

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

BOE Technology Group Co., Ltd.,
Petitioner,

v.

Paneltouch Technologies LLC,
Patent Owner.

U.S. Patent No. 9,507,477
Issue Date: November 29, 2016
Title: DISPLAY DEVICE

Case No. IPR2025-01483

**PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT NO. 9,507,477
UNDER 35 U.S.C. §§ 311-319 AND 37 C.F.R. § 42 *et seq.***

TABLE OF CONTENTS

I.	INTRODUCTION	15
II.	37 C.F.R. § 42.8(B): MANDATORY NOTICES	17
A.	37 C.F.R. § 42.8(b)(1): Notice of Real Parties-in-Interest.....	17
B.	37 C.F.R. § 42.8(b)(2): Notice of Related Matters.....	18
C.	37 C.F.R. § 42.8(b)(3) and (4): Notice of Counsel and Service Information	18
D.	Fee for <i>Inter Partes</i> Review	18
III.	REQUIREMENTS FOR IPR.....	18
A.	§42.104(a): Grounds for Standing.....	19
B.	§42.104(b): Identification of Challenge	19
1.	§42.104(b)(1): Challenged Claims	19
2.	§42.104(b)(2): The Prior Art and Statutory Grounds	19
3.	§42.104(b)(5): Evidence Supporting Challenge	21
IV.	TECHNOLOGY BACKGROUND.....	21
V.	THE CHALLENGED PATENT AND PROSECUTION HISTORY.....	29
A.	The Patent	29
B.	Prosecution History	32
C.	Claim Construction.....	32
VI.	Level of Ordinary Skill in the Art.....	32
VII.	THE PRIOR ART.....	33
A.	Kotera	33

B.	Miyagawa	34
C.	Lee	35
D.	Kida.....	36
E.	Sung	37
F.	Nishihara.....	38
G.	Kim	39
VIII. THE CHALLENGED CLAIMS ARE UNPATENTABLE OVER THE PRIOR ART.....		41
A.	GROUND 1: Kotera in View of Miyagawa Renders Claims 1– 2, 8–10, 12, 17–18, and 20–21 Obvious	41
1.	Claim 1	41
2.	Claim 2	56
3.	Claim 8	57
4.	Claim 9	71
5.	Claim 10	72
6.	Claim 12	73
7.	Claim 17	73
8.	Claim 18	73
9.	Claim 20	74
10.	Claim 21	75
11.	Motivation to Combine	75
B.	GROUND 2: Kotera in View of Miyagawa and Lee Renders Claims 3–7 and 13–16 Obvious	78
1.	Claim 3	78

2.	Claim 4.....	84
3.	Claim 5.....	84
4.	Claim 6.....	86
5.	Claim 7.....	90
6.	Claim 13.....	90
7.	Claim 14.....	91
8.	Claim 15.....	91
9.	Claim 16.....	91
10.	Motivation to Combine.....	92
C.	GROUND 3: Kotera in View of Miyagawa and Kida Renders Claims 11 and 19 Obvious	94
1.	Claim 11.....	94
2.	Claim 19.....	99
3.	Motivation to Combine	99
D.	GROUND 4: Sung in View of Nishihara Renders Claims 1–2, 10, 12, 17–18, and 20–21 Obvious	101
1.	Claim 1.....	101
2.	Claim 2.....	116
3.	Claim 10.....	117
4.	Claim 12.....	119
5.	Claim 17.....	119
6.	Claim 18.....	119
7.	Claim 20.....	122

8.	Claim 21	122
9.	Motivation to Combine	122
E.	GROUND 5: Sung in View of Nishihara and Lee Renders	
	Claims 3–7 and 13–16 Obvious	124
1.	Claim 3.....	124
2.	Claim 4.....	126
3.	Claim 5.....	126
4.	Claim 6.....	127
5.	Claim 7.....	128
6.	Claim 13.....	128
7.	Claim 14.....	128
8.	Claim 15.....	129
9.	Claim 16.....	129
10.	Motivation to Combine	129
F.	GROUND 6: Sung in View of Nishihara and Kim Renders	
	Claims 8–9 Obvious	131
1.	Claim 8.....	131
2.	Claim 9.....	141
3.	Motivation to Combine	142
IX.	SECONDARY CONSIDERATIONS	142
X.	CONCLUSION	143

TABLE OF AUTHORITIES

	Page(s)
Cases	
<i>Bos. Sci. Scimed, Inc. v. Cordis Corp.</i> , 554 F.3d 982 (Fed. Cir. 2009)	62
<i>Dome Pat. L.P. v. Lee</i> , 799 F.3d 1372 (Fed. Cir. 2015)	76
<i>Elkay Mfg. Co. v. Ebco Mfg. Co.</i> , 192 F.3d 973 (Fed. Cir. 1999)	43
<i>KSR Int’l Co. v. Teleflex Inc.</i> , 550 U.S. 398 (2007).....	77
<i>Paneltouch Technologies LLC v. BOE Technology Group Co., Ltd.</i> , No. 2:25-cv-00245-JRG (E.D. Tex.)	18
<i>Phillips v. AWH Corp.</i> , 415 F.3d 1303 (Fed. Cir. 2005) (<i>en banc</i>)	32
<i>Tokai Corp. v. Easton Enters., Inc.</i> , 632 F.3d 1358 (Fed. Cir. 2011)	143
<i>Toyota Motor Corp. v. Cellport Sys., Inc.</i> , IPR2015-00633, Paper 11 (PTAB Aug. 14, 2015).....	32
Statutes	
35 U.S.C. §315(b)	19
Rules and Regulations	
37 C.F.R. § 42.8	17, 18
37 C.F.R. § 42.104	18
Office Patent Trial Practice Guide, 77 Fed. Reg. 48759	17

LISTING OF EXHIBITS

Exhibit	Description
1001	U.S. Patent No. 9,507,477 (the “’477 patent”)
1002	Prosecution History of U.S. Patent No. 9,507,477
1003	Declaration of Richard A. Flasck, M.S. in Support of Petition for <i>Inter Partes</i> Review of U.S. Patent No. 9,507,477
1004	U.S. Patent Publication No. 2008/0007538A1 (“Kotera”)
1005	Japanese Patent Publication No. JP 2006-171386A (“Miyagawa”) and certified translation
1006	U.S. Patent Publication No. 2006/0260977A1 (“Lee”)
1007	U.S. Patent Publication No. 2010/0134137A1 (“Kida”)
1008	U.S. Patent Publication No. 2011/0005662A1 (“Sung”)
1009	U.S. Patent Publication No. 2010/0220071A1 (“Nishihara”)
1010	U.S. Patent Publication No. 2008/0062373A1 (“Kim”)
1011	Japanese Patent Publication No. JP 2009-053390A (“Nakamura”) and certified translation
1012	U.S. Patent Publication No. 2008/0074594A1 (“Tanabe”)
1013	U.S. Patent Publication No. 2001/0005200A1 (“Suzuki”)
1014	U.S. Patent Publication No. 2010/0123592A1 (“Nurmi”)
1015	U.S. Patent Publication No. 2006/0038580A1 (“Hasegawa”)
1016	U.S. Patent Publication No. 2008/0158453A1 (“Segawa”)
1017	U.S. Patent Publication No. 2009/0244021A1 (“Matsuo”)

Inter Partes Review

United States Patent No. 9,507,477

Exhibit	Description
1018	U.S. Patent Publication No. 2009/0231516A1 (“Okada”)
1019	U.S. Patent Publication No. 2011/0007251A1 (“Yamamoto”)
1020	U.S. Patent Publication No. 2011/0226726A1 (“Song”)
1021	European Patent Specification No. EP1533848B1 (“Chung”)
1022	U.S. Patent Publication No. 2004/0141110A1 (“Yu”)
1023	U.S. Patent Publication No. 2007/0181456A1 (“Kusuda”)
1024	U.S. Patent Publication No. 2011/0175841A1 (“Nakamura ’841”)
1025	Den Boer, “Active Matrix Liquid Crystal Displays” (2005)
1026	<i>Curriculum Vitae</i> of Richard A. Flasck, M.S. (“Flasck C.V.”)
1027	U.S. Patent Publication No. 2010/0085326A1 (“Anno ’326”)

CHALLENGED CLAIM LISTING

Claim	Limitation No.	Limitation
1	1[PRE]	A display device comprising:
	1[A]	a coordinate input substrate having detection electrodes disposed in a detection region, and first interconnects outside the detection region;
	1[B]	a protective plate on the coordinate input substrate;
	1[C]	a light shielding material which has an opening and is disposed between the coordinate input substrate and the protective plate; and
	1[D]	a first flexible substrate electrically connected to the coordinate input substrate,
	1[E]	wherein the coordinate input substrate has a second interconnect, a first electrode, and a second electrode,
	1[F]	wherein the second interconnect surrounds the detection region and is formed outside the first interconnects,
	1[G]	wherein the first electrode is formed at one end of the second interconnect,
	1[H]	wherein the second electrode is formed at the other end of the second interconnect,
	1[I]	wherein the second interconnect is disposed along a peripheral edge of at least three sides of the coordinate input substrate,
	1[J]	wherein a display region is surrounded by the second interconnect,
	1[K]	wherein the first electrode is electrically connected with a third electrode on the first flexible substrate, or the second electrode is electrically connected with a fourth electrode on the first flexible substrate,

Claim	Limitation No.	Limitation
	1[L]	wherein the opening of the light shielding material is larger than the display region and surrounds the display region, and
	1[M]	wherein the light shielding material overlaps the second interconnect along the peripheral edge of at least the three sides of the coordinate input substrate in a plan view.
2	2[PRE]	The display device according to claim 1, further comprising a display panel having the display region,
	2[A]	wherein the coordinate input substrate is disposed between the display panel and the protective plate.
3	3[PRE]	The display device according to claim 1, further comprising a first semiconductor chip,
	3[A]	wherein a third interconnect and the first semiconductor chip are disposed on the first flexible substrate,
	3[B]	wherein the third electrode is formed at one end of the third interconnect,
	3[C]	wherein a fifth electrode is formed at the other end of the third interconnect, and
	3[D]	wherein the first semiconductor chip doesn't overlap the third interconnect and the fifth electrode in a plan view.
4	4	The display device according to claim 3, wherein the first semiconductor chip drives the coordinate input substrate.
5	5	The display device according to claim 3, wherein the third interconnect extends from the third electrode to the fifth terminal along an edge of the first flexible substrate and is disposed between the first semiconductor chip and the edge of the first flexible substrate.

Claim	Limitation No.	Limitation
6	6[PRE]	The display device according to claim 3, wherein a fourth interconnect is disposed on the first flexible substrate,
	6[A]	wherein the fourth electrode is formed at one end of the fourth interconnect,
	6[B]	wherein a sixth electrode is formed at the other end of the fourth interconnect,
	6[C]	wherein the first semiconductor chip is disposed between the third interconnect and the fourth interconnect in plan view, and
	6[D]	wherein the first semiconductor chip doesn't overlap the fourth interconnect and the sixth terminal in a plan view.
7	7	The display device according to claim 3, wherein the first flexible [sic] substrate supplies driving signals to the detection electrodes via the first interconnects and receives detection signals corresponding to a contact position from the detection electrodes.
8	8[PRE]	The display device according to claim 2, wherein the display panel comprises:
	8[A]	a first substrate on which a plurality of video signal lines and a plurality of scanning signal lines intersecting the video signal lines are formed; and
	8[B]	a second flexible substrate electrically connected to the first substrate,
	8[C]	wherein a plurality of seventh electrodes, a fifth interconnect, an eighth electrode and ninth electrode are formed on the first substrate,

Claim	Limitation No.	Limitation
	8[D]	wherein the seventh electrodes receive video signals and scanning signals from an external system, the eighth electrode is formed at one end of the fifth interconnect, and the ninth electrode formed at the other end of the fifth interconnect,
	8[E]	wherein a plurality of tenth electrodes, a eleventh electrode, twelfth electrode are formed on the second flexible substrate, and the plurality of tenth electrodes are formed between the eleventh electrode and the twelfth electrode,
	8[F]	wherein the tenth electrodes are connected to the seventh electrodes, the eleventh electrode is connected to the eighth electrode, the twelfth electrode is connected to the ninth electrode, and
	8[G]	wherein the fifth interconnect is disposed along a peripheral edge of at least three sides of the first substrate.
9	9[PRE]	The display device according to claim 8,
	9[A]	wherein the display panel further comprises a second semiconductor chip receiving the video signals, supplying display signals to the video signal lines, and controlling the video signal lines and the scanning signal lines,
	9[B]	wherein the second semiconductor chip is formed on the first substrate and is surrounded by the fifth interconnect.
10	10	The display device according to claim 1, wherein the opening of the light shielding material is smaller than the detection region of the coordinate input substrate.
11	11[PRE]	The display device according to claim 1, further comprising:
	11[A]	a sixth interconnect surrounds the detection region and is formed outside the first interconnects,

Claim	Limitation No.	Limitation
	11[B]	wherein the sixth interconnect is electrically connected with the first flexible substrate, and
	11[C]	wherein the sixth interconnect is disposed along a peripheral edge of at least three sides of the coordinate input substrate.
12	12[PRE]	A coordinate input device comprising:
	12[A]	a coordinate input substrate having detection electrodes disposed in a detection region, and first interconnects outside the detection region; and
	12[B]	a first flexible substrate electrically connected to the coordinate input substrate,
	12[C]	wherein the coordinate input substrate has a second interconnect, a first electrode, and a second electrode,
	12[D]	wherein the second interconnect surrounds the detection region and is formed outside the first interconnects,
	12[E]	wherein the first electrode is formed at one end of the second interconnect,
	12[F]	wherein the second electrode is formed at the other end of the second interconnect,
	12[G]	wherein the second interconnect is disposed along a peripheral edge of at least three sides of the coordinate input substrate, and
	12[H]	wherein the first electrode is electrically connected with a third electrode on the first flexible substrate, or the second electrode is electrically connected with a fourth electrode on the first flexible substrate.
13	13[PRE]	The coordinate input device according to claim 12, further comprising a first semiconductor chip,

Claim	Limitation No.	Limitation
	13[A]	wherein a third interconnect and the first semiconductor chip are disposed on the first flexible substrate,
	13[B]	wherein the third electrode is formed at one end of the third interconnect,
	13[C]	wherein a fifth electrode is formed at the other end of the third interconnect, and
	13[D]	wherein the first semiconductor chip doesn't overlap the third interconnect and the fifth electrode in a plan view.
14	14	The coordinate input device according to claim 13, wherein the first semiconductor chip drives the coordinate input substrate.
15	15	The coordinate input device according to claim 13, wherein the third interconnect extends from the third electrode to the fifth electrode along an edge of the first flexible substrate and is disposed between the first semiconductor chip and the edge of the first flexible substrate.
16	16[PRE]	The coordinate input device according to claim 13,
	16[A]	wherein a fourth interconnect is disposed on the first flexible, substrate,
	16[B]	wherein the fourth electrode is formed at one end of the fourth interconnect,
	16[C]	wherein a sixth electrode is formed at the other end of the fourth interconnect,
	16[D]	wherein the first semiconductor chip is disposed between the third interconnect and the fourth interconnect in plan view, and
	16[E]	wherein the first semiconductor chip doesn't overlap the sixth electrode and the fourth interconnect in plan view.

Claim	Limitation No.	Limitation
17	17	The coordinate input device according to claim 12, wherein the opening of the light shielding material is smaller than the detection region of the coordinate input substrate.
18	18	The coordinate input device according to claim 17, wherein the first flexible [sic] substrate supplies driving signals to the detection electrodes via the first interconnects and receives detection signals corresponding to a contact position from the detection electrodes.
19	19[PRE]	The coordinate input device according to claim 12, further comprising:
	19[A]	a sixth interconnect surrounds the detection region and is formed outside the first interconnects,
	19[B]	wherein the sixth interconnect is electrically connected with the first flexible substrate, and
	19[C]	wherein sixth interconnect is disposed along a peripheral edge of at least three sides of the coordinate input substrate.
20	20	The display device according to claim 1, wherein a detection signal is supplied to the first flexible substrate via one of the first interconnect.
21	21	The coordinate input device according to claim 12, wherein a detection signal is supplied to the first flexible substrate via one of the first interconnect.

I. INTRODUCTION

BOE Technology Group Co., Ltd. (“Petitioner”) respectfully requests IPR of claims 1–21 (the “Challenged Claims”) of U.S. Patent No. 9,507,477 (the “’477 patent”) assigned to Paneltouch Technologies LLC. (“Patent Owner”). There is more than a reasonable likelihood that Petitioner will prevail with respect to at least one Challenged Claim.

Touch screens, the subject of the ’477 patent, have existed for decades. After the first iPhone was released in 2007, touch screens became ubiquitous—found in everyone’s hands, pocket, purse, or backpack.

Conventional touch screens, such as those disclosed in the ’477 patent, comprise a touch panel stacked above a display panel. The touch panel commonly operates on detecting a change in capacitance or resistance when a finger or stylus contacts its surface. The touch surface is typically slightly larger than the display surface so that the entire display area is touch operable. It was common for touch-screen devices, such as laptops and early-generation iPhones, to have the peripherals of their screen covered by a light-shielding material to hide from users’ view peripheral components such as wiring underneath. *See, e.g.,* Sung, Figs. 5A–5D. The opening of the light-shielding material is also slightly larger than the display surface to ensure that the entire display area is visible.

Touch screens are commonly constructed by fabricating multiple touch or display substrates on mother substrates, which are cut and bonded to form individual panels. Manufacturing defects unavoidably occur in the process. For example, cutting the mother substrate, typically composed of glass or another brittle material, may crack individual substrates, causing defects if a crack is large enough to break a substrate's functional wirings. Detecting such cracks early avoids wasting additional components and processing steps on defective panels.

Because of its obvious and significant benefit, crack-detection techniques were readily developed. Specifically, a wire is formed near each individual substrate's edges, surrounding functional wirings and the touch/display area, such that large cracks would break the crack-detection wire. This break could be detected with a simple continuity check across the wire. This technique benefits any devices, including both display- and touch-panel substrates, formed by dicing them from a crack-prone mother substrate.

Because a crack-detection wire is simply a wire trace around a device substrate's periphery, it is structurally similar, and often identical, to shield wires used to prevent electrostatic damage or noise degradation on devices. The prior art recognized these structural similarities and expressly taught using such shield wires for crack detection.

By the '477 patent's earliest possible priority date in 2010, the industry had long used crack-detection wires to improve manufacturing efficiency for the millions of touch displays produced each year. As this Petition shows, the purported invention of the '477 patent involves nothing more than putting together well-known, conventional components in obvious, common ways to achieve predictable results. Indeed, the '477 patent itself states that "other than ... [the] detection interconnects[,] its embodiment "is identical with that of well-known liquid crystal display devices." Ex. 1001, 4:28–31. But the crack-detection wiring/interconnect was also well known. What's more, none of the '477 patent claims even require a crack-detection functionality. Instead, they merely require a wire around the edges of touch or display panels.

Petitioner requests that the Board institute trial and find the Challenged Claims unpatentable. Richard A. Flasck's Declaration (Ex. 1003, "Flasck") ¶¶ 36–37.

II. 37 C.F.R. § 42.8(B): MANDATORY NOTICES

A. 37 C.F.R. § 42.8(b)(1): Notice of Real Parties-in-Interest

Petitioner BOE Technology Group Co., Ltd. is the real party-in-interest. No other parties exercised or could have exercised control over this Petition; no other parties funded or directed this Petition. See Office Patent Trial Practice Guide, 77 Fed. Reg. 48759-60.

B. 37 C.F.R. § 42.8(b)(2): Notice of Related Matters

To the best knowledge of Petitioner, the '477 patent has been involved in the following related matter:

Case Name	Filed
<i>Paneltouch Technologies LLC v. BOE Technology Group Co., Ltd.</i> , No. 2:25-cv-00245-JRG (E.D. Tex.)	February 28, 2025

C. 37 C.F.R. § 42.8(b)(3) and (4): Notice of Counsel and Service Information

Petitioner's Lead Counsel	Petitioner's Back-Up Counsel
Richard F. Martinelli Reg. No. 52,003 Orrick, Herrington & Sutcliffe LLP 51 West 52nd Street New York, NY 10019-6142 RFMPTABDocket@orrick.com	Johannes Hsu Reg. No. 74,689 Orrick, Herrington & Sutcliffe LLP 2050 Main Street, Suite 1100 Irvine, CA 92614-8255 PTABDocketJ1H1@orrick.com

Petitioner submits a Power of Attorney with this Petition. Please address all correspondence to the lead counsel. Petitioner consents to service by email at the email addresses listed above.

D. Fee for *Inter Partes* Review

The USPTO is authorized to charge the filing fee and any other fees incurred by Petitioner to the deposit account of Orrick, Herrington & Sutcliffe LLP: 15-0665.

III. REQUIREMENTS FOR IPR

This Petition complies with all requirements of 37 C.F.R. §42.104.

A. §42.104(a): Grounds for Standing

The '477 patent is available for IPR. Petitioner is not barred or estopped from requesting IPR. This Petition is timely filed under 35 U.S.C. §315(b).

B. §42.104(b): Identification of Challenge

Under §§42.104(b) and 42.22, Petitioner requests that the Board institute IPR on the Challenged Claims and cancel them as unpatentable.

1. §42.104(b)(1): Challenged Claims

Petitioner challenges Claims 1–21 of the '477 patent.

2. §42.104(b)(2): The Prior Art and Statutory Grounds

The application for the '477 patent claims priority to U.S. application 15/005,737, filed on January 25, 2016, and foreign application JP 2010-126877, filed on June 2, 2010. For this Petition, Petitioner assumes the '477 patent is entitled to that 2010 priority date.

The Petition relies on the following prior-art references:

Patent/Publication	Prior Art Date	Pre-AIA Prior Art	Ex.
U.S. Patent Publication No. 2008/0007538A1 (“Kotera”)	Jan. 10, 2008 / May 22, 2007	§§102(a)–(b), (e)	1004
Japanese Patent Publication No. JP 2006-171386A (“Miyagawa”)	June 29, 2006	§§102(a)–(b)	1005
U.S. Patent Publication No. 2006/0260977A1 (“Lee”)	Nov. 23, 2006 / June 30, 2005	§§102(a)–(b), (e)	1006

Patent/Publication	Prior Art Date	Pre-AIA Prior Art	Ex.
U.S. Patent Publication No. 2010/0134137A1 (“Kida”)	Oct. 23, 2009	§102(e)	1007
U.S. Patent Publication No. 2011/0005662A1 (“Sung”)	July 10, 2009	§102(e)	1008
U.S. Patent Publication No. 2010/0220071A1 (“Nishihara”)	Feb. 16, 2010	§102(e)	1009
U.S. Patent Publication No. 2008/0062373A1 (“Kim”)	Mar. 13, 2008 / Sept. 7, 2007	§§102(a)–(b), (e)	1010

Petitioner challenges the claims on the following grounds:

Number	Ground
1	Kotera in view of Miyagawa renders claims 1–2, 8–10, 12, 17–18, and 20–21 obvious
2	Kotera in view of Miyagawa and Lee renders claims 3–7 and 13–16 obvious
3	Kotera in view of Miyagawa and Kida renders claims 11 and 19 obvious
4	Sung in view of Nishihara renders claims 1–2, 10, 12, 17–18, and 20–21 obvious
5	Sung in view of Nishihara and Lee renders claims 3–7 and 13–16 obvious
6	Sung in view of Nishihara and Kim renders claims 8–9 obvious

None of these references except Kida were cited during prosecution. Kida was among twenty-four references submitted in an information disclosure statement

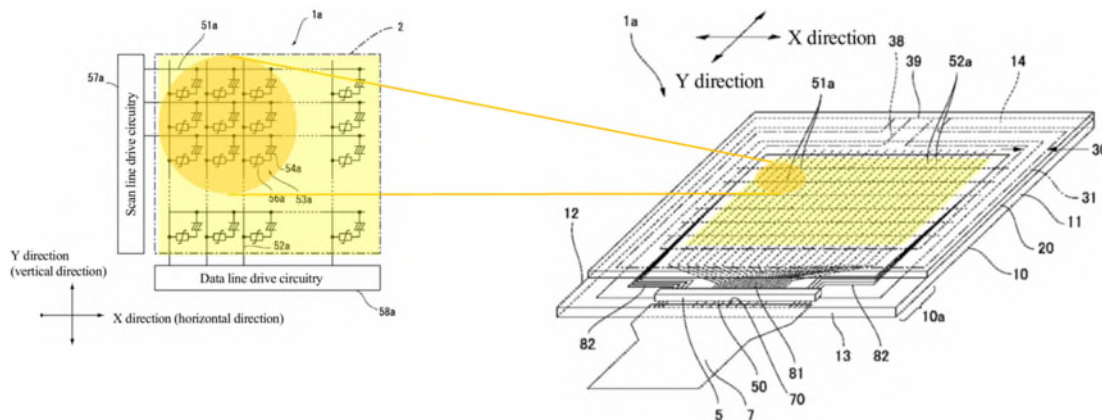
and was not cited by the Examiner in the only office action. Ex. 1002, 67–70; 138–142.

3. §42.104(b)(5): Evidence Supporting Challenge

Touch-display expert Richard A. Flasck’s declaration and other supporting evidence in the Exhibit List are filed herewith. Mr. Flasck’s background and qualifications, and the information provided to him, are discussed in Exhibit 1003. Flasck ¶¶4–33.

IV. TECHNOLOGY BACKGROUND

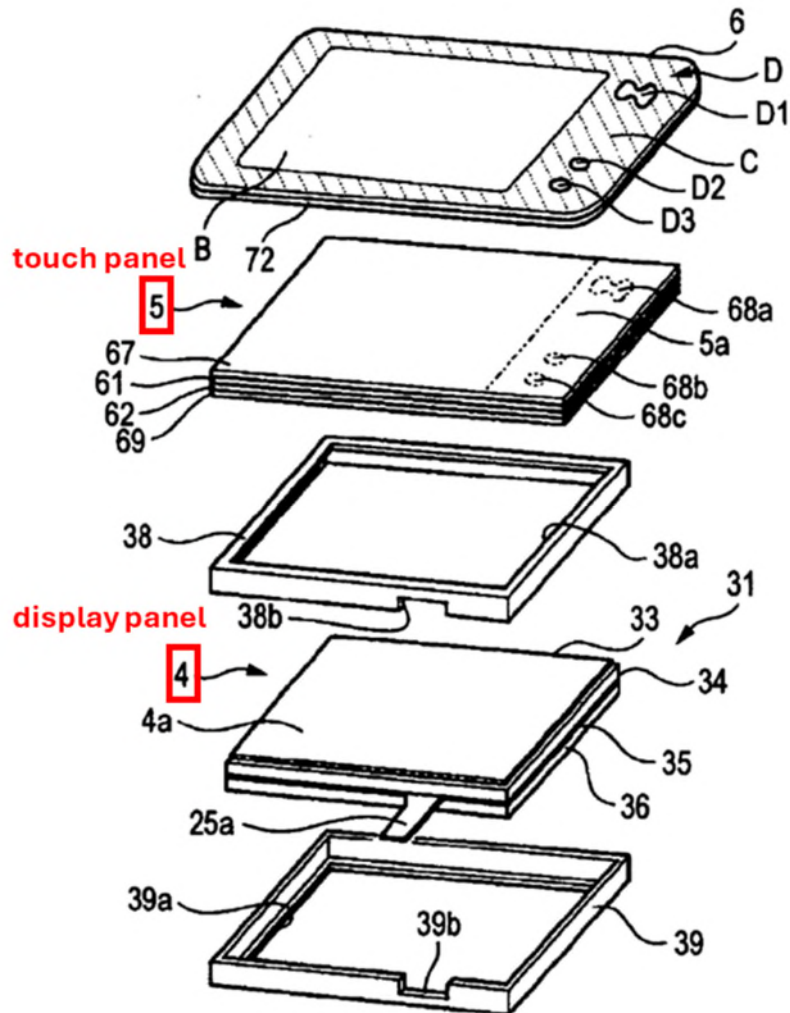
Display panels comprise a pixel array in an active area. The pixels are coupled through wirings around the active area to components that provide image signals for display.



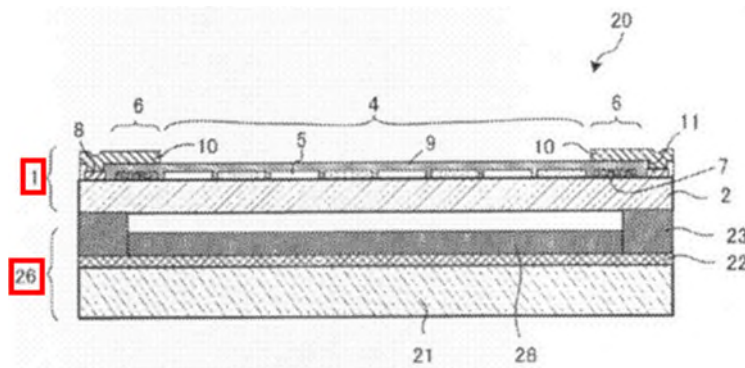
Miyagawa, Figs. 1–2;¹ *see also id.*, Figs. 6–7; Kim, Fig. 4; Ex. 1016, Fig. 3.

A touch screen adds a touch panel atop a display panel:

¹ All color annotations to figures herein are added.

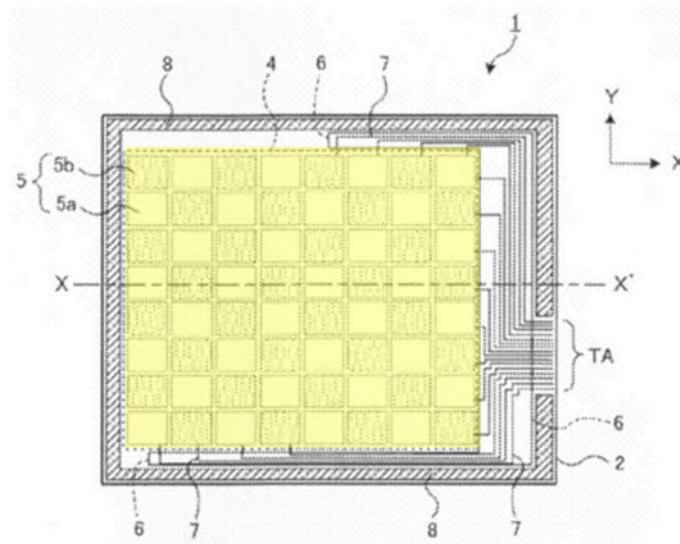


Kotera, Fig. 3 (partial). The following cross-sectional view shows a common arrangement with touch panel 1 above display panel 26:

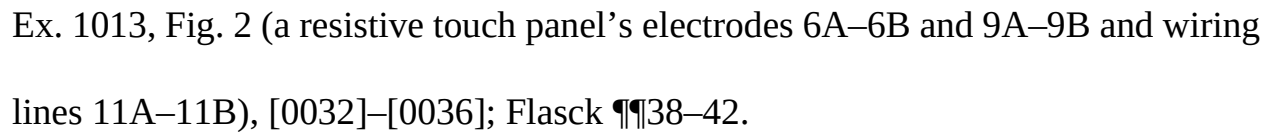


Nishihara, Fig. 8, [0066].

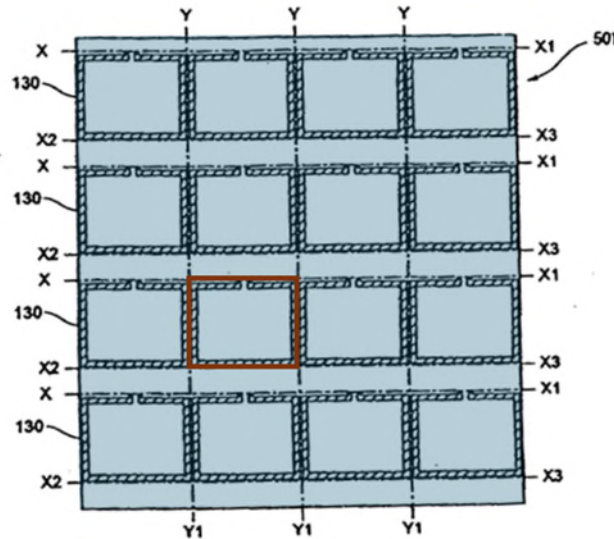
Capacitive- and resistive-type touch panels were common. Ex. 1014, [0016]; Ex. 1022, [0006]–[0007]. They comprise detection elements in an active area, surrounded by wirings and other components around the active area:



Nishihara, Fig. 1A, [0042]–[0045] (capacitive); Ex. 1017, Fig. 2 (capacitive).



-24-



Ex. 1018, Fig. 34, [0035]–[0037]; Ex. 1019, Fig. 14, [0012]; Ex. 1020, Fig. 2, [0031]–[0033]; Flasck ¶43 (explaining the cutting or singulation process).

When cutting mother substrates into individual panels, defect-causing chips or cracks may form:

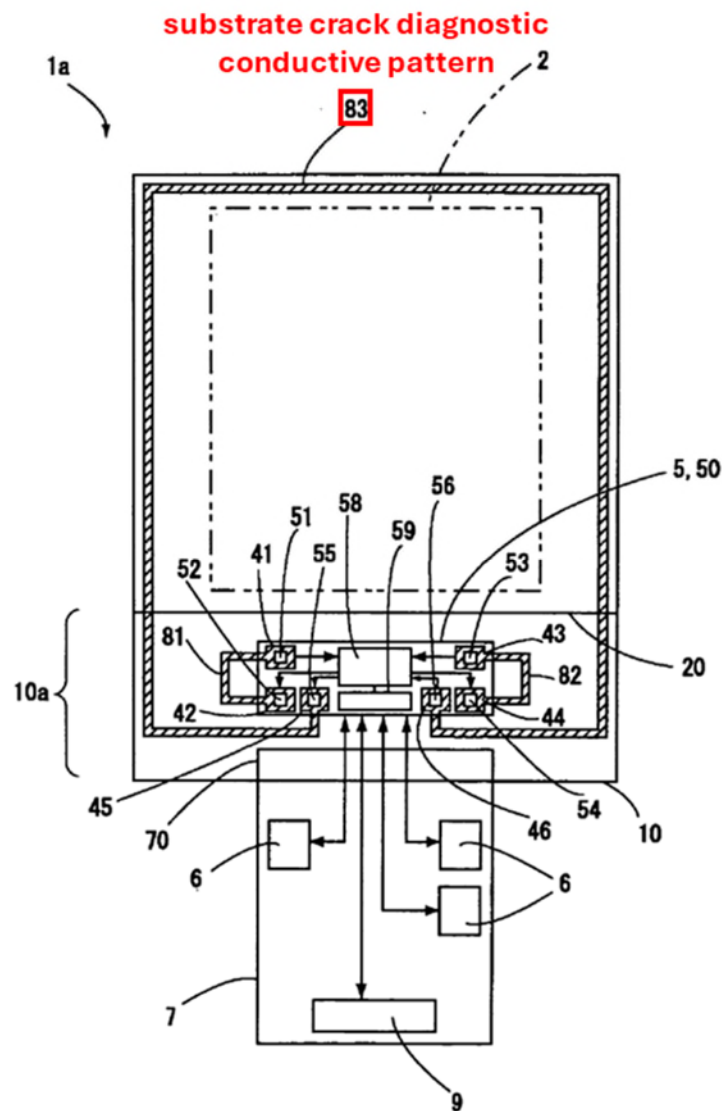


Ex. 1011, Figs. 9B–9C; Kida, [0006]–[0008].

