

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. 8,704,762

Issue Date: April 22, 2014

Title: DISPLAY DEVICE

Case No. IPR2025-01482

**PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT NO. 8,704,762
UNDER 35 U.S.C. §§ 311-319 AND 37 C.F.R. § 42 *et seq.***

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LISTING OF EXHIBITS

Exhibit	Description
1001	U.S. Patent No. 8,704,762 (the “’762 patent”)
1002	Prosecution History of U.S. Patent No. 8,704,762
1003	Declaration of Richard A. Flasck
1004	Japanese Patent Publication No. JP 2006-171386A (“Miyagawa”) and certified translation
1005	U.S. Patent Publication No. 2008/0074594A1 (“Tanabe”)
1006	U.S. Patent Publication No. 2009/0322704A1 (“Anno ’704”)
1007	U.S. Patent Publication No. 2009/0244021A1 (“Matsuo”)
1008	Japanese Patent Publication No. JP 2009-053390A (“Nakamura”) and certified translation
1009	U.S. Patent Publication No. 2010/0220071A1 (“Nishihara”)
1010	U.S. Patent Publication No. 2009/0231516A1 (“Okada”)
1011	U.S. Patent Publication No. 2011/0007251A1 (“Yamamoto”)
1012	U.S. Patent Publication No. 2011/0226726A1 (“Song”)
1013	U.S. Patent Publication No. 2010/0134137A1 (“Kida”)
1014	U.S. Patent Publication No. 2006/0038580A1 (“Hasegawa”)
1015	U.S. Patent Publication No. 2008/0062373A1 (“Kim”)
1016	European Patent Specification No. EP1533848B1 (“Chung”)
1017	U.S. Patent Publication No. 2010/0123592A1 (“Nurmi”)
1018	Wiley Electrical and Electronics Engineering Dictionary (2004)

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Exhibit	Description
1019	Microsoft Computer Dictionary (5th ed.) (2002)
1020	U.S. Patent Publication No. 2008/0158453A1 (“Segawa”)
1021	U.S. Patent Publication No. 2010/0085326A1 (“Anno ’326”)
1022	<i>Curriculum Vitae</i> of Richard A. Flasck, M.S. (“Flasck C.V.”)
1023	U.S. Patent Publication No. 2008/0007538A1 (“Kotera”)
1024	U.S. Patent Publication No. 2004/0141110A1 (“Yu”)
1025	U.S. Patent Publication No. 2001/0005200A1 (“Suzuki”)
1026	Den Boer, “Active Matrix Liquid Crystal Displays” (2005)

CHALLENGED CLAIM LISTING

Claim	Limitation No.	Limitation
1	1[pre]	A display device comprising:
	1[a]	a coordinate input device including
	1[a.1]	a transparent substrate having detection electrodes disposed in a detection region corresponding to a contact position, the transparent substrate having a first signal interconnect disposed in a region outside the detection region, the first signal interconnect having one end connected to the detection electrodes and being formed with a first electrode terminal at the other end thereof, and
	1[a.2]	a flexible interconnect substrate connected to the first electrode terminal, the flexible interconnect substrate used for supplying a driving signal to the detection electrodes by way of the first signal interconnect and extracting a detection signal from the detection electrodes; and
	1[b]	a display panel for image display based on a video signal from an external system, the coordinate input device being disposed on the display panel at the side of a display screen;
	1[c]	wherein the coordinate inputting device has a second signal interconnect disposed outside the first signal interconnect but near the peripheral edge of the transparent substrate, the second signal interconnect surrounding the area where the detection region is included and the first signal interconnect is formed, the second signal interconnect being opened at opposite ends thereof and being connected to respective electrode terminals for inspection at the open ends,
	1[d]	wherein the second signal interconnect is formed of a thin conductive film disposed along the peripheral edge portion of the transparent substrate; and

Claim	Limitation No.	Limitation
	1[e]	wherein the second signal interconnect is disposed along the peripheral edge of three sides of the transparent substrate.
2	2	A display device according to claim 1, wherein the second signal interconnect has a colored thin film layer or a thin film layer having a transmittance at a predetermined level or less.
3	3	A display device according to claim 1, wherein the second signal interconnect has a thin metal film layer.
4	4	A display device according to claim 1, wherein the second signal interconnect is formed of two or more conductive thin films.
6	6	A display device according to claim 1, wherein the flexible interconnect substrate has a third electrode terminal connected to the second signal interconnect at a position different from that of the region for forming the second electrode terminal connected with an external system.
7	7[pre]	A display device comprising:
	7[a]	a transparent substrate formed with
	7[a.1]	a plurality of video signal lines,
	7[a.2]	a plurality of scanning signal lines intersecting the video signal lines,
	7[a.3]	electrode terminals receiving a driving signal and a control signal from the video signal lines, the scanning signal lines, and an external system, and
	7[a.4]	a third signal interconnect connecting the video signal lines and the scanning signal lines with the electrode terminals; and

Claim	Limitation No.	Limitation
	7[b]	a flexible interconnect substrate connected to the first transparent substrate, the flexible interconnect substrate used for supplying the driving signal to the video signal lines and the scanning signal lines by way of the electrode terminals and the third signal interconnect;
	7[c]	a region surrounded by the video signal lines and the scanning signal lines being a pixel area;
	7[d]	a region where the pixels are formed in a matrix being a display area;
	7[e]	the third signal interconnect being formed in a region outside the display area; and
	7[f]	a fourth signal interconnect disposed outside the third signal interconnect but near the peripheral edge of the transparent substrate, the fourth signal interconnect surrounding the area where the display area is included and the third signal interconnect is formed, the fourth signal interconnect being opened at opposite ends thereof and being connected to respective electrode terminals for inspection at the open ends;
	7[g]	wherein the fourth signal interconnect is formed of a conductive thin film disposed along the peripheral edge portion of three sides of the transparent substrate.
8	8	A display device according to claim 7, wherein the fourth signal interconnect has a colored thin film layer or a thin film layer having a transmittance at a predetermined level or less.
9	9	A display device according to claim 7, wherein the fourth signal interconnect has a thin metal film layer.
10	10	A display device according to claim 7, wherein the fourth signal interconnect is formed of two or more conductive thin films.

Claim	Limitation No.	Limitation
12	12	A display device according to claim 7, wherein the flexible interconnect substrate has electrode terminals connected to the fourth signal interconnect at a position different from that of the region forming the electrode terminal connected with the external system.

I. INTRODUCTION

Petitioner BOE Technology Group Co., Ltd. (“Petitioner”) respectfully requests *inter partes* review of claims 1–4, 6–10, and 12 (the “Challenged Claims”) of U.S. Patent No. 8,704,762 (the “’762 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 ’762 patent, have existed for decades. After the first iPhone was released in 2007, touch screens became ubiquitous—found in nearly everyone’s hands, pockets, purses, or backpacks.

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

Because of the obvious and significant benefits of reducing manufacturing waste, techniques for crack detection were readily developed. Specifically, a crack-detection wire is placed near the edges of each individual substrate, surrounding the

functional wirings and the touch/display area, such that a large crack would break the crack-detection wire. This break could be detected with a simple continuity check across the wire. Obviously, this technique benefits any device formed by dicing a larger, crack-prone mother substrate, including display- and touch-panel substrates.

Because a crack-detection wire is simply a wire trace around the periphery of a device substrate, 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 '762 patent's earliest possible priority date in 2010, the industry had long used crack-detection wires to improve manufacturing efficiency for the millions of displays and touch screens produced each year. As this Petition explains, the '762 patent would have been obvious for several reasons. First, prior-art references disclose the crack-detection technique for use on either display-panel or touch-panel substrates, making it obvious to apply crack-detection structures interchangeably on either type of device. Second, prior-art references disclose using shield wires for crack detection. These references also fully disclose and render obvious the Challenged Claims.

Petitioner requests that the Board institute trial and find the Challenged

Claims unpatentable. Ex. 1003 ¶¶ 36–37, 77.

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 '762 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 '762 patent is available for IPR. Petitioner is not barred or estopped from requesting this IPR. This Petition is timely filed under 35 U.S.C. §315(b).

B. §42.104(b): Identification of Challenge

Under 37 C.F.R. §§42.104(b) and 42.22, Petitioner requests that the Board institute IPR on the Challenged Claims and cancel those claims as unpatentable.

1. §42.104(b)(1): Challenged Claims

Petitioner challenges Claims 1–4, 6–10, and 12 of the '762 patent.

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

The '762 patent was originally filed as U.S. application 13/151,362 on June 2, 2011 and claims priority from foreign application JP 2010-126877, filed on June 2, 2010. For this Petition, Petitioner assumes the '762 patent is entitled to that 2010 priority date.

This Petition relies on the following prior-art references:

Patent/Publication	Prior Art Date	Pre-AIA Prior Art	Ex.
Japanese Patent Publication No. JP 2006-171386A (“Miyagawa”)	June 29, 2006	§§102(a)–(b)	1004
U.S. Patent Publication No. 2008/0074594A1 (“Tanabe”)	March 27, 2008 / Sept. 11, 2007	§§102(a)–(b), (e)	1005
U.S. Patent Publication No. 2009/0322704A1 (“Anno ’704”)	Dec. 31, 2009 / June 29, 2009	§§102(a)–(b), (e)	1006
U.S. Patent Publication No. 2009/0244021A1 (“Matsuo”)	Oct. 1, 2009 / Feb. 24, 2009	§§102(a)–(b), (e)	1007
Japanese Patent Publication No. JP 2009-053390A (“Nakamura”)	Mar. 12, 2009	§§102(a)–(b)	1008

Petitioner challenges the claims on the following grounds:

Number	Ground
1	Claims 7–10 and 12 are obvious over Miyagawa
2	Claims 7–10 and 12 are obvious over Tanabe in view of Miyagawa
3	Claims 1–4 and 6 are obvious over Anno ’704 in view of Miyagawa
4	Claims 1–4 and 6 are obvious over Matsuo in view of Nakamura

None of these references were considered by the Examiner before the allowance of the claims in the ’762 patent.

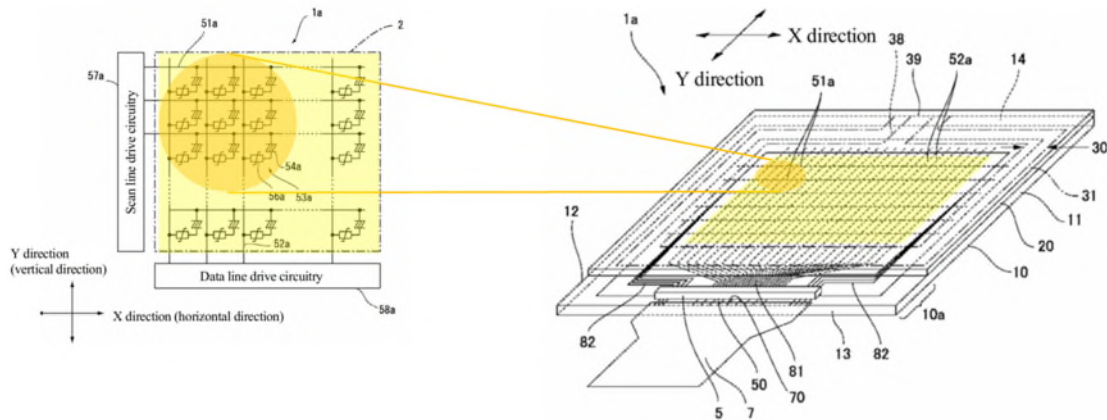
3. §42.104(b)(5): Evidence Supporting Challenge

The Declaration of touch-display expert Richard A. Flasck (Ex. 1003) 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. Ex. 1003 ¶¶ 4–33.

IV. TECHNOLOGY BACKGROUND

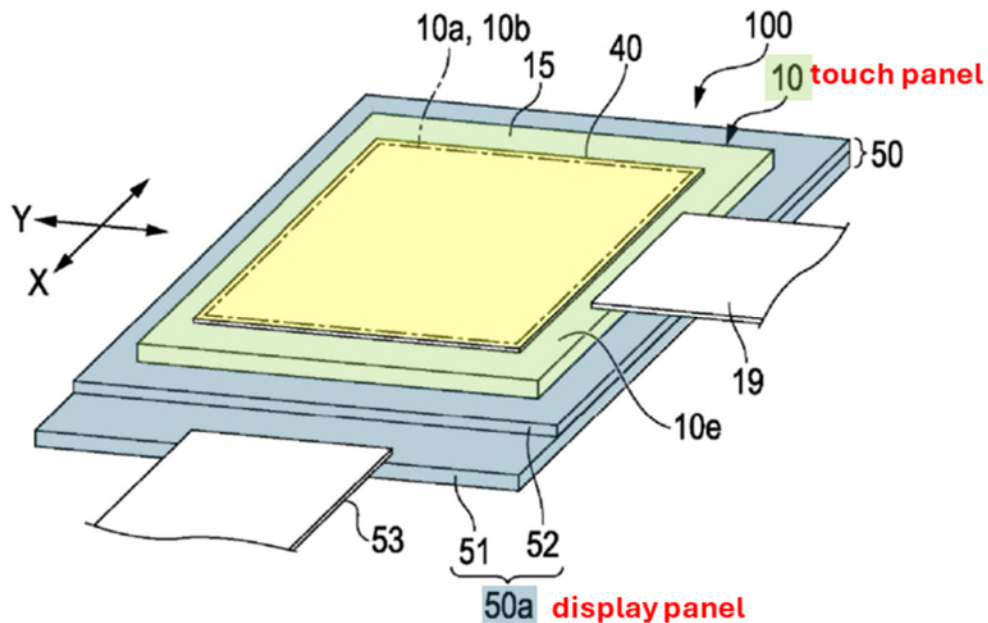
Display panels comprise an array of pixels in an active area. The pixels are coupled through wirings around the active area to components that provide the image signals for display.



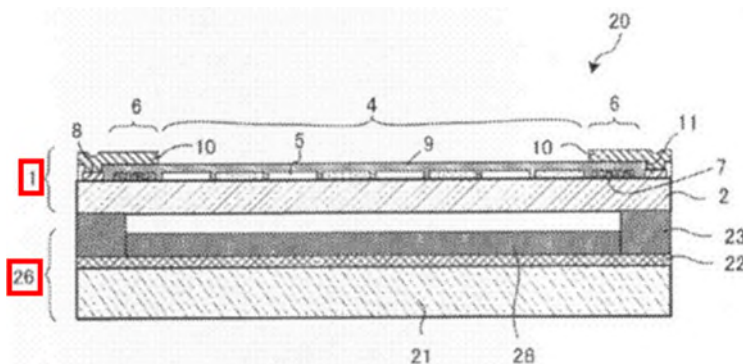
Miyagawa, Figs. 1–2;¹ *see also id.*, Figs. 6–7; Ex. 1020, Fig. 3; Ex. 1003 ¶¶ 38–40.

A touch screen adds a touch panel on top of a display panel:

¹ All color annotations to figures herein are added.

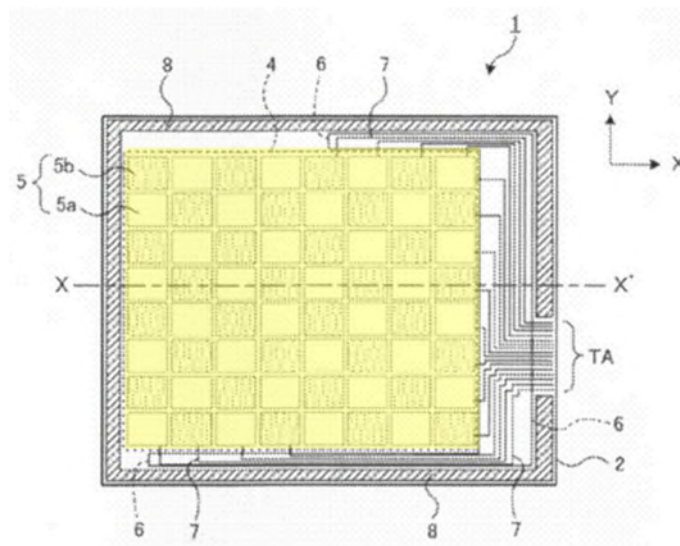


Matsuo, Fig. 1, [0038]. The following cross-sectional view shows a common arrangement with touch panel 1 above display panel 26:



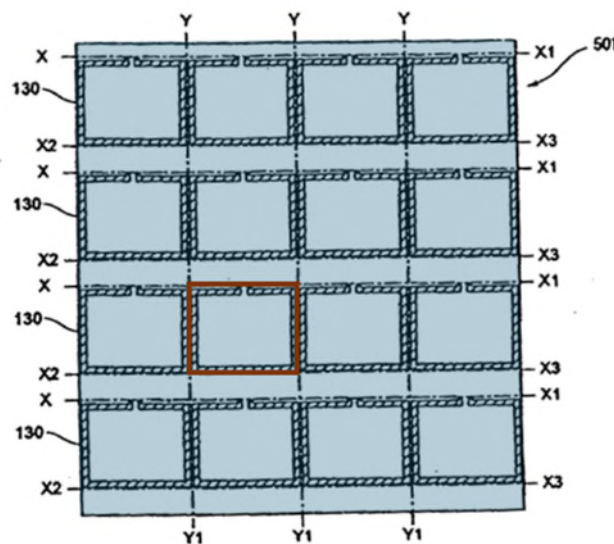
Ex. 1009, Fig. 8, [0066]; Ex. 1003 ¶ 41.

Touch panels typically comprise an array of detection elements in an active area, surrounded by wirings and other components around the active area:



Ex. 1009, Fig. 1A, [0042]–[0045]; *see also* Matsuo, Fig. 2; Ex. 1003 ¶42.

Manufacturers create display panels and touch panels on a large mother substrate (shaded below) containing multiple devices, which is cut into individual panels (one shown in an outline):



Ex. 1010, Fig. 34, [0035]–[0037]; *see also* Ex. 1011, Fig. 14, [0012]; Ex. 1012, Fig.

2, [0031]–[0033]; Ex. 1003 ¶ 43.

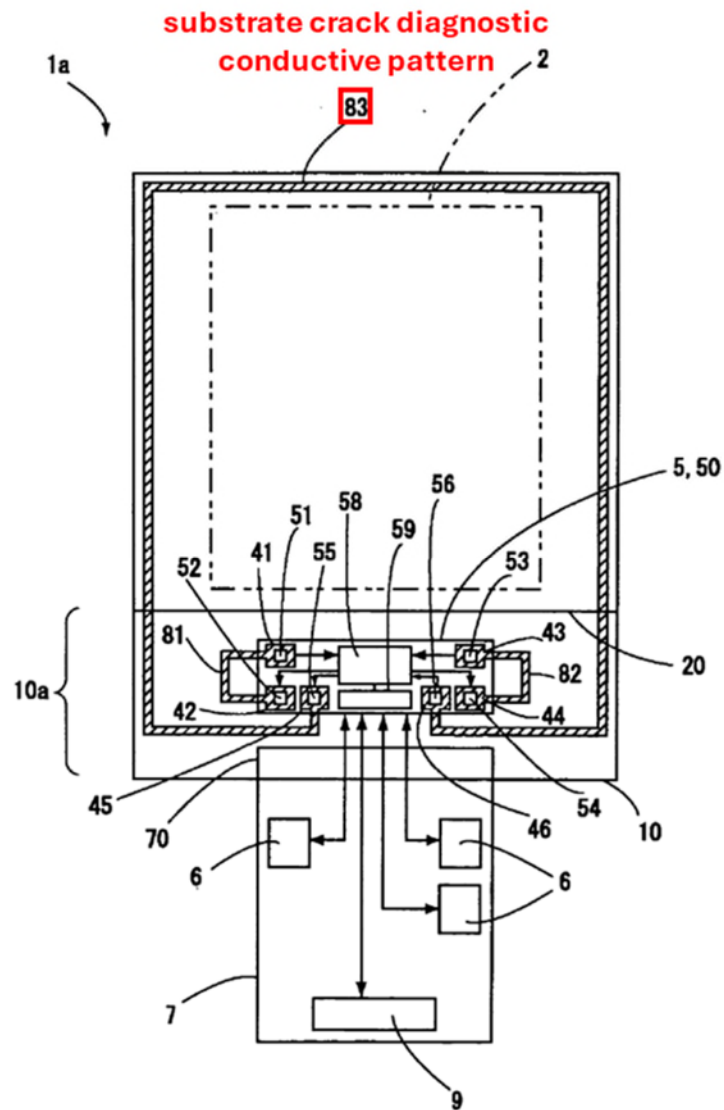
When cutting the mother substrate into individual panels, defect-causing chips or cracks may form:



Nakamura, Figs. 9B–9C; *see also* Ex. 1013, [0006]–[0008]; Ex. 1003 ¶ 44.

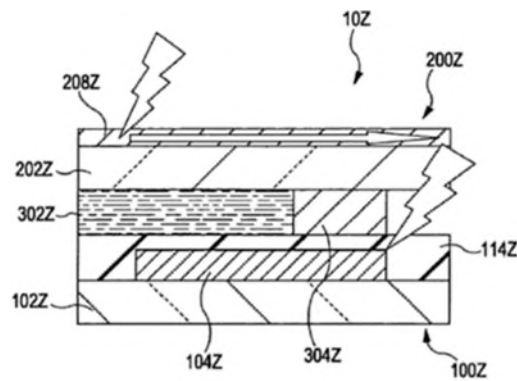
It is advantageous to detect such defects before subsequent manufacturing steps are performed to avoid wasting time, effort, and components. Nakamura, [0043]–[0044]; Ex. 1003 ¶ 45.

A typical detection technique uses a wire deposited around the periphery of individual panels. A crack large enough to cause a defect would break the wire and be discoverable with an electrical continuity check.



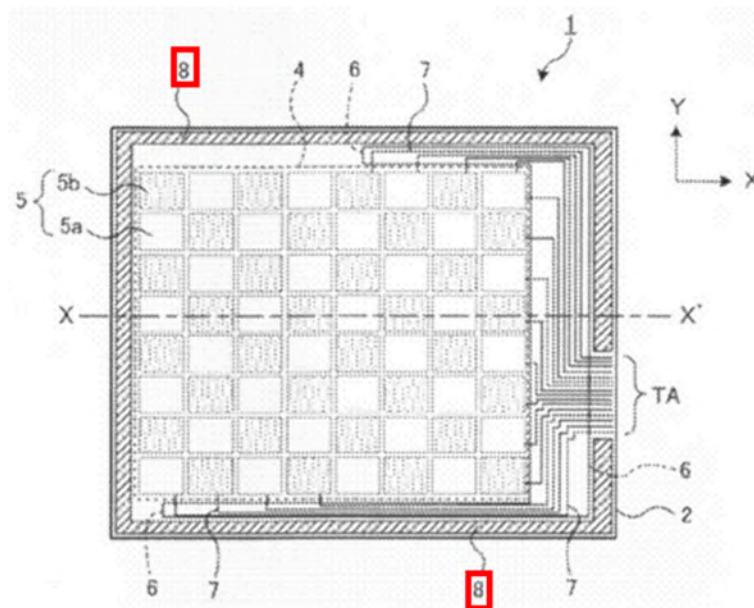
Ex. 1014, Fig. 4, [0051]–[0053]; *see also* Miyagawa, Fig. 3; Ex. 1017, Fig. 9, [0043]; Ex. 1003 ¶46.

Touch screens may also be subject to environmental stressors such as noise or electrostatic discharge that could degrade or damage the panel.



Ex. 1020, Fig. 6 (illustrating electrostatic discharge); Ex. 1003 ¶ 47.

As shown in Nishihara, a wire formed around the panel's peripheral edges can protect it from such concerns.



Ex. 1009, Fig. 1A, [0043] (shield electrode 8 for noise reduction); Ex. 1003 ¶ 48; *see also* Ex. 1020, Fig. 3; Matsuo, Fig. 2; Ex. 1015, Fig. 2, [0032]–[0033]; Ex. 1016, Fig. 3, [0030]–[0031].

Because wires used for crack detection and shielding are structurally similar

and functionally compatible, it was known that the same wire can serve both functions. Nakamura, [0041]; Ex. 1003 ¶ 49-51.

V. THE CHALLENGED PATENT AND ITS PROSECUTION HISTORY

A. The Patent

The '762 patent “relates to a technique of facilitating the inspection for signal interconnects [wirings] formed in the region outside detection and display areas for [a] display device.” Ex. 1001, 1:13–16; Ex. 1003 ¶ 53.

