

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

BOE TECHNOLOGY GROUP CO., LTD.,

Petitioner

v.

SAMSUNG DISPLAY CO., LTD.,

Patent Owner.

PTAB Case No. IPR2025-01476

U.S. Patent No. 10,541,279 B2

**PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT NO. 10,541,279 B2**

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EXHIBIT LIST

No.	Exhibit
Ex-1001	U.S. Patent No. 10,541,279 B2 (“the ’279 patent”)
Ex-1002	File History of the ’279 patent
Ex-1003	Declaration of Dr. Darran Cairns
Ex-1004	Curriculum Vitae of Dr. Darran Cairns
Ex-1005	Chinese Patent No. CN203759670U (“Chen”); filed March 17, 2014; issued and published August 6, 2014.
Ex-1006	U.S. Patent Application Publication No. 2014/0333855 (“Park”); filed May 8, 2014; published Nov. 13, 2014.
Ex-1007	U.S. Patent Application Publication No. 2012/0105343 (“Lee-343”); filed May 26, 2011; published May 3, 2012.
Ex-1008	U.S. Patent Application Publication No. 2015/0049030 (“Her”); filed Feb. 25, 2014; published Feb. 19, 2015.
Ex-1009	Chinese Application No. CN105320372A (“Hsieh”); filed Sept. 23, 2014; published Feb. 10, 2016.
Ex-1010	Japanese Patent No. JPH0646348B2 (“Kobayashi”); filed May 12, 1986, published June 15, 1994; prior art under at least §102(a)(1).
Ex-1011	Complaint, <i>Samsung Display Co., Ltd. v. BOE Technology Group Co., Ltd.</i> , E.D. Texas, filed April 21, 2025
Ex-1012	U.S. Publication No. 2012/0262389 (“Kida”); filed Mar. 15, 2012, published Oct. 18, 2012
Ex-1013	U.S. Patent No. 8,289,457 (“Hwang”); filed Dec. 10, 2010; issued Oct. 16, 2012
Ex-1014	U.S. Publication No. 2013/0341651 (“Kim”); filed Dec. 5, 2012; published Dec. 26, 2013

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No.	Exhibit
Ex-1015	U.S. Patent No. 9,363,888 (“Hwang”); filed Mar. 28, 2012; issued June 7, 2016
Ex-1016	U.S. Patent No. 9,947,727 (“Lee”); filed Sep. 6, 2016; issued Apr. 17, 2018
Ex-1017	M. Krithikaa, “Touch Screen Technology – A Review,” International Journal of Trend in Research and Development, Volume 3(1), ISSN: 2394-9333 (Jan-Feb. 2016)
Ex-1018	Fawwaz T. Ulaby et al., “Circuit Analysis and Design” Michigan Publishing (2018)
Ex-1019	U.S. Publication No. 2014/0002385 (“Ka”); filed Jan. 11, 2013; published Jan. 2, 2014
Ex-1020	Li Du, “An Overview of Mobile Capacitive Touch Technologies Trends” (Dec. 2016)
Ex-1021	Todd O’Connor, “mTouch™ Projected Capacitive Touch Screen Sensing Theory of Operation – TB3064,” Microchip (2010)
Ex-1022	ATMEL “Touch Sensors – Design Guide” (Apr. 2009)
Ex-1023	U.S. Publication No. 2015/0021565 (“Min”); filed Dec. 16, 2013; published Jan. 22, 2015
Ex-1024	U.S. Publication No. 2015/0261370 (“Yoo”); filed Dec. 30, 2014; published Sep. 17, 2015
Ex-1025	U.S. Publication No. 2014/0145979 (“Lee-979”); filed Mar. 14, 2013; published May 29, 2014
Ex-1026	U.S. Publication No. 2010/0265193 (“Kung”); filed Jan. 20, 2010; published Oct. 21, 2010
Ex-1027	Japanese Patent No. 1984029441A (Mitsubishi); filed Aug. 10, 1982; published Febr. 16, 1984

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No.	Exhibit
Ex-1028	Japanese Patent No. 627983B2 (Hitachi); filed May 30, 1986; published Apr. 13, 1994
Ex-1029	U.S. Publication No. 2013/0176070 (“Guard”); filed Jan. 11, 2012; published July 11, 2013
Ex-1030	U.S. Patent No. 6,008,868 (“Silverbrook”); filed Mar. 13, 1995; issued Dec. 28, 1999
Ex-1031	U.S. Publication No. 2014/0160374 (“Wang”); filed Dec. 6, 2013; published June 12, 2014
Ex-1032	U.S. Publication No. 2011/0294288 (“Lee”); filed Aug. 10, 2011; published Dec. 1, 2011
Ex-1033	Chinese Patent Application No. 1378276A, filed Mar. 27, 2002; published Nov. 6, 2002
Ex-1034	U.S. Publication No. 2014/0307181 (“Tang”); filed Apr. 2, 2014; published Oct. 16, 2014
Ex-1035	Geoff Walker, “A Review of Technologies for Sensing Contact Location on the Surface of a Display” Journal of the Society of Information Display (Sept. 21, 2012)
Ex-1036	U.S. Publication No. 2012/0098762 (“Kim”); filed Mar. 15, 2011; published Apr. 26, 2012
Ex-1037	U.S. Publication No. 2015/0212537 (“Cok”); filed Jan. 29, 2014; published Jul. 30, 2015
Ex-1038	U.S. Publication No. 2011/0007011 (“Mozdzyń”); filed Jun. 26, 2010; published Jan. 13, 2011
Ex-1039	William S. Wong & Alberto Salleo, “Flexible Electronics: Materials and Applications” Springer (2009)
Ex-1040	Bernard Geffroy, et al. “Review Organic light-emitting diode (OLED) technology: materials, devices and display technologies”

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No.	Exhibit
	2006 Society of Chemical Industry. Polym Int 55:572–582 (2006), DOI: 10.1002/pi.1974
Ex-1041	U.S. Patent No. 9,911,943 (“Han”); filed Sep. 28, 2015; issued Mar. 6, 2018
Ex-1042	U.S. Patent No. 9,285,842 (“Yashiro”); filed Jul. 24, 2012; issued Mar. 15, 2016
Ex-1043	U.S. Publication No. 2016/0109998 (“Watanabe”); filed Oct. 13, 2015; published Apr. 21, 2016
Ex-1044	U.S. Publication No. 2010/0110041 (“Jang”); filed Jan. 7, 2010; published May 6, 2010
Ex-1045	U.S. Publication No. 2010/0097344 (“Verweg”); filed May 1, 2009; published April 22, 2010
Ex-1046	U.S. Patent No. 8,970,508 (“An”); filed May 5, 2010; issued Mar. 3, 2015
Ex-1047	Michael D. Sangid et al., “The role of grain boundaries on fatigue crack initiation – An energy approach” International Journal of Plasticity (2010)
Ex-1048	Walter D. Pilkey, “Peterson’s Stress Concentration Factors,” Wiley Second Edition (1997)
Ex-1049	Michael B. Heaney, “Electrical Conductivity and Resistivity” Electrical Measurement, Signal Processing, and Displays, CRC Press, 7-1 (2003)
Ex-1050	William D. Callister, Jr. et al. “Materials Science and Engineering; An Introduction,” Wiley (2014)
Ex-1051	Iulian Rosu, “Impedance Matching,” QSL.net

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No.	Exhibit
Ex-1052	Catrysse, et al. “Nanopatterned Metallic Films for Use As Transparent Conductive Electrodes in Optoelectronic Devices,” American Chemical Society (2010)
Ex-1053	U.S. Publication No. 2015/0029135 (“Han”); filed Oct. 28, 2013; published Jan. 29, 2015
Ex-1054	U.S. Publication No. 2013/0278513 (“Jang”); filed Aug. 14, 2012; published Oct. 24, 2013
Ex-1055	U.S. Publication No. 2015/0242029 (“Kim”); filed Jan. 28, 2015; published Aug. 27, 2015
Ex-1056	Japanese Publication No. 2138739 (Kawasaki Steel); filed April 20, 1989; published May 28, 1990
Ex-1057	U.S. Patent No. 9,423,830 (“Wei”); filed Mar. 24, 2014; issued Aug. 23, 2016
Ex-1058	U.S. Publication No. 2011/0193793 (“An”); filed May 5, 2010; published Aug. 11, 2011
Ex-1059	U.S. Publication No. 2011/0291117 (“Kwack”); filed Mar. 21, 2011; published Dec. 1, 2011
Ex-1060	U.S. Publication No. US2012/0305981 (“Park”); filed Nov. 18, 2011; published Dec. 6, 2012
Ex-1061	U.S. Publication No. 2014/0002666 (“Eden”); filed June. 25, 2013; published Jan. 2, 2014
Ex-1062	U.S. Publication No. US 2014/0117330 (“Cho”); filed Sept. 6, 2013; published May 1, 2014
Ex-1063	U.S. Patent No. 9,276,055 (“Son”); filed Aug. 31, 2014; issued Mar. 1, 2016
Ex-1064	U.S. Publication No. 2013/0133935 (“Hsu”); filed Nov. 20, 2012; published May 30, 2013

LISTING OF CHALLENGED CLAIMS

U.S. Patent No. 10,541,279 B2
Claim 1 (Cl.1)
1[pre] A display device comprising:
1[a] a display panel; and
1[b] a touch sensing unit on the display panel, the touch sensing unit comprising:
1[c] a first conductive pattern on the display panel;
1[d] an insulating layer covering the first conductive pattern; and
1[e] a second conductive pattern on the insulating layer, partially crossing the first conductive pattern, and comprising:
1[e][i] first touch sensor parts;
1[e][ii] second touch sensor parts spaced from the first touch sensor parts; and;
1[e][iii] first connection parts connecting respective ones of the first touch sensor parts,
1[f] wherein the first conductive pattern comprises electrically conductive second connection parts connecting respective ones of the second touch sensor parts, and
1[g] wherein the second conductive pattern has a thickness that is greater than a thickness of the second connection parts.
Claim 2 (Cl.2)
2[a] The display device of claim 1, wherein the first conductive pattern and the insulating layer are directly on a thin film encapsulation layer of the display panel, and

2[b] wherein the insulating layer comprises: a first part on the first conductive pattern, and spaced from the thin film encapsulation layer; a second part contacting with the thin film encapsulation layer; and a third part connecting the first part and the second part.

Claim 3 (Cl.3)

3. The display device of claim 1, wherein the thickness of the first conductive pattern is less than a thickness of the insulating layer.

Claim 4 (Cl.4)

4[a] The display device of claim 1, wherein the thickness of the first conductive pattern is equal to or greater than about 1800 angstroms, and equal to or less than about 2100 angstroms, and

4[b] wherein the thickness of the second conductive pattern is equal to or greater than about 2700 angstroms, and equal to or less than about 3500 angstroms.

Claim 5 (Cl.5)

5[pre] The display device of claim 1, wherein the first conductive pattern comprises:

5[a] a first conductive layer on the display panel;

5[b] a second conductive layer on the first conductive layer; and

5[c] third conductive layer on the second conductive layer, the second conductive layer having an electrical resistivity that is less than an electrical resistivity of the first and third conductive layers, and having a thickness that is greater than a thickness of the first conductive layer and a thickness of the third conductive layer.

Claim 6 (Cl.6)

6. The display device of claim 5, wherein the thickness of the third conductive layer is greater than the thickness of the first conductive layer.

Claim 7 (Cl.7)
7. The display device of claim 6, wherein the thickness of the third conductive layer is within a range from about one and a half times to about three times the thickness of the first conductive layer.
Claim 8 (Cl.8)
8[a] The display device of claim 5, wherein the thickness of the first conductive layer is in a range from about 50 angstroms to about 200 angstroms,
8[b] wherein the thickness of the second conductive layer is in a range from about 1000 angstroms to about 1800 angstroms, and
8[c] wherein the thickness of the third conductive layer is in a range from about 250 angstroms to about 350 angstroms.
Claim 9 (Cl.9)
9[a] The display device of claim 5, wherein each of the first conductive layer and the third conductive layer comprises titanium (Ti), and
9[b] wherein the second conductive layer comprises aluminum (Al).
Claim 10 (Cl.10)
10[pre] A display device comprising:
10[a] a display panel; and
10[b] a touch sensing unit on the display panel, the touch sensing unit comprising:
10[b][i] a first conductive pattern on the display panel;
10[b][ii] an insulating layer covering the first conductive pattern; and

10[b][iii] a second conductive pattern on the insulating layer, partially crossing the first conductive pattern, and having a thickness that is greater than a thickness of the first conductive pattern,
10[c] wherein the first conductive pattern comprises:
10[c][i] a first conductive layer on the display panel;
10[c][ii] a second conductive layer on the first conductive layer; and
10[c][iii] a third conductive layer on the second conductive layer, the second conductive layer having an electrical resistivity that is less than an electrical resistivity of the first and third conductive layers, and having a thickness that is greater than a thickness of the first conductive layer and a thickness of the third conductive layer, and
10[d] wherein the second conductive pattern comprises:
10[d][i] a fourth conductive layer on the insulating layer;
10[d][ii] a fifth conductive layer on the fourth conductive layer; and
10[d][iii] a sixth conductive layer on the fifth conductive layer, the fifth conductive layer having an electrical resistivity that is less than an electrical resistivity of the fourth and sixth conductive layers, and having a thickness that is greater than a thickness of the fourth conductive layer and a thickness of the sixth conductive layer.
Claim 11 (Cl.11)
11. The display device of claim 10, wherein the thickness of the second conductive layer is less than the thickness of the fifth conductive layer.
Claim 12 (Cl.12)
12. The display device of claim 10, wherein the thickness of the first conductive layer is less than the thickness of the fourth conductive layer.
Claim 13 (Cl.13)

13[a] The display device of claim 10, wherein the thickness of the fourth conductive layer is in a range from about 250 angstroms to about 350 angstroms,
13[b] wherein the thickness of the fifth conductive layer is in a range from about 2200 angstroms to about 2800 angstroms, and
13[c] wherein the thickness of the sixth conductive layer is in a range from about 250 angstroms to about 350 angstroms.
Claim 14 (Cl.14)
14[a] The display device of claim 10, wherein each of the fourth conductive layer and the sixth conductive layer comprises titanium (Ti), and
14[b] wherein the fifth conductive layer comprises aluminum (Al).
Claim 15 (Cl.15)
15. The display device of claim 1, wherein the first conductive pattern comprises second connection parts connecting the second touch sensor parts, and crossing the first connection parts.
Claim 16 (Cl.16)
16[a] The display device of claim 1, wherein each of the first touch sensor parts and the second touch sensor parts comprise a plurality of mesh lines defining a plurality of mesh holes, and
16[b] wherein the second connection parts cross the mesh lines of the first touch sensor parts and the mesh lines of the second touch sensor parts.
Claim 17 (Cl.17)
17. The display device of claim 16, wherein the second connection parts do not cross the first connection parts.
Claim 18 (Cl.18)
18[a] The display device of claim 1, wherein the insulating layer is provided with a contact hole defined therethrough, and

18[b] wherein the second connection parts connect the second touch sensor parts through the contact hole.
Claim 19 (Cl.19)
19[pre] The display device of claim 1, wherein the display panel comprises:
19[a] a base layer;
19[b] a circuit layer on the base layer;
19[c] an organic light emitting device layer on the circuit layer; and
19[d] a thin film encapsulation layer on the organic light emitting device layer.

BOE Technology Group Co., Ltd. (“BOE” or “Petitioner”) petitions for *inter partes* review (“IPR”) of claims 1-19 (“Challenged Claims”) of U.S. Patent No. 10,541,279 B2 (“’279 patent”; Ex-1001) issued to Samsung Display Co. Ltd.

Over the last two decades, touch-screen displays became ubiquitous as different display designers employ a series of well-trodden principles. First, a display technology is selected—such as liquid crystal display (LCD) with LCD pixels, plasma display, light-emitting diode (LED) display with LED pixels, and organic light emitting diode (OLED) display with OLED pixels—each having its known tradeoffs, with some mandatory features as well as several known design options. Next, a touch technology is chosen—such as those based on resistance, capacitance, or optics—each again having its known tradeoffs, with some mandatory features and several known design options. Then, the two are combined, whether by separately forming the display and touch panels and simply attaching them together, or integrating the various layers of each panel together.

The ’279 patent presents itself as a new touch-screen display, but its issued claims 1-19 are nothing more than known touch-sensing electrode structures of a capacitive touch panel, and merely embody a series of well-known design choices selected from known, available options serving the exact purposes for which they were intended in the display industry. Claims 1-19 are not inventions and are not patentable; their subject matter is instead the definition of obvious.

I. GROUNDS FOR STANDING

Petitioner certifies '279 patent is available for IPR, and Petitioner is not barred or estopped from requesting IPR. EX1011.

II. IDENTIFICATION OF CHALLENGE

A. Prior Art

Petitioner requests cancellation of claims 1-19 over the following prior art:

Chinese Patent No. CN203759670U (“Chen”); filed March 17, 2014; issued/published August 6, 2014; prior art under at least §102(a)(1)
U.S. Patent Application Publication No. 2014/0333855 (“Park”); filed May 8, 2014; published Nov. 13, 2014; prior art under at least §102(a)(1)
U.S. Patent Application Publication No. 2012/0105343 (“Lee-343”); filed May 26, 2011; published May 3, 2012; prior art under at least §102(a)(1)
U.S. Patent Application Publication No. 2015/0049030 (“Her”); filed Feb. 25, 2014; published Feb. 19, 2015; prior art under at least §102(a)(1);
Chinese Application No. CN105320372A (“Hsieh”); filed Sept. 23, 2014; published Feb. 10, 2016; prior art under at least §102(a)(1)
Japanese Patent No. JPH0646348B2 (“Kobayashi”); filed May 12, 1986, published June 15, 1994; prior art under at least §102(a)(1).

B. Grounds for Challenge

Grounds under 35 U.S.C. §103	Claims	Prior Art
1A	1, 3, 15, 18	Chen, with or without Hsieh and/or Kobayashi
1B	4-14	Combination of Chen and Park, with or without Hsieh and/or Kobayashi
1C	16-17	Combination of Chen and Lee-343, with or without Hsieh and/or Kobayashi
1D	2, 19	Combination of Chen and Her, with or without Hsieh and/or Kobayashi
2A	1-3, 15, 18-19	Her, with or without Hsieh and/or Kobayashi
2B	4-14	Combination of Her and Park, with or without Hsieh and/or Kobayashi
2C	16-17	Combination of Her and Lee-343, with or without Hsieh and/or Kobayashi
3	1-3, 15	Hsieh

III. '279 PATENT OVERVIEW

A. Technology Background

Touchscreen displays have two primary components: a display panel and a touch panel that can be formed separately and attached, or their component layers integrated together. Ex-1013, 15:54-63; Ex-1012, ¶2; Ex-1003, ¶¶31-32.

A display panel can be based on a variety of underlying technologies, including LCD, LED, OLED displays. Ex-1016, 1:19-28. Touch panels are based on

various sensing mechanism, e.g., capacitive and resistive touch sensing to sense user's touch, and selected in view of known tradeoffs. Ex-1016, 1:51-54; Ex-1017, 75-76; Ex-1018 at 193; Ex-1003, ¶33.

OLED displays—relying on diodes of organic material—have increased popularity over the past decade due to their superior (physical) flexibility and display properties. Ex-1018, 192-93; Ex-1039, 90, 92; Ex-1003, ¶¶33-36.

Capacitive touch sensors have similarly predominated for several decades and they measure changes in electrical fields when altered by conductive elements (e.g., human finger). Ex-1003, ¶¶37-38; Ex-1020, 1-2. These sensors typically have two sets of electrodes oriented in two perpendicular directions.

FIGURE 1: EXAMPLE SENSOR – FRONT VIEW

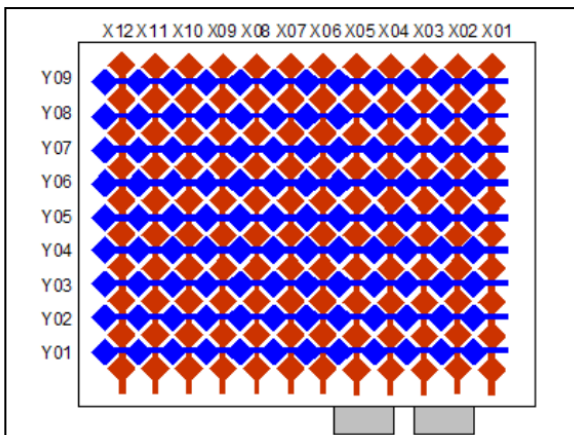
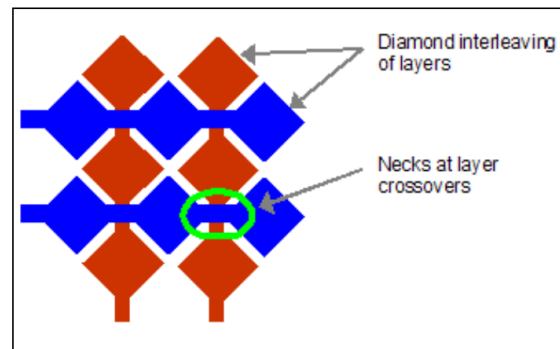


FIGURE 3: DIAMOND ELECTRODE PATTERN ALIGNMENT



Ex-1021, 1-2; Ex-2020, 1-2, Fig. 1, 3. Electrodes can be made from different materials, e.g., metal-mesh wires or (nearly) transparent metal oxides.

Figure 3-2. Common Electrode Shapes



Figure 3-3. Electrodes with 50 Percent Mesh Fills



Ex-1022, 3-2, 3-3 (p.22); Ex-1003, ¶¶39-40.

Rows/columns of touch-sensing electrodes must be physically separated from each other, by providing them either on different layers (with insulation in between), or on the same layer with “bridge” or “tunnel” connections where electrodes would otherwise intersect (like roads with overpass or underpass). Ex-1020, 1. When a capacitive touch panel is touched, individual row(s) and column(s) of sensors will respond to electric field changes, providing touch coordinates. Ex-1020, 2. Capacitive touch panels also include other layers, and largely differ in details, such as electrode’s materials, shapes, and arrangements on different conductive layers, depending on design considerations. Ex-1003, ¶¶39-49.

Before July 2016, the display industry had long established various designs for combining touch panels and display panels into touch-sensing display devices. One conventional approach uses integrated fabrication techniques to directly form layers and components of both display and touch panels on the same shared substrate.

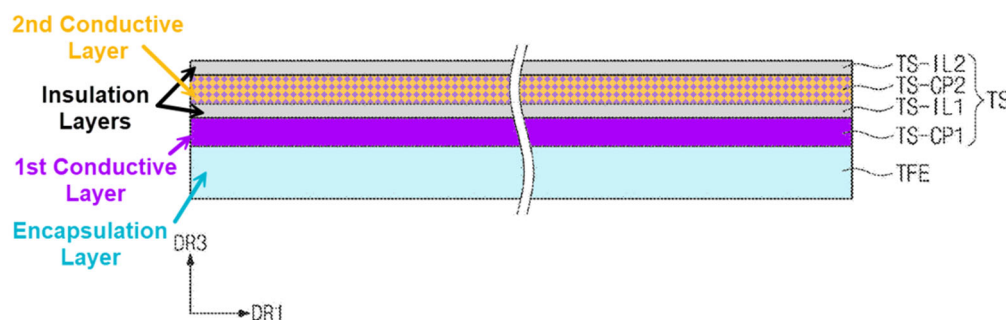
Ex-1054, ¶¶73-74, Figs. 3-5; Ex-1053, ¶¶105-07, 124, Fig. 5; Ex-1035, pp. 415-18, Fig. 6; Ex-1045, ¶¶49-57, Fig. 4; Ex-1003, ¶¶50-55.

B. The '279 Patent

The '279 patent was filed July 26, 2017 and issued January 21, 2020, and claims priority to Korean patent application filed July 29, 2016. Ex-1001, Cover. Effective filing date of each Challenged Claim can be no earlier than July 29, 2016. Ex-1003, ¶¶56-57, 68-71.

The '279 patent is directed to “touch-sensing unit” for OLED display panels. Ex-1001, Abstract. Touch-sensing unit (TS) formed on top layer of OLED display panels—or “encapsulation layer” of display panels—includes two conductive layers with insulation in between (Fig. 8A below). Ex-1001, 8:23-32, 11:22-32, 15:25-17:39, Figs. 6C, 8A-8E; Ex-1003, ¶¶58-59.

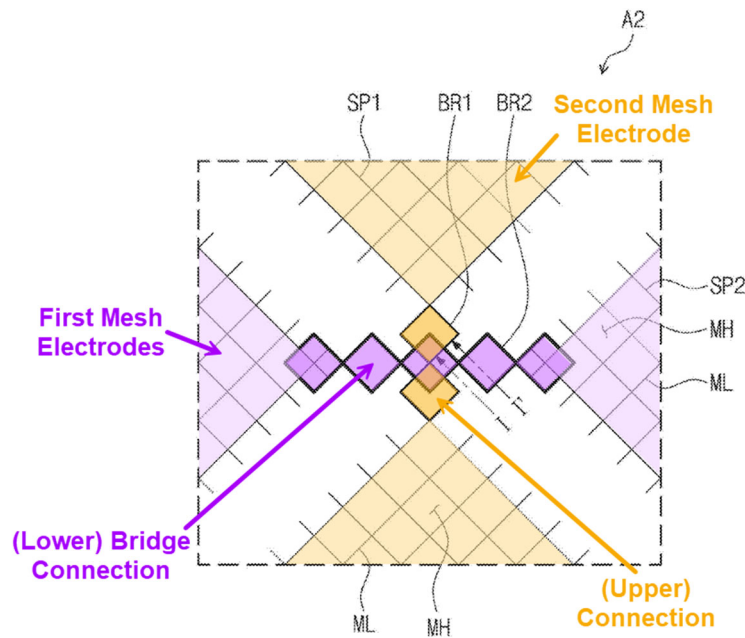
FIG. 8A



Touch-sensing unit has two sets of electrodes (TE1/TE2) oriented in different directions (DR1/DR2), and includes two conductive layers (TS-CP1/TS-CP2). Ex-

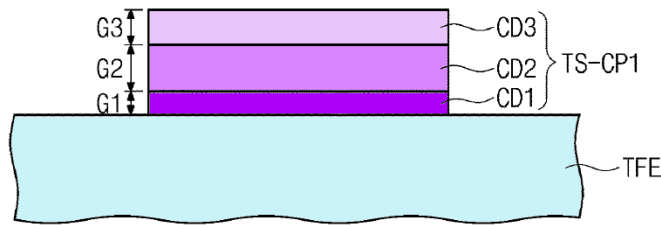
1001, 15:31-49, 16:16-44. Top conductive layer (TS-CP2) hosts metal-mesh touch sensors for both electrodes (SP1/SP2), and “connection parts” (BR1) for first touch sensors (SP1). Ex-1001, 16:61-17:14. Bottom conductive layer (TS-CP1) hosts an underpass-type bridge (BR2) to connect second touch sensors (SP2) to keep first and second electrodes electrically separated. Ex-1001, 16:61-17:14; Ex-1003, ¶¶60-64. Annotated Figure 9 shows the intersection of first and second electrodes (where BR2 is on a lower layer):

FIG. 9



Each conductive layer has a multi-layer structure with three layers of material having different thicknesses. Ex-1001, 20:13-21:40; Ex-1003, ¶¶65-66. The middle layer provides superior electrical conductivity and top and bottom layers protect the middle conductive layer. *Id.*

FIG. 15



Prior art evidence in this Petition demonstrates that touch-sensing display devices disclosed in '279 patent are nothing more than routine, known or predictable combinations of various industry's conventional and known components, layers and structures of touch panels and display panels. Ex-1003, ¶¶67, 113, 541-42.

IV. LEVEL OF SKILL IN THE ART

As of July 2016, a person of ordinary skilled in the art ("POSITA") would have had a Bachelor's degree in electrical engineering, physics, materials science, or a related field, and four years of experience in development, design or manufacturing of semiconductor devices and/or display devices or equivalent work experience. Additional education towards an advanced degree could substitute for work experience, and vice versa. Ex-1003, ¶¶1-30, 110-12.

V. DETAILED EXPLANATION OF GROUNDS

A. Ground 1A-Claims 1, 3, 15, 18: Chen with or without Hsieh and/or Kobayashi.

Claims 1, 3, 15, 18 are obvious in view of (1) Chen, and (2) Chen in view of Hsieh and/or Kobayashi. Ex-1003, ¶¶140, 148-49, 157.

1. Prior Art

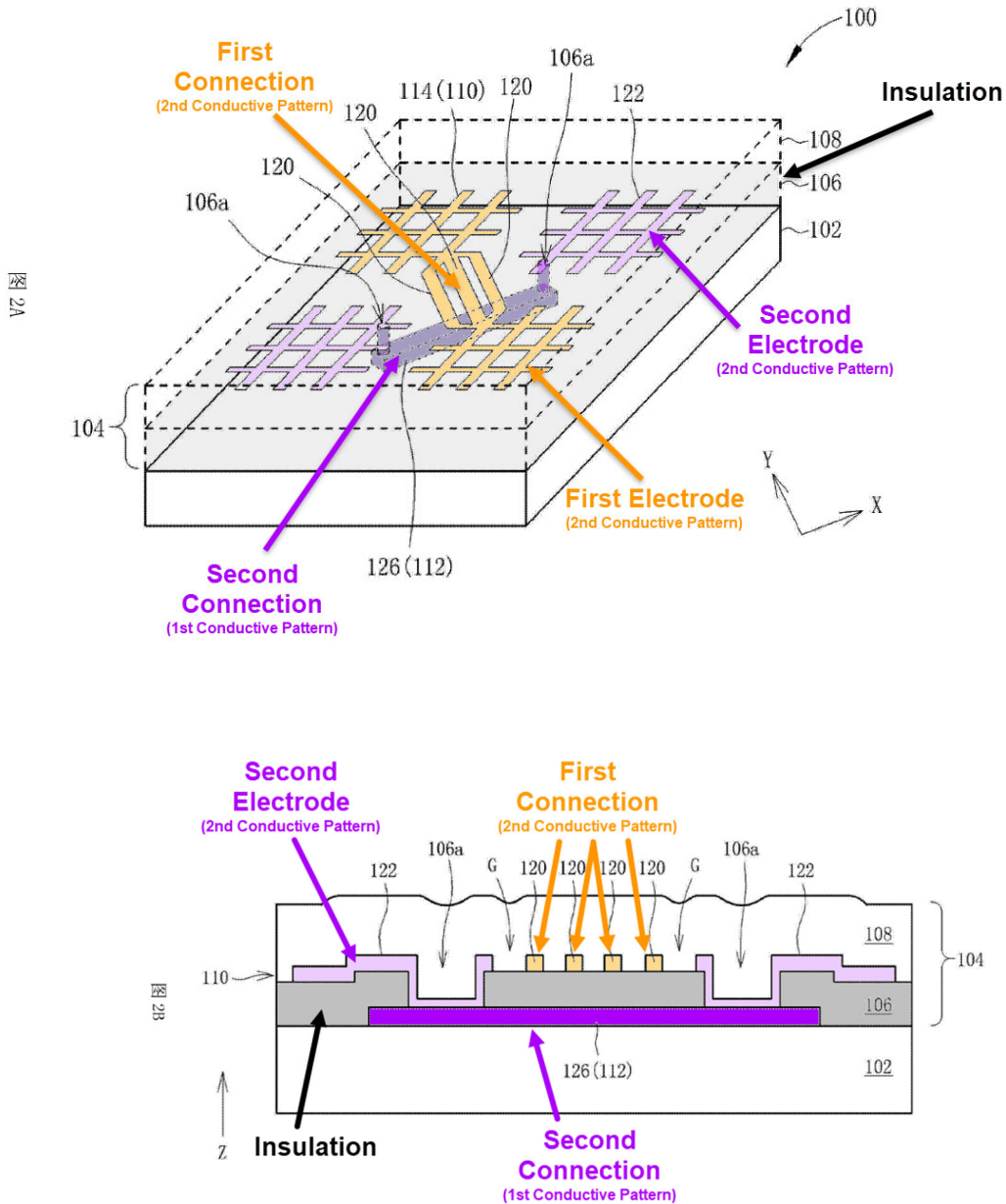
a. Chen

Chen was filed March 17, 2014 and issued/published August 6, 2014. Ex-1005, Cover. Chen constitutes prior art under at least §102(a)(1).

Chen discloses touch panels for displays, such as LCD/OLED displays. Ex-1005, Abstract, ¶74. Chen teaches several touch-panel embodiments, including a first embodiment where two conductive-pattern layers(110/112) of a touch panel are separated by insulating layer (106) formed on transparent substrate (102). Ex-1005, Abstract, ¶¶6-7, 64-66, Figs. 1-4B. The “second”/upper conductive-pattern layer (110) includes (1) all touch sensor parts, i.e., first and second touch sensor parts in form of two sets of metal-mesh electrodes(114/122) respectively oriented in perpendicular directions, and (2) “second” connections (126) as first connection parts for connecting first touch sensor parts (i.e., second set of electrodes (122)). *Id.*, ¶¶14, 66-67, Figs. 2A-2B. To connect first touch sensor parts (i.e., first set of electrodes (114)), second connection parts in form of first connections (120) are provided in “second”/upper conductive-pattern layer(110) separate from

“first”/lower conductive-pattern layer (i.e., second conductive pattern layer 112). *Id.*, ¶¶66-67, Figs. 2A-2B.¹ In other words, Chen teaches “first”/lower conductive-pattern layer (112) being underneath first touch sensor parts (i.e., first set of electrodes(114)) to implement an underpass-type bridge arrangement by bypassing and crossing the “second” connections (126) for the first connection parts. The ’279 patent’s touch-sensor electrode design with two different conductive layers mimics Chen’s design. Ex-1003, ¶¶72-76.

¹ Chen reverses the labels it applies to first and second conductive patterns from that used in ’279 patent. Specifically, ’279 patent calls lower layer the “first” conductive pattern, and upper layer the “second” conductive pattern. Ex-1001, 15:31-53, Fig. 8A. This Petition uses “first” conductive pattern for the lower layer, and the “second” conductive pattern for the upper layer, consistent with ’279 patent.



Ex-1005, Fig. 2A-2B (annotated).

