

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

BOE Technology Group Co., Ltd.,
Petitioner,
v.

Paneltouch Technologies LLC,
Patent Owner.

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

Case No. IPR2025-01483

**DECLARATION OF RICHARD A. FLASCK, M.S.
IN SUPPORT OF PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT NO. 9,507,477**

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I. INTRODUCTION

I, Richard A. Flasck, declare as follows:

1. I have been retained by counsel for BOE Technology Group Co., Ltd., (“BOE”) in the above-captioned *inter partes* review as an independent consultant to offer opinions regarding the validity of the Challenged Claims in U.S. Patent No. 9,507,477 (the “’477 patent”).

2. In the preparation of this Declaration, I have confined my analysis to the materials and opinions that were available at the time of the preparation of this Declaration, supplemented with my own knowledge and experience in the field. Should new materials, analyses, or opinions be introduced subsequent to the filing of this Declaration, I reserve the right to provide supplementary declarations to the extent necessary to address any such newly introduced items.

3. If requested, I am prepared to explain in a deposition or at a trial before the Patent Trial and Appeal Board (the “Board”) the technology disclosed in the ’477 patent, including the state of the art in 2010, the earliest possible priority date of the ’477 patent. Similarly, I am prepared to explain the technology disclosed in the prior art references cited herein. This may include, among other things, background information on the fields of display devices and touch panels.

II. QUALIFICATIONS AND COMPENSATION

4. My qualifications to testify as an expert in display devices and touch panels are set forth in my *curriculum vitae*, attached as Ex. 1026. I have decades of experience as a scientist and consultant in the display device and touch panel fields.

5. I received a Bachelor of Science in Physics from the University of Michigan, Ann Arbor in 1970. After receiving my bachelor's degree, I was employed as a scientist and manager from 1970 through 1982 by Energy Conversion Devices, Inc., where my work focused on the development of electroluminescent displays, thin film transistors, thin film photovoltaics, ablative imaging films, non-volatile memory, multi-chip modules, and superconducting materials.

6. I received a Master of Science in Physics from Oakland University in Rochester, Michigan, in 1976. After completing my master's degree, I continued my employment with Energy Conversion Devices, Inc. until 1982.

7. After leaving Energy Conversion Devices, I founded and served as CEO of Alphasil, Inc., where I developed amorphous silicon thin film transistor (TFT) active-matrix liquid crystal displays ("AMLCDs"). My work at Alphasil included thin film transistor array substrate process and circuit design, data driver and gate driver design, scalars, video circuits, gamma correction circuits, backlighting, and inverter design. At Alphasil, I also designed and incorporated

touch panel screens into active-matrix display devices. The touch panel technologies included resistive and capacitive sensing. I worked at Alphasil from 1982 through 1989.

8. I am the founder and Chief Executive Officer of RAF Electronics Corp. (“RAF”), a company that I established after leaving Alphasil, Inc. (“Alphasil”) in 1989. At RAF, I have developed and patented Liquid Crystal on Silicon (“LCOS”) microdisplay projection technology using active-matrix transistor arrays, as well as proprietary Light Emitting Diode (“LED”) based Solid State Lighting (“SSL”) products. My work at RAF has also included the development of High-Definition Television (“HDTV”) projection technology, including transistor array substrates for LCOS devices and the associated optical systems, as well as advancements in lighting systems using both traditional LED and OLED (Organic Light Emitting Diode) technologies. In 2016, I was granted a patent, U.S. Patent No. 9,328,898, which covers LED and OLED technology and lighting systems, and in 2019, RAF received a CalSEED grant—an early-stage funding award provided by the California Energy Commission, the state’s primary agency for energy policy and innovation—to develop ultra efficient lighting products and explore options on establishing a Central Valley manufacturing facility.

9. From 2002 to 2007, I also served as a co-founder and Chief Operating Officer of Diablo Optics, Inc., where I developed, produced, and commercialized key optical components for HDTV projectors, such as polarization optics, condenser lenses, projection lenses, and ultra-high performance optical interference filters using thin film stacks in conjunction with LED and thin film transistor arrays and devices.

10. Between 1997 to 1999, I held the positions of President and Chief Operating Officer at Alien Technology Corporation, where I was responsible for completing a Defense Advanced Research Projects Agency (“DARPA”) contract and implementing MicroElectroMechanical (“MEM”) fluidic self-assembly (“FSA”) technology for flat panel displays. I left that position in 1999.

11. I have over fifty-five years of professional experience focused heavily on the design and development of flat panel displays, transistor array substrates, touch panels, and OLED and LED devices.

12. I am listed as an inventor on twenty-six patents issued in the United States and foreign countries, including one United States design patent. My inventions concern technologies that include LED devices, semiconductor materials, glass materials, non-volatile memory cells, thin film transistors, flat panel

backplanes and displays, and wafer based active matrices, and various transistor array substrates. I have also authored or co-authored more than 25 publications in journals and major international conference proceedings, many of which are specifically related to displays, touch screens, and the associated thin film technologies. My *curriculum vitae* (Exhibit 1026) lists these articles, conference presentations, and patents.

13. I am also a member of several professional organizations, including Optica (formerly the Optical Society of America (“OSA”)), the International Society for Optics and Photonics (“SPIE”), the Audio Engineering Society (“AES”), the Society for Information Display (“SID”), and the Institute of Electrical and Electronics Engineers (“IEEE”).

14. I have served as an expert witness in over sixty patent cases, written scores of expert reports and declarations, and testified in district courts or before the International Trade Commission (“ITC”) eight times. Since 2019, I have also served as an expert witness in eight Patent Trial and Appeal Board (“PTAB”) proceedings involving touch panel screen technology.

15. My *curriculum vitae* contains further details regarding my experience, education, publications, and other qualifications that support my ability to render expert opinions in connection with this proceeding.

16. I am being compensated for my work in this matter at an hourly rate of \$495 for consulting services.

17. My compensation is not contingent upon the opinions I render or the outcome of this proceeding.

III. MATERIALS CONSIDERED

18. In preparing this Declaration, I reviewed and considered the following materials, along with any other documents referenced in the body of my Declaration:

Exhibit	Description
1001	U.S. Patent No. 9,507,477 (the “’477 patent”)
1002	Prosecution History of U.S. Patent No. 9,507,477
1004	U.S. Patent Publication No. 2008/0007538A1 (“Kotera”)
1005	Japanese Patent Publication No. JP 2006-171386A (“Miyagawa”) and certified translation
1006	U.S. Patent Publication No. 2006/0260977A1 (“Lee”)
1007	U.S. Patent Publication No. 2010/0134137A1 (“Kida”)
1008	U.S. Patent Publication No. 2011/0005662A1 (“Sung”)
1009	U.S. Patent Publication No. 2010/0220071A1 (“Nishihara”)

Exhibit	Description
1010	U.S. Patent Publication No. 2008/0062373A1 (“Kim”)
1011	Japanese Patent Publication No. JP 2009-053390A (“Nakamura”) and certified translation
1012	U.S. Patent Publication No. 2008/0074594A1 (“Tanabe”)
1013	U.S. Patent Publication No. 2001/0005200A1 (“Suzuki”)
1014	U.S. Patent Publication No. 2010/0123592A1 (“Nurmi”)
1015	U.S. Patent Publication No. 2006/0038580A1 (“Hasegawa”)
1016	U.S. Patent Publication No. 2008/0158453A1 (“Segawa”)
1017	U.S. Patent Publication No. 2009/0244021A1 (“Matsuo”)
1018	U.S. Patent Publication No. 2009/0231516A1 (“Okada”)
1019	U.S. Patent Publication No. 2011/0007251A1 (“Yamamoto”)
1020	U.S. Patent Publication No. 2011/0226726A1 (“Song”)
1021	European Patent Specification No. EP1533848B1 (“Chung”)
1022	U.S. Patent Publication No. 2004/0141110A1 (“Yu”)
1023	U.S. Patent Publication No. 2007/0181456A1 (“Kusuda”)
1024	U.S. Patent Publication No. 2011/0175841A1 (“Nakamura ’841”)
1025	Den Boer, “Active Matrix Liquid Crystal Displays” (2005)
1027	U.S. Patent Publication No. 2010/0085326A1 (“Anno ’326”)

19. I may use these documents and information, or other information obtained during the course of this proceeding, as well as representative charts, graphs, schematics and diagrams, animations, and models based on those documents and information, to support and to explain my testimony.

20. My opinions are based in part on a review and analysis of the above-mentioned documents and materials. I have also drawn on my education, experience, and knowledge of basic engineering and scientific principles in forming my opinions.

IV. UNDERSTANDING OF THE LAW

21. I am not an attorney, but I have been informed of several legal principles, which I have employed when forming my opinions in this Declaration. I have been informed and understand that each patent claim is considered separately for purposes of validity and that a dependent claim that depends from another claim includes all of the limitations of the claim it depends from.

A. Claim Construction

22. I have been informed and understand that the claims of the challenged patents in this proceeding are to be construed using the same claim construction standard that is applied in district court. I have been informed and understand the claim construction analysis begins with the ordinary meaning of a claim term, and

there is a presumption that the term carries its plain and ordinary meaning to persons of ordinary skill in the art (“POSITA”) as of the effective filing date of the patent. I have also been informed and understand that the most important sources for determining the meaning of a claim term are the claims, the specification, and the prosecution history of the patent at issue, which collectively is called “intrinsic evidence.” I have been further informed and understand that the meaning of a claim term may also be guided by “extrinsic evidence,” such as contemporaneous dictionaries and treatises.

B. Burden of Proof

23. I have been informed and understand that the petitioner in an *inter partes* review bears the burden of establishing invalidity by “a preponderance of the evidence.” I have been further informed and understand that, to prove an assertion by “a preponderance of the evidence,” the party with the burden of proof must demonstrate that it is more likely than not that the assertion is true.

C. Obviousness

24. I have been informed and understand that a patent claim is invalid if it would have been obvious to a POSITA at the time of the claimed invention. I have been further informed and understand that a claimed invention is not patentable if differences between it and the prior art are such that the subject matter as a whole

would have been obvious at the time the invention was made to a person having ordinary skill in the pertinent art. I have been informed and understand that factors relevant to the determination of obviousness include the scope and content of the prior art, the level of ordinary skill in the art at the time of the invention, differences between the claimed invention and the prior art, and “secondary considerations” or objective indicia of non-obviousness.

25. I have been informed that a single reference alone can render a patent claim obvious, if any differences between the reference and the claim would have been known or obvious to a POSITA at the time of the invention. That is, if a POSITA could have adapted the reference to meet the claims of the patent by applying known concepts to achieve the expected results, then the patent claims are rendered obvious by that reference.

26. I have been informed and understand that the combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results. I have been further informed and understand that when a patent claim simply arranges old elements, with each performing the same function it had been known to perform, and yields no more than one of ordinary skill would expect from such an arrangement, the combination is obvious.

27. I have been informed and understand that a patent claim composed of several limitations is not obvious merely because each limitation was independently known in the prior art. Hindsight reasoning is not an appropriate basis for combining references to form an obviousness combination. I have been further informed and understand that it can be important to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine multiple prior art references.

28. I have been informed that various “secondary considerations” (sometimes referred to as objective indicia of non-obviousness) may support a determination of non-obviousness and that such secondary considerations must be considered as part of an obviousness analysis. I have been informed that even strong evidence of secondary considerations may not be sufficient to rebut a strong showing of obviousness. I have been informed that the patentee bears the burden of showing the existence and effect of secondary considerations of non-obviousness, after which the burden of coming forward with rebuttal evidence shifts to the party arguing obviousness. I have been informed that the following secondary considerations may indicate non-obviousness:

- Copying: evidence that others, including an accused infringer, copied the patented invention.

- Long-standing problem or need: evidence of a persistent problem or need in the art that was resolved by the patented invention.
- Prior failure: evidence that others have tried and failed to solve the problem or failed to provide the need resolved by the claimed invention.
- Commercial acquiescence of competitors: the willingness of industry to license the patent at issue.
- Skepticism: evidence that those of ordinary skill in the art were skeptical as to the merits of the invention.
- Praise: evidence of praise directed to an invention by others in the field.
- Unexpected results: evidence that those of ordinary skill in the art were surprised by the capabilities of the claimed invention.

29. I have also been informed that the near-simultaneous invention by others can be evidence that a claimed invention is obvious. I have further been informed and understand that the patentee bears the burden of showing a “nexus” between the claimed invention and the evidence proffered on secondary considerations (*e.g.*, proof of commercial success of a product that practices the claimed invention is not enough; there must be evidence that the commercial success resulted, at least in part, from the claimed invention).

D. Priority Date

30. I have been informed and understand that a U.S. patent may claim “priority” to the filing date of one or more earlier filed applications. I have been informed that the priority date, also called the “effective filing date,” is the earliest filing date to which a claim is entitled and that such date is relevant for determining what qualifies as prior art. I understand that a claim must have written description support in the application(s) to which it claims priority to be entitled to an earlier effective filing date. I have been informed that the priority date determination is done on a claim-by-claim basis and that claims in the same patent may have different priority dates.

31. I understand that when a U.S. patent or application is invoked as prior art, its effective filing date may be deemed to be the filing date of a related foreign application when said related foreign applications discloses the same subject matter as said U.S. patent or application, and that a related U.S. application was filed within a year of the foreign application.

32. I have been informed and understand that the level of ordinary skill in the relevant art at the time of the invention is relevant to inquiries such as the meaning of claim terms, the meaning of disclosures found in the prior art, and the reasons one of ordinary skill in the art may have for combining references.

33. I have been informed and understand that factors that may be considered in determining the level of ordinary skill include: (1) the type of problems encountered in the art; (2) prior art solutions to those problems; (3) the rapidity with which innovations are made; (4) the sophistication of the technology; and (5) the education level of active workers in the relevant field. I have been further informed and understand that a person of ordinary skill in the art is also a person of ordinary creativity.

V. LEVEL OF SKILL IN THE ART

34. In light of the above factors relevant to determining the level of ordinary skill, I have developed an opinion on the appropriate level of ordinary skill in the art that I have applied in my analysis set forth in this Declaration. As explained below, the Challenged Patent pertains generally to the fields of displays and touch panels. A POSITA at the time of the alleged invention 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*. I was, at all relevant times, at least a POSITA relevant to the Challenged Patent.

35. While it is my opinion that the above stated level of ordinary skill in the art is correct, my opinions set forth herein remain unchanged under a different

articulation of the level of ordinary skill in the art. I reserve the right to explain how, if at all, my opinions would differ if the Patent Owner alleges that a different level of ordinary skill in the art should apply.

VI. SUMMARY OF OPINIONS

36. I have been asked to compare various prior art references to Claims 1-21 of the '477 patent (the “Challenged Claims”). In my opinion, all Challenged Claims are unpatentable as obvious – based on these prior art references, combined with the knowledge of a POSITA.

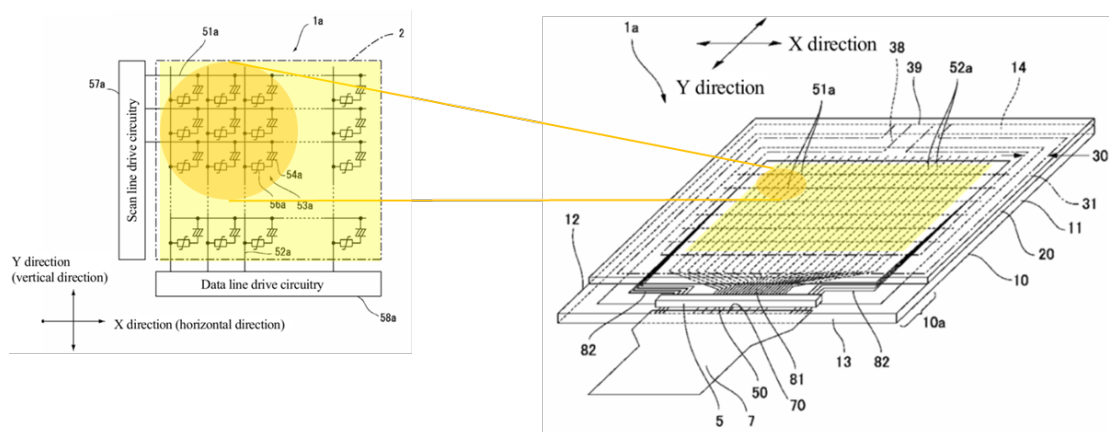
37. My substantive analysis in Section X provides examples of why these prior art references render the Challenged Claims unpatentable. I reserve the right to cite and rely on additional portions of these references in any future declarations or depositions.

VII. TECHNOLOGY BACKGROUND

38. The purported invention of the '477 patent is related to display devices—such as liquid crystal displays (“LCDs”) and touch panels—commonly used in products like smartphones, tablets, laptops, and other electronic screens. The '477 patent describes structures and methods used to detect cracks and chips in display substrates.

39. Some background about the structure and manufacturing of displays is helpful to understand the purported utility and operation of the '477 patent disclosure. Flat panel displays, such as LCDs, are built from one or more substrates layered upon one another. In the case of LCDs, a layer of liquid crystal material is sealed between the substrates. Nakamura, [0003].

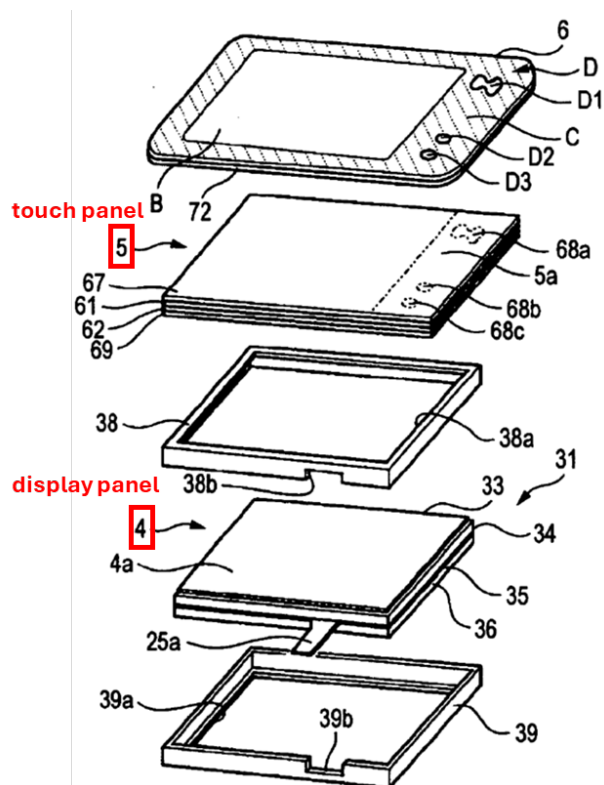
40. Display panels comprise an array of pixels that create the visuals seen on devices like TVs, monitors, smartphones, tablets, and laptops. A display's pixels are coupled through wirings around the array to components that provide the image signals for display. Pixels are connected to drive circuits via two types of wiring: scan lines and data lines. Scan lines are formed on the substrate, row-by-row, to select rows of pixels during operation. Data lines run perpendicular to the scan lines delivering image data signals to the pixels. Together, these lines enable the drive circuits to control each pixel on the panel. As shown in the image below, the scan and data lines are connected to wires (also called interconnect) around the periphery of the substrate and to the components responsible for controlling the display and sending it image signals.



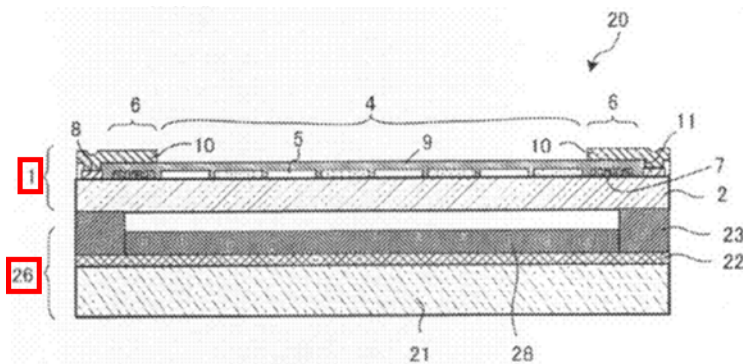
Miyagawa, Figs. 1–2;¹ *see also id.*, Figs. 6–7; Kim, Fig. 4; Ex. 1016, Fig. 3.

41. The display device disclosed in the '477 patent may comprise a touch panel. Ex. 1001, Abstract. It was conventional to integrate display panels with touch panels in electronic devices. Ex. 1023, [0046]–[0048]. A touch panel 5 is added to a display panel 4 to function as a touch screen, as shown in the exploded view below from Kotera:

¹All color annotations to figures herein are added.

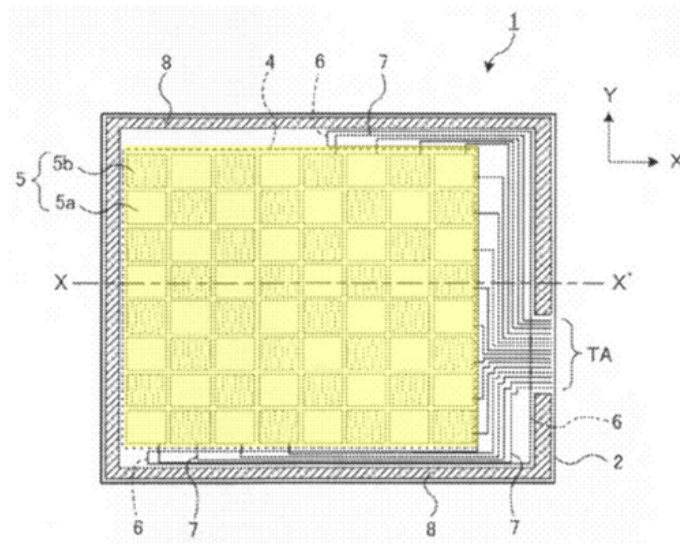


Kotera, Fig. 3 (partial), [0024]. It was also well known in the prior art to tightly integrate the touch panel substrate with the display panel substrate. For example, the following cross-sectional view shows a common arrangement, with touch panel 1 above display panel 26:

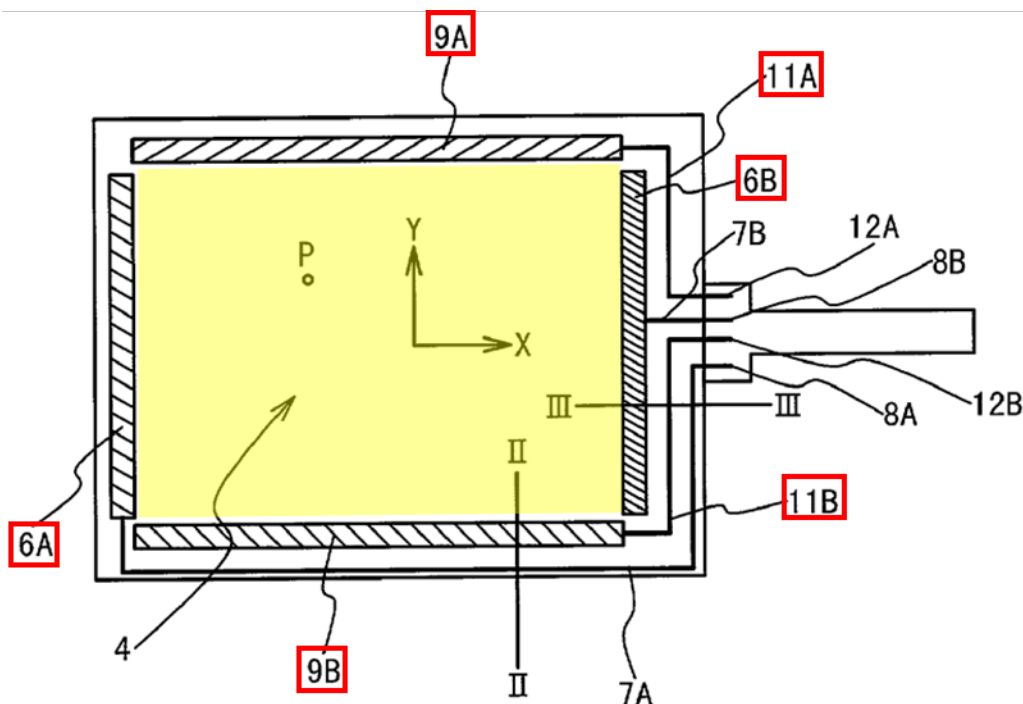


Nishihara, Fig. 8, [0066].

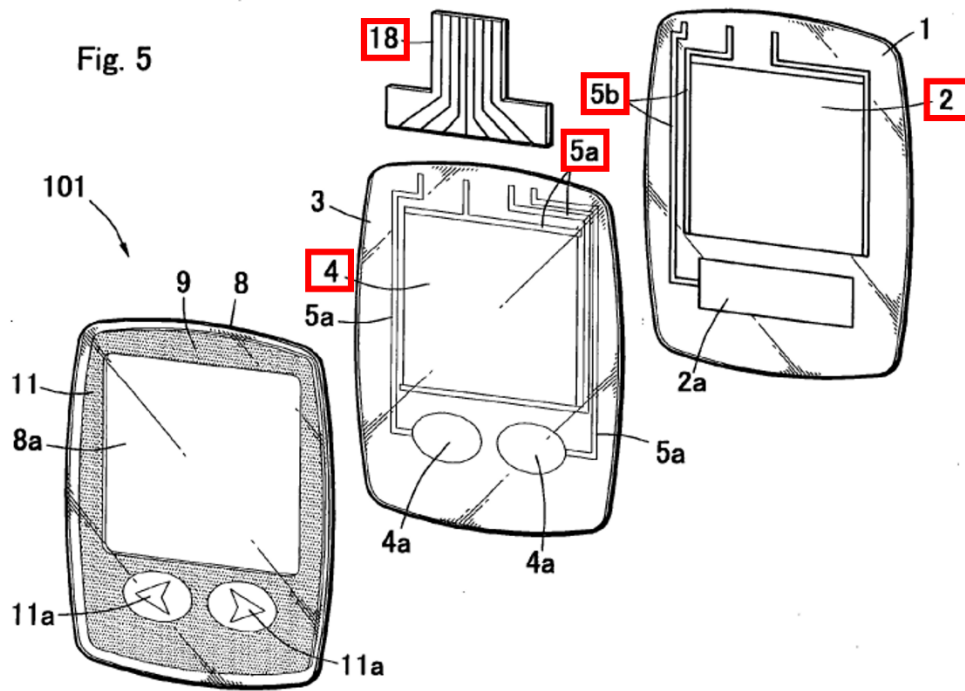
42. There are several types of touch panels, with capacitive and resistive types being most common. Ex. 1014, [0016]; Ex. 1022, [0006]–[0007]. A resistive touch panel consists of two insulating substrates with opposing ITO layers separated by insulating spacers; touching the flexible top sheet can cause the ITO layers to make electrical contact, allowing the system to detect touch location by measuring the resulting voltage changes. Ex. 1025, 192–94. A capacitive touch panel is constructed with a glass substrate and a conductive ITO layer patterned at the edges and corners, which distributes a low voltage field across the surface. *Id.*, 194–95. When a conductive object, such as a finger, touches the panel, it draws a small current proportional to its distance from the electrodes, enabling a controller circuit to calculate the touch location. *Id.*, 195. Similar to the structure of display panels, touch panels typically have signal interconnect wirings in their periphery that connect to detection elements—such as detection electrodes (for example, the ITO layers in resistive types and the patterned electrodes in capacitive types)—within the touch sensing region of the panel:



Nishihara, Fig. 1A (capacitive, shaded area showing the detection region), [0042]–[0045]; *see also* Ex. 1017, Fig. 2 (capacitive). This configuration is illustrated in other touch panel references, which show peripheral wiring connected to detection electrodes within the detection region:



Ex. 1013, Fig. 2 (electrodes 6A–6B and 9A–9B and wiring lines 11A–11B of a resistive touch panel), [0032]–[0036]; Ex. 1025, 193–94 (resistive). As discussed above, it was common in resistive touch panels for detection electrodes and associated wiring to be provided on the opposing substrates, allowing for signal transmission to external circuits. This is illustrated in the figure below, which shows an exploded view of protection panel with upper electrode 4 and lower electrode 2 formed on separate layers, and associated wiring 5a, 5b connected to external circuitry via film connector 18:

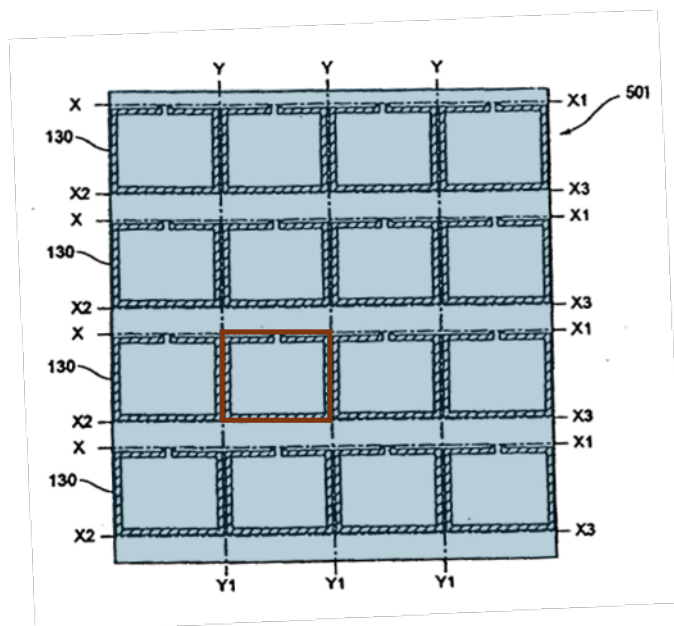


See Ex. 1023, [0076], Fig. 5. Another example of this arrangement is shown in the structure and wiring of the touch panel below, where the upper electrode 104 and lower electrode 105 are provided on opposing substrates, and wiring 106a–106d, 107a–107d is routed to connection section 108 for external signal extraction via FPC 110 and pins 111–114:

[illegible]

23

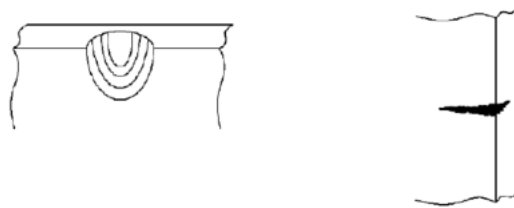
efficiency. After all the necessary manufacturing steps are completed on the mother substrate, it is cut into individual panels for further manufacturing steps.



Ex. 1018, Fig. 34, [0035]–[0037]; *see also* Ex. 1019, Fig. 14, [0012]; Ex. 1020, Fig. 2, [0031]–[0033].

44. For display panels, two mother substrates can be processed separately—one for the display’s addressing electronics and one for the color filter. After completing the necessary manufacturing steps on these large substrates, each mother substrate is cut (or “singulated”) into individual substrates. The display substrates are then rim-sealed together, and liquid crystal material is introduced to form the LCD panel. A touch panel, itself formed of singulated substrates, may be

added afterward to create a touch screen. Alternatively, the mother substrates can be bonded and then cut. Ex. 1001, 1:36–42. Either way, when cutting the mother substrate into individual panels, chips or cracks may form at the edges of the glass substrate. If such a defect occurs during the cutting process, wiring patterns and circuits that are positioned close to the edges are vulnerable to being damaged. As a result, chips or cracks can lead to broken or disconnected wiring, causing defects in an individual panel.

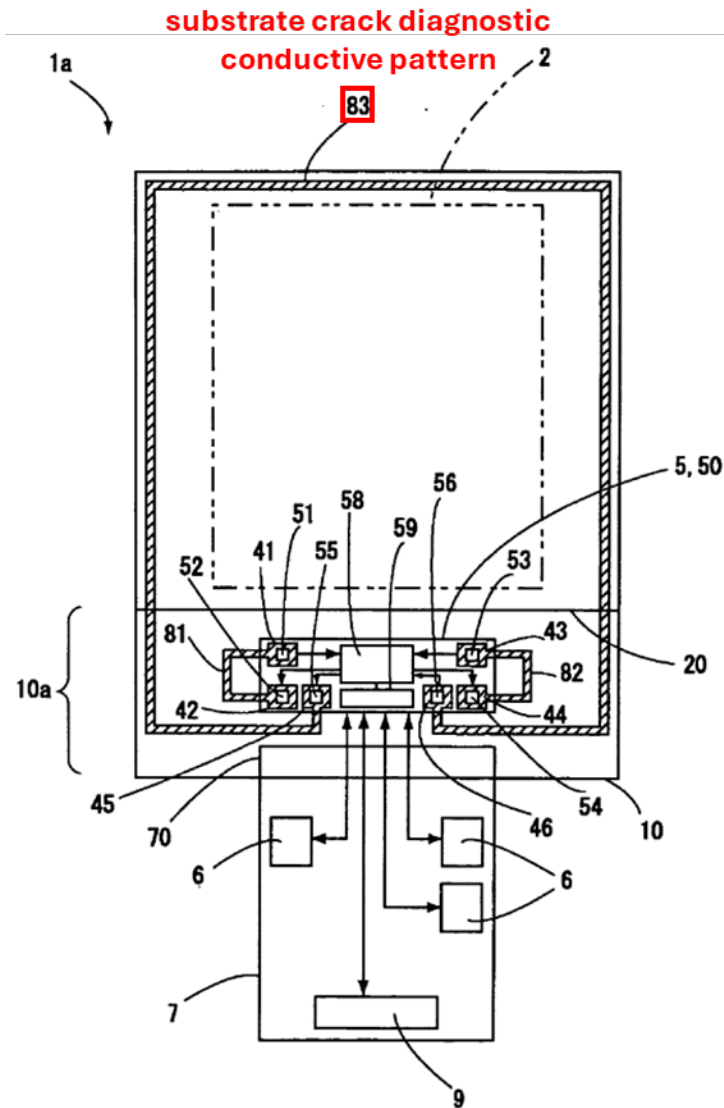


Ex. 1011, Figs. 9B–9C; *see also* Kida, [0006]–[0008].

45. It is advantageous to detect such defects early during manufacturing to avoid wasted time, effort, and components that would otherwise be spent on a defective panel. Ex. 1011, [0043]–[0044]. Crack detection can be performed either before or after the panel is assembled.

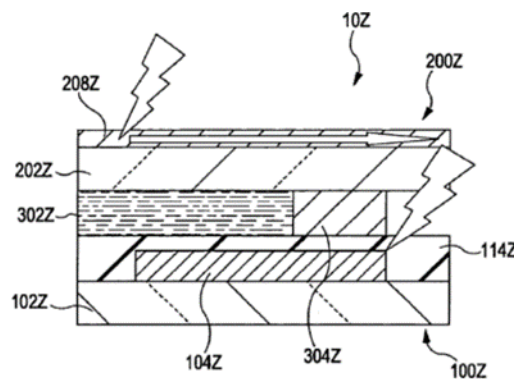
46. A typical crack detection technique uses a wire deposited on the mother substrate around the edges of each display or touch panel. After cutting, an electrical continuity check is performed by attempting to pass a current through the wire. The

peripheral, crack detecting wire, is closer to the device edge than the operative interconnect wiring and other circuitry. If a current successfully passes through the crack detecting wire, it indicates no serious defects occurred during the cutting process. On the other hand, if a current does not pass through the crack detecting wire, that indicates a crack or chip has broken the peripheral wire and likely damaged operative components, such as the interconnect wiring.



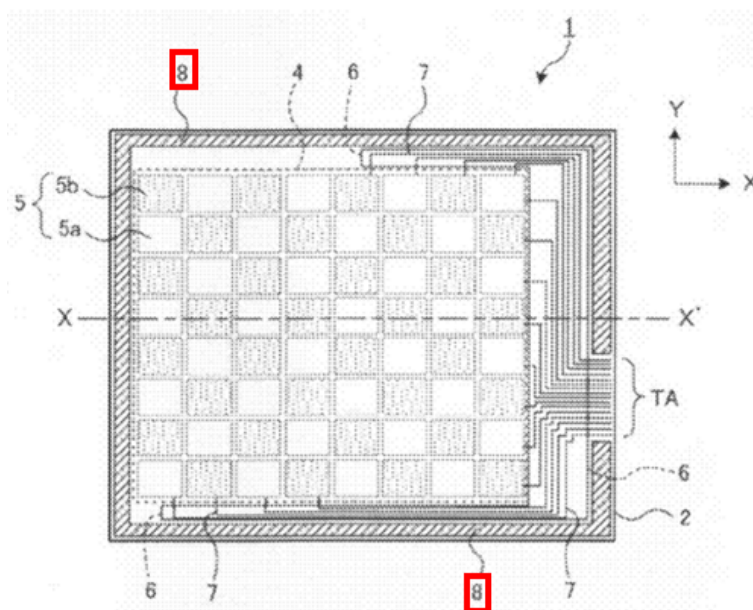
Ex. 1015, Fig. 4, [0051]–[0053]; *see also* Miyagawa, Fig. 3; Ex. 1014, Fig. 9, [0043].

47. Touch screens (display panels and touch panels) may also be subject to environmental stress, such as electrostatic discharge and other forms of electromagnetic noise, that could degrade or damage the panel.



Ex. 1016, Fig. 6 (illustrating electrostatic discharge).

48. As shown in Nishihara, a wire (8) formed around the panel's peripheral edges protects it from such stress. Such environmental stress tends to affect the touch screens during post-manufacturing operations of the screen, for example, by end users.

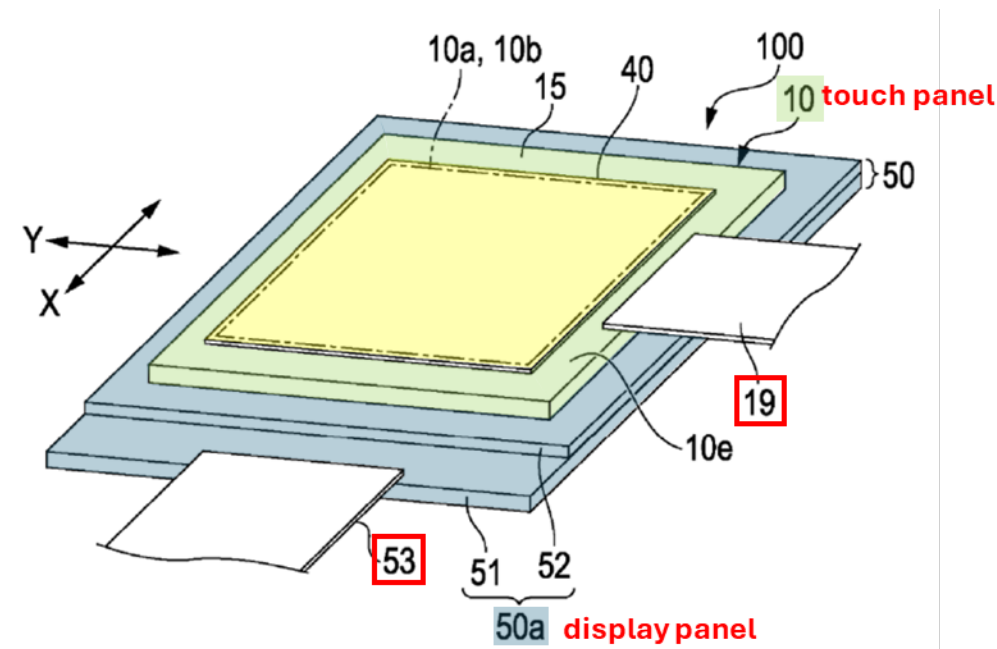


Nishihara, Fig. 1A, [0043] (shield electrode 8); *see also* Ex. 1016, Fig. 3; Ex. 1017, Fig. 2; Kim, Fig. 2, [0032]–[0033]; Ex. 1021, Fig. 3, [0030]–[0031]. Like the crack detection wire, these shielding wires are simply a conductive trace run around the periphery of the substrate.

49. Structurally, wires used for crack detection and electrostatic and noise shielding are both a conductive trace run around the periphery of the substrate. Operationally, wires for crack detection are used in manufacturing and wires for shielding are used in operation. Therefore, these two types of wires are structurally similar or identical and are functionally compatible, and the same wire can perform both functions. This was recognized in the art by 2007, as Nakamura taught that a

single wire could be used to perform both functions, stating that “each [of] defective line detection patterns D1 and D2 [for crack detection] may be formed using a conventional shield line and the like as typically formed.” Ex. 1011, [0041].

50. It was also routine to connect touch and display panels to control circuitry via flexible wiring boards or substrates (*e.g.*, ribbon cables) for signal and power transmission. For example, the flexible substrates 19 and 53 in Matsuo are respectively connected to touch and display panels in the device below:



Ex. 1017, Fig. 1.

51. Another example is provided in Anno '326, which describes using a flexible printed circuit board to connect a touch panel to control circuitry for

transmitting signals from the control circuit to the panel. Ex. 1027, [0095]–[0097]; *see also* Ex. 1024, [0047]–[0048], [0051]. Control circuitry was commonly implemented using integrated circuit (“IC”) chips placed on a substrate of the panel, a flexible substrate, or on another component coupled to the flexible substrate. Miyagawa, [0020], [0040].