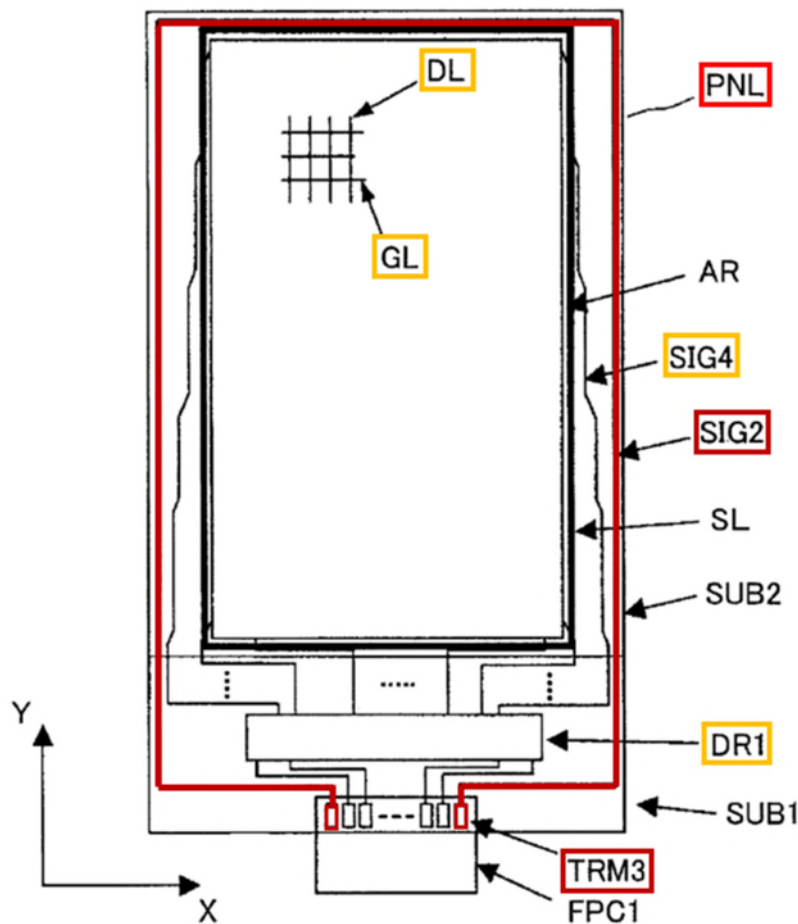
The technique is used in manufacturing. Ex. 1001, 2:30–34. The patent explains that conventional liquid crystal display (“LCD”) panels comprise two substrates sandwiching a liquid-crystal layer. *Id.*, 1:19–24. One substrate comprises transistors and electrodes. *Id.* The other comprises color filters. *Id.* During manufacturing, liquid crystals are placed between the two substrates, which are then sealed together. *Id.*, 1:25–30. The sealed glass substrate is cut to form individual LCD panels. *Id.*, 1:30–31. A touch panel can be attached to the display panel to form a touch screen. *Id.*, 1:37–42. Conventional touch panels comprise detection electrodes. *Id.*, 1:43–47. Both display and touch panels comprise interconnects. *Id.*, 1:31–50; Ex. 1003 ¶¶ 52-53. When display- or touch-panel substrates are cut to form individual panels, some interconnects may be inadvertently cut due to substrate chipping or cracking. Ex. 1001, 1:31–36, 1:47–50; Ex. 1003 ¶ 54.

The '762 patent describes a prior-art technique to address this panel-cracking

problem and its inefficiency. Ex. 1001, 1:51–60, 2:24–27. It also describes the difficulty of visual inspection to detect broken interconnects and asserts the need for a “simple inspection method.” *Id.*, 2:7–23. The allegedly inventive technique purports to “simply determine pass/failure of signal interconnects for chipping or cracking of a substrate without increas[ing]” manufacturing complexity. *Id.*, 2:30–34; Ex. 1003 ¶¶ 54-55.

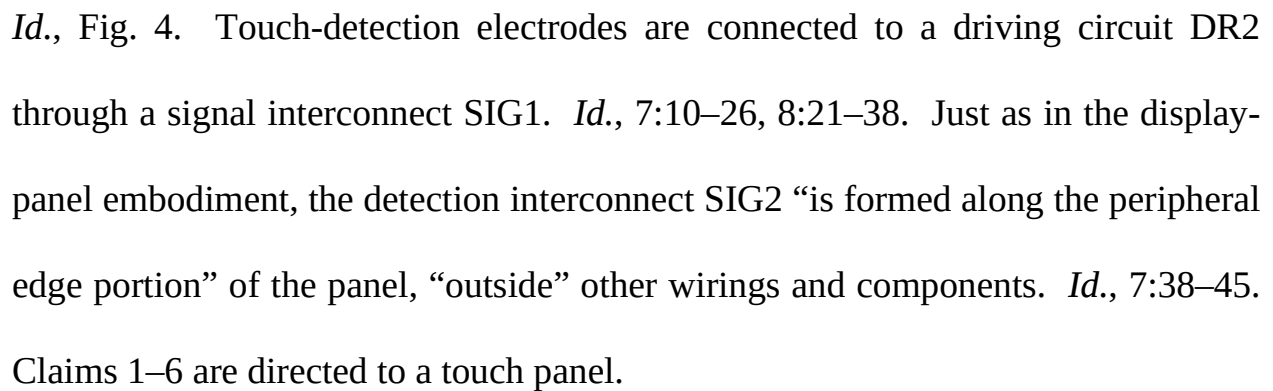
The technique disclosed in the ’762 patent uses an additional detection interconnect disposed around the edges of a substrate. *See, e.g.*, Ex. 1001, 2:53–60, 3:19–27. Electrode terminals are formed at the two ends of this interconnect to allow inspection. *Id.*, 2:58–60, 3:23–25. A break in the interconnect may be detected by measuring the resistance across the two electrodes. *Id.*, 9:8–15; Ex. 1003 ¶¶ 54-55.

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



Ex. 1001, Fig. 9. The drain lines DL and gate lines GL are connected to a driving circuit DR1 through a signal interconnect SIG4. *Id.*, 15:7–10. The detection interconnect SIG2 “is formed along the peripheral edge portion” of the panel, “surround[ing]” other wirings and components. *Id.*, 15:18–58. Claims 7–12 are directed to a display panel.

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



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B. Prosecution History

The Examiner rejected the application leading to the '762 patent under §103(a). Ex. 1002, 209–12. Specifically, the Examiner rejected all pending claims over U.S. Patent No. 7,034,442 (“Hirayama”) in view of U.S. Patent Nos. 7,167,154 (“Sato”) and 6,262,579 (“Chazan”). In response, Applicant amended claim 1 requiring the detection interconnect be “disposed along the peripheral edge of three sides of the transparent substrate.” Ex. 1002, 223–24. Applicant similarly amended independent claim 7 to require the detection interconnect on “three sides” of the substrate. *Id.*, 224–25. The Examiner allowed the amended claims. *Id.*, 241–50. After the Notice of Allowance issued, Applicant submitted an additional Information Disclosure Statement with a copy of Nakamura in Japanese. *Id.*, 261–62, 308–23; Ex. 1003 ¶¶ 56–59.

C. Claim Construction

The Board construes claims under *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (*en banc*) and its progeny. Under *Phillips*, 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 the controversy. *See, e.g., Toyota Motor Corp. v. Cellport Sys., Inc.*, IPR2015-00633, Paper 11 at 16 (PTAB Aug. 14, 2015).

Petitioner does not believe any claim construction is necessary and applies the

plain and ordinary meanings of all claim terms. Ex. 1003 ¶ 60.

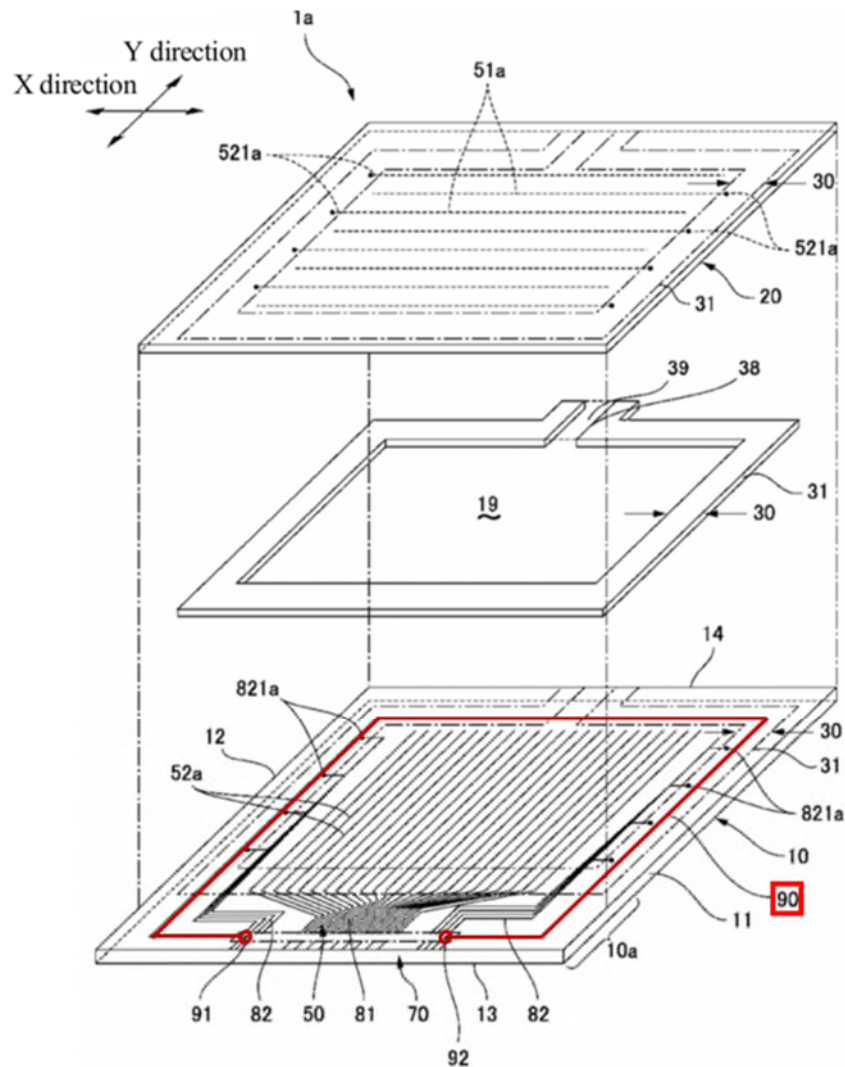
VI. LEVEL OF ORDINARY SKILL IN THE ART

A POSITA in the technology described in the '762 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 display devices having touch panels. Relevant experience can substitute for education and vice versa. Ex. 1003 ¶¶ 34-35.

VII. THE PRIOR ART

A. Miyagawa

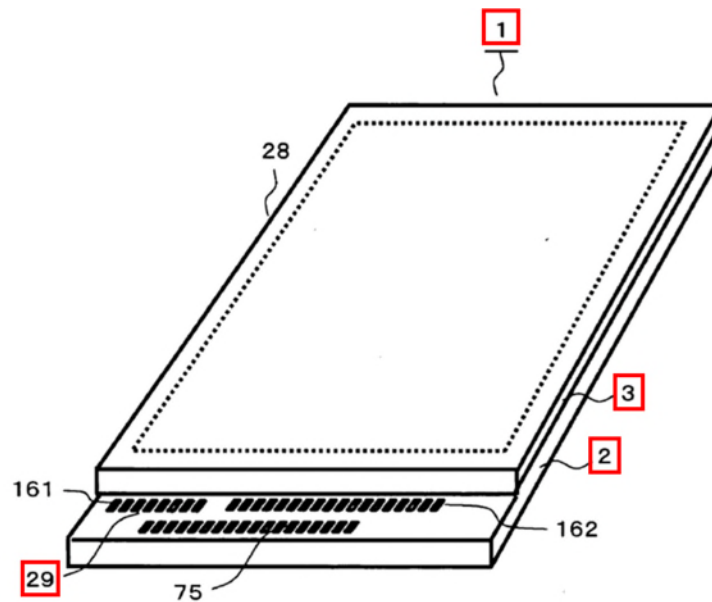
Miyagawa discloses LCD displays “capable of properly diagnosing a defect caused by a substrate crack even at a mid-manufacturing stage....” Miyagawa, Abstract. Specifically, Miyagawa discloses a diagnostic wiring that, when cracked, becomes electrically discontinuous. *Id.* The diagnostic wiring is placed on the peripheries of a display-panel substrate:



Id., Fig. 3; Ex. 1003 ¶¶ 61-62.

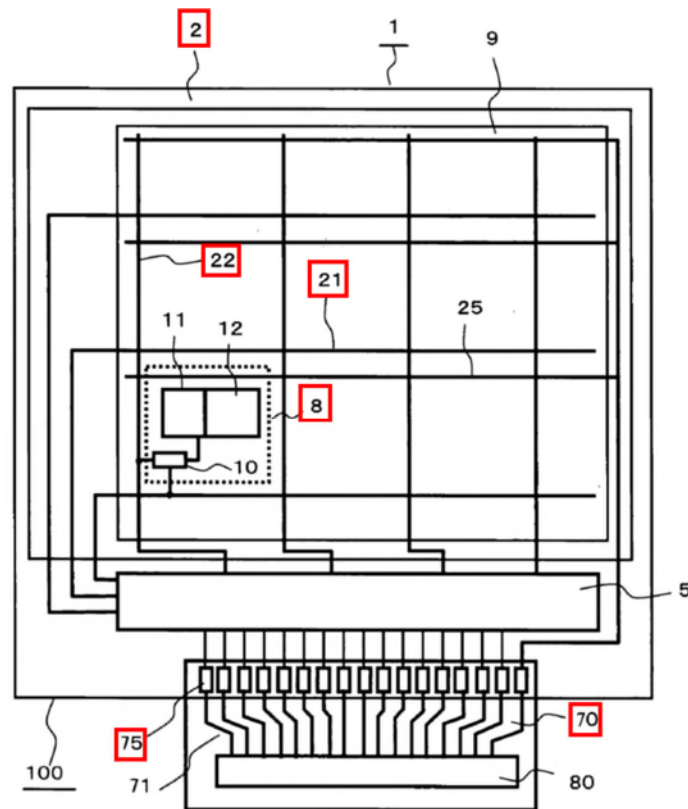
B. Tanabe

Tanabe discloses LCD displays with improved structural uniformity. Tanabe, [0023]–[0024]. Tanabe’s LCD display 1 comprises a TFT (thin film transistor) substrate 2 beneath an opposing substrate 3. The TFT substrate extends longer on one side, creating a terminal connection portion 29 on the bottom:



Id., Fig. 2, [0059]; Ex. 1003 ¶¶ 63-64.

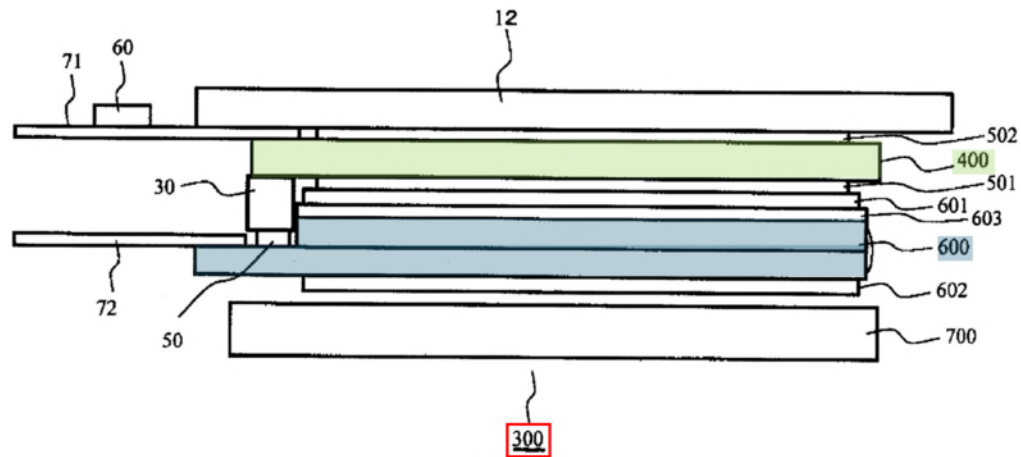
On the TFT substrate 2 are “gate signal lines (also called scan lines) 21” and “drain signal lines (also called video signal lines) 22.” Tanabe, [0056], [0058]. These lines carry signals to pixel portions 8. *Id.*, [0056].



Id., Fig. 1. Signals travel through a flexible substrate 70 to the TFT substrate via terminals 75. *Id.*, [0054]; Ex. 1003 ¶¶ 65-66.

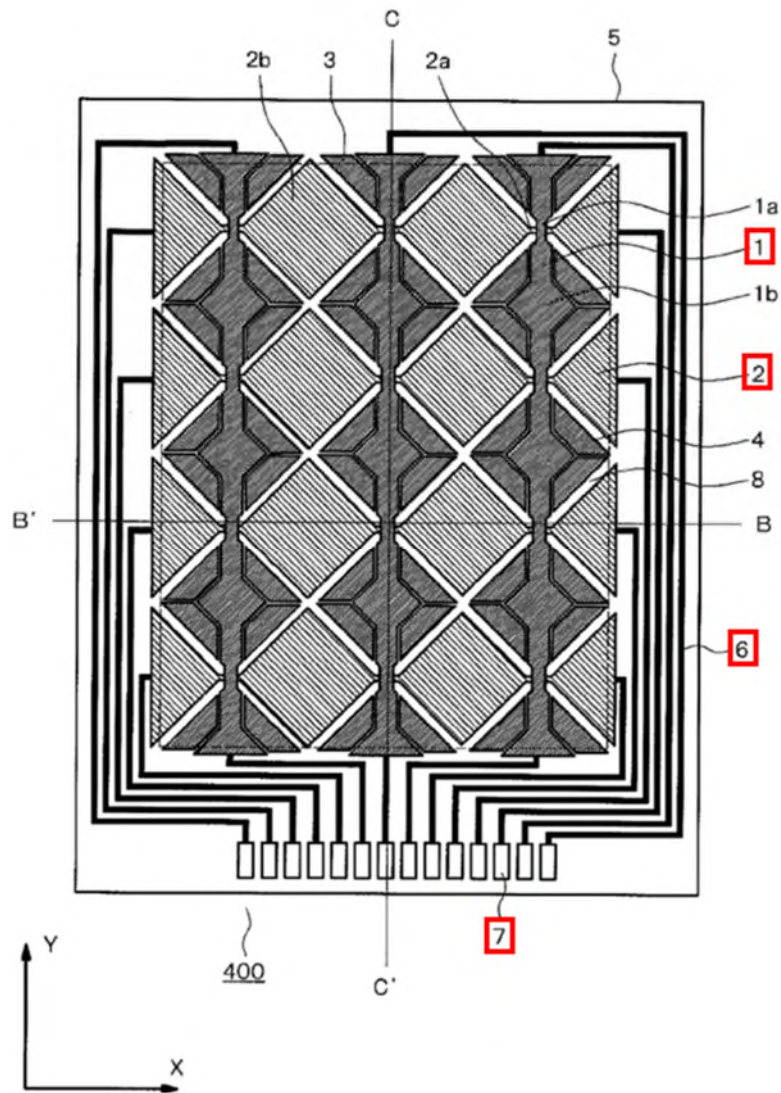
C. Anno '704

Anno '704, an uncited reference from the '762 inventor, discloses a touch display. Anno '704, Abstract. The touch display 300 comprises a touch panel 400 stacked on top of an LCD panel 600. *Id.*, [0048].



Id., Fig. 2; Ex. 1003 ¶¶ 67-68.

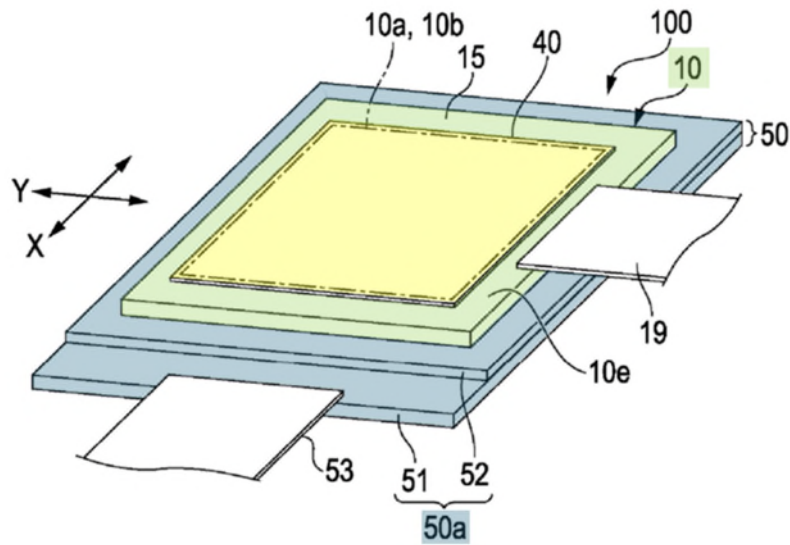
The touch panel comprises electrodes 1–2 coupled to connection terminals 7 through wiring lines 6 formed on an outer periphery of the substrate. Anno '704, [0059]–[0061]; *id.*, [0079] (peripheral wiring lines 6).



Id., Fig. 3; Ex. 1003 ¶ 69.

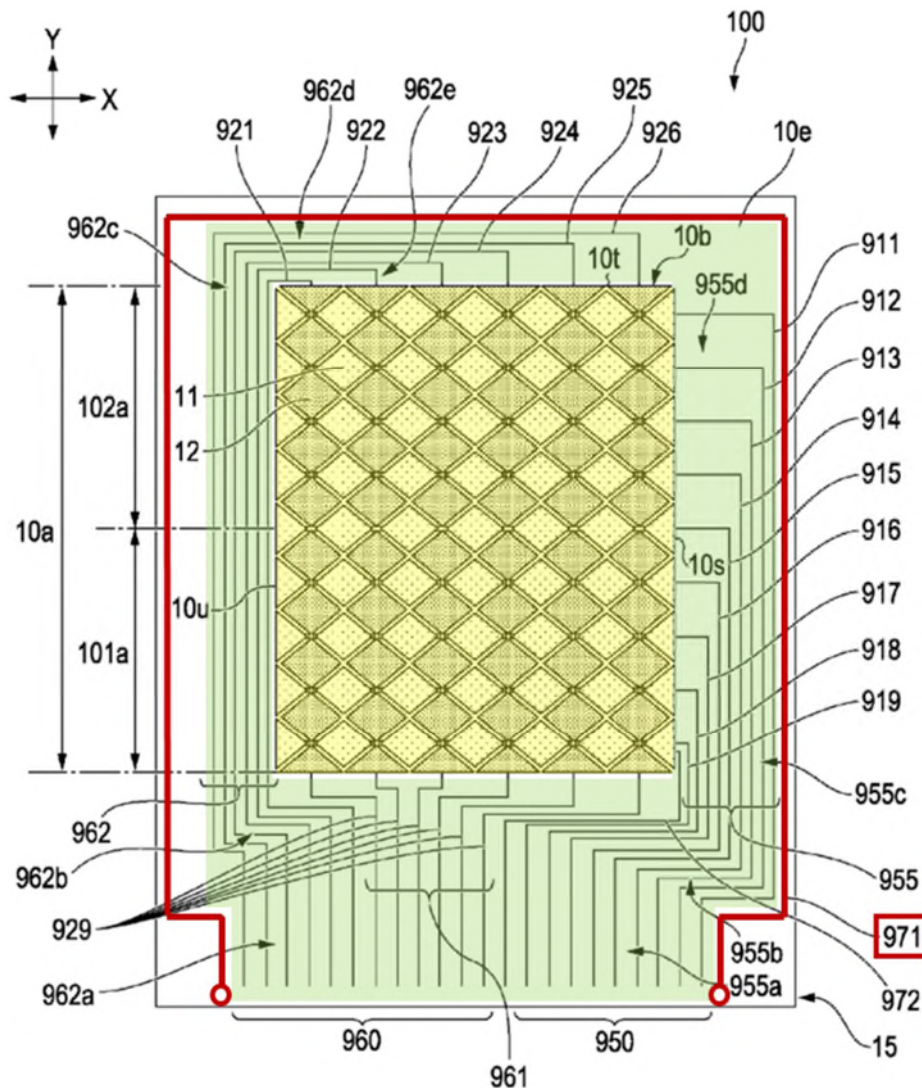
D. Matsuo

Matsuo also discloses a touchscreen device comprising a touch panel stacked on top of a display panel. Matsuo, [0038].



Id., Fig. 1; Ex. 1003 ¶¶ 70-71.

The touch panel has an auxiliary wiring on its peripherals. Matsuo, [0054]–[0056].



Id., Fig. 2. The auxiliary wiring shields the panel from external noise from degrading the touch-detection sensitivity. *Id.*, [0056], [0077]; Ex. 1003 ¶¶ 72-73.