2. Cl.1

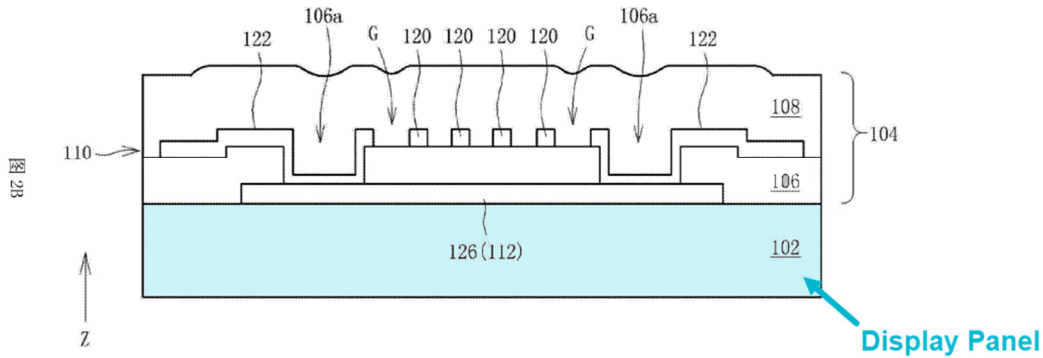
a. 1[pre]

Chen discloses a touch panel for displays, and specifically LCD/OLED displays. Ex-1005, Abstract, ¶74, Fig. 7. Particularly in first through third

embodiments(Figs. 1-6) Chen repeatedly states that touch panel is formed on a transparent “substrate” (Ex-1005, ¶¶64-65, 68, Figs. 1-6), and uses “substrate” as a generic term for some layer of a display because substrate 102 can be either rigid or flexible and formed of broad ranges of structures, including transparent glass, transparent plastic, or PET film. Ex-1005, ¶64. POSITA would have known that Chen’s touch-sensing panel in Figures 1-6 can be implemented with display panels of well-known configurations (e.g., on-cell or display below substrate 102) because Chen does not limit touch-panel/display-panel configuration in Figs. 1-6 and touch-sensing electrodes being formed on transparent glass/plastic layers of display panels (e.g., filters or encapsulation). Ex-1003, ¶¶114-16; §III.A(Technology Background). Therefore, Chen discloses or renders obvious a touch-panel display device. Ex-1003, ¶117.

b. 1[a]

Chen’s touch panel’s substrate (102) can be transparent glass, transparent plastic, or PET film. Ex-1005, ¶¶64-65, 68, Figs. 1-6. POSITA would have understood that substrate (102) as a generic term for some layer of a display, which includes a layer of display panel or an entire display panel, or that the display can be located below substrate 102. Ex-1003, ¶¶118-19; §§III.A, V.A.2.a.



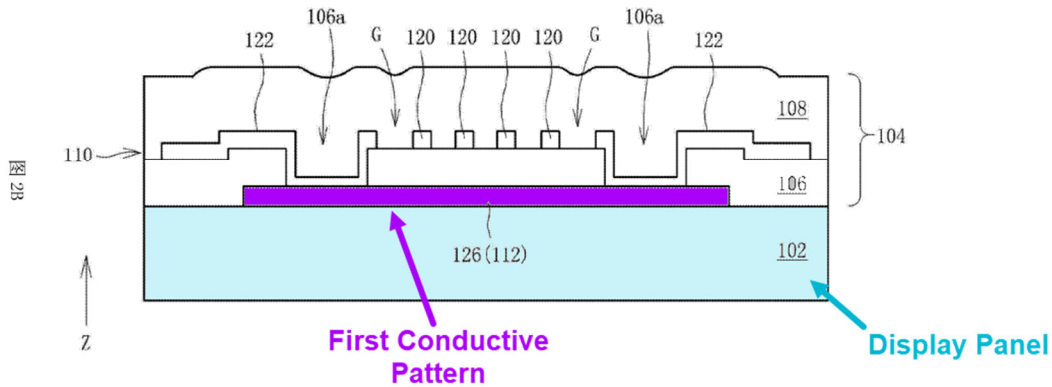
Ex-1005, Fig. 2B (annotated).

c. 1[b]

Chen’s discloses or renders obvious “touch sensing component” (104) on substrate (102). Ex-1005, ¶¶64-65, Figs. 2A-2B, 3; Ex-1003, ¶¶120-21; §V.A.2.b (1[a]) (explaining substrate(102) as a generic term and may include a display panel or on a display).

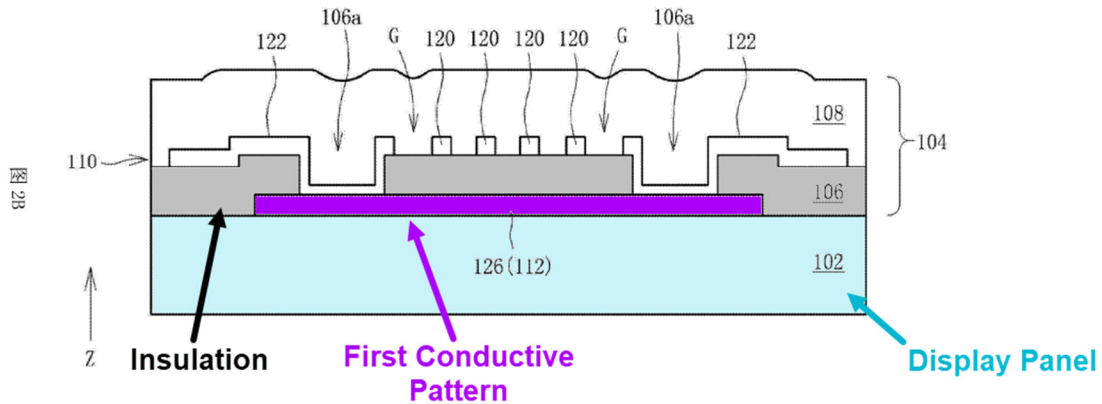
d. 1[c]

Chen discloses or renders obvious “*first conductive pattern*” by “second conductive pattern layer 112” which is on “th[e] side of the transparent substrate” and therefore is on the display panel. Ex-1005, ¶¶64-66, Figs. 1-9; §§III.A, V.A.2.a-V.A.2.c; Ex-1003, ¶¶122-23.



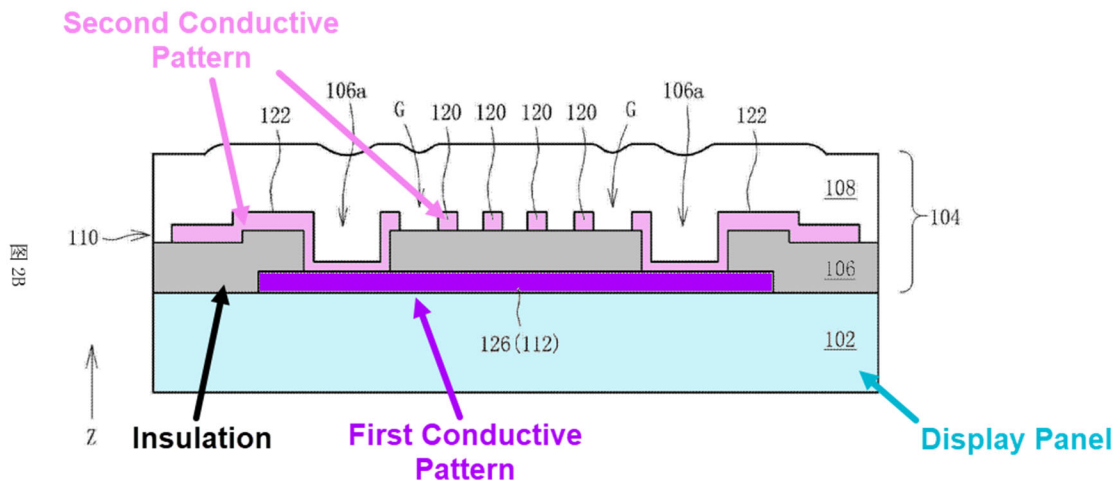
e. 1[d]

Chen discloses “insulating layer” by “first insulating layer 106 [that] covers th[e] side of the transparent substrate 102 and the second conductive pattern layer 112.” Ex-1005, ¶64; *id.*, ¶¶67-68, Figs. 2A-2B, 3; Ex-1003, ¶¶124-25.

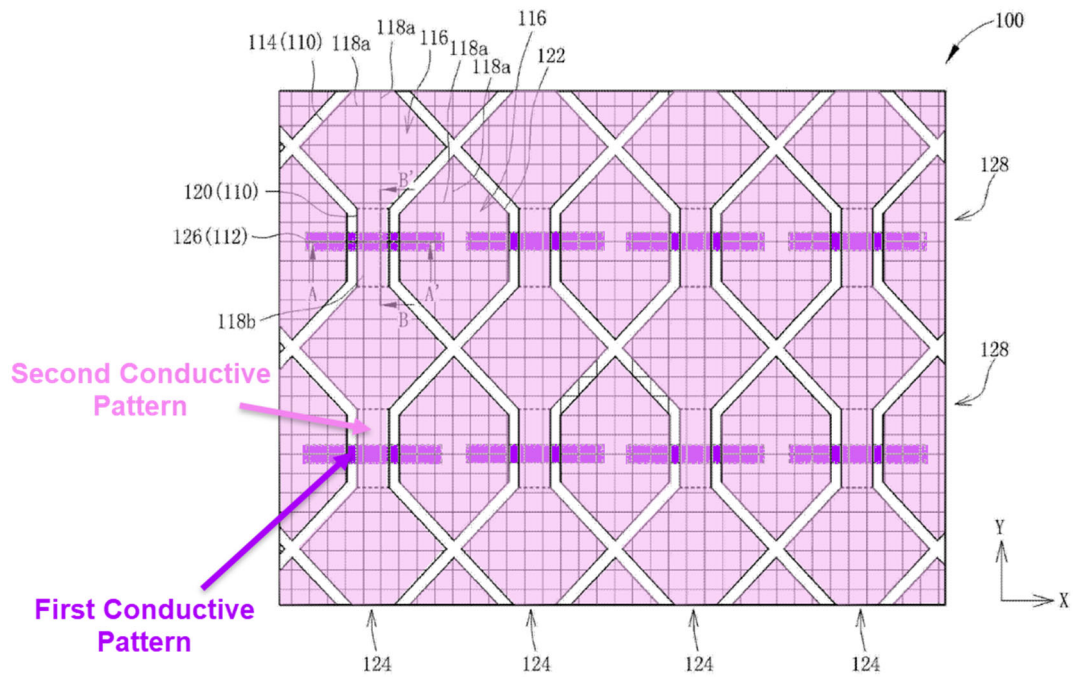
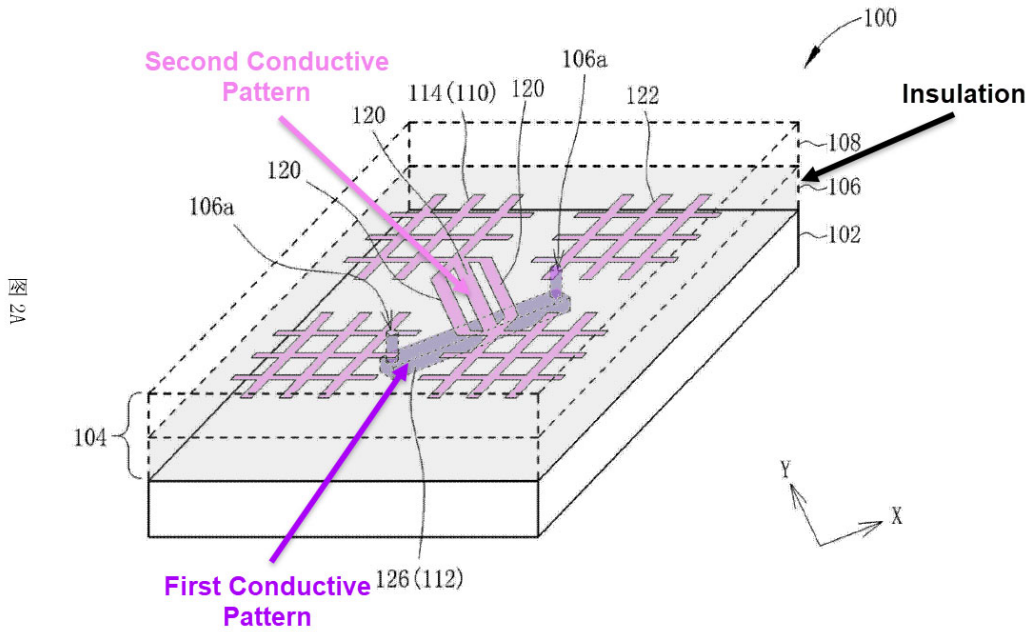


f. 1[e]

Chen’s “first conductive pattern layer 110” teaches “*second conductive pattern*” and is on first insulating layer 106 corresponding to the claimed insulating layer. Ex-1005, ¶64; *id.*, ¶¶65-66, Figs. 1, 2A-2B, 3; Ex-1003, ¶¶126-27.

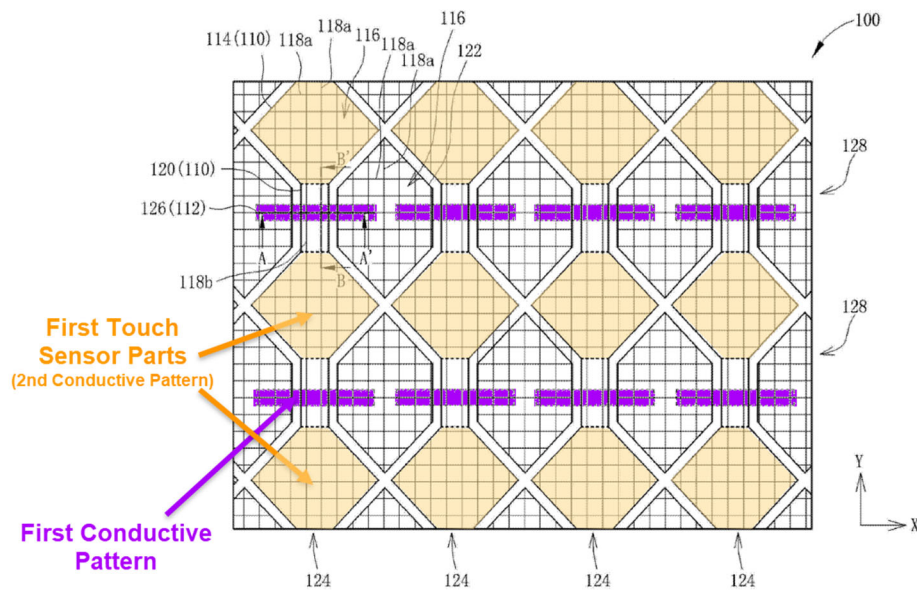


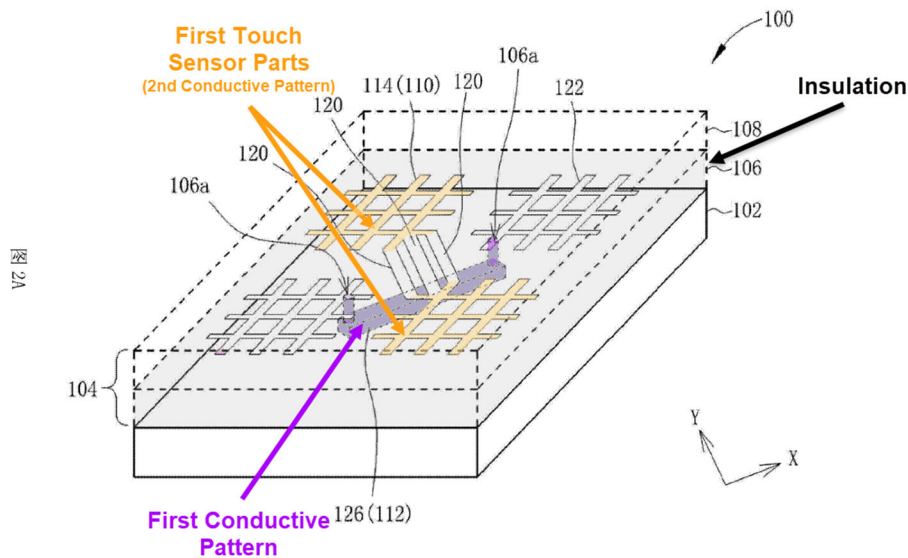
The “first” conductive pattern layer (110) partially crosses “second” conductive pattern layer (112), (Ex-1005, Fig. 1, 2A-2B), which is consistent with conventional touch-sensor panels having two sets of electrodes each running in one direction that must partially cross each other where two sets of electrodes(or their connections) intersect(Ex-1003, ¶128).



g. 1[e][i]

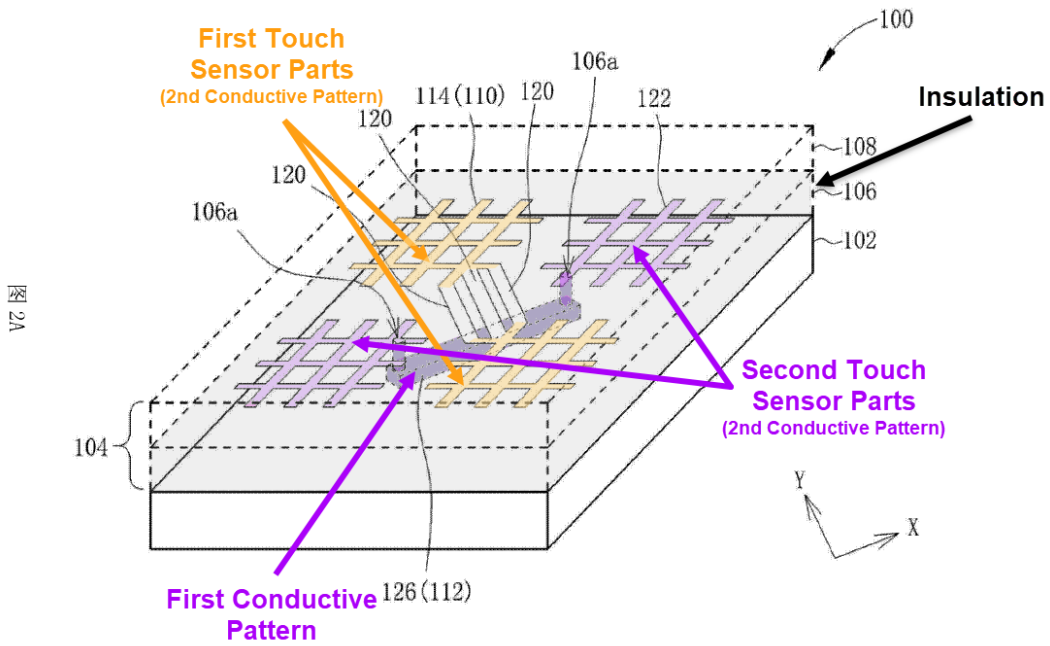
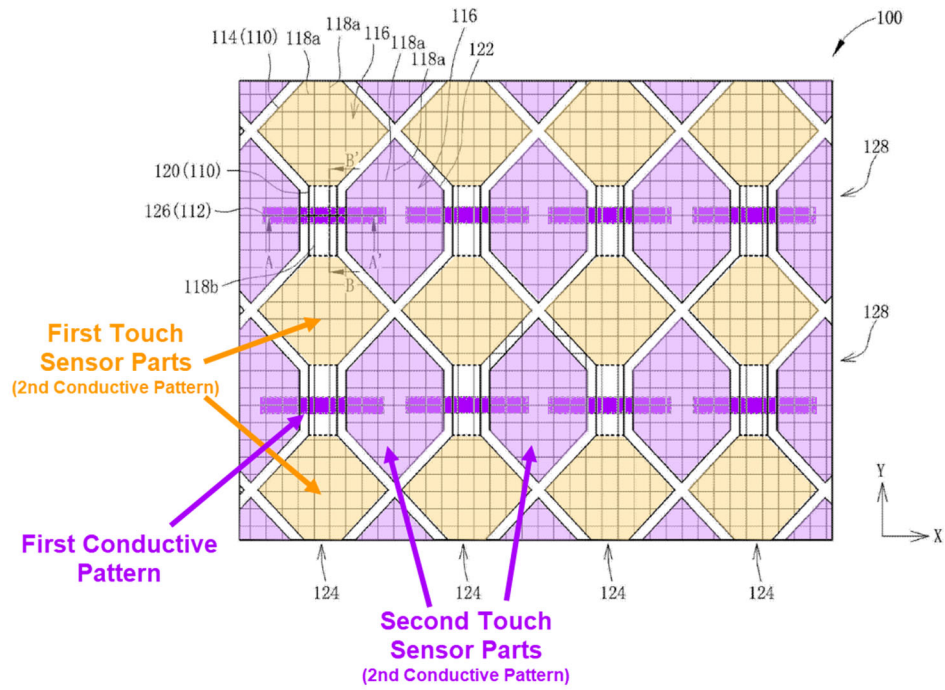
Touch sensing component's (104) "first conductive pattern layer 110 includes multiple first electrodes 114." Ex-1005, ¶¶66-67, Figs. 1, 2A-2B, 3. POSITA would have understood that, consistent with convention, first electrodes (114) are touch-sensor parts for sensing a user's touch and thus correspond to "*first touch sensor parts*." Ex-1003, ¶¶129-30.





h. 1[e][ii]

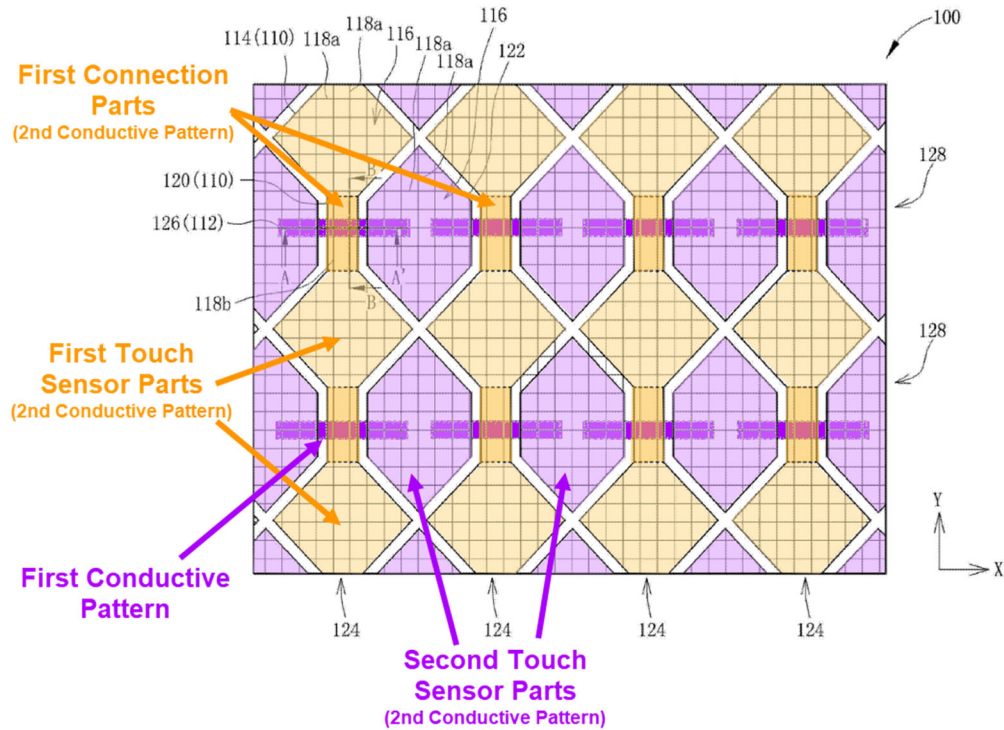
Touch sensing component's (104) "first conductive pattern layer 110 further includes ... a plurality of second electrodes 122." Ex-1005, ¶¶66-67, Figs. 1-3. Chen explains that first and second electrodes 114/122 do not overlap (Ex-1005, ¶66), such that they are spaced from one another. Consistent with convention, second electrodes (122) are touch-sensor parts for sensing user's touch. Ex-1003, ¶¶131-32.

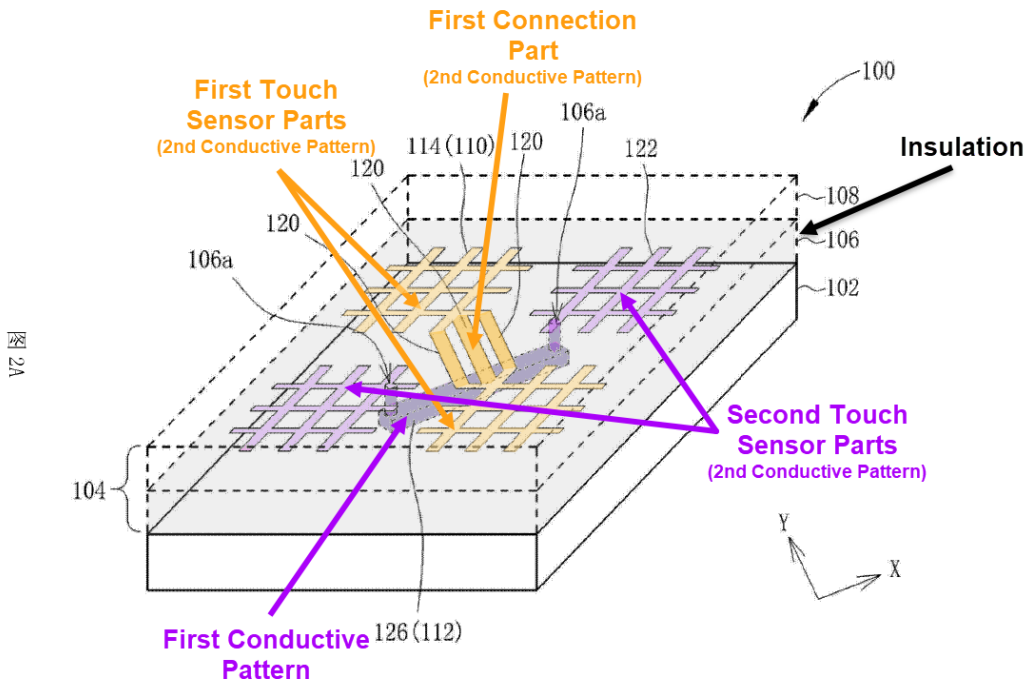


i. 1[e][iii]

Chen discloses 1[e][iii] by its first connecting electrodes 120.

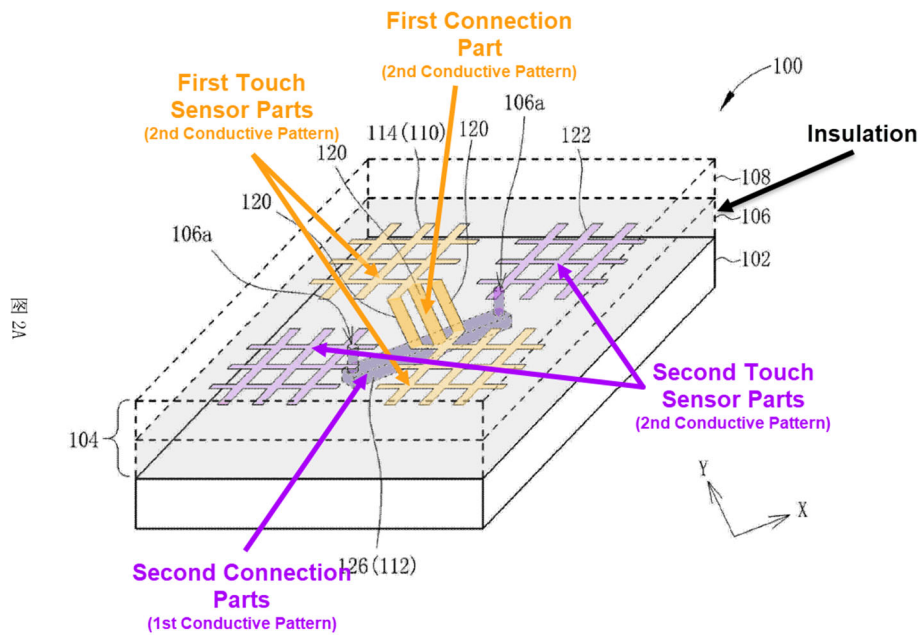
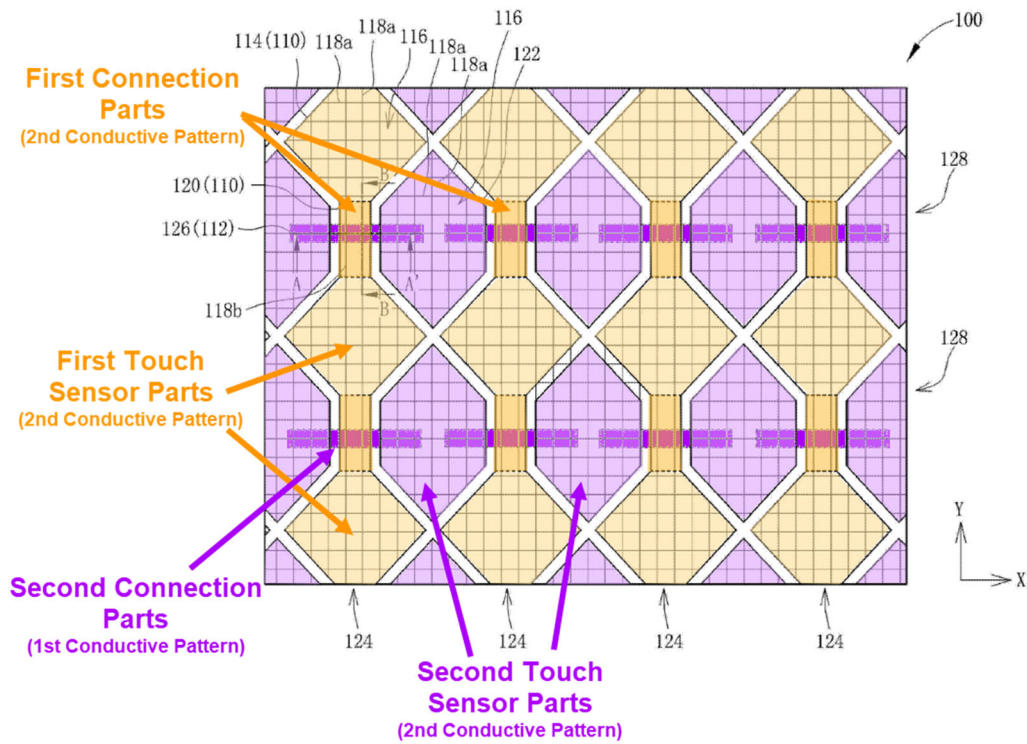
First conductive pattern layer 110 includes first connecting electrodes 120 for electrically connecting “two adjacent first electrodes 114 to form a first electrode series 124” extending along the y-direction. Ex-1005, ¶¶66-67, Figs. 1, 2A-2B, 3; Ex-1003, ¶¶133-34.





j. 1[f]

Chen's second conductive pattern layer 112 includes second connection electrodes 126 electrically connecting two adjacent second electrodes 122 "to form the second electrode series 128" extending along the x-direction. Ex-1005, ¶67, Figs. 1, 2A-2B, 3; Ex-1003, ¶¶135-36.



k. 1[g]

Chen, with or without Hsieh and/or Kobayashi, teaches or suggests 1[g].

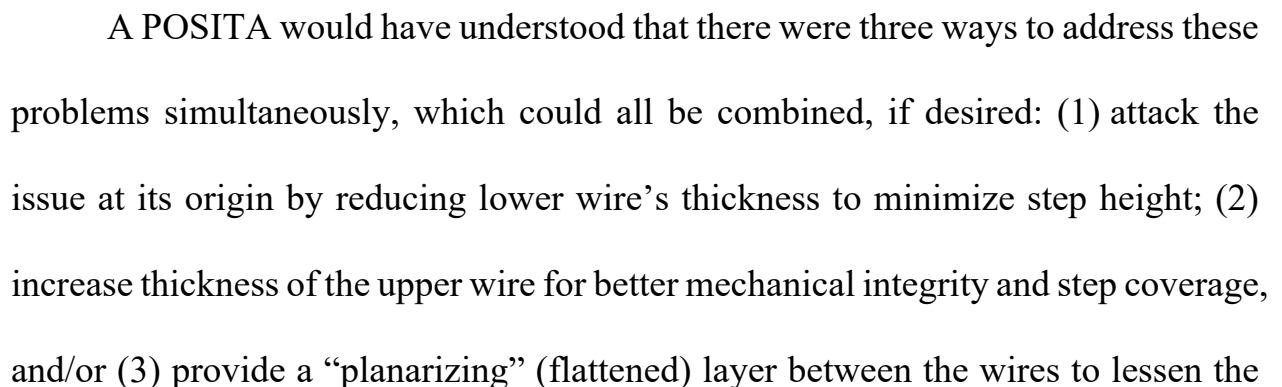
Chen discloses that “the thickness of the second conductive pattern layer 112” (or “*first conductive pattern*,” as claimed) “***may be approximately*** the same as that of the first conductive pattern layer” (or “*second conductive pattern*,” as claimed). Ex-1005, ¶68 (emphasis added).

Although Chen does not expressly disclose that second conductive pattern having thickness greater than first conductive pattern, this arrangement would have been an obvious design choice based on several known considerations. Ex-1003, ¶¶137-39.

First, it was known that relative thicknesses of each conductive layer in a touch panel is a design choice with only three possible options: first/bottom conductive pattern could be thinner than, thicker than, or the same thickness as second/top conductive pattern. For instance, Hsieh teaches a touch-sensor panel formed from two conductive layers C1(top) and C2(bottom) and expressly discloses that “the thickness of the first conductive layer C1 can be greater than the thickness of the second conductive layer C2.... In another embodiment, the thickness of the first conductive layer C1 can also be smaller than the thickness of the second conductive layer C2.” Ex-1009, ¶¶72-73. Selecting any of these options, consistent with Hsieh, would have been obvious. Ex-1003, ¶¶140-41; *Toshiba Samsung Storage Tech. Korea Corp. v. LG Elecs., Inc.*, IPR2014-00204, Paper 31, 29 (Mar. 31, 2015) (“there are only three possibilities for the first mode PSA size relative to

the second mode PSA size: equal, greater, or less. Choosing one knowing another is an obvious design choice with very predictable results”, citing *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 421(2007)); *In re Troiel*, 274 F.2d 944, 949 (C.C.P.A. 1960) (“the mere change of the relative size of the co-acting members of a known combination will not endow an otherwise unpatentable combination with patentability”).