VIII. THE CHALLENGED PATENT AND ITS PROSECUTION HISTORY

A. The Patent

52. The ’477 patent’s manufacturing techniques purportedly “facilitat[e] the inspection for signal interconnects [wirings] formed in the region outside detection and display areas for [a] display device.” Ex. 1001, 1:25–28; *see also id.*, 2:40–45 (no additional manufacturing steps). Conventional LCD panels includes two substrates: electronics on one and color filters being the other, sandwiching a liquid-crystal layer. *Id.*, 1:30–35.

53. In manufacturing, mother substrates are cut to form smaller substrates, each of which may be used to sandwich a layer of liquid crystal to form individual LCD panels. *Id.*, 1:41–48. A touch panel can be added to form a touch screen. *Id.*, 1:49–54. Both display and touch panels comprise interconnects in their periphery. *Id.*, 1:42–62. This was conventional because an active area (for display or touch) is placed in the center of the panels. *See id.*, 1:66–2:2. When mother substrates for

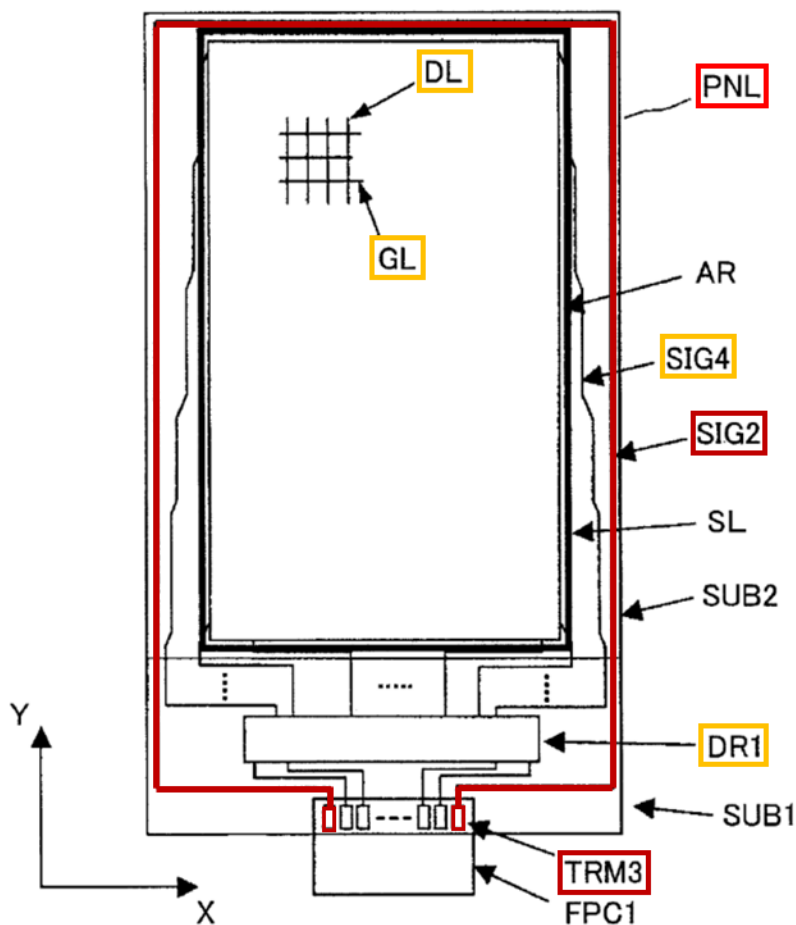
display- or touch-panels are cut to form individual panels, the interconnects may be broken in the process due to substrate chipping or cracking caused by the cutting. *Id.*, 1:42–48, 1:58–62.

54. According to the '477 patent, one form of prior art, described in JP-A-2002-350896, uses an “array technique” to detect the disconnection of common interconnects, which the patent criticizes because the array technique requires inspection on every interconnect. *Id.*, 1:63–2:4, 2:34–37. The patent also criticizes visual inspection to detect broken interconnects as difficult. *Id.*, 2:18–33. The technique of the patent purports to “simply determine pass/failure of signal interconnects for chipping or cracking of a substrate without increas[ing]” manufacturing complexity. *Id.*, 2:40–45.

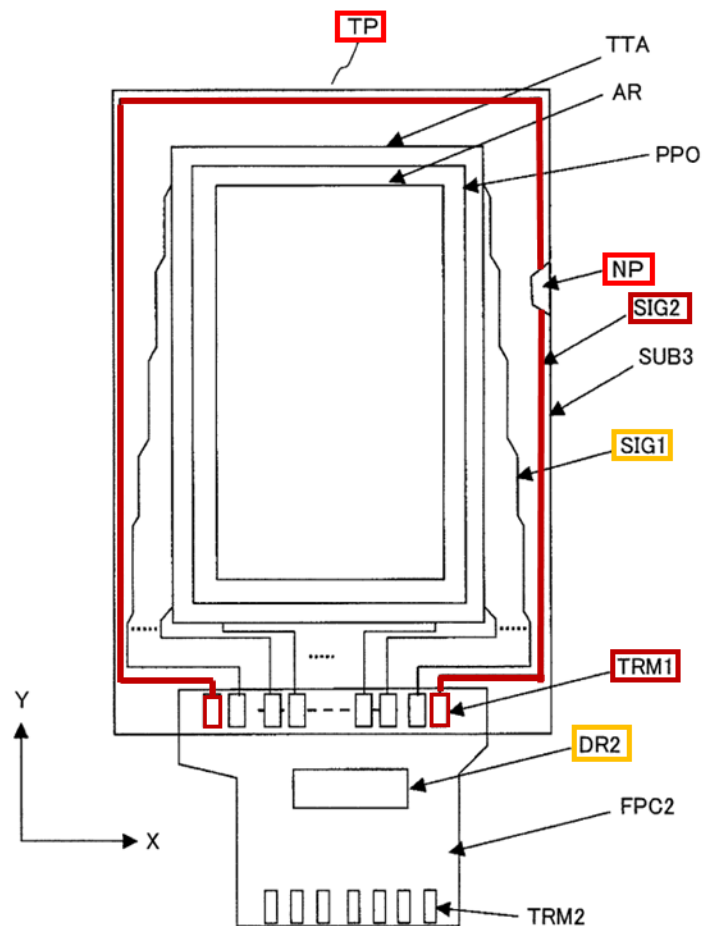
55. To solve the identified problems, the '477 patent discloses adding a conductive wire around the perimeter of the substrate, which the patent refers to as an interconnect. *See, e.g., id.*, 2:55–3:7, 3:35–42. To enable testing the continuity of the conductive wire, the patent discloses electrode terminals at the two ends of the interconnect. *Id.*, 3:4–7, 3:39–42. The electrical resistance across these electrodes is used to determine whether the detection interconnect remains continuous; if a crack or chip in the substrate breaks the interconnect, the measured

resistance will increase significantly or become infinite, indicating a break. *Id.*, 9:32–40. As discussed above with respect to the prior art discussed in the technical background, if the crack detection conductor is broken, the device is potentially damaged.

56. The '477 patent recognizes that this simple approach can be applied to different substrates used in the construction of a touch display. For example, Figure 9, below, shows a detection interconnect SIG2, with electrode terminals TRM3, added to a display panel PNL:



Id., Fig. 9. As dictated by the concept, the SIG2 crack detection line surrounds the displays drain lines DL and gate lines GL, which are coupled to a driving circuit DR1 at the bottom of the device. *Id.*, 15:32–35. As the patent explains, the crack detection interconnect SIG2 “is formed along the peripheral edge portion” of the display panel, “surround[ing]” other wirings and components. *Id.*, 15:42–16:15.



formed along the peripheral edge portion” of the panel, “outside” other wirings and components. *Id.*, 7:58–66.

58. The ’477 patent purports to invent the crack-detection wire, or “interconnect,” but admits that device substrates to which it is applied are “identical with that of well-known liquid crystal display devices.” *Id.*, 4:24–38. Consistent with this, I do not see anything novel about the touch and display devices as of the priority date of the ’477 patent. Moreover, as explained at length below, by the time of the ’477 patent’s priority date, crack detection interconnects applied to substrates were well known and it would have been obvious to adapt them to the particular touch or display substrate being created.

B. Prosecution History

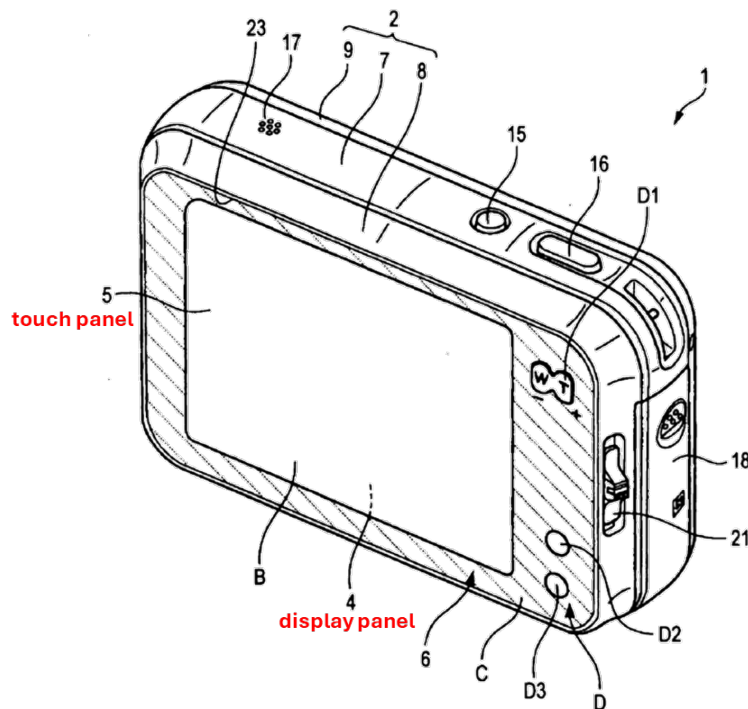
59. The prosecution history of the ’477 patent was brief. The Examiner rejected the application leading to the patent based on nonstatutory double patenting. Ex. 1002, 140–142. To overcome that rejection, Applicant filed a terminal disclaimer. *Id.*, 153. The Examiner then allowed the claims. *Id.*, 172–174.

IX. THE PRIOR ART

A. Kotera

60. Kotera discloses a touch display. Kotera, Abstract. Kotera describes a digital still camera as a main embodiment, but the touch display in Kotera can be

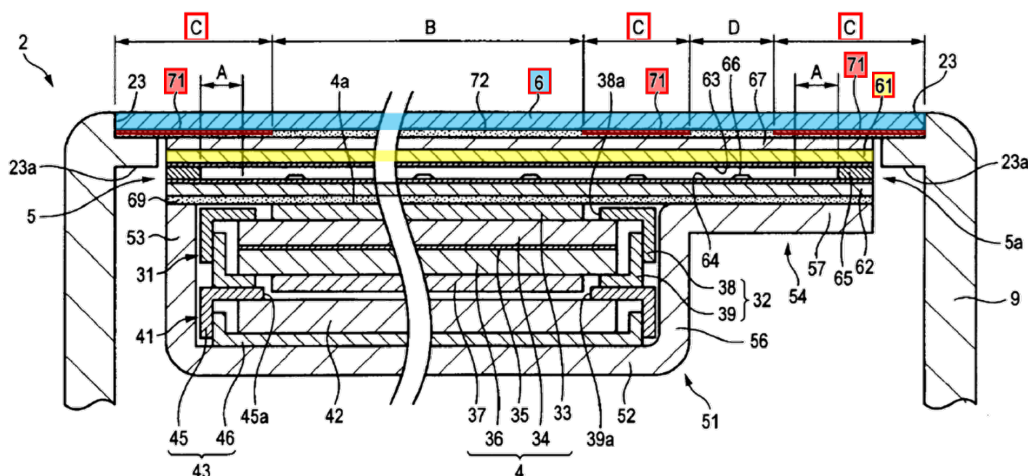
employed in other electronic devices such as digital video cameras, cell phones, personal computers, portable gaming devices. *Id.*, [0072].



Id., Fig. 2, [0023]–[0024] (describing the digital still camera embodiment at a high level).

61. Kotera’s focus is on structurally reinforcing the touch panel against pressing force (for example, to operate the panel) to prevent breakage to the touch screen. *Id.*, Abstract, [0013]. Reinforcing areas C formed from an opaque serigraph 71 provide the structural reinforcement. *Id.*, [0053]–[0054]. As shown in

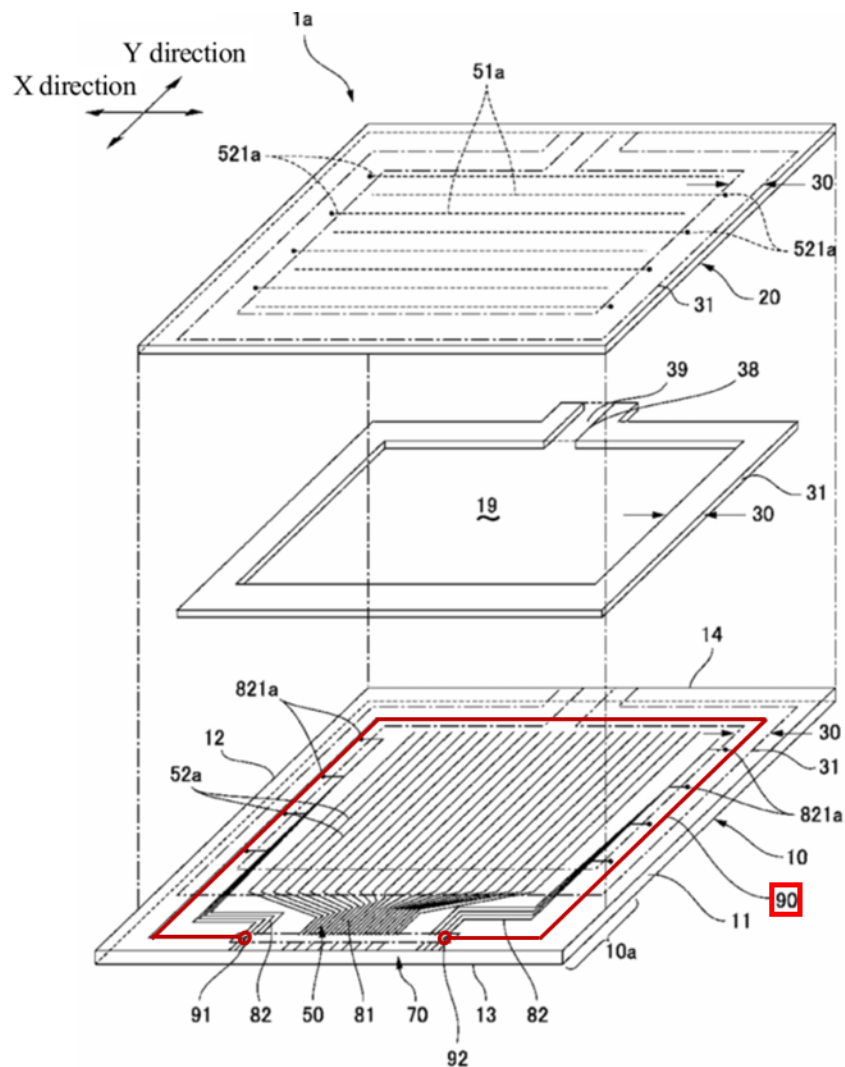
Figure 4 below, the serigraph 71 (highlighted in red) is placed between the surface sheet 6 (highlighted in blue) and upper film member 61 (highlighted in yellow):



Id., Fig. 4. The serigraph uses a rigidity enhancing coating material to improve the resistance against pressing force.

B. Miyagawa

62. Miyagawa discloses LCD displays with a diagnostic wiring that, when cracked, becomes an open circuit, that is, electrically discontinuous, thus enabling a “defect caused by a substrate crack” to be detected during manufacturing. Miyagawa, Abstract. In other words, electrical current cannot flow through the diagnostic wiring when a crack damages it. The diagnostic wiring is placed on the edges of a substrate:



Id., Fig. 3, [0023]–[0024] (describing the substrate crack diagnostic wiring and pads).

C. Lee

63. Lee discloses display panels having signal lines, an IC chip, and electrostatic discharge protective lines all disposed on a “flexible carrier.” Lee,

Abstract. The electrostatic discharge protective lines connect an LCD panel to ground terminals on a printed circuit board. *Id.*, [0024]–[0026]. The ground terminals provide a discharge path for static electricity that may impact the flexible carrier. *Id.*, [0026].

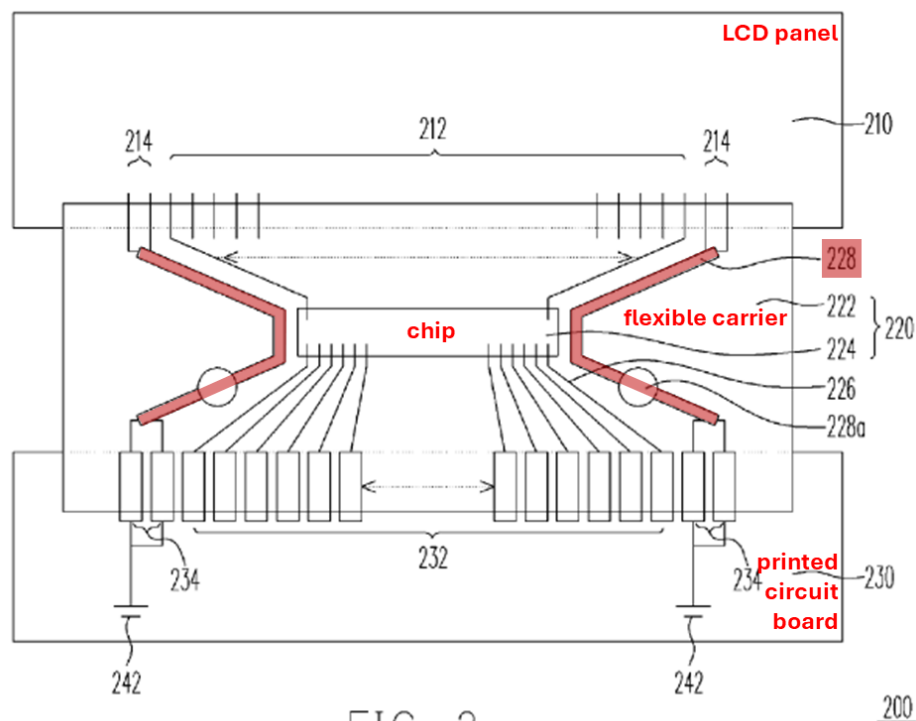
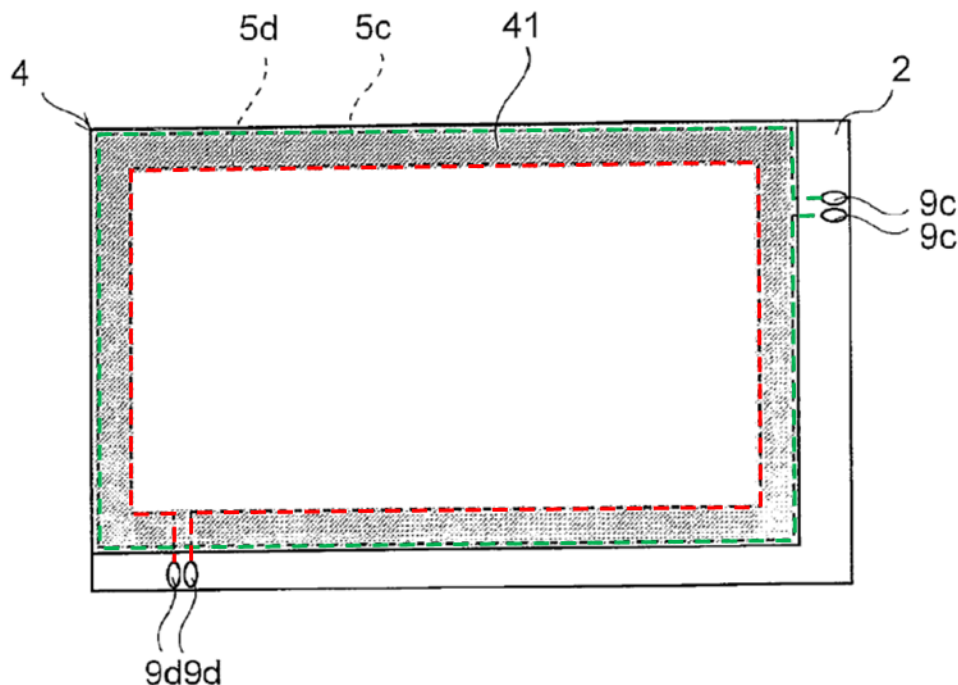


FIG. 2

Id., Fig. 2. Because of the discharge path, Lee's invention "provide[s] superior electrostatic discharge protecti[on]...." *Id.*, [0031].

D. Kida

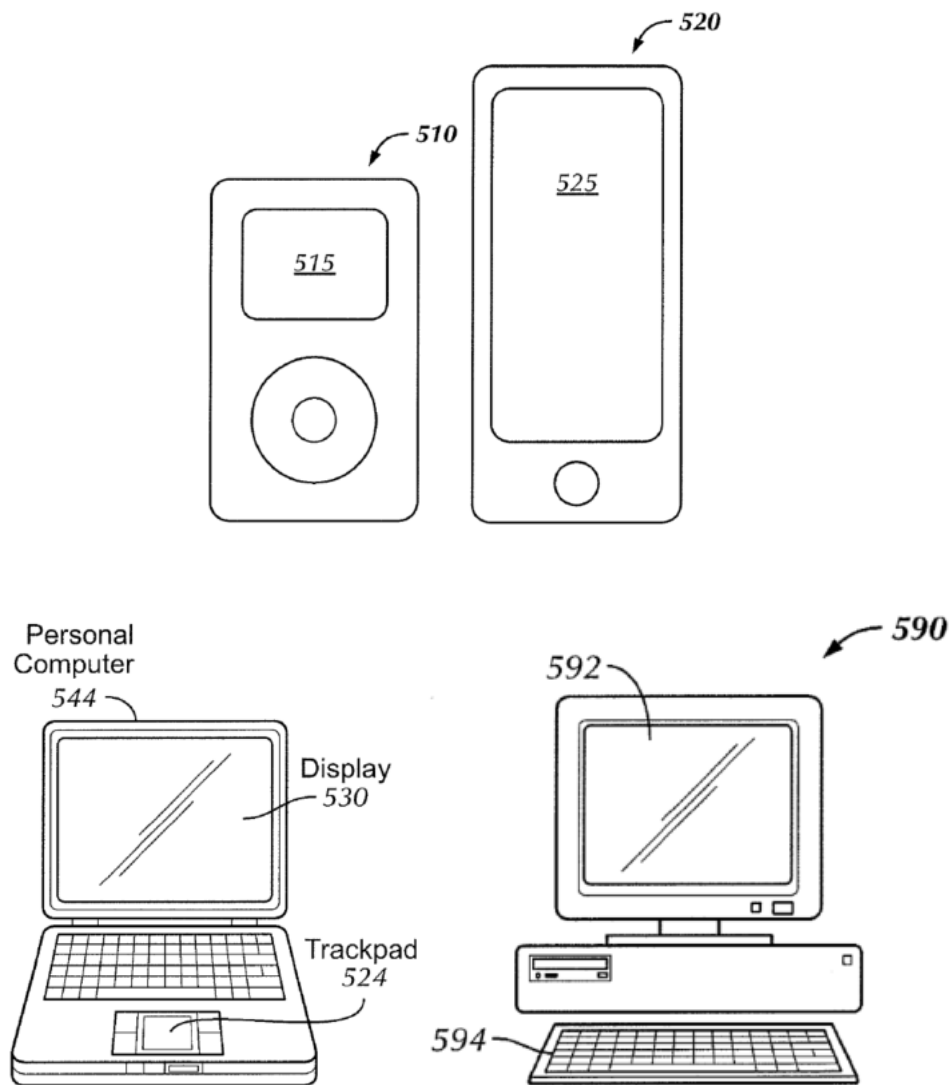
64. Kida discloses LCD panels capable of detecting a small crack that may become larger and cause the panel to become defective. Kida, Abstract. Two “inspecting conductors” on the peripherals of a substrate provide this capability.



Id., Fig. 11(b), [0114]–[0119] (description of Figure 11(b)).

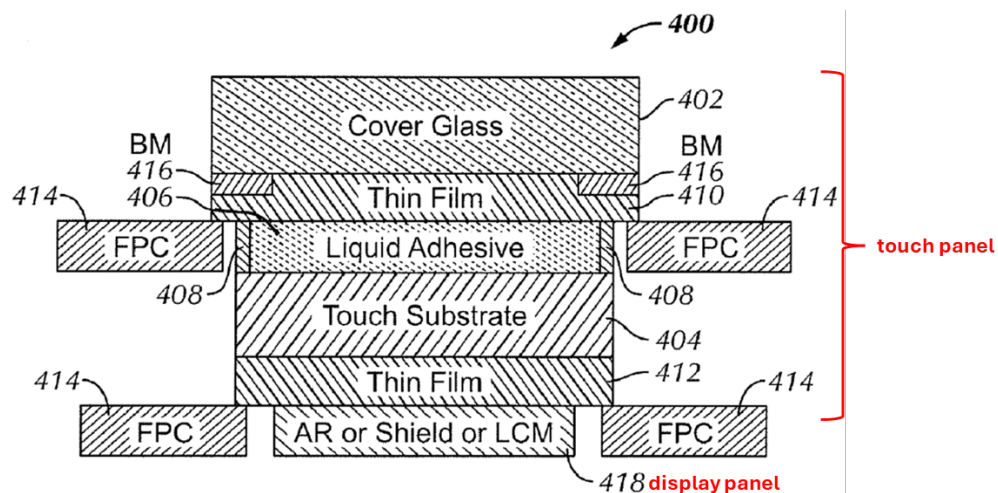
E. Sung

65. Sung discloses “[a] method for fabricating a plurality of touch sensor panels....” Sung, Abstract. Sung’s method can be applied to a variety of devices, including well-recognized portable music devices, mobile phones, and personal computers:



Id., Figs. 5A–5D, [0045]–[0049].

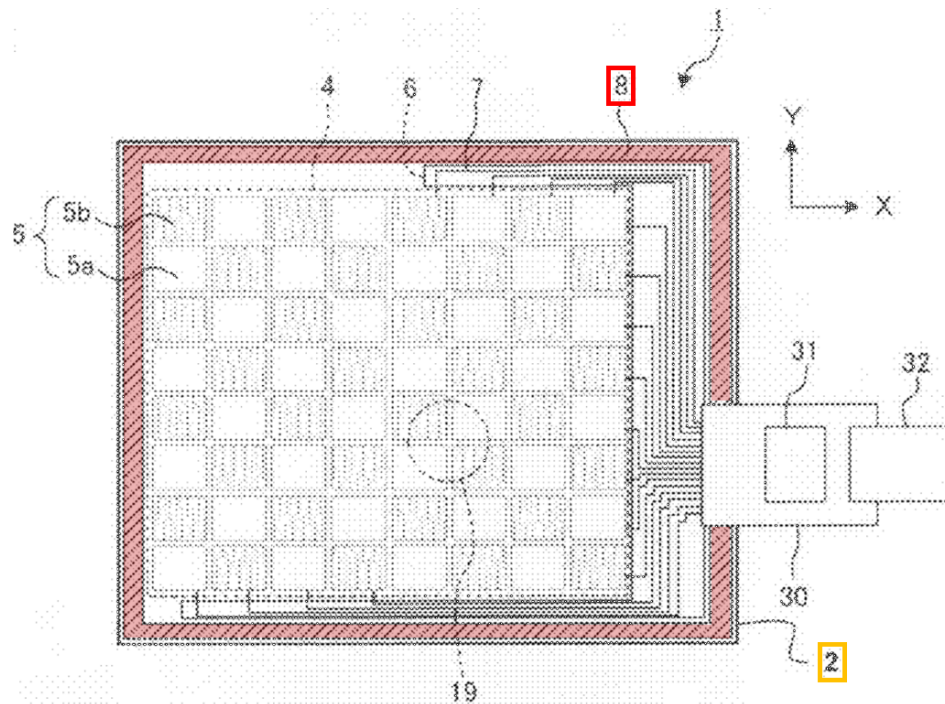
66. Sung’s devices comprise a touch panel and a display panel, *e.g.*, a liquid crystal monitor (“LCM”):



Sung, Fig. 4, [0039]–[0042]. As the figure shows, Sung focuses on the touch panel and does not disclose much about the display panel LCM.

F. Nishihara

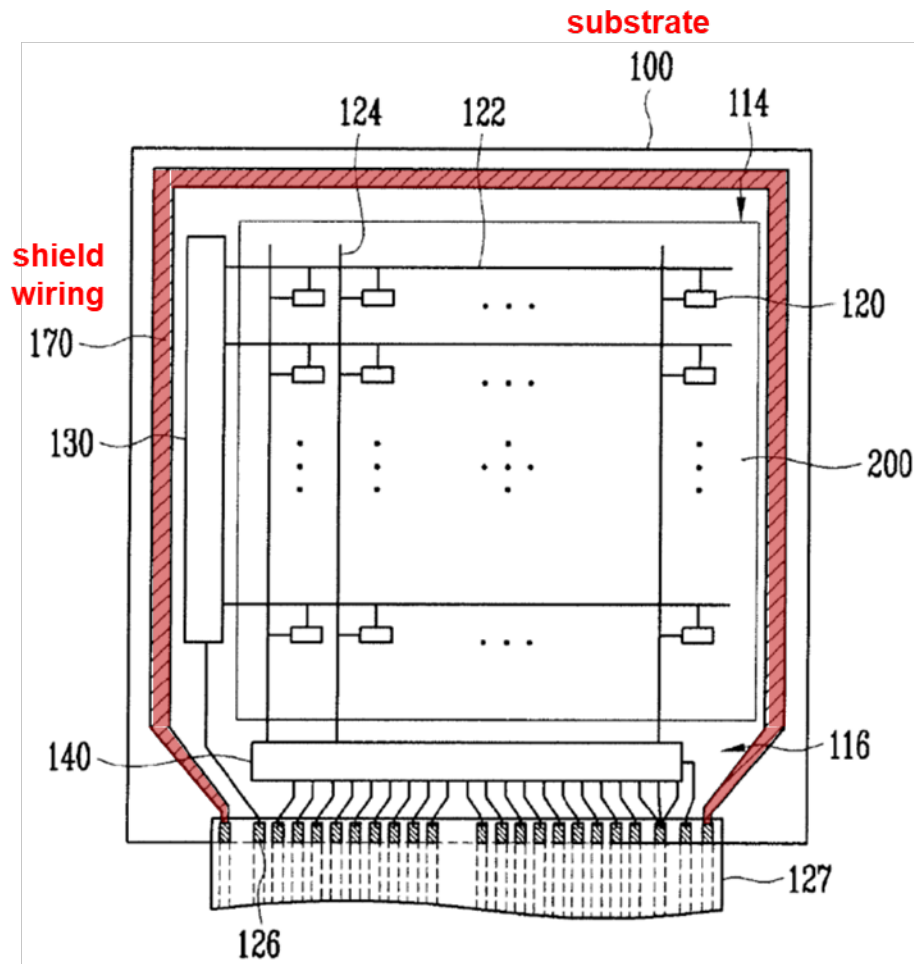
67. Nishihara discloses a touch display that is resistant to “electromagnetic noise or static electricity.” Nishihara, [0009]. A shield electrode disposed on the edges of the touch substrate provides the enhanced resistance. *Id.*, [0010], [0043].



Id., Fig. 2A, [0047]–[0050] (description of the Figure 2A embodiment).

G. Kim

68. Kim discloses display panels with a shield wiring along the edges of a display substrate:



Kim, Fig. 4; [0037]. The shield wiring is coupled to an external electrical ground. *Id.*, [0046]. The electrical ground protects the circuits on the substrate from being damaged from electrostatic discharge. *Id.*, [0047].

**X. THE CHALLENGED '477 PATENT CLAIMS ARE UNPATENT-
ABLE OVER THE PRIOR ART**

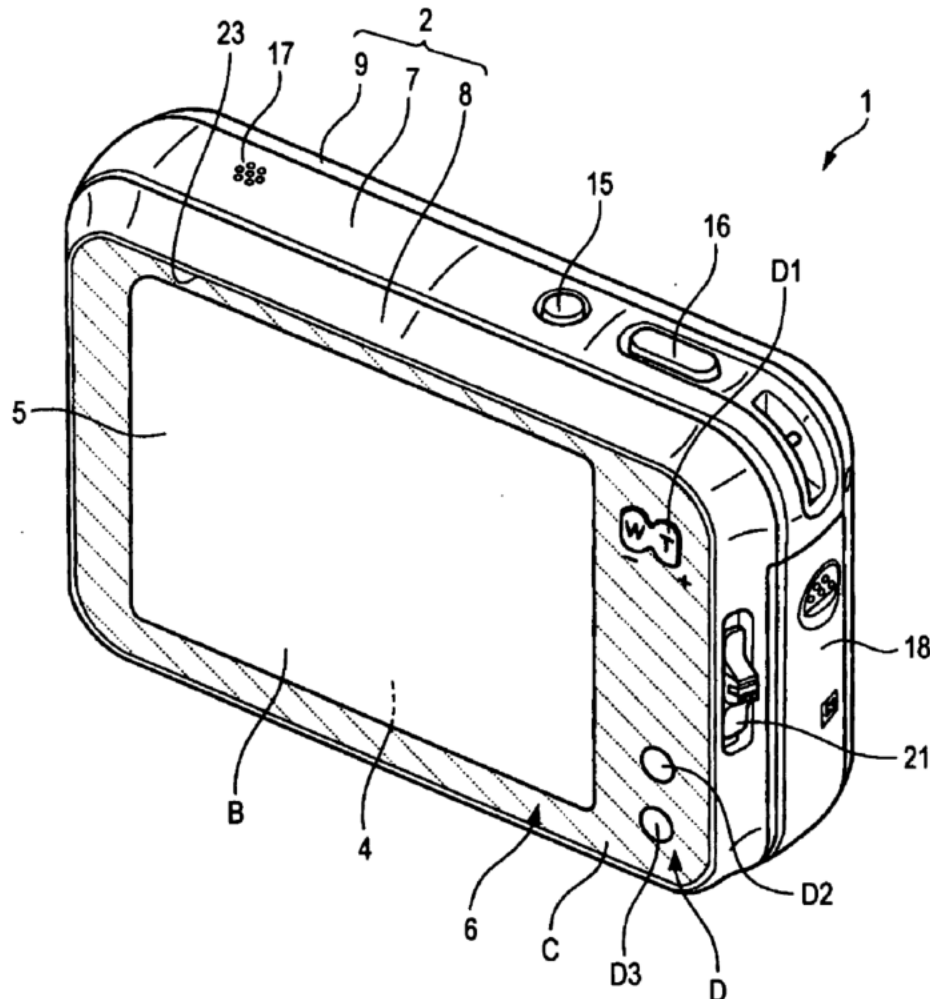
**A. GROUND 1: Kotera in View of Miyagawa Renders Claims 1–2,
8–10, 12, 17–18, and 20–21 Obvious**

1. Claim 1

a) 1[pre]

69. Kotera discloses *a display device*,² e.g., “a display device equipped with a touch panel.” Kotera, [0072]. Kotera illustrates its embodiment in a digital still camera. *Id.* But it can be applied in a range of electronic devices such as cameras, personal computers, cell phones, etc. *Id.*

² Text in red italics is verbatim claim language included in the detailed analysis of each claim limitation.

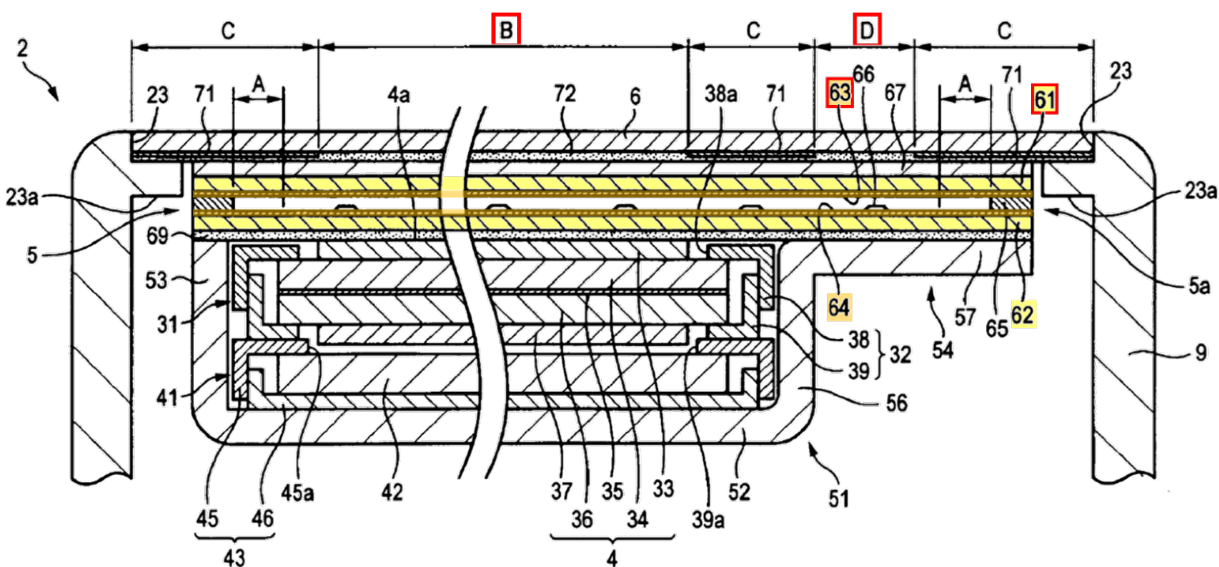


Id., Fig. 2.

b) 1[a]

70. Kotera renders obvious *a coordinate input substrate* (upper and lower film members 61–62) *having detection electrodes* (coupled to upper transparent conductive film 63) *disposed in a detection region* (area including display surface

operating area B and input section operating area D), *and first interconnects outside the detection region.*



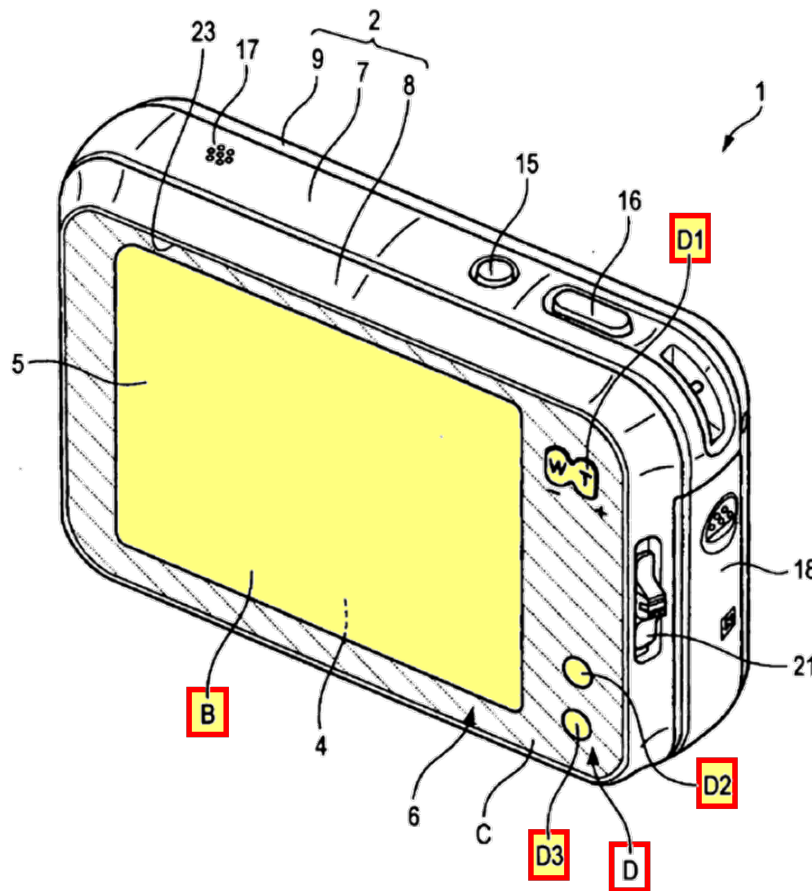
Kotera, Fig. 4.

71. The '477 patent states that, aside from the detection interconnects, the liquid crystal display device of its Embodiment 1 is identical with that of well-known liquid crystal display devices, explaining that “[t]he constitution other than that of detection interconnects in the liquid crystal display device of Embodiment 1 is identical with that of well-known liquid crystal display devices.” Ex. 1001, 4:28–31. Embodiment 1 is illustrated in Figure 1, which shows a touch panel TP stacked on top of a display panel PNL. *See id.*, Fig. 1. The patent states that the touch panel

may be capacitive or resistive. *Id.*, 4:50–52. Both were common types of touch panels.