It is advantageous to detect such defects before performing subsequent manufacturing steps to avoid wasting time and components. Ex. 1011, [0043]–[0044]. Though crack detection may be performed before or after the panel is

formed.

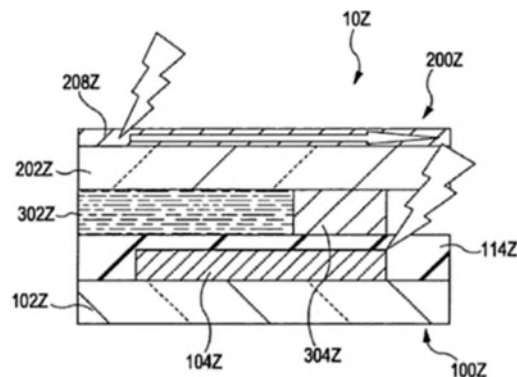
A common detection technique uses a wire deposited around individual panels' periphery. A sufficiently large crack would break the wire and be discoverable by checking electrical continuity.



Ex. 1015, Fig. 4, [0051]–[0053]; Miyagawa, Fig. 3; Ex. 1014, Fig. 9, [0043]; Flasck

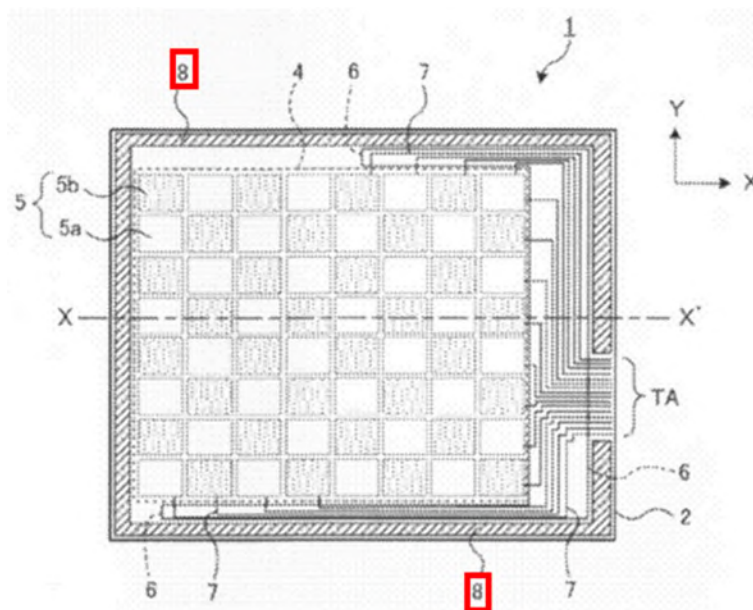
¶¶44–46.

Touch screens may be subject to noise or electrostatic discharge that could degrade or damage the panel.



Ex. 1016, Fig. 6 (illustrating electrostatic discharge); Flasck ¶47.

As shown in Nishihara, a wire (8) formed around the peripheries protects the panel from such disturbances.

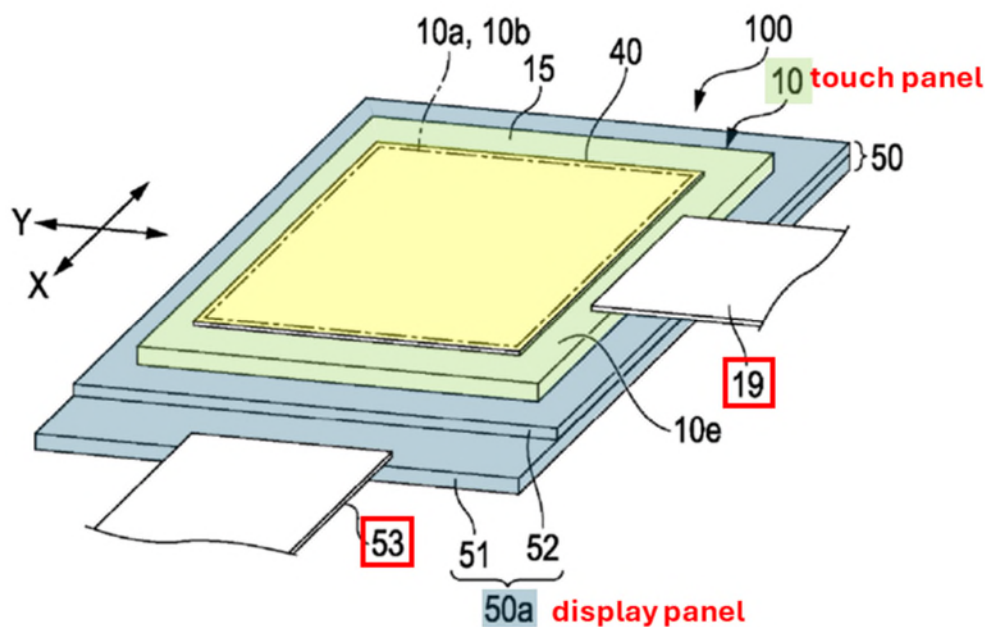


Nishihara, Fig. 1A, [0043]; Ex. 1016, Fig. 3; Ex. 1017, Fig. 2; Kim, Fig. 2, [0032]–

[0033]; Ex. 1021, Fig. 3, [0030]–[0031].

Because wires for crack detection and shielding are structurally similar and functionally compatible, one wire can serve both functions. Ex. 1011, [0041]; Flasck ¶¶48–49.

It was routine to connect touch/display panels to control circuitry via flexible wiring boards/substrates for signal/power transmission, *e.g.*, flexible substrates 19 and 53 are respectively connected to touch/display panels in the device below:



Ex. 1017, Fig. 1. Control circuitry was commonly implemented with integrated circuit (“IC”) chips placed on a panel substrate, a flexible substrate, or another component coupled to the flexible substrate. Miyagawa, [0020], [0040]; Ex. 1027, [0095]–[0097]; Flasck ¶¶50–51.

V. THE CHALLENGED PATENT AND PROSECUTION HISTORY

A. The Patent

The '477 patent's manufacturing technique facilitates the inspection of signal interconnects (*i.e.*, wirings) outside touch displays' detection/display areas. Ex. 1001, 1:25–28, 2:40–45. Conventional liquid crystal display (“LCD”) panels comprise two substrates, one providing electronics, the other color filters, sandwiching a liquid-crystal layer. *Id.*, 1:30–35.

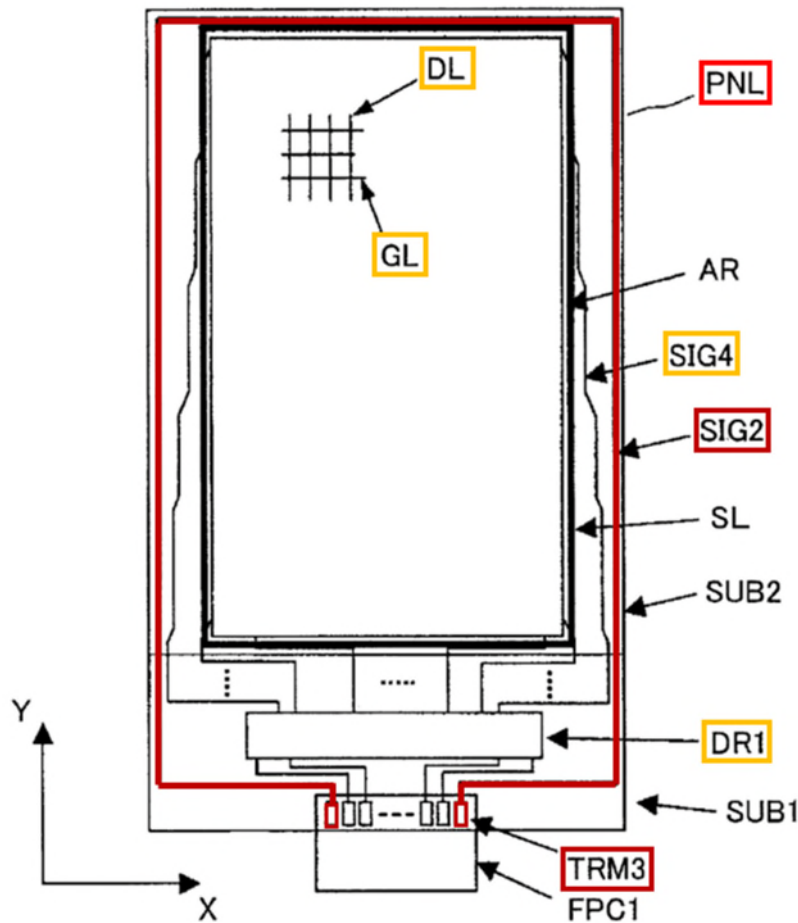
During manufacturing, mother substrates are cut to form smaller substrates, forming individual LCD panels, and a touch panel can be added to form a touch screen. *Id.*, 1:41–54. Both display and touch panels comprise signal interconnects in their peripheries. *Id.*, 1:42–62. When mother substrates are cut to form individual panels, the interconnects may be inadvertently cut due to substrate chipping or cracking. *Id.*, 1:42–48, 1:58–62.

The '477 patent criticizes a prior-art technique addressing this panel-cracking problem by testing the signal interconnects. *Id.*, 1:63–2:4, 2:34–37. It also criticizes visual inspection as difficult. *Id.*, 2:18–33. The allegedly inventive technique purports to determine broken interconnects due to substrate chipping or cracking without increasing manufacturing complexity. *Id.*, 2:40–45.

This technique involves a detection interconnect formed around the substrate's edges. *Id.*, 2:55–3:7, 3:35–42. Electrodes/terminals at the interconnect's

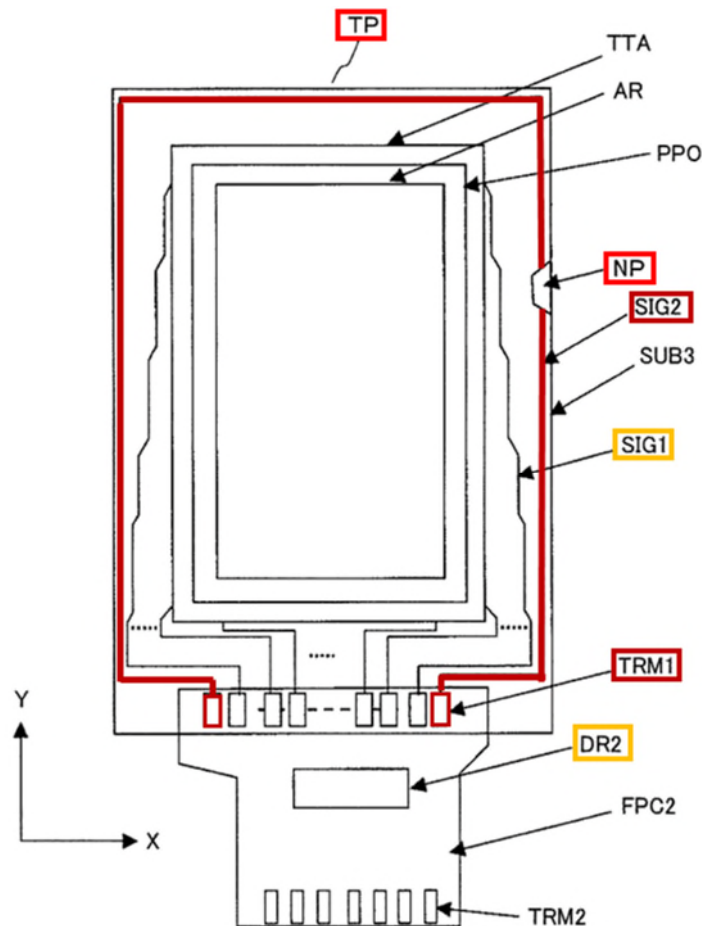
two ends facilitate inspection. *Id.*, 3:4–7, 3:39–42. Resistance across the electrodes can reveal any break in the interconnect. *Id.*, 9:32–40.

A detection interconnect SIG2 and electrode terminals TRM3 are on a display panel PNL:



Id., Fig. 9. The drain lines DL and gate lines GL are connected to a driving circuit DR1 through a signal interconnect SIG4. *Id.*, 15:32–35. The detection interconnect SIG2 runs along the panel’s edges, “surround[ing]” other wirings and components. *Id.*, 15:42–16:15.

The detection interconnect SIG2, electrode terminals TRM1, and chipping NP are shown on a touch panel TP:



Id., Fig. 4. Touch-detection electrodes are connected to a driving circuit DR2 through a signal interconnect SIG1. *Id.*, 7:30–47, 8:44–62. As on the display panel, the detection interconnect SIG2 runs along the touch panel’s edges, “outside” other wirings and components. *Id.*, 7:58–66.

The ’477 patent purports to invent the crack-detection interconnect but concedes that the underlying touch/display devices were well known. *Id.*, 4:24–38.

Flasck ¶¶52–58.

B. Prosecution History

The Examiner rejected the application leading to the '477 patent based on nonstatutory double patenting. Ex. 1002, 140–142. In response, Applicant filed a terminal disclaimer, and the Examiner allowed the claims. *Id.*, 153, 172–174; Flasck ¶59.

C. Claim Construction

The Board construes claims under *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (*en banc*). Accordingly, claims are given their plain and ordinary meaning in light of the specification. *Id.* at 1315–17. The Board only construes claim terms when necessary to resolve controversies. *Toyota Motor Corp. v. Cellport Sys., Inc.*, IPR2015-00633, Paper 11 at 16 (PTAB Aug. 14, 2015).

Petitioner applies all claim terms' plain and ordinary meanings. Flasck ¶22.

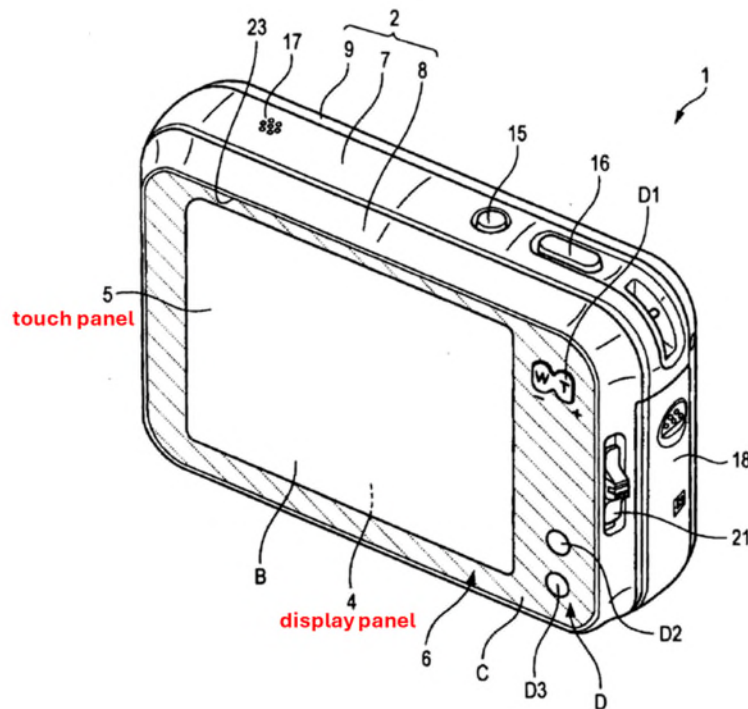
VI. LEVEL OF ORDINARY SKILL IN THE ART

A POSITA in the technology of the '477 patent in 2010 would have had at least a Bachelor's degree in electrical engineering, physics, or a similar discipline, along with at least two years of experience with touch displays. Relevant experience can substitute for education and vice versa. Flasck ¶¶34–35.

VII. THE PRIOR ART

A. Kotera

Kotera discloses touch displays. Kotera, Abstract. A camera embodiment is described but nonlimiting. *Id.*, [0072].

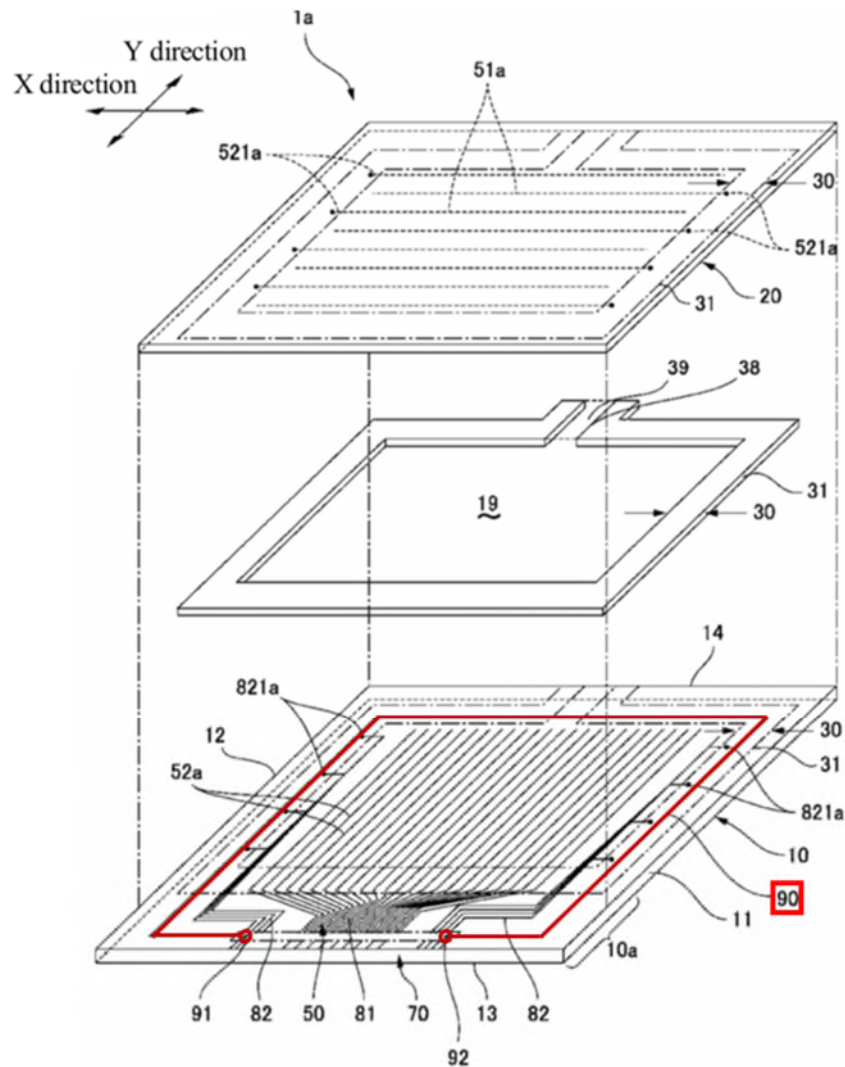


Id., Fig. 2, [0023]–[0024].

Kotera focuses on structurally reinforcing the touch panel against pressing force to prevent breakage. *Id.*, Abstract, [0013]. This is achieved through reinforcing areas C formed from an opaque serigraph. *Id.*, [0053]–[0054]. The serigraph 71 is between the surface sheet 6 and upper film member 61:



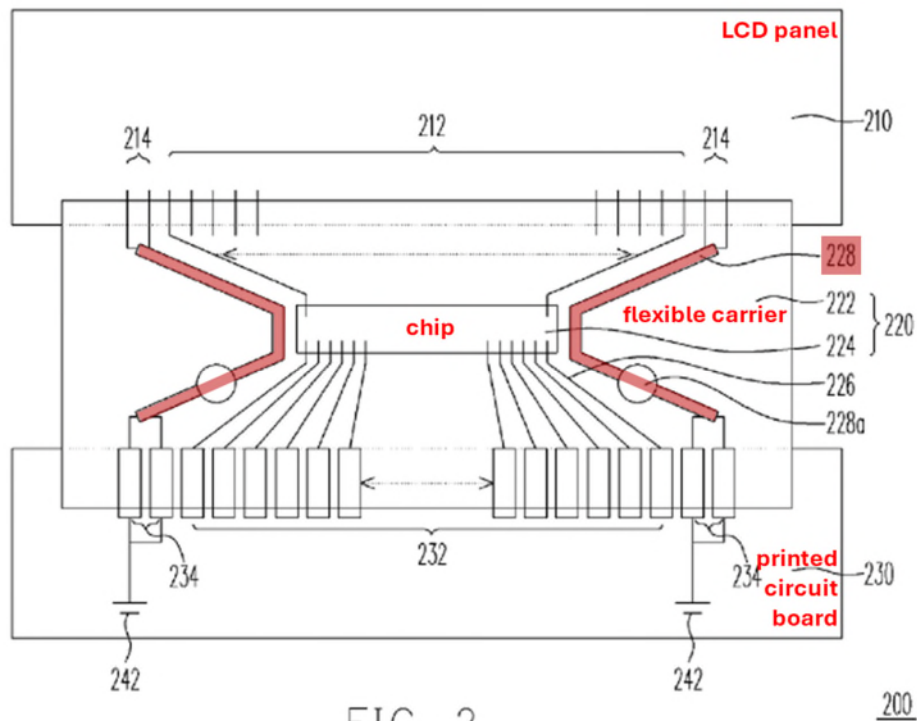
Miyagawa discloses LCD displays with a diagnostic wiring that, when cracked, becomes electrically discontinuous, thus enabling a substrate-crack defect to be detected during manufacturing. Miyagawa, Abstract. The diagnostic wiring is placed on a substrate's peripheries:



Id., Fig. 3, [0023]–[0024]; Flasck ¶62.

C. Lee

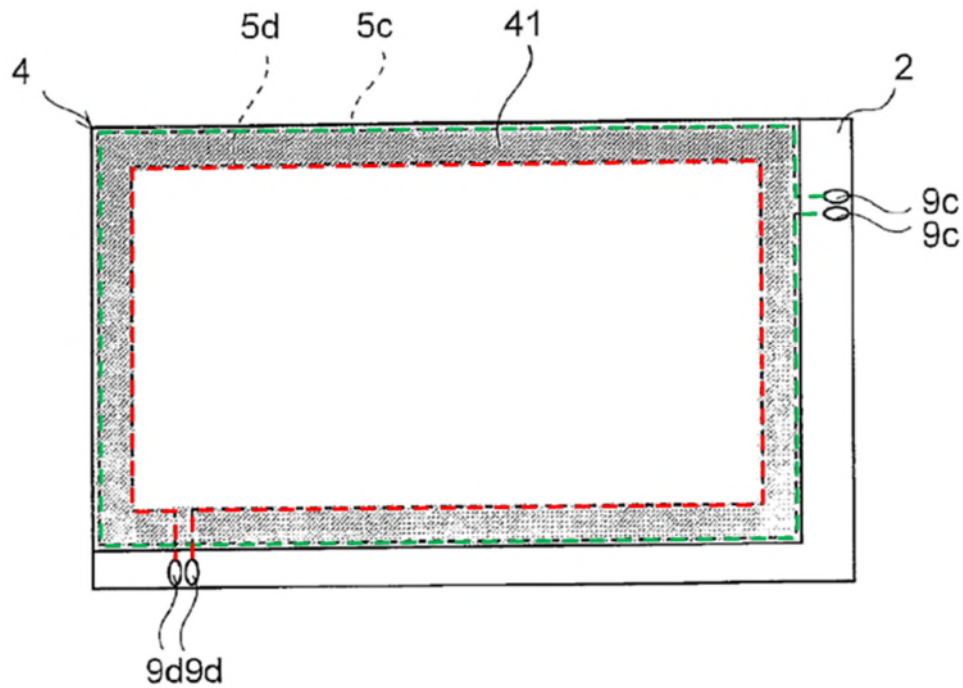
Lee discloses display panels with a flexible carrier having signal lines, an IC chip, and electrostatic-discharge-protective lines. Lee, Abstract. The electrostatic-discharge-protective lines connect an LCD panel to ground terminals on a printed circuit board. *Id.*, [0024]–[0026].



Id., Fig. 2. Lee's invention provides superior electrostatic-discharge protection. *Id.*, [0031]; Flasck ¶63.

D. Kida

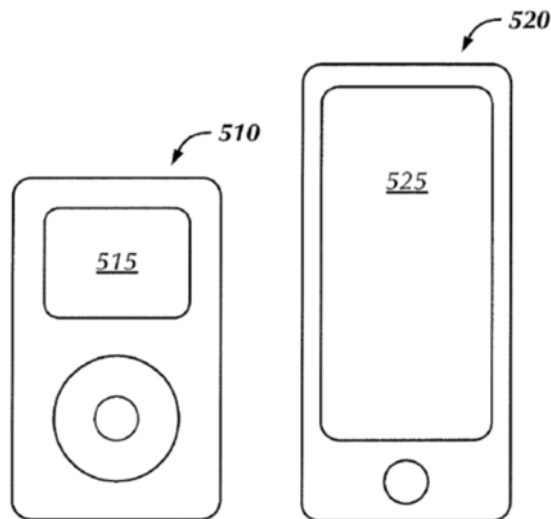
Kida discloses LCD panels that can detect small cracks that may expand in size. Kida, Abstract. This is achieved through two conductors on the substrate's peripheries.

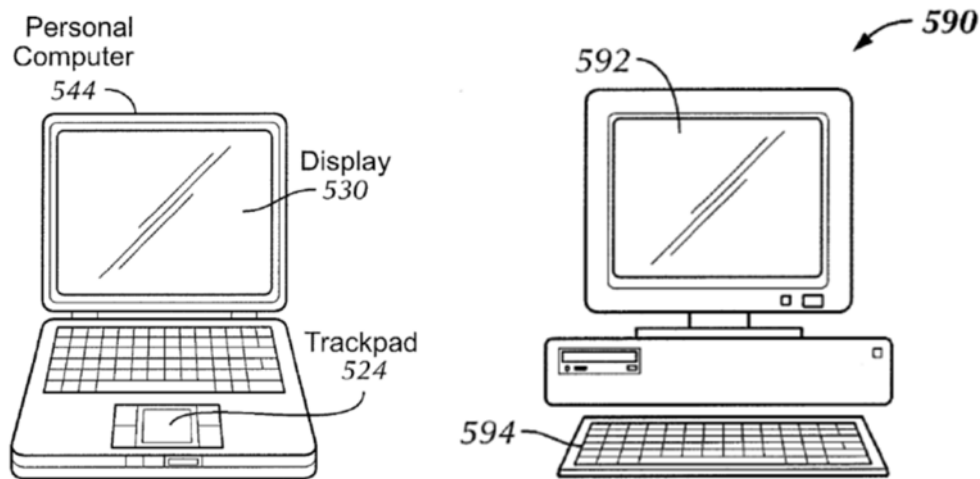


Id., Fig. 11(b), [0114]–[0119]; Flasck ¶64.

E. Sung

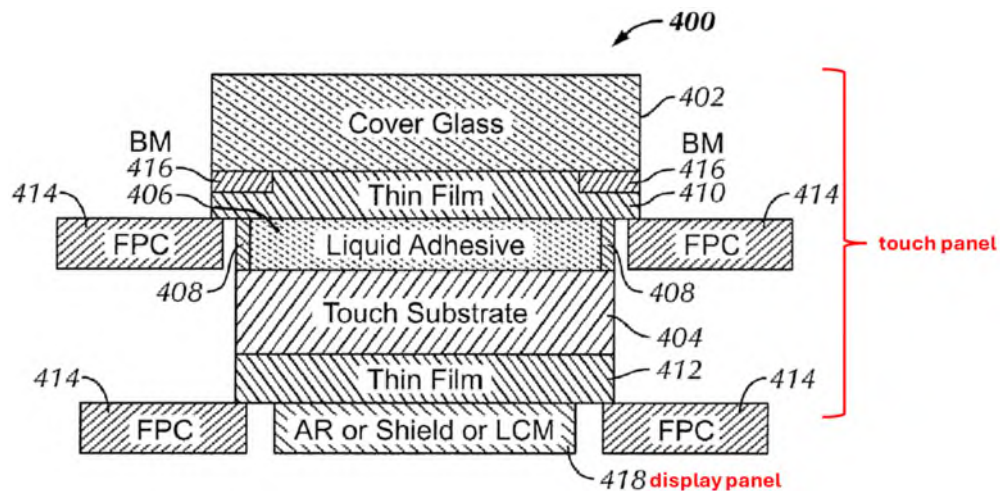
Sung discloses “[a] method for fabricating a plurality of touch sensor panels” for a variety of devices. Sung, Abstract.





Id., Figs. 5A–5D, [0045]–[0049].

Sung’s devices comprise a touch display:



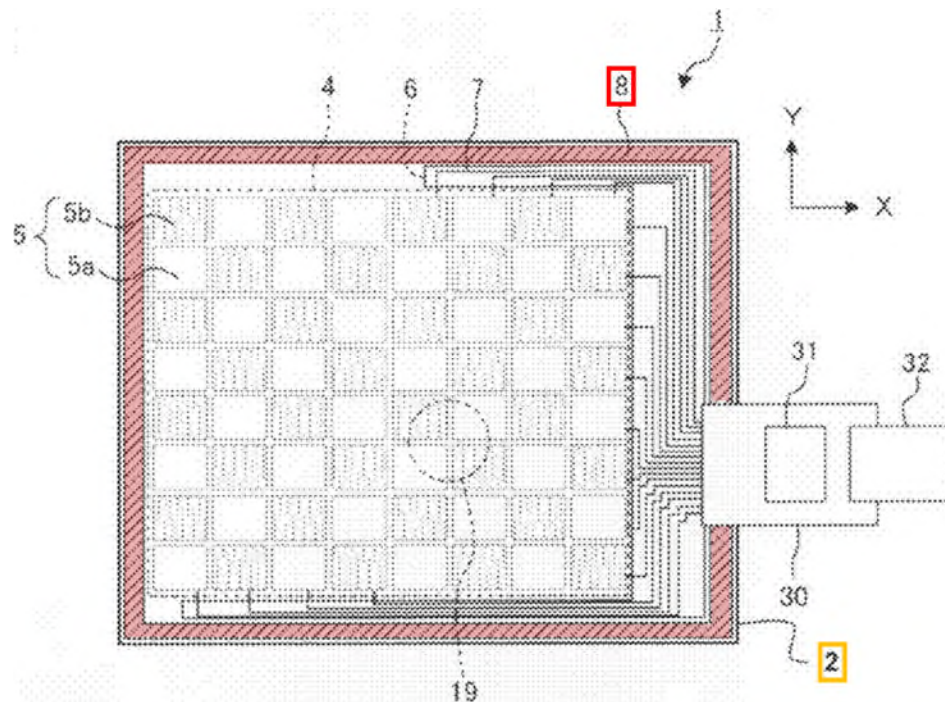
Sung, Fig. 4, [0039]–[0042]. As the figure reveals, Sung focuses on the touch panel.

Flasck ¶¶65–66.

F. Nishihara

Nishihara discloses touch displays resistant to “electromagnetic noise or static electricity.” Nishihara, [0009]. This is achieved through a shield electrode on the

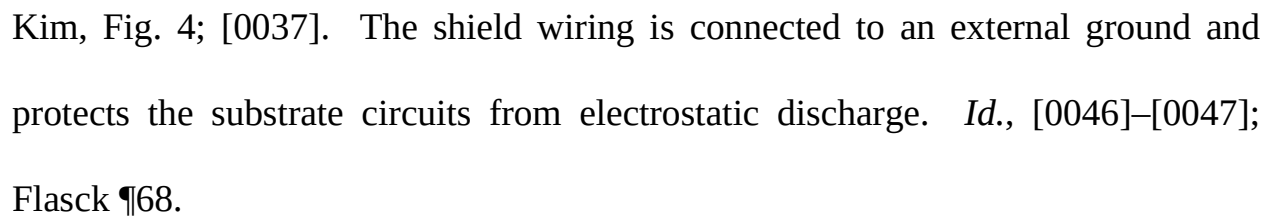
substrate's edges. *Id.*, [0010], [0043].



Id., Fig. 2A, [0047]–[0050]; Flasck ¶67.