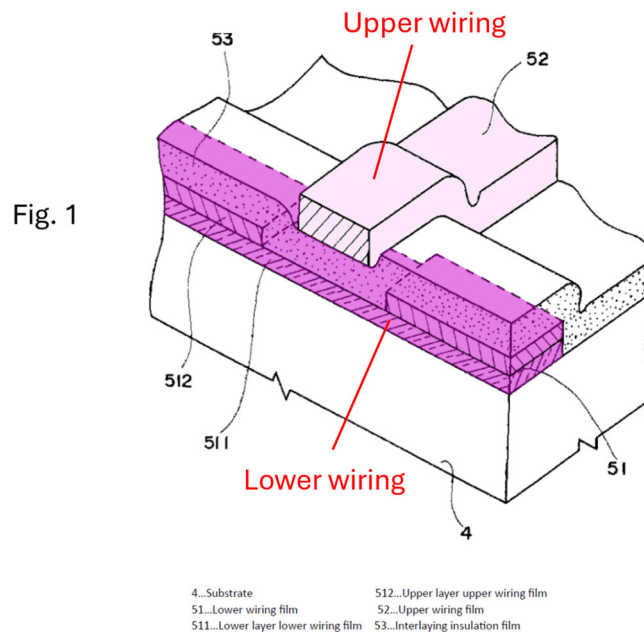
Second, when bridges are formed as first conductive patterns (consistent with Chen, §V.A.2.d (1[c])), POSITA would have been motivated to reduce bridge thickness relative to touch-sensor parts and connection parts formed as part of the second conductive pattern to reduce undesired effects caused by the bridge’s step size. Ex-1003, ¶142. When multiple material layers are formed on top of each other, thicknesses of components in lower layers create an undesired “step” that propagates to upper layers. Ex-1003, ¶143. POSITA would have also known that when two wires (like Chen’s bridge and first connection parts) cross each other on different material layers and are separated by insulation, steps at crossing locations create at least three problems: (1) inducing disconnections in the upper wire; (2) thinning of the upper wire from deposition that increases resistance and load; and (3) cracking intervening insulation due to stress concentrations at the step. Ex-1003, ¶¶144-45; Ex-1010, Fig. 2A, 2-4, Fig. 5 (the upper conductive layer is thicker than the lower conductive layer (e.g., 500nm>320nm) to reduce disconnections); Ex-1027



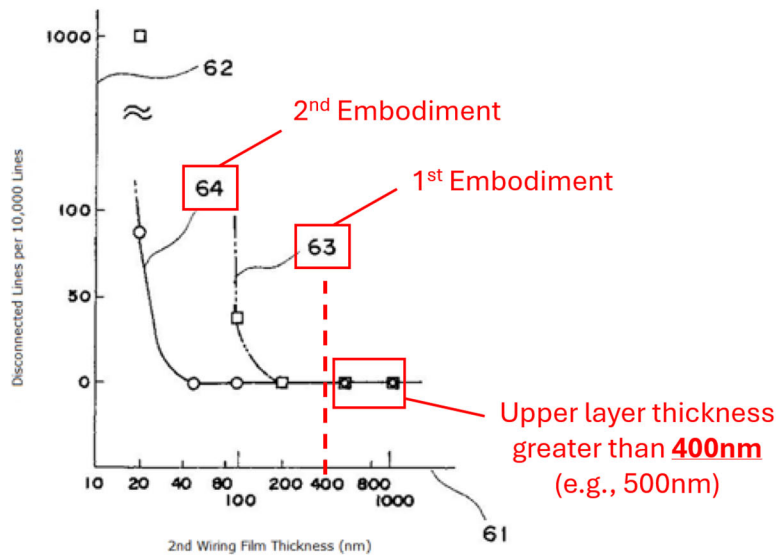
step the upper wire would be exposed to, with a sufficient thickness on top of the lower wire to avoid cracking in the insulation. Ex-1003, ¶146.

Chen, recognizes this issue and teaches “first insulating layer 106 has a flattening effect” and thickness to “reduc[e] the chance of wire disconnections.” Ex-1005, ¶68; Ex-1058, ¶52 and FIG. 6(limiting step size caused by bridge); Ex-1003, ¶147.

Kobayashi, for instance, expressly teaches two embodiments (Fig. 5, curves 63-64) both disclosing two intersecting conductive layers (like Chen’s touch-sensor connections) where upper conductive layers’ thickness(e.g., 500nm) are greater than lower conductive layers’ (e.g., 320nm) at the intersection to reduce the risk of disconnections in the upper conductive layer. Ex-1010, 2-5, Figs. 1-5; Ex-1003, ¶¶148-49.



[FIG. 5]



A POSITA would have therefore reduced Chen's bridge thickness to reduce step size, increase thickness of the touch-sensor parts and connection parts to minimize effects of the bridge's step, or both, producing a thinner first conductive layer than the second.

Additionally, POSITA would have understood that electrical resistance and mechanical stress of sensors are functions of the sensor's cross-sectional areas; increasing cross-sectional areas reduces electrical resistance and improve mechanical strength. POSITA would have understood, however, that when the sensor is an opaque metal material like Chen's touch sensors(Ex-1005, ¶¶29-31, 64, 66-67), the width should be constrained to gap sizes between adjacent light-emitting

areas; otherwise, some light emitted by underlying pixels will be blocked, reducing the display's brightness. The sensor's thickness provided more options for controlling cross-sectional areas than its width. Ex-1003, ¶¶149-55.

A POSITA would have been motivated to make touch sensors thicker than the bridge to make touch sensors more resilient to bending (since they would experience more force than the bridges), to maintain low resistance over a longer electrical connection, and, if desired, to match resistance between touch sensors and the bridge to maximize power transfers . Ex-1003, ¶156.

At base, selecting relative thicknesses of first and second conductive patterns was an obvious design choice with limited number of options, but POSITA would have been motivated to make, and had reasonable expectations of making, the second (upper) conductive pattern (e.g., Chen's touch-sensor parts and first connection parts) greater in thickness than the first (lower) conductive pattern (e.g., Chen's bridge), for reasons taught by Kobayashi and others in the art, which merely required controlling thicknesses of each layer. Ex-1003, ¶157.

3. Cl.3

Chen discloses Cl.3 because thickness of “second conductive pattern layer 112” (or “*first conductive pattern*,” as claimed) is smaller “than the thickness of the first insulating layer 106.” Ex-1005, ¶68; Ex-1003, ¶¶158-59.

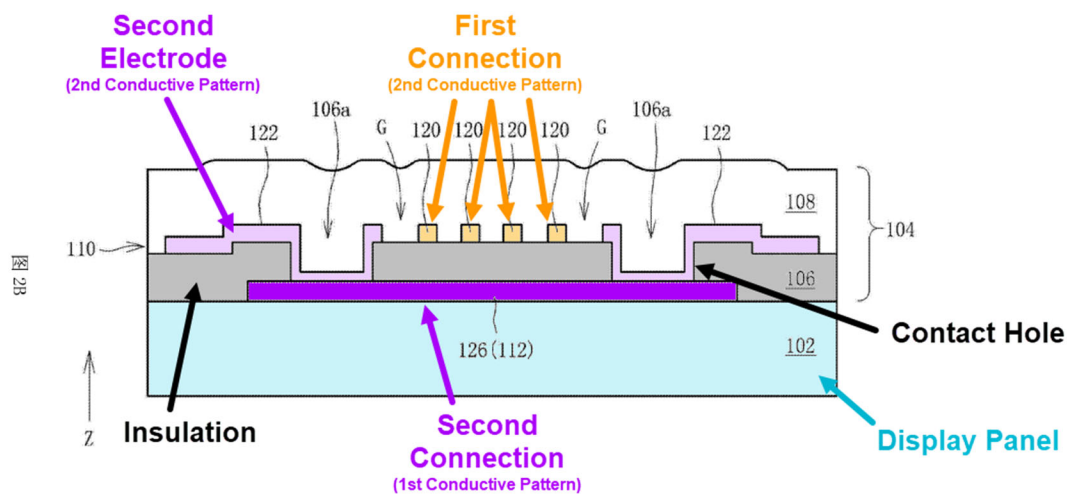
4. Cl.15

Chen discloses Claim 15. §§V.A.2.f (1[e]), V.A.2.j (1[f]); Ex-1003, ¶160.

5. Cl.18

a. 18[a]

Chen discloses 18[a]: contact holes 106a extend through first insulating layer 106. Ex-1005, ¶¶67-68, Figs. 2A-2B, 3; Ex-1003, ¶¶161-62.



b. 18[b]

Chen discloses 18[b]: second connection electrode 126 electrically connects to second electrode 122 through contact holes 106a. Ex-1005, ¶¶66-67, Figs. 1-3; Ex-1003, ¶¶163-64.

B. Ground 1B-Claims 4-14: Chen and Park, with or without Hsieh and/or Kobayashi.

Claims 4-14 are obvious in view of (1) Chen and Park, and (2) Chen and Park in further view of Hsieh and/or Kobayashi.

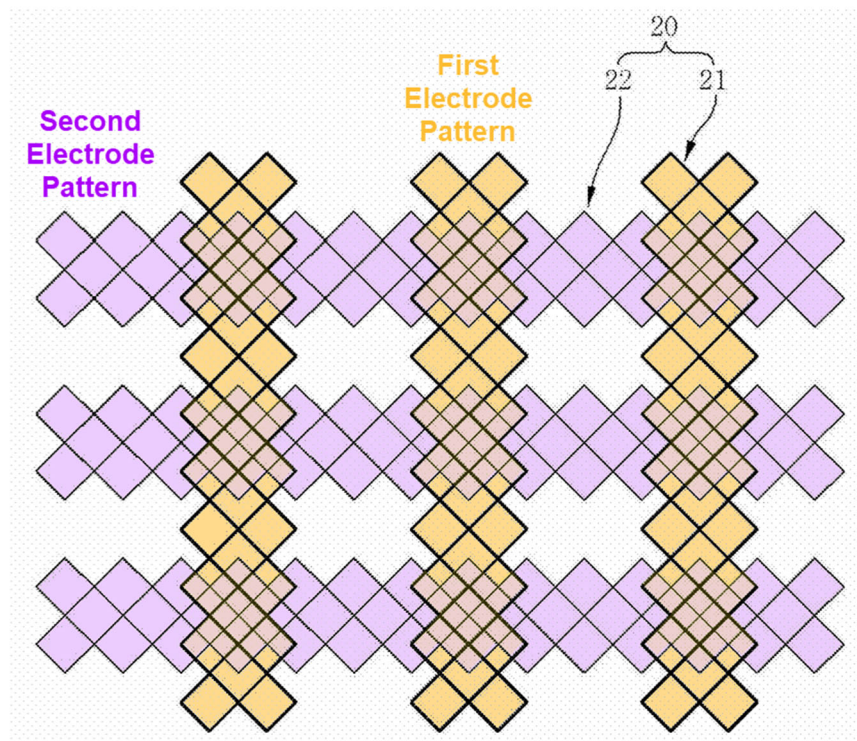
1. Prior Art

a. Park

Park was filed May 8, 2014 and published Nov. 13, 2014. Ex-1006, Cover. Park constitutes prior art under at least §102(a)(1).

Park teaches a touch panel for displays(including OLED displays) that includes two sets of electrodes extending in different directions. Ex-1006, Abstract, ¶¶3-64, 66-67, 70, Figs. 1, 4, 5; Ex-1003, ¶¶88-90.

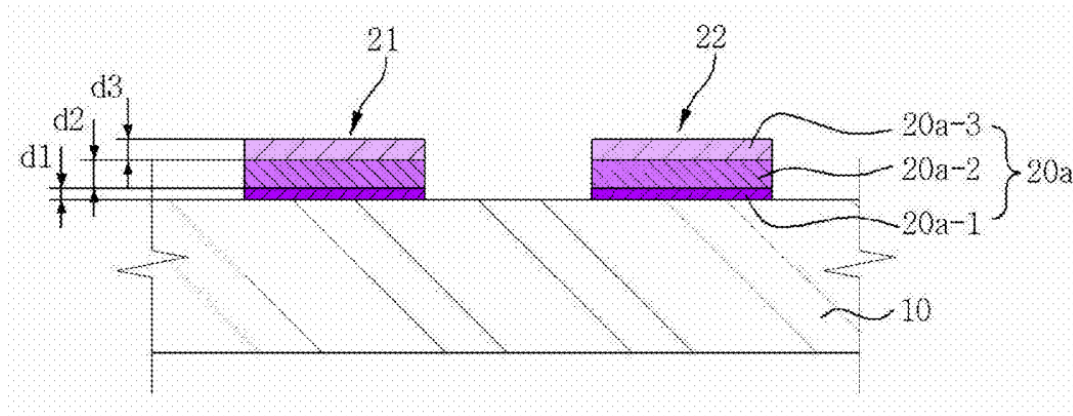
FIG. 1



Touch panel's electrode patterns include multiple layers of different material (e.g., base layer (20a-1), conductive layer (20a-2), and surface layer (20a-3)), in which the materials balance anti-corrosive properties of the sensors, their optical

visibility, electrical performance, and adhesion to display panels. Ex-1006, Abstract, ¶¶7, 11-17, 49-50, 68, 80-81, 84, 100, 107, Fig. 6, Table 1; Ex-1003, ¶¶91-95.

FIG. 6



First layer (20a-1) improves adhesion of conductive layer to underlying substrate(*id.*, ¶84), second layer (20a-2) provides good electrical conductivity (*id.*, ¶¶91, 98, 101), and third layer (20a-3) provides improved anti-corrosion and/or optical properties(*id.*, ¶84; Ex-1003, ¶¶96-97). Park also provides exemplary combinations of materials(Ex-1006, Table 1):

TABLE 1

Series No.	Electrode Material					
	Base layer (first electrode layer)	Composition (wt %)	Conductive layer (second electrode layer)	Composition (wt %)	Surface layer (third electrode layer)	Composition (wt %)
Example 1	CuNi	Ni (10 to 90) Ni (20 to 70)	Cu	98 to 100	CuNi	Ni (10 to 90) Ni (20 to 70)
Example 2	NiCr	Cr (5 to 70) Cr (3 to 50)	Cu	98 to 100	NiCr	Cr (5 to 70) Cr (3 to 50)
Example 3	Ti		Cu	98 to 100	Ti	
Example 4	Mo		Cu	98 to 100	Mo	
Example 5	CuNi	Ni (10 to 90) Ni (20 to 70)	Al	98 to 100	CuNi	Ni (10 to 90) Ni (20 to 70)
Example 6	NiCr	Cr (5 to 70) Cr (3 to 50)	Al	98 to 100	NiCr	Cr (5 to 70) Cr (3 to 50)
Example 7	Ti		Al	98 to 100	Ti	
Example 8	Mo		Al	98 to 100	Mo	
Example 9	CuNi	Ni (10 to 90) Ni (20 to 70)	Ag	80 to 97	CuNi	Ni (10 to 90) Ni (20 to 70)
Example 10	NiCr	Cr (5 to 70) Cr (3 to 50)	Ag	80 to 97	NiCr	Cr (5 to 70) Cr (3 to 50)
Example 11	Ti		Ag	80 to 97	Ti	
Example 12	Mo		Ag	80 to 97	Mo	

b. Prior Art Details

Chen's touch sensors are made of a variety of materials, including metals, metal oxides, or "metal composite layers" of different stacked materials. Ex-1005, ¶67. Although Chen provides some guidance as to thicknesses of conductive and insulating layers, they are non-exhaustive. Ex-1005, ¶68; Ex-1003, ¶¶165-66. Because Chen largely leaves selections of material layers and their thicknesses open for modification, and a variety of different materials and material thicknesses were known to be suitable for touch sensors, POSITA would have been motivated to look

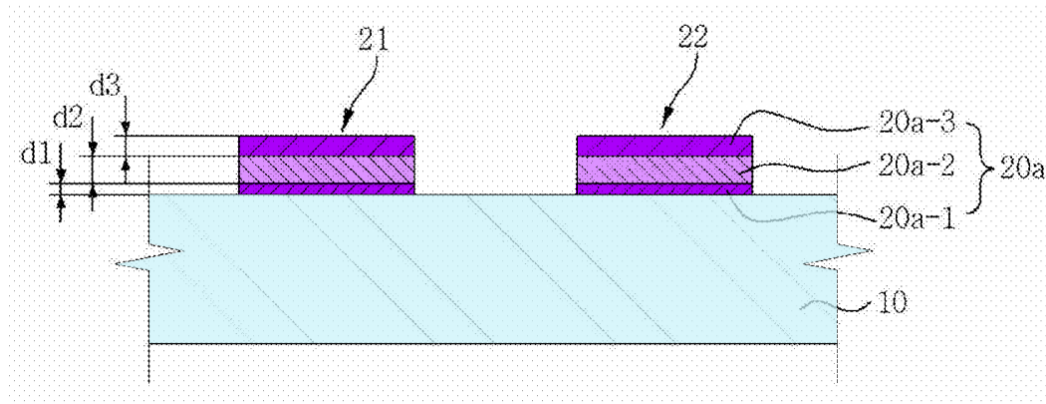
to other prior art for additional details concerning possible materials and thicknesses that could be used to form conductive layers of touch sensors.

A POSITA would have turned to Park, which provides extensive detail not only concerning available material options for touch-sensor conductive layers, but also thicknesses of the material layers and formation process for touch sensors. Ex-1006, ¶¶40-45, 72-80, 83-93, 96-104, Table 1. Specifically, POSITA would have been motivated to select from any of Park's materials and thicknesses when looking for additional details to form conductive layers for Chen's touch sensors. Ex-1003, ¶167.

A POSITA would have known that material(s) selected for conductive layers impact at least two properties of the touch sensor: resistance (because each material has a different, inherent resistivity) and mechanical strength (because each material has a different, inherent, e.g., Young's modulus). Ex-1003, ¶168; Ex-1063, 14:10-24; Ex-1064, ¶¶19-21, 25-26, Figs. 2, 10. Chen also discloses using a multilayered sandwich structure of different materials(Ex-1005, ¶67), and Park teaches such sandwich structures allow for greater control of the adhesion, conductivity, opacity, and anti-corrosion properties of the sensor(Ex-1006, Abstract, ¶¶11-13, 48-49, 84, 96-98). Since both Chen and Park use the same stacked conductive layers formed of molybdenum-aluminum-molybdenum, POSITA would have recognized that Chen is primed for improvement using Park's teaching, such as thicknesses of each layer

of the stack. Ex-1005, ¶67; Ex-1006, Table 1 (Example 8). Indeed, such material composition was well known in the art. Ex-1064, ¶¶23-33, Figs. 7A-7B, 8-10; Ex-1033, 11:12-24, Tables 1-2; Ex-1003, ¶¶168-69.

FIG. 6



In addition to Park's teachings, POSITA would have also known more generally that there are just two conventional classes of materials used for touch sensors: (1) transparent metal oxides (such as ITO, ZTO, IZO, etc.), which had higher resistivity than metals and were brittle, but provided better transparency; and (2) metals (such as copper, aluminum, titanium, silver, etc.), which had lower resistivity and were flexible, but optically opaque. Ex-1003, ¶170; Ex-1063, 13:56-9; Ex-1046, 6:36-51; Ex-1024, ¶9.

A POSITA would have appreciated that choosing a specific material (or combination of materials) from known classes of materials was a design choice based on considerations such as resistivity, strength, opacity, and cost. Ex-1003, ¶171. Because both Park and Chen focus on metals (Ex-1005, ¶4; Ex-1006, Table 1),

POSITA would have been specifically motivated to choose from any known, suitable metals, and especially a multilayered sandwich of different metals to provide greater control the adhesion, conductivity, opacity, and anti-corrosion properties of the sensor(Ex-1005, ¶67; Ex-1006, Abstract, ¶¶11-13, 48-49, 84, 96-98; Ex-1003, ¶171); *In re Leshin*, 277 F.2d 197, 199 (C.C.P.A. 1960) (selection of a known material based upon its suitability for the intended use is a design consideration within the skill of POSITA); *Ritchie v. Vast Res.*, 563 F.3d 1334, 1337 (Fed. Cir. 2009) (selection of material from known options obvious). Indeed, choosing a specific metal (or combination of metals) would have been nothing more than a simple substitution of one known element for another with predictable results. *KSR*, 550 U.S. at 416.

A POSITA would have also appreciated that thickness of the material(s) selected for touch sensors was also a design choice that impacts electrical and mechanical properties of the sensor. §V.A.2.k (1[g]); Ex-1003, ¶172. A thicker conductive layer would have less resistance and higher strength, but may be more opaque. §V.A.2.k (1[g]); Ex-1003, ¶172. POSITA would have also appreciated that the art also provided guidance as to the range of possible thicknesses for metal touch sensors. Ex-1003, ¶172. For instance, POSITA would have known that when metal materials are used as a touch sensor, the total thickness of the material is often between one- to a few-thousand angstroms. Ex-1046, 6:52-63; Ex-1013, 6:61-7:8;

Ex-1015, 10:3-11 (conductive pattern of 200nm (2,000Å)). Indeed, Park's metal layers' thicknesses could be 0.05μm-2μm (500-20,000Å), (Ex-1006, ¶42), and suitable thickness ranges for each layer are based on their intended function (e.g., first, second and third layers improve adhesion, conductivity, and opacity/anti-corrosion, respectively)(*id.*, ¶¶43-45, 84, 92, 95-96).

A POSITA would have appreciated that selecting specific thicknesses for conductive material layers would have been nothing more than routine optimization of a known result-effective variable. Ex-1003, ¶¶173-76; *In re Cohen*, 767 F. App'x 985, 988 (Fed. Cir. 2019)(finding selection of a material thickness would have been a routine optimization); *E.I. DuPont de Nemours & Co. v. Synvina C.V.*, 904 F.3d 996, 1006 (Fed. Cir. 2018)(“where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation.”(quoting *In re Aller*, 220 F.2d 454, 456 (C.C.P.A. 1955))).

A POSITA would have also had reasonable expectations of success in modifying Chen based on Park because the modifications involve nothing more than selecting from known materials for conductive layers, and controlling how much material is deposited in the touch-sensor-formation process (to control its thickness), which are well within skills of POSITA. Ex-1003, ¶¶177-81.

2. Cl.4

a. 4[a]

When discussing layer thicknesses , Chen’s primary concern is that first and second conductive pattern layers (110/112) have thicknesses less than first insulating layer (106) to “reduc[e] the chance of wire disconnections.” Ex-1005, ¶68. As one example, Chen discloses that when insulating layer (106) is $1\mu\text{m}$ ($10,000\text{\AA}$), “thickness[] of the...second conductive pattern layer 112” (or “*first conductive pattern*,” as claimed) “may be approximately 120 nanometers,” ($1200\text{\AA}$), “***but [is] not limited thereto.***” Ex-1005, ¶68. In fact, Chen discloses thicknesses of insulating layer (106) may range from 10nm - $3\mu\text{m}$ (Ex-1005, ¶19), suggesting a thicker conductive layer is provided particularly for a thicker insulating layer(Ex-1003, ¶¶182-83).

A POSITA would have also understood that Chen’s conductive layers could be made thicker, provided they remain some order of magnitude less than the insulating layer, and that the prior art taught conductive layers between $0.05\mu\text{m}$ - $2\mu\text{m}$ (500 - $20,000\text{\AA}$) (Ex-1006, ¶42), but more often focused on one to a few-thousand angstroms. §V.B.1.b (motivation). Thus, the claimed range of 1800 - $2100\text{\AA}$ is presumed obvious. *Synvina*, 904 F.3d at 1006(presumption of obviousness when prior art discloses overlapping range). Regardless, POSITA would have been motivated to select thicknesses within known ranges, including thicknesses between

1800-2100Å, as mere design choices and routine optimization of a known result-effective variable. Ex-1003, ¶184; §V.B.1.b (motivation).

b. 4[b]

Because the claimed range of 2700-3500Å is encompassed by what was taught in the prior art (§§V.B.1.b (motivation), V.B.2.a (4[a])), the claimed range is presumed obvious. *Synvina*, 904 F.3d at 1006. As discussed previously, POSITA would have been especially motivated to make Chen's second conductive pattern thicker than the first conductive pattern to decrease resistance and increase mechanical strength (§V.A.2.k (1[g])), while still maintaining thicknesses within the conventional range. Ex-1006, ¶42 (disclosing possible range of 0.05µm-2µm (500-20,000Å)); §V.B.1.b (motivation). Accordingly, POSITA would have been motivated to select thicknesses within the known range, including second conductive pattern having a greater thickness than first conductive pattern with a thickness between 2700-3500Å, as mere design choices and routine optimization of a known result-effective variable. Ex-1003, ¶¶185-86; §V.B.1.b (motivation).

3. Cl.5

a. 5[pre]

Chen discloses 5[pre]. §V.A.2.d (1[c]); Ex-1003, ¶187.

b. 5[a]

Chen discloses 5[a]:Chen’s “second conductive pattern layer” (or “*first conductive pattern*” as claimed) “may include...metal composite layers (e.g., molybdenum-aluminum-molybdenum composite layers). Ex-1005, ¶67. Thus, Chen discloses a first conductive layer of molybdenum, which POSITA would have understood is on the display panel. §§V.A.2.c-V.A.2.d (1[b]-1[c]); Ex-1006, Table 1 (Examples 7-8), ¶¶89, 91; Ex-1003, ¶¶188-89.

c. 5[b]

Chen discloses a second conductive layer of aluminum on first conductive layer. §V.B.3.b (5[a]); Ex-1006, Table 1 (Examples 7-8), ¶¶91-92; Ex-1003, ¶¶190-91.

d. 5[c]

Chen’s third conductive layer of molybdenum is on second conductive layer. §V.B.3.b (5[a]); Ex-1006, Table 1 (Examples 7-8), ¶¶89-92; Ex-1003, ¶¶192-93.

A POSITA would have known that aluminum’s electrical resistivity ($0.027\mu\Omega\cdot\text{m}$) is less than molybdenum’s ($0.0547\mu\Omega\cdot\text{m}$). Ex-1003, ¶194; Ex-1030, 9:46-49. Therefore, POSITA would have understood that the aluminum layer would be the primary conductive layer, and thus should be made thicker than molybdenum layers to reduce resistance (Ex-1003, ¶194), consistent with Park’s teachings (Ex-1006, ¶¶41 (teaching $d_1 < d_3 < d_2$), 96-98, 101-104.

4. Cl.6

Chen-Park combination teaches Cl.6. §V.B.3.d (5[c]); Ex-1003, ¶195; Ex-1006, ¶¶41, 104 (teaching $d1 < d3 < d2$).

5. Cl.7

Chen's overall thickness of first (lower) conductive pattern may be approximately 1,200Å, but POSITA would have been motivated to make it thicker to, e.g., up to a few-thousand angstroms. §§V.B.1.b (motivation), V.B.2.a (4[a]); Ex-1003, ¶¶196-97.

Park's first conductive layer's thickness is 0.01-1.935µm (100-19,350Å), and third conductive layer may be thicker at 0.015-1.95µm (150-19,500Å), encompassing claimed range (e.g., first conductive layer of 100Å and third conductive layer of 150-300Å). Ex-1006, ¶¶41-49, 94-99; *Synvina*, 904 F.3d at 1006.

Because POSITA would have found it obvious to select thicknesses for Chen's first (lower) conductive pattern on the order of a few thousand angstroms, POSITA would have been further motivated to select thicknesses for individual layers of the conductive pattern on the lower end of Park's thicknesses for first and third conductive layers, including, e.g., third conductive layer's thickness about 1.5-3 times first conductive layer's thickness not only as obvious design choices, but also to ensure each layer serves its intended function (e.g., first and third layers

sufficiently thick to improve adhesion and to inhibit corrosion, respectively). Ex-1003, ¶¶198-99; Ex-1006, ¶¶41-49, 94-99.

6. Cl.8

a. 8[a]

First conductive layer's thickness of 0.01-1.935 μ m (100-19,350Å) overlaps claimed range. Ex-1006, ¶¶43, 100; *Synvina*, 904 F.3d at 1006. Moreover, because POSITA would have found it obvious to select thicknesses for Chen's first (lower) conductive pattern on the order of a few thousand angstroms, (§§V.B.1.b (motivation), V.B.2.a (4[a])); Ex-1003, ¶¶200-01), POSITA would have been further motivated to select thicknesses for first conductive layer on the lower end of Park's range—including between 50-200Å—to ensure the overall stack remains less than a few thousand angstrom while each conductive layer serves its intended purpose (e.g., first, second, and third layers sufficiently thick to improve adhesion, lower touch-sensing resistance, and inhibit corrosion, respectively). Ex-1003, ¶201.

b. 8[b]

Second conductive layer (20a-2)'s thickness of "0.04 μ m to 1.975 μ m" (400-19,750Å) encompasses the claimed range. Ex-1006, ¶¶44, 101; *Synvina*, 904 F.3d at 1006. POSITA would have been motivated to select thicknesses for second conductive layer on the lower end of Park's range—including between 1000-

1800Å—to ensure the overall stack remains less than a few thousand angstrom while each conductive layer serves its intended purpose. Ex-1003, ¶¶202-03.

c. 8[c]

Third conductive layer (20a-3)’s thickness of 0.015μm-1.95μm” (150-19,500Å) encompasses the claimed range. Ex-1006, ¶¶45, 102, Fig. 6. POSITA would have been motivated to select thicknesses for third conductive layer on the lower end of Park’s range—including between 250-350Å—ensure the overall stack remains less than a few thousand angstrom while each conductive layer serves its intended purpose. Ex-1003, ¶¶204-05.

7. Cl.9

a. 9[a]

As an alternative to molybdenum-aluminum-molybdenum stacks, Park teaches a titanium-aluminum-titanium stack that applies same thicknesses as other material stacks. Ex-1006, Table 1, Example 7; *id.*, ¶¶40-49. Because Chen does not limit which metal composite layers may be used (and instead provides molybdenum-aluminum-molybdenum as just one example, (Ex-1005, ¶67), POSITA would have been motivated to select any material composite layers taught by, e.g., Park, including making first and third conductive layers of titanium as an obvious design choice. Ex-1003, ¶¶206-07.

b. 9[b]

Chen-Park combination teaches or suggests 9[b]. §V.B.7.a (9[a]); Ex-1003, ¶208.

8. Cl.10

a. 10[pre]-10[f][iii]

Limitations 10[pre]-10[f][iii] are substantially similar to claims 1 and 5, shown in the chart below. Therefore, Chen-Park combination teaches or suggests these limitations for the same reasons. Ex-1003, ¶209.

Claim 10	Claim	Reference
10[pre]	1[pre]	V.A.2.a
10[a]	1[a]	V.A.2.b
10[b]	1[b]	V.A.2.c
10[c]	1[c]	V.A.2.d
10[d]	1[d]	V.A.2.e
10[e]	1[e]/1[g]	V.A.2.f/V.A.2.k
10[f]	5[pre]	V.B.3.a
10[f][i]	5[a]	V.B.3.b
10[f][ii]	5[b]	V.B.3.c
10[f][iii]	5[c]	V.B.3.d

b. 10[g]-10[g][i]

Chen’s “first conductive pattern layer” (claimed “*second conductive pattern*”) “may include...metal composite layers” just like second conductive pattern layer (claimed “*first conductive pattern*”). Ex-1005, ¶67; Ex-1006, Table 1 (Examples 7-

8), ¶¶89, 91. The “first conductive pattern layer” is formed on insulating layer.
§V.A.2.f (1[e]).

Similarly, both of Park’s first and second sets of electrodes may have three-layer structures. Ex-1006, Fig. 6, Table 1, ¶¶83-115.

Accordingly, because providing both conductive patterns with a composite, three-layer sandwich structure would have been obvious, the collective teachings of Chen-Park combination teach or suggest fourth conductive layer (bottom conductive layer of Chen’s first (claimed “*second*”) metal-composite conductive pattern layer). Ex-1003, ¶¶210-13.

c. 10[g][ii]

Because it would have been obvious to provide both conductive patterns with multilayer sandwich structures, Chen-Park combination as a whole teaches or suggests fifth conductive layer (middle conductive layer of Chen’s first (claimed “*second*”) metal-composite conductive pattern layer). §V.B.8.b (10[g]); Ex-1003, ¶¶214-15.

d. 10[g][iii]

Because it would have been obvious to provide both conductive patterns with a composite, three-layer sandwich structure, the Chen-Park combination teaches or suggests a sixth conductive layer (top conductive layer of Chen’s first (claimed

“*second*”) metal-composite conductive pattern layer). §V.B.8.b (10[g]); Ex-1003, ¶216-17.

Because both Chen and Park teach using the same exemplary molybdenum-aluminum-molybdenum for both sets of electrodes, POSITA would have known that fifth conductive layer (aluminum) has lower electrical resistivity and greater thickness than fourth and sixth conductive layers (molybdenum). §V.B.3.d (5[c]); Ex-1003, ¶218.

9. Cl.11

A POSITA would have been motivated to make and had reasonable expectations of success in making Chen’s first/upper conductive pattern layer (110) (claimed “*second conductive pattern*”) thicker than the second/lower conductive pattern layer (112) (claimed “*first conductive pattern*”). §V.A.2.k (1[g]). POSITA also would have been motivated to make and had reasonable expectations of success in making each of Chen’s conductive pattern layers (110, 112) a multilayered-metal composite using a variety of materials and selecting specific thicknesses for each layer in view of Park. §V.B.3 (cl. 5); Ex-1005, ¶67; Ex-1003, ¶¶219-20.

Upon making Chen’s first/upper conductive pattern layer (110) (claimed “*second conductive pattern*”) thicker than second/lower conductive pattern layer (112), POSITA would have further found it obvious to make thicknesses of second conductive layer (e.g., conductive aluminum layer of Chen’s second-connection

parts) less than that of fifth conductive layer (e.g., conductive aluminum layer of Chen's touch-sensor parts and first connection parts) to keep the overall thickness of second/lower conductive pattern layer (112) less than thickness of first/upper conductive pattern layer (110), and because these two layers are primarily responsible for conducting electricity for each of their respective conductive pattern layers. §V.A.2.k (1[g]); Ex-1006, ¶¶91-92, 98. Additionally, because the middle conductive layer is thicker than top and bottom conductive layers of each of the upper and lower conductive pattern layers, POSITA would have found adjusting thickness of the middle conductive layer would have a greater impact on the overall thickness and easier to achieve different overall thicknesses. Ex-1003, ¶¶221-23.

10. Cl.12

For same reasons discussed above, POSITA would have been motivated to make first conductive layer thinner than fourth conductive layer (e.g., bottom molybdenum layers of each respective pattern) to ensure different overall thickness as described above. §§V.A.2.k (1[g]), V.B.9 (cl. 11); Ex-1003, ¶¶224-25.

11. Cl.13

a. 13[a]

Park's bottom layer (20a-1)'s thickness 0.01μm-1.935μm (100-19,350Å) encompasses claimed range. Ex-1006, ¶43, 100, Fig. 6; *Synvina*, 904 F.3d at 1006.

For same reasons discussed above, POSITA would have been motivated to make fourth conductive layer thicker than first conductive layer (e.g., bottom molybdenum layers of each respective pattern), including making fourth conductive layer between 250-350Å. §§V.A.2.k (1[g]), V.B.6.a (8[a]); Ex-1003, ¶¶226-28.

b. 13[b]

Park's middle layer (20a-2)'s thickness 0.04µm-1.975µm (400-19,750Å) encompasses claimed range. Ex-1006, ¶¶44, 101, Fig. 6; *Synvina*, 904 F.3d at 1006.

For same reasons discussed above, POSITA would have been motivated to make fifth conductive layer thicker than second conductive layer (e.g., middle aluminum layers of each respective pattern), including making fifth conductive layer between 2200-2800Å. §§V.A.2.k (1[g]), V.B.6.b (8[b]); Ex-1003, ¶¶229-31.

c. 13[c]

Park's top layer (20a-3)'s thickness 0.015µm-1.95µm (150-19,500Å) encompasses claimed range. Ex-1006, ¶¶45, 102, Fig. 6; *Synvina*, 904 F.3d at 1006.