72. Kotera discloses a resistive-film touch panel. Kotera, [0007]–[0008]. As was well known, resistive-film touch panels detect positions of touch events. *Id.*, [0042]–[0043]. The touch panel comprises upper and lower film members 61–62, each coupled to a transparent conductive film 63 or 64. *Id.*, [0042]. The transparent conductive films are detection electrodes within the plain meaning of the '477 patent: they are “are formed in a detection region over a glass substrate and signal interconnects for supplying driving signals to the electrodes are formed at the periphery of the detection region.” Ex. 1001, 1:54–58. I understand that the indefinite article “a” may mean one or more in patent claims. Therefore, the claimed coordinate input substrate reads on the upper and lower film members 61–62. Alternatively, the two film members are bonded together and becomes one substrate.

73. Users can operate touch functions displayed in the display surface operating area B or the input section operating area D, which are highlighted below. *Id.*, Abstract, [0050], [0056].



Id., Fig. 2.

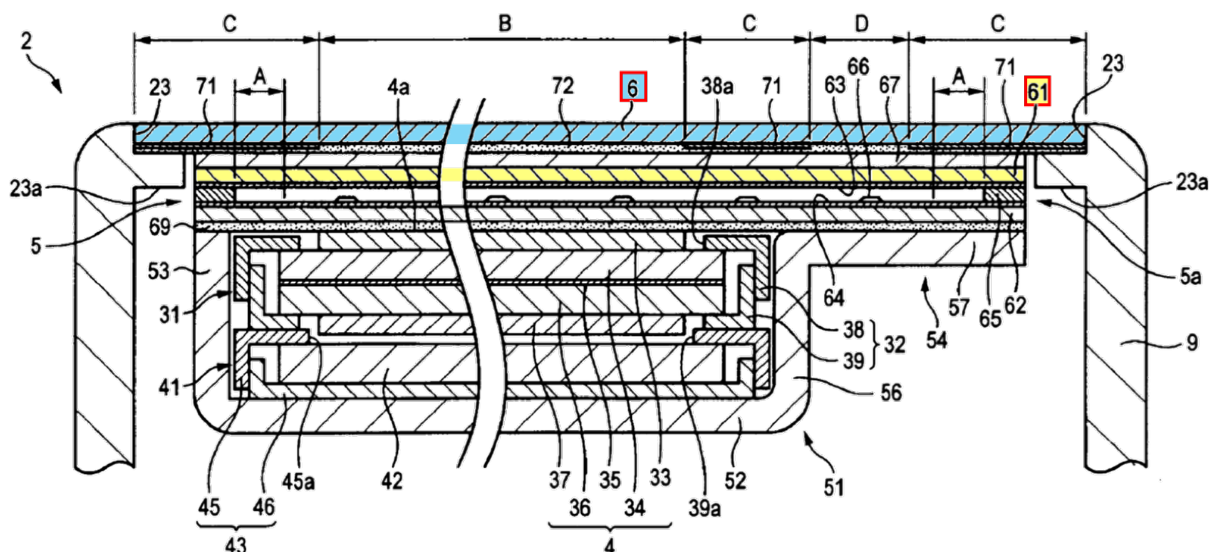
74. The transparent conductive films 63–64 form a detection area in which touch pressure causes the two films to come in contact. The touch point is detected through the change in electrical resistance. The transparent conductive films are connected to a sensing circuit through an interconnect, *e.g.*, wiring lines, outside the detection region. As I explain in the Technology Background section, this was well-known and routine for resistive touch panels. See § VII. Indeed, because the drive

signals must be transmitted to the conductive films from a driving circuit and the sense signals must be transmitted from the conductive films to a processing circuit for the touch panel to function, a POSITA would have understood, or at least found it obvious, that Kotera's panel comprises such an interconnect, as the references in the Technology Background demonstrate.

75. As shown in Figure 4 in Section X.A.1.a. above, the upper and lower film members 61–62 and transparent conductive films 63–64 extend across the display surface operating area B, the input section operating area D, and an intervening reinforcing area C. Kotera, Fig. 4. Thus, the detection area includes the operating areas B and D. They are used to operate camera functions such as menu or shutter speed. *Id.*, [0060]–[0061].

c) 1[b]

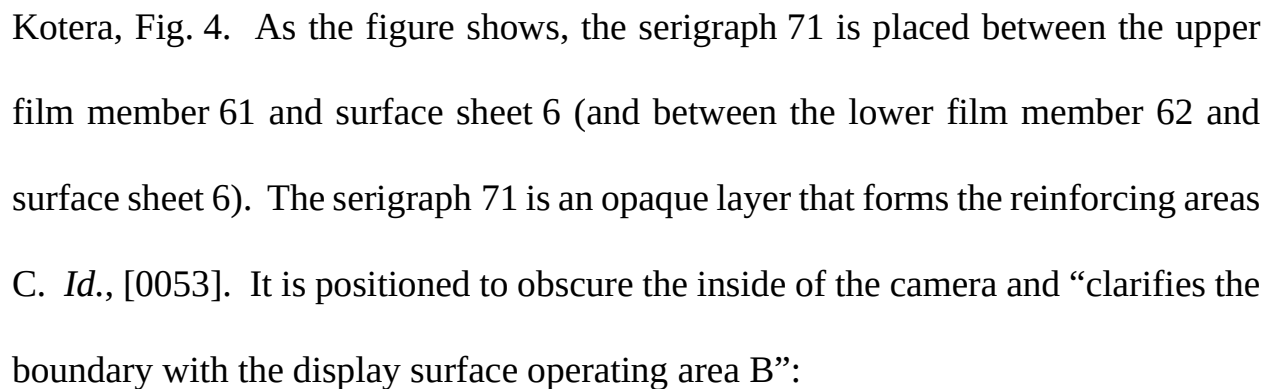
76. Kotera discloses *a protective plate* (surface sheet 6) *on the coordinate input substrate* (upper and lower film members 61–62).

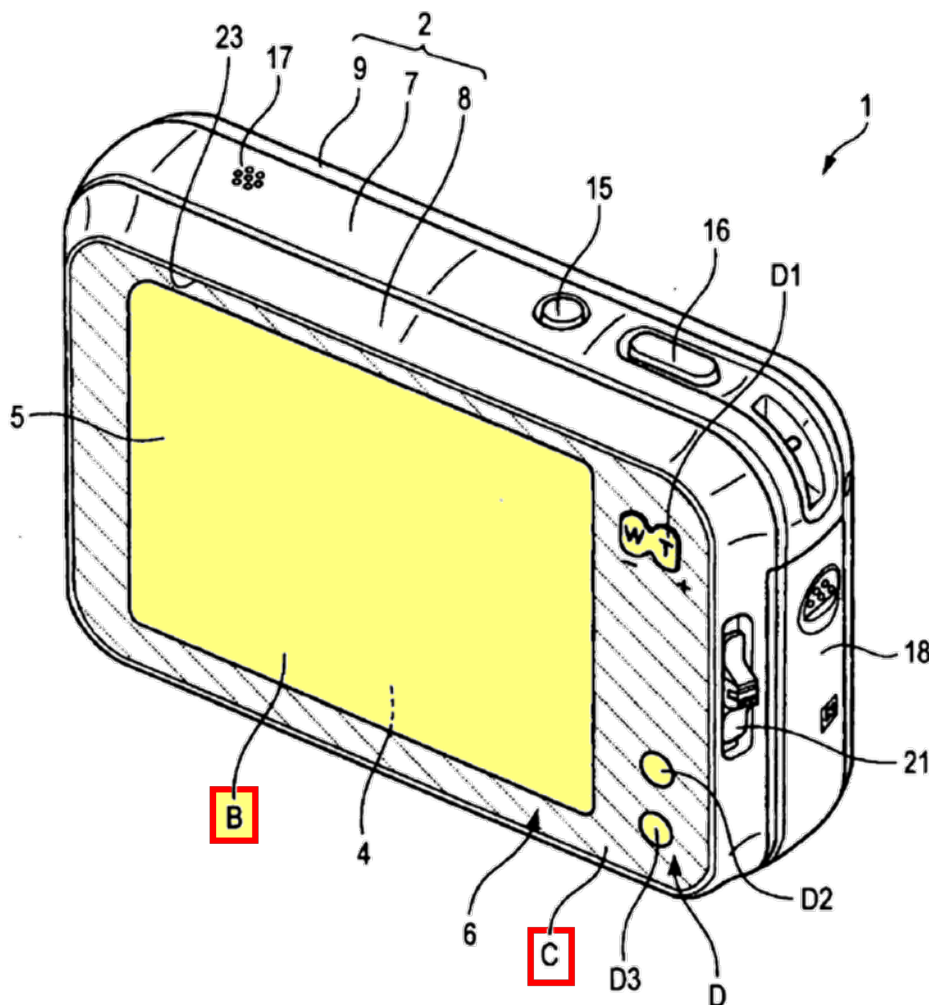


Kotera, Fig. 4. Kotera explains that the surface sheet covers the touch panel and closes the opening in the device chassis, so that the surface of the device is planar with the device chassis. *Id.*, [0013]. As a result, this design prevents dirt and foreign particles, such as dust, from accumulating on the device surface and also improves the visual quality of the device. *Id.*, [0013], [0024].

d) 1[c]

77. Kotera discloses *a light shielding material* (serigraph 71) *which has an opening and is disposed between the coordinate input substrate* (upper and lower film members 61–62) *and the protective plate* (surface sheet 6).





Id., Fig. 2, [0053]. As Figure 2 shows, the serigraph (forming the reinforcing area C illustrated with diagonal lines) has an opening for the display panel in the display surface operating area B. *Id.*, Fig. 2; see also *id.*, [0052].

e) 1[d]

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

79. The transparent conductive films 63–64 are formed of indium tin oxide, an electrical conductor. Kotera, [0043]. As Kotera notes, this is typical for touch panels. *Id.*

80. Kotera discloses a control device for driving the camera's components including the touch screen. *Id.*, [0025]. The control device comprises flexible wiring boards. *Id.*, [0025], [0032], [0037], [0041]. At the least, it would have been obvious that the transparent conductive films 63 and 64 are electrically connected to external circuits through interconnects (or wires) formed on the upper and lower film members, which are in turn connected to a flexible wiring board. This configuration was standard practice for supplying power to touch panels and for enabling them to control external components, such as a zoom lens, in response to touch input. *Id.*, [0047].

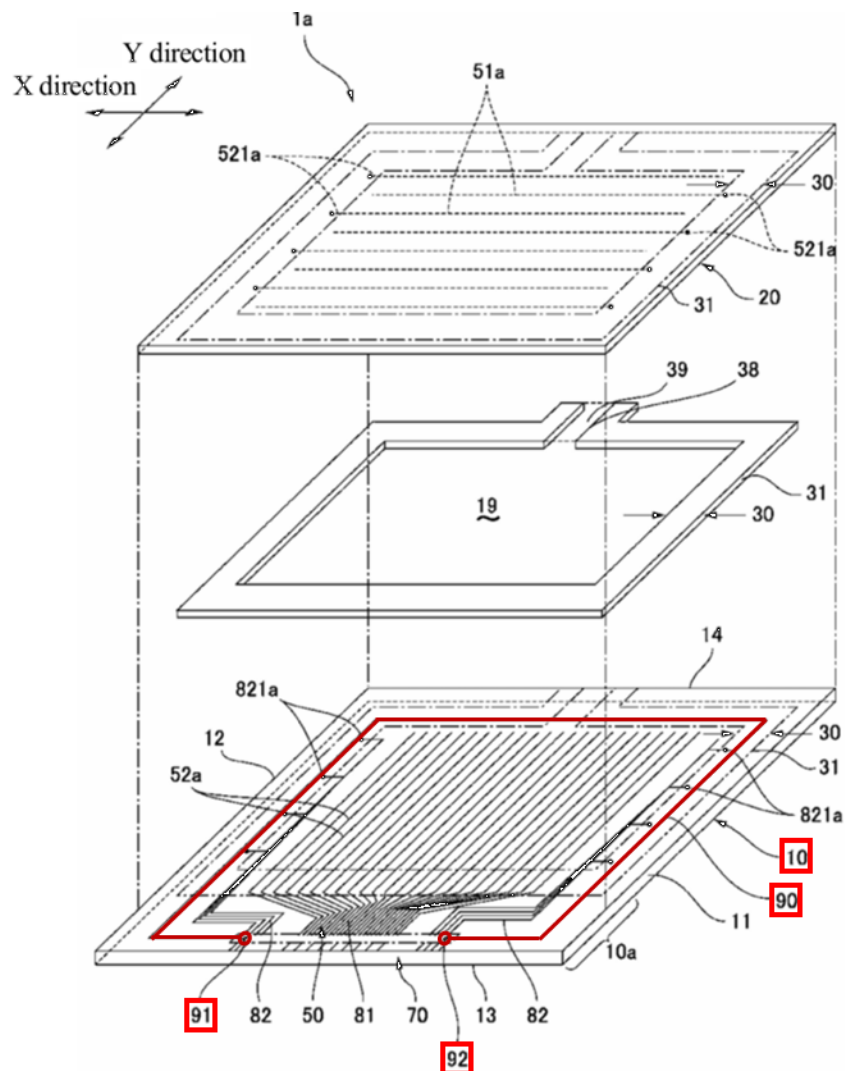
81. Similarly, Miyagawa discloses a flexible substrate. Miyagawa, [0020], Fig. 2. A POSITA would have recognized that Kotera's wiring board and Miyagawa's flexible substrate serve similar purposes and share comparable physical configurations. For example, such flexible cables were commonly used to couple a touch panel to send control signals to the touch panel and to send detection signals

to an external circuit. They typically have electrodes or terminals on two opposite ends, one connected to the touch panel and the other connected to external circuitry.

f) 1[e]

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

83. Miyagawa discloses diagnostic wiring to “diagnos[e] as to whether a substrate crack has occurred....” Miyagawa, Abstract; *see also id.*, [0027], [0030] (describing the diagnostic function and its application during manufacturing). The two ends of the diagnostic wiring are connected to the diagnostic pads 91–92. *Id.*, Abstract, [0006]–[0007], [0023]–[0024]. The diagnostic wiring 90 is located near the edges of the element substrate 10 to detect cracks, which typically occurs on an edge when a mother substrate is cut into individual substrates:

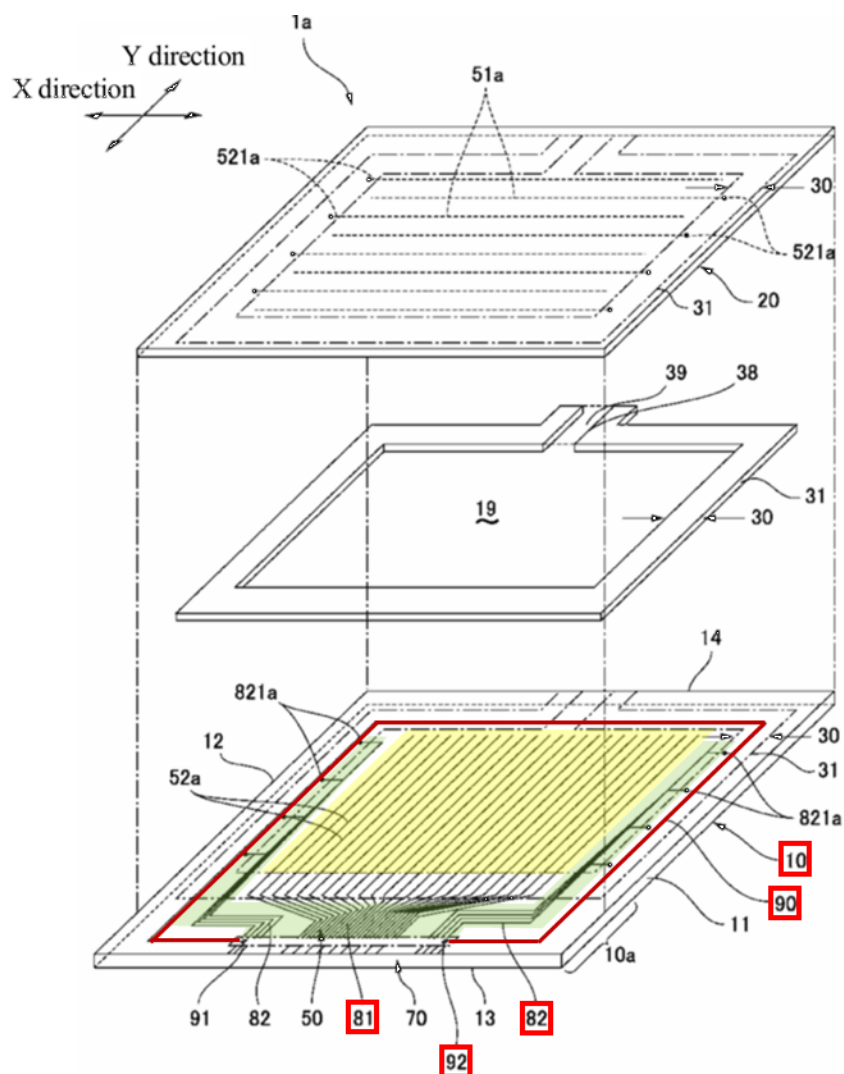


Id., Fig. 3. When a crack occurs and breaks the diagnostic wiring, the two ends become electrically discontinuous. *Id.*, [0027], [0030]. As explained below, it would have been obvious to place a diagnostic wiring around Kotera's upper and lower film members for cracks detection. *Infra* § X.A.11.

g) 1[f]

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

85. In Figure 3 below, the diagnostic wiring surrounds Miyagawa's image display region (shaded light yellow) and wiring patterns 81–82 (shaded in light green). The wiring patterns are connected to the data and scan lines in the image display region. Miyagawa, [0018].



Id., Fig. 3, Abstract. The diagnostic wiring is formed on three sides of the substrate.

Id., [0024]–[0025], [0031]. If a crack occurs on the substrate and cuts the diagnostic wiring, the two diagnostic pads would become electrically disconnected. Cracks tend to occur on an edge of the substrate when cutting a large mother substrate to form individual substrates. *Id.*, [0028]. Thus, the diagnostic wiring is placed along

the edges, outside of the image display region and functional wiring patterns. This configuration matches the function of the diagnostic wiring to detect damages to the functional components of the substrate. Since the diagnostic wiring is placed to the exterior of functional components, closer to the edges where the mother substrate is cut, any chip due to the cutting would impact the diagnostic wiring before the functional components.

86. Therefore, this configuration is directly applicable when forming diagnostic wiring on Kotera's touch panel. Miyagawa's image display region and wiring patterns have a configuration analogous to Kotera's detection region and first interconnects because both involve a central area dedicated to display or detection functions, with conductive wiring or interconnects positioned outside that area to provide electrical connections for operation. *Supra* § VII. Thus, a POSITA would have found it obvious to form diagnostic wiring to surround the detection region and outside Kotera's first interconnects.

h) 1[g]–1[h]

87. Miyagawa discloses *wherein the first electrode* (first diagnostic pad 91) *is formed at one end of the second interconnect* (diagnostic wiring 90). Miyagawa further discloses *wherein the second electrode* (second diagnostic pad 92) *is formed at the other end of the second interconnect* (diagnostic wiring 90). These

requirements are explained above in connection with the diagnostic wiring/second interconnect. *Supra* § X.A.1.f.

i) 1[i]

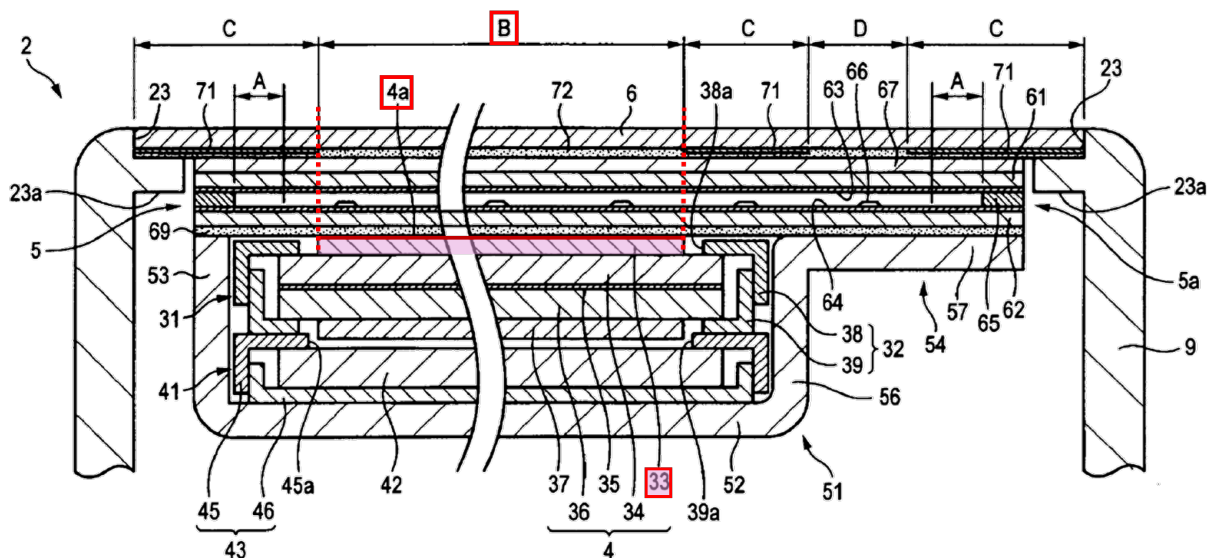
88. Kotera in view of Miyagawa renders obvious *wherein the second interconnect* (Miyagawa: diagnostic wiring 90) *is disposed along a peripheral edge of at least three sides of the coordinate input substrate* (Kotera: upper and lower film members 61–62).

89. As I explain above, Miyagawa discloses a diagnostic wiring placed along the peripheral edges on three sides of its substrate. *Supra* § X.A.1.g; Miyagawa, [0024]. This configuration is applicable when forming diagnostic wiring on Kotera's touch panel to detect cracks that may damage functional components on the upper or lower film member and associated interconnect. Placing a crack detection wire along the edges, outside the functional components of the panel, ensures that the crack detection wire would break before a functional component is damaged when cracks extend from an edge inward, as typically occurs when cutting a mother substrate.

j) 1[j]

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

91. Kotera discloses a display surface 4a as the top surface of the LCD panel 4. Kotera, [0050], [0061], [0063]. The display surface 4a is the surface of the upper polarization plate 33 (shaded in pink in Figure 4 below). *Id.*, [0029]. It has approximately the same size (slightly smaller, as I explain below) as the display surface operating area B. *Id.*, [0051]. The approximately equal sizes allow touch functions to be placed anywhere on the display panel as an application programmer may desire.



Id., Fig. 4.

92. As I explain above, it would have been obvious to place the diagnostic wiring to surround Kotera's detection region comprising area including display surface operating area B and input section operating area D. *Supra* § X.A.1.g. Kotera's display region is slightly smaller than the size of operating area B. Kotera explains that the display surface operating area B is the transparent region of the surface sheet through which the display surface 4a of the liquid crystal panel is viewed. Kotera, [0051]. Area B is specifically sized to be only slightly larger—by about 0.3 mm in each dimension—than the display surface 4a, ensuring that the visible display region closely matches the size of operating area B. *Id.*, [0051]–[0052]. This design prevents the surrounding opaque reinforcing area from covering part of the display, making the display region and operating area B are substantially coextensive. *Id.* Kotera's display region is also within the detection region. Specifically, the display surface operating area B is part of the touch panel's functional area. *Id.*, [0061]. And since the detection region includes both the display surface operating area B and the input section operating area D, the display region (approximate the same size as area B) is entirely encompassed by the detection region of the touch panel. This is further consistent with Kotera's disclosure that the

reinforcing area C, formed as an opaque layer adjacent to operating area B, clarifies the boundary of the display region and ensures that only the designated display area remains visible. *Id.*, [0053]. Therefore, the diagnostic wiring surrounds the display region.

k) 1[k]

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

94. Miyagawa's diagnostic pads are used for electrical continuity check of the diagnostic wiring. Miyagawa, [0007]. Inspection may be performed using two different methods. First, it may be performed by probing the diagnostic pads to perform an electrical continuity check. *Id.*, [0028]. Second, inspection may also be performed by coupling two pins (called "bumps" in Miyagawa) of the driving IC to the pads and performing a continuity check using the IC's substrate crack diagnostic unit. More specifically, Miyagawa explains that "the IC can diagnose whether the first diagnostic pad and the second substrate cracking diagnostic pad are electrically continuous via the substrate crack diagnostic wiring." *Id.*, [0011]. The IC is connected to the first diagnostic pads by "crimping via anisotropic conductive

material,” with “a plurality of bumps ... connected to the first diagnostic pad 91 and the second diagnostic pad 92.” *Id.*, [0026]. After mounting the IC, “the first diagnostic pad 91 and the second diagnostic pad 92 can be examined as to whether they are electrically continuous by the substrate cracking diagnostic function built into the driving IC5.” *Id.*, [0029]. In an embodiment, the IC may be placed on the flexible substrate. *Id.*, [0040]. In that configuration, the diagnostic pads are placed on the edge of the element substrate and coupled to the IC via corresponding electrodes and wiring on the flexible substrate to connect the diagnostic wiring with the IC. *Id.*, [0023].

95. Alternatively, an additional “function IC” is on the flexible substrate. *Id.*, [0020]. A POSITA would have known that whether to implement the substrate crack diagnostic unit in the driving IC or the function IC would have been a simple design choice because ICs typically comprise different, multiple functional units. Further, the diagnostic function only requires the IC to check electrical continuity between the pads, which any function IC with access to these connections can easily perform. *Id.*, [0011].

l) 1[l]

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

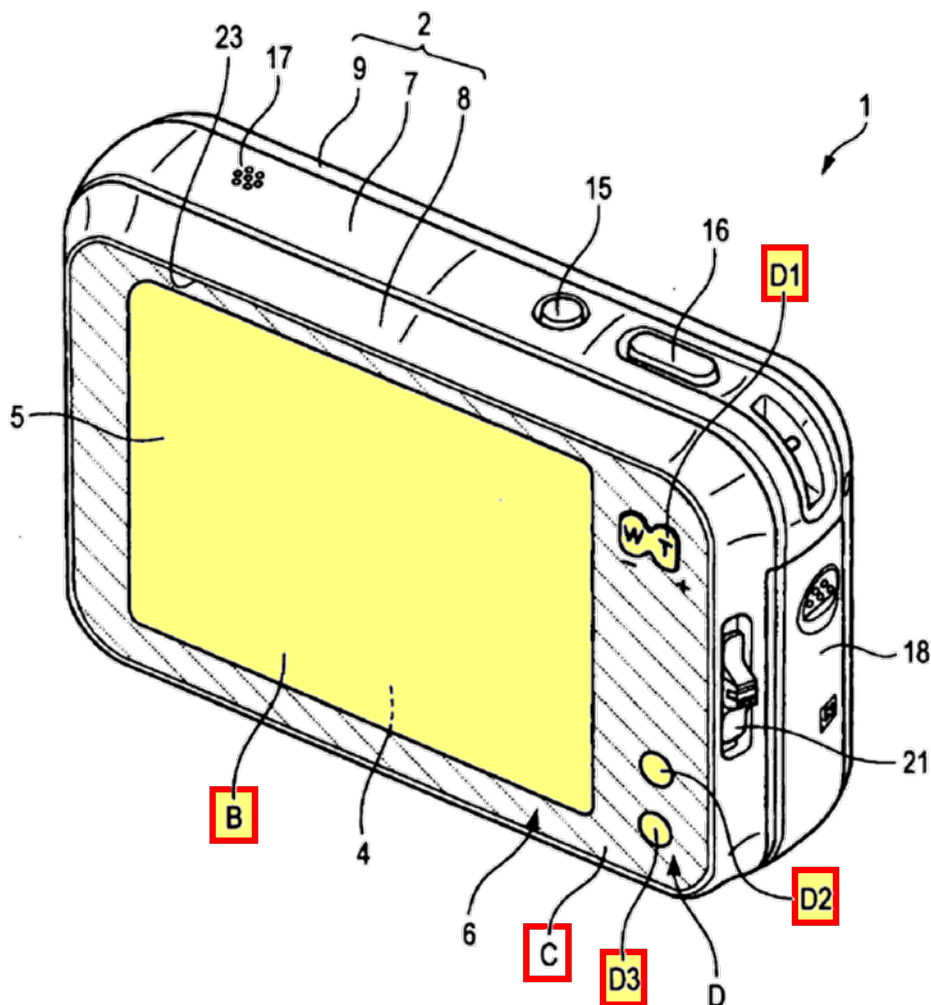
97. I explain above that an opening of the serigraph is the display surface operating area B. *Supra* § X.A.1.d; Kotera, [0051]. Kotera discloses that the operating area B is slightly larger than the display area: “[t]he display surface operating area B can be made a little bit, for example, about 0.3 mm outer from the periphery of the display surface 4a, larger than the display surface 4a of the liquid crystal panel 4.” Kotera, [0051]. The slightly larger display surface operating area B provides a manufacturing process margin to ensure the opaque serigraph forming the reinforcing area C does not block a user’s view of the display surface due to manufacturing tolerance. *Id.*, [0052]. It also provides manufacturing process margin to prevent the inside of the camera, designed to be hidden from view by a black mask, from extending outside the black mask and becoming visible. *Id.*, [0052]–[0053].

m) 1[m]

98. Kotera in view of Miyagawa renders obvious *wherein the light shielding material* (Kotera: serigraph 71) *overlaps the second interconnect*

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

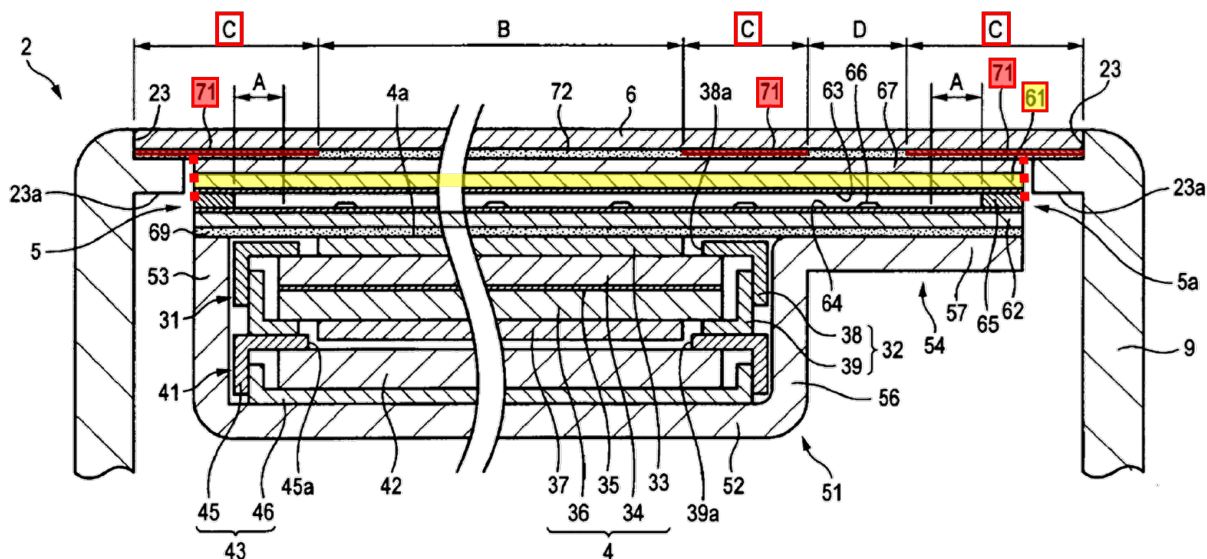
99. The serigraph covers the reinforcing area C. Kotera, [0053]–[0054]. The serigraph surrounds the display surface operating area B. *Supra* § X.A.1.d. It also surrounds the input section operating areas D1–D3. Kotera, [0058]. The serigraph and the reinforcing area C (the area with diagonal lines below) cover all four edges of the camera's back side:



Id., Fig. 2.

100. It would have been obvious to form the diagnostic wiring on the outer edges to surround the active region, the upper and lower film members 61–62, and the associated interconnects—as this placement enables reliable crack detection at the substrate edge, where cracks are most likely to occur, and ensures the diagnostic

wiring does not obstruct or interfere with the functional touch and display regions of the panel. *Supra* § X.A.1.g. The cross-sectional figure below illustrates the outer edges with red dotted lines. The figure also shows that the serigraph 71 and the reinforcing area C extend to the edges of the camera's back side. Kotera, [0050]. The serigraph 71 is an opaque layer. *Id.*, [0053]. Thus, an overlap between the serigraph and the diagnostic wiring to hide the diagnostic wiring from a plan view would have been desirable. *Id.* (the serigraph “is arranged that the inside of the camera case 2 cannot be seen through the reinforcing area C”).

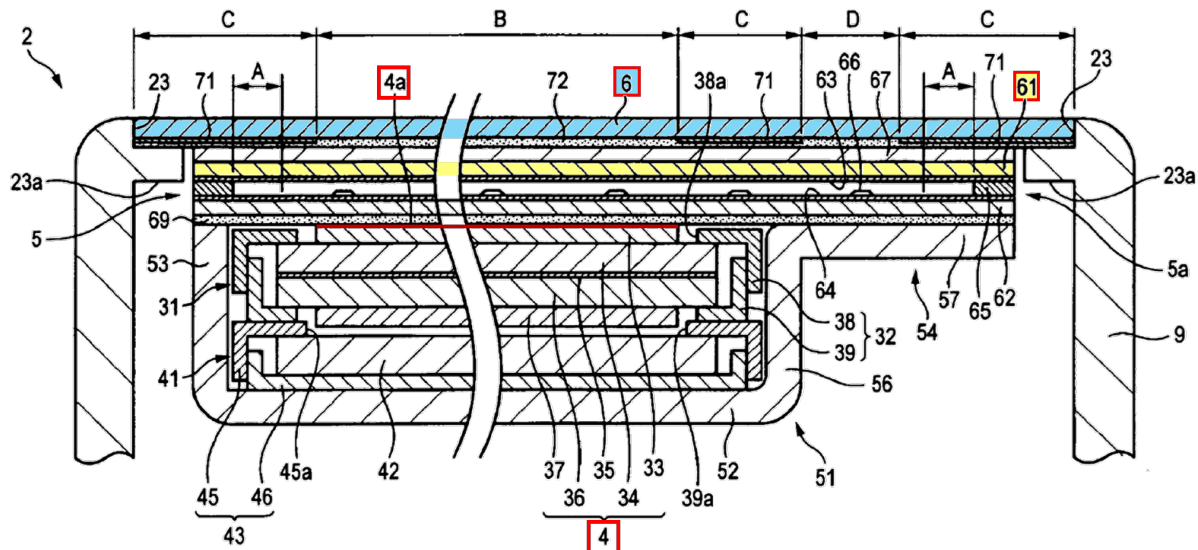


Id., Fig. 4. I explain above that the diagnostic wiring is formed along the peripheral edge of at least three sides of the upper and lower film members 61–62. *Supra*

§ X.A.1.i. Thus, in a plan view, the serigraph overlaps the diagnostic wiring at least along the same three sides, as the cross-sectional view above shows two of the sides.

2. Claim 2

101. Kotera in view of Miyagawa renders obvious *the display device according to claim 1*. *Supra* § X.A.1. Kotera discloses a display device *further comprising a display panel* (liquid crystal panel 4) *having the display region* (display surface 4a), *wherein the coordinate input substrate* (upper and lower film members 61–62) *is disposed between the display panel and the protective plate* (surface sheet 6).

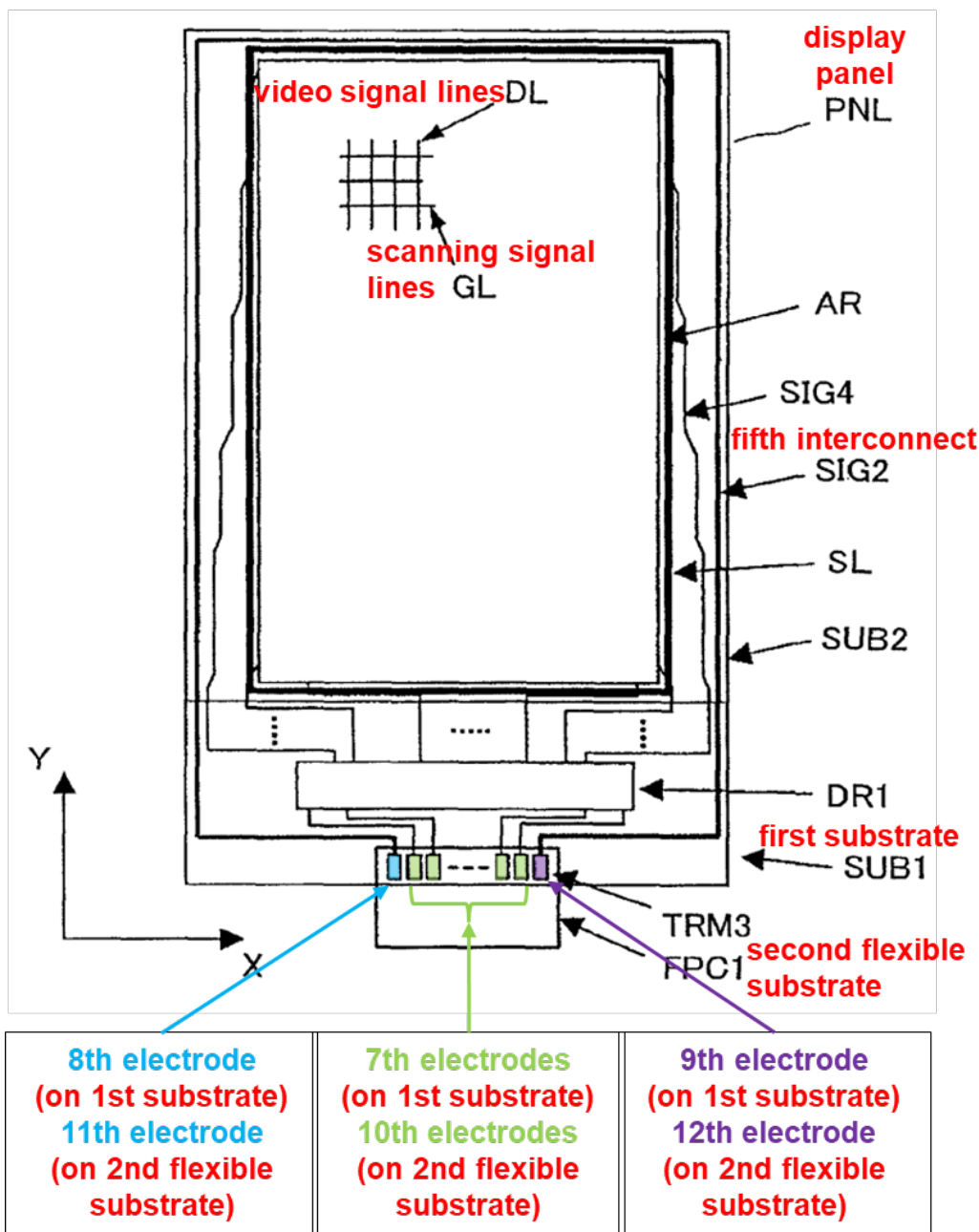


Kotera, Fig. 4. As Figure 4 above shows, the liquid crystal panel 4 is a display panel having the display surface 4a. *Id.* The liquid crystal panel 4 is mounted within the

camera case behind a large rear opening, supported by a frame and backlight assembly. *Id.*, [0028]. It is constructed from multiple stacked layers—including polarization plates, glass plates, and a liquid crystal layer—to form a flat, rectangular display surface 4a (outlined in red). *Id.*, [0029]. The touch panel 5 is disposed over this display surface, with its upper film member 61 facing toward and covered by the surface sheet 6 (highlighted in blue), and its lower film members 62 facing toward the liquid crystal panel 4. *Id.*, [0023]–[0024], [0028]. The surface sheet 6 covers the top surface of the touch panel 5,—specifically, the side with the upper film member 61, on the other side of the liquid crystal panel 4. *Id.*, [0024].

