

**CERTIFICATION AND REQUEST FOR PRIORITIZED EXAMINATION  
UNDER 37 CFR 1.102(e) (Page 1 of 1)**

|                       |                                                 |                                               |  |
|-----------------------|-------------------------------------------------|-----------------------------------------------|--|
| First Named Inventor: | Yoichi MOMOSE                                   | Nonprovisional Application Number (if known): |  |
| Title of Invention:   | METHOD OF MANUFACTURING A LIQUID CRYSTAL DEVICE |                                               |  |

**APPLICANT HEREBY CERTIFIES THE FOLLOWING AND REQUESTS PRIORITIZED EXAMINATION FOR THE ABOVE-IDENTIFIED APPLICATION.**

1. The processing fee set forth in 37 CFR 1.17(i)(1), the prioritized examination fee set forth in 37 CFR 1.17(c), and if not already paid, the publication fee set forth in 37 CFR 1.18(d) have been filed with the request. The basic filing fee, search fee, and examination fee are filed with the request or have been already been paid. I understand that any required excess claims fees or application size fee must be paid for the application.
2. I understand that the application may not contain, or be amended to contain, more than four independent claims, more than thirty total claims, or any multiple dependent claims.
3. The applicable box is checked below:

**I. ☒ Original Application (Track One) - Prioritized Examination under § 1.102(e)(1)**

- i. (a) The application is an original nonprovisional utility application filed under 35 U.S.C. 111(a). This certification and request is being filed with the utility application via EFS-Web.  
---OR---  
(b) The application is an original nonprovisional plant application filed under 35 U.S.C. 111(a). This certification and request is being filed with the plant application in paper.
- ii. An executed inventor's oath or declaration under 37 CFR 1.63 or 37 CFR 1.64 for each inventor, or the application data sheet meeting the conditions specified in 37 CFR 1.53(f)(3)(i) is filed with the application.

**II. ☐ Request for Continued Examination - Prioritized Examination under § 1.102(e)(2)**

- i. A request for continued examination has been filed with, or prior to, this form.
- ii. If the application is a utility application, this certification and request is being filed via EFS-Web.
- iii. The application is an original nonprovisional utility application filed under 35 U.S.C. 111(a), or is a national stage entry under 35 U.S.C. 371.
- iv. This certification and request is being filed prior to the mailing of a first Office action responsive to the request for continued examination.
- v. No prior request for continued examination has been granted prioritized examination status under 37 CFR 1.102(e)(2).

|                                                                                                                                                                                                       |                                               |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| Signature <u>/G. Gregory Schivley/</u>                                                                                                                                                                | Date December 16, 2014                        |
| Name (Print/Typed) <u>G. Gregory Schivley</u>                                                                                                                                                         | Practitioner Registration Number <u>27382</u> |
| <b>Note:</b> This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. Submit multiple forms if more than one signature is required.* |                                               |
| <input type="checkbox"/> *Total of _____ forms are submitted.                                                                                                                                         |                                               |

## Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                 |                        |                  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|------------------------|------------------|
| <b>Application Data Sheet 37 CFR 1.76</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                 | Attorney Docket Number | 9319S-001378-COB |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                 | Application Number     |                  |
| Title of Invention                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | METHOD OF MANUFACTURING A LIQUID CRYSTAL DEVICE |                        |                  |
| <p>The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76. This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.</p> |                                                 |                        |                  |

**Secrecy Order 37 CFR 5.2**

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

**Inventor Information:**

|                                                                                                                                                                                 |                             |                               |                    |               |                        |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|-------------------------------|--------------------|---------------|------------------------|
| <b>Inventor 1</b>                                                                                                                                                               |                             |                               |                    |               | <a href="#">Remove</a> |
| <b>Legal Name</b>                                                                                                                                                               |                             |                               |                    |               |                        |
| <b>Prefix</b>                                                                                                                                                                   | <b>Given Name</b>           | <b>Middle Name</b>            | <b>Family Name</b> | <b>Suffix</b> |                        |
|                                                                                                                                                                                 | Yoichi                      |                               | MOMOSE             |               |                        |
| <b>Residence Information (Select One)</b> <input type="radio"/> US Residency <input checked="" type="radio"/> Non US Residency <input type="radio"/> Active US Military Service |                             |                               |                    |               |                        |
| <b>City</b>                                                                                                                                                                     | Matsumoto                   | <b>Country of Residence i</b> | JP                 |               |                        |
| <b>Mailing Address of Inventor:</b>                                                                                                                                             |                             |                               |                    |               |                        |
| <b>Address 1</b>                                                                                                                                                                | c/o Seiko Epson Corporation |                               |                    |               |                        |
| <b>Address 2</b>                                                                                                                                                                | 3-5, Owa 3-chome            |                               |                    |               |                        |
| <b>City</b>                                                                                                                                                                     | Suwa-shi, Nagano-ken        | <b>State/Province</b>         |                    |               |                        |
| <b>Postal Code</b>                                                                                                                                                              | 392-8502                    | <b>Country i</b>              | JP                 |               |                        |
| <b>Inventor 2</b>                                                                                                                                                               |                             |                               |                    |               | <a href="#">Remove</a> |
| <b>Legal Name</b>                                                                                                                                                               |                             |                               |                    |               |                        |
| <b>Prefix</b>                                                                                                                                                                   | <b>Given Name</b>           | <b>Middle Name</b>            | <b>Family Name</b> | <b>Suffix</b> |                        |
|                                                                                                                                                                                 | Satoshi                     |                               | HASEGAWA           |               |                        |
| <b>Residence Information (Select One)</b> <input type="radio"/> US Residency <input checked="" type="radio"/> Non US Residency <input type="radio"/> Active US Military Service |                             |                               |                    |               |                        |
| <b>City</b>                                                                                                                                                                     | Matsumoto                   | <b>Country of Residence i</b> | JP                 |               |                        |
| <b>Mailing Address of Inventor:</b>                                                                                                                                             |                             |                               |                    |               |                        |
| <b>Address 1</b>                                                                                                                                                                | c/o Seiko Epson Corporation |                               |                    |               |                        |
| <b>Address 2</b>                                                                                                                                                                | 3-5, Owa 3-chome            |                               |                    |               |                        |
| <b>City</b>                                                                                                                                                                     | Suwa-shi, Nagano-ken        | <b>State/Province</b>         |                    |               |                        |
| <b>Postal Code</b>                                                                                                                                                              | 392-8502                    | <b>Country i</b>              | JP                 |               |                        |
| All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the <b>Add</b> button. <a href="#">Add</a>                 |                             |                               |                    |               |                        |

**Correspondence Information:**

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

|                                           |                                                 |                        |                  |
|-------------------------------------------|-------------------------------------------------|------------------------|------------------|
| <b>Application Data Sheet 37 CFR 1.76</b> |                                                 | Attorney Docket Number | 9319S-001378-COB |
|                                           |                                                 | Application Number     |                  |
| Title of Invention                        | METHOD OF MANUFACTURING A LIQUID CRYSTAL DEVICE |                        |                  |

Enter either Customer Number or complete the Correspondence Information section below.  
For further information see 37 CFR 1.33(a).

☐ An Address is being provided for the correspondence information of this application.

|                 |                     |                                          |                                             |
|-----------------|---------------------|------------------------------------------|---------------------------------------------|
| Customer Number | 27572               |                                          |                                             |
| Email Address   | docketingpt@hdp.com | <input type="button" value="Add Email"/> | <input type="button" value="Remove Email"/> |

### Application Information:

|                                         |                                                 |                                           |                          |
|-----------------------------------------|-------------------------------------------------|-------------------------------------------|--------------------------|
| Title of the Invention                  | METHOD OF MANUFACTURING A LIQUID CRYSTAL DEVICE |                                           |                          |
| Attorney Docket Number                  | 9319S-001378-COB                                | Small Entity Status Claimed               | <input type="checkbox"/> |
| Application Type                        | Nonprovisional                                  |                                           |                          |
| Subject Matter                          | Utility                                         |                                           |                          |
| Total Number of Drawing Sheets (if any) |                                                 | Suggested Figure for Publication (if any) |                          |

### Filing By Reference :

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

|                                                        |                          |                                            |
|--------------------------------------------------------|--------------------------|--------------------------------------------|
| Application number of the previously filed application | Filing date (YYYY-MM-DD) | Intellectual Property Authority or Country |
|                                                        |                          |                                            |

### Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

### Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32). Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

|                    |                                                  |                                              |                                                         |
|--------------------|--------------------------------------------------|----------------------------------------------|---------------------------------------------------------|
| Please Select One: | <input checked="" type="radio"/> Customer Number | <input type="radio"/> US Patent Practitioner | <input type="radio"/> Limited Recognition (37 CFR 11.9) |
| Customer Number    | 27572                                            |                                              |                                                         |

|                                           |                                                 |                        |                  |
|-------------------------------------------|-------------------------------------------------|------------------------|------------------|
| <b>Application Data Sheet 37 CFR 1.76</b> |                                                 | Attorney Docket Number | 9319S-001378-COB |
|                                           |                                                 | Application Number     |                  |
| Title of Invention                        | METHOD OF MANUFACTURING A LIQUID CRYSTAL DEVICE |                        |                  |

## Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, or 365(c) or indicate National Stage entry from a PCT application. Providing this information in the application data sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.

When referring to the current application, please leave the application number blank.

|                                                                                                                       |                 |                          |                          |
|-----------------------------------------------------------------------------------------------------------------------|-----------------|--------------------------|--------------------------|
| Prior Application Status                                                                                              | Pending         | <a href="#">Remove</a>   |                          |
| Application Number                                                                                                    | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) |
|                                                                                                                       | Continuation of | 14/571729                | 2014-12-16               |
| Prior Application Status                                                                                              | Pending         | <a href="#">Remove</a>   |                          |
| Application Number                                                                                                    | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) |
| 14/571729                                                                                                             | Division of     | 11/301086                | 2005-12-12               |
| Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the <b>Add</b> button. |                 |                          | <a href="#">Add</a>      |

## Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55(d). When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX) <sup>i</sup>the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(h)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

|                                                                                                        |                      |                          |                                          |
|--------------------------------------------------------------------------------------------------------|----------------------|--------------------------|------------------------------------------|
|                                                                                                        |                      |                          | <a href="#">Remove</a>                   |
| Application Number                                                                                     | Country <sup>i</sup> | Filing Date (YYYY-MM-DD) | Access Code <sup>j</sup> (if applicable) |
| 2004-375697                                                                                            | JP                   | 2004-12-27               |                                          |
| Additional Foreign Priority Data may be generated within this form by selecting the <b>Add</b> button. |                      |                          | <a href="#">Add</a>                      |

|                                           |                                                 |                        |                  |
|-------------------------------------------|-------------------------------------------------|------------------------|------------------|
| <b>Application Data Sheet 37 CFR 1.76</b> |                                                 | Attorney Docket Number | 9319S-001378-COB |
|                                           |                                                 | Application Number     |                  |
| Title of Invention                        | METHOD OF MANUFACTURING A LIQUID CRYSTAL DEVICE |                        |                  |

## Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.</p> <p><input type="checkbox"/> NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.</p> |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

## Authorization to Permit Access:

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><input checked="" type="checkbox"/> Authorization to Permit Access to the Instant Application by the Participating Offices</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <p>If checked, the undersigned hereby grants the USPTO authority to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the World Intellectual Property Office (WIPO), and any other intellectual property offices in which a foreign application claiming priority to the instant patent application is filed access to the instant patent application. See 37 CFR 1.14(c) and (h). This box should not be checked if the applicant does not wish the EPO, JPO, KIPO, WIPO, or other intellectual property office in which a foreign application claiming priority to the instant patent application is filed to have access to the instant patent application.</p> <p>In accordance with 37 CFR 1.14(h)(3), access will be provided to a copy of the instant patent application with respect to: 1) the instant patent application-as-filed; 2) any foreign application to which the instant patent application claims priority under 35 U.S.C. 119(a)-(d) if a copy of the foreign application that satisfies the certified copy requirement of 37 CFR 1.55 has been filed in the instant patent application; and 3) any U.S. application-as-filed from which benefit is sought in the instant patent application.</p> <p>In accordance with 37 CFR 1.14(c), access may be provided to information concerning the date of filing this Authorization.</p> |

## Applicant Information:

|                                                                                                                                                                                            |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.</p> |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

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|                                           |                                                 |                        |                  |
|-------------------------------------------|-------------------------------------------------|------------------------|------------------|
| <b>Application Data Sheet 37 CFR 1.76</b> |                                                 | Attorney Docket Number | 9319S-001378-COB |
|                                           |                                                 | Application Number     |                  |
| Title of Invention                        | METHOD OF MANUFACTURING A LIQUID CRYSTAL DEVICE |                        |                  |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |    |                                                                |                                                                        |                                      |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|----------------------------------------------------------------|------------------------------------------------------------------------|--------------------------------------|--|
| <b>Applicant 1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |    |                                                                |                                                                        | <b>Remove</b>                        |  |
| <p>If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.</p> |    |                                                                |                                                                        |                                      |  |
| <b>Clear</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |    |                                                                |                                                                        |                                      |  |
| <input checked="" type="radio"/> Assignee                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |    | <input type="radio"/> Legal Representative under 35 U.S.C. 117 |                                                                        | <input type="radio"/> Joint Inventor |  |
| <input type="radio"/> Person to whom the inventor is obligated to assign.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |    |                                                                | <input type="radio"/> Person who shows sufficient proprietary interest |                                      |  |
| If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |    |                                                                |                                                                        |                                      |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |    |                                                                |                                                                        |                                      |  |
| Name of the Deceased or Legally Incapacitated Inventor :                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |    |                                                                |                                                                        |                                      |  |
| If the Applicant is an Organization check here. <input checked="" type="checkbox"/>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |    |                                                                |                                                                        |                                      |  |
| Organization Name                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |    | Seiko Epson Corporation                                        |                                                                        |                                      |  |
| <b>Mailing Address Information:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |    |                                                                |                                                                        |                                      |  |
| Address 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |    | 4-1, Nishi-shinjuku 2-chome                                    |                                                                        |                                      |  |
| Address 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |    | Shinjuku-ku                                                    |                                                                        |                                      |  |
| City                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |    | Tokyo                                                          | State/Province                                                         |                                      |  |
| Country i                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | JP | Postal Code                                                    |                                                                        | 163-0811                             |  |
| Phone Number                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |    | Fax Number                                                     |                                                                        |                                      |  |
| Email Address                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |    |                                                                |                                                                        |                                      |  |
| Additional Applicant Data may be generated within this form by selecting the Add button.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |    |                                                                |                                                                        |                                      |  |
| <b>Add</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |    |                                                                |                                                                        |                                      |  |

## Assignee Information including Non-Applicant Assignee Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

|                                                                                                                                                                                                                                                                                                                                                                                                                                                               |  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| <b>Assignee 1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                             |  |
| <p>Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.</p> |  |
| <b>Remove</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |
| If the Assignee or Non-Applicant Assignee is an Organization check here. <input type="checkbox"/>                                                                                                                                                                                                                                                                                                                                                             |  |

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|-------------------------------------------|-------------------------------------------------|------------------------|------------------|
| <b>Application Data Sheet 37 CFR 1.76</b> |                                                 | Attorney Docket Number | 9319S-001378-COB |
|                                           |                                                 | Application Number     |                  |
| Title of Invention                        | METHOD OF MANUFACTURING A LIQUID CRYSTAL DEVICE |                        |                  |

|        |            |             |             |        |
|--------|------------|-------------|-------------|--------|
| Prefix | Given Name | Middle Name | Family Name | Suffix |
|        |            |             |             |        |

**Mailing Address Information For Assignee including Non-Applicant Assignee:**

|               |  |                |  |
|---------------|--|----------------|--|
| Address 1     |  |                |  |
| Address 2     |  |                |  |
| City          |  | State/Province |  |
| Country i     |  | Postal Code    |  |
| Phone Number  |  | Fax Number     |  |
| Email Address |  |                |  |

Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button.

Add

**Signature:**

Remove

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications

|            |                       |           |                   |                     |
|------------|-----------------------|-----------|-------------------|---------------------|
| Signature  | /G. Gregory Schivley/ |           | Date (YYYY-MM-DD) | 2014-12-16          |
| First Name | G. Gregory            | Last Name | Schivley          | Registration Number |
|            |                       |           |                   | 27382               |

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## METHOD OF MANUFACTURING A LIQUID CRYSTAL DEVICE

## CROSS-REFERENCE TO RELATED APPLICATIONS

This is a continuation patent application of United States Application No. 14/571,729 filed December 16, 2014, which is a divisional patent application of United States Application No. 11/301,086 filed December 12, 2005, which claims priority to Japanese Patent Application No. 2004-375697 filed December 27, 2004 all of which are hereby expressly incorporated by reference in their entireties.

## BACKGROUND

## 1. Technical Field

**[0001]** The present invention relates to a method of manufacturing a liquid crystal device, to a liquid crystal device, and an electronic apparatus.

## 2. Related Art

**[0002]** In an electronic apparatus, such as a cellular phone or the like, an electro-optical device, such as a liquid crystal device or the like, is used as a color image display unit. The liquid crystal device has a pair of substrates with a liquid crystal layer interposed therebetween. In order to form the liquid crystal device,

first, a sealant (sealing material) is coated in a peripheral portion of a surface of one substrate. At that time, a liquid crystal injection hole is formed at a part of the sealant. Next, spacers are sprayed inside the sealant, and then the other substrate is bonded to the one substrate via the sealant. Accordingly, a liquid crystal cell is formed in a region defined by the pair of substrates and the sealant. Next, the liquid crystal cell is subjected to a vacuum for de-aerating and is then brought back to an atmospheric pressure while the liquid crystal injection hole is dipped into a liquid crystal vessel. In doing so, the liquid crystal cell is filled with liquid crystal by means of a pressure difference between the inside and outside of the liquid crystal cell and surface tension. When liquid crystal is filled in such a manner, however, the liquid crystal injection process takes an extremely long time. In particular, when a large substrate whose diagonal is more than one meter is used, it takes more than one day to entirely fill the substrate with liquid crystal.

**[0003]** Therefore, a dropping assembly method has been suggested in which liquid crystal is dropped onto one substrate in which a frame-shaped sealant is provided with no liquid crystal injection hole, and the other substrate is then bonded to the one substrate. According to this method,

first, a sealant formed of thermosetting resin or the like is coated in a peripheral portion of a surface of one substrate. Next, a predetermined amount of liquid crystal is dropped onto the one substrate by a liquid droplet ejection device. Finally, the other substrate is bonded to the sealant under a vacuum atmosphere, the vacuum atmosphere is released to an air pressure atmosphere, and then the sealant is subjected to ultraviolet irradiation or heat treatment, thereby forming the liquid crystal device. For this reason, unlike the related art liquid crystal injection method, the sealant is formed in a ring shape with no injection hole.

**[0004]** According to this method, after both substrates have been bonded, the vacuum atmosphere is released to atmospheric pressure. Accordingly, a predetermined cell gap to which a uniform pressure is applied from both substrates can be obtained. Further, the cell gap can be determined according to the amount of liquid crystal dropped. For example, if the dropping amount is excessively small, the cell gap is thin, and thus air bubbles tend to occur. Further, if the dropping amount is excessively large, the cell gap is thick, and unevenness of the cell gap tends to occur. Therefore, by setting the desired optimum dropping amount of liquid crystal, a uniform cell gap can be obtained. Further, according to this method, unlike the related art

liquid crystal injection method, the amount of liquid crystal used can be reduced, and the injection/sealing process can be omitted, such that tact time can be reduced.

**[0005]** In addition, as a method of forming the sealant, a method has been suggested in which a dispenser is used. See, for example, JP-A-2002-98979, JP-A-2003-222883, and JP-A-2003-241204, which are referred to as Patent Documents 1, 2, and 3, respectively. This method is a method in which, while relatively moving the dispenser and the substrate, the sealant is ejected onto the substrate in a predetermined pattern. Here, at a part of a peripheral portion of the sealant, the previously ejected sealant and the subsequently ejected sealant overlap each other, such that the sealant ejected on the substrate is formed in a ring shape. Accordingly, when the substrates are bonded after liquid crystal is dropped, the liquid crystal can be suppressed from leaking outside the ring-shaped pattern of the sealant.

**[0006]** The inventors have founded that, in the liquid crystal devices described in the above-described Patent Documents, it is difficult to stably form the sealant, a dummy space needs to be provided with respect to an adjacent panel, and the dispenser needs to be controlled at the beginning and end of drawing in order to form one pattern by one drawing operation. In addition, the inventors have

founded that, in the method of forming the sealant by use of the dispenser, in general, a defective cell gap tends to occur.

**[0007]** As for an ejection method of a sealant by use of a dispenser, the inventors have found the following.

**[0008]** In such an ejection method, as shown in Figs. 48A and 48B, the size of a drawing start portion 500 or a drawing end portion 510 needs to be formed to have the same size as those of other parts. This is because, when the size is excessively large, the cell gap is thickened, such that display unevenness occurs, and, when the cell gap is minute, liquid crystal may leak from that portion, such that reliability is degraded. When the sealant is drawn by a dispenser, in general, as shown in Figs. 48A and 48B, at the drawing start portion 500 and the drawing end portion 510, the seal tends to be thickened or minuteness tends to occur. In addition, there are many cases in which, in order to make the size of a junction portion 520 uniform, the drawing start portion 500 and the drawing end portion 510 overlap each other, as shown in Fig. 48C. In this case, it has been confirmed that the length of the overlap portion is about 4 mm, and the width  $W2$  of that portion is made larger than a predetermined target width  $W1$  by about 0.1 to 0.2 mm ( $\Delta W = W2 - W1 = 0.1$  to  $0.2$  mm) due to the variation in viscosity of

the sealant or the like.

**[0009]** Further, in a TFD (Thin Film Diode) driving-type liquid crystal device or a liquid crystal device in which STN (Super Twisted Nematic) liquid crystal operates in a passive driving method, as shown in Figs. 49 and 50, relay wiring lines 601 formed on a surface of a circuit board having driver ICs 600 and 610 and a common electrode (hereinafter, referred to as COM electrode) 602 formed on a counter substrate need to be electrically connected to each other via a conductive pad 603. In this case, conductive particles, in which the surface of a spacer is subjected to a plating treatment, are dispersed in the sealant, and the sealant is disposed on the conductive pad 603. As a result, the relay wiring lines 601 and the COM electrode 602 are electrically connected to each other via the conductive particles, and then an output potential of the driver IC 600 is applied to a wiring line of the counter substrate.

**[0010]** On the other hand, segment electrodes (hereinafter, referred to as SEG electrode) 604 relayed from the driver IC 610 up to a display area 620 or the relay wiring lines 601 relayed from the driver IC 600 up to the conductive pad 603 need to cross the sealant. In this case, as for the relay wiring lines 601 and the SEG electrodes 604, in order to prevent the individual electrodes from being electrically

shorted, a sealant, which does not contain the conductive particles, is configured to cross the relay wiring lines 601 and the SEG electrodes 604.

**[0011]** By the way, as described above, when the sealant containing the conductive particles and the non-conductive sealant are used, from one end (A of Fig. 50) of the conductive pad 603 up to an end portion (B of Fig. 50) of the relay wiring line 601 crossing the sealant, both sealants need to be connected to each other. In the TFD liquid crystal device or the STN liquid crystal device, there are many cases in which the distance L between the end A of the conductive pad 603 and the end portion of the relay wiring line 601 crossing the sealant is set to be equal to or less than 2 mm. For this reason, if the distance L is simply made shorter than the length of the overlap portion shown in Fig. 48C, that is, 4 mm, it has been confirmed that, as shown in Fig. 48D, the length of the overlap portion of the junction portion 520 becomes 1 mm, the width W3 is made thicker than the predetermined target width W1 by about 0.5 to 0.6 mm ( $\Delta W = W3 - W1 = 0.5 \text{ to } 0.6 \text{ mm}$ ), and thus a defective cell gap easily occurs.

**[0012]** Further, in Patent Document 1, the width of the overlap portion of beginning and termination for forming a seal line is set to be 0.4 to 0.6 times as small as the seal



line width. In this method, however, the control of the dispenser is very complex, it takes a long time for drawing, the seal shape tends to be varied due to a variation in the amount of a residual sealant in the dispenser or a variation in viscosity between different lots of the sealant, and management is very difficult.

**[0013]** Further, in Patent Document 2, drawing starts from any portion outside the closed loop-shaped sealing member, and ends at a place outside the closed loop-shaped sealing member which is different from the portion where drawing starts. In this method, however, there is a problem in that a dummy space needs to be provided with respect to an adjacent panel. In addition, in any of the methods of Patent Documents 1 to 3, one member is formed by one drawing operation. Accordingly, there is a problem in that it takes time for the control of the dispenser at the beginning and end of drawing, and the tact extends.

**[0014]** Therefore, the inventors have accomplished the aspects of the invention on the basis of the above description.

**[0015]** An advantage of some aspects of the invention is that it provides a method of manufacturing a liquid crystal device which can realize a uniform cell gap, a liquid crystal device, and an electronic apparatus.

## SUMMARY

**[0016]** According to a first aspect of the invention, there is provided a method of manufacturing a liquid crystal device having a first substrate and a second substrate facing each other with a liquid crystal layer interposed therebetween, and a sealing member formed in a peripheral portion of at least one of the substrates. The method of manufacturing a liquid crystal device includes forming the sealing member, forming the liquid crystal layer inside the sealing member, and bonding the first substrate to the second substrate. In the forming of the sealing member, a ring-shaped portion that seals the liquid crystal layer inside the sealing member, and a first sealing layer and a second sealing layer that face each other to be separated from each other are formed. In the bonding of the first substrate to the second substrate, a junction portion in which the first and second sealing layers are pressed and are joined outside the sealing member so as to form the ring-shaped portion is formed.

**[0017]** Here, the first sealing layer and the second sealing layer are parts which are formed by forming the sealing member and become the junction portion by bonding the first substrate to the second substrate. That is, the first sealing layer and the second sealing layer constitute a

previous shape of the junction portion.

**[0018]** The junction portion joins sealing materials formed on the substrates to each other and blocks the ring-shaped portion in order to prevent the liquid crystal layer inside the ring-shaped portion from leaking to the outside. Further, the junction portion includes a state in which the sealing materials are joined while overlapping in a vertical direction of the substrates or a state in which the sealing materials are joined while being close to each other in a horizontal direction of the substrates. Further, since a part of the junction portion is formed outside of the ring-shaped portion, the junction portion is formed toward the outside of the ring-shaped from a portion joining the ring-shaped portion. Therefore, the entire junction portion is not formed to overlap the ring-shaped portion. That is, only part of the junction portion is joined to the ring-shaped portion and other parts are formed toward the outside of the ring-shaped portion.

**[0019]** Further, in the forming of the sealing member, an ejection method is used in which the sealing material is ejected from nozzles of a dispenser while the dispenser filled with the sealing material and the first substrate or the second substrate are relatively moved.

**[0020]** If doing so, since the ring-shaped portion is

blocked by the part of the junction portion, leakage of the liquid crystal layer from the junction portion can be suppressed, and reliability of the liquid crystal device can be enhanced. Further, since the junction portion is formed toward the outside of the ring-shaped portion, when the bonding of the first substrate to the second substrate is performed, the width of the junction portion is increased only outside the ring-shaped portion, and thus the sealing member can be suppressed from protruding inside the ring-shaped portion. Further, there is no case in which a cell gap inside the ring-shaped portion is influenced, and thus the cell gap can be uniformly maintained. Specifically, when a seal protrudes inside the ring-shaped portion, for example, the seal may run onto color filters in a display region of the liquid crystal device, and thus the cell gap is easily influenced. In contrast, in the invention, the sealing member is formed outside the ring-shaped portion, that is, in a region where the color filters are not formed, and thus there is no case in which the seal runs onto the color filters. Therefore, the cell gap can be uniformly maintained.

**[0021]** Further, as compared with the related art, the width of each member of the ring-shaped portion and the junction portion does not need to be adjusted, and the ring-shaped portion and the junction portion can be formed with a

member having the same width, such that the sealing member can be easily formed. Therefore, the dispenser can be easily controlled, and drawing of the sealing member can end in short time. Further, a variation of the amount of the sealing material remaining in the dispenser or a variation in viscosity between lots of the sealing material does not need to be regarded as questionable, and the shape of the sealing member can be easily managed.

**[0022]** Further, according to a second aspect of the invention, in the method of manufacturing a liquid crystal device according to the first aspect of the invention, it is preferable that, in the forming of the sealing member, a first side of the ring-shaped portion be formed on a straight line along which the sealing member extends, the first sealing layer be formed so as to be continuous with respect to the first side on a central line different from an axis along which the first side extends, and the second sealing layer be formed to face the first sealing layer.

**[0023]** Here, 'the first sealing layer is formed so as to be continuous with respect to the first side on the central line different from the axis along which the first side extends' means that the first sealing layer and the first side are not formed on the same straight line, but are continuously formed. That is, since the first sealing layer

and the first side are not formed on the same straight line, the first sealing layer and the first side are formed via a curve or curved portion. Further, since 'the first sealing layer is formed on the central line different from the axis along which the first side extends', the first sealing layer may be formed on a curved central line or the first sealing layer may be formed on an inclined central line to be inclined with respect to the axis along which the first side extends. As long as the first sealing layer is formed on the corresponding central line, various modes can be adopted.

**[0024]** If doing so, the same effects as those in the above-described manufacturing method can be obtained. In addition, the first side of the ring-shaped portion can be formed on the straight line along which the sealing member extends, and the first sealing layer can be formed so as to be continuous with respect to the first side. Further, the first side can be formed on the central line different from the axis along which the first side extends. Further, the second sealing layer can be formed to face the first sealing layer.

**[0025]** Further, in the method of manufacturing a liquid crystal device according to the second aspect of the invention, it is preferable that, when a line width of the sealing member in the ring-shaped portion after the bonding

of the first substrate to the second substrate is performed is  $w_2$ , and a distance between the central line of the first sealing layer and the central line of the second sealing layer is  $d_2$ , the following relationship be established.

Equation 1

$$0 \leq d_2 \leq 0.8 \times w_2$$

**[0026]** If doing so, the same effects as those in the above-described manufacturing method can be obtained. In addition, even when a variation of the size of the sealing member occurs, the first sealing layer and the second sealing layer can be reliably joined to form the junction portion.

**[0027]** Further, in the method of manufacturing a liquid crystal device according to the second aspect of the invention, it is preferable that, in the forming of the sealing member, in an axis direction perpendicular to an axis direction of the first side of the ring-shaped portion, a second side be formed, and the second sealing layer be formed so as to be continuous with respect to the second side via a curved portion.

**[0028]** If doing so, the same effects as those in the above-described manufacturing method can be obtained. In addition, the second sealing layer, which is connected to the second side via the curved portion, and the first sealing

layer can be joined, thereby reliably forming the junction portion.

**[0029]** Further, in the method of manufacturing a liquid crystal device according to the second aspect of the invention, it is preferable that, when the radius of the curved portion is  $R_2$ , the following relationship be established.

Equation 2

$$(R_2/w_2) \leq -1.2 \times (d_2/w_2) + 2.0$$

**[0030]** In addition, in the method of manufacturing a liquid crystal device according to the second aspect of the invention, it is preferable that the following relationship be established.

Equation 3

$$(R_2/w_2) \leq -(d_2/w_2) + 1.2$$

Equation 4

$$(R_2/w_2) \geq -0.6 \times (d_2/w_2) + 0.4$$

**[0031]** If doing so, the same effects as those in the above-described manufacturing method can be obtained, and leakage of the liquid crystal layer from the ring-shaped portion can be prevented, regardless of the size of the



sealing member.

**[0032]** Further, in the method according to the related art, the sealing member in the junction portion may be thickened, and the distance of the overlap portion needs to be increased in order to control thickening to the minimum. Further, the control of the device may be complicated, and then it will take a long time for drawing the sealing member. In contrast, in the method of manufacturing a liquid crystal device according to the first aspect of the invention, the sealing member can be drawn at the same speed all over. Further, since a writing start portion or a writing end portion is sufficiently separated from the liquid crystal device, a complex control can be eliminated. Accordingly, drawing time can be markedly reduced to half to one-third of drawing time in the related art. In addition, thickening of the sealing member toward the inside of the liquid crystal device in the junction portion of the sealing member can be solved.

**[0033]** Further, in the method of manufacturing a liquid crystal device according to the second aspect of the invention, it is preferable that, in the forming of the sealing member, in an axis direction perpendicular to an axis direction of the first side of the ring-shaped portion, a second side be formed, and the second sealing layer be formed so as to be continuous with respect to the second side via an

inclined portion.

**[0034]** If doing so, the same effects as those in the above-described manufacturing method can be obtained. In addition, the second sealing layer, which is connected to the second side via the inclined portion, and the first sealing layer are joined, thereby reliably forming the junction portion.

**[0035]** Further, in the method of manufacturing a liquid crystal device according to the second aspect of the invention, it is preferable that, when a chamfered amount of the inclined portion is  $c_2$ , the following relationship be established.

Equation 5

$$(c_2/w_2) \leq -0.5 \times (d_2/w_2) + 1.2$$

**[0036]** In addition, in the method of manufacturing a liquid crystal device according to the second aspect of the invention, it is preferable that the following relationship be established.

Equation 6

$$(c_2/w_2) \leq -0.5 \times (d_2/w_2) + 0.7$$

Equation 7

$$(c_2/w_2) \geq -0.5 \times (d_2/w_2) + 0.3$$

**[0037]** If doing so, the same effects as those in the above-described manufacturing method can be obtained. In addition, leakage of the liquid crystal layer from the ring-shaped portion can be prevented, regardless of the size of the sealing member.

**[0038]** Further, the sealing member can be drawn at the same speed all over. Further, since a writing start portion or a writing end portion is sufficiently separated from the liquid crystal device, a complex control can be eliminated. Accordingly, drawing time can be markedly reduced to half to one-third of drawing time in the related art. In addition, thickening of the sealing member toward the inside of the liquid crystal device in the junction portion of the sealing member can be solved.

**[0039]** Further, according to a third aspect of the invention, in the method of manufacturing a liquid crystal device according to the first aspect of the invention, it is preferable that, in the forming of the sealing member, the first sealing layer and a first side of the ring-shaped portion be formed on a coaxial straight line along which the sealing member extends, and the second sealing layer be formed to face the first sealing layer.

**[0040]** If doing so, the same effects as those in the above-described manufacturing method can be obtained. In

addition, the first sealing layer and the first side can be formed on the coaxial straight line along which the sealing member extends, that is, the first sealing layer can be formed so as to be continuous with respect to the first side. Further, the second sealing layer can be formed to face the first sealing layer.

**[0041]** Further, since the first sealing layer and the first side are formed on the coaxial straight line, drawing time can be reduced, as compared with the case in which the first sealing layer is formed while drawing the curve or inclined line.

**[0042]** Further, in the method of manufacturing a liquid crystal device according to the third aspect of the invention, it is preferable that, when a line width of the sealing member in the ring-shaped portion after the bonding of the first substrate to the second substrate is performed is  $w_1$ , and a distance between the central line of the first sealing layer and the central line of the second sealing layer is  $d_1$ , the following relationship be established.

Equation 8

$$0 \leq d_1 \leq 0.8 \times w_1$$

**[0043]** If doing so, the same effects as those in the above-described manufacturing method can be obtained. In

addition, even when the variation of the size of the sealing member occurs, the first sealing layer and the second sealing layer are reliably joined, thereby forming the junction portion.

**[0044]** Further, in the method of manufacturing a liquid crystal device according to the third aspect of the invention, it is preferable that, in the forming of the sealing member, in an axis direction perpendicular to an axis direction of the first side of the ring-shaped portion, a second side be formed, and the second sealing layer be formed so as to be continuous with respect to the second side via a curved portion.

**[0045]** If doing so, the same effects as those in the above-described manufacturing method can be obtained. In addition, the second sealing layer, which is connected to the second side via the curved portion, and the first sealing layer are joined, thereby reliably forming the junction portion.

**[0046]** Further, in the method of manufacturing a liquid crystal device according to the third aspect of the invention, it is preferable that, when the radius of the curved is R1, the following relationship be established.

Equation 9

$$(R1/w1) \leq -2.0 \times (d1/w1) + 3.0$$

**[0047]** In addition, in the method of manufacturing a liquid crystal device according to the third aspect of the invention, it is preferable that the following equation be established.

Equation 10

$$(R1/w1) \leq -1.7 \times (d1/w1) + 2.0$$

Equation 11

$$(R1/w1) \geq -1.2 \times (d1/w1) + 1.0$$

**[0048]** If doing so, the same effects as those in the above-described manufacturing method can be obtained. In addition, leakage of the liquid crystal layer from the ring-shaped portion can be prevented, regardless of the size of the sealing member.

**[0049]** Further, the sealing member can be drawn at the same speed all over. Further, since a writing start portion or a writing end portion is sufficiently separated from the liquid crystal device, a complex control can be eliminated. Accordingly, drawing time can be markedly reduced to half to one-third of drawing time in the related art. In addition, thickening of the sealing member toward the inside of the liquid crystal device in the junction portion of the sealing member can be solved.

**[0050]** Further, in the method of manufacturing a liquid crystal device according to the third aspect of the invention, it is preferable that, in the forming of the sealing member, in an axis direction perpendicular to an axis direction of the first side of the ring-shaped portion, a second side be formed, and the second sealing layer be formed so as to be continuous with respect to the second side via an inclined portion.

**[0051]** If doing so, the same effects as those in the above-described manufacturing method can be obtained. In addition, the second sealing layer, which is connected to the second side via the inclined portion, and the first sealing layer are joined, thereby reliably forming the junction portion.

**[0052]** Further, in the method of manufacturing a liquid crystal device according to the third aspect of the invention, it is preferable that, when a chamfered amount of the inclined portion is  $c1$ , the following relationship be established.

Equation 12

$$(c1/w1) \leq -0.5 \times (d1/w1) + 1.2$$

**[0053]** In addition, in the method of manufacturing a liquid crystal device according to the third aspect of the

invention, it is preferable that the following relationship be established.

Equation 13

$$(c1/w1) \leq -0.5 \times (d1/w1) + 0.7$$

Equation 14

$$(c1/w1) \geq -0.5 \times (d1/w1) + 0.3$$

**[0054]** If doing so, the same effects as those in the above-described manufacturing method can be obtained. In addition, leakage of the liquid crystal layer from the ring-shaped portion can be prevented, regardless of the size of the sealing member.

**[0055]** Further, the sealing member can be drawn at the same speed all over. Further, since a writing start portion or a writing end portion is sufficiently separated from the liquid crystal device, a complex control can be eliminated. Accordingly, drawing time can be markedly reduced to half to one-third of drawing time in the related art. In addition, thickening of the sealing member toward the inside of the liquid crystal device in the junction portion of the sealing member can be solved.

**[0056]** Further, according to a fourth aspect of the invention, in the method of manufacturing a liquid crystal



device according to the first aspect, it is preferable that a first base substrate having a plurality of first element regions be divided at mutual boundary portions of the plurality of first element regions, such that the first substrate is obtained for each first element region, and a second base substrate having a plurality of second element regions be divided at mutual boundary portions of the plurality of second element regions, such that the second substrate is obtained for each second element region.

**[0057]** If doing so, the same effects as those in the above-described manufacturing method can be obtained. In addition, since the plurality of first element regions and the plurality of second element regions are divided and taken out from the first base substrate and the second base substrate, respectively. Therefore, the plurality of the liquid crystal devices each having the first substrate and the second substrate can be taken out. As a result, a manufacturing method having excellent productivity can be implemented.

**[0058]** Further, according to a fifth aspect of the invention, in the method of manufacturing a liquid crystal device according to the fourth aspect of the invention, it is preferable that the forming of the sealing member has forming a first sealing member which serves as one of the first

sealing layer and the second sealing layer, and a part of the ring-shaped portion, and after forming the first sealing member, forming a second sealing member which serves as the other of the first sealing layer and the second sealing layer, and a remaining part of the ring-shaped portion.

**[0059]** If doing so, the same effects as those in the above-described manufacturing method can be obtained. In addition, a liquid crystal device having the sealing member, which has the first sealing member and the second sealing member, can be manufactured. When the sealing member has one sealing member, it is difficult to form the ring-shaped portion, the first sealing layer, the second sealing layer, and the junction portion with different sealing materials. In contrast, according to the aspect of the invention, the sealing materials can be individually selected for the first sealing member and the second sealing member. Therefore, for a specified part from the parts at which the sealing member is formed, one of the first sealing member and the second sealing member can be selectively formed.

**[0060]** Further, in the method of manufacturing a liquid crystal device according to the fifth aspect of the invention, it is preferable that, in the forming of the first sealing member, in an arrangement direction of the first element regions for the plurality of first element regions and the

mutual boundary portions in the first base substrate, or in an arrangement direction of the second element regions for the plurality of second element regions and the mutual boundary portions in the second base substrate, the first sealing member be continuously and collectively formed.

**[0061]** Further, it is preferable that, after the forming of the first sealing member is performed, in the forming of the second sealing member, in an arrangement direction of the first element regions for the plurality of first element regions and the mutual boundary portions in the first base substrate, or in an arrangement direction of the second element regions for the plurality of second element regions and the mutual boundary portions in the second base substrate, the second sealing member be continuously and collectively formed.

**[0062]** If doing so, through a single process from the start of drawing of the first sealing member to the end of drawing and a single process from the start of drawing of the second sealing member to the end of drawing, the sealing member can be collectively formed with respect to the arrangement direction of the plurality of first element regions or the plurality of second element regions. Therefore, the sealing member can be easily and rapidly formed, and thus a manufacturing method having excellent

productivity can be implemented.

**[0063]** On the other hand, when the sealing member is separately formed for each of the plurality of first element regions or the plurality of second element regions, the start of drawing and the end of drawing should be performed for each region, and then the start of drawing and the end of drawing should be repeatedly performed for the plurality of first element regions or the plurality of second element regions. Therefore, since the ejection and the non-ejection of the sealing material are continuously performed, it is difficult to cause the sealing material in the dispenser to stably flow, and the variation in the amount of the sealing material to be ejected tends to occur. Further, since the dispenser should scan the first base substrate or the second base substrate, the operation of the dispenser is complicated.

**[0064]** In contrast, in the invention, the first sealing member and the second sealing member are continuously and collectively formed in the arrangement direction of the first element regions or the second element regions, and thus the start of drawing and the end of drawing can be performed for each column or each row of the first element regions or the second element regions, such that the number of starts of drawing and the number of ends of drawing can be reduced. Therefore, the first sealing member and the second sealing

member can be continuously and collectively formed, while causing the sealing material in the dispenser to stably flow. Further, the sealing member can be formed in short time. Further, since the dispenser does not scan the first element regions or the second element regions in a non-ejection state, the sealing material filled in the dispenser can be prevented from being inadvertently dropped. As a result, the operation of the dispenser can be simplified, and the variation in viscosity of the sealing material or the variation in the ejection amount can be suppressed.

**[0065]** Further, the sealing members of the first element regions and the second element regions formed in such a manner are joined via the junction portion, and thus leakage of a liquid crystal material between adjacent regions can be prevented.

**[0066]** Further, in the method of manufacturing a liquid crystal device according to the fifth aspect of the invention, it is preferable that the forming of the first sealing member and the forming of the second sealing member be performed on the first base substrate or the second base substrate. Further, it is preferable that the forming of the first sealing member and the forming of the second sealing member be performed on only one of the first base substrate and the second base substrate.

**[0067]** If doing so, the same effects as those in the above-described manufacturing method can be obtained.

**[0068]** Further, according to a sixth aspect of the invention, a liquid crystal device includes a first substrate and a second substrate that face each other with a liquid crystal layer interposed therebetween, and a sealing member that are formed in peripheral portions of both substrates. The liquid crystal device is manufactured by the method of manufacturing a liquid crystal device described above.

**[0069]** If doing so, since the ring-shaped portion is blocked by the part of the junction portion, leakage of the liquid crystal material from the junction portion can be suppressed, and reliability of the liquid crystal device can be enhanced. Further, since the junction portion is formed outside the ring-shaped portion, excluding the part for blocking the ring-shaped portion, even when the width of the junction portion is thickened by bonding the first substrate to the second substrate, the width of the junction portion is increased only outside the ring-shaped portion, and thus the sealing member can be suppressed from protruding inside the ring-shaped portion. Further, there is no case in which the cell gap inside the ring-shaped portion is influenced, and thus the cell gap can be uniformly maintained. Further, as compared with the related art, the width of each member of

the ring-shaped portion and the junction portion does not need to be adjusted, and the ring-shaped portion and the junction portion can be formed with a member having the same width.

**[0070]** Further, in the liquid crystal device according to the sixth aspect of the invention, it is preferable that the sealing member have a single member, the liquid crystal layer be held in a portion surrounded by the single member in a ring shape, and the junction portion join one end and the other end of the single member at a single place.

**[0071]** Here, 'the sealing member is formed of the single member' means one which is formed by continuously ejecting the sealing material from the beginning to the termination, that is, one which is formed by ejecting the sealing material with so-called one stroke of a brush, unlike the sealing member having the first sealing member and the second sealing member to be described below.

**[0072]** If doing so, the same effects as those in the above-described liquid crystal device can be obtained. In addition, a liquid crystal device having the sealing member, which has the single member, can be implemented. Further, since the ring-shaped portion is blocked by the junction portion, which joins the beginning and the termination of the sealing member at one place, the junction portion can be

formed to the minimum. Therefore, as compared with the case in which the plurality of junction portions are provided, the liquid crystal device in which the defective cell gap is more reliably suppressed can be implemented.

**[0073]** Further, in the liquid crystal device according to the sixth aspect of the invention, it is preferable that the sealing member have a first sealing member and a second sealing member, the ring-shaped portion hold the liquid crystal layer in a portion surrounded by the first sealing member and the second sealing member in a ring shape, and the junction portion join one ends of the first sealing member and the second sealing member and also join the other ends of the first sealing member and the second sealing member.

**[0074]** If doing so, the same effect as those in the above-described liquid crystal device can be obtained. In addition, a liquid crystal device having the sealing member, which has the first sealing member and the second sealing member, can be implemented. When the sealing member has a single member, it is difficult to form the ring-shaped portion or the junction portion with different sealing materials. In contrast, according to the aspect of the invention, the sealing material can be selected for each of the first sealing member and the second sealing member. Therefore, for a specified part from the parts at which the sealing member



is formed, one of the first sealing member and the second sealing member can be selectively formed.

**[0075]** Further, according to a seventh aspect of the invention, an electronic apparatus includes the liquid crystal device described above.

**[0076]** According to this configuration, an electronic apparatus having a display unit, which has excellent reliability and performs high-quality display, is provided.

#### BRIEF DESCRIPTION OF THE DRAWINGS

**[0077]** The invention will be described with reference to the accompanying drawings, wherein like numbers reference like elements.

**[0078]** Fig. 1 is a plan view of a liquid crystal device according to a first embodiment of the invention.

**[0079]** Fig. 2 is a cross-sectional view of the liquid crystal device according to the first embodiment of the invention taken along the line II-II of Fig. 1.

**[0080]** Fig. 3 is a plan view of parts of the liquid crystal device according to the first embodiment of the invention.

**[0081]** Fig. 4 is a plan view of parts of the liquid crystal device according to the first embodiment of the invention.

**[0082]** Fig. 5 is an equivalent circuit diagram of the liquid crystal device according to the first embodiment of the invention.

**[0083]** Fig. 6 is a plan view of various elements of the liquid crystal device according to the first embodiment of the invention.

**[0084]** Fig. 7A is a diagram schematically illustrating a method of manufacturing a liquid crystal device according to an embodiment of the invention.

**[0085]** Fig. 7B is a diagram schematically illustrating a method of manufacturing a liquid crystal device according to the embodiment of the invention.

**[0086]** Fig. 7C is a diagram schematically illustrating a method of manufacturing a liquid crystal device according to the embodiment of the invention.

**[0087]** Fig. 8 is a diagram showing the configuration of a device manufacturing apparatus which is used for a method of manufacturing a liquid crystal device according to the embodiment of the invention.

**[0088]** Fig. 9 is a diagram showing the configuration of a substrate load/unload unit and a material supply unit which are used for a method of manufacturing a liquid crystal device according to the embodiment of the invention.

**[0089]** Fig. 10 is a diagram showing the configuration of a

substrate bonding unit which is used for a method of manufacturing a liquid crystal device according to the embodiment of the invention.

**[0090]** Fig. 11 is a diagram showing the configuration of a precise alignment unit which is used for a method of manufacturing a liquid crystal device according to the embodiment of the invention.

**[0091]** Fig. 12A is a diagram showing the configuration of an example of a liquid droplet ejection head which is used for a method of manufacturing a liquid crystal device according to the embodiment of the invention.

**[0092]** Fig. 12B is a diagram showing the configuration of an example of a liquid droplet ejection head which is used for a method of manufacturing a liquid crystal device according to the embodiment of the invention.

**[0093]** Fig. 13 is a diagram illustrating a driving voltage waveform and an operation of a piezoelectric element in the liquid droplet ejection head of Fig. 12.

**[0094]** Fig. 14A is a diagram illustrating a method of manufacturing a liquid crystal device according to the embodiment of the invention.

**[0095]** Fig. 14B is a diagram illustrating a method of manufacturing a liquid crystal device according to the embodiment of the invention.

**[0096]** Fig. 14C is a diagram illustrating a method of manufacturing a liquid crystal device according to the embodiment of the invention.

**[0097]** Fig. 15A is a diagram illustrating a method of manufacturing a liquid crystal device according to the embodiment of the invention.

**[0098]** Fig. 15B is a diagram illustrating a method of manufacturing a liquid crystal device according to the embodiment of the invention.

**[0099]** Fig. 15C is a diagram illustrating a method of manufacturing a liquid crystal device according to the embodiment of the invention.

**[0100]** Fig. 16A is a diagram illustrating a method of manufacturing a liquid crystal device according to the embodiment of the invention.

**[0101]** Fig. 16B is a diagram illustrating a method of manufacturing a liquid crystal device according to the embodiment of the invention.

