulating layer 430, which is an inorganic film, between the first and second conductive lines. *See* §VIII.E.2.f. Kim524, ¶¶[0078], [0074]; Ex-1003, ¶361 (explaining the intermediate layer is inorganic).

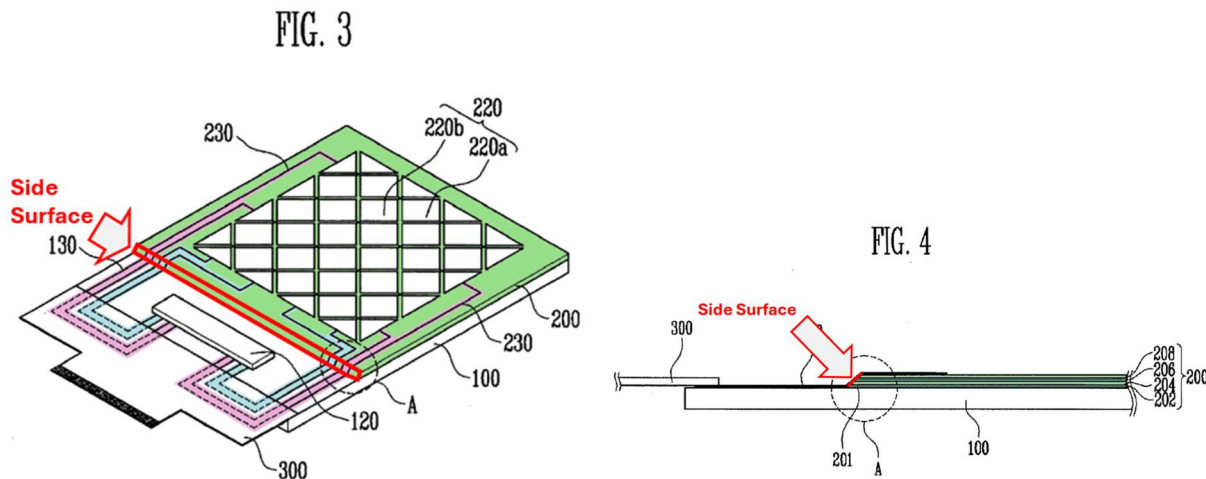
Therefore, the Kim481-Kim524 combined system renders obvious 19[f] because it includes an inorganic, insulating film formed (i.e., Kim524's intermediate film 430 between the multi-tiered sensing lines 430).

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

Kim481 and Kim524 render 19[g] obvious. Ex-1003, ¶¶363-366.

Kim481 discloses conductive lines along a side surface of the encapsulation unit and Kim481 and Kim524 render obvious the second conductive lines. Ex-1003, ¶¶363-364.

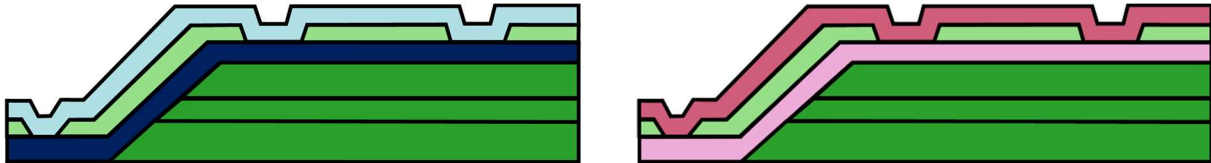
Kim481 Figures 3-4 show that the sensing lines 230 run along an inclined, side surface of Kim481's **sealing film 200 (green)** (i.e., encapsulation unit). Ex-1003, ¶365; *see* §VI.D.3.



Kim481, FIG. 3

Further, the Kim481-Kim524 combination includes second conductive lines running parallel to the sensing lines 230. *See* VI.E.2.f. The modified figure implements Kim524's stacked conductive line configuration from Figure 10 into Kim481's conductive lines running along the inclined side surface, as shown below. Ex-1003, ¶366. As shown, one set of **sensing lines 230 (i.e., first conductive lines)** (sky blue) run parallel with the second conductive lines (navy

blue) and the second conductive lines are disposed along a side surface of the encapsulation unit **(green)**.



Ex-1003, ¶366 (Representation of Kim481-Kim425)

VII. MANDATORY NOTICES

A. Real Parties-in-Interest

Petitioner Tianma Microelectronics Co., Ltd., and Tianma Microelectronics (HONG KONG) Limited, and Wuhan Tianma Microelectronics Co., Ltd. are the real parties-in-interest.