A POSITA would have been motivated to make sixth conductive layer thicker than third conductive layer (e.g., top molybdenum layers of each respective pattern), including making sixth conductive layer between 250-350Å (e.g., if third conductive layer is 250Å, making the sixth conductive layer 350Å). §§V.A.2.k (1[g]), V.B.6.c (8[c]); Ex-1003, ¶¶232-34.

12. Cl.14

a. 14[a]

Chen-Park combination teaches 14[a]. §V.B.7.a (9[a]).

A POSITA would have known that Park's alternative titanium-aluminum-titanium embodiment would be used for both first and second conductive patterns. §V.B.8 (Cl.10); Ex-1003, ¶¶235-36.

b. 14[b]

Chen-Park combination teaches or suggests 14[b]. §§V.B.7.a (9[a]), V.B.12.a (14[a]); Ex-1003, ¶237.

C. Ground 1C- Claims 16-17: Chen and Lee-343, with or without Hsieh and/or Kobayashi.

Claims 16-17 are obvious in view of (1) Chen and Lee-343, and (2) Chen and Lee-343 in further view of Hsieh and/or Kobayashi.

1. Prior Art

a. Lee-343

Lee-343 was filed on May 26, 2011 and published on May 3, 2012. Ex-1007, Cover. Lee-343 constitutes prior art under at least §102(a)(1).

Lee-343's touch panel for displays contains all of first and second touch-sensor parts and one set of connection parts formed on the same layer and another set of connection parts formed in a different layer. Ex-1007, Abstract, ¶57. Lee-343's touch panel is similar to Chen's, demonstrating that such touch panel electrode

configurations were well established. §§V.A.2.d-V.A.2.f(1[c]-1[f]); Ex-1003, ¶¶98-100.

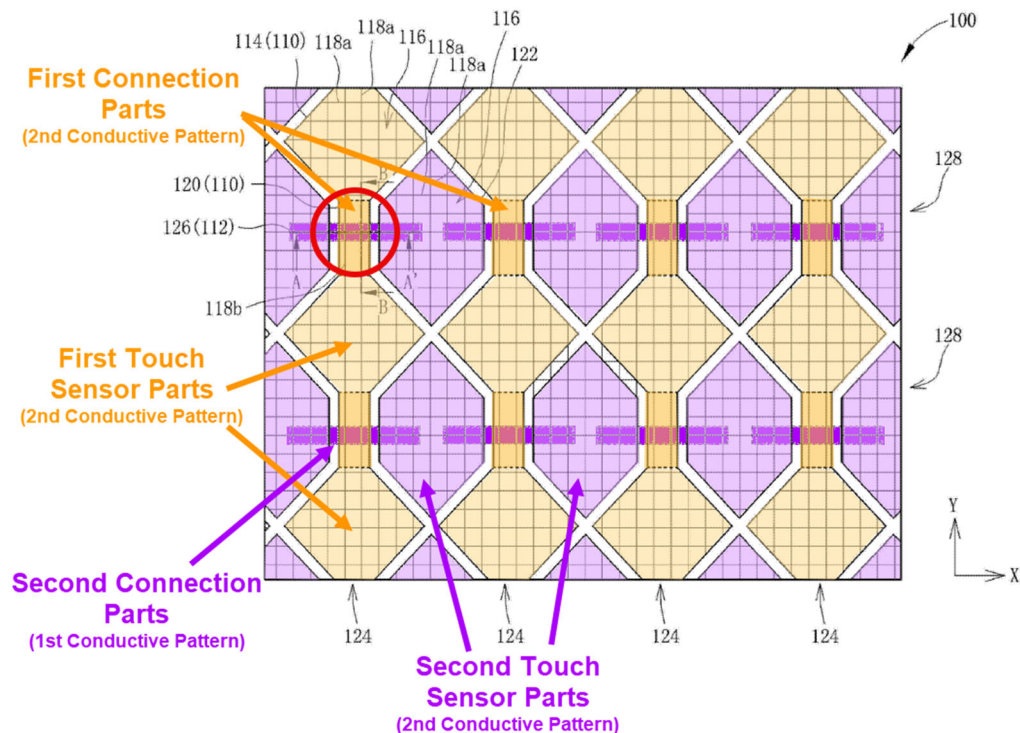
Notably, Lee-343 specifically recognizes that when connections between adjacent touch-sensor parts in the same layer overlap, touch panels are more prone to undesired static electricity and higher capacitance at the overlap area, reducing touch sensitivity of touch-sensing units. Ex-1007, ¶¶3, 9-10; Ex-1036, ¶12.

To alleviate this problem, Lee-343 teaches non-crossing touch-sensor connection parts to “prevent a vulnerability to static electricity and failure caused by the static electricity.” Ex-1007, ¶21; *id.*, ¶¶3, 9-10, 20-21, 81, 105, Figs. 2-3, 4A-4C, 5-6, 7A-7C; Ex-1003, ¶¶101-02.

Like the underpass-type bridge in Chen, Lee-343’s electrodes arranged along x-direction are connected through a pair of underpass-type bridges. Ex-1007, ¶¶37-107, Figs. 2-3, 4A-4C, 5-6, 7A-7C. Each bridge in Lee-343 contains a pair of connectors below touch-sensor electrodes and conductive “islands” in the same level as electrodes, all connected in series. *Id.*, ¶¶49-60, 65-67, 85-91, Figs. 3, 4A-4C, 6, 7A-7C. Each conductive “island” is a connector for electrically connecting adjacent electrodes, and improves display visibility by minimizing areas of low-transparent metal wiring. *Id.*, ¶¶55, 87, 93; Ex-1003, ¶103.

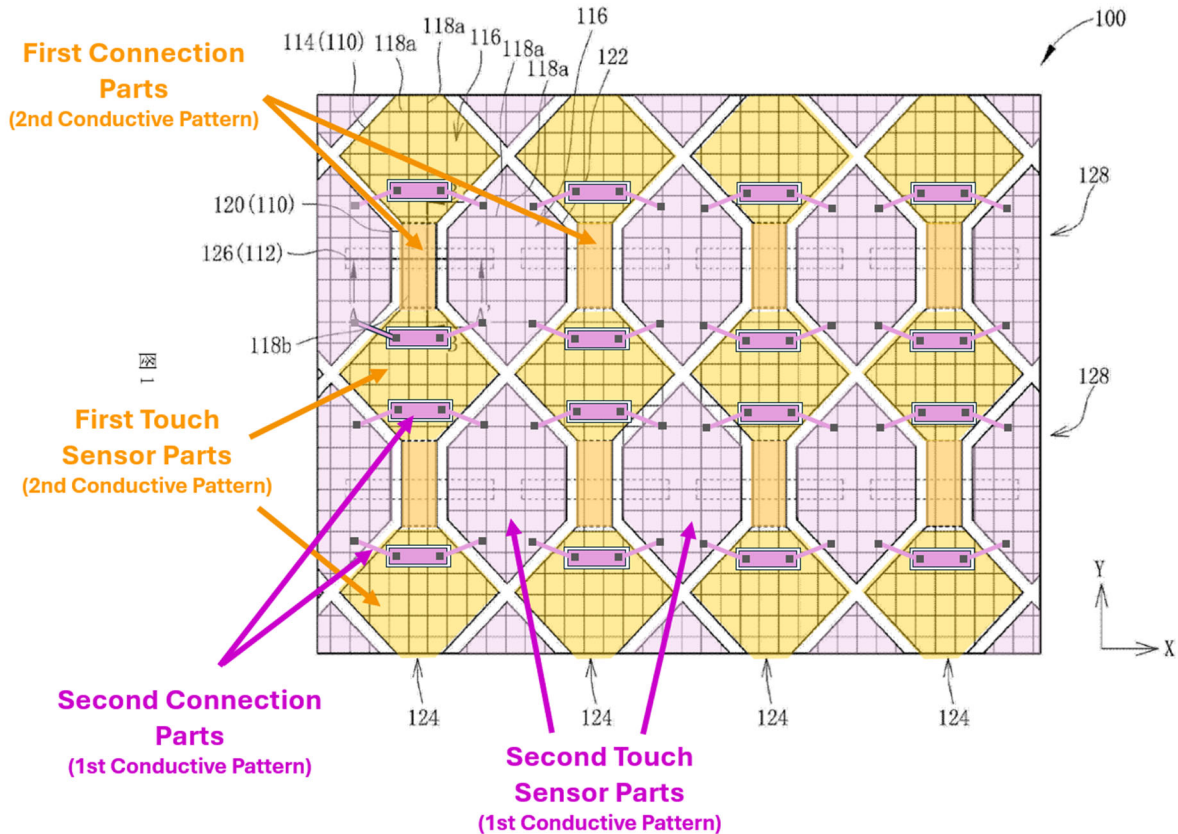
layer along with first connection parts for first touch sensor parts, and (3) underpass-type bridge design implements the second connection parts for second touch sensor parts in a different layer. Chen and Lee-343's teachings on the same design would have led POSITA to seek out both references when designing touch-sensing units for displays. Ex-1003, ¶238.

A POSITA would have been guided by teachings in both references to appreciate that, in implementing aforementioned well-known touch-electrode configurations by Chen and Lee-343, they adopted different implementations for their respective connection parts in underpass-type bridges. Chen's underpass-type bridge includes electrode connections that overlap one another. Ex-1005, Fig. 1; Ex-1003, ¶¶239-41.



Lee-343's teachings would have prompted POSITA to recognize that Chen's overlapping connections may face shortcomings and were primed for improvement. POSITA would have recognized that Chen's overlapping connections are susceptible to static electricity and higher capacitance, reducing effectiveness of touch sensors. Ex-1007, Abstract, ¶¶3, 9-10; Ex-1003, ¶242. Indeed, it was known that electrostatic discharge (ESD) issues arise from conventional process and structure. Ex-1036, ¶¶8-12; Ex-1055, ¶¶11, 56-59, 70. To alleviate that problem, POSITA would have been motivated to reconfigure Chen's connections using Lee-343's non-overlapping connectors to avoid crossing/overlapping connectors. Ex-1003, ¶242.

A POSITA would have also appreciated that several ways exist to configure connections using the same general underpass-type bridge configuration to avoid overlap. Ex-1003, ¶243. For instance, Lee-343 taught two embodiments (Ex-1007, Figs. 3 and 6) that both use underpass-type bridges just like Chen. Ex-1007, ¶¶36-103, Figs. 2-3, 4A-4C, 5-6, 7A-7C. The relative ease with which Lee-343's pair of underpass-type bridges could have been applied to Chen thus provides a further motivation to combine, and confirms that the combination would have been successful. Ex-1003, ¶243.



A POSITA would have appreciated that, not only would such a configuration reduce risks of static electricity and avoid increasing capacitance at connector areas, thus improving sensor operations, but would also improve connecting reliability between adjacent second touch-sensor parts; if one bridge connection failed, a second still remains. Ex-1007, ¶45; Ex-1003, ¶244. POSITA would have also appreciated that this modification is no more than (1) simple substitution of one known element(Lee-343's non-overlapping connectors) for another (Chen's overlapping connectors) for improvement to yield predictable results (improved capability of withstanding static electricity); or (2) using known techniques (Lee-343's non-overlapping connectors) to improve similar devices (Chen's touch-

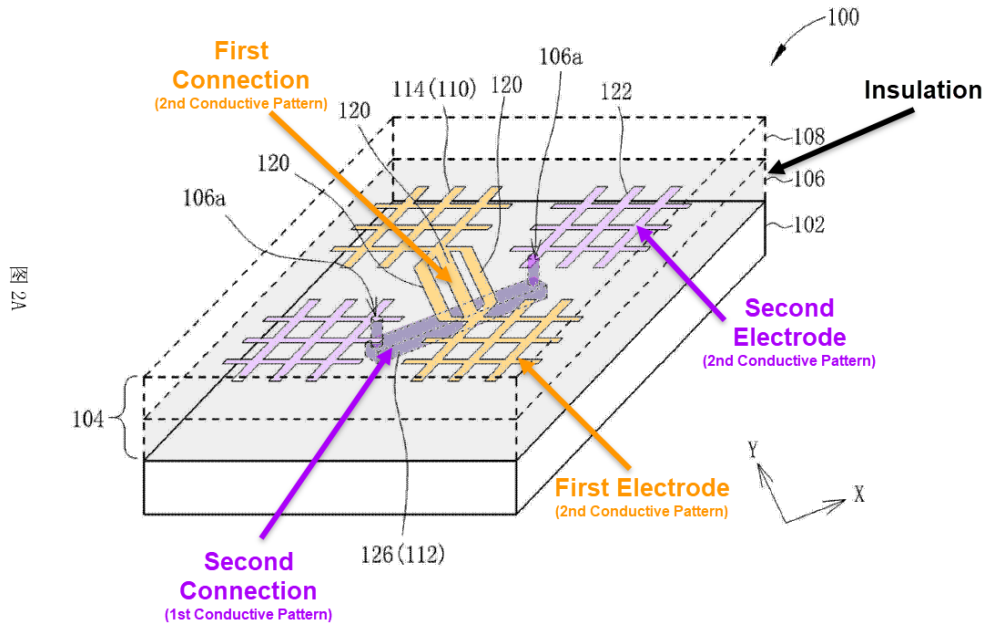
sensing electrodes) in the same way (connecting adjacent touch-sensing electrodes). *KSR*, 550 U.S. at 398, 416, 417, 421; *In re Lackey*, 371 F. App'x at 80, 82; Ex-1003, ¶244.

A POSITA would have also had reasonable expectations of success in modifying Chen because the modification under well-known industry designs using underpass-type bridges for touch-sensing units formed in two separate layers would involve nothing more than manufacturing additional second connections at different positions on the substrate, which would have involved only the routine skill of POSITA. Ex-1003, ¶¶245-50.

2. Cl.16

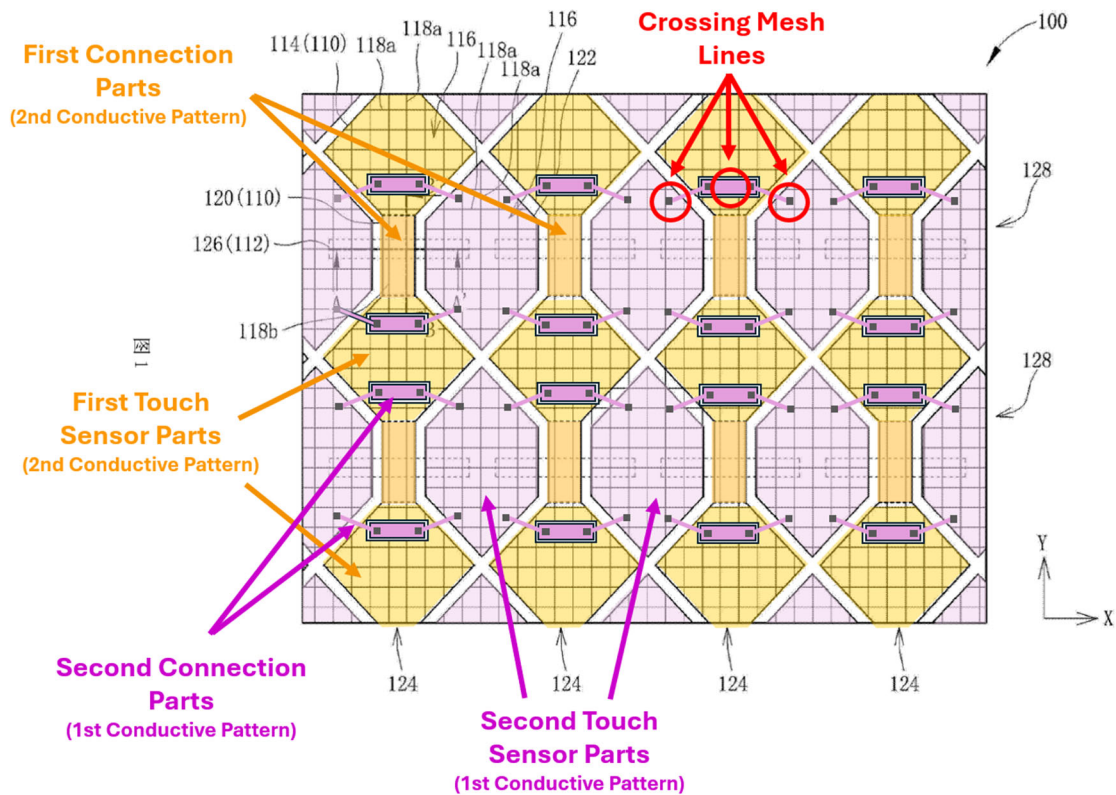
a. 16[a]

Chen's first and second electrodes (114/122) include opaque conductive lines 118a and openings. Ex-1005, ¶66, Fig. 2A; Ex-1003, ¶¶251-54.



b. 16[b]

When modifying Chen using Lee-343 to incorporate non-overlapping connections under the well-known underpass-type bridge, POSITA would have appreciated that second connection parts would cross mesh lines of first and second touch sensor parts to avoid overlapping first connection part. §V.C.1.b (motivation); Ex-1003, ¶¶255-56.



3. Cl.17

Chen-Lee-343 combination teaches non-crossing first and second connection parts. §§V.C.1.b (motivation), V.C.2.b (16[b]); Ex-1003, ¶¶257-59.

D. Ground 1D-Claims 2, 19: Chen and Her, with or without Hsieh and/or Kobayashi.

Claims 2,19 are obvious in view of (1) Chen and Her, and (2) Chen and Her in further view of Hsieh and/or Kobayashi.

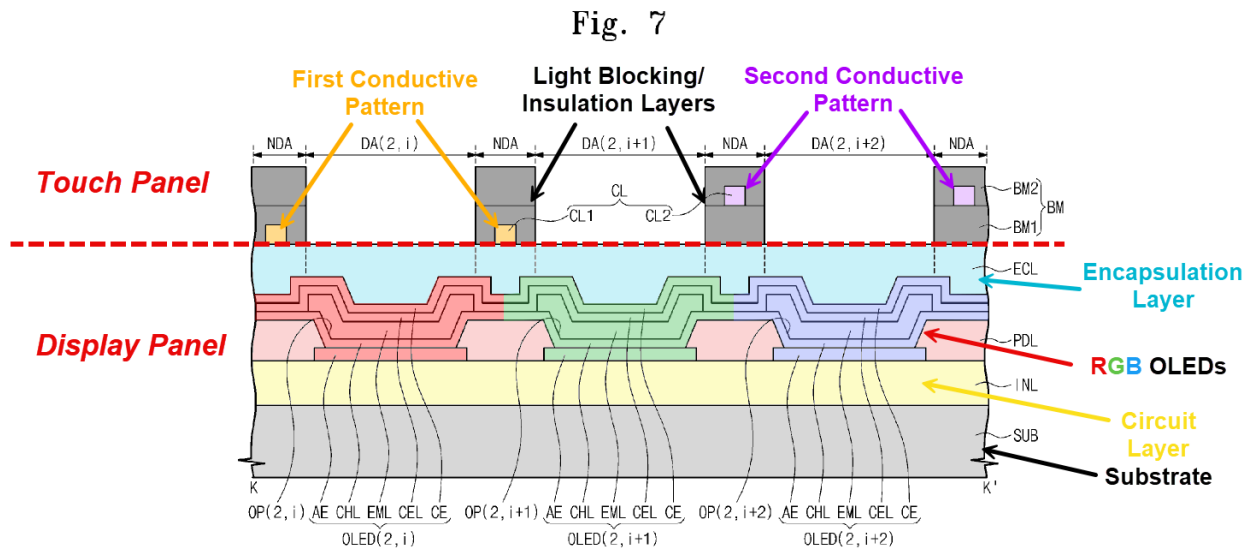
1. Prior Art

a. Her

Her was filed February 25, 2014 and published February 19, 2015. Ex-1008, Cover. Her constitutes prior art under at least §102(a)(1).

Her's OLED display device comprises an OLED display panel and a touch panel. Ex-1008, Abstract; Ex-1003, ¶¶104-05.

Similar to Chen, Her describes a conventional display panel comprising circuits and insulating layers formed on a substrate that funnel electricity to pixels of organic material. Ex-1008, ¶¶49, 51-53, 62, 64, 66-75, 80, Figs. 3-7, 11, 13, 16-17, 21; Ex-1003, ¶¶104-05. Her's display panel is encased in a “sealing” (encapsulation) layer. Ex-1008, ¶76, Fig. 7; Ex-1003, ¶¶106-07.



Ex-1008, Fig. 7 (annotated).

Her is also similar to Chen in another aspect: touch-sensing units using well-known touch sensor electrode configurations: (1) two conductive layers separated by an insulating layer, (2) all of first and second touch sensor parts are in the same layer along with first connection parts for first touch sensor parts, and (3) underpass-

type bridge design implementing second connection parts for second touch sensor parts in a different layer. Ex-1003, ¶¶108-09; §V.E.1 (Claim 1, Ground 2A).

b. Prior Art Details

Common teachings in Chen and Her on similar touch sensing OLED displays and their adoption of well-known touch sensor electrode configuration in the industry using an underpass-type bridge design for connection parts would have led POSITA to seek out both references when designing touch-sensing units for touch sensing OLED displays. Ex-1003, ¶¶260-61.

In so doing, POSITA would have been guided by teachings of both references to recognize that, although Chen discloses a touch sensor intended to be applied to displays (including OLED displays), (Ex-1005, Abstract, ¶¶64-65, 74, Figs. 2A-2B, 3, 7), Chen does not expressly disclose details of the display's layers. Ex-1003, ¶262. However, required layers of OLED displays were extremely well-known and conventional, as illustrated by Her. *Id.*

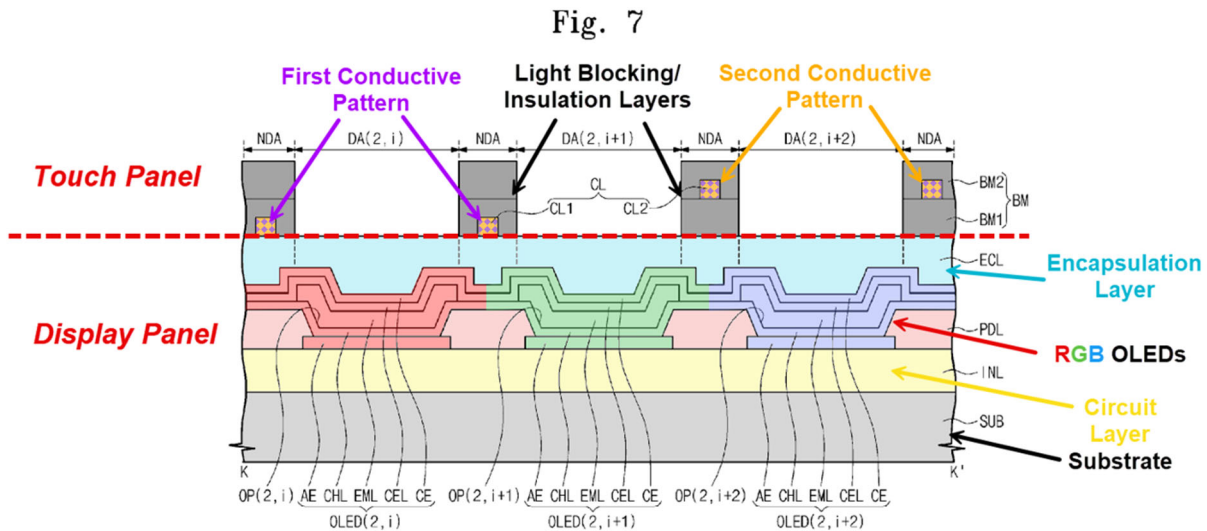
A POSITA looking to implement Chen's touch sensor on a conventional OLED display would have therefore looked to other prior art, like Her, to identify requisite layers of OLED display and ways to integrate touch-sensing panel into OLED display to form a complete touch-sensing display unit. Ex-1003, ¶¶263-64. Such a combination would have amounted to nothing more than a combination of known prior-art elements (Her's OLED display-panel components) according to

known methods (forming touch-sensing units on display units) to a known device (Chen's touch-sensing OLED display) to yield predictable results (forming a complete, functional OLED display). *KSR*, 550 U.S. at 398, 416, 417, 421; *In re Lackey*, 371 F. App'x at 80, 82.

2. Cl.2

a. 2[a]

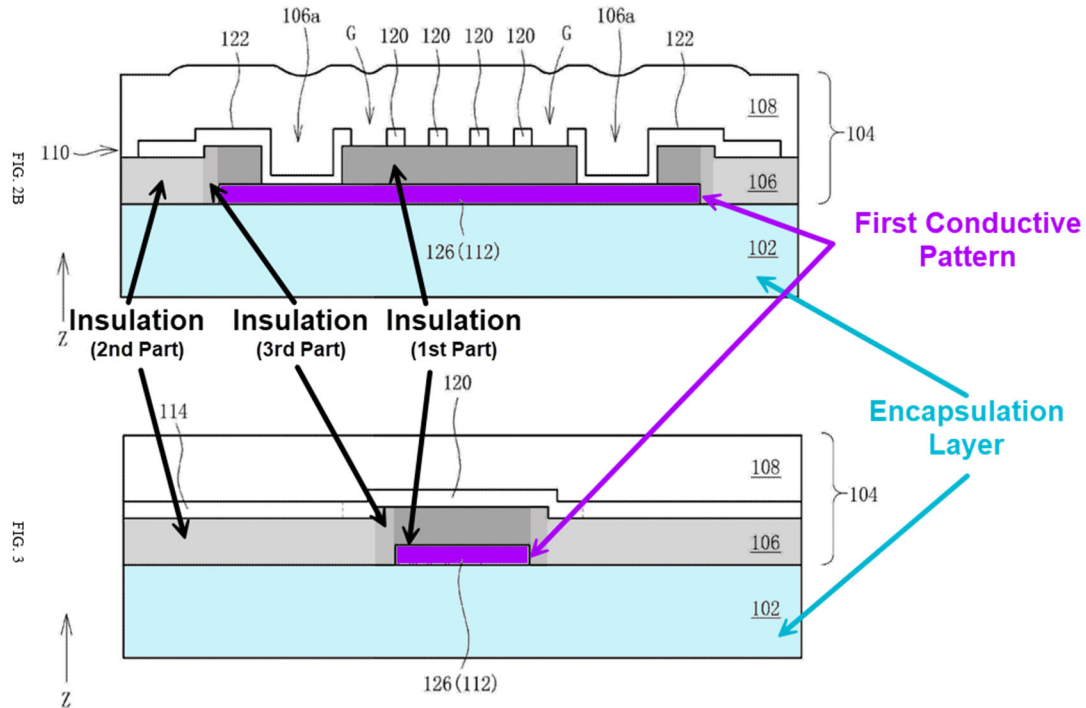
Chen's touch panel may be formed on an OLED display panel. Ex-1005, 64; §V.A.2.b (1[a]). Although Chen does not disclose details of OLED display panel, it was well-known, routine and conventional in the art that OLED display panels are provided with a thin-film encapsulation layer that protects OLEDs from oxygen and moisture. Ex-1008, ¶76; Ex-1062, ¶49; Ex-1007, ¶¶75, 78; Ex-1019, ¶73; Ex-1023, ¶87). It was also well-known, routine, and conventional for first conductive layer on the touch panel to be formed directly on the encapsulation layer, as also taught by Her. Ex-1008, ¶82; *id.*, ¶77, Figs. 5-7, 11-12, 15-17, 19; Ex-1003, ¶¶265-66.



A POSITA would have therefore understood that, when implementing Chen’s touch panel on OLED displays, first conductive pattern layer would be formed directly on the encapsulation layer of Her’s OLED display panel. Ex-1003, ¶267.

b. 2[b]

Chen’s “first insulating layer 106 covers th[e] side of the transparent substrate 102 and the second conductive pattern layer 112.” Ex-1005, ¶64; *id.*, ¶¶67-68, Figs. 2A-2B, 3. Chen’s insulating layer has: (1) first part on first conductive pattern, spaced from substrate (102), which may obviously be a thin-film encapsulation layer, §V.D.2.a (2[a])); (2) second part contacting the substrate/thin-film encapsulation layer (102); and (3) third part connecting first and second parts. Ex-1005, Figs. 2A-3; Ex-1003, ¶¶268-69.



3. Cl.19

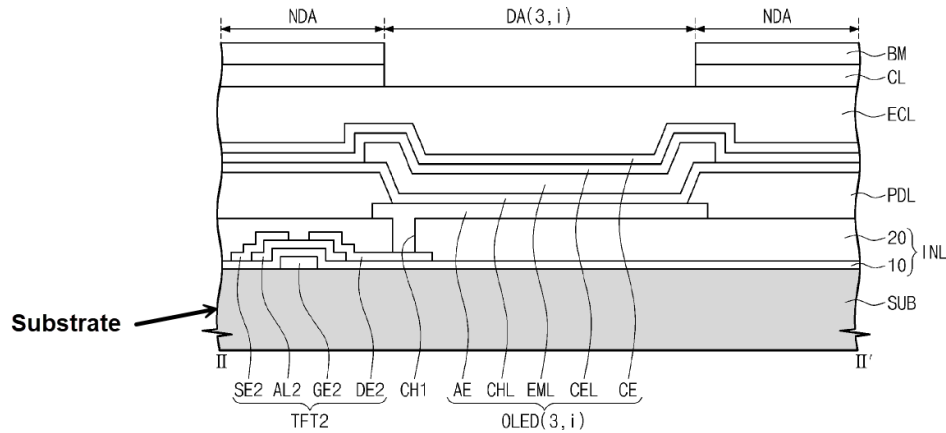
a. 19[pre]

As set forth below, Chen-Her combination teaches or suggests 19[pre]. Ex-1003, ¶270.

b. 19[a]

Her's OLED “display panel DP includes a base substrate” (SUB). Ex-1008, ¶49; *id.*, ¶¶10, 50-51, 68, 70-80, Figs. 4-7 and 19; Ex-1003, ¶¶271-72.

Fig. 6



A POSITA would have understood that, when implementing Chen's touch panel on OLED display panels, the OLED display panel would have a substrate (base) layer like Her, because such substrate (base) layers were conventional to serve as the foundation of OLED display panels. Ex-1003, ¶¶272-73.

c. 19[b]

Her discloses a circuit layer (including e.g., TFTs and Cap) on the base layer. Ex-1008, ¶¶49, 51-53, 63-74, Figs. 3-7; Ex-1003, ¶¶274-75.

Fig. 3

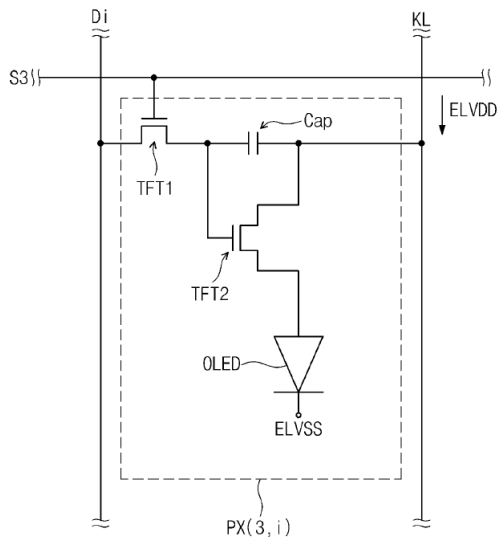


Fig. 4

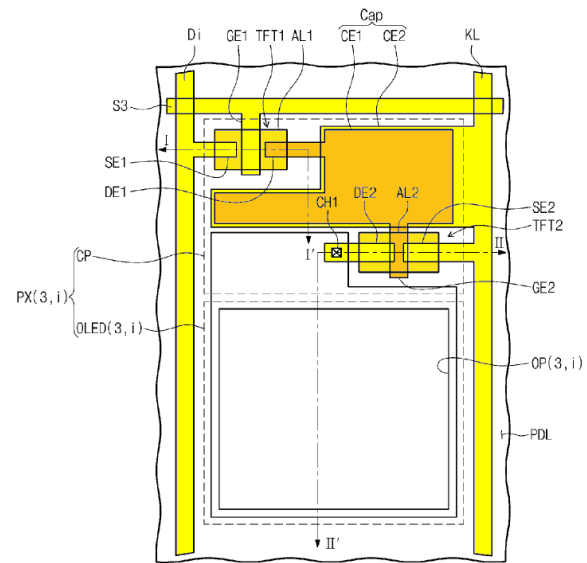
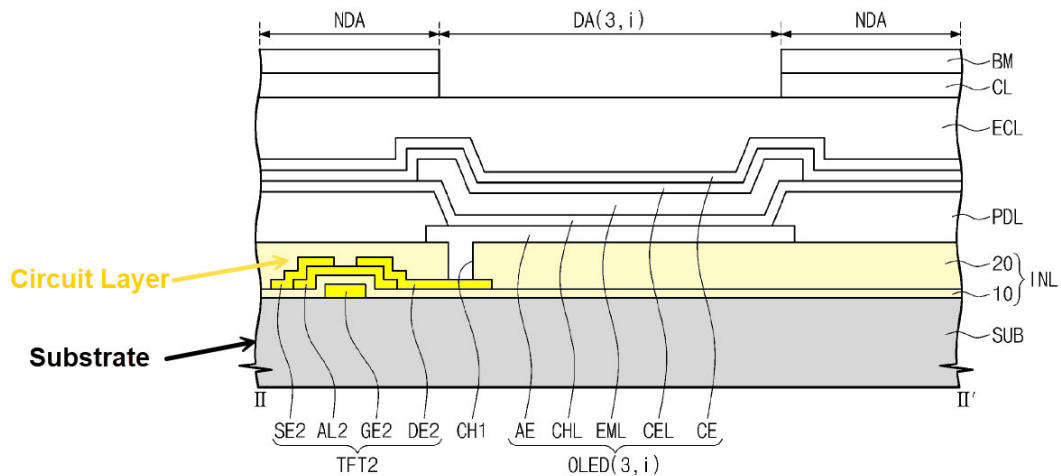


Fig. 6



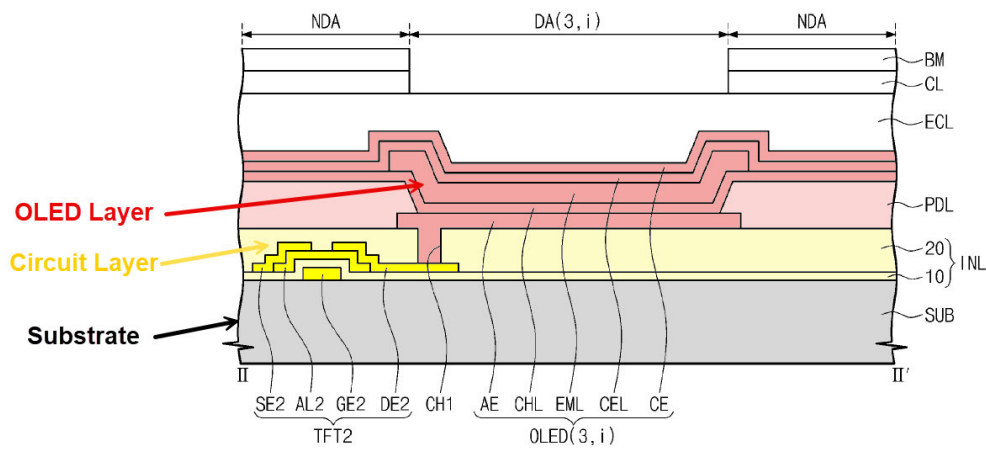
A POSITA would have understood that, when implementing Chen's touch panel on OLED display panels, OLED display panels would have a circuit layer like Her,

because such a circuit layer was conventional to funnel electricity to the OLEDs. Ex-1003, ¶¶275-76.

d. 19[c]

Her's "pixels...may include...an organic light emitting device"(Ex-1008, ¶53), which is on "second insulating layer" of the circuit layer, (*id.*, ¶74; ¶¶62, 64, 66-67, 69, 75, 80, Figs. 5-7, 11, 13, 16-17, 21; Ex-1003, ¶¶277-78).