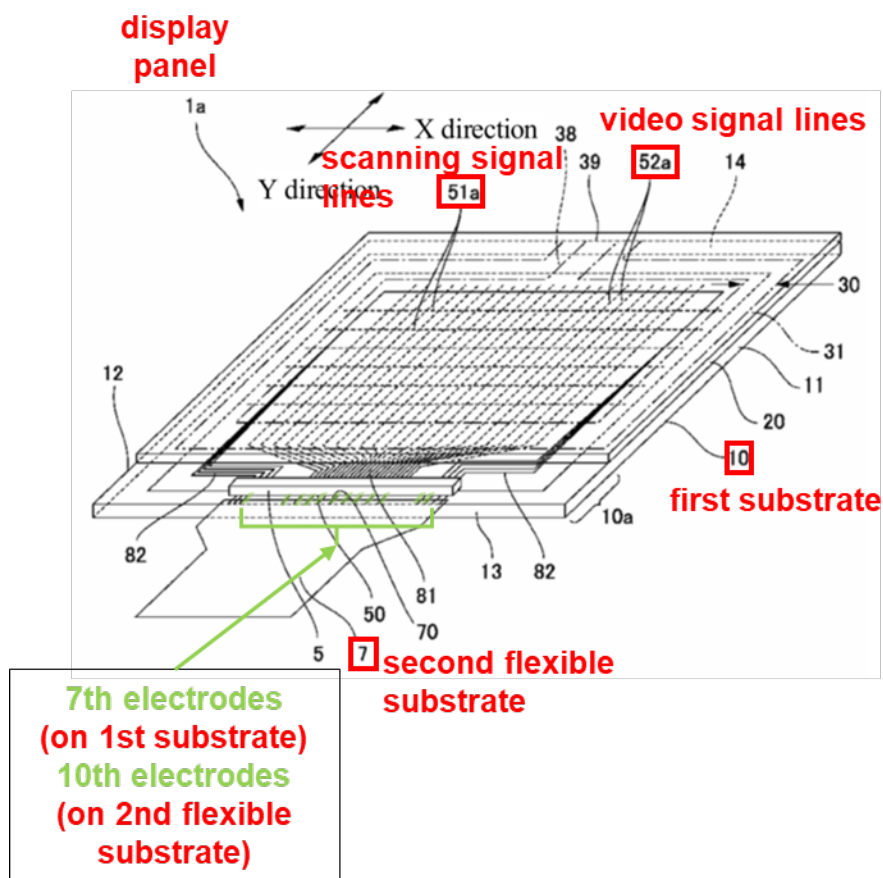
3. Claim 8

102. I find it helpful to begin by graphically illustrating claim 8:

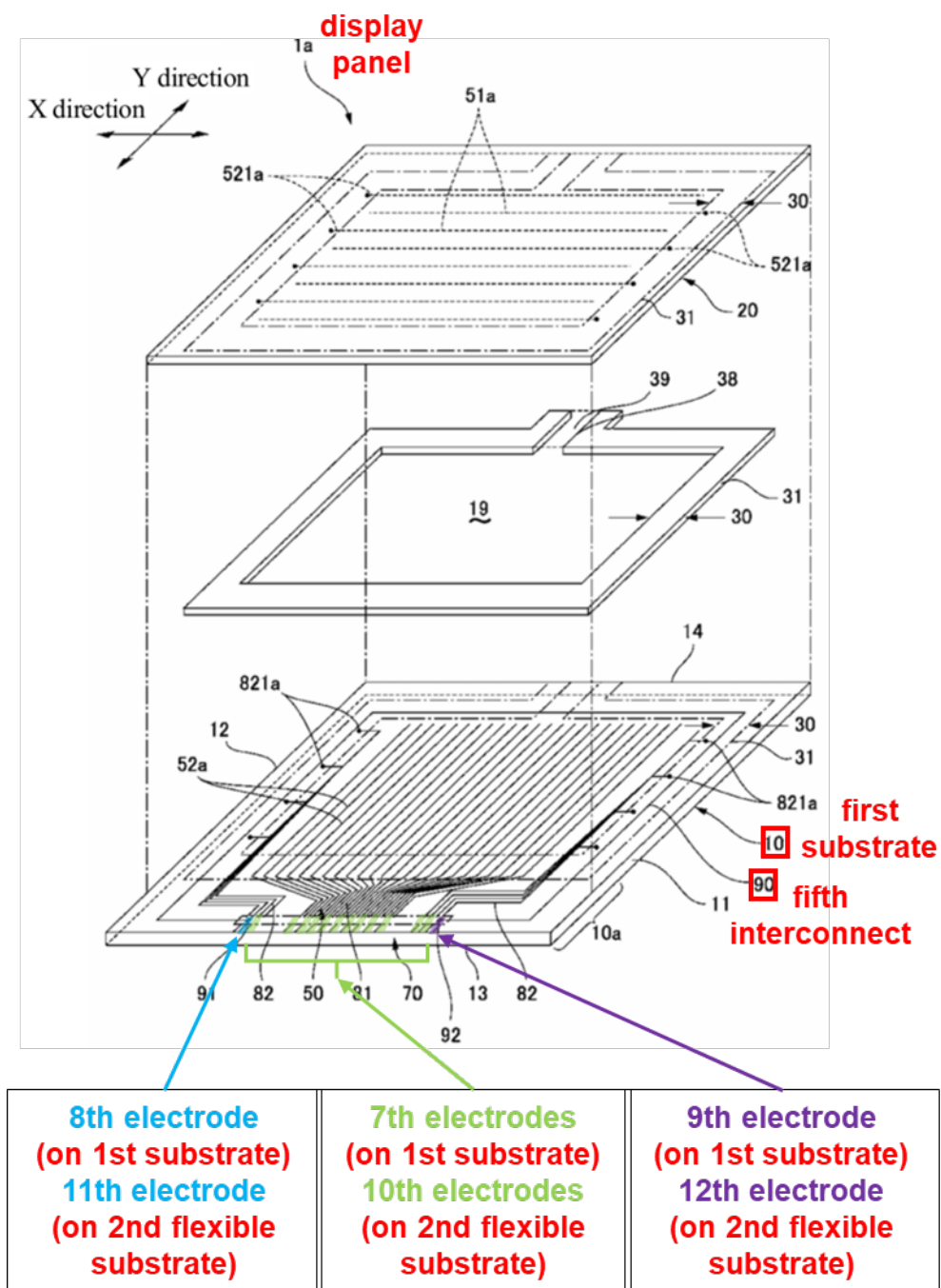


Ex. 1001, Fig. 9.

103. As I further explain below Miyagawa—illustrated in figure 2 below—satisfies claim 8.



Miyagawa, Fig. 2. As discussed above in Section X.A.1.k, Miyagawa teaches that a crack-detection function can be implemented on the flexible substrate by placing the function in either a driving IC or a function IC on the flexible substrate. In these two embodiments, the diagnostic pads are coupled to electrodes on the flexible substrate, as illustrated in Figure 3 of Miyagawa below:



Id., Fig. 3.

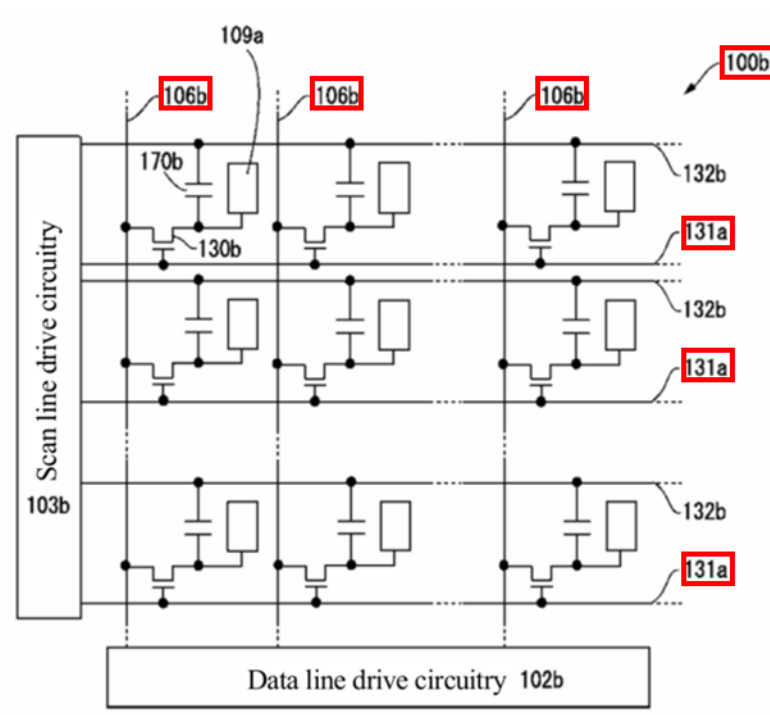
a) 8

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[pre]
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104. I explain above that Kotera in view of Miyagawa renders obvious *the display device according to claim 2. Supra* § X.A.2. Miyagawa discloses *wherein the display panel comprises* the limitations I discuss in detail below.

b) 8[a]

105. As Figure 6 below shows, Miyagawa discloses a display panel that comprises *a first substrate* (TFT array substrate) *on which a plurality of video signal lines* (data lines 106b) *and a plurality of scanning signal lines* (scan lines 131b) *intersecting the video signal lines are formed.*

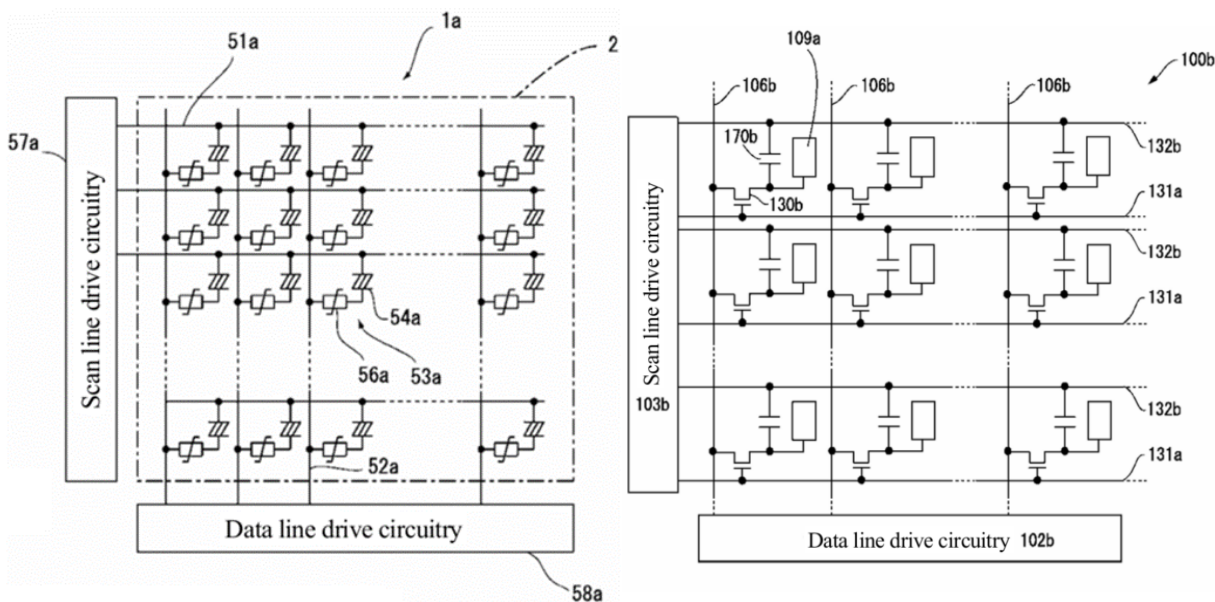


Miyagawa, Fig. 6.³

106. In a different embodiment from embodiment 1 (which is the main embodiment through which Miyagawa describes its crack-diagnostic feature), depicted in Figure 6, Miyagawa discloses “an active matrix type liquid crystal device using a thin film transistor (TFT)....” *Id.* [0042]–[0043]. The embodiment is a device comprising a TFT array substrate having intersecting data lines and scan lines. *Id.*, [0043]–[0044].

107. Miyagawa states that its disclosure of embodiment 1, which comprises diagnostic wiring, can be applied to the TFT device shown in Figure 6. *Id.*, [0041]. Below, from left to right, Figures 1 and 6 are shown.

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



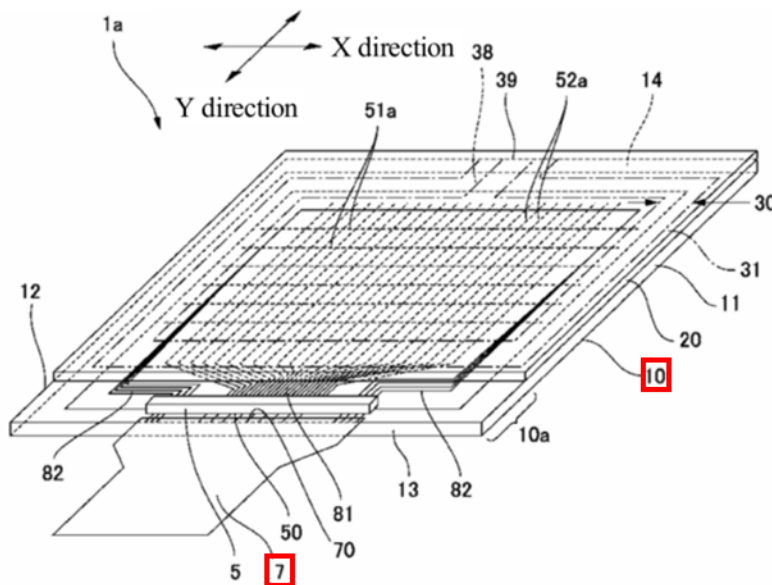
Id., Figs. 1, 6.

108. IAs the figures above make obvious, a POSITA would have recognized analogous configurations between embodiment 1 and the TFT device shown in Figure 6. The analogy would have informed a POSITA the basis of Miyagawa teaching that embodiment 1 is directly applicable to devices with TFTs as shown in Figure 6. *See id.*, [0041]. As Miyagawa explains, the basic structure and operation of embodiment 1, including the arrangement of data lines, scan lines, and pixel electrodes, remain the same, with the primary difference being that the pixel switching elements are TFTs rather than thin film diodes. *Id.*, [0043]–[0044]. In other words, the TFT array substrate would replace the element substrate 10 of

embodiment 1, but the wiring around the display region of embodiment 1 remains in basically the same configuration on the TFT array substrate.

c) 8[b]

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

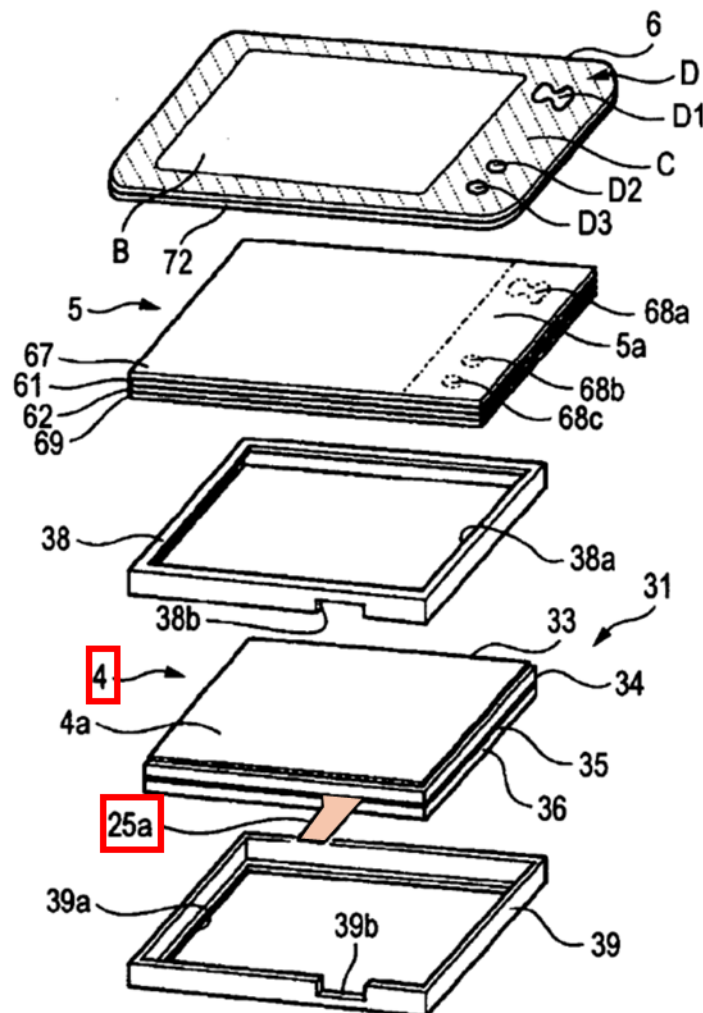


Miyagawa, Fig. 2.

110. As Figure 2 above shows, Miyagawa discloses “a flexible substrate 7 ... mounted in ... the substrate mounting region 70.” *Id.*, [0020]. The flexible substrate connects to an electronic apparatus body (not shown), which supplies driving signals to form images. *Id.* Miyagawa's flexible substrate may host

the driving IC using chip-on-film technology and supports a variety of configurations for diagnostic wiring and pads, while also playing an active role in supplying driving signals. *Id.*, [0040], [0043].

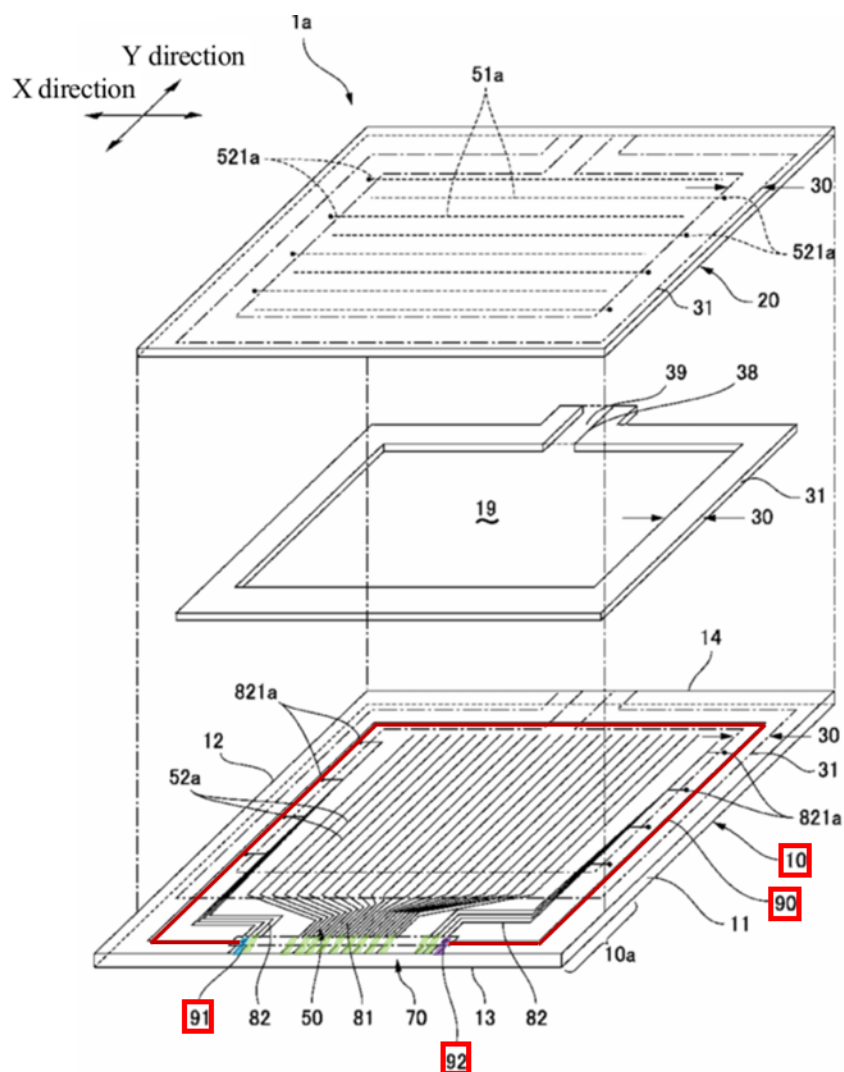
111. The flexible substrate, shown in Figure 2 of Miyagawa, is analogous to the flexible wiring board 25a, connected to the liquid crystal panel 4 shown in Figure 3 of Kotera, because both serve to provide electrical connection between the display panel circuitry and external circuits, a common function that would have been readily recognized as analogous or equivalent by POSITA:



Kotera, Fig. 3 (partial); [0032].

d) 8[c]

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



Miyagawa, Fig. 3. As Figure 3 shows, the data lines, scan lines, and the diagnostic wiring are connected to pads formed in a region at the bottom of the element substrate (or the TFT array substrate in the Figure 6 embodiment). *Id.*, [0023]; see *supra* § X.A.1.k. Two of the pads are the first and second diagnostic pads 91–92, which are formed at the two ends of the diagnostic wiring 90. *Id.*, [0023]–[0024].

The pads 91–92 are highlighted in blue and purple respectively. This configuration permits that the pads, including the first and second diagnostic pads 91–92, to be connected to the flexible substrate.

e) 8[d]

113. Miyagawa discloses *wherein the seventh electrodes* (pads) *receive video signals and scanning signals from an external system* (electronic apparatus body), *the eighth electrode* (first diagnostic pad 91) *is formed at one end of the fifth interconnect* (diagnostic wiring 90), *and the ninth electrode* (second diagnostic pad 92) *formed at the other end of the fifth interconnect*.

114. I explain above that the connections between the diagnostic wiring and the two diagnostic pads are shown in Miyagawa Figure 3. *Supra* § X.A.3.d. It is common knowledge that displays are connected to external systems—such as memory or communication devices—so they can present the wide variety of video, interactive interfaces, and data provided by their host devices, which constitutes the claimed external system because the host devices are external to the display. Anyone familiar with everyday electronics understands that these connections are what allow displays to show content from host systems, such as computers, phones, or other sources. Accordingly, Miyagawa discloses a flexible substrate 7 “for connecting to an electronic apparatus body” and mounted in the substrate mounting region 70.

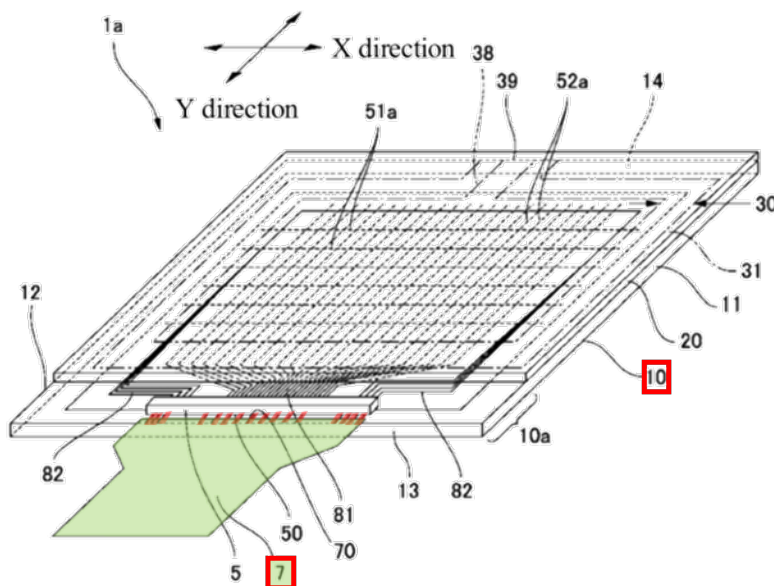
Miyagawa, [0020]. The electronic apparatus body (*i.e.*, an external host system) supplies image signals, which are supplied through the flexible substrate and the data and scan lines to display images. *Id.*, [0043].

115. In Kotera's illustrative camera embodiment, the display panel can display images captured by the camera. Kotera, [0063]. Such images are stored in a mass-storage memory, which resides in a part of the camera (a recording medium) that is analogous to Miyagawa's electronic apparatus body.

f) 8[e]

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

117. Miyagawa's display substrate comprises pads. *Supra* § X.A.3.d. As Figure 2 shows, these pads (highlighted in red) are coupled to electrodes/terminals at the bottom of the TFT array substrate (in the analogous Figure 6 embodiment and shaded in green), in the area overlapping with the flexible substrate 7:



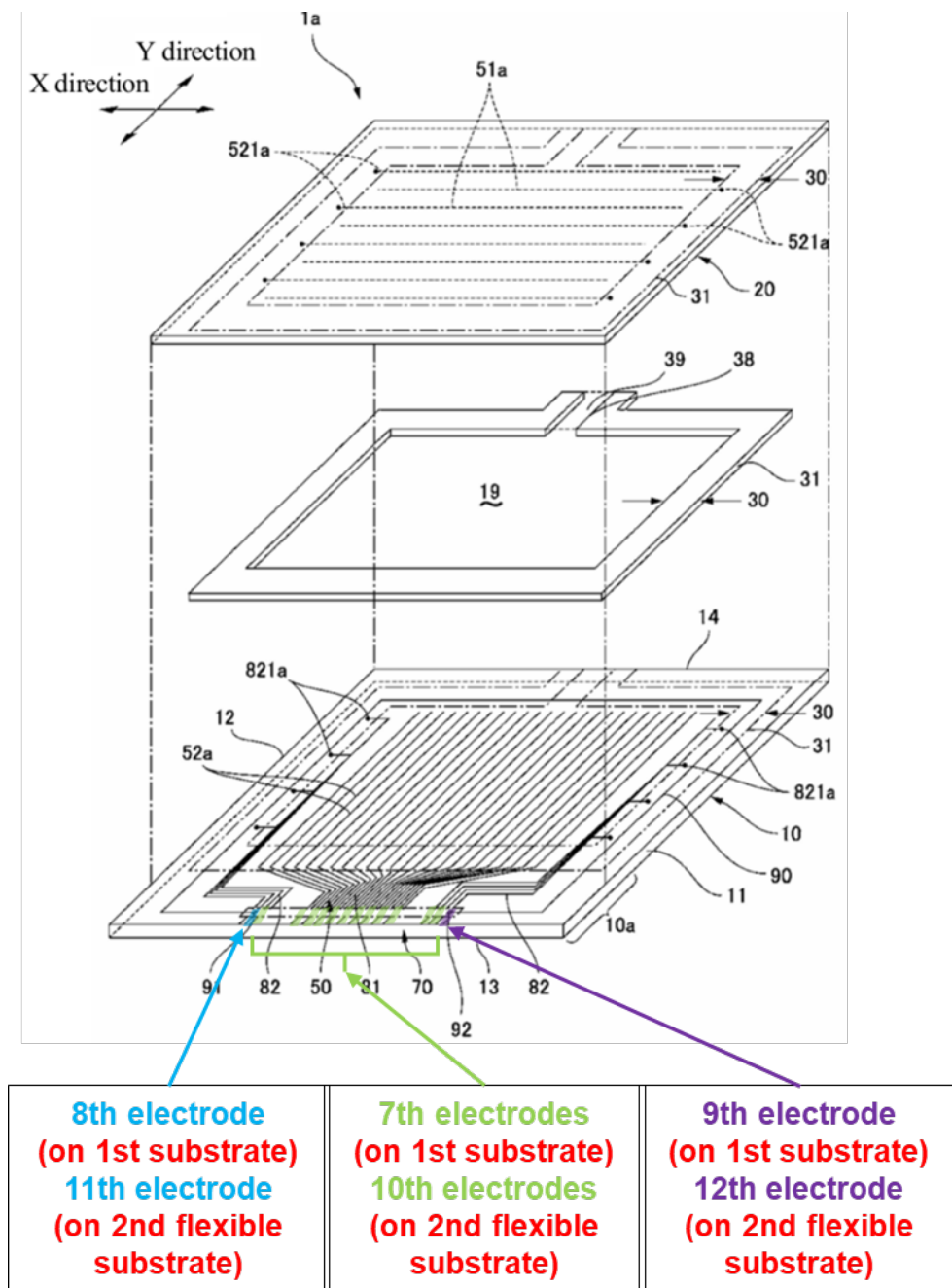
Miyagawa, Fig. 2.

118. A POSITA would have understood that the flexible substrate comprises contacts or terminals to provide the connections through coupling with the corresponding contacts or terminals of the pads on the display substrate because electrical connections are necessary to transmit signals and power between the display panel and external driving or control circuitry. As Miyagawa explains, the substrate mounting region 70 is formed along one side of the element substrate 10, specifically on the side of the overhang region 10a. Miyagawa, [0020]. The flexible substrate 7 is mounted on this region, and the driving IC 5, whether on the flexible substrate or the element substrate, outputs image signals to the data lines 52a and scan signals to the scan lines 51a. *Id.*, [0020], [0040]. This arrangement indicates

that the plurality of tenth electrodes on the flexible substrate are coupled to the contacts/terminals on the display panel, which contacts/terminals are themselves coupled to the scan and data lines. *Id.*, [0020]. Because Miyagawa discloses or renders obvious that the electrical continuity of the diagnostic wiring can be tested via a signal transmitted through the flexible substrate, *id.*, [0029], [0040], it follows that the diagnostic pads must be electrically connected to corresponding contacts or terminals on the flexible substrate to enable such testing. *Supra* § X.A.1.k. Accordingly, a POSITA would have understood, or at least found it obvious, that the diagnostic pads are coupled to two contacts or terminals on the flexible substrate, the eleventh and the twelfth electrodes. On both the TFD element substrate and the TFT array substrate, these two electrodes are the leftmost and rightmost pads on the flexible substrate because the diagnostic wiring surrounds functional wiring. Thus, the tenth electrodes, coupled to the scan and data driving units, are located between them.

g) 8[f]

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

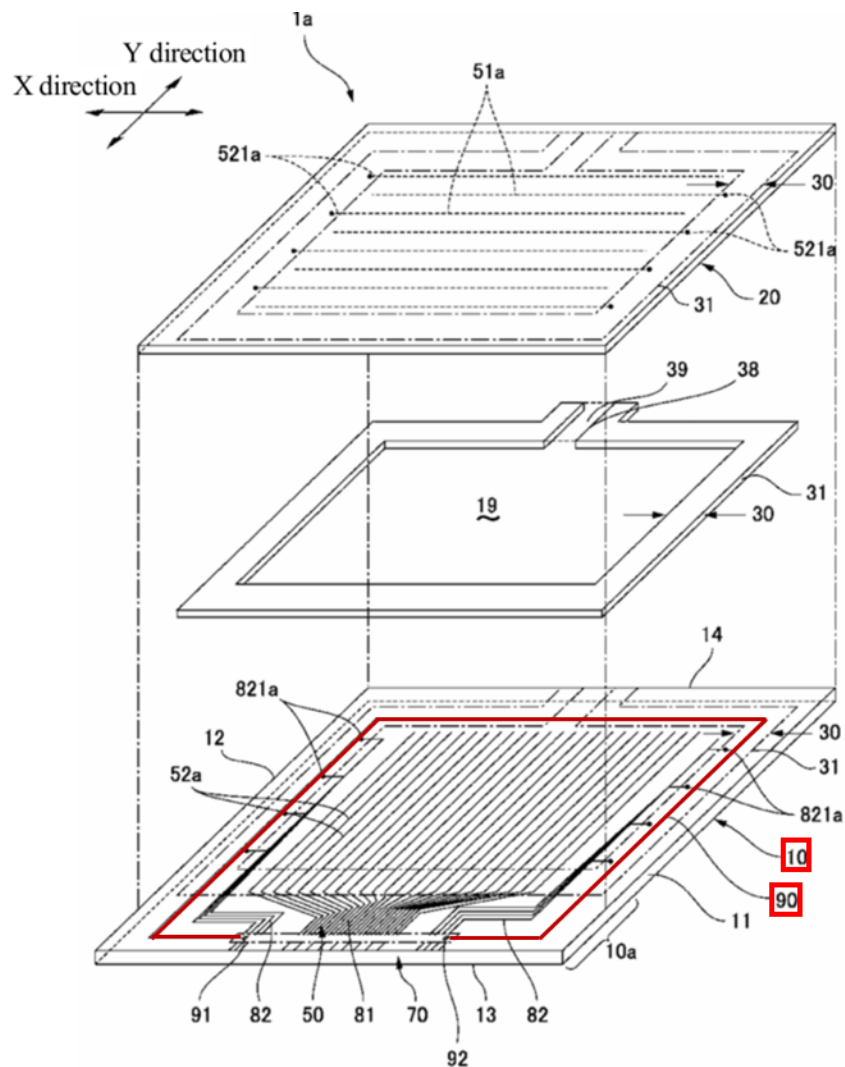


Miyagawa, Fig. 3. As I explain above, the first and second diagnostic pads 91–92 are connected to the corresponding contacts/terminals on the flexible substrate,

coupling the diagnostic wiring and the flexible substrate. *Supra* § X.A.3.f. The other contacts/terminals of the pads are connected to their corresponding contacts/terminals on the flexible substrate to transfer control and image signals from the electronic apparatus body to the scan and data lines. This is because connections are needed to transmit the control and image signals from the electronic apparatus body to the scan and data lines, enabling the display panel to receive the information necessary for proper pixel addressing and image display.

h) 8[g]

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



Miyagawa, Fig. 3. As Figure 3 shows, the diagnostic wiring surrounds three sides of the substrate but is open at the bottom. *Id.*, [0024].

4. Claim 9

a) 9[pre]

121. As I explain above, Kotera in view of Miyagawa and Miyagawa renders obvious *the display device according to claim 8. Supra § X.A.3.*

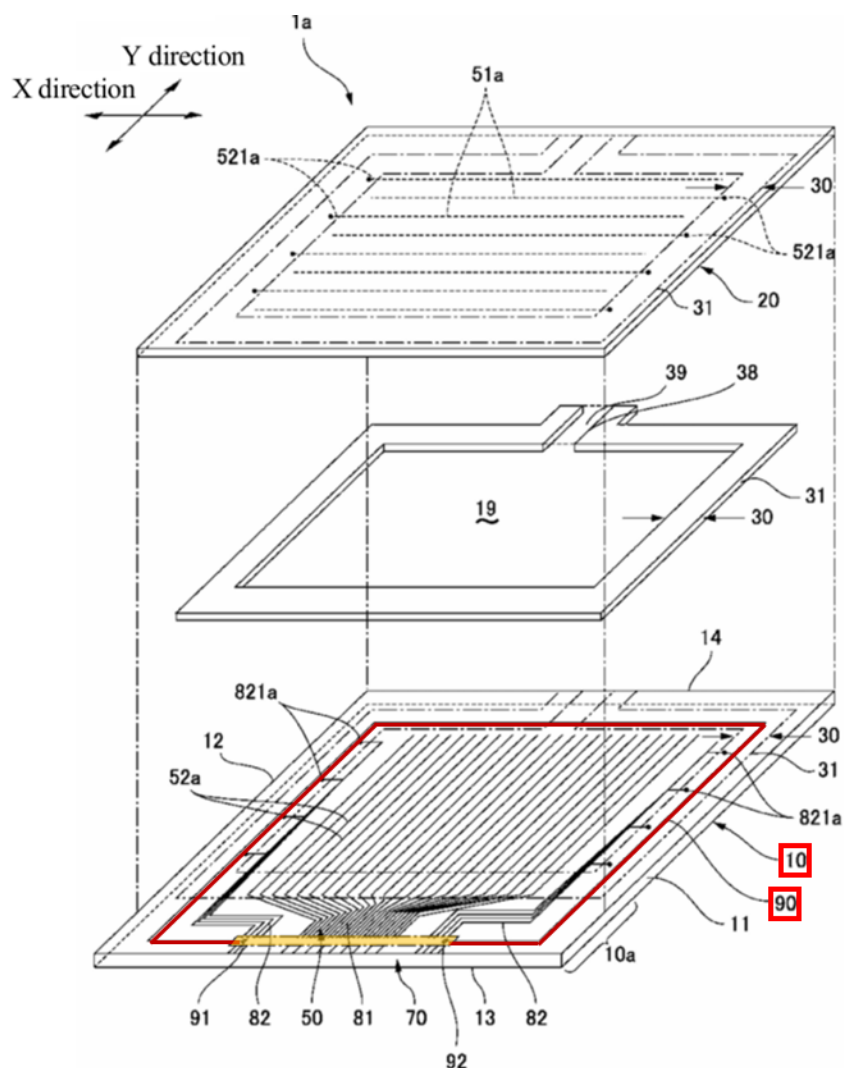
b) 9[a]

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

123. Miyagawa's driving IC "outputs an image signal to the data lines 52a and outputs a scan signal to the scan lines 51a." Miyagawa, [0020]. I explain above that, to output the image signal, the driving IC would receive it first from an external system, for example, the electronic apparatus body connected to the flexible substrate. *Supra X.A.3.e.*

c) 9[b]

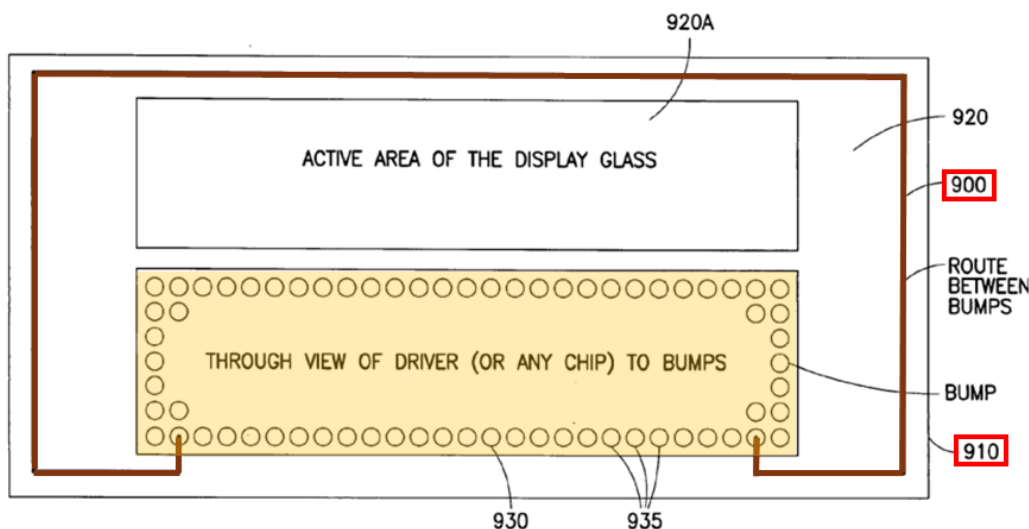
124. Miyagawa discloses or renders obvious a display device *wherein the second semiconductor chip* (driving IC 5) *is formed on the first substrate* (TFT array substrate) *and is surrounded by the fifth interconnect* (diagnostic wiring 90):



Miyagawa, Fig. 3 (IC region shaded in orange). Claim 9 merely requires the second semiconductor to process video signals and be placed on the display substrate to be surrounded by the fifth interconnect. Miyagawa's driving IC satisfies these requirements. As discussed above in Section X.A.1.k, Miyagawa renders obvious implementing crack-detection in a function IC on the flexible substrate. This

obvious configuration of Miyagawa, with a driving IC on the display substrate handling only the video signals and a function IC on the flexible substrate having a substrate crack diagnostic unit, satisfies claim 9.

125. A POSITA would understand “surround by the fifth interconnect” to not require the fifth interconnect to enclose all sides of the driving IC under the plain meaning of the phrase. Further, if enclosing all sides is required, then, since in this embodiment the diagnostic wiring is coupled to a function IC on the flexible substrate, it would have been obvious that the diagnostic wiring is routed to enclose the IC on all sides. Alternatively, a POSITA would recognize that, routing crack detection wiring around all sides of a driving IC is merely a design choice. This approach is illustrated in Nurmi, which includes the figure below that shows a crack diagnostic wiring (trace 900) around the border of a display substrate 910, with the trace 900 surrounding the driver IC:



Ex. 1014, Fig. 9, [0043].

5. Claim 10

126. As I explained above, Kotera in view of Miyagawa renders obvious *the display device according to claim 1*. *Supra* § X.A.1. Kotera further renders obvious *wherein the opening of the light shielding material* (serigraph 71) *is smaller than the detection region* (area including display surface operating area B and input section operating area D) *of the coordinate input substrate* (upper and lower film members 61–62).

127. Kotera's detection region includes display surface operating area B and input section operating area D. Kotera, [0046], [0056]. The opening of the serigraph corresponds to the display surface operating area B. Kotera, [0051]; §X.A.1.1. Because the opening of the serigraph covers only display surface operating area B,

and the detection region also includes input section operating areas D, the opening of the serigraphs is smaller than the detection region.

6. Claim 12

a) 12[pre]

128. Kotera discloses *a coordinate input device*. *Supra* § X.A.1.a.

b) 12[a]–[h]

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

7. Claim 17

130. Kotera in view of Miyagawa renders obvious *the coordinate input device according to claim 12*. *Supra* § X.A.6. The remainder of claim 17 is identical to claim 10. For that reason, Kotera renders it obvious. *Supra* § X.A.5.

8. Claim 18

131. I explain above that Kotera in view of Miyagawa renders obvious *the coordinate input device according to claim 17*. *Supra* § X.A.7. Kotera in view of Miyagawa further renders obvious *wherein the first flexile [sic] substrate* (Kotera: wiring board) *supplies driving signals to the detection electrodes* (Kotera: upper and lower transparent conductive films 63–64) *via the first interconnects* (of Kotera) *and*

receives detection signals corresponding to a contact position from the detection electrodes.

132. As I explain above, Kotera's conductive films are connected to signal wires—which are analogous to Miyagawa's wiring electrodes because both serve the same fundamental function of electrically connecting the display panel's internal circuitry to external circuits or components—which are in turn connected to the flexible wiring board. *Supra* §§ X.A.1.b, .e. A microcomputer is placed on the wiring board, Kotera, [0025], which is a flexible wiring board, *id.*, [0032], [0037]. As I explain above, a control device (*i.e.*, the microcomputer) can drive a zoom lens in response to touch pressure on the touch panel. *Supra* § X.A.1.e. Touch events and positions can be detected where the upper and lower transparent conductive films come in contact due to a pressing force and are electrically shorted. Kotera, [0007], [0042]. A POSITA would have understood or at least found it obvious that the microcomputer supplies the signals to drive the touch panel including the upper and lower film members. This is because the microcomputer responds to touch input. In Kotera, the device includes a control unit—*i.e.*, a microcomputer—that manages key functions of the camera, including the operation of the touch panel. Kotera, [0024]–[0025]. The touch panel is used to perform actions like setting the

shutter speed, meaning the device must process input from the touch panel to carry out these functions. *Id.*, [0061]. This demonstrates that the microcomputer is responsible for handling touch panel input and, by extension, generating the necessary signals to operate the touch panel.