B. Related Matters

Patent Owner LG Display Co., Ltd. asserted the '394 patent in the following litigation: *LG Display Co., Ltd. v. Tianma Microelectronics Co., Ltd. et al.*, Case No. 5-25-cv-00078 (E.D. Tex., Jun. 13, 2025).

C. Lead and Back-Up Counsel, and Service Information

Lead Counsel	Back-Up Counsel
Joshua L. Goldberg (Reg. No. 59,369) FINNEGAN, HENDERSON, FARABOW, GARRETT & DUNNER, LLP 901 New York Ave. N.W. Washington, DC 20001 Tel: (202) 408-6092 Fax: (202) 408-4400 joshua.goldberg@finnegan.com	Forrest A. Jones (Reg. No. 74,123) FINNEGAN, HENDERSON, FARABOW, GARRETT & DUNNER, LLP 901 New York Ave. N.W. Washington, DC 20001 Tel: (202) 408-4019 Fax: (202) 408-4400 forrest.jones@finnegan.com Umber Aggarwal (Reg. No. 76,098) FINNEGAN, HENDERSON, FARABOW, GARRETT & DUNNER, LLP 1875 Explorer Street, Suite 800 Reston, VA 20190 Tel: (571) 203-2423 Fax: (202) 408-4400 umber.aggarwal@finnegan.com Qingyu Yin (Reg. No. 61,329) FINNEGAN, HENDERSON, FARABOW, GARRETT & DUNNER, LLP 901 New York Ave. N.W. Washington, DC 20001 Tel: (202) 408-4213 Fax: (202) 408-4400 qingyu.yin@finnegan.com Daniel F. Klodowski (Reg. No. 72,693) FINNEGAN, HENDERSON, FARABOW, GARRETT & DUNNER, LLP 901 New York Ave. N.W.

	Washington, DC 20001 Tel: (202) 408-4216 Fax: (202) 408-4400 daniel.klodowski@finnegan.com Kathleen A. Daley (Reg. No. 36,116) FINNEGAN, HENDERSON, FARABOW, GARRETT & DUNNER, LLP 901 New York Ave. N.W. Washington, DC 20001 Tel: (202) 408-4098 Fax: (202) 408-4400 kathleen.daley@finnegan.com Min Yang, Ph.D. (Reg. No. 78,149) FINNEGAN, HENDERSON, FARABOW, GARRETT & DUNNER, LLP 901 New York Ave. N.W. Washington, DC 20001 Tel: (202) 408-4163 Fax: (202) 408-4400 min.yang@finnegan.com
--	---

Petitioner consents to service by e-mail at the above e-mail addresses along with Tianma-PTAB@finnegan.com.

VIII. GROUNDS FOR STANDING

Petitioner certifies the '394 patent is available for *inter partes* review and Petitioner is not barred or estopped from requesting review on the grounds presented here.

IX. CONCLUSION

Petitioner requests institution and cancellation of each challenged claim.

The Office may charge any required fees to Deposit Account No. 06-0916.

Dated: October 23, 2025

Respectfully submitted,

/ Joshua L. Goldberg /

Joshua L. Goldberg, Lead Counsel
Reg. No. 59,369

CERTIFICATION UNDER 37 C.F.R. §42.24(d)

As calculated by the “Word Count” feature of Microsoft Word for Microsoft 365, this Petition contains 13,971 words, excluding this Certification and the following: Table of Contents, Table of Authorities, List of Exhibits, List of Challenged Claims, Mandatory Notices, and Certificate of Service.

Dated: October 23, 2025

By: / Joshua L. Goldberg /

Joshua L. Goldberg, Reg. No. 59,369
FINNEGAN, HENDERSON, FARABOW,
GARRETT & DUNNER, L.L.P.

CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. § 42.6(e) and 37 C.F.R. § 42.105(a), the undersigned certifies that on October 23, 2025, a copy of the foregoing **Petition for *Inter Partes* Review, the associate power of attorney, and Exhibits 1001-1010** were served by FedEx Priority Overnight on the correspondence address of record below indicated in the U.S. Patent Office's public Patent Center system for U.S. Patent No. 11,251,394:

David A. Bilodeau
Birch Stewart Kolasch & Birch, LLP
2600 Park Tower Drive
Suite 600
Vienna, VA 22180-7371

Dated: October 23, 2025

By: / William Esper /

Senior Litigation Paralegal
FINNEGAN, HENDERSON, FARABOW,
GARRETT & DUNNER, L.L.P.