Fig. 6

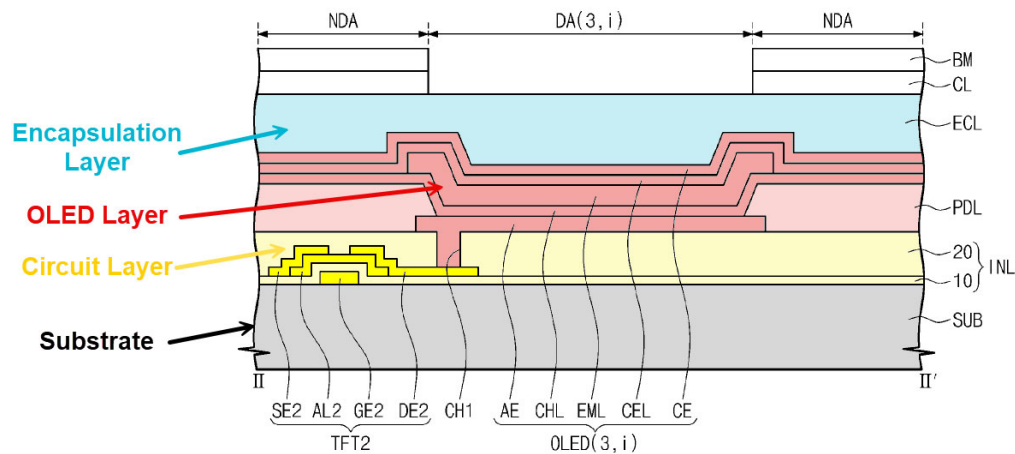


A POSITA would have understood that, when implementing Chen's touch panel on OLED display panels, OLED display panels would have an OLED layer like Her, because such OLED layers were conventional to generate light. Ex-1003, ¶¶279-80.

e. 19[d]

Her discloses a thin-film encapsulation layer to protect OLED displays in form of a sealing layer ECL on “base substrate SUB, covering the organic light emitting device OLED(3,i).” Ex-1008, ¶¶1, 10-16, 76-79, and 113-16 and Figs. 7 and 19. Her further teaches that sealing layer includes “thin layers or a sealing substrate.” Ex-1008, ¶6. POSITA would have understood that Her’s “sealing” thin layer is also conventionally called “thin film encapsulation” layer. Ex-1003, ¶¶281-82.

Fig. 6



A POSITA would have understood that, when implementing Chen’s touch panel on OLED display panels, OLED display panel would have an encapsulation layer like Her, because such encapsulation layer was conventional to protect OLEDs from degradants. Ex-1003, ¶¶282-83.

E. Ground 2A- Claims 1-3, 15, 18-19: Her, with or without Hsieh and/or Kobayashi.

Claims 1-3, 15, 18-19 are obvious in view of (1) Her, and (2) Her in view of Hsieh and/or Kobayashi. Ex-1003, ¶¶326, 332-33, 341.

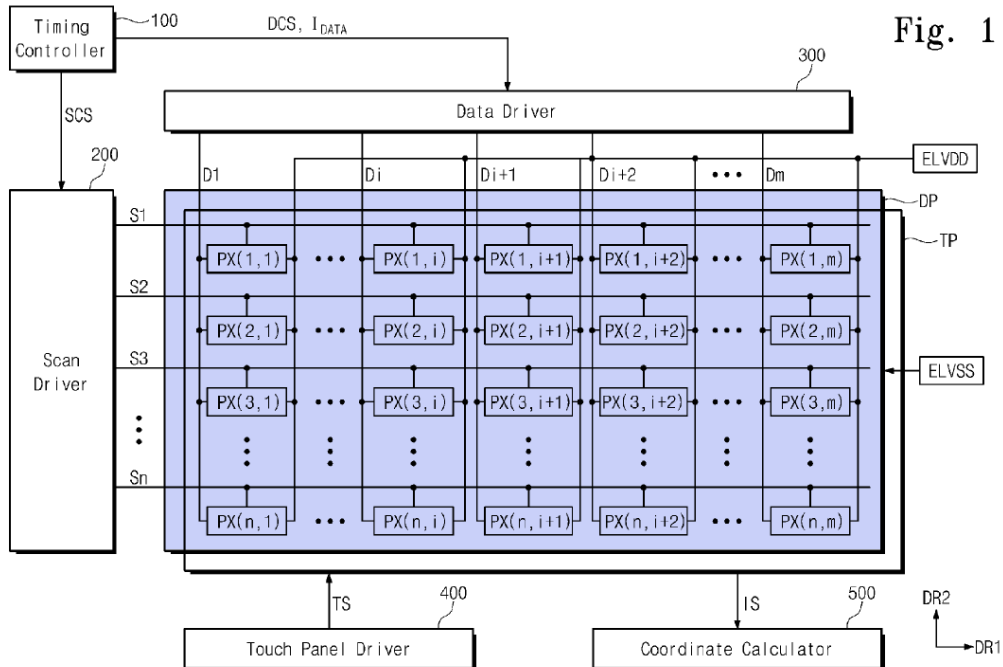
1. Cl.1

a. 1[pre]

Her discloses “an organic light emitting display device.” Ex-1008, Abstract, ¶¶3, 9, 20, 48, Fig. 1; Ex-1003, ¶¶284-85.

b. 1[a]

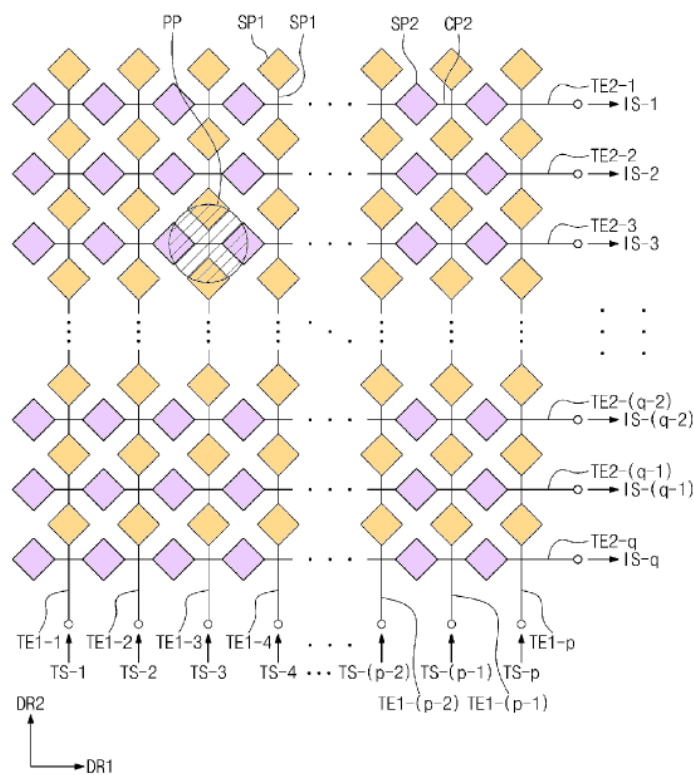
Her’s display device “includes an organic light emitting display panel” (DP). Ex-1008, Abstract, ¶¶9, 20, 48-78, Figs. 1-7; Ex-1003, ¶¶286-87.



c. 1[b]

Her discloses that “organic light emitting display device...includes...a touch panel [(TP)] disposed on the organic light emitting display panel.” Ex-1008, ¶¶9, 48; *id.*, Abstract, ¶¶57-58, 77-78, 113-17, Figs. 5-8, 18-19; Ex-1003, ¶¶288-90.

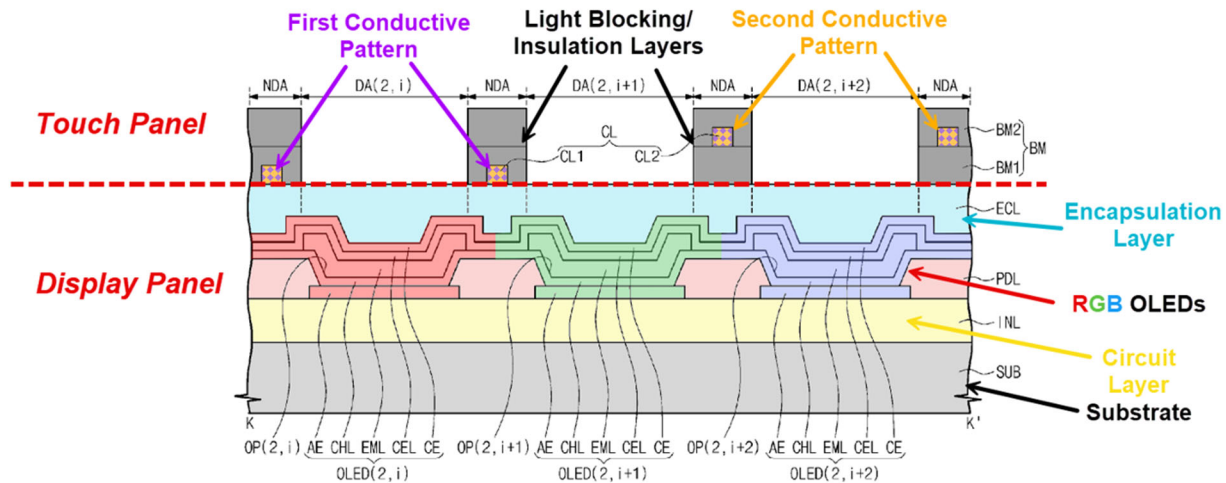
Fig. 8



d. 1[c]

Her’s touch panel has “[a]t least one conductive layer CL... disposed on the sealing layer ECL” of display panel. Ex-1008, ¶¶77, 82, Fig. 7; Ex-1003, ¶¶291-92.

Fig. 7



Although that disclosure alone meets 1[f][i], Her also discloses several touch-panel embodiments, one of which illustrates how the claim is met as a whole. To that end, Her’s first “light blocking layer” is over first conductive layer, and second conductive layer formed on top of first light blocking layer. Ex-1008, ¶83, Fig. 7; Ex-1003, ¶293.

Her’s conductive layer comprises at least some part of first and second touch electrodes (TE1/TE2), and electrode has “sensor parts” (SP1/SP2), and “connection parts” (CP1/CP2) that connect adjacent sensor parts. Ex-1008, ¶¶87-90. Her explains, however, that sensor parts and connection parts may be configured in several ways as part of either first or second conductive layers. Ex-1003, ¶¶294-95.

In one embodiment, first touch electrodes (including all first sensor parts and first connection parts) are provided as first conductive layer (above sealing layer ECL), and second touch electrodes (including all second sensor parts and second

connection parts) make up second conductive layer(above first light blocking layer BM1) extending in another direction (DR1). Ex-1008, ¶¶97-108, Figs. 7, 10-15; Ex-1003, ¶¶295-96.

Fig. 14

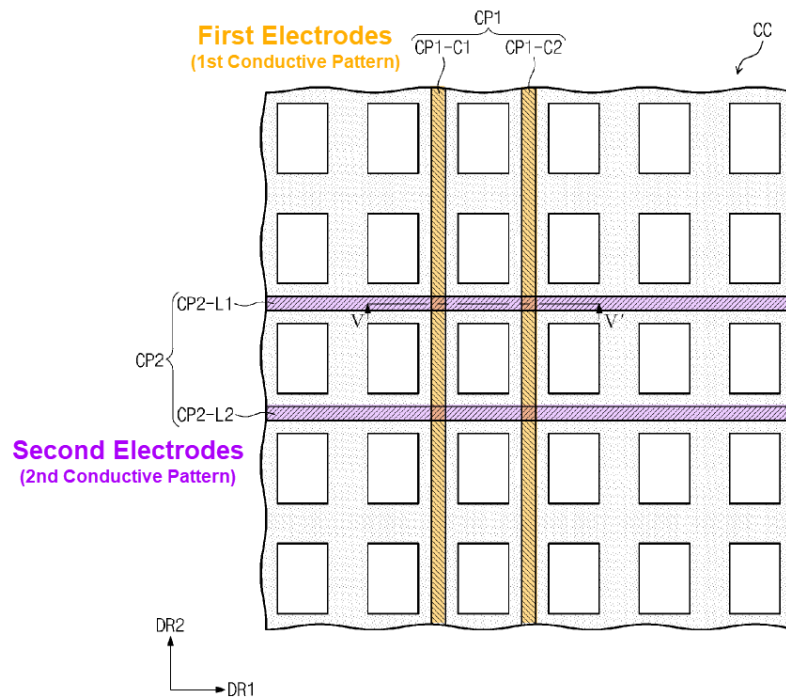
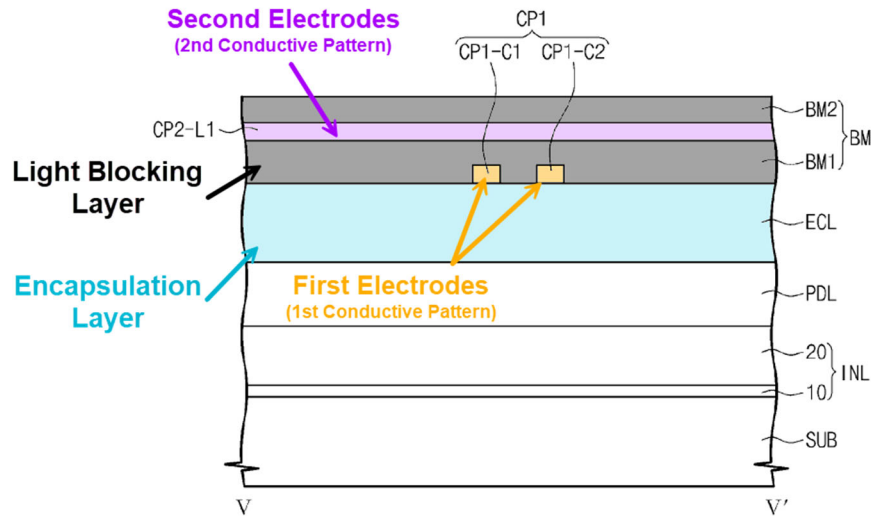
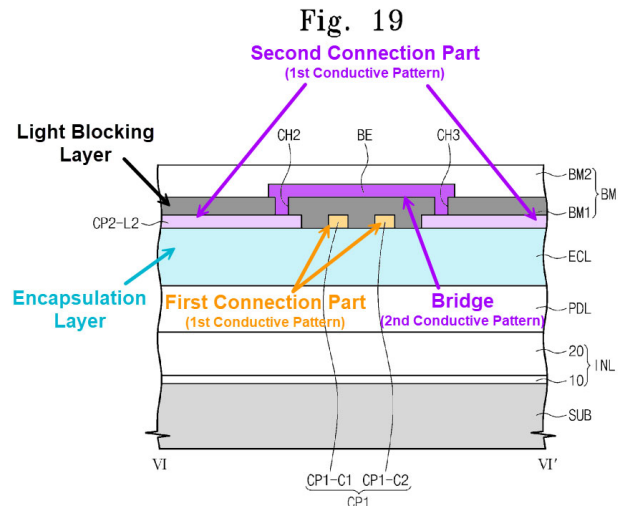
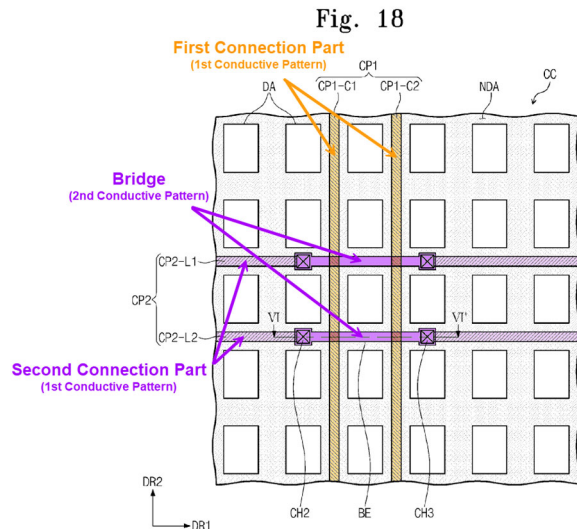


Fig. 15



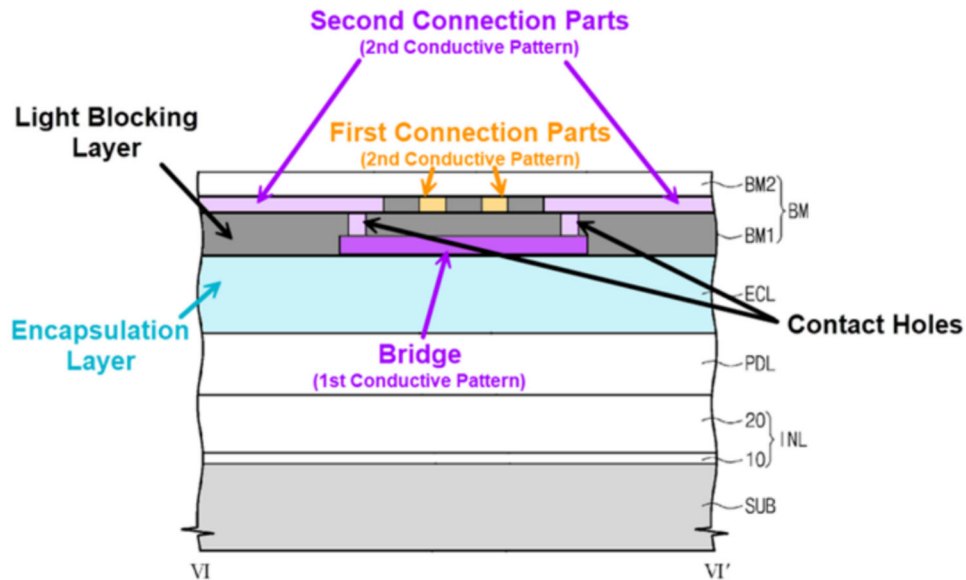
In another embodiment, “a portion of the first touch electrodes [TE1] and a portion of the second touch electrodes [TE2] may be disposed on the same layer.” Ex-1008, ¶110. For instance, “second sensor parts SP2 of the second touch electrodes [TE2] may be disposed on the same layer as the first touch electrodes [TE1],” i.e., first and second touch-sensor parts (SP1/SP2), and first connection part (CP1) are provided on a single conductive layer, and all first sensor parts (SP1) are connected together by their connection parts (CP1) in one direction (DR2). *Id.*, ¶¶110-14, Figs. 16-19; Ex-1003, ¶297. To complete the connection, “bridge” (BE) is provided on a separate conductive layer. Ex-1008, ¶110-115; Ex-1003, ¶¶297-98. Her explains that, in one embodiment, first/second touch-sensor parts (SP1/SP2) and first/second connection parts (CP1/CP2) are provided on “sealing layer” (ECL) as

first conductive layer, and the bridge is formed on first light-blocking layer as second conductive layer in an overpass-type bridge arrangement. *Id.*



Alternatively, in another embodiment, Her reverses the stacking order to provide an underpass-type bridge, explaining that first/second connection parts (CP1/CP2) can be on “first light blocking layer...and the bridge BE...may be disposed on the sealing layer ECL” in which “first light blocking layer BM1 may cover the bridge BE”. Ex-1008, ¶¶116-17; Ex-1003, ¶299. Her does not expressly depict this underpass-type bridge arrangement, but Figure 19 has been modified to depict it according to Her’s description in ¶116. *Id.*

Illustration of Her's ¶116 Embodiment



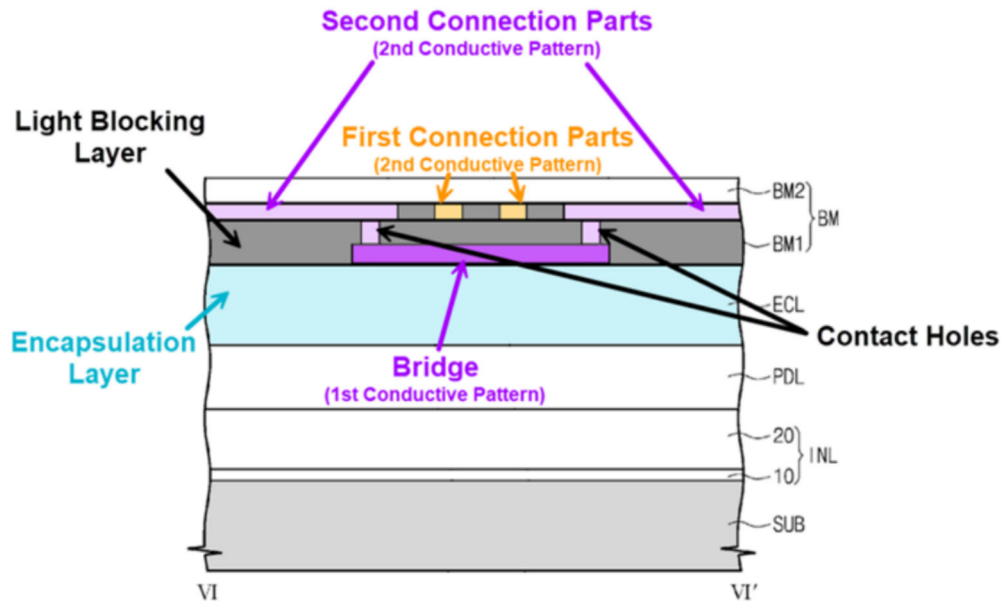
Accordingly, Her discloses bridge (BE) formed as “first conductive pattern” directly on a surface (top surface) of sealing layer (ECL) which is part of OLED display panel. Ex-1003, ¶300.

Notably, Her is similar to other prior art such as Chen and Lee-343 because Her also discloses well-known industry designs using underpass-type bridge for touch-sensing units formed in two separate layers. This further demonstrates that '279 patent's touch sensors with two different conductive layers is nothing more than mimicking Her, Chen, and Lee-343. Ex-1003, ¶301.

e. 1[d]

Her's first/second conductive layers (CL1/CL2) are covered by first and second light-blocking layers (BM1/ BM2), respectively. Ex-1008, ¶¶79-85, 114-16, Figs. 7, 19; Ex-1003, ¶¶302-03.

Illustration of Her's ¶116 Embodiment



Her explains that “second touch electrodes [are] insulated from the first touch electrodes while crossing the first touch electrodes”(Ex-1008, ¶¶11, 14, cls. 7, 17), and elsewhere, Her states that “light blocking layer” is “an *insulating* light blocking material”(id., cl. 14; Ex-1003, ¶304).

Although Her does not *expressly* state that light-blocking layers in each of its touch-sensor embodiments (§V.E.1.f (1[e])) are insulating, POSITA would have understood that they are because the only layer Her discloses between first and second conductive layers (CL1/CL2) is a first light blocking layer (BM1); no separate insulating layer is disclosed, and POSITA would have understood that first and second electrodes (TE1/TE2), including all of their respective sensor and connection parts (SP1/SP2, CP1/CP2, and optionally BE) must be electrically

insulated from one another to identify user's touch points. Ex-1003, ¶¶305; Ex-1008, ¶¶107-16. POSITA would have been motivated regardless to provide Her's light-blocking layers as an insulating material because it was well-known and conventional in the art to insulate touch electrodes from one another. Ex-1003, ¶¶306-07; Ex-1025, ¶¶82, 110, 121; Ex-1024, ¶¶63, 83.

f. 1[e]

Her's "second conductive layer CL2" is on "first light blocking layer" which is the claimed "*insulating layer*" (§V.E.1.e (1[d])). Ex-1008, ¶84. In the underpass-type bridge embodiment, Her discloses forming second conductive layer comprising first and second sensor parts (SP1/SP2) and first connection parts (CP1). §V.E.1.d (1[c]). Her shows that, in all of the various embodiments, first/second connection parts (CP1/CP2) cross each other (sometimes using a bridge). For example, annotated figures below show first connection parts (in first conductive pattern) intersect with bridges (in second conductive pattern). Ex-1003, ¶¶308-09.

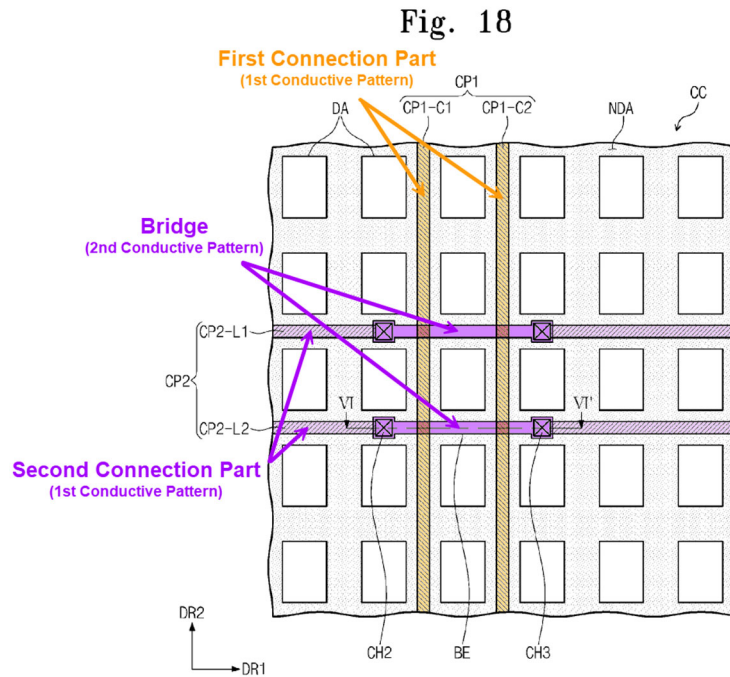
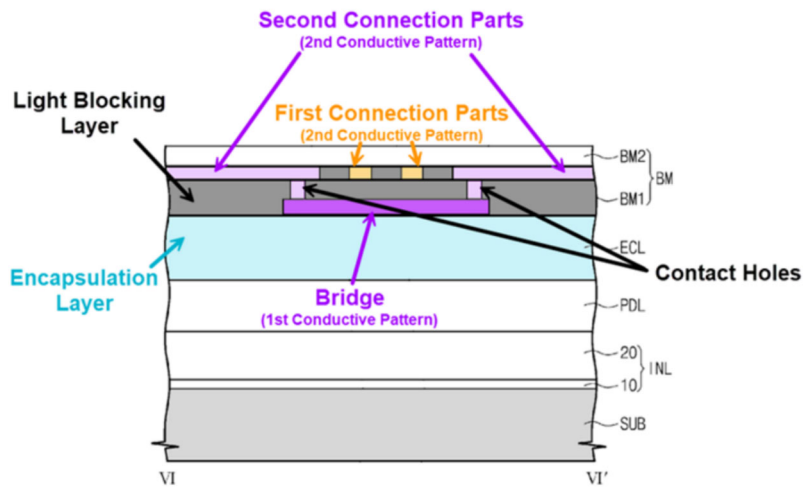


Illustration of Her's ¶116 Embodiment



g. 1[e][i]

Her discloses “first sensor parts SP1.” Ex-1008, ¶¶101-02, Figs. 8, 10; Ex-1003, ¶¶310-11.

Fig. 8

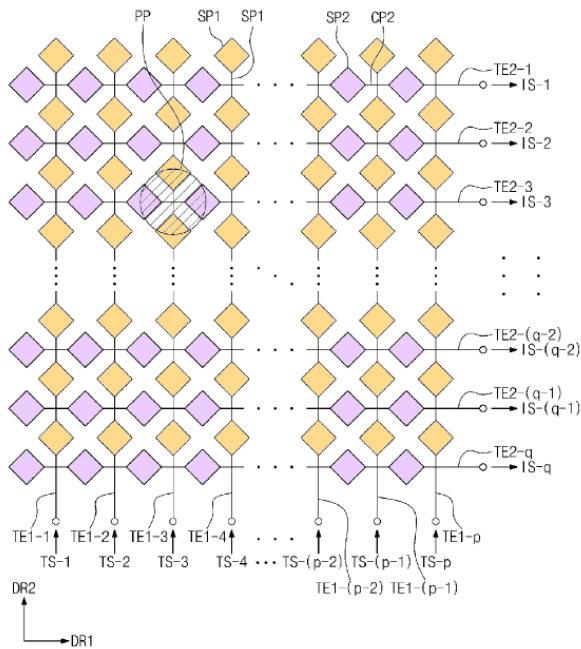
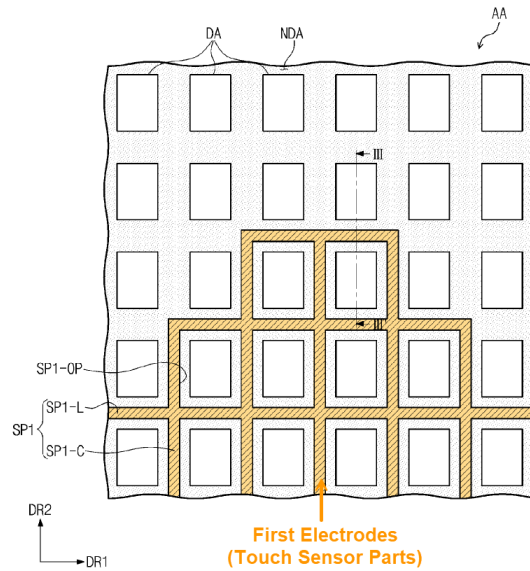
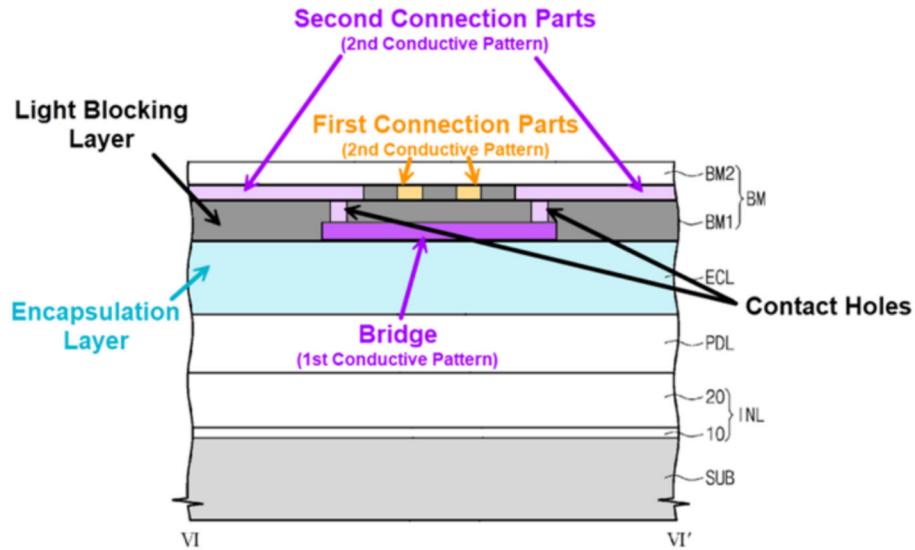


Fig. 10



When implementing Her's underpass-type bridge embodiment (§§V.E.1.d, V.E.1.f (1[c], [e])), POSITA would have understood that first sensor parts (SP1) would be part of second conductive pattern along with first connection parts (CP1) Ex-1008, ¶117 (first/second sensor parts SP1/SP2 formed in same layer); Ex-1003, ¶312.

Illustration of Her's ¶116 Embodiment



h. 1[e][ii]

Her discloses that “second sensor parts SP2” that are spaced from first sensor parts (SP1) Ex-1008, ¶¶104-05, Figs. 8, 12; Ex-1003, ¶¶313-14.