G. Kim

Kim discloses display panels with a shield wiring along their substrate's edges:



VIII. THE CHALLENGED CLAIMS ARE UNPATENTABLE OVER THE PRIOR ART

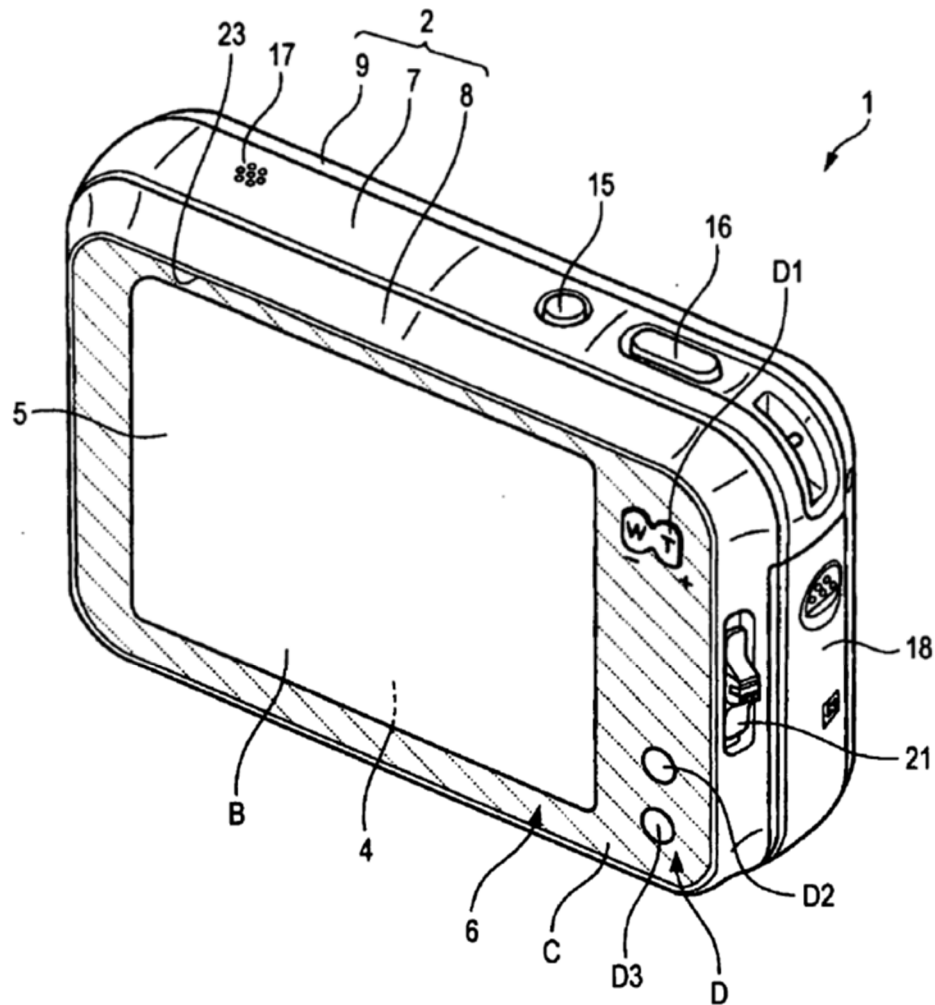
A. GROUND 1: Kotera in View of Miyagawa Renders Claims 1–2, 8–10, 12, 17–18, and 20–21 Obvious

1. Claim 1

a) 1[pre]

Kotera discloses *a display device*,² “equipped with a touch panel” such as cameras, personal computers, cell phones, etc. Kotera, [0072]. Kotera illustrates its embodiments using a camera. *Id.*

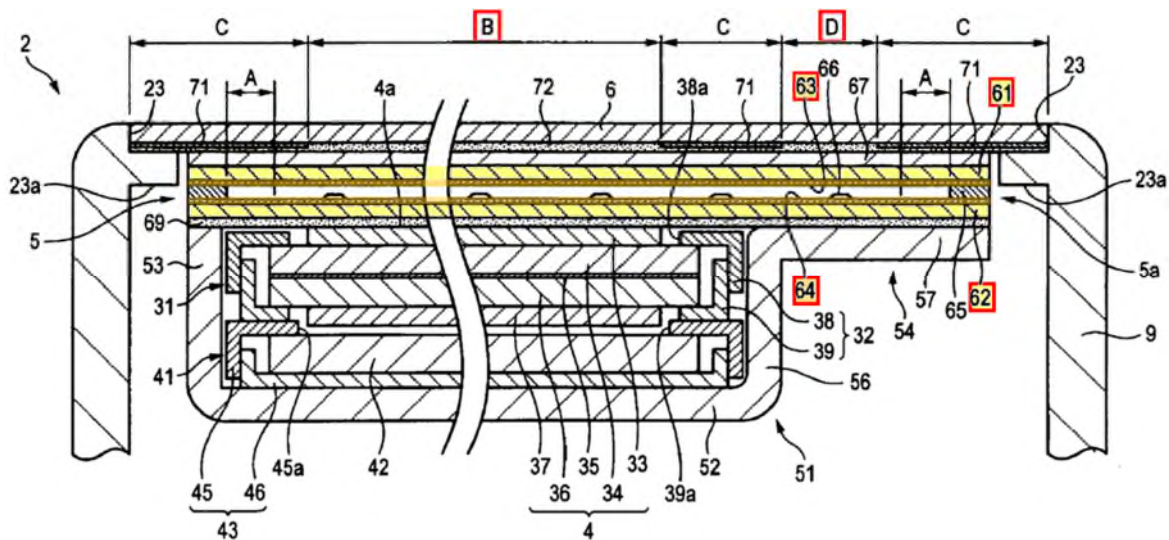
² Red *italics* denote verbatim claim language in the limitation-by-limitation sections.



Id., Fig. 2; Flasck ¶69.

b) 1[a]

Kotera renders obvious *a coordinate input substrate* (upper and lower film members 61–62) *having detection electrodes* (upper and lower transparent conductive films 63–64) *disposed in a detection region* (display-surface operating area B and input-section operating area D), *and first interconnects outside the detection region*.

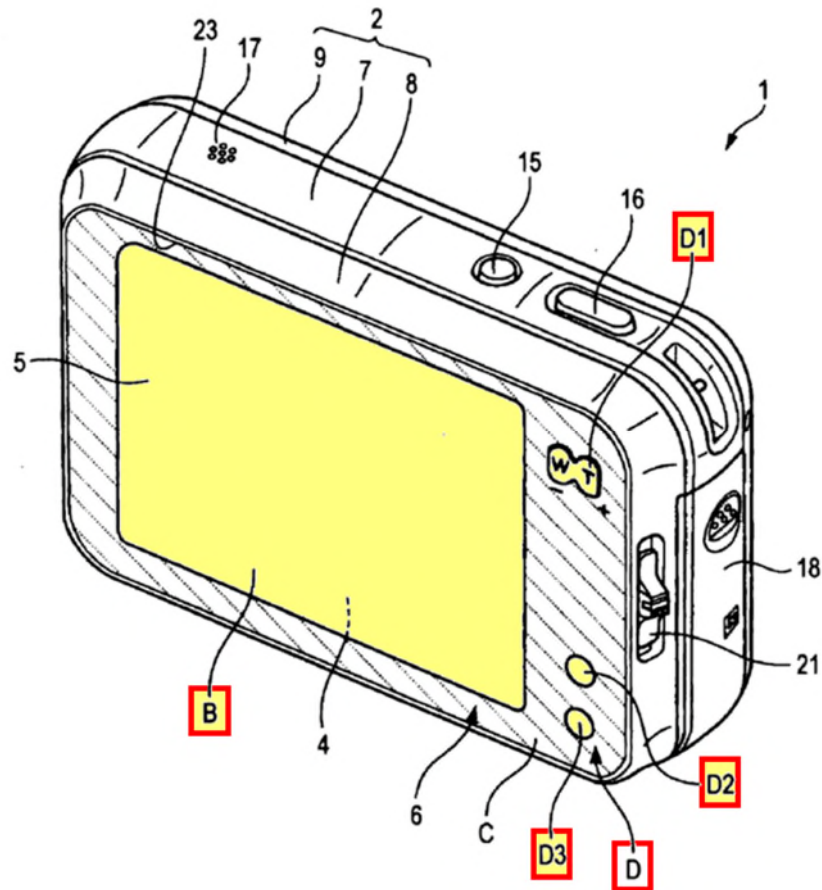


Kotera, Fig. 4.

The '477 patent touch panel may be of a “well-known” resistive type. Ex. 1001, 4:28–31, 4:50–52. Resistive-touch panels have electrodes inside, and signal interconnects outside, the detection region. *Id.*, 1:54–58.

Kotera discloses resistive-film touch panels that detect touch positions. Kotera, [0007]–[0008], [0042]–[0043]. The panels comprise upper and lower film members 61–62, each respectively having a transparent conductive film 63/64 disposed thereon. *Id.*, [0042]. The upper and lower film members constitute *a coordinate input substrate* in two ways. First, the two film members are bonded together. *Id.*, [0044]. Thus, they constitute a coordinate input substrate. Alternatively, *a coordinate input substrate* can read on multiple substrates. *Elkay Mfg. Co. v. Ebco Mfg. Co.*, 192 F.3d 973, 977 (Fed. Cir. 1999) (“a” can mean more than one). The films 63–64 are detection electrodes. Flasck ¶¶70–72.

Users can operate touch functions displayed in the display-surface operating area B or the input-section operating area D. Kotera, Abstract, [0050], [0056].

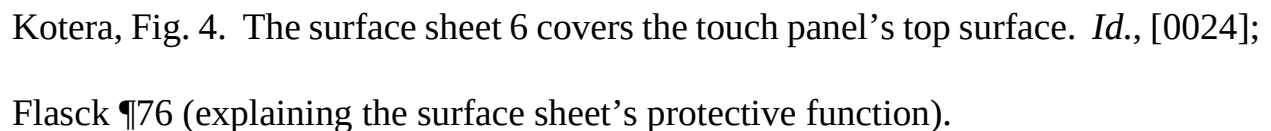


Id., Fig. 2.

As was routine, the transparent conductive films 63–64 form a detection area wherein touch points are detected when the films come in contact due to pressure. *Id.*, [0042]. These films are connected to sensing circuits through a signal interconnect/wires outside the detection region. Because the drive/sense signals must be conveyed between the conductive films and control circuits, a POSITA

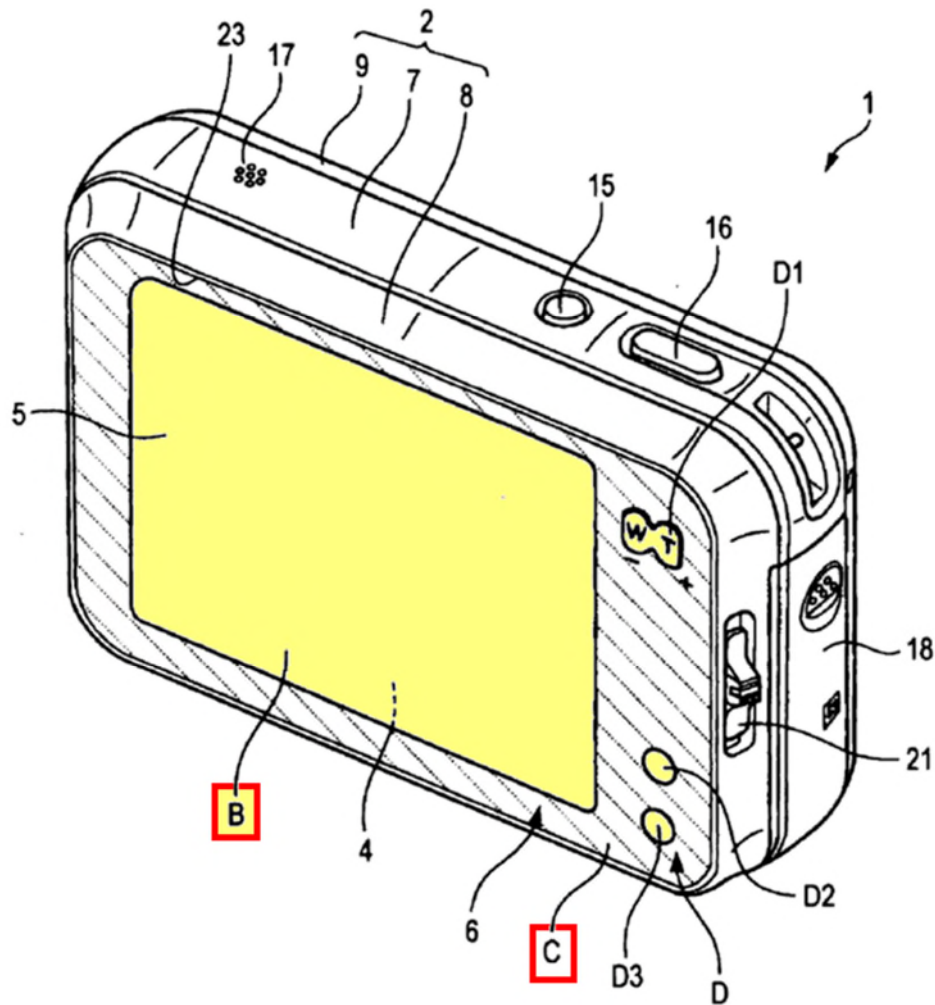
As Figure 4 (§VIII.A.1.a) shows, the upper and lower film members 61–62 and transparent conductive films 63–64 span across the operating areas B and D and an intervening reinforcing area C. Thus, the detection area includes areas B and D. Flasck ¶¶73–75.

Kotera discloses *a protective plate* (surface sheet 6) *on the coordinate input substrate* (upper and lower film members 61–62).



Kotera discloses *a light shielding material* (serigraph 71) *which has an*

-46-



Kotera, Fig. 2. As shown, the serigraph corresponding to the reinforcing area C has an opening for the display panel. *Id.*, [0052], cl. 2.

e) 1[d]

Kotera at least renders obvious *a first flexible substrate* (wiring board) *electrically connected to the coordinate input substrate* (upper and lower film members 61–62).

The transparent conductive films 63–64 comprise indium tin oxide “typical[.]”

of touch panels to conduct electricity. Kotera, [0043].

A control device drives the camera including its touch screen. *Id.*, [0025]. The control device comprises flexible wiring boards. *Id.*, [0025], [0032], [0037], [0041]. It would at least have been obvious that the transparent conductive films 63–64 are coupled to external circuits through interconnects on the upper and lower film members and flexible wiring boards. Such a configuration was routine to connect touch panels with an external power source and touch-operable components, *e.g.*, a zoom lens. *Id.*, [0047].

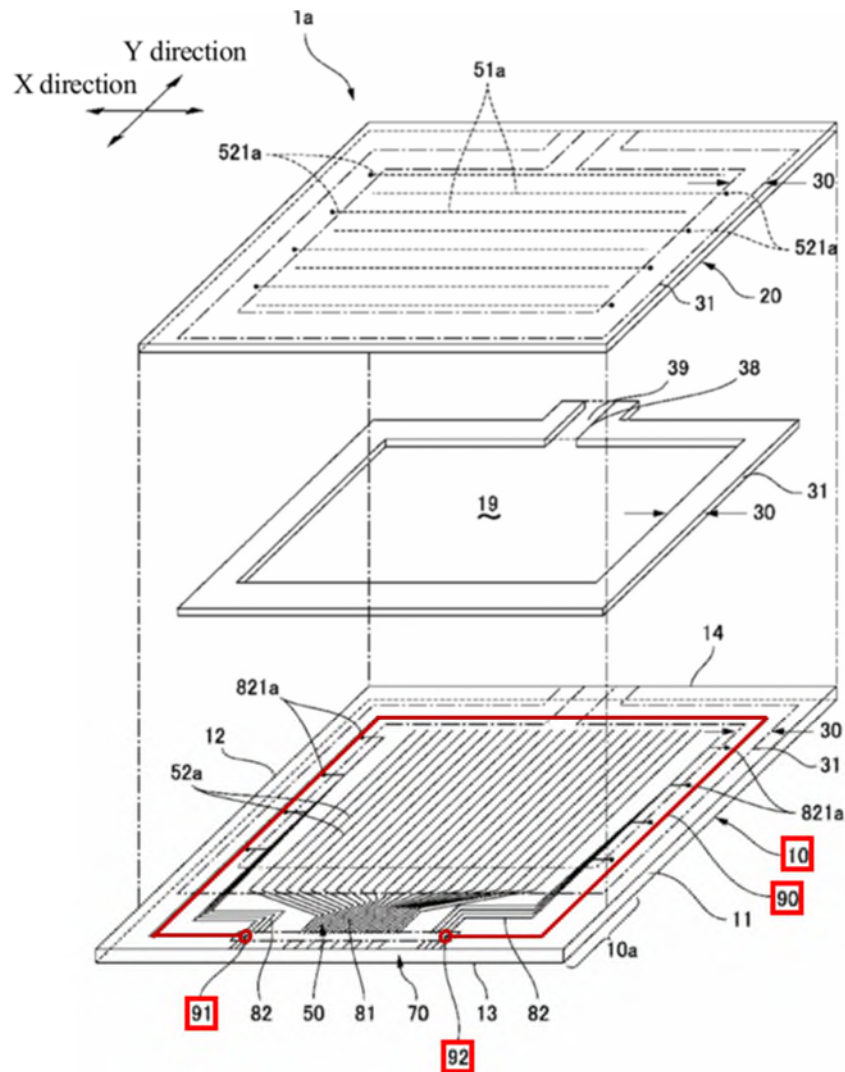
Similarly, Miyagawa discloses a flexible substrate. Miyagawa, [0020], Fig. 2. A POSITA would have known that Kotera’s wiring board and Miyagawa’s flexible substrate perform analogous functions and may have similar form factors. Flasck ¶¶78–81.

f) 1[e]

Kotera in view of Miyagawa renders obvious *wherein the coordinate input substrate* (Kotera: upper and lower film members 61–62) *has a second interconnect* (Miyagawa: diagnostic wiring 90), *a first electrode, and a second electrode* (Miyagawa: first and second diagnostic pads 91–92).

Miyagawa discloses diagnostic wiring to determine “whether a substrate crack has occurred....” Miyagawa, Abstract, [0027], [0030]. Its ends are the diagnostic pads 91–92. *Id.*, Abstract, [0006]–[0007], [0023]–[0024]. The diagnostic wiring 90

is located along the element substrate 10's edges to detect cracks:

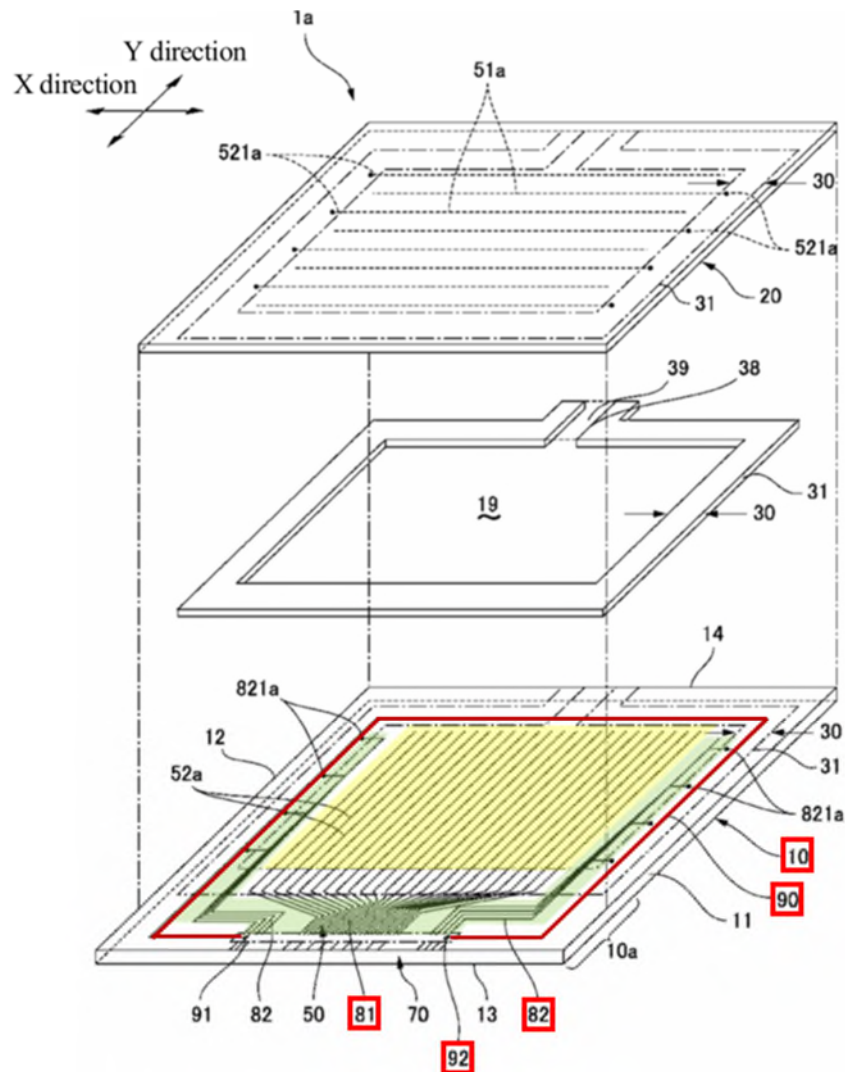


Id., Fig. 3; Flasck ¶¶82–83.

g) 1[f]

Kotera in view of Miyagawa renders obvious *wherein the second interconnect* (Miyagawa: diagnostic wiring 90) *surrounds the detection region* (Kotera: display-surface operating area B and input-section operating area D) *and is formed outside the first interconnects* (of Kotera).

The diagnostic wiring surrounds Miyagawa's display region (shaded light yellow) and functional wiring patterns 81–82:



Miyagawa, Fig. 3, Abstract, [0024]–[0025], [0031], [0044]. If cracks occur on the substrate and break the diagnostic wiring, the diagnostic pads would become electrically disconnected. Cracks usually occur on a substrate's edge when the substrate is divided from a mother substrate. *Id.*, [0028]. Suitably configured to detect such cracks, the diagnostic wiring is formed along the edges, outside the

display region and wiring patterns.

This configuration applies when forming diagnostic wiring on Kotera's touch panel. Miyagawa's display region and wiring patterns are analogous to Kotera's detection region and first interconnects. §IV (citing Exs. 1013, 1025); §VIII.A.1.b (citing Exs. 1023–24). Thus, the diagnostic wiring would be formed to surround the detection region and the first interconnects. Flasck ¶¶84–86.

h) 1[g]–1[h]

Miyagawa discloses *wherein the first electrode* (first diagnostic pad 91) *is formed at one end of the second interconnect* (diagnostic wiring 90). Miyagawa further discloses *wherein the second electrode* (second diagnostic pad 92) *is formed at the other end of the second interconnect*. §VIII.A.1.f; Flasck ¶87.

i) 1[i]

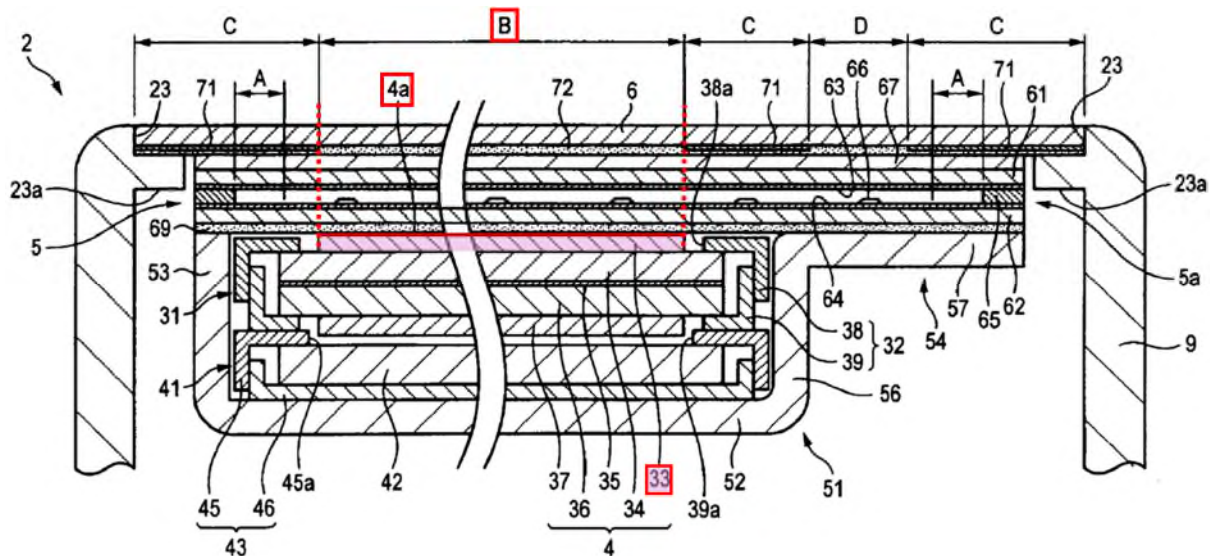
Kotera in view of Miyagawa renders obvious *wherein the second interconnect* (Miyagawa: diagnostic wiring 90) *is disposed along a peripheral edge of at least three sides of the coordinate input substrate* (Kotera: upper and lower film members 61–62).

The diagnostic wiring is disposed along Miyagawa's substrate's peripheries on three sides. §VIII.A.1.g. This configuration directly applies on Kotera's touch panel to detect cracks. Flasck ¶¶88–89.

j) 1[j]

Kotera in view of Miyagawa renders obvious *wherein a display region* (Kotera: display surface 4a) *is surrounded by the second interconnect* (Miyagawa: diagnostic wiring 90).

Kotera discloses an LCD panel 4 comprising an upper polarization plate 33 having a display surface 4a. Kotera, [0029], [0050], [0061], [0063]. The surface 4a has approximately the same size as the display-surface operating area B and is thus within the detection region including areas B and D. *Id.*, [0051].



Id., Fig. 4.

It would have been obvious to form the diagnostic wiring to surround Kotera's detection region. §VIII.A.1.g. Since the display region is within the detection region, the diagnostic wiring surrounds the display region. Kotera, [0051]–[0053]; Flasck ¶¶90–92.

k) 1[k]

Miyagawa at least renders obvious *wherein the first electrode* (first diagnostic pad 91) *is electrically connected with a third electrode on the first flexible substrate* (flexible substrate 7), *or the second electrode* (second diagnostic pad 92) *is electrically connected with a fourth electrode on the first flexible substrate*.

Miyagawa's diagnostic pads are used for electrical-continuity inspection in two alternatives. Miyagawa, [0007]. Probing the pads tests electrical continuity. *Id.*, [0028]. Additionally, coupling the driving IC to the pads enables the IC to perform a continuity check. *Id.*, [0011], [0026], [0029]. The IC may be located on the flexible substrate. *Id.*, [0040]. Correspondingly, the diagnostic pads are placed on the panel's edge and coupled to the IC via the flexible substrate's matching electrodes.

Alternatively, the flexible substrate has a function IC. *Id.*, [0020]. It would have been a simple design choice to place the substrate-cracking-diagnostic function in this function IC. Flasck ¶¶93–95.

l) 1[l]

Kotera discloses *wherein the opening* (display-surface operating area B) *of the light shielding material* (serigraph 71) *is larger than the display region* (display surface 4a) *and surrounds the display region*.

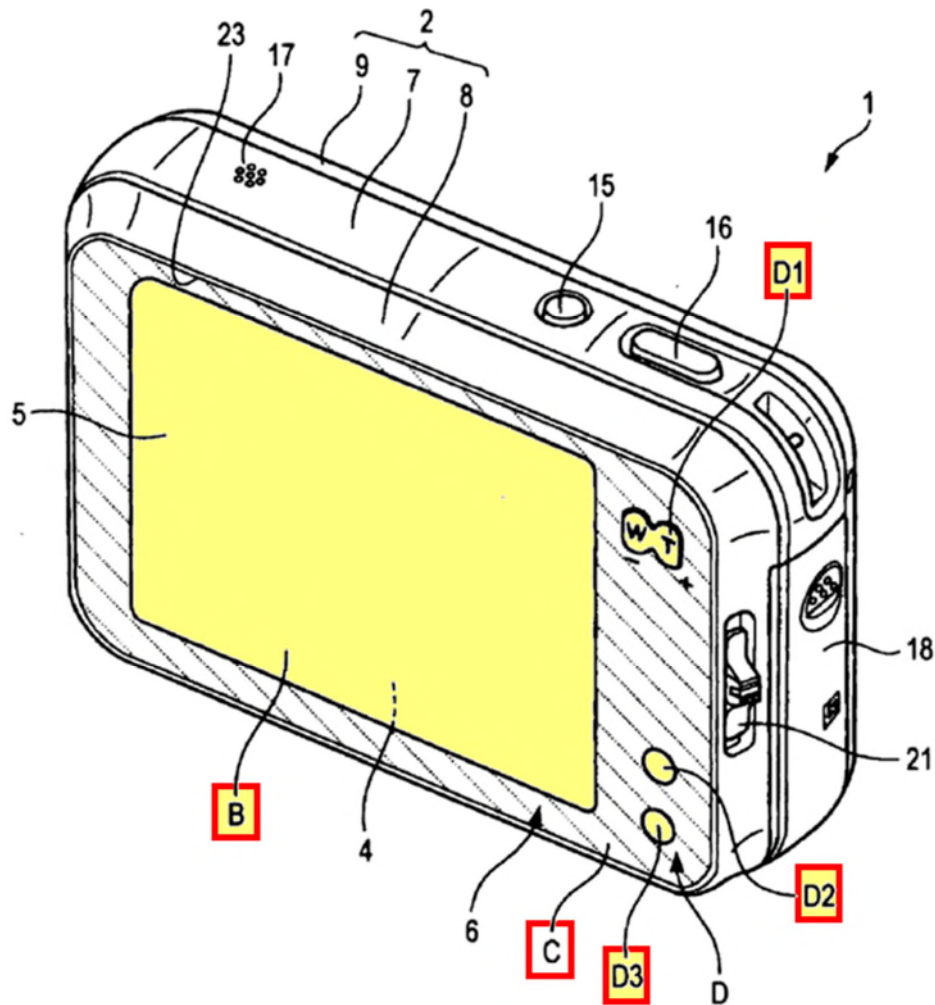
The serigraph's opening is the display-surface operating area B. §VIII.A.1.d;

Kotera, [0051]. This area B is slightly larger than the display area (surface 4a). *Id.*, [0051]–[0053]; Flasck ¶¶96–97 (explaining the benefit of a larger area B).

m) 1[m]

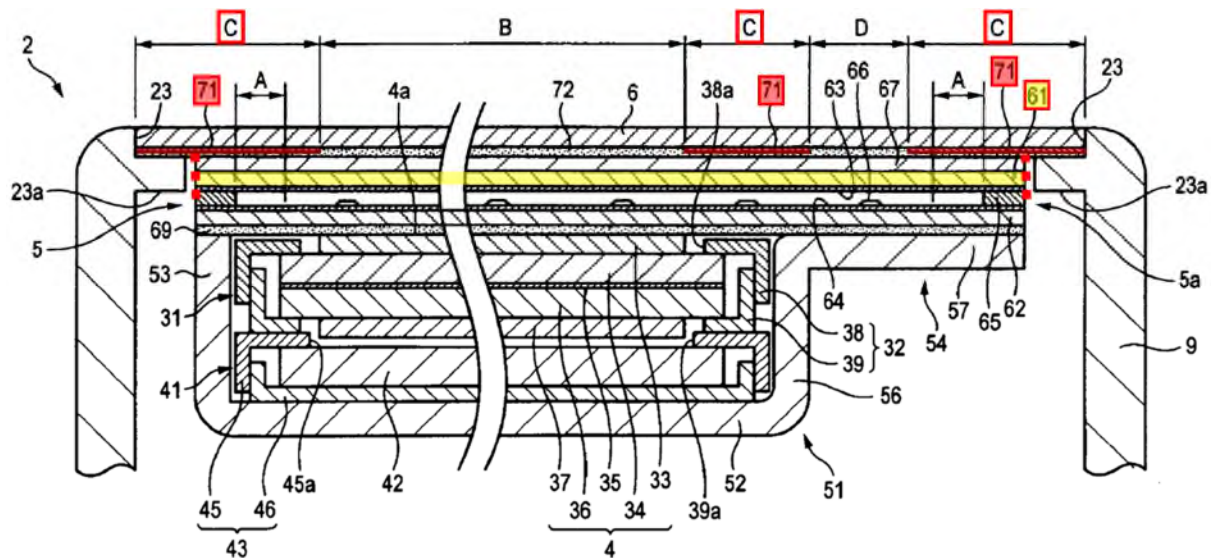
Kotera in view of Miyagawa renders obvious *wherein the light shielding material* (Kotera: serigraph 71) *overlaps the second interconnect* (Miyagawa: diagnostic wiring 90) *along the peripheral edge of at least the three sides of the coordinate input substrate* (Kotera: upper and lower film members 61–62) *in a plan view*.

The serigraph covers the reinforcing area C. Kotera, [0053]–[0054]. The serigraph (area C) covers all four edges of the camera's back side:



Id., Fig. 2.

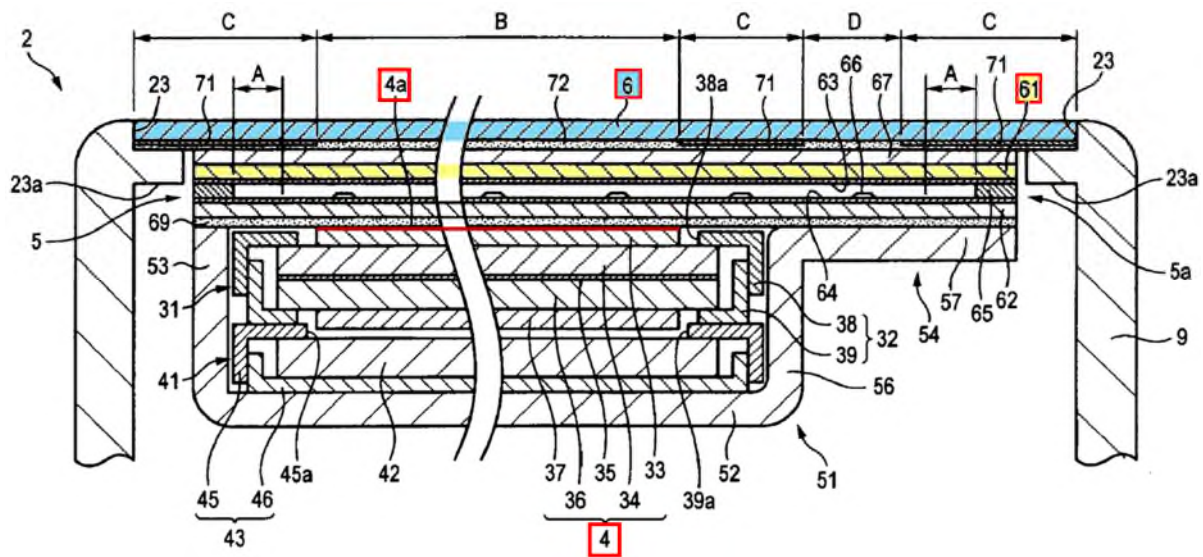
It would have been obvious to form the diagnostic wiring on the panel's edges to surround the upper and lower film members 61–62 and their associated interconnects. §VIII.A.1.g. The panel's edges are illustrated with red dotted lines below. The figure also shows that the serigraph 71 and the reinforcing area C extend to the edges of the camera's back side. *Id.*, [0050].