**[0102]** Fig. 17A is a diagram showing a method of forming a sealing member in a method of manufacturing a liquid crystal device according to the embodiment of the invention.

**[0103]** Fig. 17B is a diagram showing a method of forming a sealing member in a method of manufacturing a liquid crystal device according to the embodiment of the invention.

**[0104]** Fig. 18A is a diagram showing the appearance of a mother substrate in a method of manufacturing a liquid crystal device according to the embodiment of the invention.

**[0105]** Fig. 18B is a diagram showing the appearance of a mother substrate in a method of manufacturing a liquid crystal device according to the embodiment of the invention.

**[0106]** Fig. 18C is a diagram showing the appearance of a mother substrate in a method of manufacturing a liquid crystal device according to the embodiment of the invention.

**[0107]** Fig. 19 is a plan view showing parts of a sealing member of a liquid crystal device according to a second embodiment of the invention.

**[0108]** Fig. 20 is a plan view of a liquid crystal device according to a third embodiment of the invention.

**[0109]** Fig. 21 is a plan view of parts of the liquid crystal device according to the third embodiment of the invention.

**[0110]** Fig. 22 is a plan view of parts of the liquid crystal device according to the third embodiment of the invention.

**[0111]** Fig. 23A is a diagram showing a method of forming a sealing member of the liquid crystal device according to the third embodiment of the invention.

**[0112]** Fig. 23B is a diagram showing a method of forming a

sealing member of the liquid crystal device according to the third embodiment of the invention.

**[0113]** Fig. 24A is a plan view showing parts of a sealing member of the liquid crystal device according to the third embodiment of the invention.

**[0114]** Fig. 24B is a plan view showing parts of a sealing member of the liquid crystal device according to the third embodiment of the invention.

**[0115]** Fig. 24C is a plan view showing parts of a sealing member of the liquid crystal device according to the third embodiment of the invention.

**[0116]** Fig. 25 is a plan view showing parts of a sealing member of a liquid crystal device according to a fourth embodiment of the invention.

**[0117]** Fig. 26 is a plan view of a liquid crystal device according to a fifth embodiment of the invention.

**[0118]** Fig. 27 is a plan view of a liquid crystal device according to a sixth embodiment of the invention.

**[0119]** Fig. 28 is a plan view of a liquid crystal device according to a seventh embodiment of the invention.

**[0120]** Fig. 29 is a plan view of a liquid crystal device according to a modification of the seventh embodiment of the invention.

**[0121]** Fig. 30 is a plan view of a liquid crystal device

according to an eighth embodiment of the invention.

**[0122]** Fig. 31 is a plan view of a liquid crystal device according to a ninth embodiment of the invention.

**[0123]** Fig. 32 is a diagram illustrating an example of the invention.

**[0124]** Fig. 33 is a diagram illustrating an example of the invention.

**[0125]** Fig. 34 is a diagram illustrating an example of the invention.

**[0126]** Fig. 35 is a diagram illustrating an example of the invention.

**[0127]** Fig. 36 is a diagram illustrating an example of the invention.

**[0128]** Fig. 37 is a diagram illustrating an example of the invention.

**[0129]** Fig. 38 is a diagram illustrating an example of the invention.

**[0130]** Fig. 39 is a diagram illustrating an example of the invention.

**[0131]** Fig. 40 is a diagram illustrating an example of the invention.

**[0132]** Fig. 41 is a diagram illustrating an example of the invention.

**[0133]** Fig. 42 is a diagram illustrating an example of the

invention.

**[0134]** Fig. 43 is a diagram illustrating an example of the invention.

**[0135]** Fig. 44 is a diagram illustrating an example of the invention.

**[0136]** Fig. 45 is a diagram illustrating an example of the invention.

**[0137]** Fig. 46 is a diagram illustrating an example of the invention.

**[0138]** Fig. 47A is a perspective view showing an electronic apparatus according to the embodiment of the invention.

**[0139]** Fig. 47B is a perspective view showing an electronic apparatus according to the embodiment of the invention.

**[0140]** Fig. 47C is a perspective view showing an electronic apparatus according to the embodiment of the invention.

**[0141]** Fig. 48A is a diagram illustrating the related art.

**[0142]** Fig. 48B is a diagram illustrating the related art.

**[0143]** Fig. 48C is a diagram illustrating the related art.

**[0144]** Fig. 48D is a diagram illustrating the related art.

**[0145]** Fig. 49 is a diagram illustrating the related art.

**[0146]** Fig. 50 is a diagram illustrating the related art.



## DESCRIPTION OF EXEMPLARY EMBODIMENTS

**[0147]** Hereinafter, embodiments of a liquid crystal device, a method of manufacturing a liquid crystal device, and an electronic apparatus according to an embodiment of the invention will be described with reference to the drawings. Moreover, in the respective drawings used for the following description, the scale of each layer or member has been adjusted in order to have a recognizable size.

## First Embodiment

**[0148]** First, a liquid crystal device according to a first embodiment of the invention will be described.

**[0149]** The liquid crystal device of the present embodiment described below is an example of an active matrix type liquid crystal device which uses a thin film diode (hereinafter, referred to as TFD) as a switching element. The liquid crystal device of the present invention is also a transmissive liquid crystal device in which transmissive display can be performed.

**[0150]** Fig. 1 is a plan view of individual constituent parts of the liquid crystal device according to the present embodiment as viewed from a counter substrate. Fig. 2 is a cross-sectional view taken along the line II-II of Fig. 1.

Further, Fig. 3 is a plan view showing a region denoted by a symbol C in Fig. 1 on a magnified scale. Fig. 4 is a plan view illustrating the configuration of a sealing member in detail. Fig. 5 is an equivalent circuit diagram of various elements, wiring lines, and the like in a plurality of pixels formed in an image display region 4 of the liquid crystal device in a matrix shape. Fig. 6 is a diagram illustrating planar electrode structures (pixel structures) of various elements.

**[0151]** As shown in Figs. 1 to 3, the liquid crystal device 100 of the present embodiment primarily has a TFD substrate (first substrate) 10, a counter substrate (second substrate) 20, a sealing member 52, and a liquid crystal layer 50. Further, the sealing member 52 is formed in peripheral portions of the TFD substrate 10 and the counter substrate 20 to be interposed between both substrates. In addition, the liquid crystal layer 50 is filled and held between the TFD substrate 10 and the counter substrate 20 and inside the sealing member 52.

**[0152]** Next, the individual constituent parts will be described in detail.

**[0153]** The TFD substrate 10 is formed of a transparent member, such as a glass substrate or the like. On a surface of the TFD substrate 10, the image display region 4, the

sealing member 52, a periphery sacrificial member 53, a conductive pad (first conductive portion or conductive region) 54, a scanning signal driving circuit 110, and a data signal driving circuit 120 are provided.

**[0154]** In the image display region 4, a plurality of dots are formed in a matrix shape, and, for each dot, a pixel electrode 31 and a TFD element 40 are formed. The pixel electrode 31 is a transparent electrode primarily formed of ITO (Indium Tin Oxide). The TFD element 40 is connected to the scanning signal driving circuit 110 via an SEG electrode 56, such that a driving signal of the scanning signal driving circuit 110 is applied to the pixel electrode 31 as a potential. On a surface of the pixel electrode 31, an alignment film, which is primarily formed of polyimide to be subjected to a rubbing treatment, is formed, such that the alignment of liquid crystal molecules of the liquid crystal layer 50 with no voltage applied thereto is parallel to a rubbing direction. The periphery sacrificial member 53 is formed of a light-shielding material between the image display region 4 and the sealing member 52. The conductive pad 54 is connected to the data signal driving circuit 120 via a relay wiring line shown in Fig. 3 so as to be electrically connected to a COM electrode (second conductive portion or conductive region) 57, which is formed in a

counter substrate 20 to be described below. The scanning signal driving circuit 110 and the data signal driving circuit 120 are formed at one side of the TFD substrate 10 (the left side of Fig. 1). Then, the SEG electrode 56 which extends from the scanning signal driving circuit 110, overlaps the sealing member 52 (52a) between the scanning signal driving circuit 110 and the image display region 4. Further, the relay wiring line 55, which extends from the data signal driving circuit 120, overlaps the sealing member 52 (52a) between the data signal driving circuit 120 and the conductive pad 54.

**[0155]** Moreover, in Fig. 3, some of the relay wiring lines 55, a part of the conductive pad 54, and some of the COM electrodes 57 are shown. Actually, the same number of the relay wiring lines 55 as the number of terminals of the data signal driving circuit 120 are formed, and a plurality of conductive pads 54 and a plurality of COM electrodes 57 are formed in a horizontal direction of Fig. 1.

**[0156]** On the counter substrate 20, in a region facing the boundary region of the pixel electrodes on the TFD substrate 10, a light-shielding film 23, which is called a black matrix or a black stripe, is formed, and a pixel electrode 9 formed of ITO film is formed thereon. Further, on the pixel electrode 9, an alignment film, which is primarily formed of

polyimide to be subjected to the rubbing treatment, is formed. Further, as shown in Fig. 3, outside the image display region 4, the COM electrode 57 is formed at a position where the pixel electrode 9 extends. The COM electrode 57 is formed to face the conductive pad 54, such that a sealing member 52b (described below) containing conductive particles is interposed between the COM electrode 57 and the conductive pad 54. Therefore, a driving signal of the data signal driving circuit 120 is applied to the pixel electrode 9 as a potential via the relay wiring line 55, the conductive pad 54, the conductive particles, and the COM electrode 57.

**[0157]** The sealing member 52 has an insulating sealing member (second sealing member) 52a and a conductive sealing member (first sealing member) 52b.

**[0158]** Here, the insulating sealing member 52a is a sealing member having an electrical insulation property, and the conductive sealing member 52b is a sealing member having conductivity. The insulating sealing member 52a is formed in a non-conductive region on the relay wiring line 55 and the SEG electrode 56 so as to cause a non-conduction state between a plurality of wiring lines or electrodes in the relay wiring line 55 and the SEG electrode 56. On the other hand, the conductive sealing member 52b is formed in a conductive region of the conductive pad 54 or the COM

electrode 57 so as to cause a conduction state between the conductive pad 54 and the COM electrode 57.

**[0159]** Further, while the conductive sealing member 52b contains the conductive particles, the insulating sealing member 52a does not contain conductive particles. As the conductive particles, particles of conductive material, such as metal particles or the like, particles obtained by performing a plating treatment on the surface of resin, or the like are adopted. The conductive particles have elasticity, and thus, when the TFD substrate 10 and the counter substrate 20 are bonded to each other, the conductive pad 54 and the COM electrode 57 press the conductive particles, such that the conductive pad 54 and the COM electrode 57 are in conductive states.

**[0160]** Further, for any one of the insulating sealing member 52a and the conductive sealing member 52b, as a primary sealing material, a thermosetting or ultraviolet curable resin material or a resin material having both the thermosetting and ultraviolet curable characteristics according to a curing process is adopted. In the present embodiment, World Lock No. 717, supplied by Kyoritsu Chemical & Co., Ltd., is adopted as the sealing member 52. This material has viscosity of 400,000 mPa·s, and the thickness of the sealing member 52 after bonding is 8  $\mu\text{m}$ .

**[0161]** In addition, the insulating sealing member 52a and the conductive sealing member 52b are formed in a pattern shown in Fig. 4, and thus a single ring-shaped portion 58 for holding the liquid crystal layer 50 therein and junction portions 59 for the insulating sealing member 52a and the conductive sealing member 52b are constituted. The sealing member 52 formed in such a pattern is formed in a closed frame shape within the surface of the TFD substrate 10 with no liquid crystal hole. Further, the sealing member 52 is formed by ejecting the sealing material onto the TFD substrate 10 or the counter substrate 20 from a dispenser, which is then pressed by the TFD substrate 10 and the counter substrate 20 so as to be compressed, such that a predetermined cell gap is maintained.

**[0162]** In the ring-shaped portion 58, the insulating sealing member 52a is formed so as to pass through points R, S, T, and O in Fig. 4 and the conductive sealing member 52b is formed so as to pass through points O, P, Q, and R in Fig. 4.

**[0163]** In the junction portions 59, the insulating sealing member 52a and the conductive sealing member 52b are joined at points O and R. Therefore, the junction portions 59 are formed at a place on the side TP and at a place on the side SQ. That is, the junction portions 59 are individually

formed on opposite sides of the ring-shaped portion 58.

**[0164]** Further, the junction portions 59 are formed so as to be continuous with respect to the ring-shaped portion 58 and block (close) the ring-shaped portion 58 at the points O and R. Accordingly, the liquid crystal layer 50 held inside the ring-shaped portion 58 can be prevented from leaking outside the sealing member 52. Further, at the points O and R, parts of the individual junction portions 59 are integrated into the ring-shaped portion 58, and the other parts of the individual junction portions 59 are formed outside the ring-shaped portion 58. That is, the junction portions 59 are formed toward the outside of the ring-shaped portion 58 from the portions for blocking the ring-shaped portion 58 (points O and R). Therefore, the junction portions 59 are not formed to overlap the ring-shaped portion 58. Only parts of the individual junction portions 59 join the ring-shaped portion 58 and the other parts thereof are formed toward the outside of the ring-shaped portion 58.

**[0165]** Further, as shown in Fig. 3, the junction portion 59 is formed between an end (symbol A) of the conductive pad 54 and an end (symbol B) of the relay wiring line 55 crossing the sealing member 52, that is, in a portion indicated by a symbol L. In the liquid crystal device 100 of the present embodiment, the distance denoted by the symbol L is set to be



equal to or less than 2 mm.

**[0166]** Further, as described below, the junction portions 59 are formed by drawing the insulating sealing member 52a and the conductive sealing member 52b from the dispenser in a non-contact state to face each other, and then pressing the sealing members 52a and 52b through the bonding process so as to be contacted and joined.

**[0167]** The liquid crystal layer 50 is disposed inside the ring-shaped portion 58. For example, the liquid crystal layer 50 is ejected and formed by an ink jet method (liquid droplet ejection method) or a dispenser method. Further, the thickness of the liquid crystal layer 50 is determined to have the predetermined cell gap in connection with the thickness of the sealing member 52. Further, for the liquid crystal layer 50, a material is suitably selected according to an operation mode of the liquid crystal device 100, for example, an operation mode, such as a TN (Twisted Nematic) mode or an STN (Super Twisted Nematic) mode, or a normally white mode/normally black mode.

**[0168]** Next, the image display region 4 of the liquid crystal device 100 will be described in detail.

**[0169]** As shown in the equivalent circuit of Fig. 5, the liquid crystal device 100 has a plurality of scanning lines 13 and a plurality of data lines (pixel electrodes) 9

crossing the scanning lines 13. The scanning lines 13 are driven by the scanning signal driving circuit 110 and the data lines are driven by the data signal driving circuit 120. Here, the scanning lines 13 are correspondingly connected to the SEG electrodes 56 outside the image display region 4. Therefore, in each pixel region 150, the TFD element 40 and a liquid crystal display element 160 (liquid crystal layer 150) are connected in series between the scanning line 13 and the data line 9. Moreover, in Fig. 5, the TFD element 40 is connected to the scanning line 13, and the liquid crystal display element 160 is connected to the data line 9. Alternatively, the TFD element 40 may be connected to the data line 9, and the liquid crystal display element 160 may be connected to the scanning line 13.

**[0170]** Further, as shown in the planar electrode structure of Fig. 6, in the liquid crystal device 100, the pixel electrodes 31, which have rectangular shapes in plan view and are connected to the scanning lines 13 via the TFD elements 40, are provided in a matrix shape. The pixel electrodes 9 are provided in stripe shape so as to face the pixel electrodes 31 in a vertical direction of Fig. 6. The pixel electrodes 9 are formed by the data lines and have the stripe shape so as to cross the scanning lines 13. In the present embodiment, an individual region in which each pixel

electrode 31 is formed in one dot region, and the TFD elements 40 are provided in the individual dot regions arranged in a matrix shape, such that display can be performed for each dot region.

**[0171]** Here, the TFD element 40 is a switching element for connecting the scanning line 13 and the pixel electrode 31. The TFD element 40 has an MIM structure which includes a first conductive film primarily formed of tantalum (Ta), an insulating film formed on the surface of the first conductive film and primarily formed of  $Ta_2O_3$ , and a second conductive film formed on the surface of the insulating film and primarily formed of chromium (Cr). Further, the first conductive film of the TFD element 40 is connected to the scanning line 13, and the second conductive film thereof is connected to the pixel electrode 31.

**[0172]** Moreover, the scanning signal driving circuit 110 and the data signal driving circuit 120 may be not formed on the TFD substrate 10. Alternatively, a TAB (Tape Automated Bonding) substrate with a driving LSI mounted thereon may be electrically and mechanically connected via an anisotropy conductive film to a group of terminals which is formed in the peripheral portion of the TFD substrate 10. Moreover, in the liquid crystal device 100, a retardation plate, a polarizing plate, and the like, which are not shown in the

drawings, may be disposed in a predetermined direction according to the kind of the liquid crystal layer 50 to be used, that is, the operation mode, such as the TN (Twisted Nematic) mode or the STN (Super Twisted Nematic) mode, or the normally white mode/normally black mode. Further, when the liquid crystal device 100 is constituted for color display, in regions facing individual pixel electrodes of the TFD substrate 10 described below in the counter substrate 20, color filters of R, G, and B, and a protective film for protecting the color filters may be formed.

**[0173]** Next, a method of manufacturing a liquid crystal device according to the first embodiment of the invention will be described.

**[0174]** First, in the following description, (1) Schematic Description of Manufacturing Method of Liquid Crystal Device, (2) Device Manufacturing Apparatus, and (3) Detailed Description of Manufacturing Method of Liquid Crystal Device will be sequentially described.

(1) Schematic Description of Manufacturing Method of Liquid Crystal Device

**[0175]** Figs. 7A to 7C are diagrams schematically illustrating the method of manufacturing a liquid crystal device.

**[0176]** First, as shown in Fig. 7A, a mother substrate 10' for a TFD substrate (first base substrate) and a mother substrate 20' for a counter substrate (second base substrate) are prepared.

**[0177]** In the mother substrate 10' for the TFD substrate (first base substrate), a plurality of TFD formation regions (first element regions) 11 are divided and formed. Further, a periphery of each divided TFD formation region 11 becomes a mutual boundary portion 12. Next, on the mother substrate 10' for a TFD substrate, a semiconductor manufacturing process including a known photolithography technology is performed, such that the TFDs 40, the pixel electrodes 31, the conductive pad 54, the relay wiring lines 55, the SEG electrodes 56, the alignment film, and the like are formed in the individual TFD formation regions 11. Moreover, the scanning signal driving circuit 110 and the data signal driving circuit 120 may be simultaneously incorporated into the TFD formation region 11.

**[0178]** On the other hand, in the mother substrate 20' for a counter substrate, a plurality of counter electrode formation regions (second element regions) 21 are divided and formed. Further, a periphery of each divided counter electrode formation region 21 becomes a mutual boundary portion 22. Next, on the mother substrate 20' for a counter

substrate, a semiconductor manufacturing process including a known photolithography technology is performed, such that the pixel electrodes 9, the COM electrodes 57, the alignment film, and the like are formed in the individual counter electrode formation regions 21.

**[0179]** Here, the number of TFD formation regions 11 is the same as the number of counter electrode formation regions 21. Further, when the mother substrate 10' for a TFD substrate and the mother substrate 20' for a counter substrate are bonded to each other, the individual regions 11 and 21 are positioned with respect to each other with high precision.

**[0180]** Next, as shown in Fig. 7B, the mother substrate 10' for a TFD substrate and the mother substrate 20' for a counter substrate are bonded to each other. Here, the mother substrate 10' for a TFD substrate and the mother substrate 20' for a counter substrate are bonded to each other in a state in which the sealing member or the liquid crystal layer 50 described below is interposed therebetween.

**[0181]** Next, as shown in Fig. 7C, in a state in which the mother substrates 10' and 20' are bonded to each other, the mother substrates 10' and 20' are divided and cut along the mutual boundary portions 12 and 22, such that a plurality of liquid crystal devices 100 are formed.

## (2) Device Manufacturing Apparatus

**[0182]** Next, a device manufacturing apparatus which performs processes of the formation of the sealing member 52, the formation of the liquid crystal layer 50 by dropping liquid droplets, bonding of the substrates, and curing of the sealing member 52 in the manufacturing process of the liquid crystal device 100 will be described.

**[0183]** Fig. 8 is a diagram showing the schematic configuration of the device manufacturing apparatus 61.

**[0184]** As shown in Fig. 8, the device manufacturing apparatus 61 primarily has a substrate load/unload unit 62 that loads and unloads a substrate, a material supply unit 63, a substrate bonding unit 64, and a precise alignment unit 164.

**[0185]** Fig. 9 is a diagram showing the schematic configurations of the substrate load/unload unit 62 and the material supply unit 63. Moreover, hereinafter, on an assumption that directions along the surface of the substrate are referred to as an X direction (for example, a horizontal direction in Fig. 9) and a Y direction (for example, a vertical direction to the paper in Fig. 9), and a direction perpendicular to an XY plane is referred to as a Z direction, the description will be given.

**[0186]** As shown in Fig. 9, the material supply unit 63 primarily has a table 65 which freely moves in the X

direction, the Y direction, and a  $\theta$  direction (rotation direction around an axis parallel to the Z axis) while holding the substrate, a liquid droplet ejection head 66 that is disposed above the table 65 so as to eject and drop a liquid crystal material (electro-optical material), and sealing material coating units 67a and 67b that are disposed in the vicinity of the liquid droplet ejection head 66 so as to coat the sealing material.

**[0187]** In the sealing material coated by the sealing material coating units 67a and 67b, a substantially spherical gap control material is included, the diameter of the gap control material is formed to have the appropriate size (for example, the diameter of 8  $\mu\text{m}$ ) to maintain the cell gap of the substrate at a predetermined thickness (for example, 3  $\mu\text{m}$ ). The diameter (about 8  $\mu\text{m}$ ) of the gap control material is set to maintain the thickness (about 5  $\mu\text{m}$ ) of the color filter in the display region or the like and the cell gap (3  $\mu\text{m}$ ).

**[0188]** Further, the sealing material coating unit 67a coats the insulating sealing member 52a and the sealing material coating unit 67b coats the conductive sealing member 52b.

**[0189]** Moreover, in order to drop the liquid crystal material, in addition to the liquid droplet ejection head 66,



any device may be used as long as the dropping amount of the liquid crystal material can be controlled. For example, a precise liquid ejector (measuring dispenser) or the like may be used. Further, the gap control material is not limited to a spherical shape or one included in the sealing material. For example, various gap control materials, such as one which is formed in a fibrous shape and is included in the sealing material, one which is formed to protrude from the substrate in a columnar shape, not included in the sealing material, and the like, can be used. Preferably, one, which is fixed at a predetermined position of the substrate and does not move on the substrate at the time of bonding the substrates or the like, is used.

**[0190]** Further, the substrate load/unload unit 62 primarily has a carrier which transfers the substrate between the material supply unit 63 and the substrate bonding unit 64 and between the substrate bonding unit 64 and the precise alignment unit 164.

**[0191]** Moreover, in addition to the configuration shown in Fig. 9, the substrate load/unload unit 62 may be configured to have a transfer robot or a unit having a transfer function for connecting the material supply unit 63, the substrate bonding unit 64, and the precise alignment unit 164.

**[0192]** Fig. 10 is a diagram showing the schematic

configuration of the substrate bonding unit 64.

**[0193]** As shown in Fig. 10, the substrate bonding unit 64 is configured to have a table 68 that freely moves in the X direction, the Y direction, and the  $\theta$  direction while holding the substrate, a lower chuck unit 69 that is disposed on the table 68, a vacuum chamber 70 that is disposed above the lower chuck unit 69, an upper chuck unit 71 that is disposed in the vacuum chamber 70 to face the lower chuck unit 69, and a descending mechanism 72 that movably supports the upper chuck unit 71 in the Z direction and presses the upper chuck unit 71 toward the lower chuck unit 69.

**[0194]** In a wall surface of the vacuum chamber 70, inspection windows 70a and an exhaust portion 76 are provided. Above the inspection window 70a, optical measuring units, each having a bonding microscope 74 that magnifies and observes an alignment mark on the substrate via the inspection window 70a, and a CCD camera 81 that captures an image of the magnified and observed alignment mark, are provided. To the exhaust portion 76, a suction device 78 having a vacuum pump for exhausting gas in a housing space 70b (drawing a vacuum) is connected.

**[0195]** Further, the vacuum chamber 70 has a UV irradiation unit 82. The UV irradiation unit 82 has a UV lamp, such as a mercury lamp or the like, for radiating ultraviolet rays to

temporarily cure the sealing member 52, and, if necessary, a light-guiding unit, such as a fiber or the like.

**[0196]** Moreover, preferably, the UV irradiation unit 82 supplies sufficient energy to increase the viscosity of the sealing member 52. Further, a unit for applying energy to the sealing member 52 is not limited to the UV lamp. For example, according to the nature of the sealing member 52, various devices, such as a heating/cooling device, a visible light irradiation device, and the like, can be used.

**[0197]** In addition, in the substrate bonding unit 64, an image processing unit 83 that processes the image captured by the CCD camera 81, and a control unit 84 that controls the table 68 and the descending mechanism 72 on the basis of image information processed by the image processing unit 83 are provided.

**[0198]** Further, in the lower chuck unit 69 and the upper chuck unit 71, holding mechanisms (not shown) for holding the substrate on holding surfaces 69a and 71a, which face each other, are provided.

**[0199]** Moreover, in the lower chuck unit 69 and the upper chuck unit 71, any mechanism may be provided as long as the substrate can be held under a vacuum atmosphere. For example, a chuck mechanism using electrostatic force or adhesive force, or a mechanical holding mechanism for mechanically holding

the substrate may be used. Further, a holding method using adhesive force, inter-molecular force, or vacuum force, or a mechanical holding method may be used.

**[0200]** Fig. 11 is a diagram showing the schematic configuration of the precise alignment unit 164.

**[0201]** The precise alignment unit 164 schematically has a table 168 that freely moves in the X direction, the Y direction, and the  $\theta$  direction while holding the substrate, a lower chuck unit 169 that is provided on the table 168, an upper chuck unit 171 that is disposed to face the lower chuck unit 169, a pressing mechanism 172 that movably supports the upper chuck unit 171 in the Z direction and presses the upper chuck unit 171 toward the lower chuck unit 169, microscopes 174 for alignment that magnify and observe the alignment mark on the substrate, and a UV lamp 182, such as a mercury lamp or the like, that irradiates ultraviolet rays to cure the sealing member 52. Each microscope 174 for alignment constitutes an optical measuring unit of the present apparatus, together with a CCD camera 181 that captures an image of the magnified and observed alignment mark.

**[0202]** Further, in the precise alignment unit 164, an image processing unit 183 that processes the image captured by the CCD camera 181 and a control unit 184 that controls the table 168 on the basis of image information processed by

the image processing unit 183 are provided.

**[0203]** In the lower chuck unit 169 and the upper chuck unit 171, attraction mechanisms (not shown) for vacuum-attracting the substrate onto holding surfaces 169a and 171a, which face each other, are provided.

**[0204]** Moreover, in the lower chuck unit 169 and the upper chuck unit 171, any mechanism may be provided as long as sufficient holding force to move the bonded substrates in the X-axis direction and the Y-axis direction can be exerted. For example, a chuck mechanism using electrostatic force or adhesive force, or a mechanical holding mechanism for mechanically holding the substrate may be used.

**[0205]** Further, in the precise alignment unit 164, the pressing mechanism that presses the upper chuck unit 171 toward the lower chuck unit 169 may be provided.

**[0206]** Further, the UV lamp 182 is sufficient to cure the sealing member 52. In addition to the UV lamp 182, for example, various devices, such as a heating/cooling device, a visible light irradiation device, and the like, can be used according to the nature of the sealing member 52.

**[0207]** As the liquid droplet ejection head 66 shown in Fig. 6, for example, a liquid droplet ejection head having the configuration shown in Fig. 12A or 12B can be used. In a head main body 90 of the liquid droplet ejection head 66, a

reservoir 95 and a plurality of ink chamber (pressure generating chambers) 93 are formed. The reservoir 95 is a flow channel for supplying ink including an electro-optical material, such as liquid crystal or the like, to the individual ink chambers 93. Further, on one end surface of the head main body 90, a nozzle plate constituting an ink ejection surface 66P is mounted. In the nozzle plate, a plurality of nozzles 91 opens so as to eject ink. Further, a flow channel is formed from each ink chamber 93 toward the corresponding nozzle 91. On the other hand, on the other end surface of the head main body 90, a vibrating plate 94 is mounted.

**[0208]** The vibrating plate 94 constitutes wall surfaces of the ink chambers 93. Outside the vibrating plate 94, piezoelectric elements (pressure generating unit) 92 are provided to correspond to the ink chambers 93. In each of the piezoelectric elements 92, a piezoelectric material, such as crystal or the like, is interposed between a pair of electrodes (not shown).

**[0209]** Fig. 13 is a schematic view showing a driving voltage waveform W1 of the piezoelectric element and the operation of the liquid droplet ejection head 66 according to the driving voltage. Hereinafter, a case in which the driving voltage of the waveform W1 is applied to the pair of

electrodes constituting the piezoelectric element 92 will be described. First, in positive gradient portions a1 and a3, the piezoelectric element 92 contracts, the volume of the ink chamber 93 is increased, and then ink flows from the reservoir 95 into the ink chamber 93. Further, in a negative gradient portion a2, the piezoelectric element 92 expands, the volume of the ink chamber 93 is decreased, and then a pressed ink 99 is ejected from the nozzle 91. The coating amount of ink is determined according to the amplitude of the driving voltage waveform W1 or the number of application times.

**[0210]** Moreover, a driving method of the liquid droplet ejection head 66 is not limited to a piezoelectric jet type using the piezoelectric element 92. For example, a thermal ink jet type using thermal expansion may be adopted. Further, as a unit for coating liquid crystal, in addition to an ink jet head, other coating units may be used. As a liquid crystal coating unit, other than the ink jet head, for example, a dispenser may be adopted. The dispenser has a large-diameter nozzle, as compared with the ink jet head, and thus liquid crystal with high viscosity can be ejected.

(3) Detailed Description of Manufacturing Method of Liquid Crystal Device

**[0211]** Next, a process of manufacturing the liquid crystal device 100 by using the device manufacturing apparatus 61 will be described with reference to Figs. 14A to 18C.

**[0212]** Hereinafter, under an assumption that the pixel electrodes 9 and 31, and the like described in Fig. 7A have already been formed in the mother substrate 10' for a TFD substrate and the mother substrate 20' for a counter substrate, the description will be given.

**[0213]** First, as shown in Fig. 14A, the mother substrate 10' for a TFD substrate, on which the pixel electrodes 31 and the like are formed, is transported by the substrate load/unload unit 62, and is loaded on the table 65 of the material supply unit 63 while turning a sealing surface 10'a upward. Subsequently, while the table 65 is moved, the sealing materials are coated on the mother substrate 10' for a TFD substrate from the sealing material coating units 67a and 67b, such that the sealing member 52 is formed on the mother substrate 10' for a TFD substrate (sealing member forming process). Here, the sealing member 52 is formed by the insulating sealing member 52a and the conductive sealing member 52b. The insulating sealing member 52a is coated from the sealing material coating unit 67a, and the conductive sealing member 52b is coated from the sealing material coating unit 67b.



**[0214]** Here, a method of forming the sealing member 52 will be described in detail.

**[0215]** Figs. 17A and 17B are plan views illustrating the method of forming the sealing member 52. Figs. 18A to 18C are plan views showing the sealing member formed on the mother substrate. Fig. 18A is a diagram showing the appearance of the mother substrate, Fig. 18B is a diagram of a portion indicated by a symbol E in Fig. 18A on a magnified scale, and Fig. 18C is a diagram of a portion indicated by a symbol F in Fig. 18B on a magnified scale.

**[0216]** As shown in Fig. 17A, the insulating sealing member 52a is coated on the mother substrate 10' for a TFD substrate in a direction indicated by a symbol U (second sealing member forming process). Here, as described above, the plurality of TFD formation regions 11 and the mutual boundary portions 12 are formed on the mother substrate 10' for a TFD substrate, and then the insulating sealing member 52a is continuously and collectively coated to cover the TFD formation regions 11 and the mutual boundary portions 12. Further, the direction indicated by the symbol U represents the same direction as the arrangement direction of the plurality of TFD formation regions 11.

**[0217]** Here, when the insulating sealing member 52a is coated and formed, a first side 58a, which is a part of the

ring-shaped portion 58, is formed on a lateral side of the TFD formation region 11. Further, in the mutual boundary portion 12, a first sealing layer 59a, which is formed so as to be continuous with respect to the first side 58a, is formed. Here, the first sealing layer 59a is formed in an indented portion W which is indented toward the TFD formation region 11 from an extended axis direction (symbol U) of the first side 58a in the mutual boundary portion 12. The indented portion W is formed in a so-called 'U' shape.

**[0218]** Next, as shown in Fig. 17B, the conductive sealing member 52b is coated on the mother substrate 10' for a TFD substrate in a direction indicated by a symbol V (first sealing member forming process). In this process, like the insulating sealing member 52a, the conductive sealing member 52b is continuously and collectively coated to cover the plurality of TFD formation regions 11 and the mutual boundary portions 12. Further, the direction indicated by the symbol V represents the same direction as the arrangement direction of the plurality of TFD formation regions 11.

**[0219]** Here, when the conductive sealing member 52b is coated and formed, a second side 58b, which is a part of the ring-shaped portion 58, is formed in an axis direction perpendicular to the extended axis (symbol V) of the first side 58a, and a third side 58c is formed on a lateral side of

the TFD formation region 11 to face the first side 58a. Further, in the mutual boundary portion 12, a second sealing layer 59b, which is formed so as to be continuous with respect to the second side 58b, is formed. Here, the second sealing layer 59b is formed in an indented portion X which is indented toward the TFD formation region 11 from an extended axis direction of the third side 58c in the mutual boundary portion 12. The indented portion X is in a so-called 'U' shape.

**[0220]** Further, the first sealing layer 59a and the second sealing layer 59b are formed to face each other. Accordingly, the indented portions W and X having the U shapes face each other. Further, the insulating sealing member 52a formed in such a manner constitutes a part of the ring-shaped portion 58, and the conductive sealing member 52b constitutes the remaining parts of the ring-shaped portion 58. In addition, the first sealing layer 59a and the second sealing layer 59b form the junction portion 59 formed in the mutual boundary portion 12 through the subsequent bonding process.

**[0221]** Moreover, in the present embodiment, the insulating sealing member 52a is coated in the direction indicated by the symbol U, and the conductive sealing member 52b is coated in the direction indicated by the symbol V opposite to the direction indicated by the symbol U, but the invention is not

limited to this configuration. For example, the insulating sealing member 52a and the conductive sealing member 52b may be coated and formed in the same direction.

**[0222]** Further, in the present embodiment, as indicated by the symbols U and V, the insulating sealing member 52a and the conductive sealing member 52b are formed in the vertical directions of the paper, but the sealing members 52a and 52b may be formed in the horizontal directions of the paper. In any case, the insulating sealing member 52a and the conductive sealing member 52b are formed in the arrangement direction of the plurality of TFD formation regions 11.

**[0223]** Further, in the present embodiment, the line width of each of the sealing members 52a and 52b is uniform, but the line width may be different according to a portion where each of the sealing members 52a and 52b is formed or a shape of the junction portion to be formed by bonding.

**[0224]** With such a method of forming the sealing member 52, the plurality of TFD formation regions 11, in which the insulating sealing member 52a and the conductive sealing member 52b are coated and formed, are formed on the mother substrate 10' for a TFD substrate shown in Fig. 18A. In addition, as shown in Fig. 18B, a part of the TFD formation region 11 is formed by the insulating sealing member 52a and remaining parts thereof are formed by the conductive sealing

member 52b. Accordingly, the ring-shaped portion 58 having the sealing members 52a and 52b is formed. Further, as shown in Fig. 18C, the insulating sealing member 52a and the conductive sealing member 52b have the first sealing layer 59a and the second sealing layer 59b which face each other at the indented portions W and X, respectively. Each of the first sealing layer 59a and the second sealing layer 59b has symmetrical curved portions 59c. As described below, when the mother substrate 10' for a TFD substrate and the mother substrate 20' for a counter substrate are bonded to each other, the first sealing layer 59a and the second sealing layer 59b are crushed and joined, such that the junction portion 59 shown in Fig. 4 is formed.

**[0225]** Next, the shape sizes of the first sealing layer 59a and the second sealing layer 59b will be described with reference to Fig. 18C. Hereinafter, it is defined that R2 is the radius of the curved portion 59c, d2 is the distance between central lines at a region where the first sealing layer 59a and the second sealing layer 59b are closest to each other, and w2 is the width of the sealing member 52a or 52b after the bonding process. If doing so, in the present embodiment, the following relationship is established.

Equation 15

$$0 \leq d2 \leq 0.8 \times w2$$

**[0226]** Further, the following relationship is established.

Equation 16

$$(R2/w2) \leq -1.2 \times (d2/w2) + 2.0$$

**[0227]** Further, the following relationship is established.

Equation 17

$$(R2/w2) \leq -(d2/w2) + 1.2$$

Equation 18

$$(R2/w2) \geq -0.6 \times (d2/w2) + 0.4$$

**[0228]** By doing so, as verified with examples described below, even when a variation in size of the sealing member 52a or 52b occurs, the first sealing layer 59a and the second sealing layer 59b can be reliably joined, thereby forming the junction portion 59. Further, the sealing member 52a or 52b can be drawn at the same speed all over. Further, since a writing start portion or a writing end portion is sufficiently separated from the liquid crystal device, a complex control can be eliminated. Accordingly, drawing time can be markedly reduced to half to one-third of drawing time in the related art. In addition, thickening of the sealing member 52a or 52b toward the inside of the liquid crystal device 100 in the junction portion 59 can be solved.

**[0229]** Next, returning to Figs. 14A to 14C, the method of manufacturing the liquid crystal device will be continuously described.

**[0230]** As shown in Fig. 14B, in a state in which the mother substrate 10' for a TFD substrate is supplied onto the table 65 in the material supply unit 63, liquid crystal 50 is dropped from the liquid droplet ejection head 66. Specifically, when the table 65 is moved while turning the sealing surface 10'a upward, liquid crystal is ejected and dropped from the liquid droplet ejection head 66, such that liquid crystal 50 is disposed at a predetermined position on the sealing surface 10'a. Liquid crystal 50 is dropped in the ring-shaped portion 58 for each TFD formation region 11.

**[0231]** Further, in the present embodiment, viscosity of liquid crystal to be dropped on the sealing surface 10'a of the mother substrate 10' for a TFD substrate is preferably in a range of 130 Pa·s to 250 Pa·s. With viscosity of liquid crystal in the above-described range, liquid crystal 50 can be effectively prevented from sinking into an adhesive region of the sealing member 52a or 52b and the mother substrate 10' for a TFD substrate, such that the mother substrates 10' and 20' can be reliably bonded to each other.

**[0232]** Next, as shown in Fig. 14C, the mother substrate 20' for a counter substrate is transported and turned over,

and is loaded on the upper chuck unit 71 of the substrate bonding unit 64 by the substrate load/unload unit 62. Next, the mother substrate 20' for a counter substrate is held on the holding surface 71a by the holding mechanism.

**[0233]** On the other hand, the mother substrate 10' for a TFD substrate, on which the sealing members 52a and 52b and liquid crystal 50 are disposed, is transported and loaded on the lower chuck unit 69 of the substrate bonding unit 64 by the substrate load/unload unit 62, and is held on the holding surface 69a by the holding mechanism.

**[0234]** In the present embodiment, the load of the mother substrate 20' for a counter substrate on the substrate bonding unit 64 is performed prior to the load of the mother substrate 10' for a TFD substrate. Accordingly, in a state in which cleanliness of the sealing surfaces 10'a and 20'a of the mother substrate 10' for a TFD substrate and the mother substrate 20' for a counter substrate is maintained, both mother substrates 10'a and 20' are bonded. If the load of the mother substrate 10' for a TFD substrate to be held in the lower chuck unit 69 on the substrate bonding unit 64 is performed first, when the mother substrate 20' for a counter substrate is loaded on the upper chuck unit 71, a foreign substance may be accumulated onto the mother substrate 10' for a TFD substrate disposed previously or liquid crystal 50



disposed on the sealing surface 10'a.

**[0235]** Moreover, in the present embodiment, though the disposition process of the sealing members 52a and 52b onto the mother substrate 10' for a TFD substrate and the disposition process of liquid crystal 50 are performed by a single material supply unit 63, the disposition processes of the sealing members 52a and 52b and liquid crystal 50 may be performed by two material supply units 63. In this case, since the two processes can be performed in parallel, a throughput can be enhanced.

**[0236]** Further, in the present embodiment, the sealing members 52a and 52b are formed on the mother substrate 10' for a TFD substrate, but the sealing members 52a and 52b may be formed on the mother substrate 20' of a counter substrate. In this case, each of the sealing members 52a and 52b is continuously and collectively formed to cover the plurality of counter electrode formation regions 21 and the mutual boundary portions 22. Further, in this case, the turning-over operation of the mother substrate 20' for a counter substrate by the substrate load/unload unit 62 is preferably performed just after the substrate is discharged from the material supply unit 63. The sealing members 52a and 52b spread on the mother substrate 20' for a counter substrate as time lapses after coating, such that a coating height is

lowered. In particular, when viscosity of the sealing member 52 is equal to or less than 200,000 cps, the change in coating height becomes conspicuous. Accordingly, when the mother substrate 20' for a counter substrate is turned over and held just after coating of the sealing members 52a and 52b, the spread of the sealing members 52a and 52b can be suppressed, and 'dripping' of the sealing material can be reduced. As a result, bonding strength of the mother substrate 20' for a counter substrate and the mother substrate 10' for a TFD substrate can be maintained, and thus a liquid crystal device having excellent reliability can be manufactured.

**[0237]** Further, one of the sealing members 52a and 52b may be formed on the mother substrate 10' for a TFD substrate, and the other may be formed on the mother substrate 20' for a counter substrate. In this case, as described above, the mother substrate 10' for a TFD substrate and the mother substrate 20' for a counter substrate are bonded, while reducing 'dripping' of the sealing material. Further, bonding is performed after positioning is performed such that the positions of the sealing members 52a and 52b are aligned with each other.

**[0238]** Subsequently, as shown in Fig. 15A, the vacuum chamber 70 descends to be brought into contact with the lower

chuck unit 69, and the housing space 70b is sealed in a sealed state. After the housing space 70b is in the sealed state, the housing space 70b becomes substantially a vacuum state ( $1.33 \text{ Pa}$  to  $1.33 \times 10^{-2} \text{ Pa}$ ) through negative-pressure suction from the exhaust portion 76.

**[0239]** After the housing space 70b becomes substantially the vacuum state, as shown in Fig. 15B, the alignment marks (not shown) formed in the mother substrate 20' for a counter substrate and the mother substrate 10' for a TFD substrate are magnified by use of the microscopes 74 for bonding and are captured by the CCD cameras 81. Image data of the alignment marks captured by the CCD cameras 81 is input to the image processing unit 83, and then relative positions of the mother substrate 20' for a counter substrate and the mother substrate 10' for a TFD substrate are detected. The control unit 84 drives the table 68 so as to horizontally move the mother substrate 20' for a counter substrate on the basis of the relative positions detected by the image processing unit 83 and positions the mother substrate 20' for a counter substrate such that a deviation in relative position with respect to the mother substrate 10' for a TFD substrate is within  $\pm 10 \text{ }\mu\text{m}$ .

**[0240]** Moreover, drawing the vacuum in the housing space 70b and positioning of the mother substrates 10' and 20' may

be simultaneously performed in parallel, or positioning may be performed first and then drawing the vacuum may be performed subsequently. When drawing the vacuum and positioning are simultaneously performed, manufacturing time can be reduced.

**[0241]** Further, in the upper chuck unit 71, through holes 71b are formed just below the microscopes 74 for bonding and the inspection windows 70a. Via the through holes 71b, the alignment marks of the individual mother substrates 10' and 20' are detected.

**[0242]** After the mother substrates 10' and 20' are positioned, as shown in Fig. 15C, the upper chuck unit 71 descends (relative movement) by the descending mechanism 72, such that the mother substrates 10' and 20' facing each other are bonded to each other. In addition, the upper chuck unit 71 descends toward the lower chuck unit 69 so as to press the mother substrates 10' and 20', such that the sealing member 52 is compressed to a predetermined thickness.

**[0243]** If the mother substrates 10' and 20' are completely bonded to each other, ultraviolet rays are irradiated by the UV irradiation unit 82 so as to temporarily cure the sealing member 52 and to increase viscosity of the sealing material.

**[0244]** Moreover, pressing after the mother substrates 10' and 20' are bonded to each other may be not performed

according to a manufacturing process or the selection of the sealing members 52a and 52b or the like. Further, similarly, temporary curing of the sealing member 52 by the UV irradiation unit 82 may be not performed according to the sealing member 52.

**[0245]** Further, after bonding and before precise positioning to be described below, occurrence of a positional deviation of both substrates is expected. When deviation width and direction are statistically expected, these may be offset in advance such that the positional relationship of the mother substrates 10' and 20' after the occurrence of the positional deviation falls within the above-described range, and the positioning may be performed.

**[0246]** Subsequently, air is introduced into the housing space 70b, and the housing space 70b returns from the vacuum state back to the air pressure. If the housing space 70b of the vacuum chamber 70 is in the air pressure, both mother substrates 10' and 20' are pressed, such that the sealing member 52 is further compressed. Subsequently, holding of the upper chuck unit 71 and the lower chuck unit 69 is released, and, as shown in Fig. 16A, the vacuum chamber 70 ascends. Next, the substrate (in this case, the liquid crystal device 100 with the mother substrates 10' and 20' bonded to each other) disposed on the lower chuck unit 69 in

a not-held state is unloaded by the substrate load/unload unit 62.

**[0247]** Both mother substrates 10' and 20' bonded to each other is transported to the precise alignment unit 164 by the substrate load/unload unit 62 and, as shown in Fig. 16B, is loaded such that the mother substrate 20' for a counter substrate turns toward the upper chuck unit 171 and the mother substrate 10' for a TFD substrate turns toward the lower chuck unit 169. The upper chuck unit 171 and the lower chuck unit 169 vacuum-attracts the mother substrate 20' for a counter substrate and the mother substrate 10' for a TFD substrate by attraction mechanisms, respectively.

**[0248]** If the mother substrate 10' for a TFD substrate and the mother substrate 20' for a counter substrate are completely held, under the air pressure, the alignment marks (not shown) formed in both mother substrates 10' and 20' are captured by the CCD cameras 181 and 181 via the microscopes 174 and 174 for alignment. Image data of the alignment marks captured by the CCD cameras 181 is input to the image processing unit 183, and the relative positions of the mother substrate 20' for a counter substrate and the mother substrate 10' for a TFD substrate are detected. The control unit 184 drives the table 168 so as to precisely position on the basis of the relative positions detected by the image

processing unit 183 such that the deviation in relative position of the mother substrate 20' for a counter substrate and the mother substrate 10' for a TFD substrate is within  $\pm 1 \mu\text{m}$ .

**[0249]** Further, in the upper chuck unit 171, through holes 171b are formed at positions just below the microscopes 174 for alignment. Via the through holes 171b, the alignment marks of the individual mother substrates 10' and 20' are detected.

**[0250]** After both mother substrates 10' and 20' are precisely positioned, the upper chuck unit 171 further descends (relative movement) by the pressing mechanism 172, such that the mother substrates 10' and 20' disposed to face each other are pressed. If doing so, the sealing member 52 is further compressed, the gap control materials 52c included in the sealing members 52a and 52b are brought into contact with the mother substrates 10' and 20', such that the gap between both mother substrates 10' and 20' is adjusted to be equal to or less than about  $3 \mu\text{m}$ .

**[0251]** Moreover, as the pressing method by the pressing mechanism 172, various pressing methods, such as a pressing method in which pressing force is gradually increased, a pressing method in which pressing force is continuously increased, an S-shaped pressing method in which pressing

force at the time of pressing is temporarily maintained and then pressing force is increased, and the like, can be used.

**[0252]** Further, as for regions where the upper chuck unit 171 and the lower chuck unit 169 are brought into contact with and press the mother substrate 20' for a counter substrate and the mother substrate 10' for a TFD substrate, an entire contact surface may be pressed or only regions where the gap control materials 52c included in the sealing member 52 are disposed may be pressed. In a method in which only the disposition regions of the gap control materials 52c are pressed, regions where the gap control materials 52c are not pressed. Accordingly, the gap between the substrates due to bending of both mother substrates 10' and 20' can be prevented from narrowing or constituent members by the spacers disposed on the substrate can be prevented from being damaged.

**[0253]** If the gap between both mother substrates 10' and 20' is adjusted, the ultraviolet rays are irradiated onto the sealing member 52 by the UV lamp 182, and the sealing member 52 is cured, such that the gap between both mother substrates 10' and 20' is maintained.

**[0254]** Moreover, the irradiation of the UV lamp 182 may be performed just after pressing force of the pressing mechanism 172 reaches a predetermined pressure, or may be performed



after liquid crystal 50 spreads to every TFD formation region 11 left behind for predetermined time. That is, the irradiation can be performed with various timings. According to the material to be used, in order to obtain required adhesive force, a process of curing the sealing member may be further provided.

**[0255]** If the sealing members 52a and 52b are completely cured, the upper chuck unit 171 and the lower chuck unit 169 open sequentially or simultaneously, and then the liquid crystal device 100 disposed on the lower chuck unit 169 in the non-held state is unloaded by the substrate load/unload unit 62.

**[0256]** Next, as shown in Fig. 7C, the mother substrates 10' and 20' are cut out, such that the manufacture of the liquid crystal device 100 is completed.

**[0257]** Moreover, in the present embodiment, the bonding process is performed according to the following steps [1] to [8].