133. Further, the signals are conveyed through the associated interconnect. As Kotera discloses that these interconnects serve as the exclusive signal pathways between the film members and the flexible wiring board. Kotera, [0032], [0037]. A POSITA would have understood that, aside from this interconnect, no other connections are described or implied.

9. Claim 20

134. Kotera in view of Miyagawa renders obvious *display device according to claim 1*. *Supra* § X.A.1. Kotera in view of Miyagawa further renders obvious *wherein a detection signal is supplied to the first flexible substrate* (Kotera: wiring board) *via one of the first interconnect* (of Kotera).

135. The additional limitation of claim 20 is a subset of claim 18, with the further requirement that the detection signal must be supplied via one of the first interconnect. Kotera in view of Miyagawa renders it obvious for the same reasons. *Supra* § X.A.8.

10. Claim 21

136. Kotera in view of Miyagawa renders obvious *the coordinate input device according to claim 12*. *Supra* § X.A.6. The remainder of claim 21 is identical to claim 20. For that reason, Kotera in view of Miyagawa renders it obvious. *Supra* § X.A.9.

11. Motivation to Combine**a) Diagnostic Wiring**

137. It is my opinion that a POSITA would have been motivated to add diagnostic wiring, as Miyagawa teaches, to Kotera's device, and the POSITA would have had a reasonable expectation of success to do so.

138. A POSITA would have known that display-panel manufacturing involves cutting a mother substrate into individual substrates. This process can frequently create cracks or chips in the substrate. *Supra* § VII. Miyagawa explains that cracks in the substrate create 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 solution improves manufacturing yield and reduces waste by identifying potentially defective panels in the manufacturing process. *Id.*, [0005], [0031]. Moreover, detecting cracks after each stage of manufacturing that may cause them prevents or reduces wasting components that

would be installed on defective substrates if undetected. *Id.*, [0004], [0028], [0030]. Increased manufacturing efficiency and reduced waste would have provided a POSITA ample motivation to add a diagnostic wiring because they directly impact business profit.

139. A POSITA would have recognized diagnostic wiring for crack detection to be useful to Kotera, which discloses “brittle” transparent conductive films. Kotera, [0045]. Brittle materials easily crack. For this reason, Kotera uses serigraph in the reinforcing area to prevent the transparent conductive films from breaking when subjected to users’ pressing force. *Id.*, [0013]. But the serigraph or the reinforcing area does not prevent cracks to the substrate when mother substrates are cut. Miyagawa’s diagnostic wiring is used to detect cracks and breakage during manufacturing and complements Kotera’s technique to protect the films from breakage post-manufacturing.

140. This addition merely involves adding another thin-film wire on Kotera’s film members. Doing so would have been well within the skill of a POSITA because it merely involves surrounding the film members and associated interconnect with a thin-film conductor in a form similar to Miyagawa’s diagnostic wiring. As evidence of this conventional practice, Hasegawa’s Figure 4 clearly

depicts a diagnostic conductive pattern 83 running along the edge of the substrate, demonstrating that forming a thin-film conductor around the border of a substrate was a conventional design approach, and adapting this configuration to surround film members would have been a straightforward and routine task for someone skilled in the art. Ex. 1015, Fig. 4. Likewise, Nurmi's Figure 9 shows a trace that is routed around the border of the display panel 910 to two bumps 935 and can detect a crack or break in the display glass 920. Ex. 1014, Fig. 9; *see also id.*, [0043]. Further, this addition would have been simple to implement because the diagnostic wiring is isolated from other circuits and components, and thus its addition does not involve the complexity that may result from wiring interconnected components.

141. A POSITA would have been motivated to apply Miyagawa's diagnostic wiring approach, originally used for display panels, to Kotera's touch panel because both panels face similar manufacturing challenges, particularly the risk of substrate damage during cutting. The use of a diagnostic wire was known in the prior art; as Nurmi teaches, a broken detection feature for a touch screen or display panel can be implemented by routing a conductive trace, such as ITO trace 900, around the border of the display glass and connecting it to at least two electrically conductive bumps; if the glass cracks, the trace will also break, resulting

in an open circuit between the bumps that can be detected. Ex. 1014, [0043]. Also, as a POSITA would have understood from Kotera Figure 4, which shows display and touch panels of different sizes, the panels are cut separately, making each independently susceptible to such damage. Kotera, Fig. 4. Because Miyagawa's peripheral diagnostic wiring detects cracks in display panels, a POSITA would recognize that implementing a similar wiring pattern on Kotera's touch panel would provide the same benefit—early detection of cracks or chips caused during cutting. This motivation to combine arises naturally from the shared problem of substrate damage, and related solutions are commonly adapted across similar components for this reason.

142. For the same reason this combination involves a simple addition, a POSITA would have had a reasonable expectation of success. Kotera's touch panel and Miyagawa's LCD panel have similar configurations, such as a central touch or display area surrounded by wiring and electrodes that connect to a flexible substrate. In conventional resistive-type touch panels, the ITO film is already connected to wiring or interconnect, and there is space between the edge of the substrate and the touch wiring, which readily accommodates the addition of a thin-film crack detection wiring as taught by Miyagawa. Thus, adding diagnostic wiring to Kotera's

film members based on Miyagawa's approach involves nothing more than applying a known technique to achieve a similar improvement, in the same manner as in Miyagawa, and would be expected to yield predictable results. Indeed, the '477 patent itself acknowledges that LCD devices, including touch components, were "well-known." Ex. 1001, 4:28–31. The same is true for the devices in Kotera and Miyagawa.

b) Liquid Crystal Display

143. Miyagawa's disclosure provides the details of an LCD display panel 4 already present in Kotera. Kotera, [0024]. Kotera focuses on reinforcing its touch panel to prevent breakage from pressing force. *Id.*, Abstract. For that reason, Kotera discusses only a few aspects of the conventional LCD panel rather than providing a detailed description. Such an omission does not distract from Kotera because LCD panels were conventional and well known. Further, a POSITA would have recognized Miyagawa's display device as "identical with that of well-known liquid crystal display devices," like the display device of the '477 patent. Ex. 1001, 4:28–31. Relying on Miyagawa to provide the details of a conventional LCD that are not explicitly described in Kotera simply involves using a well-known type of apparatus in the way it is typically intended. This approach would be expected to function as anticipated and produce results that are predictable to someone skilled in the field.

144. Indeed, what Kotera discloses about its conventional LCD panel matches or is compatible with Miyagawa's conventional LCD panel. For example, both comprise upper and lower glass plates with a liquid crystal layer in between. Kotera, [0029]; Miyagawa, [0017], [0043]–[0044]. Both have a polarization plate. Kotera, [0029]; Miyagawa, [0017]. Both use LEDs for backlighting. Kotera, [0034]; Miyagawa, [0020]. Both use a flexible substrate connected to the LCD panel. Kotera, [0032]; Miyagawa, [0020]. Accordingly, a POSITA would have found it obvious that Miyagawa's descriptions apply to Kotera's LCD panel. As a further confirmation of the conventional nature of their LCD panels and the consistency of their disclosures in this regard, both disclose another conventional embodiment, an electroluminescence (EL) panel without backlighting. Kotera, [0068]; Miyagawa, [0045].

145. Given the structural and functional similarities between the references, a POSITA would have had a reasonable expectation of success in applying Miyagawa's disclosure regarding LCD panel features and techniques to Kotera's LCD panel, as the panels share the same essential components and operate according to the same principles.

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

1. Claim 3

a) 3[pre]

146. Kotera in view of Miyagawa renders obvious *the display device according to claim 1*. *Supra* § X.A.1. Kotera in view of Miyagawa and Lee further renders obvious a display device *further comprising a first semiconductor chip* (Kotera: microcomputer; Lee: chip 224).

147. Kotera discloses “electronic components such as a microcomputer, resistors, or capacitors mounted at predetermined positions on the wiring board[.]” Kotera, [0025]. As I explain in Section X.A.1.e above, “wiring board” refers to a flexible substrate connected to the display panel. *See also* Kotera, [0032], [0037], [0041] (describing different types of flexible wiring board).

148. Lee similarly discloses a chip such as a drive IC placed on a flexible carrier. Lee, [0025]. Both microcomputers and ICs, or integrated circuits, were routinely fabricated in semiconductor materials, so the “first semiconductor chip” limitation is satisfied by either reference.

b) 3[a]

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

150. Kotera discloses a microcomputer disposed on a flexible wiring board.

Supra § X.B.1.a.

151. Lee discloses chips 224 (shaded in blue) and electrostatic discharge protective lines 228 (one shaded in red) disposed on a flexible carrier 222 (outlined in orange). Lee, [0025].

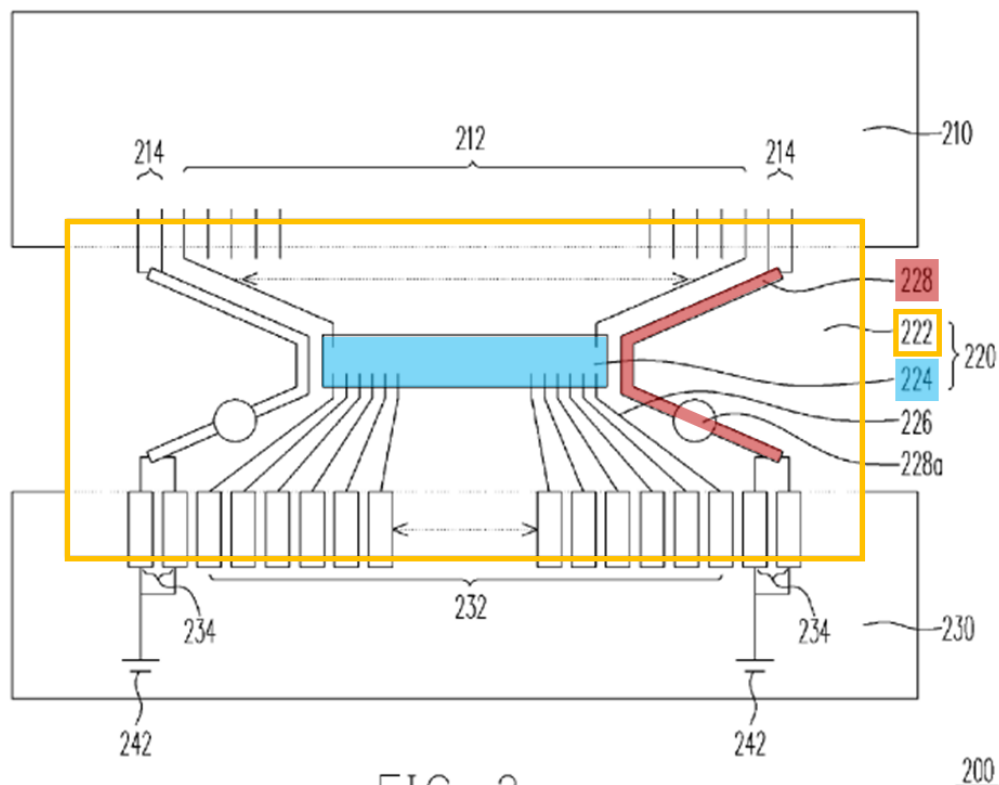


FIG. 2

Id., Fig. 2. The electrostatic discharge protective lines 228 are connected to a ground terminal 242 on a printed circuit board “for providing a[n] electrostatic discharging path” from the panel to an electrical ground *Id.*, [0025]–[0026].

152. As I explain above, it was well known to connect both display panels and touch panels to external circuits through respective flexible carriers. *Supra* § VII. Kotera’s flexible wiring board connects to signal lines on the substrate, such as those coupled to the film members, and is coupled to an external system on the other end. *Supra* § X.A.1.e. Similarly, Lee’s flexible carrier connects to signal lines

on the LCD panel and is likewise coupled to an external system at the opposite end. Lee, [0024]–[0025]; *id.*, Fig. 2. Given these similarities, a POSITA would have found it obvious that Lee’s configuration of its flexible carrier and associated components can be applied to Kotera’s wiring board. Moreover, because Lee teaches a conventional technique for providing electrostatic shielding protection, and a POSITA would have recognized the desirability of such protection, it follows that a POSITA would have been motivated and found it straightforward to combine Lee’s electrostatic discharge protective lines with Kotera’s wiring board to achieve the same shielding benefit.

c) 3[b]

153. Miyagawa and Lee renders obvious *wherein the third electrode* (coupled to Lee’s dummy pad 214 or analogously Miyagawa’s diagnostic pad) *is formed at one end of the third interconnect* (right electrostatic discharge protective lines 228). As Figure 2 shows, the dummy pad 214 is coupled to one end of the right electrostatic discharge (“ESD”) protective line 228, establishing an electrical connection between the dummy pad 214 on the LCD panel and the ESD protective line 228 on the flexible carrier 222.

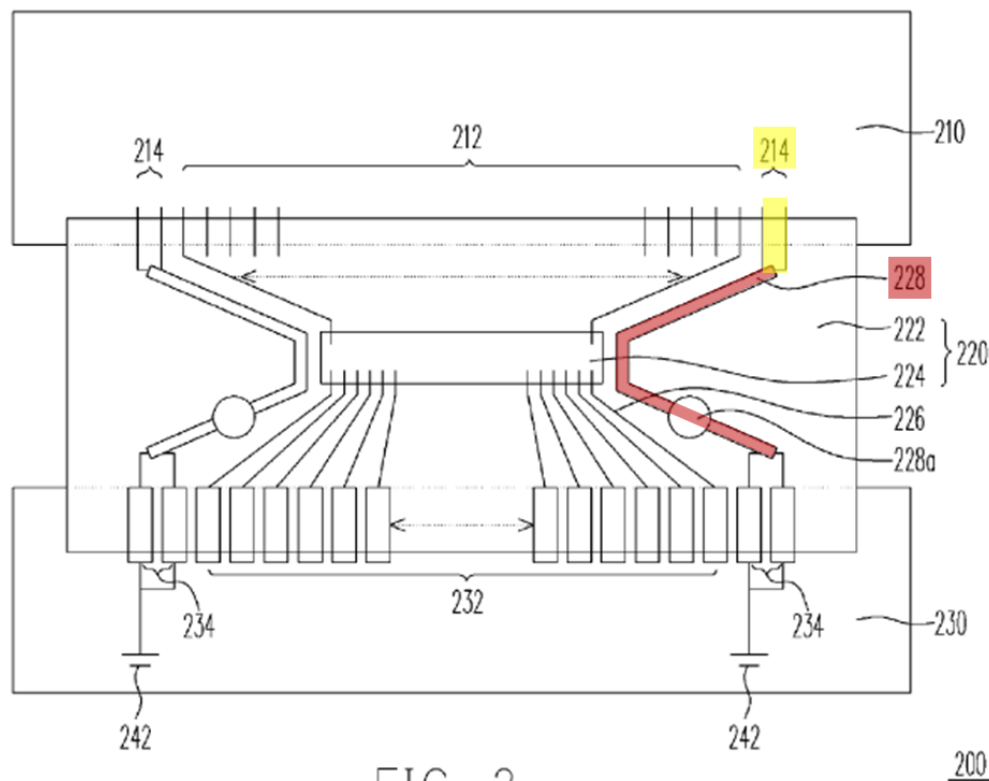


FIG. 2

Lee, Fig. 2, [0025].

154. A POSITA would have recognized that the electrostatic discharge protective lines 228, which are electrically coupled to the dummy pads 214, may function as an extension of the diagnostic wiring on the panel. In Lee, the dummy pads 214 on Lee's LCD panel are further connected, via the ESD protective lines 228, to corresponding dummy pads 234 on the printed circuit board. *Id.*, [0024], [0025]. The dummy pads 214 are connected to the source terminals 242 via the protecting lines 228. *Id.*, [0026]. This configuration enables continuity diagnostic

testing to be performed by applying a voltage at the source terminal and checking for electrical continuity through the protective lines 228 and dummy pads 214. Lee's dummy pads 214 are analogous to Miyagawa diagnostic pads, since Miyagawa teaches that continuity testing can be performed by probing the diagnostic pads 91–92, which are electrically connected to perform their diagnostic function. Miyagawa, [0028]. Together, these references demonstrate that continuity testing can be performed through the electrical connections established between the pads and the source terminals.

d) 3[c]

155. Lee discloses *wherein a fifth electrode* (dummy pads 234) *is formed at the other end of the third interconnect* (right electrostatic discharge protective line 228). As Figure 2 also shows, the dummy pad 234 is formed at the other end of the right electrostatic discharge protective line 228, thereby connecting the ESD protective line 228 on the flexible carrier to the dummy pad 234 on the printed circuit board 230.

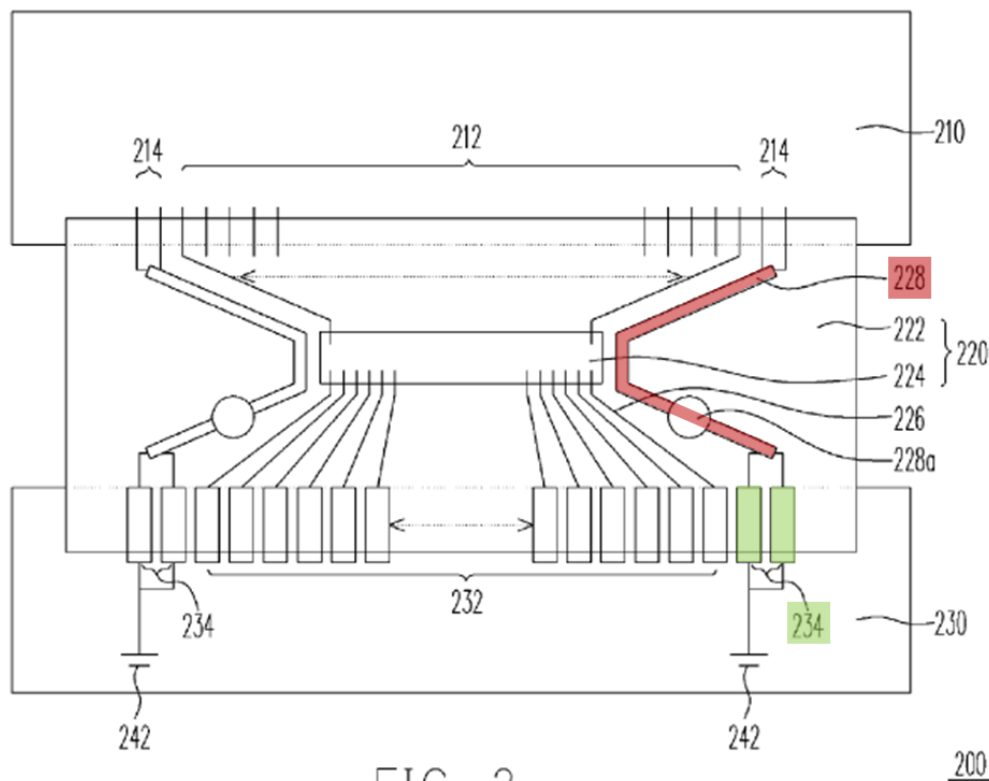
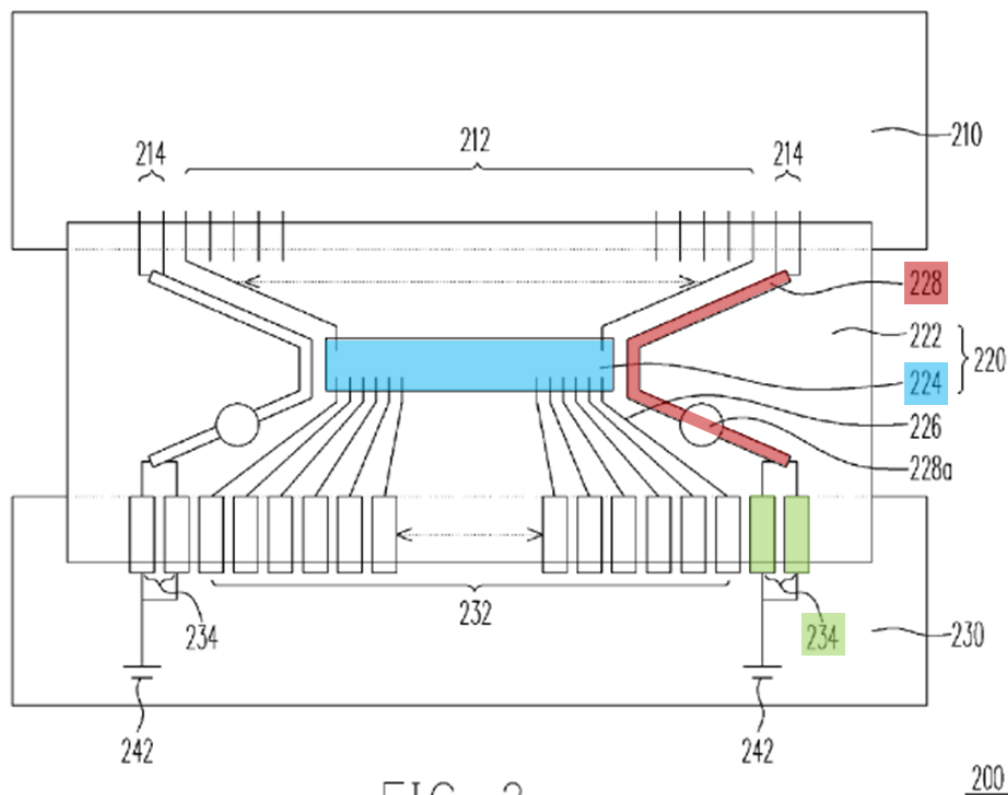


FIG. 2

Lee, Fig. 2, [0025].

e) 3[d]

156. Lee discloses *wherein the first semiconductor chip* (chip 224) *doesn't overlap the third interconnect* (right electrostatic discharge protective line 228) *and the fifth electrode* (dummy pads 234) *in a plan view*. As shown in Figure 2, the chip 224 is positioned on the flexible carrier such that it does not overlap the right electrostatic discharge protective line 228 or the dummy pads 234.



Lee, Fig. 2, [0025].

157. With such a configuration, electrical continuity test may be performed by probing diagnostic pads 91–92 (*i.e.*, dummy pads 214 in the combination) both after the mother substrate is singulated and after individual substrates are bonded or rim-sealed. See Miyagawa, [0028], [0039]. A POSITA would have understood that the electrostatic discharge protective lines 228 may function as an extension of the diagnostic wiring. That function allows for probing to be performed across either a pair of the diagnostic pads (dummy pads 214), the electricity conducting pads 228a,

or the dummy pads 234 as each of these pairs may serve as contact points for electrical continuity testing. Having such options provides additional flexibility for the continuity check, which a POSITA would have recognized is advantageous for manufacturing. Additionally, the substrate crack diagnostic unit may be placed in a driving IC, as taught in Miyagawa, on the individual substrate rather than in a driving IC or function IC on the flexible substrate. Electrical continuity testing can be performed by the substrate crack diagnostic unit in the driving IC on the substrate. And when the substrate crack diagnostic unit is not active, it may form an open circuit across the diagnostic wiring to allow the probing method to be performed. Accordingly, this configuration would have simply involved routing the diagnostic wiring to the IC mounting region as taught in Miyagawa as well as to the edge of the panel where dummy pads are placed based on Lee's teaching. Creating such parallel electrical paths were routine and would have been well within a POSITA's knowledge and skill. Indeed, this configuration would have been obvious against claim 1 as well.

158. A POSITA would have understood that electrostatic discharge may impact an electronic device at various locations, and thus that a shield line should be located around the circuitry it is designed to protect. Lee explains that "[i]t should

be noted that the electrostatic discharge protective lines 228 and the electricity conducting pads 228a can be disposed close to the chip 224 and the signal lines 226 for providing superior electrostatic discharge protective effect.” Lee, [0026]. This statement is based on the recognition that positioning the protective lines close to the chip and signal lines enhances electrostatic discharge protection by protecting a larger area outside the protective lines where ESD may strike. But a POSITA would have known that the outside area should not be enlarged to the point where the protective lines and their pads overlap the semiconductor chip itself, as such overlap would expose the chip directly to the very discharge currents that could damage it.

2. Claim 4

159. Kotera in view of Miyagawa and Lee renders obvious *the display device according to claim 3*. *Supra* § X.B.1. Kotera further discloses a display device *wherein the first semiconductor chip* (microcomputer) *drives the coordinate input substrate* (upper and lower film members 61–62).

160. Kotera’s microcomputer drives and receives detection signals from the touch panel including the upper and lower film members. *Supra* § X.A.8. Thus, its operation fully encompasses the additional limitation of claim 4.

3. Claim 5

161. Kotera in view of Miyagawa and Lee renders obvious *the display device according to claim 3*. *Supra* § X.B.1. Lee further renders obvious *wherein the third interconnect* (right electrostatic discharge protective line 228) *extends from the third electrode* (coupled to Lee's dummy pad 214 or analogously Miyagawa's diagnostic pad) *to the fifth terminal* (dummy pads 234) *along an edge of the first flexible substrate* (flexible carrier 222) *and is disposed between the first semiconductor chip* (chip 224) *and the edge of the first flexible substrate*.

162. As shown in Figure 2 below, Lee's electrostatic discharge protective lines 228 extend from the pads in direct contact with dummy pads 214 to dummy pads 234 to electrically connect the panel substrate to an external circuit, the printed circuit board 230. Lee, [0025]. They are disposed between the chip 224 and the edges of the flexible carrier 222. *Id.*

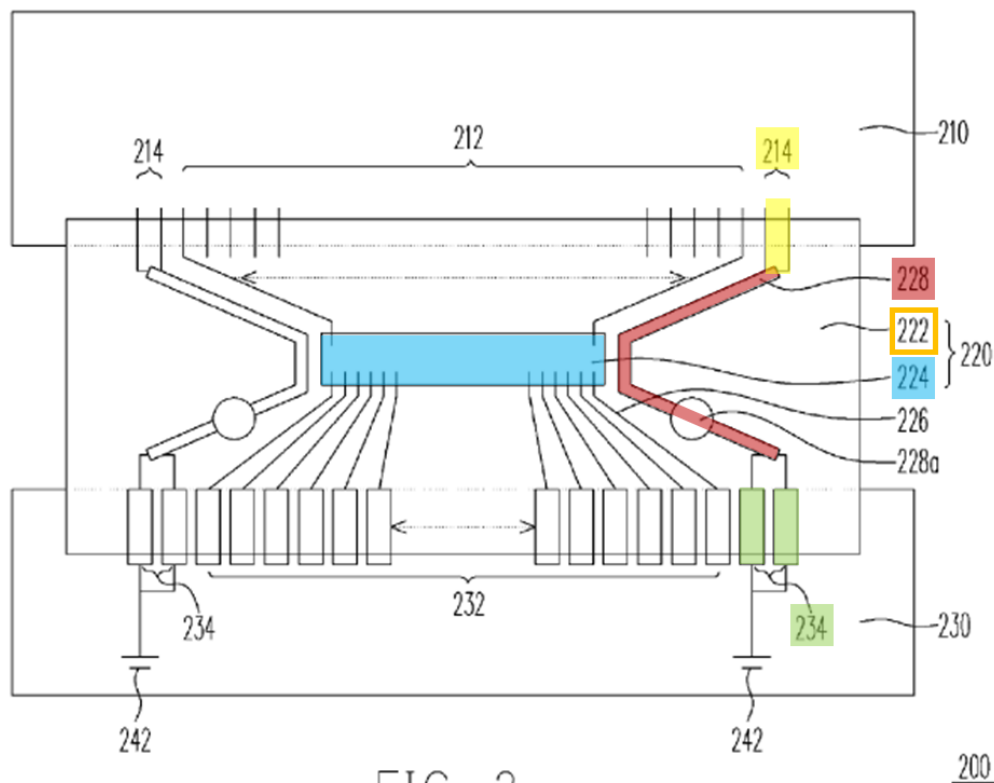


FIG. 2

Id., Fig. 2.

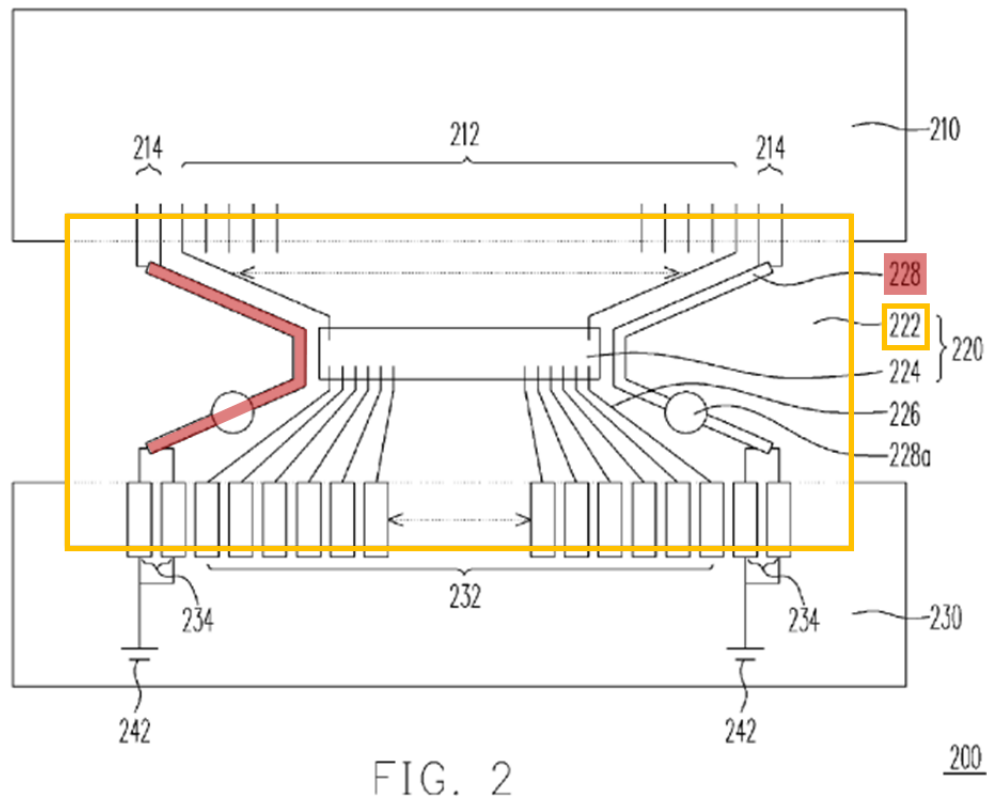
163. Lee teaches that “there is no set limit on the position or the amount of the electrostatic discharge protective lines 228 ... in the present invention, one of ordinary skill in the art may select an appropriate arrangement according to a practical necessary [*sic*].” *Id.*, [0026]. Based on this teaching, a POSITA would have recognized that routing the electrostatic discharge protective lines along an edge of the flexible carrier is a permissible arrangement contemplated by Lee, provided that the protective function is maintained. This arrangement would be

particularly desirable in situations where the components to be protected, including signal lines, are themselves located near the edge of the flexible carrier. In such cases, a POSITA would appreciate that placing the electrostatic discharge protective lines along the edge would offer effective protection and represents a routine matter of design choice.

4. Claim 6

a) 6[pre]

164. Kotera in view of Miyagawa and Lee renders obvious *the display device according to claim 3*. *Supra* § X.B.1. Lee further discloses *wherein a fourth interconnect* (left electrostatic discharge protective line 228) *is disposed on the first flexible substrate* (flexible carrier 222). As shown in Figure 2 below, the left electrostatic discharge protective line (highlighted in red) is formed on the flexible carrier 222 (outlined in orange).



Lee, Fig. 2, [0025].

b) 6[a]

165. Miyagawa and Lee renders obvious *wherein the fourth electrode* (coupled to Lee's dummy pad 214/Miyagawa's diagnostic pad) *is formed at one end of the fourth interconnect* (left electrostatic discharge protective lines 228). This is plainly shown by Figure 2 below.

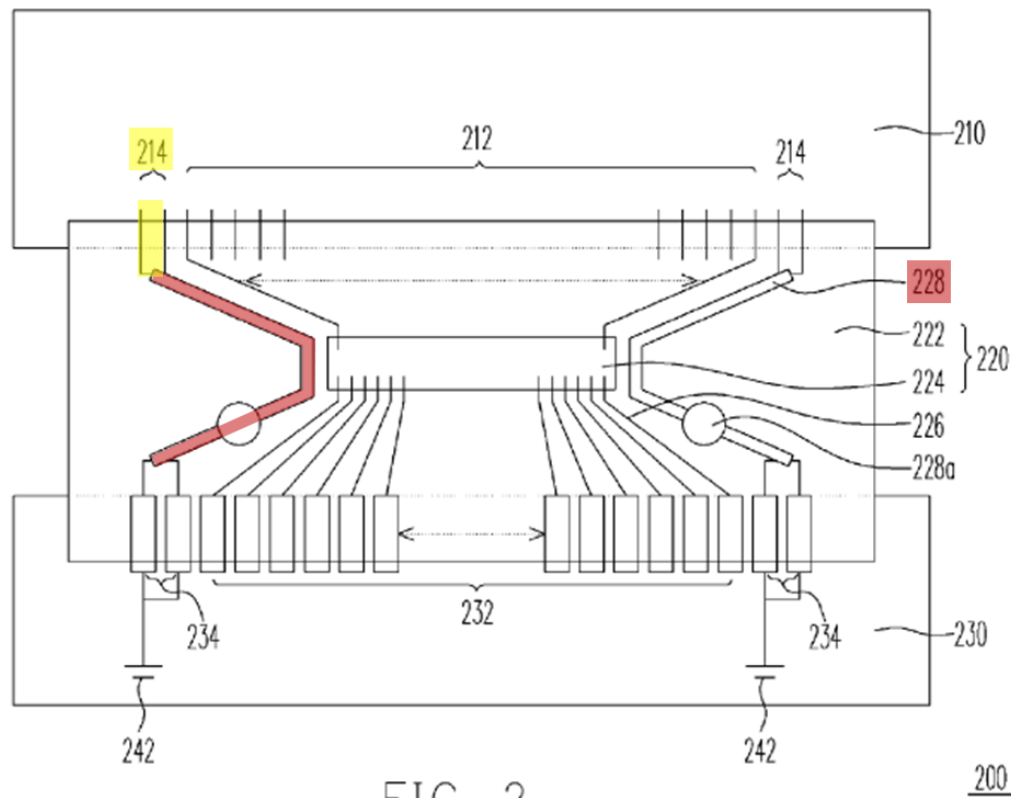


FIG. 2

Lee, Fig. 2, [0025].

c) 6[b]

166. Lee discloses *wherein a sixth electrode* (dummy pads 234) *is formed at the other end of the fourth interconnect* (left electrostatic discharge protective line 228). Likewise, this is shown by Figure 2 below.



d) $6[c]$

117

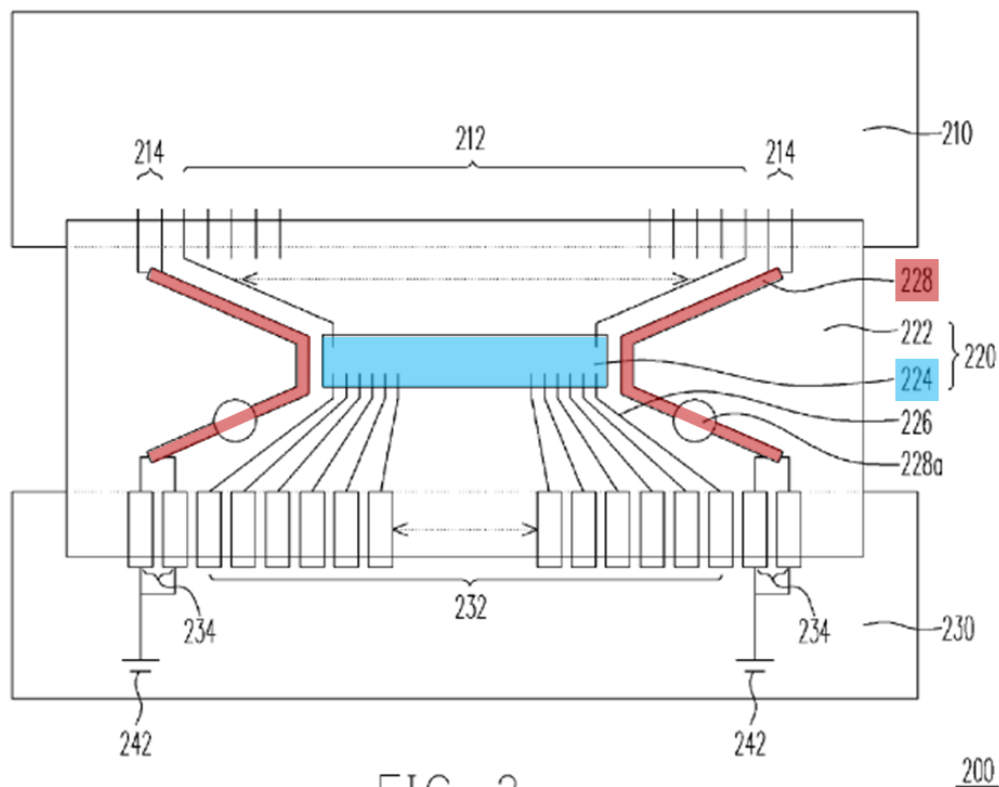


FIG. 2

Lee, Fig. 2, [0025].

e) 6[d]

168. Lee discloses *wherein the first semiconductor chip* (chip 224) *doesn't overlap the fourth interconnect* (left electrostatic discharge protective line 228) *and the sixth terminal* (dummy pads 234) *in a plan view*. This is plainly shown by Figure 2 and, as I explain above, a POSITA would have known that the electrostatic discharge protective lines and their pads should not overlap the semiconductor chip that is to be protected from electrostatic discharge.

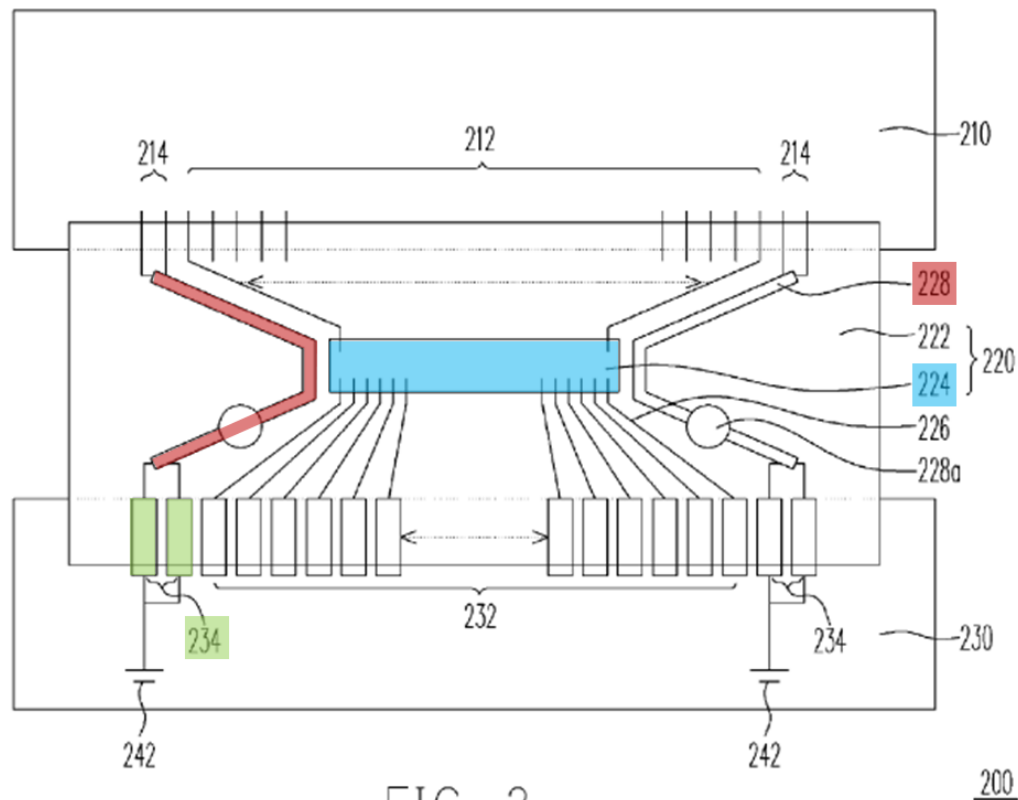


FIG. 2

Lee, Fig. 2, [0025]; *supra* § X.B.1.e.

5. Claim 7

169. I explain above that Kotera, in view of Miyagawa and Lee, renders obvious *the display device according to claim 3*. *Supra* § X.B.1. The remainder of claim 7 is identical to claim 18. For that reason, Kotera in view of Miyagawa renders it obvious. *Supra* § X.A.8.