Id., Fig. 4. The diagnostic wiring is formed along at least three peripheries of the upper and lower film members 61–62. §VIII.A.1.i. Thus, in a plan view, the serigraph overlaps the diagnostic wiring at least along the same three sides. Flasck ¶¶98–100.

2. Claim 2

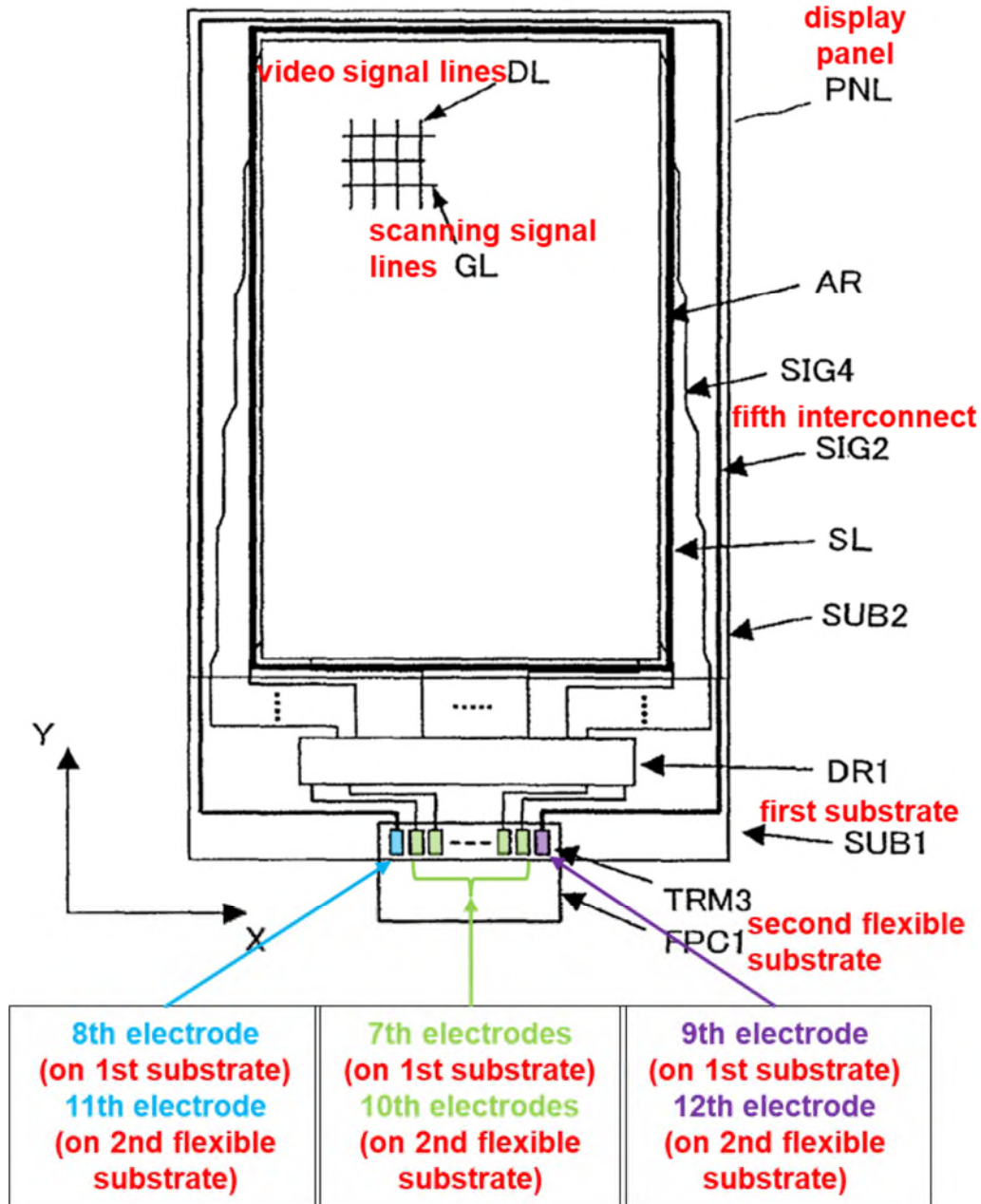
Kotera discloses a display device *further comprising a display panel* (liquid crystal panel 4) *having the display region* (display surface 4a), *wherein the coordinate input substrate* (upper and lower film members 61–62) *is disposed between the display panel and the protective plate* (surface sheet 6). See also §VIII.A.1.



Kotera, Fig. 4. The liquid crystal panel 4 is a display panel having a display surface 4a. *Id.*, [0023]–[0024], [0028]–[0029]. The surface sheet 6 “cover[s] [the top] surface of the touch panel 5[,]” comprising the upper film member, “opposite to the liquid crystal panel 4.” *Id.*, [0024]; Flasck ¶101.

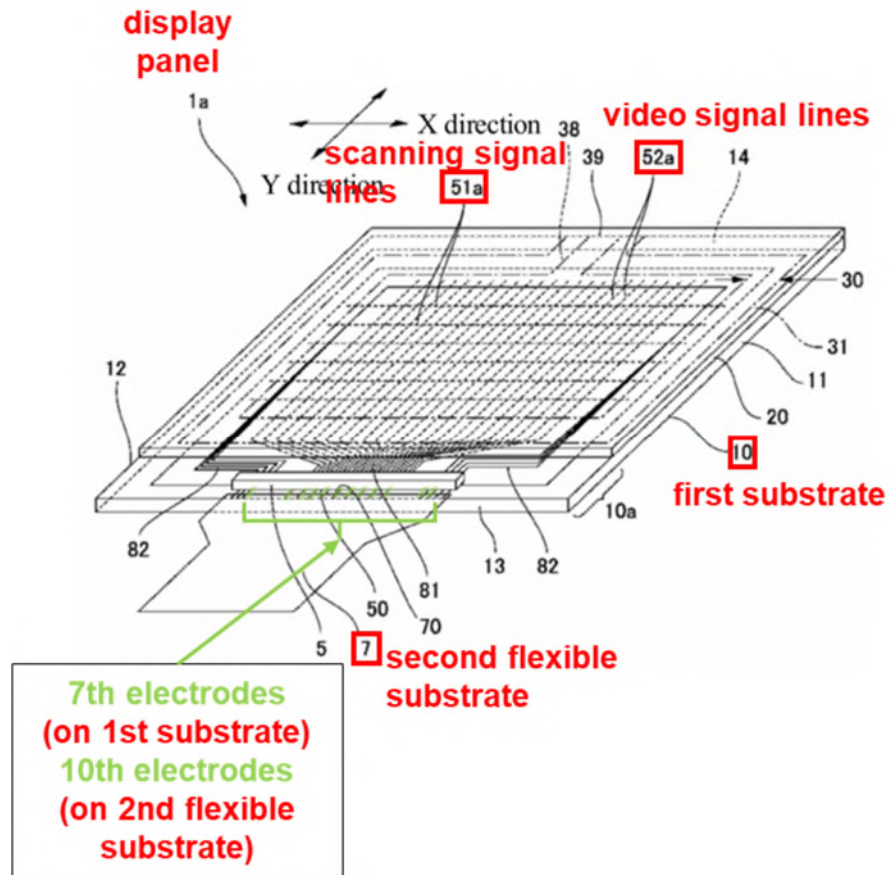
3. Claim 8

It is helpful to first graphically illustrate claim 8:

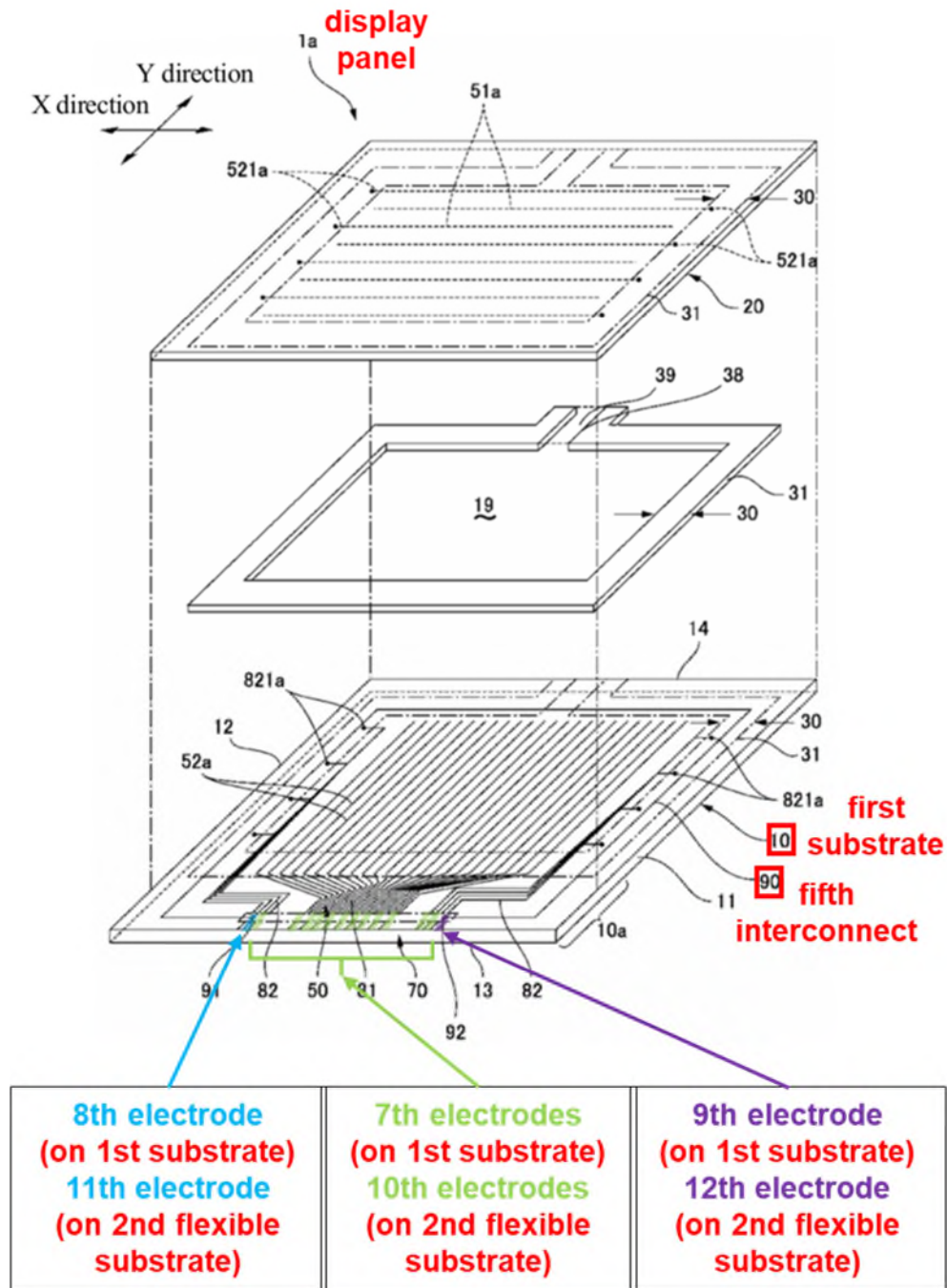


Ex. 1001, Fig. 9.

Miyagawa satisfies claim 8 as illustrated here and as explained below.



Miyagawa, Fig. 2, §VIII.A.1.k (crack-detection function on flexible substrate).



Id., Fig. 3; Flasck ¶¶102–103.

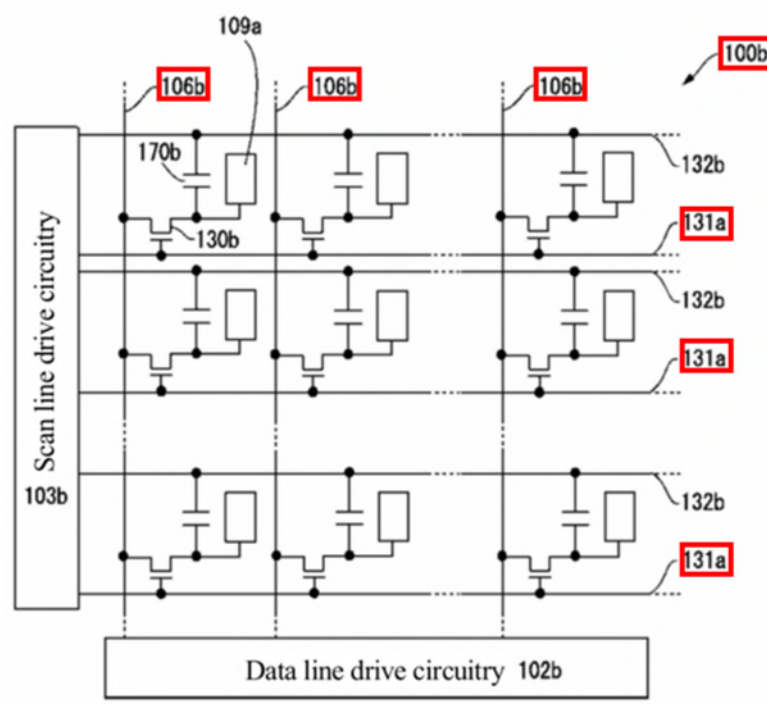
a) 8[pre]

Miyagawa discloses *wherein the display panel comprises* the limitations

below. See also §VIII.A.2.

b) 8[a]

Miyagawa's display panel comprises *a first substrate* (TFT array substrate) *on which a plurality of video signal lines* (data lines 106b) *and a plurality of scanning signal lines* (scan lines 131b) *intersecting the video signal lines are formed.*

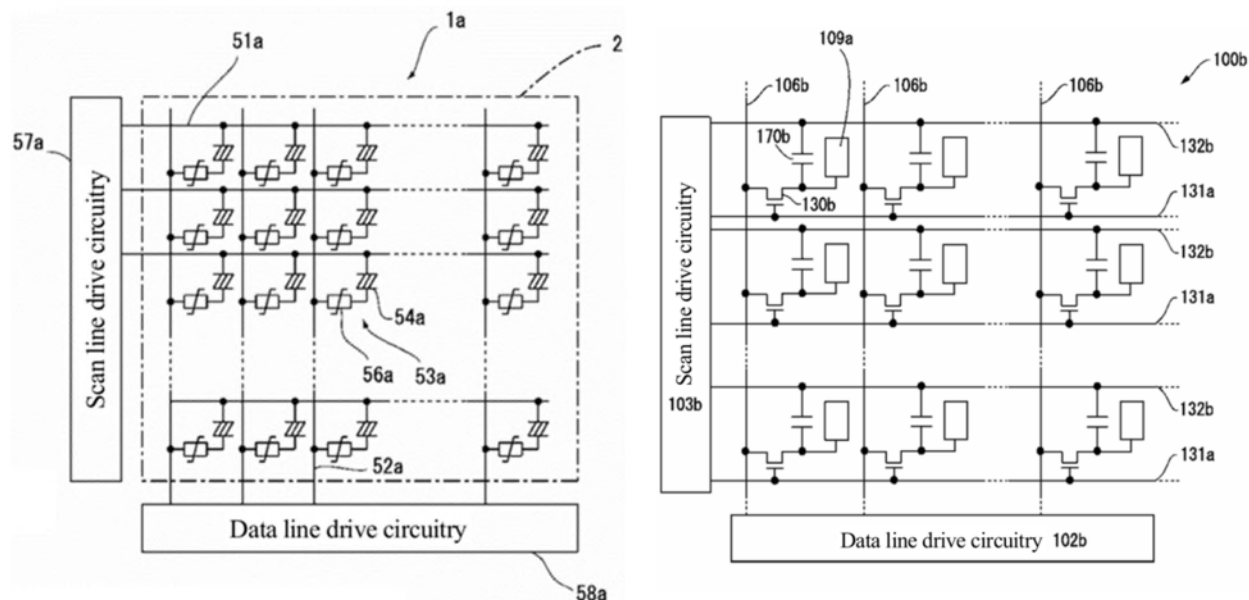


Miyagawa, Fig. 6.³

Miyagawa discloses an active-matrix thin-film-transistor (“TFT”) liquid crystal device. *Id.*, [0042]–[0043]. The device comprises a TFT-array substrate on which data lines and scan lines intersect. *Id.*, [0043]–[0044].

³ Figure 6 labels scan lines as 131a while Miyagawa’s text identifies them as 131b.

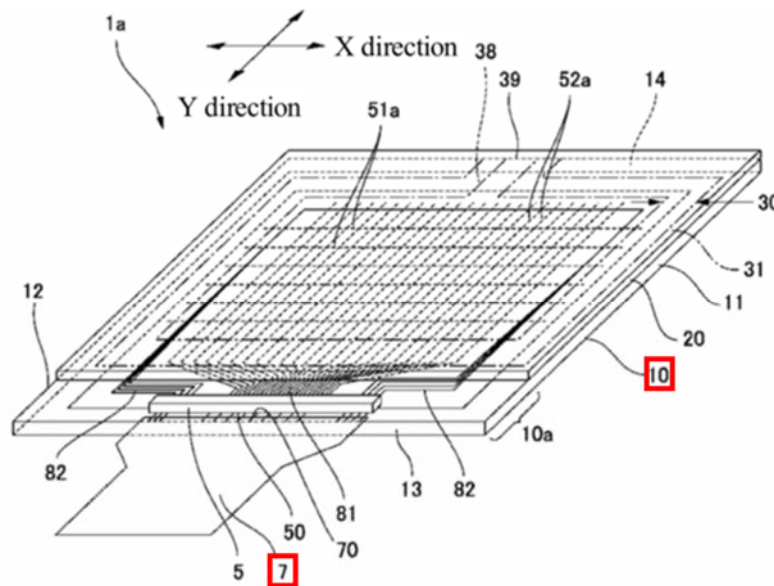
Miyagawa's embodiment-1 disclosure comprising diagnostic wiring is applicable to the TFT device. *Id.*, [0041].



Id., Figs. 1, 6; Flasck ¶¶104–108 (explaining this applicability and the diagnostic-wiring configuration on the TFT-array substrate); *Bos. Sci. Scimed, Inc. v. Cordis Corp.*, 554 F.3d 982, 991 (Fed. Cir. 2009) (“Combining two embodiments disclosed adjacent to each other in a prior art patent does not require a leap of inventiveness.”).

c) 8[b]

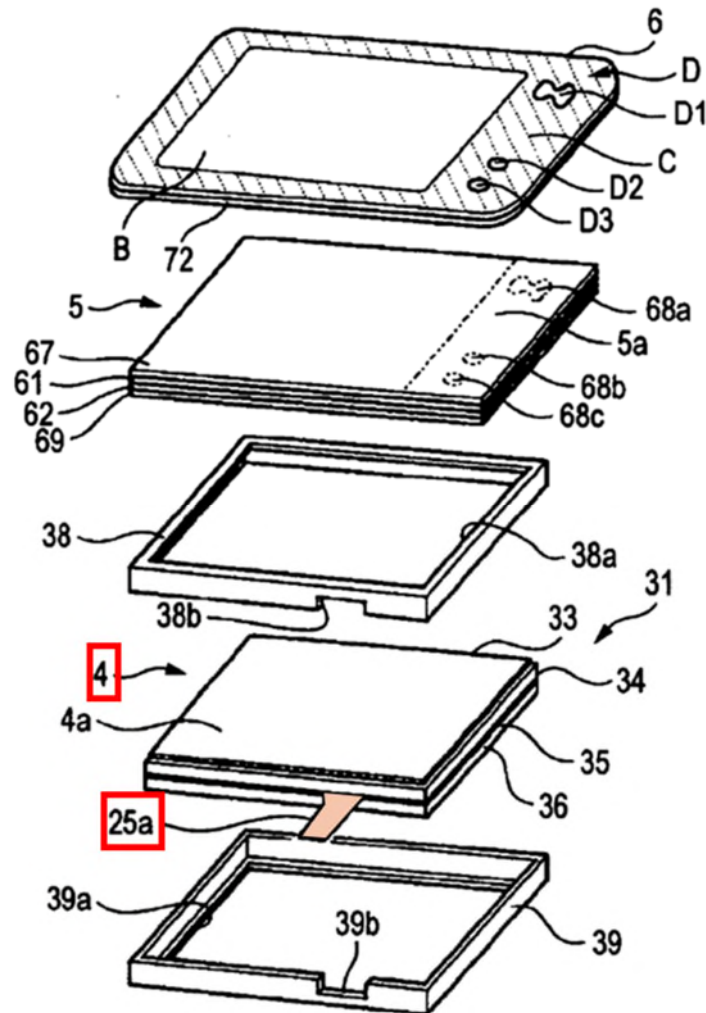
Miyagawa's display panel comprises *a second flexible substrate* (flexible substrate 7) *electrically connected to the first substrate* (TFT array substrate).



Miyagawa, Fig. 2.

“[The] flexible substrate 7 [is] ... mounted in ... the substrate mounting region 70.” *Id.*, [0020]. The flexible substrate connects to an electronic apparatus body, which supplies driving signals to form images. *Id.*, [0020], [0040], [0043].

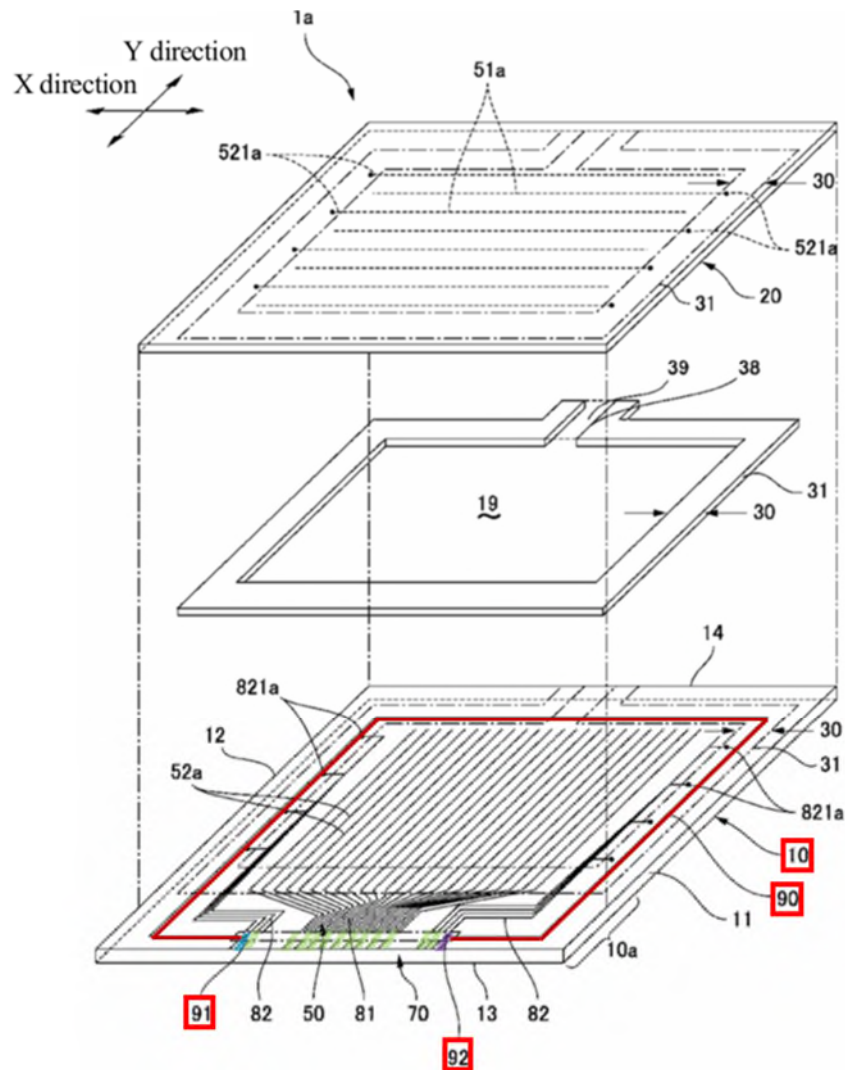
Miyagawa’s flexible substrate is analogous to Kotera’s flexible wiring board 25a connected to its liquid crystal panel 4. Kotera, [0032]; Flasck ¶¶109–111.



Kotera, Fig. 3 (partial).

d) 8[c]

Miyagawa discloses *wherein a plurality of seventh electrodes* (pads), *a fifth interconnect* (diagnostic wiring 90), *an eighth electrode* (first diagnostic pad 91) *and ninth electrode* (second diagnostic pad 92) *are formed on the first substrate* (TFT array substrate).



Miyagawa, Fig. 3. The data/scan lines and the diagnostic wiring are connected to pads formed in a region coupled to the flexible substrate. *Id.*, [0023]; §VIII.A.1.k. Two pads are the diagnostic pads 91–92, formed at the diagnostic wiring 90’s opposite ends. *Id.*, [0006]–[0007], [0023]–[0024]; Flasck ¶112.

e) 8[d]

Miyagawa discloses *wherein the seventh electrodes (pads) receive video signals and scanning signals from an external system* (electronic apparatus body),

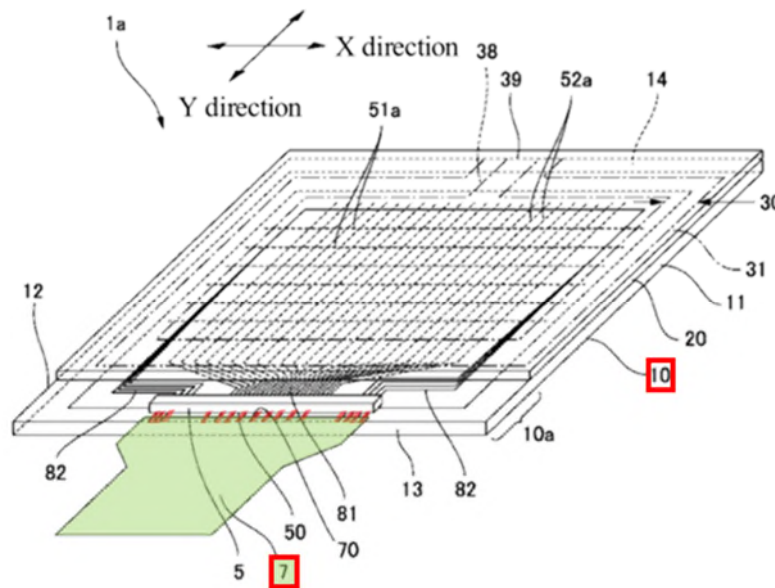
the eighth electrode (first diagnostic pad 91) *is formed at one end of the fifth interconnect* (diagnostic wiring 90), *and the ninth electrode* (second diagnostic pad 92) *formed at the other end of the fifth interconnect.*

The connections between the diagnostic wiring and the diagnostic pads are shown above. §VIII.A.3.d. Miyagawa discloses a flexible substrate 7 “for connecting to an electronic apparatus body” and mounted in the substrate-mounting region 70. Miyagawa, [0020]. The electronic apparatus body (*i.e.*, an external host system) supplies image signals, which are delivered via the flexible substrate and the data/scan lines to display images. *Id.*, [0043]; Flasck ¶¶113–115 (explaining picture storage and display in Kotera’s camera).

f) 8[e]

Miyagawa discloses or renders obvious a display panel *wherein a plurality of tenth electrodes, a[n] eleventh electrode, twelfth electrode are formed on the second flexible substrate* (flexible substrate 7), *and the plurality of tenth electrodes are formed between the eleventh electrode and the twelfth electrode.*

Miyagawa’s display substrate comprises pads. §VIII.A.3.d. These pads are coupled to electrodes/terminals in the substrate-mounting region 70 at the TFT-array substrate’s bottom:



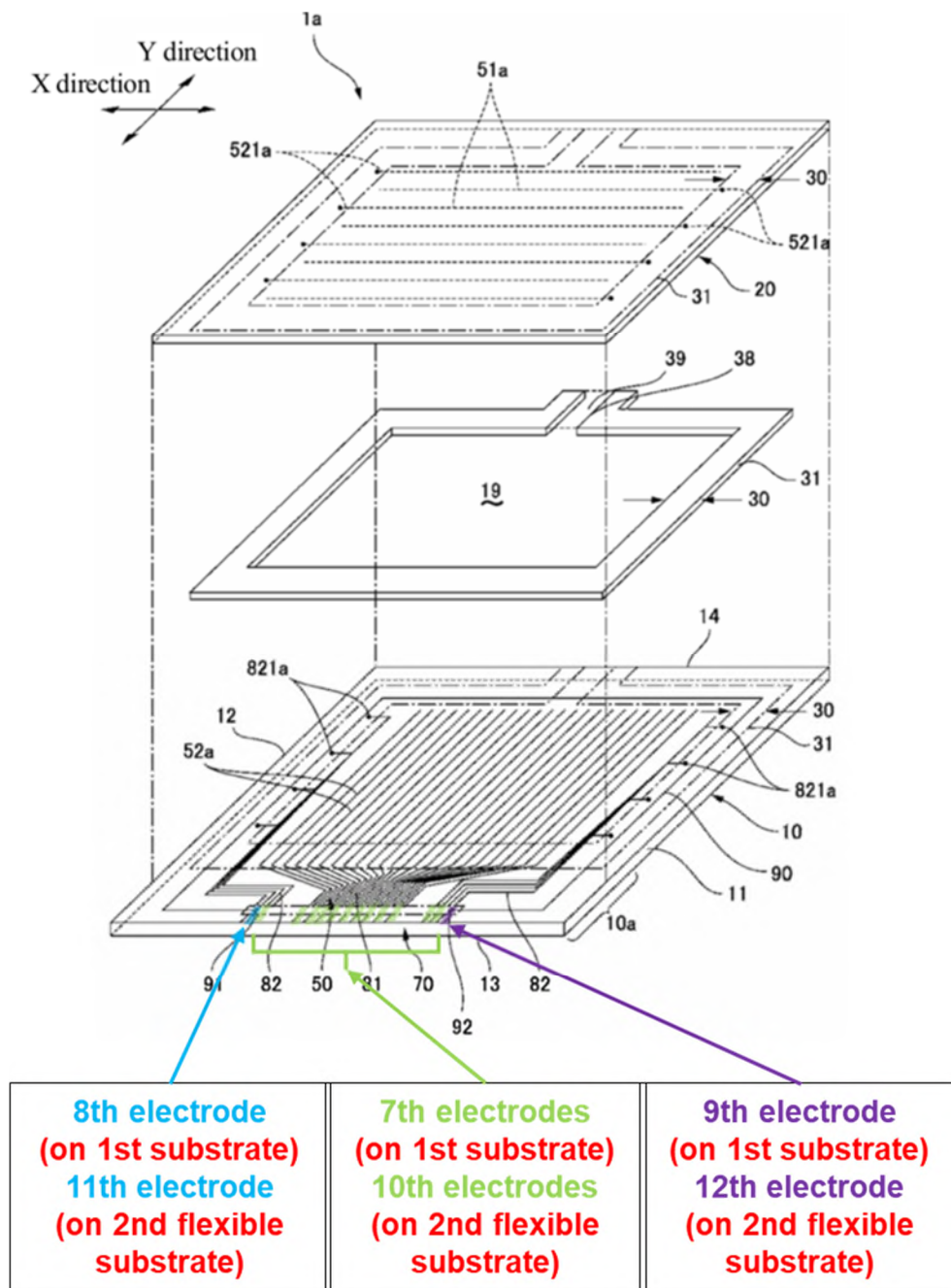
Miyagawa, Fig. 2; Flasck ¶¶116–117.

A POSITA would have understood that the flexible substrate comprises electrodes/terminals to connect through mating with the corresponding electrodes/terminals on the display substrate. The flexible substrate's plurality of tenth electrodes is coupled to the electrodes/terminals coupled to the scan and data lines. Miyagawa discloses or renders obvious that the diagnostic wiring's electrical continuity can be tested via signals transmitted through the flexible substrate. *Id.*, [0029], [0040]; §VIII.A.1.k. Accordingly, a POSITA would have understood, or at least found it obvious, that the diagnostic pads are coupled to two electrodes/terminals on the flexible substrate, the eleventh and the twelfth electrodes. Flasck ¶118. Like the TFT-array substrate's diagnostic pads, these two electrodes are the flexible substrate's leftmost and rightmost pads. Thus, the tenth electrodes,

coupled to the scan/data driving units, are formed between them.

g) 8[f]

Miyagawa discloses a display panel *wherein the tenth electrodes are connected to the seventh electrodes* (pads), *the eleventh electrode is connected to the eighth electrode* (first diagnostic pad 91), *the twelfth electrode is connected to the ninth electrode* (second diagnostic pad 92).