E. Nakamura

Nakamura discloses LCD displays comprising a defective line detection pattern “disposed on the peripheral edge of a panel substrate [that] can be inspected prior to the mounting of an IC chip.” Nakamura, Abstract. Damages to functional

Nakamura further discloses that the defective line detection pattern, *i.e.*, a panel-crack-detection line, “may be formed using a conventional shield line.” *Id.*, [0041]; Ex. 1003 ¶¶ 74-76.

VIII. THE CHALLENGED '762 PATENT CLAIMS ARE UNPATENTABLE OVER THE PRIOR ART

A. GROUND 1: Miyagawa Renders Obvious Claims 7–10 and 12

1. Independent Claim 7

a) 7[pre]

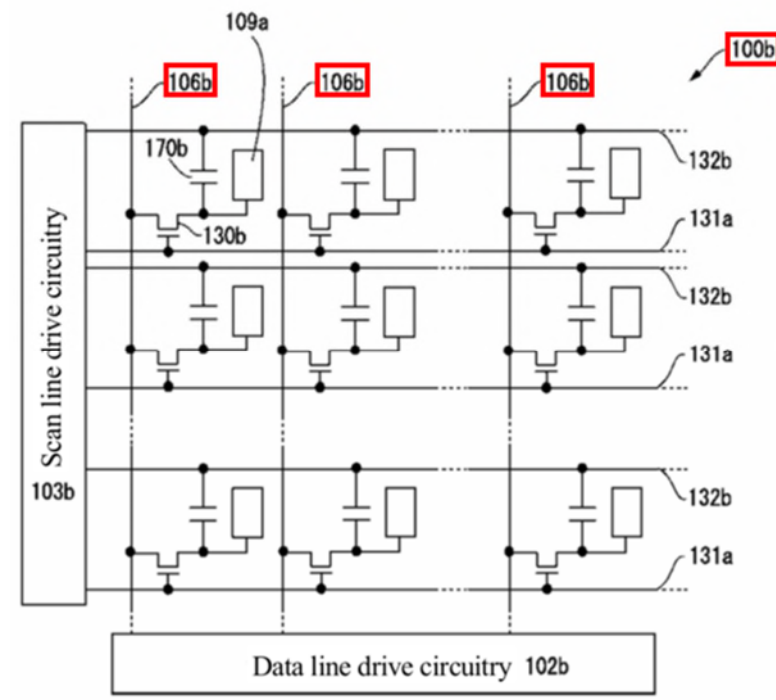
Miyagawa discloses *a display device* (electro-optical device 100b).²

Miyagawa discloses an electro-optical device that may be used in “direct-view display devices and projection type display devices.” Miyagawa, [0012]. Such devices include “an active matrix type liquid crystal device using a thin film transistor (TFT)....” *Id.* [0042]–[0043]; Ex. 1003 ¶¶ 80-81.

b) 7[a.1]

Miyagawa discloses *a transparent substrate* (TFT array substrate) *formed with a plurality of video signal lines* (data lines 106b).

² *Red italics* denote verbatim claim language covered in the present limitation-by-limitation section.



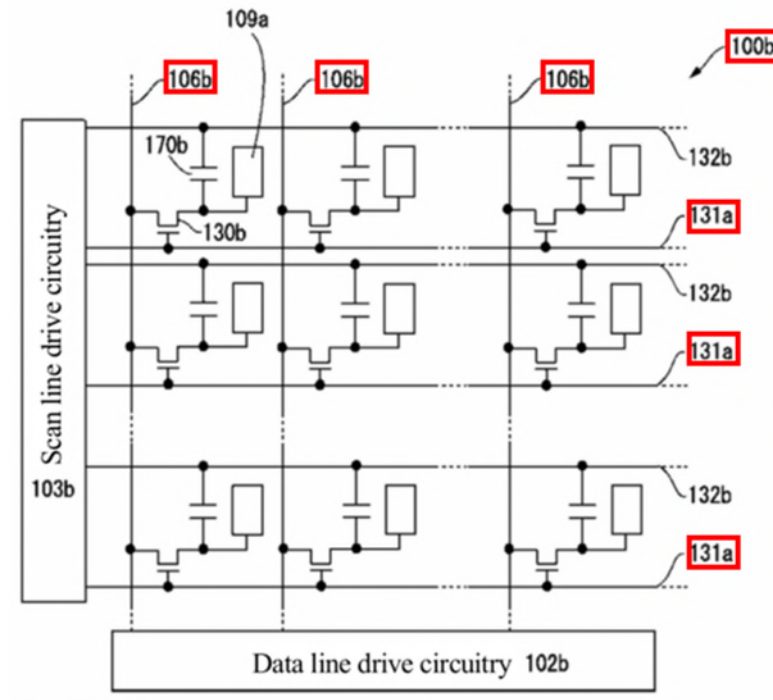
Miyagawa, Fig. 6. The data lines receive image signals and are formed on the TFT array substrate. *Id.*, [0043]–[0044]. Like the substrates of embodiment 1, the TFT array substrates are transparent to permit backlighting to shine through the liquid crystal disposed above the TFT array substrate. *See id.*, [0044], [0017]; *see also id.*, [0020] (backlighting); Ex. 1001, 5:36–40 (“well known glass substrate”); Ex. 1003 ¶¶ 82–85.

c) 7[a.2]

Miyagawa discloses *a transparent substrate* (TFT array substrate) *formed with³ ... a plurality of scanning signal lines* (scan lines 131b) *intersecting the video*

³ *Blue italics* show claim limitations first recited in a prior claim limitation.

signal lines (data lines 106b).



Miyagawa, Fig. 6.⁴ Both the scan lines 131b and the data lines 106b are formed on the TFT array substrate and intersect. *Id.*, [0044], Fig. 6; Ex. 1003 ¶¶ 86-89.

d) 7[a.3]

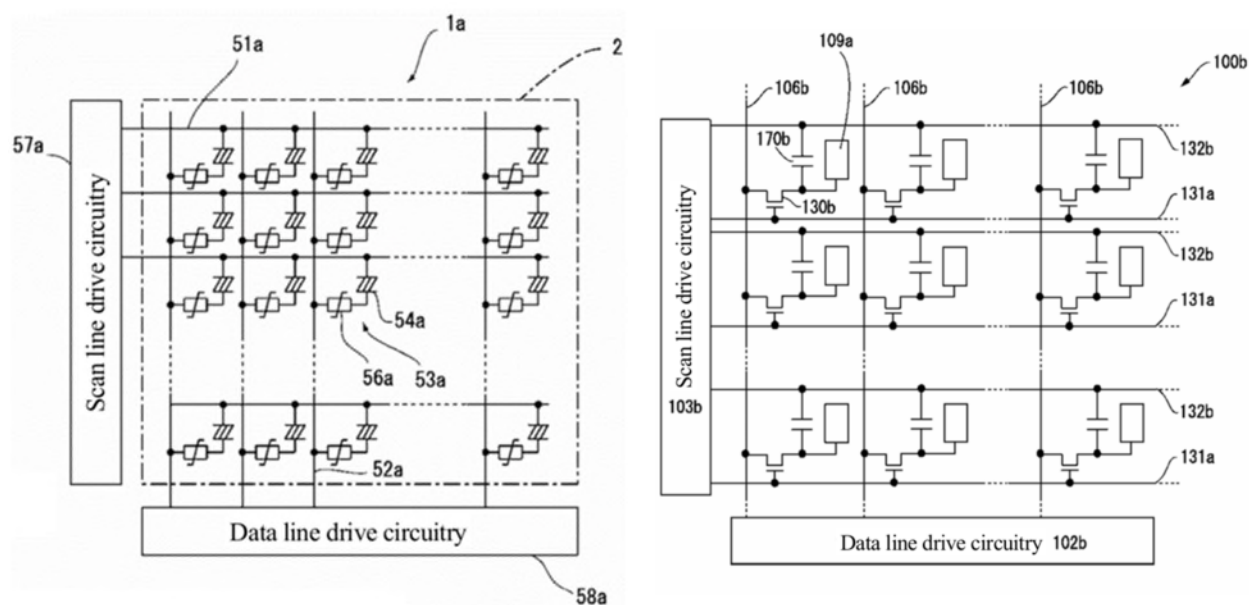
Miyagawa discloses or renders obvious *a transparent substrate* (TFT array substrate) *formed with ... electrode terminals* (pads) *receiving a driving signal and a control signal from the video signal lines* (data lines 106b), *the scanning signal lines* (scan lines 131b), *and an external system* (electronic apparatus body).

Displays receive signals from a driving circuit supplying signals to drive the

⁴ Scan line is labeled 131a in Figure 6 versus 131b in the specification.

display elements, *i.e.*, the pixels. *See, e.g.*, Ex. 1001, 1:38–43, 4:48–49. Image data or control signals are received via electrode terminals from an external system connected to a flexible substrate (*e.g.*, a ribbon cable), which is in turn connected to the transparent substrate. *Id.*, 14:62–15:16. Connections to an external system (*e.g.*, a memory or a communication device coupled to the display) are the common approach to allow a display to show the myriad video, interactive user interface, and data provided by their host devices. *Id.*, 4:11–14 (“well-known...”); Ex. 1003 ¶¶ 90-92.

Miyagawa discloses that its invention can be “applied to the electro-optical device ... [depicted in] FIG. 6....” Miyagawa, [0041]. Figure 6 “is a block diagram schematically illustrating a configuration of an electro-optical device composed of an active matrix type liquid crystal device using a thin film transistor (TFT) as a pixel switching element.” *Id.* [0042]. Figure 1, on which Miyagawa’s embodiment 1 is based, is an analogous “block diagram schematically illustrating a configuration of an electro-optical device composed of an active matrix type liquid crystal device using a TFD [thin film diode] element as a pixel switching element.” *Id.*, [0014].



Id., Figs. 1, 6; Ex. 1003 ¶ 93. A POSITA would have understood Miyagawa's embodiment 1 directly applies to devices with TFT as shown in Figure 6, except that the conventional substrates are configured for TFT devices. *See* Miyagawa, [0043]–[0044]; Ex. 1003 ¶ 94; *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.”).

Miyagawa's data-line drive circuit and scan-line drive circuit supply signals to data lines and scan lines, respectively. Miyagawa, [0043]. For the reason just explained, a POSITA would have understood that the drive circuits derive these signals from input signals received from an external system. Ex. 1003 ¶¶ 95-96. Consistent with that understanding, Miyagawa discloses a flexible substrate 7 “for connecting to an electronic apparatus body” and mounted in the substrate mounting

region 70 in the context of an image signal. Miyagawa, [0020]; *see also id.*, [0043] (image signal and source voltage). The electronic apparatus body (*i.e.*, a host system) supplies image signals, which are delivered via the flexible substrate, the drive circuits, and the data and scanning signal lines to display images. *Id.*, [0043]; Ex. 1003 ¶¶ 95-96.

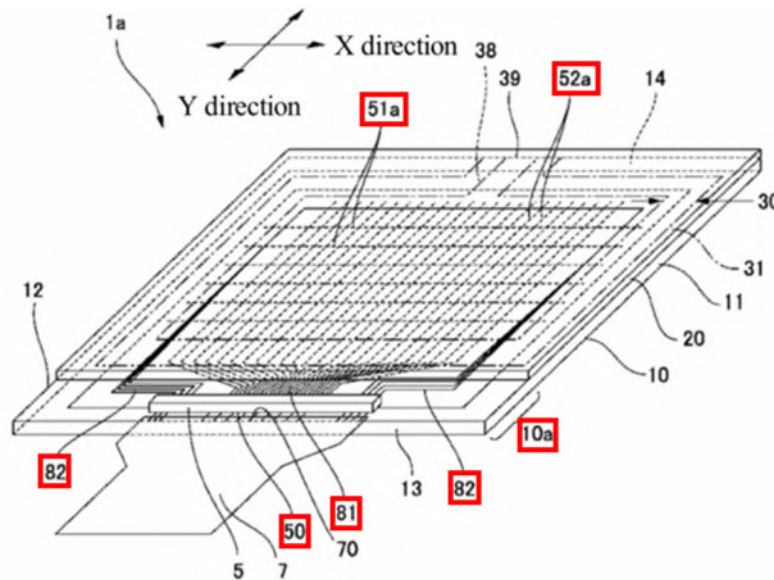
Miyagawa further discloses that the drive circuits may be placed on the transparent substrate (*e.g.*, element substrate 10 or TFT array substrate) or on the flexible substrate. *Id.*, [0040]. In either configuration, there are pads on both substrates connecting the two to transfer signals, and the pads (*i.e.*, electrodes/terminals) on the TFT array substrate receive signals from the electronic apparatus body. Either configuration was common and merely a design choice. Ex. 1003 ¶ 97.

e) 7[a.4]

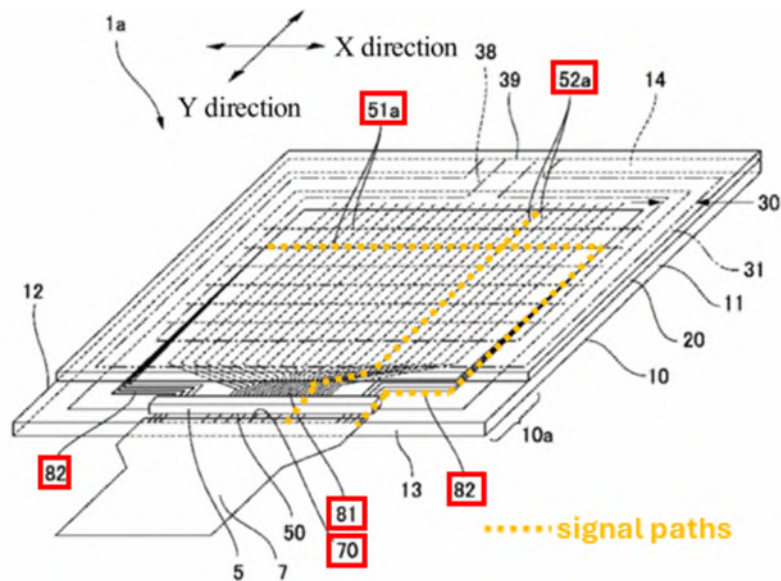
Miyagawa discloses or renders obvious *a transparent substrate* (TFT array substrate) *formed with ... a third signal interconnect* (wiring patterns 81–82) *connecting the video signal lines* (data lines 106b) *and the scanning signal lines* (scan lines 131b) *with the electrode terminals* (pads).

“Connect” as used in the ’762 patent includes direct and indirect connection. *See, e.g.*, Ex. 1001, 4:60–61 (direct); 6:33–39, 7:22–26 (indirect); Ex. 1003 ¶¶ 98–100.

Miyagawa's substrates have wiring patterns 81–82 connected to the data lines 52a/106b and scan lines 51a/131b, respectively. Miyagawa, [0018], [0043]; Ex. 1003 ¶¶ 100-101.



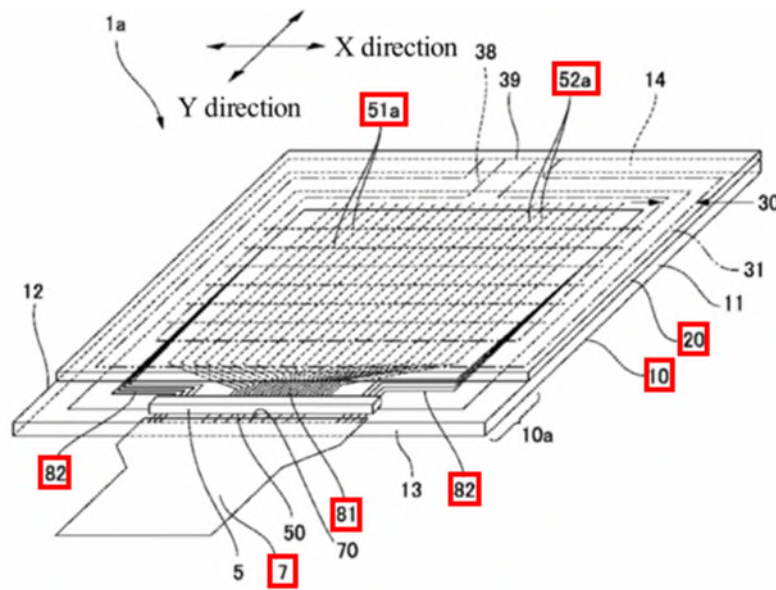
Miyagawa, Fig. 2. The wiring patterns 81–82 terminate in the overhang region 10a where they directly or indirectly connect to pads coupled to matching pads on the flexible substrate. These pads may either be coupled to a driving IC in the IC mounting region 50, or directly to pads in the substrate mounting region and coupled to a driving IC on the flexible substrate. *Id.*, [0040]. In both configurations, the wiring patterns 81–82 are coupled to the pads in the overhang region 10a, allowing image signals from the electronic apparatus to reach the display via the flexible substrate and the pads:



Id., Fig. 2; Ex. 1003 ¶ 102.

f) 7[b]

Miyagawa discloses or renders obvious *a flexible interconnect substrate* (flexible substrate 7) *connected to the first transparent substrate* (TFT array substrate), *the flexible interconnect substrate used for supplying the driving signal to the video signal lines* (data lines 106b) *and the scanning signal lines* (scan lines 131b) *by way of the electrode terminals* (pads) *and the third signal interconnect* (wiring patterns 81–82).



Miyagawa, Fig. 2; Ex. 1003 ¶¶ 103-104.

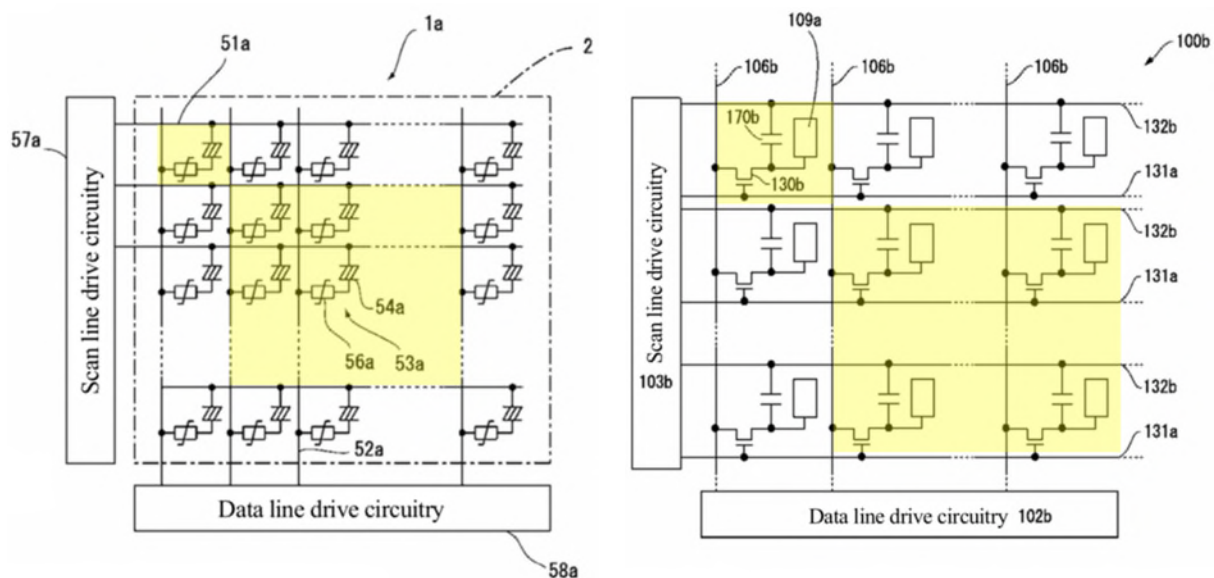
Miyagawa discloses “a flexible substrate 7 ... mounted in ... the substrate mounting region 70.” Miyagawa, [0020]; *see also id.*, [0040]. The flexible substrate connects to an electronic apparatus body, which supplies driving signals to form images. *Supra* § VIII.A.1.d. The signal path from the pads (coupled to the flexible substrate), through the wiring patterns 81–82, to the data and scan lines 106b/52a and 131b/51a is shown above. *Supra* § VIII.A.1.e. Thus, a connection path is formed between the electronic apparatus body, the flexible substrate, the pads, the wiring patterns 81–82, and the data and scan lines. Ex. 1003 ¶ 105.

g) 7[c]

Miyagawa discloses *a region surrounded by the video signal lines* (data lines 106b) *and the scanning signal lines* (scan lines 131b) *being a pixel area* (pixel

matrix).

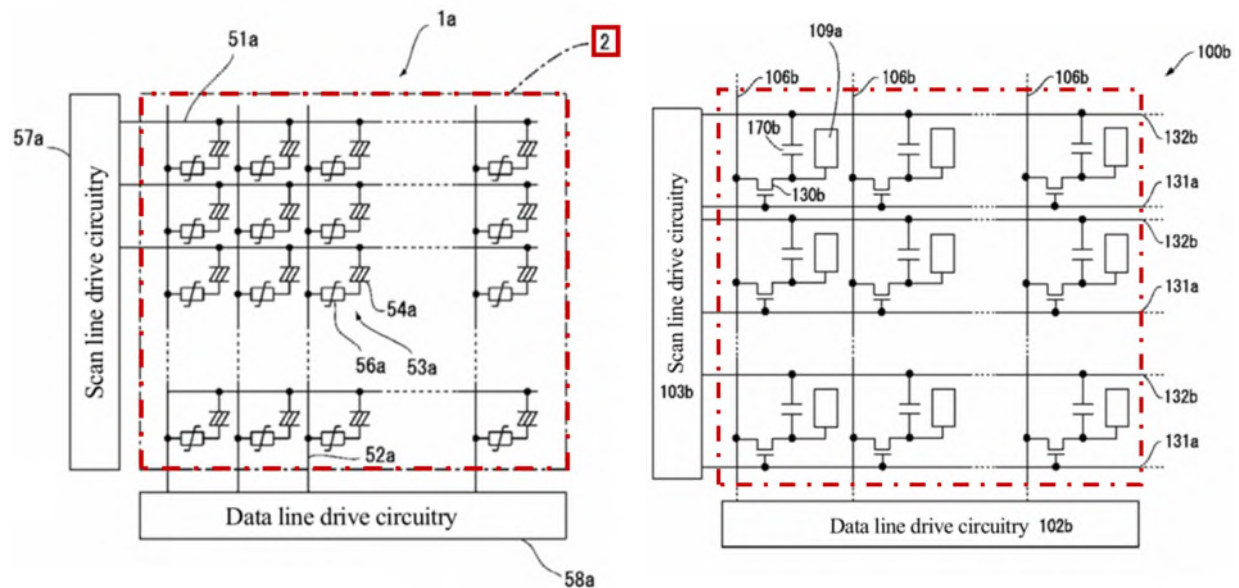
Like the TFD substrate of embodiment 1, Miyagawa's TFT array substrate comprises "a plurality of pixels formed in a matrix." Miyagawa, [0015], [0043]. The electro-optical device comprises an image display region 2 including a plurality of pixels, each of which is surrounded by video signal lines and scanning signal lines. Miyagawa, [0015], *see also id.*, Fig. 6. The area occupied by one, multiple, or all pixels may constitute the claimed pixel area. Exemplary pixel areas are highlighted below:



Id., Figs. 1, 6; Ex. 1003 ¶¶ 106-109.

h) 7[d]

Miyagawa discloses *a region where the pixels* (pixels 53a) *are formed in a matrix being a display area* (image display region 2).