**[0258]** [1] Set the mother substrates 10' and 20' on the table

**[0259]** [2] Draw the vacuum in the housing space 70b

**[0260]** [3] Position the mother substrates 10' and 20'

**[0261]** [4] Temporarily fix by UV irradiation

**[0262]** [5] Open the housing space 70b to air

- [0263] [6] Move to the precise alignment unit 164
- [0264] [7] Precisely position the mother substrates 10' and 20'
- [0265] [8] Fix by UV irradiation
- [0266] Further, the invention is not limited to this bonding process. For example, a bonding process according to the following steps [1] to [11] may be performed.
- [0267] [1] Set the mother substrates 10' and 20' on the table
- [0268] [2] Draw the vacuum in the housing space 70b
- [0269] [3] Descend the upper chuck unit 71 to a constant position
- [0270] [4] Position the mother substrates 10' and 20'
- [0271] [5] Descend the upper chuck unit 71 further
- [0272] [6] Precisely position the mother substrates 10' and 20'
- [0273] [7] Press and fix
- [0274] [8] Temporarily fix by UV irradiation
- [0275] [9] Turn off electrostatic chuck and ascend the upper chuck unit 71
- [0276] [10] Open the housing space 70b to air
- [0277] [11] Fix by UV irradiation
- [0278] In such a bonding process according to the steps [1] to [11], precise alignment is not performed in air, but

the mother substrates 10' and 20' can be reliably bonded to each other.

**[0279]** As described above, in the liquid crystal device 100 and the method of manufacturing a liquid crystal device of the present embodiment, since the sealing members 52a and 52b constitute the ring-shaped portion 58 and the junction portion 59, the ring-shaped portion 58 is blocked by the part of the junction portion 59. Therefore, leakage of the liquid crystal layer 50 from the junction portion 59 can be suppressed, and reliability of the liquid crystal device 100 can be advanced. Further, since the junction portion 59 is formed toward the outside of the ring-shaped portion 58, when the bonding process is performed, the width of the junction portion 59 is increased only outside the ring-shaped portion 58, and thus the sealing members 52a and 52b can be suppressed from protruding inside the ring-shaped portion 58. Further, there is no case in which a cell gap inside the ring-shaped portion 58 is influenced, and thus the cell gap can be uniformly maintained.

**[0280]** Further, as compared with the related art, the width of each member of the ring-shaped portion 58 and the junction portion 59 does not need to be adjusted, and the ring-shaped portion 58 and the junction portion 59 can be formed with a member having the same width, such that the

sealing members 52a and 52b can be easily formed. Therefore, the dispenser can be easily controlled, and drawing of the sealing members 52a and 52b can end in short time. Further, a variation of the amount of the sealing material remaining in the dispenser or a variation in viscosity between lots of the sealing material does not need to be regarded as questionable, and the shapes of the sealing members 52a and 52b can be easily managed.

**[0281]** Further, since the conductive sealing member 52b connects the conductive pad 54 and the COM electrode 57, the liquid crystal layer 50 can be held inside the ring-shaped portion 58, and the conductive pad 54 and the COM electrode 57 can be connected to each other. Further, since the insulating sealing member 52a is formed in the non-conduction region on the surfaces of the relay wiring line 55 and the SEG electrode 56, the liquid crystal layer 50 can be held in the ring-shaped portion 58, and an electrical insulation property in the non-conduction region can be obtained.

**[0282]** Further, with the insulating sealing member 52a and the conductive sealing member 52b, the ring-shaped portion 58 having conductivity and an electrical insulation property can be formed, and the junction portion 59 in which the members having conductivity and electrical insulation property are joined can be formed. Further, in this case, the junction

portion 59 is formed between the conduction region and the non-conduction region. However, since the junction portion 59 is formed toward the outside of the ring-shaped portion 58, when the bonding process is performed, the width of the junction portion 59 is increased only outside the ring-shaped portion 58, and thus the sealing members 52a and 52b can be suppressed from protruding inside the ring-shaped portion 58. Further, there is no case in which the cell gap inside the ring-shaped portion 58 is influenced, and thus the cell gap can be uniformly maintained.

**[0283]** Further, when the relationship of Equations 15 to 18 is established, the first sealing layer 59a and the second sealing layer 59b can be reliably joined to each other, thereby forming the junction portion 59, regardless of the variation in size of the sealing members 52a and 52b. Further, in the related art method, the sealing members 52a and 52b in the junction portion 59 may be thickened, and the distance of the overlap portion needs to be increased in order to control thickening to the minimum. Further, the control of the device may be complicated, and then it will take a long time for drawing the sealing member. In contrast, in the present embodiment, the sealing member 52a and 52b can be drawn at the same speed all over. Further, since the writing start portion or the writing end portion is

sufficiently separated from the liquid crystal device, the complex control can be eliminated. Therefore, drawing time can be markedly reduced, and thickening of the sealing members 52a and 52b toward the inside of the liquid crystal device 100 in the junction portion 59 can be solved.

**[0284]** Further, since the liquid crystal device 100 is manufactured by bonding and cutting out the mother substrate 10' for a TFD substrate and the mother substrate 20' for a counter substrate, a plurality of liquid crystal devices 100 can be cut out, and thus a manufacturing method having excellent productivity can be implemented.

**[0285]** Further, in the manufacturing method of the liquid crystal device 100, the insulating sealing member 52a is continuously and collectively coated so as to cover the TFD formation regions 11 and the mutual boundary portions 12, and the conductive sealing member 52b also is continuously and collectively coated. Therefore, excellent effects can be obtained, as compared with the related art.

**[0286]** Specifically, with the single process from the start of drawing of the conductive sealing member 52b to the end of drawing and the single process from the start of drawing of the insulating sealing member 52a to the end of drawing, the sealing members 52a and 52b are collectively formed with respect to the arrangement direction of the

plurality of TFD formation regions 11. Accordingly, the sealing members 52a and 52b can be easily and rapidly formed, and thus a manufacturing method having excellent productivity can be implemented.

**[0287]** On the other hand, like the related art, when the sealing members 52a and 52b are formed for each TFD formation region 11, the start of drawing and the end of drawing of the sealing members 52a and 52b should be performed for each TFD formation region 11, and thus the start of drawing and the end of drawing should be repeatedly performed more. Accordingly, since the ejection and the non-ejection of the sealing material are continuously performed, it is difficult to cause the sealing material in the dispenser to stably flow, and the variation in the amount of the sealing material to be ejected tends to occur. Further, since the dispenser should scan the mother substrate 10' for a TFD substrate, the operation of the dispenser is complicated.

**[0288]** In contrast, in the present embodiment, since the conductive sealing member 52b and the insulating sealing member 52a are continuously and collectively formed in the arrangement direction of the TFD formation regions, the start of drawing and the end of drawing can be performed for each column or each row of the TFD formation regions, such that the number of starts of drawing and the number of ends of

drawing can be reduced. Accordingly, the conductive sealing member 52b and the insulating sealing member 52a can be continuously and collectively formed, while causing the sealing material in the dispenser to stably flow. Further, the sealing members 52a and 52b can be formed in short time. Further, since the dispenser does not scan the mother substrate 10' for a TFD substrate in the non-ejection state, the sealing material filled in the dispenser can be prevented from being inadvertently dropped. As a result, the operation of the dispenser can be simplified, and the variation in viscosity of the sealing material or the variation in ejection amount can be suppressed.

**[0289]** Further, the sealing members 52a and 52b of the individual TFD formation regions 11 formed in such a method are connected to each other via the junction portion 59, and thus leakage of liquid crystal 50 in the mutual boundary portion 12 can be prevented.

**[0290]** Next, second to fourth embodiments of the method of manufacturing a liquid crystal device will be described.

**[0291]** In the following description, only different parts from the above-described embodiment will be described. The same parts or the same processes as those in the above-described embodiment are represented by the same reference numerals, and the descriptions thereof will be omitted.



## Second Embodiment

**[0292]** Fig. 19 is a diagram illustrating a manufacturing method of a liquid crystal device according to the second embodiment of the invention. Further, Fig. 19 is a plan view illustrating a method of forming a sealing member 52. In addition, Fig. 19 is a diagram showing a portion indicated by a symbol F in Fig. 18B on a magnified scale.

**[0293]** In the first embodiment, the first sealing layer 59a and the second sealing layer 59b are configured to have the curved portions 59c. On the other hand, in the present embodiment, the first sealing layer 59a and the second sealing layer 59b are configured to have inclined portions 59d. Then, as described above, when the mother substrate 10' for a TFD substrate and the mother substrate 20' for a counter substrate are bonded to each other, the first sealing layer 59a and the second sealing layer 59b are crushed and joined, such that the junction portion 59 shown in Fig. 4 is formed.

**[0294]** Next, the shape sizes of the first sealing layer 59a and the second sealing layer 59b will be described with reference to Fig. 19. Hereinafter, it is defined that c2 is the chamfered amount of the inclined portion 59d, d2 is the distance between the central lines in a region where the

first sealing layer 59a and the second sealing layer 59b is closest to each other, and  $w_2$  is the width of the sealing member 52a or 52b after the bonding process. If doing so, in the present embodiment, the following relationship is established.

Equation 19

$$0 \leq d_2 \leq 0.8 \times w_2$$

[0295] Further, the following relationship is established.

Equation 20

$$(c_2 / w_2) \leq -0.5 \times (d_2 / w_2) + 1.2$$

[0296] Further, the following relationship is established.

Equation 21

$$(c_2 / w_2) \leq -0.5 \times (d_2 / w_2) + 0.7$$

Equation 22

$$(c_2 / w_2) \geq -0.5 \times (d_2 / w_2) + 0.3$$

[0297] By doing so, as verified with examples described below, even when the variation in size of the sealing member 52a or 52b occurs, the first sealing layer 59a and the second sealing layer 59b can be reliably joined, thereby forming the junction portion 59. Further, the sealing member 52a or 52b

can be drawn at the same speed all over. Further, since the writing start portion or the writing end portion is sufficiently separated from the liquid crystal device, the complex control can be eliminated. Accordingly, drawing time can be markedly reduced to half to one-third of drawing time in the related art. In addition, thickening of the sealing member 52a or 52b toward the inside of the liquid crystal device 100 in the junction portion 59 can be solved.

#### Third Embodiment

**[0298]** Fig. 20 is a diagram illustrating a manufacturing method of a liquid crystal device according to a third embodiment of the invention. Further, Fig. 20 is a plan view showing respective constituent parts of the liquid crystal device as viewed from the counter substrate. Fig. 21 is a plan view showing a region indicated by a symbol C of Fig. 20 on a magnified scale. Fig. 22 is a plan view specifically illustrating the configuration of the sealing member.

**[0299]** As shown in Figs. 20 to 22, in the liquid crystal device 100 of the present embodiment, the insulating sealing member (second sealing member) 52a is linearly formed in a vertical direction of the paper. Further, at points O and R, the insulating sealing member 52a and the conductive sealing member (first sealing member) 52b are connected to each other.

**[0300]** Further, the insulating sealing member 52a and the conductive sealing member 52b are formed in a pattern shown in Fig. 22, and thus a single ring-shaped portion 58 that holds the liquid crystal layer 50 therein and a junction portion 59 in which the insulating sealing member 52a and the conductive sealing member 52b are joined are configured. The sealing member 52 formed in such a pattern is a formed in a closed box shape in a region on the surface of the TFD substrate 10, with no liquid crystal injection hole.

**[0301]** In the ring-shaped portion 58, the insulating sealing member 52a is formed to pass through points R and O in Fig. 22, and the conductive sealing member 52b is formed to pass through points O, P, Q, and R in Fig. 22.

**[0302]** In the junction portion 59, the insulating sealing member 52a and the conductive sealing member 52b are joined at the points O and R. Therefore, the junction portions 59 are formed at a place on an end of the side OP and at a place on an end of the side QR. That is, the junction portions 59 are individually formed on opposite sides of the ring-shaped portion 58.

**[0303]** Further, the junction portions 59 are formed so as to be continuous with respect to the ring-shaped portion 58 and block the ring-shaped portion 58 at the points O and R. Accordingly, the liquid crystal layer 50 held inside the

ring-shaped portion 58 can be prevented from leaking outside the sealing member 52. Further, at the points O and R, parts of the individual junction portions 59 are integrated into the ring-shaped portion 58, and the other parts of the individual junction portions 59 are formed outside the ring-shaped portion 58. That is, the junction portions 59 are formed toward the outside of the ring-shaped portion 58 from the portions for blocking the ring-shaped portion 58 (points O and R). Therefore, the junction portions 59 are not formed to overlap the ring-shaped portion 58. Only the parts of the individual junction portions 59 join the ring-shaped portion 58 and the other parts thereof are formed toward the outside of the ring-shaped portion 58.

**[0304]** Further, as shown in Fig. 21, the junction portion 59 is formed between an end (symbol A) of the conductive pad 54 and an end (symbol B) of the relay wiring line 55 crossing the sealing member 52, that is, in a portion indicated by a symbol L. In the liquid crystal device 100 of the present embodiment, the distance of the symbol L is set to be equal to or less than 2 mm.

**[0305]** Further, as described below, the junction portions 59 are formed by drawing the insulating sealing member 52a and the conductive sealing member 52b from the dispenser in the non-contact state to face each other, and then pressing

the sealing members 52a and 52b through the bonding process so as to contact and to be joined.

**[0306]** Next, a method of manufacturing a liquid crystal device according to the present embodiment will be described.

**[0307]** Figs. 23A and 23B are plan views illustrating a method of forming the sealing member 52. Figs. 24A to 24C are plan views showing the sealing member 52 formed on the mother substrate. Specifically, Fig. 24A is a diagram showing the appearance of the mother substrate, Fig. 24B is a diagram showing a portion indicated by a symbol E of Fig. 24A on a magnified scale, and Fig. 24C is a diagram showing a portion indicated by a symbol F of Fig. 24B on a magnified scale.

**[0308]** As shown in Fig. 23A, the insulating sealing member 52a is coated on the mother substrate 10' for a TFD substrate in a direction indicated by a symbol U (second sealing member forming process). Here, as described above, the plurality of TFD formation regions 11 and the mutual boundary portions 12 are formed on the mother substrate 10' for a TFD substrate, and then the insulating sealing member 52a is continuously and collectively coated to cover the TFD formation regions 11 and the mutual boundary portions 12. Further, the direction indicated by the symbol U represents the same direction as the arrangement direction of the plurality of TFD formation

regions 11.

**[0309]** Here, when the insulating sealing member 52a is coated and formed, a first side 58a, which is a part of the ring-shaped portion 58, is formed on a lateral side of the TFD formation region 11. Further, in the mutual boundary portion 12, a first sealing layer 59a, which is formed so as to be continuous with respect to the first side 58a, is formed. Here, the first sealing layer 59a is formed on a coaxial straight line (symbol U) to the first side 58a in the mutual boundary portion 12.

**[0310]** Next, as shown in Fig. 23B, the conductive sealing member 52b is coated on the mother substrate 10' for a TFD substrate in a direction indicated by a symbol V (first sealing member forming process). In this process, like the insulating sealing member 52a, the conductive sealing member 52b is continuously and collectively coated to cover the plurality of TFD formation regions 11 and the mutual boundary portions 12. Further, the direction indicated by the symbol V represents the same direction as the arrangement direction of the plurality of TFD formation regions 11.

**[0311]** Here, when the conductive sealing member 52b is coated and formed, a second side 58b, which is a part of the ring-shaped portion 58, is formed in an axis direction perpendicular to the extended axis (symbol V) of the first

side 58a, and a third side 58c is formed on a lateral side of the TFD formation region 11 to face the first side 58a. Further, in the mutual boundary portion 12, a second sealing layer 59b, which is formed so as to be continuous with respect to the second side 58b, is formed. Here, the second sealing layer 59b is formed in an indented portion X which is indented toward the TFD formation region 11 from an extended axis direction of the third side 58c in the mutual boundary portion 12. The indented portion X is in a so-called 'U' shape.

**[0312]** Further, the first sealing layer 59a and the second sealing layer 59b are formed to face each other. Accordingly, the first sealing layer 59a formed on the coaxial straight line to the first side 58a and the indented portion X having the U shape face each other. Further, the insulating sealing member 52a formed in such a manner constitutes a part of the ring-shaped portion 58, and the conductive sealing member 52b constitutes the remaining parts of the ring-shaped portion 58. In addition, the first sealing layer 59a and the second sealing layer 59b form the junction portion 59 formed in the mutual boundary portion 12 through the subsequent bonding process.

**[0313]** With such a method of forming the sealing member 52, the plurality of TFD formation regions 11, in which the



insulating sealing member 52a and the conductive sealing member 52b are coated and formed, are formed on the mother substrate 10' for a TFD substrate shown in Fig. 24A. In addition, as shown in Fig. 24B, a part of the TFD formation region 11 is formed by the insulating sealing member 52a and remaining parts thereof are formed by the conductive sealing member 52b. Accordingly, the ring-shaped portion 58 having the sealing members 52a and 52b is formed. Further, as shown in Fig. 24C, the insulating sealing member 52a and the conductive sealing member 52b have the first sealing layer 59a and the second sealing layer 59b which face each other, respectively. Next, when the mother substrate 10' for a TFD substrate and the mother substrate 20' for a counter substrate are bonded to each other, the first sealing layer 59a and the second sealing layer 59b are crushed and joined, such that the junction portion 59 shown in Fig. 22 is formed.

**[0314]** Next, the shape sizes of the first sealing layer 59a and the second sealing layer 59b will be described with reference to Fig. 24C. Hereinafter, it is defined that  $R_1$  is the radius of the curved portion 59c,  $d_1$  is the distance between the central lines at the region where the first sealing layer 59a and the second sealing layer 59b are closest to each other, and  $w_1$  is the width of the sealing member 52a or 52b after the bonding process. If doing so, in

the present embodiment, the following relationship is established.

Equation 23

$$0 \leq d1 \leq 0.8 \times w1$$

[0315] Further, the following relationship is established.

Equation 24

$$(R1/w1) \leq -2.0 \times (d1/w1) + 3.0$$

[0316] Further, the following relationship is established.

Equation 25

$$(R1/w1) \leq -1.7 \times (d1/w1) + 2.0$$

Equation 26

$$(R1/w1) \geq -1.2 \times (d1/w1) + 1.0$$

[0317] By doing so, as verified with examples described below, even when a variation in size of the sealing member 52a or 52b occurs, the first sealing layer 59a and the second sealing layer 59b can be reliably joined, thereby forming the junction portion 59. Further, the sealing member 52a or 52b can be drawn at the same speed all over. Further, since the writing start portion or the writing end portion is sufficiently separated from the liquid crystal device, the

complex control can be eliminated. Accordingly, drawing time can be markedly reduced to half to one-third of drawing time in the related art. In addition, thickening of the sealing member 52a or 52b toward the inside of the liquid crystal device 100 in the junction portion 59 can be solved.

**[0318]** Further, since the first sealing layer 59a and the first side 58a are formed, drawing time can be reduced, as compared with a case in which the first sealing layer 59a is formed while drawing a curve or an inclined line.

#### Fourth Embodiment

**[0319]** Fig. 25 is a diagram illustrating a manufacturing method of a liquid crystal device according to the fourth embodiment of the invention. Further, Fig. 25 is a plan view illustrating a method of forming a sealing member 52. In addition, Fig. 25 is a diagram showing a portion indicated by the symbol F in Fig. 18B on a magnified scale.

**[0320]** In the third embodiment, the second sealing layer 59b is configured to have the curved portion 59c. On the other hand, in the present embodiment, the second sealing layer 59b is configured to have an inclined portion 59d. Then, as described above, when the mother substrate 10' for a TFD substrate and the mother substrate 20' for a counter substrate are bonded to each other, the first sealing layer

59a and the second sealing layer 59b are crushed and joined, such that the junction portion 59 shown in Fig. 22 is formed.

**[0321]** Next, the shape sizes of the first sealing layer 59a and the second sealing layer 59b will be described with reference to Fig. 25. Hereinafter, it is defined that  $c1$  is the chamfered amount of the inclined portion 59d,  $d1$  is the distance between the central lines in the region where the first sealing layer 59a and the second sealing layer 59b is closest to each other, and  $w1$  is the width of the sealing member 52a or 52b after the bonding process. If doing so, in the present embodiment, the following relationship is established.

Equation 27

$$0 \leq d1 \leq 0.8 \times w1$$

**[0322]** Further, the following relationship is established.

Equation 28

$$(c1/w1) \leq -0.5 \times (d1/w1) + 1.2$$

**[0323]** Further, the following relationship is established.

Equation 29

$$(c1/w1) \leq -0.5 \times (d1/w1) + 0.7$$

Equation 30

$$(c1/w1) \geq -0.5 \times (d1/w1) + 0.3$$

**[0324]** By doing so, as verified with examples described below, even when the variation in size of the sealing member 52a or 52b occurs, the first sealing layer 59a and the second sealing layer 59b can be reliably joined, thereby forming the junction portion 59. Further, the sealing member 52a or 52b can be drawn at the same speed all over. Further, since the writing start portion or the writing end portion is sufficiently separated from the liquid crystal device, the complex control can be eliminated. Accordingly, drawing time can be markedly reduced to half to one-third of drawing time in the related art. In addition, thickening of the sealing member 52a or 52b toward the inside of the liquid crystal device 100 in the junction portion 59 can be solved.

**[0325]** Moreover, in the present embodiment, the inclined portions 59d are formed according to the chamfered amounts c1 and c2. That is, the inclined portion 59d is formed to be inclined at 45 degrees with respect to the central line direction of the second sealing layer 59b. The invention is not limited to this configuration, in which the inclined portion 59d is formed at 45 degrees. For example, the inclined portion 59d may be formed to an acute angle or an obtuse angle from 45 degrees.

**[0326]** Further, in the present embodiment, the sizes of the sealing members 52a and 52b are the same, but the sizes may be different from each other. The conductive sealing member 52b may be larger than the insulating sealing member 52a. For example, the insulating sealing member 52a may be 0.5 mm and the conductive sealing member 52b may be 0.7 mm.

**[0327]** Next, fifth to ninth embodiments of the liquid crystal device will be described.

**[0328]** In the following description, only different parts from the above-described embodiments will be described. The same parts as those in the above-described embodiments are represented by the same reference numerals, and the descriptions thereof will be omitted. Moreover, the liquid crystal devices of the fifth to ninth embodiments are manufactured by use of the manufacturing method of any one of the first to fourth embodiments.

#### Fifth Embodiment

**[0329]** First, the liquid crystal device according to the fifth embodiment of the invention will be described.

**[0330]** Fig. 26 is a plan view showing respective constituent parts of the liquid crystal device according to the present embodiment as viewed from the counter substrate. In the present embodiment, it is configured such that the

conductive sealing member 52b is formed between the image display region 4 and the scanning signal driving circuit 110, and the insulating sealing member 52a is formed on an opposite side to the conductive sealing member 52b via the junction portion 59. That is, as compared with the first embodiment, the positions of the insulating sealing member 52a and the conductive sealing member 52b are inverted.

**[0331]** Further, in the TFD substrate 10, the conductive pad 54 is formed on a lateral side of the data signal driving circuit 120 and is connected to the data signal driving circuit 120 via the relay wiring lines 55. On the other hand, in the counter substrate 20, the COM electrodes 57 are formed outside of the image display region 4 and extend toward the conductive pad 54. Then, the conductive sealing member 52b is interposed between the COM electrodes 57 and the conductive pad 54, such that the conductive particles electrically connect the COM electrodes 57 and the conductive pad 54. Here, since the conductive sealing member 52b is formed on wiring lines of the SEG electrodes 56, the conductive sealing member 52b is configured in consideration of the electrical short-circuit of the wiring lines of the SEG electrodes 56 to adjacent wiring lines.

**[0332]** As such, when the conductive sealing member 52b is formed between the image display region 4 and the scanning

signal driving circuit 110, the same effects as those in the above-described embodiments can be obtained.

#### Sixth Embodiment

**[0333]** Next, a liquid crystal device according to the sixth embodiment of the invention will be described.

**[0334]** Fig. 27 is a plan view of respective constituent parts of the liquid crystal device according to the present embodiment as viewed from the counter substrate. Like the fifth embodiment, in the present embodiment, it is configured such that the conductive sealing member 52b is formed between the image display region 4 and the scanning signal driving circuit 110, and the insulating sealing member 52a is formed on an opposite side to the conductive sealing member 52b via the junction portion 59.

**[0335]** Further, unlike the first to fifth embodiments, in the present embodiment, the scanning signal driving circuit 110 and the data signal driving circuit 120 are formed in the counter substrate 20. Therefore, the scanning signal driving circuit 110 is connected to the SEG electrodes 56 via the conductive pad 54.

**[0336]** Accordingly, in the counter substrate 20, the conductive pad 54 is formed on the lateral side of the scanning signal driving circuit 110 and is connected to the



scanning signal driving circuit 110 via relay wiring lines 60. Further, the data signal driving circuit 120 is connected to the pixel electrodes 9 via the COM electrodes 57. On the other hand, in the TFD substrate 10, the SEG electrodes are formed outside the image display region 4 and extend toward the conductive pad 54. Then, the conductive sealing member 52b is interposed between the SEG electrodes 56 and the conductive pad 54, such that the conductive particles electrically connect the SEG electrodes 56 and the conductive pad 54. Here, since the conductive sealing member 52b is formed on wiring lines of the COM electrodes 57, the conductive sealing member 52b is configured in consideration of the electrical short-circuit of the wiring lines of the COM electrodes 57 to adjacent wiring lines.

**[0337]** As such, when the conductive sealing member 52b is formed between the image display region 4 and the scanning signal driving circuit 110, the same effects as those in the above-described embodiments can be obtained.

**[0338]** Moreover, the liquid crystal device of each of the first to sixth embodiments is an active matrix type in which the TFD element 40 is used as a switching element, but the invention is not limited to the active matrix-type liquid crystal device. For example, the invention can be applied to a passive-type liquid crystal device.

#### Seventh Embodiment

**[0339]** Next, a liquid crystal device according to the seventh embodiment of the invention will be described.

**[0340]** The liquid crystal device of the present embodiment is an active matrix-type liquid crystal device in which a thin film transistor (hereinafter, referred to as TFT) is used as a switching element. Fig. 28 is a plan view showing respective constituent parts of the liquid crystal device according to the present embodiment as viewed from the counter substrate.

**[0341]** Here, in the liquid crystal device having the TFD of each of the first to sixth embodiment, a potential is applied from the SEG electrode 56 of the TFD substrate 10 to the pixel electrode 31, and a potential is applied from the COM electrode 57 to the pixel electrode 9, such that a voltage is applied to the liquid crystal layer 50 between the pixel electrodes 31 and 9. That is, the TFD is a two-terminal element.

**[0342]** On the other hand, in the liquid crystal device having the TFT of the present embodiment, a potential is applied to a pixel electrode by signals, which are applied to a data line and a gate line formed in a TFT substrate, and a voltage, which is generated between the pixel electrode and a

counter substrate formed on an entire surface, is applied to the liquid crystal layer 50. That is, the TFT is a three-terminal element.

**[0343]** As shown in Fig. 28, the liquid crystal device 101 has, on the TFT substrate 102, data relay wiring lines 85, gate relay wiring lines 86, an insulating sealing member 52a, a conductive sealing member 52b, and dot conductive portions (first conductive portions or conductive regions) 87. Here, the insulating sealing member 52a is formed on a left side from a portion indicated by a symbol Y, and the conductive sealing member 52b is formed on a right side from the portion indicated by the symbol Y. Then, the liquid crystal layer 50 is held inside a ring-shaped portion 58 surrounded by the sealing members 52a and 52b, such that the image display region 4 is formed. Further, a junction portion 59 is formed on a line of the symbol Y. In addition, the conductive sealing member 52b extends on the dot conductive portions 87. That is, when the TFT substrate 102 and the counter substrate are bonded to each other, the TFT substrate 102 is electrically connected to the counter substrate via the dot conductive portions 87.

**[0344]** As such, in the liquid crystal device 101 using the TFT, the conductive sealing member 52b is formed on the dot conductive portions 87, and thus the dot seals for the

connection of the upper and lower substrates in the related art do not need to be provided.

#### Modification of Seventh Embodiment

**[0345]** Fig. 29 is a diagram showing a modification of the seventh embodiment. Specifically, Fig. 29 is a plan view showing respective constituent parts of a liquid crystal device as viewed from the counter substrate.

**[0346]** In the present modification, as shown in Fig. 29, the gate relay wiring lines 86 are formed on one side of the image display region 4.

**[0347]** In such a configuration, the same effects as those in the seventh embodiment can be obtained.

#### Eighth Embodiment

**[0348]** Next, a liquid crystal device according to the eighth embodiment of the invention will be described.

**[0349]** Fig. 30 is a plan view showing respective constituent parts of the liquid crystal device according to the present embodiment as viewed from the counter substrate. Further, the liquid crystal device of the present embodiment has the TFT, like the seventh embodiment.

**[0350]** As shown in Fig. 30, in the liquid crystal device 101, in the ring-shaped portion 58, the insulating sealing

member 52a and the conductive sealing member 52b have the same length. Further, other parts are the same as those in the seventh embodiment. Specifically, the junction portion 59 is substantially disposed at a center of one side of the ring-shaped portion 58. The conductive sealing member 52b is formed on a right side from a portion indicated by a symbol Z, and the insulating sealing member 52a is formed on a left side from the portion indicated by the symbol Z. Accordingly, the insulating sealing member 52a and the conductive sealing member 52b have the same length.

**[0351]** In such a configuration, when each of the sealing members 52a and 52b is drawn by a separate dispenser, tack time of the apparatus can be arranged, and the liquid crystal device 101 can be efficiently produced. Further, the TFT substrate 102 and the counter substrate are electrically connected by the conductive sealing member 52b formed on the dot conductive portions 87.

**[0352]** Moreover, the fifth to eighth embodiments relate to the liquid crystal device manufactured by use of the manufacturing method of the first or second embodiment. Specifically, the first sealing layer 59a is formed on the central line different from the axis along which the first side 58a of the ring-shaped portion 58 extends, and the second sealing layer 59b is formed to face the first sealing

layer 59a. The fifth to eighth embodiments are not limited to the liquid crystal device formed by such a manufacturing method, but may relate to the liquid crystal device manufactured by use of the manufacturing method of the third or fourth embodiment. Specifically, the first side 58a of the ring-shaped portion 58 and the first sealing layer 59a may be formed on the same straight line, and the second sealing layer 59b may be formed to face the first sealing layer 59a.

#### Ninth Embodiment

**[0353]** Next, a liquid crystal device according to a ninth embodiment of the invention will be described.

**[0354]** Fig. 31 is a plan view showing respective constituent parts of the liquid crystal device according to the present embodiment as viewed from the counter substrate. Further, the liquid crystal device of the present embodiment has the TFT, like the seventh embodiment. In addition, the liquid crystal device of the present embodiment can be used for a large display, such as a large television or the like.

**[0355]** As shown in Fig. 31, a liquid crystal device 103 has a single sealing member 52. Specifically, though the sealing member 52 is formed by the conductive sealing member and the insulating sealing member in the first to eighth

embodiments, in the present embodiment, the sealing member is formed by the insulating sealing member.

**[0356]** Further, in the liquid crystal device 103, the ring-shaped portion 58 has the liquid crystal layer 50 therein, and the junction portion 59 blocks the ring-shaped portion 58 at one place. The ring-shaped portion 58 and the junction portion 59 are continuously and collectively formed. The ring-shaped portion 58 and the junction portion 59 are formed by coating the sealing member 52 with so-called one stroke of a brush. That is, the sealing member 52 is formed from one end of the single member to the other end and forms the junction portion 59 by joining one end and the other end. In addition, the liquid crystal layer 50 is held inside the ring-shaped portion 58 surrounded by the single member. Here, the junction portion 59 is formed toward the outside of the ring-shaped portion 58, not to overlap the path of the ring-shaped portion 58.

**[0357]** Further, the dot conductive portions 87 are formed of conductive members different from the sealing member 52, and the TFT substrate 102 and the counter substrate can be electrically connected via the dot conductive portions 87.

**[0358]** If doing so, since the ring-shaped portion 58 is blocked by the junction portion 59 in which one end of the sealing member 52 and the other end thereof are joined at one

place, the number of junction portions 59 is minimized. Therefore, as compared with a case in which a plurality of junction portions 59 are provided, a liquid crystal device, in which a defective cell gap is reliably suppressed, can be implemented. In addition, since the junction portion 59 is formed toward the outside of the ring-shaped portion 58, when the bonding process is performed, the width of the junction portion 59 is increased only outside the ring-shaped portion 58, and thus the sealing member 52 can be suppressed from protruding inside the ring-shaped portion 58. Further, there is no case in which the cell gap inside the ring-shaped portion 58 is influenced, and thus the cell gap can be uniformly maintained.

#### Examples

**[0359]** Next, an example of the invention will be described.

**[0360]** In the present example, for the shapes of the first and second sealing layers 59a and 59b of <1> to <4> described below, the measurement results of reliability of a panel (liquid crystal device), the shape of the junction portion 59 formed by the bonding process, the ratio of the hollow depth and the width of the sealing member, and the panel state are shown.

**[0361]** <1> When the first and second sealing layers 59a



and 59b have the curved portions 59c at the indented portions W and X (Fig. 18C, First Embodiment)

**[0362]** <2> When the first and second sealing layers 59a and 59b have the inclined portions 59d at the indented portions W and X (Fig. 19, Second Embodiment)

**[0363]** <3> When the first side 58a of the ring-shaped portion 58 and the first sealing layer 59a are the straight lines, and the second sealing layer 59b has the curved portion 59c (Fig. 24C, Third Embodiment)

**[0364]** <4> When the first side 58a of the ring-shaped portion 58 and the first sealing layer 59a are the straight lines, and the second sealing layer 59b has the inclined portion 59d (Fig. 25, Fourth Embodiment)

**[0365]** <1> When the first and second sealing layers 59a and 59b have the curved portions 59c at the indented portions W and X (Fig. 18C, First Embodiment)

**[0366]** Table 1 shows the examination result of the panel for the shapes of the first and second sealing layers 59a and 59b in the first embodiment.

Table 1

| w2     | R2      | d2     | h2      | h2/w2 | RELIABILITY | $\Delta$ | $\times$ |
|--------|---------|--------|---------|-------|-------------|----------|----------|
| 0.5 mm | 0.4 mm  | 0.2 mm | 0.23 mm | 0.47  | O           | 0%       | 0%       |
| 0.5 mm | 0.5 mm  | 0.2 mm | 0.30 mm | 0.60  | $\Delta$    | 1%       | 0%       |
| 0.5 mm | 0.75 mm | 0.2 mm | 0.47 mm | 0.95  | $\Delta$    | 6%       | 0%       |
| 0.5 mm | 0.8 mm  | 0.2 mm | 0.51 mm | 1.02  | $\times$    | 8%       | 2%       |
| 0.7 mm | 0.3 mm  | 0.5 mm | 0.30 mm | 0.43  | O           | 0%       | 0%       |
| 0.7 mm | 0.45 mm | 0.5 mm | 0.41 mm | 0.59  | $\Delta$    | 1%       | 0%       |
| 0.7 mm | 0.75 mm | 0.5 mm | 0.64 mm | 0.92  | $\Delta$    | 4%       | 0%       |
| 0.7 mm | 0.9 mm  | 0.5 mm | 0.76 mm | 1.09  | $\times$    | 6%       | 1%       |

**[0367]** In Table 1,  $w_2$  is the width of the sealing member after bonding,  $R_2$  is the radius of the curved portion 59c,  $d_2$  is the distance between the central lines of the sealing members, and  $h_2$  is the hollow depth from the inside of the ring-shaped portion 58 to the indented portion of the junction portion 59 (Fig. 32). That is,  $R_2$  and  $d_2$  are parameters of a pattern shape when the sealing member is drawn, and  $w_2$  and  $h_2$  are parameters obtained by performing the bonding process. Further, Table 1 shows the evaluation results obtained under an atmosphere of 60°C, 90% RH for 1000 hours. Further, in a column of reliability, 'O' means favorable with no change, 'Δ' represents that a slight change in threshold value is recognized, but within a tolerance range, and 'x' means that occurrence of irregularity of a defective level is recognized.

**[0368]** From the results of Table 1, it was confirmed the reliability is influenced by the ratio  $h_2/w_2$  of the hollow depth  $h_2$  and the width of the sealing member  $w_2$ , without depending on the width  $w_2$  of the sealing member, the radius  $R_2$  of the curved portion 59c, and the distance  $d_2$  between the central lines of the sealing members. Then, it was confirmed that, when  $h_2/w_2$  is equal to or less than 1.0, a defect does not occur and, when  $h_2/w_2$  is equal to or less than 0.5, irregularity is not recognized at all.

**[0369]** Table 2 shows the examination results of the shape of the junction portion 59 formed by the bonding process for the shapes of the first and second sealing layers 59a and 59b in the first embodiment.

Table 2

| W2     | R2      | d2      | h2      | h2/w2 | CONVEX<br>JUNCTION<br>PORTION | OF | $\Delta$ | $\times$ |
|--------|---------|---------|---------|-------|-------------------------------|----|----------|----------|
| 0.5 mm | 0 mm    | 0 mm    | 0.00 mm | 0.00  | $\Delta$                      |    | 4%       | 0%       |
| 0.5 mm | 0.2 mm  | 0 mm    | 0.05 mm | 0.09  | $\Delta$                      |    | 1%       | 0%       |
| 0.5 mm | 0.05 mm | 0.25 mm | 0.06 mm | 0.11  | $\bigcirc$                    |    | 0%       | 0%       |
| 0.7 mm | 0 mm    | 0.1 mm  | 0.01 mm | 0.01  | $\Delta$                      |    | 0%       | 0%       |
| 0.7 mm | 0.3 mm  | 0 mm    | 0.07 mm | 0.10  | $\bigcirc$                    |    | 0%       | 0%       |
| 0.7 mm | 0.15 mm | 0.2 mm  | 0.07 mm | 0.10  | $\bigcirc$                    |    | 0%       | 0%       |
| 0.7 mm | 0 mm    | 0.4 mm  | 0.06 mm | 0.09  | $\Delta$                      |    | 1%       | 0%       |

[0370] In Table 2,  $w_2$  is the width of the sealing member after bonding,  $R_2$  is the radius of the curved portion 59c,  $d_2$  is the distance between the central lines of the sealing members, and  $h_2$  is the hollow depth of the junction portion 59 (Fig. 32). Further, in a column of 'convex of junction portion', 'O' means that the convex is formed but favorable, 'Δ' means that the convex is formed but does not become a defective level, and 'x' means that the swelled amount of the convex exceeds two times of the size of the sealing member, that is, the defective level. Moreover, in general, it is known that, when the sealing member is coated and formed with the dispenser, the size of the sealing member is varied by about 10%. As a result, even when the average of  $h_2/w_2$  is 0.09, that is, even when the junction portion 59 averagedly has a indented shape, there is a case in which the junction portion 59 does not have the indented shape, but is swelled (Fig. 33) not more than 1%. The swelled amount is the maximum when  $w_2$  is 0.5 mm,  $R_2$  is 0 mm, and  $d_2$  is 0 mm, but it is equal to or less than 20 percent with respect to the width of the sealing member, and thus it does not matter practically. However, in order to completely eliminate the convex of the junction portion 59 including the variation in the seal size, it was confirmed that it is preferable to set  $h_2/w_2$  to be equal to or less than 0.1.

[0371] Table 3 shows the examination results of the ratio  $h_2/w_2$  of the hollow depth  $h_2$  and the width  $w_2$  of the sealing member, and the panel state for the shapes of the first and sealing layers 59a and 59b in the first embodiment, when the width  $w_2$  of the sealing member after bonding is fixed to 0.5 mm, and the radius  $R_2$  of the curved portion 59c and the distance  $d_2$  between the central lines of the sealing members are changed.

Table 3

|                | *2   |        |        |        | *3     |        |        |        |
|----------------|------|--------|--------|--------|--------|--------|--------|--------|
| $d_2(d_2/w_2)$ | 0 mm | 0.10mm | 0.20mm | 0.25mm | 0.30mm | 0.40mm | 0.45mm | 0.50mm |
| $R_2(R_2/w_2)$ | 0    | 0.2    | 0.4    | 0.5    | 0.6    | 0.8    | 0.9    | 1      |
| 0.00mm (0.0)   | 0.00 | 0.01   | 0.04   | 0.07   | 0.10   | 0.20   | 0.28   | 0.50   |
| 0.05mm (0.1)   | 0.01 | 0.03   | 0.08   | 0.11   | 0.15   | 0.27   | 0.36   | 0.60   |
| 0.10mm (0.2)   | 0.03 | 0.07   | 0.13   | 0.16   | 0.21   | 0.34   | 0.44   | 0.70   |
| 0.20mm (0.4)   | 0.09 | 0.15   | 0.23   | 0.28   | 0.33   | 0.49   | 0.60   | 0.90   |
| 0.25mm (0.5)   | 0.13 | 0.20   | 0.29   | 0.34   | 0.40   | 0.56   | 0.69   |        |
| 0.30mm (0.6)   | 0.18 | 0.25   | 0.35   | 0.40   | 0.47   | 0.64   | 0.77   |        |
| 0.40mm (0.8)   | 0.28 | 0.36   | 0.47   | 0.53   | 0.61   | 0.80   | 0.94   |        |
| 0.50mm (1.0)   | 0.38 | 0.48   | 0.60   | 0.67   | 0.75   | 0.96   | 1.12   |        |
| 0.60mm (1.2)   | 0.50 | 0.60   | 0.74   | 0.81   | 0.90   | 1.13   | 1.29   |        |
| 0.70mm (1.4)   | 0.62 | 0.73   | 0.88   | 0.96   | 1.05   |        |        |        |
| 0.75mm (1.5)   | 0.68 | 0.80   | 0.95   | 1.03   | 1.13   |        |        |        |
| 0.80mm (1.6)   | 0.74 | 0.87   | 1.02   | 1.11   |        |        |        |        |
| 0.90mm (1.8)   | 0.87 | 1.00   | 1.16   |        |        |        |        |        |
| 1.00mm (2.0)   | 1.00 | 1.14   |        |        |        |        |        |        |
| 1.10mm (2.2)   | 1.13 |        |        |        |        |        |        |        |

\*1

[0372] In Table 3, in a \*1 portion, the ratio  $h_2/w_2$  of the hollow depth  $h_2$  of the junction portion 59 and the width  $w_2$  of the sealing member is equal to or less than 1.0 and, in this range, reliability of the panel can be ensured. Further,

a \*2 portion does not matter practically in the junction portion 59, but, in this range, the sealing member is not indented, but is slightly swelled. Further, in a \*3 portion,  $h2/w2$  is larger than 0.1 and equal to or less than 0.5, which is an ideal range. In a portion where  $d2/w2$  exceeds 0.9, the sealing members were not brought into contact with each other due to the variation in size of the sealing member or the like (Fig. 34), leakage of liquid crystal or the like occurred.

**[0373]** Further, in Table 3,  $d2/w2$  and  $R2/w2$  of a boundary where reliability can be ensured and a boundary where the convex occurs in the junction portion are plotted to be substantially on straight lines, as shown in Fig. 35. Here, the values of  $R2/w2$  when  $h2/w2$  serving as the boundary becomes 0.1, 0.5, and 1.0 were calculated by interpolation.

**[0374]** Next, Table 4 shows the examination results of the ratio  $h2/w2$  of the hollow depth  $h2$  and the width  $w2$  of the sealing member, and the panel state for the shapes of the first and sealing layers 59a and 59b in the first embodiment, when the width  $w2$  of the sealing member after bonding is fixed to 0.7 mm, and the radius  $R2$  of the curved portion 59c and the distance  $d2$  between the central lines of the sealing members are changed.

Table 4



|               | *2      *3 |         |         |         |         |         |         |        |
|---------------|------------|---------|---------|---------|---------|---------|---------|--------|
| d2(d2/w2)     | 0 mm       | 0.10mm  | 0.20mm  | 0.30mm  | 0.40mm  | 0.50mm  | 0.60mm  | 0.70mm |
| R2 (R2/w2)    | 0          | 0.14286 | 0.28571 | 0.42857 | 0.57143 | 0.71429 | 0.85714 | 1      |
| 0.00mm (0.00) | 0.00       | 0.01    | 0.02    | 0.05    | 0.09    | 0.15    | 0.24    | 0.50   |
| 0.15mm (0.21) | 0.03       | 0.06    | 0.10    | 0.14    | 0.20    | 0.29    | 0.40    | 0.71   |
| 0.30mm (0.43) | 0.10       | 0.15    | 0.20    | 0.26    | 0.34    | 0.43    | 0.57    | 0.93   |
| 0.45mm (0.64) | 0.20       | 0.25    | 0.31    | 0.39    | 0.48    | 0.59    | 0.75    |        |
| 0.60mm (0.86) | 0.30       | 0.37    | 0.44    | 0.52    | 0.63    | 0.75    | 0.92    |        |
| 0.75mm (1.07) | 0.42       | 0.49    | 0.57    | 0.67    | 0.78    | 0.92    | 1.10    |        |
| 0.90mm (1.29) | 0.55       | 0.63    | 0.71    | 0.82    | 0.94    | 1.09    | 1.29    |        |
| 1.05mm (1.50) | 0.68       | 0.76    | 0.86    | 0.97    | 1.10    |         |         |        |
| 1.20mm (1.71) | 0.81       | 0.90    | 1.01    | 1.13    |         |         |         |        |
| 1.35mm (1.93) | 0.95       | 1.05    | 1.16    |         |         |         |         |        |
| 1.50mm (2.14) | 1.10       | 1.20    |         |         |         |         |         |        |

\*1

[0375] In Table 4, in a \*1 portion, the ratio  $h_2/w_2$  of the hollow depth  $h_2$  of the junction portion 59 and the width  $w_2$  of the sealing member is equal to or less than 1.0 and, in this range, reliability of the panel can be ensured. Further, a \*2 portion does not matter practically in the junction portion 59, but, in this range, the sealing member is not indented, but is slightly swelled. Further, in a \*3 portion,  $h_2/w_2$  is larger than 0.1 and equal to or less than 0.5, which is an ideal range. In a portion where  $d_2/w_2$  exceeds 0.85, the sealing members were not brought into contact with each other due to the variation in size of the sealing member or the like (Fig. 34), leakage of liquid crystal or the like occurred.

[0376] Further, in Table 4, when  $d_2/w_2$  and  $R_2/w_2$  of the boundary where reliability can be ensured and the boundary

where the convex occurs in the junction portion are plotted to be substantially on straight lines, as shown in Fig. 36.

**[0377]** Here, in a case in which the width  $w_2$  of the sealing member is 0.5 mm and 0.7 mm, for the boundary where reliability can be ensured and the boundary where the convex occurs in the junction portion, on the same graph, the boundaries of  $d_2/w_2$  and  $R_2/w_2$  (Figs. 35 and 36) are plotted as shown in Fig. 37.

**[0378]** As shown in Fig. 37, when the width  $w_2$  of the sealing member after bonding is 0.5 mm or 0.7 mm, the boundaries are on the same line. Therefore, even when  $w_2$  is out of the above-described range, the boundaries are on the line of Fig. 37.

**[0379]** From Fig. 37, it can be seen that the relationship of  $d_2/w_2$  and  $R_2/w_2$  is plotted to be on the same line, without depending on the width of the sealing member.

**[0380]** As such, in order to ensure reliability, without depending on the size of the sealing member, the following condition is satisfied.

Equation 31

$$(R_2/w_2) \leq -1.2 \times (d_2/w_2) + 2.0$$

**[0381]** Ideally, the following condition is to be satisfied.

Equation 32

$$(R2/w2) \leq -(d2/w2) + 1.2$$

**[0382]** Further, the convex (thickening) of the sealing member in the junction portion is less than 20 percent for the width of the sealing member, which does not matter practically. However, in order to completely eliminate the convex of the junction portion including the variation in size of the sealing member, ideally, it is preferable that the following condition is satisfied.

Equation 33

$$(R2/w2) \geq -0.6 \times (d2/w2) + 0.4$$

**[0383]** In addition, in order to prevent the sealing members from being not brought into contact with each other and to prevent liquid crystal from leaking due to the variation in size of the sealing member in the junction portion, ideally, it is preferable that the following condition is satisfied.

Equation 34

$$d2/w2 \leq 0.8$$

**[0384]** As described above, by defining the shapes of the first and second sealing layers 59a and 59b, the same effects as those in the above-described embodiments can be obtained.

On the other hand, in the related art, the sealing member in the junction portion may be thickened, and the distance of the overlap portion needs to be increased in order to control thickening to the minimum. Further, the control of the device may be complicated, and then it will take a long time for drawing the sealing member. In contrast, in the method of the present example, the sealing member can be drawn at the same speed all over. Further, since the writing start portion or the writing end portion is sufficiently separated from the panel, the complex control can be eliminated. Accordingly, drawing time can be markedly reduced to half to one-third of drawing time in the related art. In addition, thickening of the sealing member toward the inside of the liquid crystal device in the junction portion of the sealing member can be solved.

**[0385]** <2> When the first and second sealing layers 59a and 59b have the inclined portions 59d at the indented portions W and X (Fig. 19, Second Embodiment)

**[0386]** Table 5 shows the examination results of the ratio  $h2/w2$  of the hollow depth  $h2$  and the width  $w2$  of the sealing member, and the panel state for the shapes of the first and sealing layers 59a and 59b in the second embodiment, when the width  $w2$  of the sealing member after bonding is fixed to 0.5 mm, and the chamfered amount  $c2$  of the inclined portion 59d

and the distance  $d_2$  between the central lines of the sealing members are changed.