Fig. 8

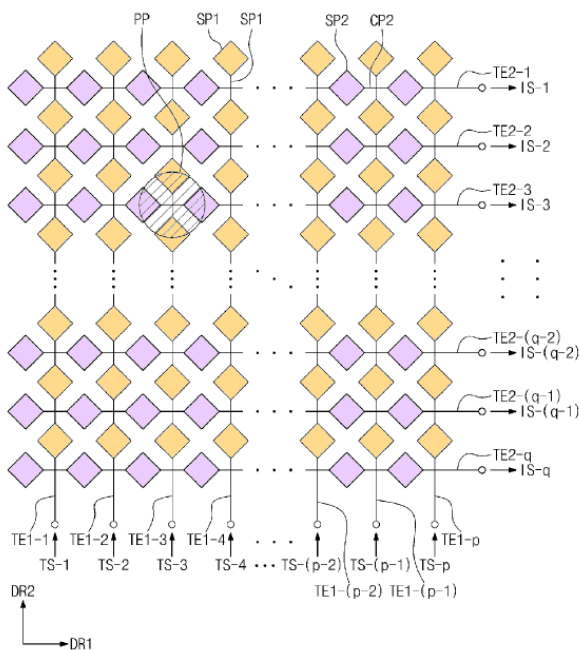
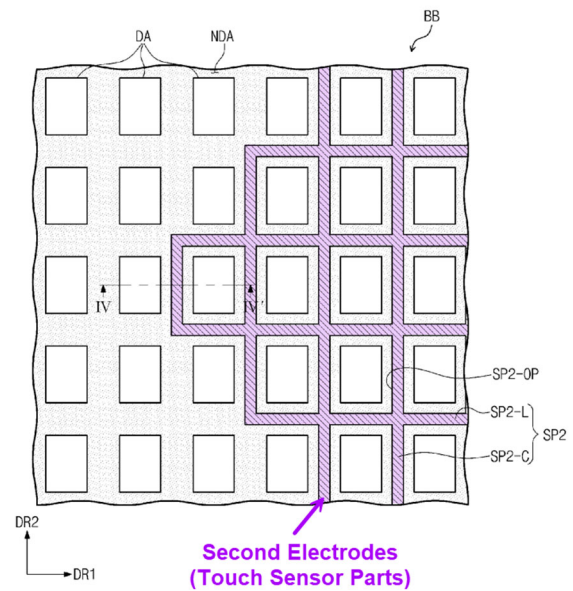
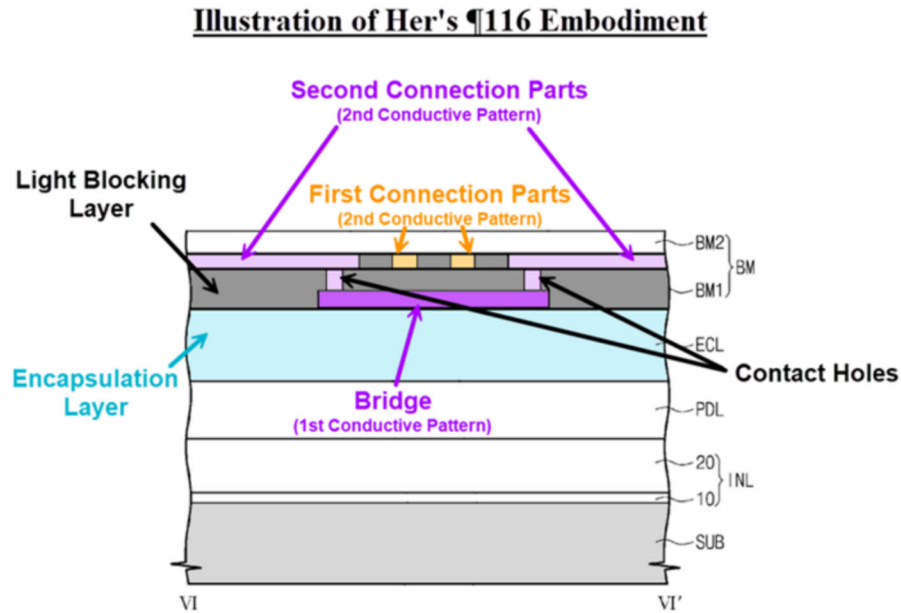


Fig. 12

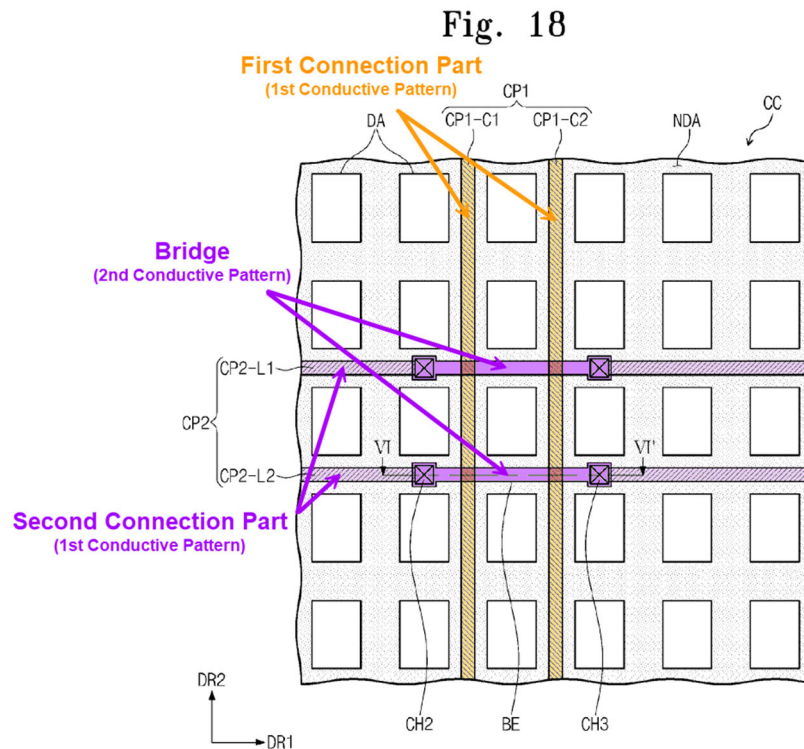


When implementing Her's underpass-type bridge embodiment (§V.E.1.f (1[e])), POSITA would have understood that second sensor parts (SP2) would be part of second conductive pattern along with second connection parts (CP2). Ex-1008, ¶117; Ex-1003, ¶315.



i. 1[e][iii]

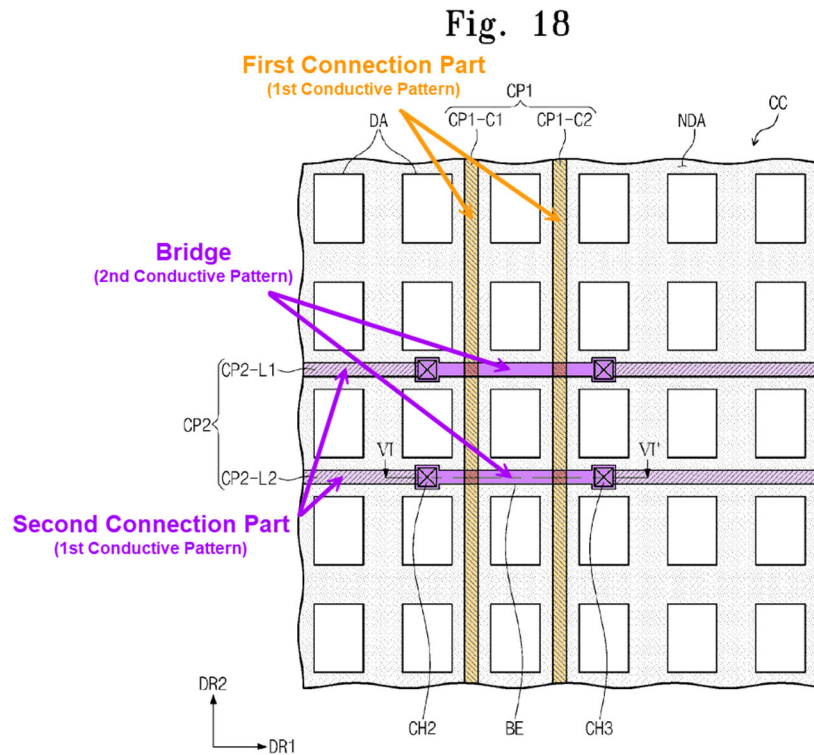
Her's "first connection parts CP1 connects vertices of the two adjacent first sensor parts," (Ex-1008, ¶90), and that "first connection part CP1 includes two vertical parts CP1-C1 and CP1-C2." (Ex-1008, ¶114, Fig. 18); Ex-1003, ¶¶316-17.



Her’s “first connection part CP1” is on “first light blocking layer,”(Ex-1008, ¶116), which POSITA would have understood as being part of second conductive pattern. Ex-1003, ¶318; §§V.E.1.d, V.E.1.f (1[c], 1[e]).

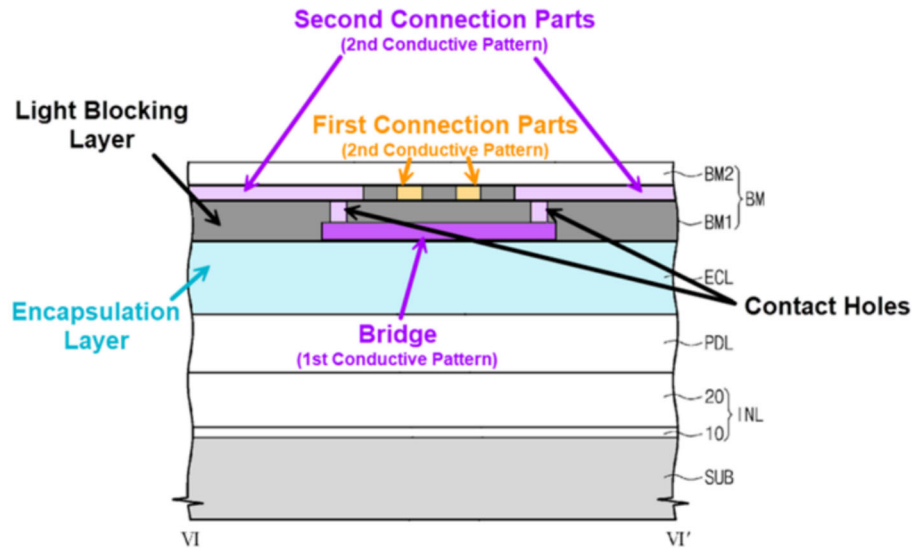
j. 1[f]

Her’s “second connection parts CP2 connects two adjacent second sensor parts...SP2.” Ex-1008, ¶89. Her’s second connection parts include “a bridge BE” on a different layer than first/second touch-sensor parts. *Id.*, ¶¶114-15; Ex-1003, ¶¶319-20.



Her’s “first...and the second connection part CP2” are on “first light blocking layer BM1,” and “bridge BE may be disposed on the sealing layer ECL” in which “first light blocking layer BM1 may cover the bridge BE.” *Id.*, ¶116. Although Her uses “second connection parts CP2” to refer to a portion of second electrode formed as part of second conducting pattern, when implementing Her’s underpass-type bridge embodiment (§V.E.1.f (1[e])), POSITA would have understood that bridge (BE) would equate to “*second connection part*” as claimed, which is formed as part of first conductive pattern. Ex-1003, ¶321.

Illustration of Her's ¶116 Embodiment



k. 1[g]

Her, with or without Hsieh and Kobayashi, teaches or suggests 1[g].

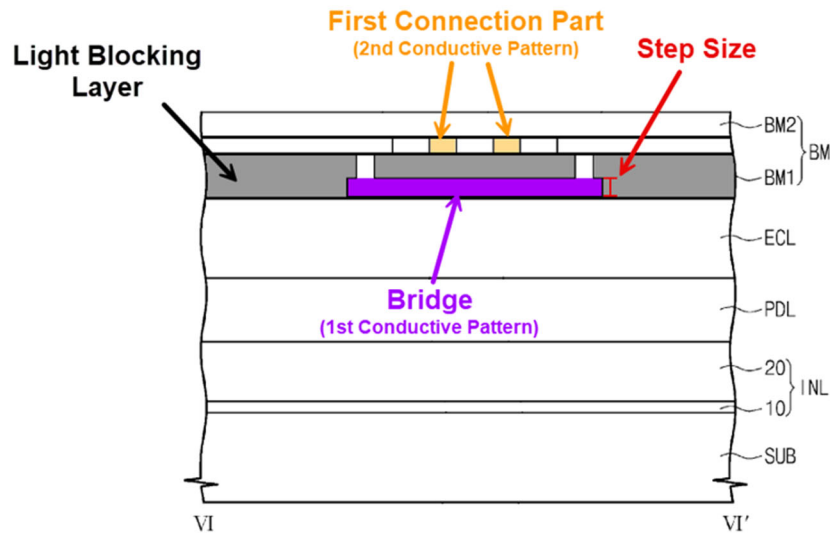
For reasons explained in §V.A.2.k (1[g], Ground 1A), Having second conductive pattern thicker than first conductive pattern would have been an obvious design choice based on several known considerations. Ex-1003, ¶¶322-25.

First, as in §V.A.2.k (1[g], Ground 1A), it was known that relative thickness of each conductive layer is a design choice with only three possible options: thinner than, thicker than, or the same thickness. Ex-1003, ¶326. For instance, Hsieh's touch-sensor panel of two conductive layers—like Her—can have upper conductive layer thicker than lower conductive layer. Ex-1009, ¶¶72-73. Selecting any of these options, consistent with Hsieh, would have been obvious. Ex-1003, ¶326; *Toshiba*

Samsung Storage Tech. Korea Corp., IPR2014-00204, Paper 31, 29; *In re Troiel*, 274 F.2d at 949.

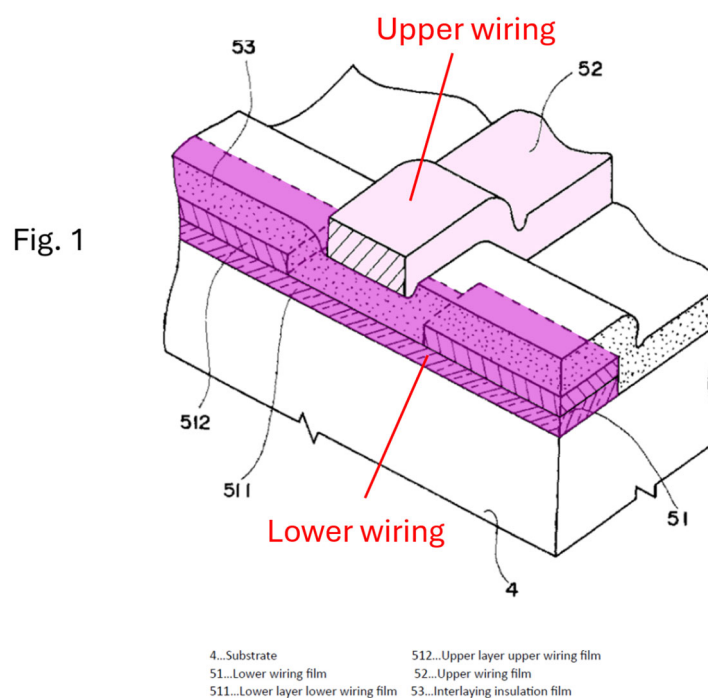
Second, as in §V.A.2.k (1[g], Ground 1A), when bridges are formed as first conductive pattern (consistent with Her, §V.E.1.d (1[c])), POSITA would have been motivated to reduce bridge thickness relative to touch-sensor parts and connection parts formed reduce effects caused by bridge's step size. Ex-1003, ¶¶327-30. POSITA would have also known that when Her's bridge and first connection parts cross each other on different material layers and separated by insulation, steps at crossing locations create at least the same three problems: (1) inducing disconnections in upper wire; (2) thinning of upper wire that increases resistance and load; and (3) cracking insulation due to stress concentrations at the step. Ex-1003, ¶¶327-30; Ex-1010, Fig. 2A, 2-4, Fig. 5; Ex-1027; Ex-1028, Fig. 2A, 1-2; Ex-1056, Fig. 12, 1-2; Ex-1057, 11:48-12:3.

Illustration of Her's ¶116 Embodiment

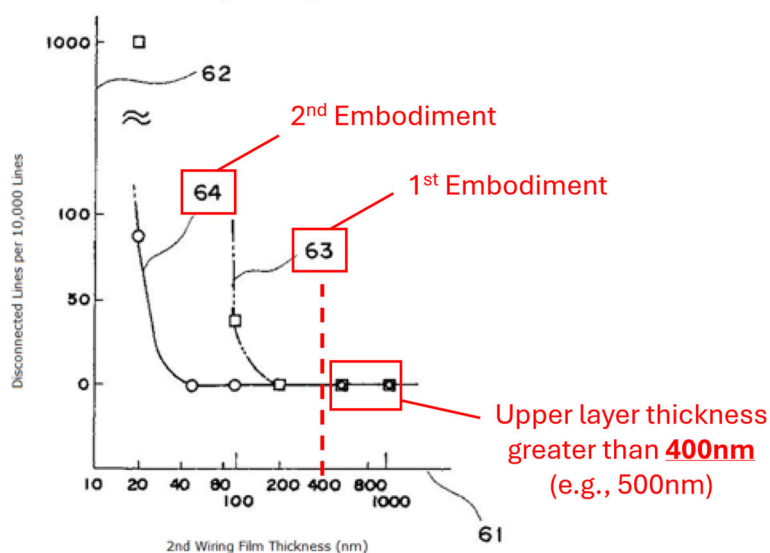


As in §V.A.2.k (1[g], Ground 1A), POSITA would have understood that the three ways to address these problems simultaneously or combined can be similarly applied to Her. Ex-1003, ¶331; Ex-1058, ¶52 and FIG. 6.

Kobayashi, for instance, expressly teaches two embodiments (Fig. 5, curves 63-64) both disclosing two intersecting conductive layers (like Her's touch-sensor connections) where upper conductive layers' thickness (e.g., 500nm) are greater than lower conductive layers (e.g., 320nm) at the intersection to prevent disconnections in upper conductive layer. Ex-1010, 2-5, Figs. 1-5; Ex-1003, ¶¶332-33.



[FIG. 5]



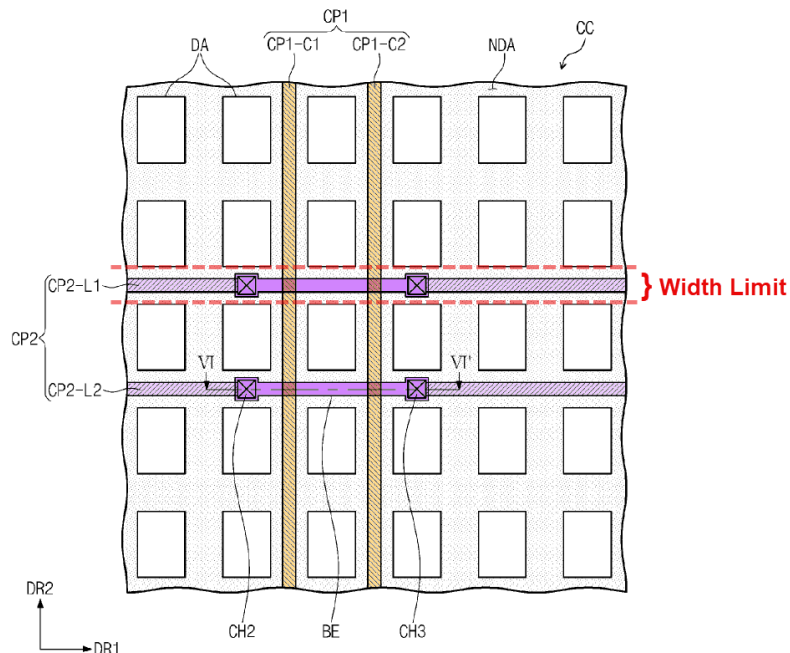
61: Horizontal line
62: Vertical line
63: Results of the prior art
64: Results of the present invention

Lower wiring thickness
less than **320nm**

A POSITA would have therefore reduced Her's bridge thickness to reduce step size, increase thickness of touch-sensor parts and connection parts to minimize effects of bridge's step, or both, producing thinner first conductive layer than the second. Ex-1003, ¶¶330-32.

Additionally, as in §V.A.2.k(1[g], Ground 1A), POSITA would have understood that increasing cross-sectional areas will reduce electrical resistance and improve mechanical strength, and when sensors consists opaque metals like Her, (Ex-1008, ¶¶101, 105), the width should be constrained to gap sizes between adjacent light-emitting areas. Ex-1003, ¶¶333-36.

Fig. 18



Her, Fig. 18 (annotated)

As explained in §V.A.2.k(1[g], Ground 1A), making touch sensors thicker than the bridge also provides additional benefits including bending resilience, low resistance, and resistance matching. Ex-1003, ¶¶337-40.

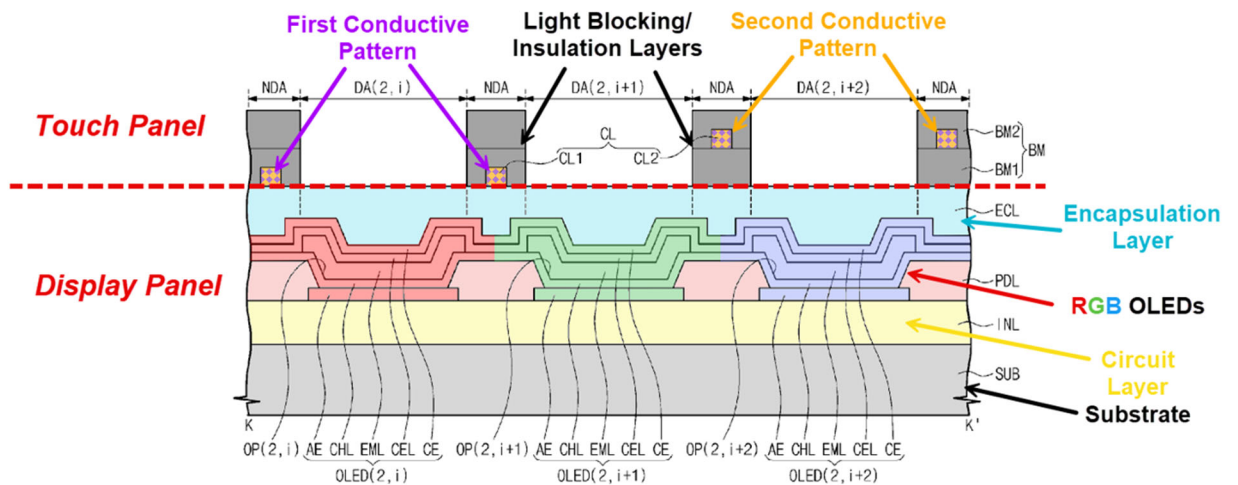
At base, selecting relative thicknesses of first and second conductive patterns was an obvious design choice with limited options, but POSITA would have been motivated to make, and had reasonable expectations of making, second conductive pattern (e.g., Her's touch-sensor parts and first connection parts) greater in thickness than first conductive pattern (e.g., Her's bridge), for reasons taught by Kobayashi and others in the art, which merely required controlling thicknesses of each layer. Ex-1003, ¶341.

2. Cl.2

a. 2[a]

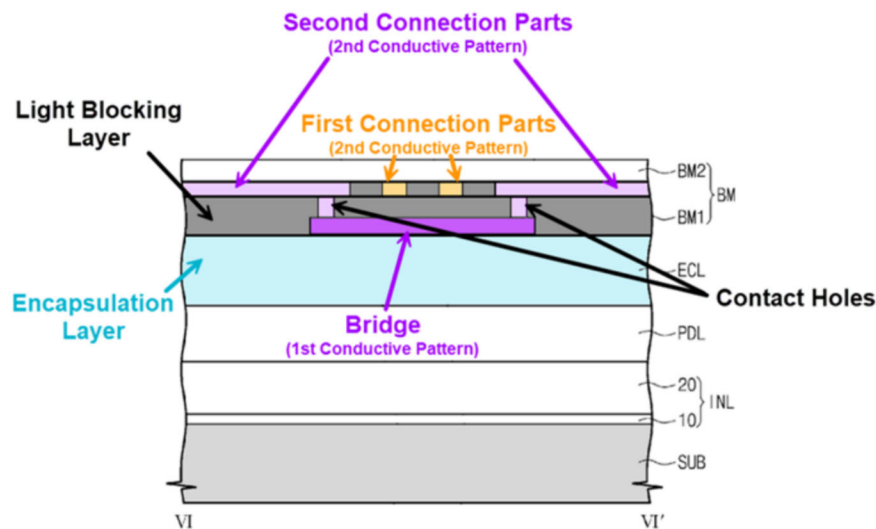
Her's conductive layer CL and light blocking layer BM are on “sealing layer ECL,” Ex-1008, ¶77, and “first conductive layer CL1 may be directly disposed on the sealing layer”(id., ¶82; Fig. 7). Ex-1003, ¶¶342-43.

Fig. 7



When implementing Her's underpass-type bridge embodiment (§V.E.1.f (1[e])), POSITA would have understood that bridge (BE) would be first conductive pattern formed directly on sealing/encapsulation layer (ECL). Ex-1003, ¶344.

Illustration of Her's ¶116 Embodiment

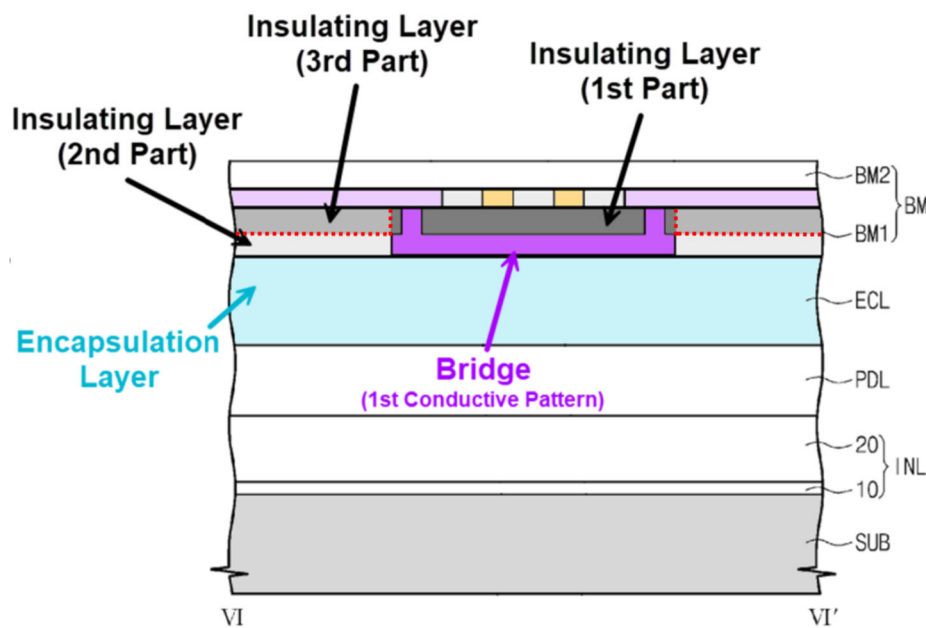


b. 2[b]

Because conductive layer CL **and** light blocking layer directly on sealing layer, POSITA would have understood that first (insulating) light-blocking layer can be

divided into three parts: first part on first conductive layer (e.g., BE) and spaced from sealing/encapsulation layer, second part on the top surface of sealing/encapsulation layer; and third part connecting first and second parts. Ex-1008, ¶77, Fig. 7; Ex-1003, ¶¶345-46.

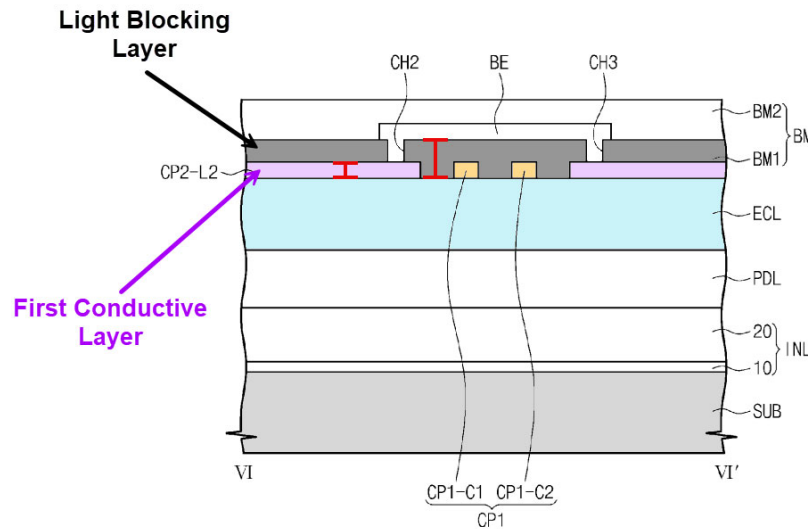
Illustration of Her's ¶116 Embodiment



3. Cl.3

Her shows in each embodiment, thickness of first conductive pattern is less than the thickness of first (insulating) light-blocking layer (BM1). Ex-1008, Figs. 7, 11-13, 15-17, 19; Ex-1003, ¶¶347-48.

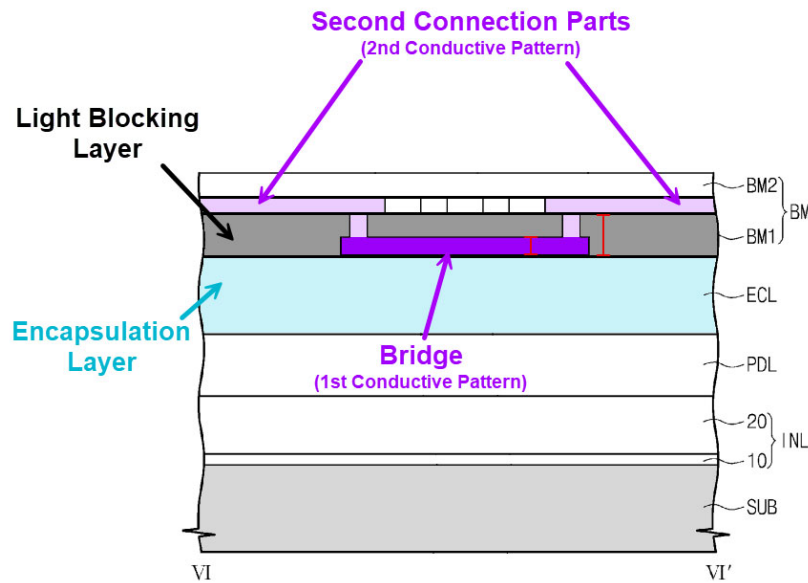
Fig. 19



A POSITA would have also known, generally, that because Her's light-blocking layer both contacts sealing/encapsulation (ECL) and is intended to *cover* first conductive layer (CL1)(*id.*, ¶83), then insulating layer would be thicker than first conductive layer (CL1)(Ex-1003, ¶349).

A POSITA would have also appreciated that the same would be true of Her's underpass-type bridge embodiment. §V.E.1.f (1[e]); Ex-1003, ¶350. Although POSITA would know that connections are provided between bridge (BE) and second connection parts (CP2) through the contact holes so that the bridge ultimately has same thickness as first light-blocking layer (BM1), POSITA would have also understood that those connections are formed separately from the bridge, as light-blocking layer with contact holes is conventionally formed first, and holes are then filled afterwards. Ex-1003, ¶350; Ex-1025, Fig. 5C.

Illustration of Her's ¶116 Embodiment



A POSITA would have also known that when two wires (like Her's bridge and first connection parts) cross each other on different material layers and are separated by insulation, thicknesses of components in lower layers create an undesired "step" that propagates to upper layers. Ex-1003, ¶¶351-52. It was well known to dispose insulating layer with a thickness greater than the underpass bridge to shrink the step so the upper wire need not account for the step, and with a sufficient thickness on top of the lower wire to avoid cracking in the insulation. *Id.* A POSITA would have understood that forming the insulation as a "planarizing" (flattened) layer between wires with sufficient thickness on top of the lower wire would have shrunk the step and avoided disconnection in the upper wire and cracks in insulation. Ex-1003, ¶¶351-52; Ex-1005, ¶68.

4. Cl.15

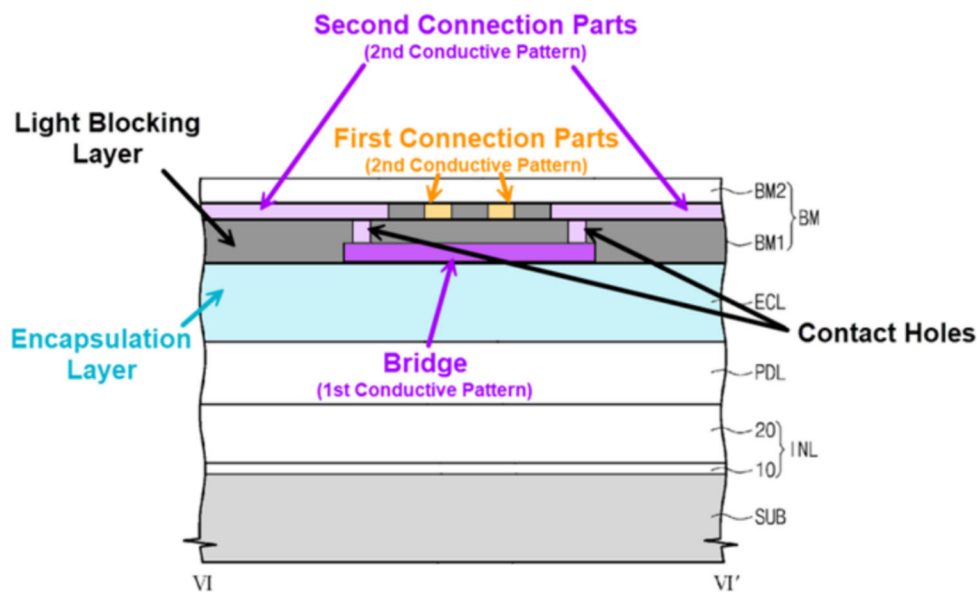
Her discloses claim 15. §§V.E.1.f (1[e]), V.E.1.j (1[f]); Ex-1003, ¶353.

5. Cl.18

a. 18[a]

Her's "bridge BE connects the portions of the second connection part CP2, which are disconnected from each other, through a second contact hole CH2 and a third contact hole CH3, which are formed through the first light blocking layer BM1." Ex-1008, ¶115; Ex-1003, ¶¶354-55.

Illustration of Her's ¶116 Embodiment



A POSITA would have understood that contact holes are required to pass through first light blocking layer BM1 for both overpass-type or underpass-type bridge embodiments to establish electrical connection between the bridge of first

conductive pattern and second connection parts of second conductive pattern. Ex-1003, ¶356; §V.E.1.f (1[e]).

b. 18[b]

Her teaches or suggests 18[b]. §§V.E.1.f (1[e]), V.E.5.a (18[a]); Ex-1003, ¶357.

6. Cl.19

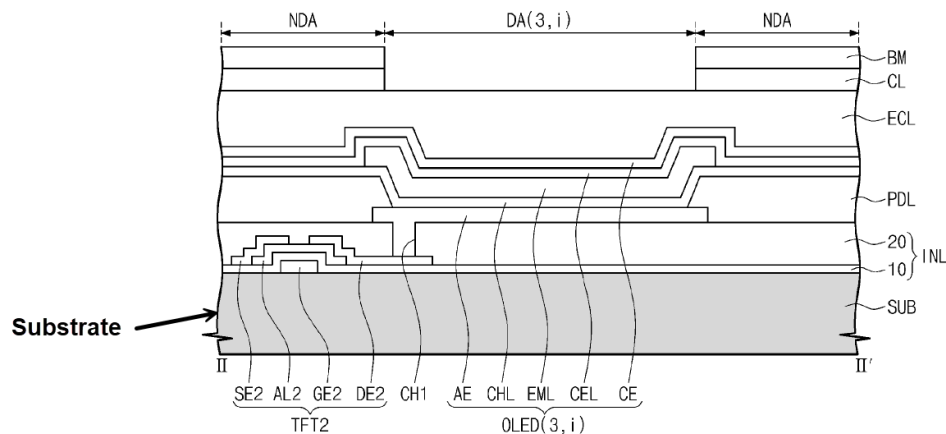
a. 19[pre]

Her discloses 19[pre]. §V.E.1 (cl. 1); Ex-1003, ¶358.

b. 19[a]

Her's “display panel DP includes a base substrate.” Ex-1008, ¶49; *id.*, ¶¶10, 50-51, 68, 70-80, Figs. 4-7 and 19; Ex-1003, ¶¶359-61.

Fig. 6



c. 19[b]

Her's circuit layer (e.g., the layers of TFT2 and INL) is on the base layer. Ex-1008, ¶¶49, 51-53, 63, 63-74, Figs. 3-7; Ex-1003, ¶¶362-64.