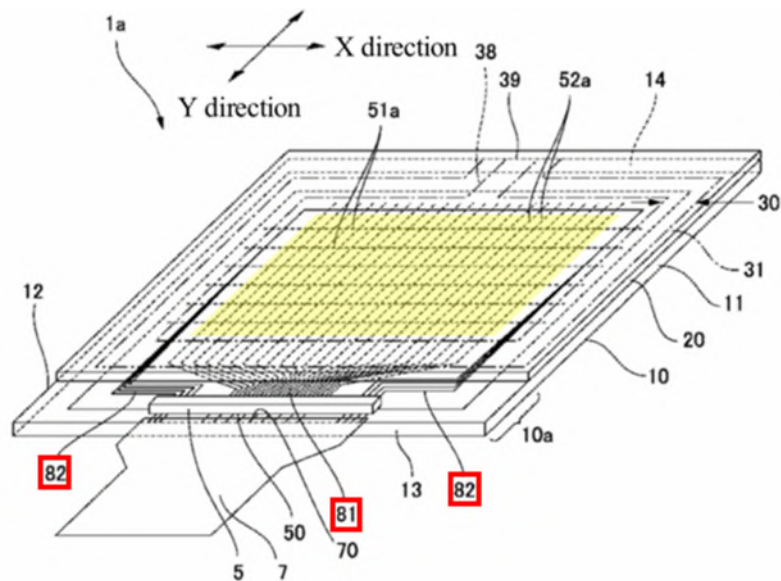


Miyagawa, Figs. 1, 6; *see also supra* § VIII.A.1.g. Ex. 1003 ¶¶ 110-111.

i) 7[e]

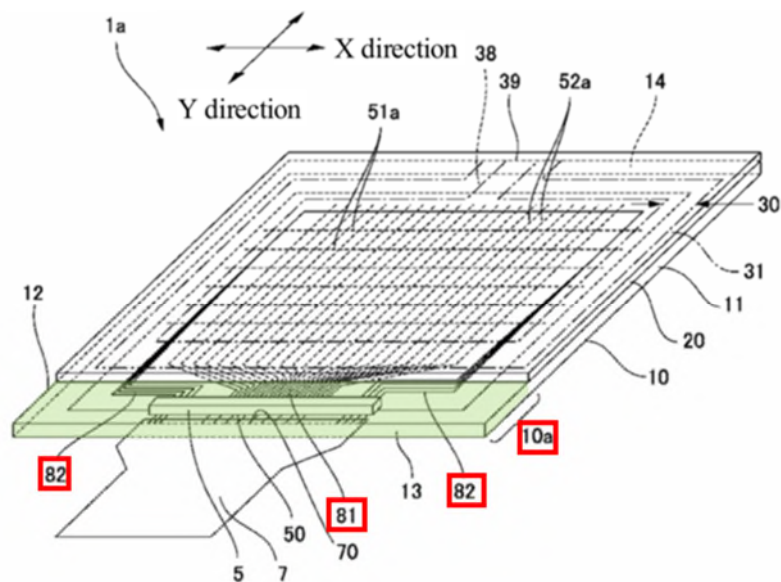
Miyagawa discloses or renders obvious *the third signal interconnect* (wiring patterns 81–82) *being formed in a region outside the display area* (image display region 2).

Pixels are formed where data lines and scan lines intersect in the image display region, forming pixels in a matrix. Miyagawa, [0015].



Id., Fig. 2. It is readily observed that the wiring patterns 81–82 are formed outside the image display region. *See also id.*, [0014]; Ex. 1003 ¶¶ 112–115.

Additionally, the wiring patterns 81–82 are formed in the overhang region 10a. Miyagawa, [0018]. The overhang region is outside the display area:

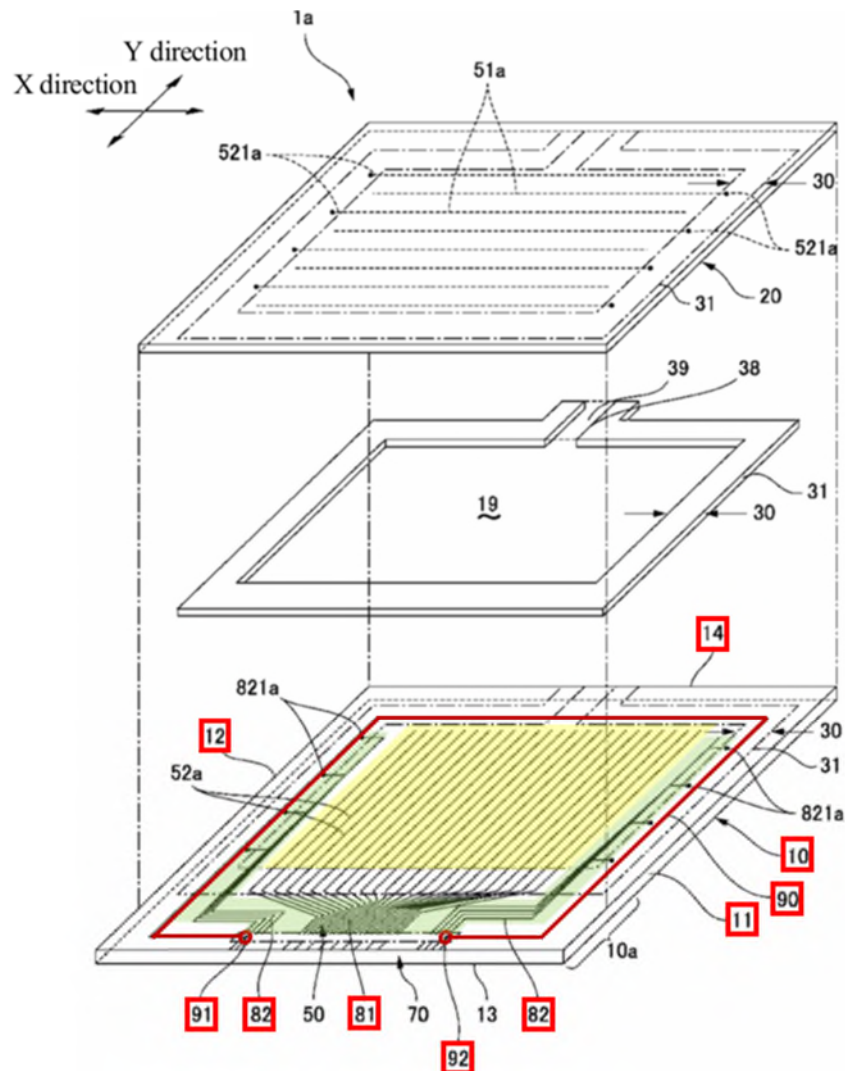


Id., Fig. 2; Ex. 1003 ¶ 116.

j) 7[f]

Miyagawa discloses or renders obvious *a fourth signal interconnect* (diagnostic wiring 90) *disposed outside the third signal interconnect* (wiring patterns 81–82) *but near the peripheral edge* (sides 11, 12 and 14) *of the transparent substrate* (TFT array substrate), *the fourth signal interconnect surrounding the area where the display area* (image display region 2) *is included and the third signal interconnect* (wiring patterns 81–82) *is formed, the fourth signal interconnect* (diagnostic wiring 90) *being opened at opposite ends thereof and being connected to respective electrode terminals* (first and second diagnostic pads 91–92) *for inspection at the open ends*. Ex. 1003, ¶¶ 117-118.

Miyagawa discloses the diagnostic wiring to “diagnos[e] as to whether a substrate crack has occurred....” Miyagawa, Abstract; *id.*, [0027], [0030], [0044]. The diagnostic wiring 90 is located near the edges of the element substrate 10 (or TFT array substrate) to detect cracks:



Id., Fig. 3; Ex. 1003 ¶ 119. As shown in the figure, the diagnostic wiring (in dark red) is disposed outside the wiring patterns 81–82 (light green), near the edges of the substrate. It surrounds the area where the image display region (light yellow) and where the wiring patterns 81–82 are formed. Miyagawa, Abstract, [0024]–[0025], [0031], [0044]; Ex. 1003 ¶ 120.

The diagnostic wiring surrounds three sides of the substrate but is open at the bottom in the overhang region 10a. Miyagawa, [0024]. Its ends are connected to

the diagnostic pads 91–92 (shown as dark red circles in annotated Figure 3). *Id.*, Abstract, [0006]–[0007], [0023]–[0024]; Ex. 1003 ¶ 121.

The diagnostic pads 91–92 are used for “inspect[ion],” *i.e.*, by testing whether they are “electrically continuous.” Miyagawa, [0007]. If a crack occurs on the substrate resulting in a cut in the diagnostic wiring, the two pads would become electrically disconnected. *Id.* Inspection may be performed in two ways. It may be performed by probing the diagnostic pads to perform an electrical continuity check. *Id.*, [0028]. This can be done after the substrate is divided from a large mother substrate or after two complementary substrates are bonded. *Id.* This can occur before components are populated on the substrate to reduce component waste. *Id.*, [0004], [0028], [0030]. Second, inspection may be done by coupling two pins (“bumps” in Miyagawa) of the driving IC to the pads and performing a continuity check using the IC’s substrate crack diagnostic unit. *Id.*, [0011], [0026], [0029]. As noted, the IC may be located on the flexible substrate. *Id.*, [0040]. In that configuration, the diagnostic pads are coupled to the IC via the flexible substrate. Ex. 1003 ¶¶ 122–123.

These descriptions apply equally to the TFD and TFT-array embodiments. Miyagawa, [0041]. Importantly, the substrate crack diagnostic wiring is disposed in the outer periphery of the TFT-array substrate in the same way as in the TFD embodiment. *Id.*, [0044]. This enables “effective[] diagnos[is]” of “cracking of the

TFT array substrate,” in the same way as in the TDF array substrate. *Id.*; Ex. 1003 ¶ 124.

k) 7[g]

Miyagawa at least renders obvious a display device *wherein the fourth signal interconnect* (diagnostic wiring 90) *is formed of a conductive thin film disposed along the peripheral edge portion of three sides of the transparent substrate* (TFT array substrate).

As shown above, the diagnostic wiring is disposed along the peripheral edges on three sides of the substrate. *Supra* § VIII.A.1.j; Miyagawa, [0024]. The wiring “is a conductive film formed simultaneously with data lines 51a [sic, 52a/106b]⁵, a TFD element, a pixel electrode, or the like.” Miyagawa, [0024]. In the TFT embodiment, thin-film transistors replace thin-film diodes as the pixel switching elements. *Id.*, [0014], [0042]. Since the diagnostic wiring is a film formed simultaneously with thin-film components, the wiring is formed of a thin film as well, or it would at least have been obvious to do so. Ex. 1003 ¶¶ 125-127.

2. Claim 8

Miyagawa renders obvious *a display device according to claim 7* as shown above. Miyagawa also renders obvious *wherein the fourth signal interconnect*

⁵ All other occurrences of data lines in this embodiment are designated 52a.

(diagnostic wiring 90) *has a colored thin film layer or a thin film layer having a transmittance at a predetermined level or less.*

Miyagawa discloses a diagnostic wiring formed of a conductive thin film. *Supra* § VIII.A.1.k. The diagnostic wiring “is a conductive film formed simultaneously with data lines 51a [sic, 52a/106b]....” Miyagawa, [0024]. Since the diagnostic wiring and data lines are formed simultaneously, it would have been obvious to use the same material and the same process to form both. “[T]he data lines ... [are] composed of a plurality of chrome lines or the like....” *Id.*, [0017]. Therefore, it would have been obvious to use chrome for the diagnostic wiring. At a thickness to form signal lines, chrome is not transparent, *i.e.*, it has a transmittance value at a predetermined level or less. Ex. 1003 ¶¶ 128-132.

3. Claim 9

Miyagawa renders obvious *a display device according to claim 7, wherein the fourth signal interconnect* (diagnostic wiring 90) *has a thin metal film layer.*

Miyagawa renders obvious a display device according to claim 7 as explained above, including that the diagnostic wiring is formed of a conductive thin film. Thus, claim 9 merely adds that this thin film comprises a metal.

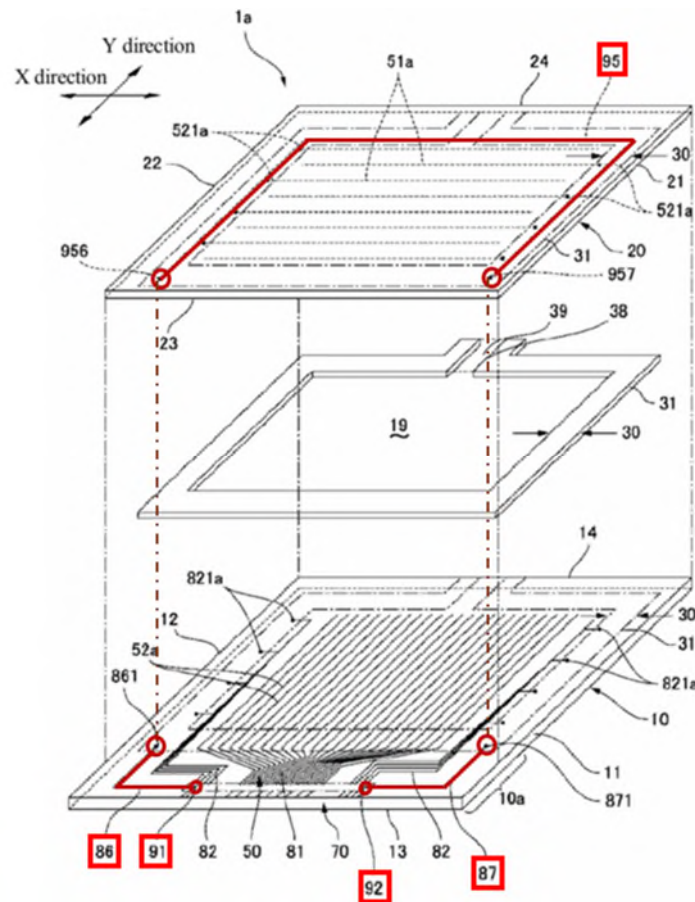
It would have been obvious to use chrome, a metal, to form the diagnostic wiring. *Supra* § VIII.A.2. Ex. 1003 ¶¶ 133-137.

4. Claim 10

Miyagawa renders obvious *a display device according to claim 7, wherein the fourth signal interconnect* (diagnostic wiring 95, first wirings 86, and second wiring 87) *is formed of two or more conductive thin films*.

Miyagawa renders obvious a display device according to claim 7 as explained above, including that the diagnostic wiring is formed of a conductive thin film. Thus, claim 10 merely adds that the diagnostic wiring is formed of at least two layers of the conductive thin film. Ex. 1001, 8:12–15 (describing a detection interconnect formed of two or more thin films or layers); Ex. 1003 ¶¶ 138-141.

Miyagawa discloses a second embodiment in which a diagnostic wiring 95 is formed on the opposing substrate 20 and is coupled through two segments of wirings 86 and 87 on the element substrate 10 to the diagnostic pads. Miyagawa, [0037]–[0039]; Ex. 1003 ¶ 142.



Miyagawa, Fig. 5 (broken lines visualizing coupling in this exploded view). This embodiment “is otherwise the same as that in [the] embodiment” described above with respect to claim 7 and therefore satisfies claim 7 in the same way. *Id.*, [0039]; [0034]–[0036]¶ 1. This embodiment is useful to detect cracks in the opposing substrate. *Id.*; Ex. 1003 ¶ 143.

Miyagawa further discloses another configuration in which the multi-layer configuration is reversed, *i.e.*, “a substrate crack diagnostic wiring is formed on the element substrate 10 and a diagnostic pad is formed on the opposing substrate 20....” *Id.*, [0040]. This configuration is suitable for the TFT embodiment to detect cracks

in the TFT array substrate. In either configuration, the diagnostic wiring 95 and second wirings 86 and 87 are formed of two conductive thin films or layers, one on the TFT array substrate and the other on the opposing substrate. *See id.*, [0043]–[0044]. Forming signal lines with multiple films such as ITO, chrome, titanium, and aluminum was a well-known practice. Ex. 1003 ¶¶144-145.

5. Claim 12

Miyagawa renders obvious *a display device according to claim 7, wherein the flexible interconnect substrate* (flexible substrate 7) *has electrode terminals connected to the fourth signal interconnect* (diagnostic wiring 90) *at a position different from that of the region forming the electrode terminal connected with the external system* (electronic apparatus body).

In Miyagawa's configuration where the driving IC is placed on the flexible substrate, the flexible substrate has electrode terminals coupled to the first and second diagnostic pads in the region where the flexible substrate overlaps the substrate mounting region. *See Miyagawa*, [0040]. Further, it was common and routine to couple the flexible substrate to an external system via electrode terminals on the opposite end. Such a configuration satisfies claim 12. Ex. 1003 ¶¶146-150.

**B. GROUND 2: Tanabe in View of Miyagawa Renders Obvious
Claims 7–10 and 12**

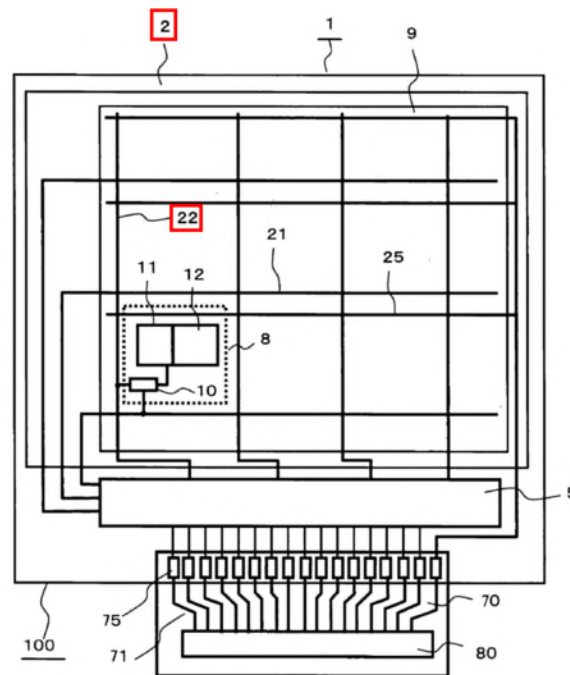
1. Independent Claim 7

a) 7[pre]

Tanabe discloses *a display device*, “a liquid crystal display device.” Tanabe, [0054]; Ex. 1003 ¶ 152.

b) 7[a.1]

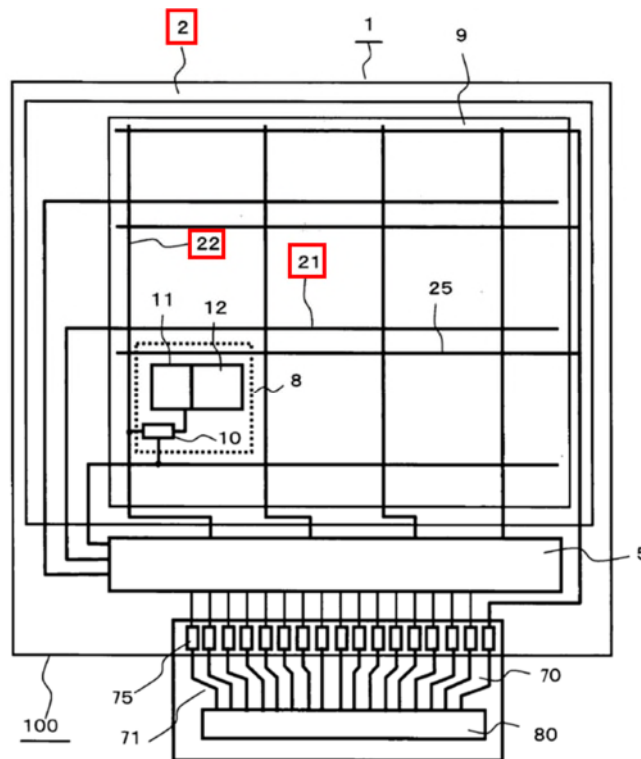
Tanabe discloses *a transparent substrate* (TFT substrate 2) *formed with a plurality of video signal lines* (drain signal lines 22).



Tanabe, Fig. 1. The TFT substrate “is formed from transparent glass or resin.” *Id.*, [0073]. The drain signal lines are formed on the TFT substrate. *Id.*, [0058]. They are “also called video signal lines.” *Id.*, [0056]; Ex. 1003 ¶¶ 153-155.

c) 7[a.2]

Tanabe discloses *a transparent substrate* (TFT substrate 2) *formed with ... a plurality of scanning signal lines* (gate signal lines 21) *intersecting the video signal lines* (drain signal lines 22).



Tanabe, Fig. 1. The gate signal lines are formed on the TFT substrate. *Id.*, [0058].

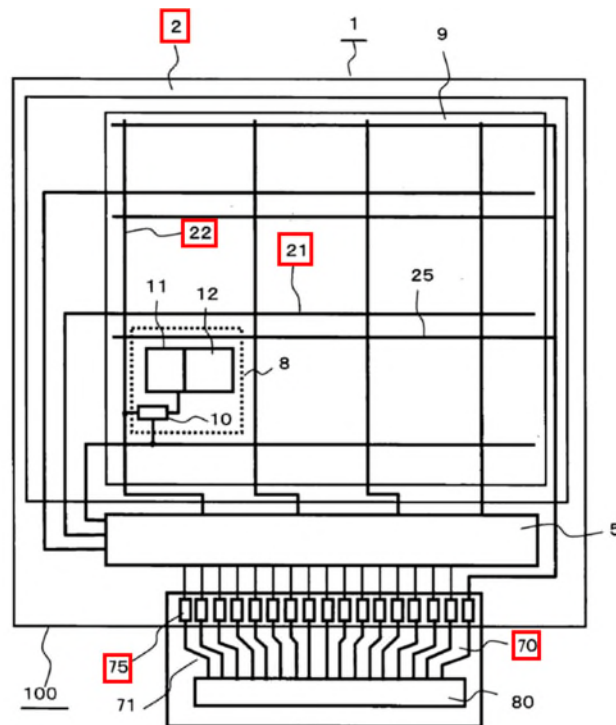
They are “also called scan lines.” *Id.*, [0056]; Ex. 1003 ¶¶ 156-158.

The gate signal lines and the drain signal lines intersect near switching elements 10 in the pixel portions 8. Tanabe, [0056], [0069]; Ex. 1003 ¶ 159.

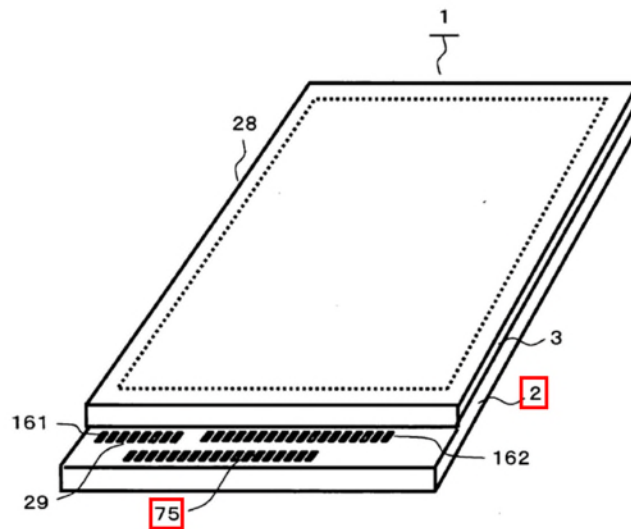
d) 7[a.3]

Tanabe discloses *a transparent substrate* (TFT substrate 2) *formed with ...*

electrode terminals (terminals 75) *receiving a driving signal and a control signal from the video signal lines* (drain signal lines 22), *the scanning signal lines* (gate signal lines 21), *and an external system* (portable device). See *supra* § VIII.A.1.d (explaining the limitation).



Tanabe, Fig. 1. Tanabe’s “flexible substrate 70 is connected to the connection terminals 75.” *Id.*, [0059]. The “FPC [Flexible Printed Circuit] connection terminals 75 are disposed on the terminal connection portion 29” of the TFT substrate 2. *Id.*; Ex. 1003 ¶¶ 160-162.



Id., Fig. 2. Signals driving the display “are transmitted to the liquid crystal panel 1 via ... terminals 75.” *Id.*, [0054]. The signals include “[c]ontrol signals ... supplied from the gate signal lines” and “video signals transmitted via the drain signal lines 22.” *Id.*, [0057]–[0058]; Ex. 1003 ¶ 163.

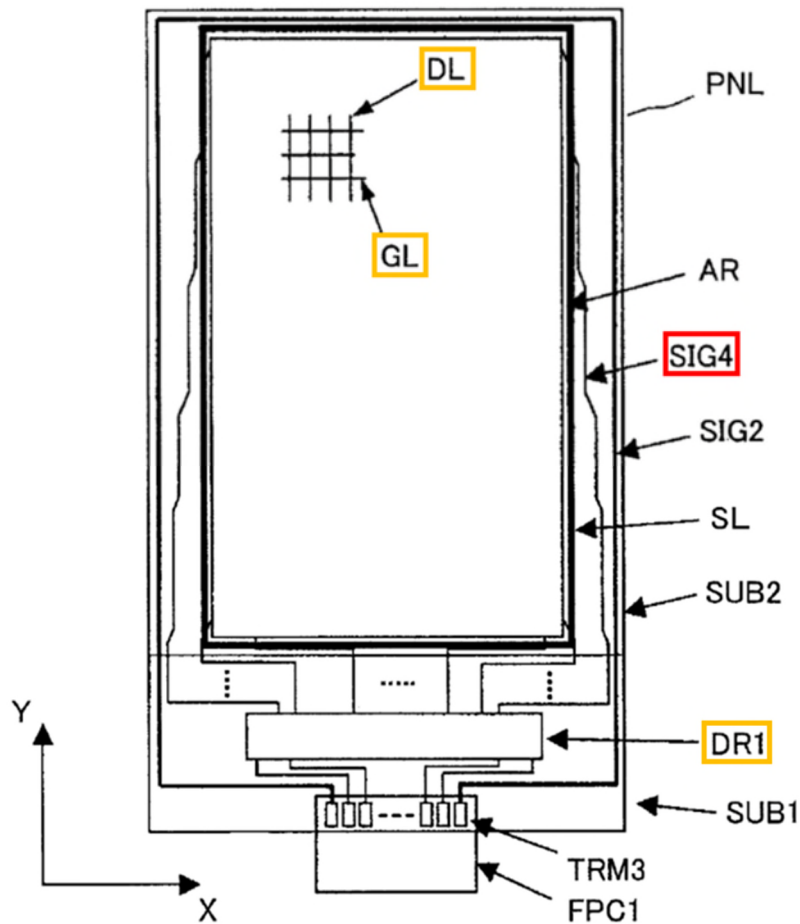
A POSITA would have understood that the flexible substrate is connected to an external system, *e.g.*, a host device such as a portable device, from which displayed images are received. Tanabe, [0004], [0061]; Ex. 1003 ¶164.

e) 7[a.4]

Tanabe discloses *a transparent substrate* (TFT substrate 2) *formed with ... a third signal interconnect* ((unnamed) bus wires extending from gate and drain signal lines) *connecting the video signal lines* (drain signal lines 22) *and the scanning signal lines* (gate signal lines 21) *with the electrode terminals* (terminals 75).