Table 5

| $d_2(d_2/w_2)$<br>$c_2(c_2/w_2)$ | 0 mm | 0.10mm | 0.20mm | 0.30mm | 0.40mm | 0.45mm | 0.50mm |
|----------------------------------|------|--------|--------|--------|--------|--------|--------|
|                                  | 0    | 0.2    | 0.4    | 0.6    | 0.8    | 0.9    | 1      |
| 0.00mm ( 0.00 )                  | 0.00 | 0.01   | 0.04   | 0.10   | 0.20   | 0.28   | 0.50   |
| 0.10mm ( 0.20 )                  | 0.04 | 0.10   | 0.19   | 0.29   | 0.40   | 0.48   | 0.70   |
| 0.20mm ( 0.40 )                  | 0.19 | 0.29   | 0.39   | 0.49   | 0.60   | 0.68   | 0.90   |
| 0.30mm ( 0.60 )                  | 0.39 | 0.49   | 0.59   | 0.69   | 0.80   | 0.88   |        |
| 0.40mm ( 0.80 )                  | 0.59 | 0.69   | 0.79   | 0.89   | 1.00   | 1.08   |        |
| 0.50mm ( 1.00 )                  | 0.79 | 0.89   | 0.99   | 1.09   | 1.20   | 1.28   |        |
| 0.60mm ( 1.20 )                  | 0.99 | 1.09   | 1.19   |        |        |        |        |
| 0.70mm ( 1.40 )                  | 1.19 |        |        |        |        |        |        |

[0387] In Table 5, in a \*1 portion, the ratio  $h_2/w_2$  of the hollow depth  $h_2$  of the junction portion 59 and the width  $w_2$  of the sealing member is equal to or less than 1.0 and, in this range, reliability of the panel can be ensured. Further, a \*2 portion does not matter practically in the junction portion 59, but, in this range, the sealing member is not indented, but is slightly swelled. Further, in a \*3 portion,  $h_2/w_2$  is larger than 0.1 and equal to or less than 0.5, which is an ideal range. In a portion where  $d_2/w_2$  exceeds 0.9, the sealing members were not brought into contact with each other due to the variation in size of the sealing member or the like (Fig. 34), leakage of liquid crystal or the like occurred.

[0388] Further, in Table 5,  $d2/w2$  and  $c2/w2$  of the boundary where reliability can be ensured and the boundary where the convex occurs in the junction portion are plotted to be substantially on straight lines, as shown in Fig. 38. Here, the values of  $c2/w2$  when  $h2/w2$  serving as the boundary becomes 0.5 and 1.0 were calculated by interpolation.

[0389] Next, Table 6 shows the examination results of the change of hollow depth  $h2$  and the panel state for the shapes of the first and sealing layers 59a and 59b in the second embodiment, when the width  $w2$  of the sealing member after bonding is fixed to 0.7 mm, and the chamfered amount  $c2$  of the inclined portion 59d and the distance  $d2$  between the central lines of the sealing members are changed.

Table 6

| $d2(d2/w2)$<br>$c2(c2/w2)$ |           |                   |                   |                   |                   |                   |                   |             |
|----------------------------|-----------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------|
|                            | 0 mm<br>0 | 0.10mm<br>0.14286 | 0.20mm<br>0.28571 | 0.30mm<br>0.42857 | 0.40mm<br>0.57143 | 0.50mm<br>0.71429 | 0.60mm<br>0.85714 | 0.70mm<br>1 |
| 0.00mm (0.00)              | 0.00      | 0.01              | 0.02              | 0.05              | 0.09              | 0.15              | 0.24              | 0.50        |
| 0.10mm (0.14)              | 0.02      | 0.05              | 0.09              | 0.15              | 0.22              | 0.29              | 0.39              | 0.64        |
| 0.20mm (0.29)              | 0.09      | 0.15              | 0.22              | 0.29              | 0.36              | 0.44              | 0.53              | 0.79        |
| 0.30mm (0.43)              | 0.22      | 0.29              | 0.36              | 0.44              | 0.51              | 0.58              | 0.67              |             |
| 0.40mm (0.57)              | 0.36      | 0.44              | 0.51              | 0.58              | 0.65              | 0.72              | 0.81              |             |
| 0.50mm (0.71)              | 0.51      | 0.58              | 0.65              | 0.72              | 0.79              | 0.86              | 0.96              |             |
| 0.60mm (0.86)              | 0.65      | 0.72              | 0.79              | 0.86              | 0.94              | 1.01              | 1.10              |             |
| 0.70mm (1.00)              | 0.79      | 0.86              | 0.94              | 1.01              | 1.08              | 1.15              |                   |             |
| 0.80mm (1.14)              | 0.94      | 1.01              | 1.08              | 1.15              |                   |                   |                   |             |
| 0.90mm (1.29)              | 1.08      | 1.15              |                   |                   |                   |                   |                   |             |
| 1.00mm (1.43)              | 1.22      |                   |                   |                   |                   |                   |                   |             |

\*1

[0390] In Table 6, in a \*1 portion, the ratio  $h2/w2$  of the

hollow depth  $h_2$  of the junction portion 59 and the width  $w_2$  of the sealing member is equal to or less than 1.0 and, in this range, reliability of the panel can be ensured. Further, a  $\ast 2$  portion does not matter practically in the junction portion 59, but, in this range, the sealing member is not indented, but is slightly swelled. Further, in a  $\ast 3$  portion,  $h_2/w_2$  is larger than 0.1 and equal to or less than 0.5, which is an ideal range. In a portion where  $d_2/w_2$  exceeds 0.85, the sealing members were not brought into contact with each other due to the variation in size of the sealing member or the like (Fig. 34), leakage of liquid crystal or the like occurred.

**[0391]** Further, in Table 6, when  $d_2/w_2$  and  $R_2/w_2$  of the boundary where reliability can be ensured and the boundary where the convex occurs in the junction portion are plotted to be substantially on straight lines, as shown in Fig. 39. Here, the values of  $c_2/w_2$  when  $h_2/w_2$  serving as the boundary is 0.1, 0.5, and 1.0 were calculated by interpolation.

**[0392]** Here, in a case in which the width  $w_2$  of the sealing member is 0.5 mm and 0.7 mm, for the boundary where reliability can be ensured and the boundary where the convex occurs in the junction portion, on the same graph, the boundaries of  $d_2/w_2$  and  $c_2/w_2$  (Figs. 38 and 39) are plotted as shown in Fig. 37.

**[0393]** As shown in Fig. 40, when the width  $w_2$  of the sealing member after bonding is 0.5 mm or 0.7 mm, the boundaries are on the same line. Therefore, even when  $w_2$  is out of the above-described range, the boundaries are on the line of Fig. 40.

**[0394]** From Fig. 40, it can be seen that the relationship of  $d_2/w_2$  and  $c_2/w_2$  is plotted to be on the same line, without depending on the width of the sealing member.

**[0395]** As such, in order to ensure reliability, without depending on the size of the sealing member, the following condition is satisfied.

Equation 35

$$(c_2/w_2) \leq -0.5 \times (d_2/w_2) + 1.2$$

**[0396]** Ideally, the following condition is to be satisfied.

Equation 36

$$(c_2/w_2) \leq -0.5 \times (d_2/w_2) + 0.7$$

**[0397]** Further, the convex (thickening) of the sealing member in the junction portion is less than 20 percent for the width of the sealing member, which does not matter practically. However, in order to completely eliminate the convex of the junction portion including the variation in size of the sealing member, ideally, it is preferable that



the following condition is satisfied.

Equation 37

$$(c2/w2) \geq -0.5 \times (d2/w2) + 0.3$$

**[0398]** In addition, in order to prevent the sealing members from being not brought into contact with each other and to prevent liquid crystal from leaking due to the variation in size of the sealing member in the junction portion, ideally, it is preferable that the following condition is satisfied.

Equation 38

$$d2/w2 \leq 0.8$$

**[0399]** As described above, by defining the shapes of the first and second sealing layers 59a and 59b, the same effects as those in the above-described embodiments can be obtained. That is, the sealing member can be drawn at the same speed all over. Further, since the writing start portion or the writing end portion is sufficiently separated from the panel, the complex control can be eliminated. Accordingly, drawing time can be markedly reduced to half to one-third of drawing time in the related art. In addition, thickening of the sealing member toward the inside of the liquid crystal device in the junction portion of the sealing member can be solved.

[0400] <3> When the first side 58a of the ring-shaped portion 58 and the first sealing layer 59a are the straight lines, and the second sealing layer 59b has the curved portion 59c (Fig. 24C, Third Embodiment)

[0401] Table 7 shows the examination results of the ratio  $h1/w1$  of the hollow depth  $h1$  and the width  $w1$  of the sealing member, and the panel state for the shapes of the first and sealing layers 59a and 59b in the third embodiment, when the width  $w1$  of the sealing member after bonding is fixed to 0.5 mm, and the radius  $R1$  of the curved portion 59c and the distance  $d1$  between the central lines of the sealing members are changed.

Table 7

| $d1(d1/w1)$<br>$R1(R1/w1)$ | *2 *3     |               |               |               |               |               |             |
|----------------------------|-----------|---------------|---------------|---------------|---------------|---------------|-------------|
|                            | 0 mm<br>0 | 0.05mm<br>0.1 | 0.10mm<br>0.2 | 0.20mm<br>0.4 | 0.30mm<br>0.6 | 0.40mm<br>0.8 | 0.50mm<br>1 |
| 0.00mm (0.0)               | 0.00      | 0.00          | 0.00          | 0.00          | 0.01          | 0.10          | 0.50        |
| 0.20mm (0.4)               | 0.00      | 0.00          | 0.01          | 0.05          | 0.15          | 0.33          | 0.90        |
| 0.40mm (0.8)               | 0.04      | 0.06          | 0.10          | 0.20          | 0.36          | 0.61          | 1.30        |
| 0.60mm (1.2)               | 0.15      | 0.20          | 0.26          | 0.40          | 0.60          | 0.90          |             |
| 0.80mm (1.6)               | 0.31      | 0.38          | 0.45          | 0.63          | 0.87          | 1.21          |             |
| 1.00mm (2.0)               | 0.50      | 0.58          | 0.67          | 0.88          | 1.14          |               |             |
| 1.20mm (2.4)               | 0.71      | 0.80          | 0.90          | 1.13          |               |               |             |
| 1.40mm (2.8)               | 0.93      | 1.04          | 1.15          |               |               |               |             |

\*1

[0402] In Table 7, in a \*1 portion, the ratio  $h1/w1$  of the hollow depth  $h1$  of the junction portion 59 and the width  $w1$  of the sealing member is equal to or less than 1.0 and, in this range, reliability of the panel can be ensured. Further,

a \*2 portion does not matter practically in the junction portion 59, but, in this range, the sealing member is not indented, but is slightly swelled. Further, in a \*3 portion,  $h1/w1$  is larger than 0.1 and equal to or less than 0.5, which is an ideal range. In a portion where  $d1/w1$  exceeds 0.9, the sealing members were not brought into contact with each other due to the variation in size of the sealing member or the like (Fig. 34), leakage of liquid crystal or the like occurred.

**[0403]** Further, in Table 7,  $d1/w1$  and  $R1/w1$  of the boundary where reliability can be ensured and the boundary where the convex occurs in the junction portion are plotted to be substantially on straight lines, as shown in Fig. 41.

**[0404]** Next, Table 8 shows the examination results of the change of hollow depth  $h1$  and the panel state for the shapes of the first and sealing layers 59a and 59b in the third embodiment, when the width  $w1$  of the sealing member after bonding is fixed to 0.7 mm, and the radius of the curved portion 59c and the distance  $d2$  between the central lines of the sealing members are changed.

Table 8

| d1(d1/w1)<br>R1 (R1/w1) | 0 mm | 0.20mm  | 0.40mm  | 0.50mm  | 0.60mm  | 0.70mm |
|-------------------------|------|---------|---------|---------|---------|--------|
|                         | 0    | 0.28571 | 0.57143 | 0.71429 | 0.85714 | 1      |
| 0.00mm ( 0.00 )         | 0.00 | 0.00    | 0.01    | 0.05    | 0.15    | 0.50   |
| 0.20mm ( 0.29 )         | 0.00 | 0.00    | 0.09    | 0.18    | 0.33    | 0.79   |
| 0.40mm ( 0.57 )         | 0.00 | 0.06    | 0.21    | 0.34    | 0.54    | 1.07   |
| 0.60mm ( 0.86 )         | 0.05 | 0.16    | 0.37    | 0.52    | 0.75    |        |
| 0.80mm ( 1.14 )         | 0.13 | 0.29    | 0.54    | 0.72    | 0.97    |        |
| 1.00mm ( 1.43 )         | 0.24 | 0.43    | 0.72    | 0.92    | 1.20    |        |
| 1.20mm ( 1.71 )         | 0.36 | 0.59    | 0.90    | 1.13    |         |        |
| 1.40mm ( 2.00 )         | 0.50 | 0.75    | 1.10    |         |         |        |

[0405] In Table 8, in a \*1 portion, the ratio  $h1/w1$  of the hollow depth  $h1$  of the junction portion 59 and the width  $w1$  of the sealing member is equal to or less than 1.0 and, in this range, reliability of the panel can be ensured. Further, a \*2 portion does not matter practically in the junction portion 59, but, in this range, the sealing member is not indented, but is slightly swelled. Further, in a \*3 portion,  $h1/w1$  is larger than 0.1 and equal to or less than 0.5, which is an ideal range. In a portion where  $d1/w1$  exceeds 0.85, the sealing members were not brought into contact with each other due to the variation in size of the sealing member or the like (Fig. 34), leakage of liquid crystal or the like occurred.

[0406] Further, in Table 8, when  $d1/w1$  and  $R1/w1$  of the boundary where reliability can be ensured and the boundary where the convex occurs in the junction portion are plotted

to be substantially on straight lines, as shown in Fig. 42.

**[0407]** Here, in a case in which the width  $w_1$  of the sealing member is 0.5 mm and 0.7 mm, for the boundary where reliability can be ensured and the boundary where the convex occurs in the junction portion, on the same graph, the boundaries of  $d_1/w_1$  and  $R_1/w_1$  (Figs. 41 and 42) are plotted as shown in Fig. 43.

**[0408]** As shown in Fig. 43, when the width  $w_1$  of the sealing member after bonding is 0.5 mm or 0.7 mm, the boundaries are on the same line. Therefore, even when  $w_1$  is out of the above-described range, the boundaries are on the line of Fig. 43.

**[0409]** From Fig. 43, it can be seen that the relationship of  $d_1/w_1$  and  $R_1/w_1$  is plotted to be on the same line, without depending on the width of the sealing member.

**[0410]** As such, in order to ensure reliability, without depending on the size of the sealing member, the following condition is satisfied.

Equation 39

$$(R_1/w_1) \leq -2.0 \times (d_1/w_1) + 3.0$$

**[0411]** Ideally, the following condition is to be satisfied.

Equation 40

$$(R_1/w_1) \leq -1.7 \times (d_1/w_1) + 2.0$$

**[0412]** Further, the convex (thickening) of the sealing member in the junction portion is less than 20 percent for the width of the sealing member, which does not matter practically. However, in order to completely eliminate the convex of the junction portion including the variation in size of the sealing member, ideally, it is preferable that the following condition is satisfied.

Equation 41

$$(R1/w1) \geq -1.2 \times (d1/w1) + 1.0$$

**[0413]** In addition, in order to prevent the sealing members from being not brought into contact with each other and to prevent liquid crystal from leaking due to the variation in size of the sealing member in the junction portion, ideally, it is preferable that the following condition is satisfied.

Equation 42

$$d1/w1 \leq 0.8$$

**[0414]** As described above, by defining the shapes of the first and second sealing layers 59a and 59b, the same effects as those in the above-described embodiments can be obtained. That is, the sealing member can be drawn at the same speed all over. Further, since the writing start portion or the

writing end portion is sufficiently separated from the panel, the complex control can be eliminated. Accordingly, drawing time can be markedly reduced to half to one-third of drawing time in the related art. In addition, thickening of the sealing member toward the inside of the liquid crystal device in the junction portion of the sealing member can be solved.

**[0415]** <4> When the first side 58a of the ring-shaped portion 58 and the first sealing layer 59a are the straight lines, and the second sealing layer 59b has the inclined portion 59d (Fig. 25, Fourth Embodiment)

**[0416]** Table 9 shows the examination results of the ratio  $h1/w1$  of the hollow depth  $h1$  and the width  $w1$  of the sealing member, and the panel state for the shapes of the first and sealing layers 59a and 59b in the fourth embodiment, when the width  $w1$  of the sealing member after bonding is fixed to 0.5 mm, and the chamfered amount  $c1$  of the inclined portion 59d and the distance  $d1$  between the central lines of the sealing members are changed.

Table 9

| d1(d1/w1)<br>c1 (c1/w1) | 0 mm | 0.10mm | 0.20mm | 0.30mm | *2<br>0.40mm | *3<br>0.50mm |
|-------------------------|------|--------|--------|--------|--------------|--------------|
|                         | 0    | 0.2    | 0.4    | 0.6    | 0.8          | 1            |
| 0.00mm ( 0.00 )         | 0.00 | 0.00   | 0.00   | 0.01   | 0.10         | 0.50         |
| 0.15mm ( 0.30 )         | 0.00 | 0.00   | 0.04   | 0.19   | 0.39         | 0.80         |
| 0.30mm ( 0.60 )         | 0.01 | 0.10   | 0.29   | 0.49   | 0.69         | 1.10         |
| 0.45mm ( 0.90 )         | 0.19 | 0.39   | 0.59   | 0.79   | 0.99         | 1.40         |
| 0.60mm ( 1.20 )         | 0.49 | 0.69   | 0.89   | 1.09   | 1.29         | 1.70         |
| 0.75mm ( 1.50 )         | 0.79 | 0.99   | 1.19   | 1.39   | 1.59         | 2.00         |
| 0.90mm ( 1.80 )         | 1.09 | 1.29   | 1.49   | 1.69   | 1.89         | 2.30         |

\*1

[0417] In Table 9, in a \*1 portion, the ratio  $h1/w1$  of the hollow depth  $h1$  of the junction portion 59 and the width  $w1$  of the sealing member is equal to or less than 1.0 and, in this range, reliability of the panel can be ensured. Further, a \*2 portion does not matter practically in the junction portion 59, but, in this range, the sealing member is not indented, but is slightly swelled. Further, in a \*3 portion,  $h1/w1$  is larger than 0.1 and equal to or less than 0.5, which is an ideal range. In a portion where  $d1/w1$  exceeds 0.9, the sealing members were not brought into contact with each other due to the variation in size of the sealing member or the like (Fig. 34), leakage of liquid crystal or the like occurred.

[0418] Further, in Table 9,  $d1/w1$  and  $c1/w1$  of the boundary where reliability can be ensured and the boundary where the convex occurs in the junction portion are plotted



to be substantially on straight lines, as shown in Fig. 44.

**[0419]** Next, Table 10 shows the examination results of the change of the hollow depth  $h_1$  and the panel state for the shapes of the first and sealing layers 59a and 59b in the fourth embodiment, when the width  $w_1$  of the sealing member after bonding is fixed to 0.7 mm, and the chamfered amount  $c_1$  of the inclined portion 59d and the distance  $d_1$  between the central lines of the sealing members are changed.

Table 10

| $d_1(d_1/w_1)$ \ $c_1(c_1/w_1)$ |      |         |         |         |         |         |         |        |
|---------------------------------|------|---------|---------|---------|---------|---------|---------|--------|
|                                 | 0 mm | 0.10mm  | 0.20mm  | 0.30mm  | 0.40mm  | 0.50mm  | 0.60mm  | 0.70mm |
|                                 | 0    | 0.14286 | 0.28571 | 0.42857 | 0.57143 | 0.71429 | 0.85714 | 1      |
| 0.00mm ( 0.00 )                 | 0.00 | 0.00    | 0.00    | 0.00    | 0.01    | 0.05    | 0.15    | 0.50   |
| 0.15mm ( 0.21 )                 | 0.00 | 0.00    | 0.00    | 0.02    | 0.09    | 0.22    | 0.36    | 0.71   |
| 0.30mm ( 0.43 )                 | 0.00 | 0.01    | 0.05    | 0.15    | 0.29    | 0.44    | 0.58    | 0.93   |
| 0.45mm ( 0.64 )                 | 0.02 | 0.09    | 0.22    | 0.36    | 0.51    | 0.65    | 0.79    |        |
| 0.60mm ( 0.86 )                 | 0.15 | 0.29    | 0.44    | 0.58    | 0.72    | 0.86    | 1.01    |        |
| 0.75mm ( 1.07 )                 | 0.36 | 0.51    | 0.65    | 0.79    | 0.94    | 1.08    | 1.22    |        |
| 0.90mm ( 1.29 )                 | 0.58 | 0.72    | 0.86    | 1.01    | 1.15    |         |         |        |
| 1.05mm ( 1.50 )                 | 0.79 | 0.94    | 1.08    |         |         |         |         |        |
| 1.20mm ( 1.71 )                 | 1.01 | 1.15    |         |         |         |         |         |        |

**[0420]** In Table 10, in a \*1 portion, the ratio  $h_1/w_1$  of the hollow depth  $h_1$  of the junction portion 59 and the width  $w_1$  of the sealing member is equal to or less than 1.0 and, in this range, reliability of the panel can be ensured. Further, a \*2 portion does not matter practically in the junction portion 59, but, in this range, the sealing member is not indented, but is slightly swelled. Further, in a \*3 portion,

$h_1/w_1$  is larger than 0.1 and equal to or less than 0.5, which is an ideal range. In a portion where  $d_1/w_1$  exceeds 0.85, the sealing members were not brought into contact with each other due to the variation in size of the sealing member or the like (Fig. 34), leakage of liquid crystal or the like occurred.

**[0421]** In addition, in Table 10, when  $d_1/w_1$  and  $c_1/w_1$  of the boundary where reliability can be ensured and the boundary where the convex occurs in the junction portion are plotted to be substantially on straight lines, as shown in Fig. 45.

**[0422]** Here, in a case in which the width  $w_1$  of the sealing member is 0.5 mm and 0.7 mm, for the boundary where reliability can be ensured and the boundary where the convex occurs in the junction portion, on the same graph, the boundaries of  $d_1/w_1$  and  $c_1/w_1$  (Figs. 44 and 45) are plotted as shown in Fig. 46.

**[0423]** As shown in Fig. 46, when the width  $w_1$  of the sealing member after bonding is 0.5 mm or 0.7 mm, the boundaries are on the same line. Therefore, even when  $w_1$  is out of the above-described range, the boundaries are on the line of Fig. 46.

**[0424]** From Fig. 46, it can be seen that the relationship of  $d_1/w_1$  and  $c_1/w_1$  is plotted to be on the same line, without

depending on the width of the sealing member.

**[0425]** As such, in order to ensure reliability, without depending on the size of the sealing member, the following condition is satisfied.

Equation 43

$$(c1/w1) \leq -0.5 \times (d1/w1) + 1.2$$

**[0426]** Ideally, the following condition is to be satisfied.

Equation 44

$$(c1/w1) \leq -0.5 \times (d1/w1) + 0.7$$

**[0427]** Further, the convex (thickening) of the sealing member in the junction portion is less than 20 percent for the width of the sealing member, which does not matter practically. However, in order to completely eliminate the convex of the junction portion including the variation in size of the sealing member, ideally, it is preferable that the following condition is satisfied.

Equation 45

$$(c1/w1) \geq -0.5 \times (d1/w1) + 0.3$$

**[0428]** In addition, in order to prevent the sealing members from being not brought into contact with each other and to prevent liquid crystal from leaking due to the

variation in size of the sealing member in the junction portion, ideally, it is preferable that the following condition is satisfied.

Equation 46

$$d1/w1 \leq 0.8$$

**[0429]** As described above, by defining the shapes of the first and second sealing layers 59a and 59b, the same effects as those in the above-described embodiments can be obtained. That is, the sealing member can be drawn at the same speed all over. Further, since the writing start portion or the writing end portion is sufficiently separated from the panel, the complex control can be eliminated. Accordingly, drawing time can be markedly reduced to half to one-third of drawing time in the related art. In addition, thickening of the sealing member toward the inside of the liquid crystal device in the junction portion of the sealing member can be solved.

#### Electronic Apparatus

**[0430]** The specified examples of an electronic apparatus according to the embodiment of the invention will be described.

**[0431]** Fig. 47A is a perspective view showing an example of a cellular phone. In Fig. 47A, reference numeral 700

denotes a cellular phone main body, and reference numeral 701 denotes a liquid crystal display unit having the liquid crystal device according to any one of the embodiments.

**[0432]** Fig. 47B is a perspective view showing an example of a portable information processing apparatus, such as a word processor, a personal computer, or the like. In Fig. 47B, reference numeral 800 denotes an information processing apparatus, reference numeral 801 denotes an input unit, such as a keyboard or the like, reference numeral 803 denotes an information processing apparatus main body, and reference numeral 802 denotes a liquid crystal display unit having the liquid crystal device according to any one of the embodiments.

**[0433]** Fig. 47C is a perspective view showing an example of a wristwatch-type electronic apparatus. In Fig. 47C, reference numeral 900 denotes a watch main body, and reference numeral 901 denotes a liquid crystal display unit having the liquid crystal device according to any one of the embodiments.

**[0434]** The electronic apparatuses shown in Figs. 47A to 47C have the liquid crystal device according to any one of the embodiments. Therefore, an electronic apparatus including a display unit, which has superior reliability and performs high-quality display, is obtained.

## CLAIMS

What is claimed is:

1. A display device, comprising:

a first substrate including a plurality of pixel electrodes and a plurality of active elements;

a second substrate including a common electrode;

a display region in which the plurality of pixel electrodes and the plurality of active elements are aligned in a plan-view of the first substrate;

a seal region positioned around the display region in a plan-view of the first substrate; and

a seal member in the seal region and disposed between the first substrate and the second substrate so as to the common electrode faces to the plurality of pixel electrodes,

wherein the first substrate includes a protruding region which protrudes over the second substrate in the plan-view of the first substrate and a plurality of conductive portions,

the seal region forms a rectangular closed-shape so as to surround the display region, and has a first side, a second side, a third side and a fourth side, the first side is positioned between the display region and the protruding region, and opposed to the third side, and the second side is

opposed to the fourth side, and

the seal member includes a first seal portion and a second seal portion,

wherein the first seal portion is disposed at least on the first side and the second seal portion is disposed at least on the third side,

the first seal portion and the second seal portion are connected in a first junction portion positioned on the second side, and

the first seal portion and the second seal portion are connected in a second junction portion positioned on the fourth side,

wherein the second seal portion includes a plurality of conductive particles and the plurality of conductive portions are disposed at least on the third side and electrically connected to the common electrode.

2. The display device, according to Claim 1,

wherein each of the plurality of the conductive portions are spaced apart from each other.

3. The display device, according to Claim 1,

wherein the first seal portion and the second seal portion extend from the second side toward an edge of the first substrate in the first junction portion,

the first seal portion and the second seal portion extend from the fourth side toward an edge of the first substrate in the second junction portion, and

the first junction portion and the second junction portion projecting in an opposite direction with respect to the pixel area..

4. The display device, according to Claim 1,

wherein the first substrate further includes a first conductive portion on the second side,

the second seal portion includes a first part of the seal member on the second side,

wherein the first part of the seal member extends from one end of the seal member disposed on the third side over the first conductive portion on the second side, and the first part of the seal member includes a plurality of conductive particles, and



the first conductive portion is electrically connected to the common electrode.

5. The display device, according to Claim 4, wherein the first substrate further includes a second conductive portion on the fourth side,

the second seal portion includes a second part of the seal member on the fourth side,

wherein the second part of the seal member extends from another end of the seal member disposed on the third side over the second conductive portion on the fourth side, and the second part of the seal member includes a plurality of conductive particles, and

the second conductive portion is electrically connected to the common electrode.

6. An electronic device comprising the display device according to claim 1.

7. A display device, comprising:

a first substrate including a pixel region and a seal

region which is defined around the pixel region on a first surface of the first substrate, the pixel region including a plurality of pixels and a plurality of active elements, and the seal region forming a rectangular ring shape; and

a second substrate including a common electrode on a second surface; and

a seal member bonding the first substrate and the second substrate so that the first surface faces the second surface,

wherein the first substrate includes a protruding region which protrudes over the second substrate in plan-view of the first substrate,

the seal region includes a first side, a second side, a third side and a fourth side, the first side is positioned between the pixel region and the protruding region, and opposed to the third side, and the second side is opposed to the fourth side,

the seal member is positioned on the first side, the second side, the third side and the fourth side continuously and forms a closed-ring shape in which the pixel region is positioned,

a first part of the seal member disposed on the third

side which is opposed to the protruding region with respect to the pixel region includes a plurality of conductive particles,

a plurality of conductive portions are disposed on the third side of the first substrate, the plurality of the conductive portions are electrically connected to the common electrode, and

each of the plurality of the conductive portions are spaced apart from each other.

8. The display device, according to Claim 7,

wherein the first substrate includes a first conductive portion on the second side and the seal member includes a second part of the seal member on the second side, the second part of the seal member extends from one end of the first part of the seal member over the first conductive portion on the second side, and the second part of the seal member includes a plurality of conductive particles, and

wherein the first conductive portion is electrically connected to the common electrode.

9. The display device, according to Claim 8,

wherein the first substrate includes a second conductive portion on the fourth side and the seal member includes a third part of the seal member on the fourth side, the third part of the seal member extends from another end of the first part of the seal member over the second conductive portion on the fourth side, and the third part of the seal member includes a plurality of conductive particles, and

wherein the second conductive portion is electrically connected to the common electrode.

10. The display device, according to Claim 7,

wherein the seal member extends to a first edge of the seal region opposite to the pixel region on the second side.

11. The display device, according to Claim 10,

wherein the seal member extends to a second edge of the seal region opposite to the pixel region on the fourth side.

12. An electronic device comprising the display device according to claim 7.

13. A display device, comprising:

a first substrate including a plurality of pixel electrodes and a plurality of active elements;

a second substrate including a common electrode;

a display region in which the plurality of pixel electrodes and the plurality of active elements are aligned in a plan-view of the first substrate;

a seal region positioned around the display region in the plan-view of the first substrate and forming a closed-ring shape in which the display region is disposed;

a seal member in the seal region and bonding the first substrate and the second substrate so that the common electrode faces the plurality of pixel electrodes, the seal member forming a closed-ring shape in which the display region is positioned;

wherein the first substrate includes a protruding region which protrudes over the second substrate in the plan-view of the first substrate and a plurality of conductive portions,

the seal region includes a first portion and a second portion, the first portion is positioned at least between the

display region and the protruding region, and the second portion is positioned at least opposite to the protruding region with respect to the display region, and

the seal member includes a first part and the second part, the first part of the seal member is positioned on the first portion and the second part of the seal member is positioned on the second portion, and the first part of the seal member includes a plurality of conductive particles,

wherein the plurality of conductive portions are disposed on the second portion of the first substrate, the plurality of the conductive portions are electrically connected to the common electrode,

each of the plurality of the conductive portions are spaced apart from each other.

14. The display device, according to Claim 13,

wherein no conductive portions are disposed on the first portion of the first substrate and no conductive particles are included in the first part of the seal member.

15. The display device, according to Claim 13,

wherein the seal member further includes a third part and a fourth part, the third part of the seal member extends from one end of the first part, and the fourth part of the seal member extends from one end of the second part and includes a first plurality of conductive particles.

16. The display device, according to Claim 15,

wherein the third part and the fourth part are connected and extend to a first edge of the seal region opposite to the display region.

17. The display device, according to Claim 16,

wherein the seal member further includes a fifth part and a sixth part, the fifth part of the seal member extends from another end of the first part, and the sixth part of the seal member extends from another end of the second part and includes a second plurality of conductive particles, and

the fifth part and the sixth part are connected and extend to a second edge of the seal region opposite to the display region.

18. The display device, according to Claim 17,

wherein the first edge of the seal region is positioned opposite to the second edge of the seal region with respect to the display region.

19. The display device, according to Claim 18,

wherein the first substrate further includes a first conductive portion and a second conductive portion, different from the plurality of conductive portions, and the first conductive portion, the second conductive portion and the plurality of conductive portions are disposed apart from each other, and

the first conductive portion is electrically connected to the common electrode through the first plurality of conductive particles and the second conductive portion is electrically connected to the common electrode through the second plurality of conductive particles

20. An electronic device comprising the display device according to claim 13.



## ABSTRACT

A method of manufacturing a liquid crystal device having a first substrate and a second substrate facing each other with a liquid crystal layer interposed therebetween, and a sealing member formed in a peripheral portion of at least one of the substrates. The method includes forming the sealing member, disposing the liquid crystal layer inside the sealing member, and bonding the first substrate to the second substrate. In forming the sealing member, a ring-shaped portion that seals the liquid crystal layer inside the sealing member, a first sealing layer and a second sealing layer that face each other to be separated from each other are formed. In the bonding of the first substrate to the second substrate, a junction portion is formed in which the first and second sealing layers are pressed and joined outside the sealing member so as to form the ring-shaped portion.

**PATENT**

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

Application No.: (Continuation of 14/571,729)  
Filing Date: Herewith  
Applicant: Yoichi Momose  
Group Art Unit: 2871  
Examiner: Lauren Nguyen  
Title: METHOD OF MANUFACTURING A LIQUID CRYSTAL  
DEVICE  
Attorney Docket: 9319S-001378-COB

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Director of the United States Patent and Trademark Office  
P.O. Box 1450  
Alexandria, VA 22313-1450

**INFORMATION DISCLOSURE STATEMENT**

Sir:

In accordance with the provisions set forth in 37 CFR § 1.97 and 1.98, the Examiner is hereby respectfully advised of the references listed on the attached PTO-1449 Form. These references were of record in both the prosecution of the grandparent application and the parent application which this divisional claims domestic priority. Thus, copies of the references are not provided herein but can be found in the files of either the grandparent application or the parent application.

The listed references are cited only in the interest of candor and without any admission that they constitute statutory prior art, or contain matter which anticipates the invention or which would render the same obvious, either singly or in combination, to a person of ordinary skill in the art.

Respectfully submitted,

Dated: December 16, 2014

By: G. Gregory Schivley/  
G. Gregory Schivley, Reg. No. 27,382  
Bryant E. Wade, Reg. No. 40,344

HARNESS, DICKEY & PIERCE, P.L.C.  
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Bloomfield Hills, Michigan 48303  
(248) 641-1600  
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|                                                                                                          |   |    |   |                          |                       |
|----------------------------------------------------------------------------------------------------------|---|----|---|--------------------------|-----------------------|
| Substitute for form 1449/PTO                                                                             |   |    |   | <b>Complete if Known</b> |                       |
| <b>INFORMATION DISCLOSURE<br/>STATEMENT BY APPLICANT</b><br><br><i>(Use as many sheets as necessary)</i> |   |    |   | Application Number       | (CON of 14/571,729)   |
|                                                                                                          |   |    |   | Filing Date              | Concurrently Herewith |
|                                                                                                          |   |    |   | First Named Inventor     | Yoichi MOMOSE         |
|                                                                                                          |   |    |   | Art Unit                 | 2871                  |
|                                                                                                          |   |    |   | Examiner Name            | Lauren Nguyen         |
| Sheet                                                                                                    | 1 | of | 2 | Attorney Docket Number   | 9319S-001378-COB      |

| U.S. PATENT DOCUMENTS |                       |                                          |                                |                                                    |                                                                                 |
|-----------------------|-----------------------|------------------------------------------|--------------------------------|----------------------------------------------------|---------------------------------------------------------------------------------|
| Examiner Initials*    | Cite No. <sup>1</sup> | Document Number                          | Publication Date<br>MM-DD-YYYY | Name of Patentee or<br>Applicant of Cited Document | Pages, Columns, Lines, Where<br>Relevant Passages or Relevant<br>Figures Appear |
|                       |                       | Number-Kind Code <sup>2</sup> (if known) |                                |                                                    |                                                                                 |
|                       | AA*                   | US-7,190,430                             | 03-13-2007                     | Miyazaki et al.                                    |                                                                                 |
|                       | AB*                   | US-2004-0070722-A1                       | 04-15-2004                     | Park                                               |                                                                                 |
|                       | AC*                   | US-7,280,179                             | 10-09-2007                     | Hsu et al.                                         |                                                                                 |
|                       | AD*                   | US-2003-0025867-A1                       | 02-06-2003                     | Yoshizoe                                           |                                                                                 |
|                       | AE*                   | US-2004-0125317-A1                       | 07-01-2004                     | Suzuki                                             |                                                                                 |
|                       | AF*                   | US-2005-0094084-A1                       | 05-05-2005                     | Hsu et al.                                         |                                                                                 |
|                       | AG*                   | US-2005-0099574-A1                       | 05-12-2005                     | Ueyama                                             |                                                                                 |
|                       | AH*                   | US-2005-0117106-A1                       | 06-02-2005                     | Tatemura et al.                                    |                                                                                 |
|                       | AI*                   | US-6,525,799                             | 02-25-2003                     | Fukuda                                             |                                                                                 |
|                       | AJ*                   | US-6,531,329                             | 03-11-2003                     | Asakura et al.                                     |                                                                                 |
|                       | AK*                   | US-7,133,107                             | 11-07-2006                     | Park                                               |                                                                                 |
|                       | AL*                   | US-6,930,745                             | 08-16-2005                     | Miyazaki et al.                                    |                                                                                 |
|                       | AM*                   | US-2011/0096269-A1                       | 04-28-2011                     | Mukai                                              |                                                                                 |
|                       | AN*                   | US-2004/0239864-A1                       | 12-02-2004                     | Asakawa                                            |                                                                                 |
|                       | AO*                   | US-2004/0252270-A1                       | 12-16-2004                     | LEE                                                |                                                                                 |
|                       | AP*                   | US-6,099,672                             | 08-08-2000                     | Yamazaki et al.                                    |                                                                                 |
|                       | AQ*                   | US-2002/0030783-A1                       | 03-14-2002                     | Taniguchi                                          |                                                                                 |
|                       | AR*                   | US-2004/0070723-A1                       | 04-15-2004                     | Imayama et al.                                     |                                                                                 |
|                       | AS*                   | US-6,388,729                             | 05-14-2002                     | Ahn et al.                                         |                                                                                 |
|                       | AT*                   | US-6,567,147                             | 05-20-2003                     | Hirakata                                           |                                                                                 |

| FOREIGN PATENT DOCUMENTS |                       |                                                                                   |                                |                                                    |                                                                                 |                |
|--------------------------|-----------------------|-----------------------------------------------------------------------------------|--------------------------------|----------------------------------------------------|---------------------------------------------------------------------------------|----------------|
| Examiner Initials*       | Cite No. <sup>1</sup> | Foreign Patent Document                                                           | Publication Date<br>MM-DD-YYYY | Name of Patentee or<br>Applicant of Cited Document | Pages, Columns, Lines, Where<br>Relevant Passages Or Relevant<br>Figures Appear | T <sup>6</sup> |
|                          |                       | Country Code <sup>3</sup> -Number <sup>4</sup> -Kind Code <sup>5</sup> (if known) |                                |                                                    |                                                                                 |                |
|                          | BA**                  | JP-2002-122870-A                                                                  | 04-26-2002                     | Fujitsu Ltd                                        |                                                                                 |                |
|                          | BB**                  | JP-2003-043499-A                                                                  | 02-13-2003                     | Nippon Electric Kagoshima Ltd                      |                                                                                 |                |
|                          | BC**                  | JP-08-190099                                                                      | 07-23-1996                     |                                                    |                                                                                 |                |
|                          | BD**                  | JP-2003-295201-A                                                                  | 10-15-2003                     | Shibaura Mechatronics Corp                         |                                                                                 |                |
|                          | BE**                  | JP-2002-098979-A                                                                  | 04-05-2002                     | Matsushita Electric Ind Co Ltd                     |                                                                                 |                |
|                          | BF**                  | JP-2003-241204-A                                                                  | 08-27-2003                     | Lg Philips Lcd Co Ltd                              |                                                                                 |                |
|                          | BG**                  | JP-2003-222883-A                                                                  | 08-08-2003                     | Toshiba Corp                                       |                                                                                 |                |
|                          | BH**                  | KR-2001-0072397                                                                   | 07-31-2001                     |                                                    |                                                                                 |                |
|                          | BI**                  | KR-2004-0003548-A                                                                 | 01-13-2004                     | Lg.philips Lcd Co., Ltd                            |                                                                                 |                |
|                          | BJ**                  | TW-594303-B                                                                       | 06-21-2004                     | Chi Mei Optoelectronics Corp                       |                                                                                 |                |
|                          | BK**                  | JP-62-164020                                                                      | 07-1987                        | Shibatani                                          |                                                                                 |                |
|                          | BL**                  | WO-00-77567-A1                                                                    | 12-21-2000                     | Seiko Epson Corp                                   |                                                                                 |                |

|                    |  |                 |  |
|--------------------|--|-----------------|--|
| Examiner Signature |  | Date Considered |  |
|--------------------|--|-----------------|--|

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|                                                                                                          |   |    |   |                          |                       |
|----------------------------------------------------------------------------------------------------------|---|----|---|--------------------------|-----------------------|
| Substitute for form 1449/PTO                                                                             |   |    |   | <b>Complete if Known</b> |                       |
| <b>INFORMATION DISCLOSURE<br/>STATEMENT BY APPLICANT</b><br><br><i>(Use as many sheets as necessary)</i> |   |    |   | Application Number       | (CON of 14/571,729)   |
|                                                                                                          |   |    |   | Filing Date              | Concurrently Herewith |
|                                                                                                          |   |    |   | First Named Inventor     | Yoichi MOMOSE         |
|                                                                                                          |   |    |   | Art Unit                 | 2871                  |
|                                                                                                          |   |    |   | Examiner Name            | Lauren Nguyen         |
| Sheet                                                                                                    | 2 | of | 2 | Attorney Docket Number   | 9319S-001378-COB      |

\*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. \* CITE NO.: Those application(s) which are marked with an single asterisk (\*) next to the Cite No. are not supplied (under 37 CFR 1.98(a)(2)(iii)) because that application was filed after June 30, 2003 or is available in the IFW. \*\* CITE NO.: Those document(s) which are marked with an double asterisk (\*\*) next to the Cite No. are not supplied because they were previously cited by or submitted to the Office in a prior application relied upon in this application for an earlier filing date under 35 U.S.C. 120. <sup>1</sup> Applicant's unique citation designation number (optional). <sup>2</sup> See Kinds Codes of USPTO Patent Documents at [www.uspto.gov](http://www.uspto.gov) or MPEP 901.04. <sup>3</sup> Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). <sup>4</sup> For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. <sup>5</sup> Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. <sup>6</sup> Applicant is to place a check mark here if English language Translation is attached.

| NON PATENT LITERATURE DOCUMENTS |                       |                                                                                                                                                                                                                                                                 |                |
|---------------------------------|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| Examiner Initials               | Cite No. <sup>1</sup> | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. | T <sup>2</sup> |
|                                 | CA**                  | Extended European Search Report for Application No. 05 257 233.6 mailed March 31, 2006 (8 pages).                                                                                                                                                               |                |

\*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

<sup>1</sup> Applicant's unique citation designation number (optional). <sup>2</sup> Applicant is to place a check mark here if English language Translation is attached.

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|                    |  |                 |  |
|--------------------|--|-----------------|--|
| Examiner Signature |  | Date Considered |  |
|--------------------|--|-----------------|--|

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## TRANSMITTAL FOR POWER OF ATTORNEY TO ONE OR MORE REGISTERED PRACTITIONERS

NOTE: This form is to be submitted with the Power of Attorney by Applicant form (PTO/AIA/82B) to identify the application to which the Power of Attorney is directed, in accordance with 37 CFR 1.5, unless the application number and filing date are identified in the Power of Attorney by Applicant form. If neither form PTO/AIA/82A nor form PTO/AIA/82B identifies the application to which the Power of Attorney is directed, the Power of Attorney will not be recognized in the application.

|                        |                                                 |
|------------------------|-------------------------------------------------|
| Application Number     |                                                 |
| Filing Date            | December 16, 2014                               |
| First Named Inventor   | Yoichi MOMOSE                                   |
| Title                  | METHOD OF MANUFACTURING A LIQUID CRYSTAL DEVICE |
| Art Unit               | 2871                                            |
| Examiner Name          | Lauren Nguyen                                   |
| Attorney Docket Number | 9319S-001378-COB                                |

### SIGNATURE of Applicant or Patent Practitioner

|                                                    |                       |                     |            |
|----------------------------------------------------|-----------------------|---------------------|------------|
| Signature                                          | /G. Gregory Schivley/ | Date (Optional)     | 12-16-2014 |
| Name                                               | G. Gregory Schivley   | Registration Number | 27,382     |
| Title (if Applicant is a juristic entity)          |                       |                     |            |
| Applicant Name (if Applicant is a juristic entity) |                       |                     |            |

**NOTE:** This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. If more than one applicant, use multiple forms.

☐

\*Total of \_\_\_\_\_ forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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## POWER OF ATTORNEY BY APPLICANT

I hereby revoke all previous powers of attorney given in the application identified in either the attached transmittal letter or the boxes below.

|                    |                   |
|--------------------|-------------------|
| Application Number | Filing Date       |
|                    | December 16, 2014 |

(Note: The boxes above may be left blank if information is provided on form PTO/AIA/82A.)

☒ I hereby appoint the Patent Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above:

27572

OR

☐ I hereby appoint Practitioner(s) named in the attached list (form PTO/AIA/82C) as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the patent application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above. (Note: Complete form PTO/AIA/82C.)

Please recognize or change the correspondence address for the application identified in the attached transmittal letter or the boxes above to:

☒ The address associated with the above-mentioned Customer Number

OR

☐ The address associated with Customer Number:

OR

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| Firm or Individual Name |  |       |  |     |
| Address                 |  |       |  |     |
| City                    |  | State |  | Zip |
| Country                 |  |       |  |     |
| Telephone               |  | Email |  |     |

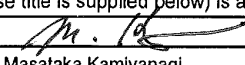
I am the Applicant (if the Applicant is a juristic entity, list the Applicant name in the box):

|  |
|--|
|  |
|--|

- ☐ Inventor or Joint Inventor (title not required below)
- ☐ Legal Representative of a Deceased or Legally Incapacitated Inventor (title not required below)
- ☒ Assignee or Person to Whom the Inventor is Under an Obligation to Assign (provide signer's title if applicant is a juristic entity)
- ☐ Person Who Otherwise Shows Sufficient Proprietary Interest (e.g., a petition under 37 CFR 1.46(b)(2) was granted in the application or is concurrently being filed with this document) (provide signer's title if applicant is a juristic entity)

### SIGNATURE of Applicant for Patent

The undersigned (whose title is supplied below) is authorized to act on behalf of the applicant (e.g., where the applicant is a juristic entity).

|           |                                                                                     |                 |               |
|-----------|-------------------------------------------------------------------------------------|-----------------|---------------|
| Signature |  | Date (Optional) | June 10, 2014 |
| Name      | Masataka Kamiyanagi                                                                 |                 |               |
| Title     | Managing Executive Officer, Seiko Epson Corporation                                 |                 |               |

**NOTE:** Signature - This form must be signed by the applicant in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. If more than one applicant, use multiple forms.