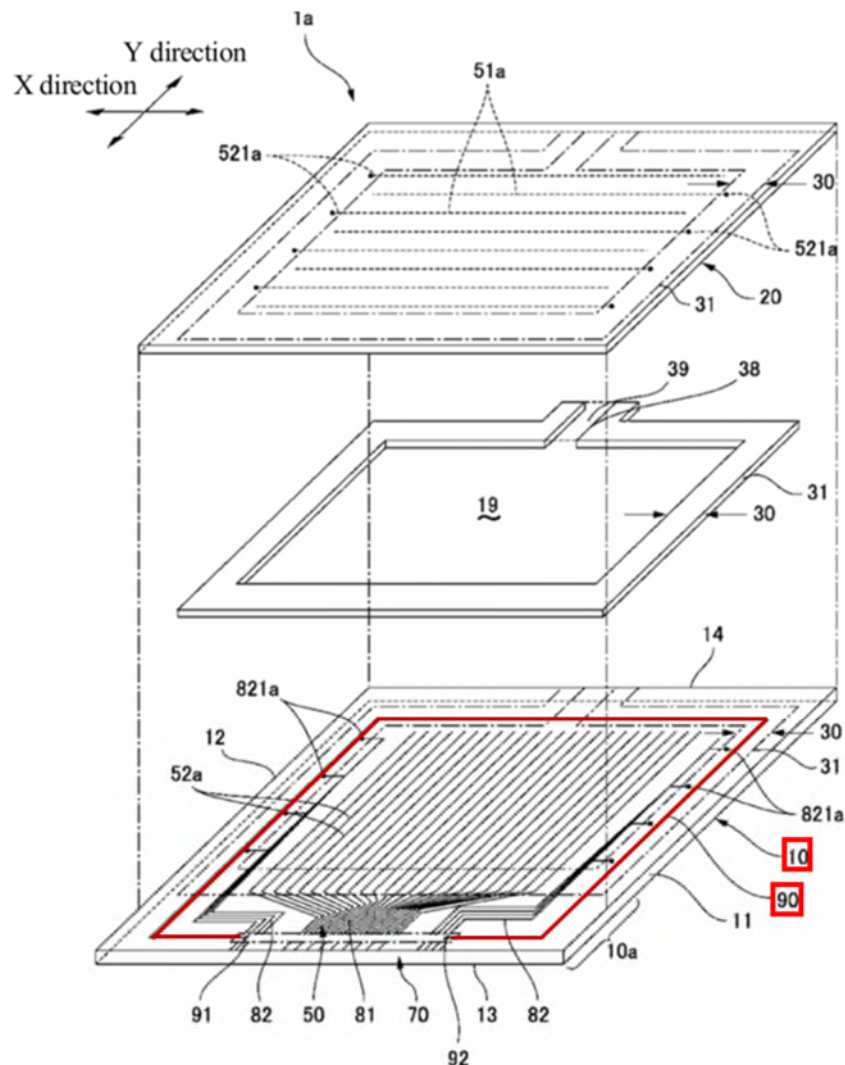


Miyagawa, Fig. 3. The diagnostic pads 91–92 are coupled to the flexible substrate’s corresponding electrodes/terminals, connecting the diagnostic wiring and the flexible substrate. §VIII.A.3.f. The other pad electrodes/terminals are connected to their corresponding electrodes/terminals on the flexible substrate to transfer control

and image signals from the electronic apparatus body to the scan/data lines. Flasck ¶119.

h) 8[g]

Miyagawa discloses a display panel *wherein the fifth interconnect* (diagnostic wiring 90) *is disposed along a peripheral edge of at least three sides of the first substrate* (TFT array substrate).



Miyagawa, Fig. 3. The diagnostic wiring surrounds the substrate's three sides. *Id.*,

[0024]; Flasck ¶120.

4. Claim 9

a) 9[pre]

See §VIII.A.3; Flasck ¶121.

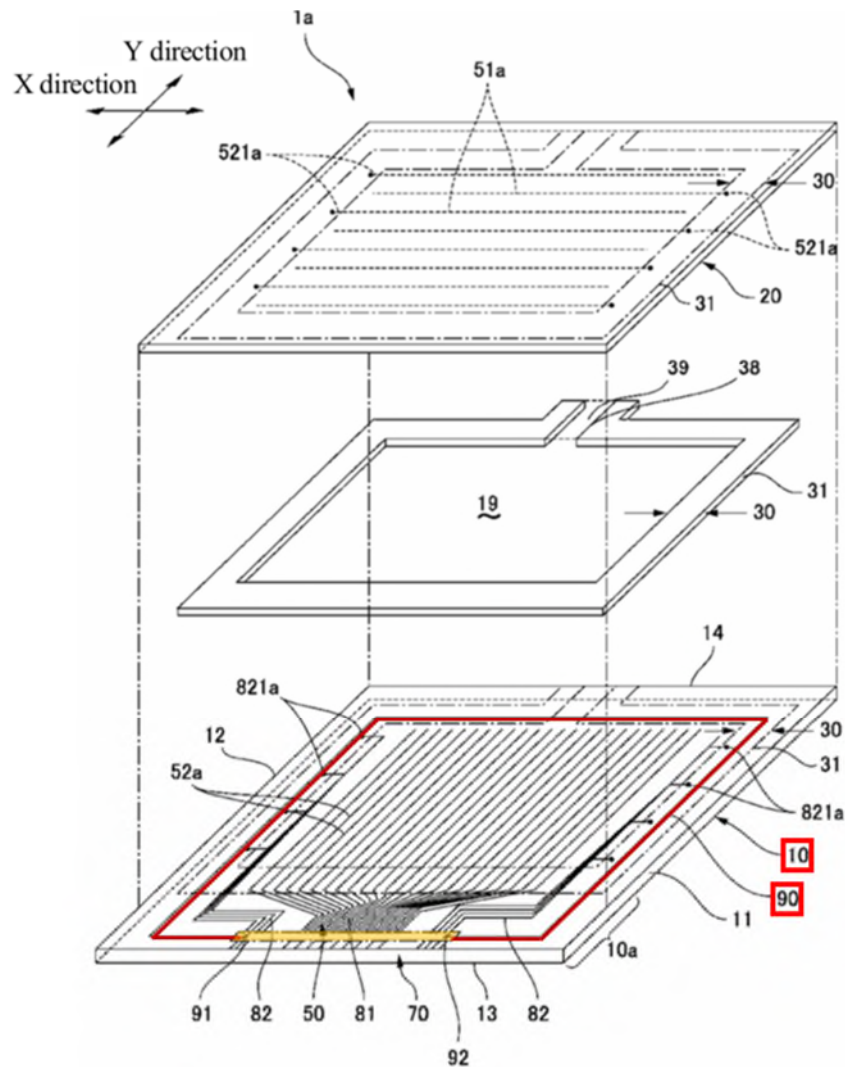
b) 9[a]

Miyagawa discloses *wherein the display panel further comprises a second semiconductor chip* (driving IC 5) *receiving the video signals, supplying display signals to the video signal lines* (data lines 106b), *and controlling the video signal lines and the scanning signal lines* (scan lines 131b).

Miyagawa's driving IC outputs image signals and scan signals respectively to the data and scan lines. Miyagawa [0020]. To output the image signals, the driving IC receives them first from an external system, *e.g.*, the electronic apparatus body. Flasck ¶¶122–123.

c) 9[b]

Miyagawa discloses or renders obvious a display device *wherein the second semiconductor chip* (driving IC 5) *is formed on the first substrate* (TFT array substrate) *and is surrounded by the fifth interconnect* (diagnostic wiring 90):



Miyagawa, Fig. 3 (IC region shaded in orange); §VIII.A.1.k (crack-diagnostic function in function IC); Flasck ¶¶124–125 (explaining that the diagnostic wiring surrounds the driving IC).

5. Claim 10

Kotera further renders obvious *wherein the opening of the light shielding material* (serigraph 71) *is smaller than the detection region* (display-surface

operating area B and input-section operating area D) *of the coordinate input substrate* (upper and lower film members 61–62). *See also* §VIII.A.1.

Kotera’s detection region includes display-surface operating area B and input-section operating area D. Kotera, [0046], [0056]. The serigraph’s opening is the display-surface operating area B. §VIII.A.1.l; Kotera, [0051]. This opening is smaller than the detection region, which includes area D in addition to area B. Flasck ¶¶126–127.

6. Claim 12

a) 12[pre]

Kotera discloses *a coordinate input device*. §VIII.A.1.a; Flasck ¶128.

b) 12[a]–[h]

Claim limitations 12[a]–[h] are respectively identical to claim limitations 1[a], 1[d]–[i], and 1[k]. Kotera in view of Miyagawa renders them obvious. §§VIII.A.1.b, .e–.i, .k; Flasck ¶129.

7. Claim 17

Kotera renders obvious claim 17’s additional limitation, which is identical to claim 10. §VIII.A.5; *see also* §VIII.A.6; Flasck ¶130.

8. Claim 18

Kotera in view of Miyagawa further renders obvious *wherein the first flexible [sic] substrate* (Kotera: wiring board) *supplies driving signals to the detection*

electrodes (Kotera: upper and lower transparent conductive films 63–64) *via the first interconnects* (of Kotera) *and receives detection signals corresponding to a contact position from the detection electrodes*. See also §VIII.A.7.

Kotera's conductive films are connected to signal wires analogous to Miyagawa's wiring electrodes, which are in turn connected to the flexible wiring board. §§VIII.A.1.b, .e. A microcomputer is disposed on Kotera's flexible wiring board and can drive a zoom lens based on touch operations. §VIII.A.1.e. Touch positions are detected where the upper and lower transparent conductive films are shorted. Kotera, [0007], [0042]. A POSITA would have understood or at least found it obvious that the microcomputer supplies the signals to drive the touch panel including the upper and lower film members since it responds to touch input. Further, the signals are conveyed through the associated interconnect, the sole path between the film members and the flexible wiring board. Flasck ¶¶131–133.

9. Claim 20

Kotera in view of Miyagawa further renders obvious *wherein a detection signal is supplied to the first flexible substrate* (Kotera: wiring board) *via one of the first interconnect* (of Kotera). See also §VIII.A.1.

Claim 20's additional limitation is a subset of claim 18, except that claim 20 additionally recites that the detection signal is supplied via one of the first

interconnect. Kotera in view of Miyagawa renders it obvious for the same reasons.

§VIII.A.8; Flasck ¶¶134–135.

10. Claim 21

Claim 21’s additional limitation is identical to claim 20 and is obvious.

§VIII.A.9; *see also* §VIII.A.6; Flasck ¶136.

11. Motivation to Combine

a) Diagnostic Wiring

A POSITA would have been motivated to add diagnostic wiring as Miyagawa teaches to Kotera’s device and would have had a reasonable expectation of success to do so.

It was well known that display-panel manufacturing involves cutting mother substrates into individual substrates, potentially creating substrate cracks. §IV. Miyagawa teaches that such cracks may break signal lines. Miyagawa, [0003]. Miyagawa discloses a crack-detection solution, making it “eas[y]” to identify cracks. *Id.*, [0004], [0030]. This improves manufacturing yield and reduces waste. *Id.*, [0004], [0031]. Moreover, detecting cracks after each manufacturing stage prevents wasting components that otherwise would be installed on defective substrates. *Id.*, [0004], [0028], [0030]. These benefits would have provided a POSITA ample motivation to incorporate a diagnostic wiring.

Crack-detection wiring is especially useful to Kotera, which uses “brittle”

transparent conductive films. Kotera, [0045]. Due to that brittleness, Kotera's method prevents the transparent conductive films from breaking when subjected to users' operating, pressing force. *Id.*, [0013]. Miyagawa's crack-detection wiring is used during manufacturing and complements Kotera's technique. Flasck ¶¶137–139.

This incorporation merely involves adding another thin-film wire on Kotera's film members. Doing so would have been within a POSITA's skill because it simply surrounds the film members and associated signal interconnect with a thin-film conductor similar to Miyagawa's diagnostic wiring. *See* Ex. 1015, Fig. 4; Ex. 1014, Fig. 9, [0043] (disclosing conventional traces having the same form and function); Flasck ¶140. Further, this addition would have been straightforward because the diagnostic wiring is isolated from other components, and thus its addition avoids the complexity from interconnected components.

A POSITA would have been motivated to apply Miyagawa's display-panel diagnostic wiring on Kotera's touch panel. Both panel types are cut from mother substrates and are susceptible to cracking. *See* Ex. 1014, [0043] (disclosing a conventional crack-detection trace for either panel type). Separate cutting processes are applied to Kotera's display and touch panels; both can benefit from crack detection. Flasck ¶141; *Dome Pat. L.P. v. Lee*, 799 F.3d 1372, 1380 (Fed. Cir. 2015)

(finding motivation to combine related components in references based on “the nature of the problem to be solved”).

A POSITA would have had a reasonable expectation of success because the incorporation is straightforward. Kotera’s and Miyagawa’s panels have similar configurations, *e.g.*, a touch/display area surrounded by wiring/electrodes to connect to a flexible substrate. Adding a diagnostic wiring to Kotera’s film members based on Miyagawa involves nothing more than applying a known technique for a similar improvement in the same way it does in Miyagawa, yielding predictable results. Indeed, the ’477 patent acknowledges LCD touch screens were “well-known.” Ex. 1001, 4:28–31; Flasck ¶142; *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 416 (2007) (“The combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results.”).

b) Liquid Crystal Display

Miyagawa provides the details of a display device integrated in Kotera, the liquid crystal panel 4. Kotera, [0024]. Kotera focuses on reinforcing its touch panel to prevent breakage from pressing force. *Id.*, Abstract. Thus, Kotera describes the conventional LCD panel’s relevant aspects while omitting other details. Just like the ’477 patent display device, Miyagawa’s is “identical with that of well-known liquid crystal display devices.” Ex. 1001, 4:28–31. Using Miyagawa to supply the

details of Kotera's conventional LCD merely involves deploying a known apparatus for its intended purpose to achieve predictable results. Flasck ¶143.

Indeed, Kotera's disclosures about its LCD panel's composition, *e.g.*, plates, backlight, etc., dovetail with Miyagawa's. Flasck ¶144 (explaining that references disclose consistent conventional LCD panel features (citing Kotera, [0029], [0032], [0034], [0068]; Miyagawa, [0017], [0020], [0043]–[0045])). Accordingly, a POSITA would have found it obvious that Miyagawa's descriptions apply to Kotera's LCD panel. *Id.*

Therefore, a POSITA would have had a reasonable expectation of success in applying Miyagawa's LCD disclosure to Kotera. Flasck ¶145.

B. GROUND 2: Kotera in View of Miyagawa and Lee Renders Claims 3–7 and 13–16 Obvious

1. Claim 3

a) 3[pre]

Kotera in view of Miyagawa and Lee further renders obvious a display device *further comprising a first semiconductor chip* (Kotera: microcomputer; Lee: chip 224). *See also* §VIII.A.1.

Kotera discloses electronic components such as a microcomputer mounted on the wiring board. Kotera, [0025]. “Wiring board” refers to a flexible substrate connected to its panel. *Id.*, [0032], [0037], [0041].

Lee similarly discloses a chip, *e.g.*, a drive IC, on a flexible carrier. Lee, [0025]. Both microcomputers and ICs were routinely fabricated using semiconductors. Flasck ¶¶146–148.

b) 3[a]

Kotera in view of Miyagawa and Lee renders obvious *wherein a third interconnect* (Lee: right electrostatic discharge protective line 228) *and the first semiconductor chip* (Kotera: microcomputer; Lee: chip 224) *are disposed on the first flexible substrate* (Kotera: wiring board; Lee: flexible carrier 222).

Kotera discloses a microcomputer on a flexible wiring board. §VIII.B.1.a.

Lee discloses chips 224 and electrostatic-discharge-protective lines 228 on a flexible carrier 222. Lee, [0025].



It was well known to connect both display and touch panels to external circuits through respective flexible carriers. §IV. Both Kotera's and Lee's flexible substrates connect to signal lines on the main substrate (Kotera's film members and Lee's LCD panel). §VIII.A.1.b; Lee, [0024]–[0025]. Both are coupled to an external system on the other end. §VIII.A.1.e; Lee, Fig. 2, [0024]. Based on their similarities, a POSITA would have found it obvious that Lee's flexible-carrier

c) $3[b]$

FIG. 2

FIG. 2

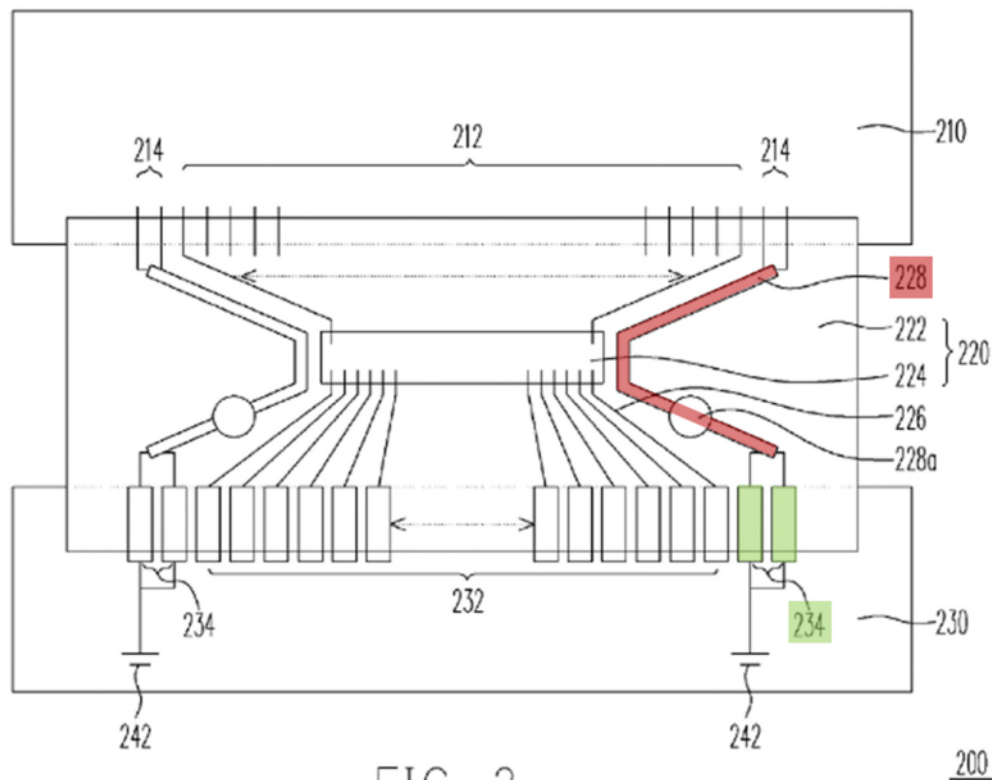
-81-

between the dummy pads (analogous to Miyagawa's diagnostic pads) and source terminals enable continuity testing to be performed through the source terminals.

Lee, [0026]; Miyagawa, [0028]; Flasck ¶¶153–154.

d) 3[c]

Lee discloses *wherein a fifth electrode* (dummy pads 234) *is formed at the other end of the third interconnect* (right electrostatic discharge protective line 228).



Lee, Fig. 2, [0025]; Flasck ¶155.

e) 3[d]

Lee discloses *wherein the first semiconductor chip* (chip 224) *doesn't overlap the third interconnect* (right electrostatic discharge protective line 228) *and the fifth electrode* (dummy pads 234) *in a plan view*.

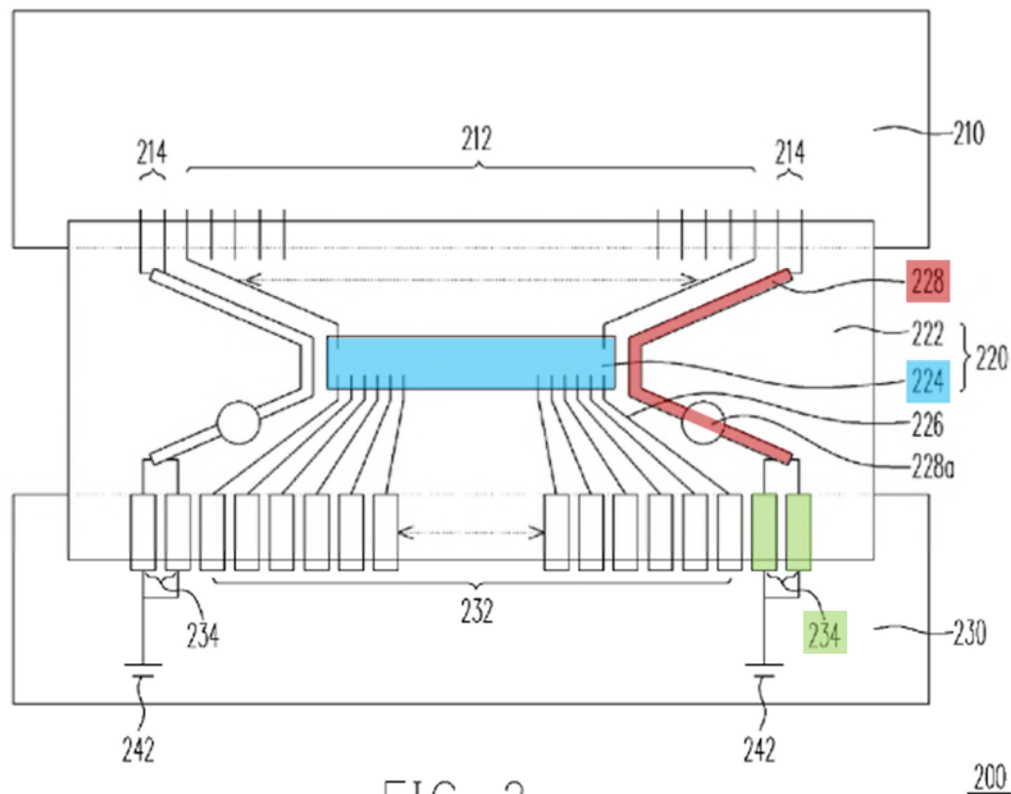


FIG. 2

Lee, Fig. 2, [0025].

With such a configuration, crack detection can be performed via Miyagawa's probe method. Miyagawa, [0028], [0039]. Advantageously for manufacturing flexibility, probes may be applied across the dummy pads 214 (Miyagawa's diagnostic pads), electricity conducting pads 228a, or dummy pads 234.

Additionally, the substrate-crack-diagnostic function may be placed in the driving IC on the panel.

A POSITA would have understood that electrostatic discharge may impact an electronic device at various locations, and that a shield line should be located around the circuitry to be protected. Lee, [0026] (disclosing that the electrostatic-discharge-protective lines 228 provides superior electrostatic-discharge-protective effect to flexible-carrier components). Thus, a POSITA would have known that the electrostatic-discharge-protective lines and associated pads should not overlap the chip they protect. Flasck ¶¶156–158.

2. Claim 4

Kotera further discloses a display device *wherein the first semiconductor chip* (microcomputer) *drives the coordinate input substrate* (upper and lower film members 61–62). *See also* §VIII.B.1.

Kotera’s microcomputer drives and receives detection signals from the touch panel including the upper and lower film members. §VIII.A.8; Flasck ¶¶159–160.

3. Claim 5

Lee further renders obvious *wherein the third interconnect* (right electrostatic discharge protective line 228) *extends from the third electrode* (coupled to Lee’s dummy pad 214/Miyagawa’s diagnostic pad) *to the fifth terminal* (dummy pads 234) *along an edge of the first flexible substrate* (flexible carrier 222) *and is disposed*

between the first semiconductor chip (chip 224) and the edge of the first flexible substrate. See also §VIII.B.1.

Lee's electrostatic-discharge-protective lines 228 extend from the pads coupled to the dummy pads 214 to pads 234 to electrically connect the substrate to an external circuit. Lee, [0025]. They are disposed between the chip 224 and the flexible carrier 222's edges. *Id.*

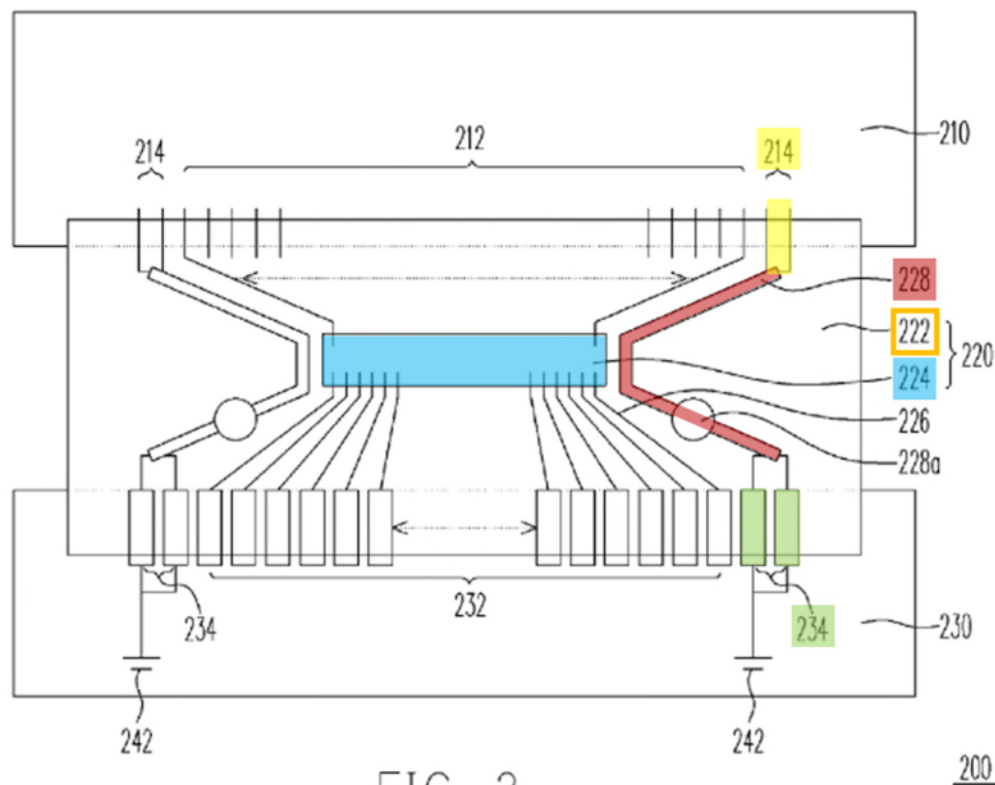


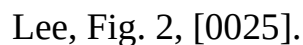
FIG. 2

Id., Fig. 2.

As confirmed via Lee's teaching regarding the electrostatic-discharge-protective lines' positions, a POSITA would have found it obvious that routing them

4. Claim 6

Lee further discloses *wherein a fourth interconnect* (left electrostatic discharge protective line 228) *is disposed on the first flexible substrate* (flexible carrier 222). See also §VIII.B.1; Flasck ¶164.



b) 6[a]

Lee discloses *wherein the fourth electrode* (coupled to dummy pad 214/Miyagawa's diagnostic pad) *is formed at one end of the fourth interconnect* (left electrostatic discharge protective lines 228).

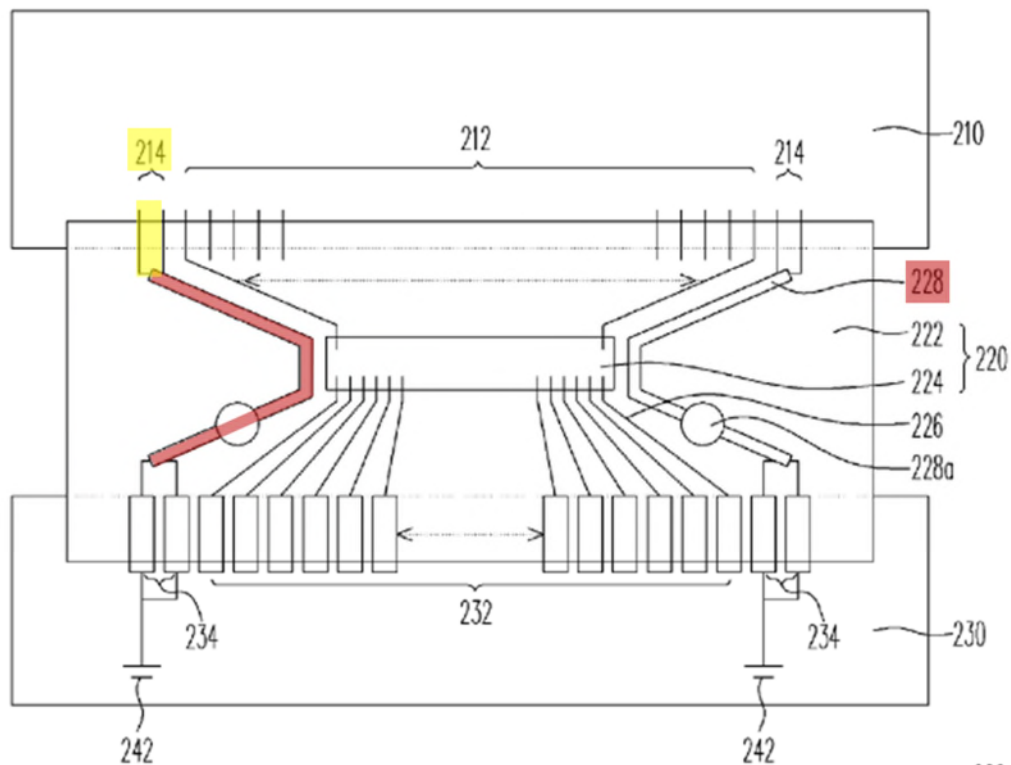
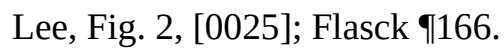


FIG. 2

Lee, Fig. 2, [0025]; Flasck ¶165.

c) 6[b]

Lee discloses *wherein a sixth electrode* (dummy pads 234) *is formed at the other end of the fourth interconnect* (left electrostatic discharge protective line 228).



Lee discloses *wherein the first semiconductor chip* (chip 224) *is disposed between the third interconnect* (right electrostatic discharge protective line 228) *and the fourth interconnect* (left electrostatic discharge protective line 228) *in plan view*.

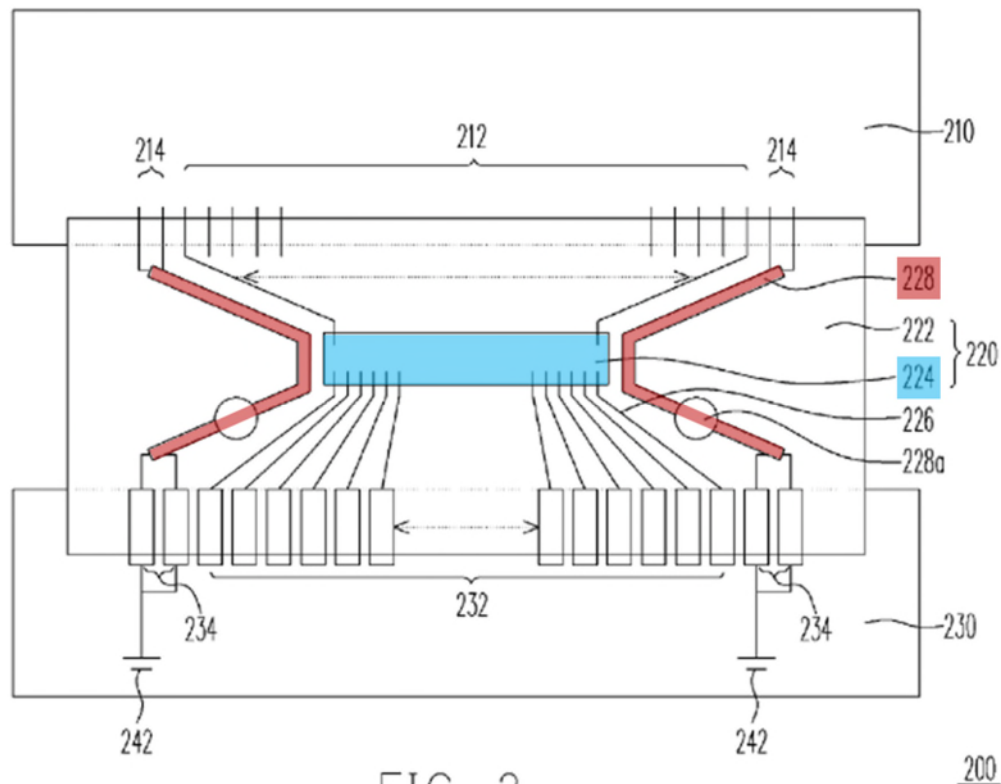


FIG. 2

Lee, Fig. 2, [0025]; Flasck ¶167.

e) 6[d]

Lee discloses *the first semiconductor chip* (chip 224) *doesn't overlap the fourth interconnect* (left electrostatic discharge protective line 228) *and the sixth terminal* (dummy pads 234) *in a plan view*.

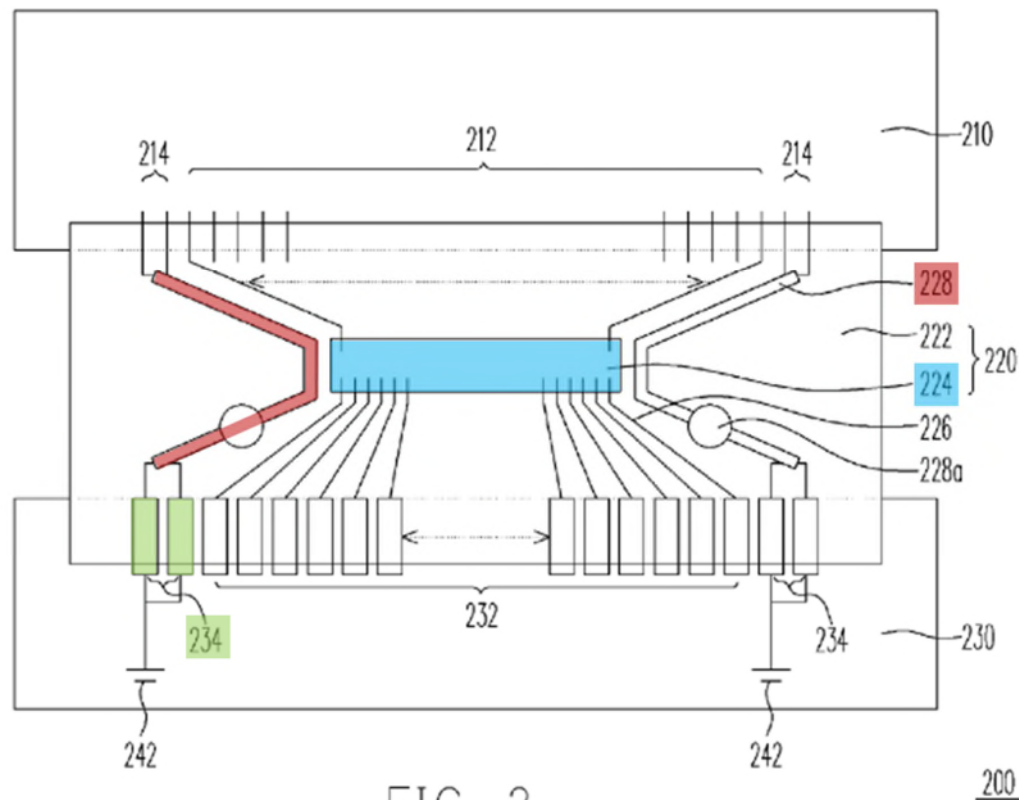


FIG. 2

Lee, Fig. 2, [0025]; §VIII.B.1.e; Flasck ¶168.

5. Claim 7

Claim 7's additional limitation is identical to claim 18. Kotera in view of Miyagawa renders it obvious. §VIII.A.8; *see also* §VIII.B.1; Flasck ¶169.

6. Claim 13

a) 13[pre]

Kotera in view of Miyagawa and Lee further renders obvious a display device *further comprising a first semiconductor chip*. §VIII.B.1.a; *see also* §VIII.A.6; Flasck ¶170.

b) 13[a]–[d]

Claim limitations 13[a]–[d] are respectively identical to claim limitations 3[a]–[d]. Kotera in view of Miyagawa and Lee renders them obvious. §§VIII.B.1.b–e; Flasck ¶171.