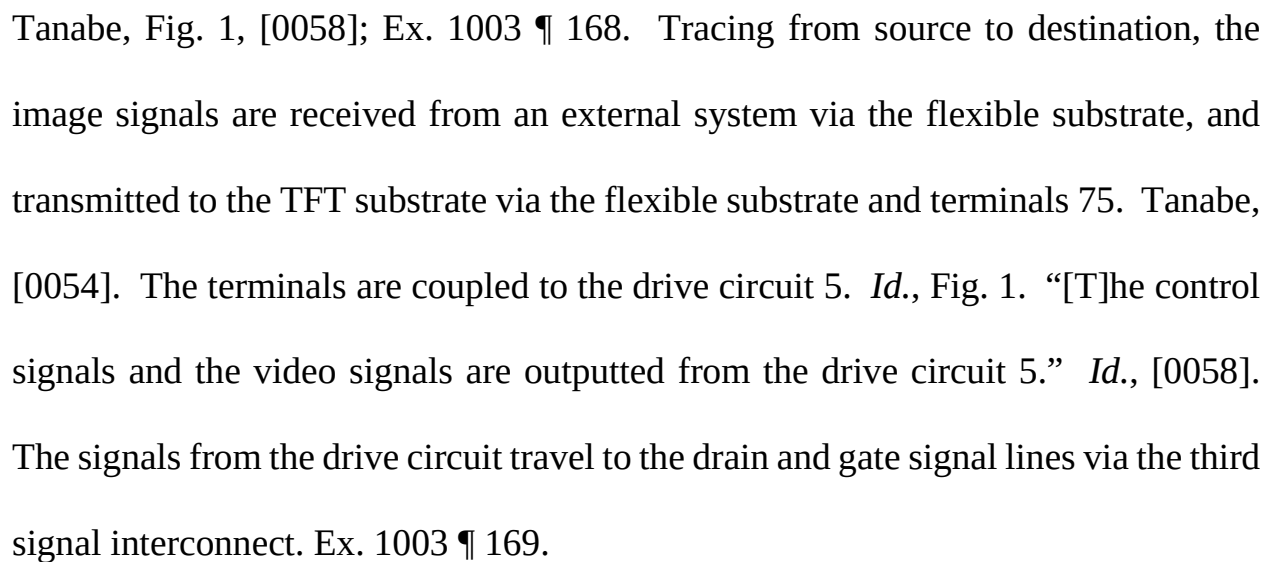
“Connect[ion]” of the ’762 patent may be direct or indirect. *Supra* §

VIII.A.1.e. The third signal interconnect (SIG4) are bus wires connecting the video and scanning signal lines DL and GL to a driving circuit DR1. Ex. 1001, 15:7–16.



Id., Fig. 9; Ex. 1003 ¶¶ 165-167.

Tanabe similarly comprises a signal interconnect (in green shaded areas) on the TFT substrate 2 forming bus wires connecting drain signal lines 22 and gate signal lines 21 with drive circuit 5:



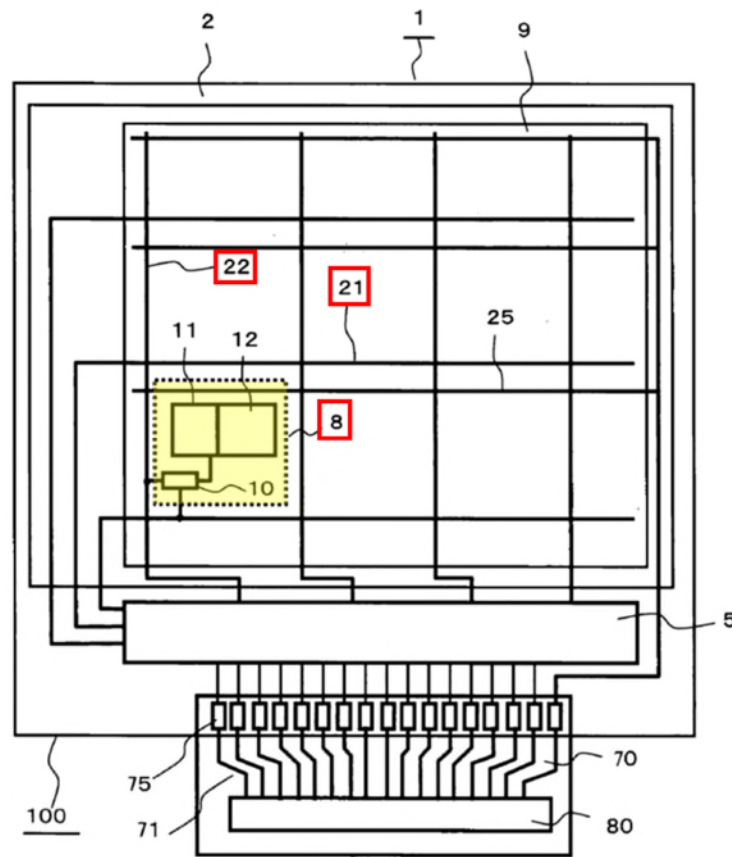
f) 7[b]

Tanabe discloses *a flexible interconnect substrate* (flexible substrate 70) *connected to the first transparent substrate* (TFT substrate 2), *the flexible interconnect substrate used for supplying the driving signal to the video signal lines* (drain signal lines 22) *and the scanning signal lines* (gate signal lines 21) *by way of the electrode terminals* (terminals 75) *and the third signal interconnect* ((unnamed) bus wires extending from gate and drain signal lines).

This is shown above. *Supra* § VIII.B.1.e; Ex. 1003 ¶¶ 170-172.

g) 7[c]

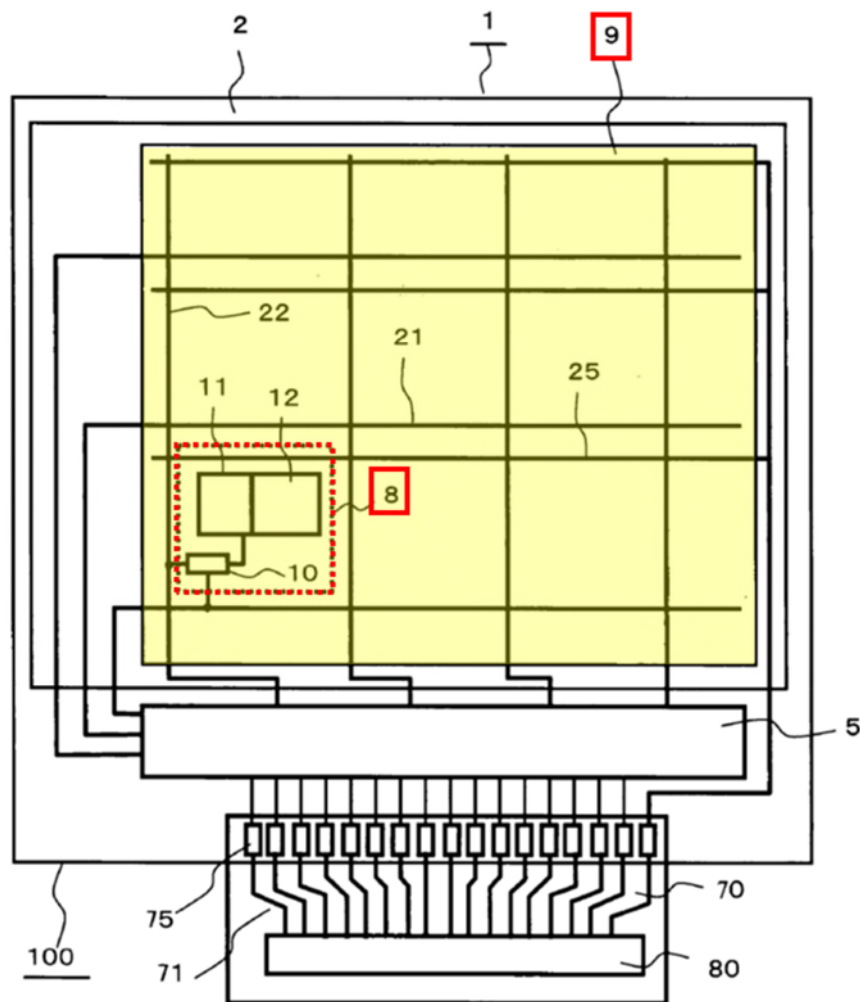
Tanabe discloses *a region surrounded by the video signal lines* (drain signal lines 22) *and the scanning signal lines* (gate signal lines 21) *being a pixel area* (pixel portion 8).



Tanabe, Fig. 1. “The pixel portions 8 are formed in regions surrounded by the gate signal lines 21 and the drain signal lines 22.” *Id.*, [0056]; Ex. 1003 ¶¶ 173-175.

h) 7[d]

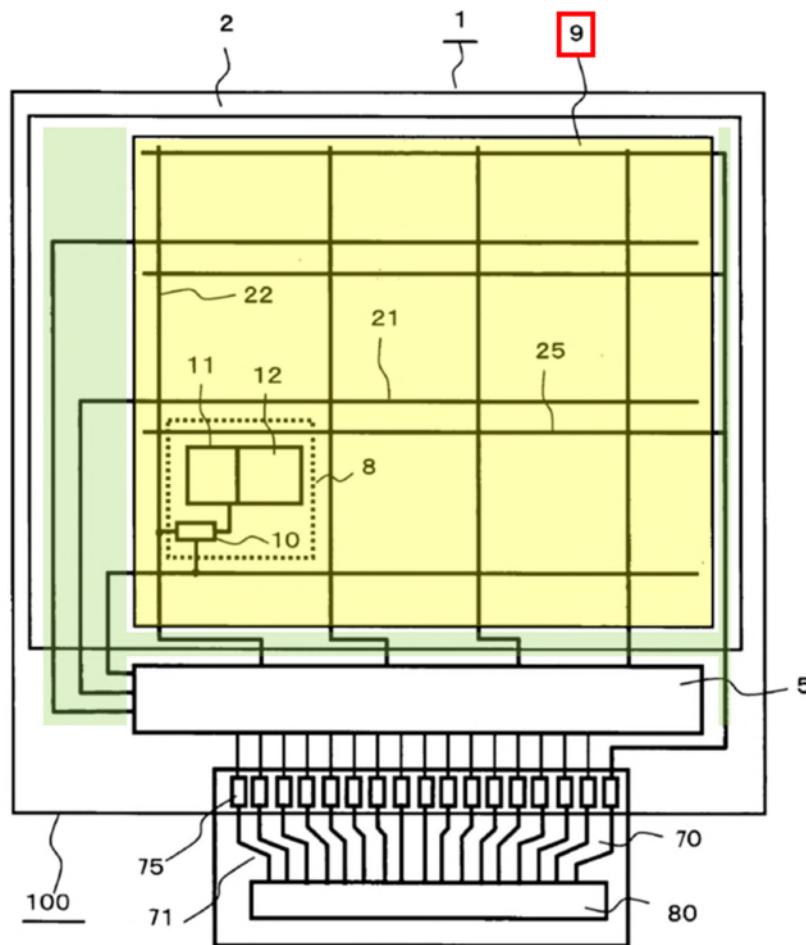
Tanabe discloses *a region where the pixels* (pixel portions 8) *are formed in a matrix being a display area* (display region 9):



Tanabe, Fig. 1. “The pixel portions 8 arranged in a matrix form a display region 9....” *Id.*, [0055]; Ex. 1003 ¶¶ 176-178.

i) 7[e]

Tanabe discloses *the third signal interconnect* ((unnamed) bus wires extending from gate and drain signal lines) *being formed in a region outside the display area* (display region 9):



Tanabe, Fig. 1; Ex. 1003 ¶¶ 179-181.

j) 7[f]

Tanabe in view of Miyagawa renders obvious claim limitation 7[f].

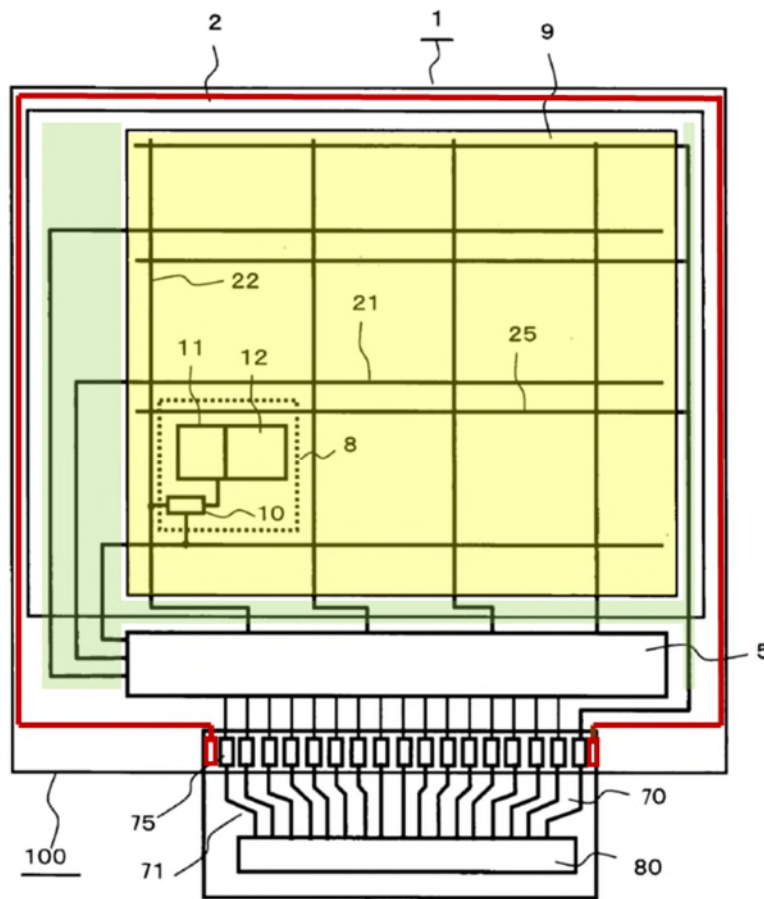
The display device comprises *a fourth signal interconnect* (Miyagawa: diagnostic wiring 90) *disposed outside the third signal interconnect* (Tanabe: (unnamed) bus wires extending from gate and drain signal lines; Miyagawa wiring patterns 81–82) *but near the peripheral edge* (Miyagawa: sides 11, 12 and 14) *of the transparent substrate* (Tanabe: TFT substrate 2; Miyagawa: TFT array substrate),

the fourth signal interconnect surrounding the area where the display area (Tanabe: display region 9, Miyagawa: image display region 2) *is included and the third signal interconnect* (Tanabe: (unnamed) bus wires extending from gate and drain signal lines; Miyagawa: wiring patterns 81–82) *is formed, the fourth signal interconnect* (Miyagawa: diagnostic wiring 90) *being opened at opposite ends thereof and being connected to respective electrode terminals* (Miyagawa: first and second diagnostic pads 91–92) *for inspection at the open ends.*

Preliminarily, apart from allegedly the crack-detection interconnects, the LCD panel was well known. Ex. 1001, 4:11–14. So were Miyagawa’s and Tanabe’s TFT LCD panels. Ex. 1003 ¶¶ 182-184

Miyagawa discloses a diagnostic wiring that satisfies claim limitation 7[f]. *Supra* § VIII.A.1.j; Ex. 1003 ¶ 185.

From Miyagawa, a POSITA would have readily recognized that the crack-detection wire would beneficially improve the manufacturing process of Tanabe to increase production efficiency through early defect detection. Miyagawa, [0028]. A POSITA would have added a crack-detection wire in the substrate periphery to detect cracks. As taught by Miyagawa, a crack-detection wire applied to Tanabe would surround the third signal interconnect and the display area, ending at electrode terminals open for inspection. Ex. 1003 ¶ 185. The combination is illustrated as follows, with an added crack-detection wire:



Tanabe, Fig. 1 (diagnostic wiring and terminals added); Ex. 1003 ¶ 185. It would have been obvious to add Miyagawa's diagnostic wiring to Tanabe's TFT substrate because the diagnostic wiring is used to detect broken signal lines, and Tanabe's signal lines are disposed on the TFT substrate. Ex. 1003 ¶ 186; Miyagawa, [0007], [0031], [0043]–[0044]; *supra* §§ VIII.B.1.b–e. The configuration of the diagnostic wiring on Tanabe's TFT substrate is analogous to that on Miyagawa's TFT array substrate, for the same reasons that Miyagawa designs its configuration. Miyagawa, [0007], [0031], [0043]–[0044]. The configuration additionally accounts for the

routing of common signal lines 25. The combination would have been straightforward and obvious. Ex. 1003 ¶¶186-187. Claim limitations involving the fourth signal interconnect are “rendered obvious by the teachings ... [of Tanabe and Miyagawa] as a whole.” *In re Etter*, 756 F.2d 852, 859 (Fed. Cir. 1985) (*en banc*).

k) 7[g]

Tanabe in view of Miyagawa at least renders obvious a display device *wherein the fourth signal interconnect* (Miyagawa: diagnostic wiring 90) *is formed of a conductive thin film disposed along the peripheral edge portion of three sides of the transparent substrate* (Tanabe: TFT substrate 2; Miyagawa: TFT array substrate).

As shown above, the diagnostic wiring is disposed along the peripheral edges on three sides of the substrate. *Supra* § VIII.B.1.j; Miyagawa, [0024]. Miyagawa’s wiring “is a conductive film formed simultaneously with data lines 51a [sic, 52a/106a], a TFD [or TFT] element, a pixel electrode, or the like.” Miyagawa, [0024]. A POSITA would have recognized the benefits of using the same thin-film process used to construct other wiring to construct the crack-detection wire. Ex. 1003 ¶ 190. For example, it would be more efficient to form the wires simultaneously to avoid unnecessary processing steps. Furthermore, using the same processing for the crack-detection wire as the other wires would make it more likely that any defect would similarly impact them. Because Tanabe also uses thin-film manufacturing (Tanabe, [0069]), a POSITA would have obviously constructed the diagnostic

wiring using a thin film formed simultaneously with other thin film structures, such as the bus lines, on the device. Ex. 1003 ¶¶ 188-191.

2. Claim 8

Tanabe in view of Miyagawa renders obvious *a display device according to claim 7, wherein the fourth signal interconnect* (Miyagawa: diagnostic wiring 90) *has a colored thin film layer or a thin film layer having a transmittance at a predetermined level or less.*

Tanabe discloses forming multilayer gate and drain signal lines. Tanabe, [0073]–[0074]. One layer can comprise chrome and another layer comprises aluminum. *Id.* Tanabe further teaches using the same materials for different components in the same layer. *Id.*, [0076], [0086]. A POSITA would have understood this to be an efficient manufacturing process. Ex. 1003 ¶ 195. Similarly, Miyagawa discloses simultaneously forming various components including the diagnostic wiring. Miyagawa, [0024]. Further, Miyagawa can also use chrome to form its signal lines. *Id.*, [0017]. Tanabe’s and Miyagawa’s similar and compatible disclosures render it obvious to use chrome for the diagnostic wiring in the combination. Ex. 1003 ¶¶ 192-195.

At a thickness to form signal lines, chrome is not transparent, *i.e.*, it has a transmittance value at a predetermined level or less. *Id.* ¶ 196.

3. Claim 9

Tanabe in view of Miyagawa renders obvious *a display device according to claim 7, wherein the fourth signal interconnect* (Miyagawa: diagnostic wiring 90) *has a thin metal film layer*.

Claim 9 merely adds that the fourth signal interconnect comprises a metal. *Supra* § VIII.A.3; Ex. 1003 ¶¶ 197-200.

Chrome, a metal, would have been an obvious choice for the diagnostic wiring. *Supra* § VIII.B.2; Ex. 1003 ¶ 201.

4. Claim 10

Tanabe in view of Miyagawa renders obvious *a display device according to claim 7, wherein the fourth signal interconnect* (Miyagawa: diagnostic wiring 90) *is formed of two or more conductive thin films*.

Claim 10 merely adds that the diagnostic wiring is formed of at least two layers of the conductive thin film. *Supra* § VIII.A.4; Ex. 1003 ¶¶ 202-205.

Tanabe and Miyagawa include analogous teachings regarding the formation of signal lines. *Supra* § VIII.B.2. Further, Tanabe discloses multilayer signal lines. Tanabe, [0073]–[0074]. Thus, in the combination, it would have been obvious to form a multilayer diagnostic wiring simultaneously with Tanabe’s gate or drain signal lines. Per Tanabe, one layer comprises chrome and another layer comprises aluminum. *Id.* Both metals are conductive. Ex. 1003 ¶¶ 206-207.

5. Claim 12

Tanabe in view of Miyagawa renders obvious *a display device according to claim 7, wherein the flexible interconnect substrate* (Tanabe: flexible substrate 70) *has electrode terminals connected to the fourth signal interconnect* (Miyagawa: diagnostic wiring 90) *at a position different from that of the region forming the electrode terminal connected with the external system.*

Tanabe in view of Miyagawa renders obvious claim 12 for reasons already explained. *Supra* §§ VIII.A.5; VIII.B.1.d. Coupling the diagnostic wiring directly to the flexible substrate is compatible with Tanabe's configuration because diagnostic wiring is routed on Tanabe's TFT substrate directly to the electrode terminals coupled to the flexible substrate. *Supra* § VIII.B.1.j; Ex. 1003 ¶¶ 208-211.

6. Motivation to Combine

A POSITA would have been motivated to add Miyagawa's diagnostic wiring to Tanabe's LCD panel. Ex. 1003 ¶¶ 151, 212.

Recognizing that defects occur in display manufacturing, Tanabe discloses an inspection scheme for gate and drain electrodes in the pixel region. Tanabe, [0061]–[0065]. Consistent with that recognition, it was well known that display-panel manufacturing involves cutting a mother substrate into individual substrates, which process can create cracks in the substrate. *Supra* § IV. Miyagawa teaches that such a crack creates a risk of broken signal lines. Miyagawa, [0003]. Miyagawa discloses

a solution for diagnosing substrate cracks, 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 stage of manufacturing that may cause them reduces wasting components that otherwise would be installed on defective substrates. *Id.*, [0004], [0028], [0030]. Increased manufacturing efficiency and reduced waste would have provided a POSITA ample motivation to add a diagnostic wiring, especially because Tanabe already recognizes the importance of inspecting display substrates for defects. Ex. 1003 ¶¶ 213-214. Further, substrates made from glass like Tanabe’s were known to be brittle, rendering obvious that Miyagawa’s benefits apply to Tanabe. *Id.*

This addition merely involves adding another thin-film wire on Tanabe’s TFT substrate. Doing so would have been well within the skill of a POSITA because it merely involves surrounding the panel with a thin-film conductor in a form similar to Miyagawa’s diagnostic wiring. See Ex. 1014, Fig. 4; Ex. 1017, Fig. 9, [0043] (disclosing a conventional trace of the same form for panel-crack detection); Ex. 1003 ¶¶ 214-215. Further, this addition would have been simple because the diagnostic wiring is isolated from other circuits and components, and thus its addition does not involve the complexity that may result from interconnected components.