☐ Total of \_\_\_\_\_ forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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| Electronic Patent Application Fee Transmittal                                                    |          |                                                 |        |                      |
|--------------------------------------------------------------------------------------------------|----------|-------------------------------------------------|--------|----------------------|
| Application Number:                                                                              |          |                                                 |        |                      |
| Filing Date:                                                                                     |          |                                                 |        |                      |
| Title of Invention:                                                                              |          | METHOD OF MANUFACTURING A LIQUID CRYSTAL DEVICE |        |                      |
| First Named Inventor/Applicant Name:                                                             |          | Yoichi MOMOSE                                   |        |                      |
| Filer:                                                                                           |          | G. Gregory Schivley/Michele Mester              |        |                      |
| Attorney Docket Number:                                                                          |          | 93195-001378-COB                                |        |                      |
| Filed as Large Entity                                                                            |          |                                                 |        |                      |
| Filing Fees for Track I Prioritized Examination - Nonprovisional Application under 35 USC 111(a) |          |                                                 |        |                      |
| Description                                                                                      | Fee Code | Quantity                                        | Amount | Sub-Total in USD(\$) |
| <b>Basic Filing:</b>                                                                             |          |                                                 |        |                      |
| Utility application filing                                                                       | 1011     | 1                                               | 280    | 280                  |
| Utility Search Fee                                                                               | 1111     | 1                                               | 600    | 600                  |
| Utility Examination Fee                                                                          | 1311     | 1                                               | 720    | 720                  |
| Request for Prioritized Examination                                                              | 1817     | 1                                               | 4000   | 4000                 |
| <b>Pages:</b>                                                                                    |          |                                                 |        |                      |
| Utility Appl Size fee per 50 sheets >100                                                         | 1081     | 1                                               | 400    | 400                  |
| <b>Claims:</b>                                                                                   |          |                                                 |        |                      |
| <b>Miscellaneous-Filing:</b>                                                                     |          |                                                 |        |                      |

| Description                              | Fee Code | Quantity | Amount | Sub-Total in USD(\$) |
|------------------------------------------|----------|----------|--------|----------------------|
| Publ. Fee- Early, Voluntary, or Normal   | 1504     | 1        | 0      | 0                    |
| PROCESSING FEE, EXCEPT PROV. APPLS.      | 1830     | 1        | 140    | 140                  |
| <b>Petition:</b>                         |          |          |        |                      |
| <b>Patent-Appeals-and-Interference:</b>  |          |          |        |                      |
| <b>Post-Allowance-and-Post-Issuance:</b> |          |          |        |                      |
| <b>Extension-of-Time:</b>                |          |          |        |                      |
| <b>Miscellaneous:</b>                    |          |          |        |                      |
| <b>Total in USD (\$)</b>                 |          |          |        | <b>6140</b>          |



| Electronic Acknowledgement Receipt          |                                                 |
|---------------------------------------------|-------------------------------------------------|
| <b>EFS ID:</b>                              | 20977807                                        |
| <b>Application Number:</b>                  | 14572068                                        |
| <b>International Application Number:</b>    |                                                 |
| <b>Confirmation Number:</b>                 | 6575                                            |
| <b>Title of Invention:</b>                  | METHOD OF MANUFACTURING A LIQUID CRYSTAL DEVICE |
| <b>First Named Inventor/Applicant Name:</b> | Yoichi MOMOSE                                   |
| <b>Customer Number:</b>                     | 27572                                           |
| <b>Filer:</b>                               | G. Gregory Schivley/Michele Mester              |
| <b>Filer Authorized By:</b>                 | G. Gregory Schivley                             |
| <b>Attorney Docket Number:</b>              | 93195-001378-COB                                |
| <b>Receipt Date:</b>                        | 16-DEC-2014                                     |
| <b>Filing Date:</b>                         |                                                 |
| <b>Time Stamp:</b>                          | 16:00:10                                        |
| <b>Application Type:</b>                    | Utility under 35 USC 111(a)                     |

### Payment information:

|                                                                                                                                                                                                                                                                                                                                                                                          |                 |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| Submitted with Payment                                                                                                                                                                                                                                                                                                                                                                   | yes             |
| Payment Type                                                                                                                                                                                                                                                                                                                                                                             | Deposit Account |
| Payment was successfully received in RAM                                                                                                                                                                                                                                                                                                                                                 | \$6140          |
| RAM confirmation Number                                                                                                                                                                                                                                                                                                                                                                  | 2746            |
| Deposit Account                                                                                                                                                                                                                                                                                                                                                                          | 506518          |
| Authorized User                                                                                                                                                                                                                                                                                                                                                                          |                 |
| <p>The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:</p> <p>Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees)</p> <p>Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)</p> |                 |

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.20 (Post Issuance fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

## File Listing:

| Document Number                                 | Document Description                                | File Name                           | File Size(Bytes)/ Message Digest         | Multi Part /.zip | Pages (if appl.) |
|-------------------------------------------------|-----------------------------------------------------|-------------------------------------|------------------------------------------|------------------|------------------|
| 1                                               | Drawings-only black and white line drawings         | Drawings.PDF                        | 576395                                   | no               | 31               |
|                                                 |                                                     |                                     | 0038457fa019a2b74bc6338fe7a5a80a65476c51 |                  |                  |
| Warnings:                                       |                                                     |                                     |                                          |                  |                  |
| Information:                                    |                                                     |                                     |                                          |                  |                  |
| 2                                               | Information Disclosure Statement (IDS) Form (SB08)  | 1449.PDF                            | 34314                                    | no               | 2                |
|                                                 |                                                     |                                     | d188a9bd16f7061f5db7b42a0d46173cd9cee64  |                  |                  |
| Warnings:                                       |                                                     |                                     |                                          |                  |                  |
| Information:                                    |                                                     |                                     |                                          |                  |                  |
| This is not an USPTO supplied IDS fillable form |                                                     |                                     |                                          |                  |                  |
| 3                                               | TrackOne Request                                    | CertificationReqPrioritizedExam.PDF | 152770                                   | no               | 2                |
|                                                 |                                                     |                                     | 83457fcb36db11ec11751d5762f7d8ef717de86f |                  |                  |
| Warnings:                                       |                                                     |                                     |                                          |                  |                  |
| Information:                                    |                                                     |                                     |                                          |                  |                  |
| 4                                               | Application Data Sheet                              | ADS.PDF                             | 1561460                                  | no               | 7                |
|                                                 |                                                     |                                     | 1d38d0ae31223c0500df4e81ff1074997753b650 |                  |                  |
| Warnings:                                       |                                                     |                                     |                                          |                  |                  |
| Information:                                    |                                                     |                                     |                                          |                  |                  |
| 5                                               |                                                     | ContinuationPatentApp.PDF           | 2089593                                  | yes              | 152              |
|                                                 |                                                     |                                     | d427f9fc406857af3ac6ee5dd460eb3e4d428c54 |                  |                  |
|                                                 | Multipart Description/PDF files in .zip description |                                     |                                          |                  |                  |
|                                                 | Document Description                                |                                     | Start                                    | End              |                  |
|                                                 | Specification                                       |                                     | 1                                        | 140              |                  |
|                                                 | Claims                                              |                                     | 141                                      | 151              |                  |
|                                                 | Abstract                                            |                                     | 152                                      | 152              |                  |
| Warnings:                                       |                                                     |                                     |                                          |                  |                  |
| Information:                                    |                                                     |                                     |                                          |                  |                  |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                      |                     |                                                               |    |   |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|---------------------|---------------------------------------------------------------|----|---|
| 6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Transmittal Letter   | IDS.PDF             | 12287<br><div>684c0391b79ce87208aa89c321a7856891830232</div>  | no | 1 |
| Warnings:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                      |                     |                                                               |    |   |
| Information:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                      |                     |                                                               |    |   |
| 7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Power of Attorney    | PowerOfAttorney.PDF | 304585<br><div>34c8c5ae315f9d2d86587939b5609344a77a6476</div> | no | 2 |
| Warnings:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                      |                     |                                                               |    |   |
| Information:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                      |                     |                                                               |    |   |
| 8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Fee Worksheet (SB06) | fee-info.pdf        | 42339<br><div>3b274eb25b84a6bd83726819b78c1b557a5bbe3e</div>  | no | 2 |
| Warnings:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                      |                     |                                                               |    |   |
| Information:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                      |                     |                                                               |    |   |
| Total Files Size (in bytes):                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                      |                     | 4773743                                                       |    |   |
| <p>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</p> <p><b><u>New Applications Under 35 U.S.C. 111</u></b><br/>If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><b><u>National Stage of an International Application under 35 U.S.C. 371</u></b><br/>If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><b><u>New International Application Filed with the USPTO as a Receiving Office</u></b><br/>If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p> |                      |                     |                                                               |    |   |

FIG. 1

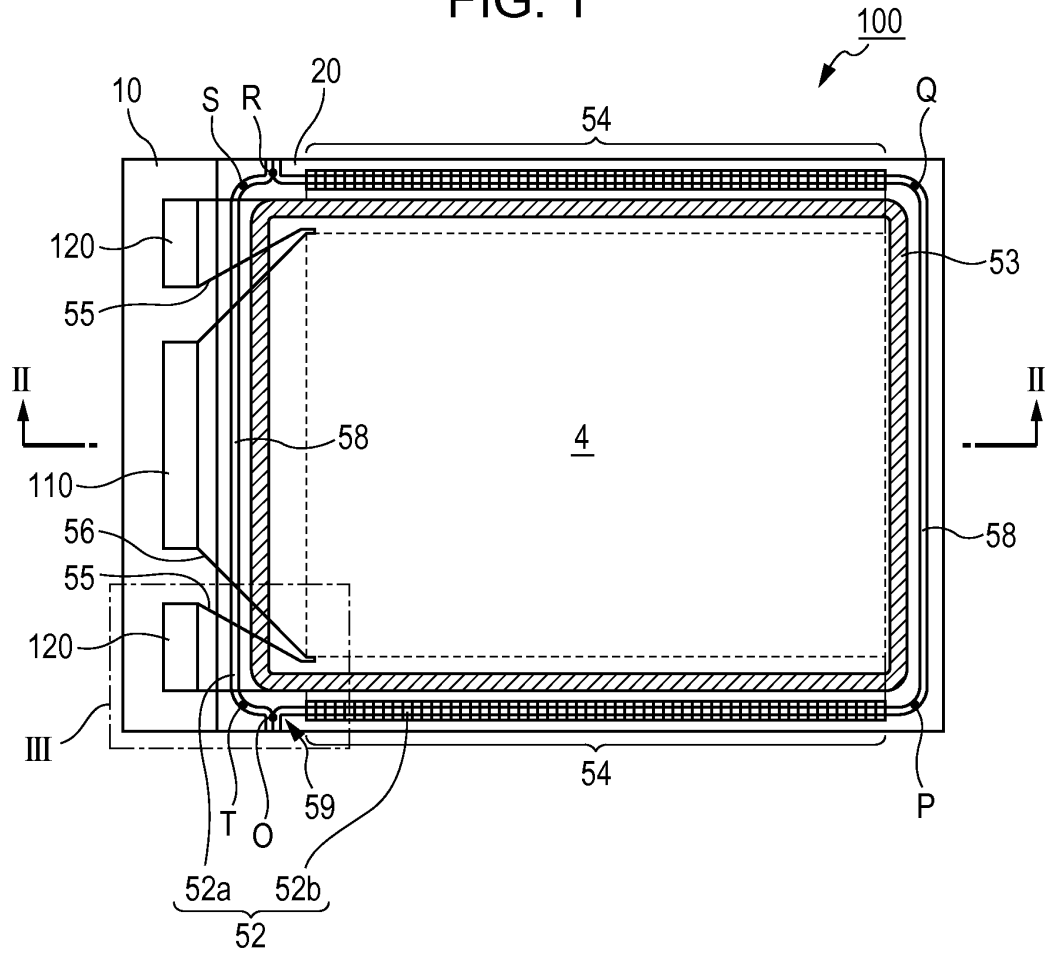


FIG. 2

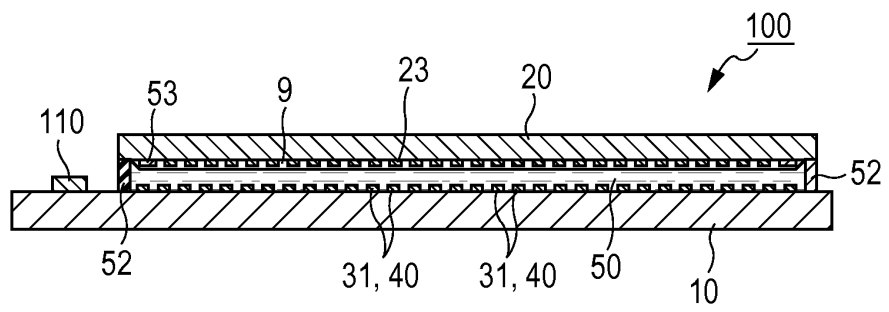


FIG. 3

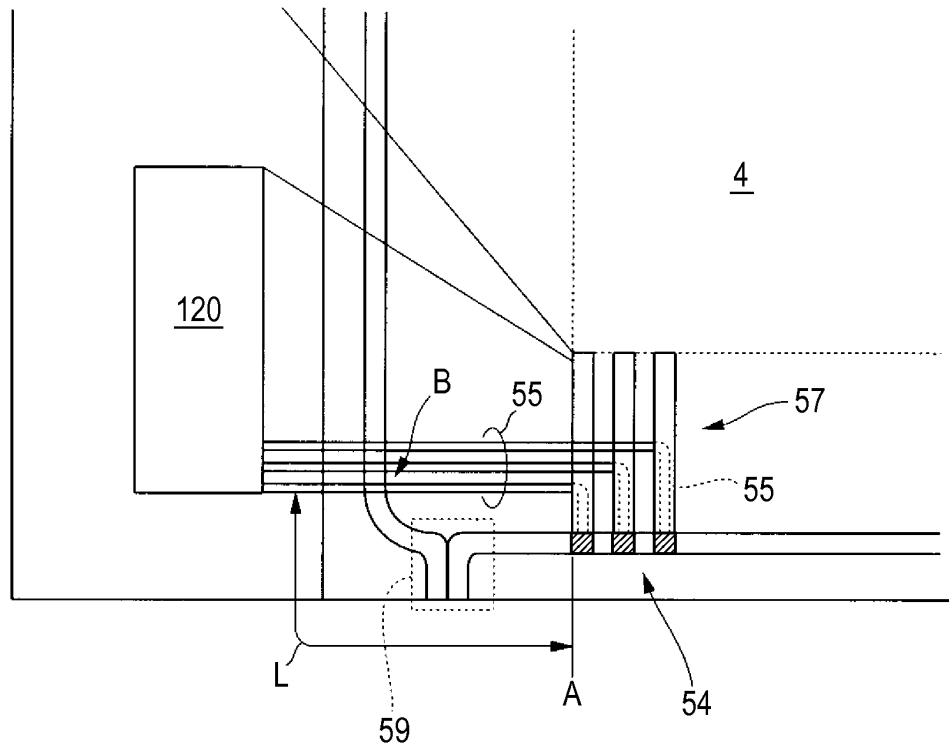


FIG. 4

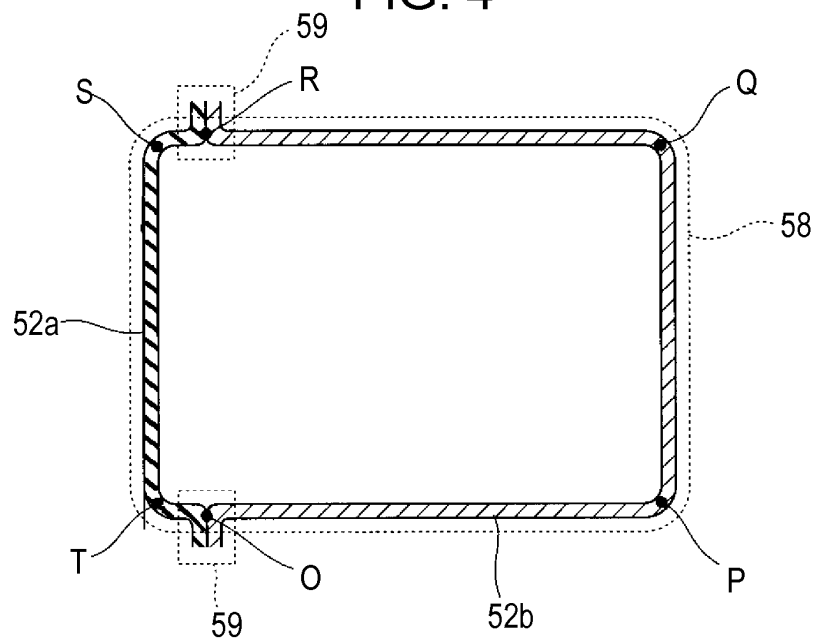


FIG. 5

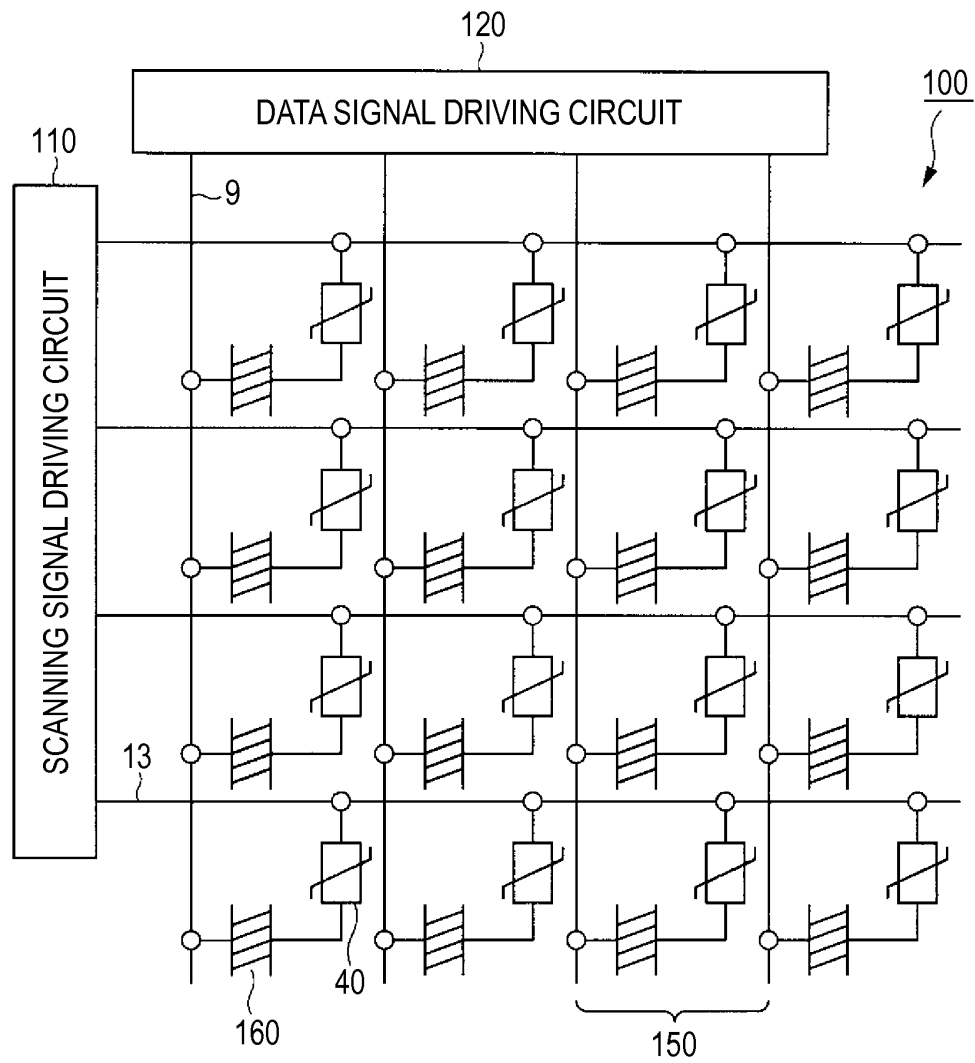


FIG. 6

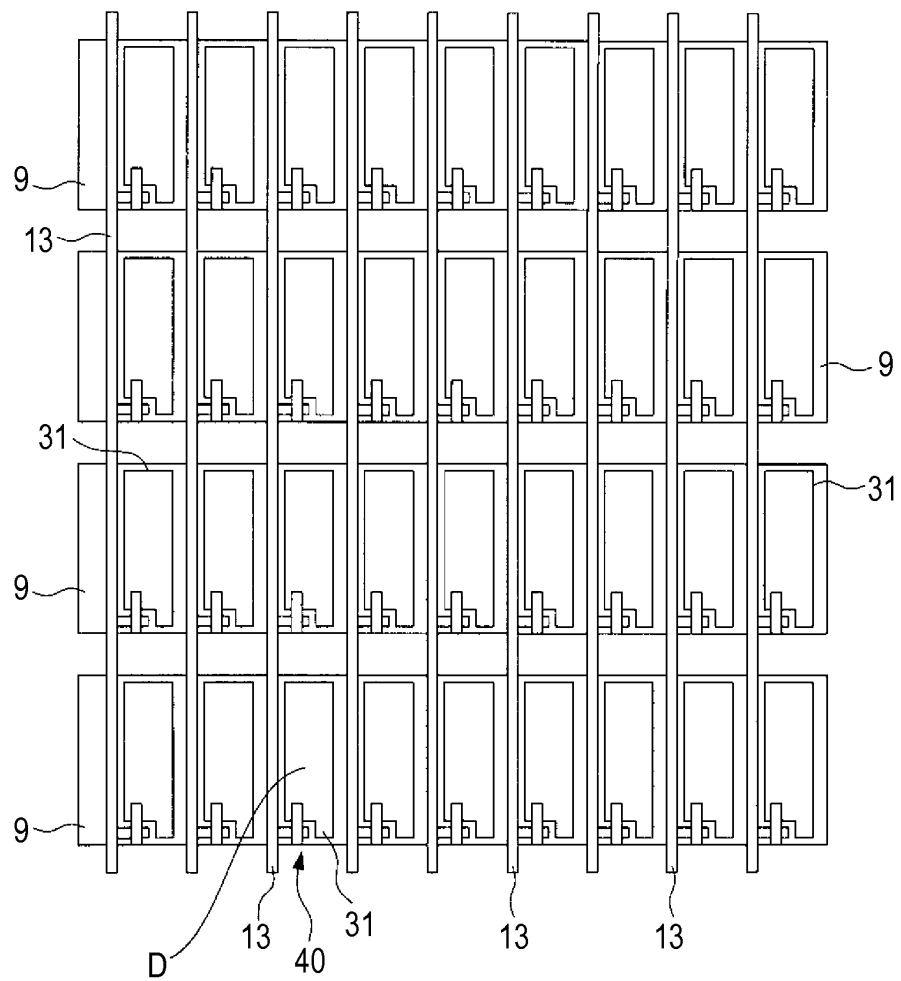


FIG. 7A

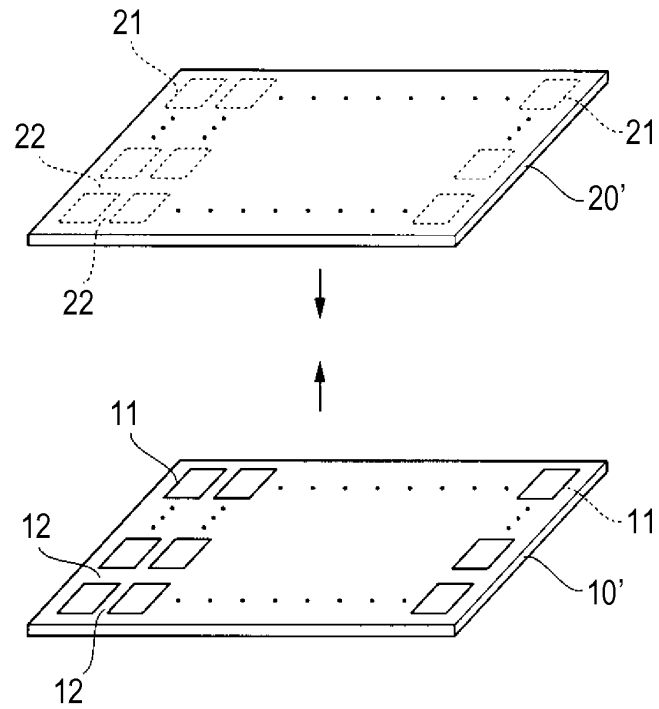


FIG. 7B

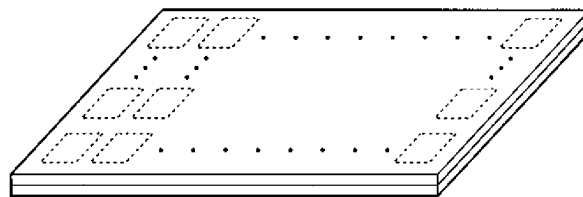


FIG. 7C

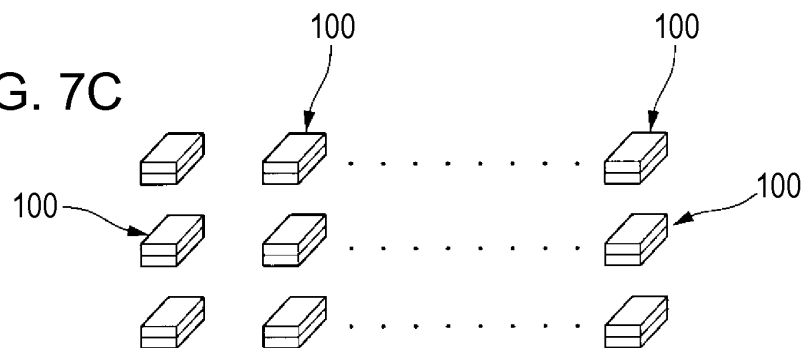




FIG. 8

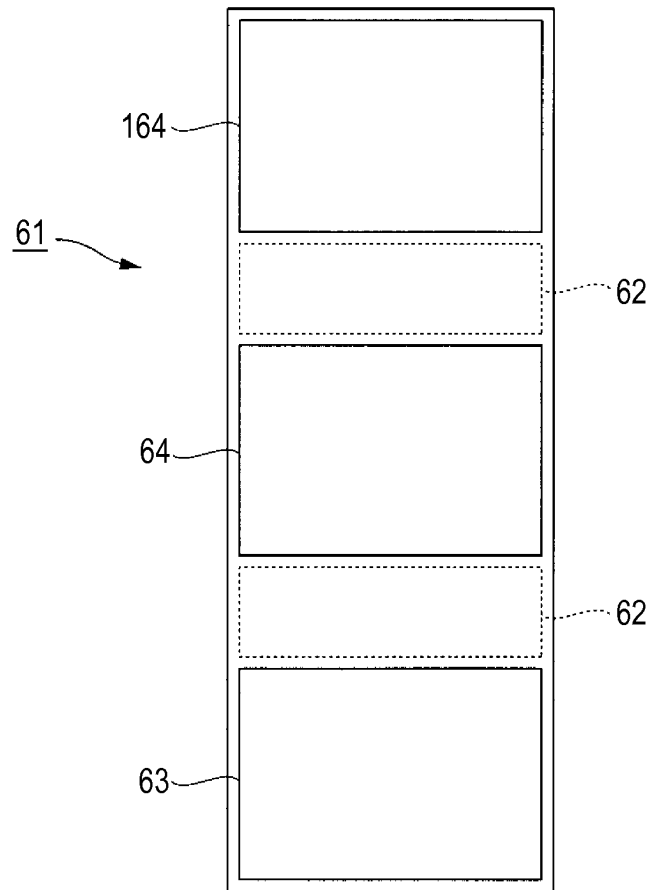


FIG. 9

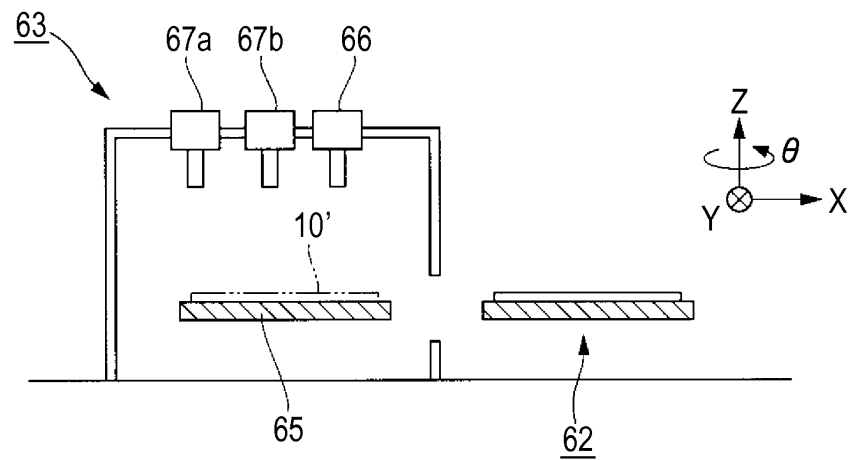


FIG. 10

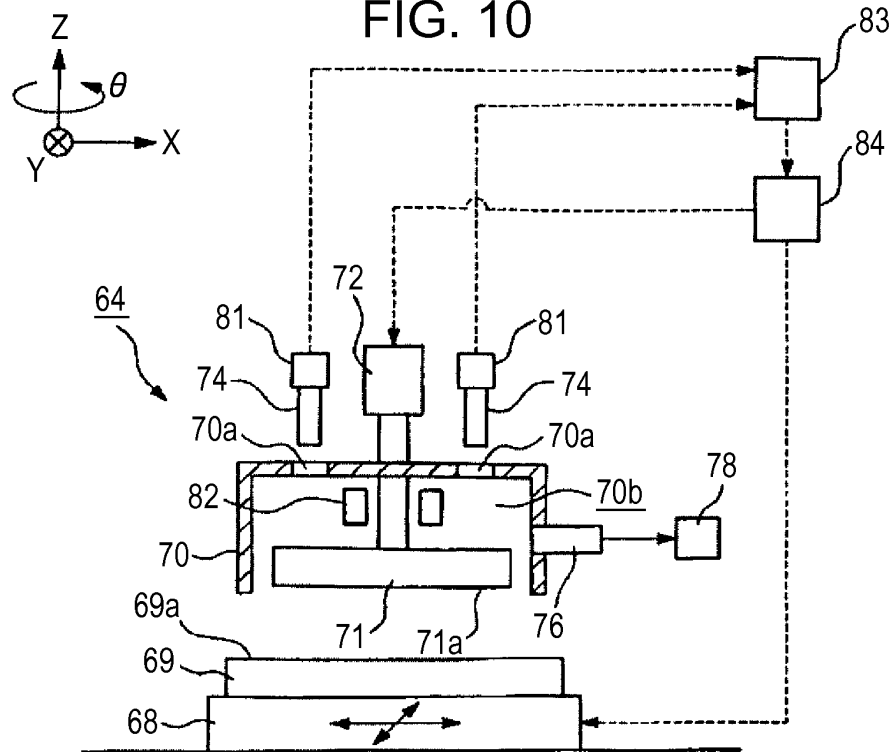


FIG. 11

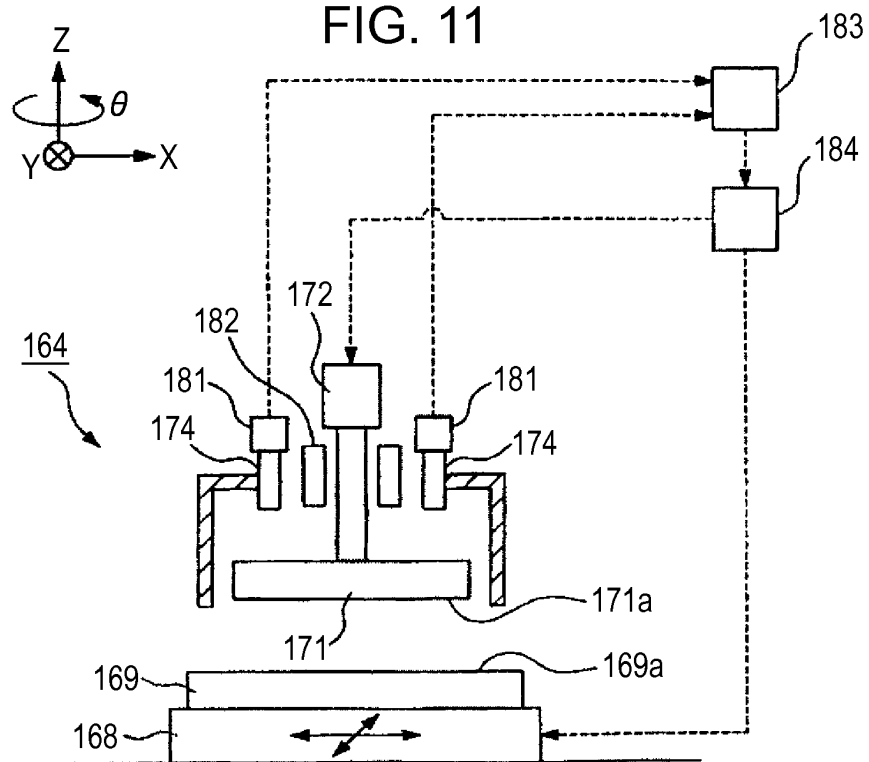


FIG. 12A

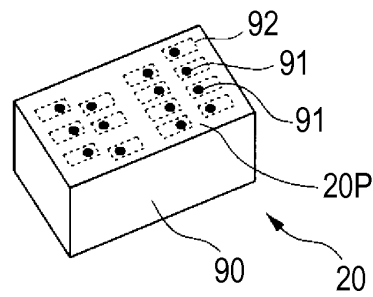


FIG. 12B

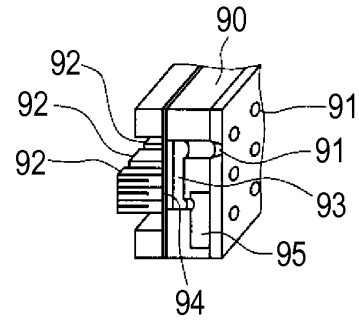


FIG. 13

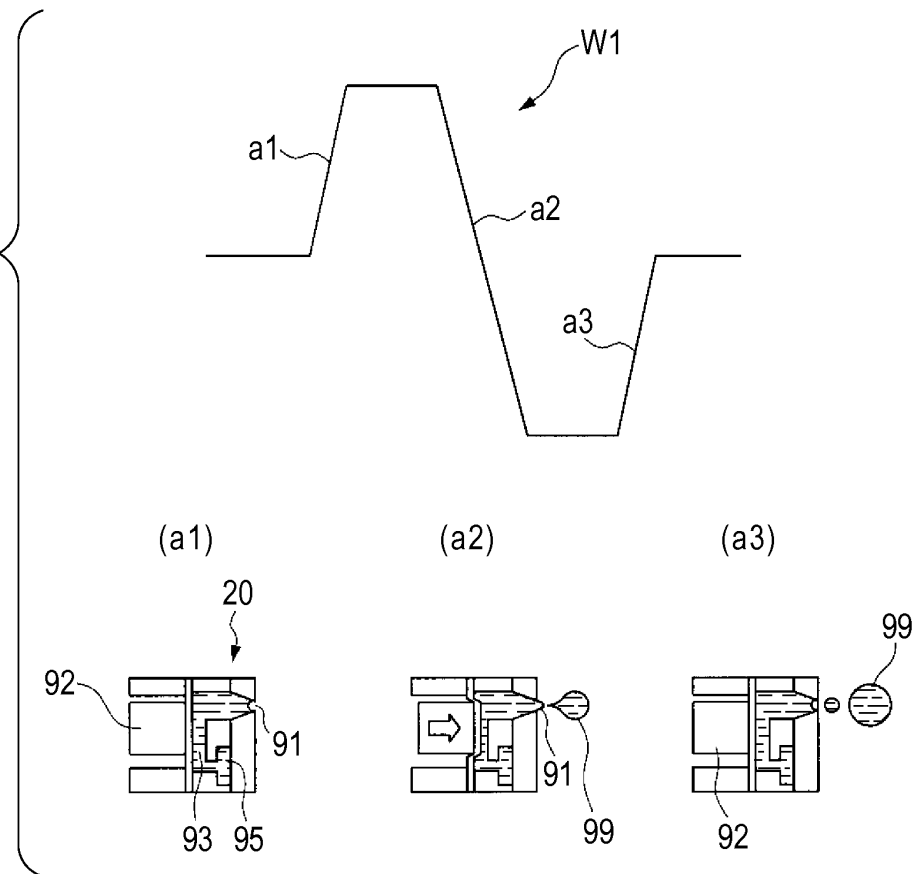


FIG. 14A

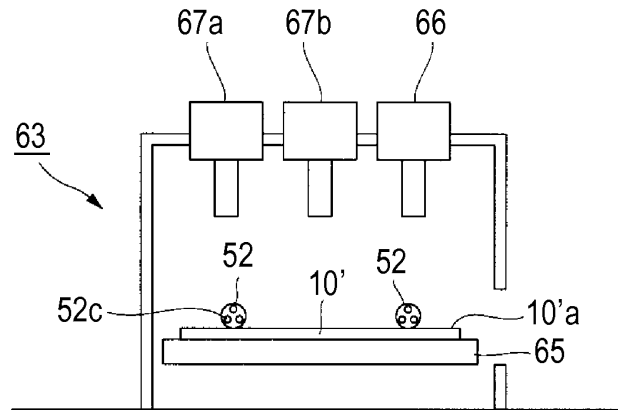


FIG. 14B

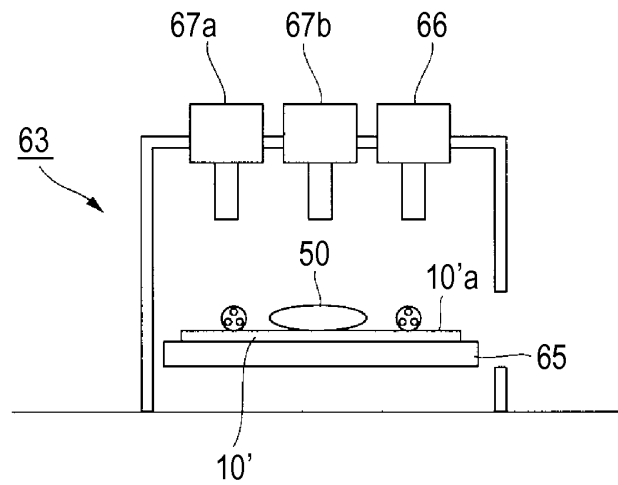
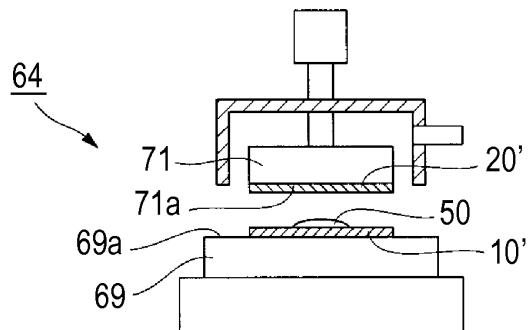