7. Claim 14

Claim 14’s additional limitation is identical to claim 4. Kotera in view of Miyagawa and Lee renders it obvious. §VIII.B.2; *see also* §VIII.B.6; Flasck ¶172.

8. Claim 15

Claim 15’s additional limitation is virtually identical to claim 5, except that claim 5/15 respectively recites “the fifth terminal”/“the fifth electrode.” The two terms refer to the same electrode/terminal. Kotera in view of Miyagawa and Lee renders claim 15 obvious. §VIII.B.3; *see also* §VIII.B.6; Flasck ¶173–174.

9. Claim 16

See §VIII.B.6.

a) 16[a]–[d]

Claim limitations 16[a]–[d] are respectively identical to the additional requirements in claim limitations 6[pre]–[c]. Kotera in view of Miyagawa and Lee renders them obvious. §§VIII.B.4.a–d; Flasck ¶¶175–176.

b) 16[e]

Claim limitation 16[e] is substantively identical to claim limitation 6[d], except that it recites “the sixth electrode” instead of “the sixth terminal.” Kotera in view of Miyagawa and Lee renders claim limitation 16[e] obvious. §§VIII.B.4.e, VIII.B.8; Flasck ¶177.

10. Motivation to Combine

A POSITA would have been motivated to apply Lee’s flexible-carrier teaching to Kotera’s display device. Miyagawa’s teaching would have further motivated this combination.

A POSITA would have understood, or at least found it obvious, that Kotera’s microcomputer is on a flexible wiring board. §VIII.B.1.a. Miyagawa’s embodiment in which an IC is mounted on a flexible substrate confirms that this configuration was common. Miyagawa, [0020], [0040]. Thus, Lee merely adds the electrostatic-discharge-protective lines, associated pads, and component placement on the flexible substrate.

A POSITA would have known that crack-detection wiring can also function as a shield to reduce the noise-and-electrostatic-discharge effects to the touch panel. Ex. 1011, [0041], [0053]; Lee, Abstract. It was well known that electrostatic discharge is a common and serious threat to electronic devices. *See, e.g.*, Ex. 1016,

[0025], Fig. 6. Thus, it would have been desirable to use Miyagawa's diagnostic wiring also as a shield wiring.

Additionally, a POSITA would have been motivated to connect the diagnostic/shield wiring on the touch panel via a flexible substrate to an external ground. Such a connection provides improved electrostatic-discharge resistance because of the coupling to a ground more substantial than an internal ground. Ex. 1016, [0044], [0047]. A POSITA would have understood this as Lee's rationale for connecting electrostatic-discharge-protective lines to ground terminals. See Lee, [0026].

The electrostatic-discharge-protective lines provide an electrostatic-discharging path. *Id.*, [0017]. This improves manufacturing yield and device performance by reducing damages to components. *Id.*, [0017], [0031]. These improvements would have further motivated a POSITA to provide electrostatic-discharge-protective lines on Kotera's flexible wiring board.

Moreover, a POSITA would have recognized that Lee's electrostatic-discharge-protective lines complement Miyagawa's diagnostic wiring's dual function as a shield. Both perform the same function, reducing electrostatic discharge's impact. *Id.* Lee's electrostatic-discharge-protective lines would have been an obvious extension of Miyagawa's diagnostic/shield wiring to provide an

electrostatic-discharge path to ground. Conversely, Lee's dummy pads 234 and electricity conducting pads 228a provide additional probe points for crack detection. §VIII.B.1.e. This would have further motivated a POSITA to apply Lee in the combination.

Further, Miyagawa's diagnostic pads increase the bonding strength between the device and flexible substrates. Lee, [0024]. This results in enhanced reliability that would have motivated a POSITA to apply Miyagawa's teaching. Flasck ¶¶178–185.

A POSITA would have had a reasonable expectation of success of implementing Lee's electrostatic-discharge-protective lines. Like Miyagawa's diagnostic/shield wiring, these lines are isolated from other wiring and components. Lee, Fig. 2. Thus, forming these lines does not affect other circuits, requiring a simple design—nothing else must be changed. Lee confirms as much. *Id.*, [0027]; Flasck ¶186.

C. GROUND 3: Kotera in View of Miyagawa and Kida Renders Claims 11 and 19 Obvious

1. Claim 11

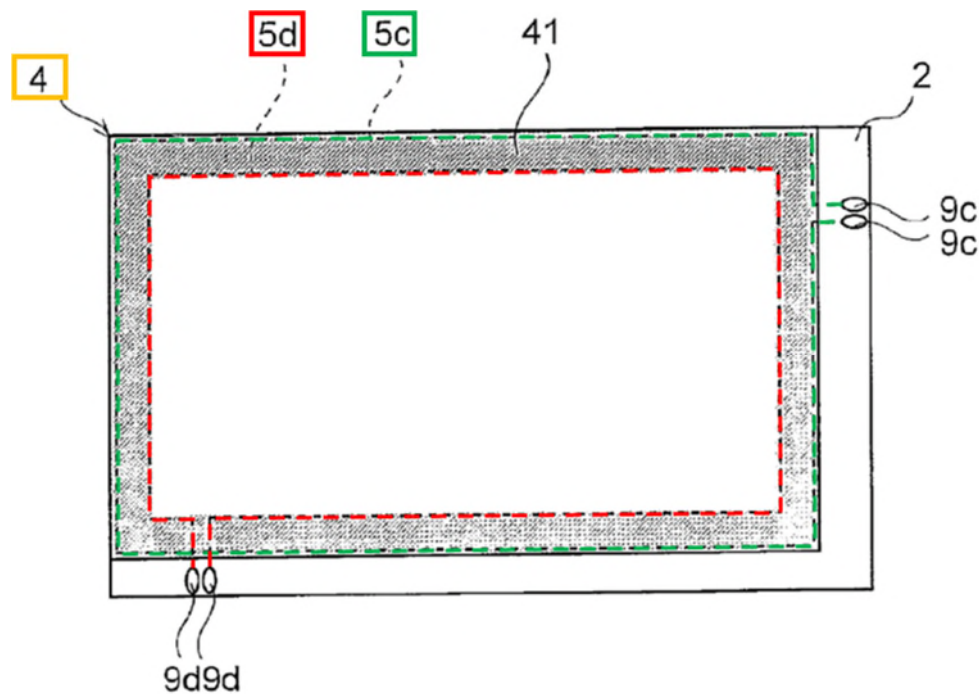
a) 11[pre]

Kotera in view of Miyagawa and Kida renders obvious a display device further comprising the limitations below. *See also* §VIII.A.1; Flasck ¶187.

b) 11[a]

Kotera in view of Miyagawa and Kida renders obvious *a sixth interconnect* (Kida: fourth inspecting conductor 5d) *surrounds the detection region* (Kotera: display-surface operating area B and input-section operating area D) *and is formed outside the first interconnects* (of Kotera).

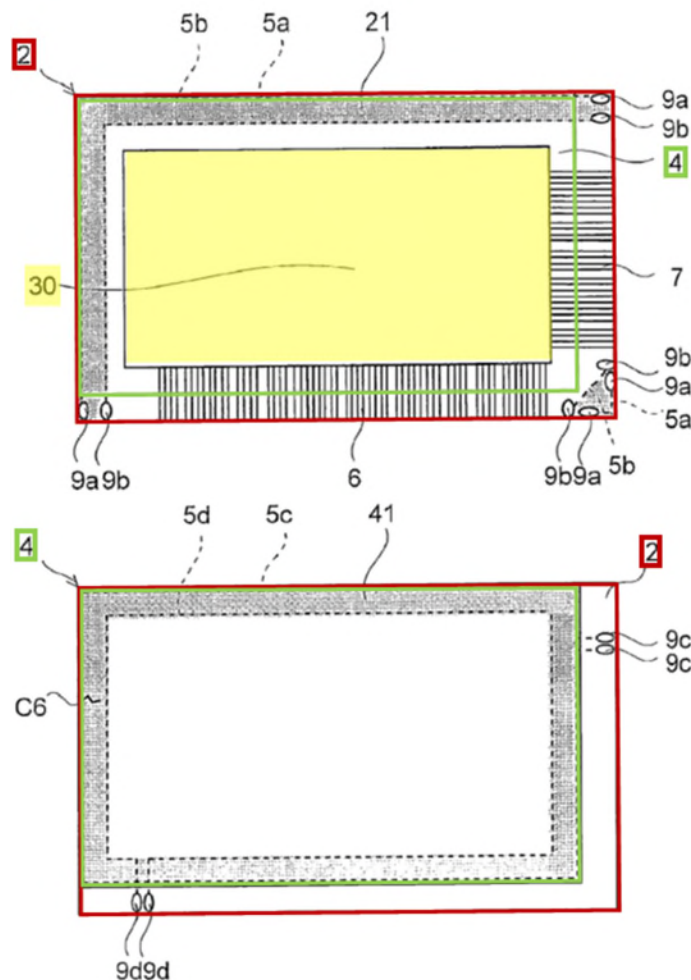
Kida discloses a third inspecting conductor 5c formed along the counter substrate 4's edges. Kida, [0114]. A fourth inspecting conductor 5d is formed inside the third inspecting conductor 5c. *Id.*



Id., Fig. 11(b). Through applying a voltage to the pads 9c or 9d, the inspecting conductors 5c–5d can detect cracks in the substrate. *Id.*, [0114], [0116]. If a large crack breaks both conductors, the substrate is deemed defective. *Id.*, [0117]. If both

conductors remain conductive, the substrate has no cracks. *Id.* If only the exterior third conductor is cut by a small crack, the substrate is visually inspected for defects. *Id.*, [0118].

Kida discloses an active display area 30. *Id.*, [0070], [0106].



Id., Figs. 11(a)–(b). A POSITA would have recognized that this active area is analogous to a touch panel’s detection area, and that the fourth inspecting conductor 5d is formed to surround the active area. Further, based on the fourth inspecting

conductor's function to detect defect-causing cracks, a POSITA would have found it obvious that, in the combination, the fourth inspecting conductor is formed outside the first interconnects that connects the detection electrodes with the flexible substrate. Otherwise, the first interconnect may be broken without the fourth inspecting conductor also becoming broken, rendering it ineffective in detecting cracks. Miyagawa, [0007]–[0009], [0031].

Kida also discloses that the inspecting conductors may be configured based on the arrangement of other substrate components. Kida, [0082]. Thus, a POSITA would have found it obvious to configure the fourth inspecting conductor according to Kotera's touch-panel-component arrangement. Flasck ¶¶188–191.

c) 11[b]

Kotera in view of Miyagawa and Kida renders obvious *wherein the sixth interconnect* (Kida: fourth inspecting conductor 5d) *is electrically connected with the first flexible substrate* (Kotera: wiring board).

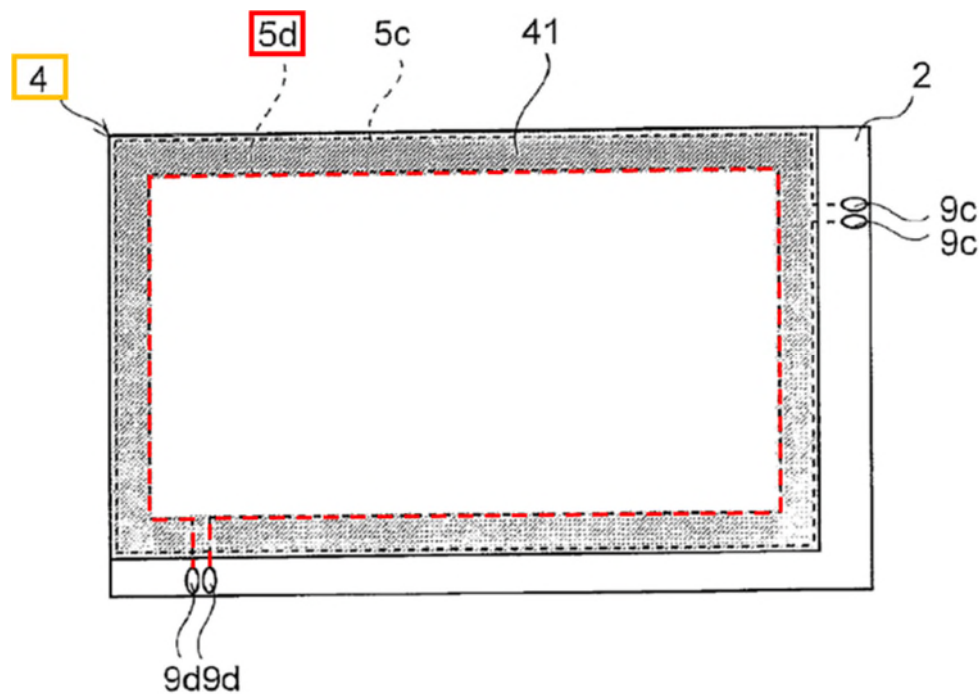
Both Kida's fourth inspecting conductor and Miyagawa's diagnostic wiring perform the same crack-detection function. Thus, it would have been obvious that they can be configured similarly. Miyagawa's diagnostic wiring is electrically connected to the first flexible substrate, where an IC is located. §VIII.A.1.k. It would have been obvious to similarly configure Kida's fourth inspecting conductor. This is consistent with Kida, which discloses "electrode terminals ... exposed to the

outside and electrically connected to driving ICs.” Kida, [0106]. It would have been obvious to form such connections using a flexible substrate, including mounting an IC thereon. *See* Miyagawa, [0040]. A POSITA would also have found it obvious that such electrical connections can be formed for the inspecting conductors because the pads at their ends are simply electrodes/terminals. Flasck ¶¶192–193.

d) 11[c]

Kotera in view of Miyagawa and Kida renders obvious *wherein the sixth interconnect* (Kida: fourth inspecting conductor 5d) *is disposed along a peripheral edge of at least three sides of the coordinate input substrate* (Kotera: upper and lower film members 61–62).

The fourth inspecting conductor 5d is disposed along at least three edges of the substrate 4:



Kida, Fig. 11(b); Flasck ¶¶194–195.

2. Claim 19

Claim 19's additional limitation is substantively identical to claim 11. Kotera in view of Miyagawa and Kida renders it obvious. §VIII.C.1; *see also* §VIII.A.6; Flasck ¶196.

3. Motivation to Combine

A POSITA would have been motivated to add a fourth inspecting conductor as Kida teaches and would have had a reasonable expectation of success to do so.

A POSITA would have known that panel cracks routinely occur in manufacturing. §VIII.A.11.a; Kida, [0074]. A POSITA would have been motivated to detect such cracks to reduce manufacturing waste. §VIII.A.11.a; Kida, Abstract.

Kida's dual-wiring solution differentiates large cracks from smaller ones that do not render panels defective. Kida, Figs. 12(a)–15(b), [0124]–[0138]. This allows selective and effective visual inspections. *Id.*, [0007], [0117]–[0119]. Kida's solution "improve[s] the efficiency of the inspecting process" and more reliably detects defective panels. *Id.*, [0028]. These advantages would have motivated a POSITA to adopt Kida by adding a second crack-detection wire near the substrate's edges. Flasck ¶¶197–198.

This addition merely involves adding another thin-film wire on Kotera's film members. See Kida, [0122] (ITO inspecting conductors). Doing so would have been within a POSITA's skill because it merely involves surrounding Kotera's film members with a thin-film conductor in a form similar to Miyagawa's diagnostic wiring and Kida's fourth inspecting conductor. §VIII.A.11.a (citing Exs. 1014–1015). Further, this addition would have been straightforward because the inspecting conductor is isolated from other components, and thus its addition does not involve the complexity resulting from interconnected components. Flasck ¶199.

A POSITA would have been motivated to apply Kida's inspecting conductor for a display panel on Kotera's touch panel. §VIII.A.11.a; Flasck ¶200.

For the same reason that this combination involves a straightforward addition, a POSITA would have had a reasonable expectation of success. Further, Kida

teaches that the inspecting-conductor arrangement may be adjusted based on the substrate configuration. Kida, [0082]. This flexibility would have bolstered the expectation of success. Kida further discloses embodiments with fewer inspecting conductors on either substrate to be within its scope. Kida, [0159]. A single-inspecting-conductor embodiment is analogous to the combination of Kotera with Miyagawa. Adding an inner fourth inspecting conductor as Kida teaches would have been an obvious design choice and within a POSITA's skill. Flasck ¶201.

D. GROUND 4: Sung in View of Nishihara Renders Claims 1–2, 10, 12, 17–18, and 20–21 Obvious

1. Claim 1

a) 1[pre]

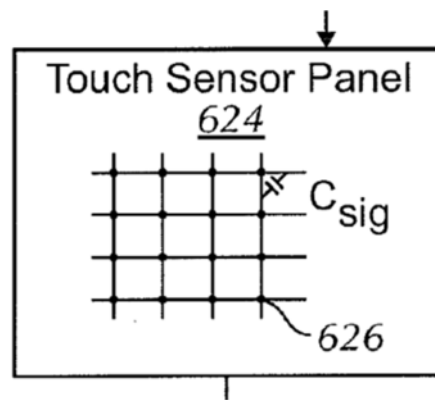
Sung discloses *a display device*, e.g., one incorporating a touch screen. Sung, Abstract, Figs. 5A–5D; Flasck ¶202.

b) 1[a]

Sung in view of Nishihara renders obvious *a coordinate input substrate* (Sung: touch substrate 404, Nishihara: substrate 2) *having detection electrodes* (Sung: drive and sense lines, Nishihara: detection electrodes 5a–5b) *disposed in a detection region* (Sung: ITO layer 306's area; Nishihara: detection region 4), *and first interconnects* (Nishihara: wiring electrodes 7) *outside the detection region*.

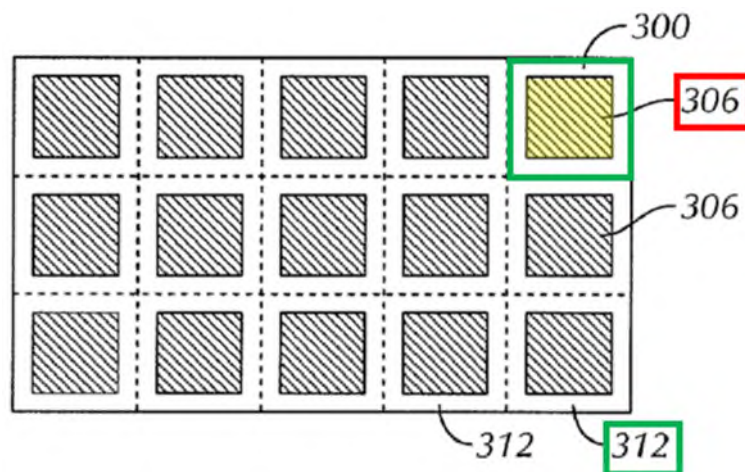
A cross-sectional view of a display device 400. The device consists of a central stack of layers: a Cover Glass (402) at the top, followed by a Thin Film (416), a Liquid Adhesive (410), a Touch Substrate (404), another Thin Film (412), and a bottom layer (418) which can be AR or Shield or LCM. This central stack is flanked by FPC (Flexible Printed Circuit) regions (414) on both sides. The FPC regions are connected to the central stack via bonding structures (406 and 408). The entire assembly is labeled 400.

Drive and sense lines are formed in these thin-film layers to provide the touch-sensing functionality. *Id.*, [0040]. These lines are separated by the touch substrate and a liquid adhesive layer 406. *Id.* Alternatively, they may be formed on the same side of the substrate. *Id.*, [0024]. In a plan view, these lines form a grid pattern. *Id.*, [0008], [0021]. Their intersections function as a matrix of capacitive sensing nodes or pixels 626. *Id.*, [0026], [0051].



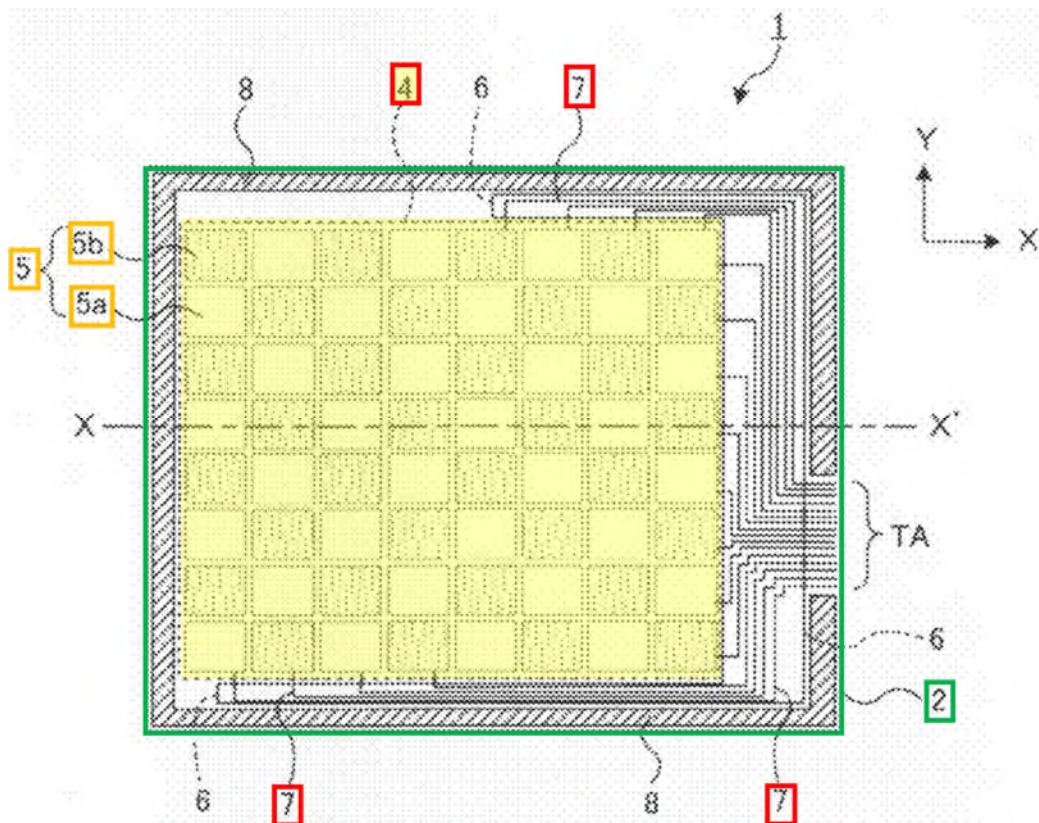
Id., Fig. 6 (partial).

Because touch-sensing nodes correspond to the intersections of drive and sense lines, a detection region is coextensive with the matrix formed where these lines intersect. Sung, [0051]. Sung’s display device comprises an ITO layer 306 that is “patterned to create capacitive touch sensor pixels on the individual touch substrate units [312].” *Id.*, [0026].



Id., Fig. 3B. The ITO-layer area corresponds to a detection region.

Nishihara, [0045].



Id., Fig. 1A.⁴

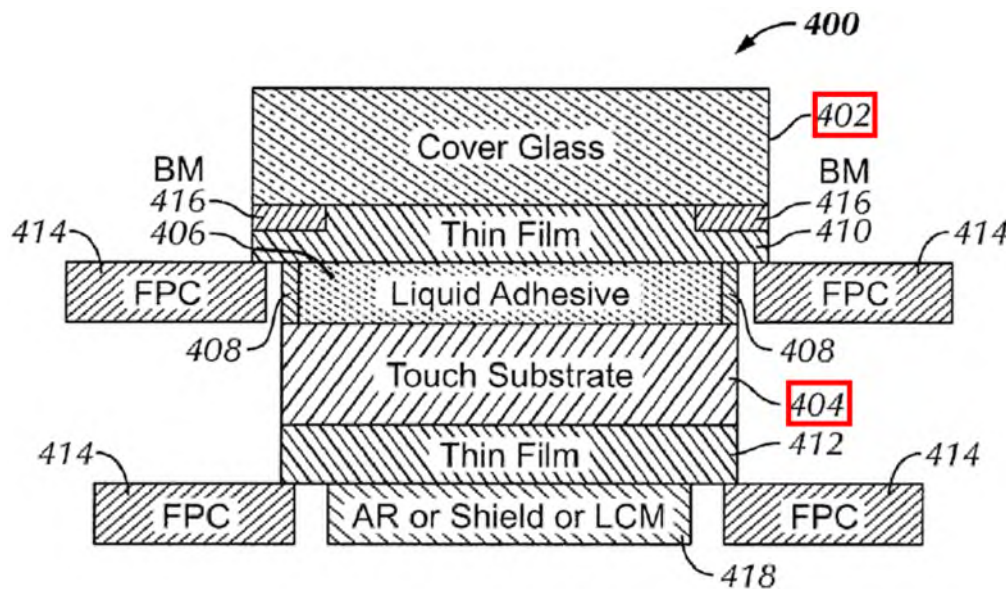
connect detection electrodes to touch-control functions. See Nishihara, [0043],

⁴ “Base substrate” herein refers to either Sung’s touch substrate 404 or Nishihara’s substrate 2, which for purpose of this Petition are analogous. Flasck ¶208 n.4.

Sung, [0041]. For example, Sung's panel subsystem applies signals to the drive lines and reads signals from the sense lines. Sung, [0050]–[0051], Fig. 6. As was routine, a set of wires like Nishihara's wiring electrode 7 connect Sung's drive and sense lines to the panel subsystem. Flasck ¶¶203–209.

c) 1[b]

Sung discloses *a protective plate* (cover glass 402) *on the coordinate input substrate* (touch substrate 404).

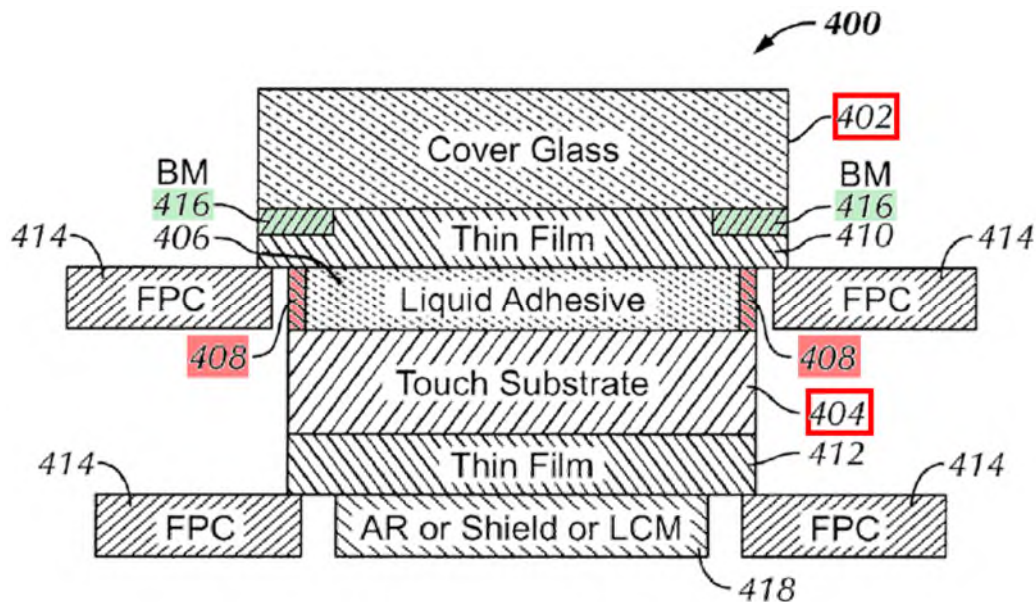


Sung, Fig. 4, [0039]. The cover glass may be coated with a protective, anti-scratch layer. *Id.*, [0033], [0003]; Flasck ¶210.

d) 1[c]

Sung discloses *a light shielding material* (black mask 416 or edge seals 408) *which has an opening and is disposed between the coordinate input substrate* (touch

substrate 404) *and the protective plate* (cover glass 402).



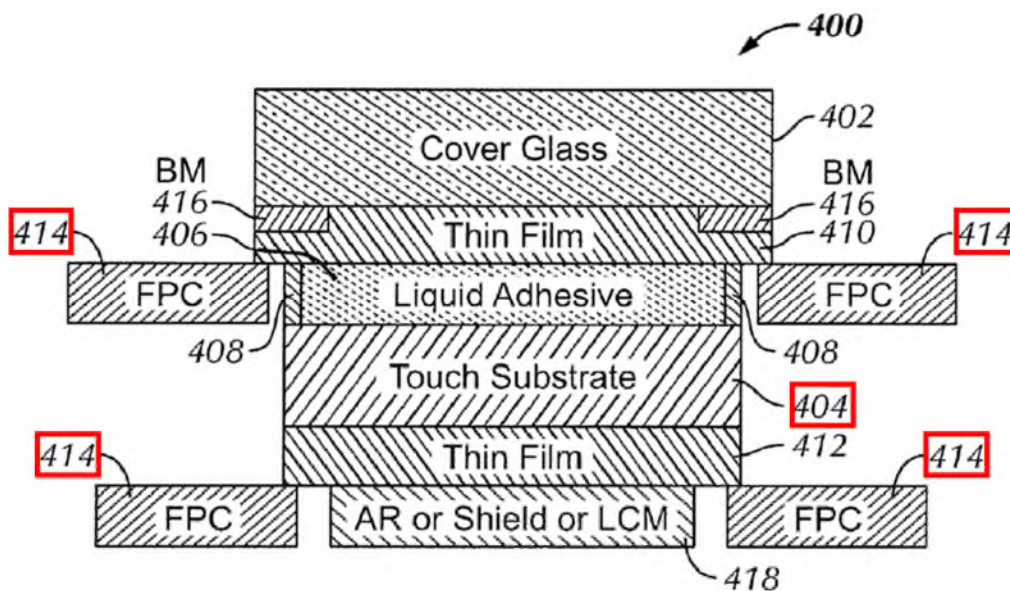
Sung, Fig. 4.

Sung discloses two light-shielding materials: black mask 416 and edge seals 408. The black mask is an opaque cosmetic plate. *Id.*, [0041]. The edge seals are opaque adhesive borders. *Id.*, [0041], [0039], [0028]. As shown above, both materials are disposed between the touch substrate and the cover glass. The horizontal gap between the respective “pairs” of these materials in the cross-sectional view above corresponds to an opening in a plan view to allow liquid crystal monitor (“LCM”) display 418 to be visible from above the cover glass. *Id.*, [0041]–[0042]; *id.*, Fig. 2C, [0027] (showing adhesive borders 204 (*i.e.*, edge seals 408) “conformed to the outline of the individual touch substrate units on the mother sheet 200”); Flasck ¶¶211–212.

e) 1[d]

Sung discloses *a first flexible substrate* (FPC 414) *electrically connected to the coordinate input substrate* (touch substrate 404).

Sung discloses a flexible printed circuits (“FPC”) 414 electrically connected to the touch substrate’s thin-film conductors, *e.g.*, drive and sense lines. *Id.*, [0041].

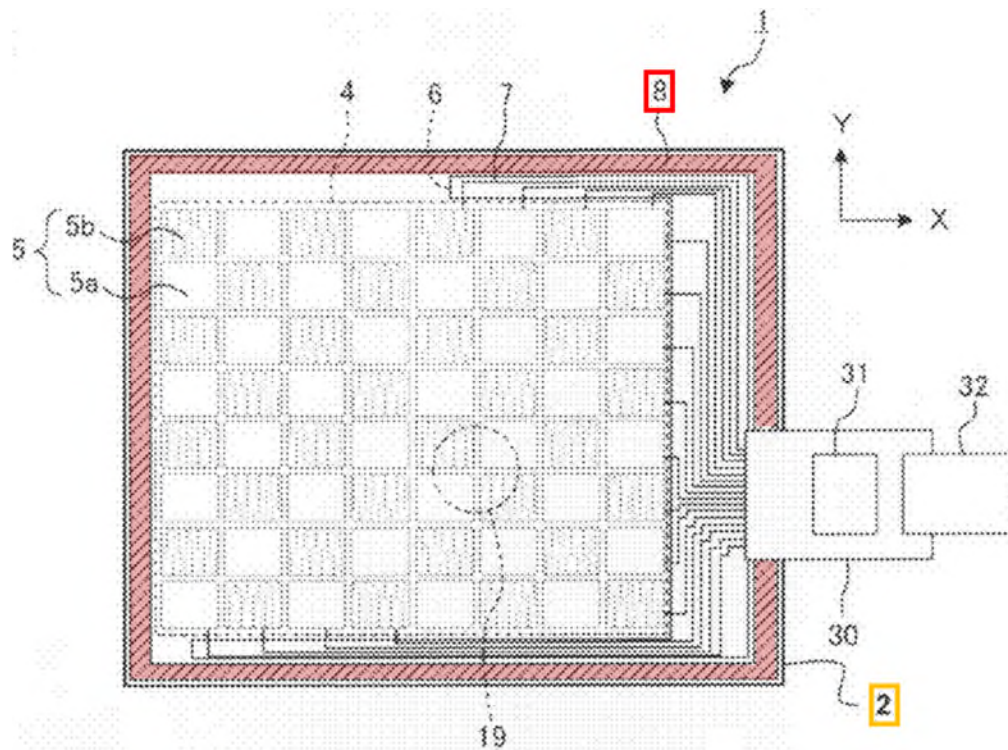


Sung, Fig. 4. The FPCs 414 are “bonded to the edge ... of the [substrate’s] thin film layers 410, 412” and are “electrically connected to the drive and sense lines....” *Id.*, [0041]; Flasck ¶¶213–214.

f) 1[e]

Sung in view of Nishihara renders obvious *wherein the coordinate input substrate* (Sung: touch substrate 404, Nishihara: substrate 2) *has a second interconnect* (Nishihara: first shield electrode 8), *a first electrode, and a second*

electrode.