6. Claim 13**a) 13[pre]**

170. As I explain above, Kotera in view of Miyagawa renders obvious *the coordinate input device according to claim 12*. *Supra* § X.A.6. As I also explain above, Kotera in view of Miyagawa and Lee further renders obvious a display device *further comprising a first semiconductor chip*. *Supra* § X.B.1.a.

b) 13[a]–[d]

171. Claim limitations 13[a]–[c] are respectively identical to claim limitations 3[a]–[d]. Given that, Kotera in view of Miyagawa and Lee renders them obvious. *Supra* §§ X.B.1.b–e.

7. Claim 14

172. Kotera in view of Miyagawa and Lee renders obvious *the coordinate input device according to claim 13*. *Supra* § X.B.6. The remainder of claim 14 is identical to claim 4. Given that, Kotera in view of Miyagawa and Lee renders it obvious. *Supra* § X.B.2.

8. Claim 15

173. As I explain above, Kotera in view of Miyagawa and Lee renders obvious *the coordinate input device according to claim 13*. *Supra* § X.B.6.

174. The remainder of claim 15 is virtually identical to claim 5, except that claim 5 recites “the fifth terminal” but claim 15 recites “the fifth electrode.” Terminals and electrodes in this context have the same meaning, and “the fifth terminal” and “the fifth electrode” refer to the same electrode/terminal. Given that, Kotera in view of Miyagawa and Lee renders claim 15 obvious. *Supra* § X.B.3.

9. Claim 16

175. I explain above that Kotera in view of Miyagawa and Lee renders obvious *the coordinate input device according to claim 13*. *Supra* § X.B.6.

a) 16[a]–[d]

176. Claim limitations 16[a]–[d] are respectively identical to the additional requirements in claim limitations 6[pre]–[c]. Given that, Kotera in view of Miyagawa and Lee renders them obvious. *Supra* §§ X.B.4.a–d.

b) 16[e]

177. Claim limitation 16[e] is substantively identical to claim limitation 6[d], except that it recites “the sixth electrode” instead of “the sixth terminal.” Terminals and electrodes in this context have the same meaning, and “the sixth terminal” and “the sixth electrode” refer to the same electrode/terminal. Given that, Kotera in view of Miyagawa and Lee renders claim limitation 16[e] obvious. *Supra* § X.B.4.e.

10. Motivation to Combine

178. It is my opinion that a POSITA would have been motivated to apply Lee's teaching regarding its flexible carrier and the associated components to Kotera's display device. Miyagawa's teaching would have further motivated this combination.

179. As explained above, a POSITA would have understood, or at least found it obvious, that Kotera's microcomputer is disposed on a flexible wiring board. *Supra* § X.B.1.a. Miyagawa's embodiment in which a driving or function IC is mounted on a flexible substrate confirms that this configuration was common and well known. Miyagawa, [0020], [0040]. Thus, applying Lee would merely have involved adding the electrostatic discharge protective lines, associated pads, and the placement of components on the flexible substrate.

180. Based on Nakamura, a POSITA would have known that diagnostic wiring for crack detection can also function as a shield wiring to reduce the effect of noise and electrostatic discharge to the touch panel. Ex. 1011, [0041]. It was well known that electrostatic discharge is a common and serious threat to electronic devices. *See, e.g.*, Ex. 1016, [0025], Fig. 6. Thus, a POSITA would have found it desirable to dual purpose Miyagawa's diagnostic wiring as a shield wiring. The suitability as shield wiring of Miyagawa's diagnostic wiring is further confirmed by

Nakamura and Lee, which respectively refer to a defective line and electrostatic discharge pads as “dummy,” based on their inactivity during normal operations. Ex. 1011, [0053]; Lee, Abstract.

181. Additionally, a POSITA would have been motivated to connect the diagnostic/shield wiring on the touch panel via a flexible substrate to an external ground. This is because it was widely understood in the field that connecting to an external ground—such as a system or chassis ground outside the panel—offers better protection against electrostatic discharge than relying solely on a ground point located within the panel itself. The external ground provides a larger and more stable path for dissipating unwanted electrical charges, thereby reducing the risk of electrostatic discharge damage to sensitive components. This principle is supported by Segawa, which explains that connecting electrostatic discharge protection to an external ground improves resistance to electrostatic discharge. Ex. 1016, [0044], [0047]. It follows that a POSITA would have understood this to be a main reason that Lee teaches connecting electrostatic discharge protective lines to a ground terminal. Lee, [0026].

182. Lee teaches that the electrostatic discharge protective lines provide a discharging path for static electricity. *Id.*, [0017]. Employing this configuration

improves manufacturing yield and device performance by reducing damages to components. *Id.*, [0017], [0031]. Based on these improvements, a POSITA would have been motivated to provide electrostatic discharge protective lines on Kotera's flexible wiring board.

183. Further, a POSITA would have recognized that Lee's electrostatic discharge protective lines complement Miyagawa's diagnostic wiring functioning as a shield wiring, as both perform the same function of reducing the impact of static electricity on the device but at different locations. *Id.* Given this shared function, it would have been obvious that Lee's electrostatic discharge protective lines may be an extension on the flexible substrate of Miyagawa's diagnostic/shield wiring to provide a conductive path to ground for static electricity. Indeed, Miyagawa's diagnostic/shield wiring completes an electrical loop connecting the two sides of Lee's electrostatic discharge protective lines. They complement and complete one another.

184. Additionally, as I explain above, Lee's dummy pads 234 and electricity conducting pads 228a provide additional probe points for electrical continuity testing. *Supra* § X.B.1.e. Accordingly, a POSITA would have been further motivated to incorporate Lee's electrostatic discharge protective lines as an

extension of Miyagawa's diagnostic wiring into Kotera's flexible wiring board to increase manufacturing flexibility for crack detection by increasing the number of available probe points.

185. Moreover, a POSITA would have recognized that Miyagawa's diagnostic pads, analogous to Lee's dummy pads 214, "increase bonding strength" between the device substrate and the flexible substrate. Lee, [0024]. Such increased bonding strength would, in turn, improve the reliability of the device.

186. A POSITA would have had a reasonable expectation of success of implementing Lee's electrostatic discharge protective lines. Like Miyagawa's diagnostic/shield wiring, Lee's electrostatic discharge protective lines are isolated from other wiring and components on the substrate. Lee, Fig. 2. Because of the isolation, forming them does not affect other circuits, meaning that adding Lee's protective lines on the sides of the flexible wiring board would have been straightforward—no other design changes are needed. Lee confirms this when it states "the electrostatic protective effect can be attained without modifying the original circuit design of the printed circuit board or the LCD panel." *Id.*, [0027].

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

1. Claim 11

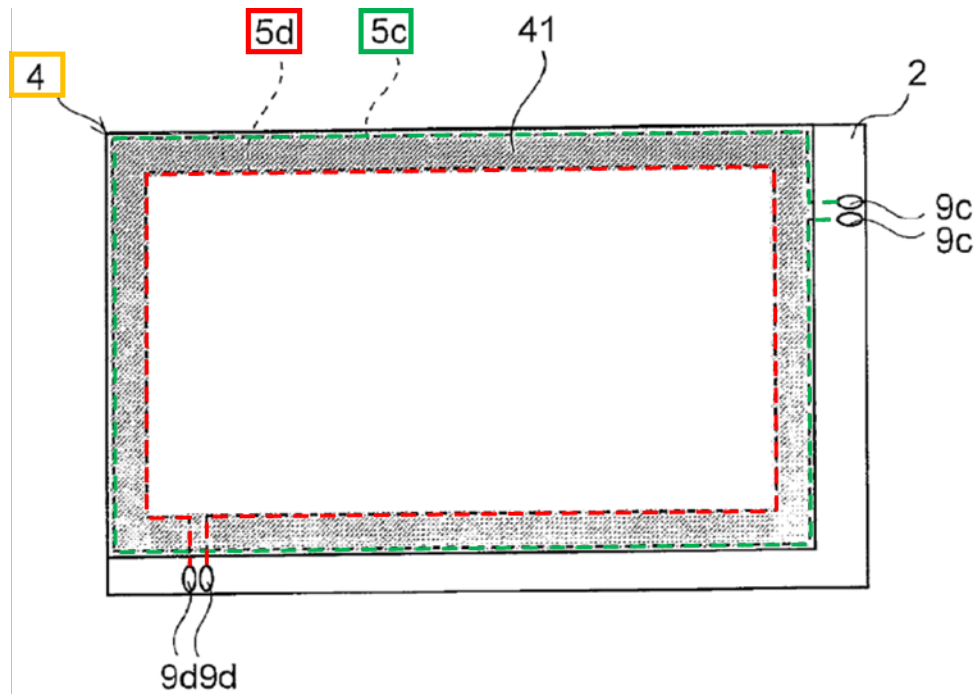
a) 11[pre]

187. Kotera in view of Miyagawa renders obvious *the display device according to claim 1*. *Supra* § X.A.1. Kotera in view of Miyagawa and Kida renders obvious a display device further comprising the limitations below.

b) 11[a]

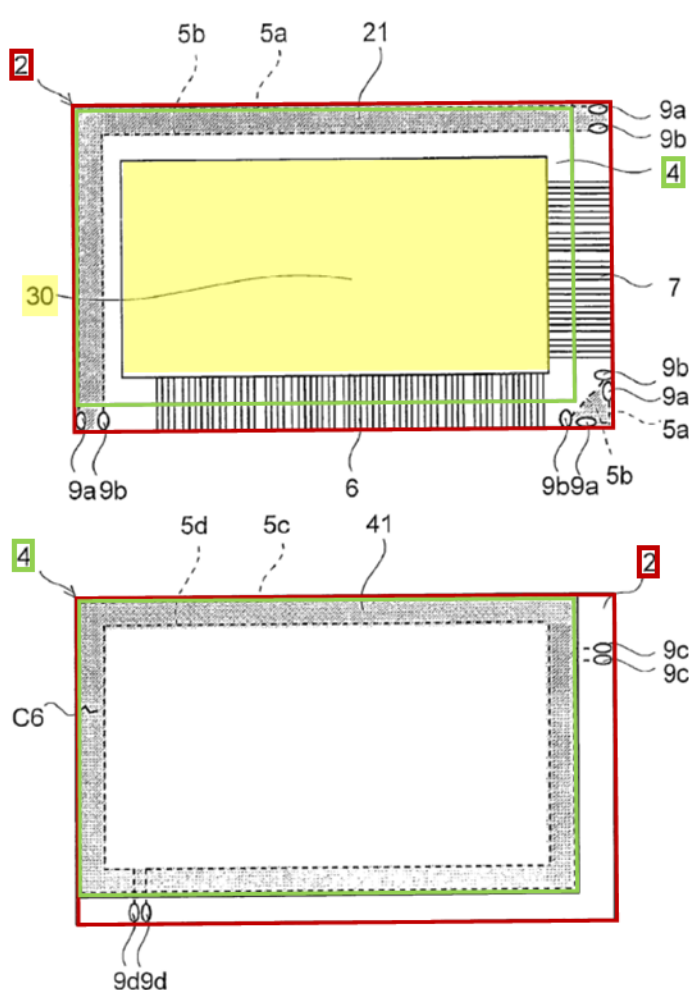
188. Kotera in view of Miyagawa and Kida renders obvious *a sixth interconnect* (Kida: fourth inspecting conductor 5d) *surrounds the detection region* (Kotera: area including display surface operating area B and input section operating area D) *and is formed outside the first interconnects* (of Kotera).

189. Kida discloses a third inspecting conductor 5c formed “along the edge of the counter substrate 4.” Kida, [0114]. As shown in Figure 11(b) below, the fourth inspecting conductor 5d (indicated by the red dashed line) is formed on the panel inside the third inspecting conductor 5c (indicated by the green dashed line).
Id.



Id., Fig. 11(b). The inspecting conductors 5c–5d can detect cracks in the counter substrate 4. *Id.*, [0114]. To achieve this, the user performs a continuity check by applying a voltage to the pairs of pads 9c, which correspond to the ends of the wiring 5c, or to the pairs of pads 9d, which correspond to the ends of the wiring 5d. *Id.*, [0116]. If both conductors remain conductive, the user deems the substrate acceptable with no cracks. *Id.*, [0117]. If only the exterior third conductor is cut, the user visually inspects the substrate to determine whether it is defective. *Id.*, [0118]. If a large crack is present and breaks both conductors, the user deems the substrate defective. *Id.*, [0117].

190. As Figures 11(a) and 11(b) show, Kida discloses an active display area 30, highlighted in yellow. *Id.*, [0070], [0106].



Id., Figs. 11(a)–(b). The counter substrate 4 is indicated by green outlining, while the pixel substrate 2 is indicated by red outlining. A POSITA would have recognized that Kida’s active display area 30 is analogous to Kotera’s display surface operating area B and input section operating area D, as both represent the active area for user

interaction with touch or display. Thus, Kida's teaching of forming a fourth inspecting conductor 5d around the active area would have been understood to apply equally to the corresponding regions in Kotera's device. Further, Kida's fourth inspecting conductor's function is to detect cracks that may render a substrate defective. Miyagawa teaches that crack-detection wiring should be positioned outside and close to the signal lines. This placement ensures that only cracks severe enough to break signal interconnects are detected. Miyagawa, [0007]–[0008], [0031]. In light of these teachings, a POSITA would have found it obvious, in a combination with Kotera and Miyagawa, to form the fourth inspecting conductor outside the first interconnects that connect the detection electrodes in the active area with the flexible substrate. This arrangement ensures that the crack-detection system reliably identifies those cracks that could compromise device reliability, while ignoring minor cracks that do not result in defects.

191. Kida also discloses that the inspecting conductors formed on a substrate may be configured based on the arrangement of other components on the substrate. Kida, [0082]. It follows that a POSITA would have found it obvious to configure the fourth inspecting conductor according to the arrangement of components on Kotera's touch substrate.

c) 11[b]

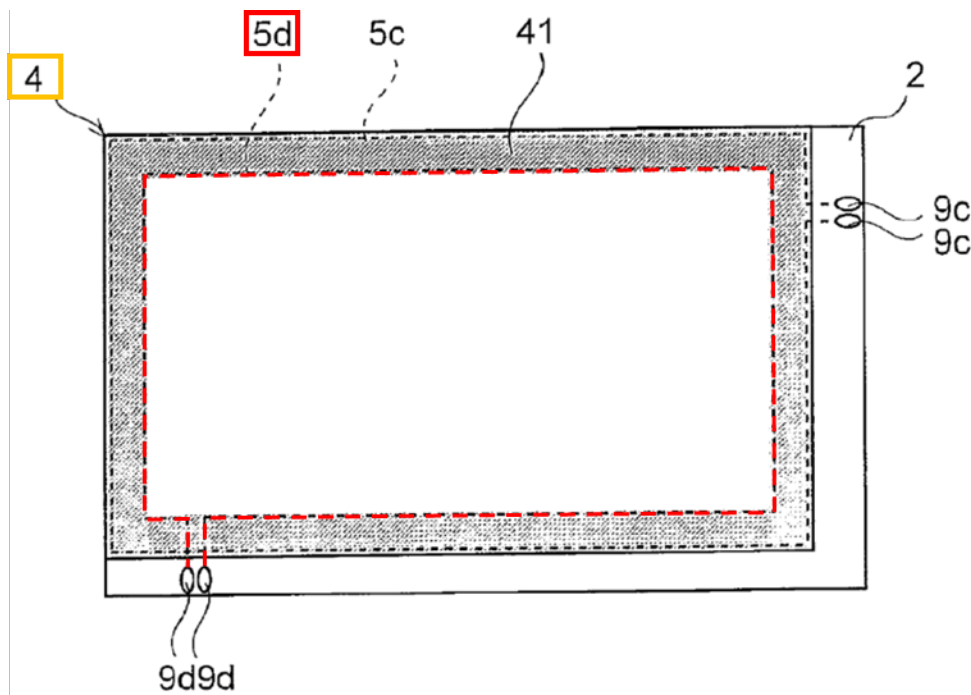
192. Kotera in view of Miyagawa and Kida renders obvious *wherein the sixth interconnect* (Kida: fourth inspecting conductor 5d) *is electrically connected with the first flexible substrate* (Kotera: wiring board).

193. Both Kida's fourth inspecting conductor and Miyagawa's diagnostic wiring detect cracks to the substrate. Given their same function, it would have been obvious to a POSITA that they can be configured similarly. Miyagawa's diagnostic wiring is electrically connected with the first flexible substrate, and in this embodiment, an IC is located on the first flexible substrate. *Supra* § X.A.1.k. This demonstrates that connecting diagnostic wiring to circuitry on a flexible substrate is conventional. Accordingly, it would have been obvious to do the same with Kida's inspecting conductor since both Kida and Miyagawa use peripheral conductors for crack detection and Miyagawa shows it was routine to connect such conductors to an IC on the flexible substrate. Miyagawa, [0040]. This approach is consistent with Kida, which discloses "electrode terminals ... exposed to the outside and electrically connected to driving ICs." Kida, [0106]. A POSITA would also have recognized that the same approach can be used for the inspecting conductors, since the inspecting pads at their ends function as electrode terminals and can be connected to the flexible substrate in the same manner.

d) 11[c]

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

195. As shown in Figure 11(b), the fourth inspecting conductor 5d is disposed along a peripheral edge of at least three sides of the substrate 4:



Kida, Fig. 11(b). A POSITA would have recognized that arranging the inspecting conductor along the periphery of the upper and lower film members 61–62 including

their associated electrodes would enable effective crack detection by ensuring that cracks in the upper and lower film members are identified.

2. Claim 19

196. Kotera in view of Miyagawa renders obvious *the coordinate input device according to claim 12*. *Supra* § X.A.6. The remainder of claim 19 is substantively identical to claim 11. Thus, Kotera in view of Miyagawa and Kida renders it obvious. *Supra* § X.C.1.

3. Motivation to Combine

197. It is my opinion that a POSITA would have been motivated to add a fourth inspecting conductor as Kida teaches and would have had a reasonable expectation of success to do so.

198. As explained above, a POSITA would have known that cracks routinely result from manufacturing. *Supra* § X.A.11.a; *see also* Kida, [0074]. Because undetected cracks can lead to increased manufacturing waste—by allowing defective panels to proceed through later stages—a POSITA would have been motivated to find ways to identify and remove cracked panels as early as possible. *Supra* § X.A.11.a; Kida, Abstract. Kida addresses this problem by introducing a double wiring approach, which enables distinguishing between large cracks that compromise panel quality and smaller chips that do not cause a genuine defect.

Kida, Figs. 12(a)–15(b), [0124]–[0138]. This system allows manufacturers to focus visual inspection only on panels where the wiring indicates a potentially serious crack, thereby making the inspection process more targeted and efficient. *Id.*, [0007], [0117]–[0119]. Kida explicitly teaches that this method “improve[s] the efficiency of the inspecting process” and increases the reliability of detecting defective panels due to cracks. *Id.*, [0028]. Given these clear benefits—including reduced waste, improved inspection efficiency, and more reliable defect detection—a POSITA would have been motivated to adopt Kida’s solution by adding a second crack-detection wire near the substrate edges, with the expectation of achieving similar advantages in their own manufacturing processes.

199. Adding a fourth inspecting conductor simply requires adding a thin-film wire on Kotera’s film members. Kida explains that the inspecting conductors are formed of indium-tin-oxide (ITO), a transparent and conductive material widely used in display technology for creating thin-film wiring. Kida, [0122]. Because it was conventional to deposit ITO as a thin-film conductor on substrates—as demonstrated by Hasegawa’s diagnostic conductive pattern 83 running along the substrate edge, Ex. 1015, Fig. 4, and by Nurmi’s border trace for crack detection, Ex. 1014, Fig. 9, [0043]—a POSITA would have found it straightforward to

surround Kotera's film members with such a conductor, just as is done for Miyagawa's diagnostic wiring. *Supra* § X.A.11.a (citing Exs. 1014–1015). Further, this addition would have been simple because the inspecting conductor is isolated from other circuits and components, and thus its addition does not involve the complexity that may result from interconnected components.

200. For the same reason as explained above with respect to combining Miyagawa's diagnostic wiring with Kotera's touch panel disclosure, a POSITA would have been motivated to apply Kida's inspecting conductor for a display panel on Kotera's touch panel. *Supra* § X.A.11.a.

201. For the same reason that this combination involves a simple addition, a POSITA would have had a reasonable expectation of success. Another reason is that Kida teaches that the arrangement of the inspecting conductors may be changed based on the configuration of other components on the substrate. Kida, [0082]. This flexibility would have bolstered the expectation of success because it allows the crack-detection wiring to be adapted to fit around existing circuitry or features without compromising its function. Knowing that the inspecting conductors can be repositioned as needed to accommodate different panel layouts would reassure a POSITA that Kida's crack-detection approach could be effectively implemented in

a variety of device designs. Kida also teaches that embodiments with fewer inspecting conductors on either substrate are included within the scope of its disclosure. Kida, [0159]. An embodiment with one inspecting conductor on one substrate (what a POSITA may call a degenerate case) shares the same functional purpose and structural arrangement as the combination of Kotera with Miyagawa, as both approaches use a peripheral conductor for crack detection. Thus, whether to have one or two crack detection wires (whether called diagnostic wiring or inspecting conductors) would have been nothing more than choosing between two configurations taught by Kida. A POSITA would have recognized that incorporating an additional conductor into the combined structure would achieve reliable crack detection using a conventional fabrication technique that would have been well within a POSITA's skill.

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

1. Claim 1

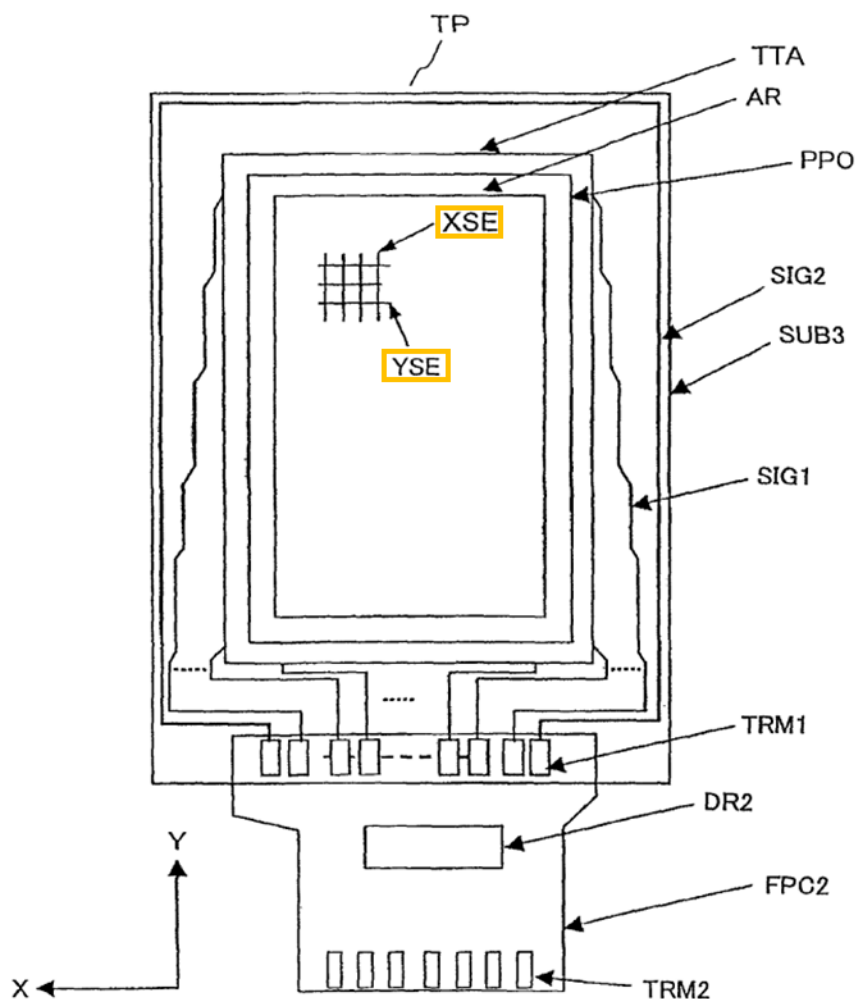
a) 1[pre]

202. Sung discloses *a display device*, for example, a display device incorporating a touch screen. Sung, Abstract, Figs. 5A–5D.

b) 1[a]

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

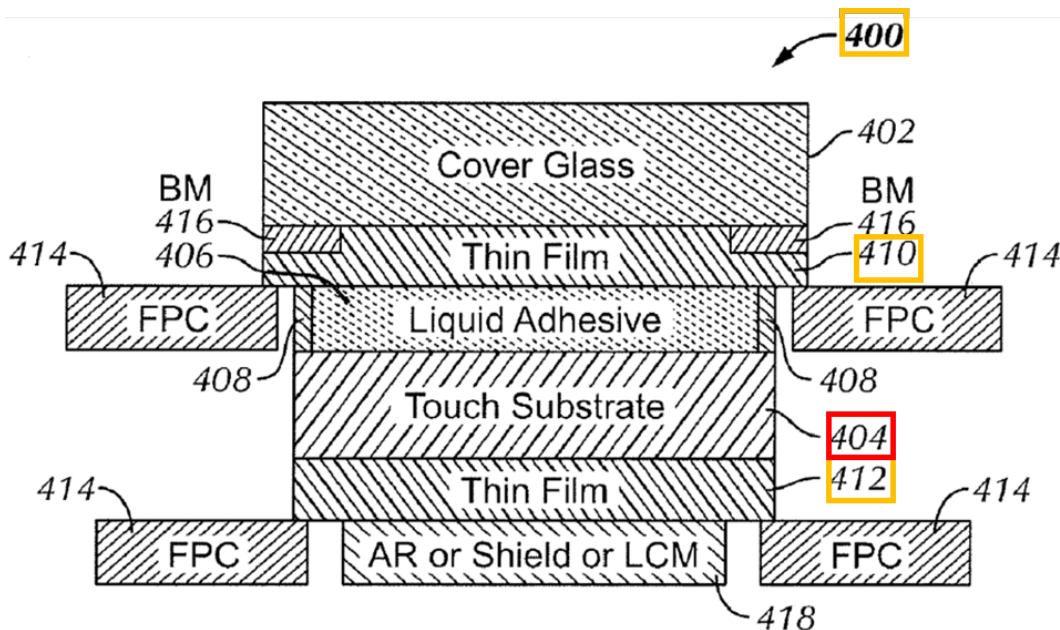
204. As shown in Figure 3 below, the '477 patent discloses detection electrodes XSE and YSE extending in the Y and X directions, respectively. Ex. 1001, 7:11–16. The YSE and XSE electrodes are arranged so that they cross each other at right angles, but at their intersection points, they are separated by an insulating film, ensuring that the electrodes do not make electrical contact where they overlap in the device structure. *Id.*, 7:16–18.



Id., Fig. 3; 7:18–29.

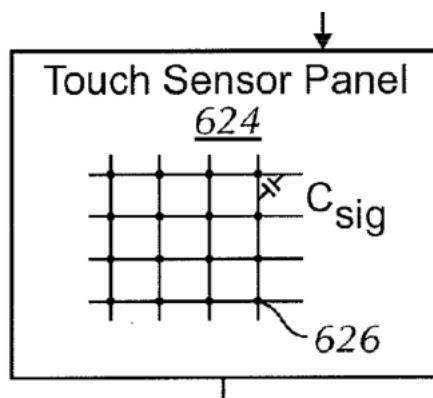
205. Sung’s display device comprises a touch sensor panel 400. Sung, [0039]. As Figure 4 below illustrates, the panel comprises touch substrate 404 having thin film layers 410 and 412 disposed on the two sides of the substrate. *Id.*, [0040] (drive lines in thin film layer 410 and sense lines in thin film layer 412). The thin film layers are “laid out as a grid of drive lines and sense lines that form multiple

touch pixels on a capacitive touch sensor panel for detecting touches.” *Id.*, [0021]; *see also id.*, [0024] (describing an embodiment wherein the drive and sense lines are formed on two sides of the touch substrate).



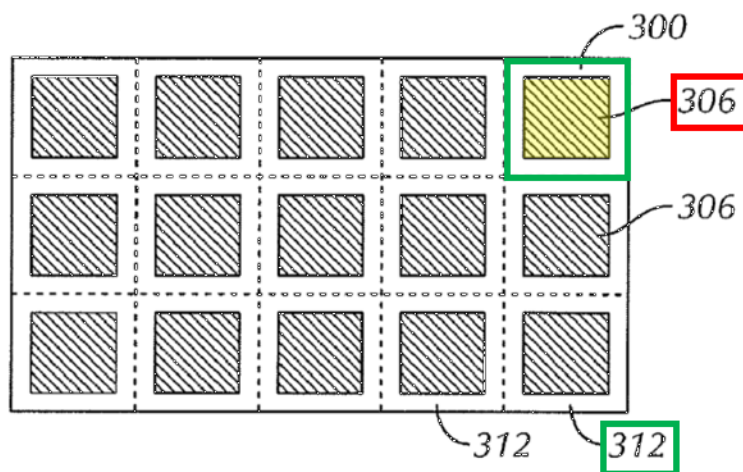
Id., Fig. 4.

206. Drive lines and sense lines that provide the touch-sensing functionality may be formed in these thin-film layers. *Id.*, [0040]. In the embodiment illustrated in Figure 4, the touch substrate and a liquid adhesive layer 406 separate these lines. *Id.*, [0024], [0040]. In a plan view, these lines form a grid pattern. *Id.*, [0008], [0021]. As shown below in Figure 6, their intersections function as a matrix of capacitive sensing nodes or pixels 626. *Id.*, [0026], [0051].



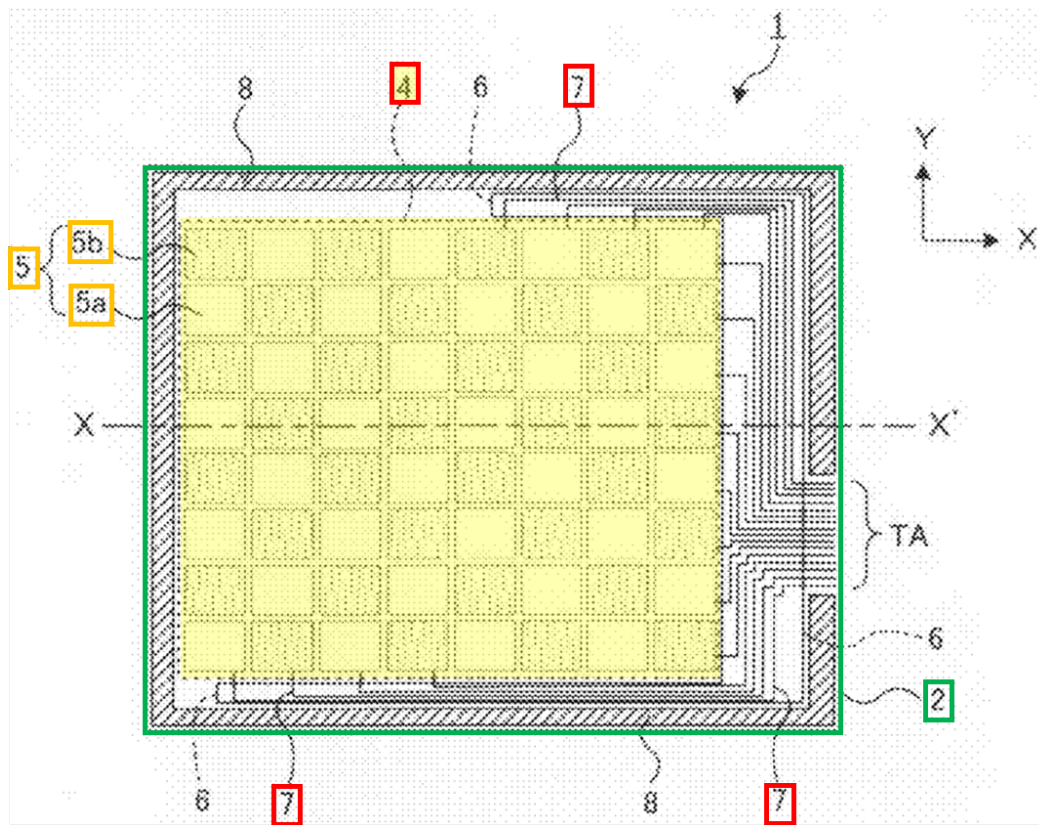
Id., Fig. 6 (partial).

207. The structure and extent of the detection region in a capacitive touch panel are defined by the matrix of intersecting drive and sense lines, with each intersection forming an individual touch-sensing node. Because touch-sensing nodes correspond to the intersections of drive and sense lines, a detection region is coextensive with the matrix formed where these lines intersect, as Sung explains by stating that “[e]ach intersection of drive and sense lines can represent a capacitive sensing node....” Sung, [0051] (emphasis added). As shown in Figure 3B, Sung’s display device comprises an ITO layer 306 that is “patterned to create capacitive touch sensor pixels on the individual touch substrate units [312].” *Id.*, [0026].



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

208. Sung's detection region, highlighted in yellow in Figure 3B above, is analogous to Nishihara's detection region 4, which is also highlighted in yellow below, as both detect touch at the intersections of lines or electrodes. In Sung, the detection region is defined by a matrix of intersecting electrodes or lines arranged on a substrate to create touch-sensing nodes. Sung, [0026]. Likewise, in Nishihara, detection electrodes 5a–5b are formed in the X and Y directions on substrate 2, and the detection electrodes' arrangement enables position detection at the intersections of these electrodes:

Nishihara, Fig. 1A; [0045].⁴

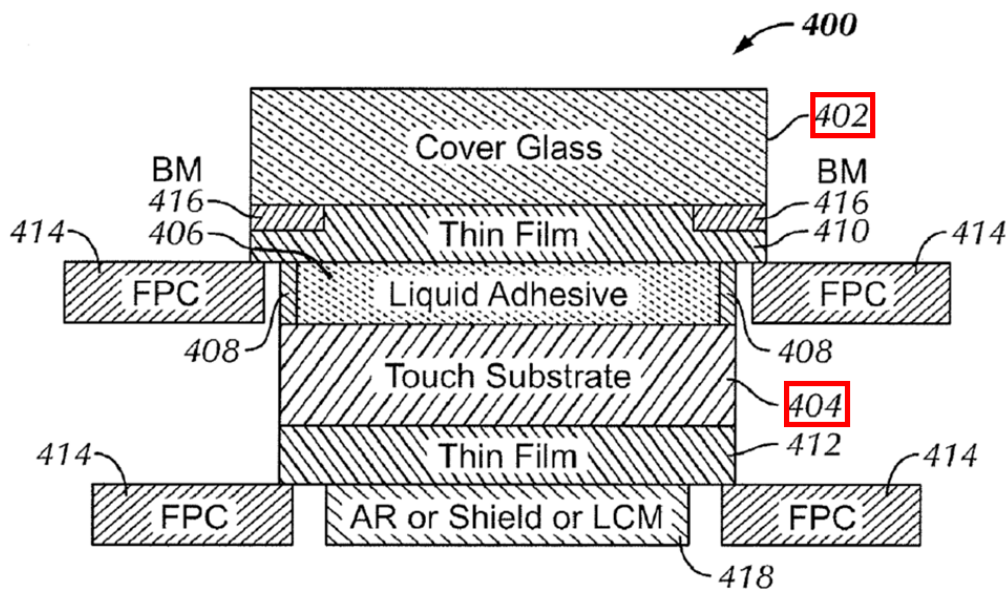
⁴“Sung’s touch substrate 404 and Nishihara’s substrate 2, which I will refer to as “base substrate,” are analogous. This is because both Sung’s touch substrate 404 and Nishihara’s substrate 2 serve as the foundational layer on which the detection electrodes and associated wiring are formed, enabling touch sensing functionality in their respective panels. In both references, the substrate provides structural

209. In Nishihara and Sung, detection electrodes are connected through wires on the touch substrate and on a flexible substrate to touch-control functions. See Nishihara, Fig. 2A; Sung, [0041]. Sung's panel subsystem applies signals to the drive lines and reads signals from the sense lines. Sung, [0050]–[0051], Fig. 6. Sung's drive and sense lines were connected to the panel subsystem through a set of wires. Sung's setup is analogous to Nishihara's arrangement, where wiring electrodes 7 on the touch substrate connect the detection electrodes to the external circuitry for touch control. See Nishihara, Fig. 2A, [0043]. From Nishihara's and Sung's disclosures, a POSITA would have understood that Sung's detection electrodes are connected to its panel subsystem through wires or interconnects analogous to Nishihara's wiring electrode 7.

c) 1[b]

210. As shown in Figure 4 of Sung below, Sung discloses *a protective plate* (cover glass 402) *on the coordinate input substrate* (touch substrate 404).

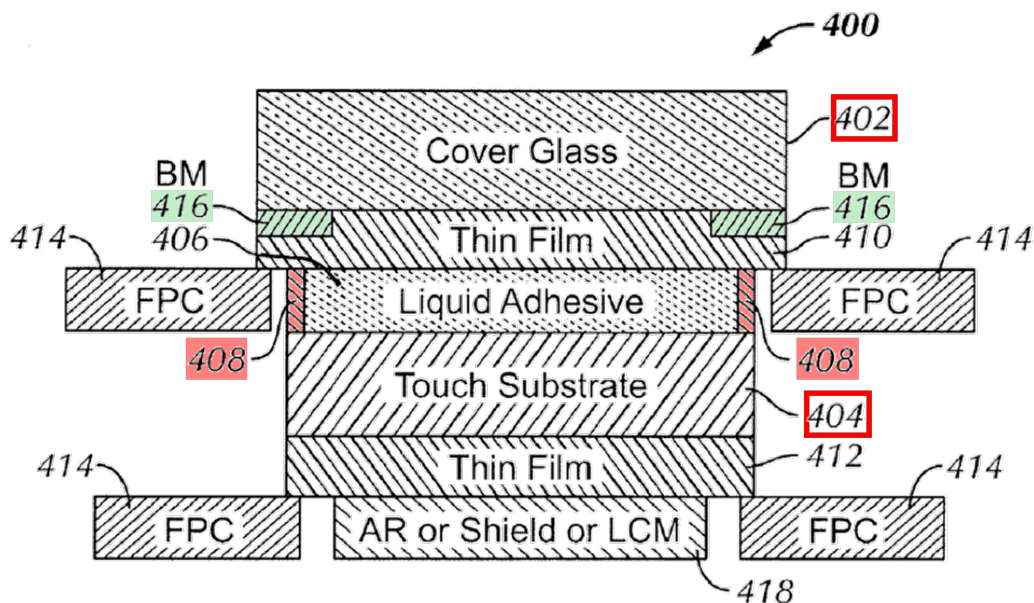
support and acts as the platform for the key electrical components involved in touch detection and control.



Sung, Fig. 4, [0039]. The cover glass may be coated with a protective, anti-scratch layer to prevent damage to the surface. *Id.*, [0033], [0003]. More specifically, the cover glass 402 is cut from a cover glass mother sheet, which “may be coated with a protective mask” such as “an anti-scratching layer ... to prevent damage to the surface.” *Id.*, [0033]. The cover glass “can protect the underlying touch substrate from being damaged by external forces.” *Id.*, [0003].

d) 1[c]

211. Sung discloses *a light shielding material* (black mask 416 or edge seals 408) *which has an opening and is disposed between the coordinate input substrate* (touch substrate 404) *and the protective plate* (cover glass 402).



Sung, Fig. 4.