FIG. 14C



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FIG. 15A

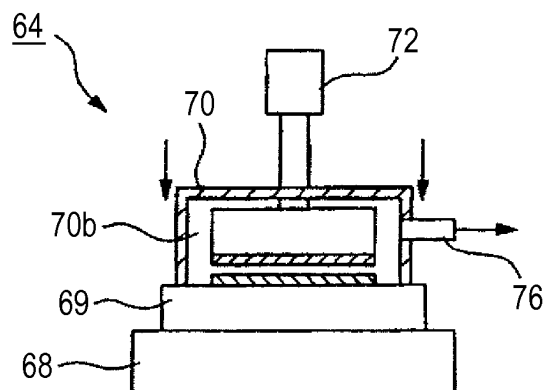


FIG. 15B

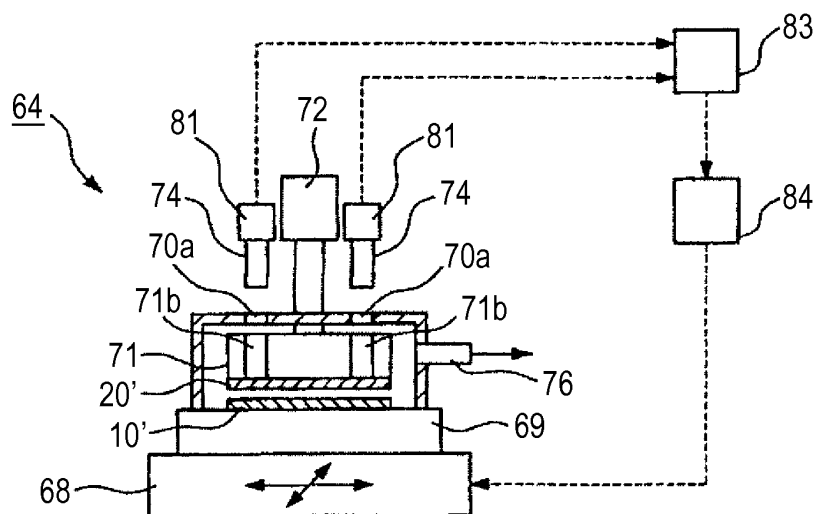


FIG. 15C

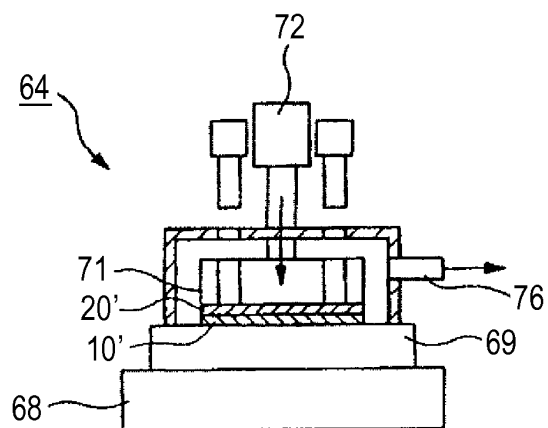


FIG. 16A

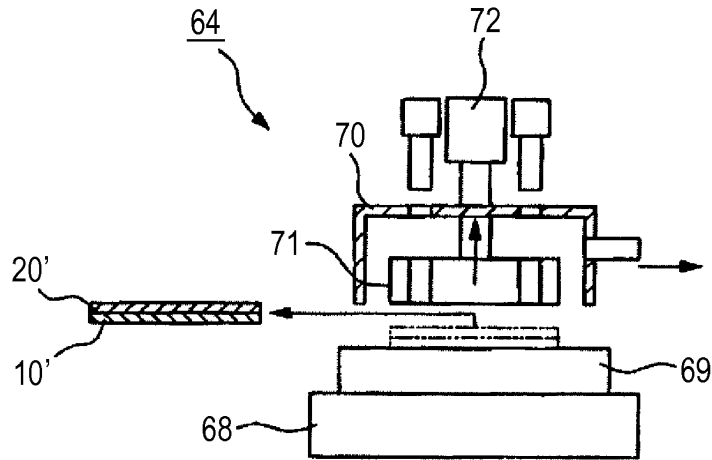


FIG. 16B

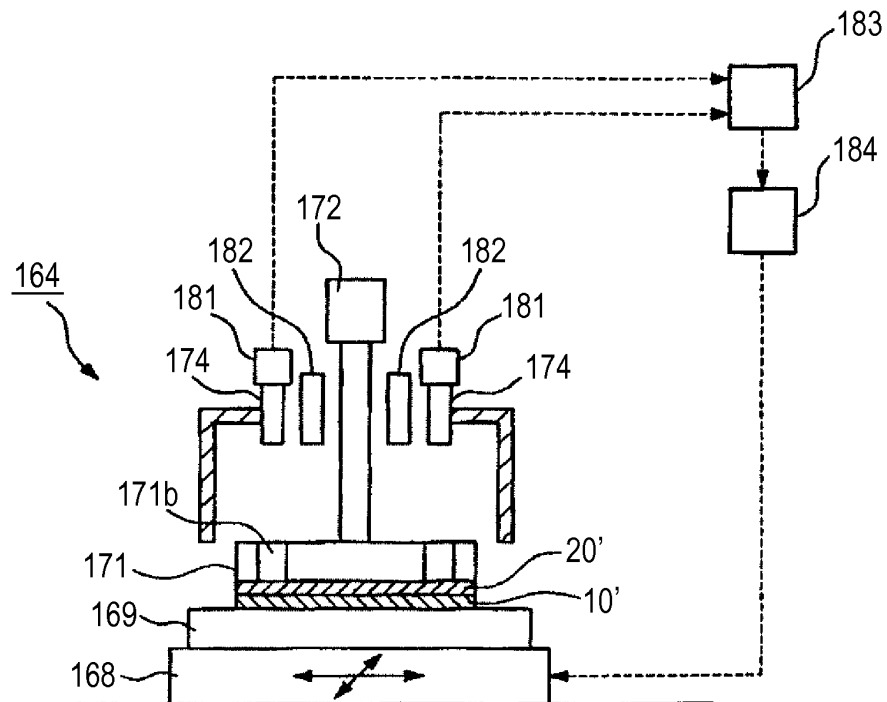


FIG. 17A

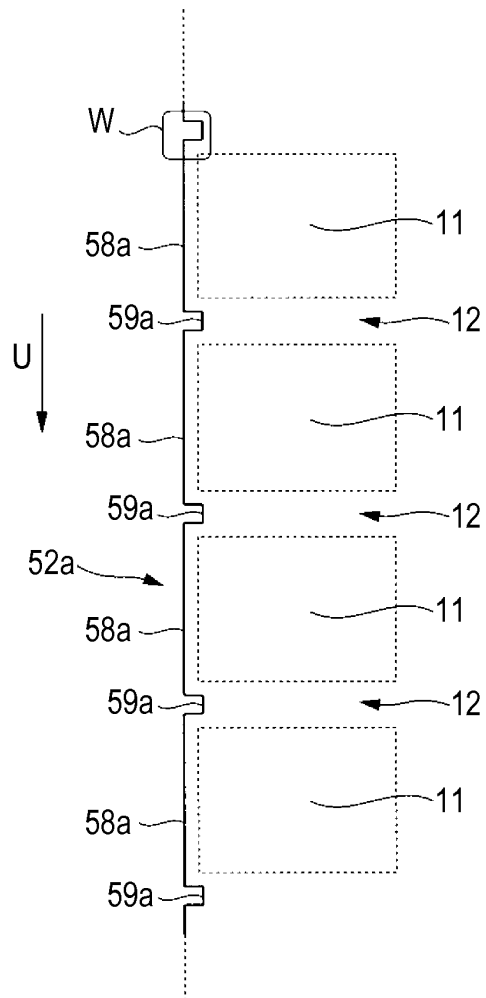


FIG. 17B

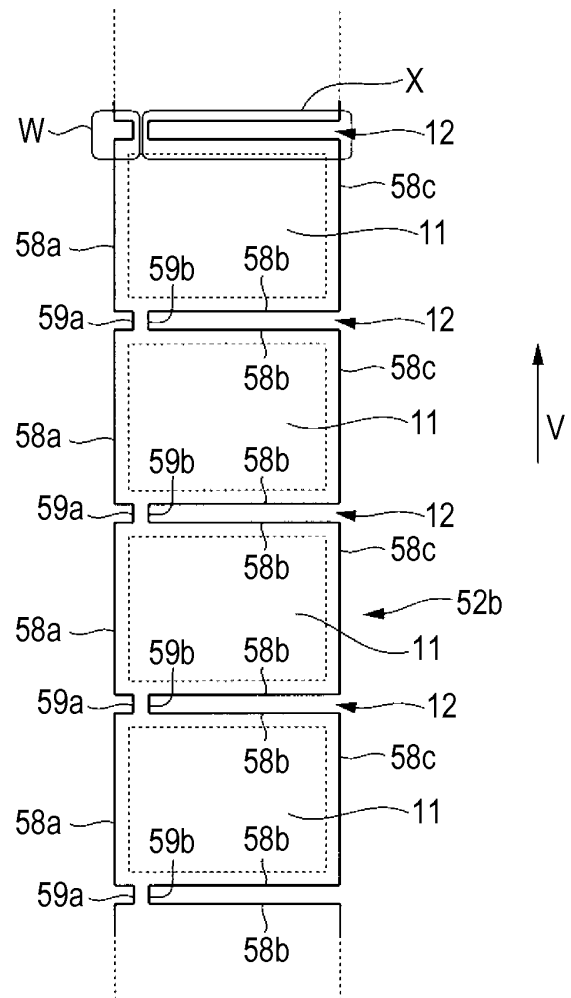


FIG. 18A

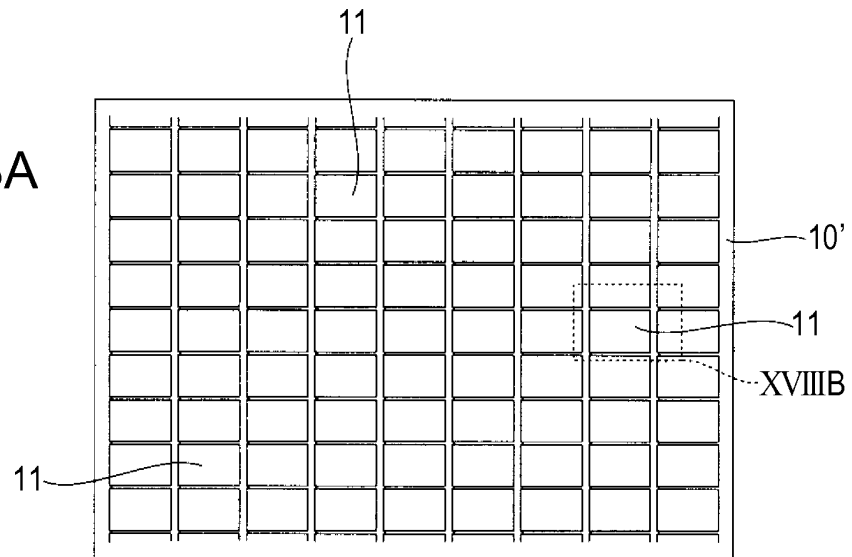


FIG. 18B

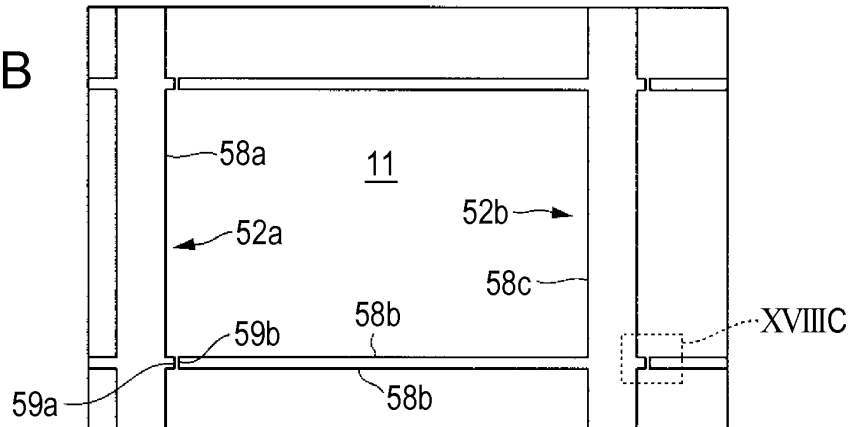


FIG. 18C

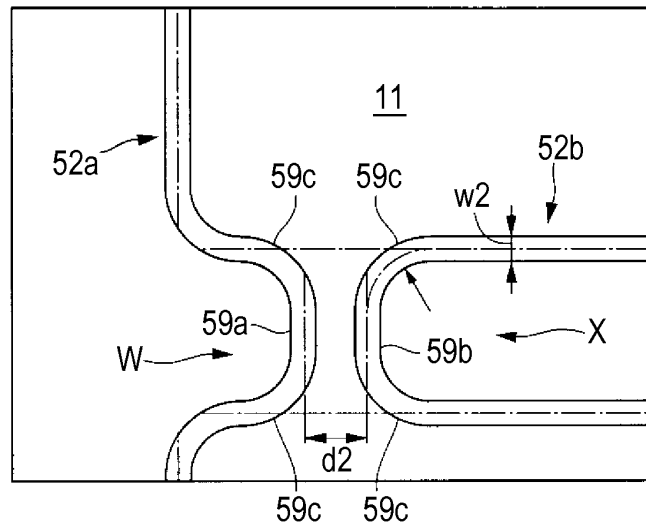




FIG. 19

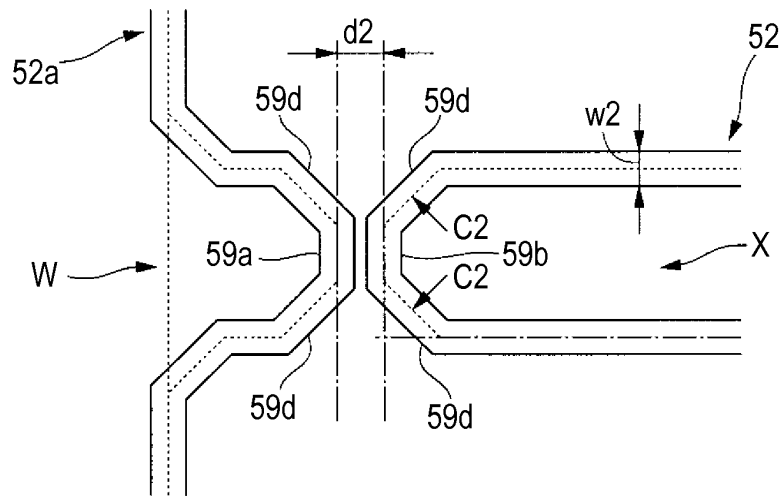


FIG. 20

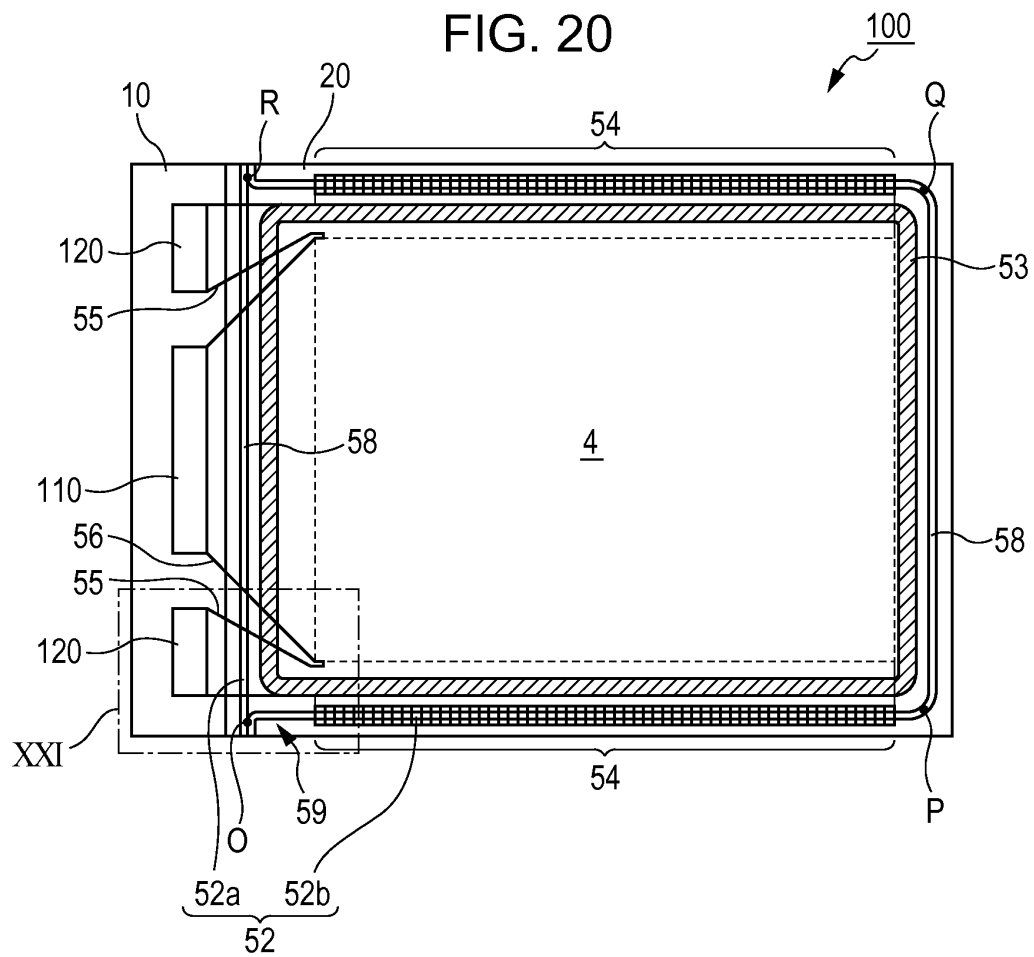


FIG. 21

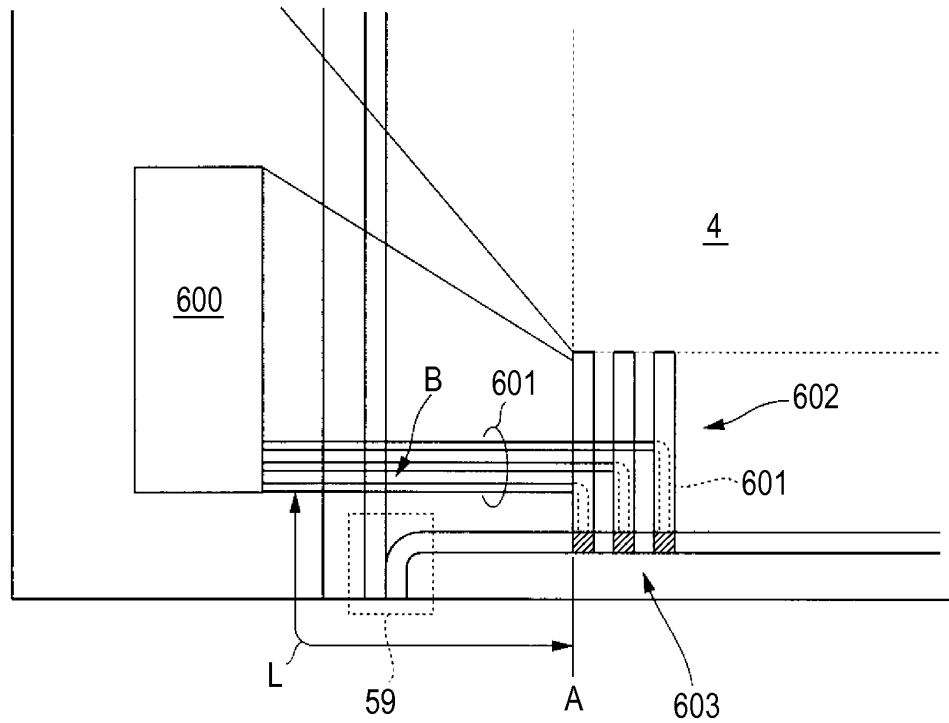


FIG. 22

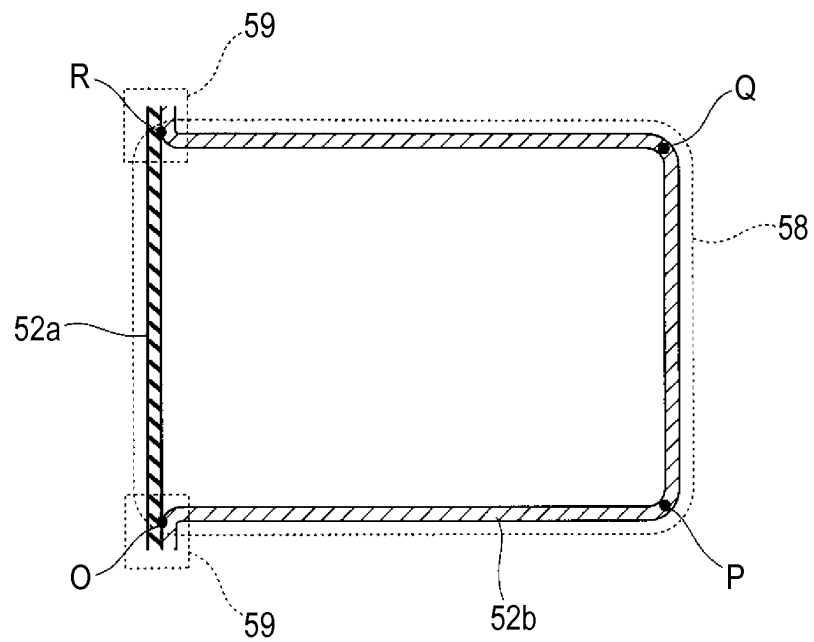


FIG. 23A

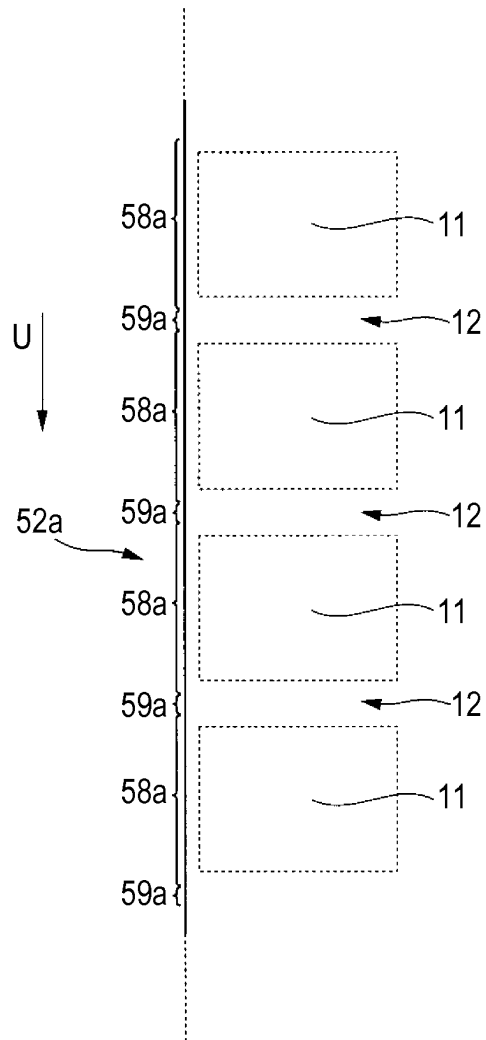
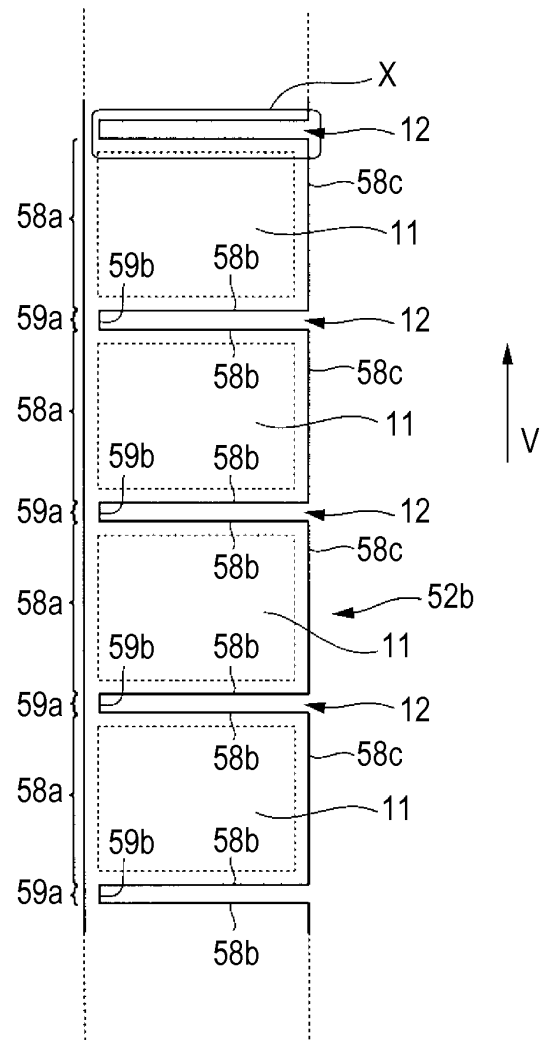


FIG. 23B



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FIG. 24A

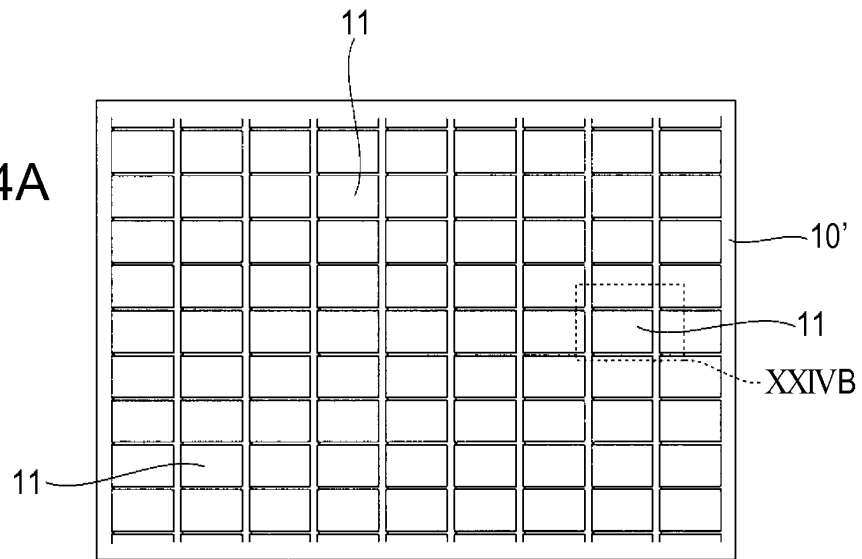


FIG. 24B

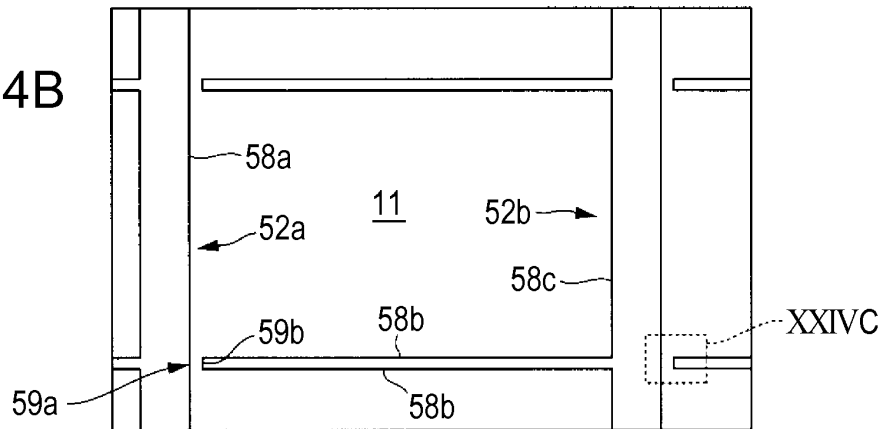


FIG. 24C

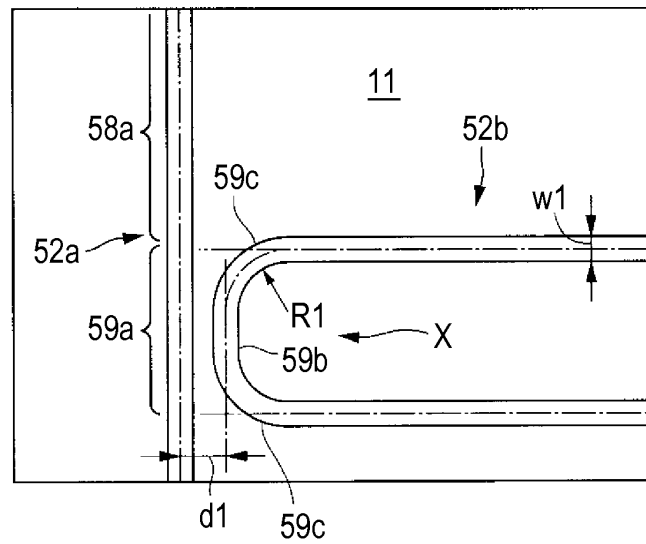


FIG. 26 is a schematic diagram of a display device 100. The top portion shows a top view of a corner of the device, where a display area 4 is defined by a dashed line. The corner is formed by a bezel 58 and a frame 54. A bracket 52 indicates a distance from the corner to the center of the display area, with sub-brackets 52a and 52b. The bottom portion is a detailed cross-sectional view of the corner, showing the bezel 58, the frame 54, and the display area 4. The bezel 58 is composed of a bezel body 58a and a bezel lip 58b. The frame 54 is composed of a frame body 54a and a frame lip 54b. The display area 4 is defined by a dashed line. The corner is formed by a bezel 58 and a frame 54. A bracket 52 indicates a distance from the corner to the center of the display area, with sub-brackets 52a and 52b. The bottom portion is a detailed cross-sectional view of the corner, showing the bezel 58, the frame 54, and the display area 4. The bezel 58 is composed of a bezel body 58a and a bezel lip 58b. The frame 54 is composed of a frame body 54a and a frame lip 54b. The display area 4 is defined by a dashed line.

FIG. 27

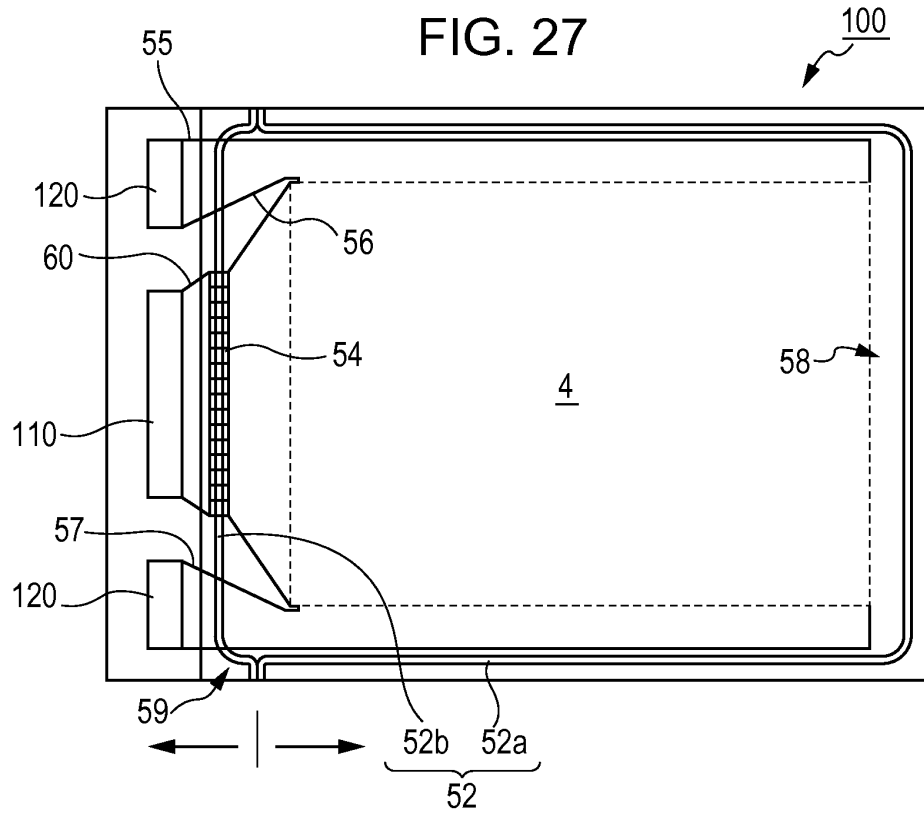


FIG. 28

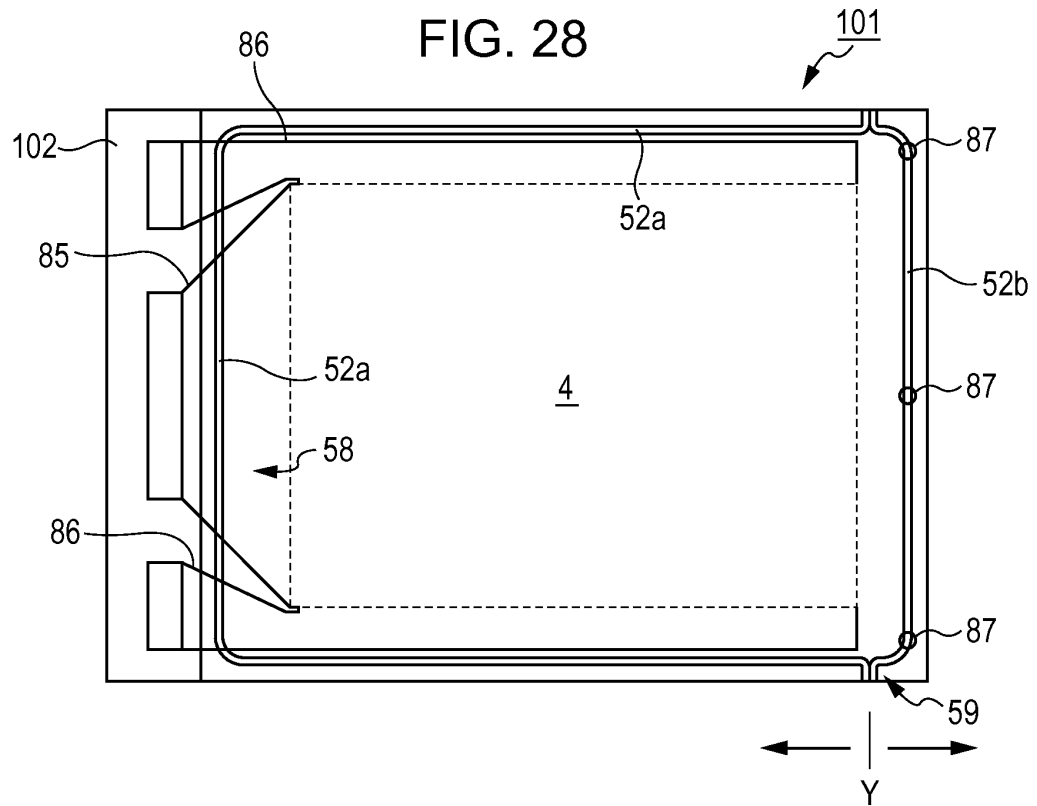


FIG. 29

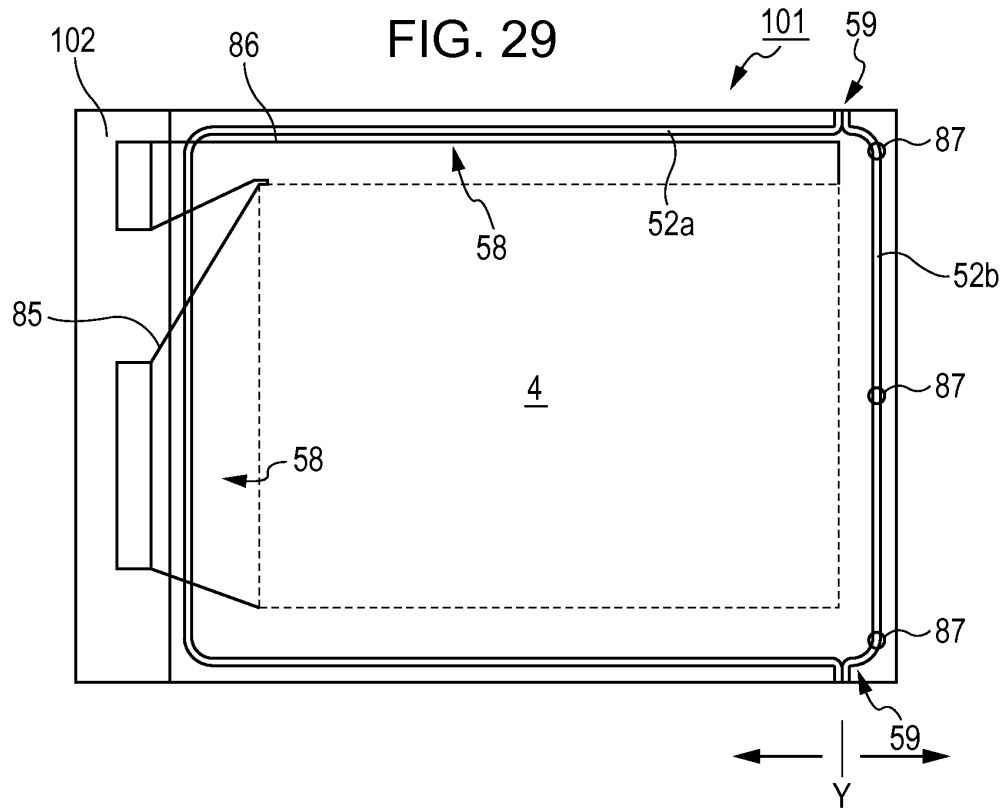


FIG. 30

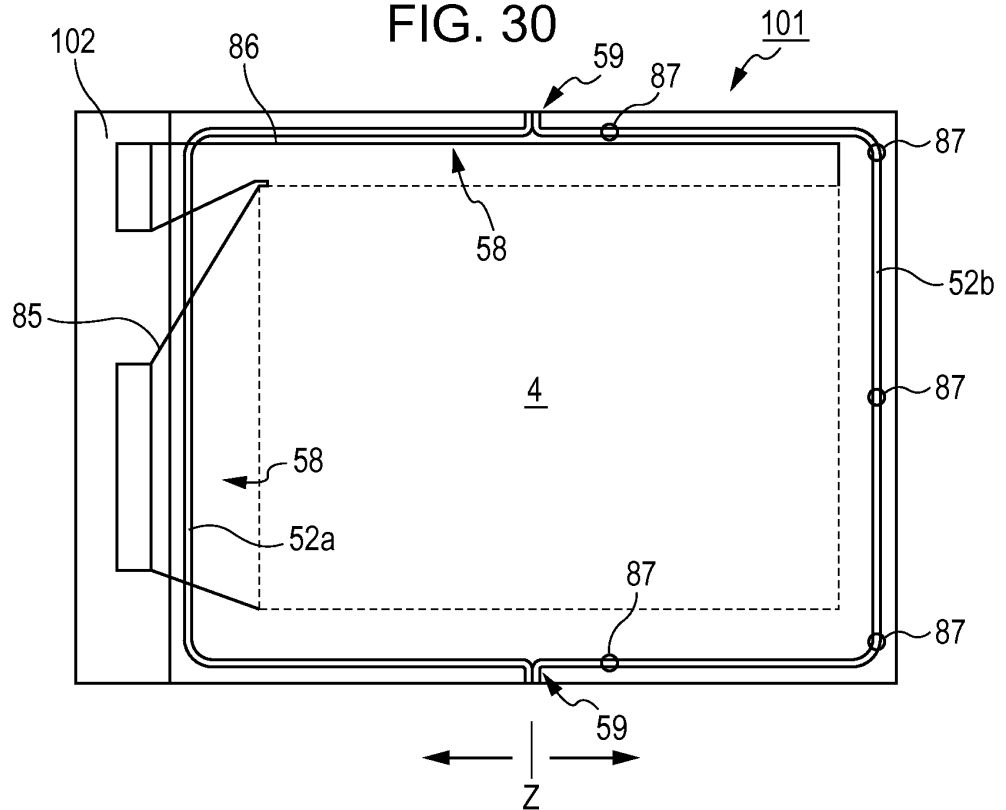


FIG. 31

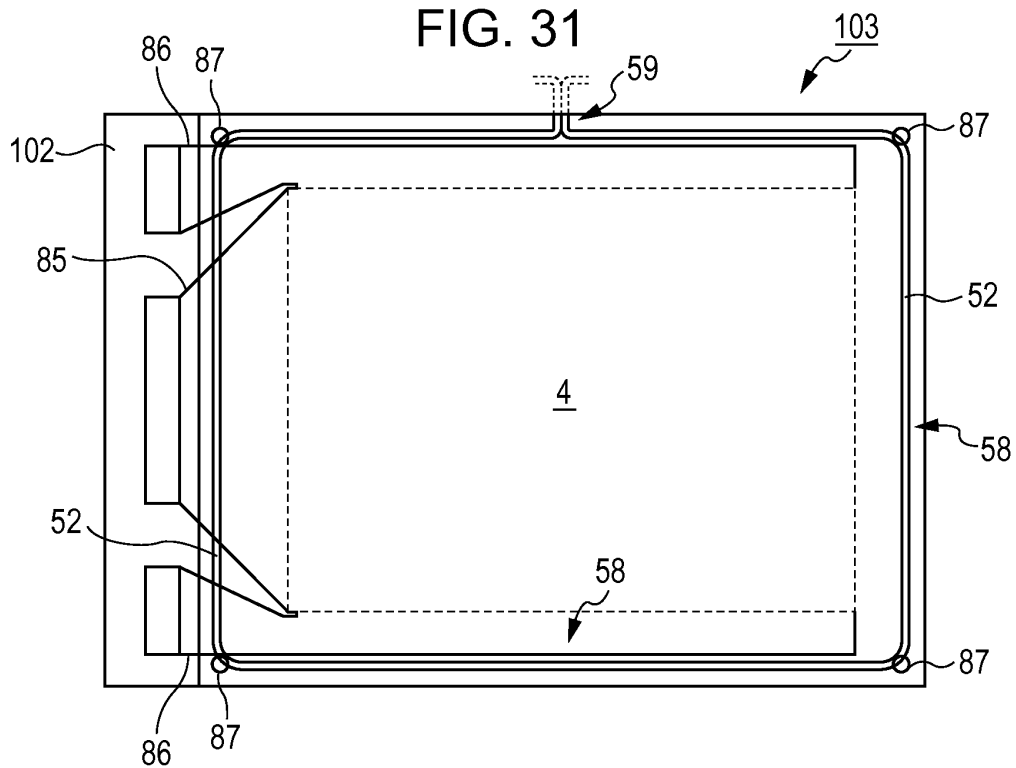


FIG. 32

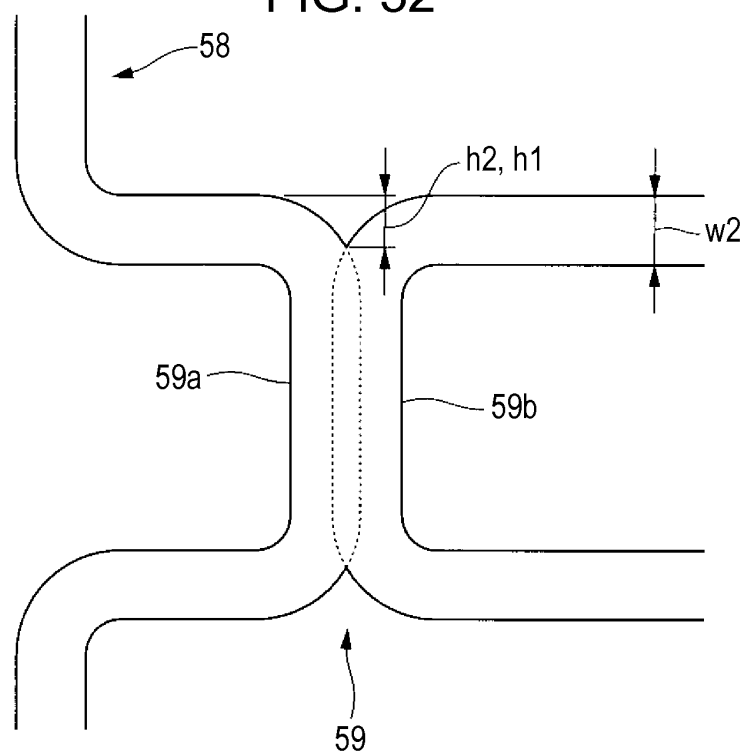




FIG. 33

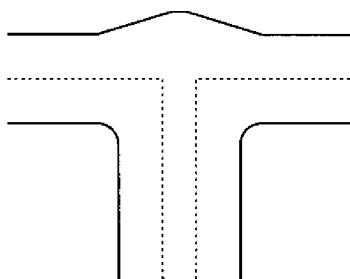


FIG. 34

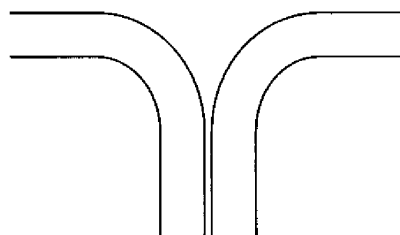


FIG. 35

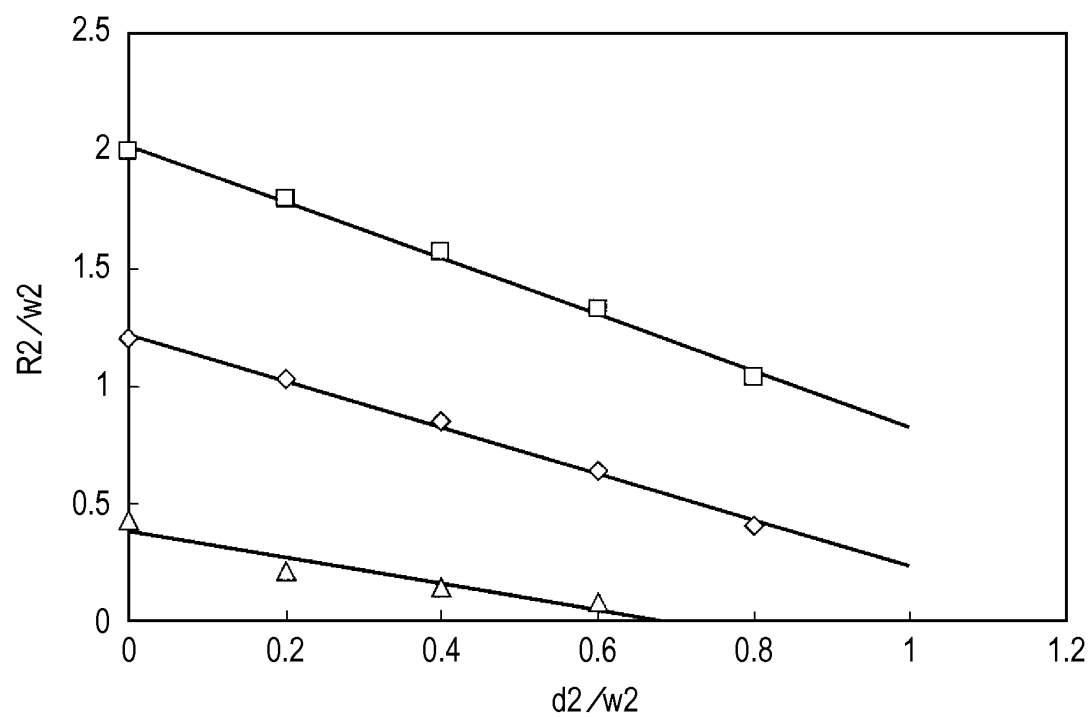


FIG. 36

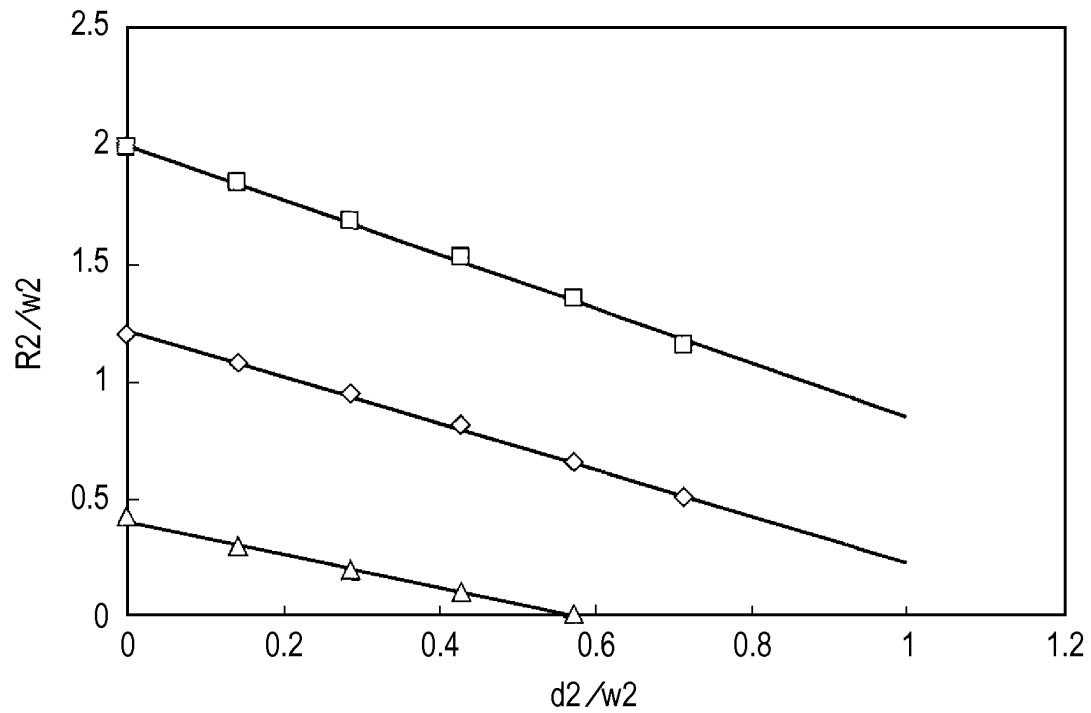


FIG. 37

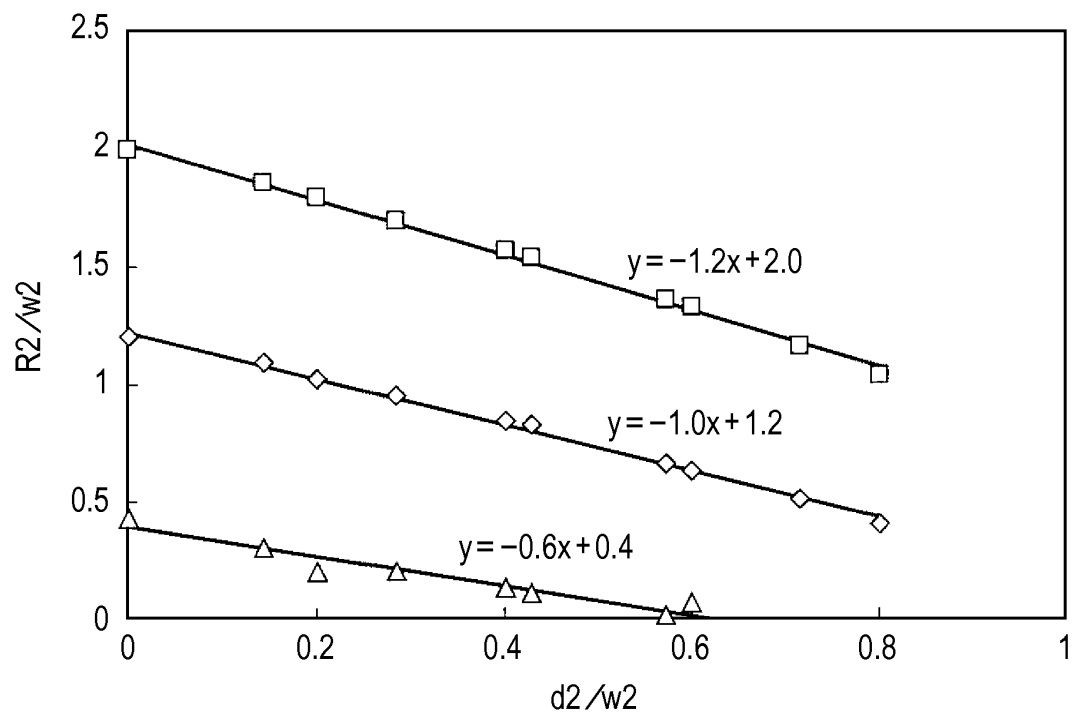


FIG. 38

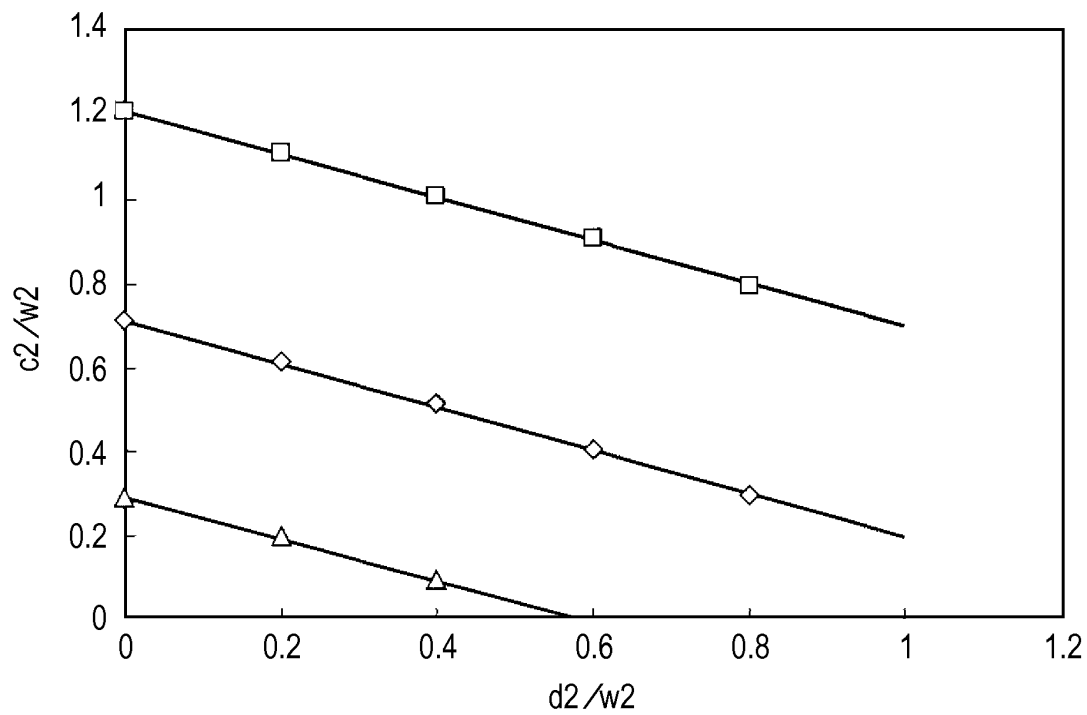


FIG. 39

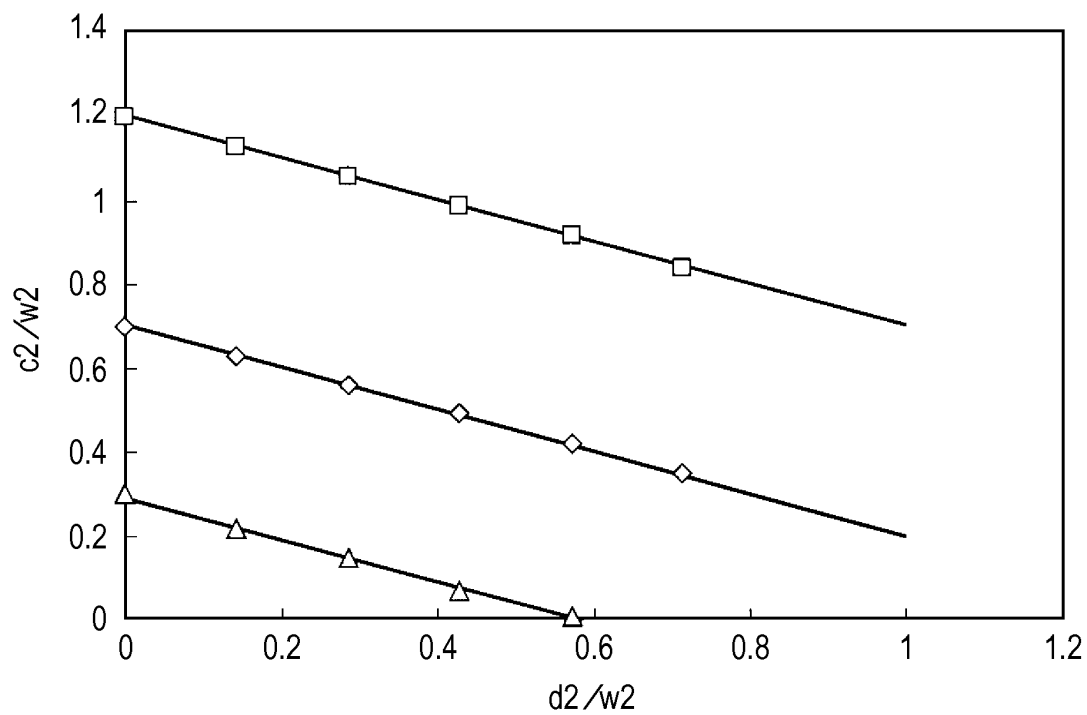


FIG. 40

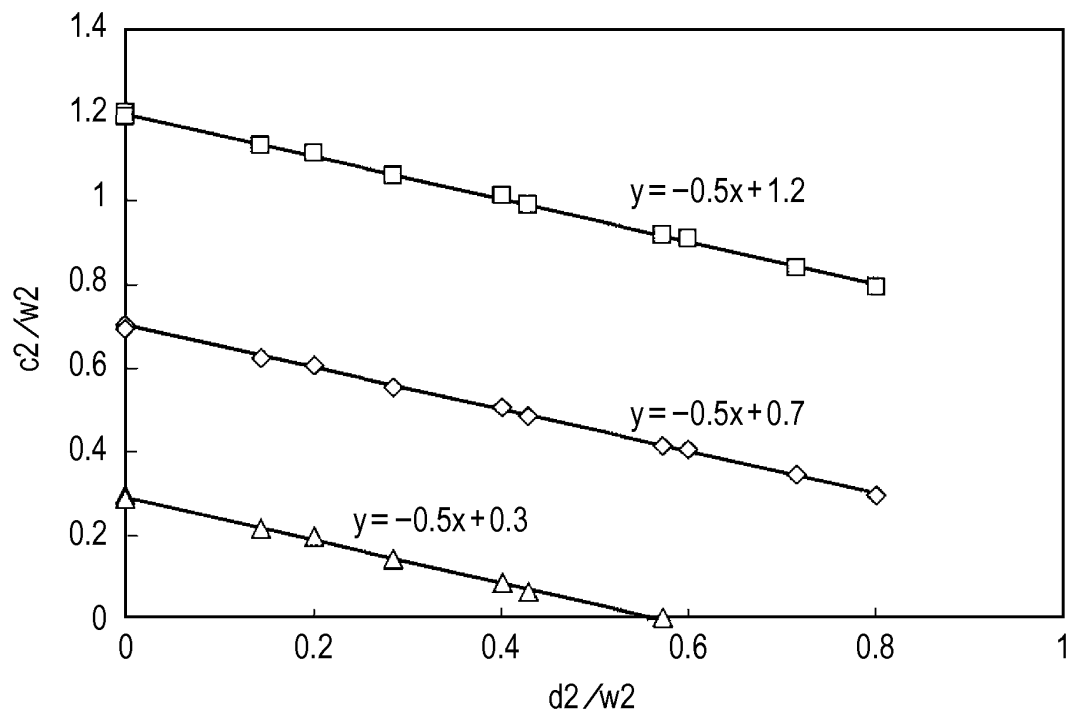
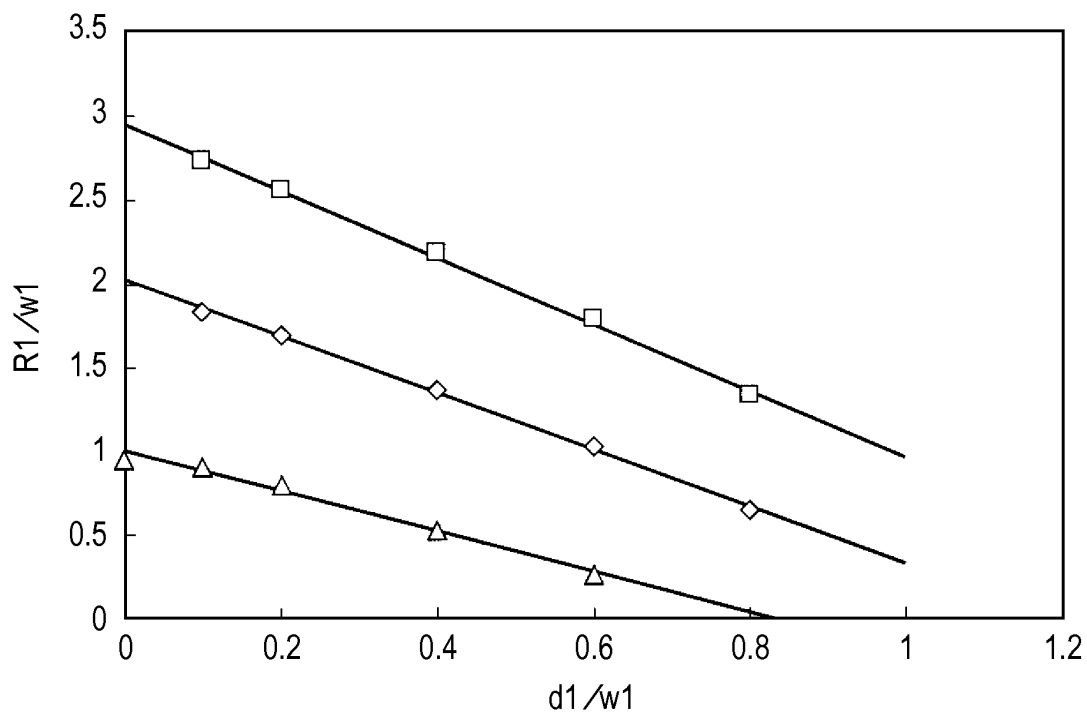