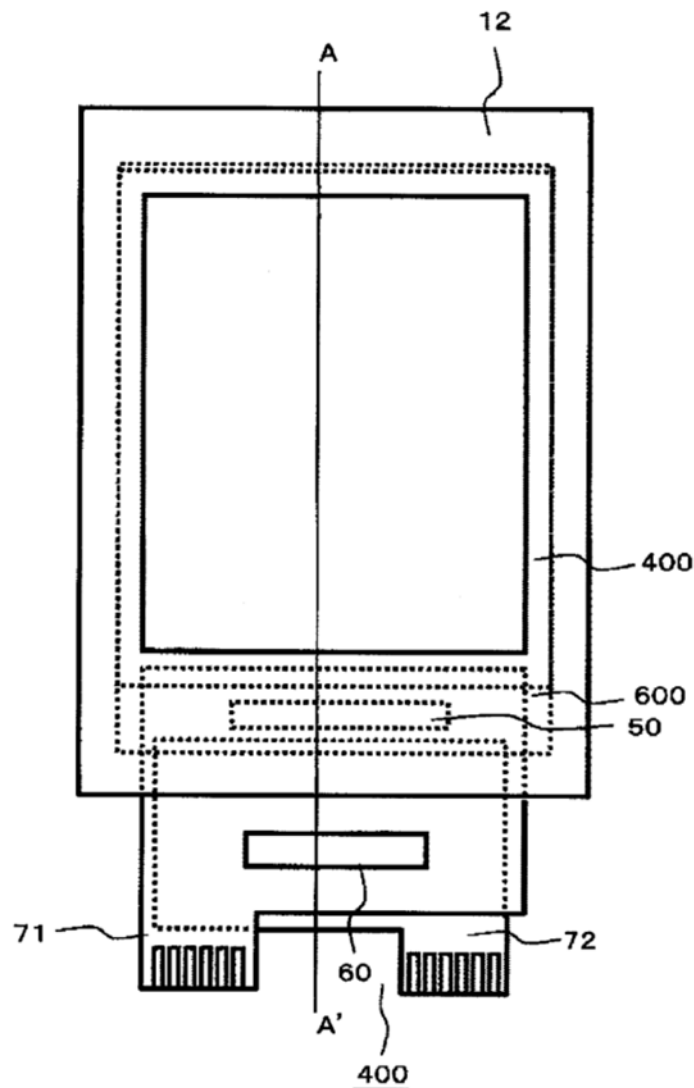
For the same reason that this combination involves a simple addition, a POSITA would have had a reasonable expectation of success. Tanabe and Miyagawa both disclose TFT LCDs with analogous components and designs. Adding a diagnostic wiring to Tanabe's substrate based on Miyagawa involves nothing more than applying a known technique for a similar improvement in the same way it does in Miyagawa, yielding predictable results. Indeed, the '762 patent acknowledges the LCD devices of its embodiments were "well-known." Ex. 1001, 4:11–14. So were Tanabe's and Miyagawa's. Ex. 1003 ¶216; *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.").

C. GROUND 3: Anno '704 in View of Miyagawa Renders Claims 1–4 and 6 Obvious

1. Independent Claim 1

a) 1[pre]

Anno '704 discloses *a display device* (display device 300 with a touch panel 400).

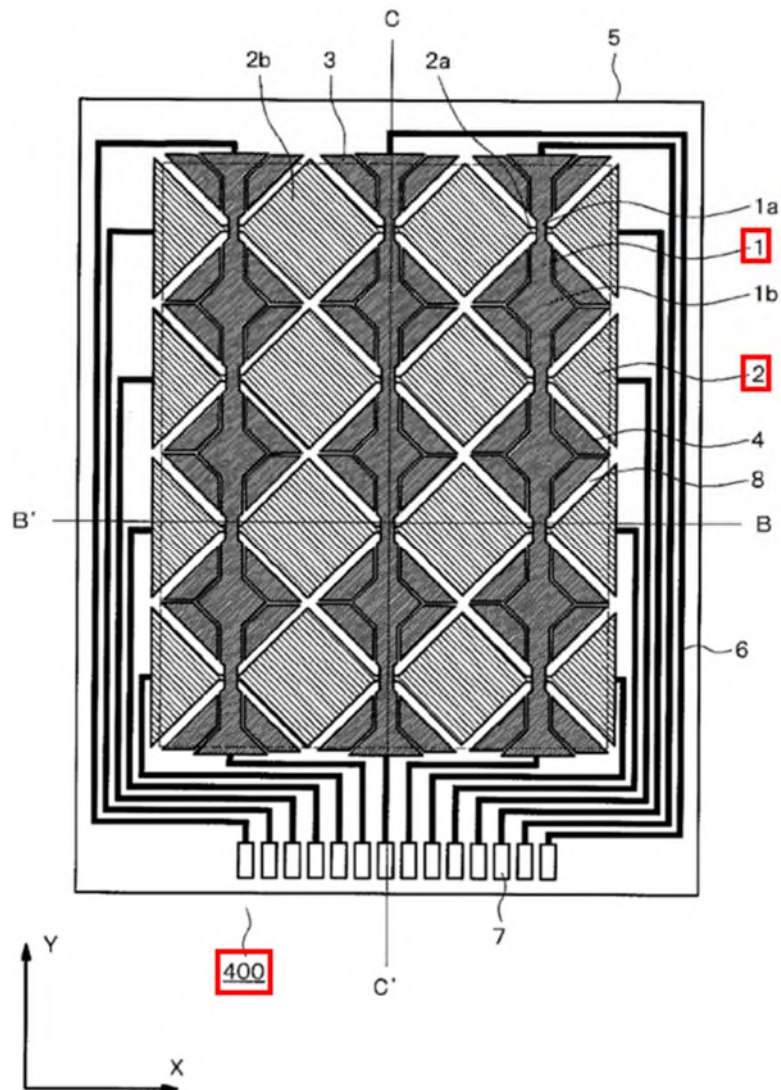


Anno '704, Fig. 1⁶, Abstract; [0048]; Ex. 1003 ¶ 218.

b) 1[a]

Anno '704 discloses *a coordinate input device* (touch panel 400).

⁶ The numeral 400 on the bottom of Figure 1 should be 300 based on paragraph [0048].



Id., Fig. 3.

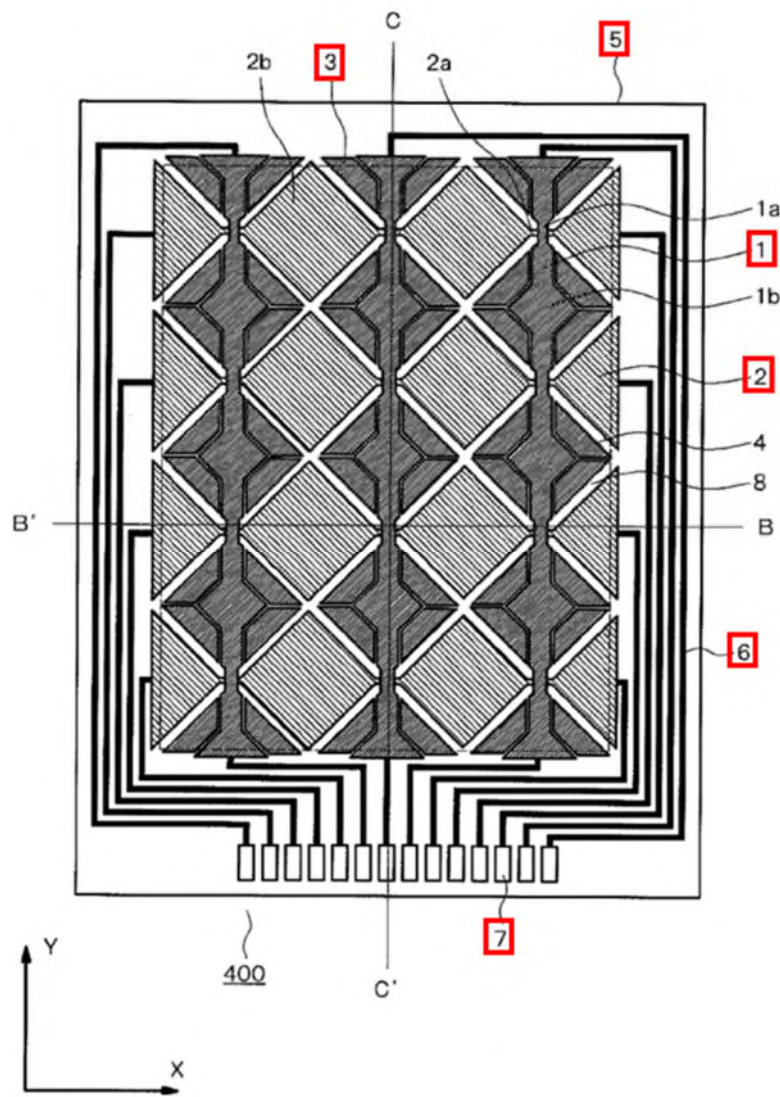
Like the device of the '762 patent, Anno '704's touch panel has two sets of X/Y electrodes 1–2 extending in perpendicular directions to detect a point of touch.

Anno '704, Abstract, [0060]–[0061]; Ex. 1003 ¶¶ 219-221.

c) 1[a.1]

Anno '704 discloses a touch panel *including a transparent substrate* (glass

substrate 5) *having detection electrodes* (X/Y electrodes 1-2) *disposed in a detection region* (input region 3) *corresponding to a contact position, the transparent substrate having a first signal interconnect* (wiring lines 6) *disposed in a region outside the detection region, the first signal interconnect having one end connected to the detection electrodes and being formed with a first electrode terminal* (connection terminals 7) *at the other end thereof.*

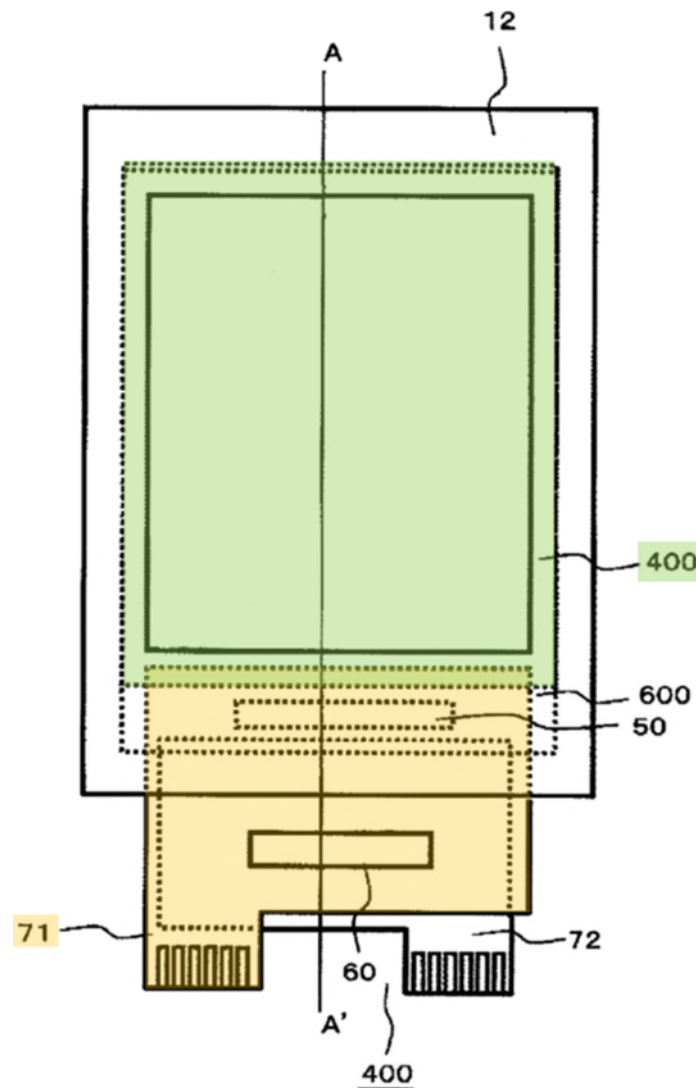


Anno '704, Fig. 3.

Anno '704's touch panel 400 includes a glass substrate 5, a transparent substrate. *Id.*, [0058]–[0059]. X/Y electrodes 1–2 are formed on a surface of the substrate. *Id.*, [0059]–[0060]. The electrodes detect changes in capacitances due to contact at a position in an input region 3. *Id.*, [0060], [0011]. Peripheral wiring lines 6 are formed outside the input region 3 on the glass substrate and connect the connection terminals 7 with the X/Y electrodes 1–2. *Id.*, Fig. 3, [0059], [0078]–[0079]; Ex. ¶¶ 222–225.

d) 1[a.2]

Anno '704 discloses or at least renders obvious a touch panel *including a flexible interconnect substrate* (flexible printed circuit board 71) *connected to the first electrode terminal* (connection terminals 7), *the flexible interconnect substrate used for supplying a driving signal to the detection electrodes* (X/Y electrodes 1–2) *by way of the first signal interconnect* (wiring lines 6) *and extracting a detection signal from the detection electrodes*.



Anno '704, Fig. 1 (showing touch panel 400 attached to circuit board 71), Fig. 2 (same), [0056]; Ex. 1003 ¶¶ 226-227.

“A touch panel control circuit 60 is mounted to the flexible printed board 71 to control the detection of an input point and other operations.” Anno '704, [0056]. Thus, a POSITA would have understood, or at least found it obvious, that the flexible printed board 71 is connected to the connection terminals 7. Ex. 1003 ¶ 228. The

control circuit controls the detection of input positions, *e.g.*, by calculating the touch position from detection signals from changes of capacitances. Anno '704, [0056], [0060]. The control functionality involves supplying driving signals to, and extracting detection signals from, the X/Y electrodes because these are essential to the functioning of the touch panel. *Id.*, [0089]–[0094], Figs. 13–14. Further, a POSITA would have understood the wiring lines 6 connect the X/Y electrodes to the control circuit, as a later patent publication from the same inventor confirms. Ex. 1021, [0089]–[0090], [0093]–[0096]. Thus, the signals are supplied to and extracted from the detection electrodes by way of the wiring lines. Ex. 1003 ¶ 229.

e) 1[b]

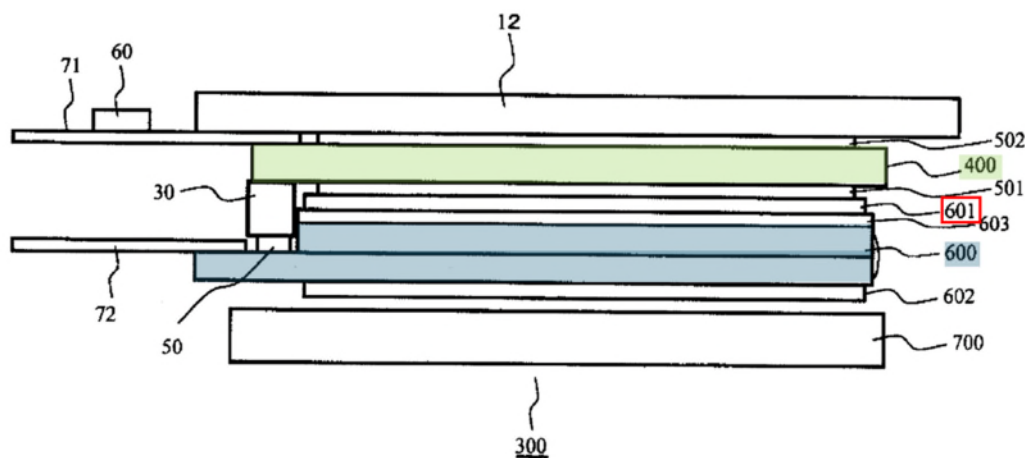
Anno '704 discloses *a display panel* (liquid crystal display panel 600) *for image display based on a video signal from an external system* (mobile equipment), *the coordinate input device* (touch panel 400) *being disposed on the display panel at the side of a display screen* (polarizing plate 601).

In preferred embodiments, an external system of the '762 patent is connected to the flexible printed substrate FPC via electrode terminals TRM2. Ex. 1001, 8:33–38, 14:62–15:2; Ex. 1003 ¶¶ 230–232.

Anno '704's display device comprises liquid crystal display panel 600, which can display images, *e.g.*, a video. Anno '704, [0012], [0055], [0100]. A flexible printed circuit board 72 carries signal to the display panel “from the outside,” *i.e.*,

an external system such as a “mobile equipment.” *Id.*, [0055], [0005]; *see also* Miyagawa, [0020] (an electronic apparatus body). Connecting to an external system was routine for display panels in electronic devices. Ex. 1003 ¶¶233-234.

The touch panel 400 is “placed on an observer side of the liquid crystal display panel 600.” Anno ’704, [0048].



Id., Fig. 2; Ex. 1003 ¶ 234.

f) 1[c]

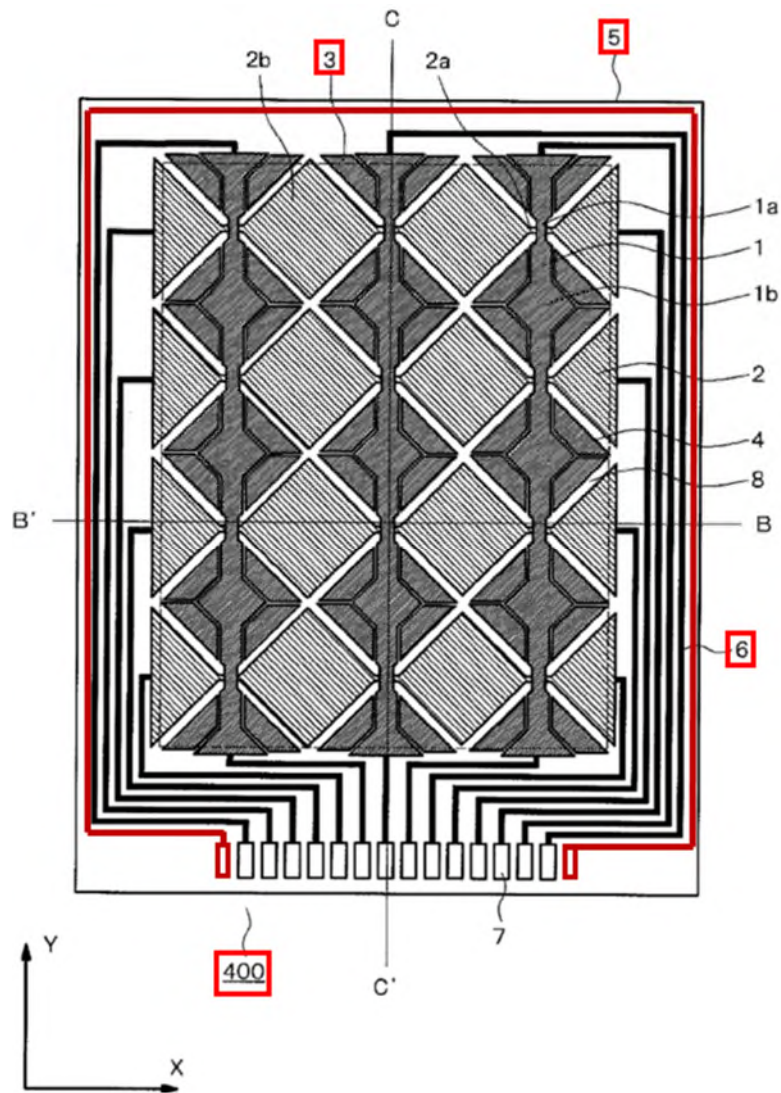
Anno ’704 in view of Miyagawa renders obvious a display device *wherein the coordinate inputting device* (Anno ’704: touch panel 400) *has a second signal interconnect* (Miyagawa: diagnostic wiring 90) *disposed outside the first signal interconnect* (Anno ’704: wiring lines 6) *but near the peripheral edge of the transparent substrate* (Anno ’704: glass substrate 5), *the second signal interconnect surrounding the area where the detection region* (Anno ’704: input region 3) *is included and the first signal interconnect is formed, the second signal interconnect*

being opened at opposite ends thereof and being connected to respective electrode terminals (Miyagawa: first and second diagnostic pads 91–92) *for inspection at the open ends.*

Claim limitation 1[c] mirrors claim limitation 7[f], except that the crack-detection wiring surrounds the detection region on the touch-panel substrate rather than the display area on a display-panel substrate, and with the following changes in nomenclatures:

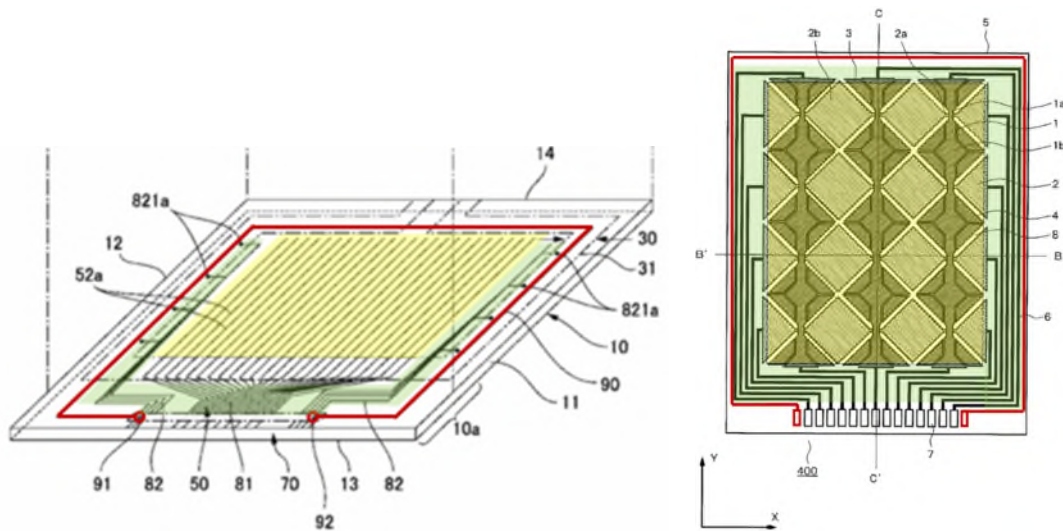
Claim Limitation 1[c]	Claim Limitation 7[f]
second signal interconnect	fourth signal interconnect
first signal interconnect	third signal interconnect

Miyagawa discloses or renders obvious claim limitation 7[f]. *Supra* VIII.A.1.j; Ex. 1003 ¶¶ 235-238. It would have been obvious to dispose Miyagawa's diagnostic wiring on Anno '704's touch panel 400, outside wiring line 6 and near the peripheral edge of the glass substrate 5, the diagnostic wiring surrounding the area where the input region 3 is included and wiring line 6 is formed:



Anno '704, Fig. 3 (diagnostic wiring and pads in dark red added); Ex. 1003 ¶ 238.

This configuration would have been obvious because of the similarities in touch-panel-substrate and display-panel-substrate configurations, *e.g.*, both comprise an active (display or detection) area surrounded by functional wirings:



Miyagawa, Fig. 3 (partial); Anno '704, Fig. 3 (diagnostic wiring and pads in dark red added); Ex. 1003 ¶ 239. Furthermore, this configuration would have been obvious because panel-crack-detection wiring should be placed near the edges of the substrate, close to the cutting lines on the mother substrate to form individual substrates, and should surround the functional components and wiring a break in which the panel-crack-detection wiring is intended to detect. *Id.* ¶ 240.

g) 1[d]

Anno '704 in view of Miyagawa at least renders obvious a display device wherein the second signal interconnect (Miyagawa: diagnostic wiring 90) is formed of a thin conductive film disposed along the peripheral edge portion of the transparent substrate (Anno '704: glass substrate 5).

Claim limitation 1[d] is similar to claim limitation 7[g] except for the differences in nomenclatures (second versus fourth signal interconnect and thin

conductive film versus conductive thin film), and that limitation 1[d] omits “three sides of” the transparent substrate. Miyagawa at least renders obvious claim limitation 1[d]. *Supra* § VIII.A.1.k; Ex. 1003 ¶¶ 241-243.

A POSITA would have found multiple choices for the material of the second signal interconnect obvious. Ex. 1003 ¶ 245. Miyagawa discloses using “chrome lines or the like” to form both the data lines and the diagnostic wiring. Miyagawa, [0017]; *supra* § VIII.A.2. Thus, chrome would have been an obvious choice. Anno ’704 discloses using silver alloy film to form its wiring lines 6. Anno ’704, [0078]. Since Miyagawa discloses a material similar to chrome may be used for the data lines and the diagnostic wiring, another obvious material choice for the second signal interconnect (and the first signal interconnect, if desired) would have been silver alloy. Ex. 1003 ¶¶ 244-245.

h) 1[e]

Anno ’704 in view of Miyagawa renders obvious a display device *wherein the second signal interconnect* (Miyagawa: diagnostic wiring 90) *is disposed along the peripheral edge of three sides of the transparent substrate* (Anno ’704: glass substrate 5). *Supra* § VIII.C.1.f; § VIII.A.1.j–k; Ex. 1003 ¶¶ 246-248.