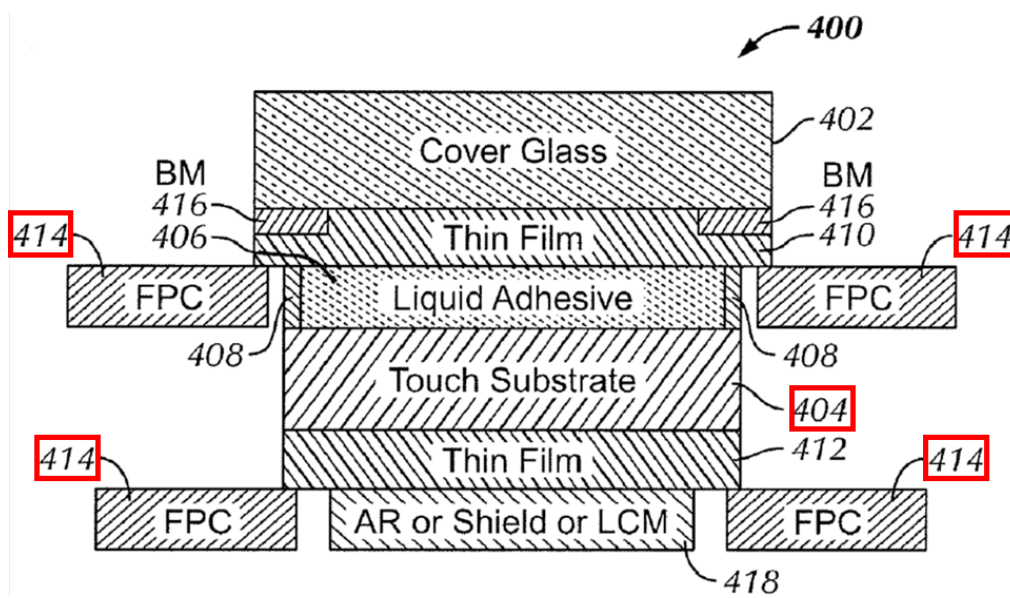
212. Sung discloses two light shielding materials: black mask 416 and edge seals 408. The black mask is an opaque cosmetic plate “formed on the bottom surface of the cover glass 402 and around the outer edge of the thin film layer 410.” *Id.*, [0041]. The edge seals are adhesive borders. *Id.*, [0039]. They may have an opacity up to 100%. *Id.*, [0028]. The black mask hides the edge seals from a user’s view. *Id.*, [0041]. As shown above, both materials are formed between the touch substrate and the cover glass. The horizontal gap between the respective “pairs” of these materials in the cross-sectional view above corresponds to an opening in a plan view to allow liquid crystal monitor (“LCM”) display 418 to be visible from above the cover glass. *Id.*, [0041]–[0042]. As further shown in Figure 2C and described

in [0027], adhesive borders 204—or, equivalently, edge seals 408—are arranged to conform to the outline of the individual touch substrate units on the mother sheet 200. This arrangement ensures that the adhesive or sealant forms a perimeter around each unit, leaving a central opening through which the display can be viewed..

e) 1[d]

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

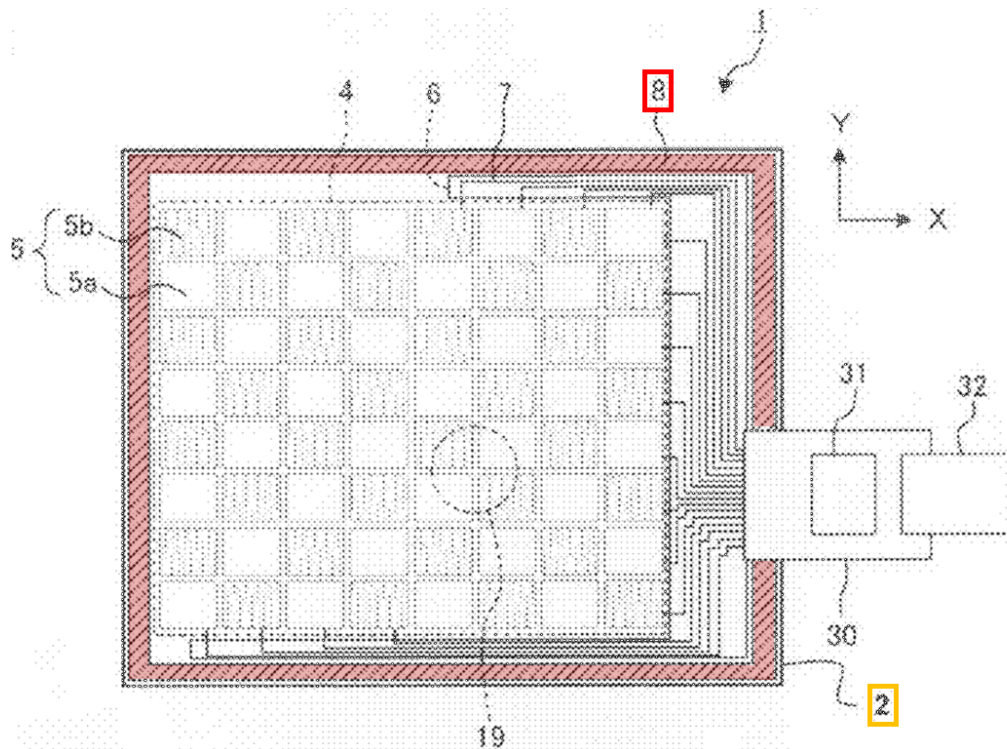
214. Sung discloses a flexible printed circuits (“FPC”) 414 that is electrically connected to the touch substrate’s conductors, *e.g.*, drive and sense lines, which are conductors on the substrate’s thin-film layers. *Id.*, [0041]. In the configuration of Figure 4, FPCs are connected to both top and bottom thin-film layers:



Sung, Fig. 4. The FPCs 414 are “bonded to the edge of ... both of the [substrate’s] thin film layers 410, 412” and are “electrically connected to the drive and sense lines of the thin film layers.” *Id.*, [0041]. This electrical connection allows drive and sense signals to travel between the drive and sense lines and the detection processing circuit in the panel subsystem. *Id.*, [0051].

f) 1[e]

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



Nishihara, Fig. 2A. The shield electrode 8, shaded in red in Figure 2A above, “shield[s] against noise from outside.” *Id.*, [0043]. It is formed “on an outer periphery of the substrate 2,” surrounding the sensitive regions of the touch panel to block external electromagnetic interference. *Id.* For the shield electrode to perform its shielding function, it must be electrically connected to ground, maintaining a ground potential throughout its entire length. This is accomplished by connecting the shield electrode to ground terminals of the flexible electrode 30, which are themselves connected to an electrical ground via the flexible substrate. *Id.*, [0049], [0044]. Specifically, a first and a second electrode are provided at the two ends of

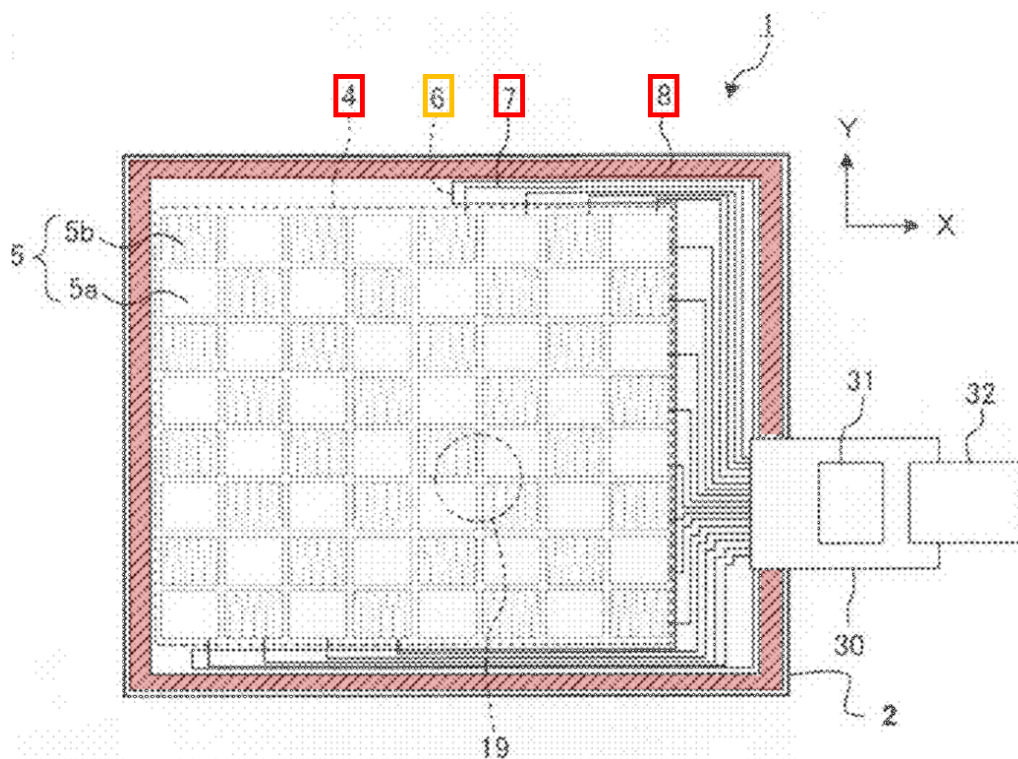
the shield electrode, and these electrodes couple the shield electrode to the electrical ground through coupled electrodes on the flexible substrate. Thus, the shield electrode is part of a closed ground loop, enabling it to effectively shield the touch panel from external noise.

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

217. Nishihara's shield electrode satisfies the second-interconnect limitation because the claim does not require the interconnect to be used for crack inspection. Even if somehow the claims were interpreted to require the second interconnect to support crack inspection (a reading with which I disagree), a POSITA would have understood that a wiring interconnect for crack inspection structurally "may be formed using a conventional shield line." Ex. 1011, [0041]. This is because the shield electrode in Nishihara is simply a conductive wire formed around the periphery of the substrate, which matches the structural characteristics of a crack detection interconnect. Therefore, even though Nishihara's shield electrode is primarily intended for shielding against noise, its configuration as a conventional shield line fulfills the second-interconnect limitation even if an inspection function were required.

g) 1[f]

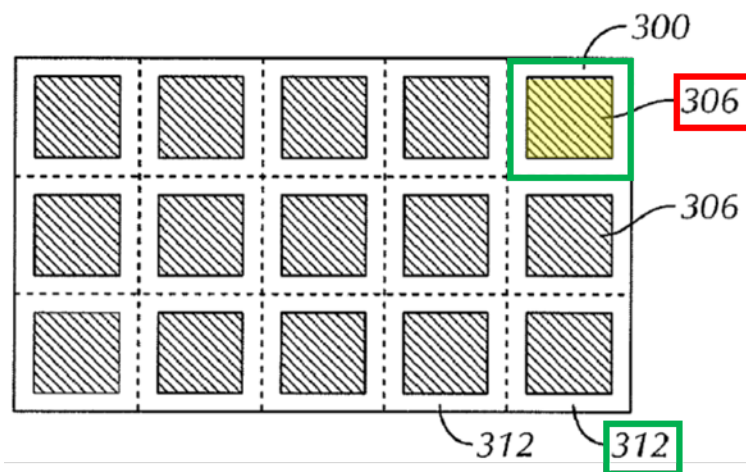
218. Sung in view of Nishihara renders obvious *wherein the second interconnect* (Nishihara: first shield electrode 8) *surrounds the detection region* (Sung: area of ITO layer 306; Nishihara: detection region 4) *and is formed outside the first interconnects* (Nishihara: wiring electrodes 7).



Nishihara, Fig. 2A. The first shield electrode 8, shaded in red in Figure 2A above, “is formed outside a region including the detection region 4 and the wiring region 6 so as to surround the detection region 4 and the wiring region 6.” *Id.*, [0043]. The wiring electrodes 7 are formed in the wiring region 6. *Id.* This configuration allows

the shield electrode to protect both the components in the detection region and the wiring electrodes from electromagnetic noise. *Id.*, [0052].

219. As I explain above, it was routine to form wires on the peripheral of touch substrates to connect sense and drive lines with touch controllers. *Supra* § X.D.1.b. Placing Nishihara's first shield electrode on Sung's touch panel merely involves forming an additional wire next to and surrounding the touch-signal wires. Nishihara, [0049]. As shown in Nishihara, the shield electrode is a wire isolated from other wires and circuits on the touch substrate. *Id.*, Fig. 2A. Such a placement is compatible with Sung's touch substrate units 312, each of which has a detection region, area of ITO layer 306, surrounded on all four sides by wiring regions, as shown in Figure 3B of Sung below:



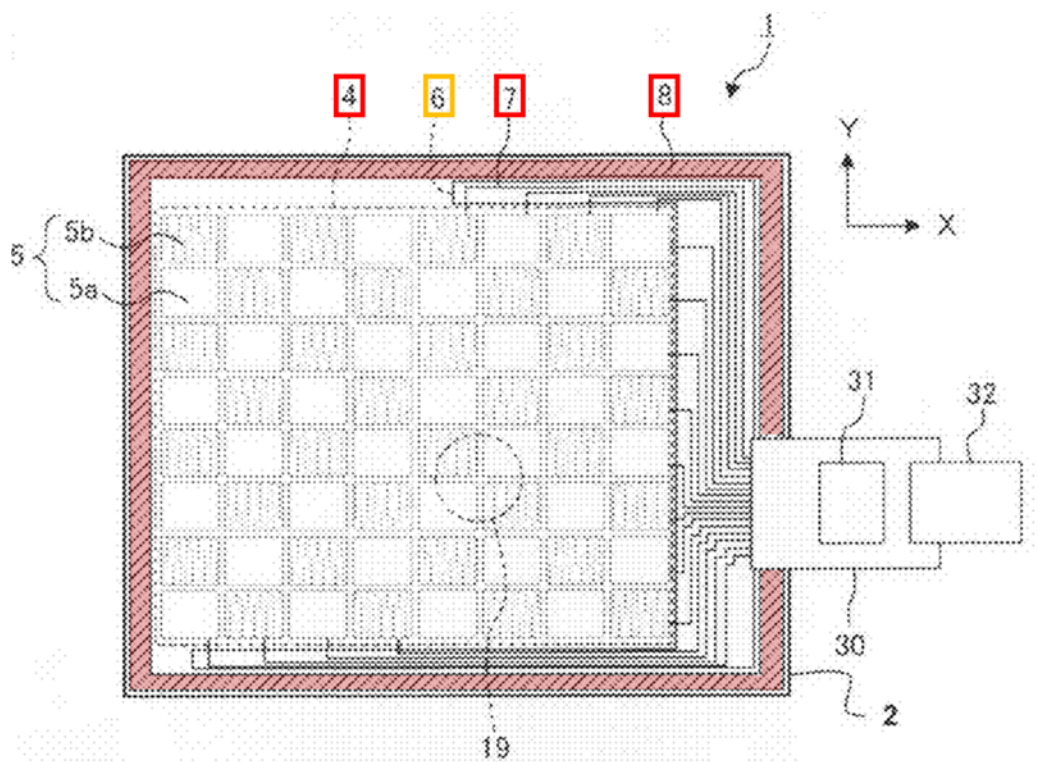
Sung, Fig. 3B.

h) 1[g]–1[h]

220. Nishihara discloses or renders obvious *wherein the first electrode is formed at one end of the second interconnect* (first shield electrode 8). As explained above, Nishihara further discloses or renders obvious *wherein the second electrode is formed at the other end of the second interconnect* (first shield electrode 8). *Supra* § X.D.1.f.

i) 1[i]

221. Sung in view of Nishihara renders obvious *wherein the second interconnect* (Nishihara: first shield electrode 8) *is disposed along a peripheral edge of at least three sides of the coordinate input substrate* (Sung: touch substrate 404, Nishihara: substrate 2).



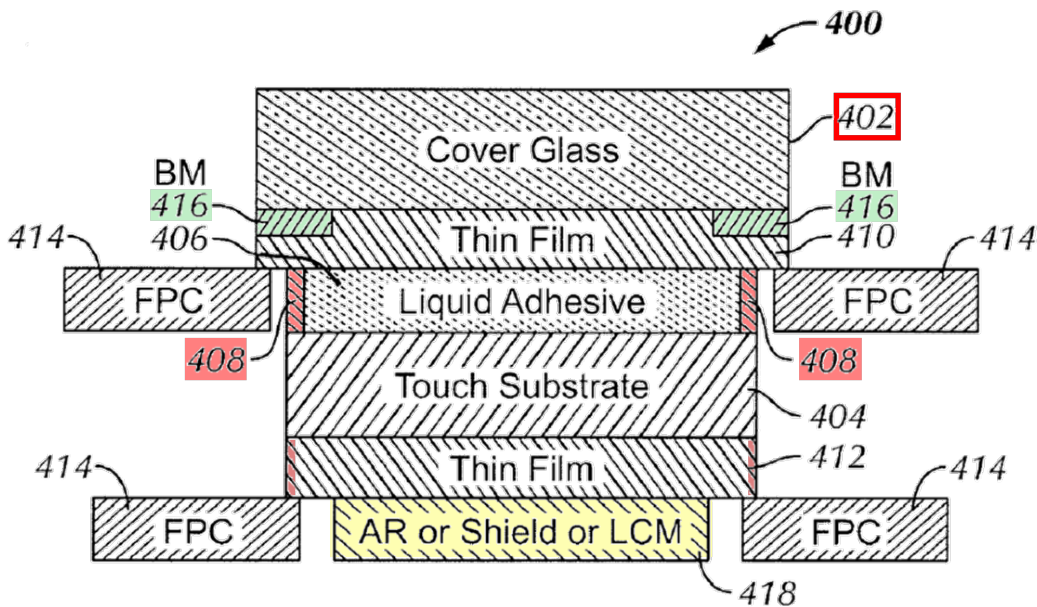
Nishihara, Fig. 2A.

222. The first shield electrode is formed “on an outer periphery of the [base] substrate....” *Id.*, [0043]. It surrounds the detection region and the wiring region, except where the base substrate connects to the flexible substrate to connect the shield electrode to a ground terminal. *Id.*, [0049], Fig. 2A. As explained above, the first shield electrode is similarly configured on Sung’s touch substrate in the combination to perform the same function (and, if needed, to double as a crack detection wire). *Supra* § X.D.1.f–g.

j) 1[j]

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

224. Sung's LCM 418 is a display viewable from above the cover glass 402. Sung, [0038], [0042]. It was routine to place a display panel beneath a touch panel. *Supra* § VII. And to have the display viewable from above was the expected way to allow the display panel to function as a display. The area of the LCM in a plan view is a display region (yellow in the cross-sectional view of Figure 4 below).



Id., Fig. 4.

225. The second interconnect, which is configured based on the configuration of Nishihara's first shield electrode, is formed on the outer periphery of the base substrate. *Supra* §§ X.D.1.f–g, i. In the cross-sectional view above, a pair of dark red rectangles in the thin-film layer 412 identifies the shield electrode on the outer periphery of the substrate. Sense lines are formed in the thin-film layer 412. Sung, [0040]. The shield line mitigates noise by preventing interference from reaching the sense lines or reducing the amplitude of any noise that does reach the sense lines. *See* Nishihara, [0043].

226. It would have been obvious to arrange the shield electrode outside the sense lines in an area surrounding of the display area, a non-active region outside the active (display) area, so as not to block light from the LCM. Sung explains that the middle part of the touch sensor panel 400, where the black mask 416 does not reach, may be substantially see-through. Sung, [0042]. Sung thus demonstrates that it was conventional (and indeed expected) to leave the viewable area clear. Consistent with this design principle, Nishihara further teaches that the shield wiring 8 and the wiring electrode 7 may be formed of a metal film, and specifically, that the first shield electrode 8 may be formed by depositing a metal film on the front surface of the substrate by sputtering or vapor deposition and then carrying out patterning.

Nishihara, [0045]. Since a metal film would block light, it is obvious that the shield wiring and wiring electrode are located outside the display region, in the non-active region, to avoid obstructing the display.

k) 1[k]

227. Sung in view of Nishihara renders obvious *wherein the first electrode is electrically connected with a third electrode on the first flexible substrate* (Sung: FPC 414), *or the second electrode is electrically connected with a fourth electrode on the first flexible substrate*. See Nishihara, [0049], [0044]; *supra* § X.D.1.f. These electrical connections establish a ground loop from an external ground through the first shield electrode. This ground loop maintains a ground potential through the shield electrode, enabling it to provide protection against electromagnetic noise for the circuits it surrounds.

l) 1[l]

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

229. The display region is the area of the LCM in a plan view. *Supra* § X.D.1.j. Sung teaches that the entire LCM display 418 underneath the touch sensor panel 400 is visible from above the top cover 402, meaning that not just a portion,

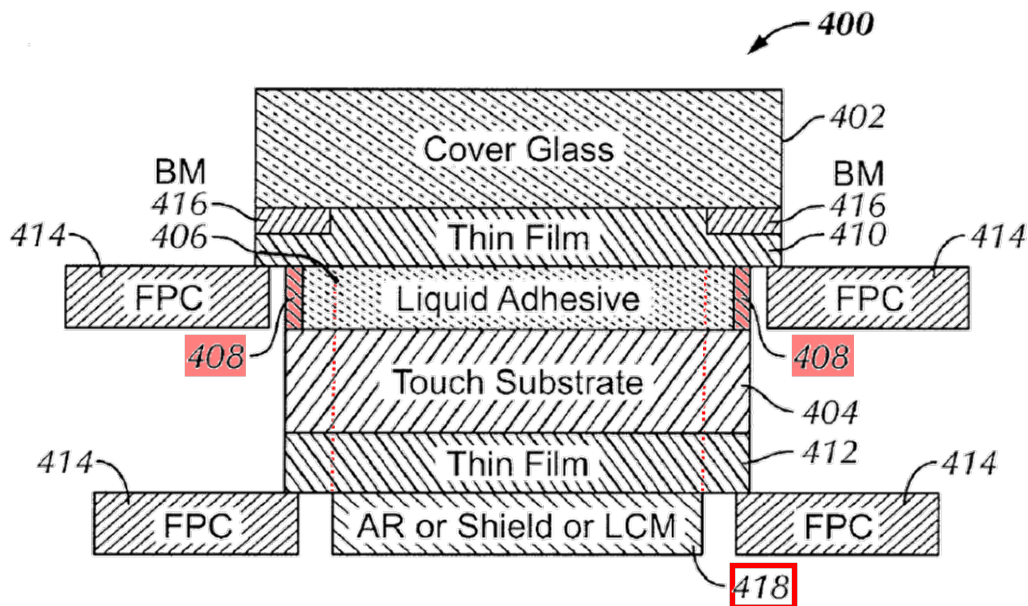
but the full area of the LCM is viewable through the cover glass. Sung, [0042]. This configuration is desirable because it does not visually obstruct the edges of displayed images. Otherwise, the viewing experience would be degraded by the visual obstruction. From a different perspective, it makes no sense for a manufacturer to build a bigger (and more costly) display panel only to obscure its edges, effectively reducing its viewable size.

230. Sung further discloses that allowing the entire LCM display to be viewable is achieved by limiting the extent of the black mask to the periphery of the panel, so that it does not overlap the display region. Sung makes this clear by explaining that “the middle part of the touch sensor panel 400 where the black mask 416 does not reach may be substantially see-through. This can allow the LCM display 418 underneath the touch sensor panel 400 to be visible from above the top cover 402.” *Id.* Thus, the opening of the black mask is obviously sized so that it surrounds, but does not cover, the LCM display region, ensuring the display remains fully visible.

231. Alternatively, in the read that maps the claimed light shielding material on Sung’s edge seals, Figure 4 illustrates that the edge seals 408 are positioned outside the area of the LCM display 418, indicating that the opening defined by the

edge seals is larger than the display region, the area of the LCM 418, in a plan view.

The red vertical dotted lines in the annotated figure below highlight this relationship:



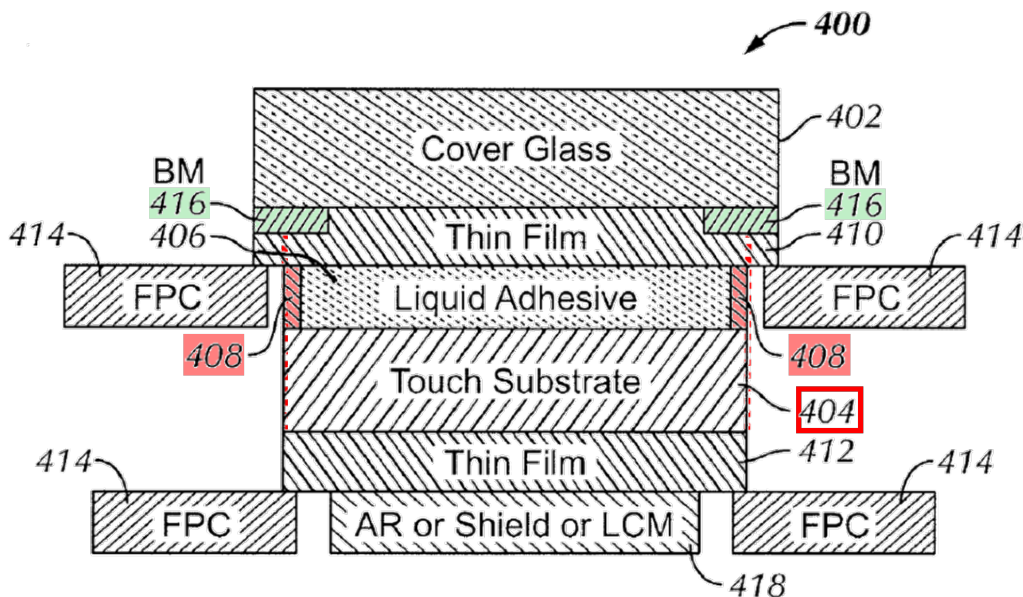
Id., Fig. 4.

232. Both the edge seals and the black mask surround the display region in a plan view. The edge seals, which are solid and correspond to adhesive borders 204, enclose the liquid adhesive on all sides to ensure a complete seal. Sung, [0039], [0027], Fig. 2C. The black mask is formed “around the outer edge of the thin film layer 410.” *Id.*, [0041]. The middle part of the touch sensor panel 400 is see-through. *Id.*, [0042]. Further, to hide the edge seals “from a user’s view,” the black mask must completely cover the edge seals. Because the edge seals surround the display region, the black mask must also surround the display region. *Id.*, [0041].

m) 1[m]

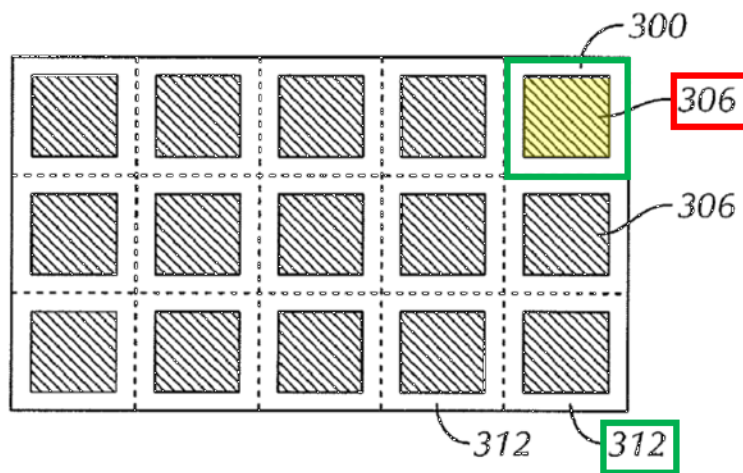
233. Sung in view of Nishihara renders obvious *wherein the light shielding material* (Sung: black mask 416 or edge seals 408) *overlaps the second interconnect* (Nishihara: first shield electrode 8) *along the peripheral edge of at least the three sides of the coordinate input substrate* (Sung: touch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

234. As I explain above, the black mask and the edge seals surround the display region on all four sides of the display. *Supra* § X.D.1.i. As shown in Figure 4 below, they are formed above the peripheral edges of the touch substrate:



Sung, Fig. 4. The first shield electrode is formed along the peripheral edges of the touch substrate. *Supra* § X.D.1.i. And since the first shield electrode may be formed of a nontransparent metal film, it would have been desirable to hide it from view

235. Figure 3B of Sung confirms that overlapping the light shielding material and the shield electrode along the periphery of the base substrate would have been obvious to a POSITA. In a plan view, both the light shielding material (black mask or edge seals) and the second interconnect (shield electrode) are placed outside the detection region (shaded yellow) and on the base substrate (within the borders in green):

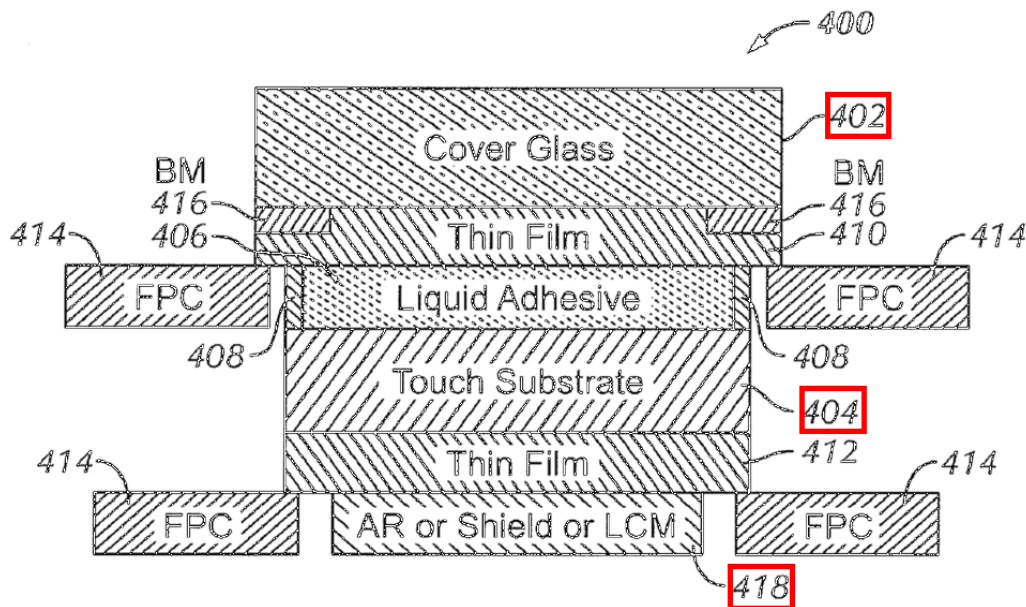


159

2. Claim 2

236. Sung in view of Nishihara renders obvious *the display device according to claim 1*. *Supra* § X.D.1. Sung discloses a display device *further comprising a display panel* (LCM 418) *having the display region* (top surface area of LCM 418), *wherein the coordinate input substrate* (touch substrate 404) *is disposed between the display panel and the protective plate* (cover glass 402).

237. I explain above that the display region is the area of the LCM in a plan view. *Supra* § X.D.1.j. Figure 4 of Sung plainly shows that the touch substrate 404 is formed between the LCM 418 and the cover glass 402:



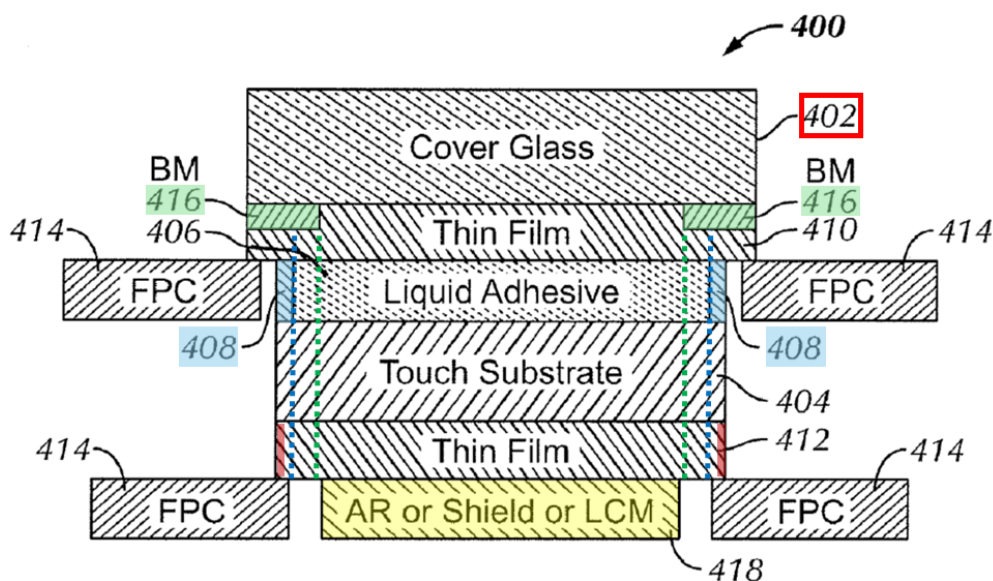
Sung, Fig. 4.

3. Claim 10

238. Sung in view of Nishihara renders obvious *the display device according to claim 1*. *Supra* § X.D.1. Sung further renders obvious *wherein the opening of the light shielding material* (black mask 416 or edge seals 408) *is smaller than the detection region* (area of ITO layer 306) *of the coordinate input substrate* (touch substrate 404).

239. The detection region is coextensive with the matrix formed where the drive and sense lines intersect. *Supra* § X.D.1.b. As explained above, Sung's detection region, the area of its ITO layer, is analogous to Nishihara's detection region 4. *Supra* § X.D.1.b. Thus, in the combination, Sung's detection region extends outward toward the peripheries of the touch substrate but within the surrounding regions occupied by the first and second interconnects. A POSITA would have known that it was generally desirable to maximize the area of the detection region. This is because maximizing the detection region allows for greater interactive display area and provides margin for users' touch that may be off target toward the outer edges, thus improving device usability. Therefore, it would have been obvious and desirable to design the touch panel such that the opening of the light shielding materials does not limit the size of the detection region. This principle is illustrated in Sung's Figure 4, which confirms both the obviousness and

desirability of such a design. The figure shows that the detection region, where the drive and sense lines intersect, is made larger than the opening of black mask 416 or edge seals 408 (respectively denoted by green and blue dotted lines):



Sung, Fig. 4. This is feasible since the two thin-film layers forming the sense and drive lines and the interconnects are larger than the openings of black mask and edge seals. This configuration involves forming the black mask, the edge seals, and the widths of the first and second interconnects with their respective suitable sizes. This was well within the knowledge and skill of a POSITA. The techniques for adjusting these peripheral features—such as patterning thin-film layers and configuring mask and seal dimensions—were well established and commonly used in the field. As shown in the references, applying these known techniques reliably resulted in the

predictable outcome of a larger, unobstructed detection region, thereby improving the visibility and functionality of the touch panel.

4. Claim 12

a) 12[pre]

240. Sung discloses *a coordinate input device*. *Supra* § X.D.1.a.

b) 12[a]–[h]

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

5. Claim 17

242. Sung in view of Nishihara renders obvious *the coordinate input device according to claim 12*. *Supra* § X.D.4. The remainder of claim 17 is identical to claim 10. Sung renders it obvious. *Supra* § X.D.3.

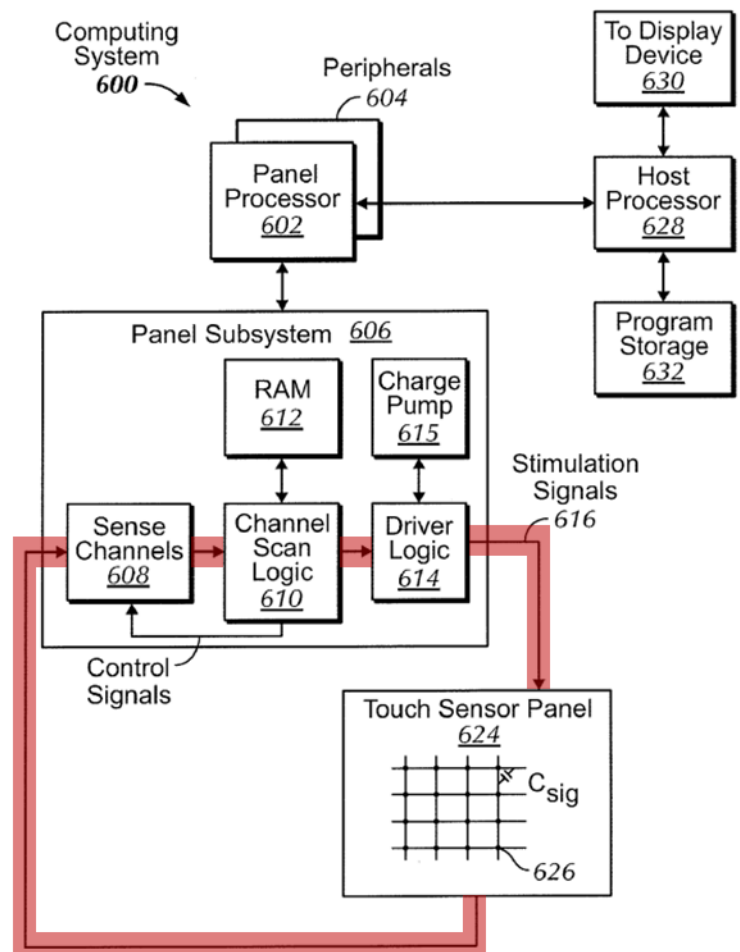
6. Claim 18

243. Sung in view of Nishihara renders obvious *the coordinate input device according to claim 17*. *Supra* § X.D.5. Sung in view of Nishihara further renders obvious *wherein the first flexile [sic] substrate* (Sung: FPC 414) *supplies driving signals to the detection electrodes* (Sung: drive and sense lines) *via the first*

interconnects (Nishihara: wiring electrodes 7) *and receives detection signals corresponding to a contact position from the detection electrodes.*

244. Sung's drive and sense lines are connected to signal wires, just as Nishihara's wiring electrodes connect the detection region to external circuitry, in order to transmit signals between the sensing matrix and external circuits. The signal wires or wiring electrodes are in turn connected to the FPC to convey the signals. *Supra* § X.D.1.b.

245. Sung discloses that a panel subsystem uses driver logic capable of generating stimulation signals, *i.e.*, driving signals, "at various frequencies and phases that can be selectively applied to drive lines...." Sung, [0050]. Touch events and positions can be detected at the intersections of the drive and sense lines. *See id.*, [0002] ("Touch screens can recognize a touch event and the position of the touch event on the touch sensor panel...."). The resulting detection signals are transmitted to a sense channel. *Id.*, [0050]. Detection data is then read by the channel scan logic for further processing. *Id.*, [0051]. The following block diagram highlights this signal loop:



Id., Fig. 6. Sung confirms that it was known in the art to determine the contact position of a touch event through sense signals derived from the change in capacitive coupling between the drive and sense lines, with selective frequency and phase applied to each drive line.

246. Sung explains that the FPC is used to “measure the changes in capacitance” resulting from contacts on the touch panel. Sung, [0041]. This

measurement process is a part of the sense function provided by the panel subsystem. *See id.*, [0050]. A POSITA would have recognized that, for the panel subsystem to provide the sense function (capacitance measurement), it may be integrated with the FPC, since that is where the measurement occurs. *Id.*, [0041]. Thus, a POSITA would have understood, or at least found it obvious, that Sung's panel subsystem is implemented on the FPC to perform this measurement.

7. Claim 20

247. Sung in view of Nishihara renders obvious *display device according to claim 1*. *Supra* § X.D.1. Sung in view of Nishihara further renders obvious *wherein a detection signal is supplied to the first flexible substrate* (Sung: FPC 414) *via one of the first interconnect* (Nishihara: wiring electrodes 7).

248. The additional limitation of claim 20 is a subset of claim 18, except that claim 20 additionally recites that the detection signal is supplied via one of the first interconnect. Sung in view of Nishihara renders it obvious for the same reasons. *Supra* § X.D.6.

8. Claim 21

249. Sung in view of Nishihara renders obvious *the coordinate input device according to claim 12*. *Supra* § X.D.4. The remainder of claim 21 is identical to claim 20. Sung in view of Nishihara renders it obvious. *Supra* § X.D.7.

9. Motivation to Combine

250. It is my opinion that a POSITA would have been motivated to add a shield electrode as Nishihara teaches to Sung's device and would have had a reasonable expectation of success to do so.⁵

251. Sung's display device uses a capacitive touch panel. Sung, [0008]. Nishihara teaches that capacitive touch panels are susceptible to "electromagnetic noise and static electricity...." Nishihara, [0008]. Such external noise can enter from various gaps in the device. *Id.* Such noise generates "erroneous determination[s]" of touch detection because capacitive touch panels operate by "detecting weak current caused by the changed capacitance." *Id.* Nishihara's shield electrode reduces errors by shielding the panel from the effect of noise entering through a surface of the touch substrate. *Id.*, [0008]–[0009], [0019]. More specifically, the shield electrode, as configured based on Nishihara's teaching,

⁵Nishihara also explains the wiring connecting the drive and sense lines to the flexible printed circuit, a detail that Sung does not discuss. Nishihara, [0048]–[0049]. However, a POSITA would have understood Sung's device to comprise such wiring because it was routine in the art to connect drive and sense lines to control circuitry using wiring and flexible printed circuits. *Supra* § VII.

“shields against noise entering from an edge portion of the substrate 2 before the noise reaches the wiring electrodes 7 or the detection electrodes 5.” *Id.*, [0043]. Given the challenges posed by electromagnetic noise and static electricity in capacitive touch panels, a POSITA would have been motivated to apply Nishihara’s teaching to enhance the performance of Sung’s touch panel.

252. A POSITA would have had a reasonable expectation of success in adding a shield electrode, as Nishihara teaches, to Sung’s touch substrate. Important to the expectation of success, the shield electrode is isolated from other wiring and components on the substrate. *Id.*, Fig. 1A, [0043]. Forming this electrode does not affect other circuits. Thus, adding Nishihara’s shield electrode to surround the base substrate involves a simple design and need not affect the design of the panel or its components. To the extent that the sizes or placements of certain components, such as the wiring connecting the drive and sense lines, may need adjustment, such minor tweaks would have been well within a POSITA’s knowledge and skill. For example, the shield electrode may be formed using a thin-film deposition technique. *Id.*, [0045]. Sung also uses thin-film deposition to form its device. Sung, [0024]–[0025]. Further, the parameters of sputtering or vapor deposition to form thin films may be adjusted to effectuate such tweaks. *See* Nishihara, [0045], [0050] (disclosing the use

of such conventional techniques to form the interconnects and detection electrodes). Thus, the addition employs a known technique for wire formation to achieve a predictable result.

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

1. Claim 3

a) 3[pre]

253. Sung in view of Nishihara renders obvious *the display device according to claim 1*. *Supra* § X.D.1. Sung in view of Nishihara and Lee further renders obvious a display device *further comprising a first semiconductor chip* (Sung: ASIC; Lee: chip 224).