FIG. 41



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FIG. 42

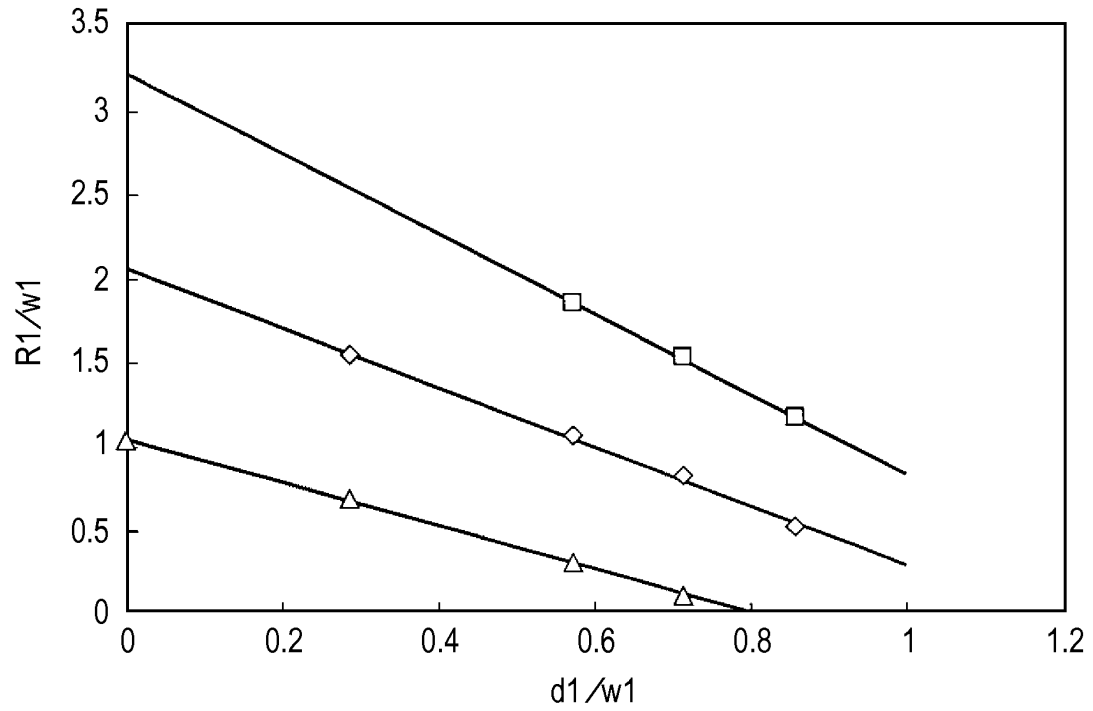
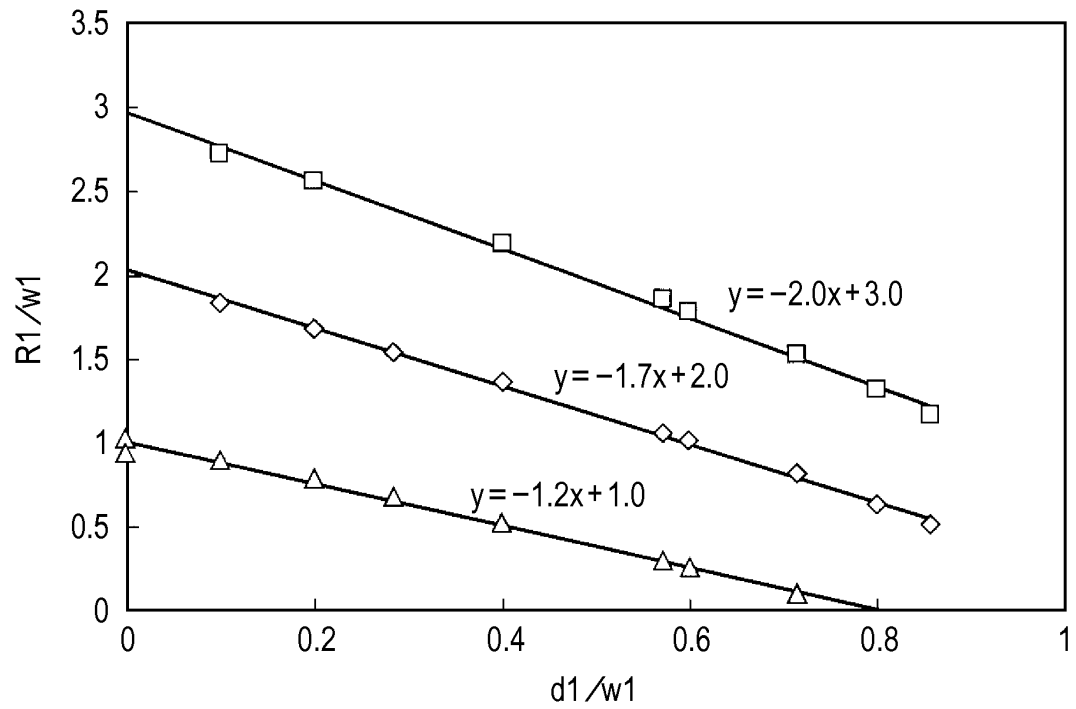


FIG. 43



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FIG. 44

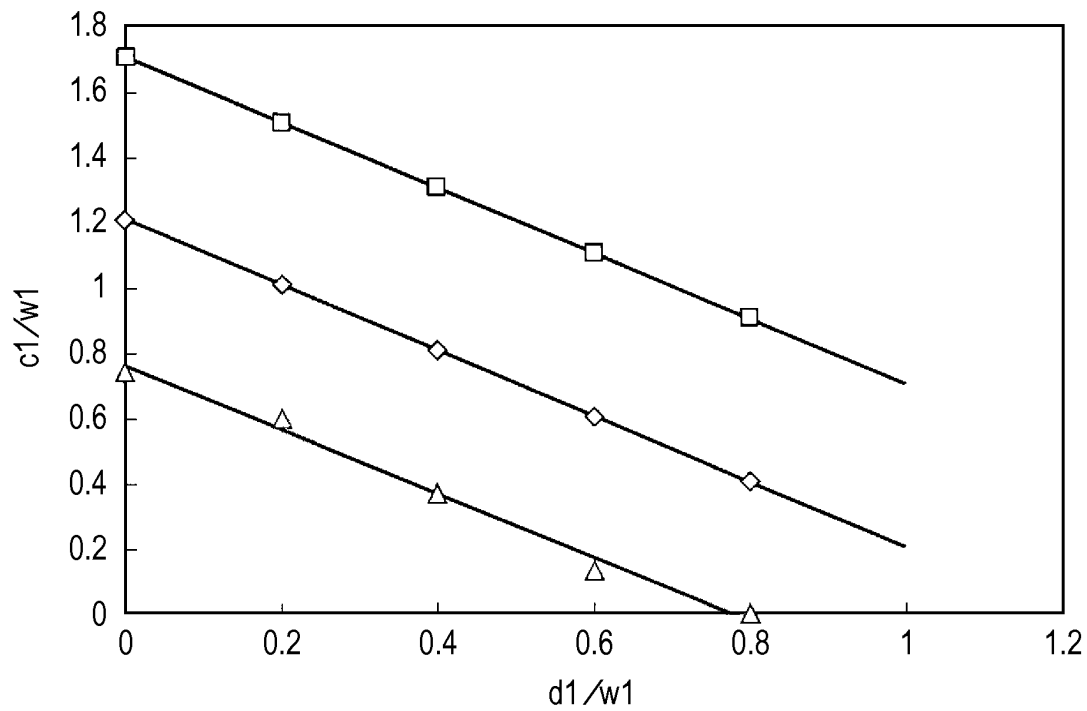


FIG. 45

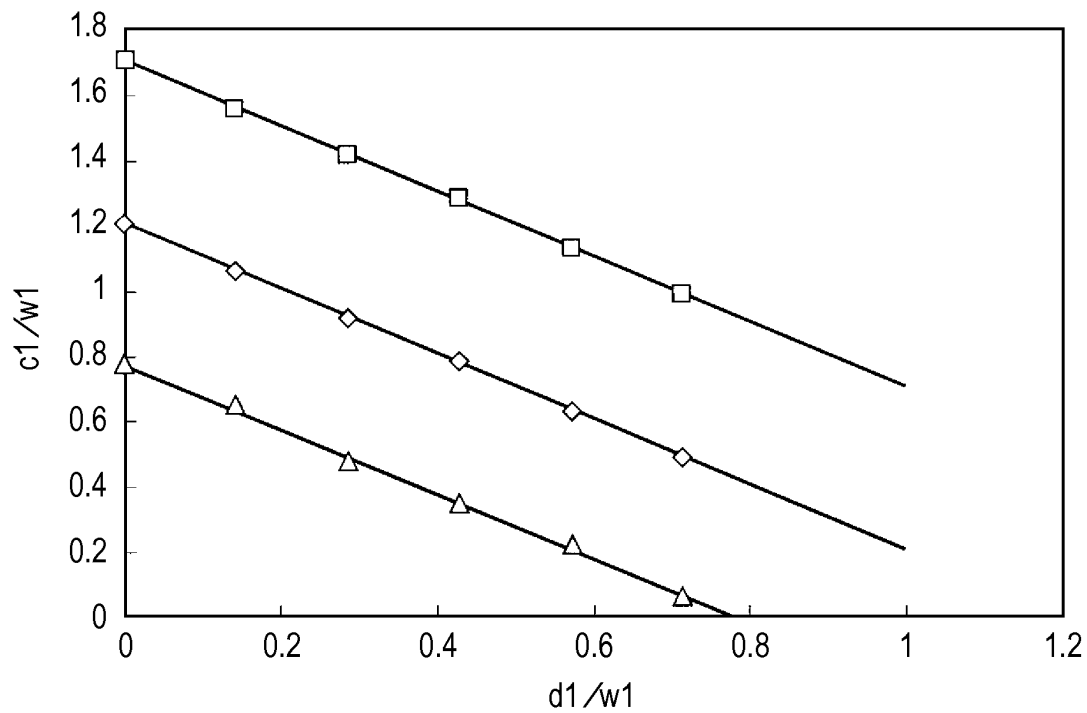


FIG. 46

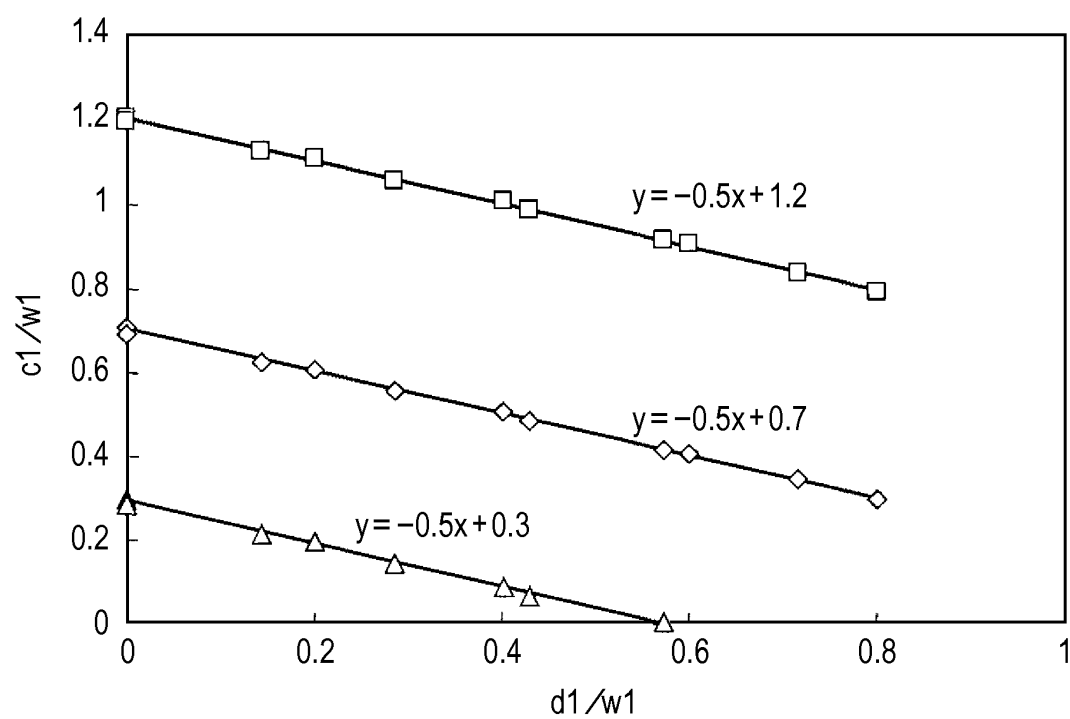


FIG. 47A

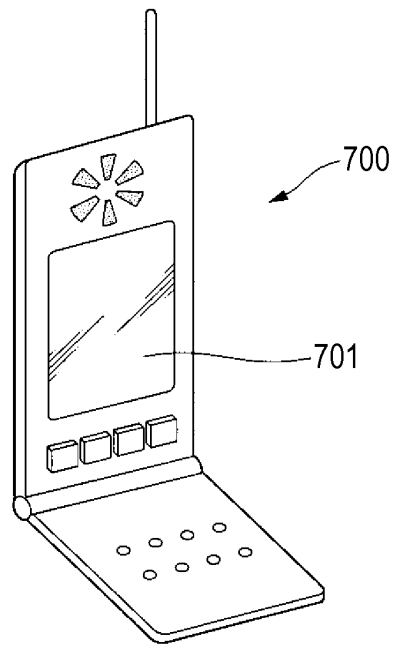


FIG. 47B

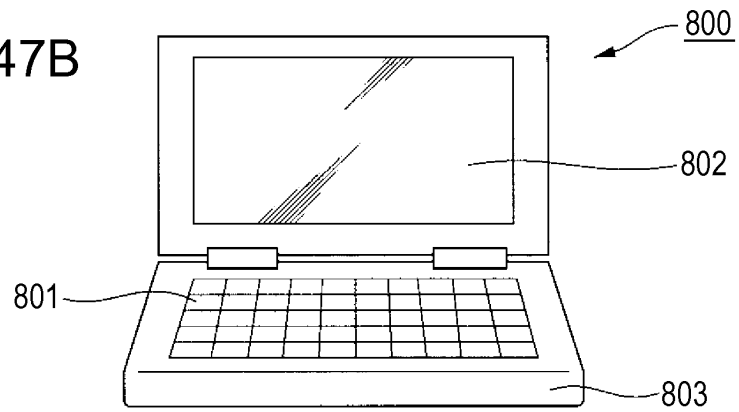


FIG. 47C

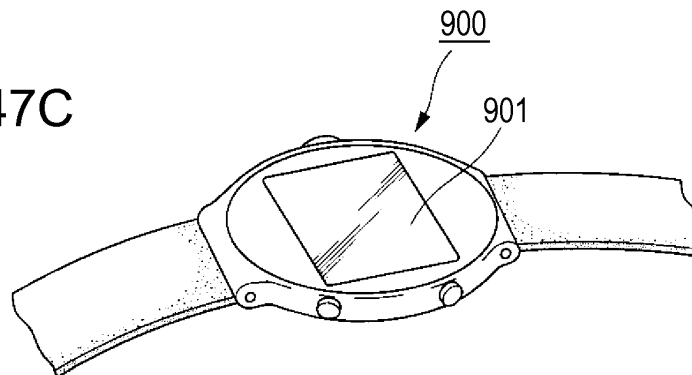




FIG. 48A  
PRIOR ART



FIG. 48B  
PRIOR ART

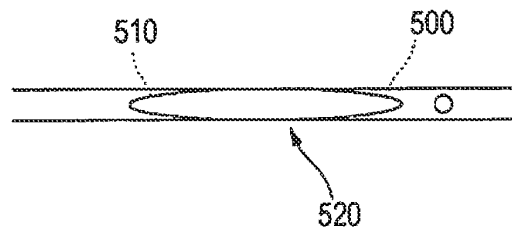


FIG. 48C  
PRIOR ART

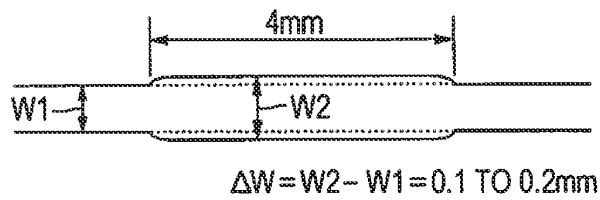


FIG. 48D  
PRIOR ART

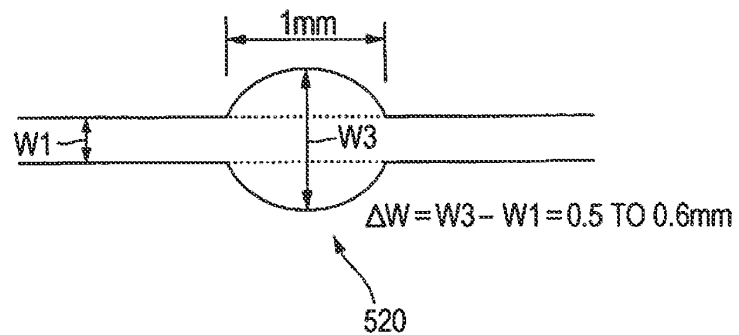


**Fig. 49**  
PRIOR ART

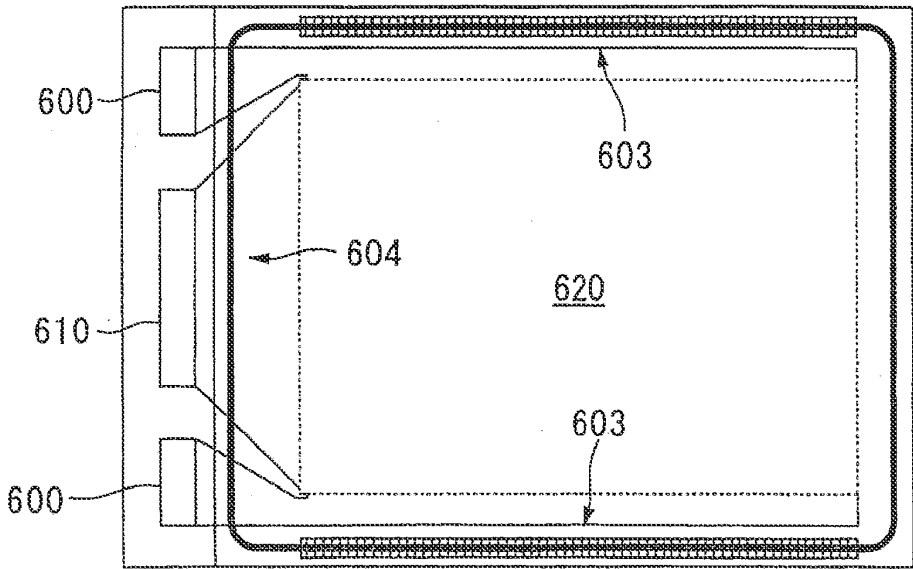
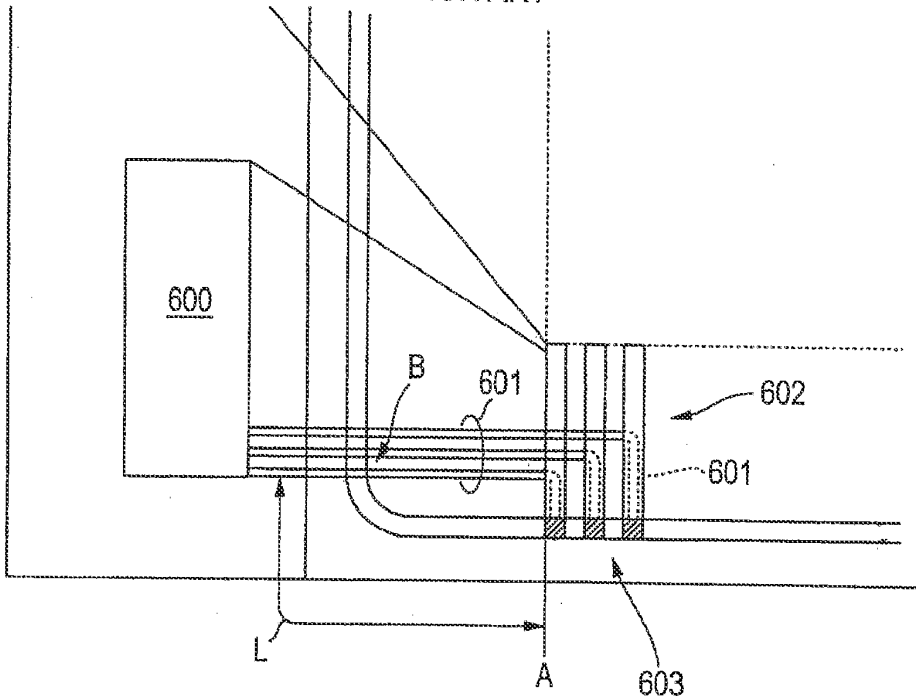


FIG. 50  
PRIOR ART



## Declaration For Utility Or Design Patent Application

特許または意匠出願宣言書

## Japanese Language Declaration

日本語宣言書

## 発明の名称

## Title of Invention

METHOD OF MANUFACTURING A LIQUID CRYSTAL DEVICEMETHOD OF MANUFACTURING A LIQUID CRYSTAL  
DEVICE

下記に記載の発明者として、私は以下の通り宣言します：

As a below named inventor, I hereby declare that:

本宣言書は、ここに添付された本出願に関するものです。  
ただし、次の欄がチェックされているときには、この限りでは  
ありません：

This declaration is directed to the application which is  
attached hereto unless the following box is checked:

☐ 米国出願または特許協力条約(PCT)国際出願番号を  
\_\_\_\_\_とし、\_\_\_\_\_年\_\_\_\_\_月  
\_\_\_\_\_日付けの出願。

☐ United States application or PCT international  
application number \_\_\_\_\_  
filed on \_\_\_\_\_.

上記本出願は、私が作成したものか、あるいは私がその作  
成を許可したものです。

The above-identified application was made or authorized to  
be made by me.

私は、本出願に係る発明の原発明者、あるいは原共同発明  
者であると信じています。

I believe that I am the original inventor or an original joint  
inventor of a claimed invention in the application.

私は、本宣誓書において、故意に偽りを述べた場合、合衆  
国法典第 18 編第 1001 条に基づき、罰金あるいは 5 年以下の  
投獄・懲役、または両方の懲罰を受けることをここに認めま  
す。

I hereby acknowledge that any willful false statement made  
in this declaration is punishable under 18 U.S.C. §1001 by  
fine or imprisonment of not more than five (5) years, or both.

私は、特許請求の範囲を含む上記本出願の内容を検討し、  
内容を理解していることをここに表明します。

I hereby state that I have reviewed and understand the  
contents of the above identified application, including the  
claims.

私は、連邦規則基準第 37 編規則 1.56 に定義される通  
り、特許性に強い影響を及ぼす情報を開示する義務があるこ  
とを承知していることを認めます。

I acknowledge that I am aware of the duty to disclose  
information which is material to patentability as defined in  
37 C.F.R. §1.56.

| Japanese Language Declaration<br>(日本語宣言書) |             |                                            |                   |
|-------------------------------------------|-------------|--------------------------------------------|-------------------|
| 唯一または第一発明者氏名                              |             | Full name of sole or first inventor        |                   |
| 百瀬 洋一                                     |             | Yoichi MOMOSE                              |                   |
| 発明者の署名                                    | 日付          | Inventor's signature                       | Date              |
| 百瀬 洋一                                     | 2014年12月10日 | Yoichi Momose                              | December 10, 2014 |
| 第二共同発明者氏名 (いる場合)                          |             | Full name of Second joint inventor, if any |                   |
| 長谷川 敏                                     |             | Satoshi HASEGAWA                           |                   |
| 第二共同発明者の署名                                | 日付          | Second Inventor's signature                | Date              |
| 長谷川 敏                                     | 2014年12月12日 | Satoshi Hasegawa                           | December 12, 2014 |

| Electronic Patent Application Fee Transmittal |          |                                                 |        |                      |
|-----------------------------------------------|----------|-------------------------------------------------|--------|----------------------|
| Application Number:                           |          | 14572068                                        |        |                      |
| Filing Date:                                  |          |                                                 |        |                      |
| Title of Invention:                           |          | METHOD OF MANUFACTURING A LIQUID CRYSTAL DEVICE |        |                      |
| First Named Inventor/Applicant Name:          |          | Yoichi MOMOSE                                   |        |                      |
| Filer:                                        |          | Bryant Edward Wade/Michele Mester               |        |                      |
| Attorney Docket Number:                       |          | 93195-001378-COB                                |        |                      |
| Filed as Large Entity                         |          |                                                 |        |                      |
| Filing Fees for Utility under 35 USC 111(a)   |          |                                                 |        |                      |
| Description                                   | Fee Code | Quantity                                        | Amount | Sub-Total in USD(\$) |
| Basic Filing:                                 |          |                                                 |        |                      |
| Pages:                                        |          |                                                 |        |                      |
| Claims:                                       |          |                                                 |        |                      |
| Miscellaneous-Filing:                         |          |                                                 |        |                      |
| Late Filing Fee for Oath or Declaration       | 1051     | 1                                               | 140    | 140                  |
| Petition:                                     |          |                                                 |        |                      |
| Patent-Appeals-and-Interference:              |          |                                                 |        |                      |
| Post-Allowance-and-Post-Issuance:             |          |                                                 |        |                      |

| Description               | Fee Code | Quantity | Amount | Sub-Total in USD(\$) |
|---------------------------|----------|----------|--------|----------------------|
| <b>Extension-of-Time:</b> |          |          |        |                      |
| <b>Miscellaneous:</b>     |          |          |        |                      |
| <b>Total in USD (\$)</b>  |          |          |        | <b>140</b>           |

| <b>Electronic Acknowledgement Receipt</b>   |                                                 |
|---------------------------------------------|-------------------------------------------------|
| <b>EFS ID:</b>                              | 21194519                                        |
| <b>Application Number:</b>                  | 14572068                                        |
| <b>International Application Number:</b>    |                                                 |
| <b>Confirmation Number:</b>                 | 6575                                            |
| <b>Title of Invention:</b>                  | METHOD OF MANUFACTURING A LIQUID CRYSTAL DEVICE |
| <b>First Named Inventor/Applicant Name:</b> | Yoichi MOMOSE                                   |
| <b>Customer Number:</b>                     | 27572                                           |
| <b>Filer:</b>                               | Bryant Edward Wade/Michele Mester               |
| <b>Filer Authorized By:</b>                 | Bryant Edward Wade                              |
| <b>Attorney Docket Number:</b>              | 93195-001378-COB                                |
| <b>Receipt Date:</b>                        | 13-JAN-2015                                     |
| <b>Filing Date:</b>                         |                                                 |
| <b>Time Stamp:</b>                          | 13:54:22                                        |
| <b>Application Type:</b>                    | Utility under 35 USC 111(a)                     |

### **Payment information:**

|                                          |                 |
|------------------------------------------|-----------------|
| Submitted with Payment                   | yes             |
| Payment Type                             | Deposit Account |
| Payment was successfully received in RAM | \$ 140          |
| RAM confirmation Number                  | 127             |
| Deposit Account                          | 506518          |
| Authorized User                          |                 |

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees)

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### File Listing:

| Document Number | Document Description      | File Name       | File Size(Bytes)/ Message Digest                   | Multi Part /.zip | Pages (if appl.) |
|-----------------|---------------------------|-----------------|----------------------------------------------------|------------------|------------------|
| 1               | Oath or Declaration filed | Declaration.PDF | 288704<br>7f60cf394847023c57b9746a26ec1bc560e8472f | no               | 2                |

### Warnings:

### Information:

|   |                      |              |                                                   |    |   |
|---|----------------------|--------------|---------------------------------------------------|----|---|
| 2 | Fee Worksheet (SB06) | fee-info.pdf | 30498<br>8c7677eefdc391bb26957191ecb7611b055cf9b3 | no | 2 |
|---|----------------------|--------------|---------------------------------------------------|----|---|

### Warnings:

### Information:

Total Files Size (in bytes):

319202

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

### New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

### National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

### New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.





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| APPLICATION<br>NUMBER | FILING or<br>371(c) DATE | GRP ART<br>UNIT | FIL FEE REC'D | ATTY. DOCKET NO  | TOT CLAIMS | IND CLAIMS |
|-----------------------|--------------------------|-----------------|---------------|------------------|------------|------------|
| 14/572,068            | 12/16/2014               | 2871            | 2140          | 9319S-001378-COB | 20         | 3          |

CONFIRMATION NO. 6575

27572

HARNESS, DICKEY & PIERCE, P.L.C.  
P.O. BOX 828  
BLOOMFIELD HILLS, MI 48303

## FILING RECEIPT



OC000000073370388

Date Mailed: 02/12/2015

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

### Inventor(s)

Yoichi MOMOSE, Matsumoto, JAPAN;  
Satoshi HASEGAWA, Matsumoto, JAPAN;

### Applicant(s)

Seiko Epson Corporation, Tokyo, JAPAN

**Power of Attorney:** The patent practitioners associated with Customer Number 27572

### Domestic Priority data as claimed by applicant

This application is a CON of 14/571,729 12/16/2014  
which is a DIV of 11/301,086 12/12/2005

**Foreign Applications** (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see <http://www.uspto.gov> for more information.)  
JAPAN 2004-375697 12/27/2004

Permission to Access - A proper **Authorization to Permit Access to Application by Participating Offices** (PTO/SB/39 or its equivalent) has been received by the USPTO.

Request to Retrieve - This application either claims priority to one or more applications filed in an intellectual property Office that participates in the Priority Document Exchange (PDX) program or contains a proper **Request to Retrieve Electronic Priority Application(s)** (PTO/SB/38 or its equivalent). Consequently, the USPTO will attempt to electronically retrieve these priority documents.

**If Required, Foreign Filing License Granted:** 02/11/2015

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 14/572,068**

**Projected Publication Date:** Perfected

**Non-Publication Request:** No

**Early Publication Request:** No  
**Title**

METHOD OF MANUFACTURING A LIQUID CRYSTAL DEVICE

**Preliminary Class**

349

**Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications:** No

## **PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES**

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

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**Title 37, Code of Federal Regulations, 5.11 & 5.15**

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| <b>PATENT APPLICATION FEE DETERMINATION RECORD</b><br>Substitute for Form PTO-875                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                               |                                    |               |                 |                    | Application or Docket Number<br>14/572,068 |                 |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|---------------|-----------------|--------------------|--------------------------------------------|-----------------|
| <b>APPLICATION AS FILED - PART I</b>                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                               |                                    |               |                 |                    |                                            |                 |
| (Column 1)                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                               | (Column 2)                         |               | SMALL ENTITY    |                    | OTHER THAN SMALL ENTITY                    |                 |
| FOR                                                                                                                                                                                                                                                                                                                                                                                                        | NUMBER FILED                                                                                                                                                                                                                  | NUMBER EXTRA                       | RATE(\$)      | FEE(\$)         |                    | RATE(\$)                                   | FEE(\$)         |
| BASIC FEE<br>(37 CFR 1.16(a), (b), or (c))                                                                                                                                                                                                                                                                                                                                                                 | N/A                                                                                                                                                                                                                           | N/A                                | N/A           |                 |                    | N/A                                        | 280             |
| SEARCH FEE<br>(37 CFR 1.16(k), (i), or (m))                                                                                                                                                                                                                                                                                                                                                                | N/A                                                                                                                                                                                                                           | N/A                                | N/A           |                 |                    | N/A                                        | 600             |
| EXAMINATION FEE<br>(37 CFR 1.16(o), (p), or (q))                                                                                                                                                                                                                                                                                                                                                           | N/A                                                                                                                                                                                                                           | N/A                                | N/A           |                 |                    | N/A                                        | 720             |
| TOTAL CLAIMS<br>(37 CFR 1.16(i))                                                                                                                                                                                                                                                                                                                                                                           | 20                                                                                                                                                                                                                            | minus 20 = *                       |               |                 |                    | x 80 =                                     | 0.00            |
| INDEPENDENT CLAIMS<br>(37 CFR 1.16(h))                                                                                                                                                                                                                                                                                                                                                                     | 3                                                                                                                                                                                                                             | minus 3 = *                        |               |                 |                    | x 420 =                                    | 0.00            |
| APPLICATION SIZE FEE<br>(37 CFR 1.16(s))                                                                                                                                                                                                                                                                                                                                                                   | If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s). |                                    |               |                 |                    |                                            | 400             |
| MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                               |                                    |               |                 |                    |                                            | 0.00            |
|                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                               |                                    | TOTAL         |                 |                    | TOTAL                                      | 2000            |
| * If the difference in column 1 is less than zero, enter "0" in column 2.                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                               |                                    |               |                 |                    |                                            |                 |
| <b>APPLICATION AS AMENDED - PART II</b>                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                               |                                    |               |                 |                    |                                            |                 |
| (Column 1)                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                               | (Column 2)                         |               | (Column 3)      |                    | SMALL ENTITY                               |                 |
| AMENDMENT A                                                                                                                                                                                                                                                                                                                                                                                                | CLAIMS REMAINING AFTER AMENDMENT                                                                                                                                                                                              | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA | RATE(\$)        | ADDITIONAL FEE(\$) |                                            | RATE(\$)        |
|                                                                                                                                                                                                                                                                                                                                                                                                            | Total<br>(37 CFR 1.16(i))                                                                                                                                                                                                     | *                                  | Minus **      | =               | x =                |                                            | x =             |
|                                                                                                                                                                                                                                                                                                                                                                                                            | Independent<br>(37 CFR 1.16(h))                                                                                                                                                                                               | *                                  | Minus ***     | =               | x =                |                                            | x =             |
|                                                                                                                                                                                                                                                                                                                                                                                                            | Application Size Fee (37 CFR 1.16(s))                                                                                                                                                                                         |                                    |               |                 |                    |                                            |                 |
|                                                                                                                                                                                                                                                                                                                                                                                                            | FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))                                                                                                                                                               |                                    |               |                 |                    |                                            |                 |
|                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                               |                                    |               | TOTAL ADD'L FEE |                    |                                            | TOTAL ADD'L FEE |
| (Column 1)                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                               | (Column 2)                         |               | (Column 3)      |                    | SMALL ENTITY                               |                 |
| AMENDMENT B                                                                                                                                                                                                                                                                                                                                                                                                | CLAIMS REMAINING AFTER AMENDMENT                                                                                                                                                                                              | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA | RATE(\$)        | ADDITIONAL FEE(\$) |                                            | RATE(\$)        |
|                                                                                                                                                                                                                                                                                                                                                                                                            | Total<br>(37 CFR 1.16(i))                                                                                                                                                                                                     | *                                  | Minus **      | =               | x =                |                                            | x =             |
|                                                                                                                                                                                                                                                                                                                                                                                                            | Independent<br>(37 CFR 1.16(h))                                                                                                                                                                                               | *                                  | Minus ***     | =               | x =                |                                            | x =             |
|                                                                                                                                                                                                                                                                                                                                                                                                            | Application Size Fee (37 CFR 1.16(s))                                                                                                                                                                                         |                                    |               |                 |                    |                                            |                 |
|                                                                                                                                                                                                                                                                                                                                                                                                            | FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))                                                                                                                                                               |                                    |               |                 |                    |                                            |                 |
|                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                               |                                    |               | TOTAL ADD'L FEE |                    |                                            | TOTAL ADD'L FEE |
| * If the entry in column 1 is less than the entry in column 2, write "0" in column 3.<br>** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".<br>*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".<br>The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1. |                                                                                                                                                                                                                               |                                    |               |                 |                    |                                            |                 |

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別紙添付の書類に記載されている事項は下記の出願書類に記載されている事項と同一であることを証明する。

This is to certify that the annexed is a true copy of the following application as filed with this Office.

出 願 年 月 日                      2 0 0 4 年 1 2 月 2 7 日  
Date of Application:

出 願 番 号                      特 願 2 0 0 4 - 3 7 5 6 9 7  
Application Number:

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に用いる優先権の主張の基礎  
となる出願の国コードと出願  
番号  
The country code and number  
of your priority application,  
to be used for filing abroad  
under the Paris Convention, is

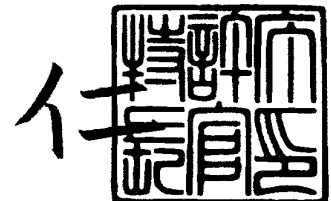
J P 2 0 0 4 - 3 7 5 6 9 7

出 願 人                      セイコーエプソン株式会社  
Applicant(s):

2 0 1 5 年   2 月 1 3 日

特許庁長官  
Commissioner,  
Japan Patent Office

伊 藤



|           |                               |
|-----------|-------------------------------|
| 【書類名】     | 特許願                           |
| 【整理番号】    | J011397001                    |
| 【あて先】     | 特許庁長官 殿                       |
| 【国際特許分類】  | B05C 5/00<br>G02F 1/13        |
| 【発明者】     |                               |
| 【住所又は居所】  | 長野県諏訪市大和3丁目3番5号 セイコーエプソン株式会社内 |
| 【氏名】      | 百瀬 洋一                         |
| 【発明者】     |                               |
| 【住所又は居所】  | 長野県諏訪市大和3丁目3番5号 セイコーエプソン株式会社内 |
| 【氏名】      | 長谷川 敏                         |
| 【特許出願人】   |                               |
| 【識別番号】    | 000002369                     |
| 【氏名又は名称】  | セイコーエプソン株式会社                  |
| 【代理人】     |                               |
| 【識別番号】    | 100095728                     |
| 【弁理士】     |                               |
| 【氏名又は名称】  | 上柳 雅誓                         |
| 【選任した代理人】 |                               |
| 【識別番号】    | 100107076                     |
| 【弁理士】     |                               |
| 【氏名又は名称】  | 藤綱 英吉                         |
| 【電話番号】    | 0266-52-3528                  |
| 【連絡先】     | 担当                            |
| 【選任した代理人】 |                               |
| 【識別番号】    | 100107261                     |
| 【弁理士】     |                               |
| 【氏名又は名称】  | 須澤 修                          |
| 【手数料の表示】  |                               |
| 【予納台帳番号】  | 013044                        |
| 【納付金額】    | 16,000円                       |
| 【提出物件の目録】 |                               |
| 【物件名】     | 特許請求の範囲 1                     |
| 【物件名】     | 明細書 1                         |
| 【物件名】     | 図面 1                          |
| 【物件名】     | 要約書 1                         |
| 【包括委任状番号】 | 0109826                       |

【書類名】特許請求の範囲

【請求項 1】

液晶層を挟持して対向配置された第 1 基板及び第 2 基板と、当該両基板の周縁部に形成されたシール部材とを具備する液晶装置の製造方法であって、

前記シール部材を形成するシール部材形成工程と、

前記シール部材の内側に液晶層を形成する液晶層形成工程と、

前記第 1 基板と前記第 2 基板とを貼り合わせる貼り合わせ工程と、

を含み、

前記シール部材形成工程は、

前記シール部材の内側に前記液晶層をシールする環状部と、

前記シール部材が相互に離間して対向する第 1 シール層及び第 2 シール層と、

を形成し、

前記貼り合わせ工程は、前記第 1 及び第 2 シール層を押圧し、前記環状部の外側に、前記第 1 及び第 2 シール層を接合して前記環状部を形成する接合部を形成すること、

を特徴とする液晶装置の製造方法。

【請求項 2】

前記シール部材形成工程は、

前記環状部の第 1 辺を前記シール部材が延在する直線上に形成し、

前記第 1 シール層を、前記第 1 辺と連続して形成すると共に、当該第 1 辺が延在する軸とは異なる中心線上に形成し、

前記第 2 シール層を、前記第 1 シール層に対向して形成すること、

を特徴とする請求項 1 に記載の液晶装置の製造方法。

【請求項 3】

前記シール部材形成工程は、

前記環状部における前記第 1 辺の軸方向に直交する軸方向において、第 2 辺を形成し、

曲線部を介して前記第 2 シール層を前記第 2 辺に連続して形成すること、

を特徴とする請求項 1 又は請求項 2 に記載の液晶装置の製造方法。

【請求項 4】

前記シール部材形成工程は、

前記環状部における前記第 1 辺の軸方向に直交する軸方向において、第 2 辺を形成し、

傾斜部を介して前記第 2 シール層を前記第 2 辺に連続して形成すること、

を特徴とする請求項 1 又は請求項 2 に記載の液晶装置の製造方法。

【請求項 5】

前記シール部材形成工程は、

前記第 1 シール層と前記環状部の第 1 辺とを、前記シール部材が延在する同軸直線上に形成し、

前記第 2 シール層を、前記第 1 シール層に対向して形成すること、

を特徴とする請求項 1 に記載の液晶装置の製造方法。

【請求項 6】

前記シール部材形成工程は、

前記環状部における前記第 1 辺の軸方向に直交する軸方向において、第 2 辺を形成し、

曲線部を介して前記第 2 シール層を前記第 2 辺に連続して形成すること、

を特徴とする請求項 1 又は請求項 5 に記載の液晶装置の製造方法。

【請求項 7】

前記シール部材形成工程は、

前記環状部における前記第 1 辺の軸方向に直交する軸方向において、第 2 辺を形成し、

傾斜部を介して前記第 2 シール層を前記第 2 辺に連続して形成すること、

を特徴とする請求項 1 又は請求項 5 に記載の液晶装置の製造方法。

【請求項 8】

前記第 1 基板は、複数の第 1 素子領域を有する第 1 母材を、当該複数の第 1 素子領域の

相互境界部において分割して、前記第 1 素子領域毎に得られたものであり、

前記第 2 基板は、複数の第 2 素子領域を有する第 2 母材を、当該複数の第 2 素子領域の相互境界部において分割して、前記第 2 素子領域毎に得られたものであること、  
を特徴とする請求項 1 に記載の液晶装置の製造方法。

【請求項 9】

前記シール部材形成工程は、

前記第 1 シール層と前記第 2 シール層のうち的一方、かつ、前記環状部の一部、  
となる第 1 シール部材を形成する第 1 シール部材形成工程と、

当該第 1 シール部材形成工程の後に、

前記第 1 シール層と前記第 2 シール層のうち他方、かつ、前記環状部の残部、  
となる第 2 シール部材を形成する第 2 シール部材形成工程と、

を含むこと、

を特徴とする請求項 1 から請求項 8 のいずれか一項に記載の液晶装置の製造方法。

【請求項 10】

前記第 1 シール部材形成工程は、

前記第 1 母材における前記複数の第 1 素子領域及び前記相互境界部に対し、前記第 1 素子領域が配列する方向に向けて、

又は、

前記第 2 母材における前記複数の第 2 素子領域及び前記相互境界部に対し、前記第 2 素子領域が配列する方向に向けて、

前記第 1 シール部材を連続して一括に形成すること、

を特徴とする請求項 1 から請求項 9 のいずれか一項に記載の液晶装置の製造方法。

【請求項 11】

前記第 2 シール部材形成工程は、前記第 1 シール部材形成工程を施した後に、

前記第 1 母材における前記複数の第 1 素子領域及び前記相互境界部に対し、前記第 1 素子領域が配列する方向に向けて、

又は、

前記第 2 母材における前記複数の第 2 素子領域及び前記相互境界部に対し、前記第 2 素子領域が配列する方向に向けて、

前記第 2 シール部材を連続して一括に形成すること、

を特徴とする請求項 1 から請求項 10 のいずれか一項に記載の液晶装置の製造方法。

【請求項 12】

前記第 1 母材又は前記第 2 母材のいずれか一方の母材に前記第 1 シール部材形成工程を施し、他方の母材に前記第 2 シール部材形成工程を施すこと、

を特徴とする請求項 1 から請求項 11 のいずれか一項に記載の液晶装置の製造方法。

【請求項 13】

前記第 1 母材又は前記第 2 母材の一方のみに前記第 1 シール部材形成工程及び前記第 2 シール部材形成工程を施すこと、

を特徴とする請求項 1 から請求項 11 のいずれか一項に記載の液晶装置の製造方法。

【請求項 14】

液晶層を挟持して対向配置された第 1 基板及び第 2 基板と、当該両基板の周縁部に形成されたシール部材とを具備する液晶装置であって、

請求項 1 から請求項 13 のいずれか一項に記載の製造方法によって製造されたことを特徴とする液晶装置。

【請求項 15】

請求項 14 に記載の液晶装置を具備すること、

を特徴とする電子機器。



【書類名】明細書

【発明の名称】液晶装置の製造方法、液晶装置、及び電子機器

【技術分野】

【0001】

本発明は、液晶装置の製造方法、液晶装置、及び電子機器に関するものである。

【背景技術】

【0002】

携帯電話等の電子機器におけるカラー画像表示部には、液晶装置等の電気光学装置が使用されている。液晶装置は、一対の透明基板の間に液晶層が挟持されて構成されている。この液晶装置を形成するには、まず一方の基板の表面周縁部にシール材（封止材）を塗布する。その際、シール材の一部に液晶の注入口を形成しておく。次に、シール材の内側にスペーサを散布し、シール材を介して他方の基板を貼り合わせる。これにより、一対の基板とシール材とによって囲まれた領域に液晶セルが形成される。次に、真空中で液晶セル内を脱気し、液晶注入口を液晶槽内に浸漬した状態で、全体を大気圧下に戻す。すると、液晶セルと外部との圧力差および表面張力によって、液晶セル内に液晶が充填される。しかしながら、上述した方法で液晶を充填した場合には、充填時間が非常に長くなる。特に、対角1m以上の大型の基板を使用する場合には、液晶の充填に1日以上を要することになる。

【0003】

そこで、上記液晶注入口を有しない枠状のシール材を設けた基板上に液晶を滴下し、基板の貼り合わせを行う滴下組立法が提案されている。この方法は、まず一方の基板の表面周縁部に、熱硬化性樹脂等からなるシール材を塗布する。次に、そのシール材の内側に、液滴吐出装置により所定量の液晶を滴下する。最後に、シール材を介して他方の基板を真空雰囲気にて貼り合わせ、大気圧雰囲気に解放、シール材に紫外線を照射したり加熱処理をしたりすることで、液晶装置を形成するというものである。そのため、従来の液晶注入方法とは異なり、シール材は注入口が無い環状に形成される。

【0004】

このような方法によれば、両基板を貼り合わせた後に、大気圧雰囲気に解放することで両基板表面から均一な圧力がかかり所定のセルギャップを得ることが可能となる。また、セルギャップは液晶の滴下量により決定することが可能となる。例えば、液晶の滴下量が少な過ぎるとセルギャップが薄くなって気泡等が発生し易くなり、また、滴下量が多過ぎるとセルギャップが厚くなってセルギャップムラが発生し易くなる。そこで、液晶の滴下量を最適に設定することにより、均一なセルギャップを得ることが可能となる。更に、このような方法は、従来の液晶注入法とは異なり、液晶の使用量削減、注入・封止工程省略によるタクトタイム短縮が可能となる。

【0005】

また、シール材の形成方法としては、ディスペンサを用いる方法が提案されている（例えば、特許文献1～3。）。この方法は、ディスペンサと基板とを相対移動させながら、基板上にシール材を所定のパターンに吐出形成する方法である。ここで、基板上に吐出されたシール材が環状パターンとなるように、パターンの外周部の一部において先に吐出されたシール材と、後に吐出されたシール材とを重合させている。これにより、液晶を滴下した後に基板を貼り合わせた場合に、液晶がシール材の環状パターンの外部に漏れるのを抑制している。

【特許文献1】特開2002-98979号公報

【特許文献2】特開2003-222883号公報

【特許文献3】特開2003-241204号公報

【発明の開示】

【発明が解決しようとする課題】

【0006】

しかしながら、本発明者らは、上記の特許文献に記載された液晶装置においては、シー

ル材を安定して形成することが困難であること、隣接するパネルとの間にダミースペースを設ける必要があるということ、1回の描画動作で一つのパターンを形成するために描画開始及び描画終了の際にディスペンサを制御する必要があること、を見出した。更に、一般的にディスペンサを用いてシール材を形成する方法においては、セルギャップ不良が生じ易いことを見出した。

本発明は、上記課題を解決するためになされたものであり、均一なセルギャップを実現できる液晶装置の製造方法、液晶装置、及び電子機器を提供することを目的としている。

【課題を解決するための手段】

【0007】

本発明者らは、ディスペンサを利用したシール材の吐出方法に関し、以下の知見を見出した。

このような吐出方法においては、図48(a)、(b)に示すようにシール材の描画開始部500、及び描画終了部510の部材の太さを、その他の部分と同じ太さに形成する必要がある。その理由は、太すぎるとセルギャップが厚くなり表示ムラが発生してしまい、また、細いとその部分から液晶が漏れ易くなり、信頼性が低下してしまうためである。ところが、ディスペンサにてシール材を描画する場合、一般に図48(a)、(b)に示すように描画開始部500及び描画終了部510でシールの太り(飛び)、もしくは細りが発生しやすい傾向があり、接合部520を均一な太さにするためには、図48(c)に示すように描画開始部500と描画終了部510とを重ねることが多い。この場合、重なり部分の長さは4mm程度必要となり、シール材の粘度ばらつき等により、その部分の幅W2が所定の狙い幅W1より、0.1~0.2mm程度( $\Delta W = W2 - W1 = 0.1 \sim 0.2$ mm)太くなることが確認されている。

【0008】

また、TFD(Thin Film Transistor)駆動の液晶装置や、STN(Super Twisted Nematic)液晶をパッシブ駆動で動作させる液晶装置等においては、図49及び図50に示すようにドライバIC600、610を備える回路基板の表面に形成された引き回し配線601と、対向基板に形成されたコモン電極(以下、COM電極と称する。)602とを、導通パッド603において電気的に接続(導通)させる必要がある。この場合、スペーサ表面にメッキ処理を施した導通粒子をシール材に分散させ、当該シール材を導通パッド603上に配置することにより、当該導通粒子を介して引き回し配線601と、COM電極602とが導通し、ドライバIC600の出力電位が対向基板の配線に付与される。

一方、ドライバIC610から表示エリア620まで引き回されたセグメント電極(以下、SEG電極と称する。)604や、ドライバIC600から導通パッド603まで引き回された引き回し配線601においては、シール材を横断させる必要がある。この場合、引き回し配線601及びSEG電極604における各々の電極が互いに短絡してしまうのを防止するために、導通粒子を含有しないシール材を引き回し配線601及びSEG電極604上に横断させている。

ところで、このように導通粒子を含有するシール材、及び非導通性のシール材の両者を用いる場合には、導通パッド603の端(図50中A)から、COM電極601がシール材を横断する最も端の部分(図50中B)までの間で、当該両シール材を接続する必要がある。TFD液晶装置や、STN液晶装置においては、この部分の距離Lを2mm以下に設定することが多い。このため、単純に図48(c)に示す重なり部分の長さ4mmよりも短くすると、図48(d)のように接合部520の重なり部分の長さが1mmとなり、幅W3が所定の狙い幅W1より、0.5~0.6mm程度( $\Delta W = W3 - W1 = 0.5 \sim 0.6$ mm)太くなり、これに起因してセルギャップ不良が生じ易くなってしまうことが確認されている。

【0009】

また、特許文献1は、シールラインを形成する始端と終端の重なり部分の幅寸法をシールライン幅の0.4~0.6倍に設定するものであるが、この方法ではディスペンサの制御が非常に複雑になり、描画に多くの時間を要し、ディスペンサの中に残存するシール材