2. Claim 2

Anno ’704 in view of Miyagawa renders obvious *a display device according to claim 1*. *Supra* § VIII.C.1. Anno ’704 in view of Miyagawa further renders

obvious *a display device wherein the second signal interconnect* (Miyagawa: diagnostic wiring 90) *has a colored thin film layer or a thin film layer having a transmittance at a predetermined level or less.*

The additional limitation of claim 2 is identical to that of claim 8 with the understanding that the second and the fourth signal interconnects are analogous counterparts. Miyagawa renders it obvious. *Supra* § VIII.A.2. Alternatively, Anno '704 in view of Miyagawa renders obvious using silver alloy for the second signal interconnect. *Supra* § VIII.C.1.g. "The silver alloy film 15 ... is opaque," *i.e.*, it has a transmittance value at a predetermined level or less. Ex. 1003 ¶¶ 249-252.

3. Claim 3

Anno '704 in view of Miyagawa renders obvious *a display device according to claim 1*. *Supra* § VIII.C.1. Anno '704 in view of Miyagawa further renders obvious *a display device wherein the second signal interconnect* (Miyagawa: diagnostic wiring 90) *has a thin metal film layer.*

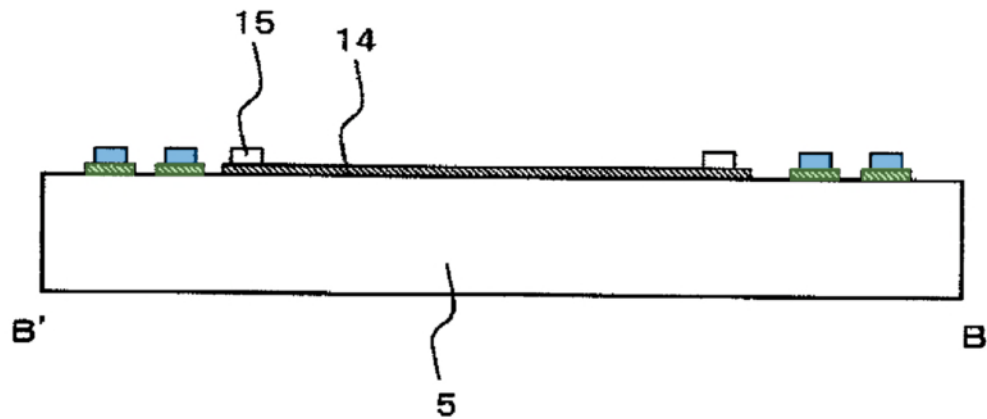
The additional limitation of claim 3 is identical to that of claim 9 with the understanding that the second and the fourth signal interconnects are analogous counterparts. Miyagawa renders it obvious. *Supra* § VIII.A.3. Alternatively, Anno '704 in view of Miyagawa renders obvious that the second signal interconnect comprises a silver alloy film. *Supra* § VIII.C.1.g; Ex. 1003 ¶¶ 253-256.

4. Claim 4

Anno '704 in view of Miyagawa renders obvious *a display device according to claim 1*. *Supra* § VIII.C.1. Anno '704 in view of Miyagawa further renders obvious *wherein the second signal interconnect* (Miyagawa: diagnostic wiring 90) *is formed of two or more conductive thin films*.

The additional limitation of claim 4 is identical to that of claim 10 with the understanding that the second and the fourth signal interconnects are analogous counterparts. Miyagawa renders it obvious. *Supra* § VIII.A.4; Ex. 1003 ¶¶ 257-259.

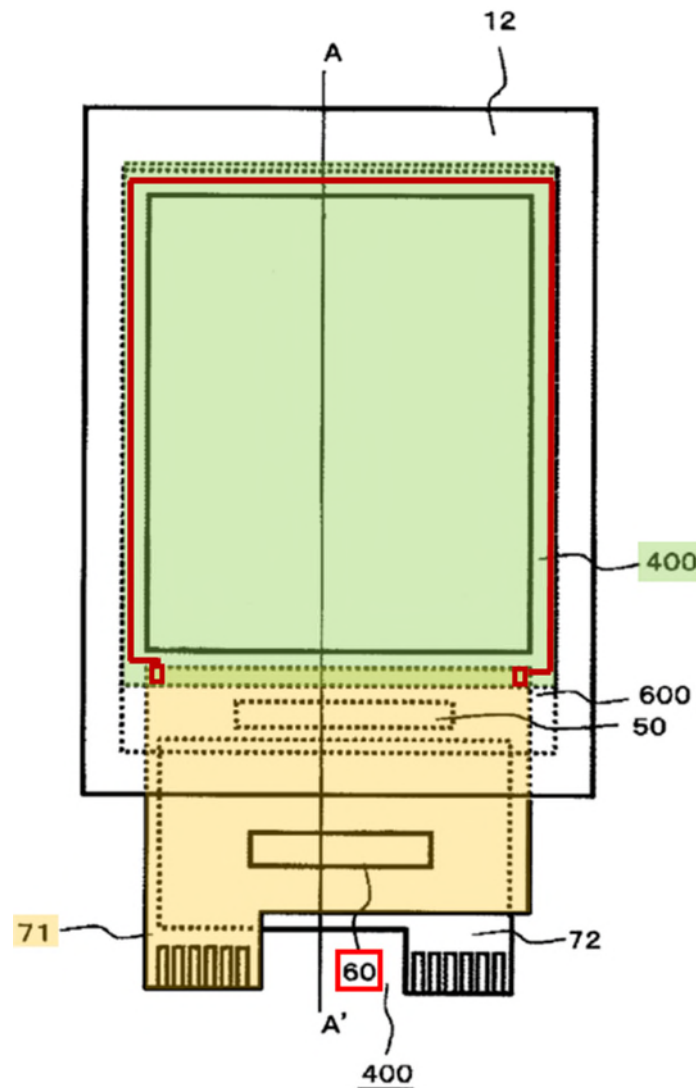
Alternatively, it would have been obvious to apply Anno '704's disclosure on its wiring lines 6 to form the second signal interconnect. *Supra* § VIII.C.1.g; Ex. 1003 ¶ 260. Anno '704 teaches forming wiring lines 6 by depositing an ITO film 14 and a silver alloy film 15, and forming the wiring pattern through a photolithography process. Anno '704, [0074]–[0079]. This results in a wiring pattern comprising two conductive thin films:



Id., Fig. 5 (cross-sectional view); see also *id.*, Fig. 9 (same), Fig. 3 (plan view).

5. Claim 6

Anno '704 in view of Miyagawa renders obvious *a display device according to claim 1*. *Supra* § VIII.C.1. Anno '704 in view of Miyagawa further renders obvious *wherein the flexible interconnect substrate* (Anno '704: flexible printed circuit board 71) *has a third electrode terminal connected to the second signal interconnect* (Miyagawa: diagnostic wiring 90) *at a position different from that of the region for forming the second electrode terminal connected with an external system*.



Anno '704, Fig. 1 (diagnostic wiring and pads in dark red added on the peripheral of touch panel 400); Ex. 1003 ¶¶ 261-262.

Anno '704 discloses a touch panel control circuit 60 mounted to the flexible printed board 71. Anno '704, [0056]. Miyagawa also discloses a configuration wherein a driving IC is mounted on its flexible substrate. Miyagawa, [0040]. In that configuration, the diagnostic pads are coupled to the IC via the flexible substrate.

Supra § VIII.A.1.j. A POSITA would have found it obvious that, in implementing diagnostic wiring on Anno '704's touch panel based on Miyagawa, the substrate crack diagnostic unit of the driving IC may be implemented in Anno '704's control circuit. Doing so would have been an obvious design choice, simply adding an additional functionality to the control circuit to achieve a predictable result. Ex. 1003 ¶¶ 263-265, 268. In such a configuration, the diagnostic wiring would be coupled to the flexible printed circuit board via electrode terminals connected to diagnostic pads at the ends of the diagnostic wiring. *Id.* ¶ 266. These terminals are located where the glass substrate and the flexible printed circuit board overlap. At the other end of the flexible printed circuit board are the claimed second electrode terminal connected with an external system:



Anno '704, Fig. 1 (partial); *see also* Ex. 1021, [0090] (external-device-side input/output terminals 74 on flexible printed circuit board 71), Fig. 5; Ex. 1003 ¶ 266. Thus, the electrode terminals on the flexible printed circuit board connected to the diagnostic wiring and those connected to an external system are at opposite ends of the flexible printed circuit board. *See* Anno '704, [0005] (mobile equipment); Miyagawa, [0020] (electronic apparatus body); Ex. 1003 ¶¶ 267-268.

6. Motivation to Combine

A POSITA would have been motivated to apply diagnostic wiring for panel-crack detection, which Miyagawa teaches, on Anno '704's touch panel, and would have had a reasonable expectation of success. Ex. 1003 ¶¶ 217, 269.

A POSITA would have been motivated to do so for the same reason explained above with respect to Tanabe in view of Miyagawa. *Supra* § VIII.B.6; Ex. 1003 ¶ 270. That motivation applies equally to Anno '704's touch panel because both display panels and touch panels are formed by cutting a brittle mother substrate into individual panels. *Supra* § IV. For example, like Tanabe, Anno '704's touch substrate is made from glass, a brittle material. Tanabe, [0073]; Anno '704, [0059]. Further, the functional wiring patterns of touch substrates are similar to those of display substrates. Both comprise an active area (respectively with touch and display components) surrounded by signal wiring. Thus, a POSITA would have found it obvious that Miyagawa's benefits of detecting broken signal lines early and reducing manufacturing waste apply to Anno '704's touch device. Ex. 1003 ¶ 270.

This addition merely involves adding another thin-film wire on Anno '704's touch-panel glass substrate. Doing so would have been well within the skill of a POSITA because it merely involves surrounding the panel with a thin-film conductor in a form similar to Miyagawa's diagnostic wiring. *See* Ex. 1014, Fig. 4; Ex. 1017, Fig. 9, [0043] (disclosing a conventional trace of the same form for panel-

crack detection). Anno '704 already uses conductive thin film in touch panel. Anno '704, [0054], [0060], [0068], [0078]. Further, this addition would have been simple because the diagnostic wiring is isolated from other circuits and components, and thus its addition does not involve the complexity that may result from interconnected components. Ex. 1003 ¶271.

For the same reason that this combination involves a simple addition, a POSITA would have had a reasonable expectation of success. *Id.* ¶¶ 272-275. Touch panel and LCDs have similar components and configurations. This similarity was expected because the touch-detection area overlaps the display area to enable users to perform touch functions based on displayed images. Adding a diagnostic wiring to Anno '704's substrate 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 '762 patent acknowledges the LCD devices of its embodiments were "well-known." Ex. 1001, 4:11–14. So were Anno '704's and Miyagawa's. Ex. 1003 ¶ 274; *KSR Int'l*, 550 U.S. at 416.

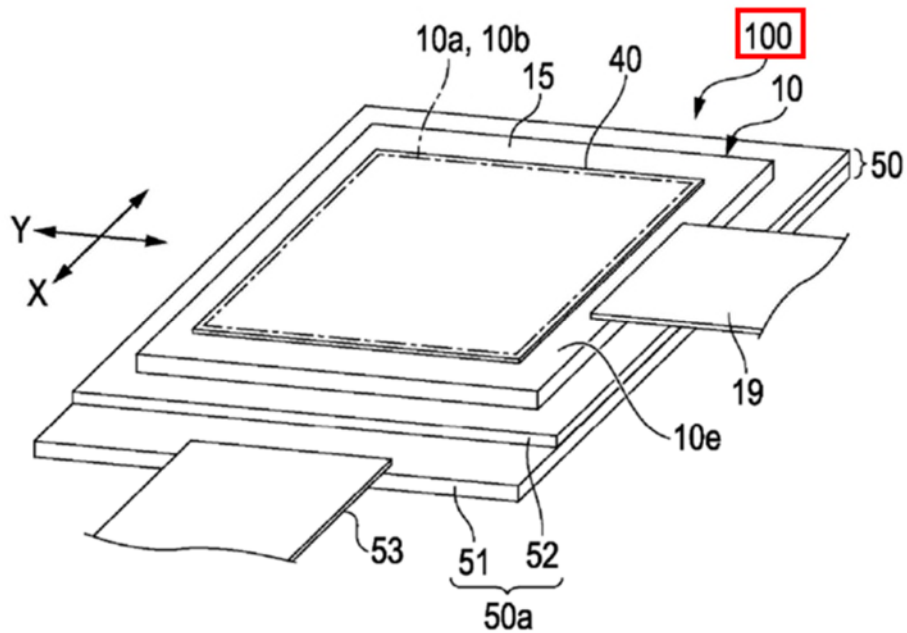
D. GROUND 4: Matsuo in View of Nakamura Renders Claims 1–4 and 6 Obvious

1. Independent Claim 1

a) 1[pre]

Matsuo discloses *a display device*, such as "a display apparatus with an input

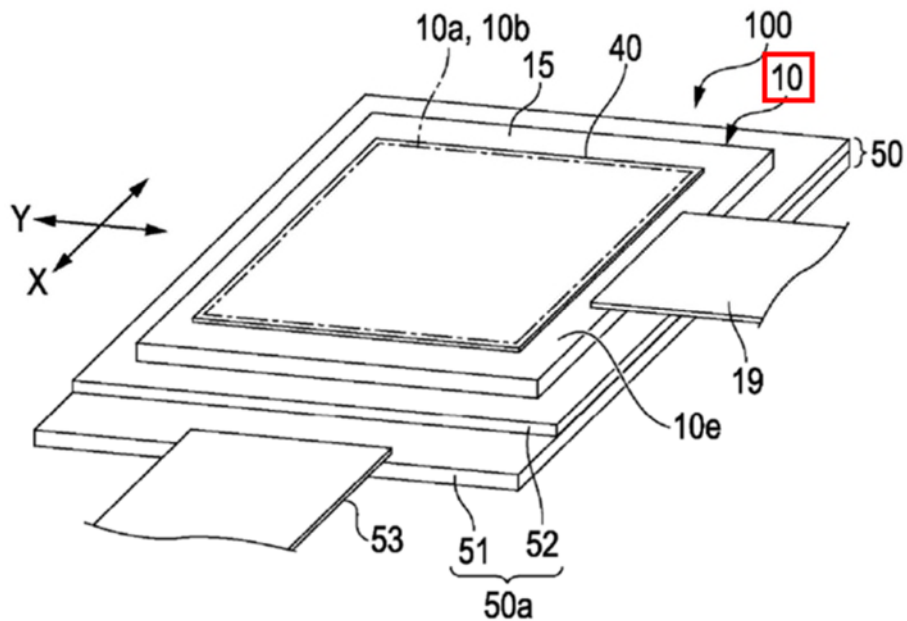
function 100.” Matsuo, [0038]; Ex. 1003 ¶ 277.



Id., Fig. 1.

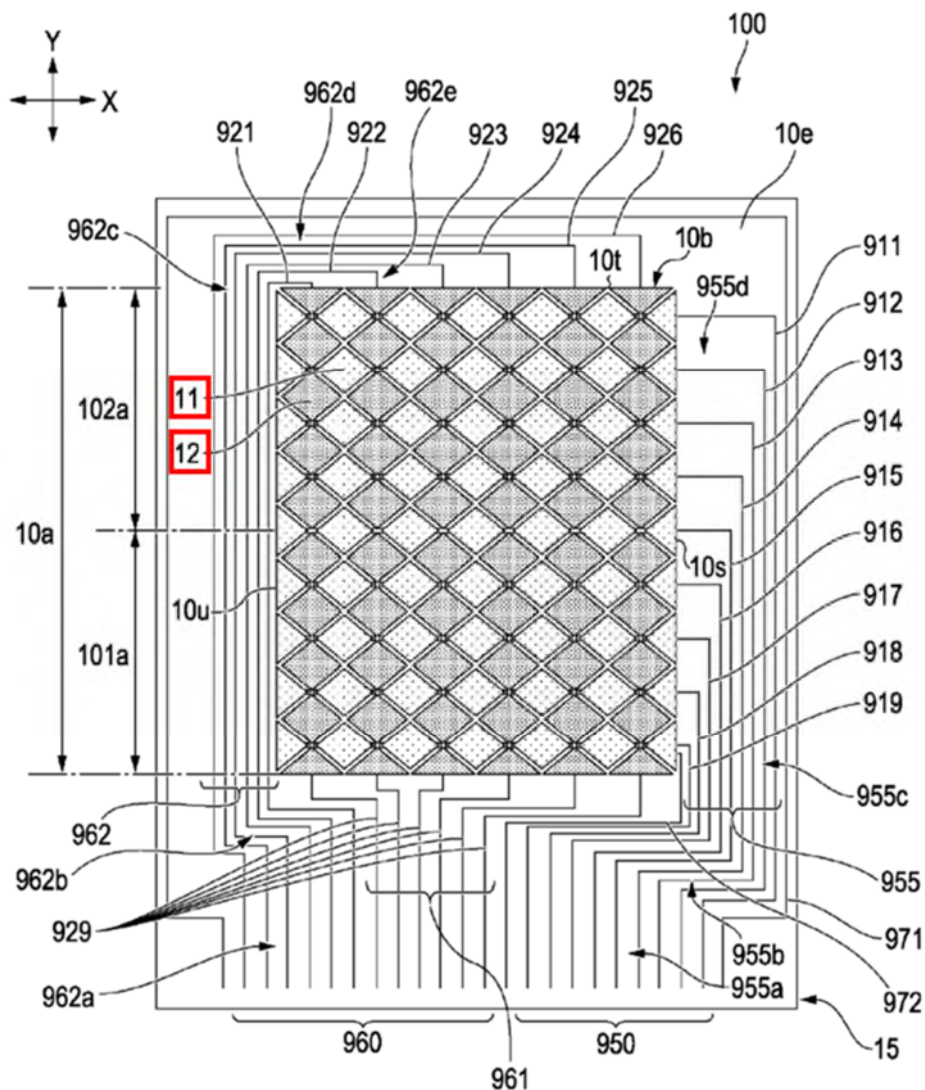
b) 1[a]

Matsuo discloses *a coordinate input device*, for example, “a panel-shaped input device 10 (touch panel)” of the display apparatus. Matsuo, [0038].



Id., Fig. 1.

Like the device of the '762 patent, Matsuo's input device 10 has two sets of detection electrode patterns 11 and 12 extending in two directions to detect a point of touch. Matsuo, Abstract, [0039]–[0041], Figs. 2, 3A; Ex. 1003 ¶¶ 278-281.



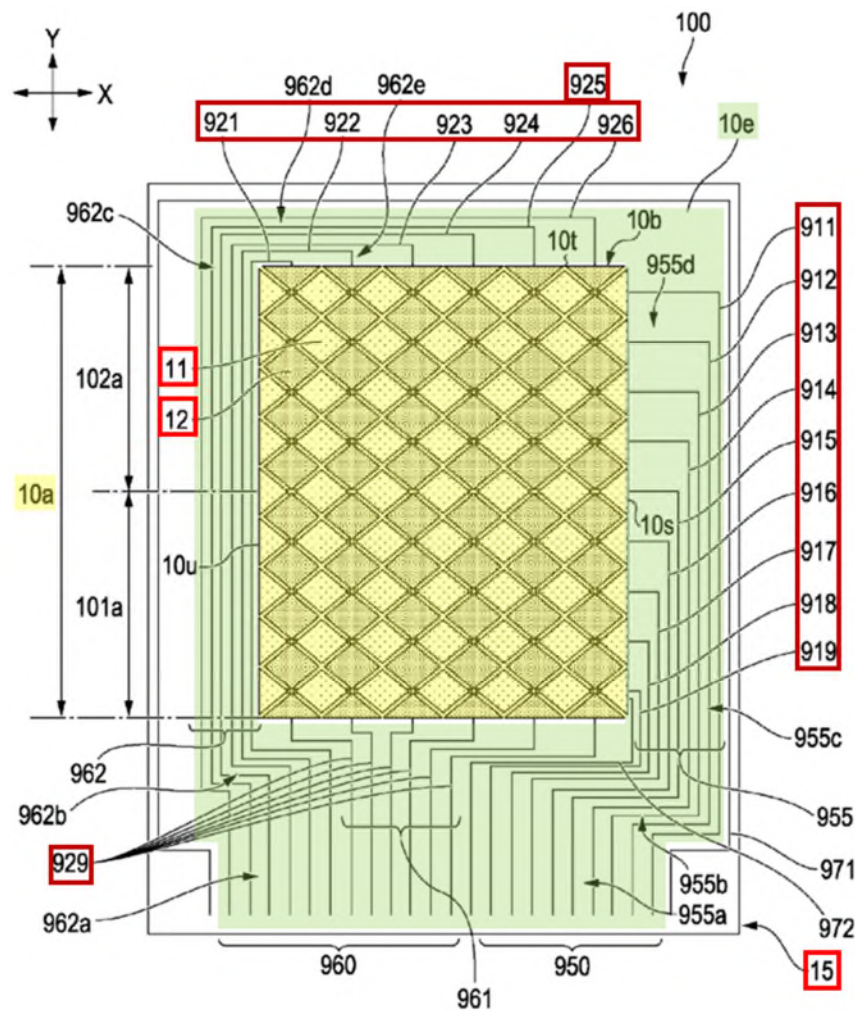
Matsuo, Fig. 2.

c) 1[a.1]

Matsuo's input device 10 *includ[es] a transparent substrate* (translucent substrate 15) *having detection electrodes* (electrode patterns 11–12) *disposed in a detection region* (input area 10a) *corresponding to a contact position, the transparent substrate having a first signal interconnect* (metal lines 9a, which

includes lines 911–919, 921–926, and 929) *disposed in a region* (peripheral area 10e) *outside the detection region, the first signal interconnect having one end connected to the detection electrodes and being formed with a first electrode terminal* (terminals 19a) *at the other end thereof*.

Specifically, Matsuo's input device comprises a translucent substrate 15 on which the detection electrode patterns 11–12 are disposed. Matsuo, [0040]. The electrodes are disposed in an input area 10a. *Id.* When a finger touches any point in the input area, the device detects the point of touch. *Id.*, [0041]; Ex. 1003 ¶¶ 282–284.

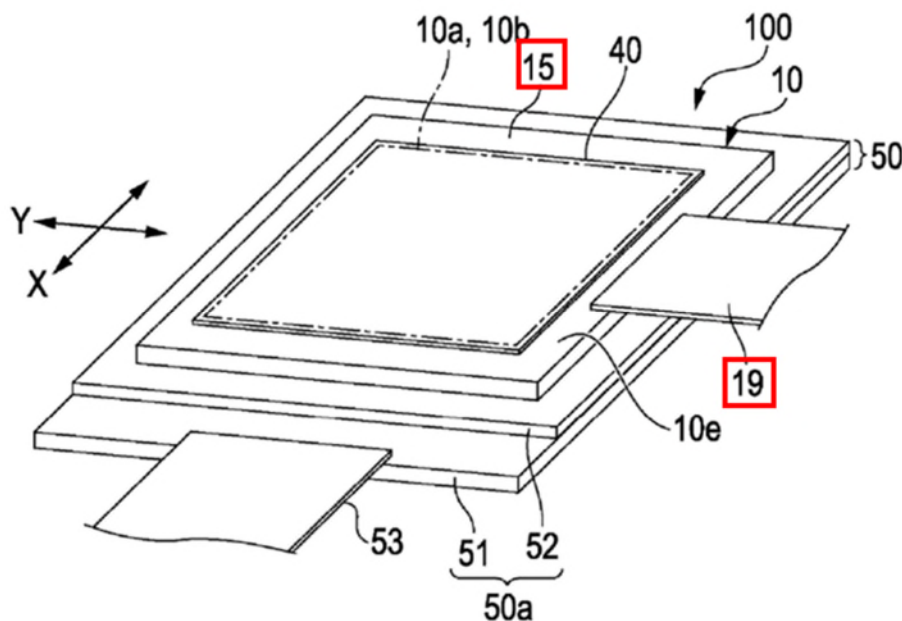


Matsuo, Fig. 2, [0048]–[0049]. On the translucent substrate are metal lines 9a (including lines 911–919, 921–926, and 929) that “are formed on the outer area (peripheral area 10e) of the input area 10a.” *Id.*, [0046]. One end of the metal lines is connected to the detection electrodes, forming electrical contacts. *Id.* The other end of metal lines is terminals 19a “for connecting [a] flexible substrate 19.” *Id.*; Ex. 1003 ¶ 285.

d) 1[a.2]

Matsuo's input device 10 *includ[es] a flexible interconnect substrate* (flexible substrate 19) *connected to the first electrode terminal* (terminals 19a), *the flexible interconnect substrate used for supplying a driving signal to the detection electrodes* (electrode patterns 11–12) *by way of the first signal interconnect* (metal lines 9a) *and extracting a detection signal from the detection electrodes*.

Matsuo's input device 10 “includes ... a flexible substrate 19 connected to an end of the translucent substrate 15.” Matsuo, [0039]:



Id., Fig. 1; Ex. 1003 ¶¶ 286-288. The flexible substrate is connected to terminals 19a. Matsuo, [0046]. The flexible substrate is connected to a drive circuit for touch detection. *Id.*, [0039]; Ex. 1003 ¶ 289.