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

255. Lee discloses a chip such as a drive IC disposed on a flexible carrier. Lee, [0025]. IC or integrated circuit was routinely fabricated in semiconductor materials. *Supra* § X.B.1.a.

b) 3[a]

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

257. Sung discloses a panel subsystem embodied in an ASIC. Sung, [0050]. As explain above, the panel-subsystem ASIC is disposed on the FPC. *Supra* § X.D.6.

258. Lee discloses chips 224 and electrostatic discharge protective lines 228 disposed on a flexible carrier 222. *Supra* § X.B.1.b.

259. It was well known to connect both display panels and touch panels to external circuits through respective flexible carriers. *Supra* § VII. Such connections are needed to couple the panels to the components that facilitate panel functions, such as a source of image data for a display panel and a component generating drive signals and process sense signals for a touch panel. Both Sung's FPC and Lee's flexible carriers connect to signal lines on the substrate (Sung's touch substrate and Lee's LCD panel). Sung, [0041]; Lee, [0024]–[0025]. Both flexible substrates are coupled to an external system on the other end. Sung, Fig. 6; Lee, Fig. 2, [0024]. Based on these similarities, a POSITA would have found it obvious that Lee's

configuration of its flexible carrier and associated components is applicable to Sung's FPC. Specifically, it would have been obvious that Lee's disclosure about its electrostatic discharge protective lines and the placement of those lines and of the IC are applicable to Sung, especially in light of Nishihara's similar teaching. Lee's electrostatic discharge protective lines are routed to dummy pads and coupled to ground or source terminals, providing a discharge path for static electricity and protecting sensitive ICs from electrostatic discharge damage. Lee, [0029]. Applying Lee's teaching to Sung in view of Nishihara would have been no more than applying a known technique with predictable results. Implementing these features in Sung's FPC would require only layout adjustments well within a POSITA's skill and would enhance device reliability and electrostatic discharge protection.

c) 3[b]

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

d) 3[c]

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

e) 3[d]

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

2. Claim 4

263. Sung in view of Nishihara and Lee renders obvious *the display device according to claim 3*. *Supra* § X.E.1. Sung further discloses a display device *wherein the first semiconductor chip* (ASIC) *drives the coordinate input substrate* (touch substrate 404).

264. Sung's panel subsystem comprises "driver logic 614 to generate stimulation signals 616 at various frequencies and phases that can be selectively applied to drive lines of touch sensor panel 624." Sung, [0050]. The panel subsystem may be implemented in the ASIC. *Id.*

3. Claim 5

265. Sung in view of Nishihara and Lee renders obvious *the display device according to claim 3*. *Supra* § X.E.1. Lee further renders obvious *wherein the third interconnect* (right electrostatic discharge protective line 228) *extends from the third electrode* (coupled to dummy pad 214) *to the fifth terminal* (dummy pads 234) *along an edge of the first flexible substrate* (flexible carrier 222) *and is disposed between the first semiconductor chip* (chip 224) *and the edge of the first flexible substrate*. *Supra* § X.B.3.

4. Claim 6

a) 6[pre]

266. Sung in view of Nishihara and Lee renders obvious *the display device according to claim 3*. *Supra* § X.E.1. Lee further discloses *wherein a fourth interconnect* (left electrostatic discharge protective line 228) *is disposed on the first flexible substrate* (flexible carrier 222). *Supra* § X.B.4.a.

b) 6[a]

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

c) 6[b]

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

d) 6[c]

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

e) 6[d]

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

5. Claim 7

271. Sung in view of Nishihara and Lee renders obvious *the display device according to claim 3*. *Supra* § X.E.1. The remainder of claim 7 is identical to claim 18. Sung in view of Nishihara renders it obvious. *Supra* § X.D.6.

6. Claim 13

a) 13[pre]

272. Sung in view of Nishihara renders obvious *the coordinate input device according to claim 12*. *Supra* § X.D.4. Sung in view of Nishihara and Lee further renders obvious a display device *further comprising a first semiconductor chip*. *Supra* § X.E.1.a.

b) 13[a]–[d]

273. Claim limitations 13[a]–[d] are respectively identical to claim limitations 3[a]–[d]. Sung in view of Nishihara and Lee renders them obvious. *Supra* §§ X.E.1.b–e.

7. Claim 14

274. Sung in view of Nishihara and Lee renders obvious *the coordinate input device according to claim 13*. *Supra* § X.E.6. The remainder of claim 14 is identical to claim 4. Sung in view of Nishihara and Lee renders it obvious. *Supra* § X.E.2.

8. Claim 15

275. Sung in view of Nishihara and Lee renders obvious *the coordinate input device according to claim 13*. *Supra* § X.E.6.

276. The remainder of claim 15 is virtually identical to claim 5, except that claim 5 recites “the fifth terminal” while claim 15 recites “the fifth electrode.” The

two terms refer to the same electrode/terminal. Sung in view of Nishihara and Lee renders claim 15 obvious. *Supra* § X.E.3.

9. Claim 16

277. Sung in view of Nishihara and Lee renders obvious *the coordinate input device according to claim 13*. *Supra* § X.E.6.

a) 16[a]–[d]

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

b) 16[e]

279. Claim limitation 16[e] is substantively identical to claim limitation 6[d], except that it recites “the sixth electrode” instead of “the sixth terminal.” The two terms refer to the same electrode/terminal. Sung in view of Nishihara and Lee renders claim limitation 16[e] obvious. *Supra* § X.E.4.e.

10. Motivation to Combine

280. It is my opinion that a POSITA would have been motivated to apply Lee’s teaching regarding its flexible carrier and associated components to Sung’s display device. Nishihara’s teaching would have further motivated this combination.

281. A POSITA would have understood, or at least found it obvious, that Sung's panel-subsystem ASIC is formed on the FPC because Sung's FPC "measure[s] the changes in capacitance" and the panel subsystem performs this measurement. *Supra* § X.D.6 (citing Sung, [0041], [0051]). Thus, Lee merely adds the electrostatic discharge protective lines, associated pads, and the placement of components on the flexible substrate.

282. Lee teaches that the electrostatic discharge protective lines provide a discharging path for static electricity. Lee, [0017]. By safely diverting static electricity away from sensitive components, these protective lines help prevent damage that can occur both during manufacturing and device operation. As a result, the risk of component failure is reduced, which in turn improves manufacturing yield and overall device performance. *Id.*, [0017], [0031]. Since Sung's panel subsystem is located in an ASIC on the FPC, analogous to Lee's chip, and since Sung's panel subsystem performs functions critical to the touch panel, Sung's ASIC would benefit from electrostatic protection. Given these benefits, a POSITA would have been motivated to provide electrostatic discharge protective lines on Sung's FPC.

283. Further, a POSITA would have recognized Lee's electrostatic discharge protective lines as an extension of Nishihara's shield electrode, as both

serve the function of providing a discharge path to ground for unwanted electrical interferences. Nishihara's shield electrode is connected to ground via the flexible substrate. Nishihara, [0049]. This forms a ground loop from the external ground through the flexible substrate and the shield electrode. Similarly, Lee's electrostatic discharge protective lines are routed to dummy pads and coupled to ground or source terminals, thereby forming part of a ground loop. Lee, [0014], [0017], [0026], [0031]. It would have been obvious to use Lee's electrostatic discharge protective lines to connect Nishihara's shield electrode to ground, as both references teach peripheral conductive paths for grounding and electrostatic discharge protection. Thus, in the combination, Nishihara provides additional motivation for a POSITA to apply Lee to configure Sung's FPC.

284. Moreover, a POSITA would have recognized that the end terminals at Nishihara's shield electrode, analogous to Lee's dummy pads 214, "increase[s] bonding strength" between the device substrate and the flexible substrate. *Id.*, [0024]. This would further improve the reliability of the device.

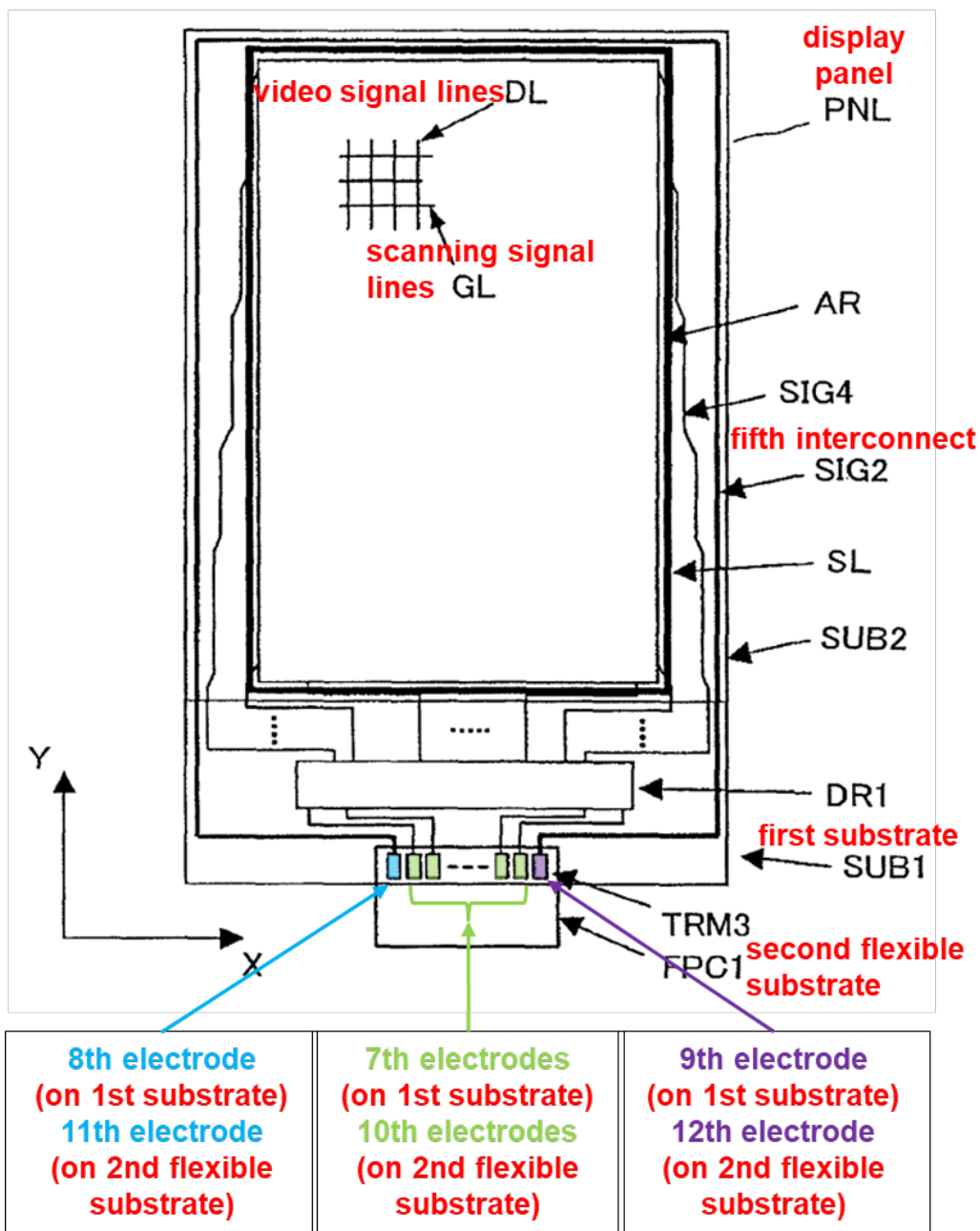
285. A POSITA would have had a reasonable expectation of success of implementing Lee's electrostatic discharge protective lines. Like Nishihara's shield electrode, Lee's electrostatic discharge protective lines are isolated from other

wiring and components on the substrate. Lee, Fig. 2. Forming these lines does not affect other circuits. Thus, adding Lee's protective lines on the sides of the FPC involves a simple design and need not affect the designs of the FPC, the base substrate, or their components. In fact, Lee expressly confirms that adding electrostatic discharge protective lines is a straightforward modification by stating that "the electrostatic protective effect can be attained without modifying the original circuit design of the printed circuit board or the LCD panel." *Id.*, [0027].

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

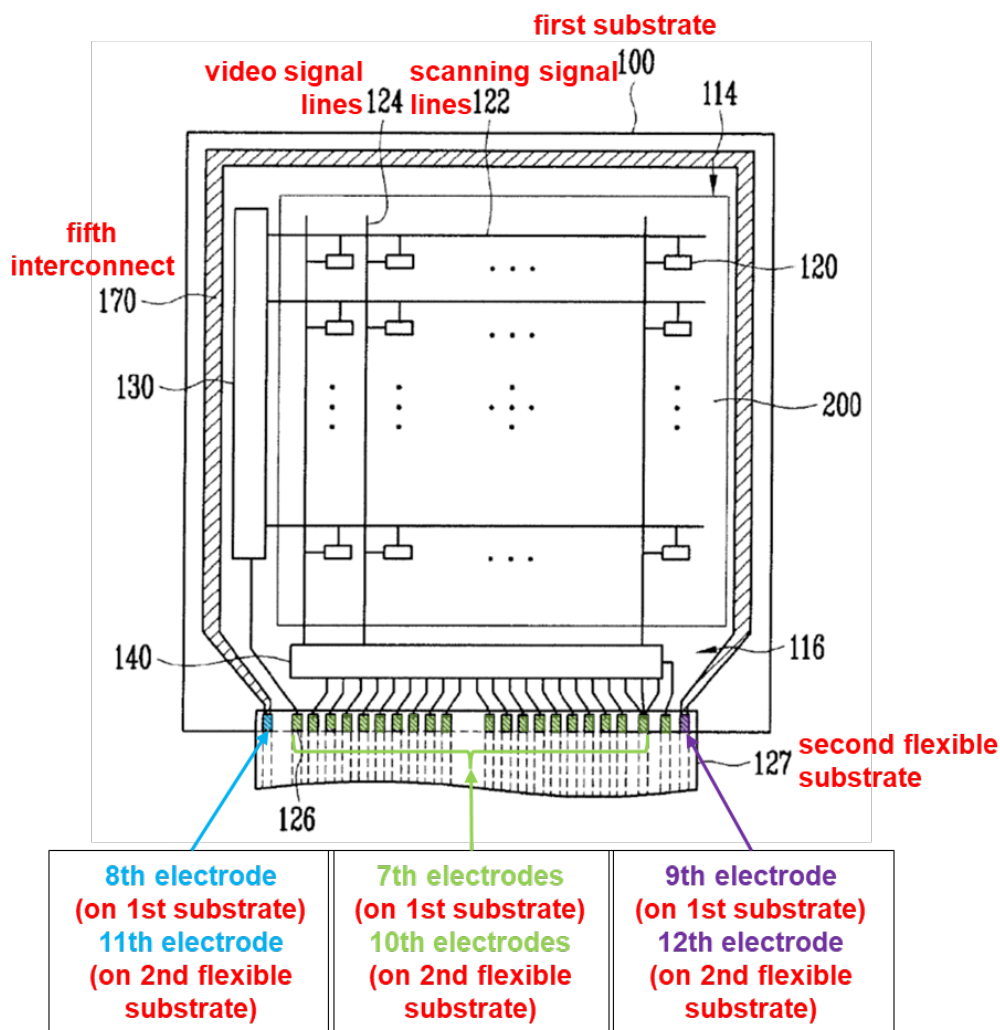
1. Claim 8

286. I find it is again helpful to graphically illustrate claim 8 using Figure 9 of the '477 patent:



Ex. 1001, Fig. 9.

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



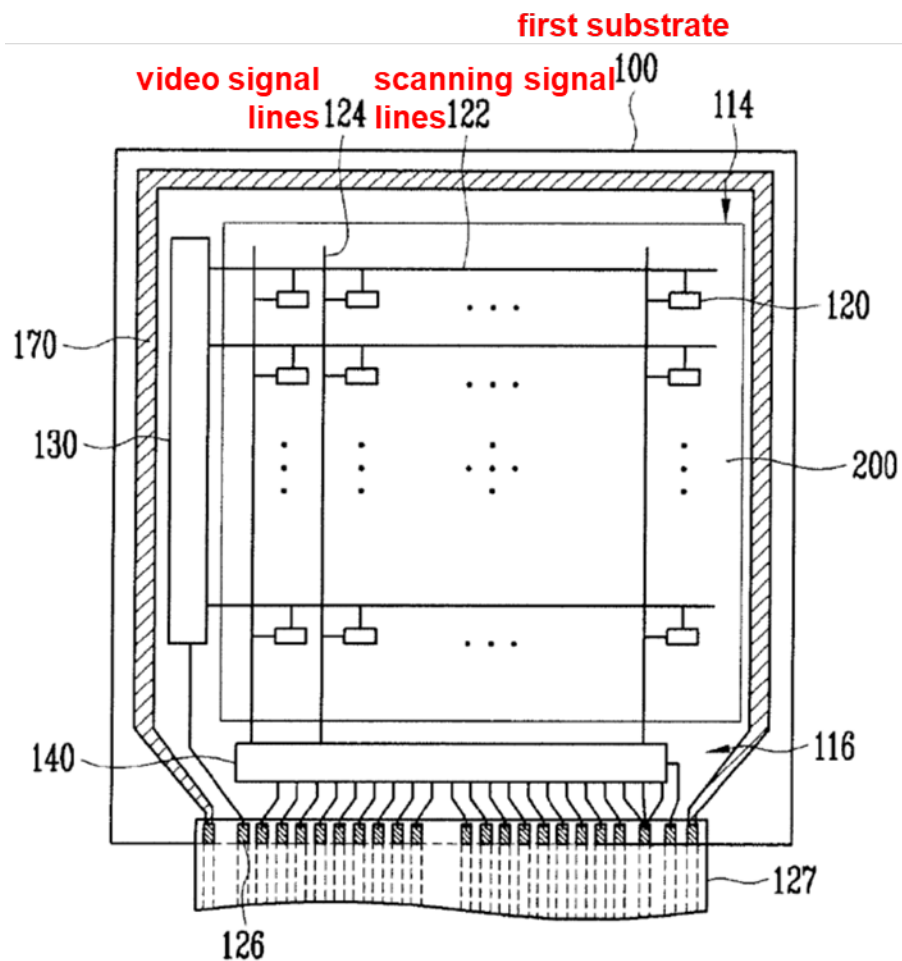
Kim, Fig. 4.

a) 8

288. As explained above, Sung in view of Nishihara renders obvious *the display device according to claim 2*. *Supra* § X.D.2. Kim discloses *wherein the display panel comprises* the limitations below.

b) 8[a]

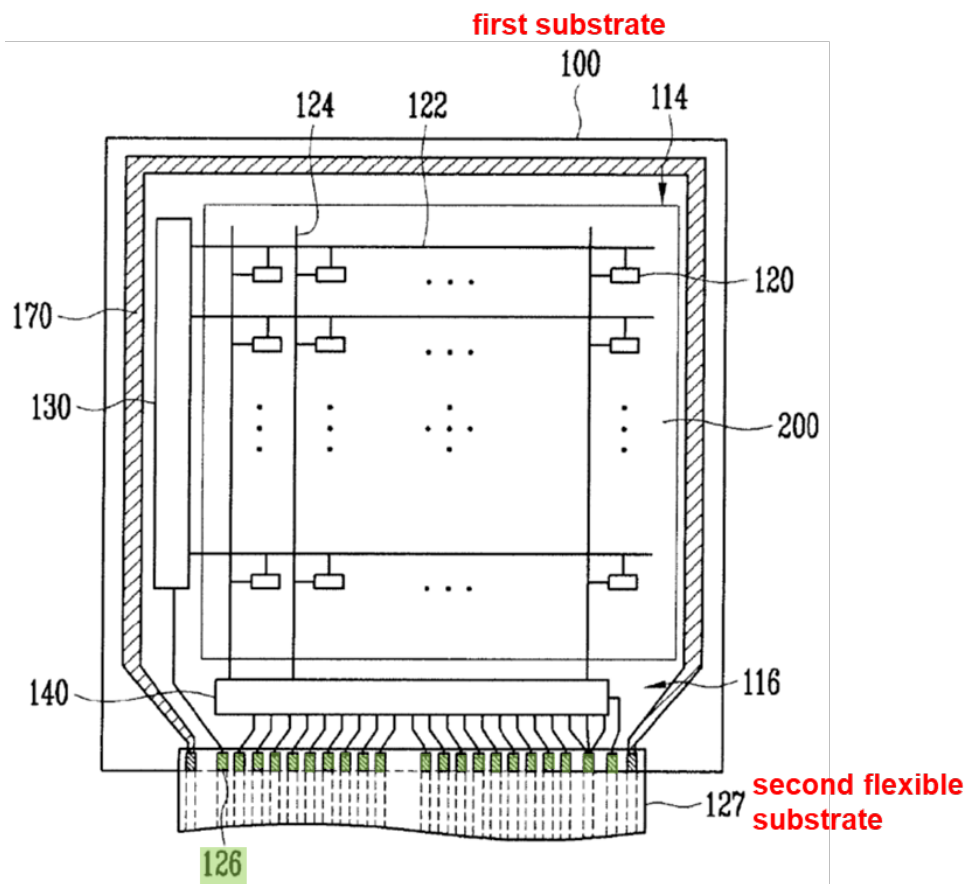
289. Kim's display panel comprises *a first substrate* (substrate 100) *on which a plurality of video signal lines* (data lines 124) *and a plurality of scanning signal lines* (scan line 122) *intersecting the video signal lines are formed*. Kim expressly describes that, in the pixel area 114, the scan lines 122 and data lines 124 are arranged to cross each other, thereby forming a matrix structure. Kim, [0036]. The video signal lines, scanning signal lines, and first substrate are shown below in Figure 4.



Kim, Fig. 4.

c) 8[b]

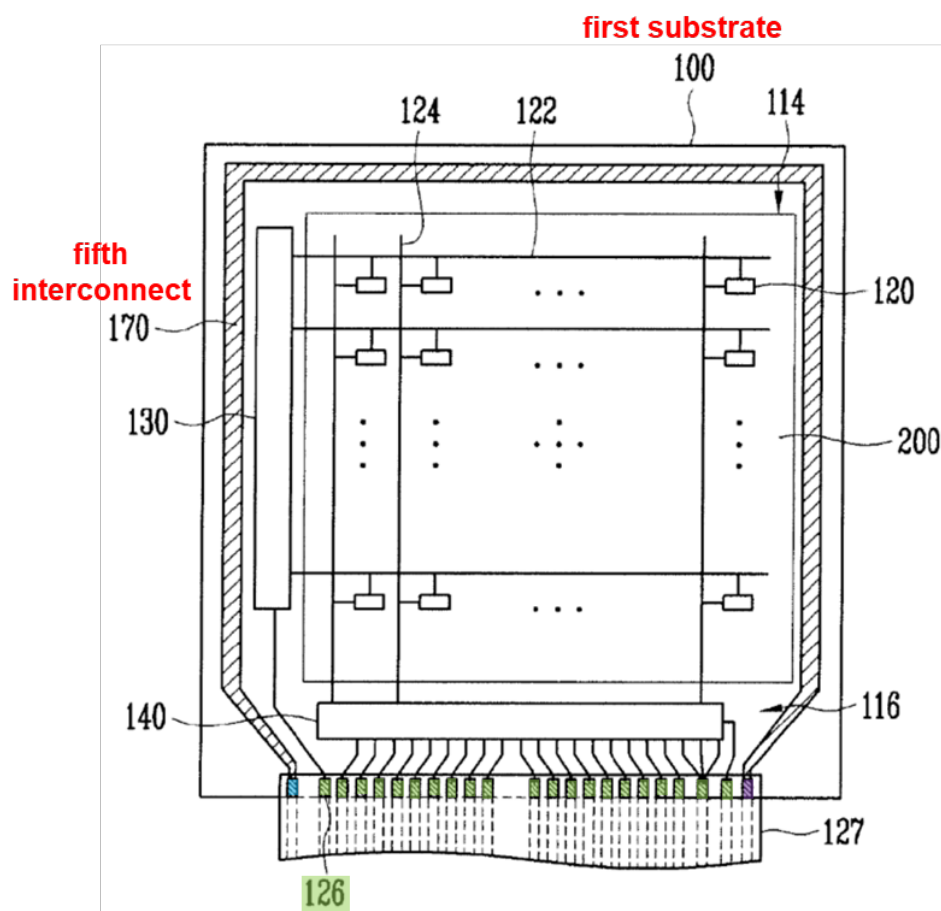
290. Kim's display panel comprises *a second flexible substrate* (FPC 127) *electrically connected to the first substrate* (substrate 100).



Kim, Fig. 4. The substrate 100 comprises a pad unit 126. *Id.*, [0037]. The pad unit 126 is coupled to the scan and data lines through the scan driving unit 130 and the data driving unit 140. *Id.* The pad unit 126 is also “electrically coupled with” the FPC. *Id.*, [0044]. This configuration connects an external source of image data to the display pixels through the FPC, a configuration that was well known.

d) 8[c]

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



Kim, Fig. 4. The substrate 100 comprises a pad unit 126 and a shield wiring 170. *Id.*, [0036]–[0037]. A plurality of contacts/terminals of the pad unit is coupled to the scan and data driving units. *Id.*, [0037]. Two of the contacts/terminals of the

pad unit are coupled with the shield wiring 170. *Id.*, [0044], Fig. 4. These two terminals are on the ends of the pad unit 126 since the shield wiring 170 surrounds the scan and data driving units. *See id.*, Fig. 4.

e) 8[d]

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

293. The connections between two contacts or terminals (highlighted in blue and purple) of pad unit 126 and the shield wiring 170 are shown above. *Supra* § X.F.1.d. As I explain, these two are on the two ends of the pad unit 126. *Id.* “[S]ignals including power supply voltage, control signal, data, etc., are input from the outside” through the FPC 127 and the pad unit. Kim, [0044]. The “outside” refers to an external system, such as a mainboard or controller, that supplies the necessary data signals for display operation. Based on my explanation in the Technology Background, this interpretation is supported by the standard role of the FPC as an interface between the display and external electronics. *Supra* § VII. The “control signal” and “data” respectively correspond to scanning and video signals. This is evidenced by Kim, which explains that the driving circuit “generates

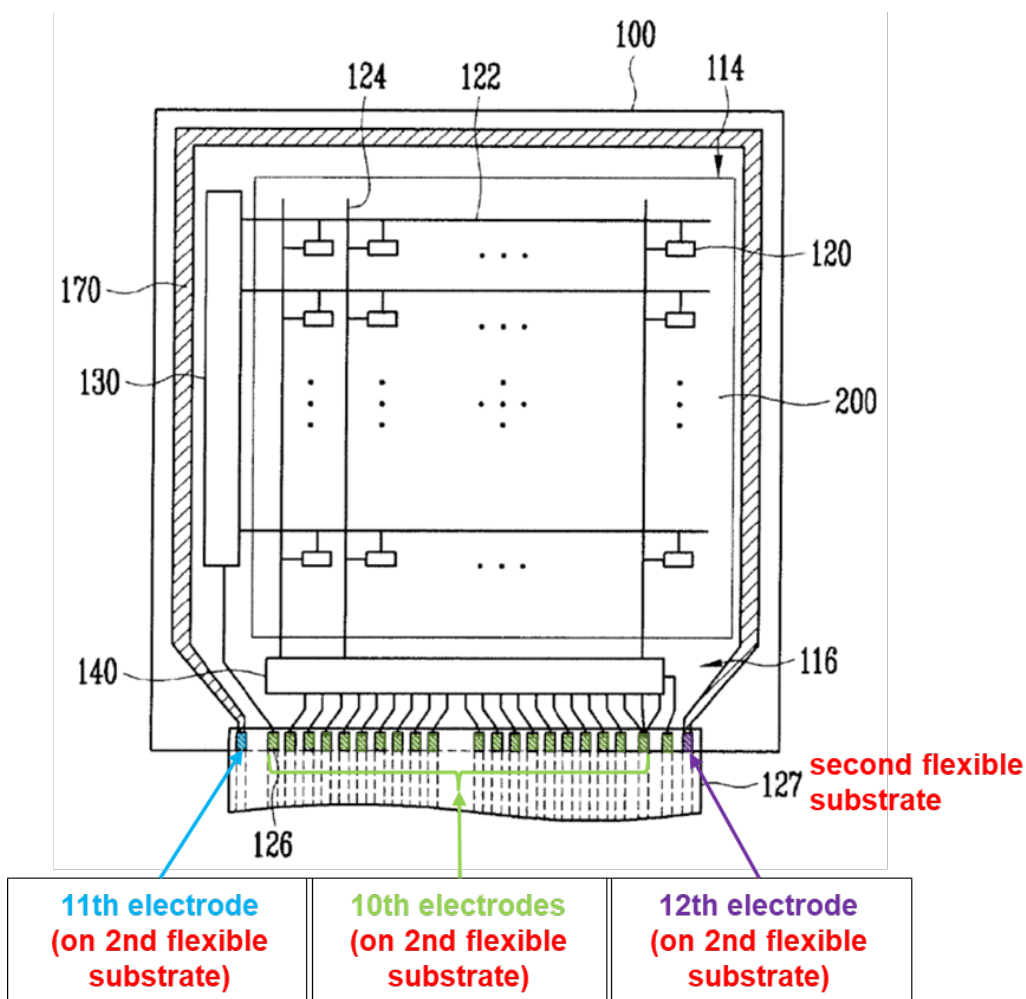
scanning signals and data signals to transmit the signals to the corresponding scan lines 12 and data lines 14, respectively,” *id.*, [0031], and describes the driving circuit as “controlling display of images on the plurality of pixels,” *id.*, [0016]. Thus, the control signal enables the selection of pixel rows for scanning, while the data signal determines the image content to be displayed.

f) 8[e]

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

295. Kim’s display substrate comprises a pad unit 126. *Supra* § X.F.1.d. The pad unit is electrically coupled to the FPC 127. *Id.* Power, control, and data signals are provided through the connection. Kim, [0044]. A POSITA would have understood that the FPC comprises contacts or terminals to provide the connections through mating with corresponding contacts or terminals of the pad unit on the display substrate. *See supra* § X.A.3.f. The plurality of tenth electrodes on the FPC are coupled to the contacts/terminals coupled to the scan and data driving units. Kim, [0037]. Two of the contacts/terminals on the FPC are coupled to the shield wiring 170 on the substrate. *Id.*, [0044]. These two constitute the eleventh and the

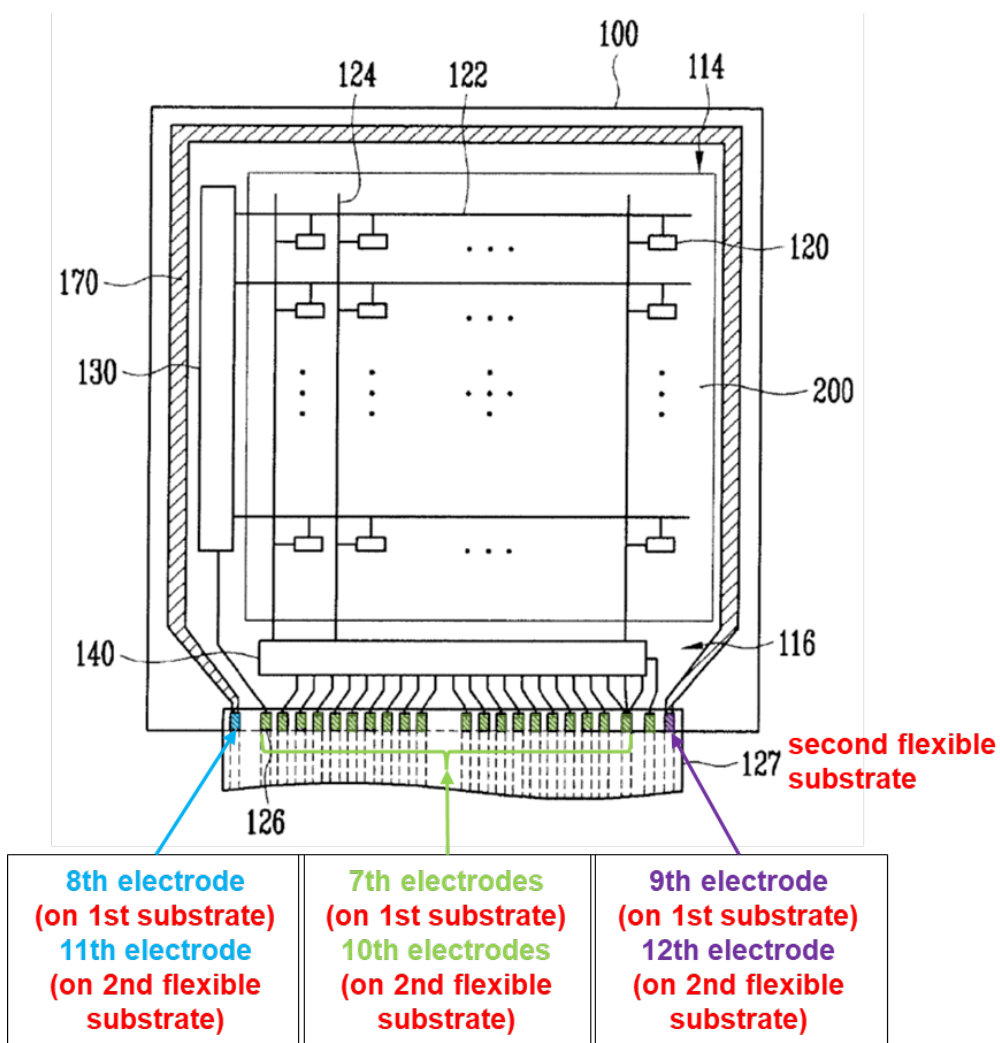
twelfth electrodes (shaded respectively in blue and purple in Figure 4 below). As shown in Figure 4, these two electrodes are the leftmost and rightmost contacts to the pad unit (since they are coupled to shield wiring 170 surrounding the functional components). It follows that, the tenth electrodes, coupled to the scan and data driving units, are the remainder of electrodes formed between them:



Id., Fig. 4.

g) 8[f]

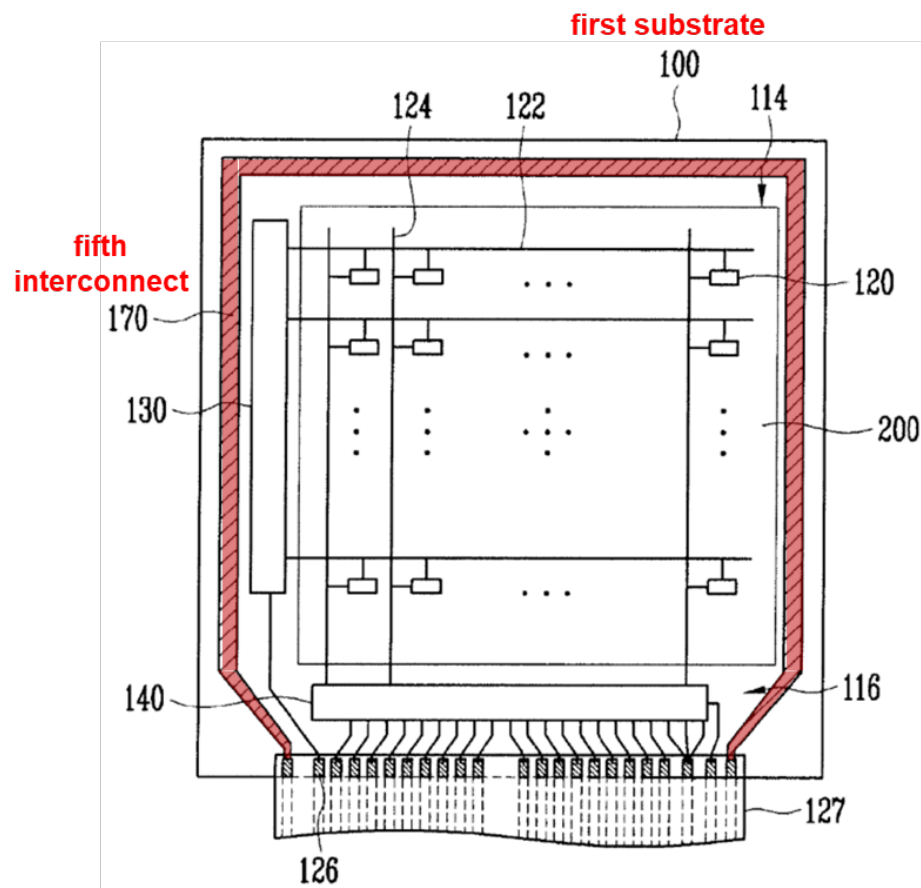
296. Kim discloses a display panel *wherein the tenth electrodes are connected to the seventh electrodes* (pad unit 126), *the eleventh electrode is connected to the eighth electrode* (pad unit 126), *the twelfth electrode is connected to the ninth electrode* (pad unit 126).



Kim, Fig. 4. The leftmost and rightmost contacts or terminals of the pad unit 126 are connected to the corresponding contacts or terminals on the FPC to couple the shield wiring to ground. *Id.*, [0044]. The other contacts or terminals of the pad unit are connected to their corresponding contacts or terminals on the FPC to transfer power supply voltages and control and data signals from the outside to the scan and data driving units. *Id.*, [0044]–[0045].

h) 8[g]

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



Kim, Fig. 4. “[The] shield wiring 170 [is formed] along the edge (or periphery).” *Id.*, [0037]. It “at least partly surround[s] (*e.g.*, formed along three of the four sides) the scan lines 122, the data lines 124, the scan driving unit 130 and the data driving unit 140.” *Id.*, [0046].

2. Claim 9**a) 9[pre]**

298. As I explain above, Sung in view of Nishihara and Kim renders obvious *the display device according to claim 8. Supra § X.F.1.*

b) 9[a]

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

300. Kim's scan driving unit 130 and data driving unit 140 are "for driving the display panel." Kim, [0035]. The driving circuit is coupled to the plurality of pixels through signal wirings, allowing it to control the display of images by sending signals to the scan and data lines. *Id.*, [0016]. The pad unit 126 is outside the pixel area and is coupled with both the scan driving unit 130 and the data driving unit 140, serving as a connection point for signal transmission. *Id.*, [0037]. The scan and data driving units may be formed directly on the lower substrate or mounted as separate drive ICs, and they are connected to the scan lines 122 and data lines 124. *Id.*,

[0038]. The driving units are integrated circuits routinely implemented as semiconductor chips. *Id.*, [0038] (“a driving circuit chip (i.e., a drive IC)”).

301. I understand that the indefinite article “a” may mean one or more in patent claims. Thus, the claimed second semiconductor chip may read on one or multiple chips. If the claim requires a single chip (which I understand is not the case), implementing the functionalities of both scan and data driving units in a single chip (which the claim limitation does not require) and routing the signal wires accordingly would have been a simple and common design choice well within a POSITA’s knowledge and skill. This is reflected in Tanabe, where Figure 1 illustrates a display device architecture that includes a drive circuit 5, to which gate signal lines 21 and drain signal lines 22 are connected, as described in paragraph [0058]. Tanabe thus demonstrates that combining scan and data driving functionalities in a single chip and routing the signal wires accordingly was a conventional and straightforward approach well within the skill of a POSITA.

c) 9[b]

302. Kim discloses a display device *wherein the second semiconductor chip* (scan driving unit 130 and data driving unit 140) *is formed on the first substrate* (substrate 100) *and is surrounded by the fifth interconnect* (shield wiring 170).

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

3. Motivation to Combine

304. Kim’s disclosure provides the details of constructing a display device, like LCM 418 used by Sung. Sung, [0038]. Because Sung focuses on the touch panel it does not disclose the detail of the LCM. *Id.*, [0042]. Because a POSITA tasked with constructing a display device comprising both a touch panel and an LCM would need information about each component, a POSITA in applying Sung would be motivated to look to display art like Kim in constructing the LCM. Moreover, the ’477 patent does not teach anything different, stating its display device is “identical with that of well-known liquid crystal display devices.” Ex. 1001, 4:28–31. Because Sung describes incorporating an LCM but omits its construction details, a POSITA would be prompted by Sung’s disclosure to consult references like Kim that provide those details, and would merely be applying Kim’s conventional display for its intended purpose to achieve predictable results.

XI. SECONDARY CONSIDERATIONS

305. I am not aware of any secondary considerations that would overcome the strong showing of obviousness provided in this Declaration. None were identified during prosecution. *See generally* Ex. 1002. In the event that Patent Owner proffers any such evidence, I reserve my right to provide rebuttal opinions on such evidence in a reply declaration.

XII. DECLARATION

306. In signing this Declaration, I understand that it will be filed as evidence in a contested case before the Patent Trial and Appeal Board of the USPTO.

307. I am aware that willfully false statements and the like made by me in connection with this Declaration are punishable by fine or imprisonment, or both (18 U.S.C. § 1001) and may jeopardize the validity of the Petition. All statements herein made by me of my own knowledge are true and all statements made on information and belief are believed to be true.

Declaration of Richard A. Flasck, M.S.

U.S. Patent No. 9,507,477

I declare under penalty of perjury that the foregoing is true and correct.

Executed this 18th day of September, 2025 in San Ramon, CA.

A handwritten signature in blue ink, reading "Richard A. Flasck", is positioned above a horizontal line.

Richard A. Flasck, M.S.