Fig. 3

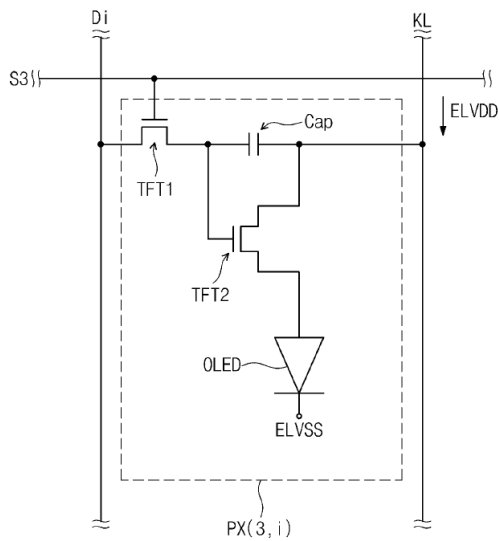


Fig. 4

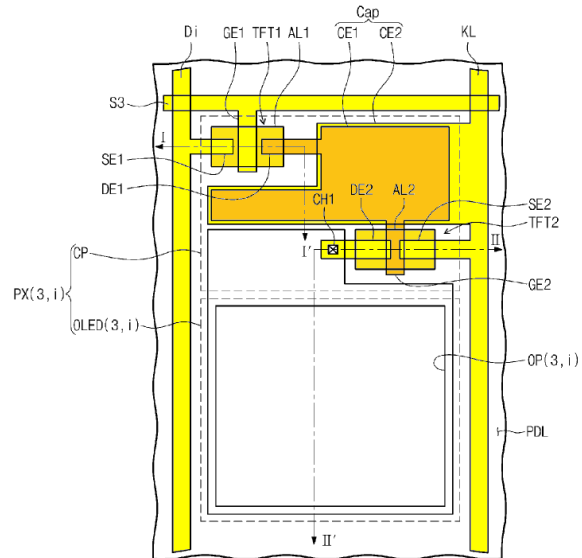
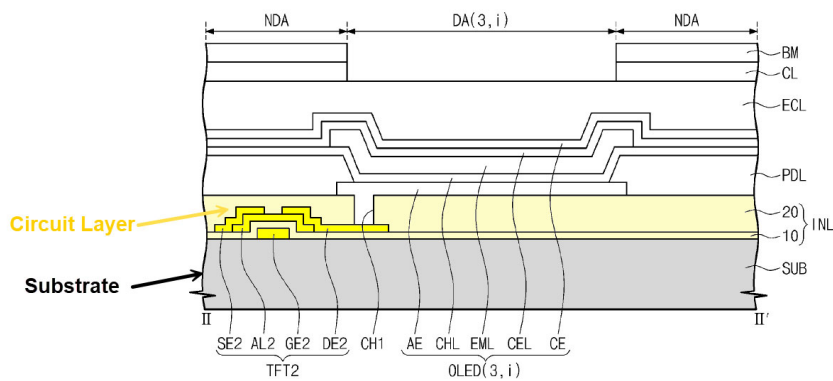


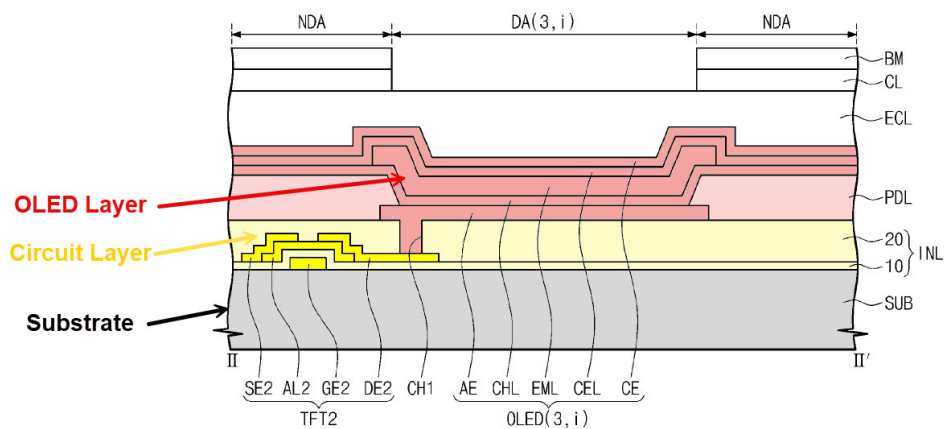
Fig. 6



d. 19[c]

Her’s “pixels...may include...an organic light emitting device”(Ex-1008, ¶53), which is on “second insulating layer” of the circuit layer(*id.*, ¶74; *id.*, ¶¶62, 66-69, 74-75, 80, Figs. 5-7, 11, 13, 16-17, 21; Ex-1003, ¶¶365-67).

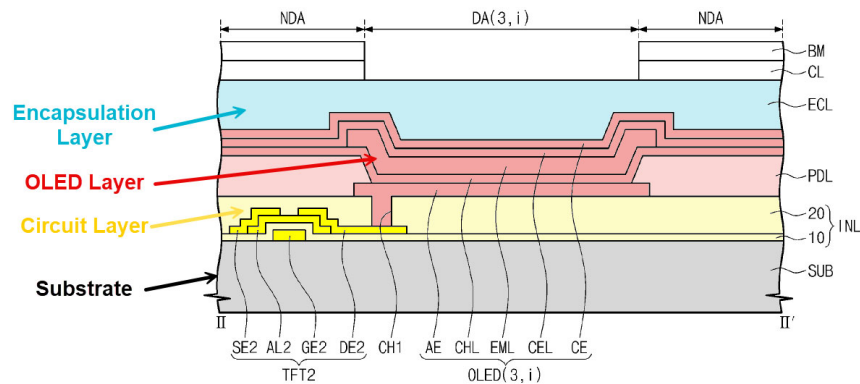
Fig. 6



e. 19[d]

Her’s sealing layer (ECL) is on “base substrate SUB, covering the organic light emitting device OLED(3,i).” Ex-1008, ¶¶76-79, Fig. 7; *id.*, ¶¶10, 113-16, Fig. 19. POSITA would have understood that “sealing” layer is also conventionally called a thin-film “encapsulation” layer. Ex-1003, ¶¶368-70.

Fig. 6



F. Ground 2B-Claims 4-14: Her and Park, with or without Hsieh and/or Kobayashi.

Claims 4-14 are obvious in view of (1) Her and Park, and (2) Her and Park in further view of Hsieh and/or Kobayashi.

1. Prior Art

Her's sensor parts (SP1/SP2) and connection parts (CP1/CP2) can be made out of a number of different, conventional materials, including "indium tin oxide" or metals such as "copper, aluminum, etc." Ex-1008, ¶¶101, 105, 108, 115, 126. Because Her largely leaves the selection of materials and their thicknesses open for modification, and a variety of different materials and thicknesses were known to be suitable for touch sensors, POSITA would have been motivated to look to other prior art to provide additional details concerning possible materials and thicknesses that could be used to form conductive layers of touch sensors. And, for the same reasons discussed previously with respect to Chen and Park, POSITA would have been

especially motivated to select a multilayered sandwich structure for conductive layers of a touch sensor, as well as select specific materials and thicknesses of those layers as obvious design choices. §V.B.1.b (Ground 1B, motivation). Ex-1003, ¶¶371-83.

2. Cl.4

a. 4[a]

Although Her does not expressly disclose thicknesses of first conductive layer, because prior art taught conductive layers conventionally have thicknesses between $0.05\mu\text{m}$ - $2\mu\text{m}$ (500 - $20,000\text{\AA}$), (Ex-1006, ¶42), but more often focused on one to a few-thousand angstroms (§V.B.1.b (motivation)), the claimed range of 1800 - $2100\text{\AA}$ is presumed obvious. *Synvina*, 904 F.3d at 1006. But regardless, POSITA would have been motivated to select thicknesses within known ranges, including between 1800 - $2100\text{\AA}$, as a mere design choice and routine optimization of known result-effective variables. §§V.B.1.b (Ground 1B, motivation), V.F.1 (same motivation for modifying Her); Ex-1003, ¶¶384-87.

b. 4[b]

Although Her does not expressly disclose thicknesses of second conductive layer, because prior art taught conductive layers conventionally have thicknesses between $0.05\mu\text{m}$ - $2\mu\text{m}$ (500 - $20,000\text{\AA}$), (Ex-1006, ¶42), but more often focused on one to a few-thousand angstroms (§V.B.1.b (motivation)), the claimed range of 2700 -

3500Å is presumed obvious. *Synvina*, 904 F.3d at 1006. However, as discussed previously, POSITA would have been especially motivated to make Her's second conductive pattern thicker than first conductive pattern to decrease resistance and increase mechanical strength (§V.E.1.k (1[g])), while still maintaining thicknesses within conventional range. Ex-1006, ¶42; §§V.B.1.b (Ground 1B, motivation, V.F.1 (same motivation for modifying Her)). Accordingly, POSITA would have been motivated to select thicknesses within known ranges, including a thickness between 2700-3500Å, as a mere design choice and routine optimization of a known result-effective variable. §V.B.1.b (motivation); Ex-1003, ¶¶388-92.

3. Cl.5

a. 5[pre]

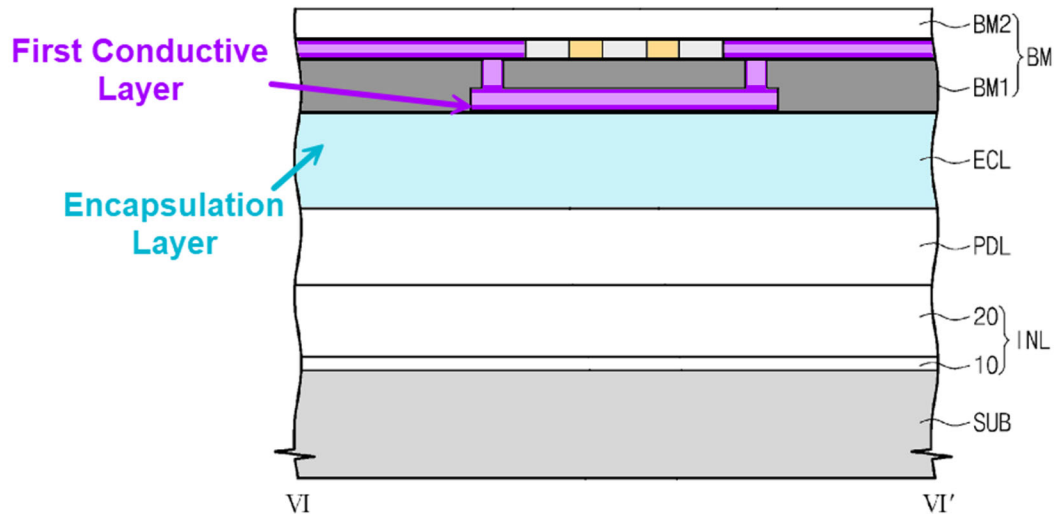
Her discloses 5[pre]. §V.E.1.d (1[c]); Ex-1003, ¶393.

b. 5[a]

Her's first conductive pattern is on the display panel. §V.E.1.d (1[c]); Ex-1003, ¶¶394-95.

When forming first conductive pattern as a multilayered sandwich structure, as taught by Park (§§V.B.1.b (Ground 1B, motivation), V.F.1 (Her motivation)), POSITA would have appreciated the conductive pattern would have a first conductive layer on the display panel. Ex-1003, ¶¶396-98.

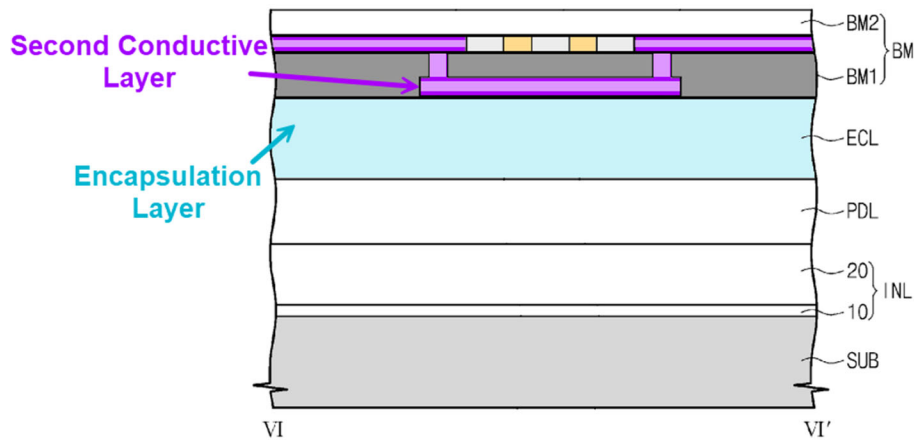
Illustration of Her's ¶116 Embodiment



c. 5[b]

When forming first conductive pattern as a multilayered sandwich structure, as taught by Park (§§V.B.1.b (Ground 1B, motivation), V.F.1 (Her motivation), POSITA would have appreciated the conductive pattern would have a second conductive layer on first conductive layer. Ex-1003, ¶¶399-401.

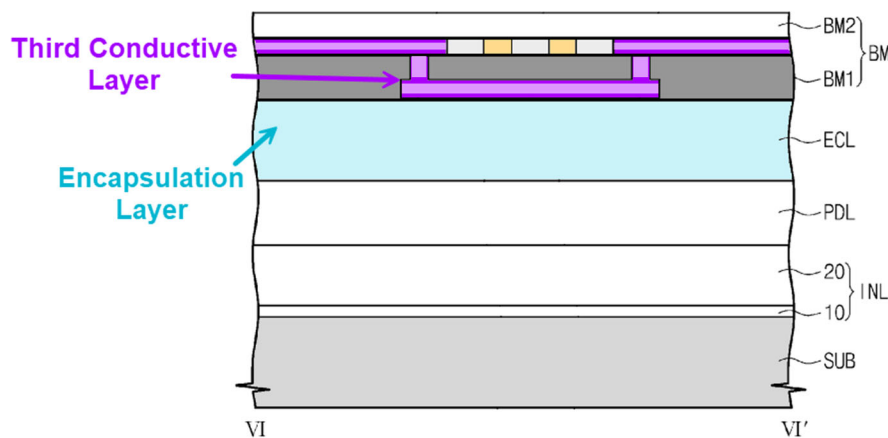
Illustration of Her's ¶116 Embodiment



d. 5[c]

When forming Her's first conductive pattern as a multilayered sandwich structure, as taught by Park (§§V.B.1.b (Ground 1B, motivation), V.F.1 (Her motivation), POSITA would have appreciated the conductive pattern would have third conductive layer on second conductive layer. Ex-1003, ¶¶402-03.

Illustration of Her's ¶116 Embodiment



Moreover, POSITA would have also understood second conductive layer would have less resistivity and a greater thickness than first and third conductive layers. Specifically, Park teaches second conductive layer should serve as primary electrical conductor for the conductive pattern, and thus should have an electrical conductivity greater than first and third conductive layers (or less resistivity) and a greater thickness. Ex-1006, ¶¶41 (teaching $d_1 < d_3 < d_2$), 96-104. For example, Park discloses a titanium-aluminum-titanium sandwich (Ex-1006, Table 1 (Example 7), ¶85), and POSITA would have understood that aluminum's resistivity is substantially less than titanium's. Ex-1030, 9:46-49; Ex-1061, ¶64; Ex-1003, ¶¶404-06.

4. Cl.6

Her-Park combination teaches claim 6. §V.B.3.d (5[c]); Ex-1006, ¶41; Ex-1003, ¶¶407-09.

5. Cl.7

Park's first conductive layer's thickness is $0.01\text{-}1.935\mu\text{m}$ ($100\text{-}19,350\text{\AA}$), and third conductive layer may be thicker at $0.015\text{-}1.95\mu\text{m}$ ($150\text{-}19,500\text{\AA}$), which encompass the claimed range (e.g., first conductive layer of $100\text{\AA}$, and a third conductive layer of $150\text{-}300\text{\AA}$). Ex-1006, ¶¶41-49, 94-99; *Synvina*, 904 F.3d at 1006.

Because POSITA would have found it obvious to select thicknesses for Her's first (lower) conductive pattern on the order of a few thousand angstroms, POSITA

would have been further motivated to select thicknesses for individual layers of the conductive pattern on the lower end of Park's thicknesses for first and third conductive layers, including, e.g., third conductive layer's thickness about 1.5-3 times first conductive layer's thickness not only as obvious design choices, but also to ensure each layer serves its intended function. Ex-1006, ¶¶41-49, 94-99; Ex-1003, ¶¶410-13.

6. Cl.8

a. 8[a]

Park's first conductive layer (20a-1)'s thickness of 0.01-1.935 μ m (100-19,350Å) overlaps the claimed range. Ex-1006, ¶¶43, 100; *Synvina*, 904 F.3d at 1006. Moreover, because POSITA would have found it obvious to select thicknesses for Her's first/lower conductive pattern on the order of a few thousand angstroms, (§§V.B.1.b (Ground 1B, motivation), V.F.1 (Her motivation), V.F.2.a (4[a])), POSITA would have been further motivated to select thicknesses for first conductive layer on the lower end of Park's range—including between 50-200Å—to ensure the overall stack remains less than a few thousand angstrom while each conductive layer serves its intended purpose. Ex-1003, ¶¶414-15.

b. 8[b]

Park's second conductive layer (20a-2)'s thickness of "0.04 μ m to 1.975 μ m" (400-19,750Å) encompasses the claimed range. Ex-1006, ¶¶44, 101; *Synvina*, 904

F.3d at 1006. POSITA would have been motivated to select thicknesses for second conductive layer on the lower end of Park’s range—including between 1000-1800Å—to ensure to ensure the overall stack remains less than a few thousand angstrom while each conductive layer serves its intended purpose. Ex-1003, ¶¶416-18.

c. 8[c]

Park’s third conductive layer (20a-3)’s thickness of “0.015μm to 1.95μm” (150-19,500Å) encompasses the claimed range. Ex-1006, ¶¶45, 102, Fig. 6. POSITA would have been motivated to select thicknesses for third conductive layer on the lower end of Park’s range—including between 250-350Å—to ensure to ensure the overall stack remains less than a few thousand angstrom while each conductive layer serves its intended purpose. Ex-1003, ¶¶419-21.

7. Cl.9

a. 9[a]

Park’s titanium-aluminum-titanium sandwich is one exemplary material selection for multilayered sandwich conductive patterns, in which first and third conductive layers are titanium(Ex-1006, Table 1 (Example 7), ¶85). POSITA would have been motivated to select titanium-aluminum-titanium to implement as Her’s first conductive pattern as an obvious design choice. §§V.B.1.b (Ground 1B, motivation), V.F.1 (Her motivation); Ex-1003, ¶¶422-24.

b. 9[b]

Her-Park combination teaches or suggests 9[b]. §V.F.7.a (9[a]), Ex-1003, ¶425.

8. Cl.10

a. 10[pre]-10[f][iii]

Limitations 10[pre]-10[f][iii] are substantially similar to claims 1 and 5, as shown below. Therefore, the Her-Park combination teaches or suggests these limitations for the same reasons. Ex-1003, ¶¶426-27.

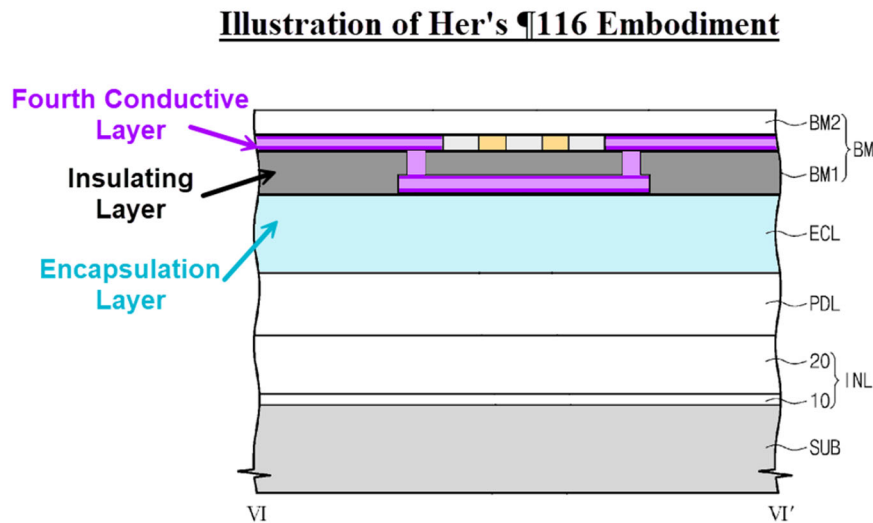
Claim 10	Claim	Reference
10[pre]	1[pre]	V.E.1.a
10[a]	1[a]	V.E.1.b
10[b]	1[b]	V.E.1.c
10[c]	1[c]	V.E.1.d
10[d]	1[d]	V.E.1.e
10[e]	1[e]/1[g]	V.E.1.f/V.E.1.k
10[f]	5[pre]	V.F.3.a
10[f][i]	5[a]	V.F.3.b
10[f][ii]	5[b]	V.F.3.c
10[f][iii]	5[c]	V.F.3.d

b. 10[g]-10[g][i]

Her's second conductive pattern is formed on insulating layer (§V.E.1.f (1[e])), and the same exemplary materials are used for both first and second conductive patterns (CL1/CL2). Ex-1008, ¶¶101, 105. Similarly, Park teaches both

first and second sets of electrodes may have a three-layer structure. Ex-1006, Fig. 6, Table 1, ¶¶83-115; Ex-1003, ¶¶428-29.

When implementing multilayer sandwich structures for first conductive pattern, POSITA would have been motivated to also implement multilayer sandwich structures for second conductive pattern as well, for same reasons as first conductive pattern (design choice, e.g., improved adhesion, conductivity, opacity, and anti-corrosion control). §§V.B.1.b (Ground 1B, motivation), §V.F.1 (Her motivation). POSITA would have understood that second conductive pattern would have fourth layer (e.g., first, bottom-most layer of second conductive pattern) on insulating layer. Ex-1003, ¶¶430-31.



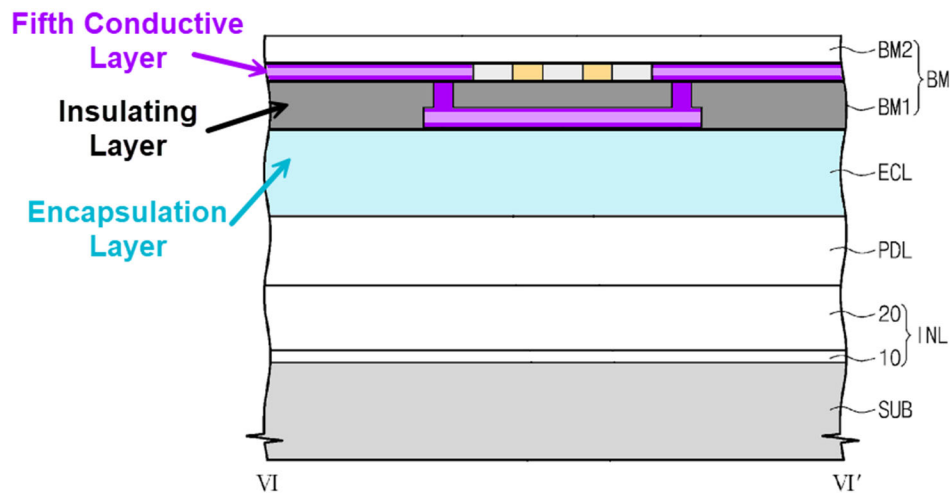
c. 10[g][ii]

Because it would have been obvious to provide both conductive patterns with multilayer sandwich structures, Her-Park combination teaches or suggests fifth

conductive layer (middle conductive layer of second conductive pattern (CL2)).

§V.F.8.b (10[g]); Ex-1003, ¶¶432-34.

Illustration of Her's ¶116 Embodiment



d. 10[g][iii]

Because it would have been obvious to provide both conductive patterns with multilayer sandwich structures, Her-Park combination teaches or suggests a sixth conductive layer (top conductive layer of second conductive pattern (CL2)).

§V.F.8.b (10[g]); Ex-1003, ¶¶435-36.

Moreover, when choosing materials (e.g., Park's titanium-aluminum-titanium), POSITA would have appreciated fifth conductive layer has an electrical resistivity less than fourth and sixth conductive layers, and thickness greater than fourth and sixth conductive layers. §V.F.3.d (5[c]); Ex-1003, ¶¶437-38.

9. CL11

A POSITA would have been motivated to make and had reasonable expectations of success in making Her's second conductive pattern (CL2) thicker than first conductive pattern (CL1), particularly for Her's underpass-type bridge embodiment. §V.E.1.k (1[g]); Ex-1003, ¶¶439-40. POSITA also would have been motivated to make and had a reasonable expectation of success in making each of Her's conductive patterns (CL1/CL2) a multilayered-metal composite using a variety of materials and selecting specific thicknesses for each layer in view of Park. §V.B.3 (cl. 5); Ex-1003, ¶440.

Upon making Her's second conductive pattern (CL2) thicker than first conductive pattern (CL1), POSITA would have further found it obvious to make the thickness of second conductive layer (e.g., conductive layer of Her's bridge) less than that of fifth conductive layer (e.g., conductive layer of Her's touch-sensor parts and connection parts) to keep the overall thickness of first conductive pattern (CL1: BE) less than the thickness of second conductive pattern (CL2: SP1/SP2/CP1/CP2), and because these two layers are primarily responsible for conducting electricity for each of their respective conductive pattern layers. §V.E.1.k (1[g]); Ex-1006, ¶¶91-92, 98; Ex-1003, ¶441.

Additionally, because middle conductive layer is thicker than top and bottom conductive layers of each of upper/lower conductive pattern layers, POSITA would

have found adjusting thickness of middle conductive layer would have a greater impact on overall thickness and easier to achieve different overall thicknesses. Ex-1003, ¶¶442-43.

10. Cl.12

For same reasons discussed above, upon making Her's second conductive pattern (CL2) thicker than first conductive pattern (CL1), POSITA would have been motivated to make first conductive layer thinner than fourth conductive layer (bottom layers of each respective pattern). §§V.E.1.k (1[g]), V.F.9 (cl. 11); Ex-1003, ¶¶444-47.

11. Cl.13

a. 13[a]

Park's bottom layer (20a-1)'s thickness is 0.01µm-1.935µm (100-19,350Å), encompassing claimed range. Ex-1006, ¶¶43, 100, Fig. 6; Ex-1003, ¶¶448-49; *Synvina*, 904 F.3d at 1006.

For same reasons discussed above, upon making second conductive pattern (CL2) thicker than first conductive pattern (CL1), POSITA would have been motivated to make fourth conductive layer thicker than first conductive layer (e.g., bottom layers of each respective pattern), including making fourth conductive layer between 250-350Å. §§V.E.1.k (1[g]), V.F.6.a (8[a]); Ex-1003, ¶¶450-51.

b. 13[b]

Park's middle layer (20a-2)'s thickness is 0.04 μ m-1.975 μ m (400-19,750Å), encompassing claimed range. Ex-1006, ¶¶44, 101, Fig. 6; Ex-1003, ¶¶452-53; *Synvina*, 904 F.3d at 1006.

For same reasons discussed above, POSITA would have been motivated to make fifth conductive layer thicker than second conductive layer (e.g., the middle layers of each respective pattern), including making fifth conductive layer between 2200-2800Å. §§V.E.1.k (1[g]), V.F.6.b (8[b]); Ex-1003, ¶¶454-55.

c. 13[c]

Park's top layer (20a-3)'s thickness is 0.015 μ m-1.95 μ m (150-19,500Å), encompassing claimed range. Ex-1006, ¶¶45, 102, Fig. 6; Ex-1003, ¶¶456-57; *Synvina*, 904 F.3d at 1006.

For same reasons discussed above, POSITA would have been motivated to make sixth conductive layer thicker than third conductive layer (e.g., top layers of each respective pattern), including making sixth conductive layer between 250-350Å (e.g., if third conductive layer is 250Å, making sixth conductive layer 350Å). §§V.E.1.k (1[g]), V.F.6.c (8[c]); Ex-1003, ¶¶458-59.

12. Cl.14

a. 14[a]

Her-Park combination teaches or suggests 14[a]. §V.F.7.a (9[a]), Ex-1003, ¶¶460-61.

b. 14[b]

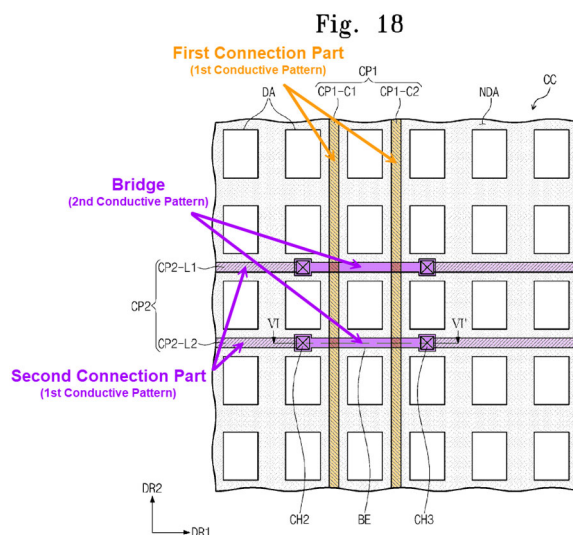
Her-Park combination teaches or suggests 14[b]. §V.F.7.a (9[a]), Ex-1003, ¶¶462-63.

G. Ground 2C-Claim 16-17: Her and Lee-343, with or without Hsieh and/or Kobayashi.

Claims 16-17 are obvious in view of (1) Her and Lee-343, and (2) Her and Lee-343 in further view of Hsieh and/or Kobayashi.

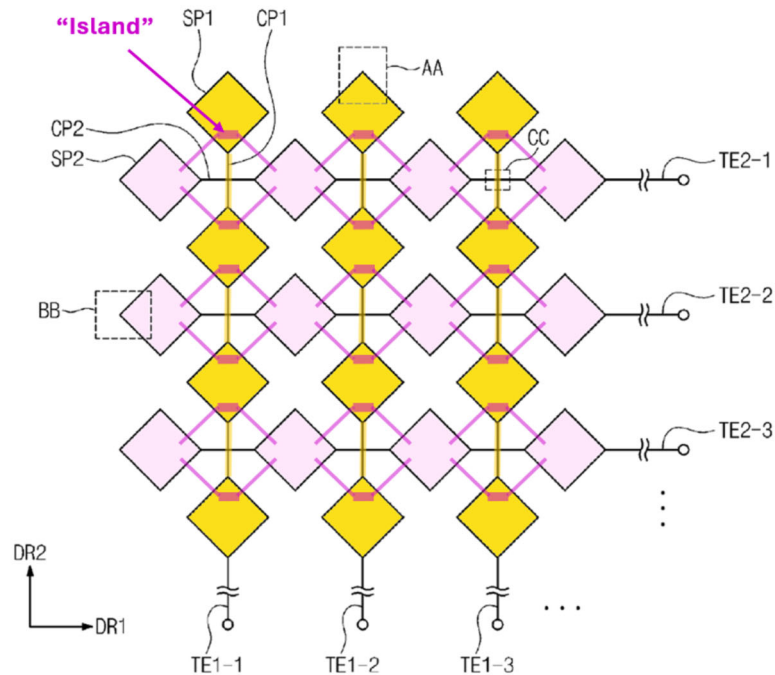
1. Prior Art

Her's electrode connections overlap one another. Ex-1008, Fig. 18; Ex-1003, ¶464.



However, as discussed above regarding Chen and Lee-343, POSITA would have perceived that Her's overlapping connections were also primed for improvement under well-known industry design using the underpass-type bridge for touch-sensing units formed in two separate layers taught by both references. As in §V.C.1.b (Ground 1C, motivation), POSITA would have appreciated that providing two bridges for second connection parts of Her, just like with Chen, would have provided similar benefits. Ex-1003, ¶465. Her's Figure 9 modified below shows two bridges connecting second touch-sensor parts (SP2) that passes through "islands" in first touch-sensor parts (SP1) but do not cross first connection parts (CP1).

Fig. 9



For similar reasons as in §V.C.1.b (Ground 1C, motivation), POSITA would have been similarly motivated to arrange, and had reasonable expectations of success in arranging Her's electrode connections to avoid crossing to reduce static electricity and avoid increasing capacitance, improve connection reliability, thereby improving touch-sensor effectiveness. Ex-1003, ¶¶466-70.

2. Cl.16

a. 16[a]

Her's "first horizontal portions SP1-L [of first sensor parts of the first electrodes] are connected to the first vertical portions SP1-C to form the openings SP1-OP. In other words, the first sensor parts SP1 have a mesh shape with the openings SP1-OP." Ex-1008, ¶¶101-02, Fig. 10. Her's "second sensor parts SP2" have "second horizontal portions SP2-L [that] are connected to the second vertical portions SP2-C to form the openings SP2-OP," such that "second sensor parts SP2 have a grid shape with the openings SP2-OP." Ex-1008, ¶¶104-05, Fig. 12.