Nishihara, Fig. 2A. Formed at the substrate's edges, the shield electrode "shield[s] against noise from outside." *Id.*, [0043]. It is connected to the flexible substrate 30's ground terminals and to an external electrical ground. *Id.*, [0049], [0044]. This ground connection involves a first and a second electrode at the shield electrode's two ends. *Flasck ¶215.*

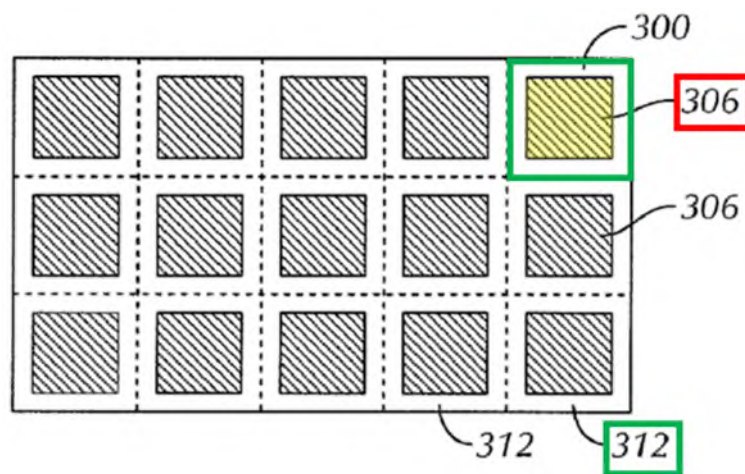
In the combination, Nishihara's shield electrode is formed on Sung's touch substrate's outer peripheries and connected to ground via an FPC. *Id.* ¶216.

Nishihara's shield electrode satisfies the second-interconnect limitation, which does not require crack inspection. Regardless, POSITA would have

g) 1[f]

-109-

It was routine to form wires on touch substrates' peripheries to connect sense and drive lines with touch controllers. §VIII.D.1.b. Placing Nishihara's shield electrode on Sung's touch panel merely involves forming an additional wire next to and surrounding the touch-signal wires. Nishihara, [0049]. Such a placement is compatible with Sung's touch substrate, which has a detection region, ITO layer 306's area, surrounded on all four sides by wiring regions:



Sung, Fig. 3B; Flasck ¶¶218–219.

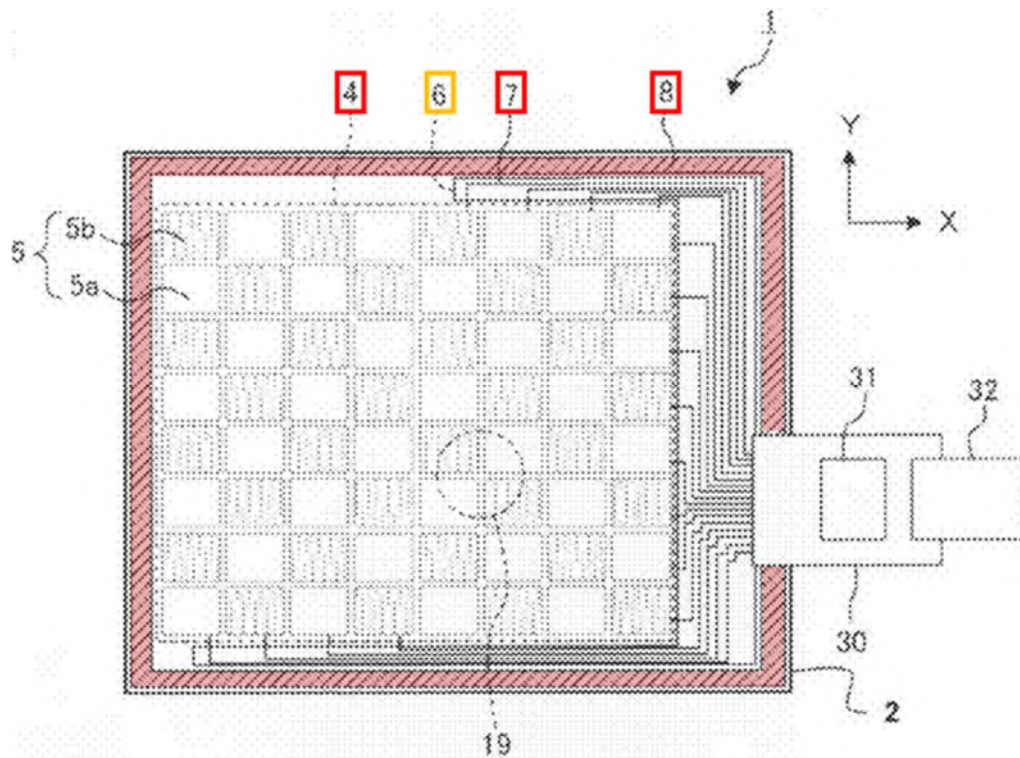
h) 1[g]–1[h]

Nishihara discloses or renders obvious *wherein the first electrode is formed at one end of the second interconnect* (first shield electrode 8). Nishihara further discloses or renders obvious *wherein the second electrode is formed at the other end of the second interconnect*. §VIII.D.1.f; Flasck ¶220.

i) 1[i]

Sung in view of Nishihara renders obvious *wherein the second interconnect*

(Nishihara: first shield electrode 8) *is disposed along a peripheral edge of at least three sides of the coordinate input substrate* (Sung: touch substrate 404, Nishihara: substrate 2).



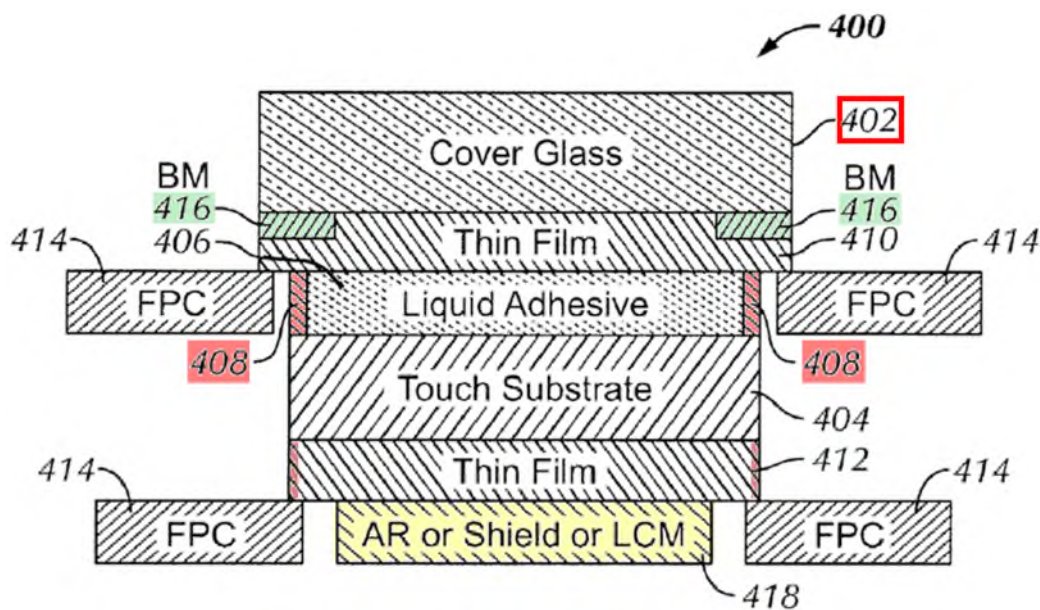
Nishihara, Fig. 2A.

The first shield electrode is formed “on an outer periphery of the [base] substrate....” *Id.*, [0043]. It surrounds the detection region and the wiring region, except where the base substrate connects to the flexible substrate. *Id.*, [0049], Fig. 2A. In the combination, the first shield electrode is similarly configured on Sung’s touch substrate. §VIII.D.1.f–g; Flasck ¶¶221–222.

j) 1[j]

Sung in view of Nishihara renders obvious *wherein a display region* (Sung: LCM 418's top surface area) *is surrounded by the second interconnect* (Nishihara: first shield electrode 8).

Sung's display, liquid crystal monitor ("LCM") 418, is viewable from above the cover glass 402. Sung, [0038], [0042]. The LCM area in a plan view, *i.e.*, the LCM's top surface, is a display region.



Id., Fig. 4.

The second interconnect, configured similarly to Nishihara's first shield electrode, is formed on the base substrate's outer periphery, identified by two dark red rectangles in the thin-film layer 412 in the cross-sectional view above. §§VIII.D.1.f–g, i. Sense lines are formed in the thin-film layer 412. Sung, [0040].

The shield line shields against noise to prevent noise from reaching the sense lines or reduces the noise power reaching the sense lines. Nishihara, [0043].

It would have been obvious that the LCM's viewable area is surrounded by the shield electrode in a plan view. See Sung, [0042] (disclosing a see-through area surrounded by the black mask); Nishihara, [0045]; Flasck ¶¶223–226.

k) 1[k]

Sung in view of Nishihara renders obvious *wherein the first electrode is electrically connected with a third electrode on the first flexible substrate* (Sung: FPC 414), *or the second electrode is electrically connected with a fourth electrode on the first flexible substrate*. See Nishihara, [0049], [0044]; §VIII.D.1.f. These electrical connections establish a ground loop from an external ground through the first shield electrode. Flasck ¶227.

l) 1[l]

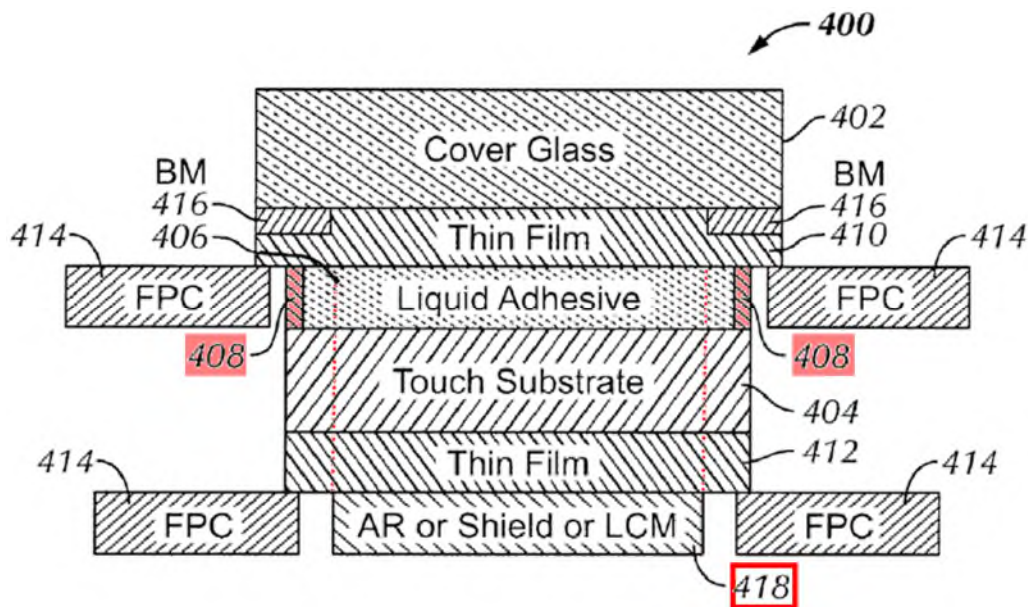
Sung discloses *wherein the opening of the light shielding material* (black mask 416 or edge seals 408) *is larger than the display region* (Sung: LCM 418's top surface area) *and surrounds the display region*.

The display region is the LCM's top-surface area in a plan view. §VIII.D.1.j. Sung teaches that the entire LCM is viewable from above the cover glass. Sung, [0042] (“This can allow *the* LCM display 418 underneath the touch sensor panel 400 to be visible from above the top cover 402.”). This configuration is desirable

because it does not block the edges of displayed images from users' view.

Allowing the entire LCM to be viewable is done through limiting the black mask's reach. *Id.* (“the middle part of the touch sensor panel 400 where the black mask 416 does not reach may be substantially see-through....”). Thus, the black mask's opening is larger than the LCM's viewable area. Flasck ¶¶228–230.

Alternatively, Figure 4 conveys that the edge seals' opening is also larger than the LCM's top-surface area:



Sung, Fig. 4.

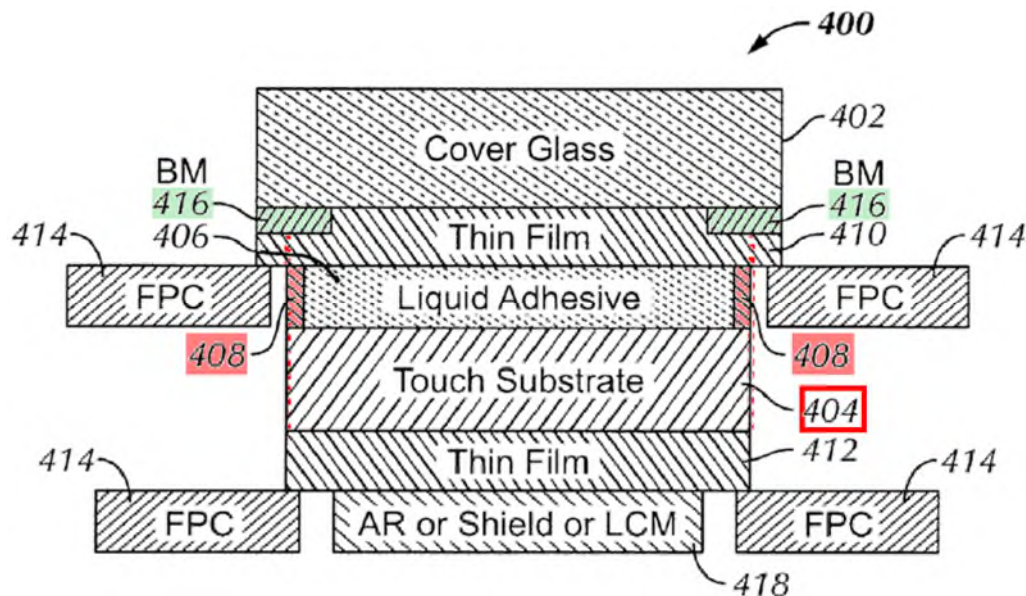
Both the edge seals and the black mask surround the display region in a plan view. For its function as adhesive borders to seal the liquid adhesive, the edge seals enclose the adhesive on all sides. Sung, [0039], [0027], Fig. 2C. The black mask is formed “around the outer edge of the thin film layer 410.” *Id.*, [0041]. It has a see-

through opening in the middle. *Id.*, [0042]. Further, to hide the edge seals beneath from a user's view, the black mask must completely cover the edge seals and thus also surround the display region. *Id.*, [0041]; Flasck ¶¶231–232.

m) 1[m]

Sung in view of Nishihara renders obvious *wherein the light shielding material* (Sung: black mask 416 or edge seals 408) *overlaps the second interconnect* (Nishihara: first shield electrode 8) *along the peripheral edge of at least the three sides of the coordinate input substrate* (Sung: touch substrate 404) *in a plan view*.

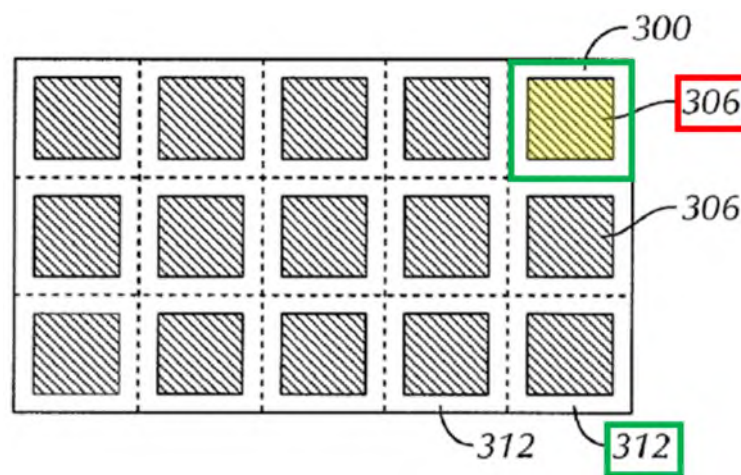
The black mask and the edge seals surround the display region on all four sides. §VIII.D.1.i. They are formed above the touch substrate's peripheries:



Sung, Fig. 4. The first shield electrode is disposed along the touch substrate's peripheries. §VIII.D.1.i. Thus, it would at least have been obvious that the black

mask and the edge seals overlap the first shield electrode over its entire length, *i.e.*, along at least three edges of the touch substrate.

In a plan view, both the light-shielding material (black mask or edge seals) and the second interconnect (shield electrode) are placed outside the detection region (shaded yellow) on the base substrate (borders in green):

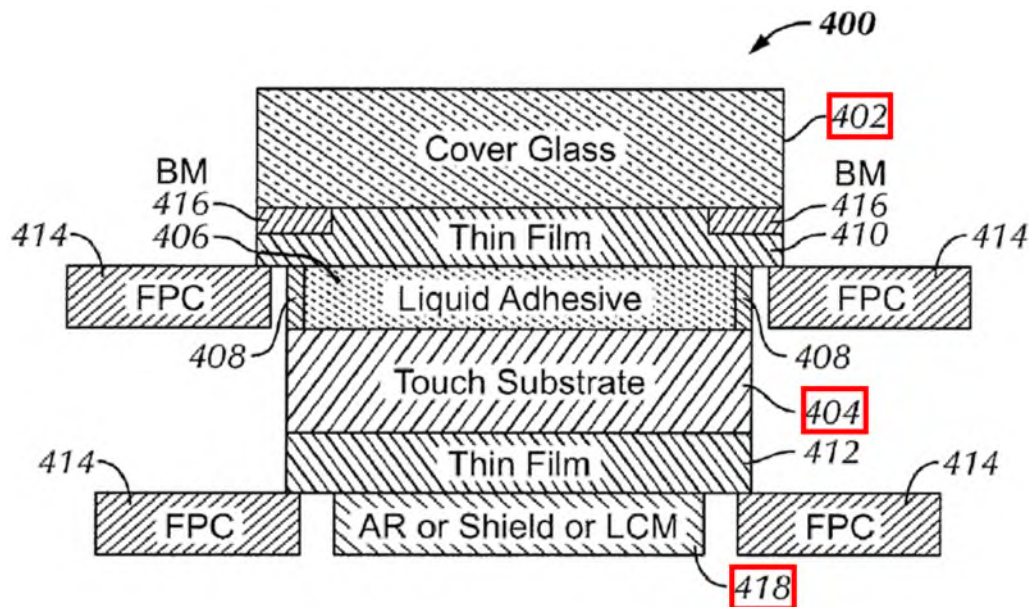


Sung, Fig. 3B. Thus, it would have been obvious that they overlap. Flasck ¶¶233–235 (additionally explaining that the overlap desirably covers the shield electrode from view).

2. Claim 2

Sung discloses a display device *further comprising a display panel* (LCM 418) *having the display region* (LCM's top surface area), *wherein the coordinate input substrate* (touch substrate 404) *is disposed between the display panel and the protective plate* (cover glass 402). See also §VIII.D.1.

The display region is the LCM's top-surface area. §VIII.D.1.j. The touch substrate 404 is disposed between the LCM 418 and the cover glass 402:



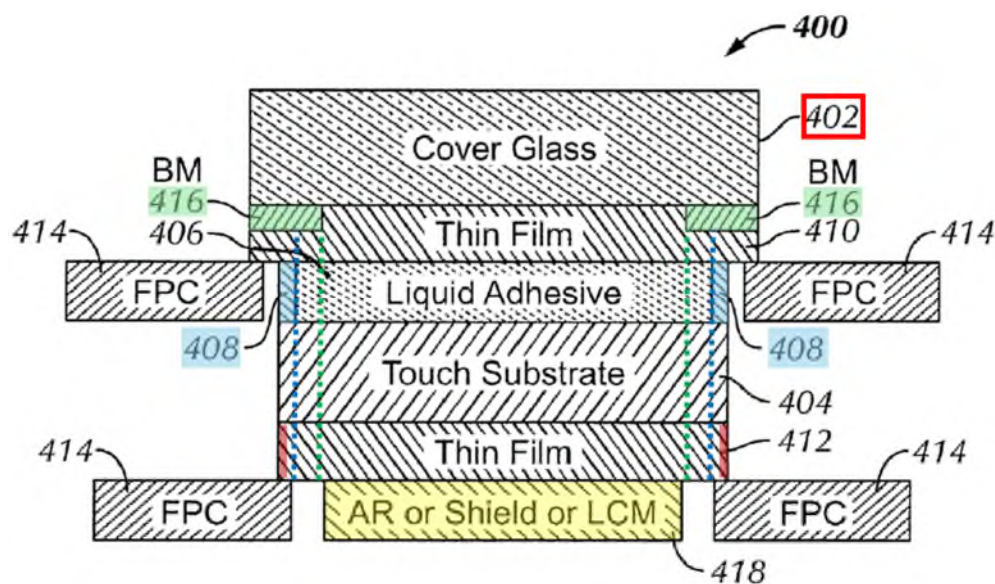
Sung, Fig. 4; Flasck ¶¶236–237.

3. Claim 10

Sung further renders obvious *wherein the opening of the light shielding material* (black mask 416 or edge seals 408) *is smaller than the detection region* (ITO layer 306's area) *of the coordinate input substrate* (touch substrate 404). See also §VIII.D.1.

The detection region is coextensive with the matrix wherein the drive and sense lines intersect. §VIII.D.1.b. In a plan view, Sung's detection region, its ITO layer's area, is analogous to Nishihara's detection region 4. §VIII.D.1.b. Accordingly, Sung's detection region extends outward toward the touch panel's

peripheries but within the surrounding regions occupied by the first and second interconnects. A POSITA would have known that it was desirable to maximize the detection area. Thus, it would have been obvious and desirable to design the touch panel such that the light-shielding material's opening does not limit the detection area. *Flasck ¶¶238–239*. Visualizing this using Sung's figure, this corresponds to a design in which the detection region, the drive-and-sense-line matrix, is made larger than the opening of black mask 416 or edge seals 408 (respectively denoted by green and blue dotted lines):



Sung, Fig. 4. This is feasible since the two thin-film layers forming the sense and drive lines and the interconnects are larger than the openings. Doing so involves appropriately sizing the black mask, the edge seals, and the first and second

interconnects' widths. This was within a POSITA's knowledge and skill and merely involved applying known techniques to achieve predictable results. Flasck ¶239.

4. Claim 12

a) 12[pre]

Sung discloses *a coordinate input device*. §VIII.D.1.a.

b) 12[a]–[h]

Claim limitations 12[a]–[h] are respectively identical to claim limitations 1[a], 1[d]–[i], and 1[k]. Sung in view of Nishihara renders them obvious. §§VIII.D.1.b, .e–.i, .k; Flasck ¶¶240–241.

5. Claim 17

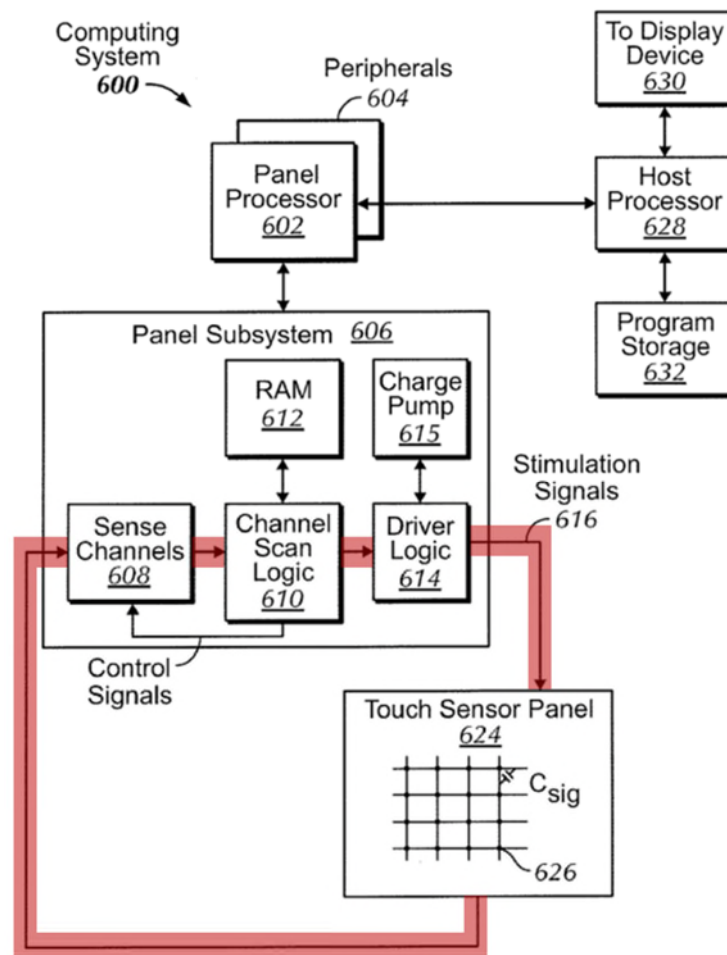
Claim 17's additional limitation is identical to claim 10. Sung renders it obvious. §VIII.D.3; *see also* §VIII.D.4; Flasck ¶242.

6. Claim 18

Sung in view of Nishihara further renders obvious *wherein the first flexible [sic] substrate* (Sung: FPC 414) *supplies driving signals to the detection electrodes* (Sung: drive and sense lines) *via the first interconnects* (Nishihara: wiring electrodes 7) *and receives detection signals corresponding to a contact position from the detection electrodes*. *See also* §VIII.D.5.

Sung's drive and sense lines are connected to signal wires analogous to Nishihara's wiring electrodes, which are in turn connected to the FPC to convey the signals. §VIII.D.1.b.

Sung discloses a panel subsystem comprising driver logic to generate stimulation signals, *i.e.*, driving signals, “[to] be selectively applied to drive lines....” Sung, [0050]. Touch events and positions are detected at the drive-and-sense-line intersections. The detection signals are sent to a sense channel from which detection data is read by the channel scan logic. *Id.*, [0050]–[0051], [0002]. This signal loop is highlighted below:



Id., Fig. 6. Touch positions may be determined through sense signals derived from the change in capacitive coupling between the drive and sense lines. Flasck ¶¶243–245.

Sung’s panel subsystem provides a sense function, including capacitance measurements. Sung, [0050]. Sung’s FPC “measure[s] the changes in capacitance” from contacts on the touch panel. *Id.*, [0041]. Thus, a POSITA would have understood, or at least found it obvious, that Sung’s panel subsystem is on the FPC. Flasck ¶246.

7. Claim 20

Sung in view of Nishihara further renders obvious *wherein a detection signal is supplied to the first flexible substrate* (Sung: FPC 414) *via one of the first interconnect* (Nishihara: wiring electrodes 7). *See also* §VIII.D.1.

Claim 20's additional limitation is a subset of claim 18, except that claim 20 additionally recites that the detection signal is supplied via one of the first interconnect. Sung in view of Nishihara renders it obvious for the same reasons. §VIII.D.6; Flasck ¶¶247–248.

8. Claim 21

Claim 21's additional limitation is identical to claim 20. Sung in view of Nishihara renders it obvious. §VIII.D.7; *see also* §VIII.D.4; Flasck ¶249.

9. Motivation to Combine

A POSITA would have been motivated to add a shield electrode as Nishihara teaches to Sung's device and would have had a reasonable expectation of success to do so. Flasck ¶250.⁵

⁵ Nishihara also explains the wiring connecting the drive and sense lines to the FPC, a detail that Sung does not discuss because such wiring was routine. A POSITA would have understood Sung's device to comprise such wiring. Flasck ¶250 n.5.

Sung employs capacitive touch panels. Sung, [0008]. Nishihara teaches that capacitive touch panels are susceptible to “electromagnetic noise and static electricity,” resulting in “erroneous [touch] determination[s]” because capacitive touch panels operate by “detecting weak current caused by the changed capacitance.” Nishihara, [0008]. Nishihara’s shield electrode reduces errors by attenuating noise. *Id.*, [0008]–[0009], [0019], [0043]. A POSITA would have been motivated to apply Nishihara’s teaching to improve Sung’s performance. Flasck ¶251.

A POSITA would have had a reasonable expectation of success in adding a shield electrode to Sung’s touch substrate. The shield electrode is isolated from other substrate components. Nishihara, Fig. 1A, [0043]. Thus, forming this electrode does not affect other components and involves a straightforward design—nothing else must be changed. If the sizes or placements of components, such as the wiring connecting the drive and sense lines, may need adjustment, such minor tweaks would have been within a POSITA’s knowledge and skill. Further, the shield electrode may be formed using a thin-film deposition technique. *Id.*, [0045]. Sung’s manufacturing also uses thin-film deposition. Sung, [0024]–[0025]. Thus, the addition may employ a known technique for wire formation to achieve a predictable result. Flasck ¶252.

E. GROUND 5: Sung in View of Nishihara and Lee Renders Claims 3–7 and 13–16 Obvious

1. Claim 3

a) 3[pre]

Sung in view of Nishihara and Lee further renders obvious a display device *further comprising a first semiconductor chip* (Sung: ASIC; Lee: chip 224). See also §VIII.D.1.

Sung's panel subsystem is embodied in an ASIC (application-specific integrated circuit), a semiconductor chip. Sung, [0050].

Lee discloses a drive IC on a flexible carrier. Lee, [0025]. IC or integrated circuit was routinely fabricated in semiconductor. Flasck ¶¶253–255.

b) 3[a]

Sung in view of Nishihara and Lee renders obvious *wherein a third interconnect* (Lee: right electrostatic discharge protective line 228) *and the first semiconductor chip* (Sung: ASIC; Lee: chip 224) *are disposed on the first flexible substrate* (Sung: FPC 414; Lee: flexible carrier 222).

Sung discloses a panel subsystem in an ASIC. Sung, [0050]. The panel-subsystem ASIC is on the FPC. §VIII.D.6.

Lee discloses chips 224 and electrostatic-discharge-protective lines 228 on a flexible carrier 222. §VIII.B.1.b.

It was well known to connect both display and touch panels to external circuits through respective flexible carriers. §IV. Both Sung's and Lee's flexible substrates connect to signal lines on the main substrate (Sung's touch substrate and Lee's LCD panel). Sung, [0041]; Lee, [0024]–[0025]. Both are coupled to an external system on the other end. Sung, Fig. 6; Lee, Fig. 2, [0024]. Based on their similarities, a POSITA would have found it obvious that Lee's flexible-carrier configuration is applicable to Sung's FPC. Applying Lee's teaching to Sung would have been no more than applying a known technique to address a shared concern with predictable results. Flasck ¶¶256–259.

c) 3[b]

Lee discloses *wherein the third electrode* (coupled to dummy pad 214) *is formed at one end of the third interconnect* (right electrostatic discharge protective lines 228). §VIII.B.1.c; Flasck ¶260.

d) 3[c]

Lee discloses *wherein a fifth electrode* (dummy pads 234) *is formed at the other end of the third interconnect* (right electrostatic discharge protective line 228). §VIII.B.1.d; Flasck ¶261.

e) 3[d]

Lee discloses *wherein the first semiconductor chip* (chip 224) *doesn't overlap the third interconnect* (right electrostatic discharge protective line 228) *and the fifth electrode* (dummy pads 234) *in a plan view*. §VIII.B.1.e; Flasck ¶262.

2. Claim 4

Sung further discloses a display device *wherein the first semiconductor chip* (ASIC) *drives the coordinate input substrate* (touch substrate 404). See also §VIII.E.1.

Sung's panel subsystem comprises "driver logic to generate stimulation signals ... that can be selectively applied to drive lines of touch sensor panel." Sung, [0050] (numerals omitted). The panel subsystem may be implemented in the ASIC. *Id.*; Flasck ¶¶263–264.

3. Claim 5

Lee further renders obvious *wherein the third interconnect* (right electrostatic discharge protective line 228) *extends from the third electrode* (coupled to dummy pad 214) *to the fifth terminal* (dummy pads 234) *along an edge of the first flexible substrate* (flexible carrier 222) *and is disposed between the first semiconductor chip* (chip 224) *and the edge of the first flexible substrate*. §VIII.B.3; see also §VIII.E.1; Flasck ¶265.

4. Claim 6

a) 6[pre]

Lee further discloses *wherein a fourth interconnect* (left electrostatic discharge protective line 228) *is disposed on the first flexible substrate* (flexible carrier 222). §VIII.B.4.a; *see also* §VIII.E.1; Flasck ¶266.

b) 6[a]

Lee discloses *wherein the fourth electrode* (coupled to dummy pad 214) *is formed at one end of the fourth interconnect* (left electrostatic discharge protective lines 228). §VIII.B.4.b; Flasck ¶267.

c) 6[b]

Lee discloses *wherein a sixth electrode* (dummy pads 234) *is formed at the other end of the fourth interconnect* (left electrostatic discharge protective line 228). §VIII.B.4.c; Flasck ¶268.

d) 6[c]

Lee discloses *wherein the first semiconductor chip* (chip 224) *is disposed between the third interconnect* (right electrostatic discharge protective line 228) *and the fourth interconnect* (left electrostatic discharge protective line 228) *in plan view*. §VIII.B.4.d; Flasck ¶269.

e) 6[d]

Lee discloses *the first semiconductor chip* (chip 224) *doesn't overlap the fourth interconnect* (left electrostatic discharge protective line 228) *and the sixth terminal* (dummy pads 234) *in a plan view*. §VIII.B.4.e; Flasck ¶270.

5. Claim 7

Claim 7's additional limitation is identical to claim 18. Sung in view of Nishihara renders it obvious. §VIII.D.6; *see also* §VIII.E.1; Flasck ¶271.

6. Claim 13

a) 13[pre]

Sung in view of Nishihara and Lee further renders obvious a display device *further comprising a first semiconductor chip*. §VIII.E.1.a; *see also* §VIII.D.4.

b) 13[a]–[d]

Claim limitations 13[a]–[d] are respectively identical to claim limitations 3[a]–[d]. Sung in view of Nishihara and Lee renders them obvious. §§VIII.E.1.b–e; Flasck ¶¶272–273.

7. Claim 14

Claim 14's additional limitation is identical to claim 4. Sung in view of Nishihara and Lee renders it obvious. §VIII.E.2; *see also* §VIII.E.6; Flasck ¶274.

8. Claim 15

Claim 15's additional limitation is virtually identical to claim 5, except that claim 5/15 respectively recites "the fifth terminal"/"the fifth electrode." Sung in view of Nishihara and Lee renders claim 15 obvious. §VIII.E.3, VIII.B.8; *see also* §VIII.E.6; Flasck ¶¶275–276.