It would have been at least obvious that the flexible substrate is *used for*

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Ex. 1003, ¶291. The input signals “charge” the detection electrodes. Matsuo, [0041]. The output signals indicate the touch point detected through a touch-induced lower electrostatic capacitance. *Id.*

Further, the metal lines couple the detection electrodes to the flexible substrate, which is in turn coupled to a drive circuit for touch detection. *Supra* § VIII.D.1.c. As Figure 2 shows, the detection electrodes are only coupled to the metal lines. Because the detection electrodes must receive input signals and send output signals to perform their touch functionality, the signals must be supplied and extracted through the metal lines, the terminals, and the flexible substrate. Ex. 1003, ¶ 292.

e) 1[b]

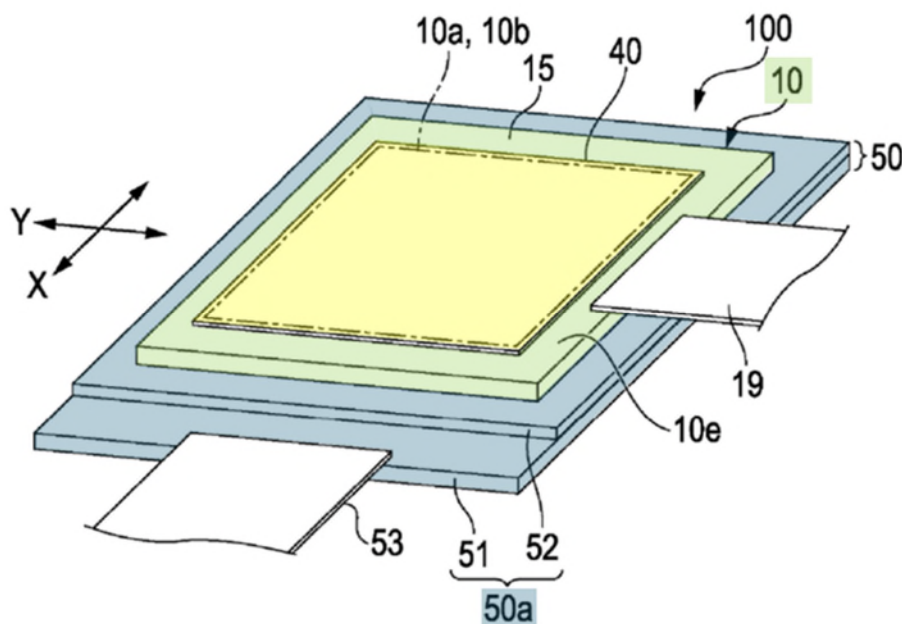
Matsuo discloses *a display panel* (liquid crystal panel 50a) *for image display based on a video signal from an external system, the coordinate input device* (input device 10) *being disposed on the display panel at the side of a display screen* (polarizing plate).

In preferred embodiments, an external system of the '762 patent is connected to the flexible printed substrate FPC via electrode terminals TRM2. Ex. 1001, 8:33–38, 14:62–15:2; Ex. 1003 ¶¶ 293-295.

Matsuo's display device comprises a liquid crystal device, which can “display moving images and still images.” Matsuo, [0038]. Images are displayed based on

a video signal, for example, provided through a drive IC. *Id.* The liquid crystal panel is connected to a flexible substrate 53, which routes video signals from an external system, *i.e.*, “electronic apparatuses such as mobile phone sets,” etc. *Id.*, [0038], [0023], [0082]; Ex. 1003 ¶296.

Matsuo’s input device 10 is disposed on the liquid crystal panel 50a *at the side of a display screen*, *i.e.*, the surface of the liquid crystal panel from which “display light is emitted.” Matsuo, [0038]; *see also id.* cl. 9. This is commonly a polarizing plate. *Id.*, [0038]; Anno ’704, Fig. 2, [0049]; Ex. 1003 ¶ 297.



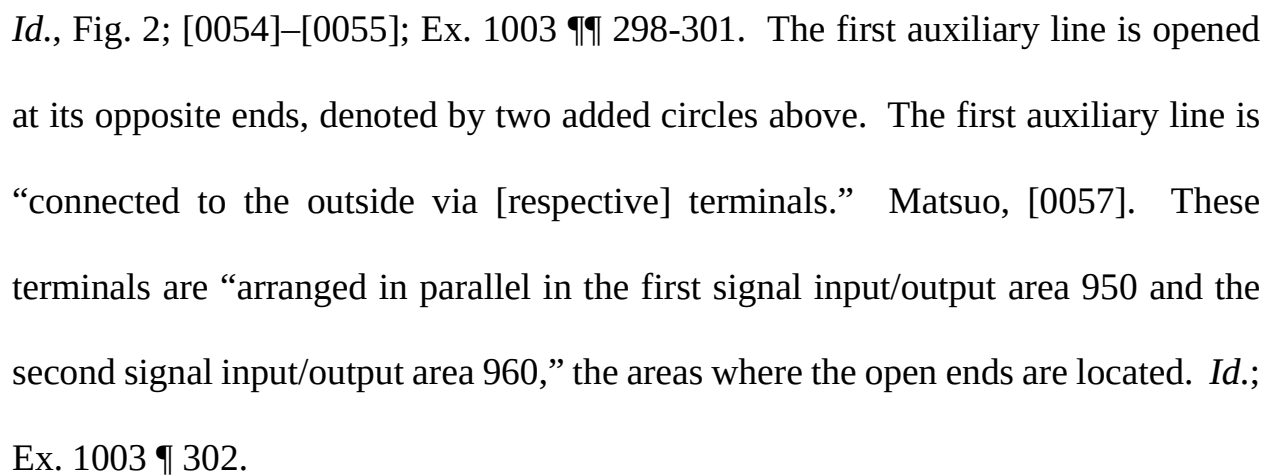
Matsuo, Fig. 1.

f) 1[c]

Matsuo in view of Nakamura renders obvious a display device *wherein the coordinate inputting device* (input device 10) *has a second signal interconnect* (first

auxiliary line 971) *disposed outside the first signal interconnect* (metal lines 9a) *but near the peripheral edge of the transparent substrate* (translucent substrate 15), *the second signal interconnect surrounding the area where the detection region* (input area 10a) *is included and the first signal interconnect is formed, the second signal interconnect being opened at opposite ends thereof and being connected to respective electrode terminals for inspection at the open ends.*

Matsuo discloses a first auxiliary line 971, which functions as a shield line surrounding the detection area to reduce the effect of external noise on the touch-detection sensitivity. Matsuo, [0019], [0056], [0077]. That the first auxiliary line is disposed outside the metal lines 9a (lines 911–919, 921–926, and 929), near the peripheral edge of the translucent substrate 15, and surrounding the input area 10a and the metal lines 9a can readily be observed:



The first auxiliary line functions as a shield line to which a ground potential may be applied to reduce the effect of external noise on touch-detection sensitivity. Matsuo, [0056]–[0057]. Nakamura discloses that a defective line detection pattern, *i.e.*, a panel-crack-detection line, “may be formed using a conventional shield line.” Nakamura, [0041]. A POSITA also would have known that conventional panel-crack-detection lines are structurally analogous to conventional shield lines such as Matsuo’s first auxiliary line. *See supra* § IV; Ex. 1003 ¶¶ 303-304. Thus, it would have been obvious that Matsuo’s first auxiliary line may function as a panel-crack-detection line for inspection. This function may be performed using a “simple inspection” via a continuity check. Nakamura, [0043]. Specifically, by “apply[ing] a voltage” between the terminals connected to the open ends of the first auxiliary line, a crack may be detected if the terminals are not electrically coupled. *Id.* Nakamura’s manufacturing usage for crack detection is complementary to Matsuo’s operational usage for noise shielding. And as Nakamura discloses, such a panel-crack-detection line is formed along and near the peripheral edge of the substrate. Nakamura, Abstract, Fig. 1; Ex. 1003 ¶ 304.

g) 1[d]

Matsuo in view of Nakamura at least renders obvious a display device *wherein the second signal interconnect* (first auxiliary line 971) *is formed of a thin conductive film disposed along the peripheral edge portion of the transparent substrate*

(translucent substrate 15).

The first auxiliary line is formed of a *conductive* material so that a constant potential may be applied on it to reduce the effect of noise on touch detection. Matsuo, [0056], [0077]; Ex. 1003 ¶¶ 305-307.

Matsuo at least renders obvious that the first auxiliary line *is formed of a thin ... film*. This would have been obvious because the translucent electrode patterns are formed of thin ITO or IZO film. Matsuo, [0047]. Since the first auxiliary line is simultaneously formed with metal lines, it would have been obvious to make all of these components simultaneously, using the same thin-film process. *Id.*, [0057]–[0058]. Indeed, this is consistent with Matsuo’s teaching of forming these components together, without additional steps, to improve productivity. *Id.*, [0057]. Further, forming the first auxiliary line from thin film would have been obvious based on a POSITA’s knowledge. Ex. 1018, 3 (definition of thin film); Ex. 1019, 3 (same); Ex. 1003 ¶ 308. Where, as here, a reference does not “specifically” teach a claim limitation that is within a POSITA’s knowledge, the claim limitation is still obvious. *Fleming v. Cirrus Design Corp.*, 28 F.4th 1214, 1222–23 (Fed. Cir. 2022).

As shown above, the first auxiliary line *is disposed along the peripheral edge portion of the* translucent substrate 15, *e.g.*, “on the outer peripheral side.” Matsuo, [0056], [0077]; *supra* § VIII.D.1.f; Ex. 1003 ¶ 309.

h) 1[e]

Matsuo discloses a display device *wherein the second signal interconnect* (first auxiliary line 971) *is disposed along the peripheral edge of three sides of the transparent substrate* (translucent substrate 15). *Supra* § VIII.D.1.f; *see also* Matsuo, [0054]–[0055]; Ex. 1003 ¶¶ 310-311.

2. Claim 2

Matsuo in view of Nakamura renders obvious *a display device according to claim 1*, including that *the second signal interconnect* (first auxiliary line 971) *has a thin film layer*. *Supra* § VIII.D.1. Matsuo in view of Nakamura further renders obvious *a display device wherein the second signal interconnect* (first auxiliary line 971) *has a colored thin film layer or a thin film layer having a transmittance at a predetermined level or less*.

Matsuo discloses that the first auxiliary line may be formed simultaneously with metal lines 9a. Matsuo, [0057]. Thus, the first auxiliary line comprises metal. Nakamura discloses using “a light-shielding metal material, for example, Cr, Al, [or] Ti” for both its connection lines L1–L2 (analogous to Matsuo’s metal lines 9a) and the defective line detection patterns D1–D2 (analogous to Matsuo’s first auxiliary line 971). Nakamura, [0035]–[0036], [0040]. Such a material has *a transmittance at a predetermined level or less*, which provides it with a “light-shielding” property. Each of Cr, Al, and Ti, for example, has a known transmittance and thus can satisfy

a predetermined level. Thus, applying Nakamura's materials to Matsuo's first auxiliary line satisfies claim 2. Ex. 1003 ¶¶312-315; *Wavetronix LLC v. Smart Microwave Sensors GmbH*, 746 F. App'x 984, 991 (Fed. Cir. 2018) (affirming the Board's finding of obviousness based on a reference disclosing "a sensor that can generate a signal of 'any desired type'" with another reference disclosing a sensor with a specific type of signal generator "as required by the claims").

3. Claim 3

Matsuo in view of Nakamura renders obvious *a display device according to claim 1*. Matsuo in view of Nakamura further renders obvious *a display device wherein the second signal interconnect* (first auxiliary line 971) *has a thin metal film layer*.

This additional limitation is substantively the same as claims 1[d] and 2. Matsuo in view of Nakamura thus renders it obvious. *Supra* §§ VIII.D.1.g, VIII.D.2; Ex. 1003 ¶¶ 316-318.

4. Claim 4

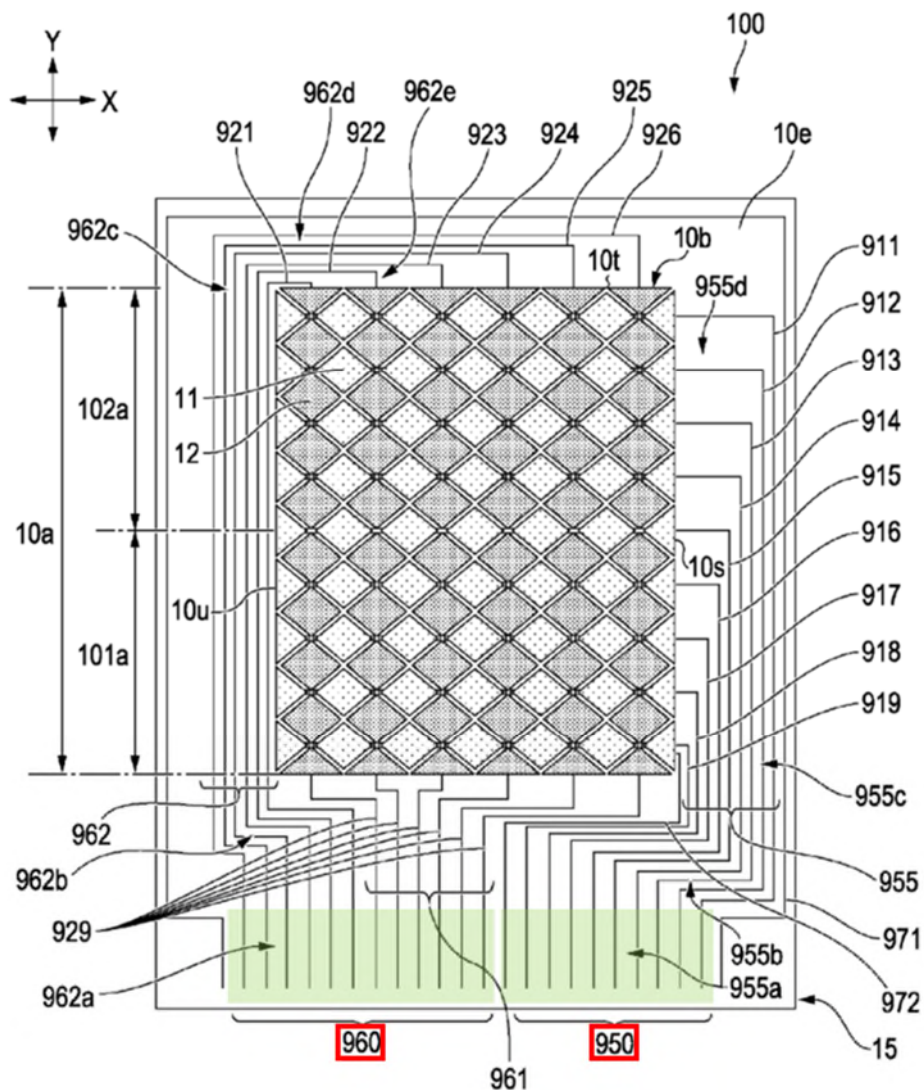
Matsuo in view of Nakamura renders obvious *a display device according to claim 1*. Matsuo in view of Nakamura further renders obvious *wherein the second signal interconnect* (first auxiliary line 971) *is formed of two or more conductive thin films*.

Matsuo in view of Nakamura renders obvious that the first auxiliary line is formed of conductive thin films. *Supra* § VIII.D.1.g. Thus, claim 4 merely adds that the first auxiliary line is formed of at least two layers of the film. Nakamura discloses this: its detection patterns (analogous to the first auxiliary line) may comprise “a *multilayer* structure....” Nakamura, [0035]; Ex. 1003 ¶¶ 319-321.

5. Claim 6

Matsuo in view of Nakamura renders obvious *a display device according to claim 1*. Matsuo in view of Nakamura further renders obvious *wherein the flexible interconnect substrate* (flexible substrate 19) *has a third electrode terminal connected to the second signal interconnect* (first auxiliary line 971) *at a position different from that of the region for forming the second electrode terminal connected with an external system*.

Matsuo’s metal lines 9a have terminals 19a “for connecting [a] flexible substrate 19.” Matsuo, [0046]. These terminals are located in a first and second signal input/output area 950 and 960. *Id.*, [0048]–[0049]; Ex. 1003 ¶¶ 322-324.

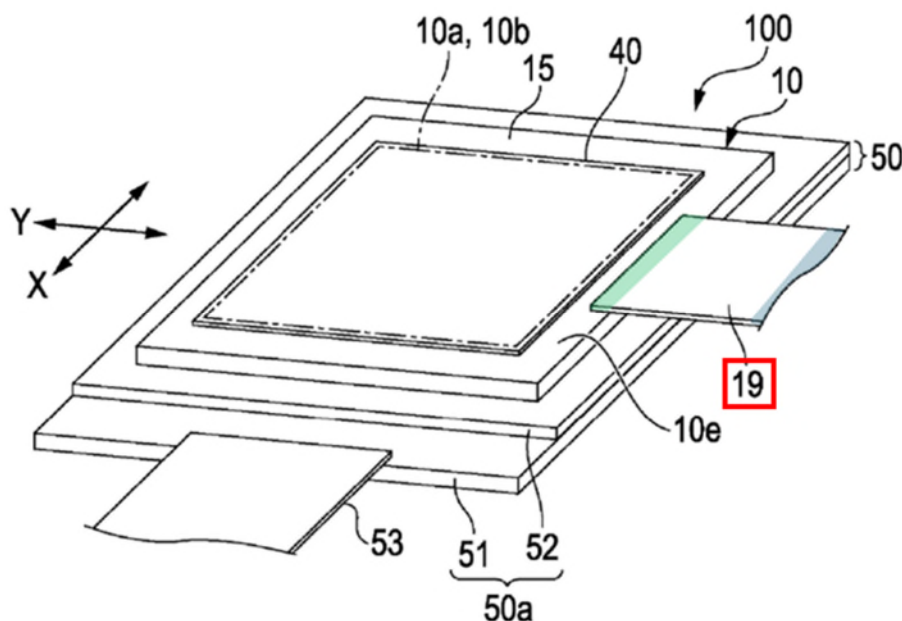


Matsuo, Fig. 2.

Matsuo's first auxiliary line is "connected to the outside via [respective] terminals." *Id.*, [0057]. These terminals are "arranged in parallel" in the first and second signal input/output area 950 and 960. *Id.* This means that flexible substrate 19 has corresponding terminals (the *third electrode terminal*) that overlap with, and are connected to, terminals of the first auxiliary line in a plan view. Ex. 1003 ¶¶

325.

It was routine and common, or at least would have been obvious, that *the region for forming [a] second electrode terminal connected with an external system* is located on the end of the flexible substrate 19 away from the substrate. Such a configuration facilitates connections between the flexible substrate with the external system, “such as mobile phone sets....” Matsuo, [0023], [0082]; Ex. 1003 ¶326. To illustrate, the third electrode terminal is located in the green shaded area, and the region for connecting with an external system is in or near the blue shaded area:



Matsuo, Fig. 1.

6. Motivation to Combine

A POSITA would have been motivated to use Matsuo's first auxiliary line for panel-crack detection in view of Nakamura. Ex. 1003 ¶¶ 276, 327.

Fabricating large mother substrates and cutting them into individual panels was a common and routine practice. Nakamura, [0003]. But it was also well known that “defects readily arise” during such a cutting process. *Id.*, [0011]. Such defects, if not detected until the panel is assembled, waste not only the panel itself but also expensive ICs installed on the panel. *Id.*, [0012]. Thus, a method to detect panel cracks early in manufacturing, especially before any components are installed, is desirable to reduce manufacturing waste and associated cost. *Id.*; Ex. 1003 ¶ 328.

Nakamura discloses a solution for early detection of panel cracks. Accordingly, a POSITA would have been motivated to apply its teaching to Matsuo to reduce manufacturing waste. Ex. 1003 ¶¶ 329-330. Further, based on Nakamura’s teaching that the detection pattern “may be formed using a conventional shield line and the like as typically formed,” a POSITA would have found it obvious and easy to use Matsuo’s shield line for panel crack detection because the shield line and crack detection line are structurally similar. Nakamura, [0041]; *supra* § IV; Ex. 1003 ¶¶ 329-330.

That Matsuo discloses a touch panel and Nakamura discloses a display panel does not affect a POSITA’s motivation to combine their teachings. Both types of panels are cut from larger, mother substrates. Thus, both are susceptible to cracking or chipping when cut. *See* Ex. 1017, [0043] (disclosing a conventional crack-detection trace for either touch or display panel). Matsuo’s display panel and touch

panel are different in size, and separate cutting processes are applied to these panels and both panels can benefit from crack detection. See Matsuo, Fig. 1 (different panel sizes); Ex. 1003 ¶¶ 331-332; *Dome Pat. L.P. v. Lee*, 799 F.3d 1372, 1380 (Fed. Cir. 2015).

Using Matsuo's auxiliary line for crack detection has an additional benefit that the two functions can be performed using the same component. Matsuo identifies its auxiliary line as a conventional shield line. Matsuo, [0019], [0077]. Nakamura teaches such shield lines are suitable for crack detection. Nakamura, [0041]. The detection pattern is useful in manufacturing. *Supra* § VIII.D.1.f. The auxiliary line is useful to improve touch-detection sensitivity in operation. Matsuo, [0019], [0077]. Thus, the two functions are complementary. Configuring the same wiring for both functions would have been a desirable approach to obtain their benefits without additional manufacturing or material cost. Ex. 1003 ¶333.

Further, it would have been obvious that Matsuo's auxiliary line was an example of Nakamura's "conventional shield line." These were contemporary references in the same field from the same assignee, Epson Imaging Devices Corp. Matsuo, cover; Nakamura, Cover. Thus, it is reasonable that Nakamura was aware of Matsuo's concurrent development in the same company and would consider Matsuo's auxiliary line as a conventional shield line. Ex. 1003 ¶ 334.

Additionally, a POSITA would have been motivated to use Nakamura's single- or multilayer light-shielding material for Matsuo's first auxiliary line. *Id.* ¶¶ 276, 335.

Nakamura discloses using the same process and the same material to form both the connection lines and defective line detection pattern. Nakamura, [0040]. Similarly, Matsuo discloses forming the auxiliary line in the same step as forming the metal lines (analogous to Nakamura's connection lines). Matsuo, [0057]. Their analogous disclosures would have rendered it obvious to apply Nakamura's single- or multilayer metal thin films in the combination. Ex. 1003 ¶ 336; *Wavetronix*, 746 F. App'x at 991.

A POSITA would have had a reasonable expectation of success in applying Nakamura's teaching of forming panel-crack detection lines using conventional shield line to Matsuo's first auxiliary line. Matsuo's auxiliary line is a conventional shield line as a POSITA would have recognized. *Supra* § IV ¶ 3. It is similar in form to conventional crack-detection lines. *Id.* Using Matsuo's auxiliary line for crack detection simply involves performing a continuity check at an appropriate time because both wirings are conductors with end terminals to apply an electrical potential. Neither wiring contacts any other components on the substrate. Matsuo, Fig. 2; Nakamura, Figs. 1, 3A–3C. This isolation from other components would

have rendered it straightforward to combine the disclosures about these lines. Ex. 1003 ¶ 336.

Further, Nakamura's identified metal materials and alternative single- or multilayer process to form the detection patterns merely focuses the design choice from Matsuo's broad disclosure to Nakamura's specific recommendations. And since panels disclosed by both are used in familiar electronic devices such as laptop computers that had opaque borders around their displays, using light-shielding metals for Matsuo's auxiliary line would have been an obvious design choice that would not degrade the outward appearances of these electronic devices. *Id.* ¶ 337.

IX. SECONDARY CONSIDERATIONS

Petitioner is unaware of any secondary considerations of non-obviousness. None were identified during prosecution. *See generally* Ex. 1002. Even if any existed, none would overcome the strong *prima facie* case of obviousness. Ex. 1003 ¶ 338; *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 '762 patent and cancel all Challenged Claims.

Inter Partes Review

United States Patent No. 8,704,762

Dated: September 18, 2025

Respectfully submitted,

By: /Richard F. Martinelli/

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CERTIFICATE OF WORD COUNT

The undersigned certifies that the foregoing PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 8,704,762 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 13,321 words.

Dated: September 18, 2025

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CERTIFICATE OF SERVICE

The undersigned hereby confirms that the foregoing PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 8,704,762 UNDER 35 U.S.C. §§311–319 AND 37 C.F.R. §42, and associated Power of Attorney and Exhibits 1001–1026, were served on September 18, 2025 via overnight courier upon the following counsel of record for Patent Owner:

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Re: Paneltouch Technologies LLC; U.S. Patent No. 8,704,762

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.):

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