Fig. 10

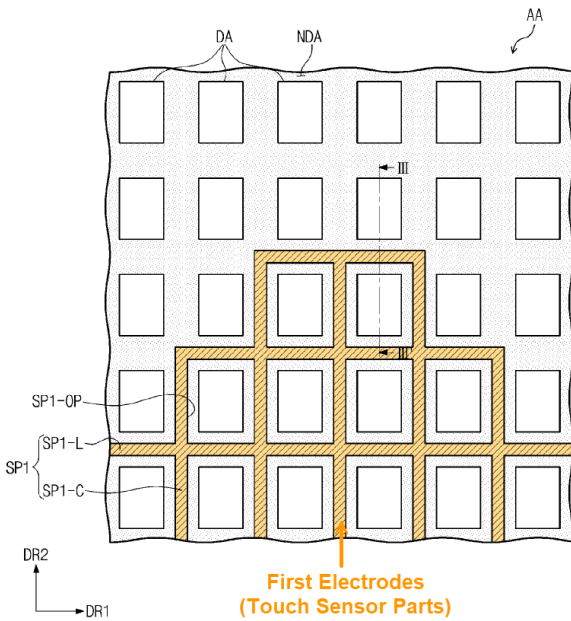
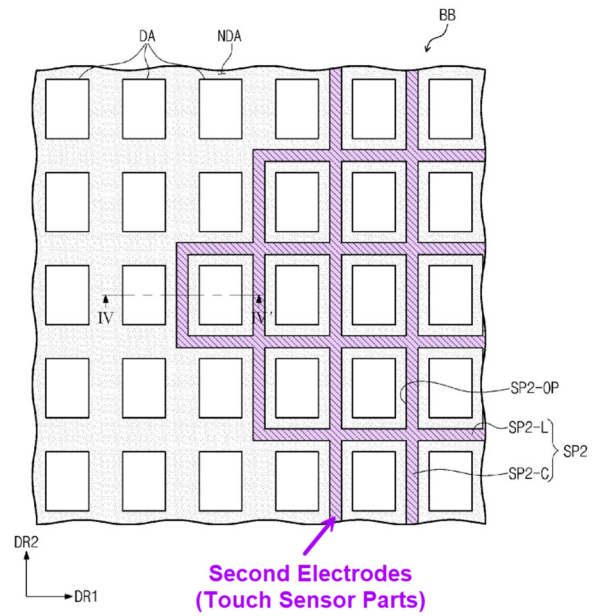
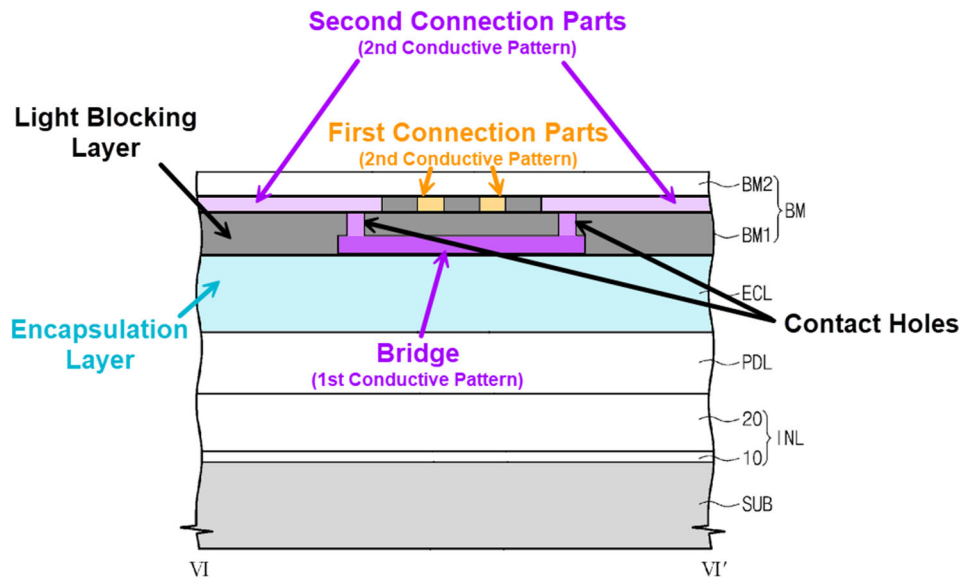


Fig. 12



Ex-1008, Figs. 10 and 12 (annotated). When implementing Her's underpass-type bridge embodiment (§V.E.1.f (1[e])), POSITA would have understood that first/second touch-sensor parts (SP1/SP2) would be part of second conductive pattern along with first/second connection parts (CP1/CP2). Ex-1003, ¶¶471-75.

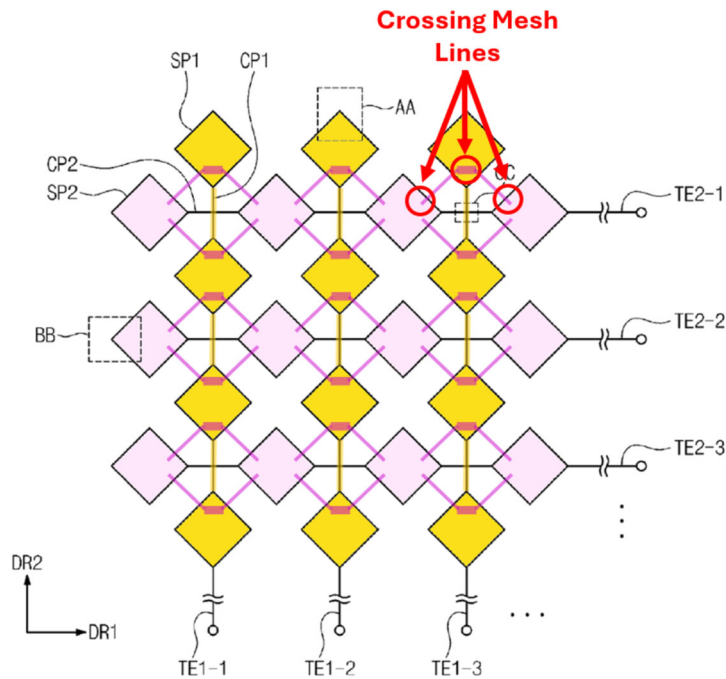
Illustration of Her's ¶116 Embodiment



b. 16[b]

As explained previously, when modifying Her in view of Lee-343 to incorporate non-overlapping connections under well-known industry designs using underpass-type bridge for touch-sensing units formed in two separate layers, POSITA would have appreciated that second connection parts would cross mesh lines of first touch sensor parts and mesh lines of second touch sensor parts to avoid overlapping first connection part. §V.G.1 (motivation); Ex-1003, ¶¶476-82.

Fig. 9



3. Cl.17

Her-Lee-343 combination teaches non-crossing first and second connection parts. §§V.G.1 (motivation), V.G.2.b (16[b]); Ex-1003, ¶¶483-85.

H. Ground 3-Claims 1-3, 15: Hsieh

1. Hsieh

Hsieh was filed Sept. 23, 2014 and published Feb. 10, 2016. Ex-1009, Cover. Hsieh constitutes prior art under at least §102(a)(1).

Hsieh's touch panel (100) is for displays, e.g., LCD/OLED displays. Ex-1009, Abstract, ¶¶59-60, Fig. 1. Touch panel includes two sets of electrodes oriented in perpendicular directions. Ex-1009, ¶¶59, 61-68, Figs. 1-2.

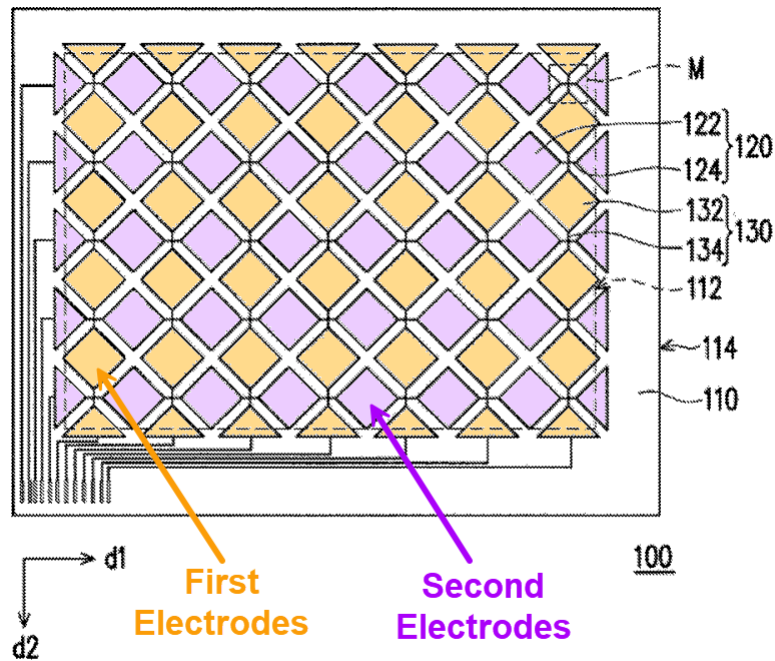


FIG. 1

Electrodes are formed as two layers. Ex-1009, ¶¶62-63, Figs. 2-7. The first layer provides a bottom layer for each of first and second electrodes, and a connection connecting one set of electrodes in one direction. *Id.*

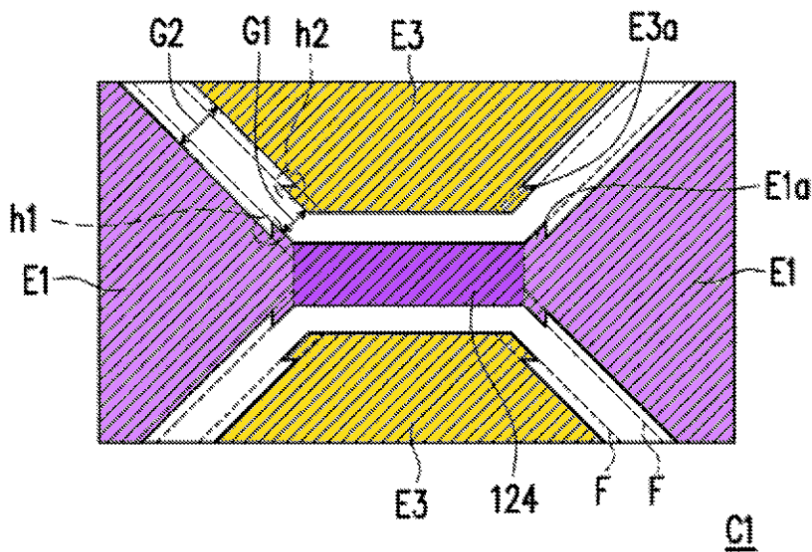


FIG. 3

Then, an insulating layer is formed where two sets of electrodes would otherwise intersect. *Id.*, ¶¶64, Figs. 2, 4, 6. Next, a second layer provides a top layer for each of the first and second electrodes, and a connection connecting the other set of electrodes in the other direction. Ex-1009, ¶¶62-63, Figs. 2-7.

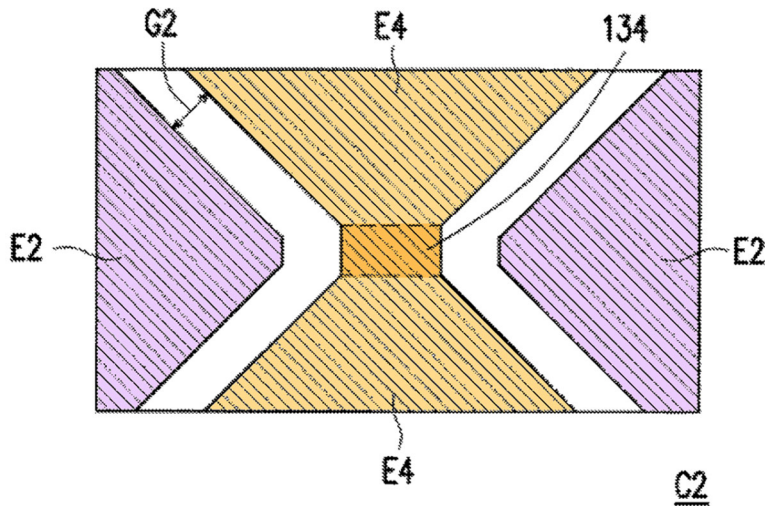


FIG. 5

Simply put, Hsieh's touch panel includes two-layer-thick touch sensors, with each set of touch sensors connected by one-layer-thick connection bridges in different directions, separated by insulation where touch-sensor electrodes cross. Ex-1003, ¶¶77-87.



2. Cl.1

a. 1[pre]

Hsieh's touch panel is for displays, specifically LCD and OLED. Ex-1009, Abstract, ¶¶59-60, Fig. 1. Hsieh repeatedly states that touch panel is formed on transparent "substrate" (Ex-1009, ¶¶5, 59-60), and explains how substrate (110) may "be a substrate independent of the display or a component substrate integrated into the display." Ex-1009, ¶60. POSITA would have understood, therefore, that Hsieh can be implemented with display panels of well-known configurations (e.g., on-cell or display panel below touch-sensing panel's substrate) and therefore discloses or renders obvious 1[pre]. Ex-1003, ¶¶486-88.

b. 1[a]

Hsieh discloses or renders obvious 1[a]. §V.H.2.a (1[pre]); Ex-1003, ¶¶489-91.

c. 1[b]

Hsieh's touch-sensing unit (100) is on substrate (110) which may be a layer attached to display panels, or an integrated layer of display panels for use in well-known touch-sensor panel/display panel combinations (e.g., on-cell or touch-panel substrate on display). Ex-1009, ¶¶59-60; Ex-1003, ¶¶492-95; Ex-1009, ¶¶61-73, Figs. 1-7; §III.A.

d. 1[c]

Hsieh's touch-sensing unit (100) has a two-layered electrode structure where first conductive pattern (C1) is on substrate (110) (the display panel, §§V.H.2.b-V.H.2.c (1[a]-1[b])) and includes bottom layers (E1/E3) of first/second electrodes (122/132) and first connecting portion (124) for first electrodes (122). Ex-1009, ¶¶60-67, Figs. 2-6; Ex-1003, ¶¶496-98. Annotated Figure 3 below shows all structures provided in first conductive pattern.

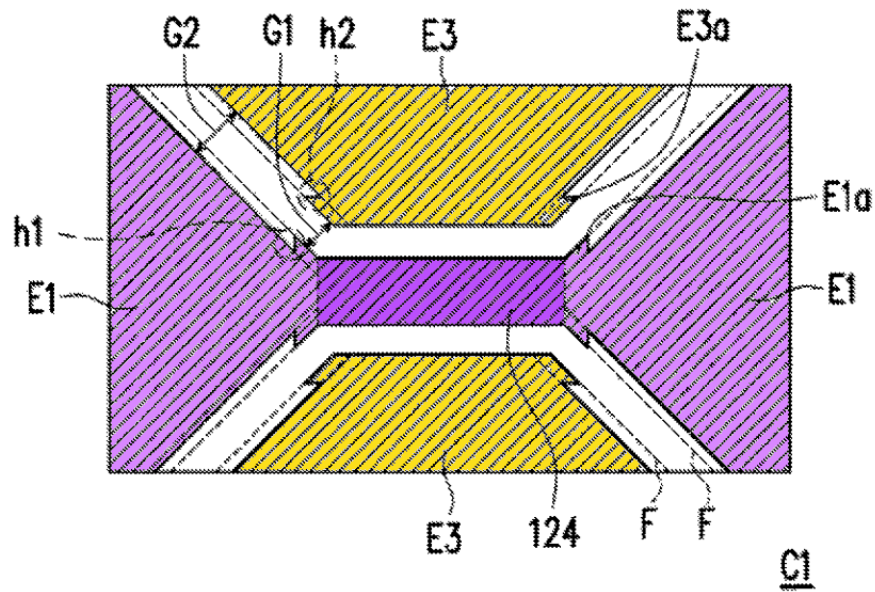
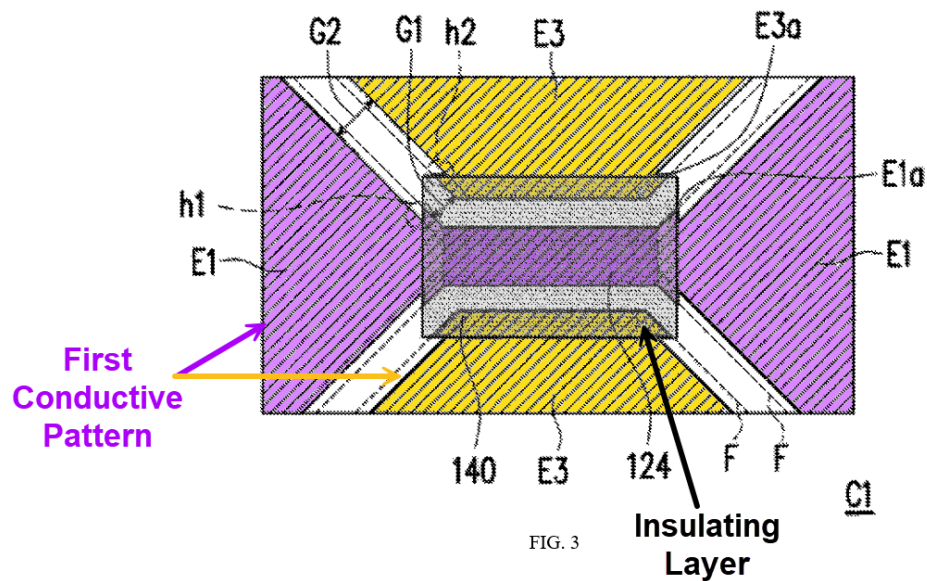


FIG. 3

e. 1[d]

Hsieh's insulating pattern (140) is formed on first conductive pattern (C1). *Id.*, ¶¶64-67, Figs. 2, 4, 6. Although Hsieh does not provide a figure showing only first conductive pattern (C1) and insulating layer (140), modified Figure 3 below shows Figure 4's insulating layer overlayed on Figure 3. As shown below, insulating layer 140 covers first connecting portion 124 in its entirety and portions of first sub-electrodes E1 and third sub-electrodes E3. Ex-1003, ¶¶499-501.



f. **1[e]**

Second conductive pattern (C2) is on insulating layer (140) and first conductive pattern (C1). Ex-1009, ¶71, Figs. 2-6. Second conductive pattern (C2) includes top layers (E2/E4) of first and second electrodes (122/132), as well as second connecting portion(134) for first electrodes (122) that partially crosses first conductive pattern (134 crosses 124). Ex-1009, ¶¶63-64, Figs. 2-6; Ex-1003, ¶¶502-06. Annotated Figures 5 below shows second conductive pattern (C2) alone, and annotated Figure 2 shows it stacked on top of first conductive pattern(C1) and insulating layer (140).

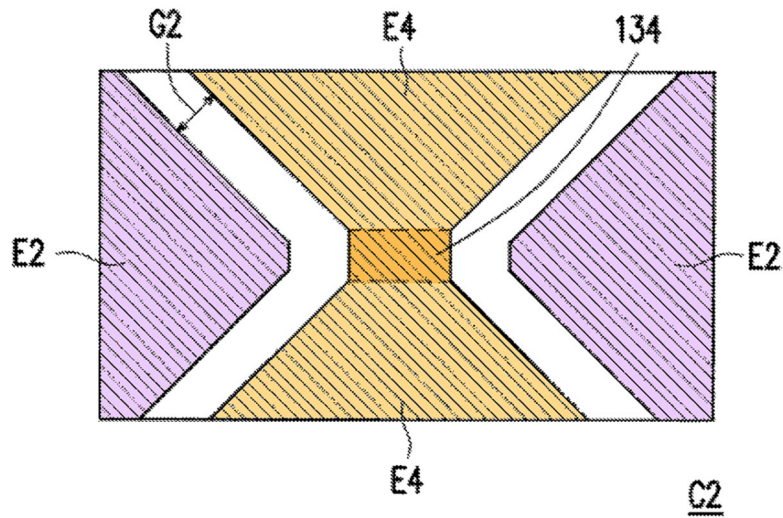


FIG. 5

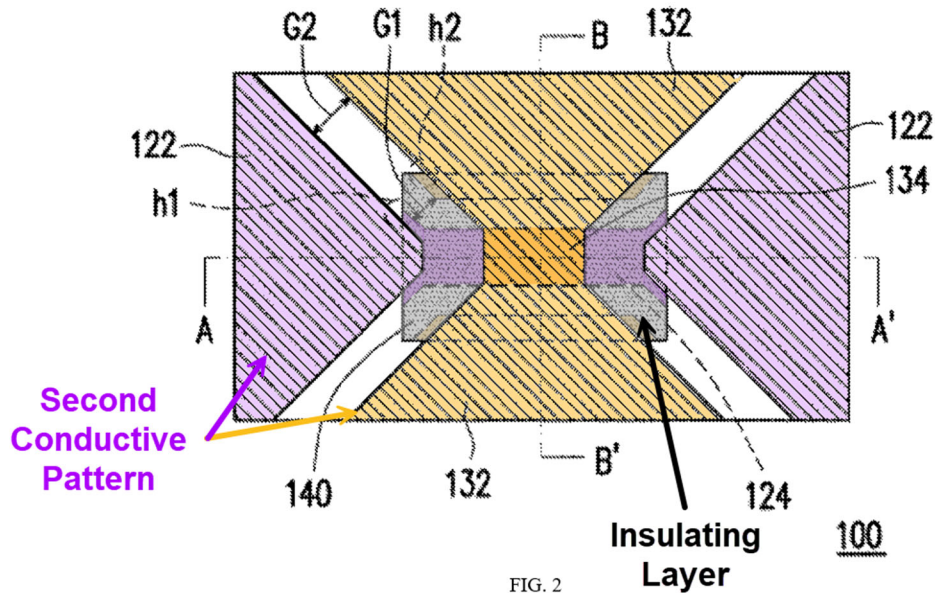
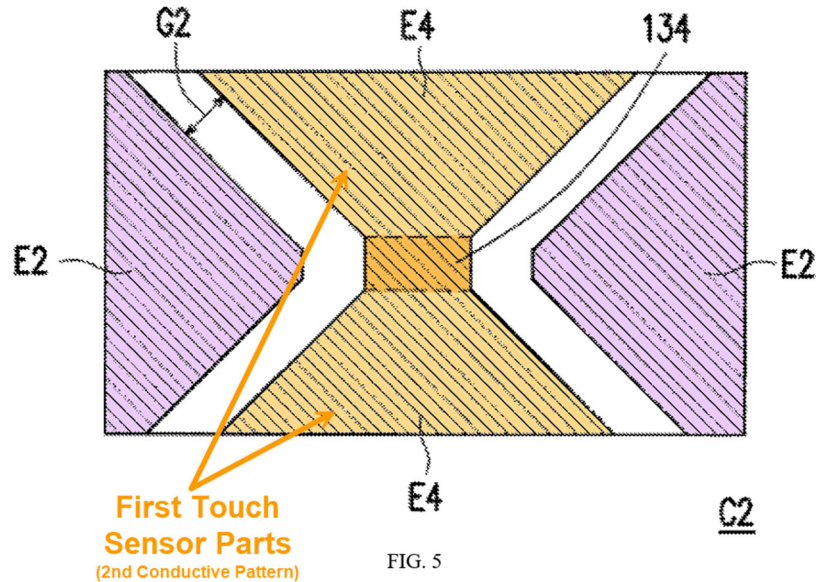


FIG. 2

g. 1[e][i]

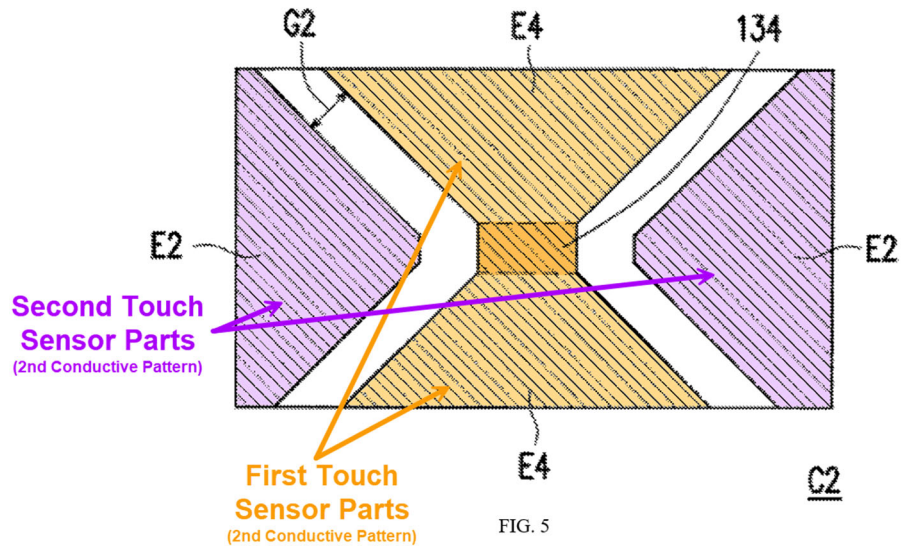
Second conductive pattern (C2) includes first electrodes (132), and specifically top layer (E4) of first electrodes. Ex-1009, ¶¶61-67, Figs. 2-6. Electrodes (132) form part of “conductive unit” (130) “to detect the position of a

touch event.” Ex-1009, ¶61. POSITA would have therefore understood first electrodes (132) form first touch sensor parts. Ex-1003, ¶¶507-12.



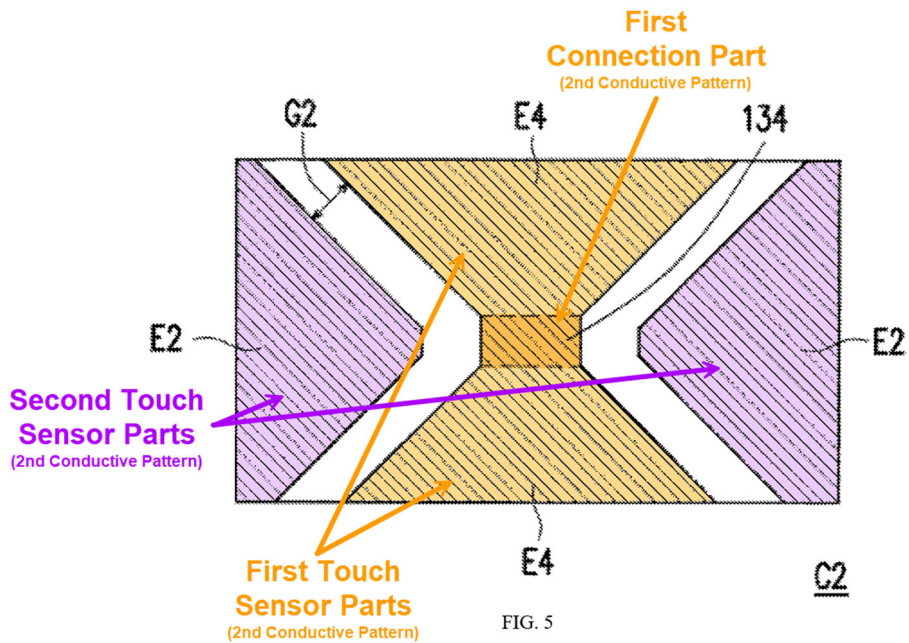
h. 1[e][iii]

Second conductive pattern (C2) includes second electrodes (122), and specifically top layer (E2) of second electrodes with a gap between E2 and E4. Ex-1009, ¶¶61-67, 71; Figs. 2-6. Electrodes (122) form part of a “conductive unit” (120) “to detect the position of a touch event.” Ex-1009, ¶61. POSITA would have therefore understood second electrodes(122) form first touch sensor parts. Ex-1003, ¶¶513-15.



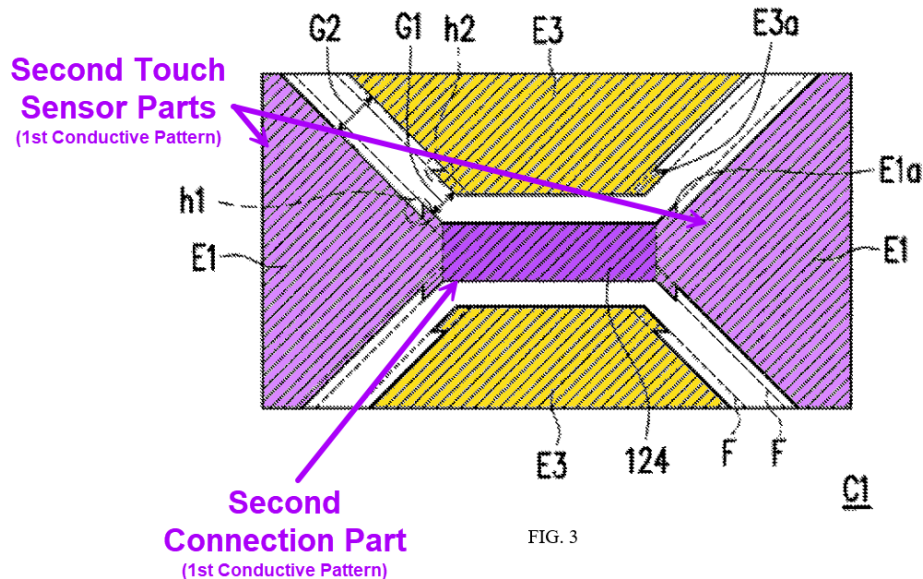
i. 1[e][iii]

Second conductive pattern (C2) includes conductive first connection parts (134) connecting adjacent first electrodes (132). Ex-1009, ¶63; *id.*, ¶¶61-64, 71-73, Figs. 1-7; Ex-1003, ¶¶516-18.



j. 1[f]

First conductive pattern (C1) includes conductive second connection part (124) that connects adjacent second electrodes 122. Ex-1009, ¶¶61-71, Figs. 1-7. Ex-1003, ¶¶519-22.



k. 1[g]

Hsieh discloses two embodiments, one in which “thickness of the first conductive layer C1 can be greater than the thickness of the second conductive layer C2,” (Ex-1009, ¶72), and another in which “thickness of the first conductive layer C1 can also be smaller than the thickness of the second conductive layer C2”(id., ¶73, Fig. 7). Simply put, Hsieh discloses relative thickness of two conductive layers is an obvious design choice, and POSITA would have been motivated to pick either configuration. Ex-1003, ¶¶523-26.

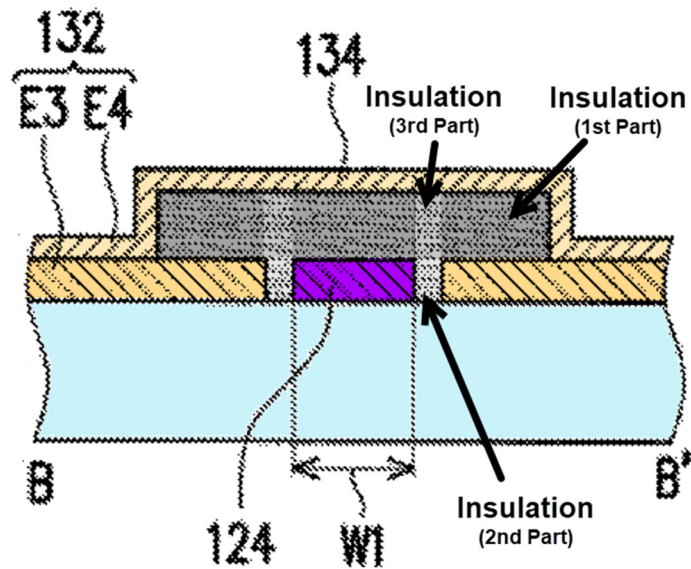
3. C1.2

a. 2[a]

Hsieh's substrate can be "encapsulating cover" for OLED display. Ex-1009, ¶60. Because Hsieh then discloses forming first conductive pattern directly on substrate (110), *id.*, ¶¶62-63, 68 ("a first conductive layer C1 can be formed on the substrate 110"), POSITA would have appreciated that when forming touch-sensing unit on OLED display panels, first conductive pattern would be formed on OLED display panel's encapsulation layer, consistent with Hsieh's disclosure and conventional touch-sensing OLED displays. Ex-1003, ¶¶527-30.

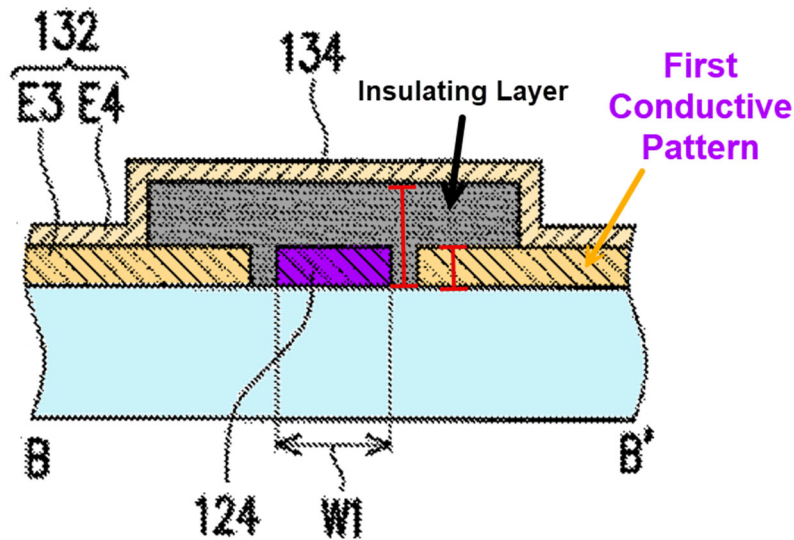
b. 2[b]

Based on Hsieh's description of insulating layer (140) on first conductive pattern (C1), and Hsieh's cross-sectional view in Figure 6, POSITA would have understood that insulating layer (140) includes first part on first conductive layer (C1) spaced from substrate (110, which may obviously be an encapsulation layer, §V.H.3.a (2[a])); second part on substrate (110); and third part connecting first and second parts. Ex-1003, ¶¶531-33.



4. C1.3

First conductive pattern (C1) is thinner than insulating layer (140). Ex-1009, Fig. 6. POSITA would have known that because Hsieh's insulating layer both contacts substrate (110) and is intended to *cover* first conductive layer (C1)(*id.*, ¶64 (“insulating pattern 140 may cover the first connecting portion 124”), then insulating layer would be thicker than first conductive layer (C1)(Ex-1003, ¶¶534-39).



5. Cl.15

Hsieh discloses cl.15. §§V.H.2.f(1[e]), V.H.2.j(1[f]); Ex-1003, ¶540.

VI. CONCLUSION

Challenged Claims, claims 1-19, are unpatentable.

VII. MANDATORY NOTICES

A. Real Party in Interest

Petitioner BOE Technology Group Co., Ltd. identifies the following parties as all real parties in interest for the purpose of this Petition:

1. Mianyang BOE Optoelectronics Technology Co., Ltd.
2. Ordos Yuansheng Optoelectronics Co., Ltd.,
3. Chengdu BOE Optoelectronics Technology Co., Ltd.,
4. Chongqing BOE Optoelectronics Technology Co., Ltd.,
5. Wuhan BOE Optoelectronics Technology Co., Ltd.,

6. Yunnan Invensight Optoelectronics Technology Co., Ltd. f/k/a BMOT

f/k/a Kunming BOE Display Technology, and

7. BOE Technology America, Inc.

B. Related Matters

To the best of Petitioner's knowledge, '279 patent has been involved in the following matters:

- *Samsung Display Co. v. BOE Technology Group Co.*, No. 2:25-cv-00426-JRG (E.D. Tex.).

C. Notice of Counsel and Service Information

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Petition for *Inter Partes* Review of U.S. Patent No. 10,541,279 B2
PTAB Case No. IPR2025-01476

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Petitioner consents to electronic service. All services and communications to
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D. Power of Attorney

A power of attorney is filed herewith according to 37 C.F.R. §42.10(b).

Respectfully submitted,

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Date: August 31, 2025

CERTIFICATE OF WORD COUNT UNDER 37 CFR §42.24(d)

Pursuant to 37 C.F.R. §42.24(a), Petitioner hereby certifies that portions of the above-captioned Petition for *inter partes* review of U.S. Patent No. 10,541,279 B2, in accordance with and reliance on the word count provided by the word-processing system used to prepare this Petition, that the number of words in this paper is 13,921. Pursuant to 37 C.F.R. §42.24(a), this word count is in compliance and excludes the table of contents, table of authorities, mandatory notices under §42.8, certificate of service, certificate of word count, appendix of exhibits, and any claim listing. This word count was prepared using Microsoft Word.

Respectfully submitted,

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CERTIFICATE OF SERVICE

The undersigned hereby certifies that true copies of the Petition for *inter partes* review of U.S. Patent No. 10,541,279 B2 and supporting materials (Exhibits and Power of Attorney) were served via USPS Priority Mail Express on the Patent Owner at the correspondence address of record as listed on PAIR:

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Date: August 31, 2025