9. Claim 16

See §VIII.E.6; Flasck ¶277.

a) 16[a]–[d]

Claim limitations 16[a]–[d] are respectively identical to the additional requirements in claim limitations 6[pre]–[c]. Sung in view of Nishihara and Lee renders them obvious. §§VIII.E.4.a–d; Flasck ¶278.

b) 16[e]

Claim limitation 16[e] is substantively identical to claim limitation 6[d], except that it recites "the sixth electrode" instead of "the sixth terminal." Sung in view of Nishihara and Lee renders claim limitation 16[e] obvious. §§VIII.E.4.e, VIII.B.9; Flasck ¶279.

10. Motivation to Combine

A POSITA would have been motivated to apply Lee's flexible-carrier teaching to Sung's display device. Nishihara's teaching would have further motivated this combination.

A POSITA would have understood, or at least found it obvious, that Sung's panel-subsystem ASIC is on the FPC. §VIII.D.6. Thus, Lee merely adds the electrostatic-discharge-protective lines, associated pads, and the component placement on the flexible substrate.

Lee teaches that the electrostatic-discharge-protective lines provide an electrostatic-discharging path. Lee, [0017]. This improves manufacturing yield and device performance by reducing damages to components. *Id.*, [0017], [0031]. These improvements would have motivated a POSITA to provide electrostatic-discharge-protective lines on Sung's FPC.

Further, a POSITA would have recognized these lines as an extension of Nishihara's shield electrode. Nishihara's shield electrode is connected to ground via the flexible substrate. Nishihara, [0049]. This forms a ground loop from the external ground through the flexible substrate and the shield electrode. Lee's electrostatic-discharge-protective lines themselves are part of a ground loop. Lee, [0014], [0017], [0026], [0031]. It would have been obvious to use these lines to connect Nishihara's shield electrode to ground. Thus, Nishihara provides a POSITA additional motivation to apply Lee to configure Sung's FPC. Flasck ¶¶280–283.

Further, the end terminals at Nishihara's shield electrode would increase the bonding strength between the device and flexible substrates. Lee, [0024]. This

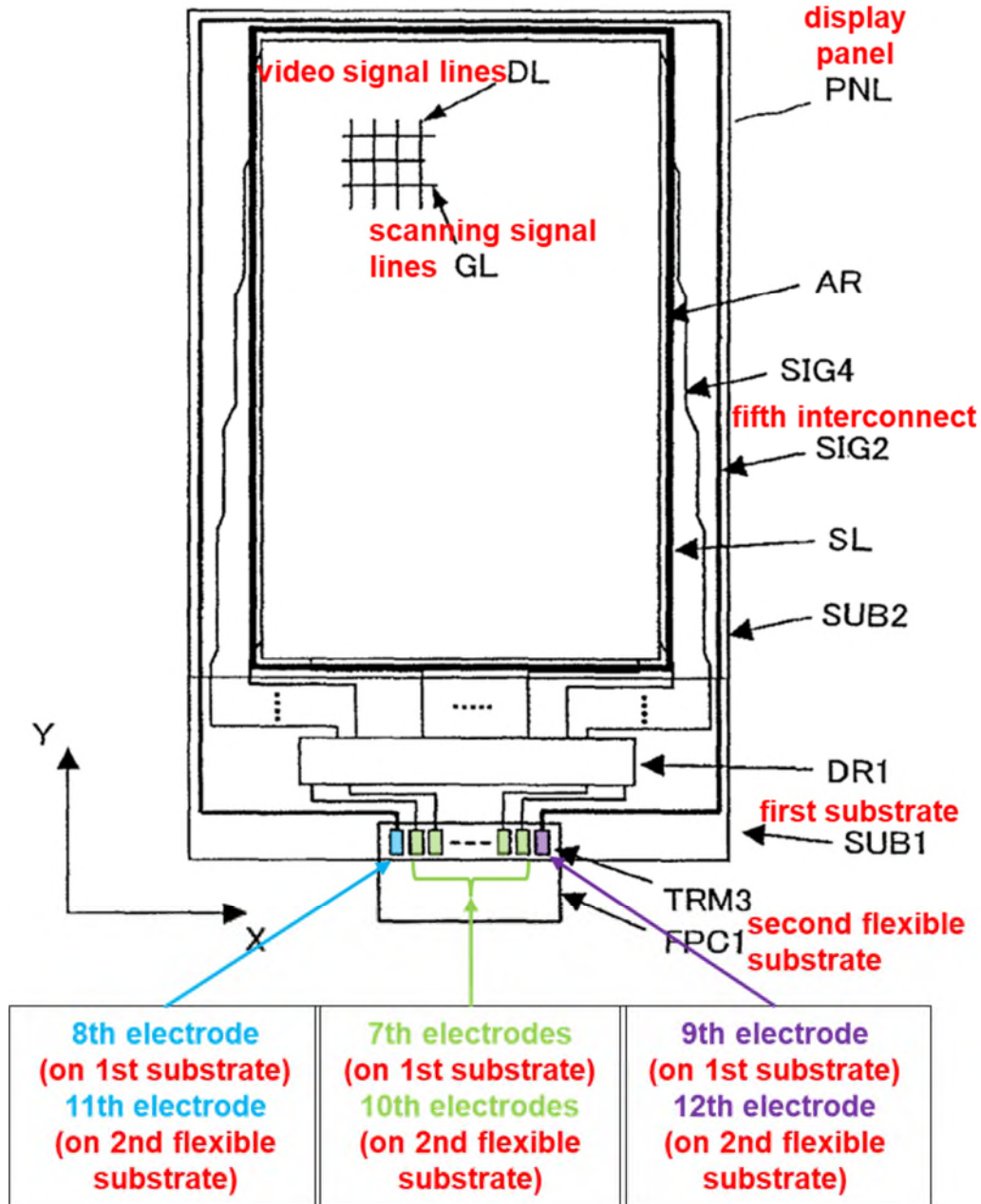
results in enhanced reliability that would have further motivated a POSITA to apply Nishihara's teaching. Flasck ¶284.

A POSITA would have had a reasonable expectation of success of implementing Lee's electrostatic-discharge-protective lines. Like Nishihara's shield electrode, these lines are isolated from other substrate components. Lee, Fig. 2. Forming these lines does not affect other circuits. Thus, adding these lines on the FPC's sides involves a straightforward design—nothing else must be changed. Lee confirms as much. *Id.*, [0027]; Flasck ¶285.

F. GROUND 6: Sung in View of Nishihara and Kim Renders Claims 8–9 Obvious

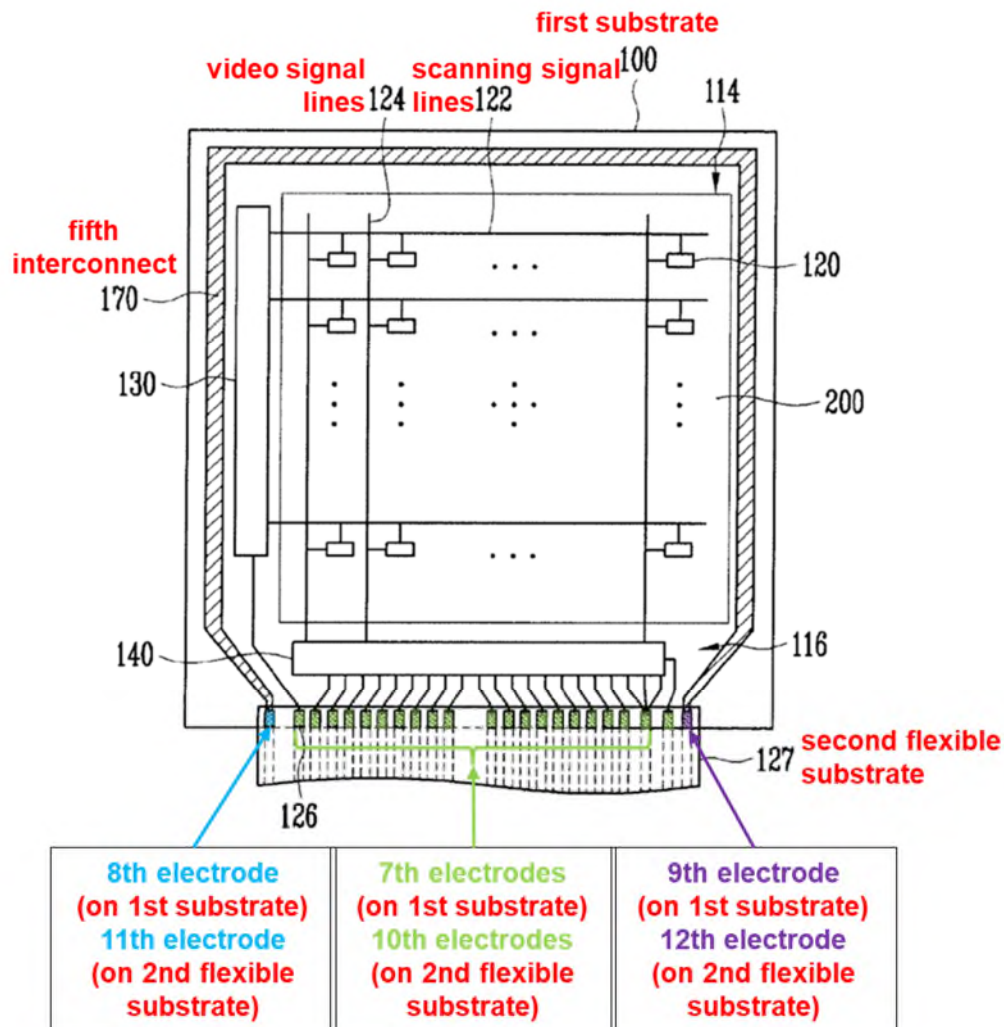
1. Claim 8

It is again helpful to graphically illustrate claim 8:



Ex. 1001, Fig. 9.

Kim satisfies claim 8 as illustrated here and as explained below.



Kim, Fig. 4; Flasck ¶¶286–287.

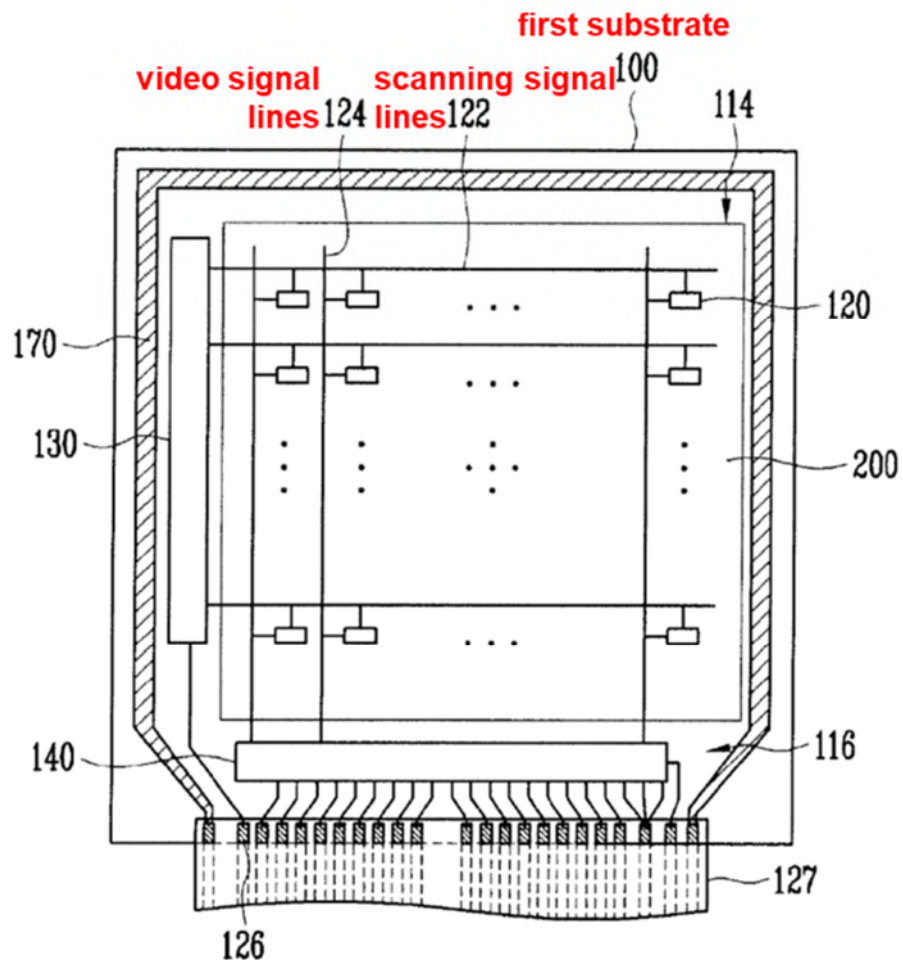
a) 8[pre]

Kim discloses *wherein the display panel comprises* the limitations below. See also §VIII.D.2; Flasck ¶288.

b) 8[a]

Kim’s display panel comprises *a first substrate* (substrate 100) *on which a plurality of video signal lines* (data lines 124) *and a plurality of scanning signal lines*

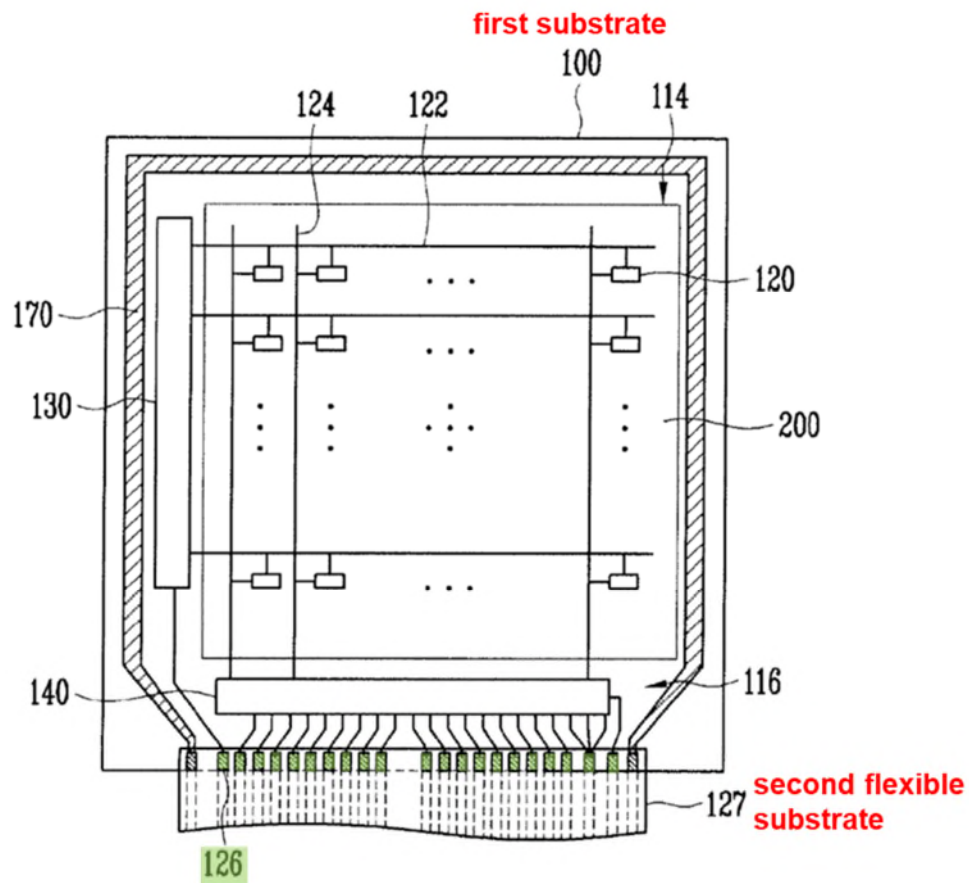
(scan line 122) *intersecting the video signal lines are formed.*



Kim, Fig. 4, [0036] (disclosing intersecting scan lines 122 and data lines 124); Flasck ¶289.

c) 8[b]

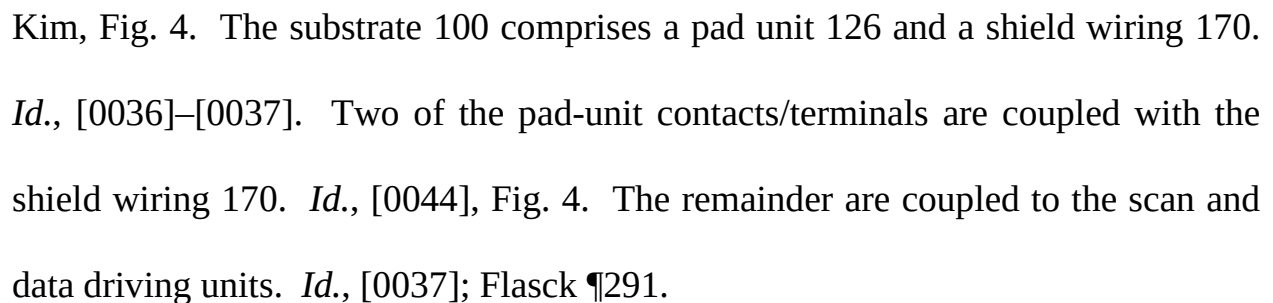
Kim's display panel comprises *a second flexible substrate* (FPC 127) *electrically connected to the first substrate* (substrate 100).



Kim, Fig. 4. The substrate comprises a pad unit 126. *Id.*, [0037]. The pad unit is “electrically coupled with” the FPC. *Id.*, [0044]; Flasck ¶290.

d) 8[c]

Kim discloses *wherein a plurality of seventh electrodes* (pad unit 126), *a fifth interconnect* (shield wiring 170), *an eighth electrode* (pad unit 126) *and ninth electrode* (pad unit 126) *are formed on the first substrate* (substrate 100).



Kim discloses *wherein the seventh electrodes* (pad unit 126) *receive video signals and scanning signals from an external system, the eighth electrode* (pad unit 126) *is formed at one end of the fifth interconnect* (shield wiring 170), *and the ninth*

electrode (pad unit 126) *formed at the other end of the fifth interconnect.*

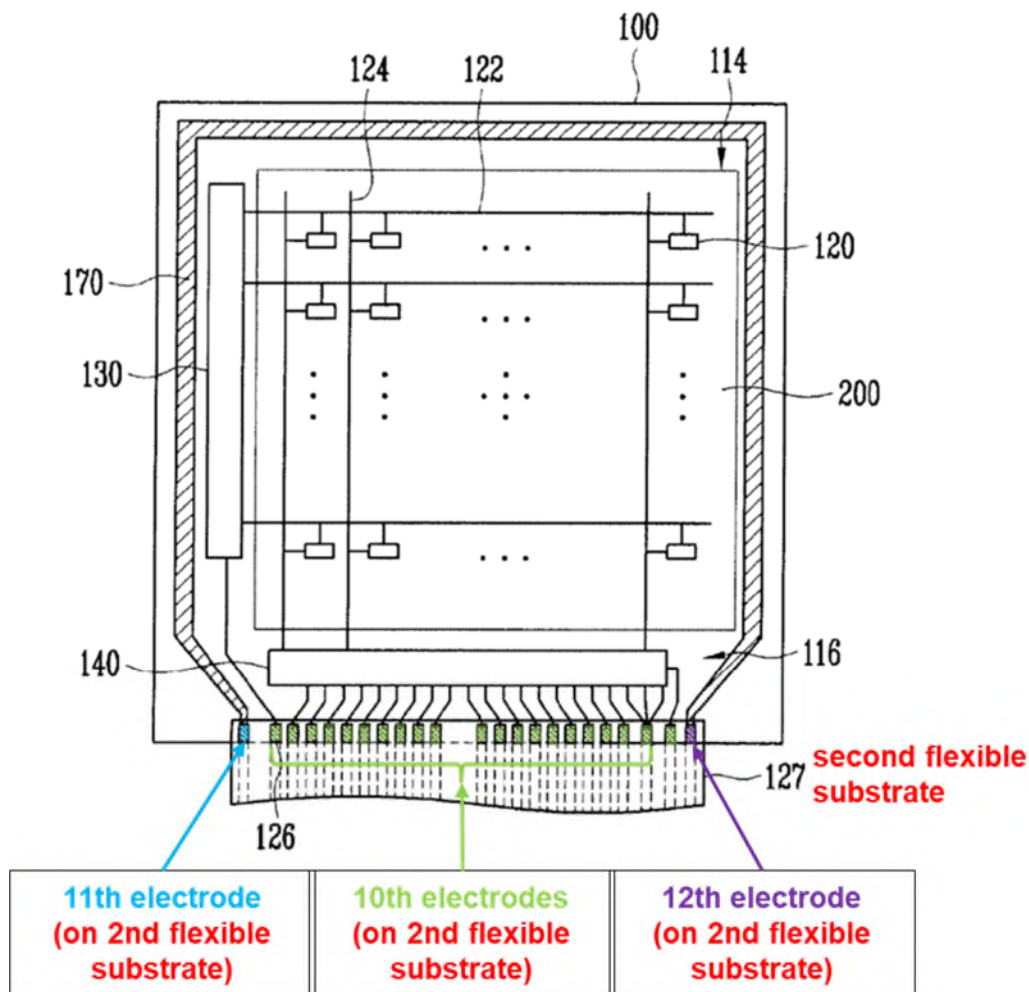
The connections between two contacts/terminals (highlighted in blue and purple) of pad unit 126 and the shield wiring 170 are shown above. §VIII.F.1.d. “[S]ignals including power supply voltage, control signal, data, etc., are input from the outside” through the FPC 127 to which the pad unit is connected. Kim, [0044]. “[T]he outside” refers to an external system. The “control signal” and “data” respectively correspond to scanning and video signals. Kim, [0016], [0031]; Flasck ¶¶292–293.

f) 8[e]

Kim discloses a display panel *wherein a plurality of tenth electrodes, a[n] eleventh electrode, twelfth electrode are formed on the second flexible substrate (FPC 127), and the plurality of tenth electrodes are formed between the eleventh electrode and the twelfth electrode.*

Kim’s display substrate comprises a pad unit 126. §VIII.F.1.d. The pad unit is electrically coupled to the FPC 127; signals are provided through the connection. Kim, [0044]. A POSITA would have understood that the FPC comprises contacts/terminals to connect with corresponding pad-unit contacts/terminals on the display substrate. The FPC’s plurality of tenth electrodes are coupled to the contacts/terminals coupled to the scan and data driving units. *Id.*, [0037]. Two FPC contacts/terminals (the eleventh and the twelfth electrodes) are coupled to the shield

wiring 170 on the substrate. *Id.*, [0044]. These two electrodes are the leftmost and rightmost contacts to the pad unit. Thus, the tenth electrodes are formed between them:

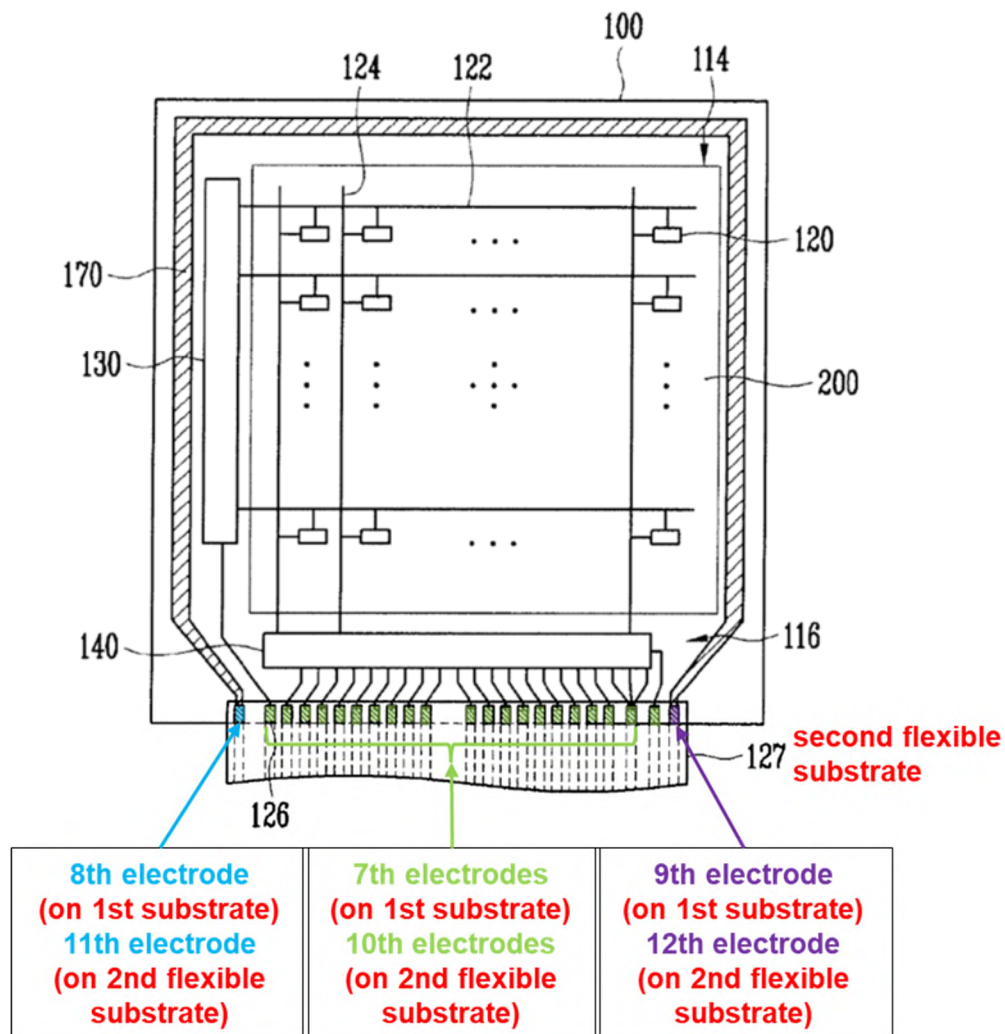


Id., Fig. 4; Flasck ¶¶294–295.

g) 8[f]

Kim discloses a display panel *wherein the tenth electrodes are connected to the seventh electrodes* (pad unit 126), *the eleventh electrode is connected to the*

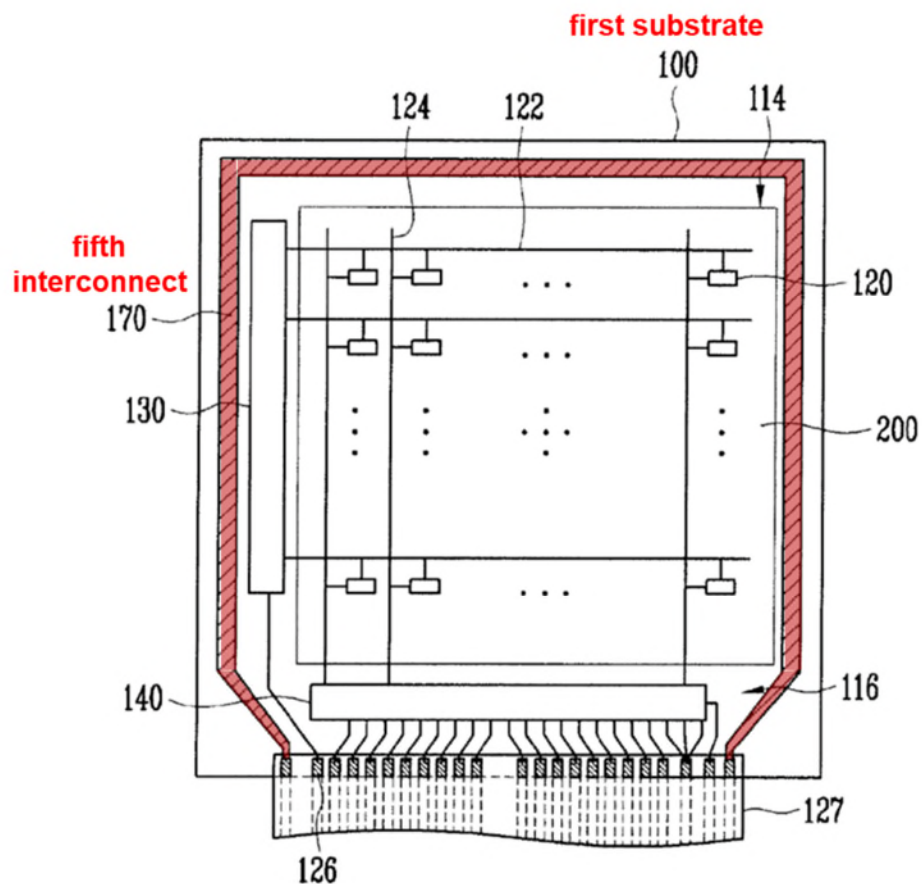
eighth electrode (pad unit 126), *the twelfth electrode is connected to the ninth electrode* (pad unit 126).



Kim, Fig. 4. The leftmost and rightmost contacts/terminals of the pad unit 126 are connected to the FPC's corresponding contacts/terminals to couple the shield wiring to ground. *Id.*, [0044]. The remaining contacts/terminals are connected to their corresponding FPC contacts/terminals to transfer signals from the outside to the scan and data driving units. *Id.*, [0044]–[0045]; Flasck ¶296.

h) 8[g]

Kim discloses a display panel *wherein the fifth interconnect* (shield wiring 170) *is disposed along a peripheral edge of at least three sides of the first substrate* (substrate 100).



Kim, Fig. 4. “[The] shield wiring 170 [is formed] along the edge (or periphery),” “at least partly surround (e.g., formed along three ... sides)” of the substrate. *Id.*, [0037], [0046]; Flasck ¶297.

2. Claim 9

a) 9[pre]

See §VIII.F.1.

b) 9[a]

Kim discloses *wherein the display panel further comprises a second semiconductor chip* (scan and data driving units 130 and 140) *receiving the video signals, supplying display signals to the video signal lines* (data lines 124), *and controlling the video signal lines and the scanning signal lines* (scan line 122).

Kim's scan and data driving unit 130 and 140 are "for driving the display panel." Kim, [0035]. They are coupled to the pad unit 126 and receive signals to send to the scan and data lines, thereby controlling those lines to generate images. *Id.*, [0016], [0037], [0045]. The driving units, *i.e.*, drive ICs, are semiconductor chips. *Id.*, [0038].

Implementing both scan and data driving units' functionalities in a single chip (which the claim limitation does not require) and routing the signal wires accordingly would have been a simple and common design choice within a POSITA's knowledge and skill. *See, e.g.*, Ex. 1012, Fig. 1, [0058]; Flasck ¶¶298–301.

c) 9[b]

Kim discloses a display device *wherein the second semiconductor chip* (scan

and data driving unit 130 and 140) *is formed on the first substrate* (substrate 100) *and is surrounded by the fifth interconnect* (shield wiring 170).

The scan and data driving units are formed on substrate 100. Kim, [0035], Fig. 4. “[T]he shield wiring 170 is formed to at least partly surround (e.g., formed along three ... sides) ..., the scan driving unit 130 and the data driving unit 140.” *Id.*, [0046]; Flasck ¶¶302–303.

3. Motivation to Combine

Kim’s disclosure provides the details of constructing a display device, like LCM 418 used by Sung. Sung, [0038]. Because Sung focuses on the touch panel, it does not disclose the LCM’s details. *Id.*, [0042]. Thus, a POSITA in applying Sung would be motivated to look to display art like Kim in constructing the LCM. Moreover, the ’477 patent does not teach anything different, stating its display device is “identical with that of well-known liquid crystal display devices.” Ex. 1001, 4:28–31. Using Kim to supplies the details of a conventional LCD that Sung does not disclose is directly motivated by Sung’s disclosure and merely involves applying Kim’s display for its intended purpose to achieve predictable results. Flasck ¶304.

IX. SECONDARY CONSIDERATIONS

Petitioner is not aware of any secondary considerations that would overcome the strong showing of obviousness above. Flasck ¶305. Further, any attempt by

Patent Owner to rely on alleged secondary considerations cannot overcome this showing. *Tokai Corp. v. Easton Enters., Inc.*, 632 F.3d 1358, 1370 (Fed. Cir. 2011).

X. CONCLUSION

Petitioner respectfully requests the Board institute review of the '477 patent and cancel all Challenged Claims.

Dated: September 18, 2025

Respectfully submitted,

By: /Richard F. Martinelli/

Richard F. Martinelli (Reg. No. 52,003)
Orrick, Herrington & Sutcliffe LLP
51 West 52nd Street
New York, NY 10019-6142
Telephone: (212) 506-3702
RFMPTABDocket@orrick.com

Counsel for Petitioner

CERTIFICATE OF WORD COUNT

The undersigned certifies that the foregoing PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 9,507,477 UNDER 35 U.S.C. §§311–319 AND 37 C.F.R. §42 complies with the type volume limitation in 37 C.F.R. §42.24(a)(1). According to the utilized word-processing system’s word count, the petition—excluding the caption, table of contents, a table of authorities, mandatory notices under §42.8, certificate of service, certificate of word count, or listing of exhibits, and claim listing—contains 14,000 words.

Dated: September 18, 2025

By: /Richard F. Martinelli/

Richard F. Martinelli (Reg. No. 52,003)
Orrick, Herrington & Sutcliffe LLP
51 West 52nd Street
New York, NY 10019-6142
Telephone: (212) 506-3702
RFMPTABDocket@orrick.com

Counsel for Petitioner

CERTIFICATE OF SERVICE

The undersigned hereby confirms that the foregoing PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 9,507,477 UNDER 35 U.S.C. §§311–319 AND 37 C.F.R. §42 and associated Power of Attorney and Exhibits 1001-1027 were caused to be served on September 18, 2025 via overnight courier upon the following counsel of record for Patent Owner:

27197 - Michael J. Cherskov
Szymon M. Gurda
Cherskov Flaynik & Gurda, LLC
903 Commerce Drive, Suite 310
Oak Brook, IL 60523
United States
Re: Paneltouch Technologies LLC; U.S. Patent No. 9,507,477

Courtesy copies were also served via email on Patent Owner's counsel of record in a related district court litigation styled *Paneltouch Technologies LLC v. BOE Technology Group Co., Ltd.*, No. 2:25-cv-00245 (E.D. Tex.):

Benjamin T. Wang (bwang@raklaw.com)
Andrew D. Weiss (aweiss@raklaw.com)
Christian W. Conkle (cconkle@raklaw.com)
Paul A. Kroeger (pkroeger@raklaw.com)
RUSS AUGUST & KABAT
12424 Wilshire Blvd. 12th Floor
Los Angeles, CA 90025
Phone: (310) 826-7474

/ Richard F. Martinelli /