の量のばらつきや、シール材のロット間の粘度ばらつきに起因して、シール形状がばらつきやすく、管理が非常に困難であるという問題を有している。

また、特許文献2は、閉ループ状シール部材の外のいずれかの部分から描画を開始し、かつ描画を開始した部分と異なる閉ループ状シール部材の外の箇所で描画を終了しているが、この方法では隣接するパネルとの間にダミースペースを設ける必要があるという問題がある。また、特許文献1～3のいずれの方法も、1回の描画動作で一つの部材を形成するため、描画開始及び描画終了の際にディスペンサを制御するのに時間を要し、タクトが長くなるという問題もある。

そこで、本発明者らは、上記に基づいて以下の手段を有する本発明を想到した。

#### 【0010】

即ち、本発明の液晶装置の製造方法は、液晶層を挟持して対向配置された第1基板及び第2基板と、当該両基板の周縁部に形成されたシール部材とを具備する液晶装置の製造方法であって、前記シール部材を形成するシール部材形成工程と、前記シール部材の内側に液晶層を形成する液晶層形成工程と、前記第1基板と前記第2基板とを貼り合わせる貼り合わせ工程と、を含み、前記シール部材形成工程は、前記シール部材の内側に前記液晶層をシールする環状部と、前記シール部材が相互に離間して対向する第1シール層及び第2シール層と、を形成し、前記貼り合わせ工程は、前記第1及び第2シール層を押圧し、前記環状部の外側に、前記第1及び第2シール層を接合して前記環状部を形成する接合部を形成すること、を特徴としている。

#### 【0011】

ここで、第1シール層及び第2シール層とは、シール部材形成工程によって形成され、貼り合わせ工程によって接合部となる部位である。従って、換言すれば、接合部の前形状となるものである。

また、接合部とは、基板上に形成されたシール材料が相互に接合している部位であり、また、環状部の内側の液晶層が外部に漏れるのを防ぐために当該環状部を閉塞させている部位である。また、当該接合部は、基板の鉛直方向にシール材料が重なって接合された状態や、基板の水平方向にシール材料が隣接して接合された状態を含むものである。また、当該接合部は、その一部が環状部の外側に形成されていることから、当該接合部は環状部を接合させている部分から環状部の外側に向けて形成されたものとなっている。従って、環状部に全ての接合部が重なって形成されたものではなく、接合部の一部のみが環状部を接合させ、その他の部分が環状部の外側に向けて形成されたものとなっている。

また、シール部材形成工程においては、シール材料が充填されたディスペンサと第1基板又は第2基板とを相対移動させながら、ディスペンサのノズルからシール材料を吐出する吐出方法が利用される。

#### 【0012】

このようにすれば、接合部の一部によって環状部を閉塞させるので、接合部からの液晶層の漏れを抑制でき、液晶装置の信頼性を向上させることができる。また、接合部は環状部の外側に向けて形成されているので、貼り合わせ工程を施した際には環状部の外側において接合部の幅が広がるだけで済み、環状部の内部にシール部材が突出するのを抑制できる。また、環状部の内部のセルギャップに影響を与えることがなく、当該セルギャップを均一に保持できる。ここで、具体的に説明すれば、環状部の内部にシールが突出した場合では、例えば液晶装置の表示領域内のカラーフィルタにシールが乗り上げる場合があり、セルギャップに影響を与え易くなる。これに対して、本発明では、環状部の外側、即ち、カラーフィルタが形成されていない領域にシール部材が形成されているので、カラーフィルタにシールが乗り上がることがない。従って、セルギャップを均一に保持できる。

また、従来技術と比較して、環状部及び接合部の各々の部材幅を調整する必要がなく、同一幅の部材で環状部及び接合部を形成することができ、容易にシール部材を形成できる。従って、ディスペンサの制御が容易になり、シール部材の描画を短時間で終了させることができる。また、ディスペンサの中に残存するシール材料の量のばらつきや、シール材料のロット間の粘度ばらつきを問題視する必要がなく、シール部材の形状の管理を容易に

できる。

【0013】

また、本発明の液晶装置の製造方法においては、前記シール部材形成工程は、前記環状部の第1辺を前記シール部材が延在する直線上に形成し、前記第1シール層を、前記第1辺と連続して形成すると共に、当該第1辺が延在する軸とは異なる中心線上に形成し、前記第2シール層を、前記第1シール層に対向して形成すること、を特徴としている。

ここで、「第1シール層を、第1辺と連続して形成すると共に、第1辺が延在する軸とは異なる中心線上に形成し」とは、第1シール層と第1辺とを同一直線上に形成せずに、連続して形成することを意味している。従って、換言すれば、第1シール層と第1辺とを同一直線上に形成しないことから、第1シール層と第1辺とを少なくとも曲線や曲部を介して形成することを意味する。また、「第1辺が延在する軸とは異なる中心線上に形成し」としているの、曲線状の中心線上に第1シール層を形成したり、第1辺が延在する軸に対して傾斜している傾斜状の中心線上に第1シール層を形成したり等、当該中心線上に第1シール層を形成するのであれば、その形態は様々である。

【0014】

このようにすれば、上記の製造方法と同様の効果が得られるだけでなく、シール部材が延在する直線上に環状部の第1辺を形成することができ、当該第1辺と連続させて第1シール層を形成することができる。また、第1辺が延在する軸とは異なる中心線上に第1シール層を形成することができる。また、第2シール層を、第1シール層に対向して形成することができる。

【0015】

また、本発明の液晶装置の製造方法においては、前記貼り合わせ工程を施した後の前記環状部における前記シール部材の線幅を $w_2$ 、前記第1シール層の中心線と前記第2シール層の中心線との間の距離を $d_2$ 、とすると、

【数1】

$$0 \leq d_2 \leq 0.8 \times w_2$$

の関係が成立すること、を特徴としている。

このようにすれば、上記の製造方法と同様の効果が得られるだけでなく、シール部材の太さのばらつきが生じていたとしても、第1シール層と第2シール層とを確実に接合して接合部を形成することができる。

【0016】

また、本発明の液晶装置の製造方法においては、前記シール部材形成工程は、前記環状部における前記第1辺の軸方向に直交する軸方向において、第2辺を形成し、曲線部を介して前記第2シール層を前記第2辺に連続して形成すること、を特徴としている。

このようにすれば、上記の製造方法と同様の効果が得られるだけでなく、曲線部によって第2辺と接続している第2シール層と、第1シール層とを接合し、接合部を確実に形成することができる。

【0017】

また、本発明の液晶装置の製造方法においては、前記曲線部の半径を $R_2$ とすると、

【数2】

$$(R_2 / w_2) \leq -1.2 \times (d_2 / w_2) + 2.0$$

の関係が成立すること、を特徴としている。更に、本発明においては、

【数3】

$$(R_2 / w_2) \leq -(d_2 / w_2) + 1.2$$

の関係が成立し、かつ、

【数4】

$$(R2/w2) \geq -0.6 \times (d2/w2) + 0.4$$

の関係が成立すること、が好ましい。

【0018】

このようにすれば、上記の製造方法と同様の効果が得られるだけでなく、シール部材の太さに依らず、環状部から液晶層が漏れるのを防止することができる。

また、従来の方法では、接合部においてシール部材の太りが発生したり、太りを最小限に抑制するために重ね部分の距離を長くしたりする必要があり、また、装置の制御も複雑になってシール部材の描画時間が長くなるという課題があった。これに対し、本発明の方法によれば、シール部材を全ての部分において同一のスピードで描画することが可能であり、また、書き始め部分や、書き終わり部分も液晶装置から十分離れた部分であるため複雑な制御も必要なくなる。これらの効果により描画時間は従来の  $1/2 \sim 1/3$  と大幅な短縮ができ、且つシール部材の接合部での液晶装置の内側方向へのシール部材の太りも解消できる。

【0019】

また、本発明の液晶装置の製造方法においては、前記シール部材形成工程は、前記環状部における前記第1辺の軸方向に直交する軸方向において、第2辺を形成し、傾斜部を介して前記第2シール層を前記第2辺に連続して形成すること、を特徴としている。

このようにすれば、上記の製造方法と同様の効果が得られるだけでなく、傾斜部によって第2辺と接続している第2シール層と、第1シール層とを接合し、接合部を確実に形成することができる。

【0020】

また、本発明の液晶装置の製造方法においては、前記傾斜部の面取り量を  $c2$  とすると、

【数5】

$$(c2/w2) \leq -0.5 \times (d2/w2) + 1.2$$

の関係が成立すること、を特徴としている。更に、本発明においては、

【数6】

$$(c2/w2) \leq -0.5 \times (d2/w2) + 0.7$$

の関係が成立し、かつ、

【数7】

$$(c2/w2) \geq -0.5 \times (d2/w2) + 0.3$$

の関係が成立すること、が好ましい。

【0021】

このようにすれば、上記の製造方法と同様の効果が得られるだけでなく、シール部材の太さに依らず、環状部から液晶層が漏れるのを防止することができる。

また、シール部材を全ての部分において同一のスピードで描画することが可能であり、また、書き始め部分や、書き終わり部分も液晶装置から十分離れた部分であるため複雑な制御も必要なくなる。これらの効果により描画時間は従来の  $1/2 \sim 1/3$  と大幅な短縮ができ、且つシール部材の接合部での液晶装置の内側方向へのシール部材の太りも解消できる。

【0022】

また、本発明の液晶装置の製造方法においては、前記シール部材形成工程は、前記第1シール層と前記環状部の第1辺とを、前記シール部材が延在する同軸直線上に形成し、前記第2シール層を、前記第1シール層に対向して形成すること、を特徴としている。

このようにすれば、上記の製造方法と同様の効果が得られるだけでなく、第1シール層と第1辺とをシール部材が延在する同軸直線上に形成することができ、即ち、第1辺と連続させて第1シール層を形成することができる。また、第2シール層を、第1シール層に対向して形成することができる。

また、同軸直線上に第1シール層と第1辺を形成するので、曲線や傾斜線を描きながら第1シール層を形成する場合と比較して、描画時間を短縮することができる。

【0023】

また、本発明の液晶装置の製造方法においては、前記貼り合わせ工程を施した後の前記環状部における前記シール部材の線幅を $w1$ 、前記第1シール層の中心線と前記第2シール層の中心線との間の距離を $d1$ 、とすると、

【数8】

$$0 \leq d1 \leq 0.8 \times w1$$

の関係が成立すること、を特徴としている。

このようにすれば、上記の製造方法と同様の効果が得られるだけでなく、シール部材の太さのばらつきが生じていたとしても、第1シール層と第2シール層とを確実に接合して接合部を形成することができる。

【0024】

また、本発明の液晶装置の製造方法においては、前記シール部材形成工程は、前記環状部における前記第1辺の軸方向に直交する軸方向において、第2辺を形成し、曲線部を介して前記第2シール層を前記第2辺に連続して形成すること、を特徴としている。

このようにすれば、上記の製造方法と同様の効果が得られるだけでなく、曲線部によって第2辺と接続している第2シール層と、第1シール層とを接合し、接合部を確実に形成することができる。

【0025】

また、本発明の液晶装置の製造方法においては、前記曲線部の半径を $R1$ とすると、

【数9】

$$(R1/w1) \leq -2.0 \times (d1/w1) + 3.0$$

の関係が成立すること、を特徴としている。更に、本発明においては、

【数10】

$$(R1/w1) \leq -1.7 \times (d1/w1) + 2.0$$

の関係が成立し、かつ、

【数11】

$$(R1/w1) \geq -1.2 \times (d1/w1) + 1.0$$

の関係が成立すること、が好ましい。

【0026】

このようにすれば、上記の製造方法と同様の効果が得られるだけでなく、シール部材の太さに依らず、環状部から液晶層が漏れるのを防止することができる。

また、シール部材を全ての部分において同一のスピードで描画することが可能であり、

また、書き始め部分や、書き終わり部分も液晶装置から十分離れた部分であるため複雑な制御も必要なくなる。これらの効果により描画時間は従来の  $1/2 \sim 1/3$  と大幅な短縮ができ、且つシール部材の接合部での液晶装置の内側方向へのシール部材の太りも解消できる。

【0027】

また、本発明の液晶装置の製造方法においては、前記シール部材形成工程は、前記環状部における前記第1辺の軸方向に直交する軸方向において、第2辺を形成し、傾斜部を介して前記第2シール層を前記第2辺に連続して形成すること、を特徴としている。

このようにすれば、上記の製造方法と同様の効果が得られるだけでなく、傾斜部によって第2辺と接続している第2シール層と、第1シール層とを接合し、接合部を確実に形成することができる。

【0028】

また、本発明の液晶装置の製造方法においては、前記傾斜部の面取り量を  $c1$  とすると、

【数12】

$$(c1/w1) \leq -0.5 \times (d1/w1) + 1.2$$

の関係が成立すること、を特徴としている。更に、本発明においては、

【数13】

$$(c1/w1) \leq -0.5 \times (d1/w1) + 0.7$$

の関係が成立し、かつ、

【数14】

$$(c1/w1) \geq -0.5 \times (d1/w1) + 0.3$$

の関係が成立すること、が好ましい。

【0029】

このようにすれば、上記の製造方法と同様の効果が得られるだけでなく、シール部材の太さに依らず、環状部から液晶層が漏れるのを防止することができる。

また、シール部材を全ての部分において同一のスピードで描画することが可能であり、また、書き始め部分や、書き終わり部分も液晶装置から十分離れた部分であるため複雑な制御も必要なくなる。これらの効果により描画時間は従来の  $1/2 \sim 1/3$  と大幅な短縮ができ、且つシール部材の接合部での液晶装置の内側方向へのシール部材の太りも解消できる。

【0030】

また、本発明の液晶装置の製造方法においては、前記第1基板は、複数の第1素子領域を有する第1母材を、当該複数の第1素子領域の相互境界部において分割して、前記第1素子領域毎に得られたものであり、前記第2基板は、複数の第2素子領域を有する第2母材を、当該複数の第2素子領域の相互境界部において分割して、前記第2素子領域毎に得られたものであること、を特徴としている。

このようにすれば、上記の製造方法と同様の効果が得られるだけでなく、第1母材及び第2母材から複数の第1素子領域及び第2素子領域を分割して取り出すことにより第1基板及び第2基板からなる液晶装置を複数取り出すことができる。従って、生産性が優れた製造方法を実現できる。

【0031】

また、本発明の液晶装置の製造方法においては、前記シール部材形成工程は、前記第1シール層と前記第2シール層のうち的一方、かつ、前記環状部の一部、となる第1シール

部材を形成する第1シール部材形成工程と、当該第1シール部材形成工程の後に、前記第1シール層と前記第2シール層のうちの他方、かつ、前記環状部の残部、となる第2シール部材を形成する第2シール部材形成工程と、を含むこと、を特徴としている。

このようにすれば、上記の製造方法と同様の効果が得られるだけでなく、第1シール部材及び第2シール部材で形成されたシール部材を有する液晶装置を製造できる。また、シール部材が一の部材のみからなる場合では、シール材料を異ならせて環状部、第1シール層、第2シール層、及び接合部を形成することが困難であるが、本発明によれば第1シール部材と第2シール部材の各々についてシール材料を選択できる。これにより、シール部材が形成される部位のうち、特定の部位のみに対して第1シール部材又は第2シール部材のいずれか一方を選択して形成できる。

#### 【0032】

また、本発明の液晶装置の製造方法においては、前記第1シール部材形成工程は、前記第1母材における前記複数の第1素子領域及び前記相互境界部に対し、前記第1素子領域が配列する方向に向けて、又は、前記第2母材における前記複数の第2素子領域及び前記相互境界部に対し、前記第2素子領域が配列する方向に向けて、前記第1シール部材を連続して一括に形成すること、を特徴としている。

また、前記第2シール部材形成工程は、前記第1シール部材形成工程を施した後に、前記第1母材における前記複数の第1素子領域及び前記相互境界部に対し、前記第1素子領域が配列する方向に向けて、又は、前記第2母材における前記複数の第2素子領域及び前記相互境界部に対し、前記第2素子領域が配列する方向に向けて、前記第2シール部材を連続して一括に形成すること、を特徴としている。

#### 【0033】

このようにすれば、第1シール部材の描画開始から描画終了までの単工程、及び第2シール部材の描画開始から描画終了までの単工程によって、複数の第1素子領域又は複数の第2素子領域の配列方向に対してシール部材を一括形成できる。これにより、容易かつ迅速にシール部材を形成することができ、生産性が優れた製造方法を実現できる。

一方、複数の第1素子領域や複数の第2素子領域の各々にシール部材を形成する場合は、各領域に対してシール部材の描画開始と描画終了を行わなければならない。従って、複数の第1素子領域や複数の第2素子領域に対して描画開始と描画終了を繰り返さなければならない。これにより、シール材料の吐出、非吐出が連続して生じるので、ディスペンサ内においてシール材料を安定して流動させることが困難となり、吐出するシール材料の量のばらつきが生じやすくなる。また、ディスペンサを第1母材上又は第2母材上を走査しなければならず、ディスペンサの動作が煩雑化してしまう。

これに対して、本発明は、第1素子領域又は第2素子領域の配列方向に向けて連続して一括に第1シール部材及び第2シール部材を形成しているので、第1素子領域又は第2素子領域の列又は行毎に描画開始と描画終了を行うだけでよく、従って、描画開始数と描画終了数を少なくすることができる。これにより、ディスペンサ内のシール材料を安定して流動させながら、第1シール部材及び第2シール部材を連続かつ一括に形成できる。また、短時間でシール部材を形成することができる。また、ディスペンサが非吐出状態で第1素子領域上又は第2素子領域上を走査することがないので、ディスペンサに充填されたシール材料が不用意に滴下するのを防止できる。従って、ディスペンサの動作を簡素化でき、シール材料の粘度ばらつきや、吐出量ばらつきを抑制できる。

また、このような方法によって形成された第1素子領域及び第2素子領域の各々のシール部材は、接合部を介して接続されているので、隣接する領域間において液晶材料が漏れるのを防止できる。

#### 【0034】

また、本発明の液晶装置の製造方法においては、前記第1母材又は前記第2母材のいずれか一方の母材に前記第1シール部材形成工程を施し、他方の母材に前記第2シール部材形成工程を施すこと、を特徴としている。また、前記第1母材又は前記第2母材の一方のみに前記第1シール部材形成工程及び前記第2シール部材形成工程を施すこと、を特徴と



している。

このようにすれば、上記の製造方法と同様の効果が得られる。

【0035】

また、本発明の液晶装置は、液晶層を挟持して対向配置された第1基板及び第2基板と、当該両基板の周縁部に形成されたシール部材とを具備する液晶装置であって、先に記載の製造方法によって製造されたことを特徴としている。

このようにすれば、接合部の一部によって環状部を閉塞させるので、接合部からの液晶材料の漏れを抑制でき、液晶装置の信頼性を向上させることができる。また、環状部を閉塞させている部分を除き、環状部の外側に接合部が形成されるので、第1基板と第2基板との貼り合わせによって接合部の幅が太くなったとしても、環状部の外側において幅が広がるだけで済み、環状部の内部にシール部材が突出するのを抑制できる。従って、環状部の内部のセルギャップに影響を与えることがなく、当該セルギャップを均一に保持できる。また、従来技術と比較して、環状部及び接合部の各々の部材幅を調整する必要がなく、同一幅の部材で環状部及び接合部を形成できる。

【0036】

また、本発明の液晶装置においては、前記シール部材は、一の部材からなり、前記環状部は、前記一の部材によって環状に囲まれた部分に前記液晶層を保持し、前記接合部は、前記一の部材の一端と他端とを1箇所で接合させていること、を特徴としている。

ここで、「シール部材は、一の部材からなり」とは、後述する第1シール部材及び第2シール部材によって形成されたものとは異なり、始端から終端に向けてシール材料を連続吐出して形成したもの、所謂一筆書きでシール材料を吐出して形成したものを意味する。

このようにすれば、上記の液晶装置と同様の効果が得られるだけでなく、シール材料が一の部材で形成されたシール部材を有する液晶装置を実現できる。また、シール部材の一端と他端とを1箇所で接合させた接合部によって環状部が閉塞するので、接合部を最小数にすることができ、接合部が複数設けられた場合と比較して、セルギャップ不良がより確実に抑制された液晶装置を実現できる。

【0037】

また、本発明の液晶装置においては、前記シール部材は、第1シール部材と第2シール部材とからなり、前記環状部は、前記第1シール部材及び前記第2シール部材によって環状に囲まれた部分に前記液晶層を保持し、前記接合部は、前記第1シール部材及び前記第2シール部材の一端を接合させ、かつ、前記第1シール部材及び前記第2シール部材の他端を接合させていること、を特徴としている。

このようにすれば、上記の液晶装置と同様の効果が得られるだけでなく、第1シール部材及び第2シール部材で形成されたシール部材を有する液晶装置を実現できる。また、シール部材が一の部材のみからなる場合では、シール材料を異ならせて環状部や接合部を形成することが困難であるが、本発明によれば第1シール部材と第2シール部材の各々についてシール材料を選択できる。これにより、シール部材が形成される部位のうち、特定の部位のみに対して第1シール部材又は第2シール部材のいずれか一方を選択して形成できる。

【0038】

また、本発明の電子機器は、先に記載の液晶装置を具備することを特徴としている。

本発明によれば、信頼性に優れ、高品質の表示が得られる表示部を備えた電子機器が提供される。

【発明を実施するための最良の形態】

【0039】

以下、本発明の液晶装置、液晶装置の製造方法、及び電子機器の実施形態について、図面を参照して説明する。なお、以下の説明に用いた各図においては、各層や各部材を図面上で認識可能な程度の大きさとするため、各層や各部材毎に縮尺を異ならせてある。

【0040】

(第1実施形態)

まず、本発明の第1実施形態に係る液晶装置について説明する。

以下に示す本実施形態の液晶装置は、スイッチング素子として薄膜ダイオード（Thin Film Diode、以下、TFDと略記する）を用いたアクティブマトリクス型の液晶装置の例であり、透過表示を可能にした透過型の液晶装置である。

図1は本実施形態に係る液晶装置の各構成要素を対向基板側から見た平面図であり、図2は図1のH-H'線に沿う断面図である。また、図3は図1の符号Cの領域を拡大して示した平面図であり、図4はシール部材の構成を詳述するための平面図である。図5は液晶装置の画像表示領域4においてマトリクス状に形成された複数の画素における各種素子、配線等の等価回路図であり、図6は各種素子の電極平面構造（画素構造）を説明するための図である。

#### 【0041】

図1～図3に示すように、本実施形態の液晶装置100は、TFD基板（第1基板）10、対向基板（第2基板）20、シール部材52、及び液晶層50を主な構成要素として備えている。また、シール部材52は、TFD基板10及び対向基板20の周縁部に形成され、当該両基板によって挟持されている。更に、TFD基板10及び対向基板20の間、かつ、シール部材52の内側に液晶層50が封入、保持されている。

次に、各構成要素について詳述する。

#### 【0042】

TFD基板10は、ガラス基板等の透明性部材からなるものであり、その表面に画像表示領域4、シール部材52、周辺見切り部材53、導通パッド（第1導通部、導通領域）54、走査信号駆動回路110、及びデータ信号駆動回路120を備えている。

画像表示領域4においては、複数のドットがマトリクス状に形成され、当該ドット毎に画素電極31及びTFD素子40が形成されている。画素電極31は、ITO（インジウム錫酸化物）を主体とする透明電極にて構成されたものである。TFD素子40はSEG電極56を介して走査信号駆動回路110と接続されており、走査信号駆動回路110の駆動信号が電位として画素電極31に付与されるようになっている。画素電極31の表層にはポリイミドを主体として構成される膜に対してラビング処理が施された配向膜が形成されており、電圧が印加されていない液晶層50の液晶分子の配向をラビング方向に揃えるようになっている。周辺見切り部材53は、遮光性材料からなるものであって、画像表示領域4とシール部材52との間に形成されている。導通パッド54は、図3に示すよう引き回し配線55を介してデータ信号駆動回路120と接続されており、後述する対向基板20に形成されたCOM電極（第2導通部、導通領域）57と導通接続するようになっている。走査信号駆動回路110及びデータ信号駆動回路120は、TFD基板10の一边（紙面左側）に形成されている。そして、走査信号駆動回路110から延出するSEG電極56は、走査信号駆動回路110と画像表示領域4との間においてシール部材52（52a）と重なっている。また、データ信号駆動回路120から延出する引き回し配線55は、データ信号駆動回路120と導通パッド54との間においてシール部材52（52a）と重なっている。

なお、図3における引き回し配線55、導通パッド54、及びCOM電極57においては、各々の一部分のみを示している。実際には、引き回し配線55はデータ信号駆動回路120の端子数と同数の本数が形成されており、導通パッド54及びCOM電極57は図1の紙面左右方向に向けて複数配列して形成されている。

#### 【0043】

対向基板20は、TFD基板10上の画素電極9の境界領域と対向する領域に、ブラックマトリクスまたはブラックストライプと称せられる遮光膜23が形成され、その上層側にはITO膜からなる画素電極9が形成されている。また、画素電極9の上層側には、ポリイミドを主体として構成される膜に対してラビング処理が施された配向膜が形成されている。また、図3に示すように画像表示領域4の外部においては、画素電極9が延在する位置にCOM電極57が形成されている。当該COM電極57は、導通パッド54と対向して形成されていると共に、導通性粒子が含有されたシール部材52b（後述）をCOM

電極57と導通パッド54とによって挟持した状態となっている。従って、データ信号駆動回路120の駆動信号は、引き回し配線55、導通パッド54、導電性粒子、及びCOM電極57を介して、画素電極9に電位として付与するようになっている。

#### 【0044】

シール部材52は、絶縁性シール部材（第2シール部材）52aと導電性シール部材（第1シール部材）52bとによって形成されている。

ここで、絶縁性シール部材52aは電気絶縁性を有するシール部材であり、導電性シール部材52bは導電性を有するシール部材である。絶縁性シール部材52aは、引き回し配線55及びSEG電極56の表面上の非導通領域に形成されており、引き回し配線55及びSEG電極56の各々における複数の配線間や電極間を非導通状態にするものである。一方、導電性シール部材52bは、導通パッド54やCOM電極57の表面上の導通領域に形成されており、当該導通パッド54及びCOM電極57を導通状態にするものである。

#### 【0045】

また、導電性シール部材52bには導電性粒子が含有されているのに対し、絶縁性シール部材52aには当該導電性粒子が含有されていない。このような導電性粒子としては、金属粒子等の導電性材料を有する粒子や、樹脂表面にメッキ処理が施された粒子等が採用される。当該導電性粒子は、弾性を有していることから、TFD基板10及び対向基板20が貼り合わされることによって、導通パッド54及びCOM電極57が導電性粒子を押圧し、弾性力によって導通パッド54及びCOM電極57を導通させることが可能となっている。

また、絶縁性シール部材52a及び導電性シール部材52bのいずれにおいても、主体となるシール材料は、熱硬化性や紫外線硬化性の樹脂材料、又は、硬化工程に応じて熱硬化と紫外線硬化の両者の特性を有する樹脂材料が採用される。本実施形態においては、ワールドロックNo. 717（協立化学製）をシール部材52の採用している。当該材料の粘度は400, 000 mPa・s、貼り合わせ後のシール部材52の厚みは8 μmとなるようにしている。

#### 【0046】

更に、当該絶縁性シール部材52a及び導電性シール部材52bが図4に示すようなパターンに形成されることによって、液晶層50を内側で保持する一重の環状部58と、絶縁性シール部材52aと導電性シール部材52bとが接合されている接合部59と、が構成される。このようなパターンで形成されたシール部材52は、TFD基板10の面内の領域において閉ざされた枠状に形成されたものであり、液晶注入口を備えないものとなっている。また、シール部材52は、後述するようにディスペンサからTFD基板10や対向基板20に向けてシール材料を吐出形成した後に、TFD基板10及び対向基板20によって押圧されることによって押し潰されると共に、所定のセルギャップを維持するものである。

#### 【0047】

環状部58においては、絶縁性シール部材52aは図4中の点RSTOを通過するように形成されており、また、導電性シール部材52bは図4中の点OPQRを通過するように形成されている。

接合部59においては、絶縁性シール部材52aと導電性シール部材52bが点O、Rで接合されている。従って、接合部59は環状部の辺TPの側に一箇所、及び辺SQの側に一箇所、各々形成されている。換言すれば、環状部58の対向する辺の各々に形成されている。

また、接合部59は、環状部58に連設して形成されており、点O、Rにおいて環状部58を閉塞させている。これによって、環状部58の内側に保持される液晶層50がシール部材52の外部に漏れるのを防止することが可能となる。また、接合部59の一部分は当該点O、Rにおいて、環状部58と一体となっており、接合部59の他の部分は環状部58の外側に形成されている。また、換言すれば、接合部59は、環状部58を閉塞させ

ている部分（点O、R）から、環状部58の外側に向けて形成されたものとなっている。従って、環状部58に対して接合部59が重なって形成されたものではなく、接合部59の一部のみが環状部58を接合させ、その他の部分が環状部58の外側に向けて形成されたものとなっている。

また、接合部59は、図3に示すように、導通パッド54の端（符号A）から、引き回し配線55がシール部材52を横断する最も端の部分（符号B）までの間、即ち符号Lに示す部分の中に形成される。本実施形態の液晶装置100においては、符号Lの距離が2mm以下に設定されている。

また、接合部59は、後述するように、ディスペンサから絶縁性シール部材52a及び導電性シール部材52bを非接触状態に対向させて描画形成した後に、貼り合わせ工程によって当該シール部材52a、52bを押圧し、互いに接触、接合させて形成されたものである。

#### 【0048】

液晶層50は、環状部58の内側に位置するものである。例えば、インクジェット法（液滴吐出法）やディスペンサ法によって吐出形成されている。また、液晶層50の層厚は、シール部材52の厚さにも関係して、所定のセルギャップを有するように決定される。また、液晶層50は、液晶装置100の動作モードによって、例えば、TN（Twisted Nematic）モード、STN（Super Twisted Nematic）モード等の動作モードや、ノーマリホワイトモード／ノーマリブラックモードの別に応じて適宜材料が選択される。

#### 【0049】

次に、液晶装置100の画像表示領域4について詳述する。

図5の等価回路に示すように、液晶装置100は、複数の走査線13と、該走査線13と交差する複数のデータ線（画素電極）9とが設けられ、走査線13は走査信号駆動回路110により、データ線9はデータ信号駆動回路120により駆動される。ここで、走査線13は、画像表示領域4の外周においてSEG電極56と接続しているものである。そして、各画素領域150において、走査線13とデータ線9との間にTFD素子40と液晶表示要素160（液晶層50）とが直列に接続されている。なお、図5では、TFD素子40が走査線13側に接続され、液晶表示要素160がデータ線9側に接続されているが、これとは逆にTFD素子40をデータ線9側に、液晶表示要素160を走査線13側に設ける構成としてもよい。

#### 【0050】

また、図6の電極平面構造図に示すように、液晶装置100では、走査線13にTFD素子40を介して接続された平面視矩形状の画素電極31がマトリクス状に設けられており、該画素電極31と紙面垂直方向に対向して画素電極9が短冊状（ストライプ状）に設けられている。画素電極9はデータ線からなり走査線13と交差する形のストライプ形状を有している。本実施形態において、各画素電極31が形成された個々の領域が1つのドット領域であり、マトリクス状に配置された各ドット領域にTFD素子40が具備され、該ドット領域毎に表示が可能な構造になっている。

#### 【0051】

ここで、TFD素子40は走査線13と画素電極31とを接続するスイッチング素子であって、TFD素子40は、Taを主成分とする第1導電膜と、第1導電膜の表面に形成され、Ta<sub>2</sub>O<sub>3</sub>を主成分とする絶縁膜と、絶縁膜の表面に形成され、Crを主成分とする第2導電膜とを含むMIM構造を具備して構成されている。そして、TFD素子40の第1導電膜が走査線13に接続され、第2導電膜が画素電極31に接続されている。

#### 【0052】

なお、走査信号駆動回路110及びデータ信号駆動回路120をTFD基板10の上に形成する代わりに、例えば、駆動用LSIが実装されたTAB（Tape Automated Bonding）基板とTFD基板10の周辺部に形成された端子群とを異方性導電膜を介して電氣的及び機械的に接続するようにしてもよい。なお、液晶装置100においては、使用する液晶層50の種類、すなわち、TN（Twisted Nematic）モード、STN（Super Twisted Nem

atic) モード等の動作モードや、ノーマリホワイトモード／ノーマリブラックモードの別に応じて、位相差板、偏光板等が所定の向きに配置されるが、ここでは図示を省略する。また、液晶装置100をカラー表示用として構成する場合には、対向基板20において、TFD基板10の後述する各画素電極に対向する領域に、例えば、赤(R)、緑(G)、青(B)のカラーフィルタと、当該カラーフィルタを保護する保護膜とが形成される。

【0053】

次に、本発明の第1実施形態に係る液晶装置の製造方法について説明する。

まず、以下の説明では、(1)液晶装置の製造方法の概略説明、(2)デバイス製造装置、(3)液晶装置の製造方法の詳細説明について順次説明する。

【0054】

(1)液晶装置の製造方法の概略説明

図7は、液晶装置の製造方法を概略して説明するための図である。

まず、図7(a)に示すように、TFD基板用マザー基板(第1母材)10'と、対向基板用マザー基板(第2母材)20'を用意する。

TFD基板用マザー基板(第1母材)10'においては、複数のTFD形成領域(第1素子領域)11を区画して形成する。また、区画されたTFD形成領域11の周囲は、相互境界部12となる。そして、TFD基板用マザー基板10'に対して、公知のフォトリソグラフィ技術を含む半導体製造工程を施すことにより、TFD形成領域11にTFD40、画素電極31、導通パッド54、引き回し配線55、SEG電極56、配向膜等、が形成される。なお、走査信号駆動回路110、及びデータ信号駆動回路120をTFD形成領域11内に同時に作り込んでもよい。

【0055】

一方、対向基板用マザー基板20'においては、複数の対向電極形成領域(第2素子領域)21を区画して形成する。また、区画された対向電極形成領域21の周囲は、相互境界部22となる。そして、対向基板用マザー基板20'に対して、公知のフォトリソグラフィ技術を含む半導体製造工程を施すことにより、対向電極形成領域21に画素電極9、COM電極57、配向膜等、を形成する。

ここで、TFD形成領域11及び対向電極形成領域21の各々の個数は同数となっている。また、TFD基板用マザー基板10'と対向基板用マザー基板20'とが貼り合わされた際に、各領域11、21は互いに高精度に位置合わせようになっている。

【0056】

次に、図7(b)に示すように、TFD基板用マザー基板10'と対向基板用マザー基板20'とを貼り合わせる。ここでは、後述するシール部材52や液晶層50を挟持させた状態で、TFD基板用マザー基板10'及び対向基板用マザー基板20'を貼り合わせている。

次に、図7(c)に示すように、マザー基板10'、20'が貼り合わされた状態で、相互境界部12、22においてマザー基板10'、20'を分割して切り出すことにより、複数の液晶装置100が形成される。

【0057】

(2)デバイス製造装置

次に、液晶装置100の製造のうち、シール部材52の形成から、液晶滴下による液晶層50の形成、基板貼合わせ、シール部材52の硬化に至る工程を行うデバイス製造装置について説明する。

【0058】

図8は、デバイス製造装置61の概略構成図である。

図8に示すように、デバイス製造装置61は、基板の給材及び除材を行う基板給除部62と材料供給部63と基板貼り合わせ部64と精密アライメント部164とを主体に構成されている。

【0059】

図9は、基板給除部62および材料供給部63の概略構成図である。なお、以下の説明

では、基板の表面に沿う方向をX方向（例えば図9中、左右方向）及びY方向（例えば図9中、紙面と垂直な方向）とし、XY平面と直交する方向をZ方向として説明する。

材料供給部63は、図9に示すように、基板を保持してX方向、Y方向及びθ方向（Z軸と平行な軸周りの回転方向）に移動自在なテーブル65と、テーブル65の上方に配設され液晶材料（電気光学材料）を吐出、滴下する液滴吐出ヘッド66と、液滴吐出ヘッド66の近傍に配設されシール材料を塗布するシール材塗布部67a、67bとを主体に構成されている。

#### 【0060】

シール材塗布部67a、67bから塗布されるシール材料には、略球形状のギャップ制御材が含まれており、ギャップ制御材の直径は、基板のセルギャップを所定厚さ（例えば3μm）に保持できる寸法（例えば直径8μm）に形成されている。このようなギャップ制御材の直径（約8μm）は、表示領域内のカラーフィルタ等の厚さ（約5μm）とセルギャップ（3μm）を保持するために設定されたものである。

また、シール材塗布部67aは、上記の絶縁性シール部材52aを塗布するものであり、シール材塗布部67bは上記の導電性シール部材52bを塗布するものである。

なお、液晶材料を滴下させるのに液滴吐出ヘッド66の他に、精密薬液吐出機（計量型ディスペンサ）など、滴下する液晶材料量を制御できるものであればどのような装置を用いてもよい。また、ギャップ制御材は略球形状に形成され、シール材料に含まれるものに限られることなく、繊維形状に形成されシール材料に含まれるものや、シール材料に含まれず基板から柱状に突出して形成されたもの等さまざまなものを使用することができるが、基板の所定位置に固定され、基板の貼り合わせ時等において基板上を移動しないものを用いることが好ましい。

#### 【0061】

また、基板給除部62は、材料供給部63と基板貼り合わせ部64との間、および基板貼り合わせ部64と精密アライメント部164との間で基板を搬送するキャリアを主な構成要素としている。

なお、基板給除部62は、図9に示した構成の他に、搬送ロボットや、材料供給部63と基板貼り合わせ部64と精密アライメント部164とを接続する搬送機能を有したユニットを含んで構成されていてもよい。

#### 【0062】

図10は、基板貼り合わせ部64の概略構成図である。

基板貼り合わせ部64は、図10に示すように、基板を保持してX方向、Y方向及びθ方向に移動自在なテーブル68と、テーブル68上に設置された下チャック部69と、下チャック部69の上方に配置された真空チャンバ70と、真空チャンバ70内に下チャック部69と対向配置された上チャック部71と、上チャック部71をZ方向に移動自在に支持し、且つ下チャック部69に向けて加圧する下降機構72とを備えて構成されている。

真空チャンバ70の壁面には、覗き窓70aと排気部76とが配設されている。覗き窓70aの上方には、覗き窓70aを介して基板上のアライメントマークを拡大、観測する貼り合わせ用顕微鏡74と、拡大観測されたアライメントマークの画像を取り込むCCDカメラ81とを備えた光学測定手段が設けられている。排気部76には、収容空間70b内の気体を排気（真空引き）するための真空ポンプ等を備えた吸引装置78が接続されている。

#### 【0063】

また、真空チャンバ70には、UV照射ユニット82が備えられている。UV照射ユニット82には、シール部材52を仮硬化させるための紫外線を放射する水銀ランプ等のUVランプが備えられ、必要に応じて、ファイバなどの導光手段が備えられる。

なお、UV照射ユニット82は、シール部材52の粘度を高める程度のエネルギーを供給できればよい。また、シール部材52にエネルギーを与える手段は、UVランプに限られることなく、加熱・冷却装置や、可視光照射装置など、シール部材52の性質によりさ

まざまな装置を用いることができる。

【0064】

更に、基板貼り合わせ部64には、CCDカメラ81により取り込まれた画像を処理する画像処理部83と、画像処理部83により処理された画像情報に基づいてテーブル68と下降機構72とを制御する制御部84が設けられている。

【0065】

また、下チャック部69及び上チャック部71には、互いに対向する保持面69a、71aでそれぞれ基板を保持するための保持機構（図示せず）が備えられている。

なお、下チャック部69及び上チャック部71には、静電気力や粘着力を用いたチャック機構、または機械的に基板を保持する機械的保持機構など、略真空雰囲気においても基板を保持できる機構であればどのような機構が備えられていてもよい。また、接着力、分子間力、真空力、機械式保持等の保持方法を用いてもよい。

【0066】

図11は、精密アライメント部164の概略構成図である。

精密アライメント部164は、基板を保持してX方向、Y方向及びθ方向に移動自在なテーブル168と、テーブル168上に設置された下チャック部169と、下チャック部169と対向配置された上チャック部171と、上チャック部171をZ方向に移動自在に支持し、且つ下チャック部169に向けて加圧する加圧機構172と、基板上的のアライメントマークを拡大、観測するアライメント用顕微鏡174と、シール部材52を硬化させる紫外線を照射する水銀ランプ等のUVランプ182とから概略構成されている。アライメント用顕微鏡174は、拡大観測されたアライメントマークの画像を取り込むCCDカメラ181とともに本装置の光学測定手段を構成している。

更に、精密アライメント部164には、CCDカメラ181により取り込まれた画像を処理する画像処理部183と、画像処理部183により処理された画像情報に基づいてテーブル168を制御する制御部184が設けられている。

【0067】

下チャック部169及び上チャック部171には、互いに対向する保持面169a、171aでそれぞれ基板を真空吸着するための吸着機構（図示せず）が備えられている。

なお、下チャック部169及び上チャック部171には、静電気力や粘着力を用いたチャック機構、または機械的に基板を保持する機械的保持機構など、貼り合わされた基板をX軸、Y軸方向に動かすのに十分な保持力を発揮できる機構であれば、どのような機構が備えられていてもよい。

また、精密アライメント部164には、上チャック部171を下チャック部169に向けて加圧する加圧機構172が設けられていなくてもよい。

また、UVランプ182は、シール部材52を硬化させることができればよく、UVランプ182の他に、例えば加熱・冷却装置や、可視光照射装置など、シール部材52の性質によりさまざまな装置を用いることができる。

【0068】

図9に示した液滴吐出ヘッド66としては、例えば図12に示す構成の液滴吐出ヘッドを用いることができる。液滴吐出ヘッド66のヘッド本体90には、リザーバ95および複数のインク室（圧力発生室）93が形成されている。リザーバ95は、各インク室93に液晶等の電気光学材料を含むインクを供給するための流路になっている。また、ヘッド本体90の一方端面には、インク吐出面66Pを構成するノズルプレートが装着されている。そのノズルプレートには、各インク室93に対応して、インクを吐出する複数のノズル91が開口されている。そして、各インク室93から対応するノズル91に向かって流路が形成されている。一方、ヘッド本体90の他方端面には振動板94が装着されている。

この振動板94はインク室93の壁面を構成している。その振動板94の外側には、各インク室93に対応して、ピエゾ素子（圧力発生手段）92が設けられている。ピエゾ素子92は、水晶等の圧電材料を一對の電極（図示せず）で挟持したものである。

#### 【0069】

図13は、ピエゾ素子の駆動電圧波形W1と、その駆動電圧に対応した液滴吐出ヘッド66の動作を示す概略図である。以下には、ピエゾ素子92を構成する一対の電極に対して、波形W1の駆動電圧が印加された場合について説明する。まず正勾配部a1、a3では、ピエゾ素子92が収縮してインク室93の容積が増加し、リザーバ95からインク室93内にインクが流入する。また負勾配部a2では、ピエゾ素子92が膨張してインク室93の容積が減少し、加圧されたインク99がノズル91から吐出される。そして、この駆動電圧波形W1の振幅および印加回数等により、インクの塗布量が決定される。

#### 【0070】

なお、液滴吐出ヘッド66の駆動方式として、ピエゾ素子92を用いたピエゾジェットタイプに限られず、例えば熱膨張を利用したサーマルインクジェットタイプなどを採用してもよい。また液晶の塗布手段として、インクジェットヘッド以外の塗布手段を採用することも可能である。インクジェットヘッド以外の液晶塗布手段として、たとえばディスペンサを採用することができる。ディスペンサは、インクジェットヘッドに比べて大口径のノズルを有しているため、粘度が高い状態の液晶を吐出することも可能である。

#### 【0071】

##### (3) 液晶装置の製造方法の詳細説明

次に、上記のデバイス製造装置61により液晶装置100を製造する手順について図14～図18を参照して説明する。

以下では、TFD基板用マザー基板10'及び対向基板用マザー基板20'には、図7(a)にて説明した画素電極9、31等が既に形成されているものとして説明する。

#### 【0072】

まず、図14(a)に示すように、画素電極31等が形成されたTFD基板用マザー基板10'は、基板給除部62により運搬され、封止面10'aを上側に向けて材料供給部63のテーブル65上に給材される。その後、テーブル65を移動させつつ、TFD基板用マザー基板10'上にシール材塗布部67aからシール材料が塗布され、更に、シール材塗布部67bからシール材料が塗布されることによって、TFD基板用マザー基板10'上にシール部材52が形成される(シール部材形成工程)。ここで、当該シール部材52は、上記の絶縁性シール部材52aと導電性シール部材52bとによって形成される。絶縁性シール部材52aは、シール材塗布部67aによって塗布されるものであり、導電性シール部材52bは、シール材塗布部67bによって塗布されるものである。

ここで、シール部材52の形成方法について詳述する。

#### 【0073】

図17はシール部材52の形成方法を説明するための平面図である。図18はマザー基板上に形成されたシール部材52を示す平面図であり、図18(a)はマザー基板の外観を示す図、図18(b)は図18(a)における符号Eを拡大した図、図18(c)は図18(b)における符号Fを拡大した図である。

#### 【0074】

図17(a)に示すように、TFD基板用マザー基板10'上に絶縁性シール部材52aを符号Uに示す方向に塗布する(第2シール部材形成工程)。ここで、上記のようにTFD基板用マザー基板10'上には予め複数のTFD形成領域11と相互境界部12が形成されており、これらを跨ぐように絶縁性シール部材52aが連続かつ一括して塗布される。また、符号Uが示す方向とは、複数のTFD形成領域11が配列する方向と同一方向を示している。

ここで、絶縁性シール部材52aが塗布形成されることにより、TFD形成領域11の側方に環状部58の一部となる第1辺58aが形成され、相互境界部12には、第1辺58aに連続して形成される第1シール層59aが形成される。ここで、第1シール層59aは、相互境界部12において第1辺58aの延在軸方向(符号U)よりもTFD形成領域11の側に凹んでいる凹部Wに形成されたものとなっている。当該凹部Wは、所謂「コの字」状となっている。



#### 【0075】

次に、図17(b)に示すように、TFD基板用マザー基板10'上に導電性シール部材52bを符号Vに示す方向に塗布する(第1シール部材形成工程)。この工程においても、先と同様に複数のTFD形成領域11及び相互境界部12を跨ぐように導電性シール部材52bが連続かつ一括して塗布される。また、符号Vが示す方向とは、複数のTFD形成領域11が配列する方向と同一方向を示している。

ここで、導電性シール部材52bが塗布形成されることにより、第1辺58aの延在軸(符号V)に直交する軸方向に向けて、環状部58の一部となる第2辺58bが形成され、TFD形成領域11の側方に第1辺58aと対向する第3辺58cが形成される。また、相互境界部12には、第2辺58bに連続して形成される第2シール層59bが形成される。ここで、第2シール層59bは、相互境界部12において第3辺58cの延在軸方向よりもTFD形成領域11の側に凹んでいる凹部Xに形成されたものとなっている。当該凹部Xは、所謂「コの字」状となっている。

#### 【0076】

そして、第1シール層59a及び第2シール層59bは、互いに対向するように形成される。従って、コの字状に形成された凹部W、Xは、互いに向き合うこととなる。また、上記のように形成された絶縁性シール部材52aは環状部58の一部を構成し、導電性シール部材52bは、環状部58の残部を構成するものとなる。更に、第1シール層59a及び第2シール層59bは、後述する貼り合わせ工程が施されることによって、相互境界部12に形成される接合部59となるものである。

#### 【0077】

なお、本実施形態においては、符号Uが示す方向に絶縁性シール部材52aを塗布し、当該符号Uとは反対方向の符号Vが示す方向に導電性シール部材52bを塗布したが、これを限定するものではない。同一の方向に絶縁性シール部材52a及び導電性シール部材52bを塗布形成してもよい。

また、本実施形態においては、符号U、Vに示すように、紙面上下方向に絶縁性シール部材52a及び導電性シール部材52bを形成したが、紙面左右方向にこれらを形成してもよい。いずれにしても、複数のTFD形成領域11が配列する方向に向けて、絶縁性シール部材52a及び導電性シール部材52bを形成している。

また、本実施形態においては、上記のシール部材52a、52bの線幅は、いずれも線幅が同一となっているが、各シール部材52a、52bが形成される部位に応じて、又は、貼り合わせによって形成される接合部59の形状に応じて、各々の線幅を異ならせてもよい。

#### 【0078】

このようなシール部材52の形成方法によって、図18(a)に示すTFD基板用マザー基板10'上に、絶縁性シール部材52a及び導電性シール部材52bが塗布形成された複数のTFD形成領域11が形成される。更に、図18(b)に示すように、TFD形成領域11の一部が絶縁性シール部材52aによって形成され、その残部が導電性シール部材52bによって形成される。これによって当該シール部材52a、52bからなる上記の環状部58が形成される。また、図18(c)に示すように、絶縁性シール部材52a及び導電性シール部材52bの各々は、凹部W、Xにおいて互いに対向する第1シール層59a及び第2シール層59bを有している。第1シール層59a及び第2シール層59bは、左右対称の曲線部59cを有している。後に説明するように、TFD基板用マザー基板10'と対向基板用マザー基板20'とが貼り合わされることによって、第1シール層59a及び第2シール層59bが押し潰されて接合し、上記の図4に示す接合部59が形成されるようになっている。

#### 【0079】

次に、図18(c)を参照して、第1シール層59a及び第2シール層59bの形状寸法について説明する。以下では、

R2: 曲線部59cの半径

d 2 : 第1シール層5 9 a、第2シール層5 9 bが最も近接する領域における中心線間の距離

w 2 : 貼り合わせ工程の後のシール部材5 2 a、5 2 bの幅と定義する。すると、

本実施形態においては、

【数1 5】

$$0 \leq d2 \leq 0.8 \times w2$$

の関係が成立している。また、

【数1 6】

$$(R2/w2) \leq -1.2 \times (d2/w2) + 2.0$$

の関係が成立している。更には、

【数1 7】

$$(R2/w2) \leq -(d2/w2) + 1.2$$

【数1 8】

$$(R2/w2) \geq -0.6 \times (d2/w2) + 0.4$$

の関係が成立している。

【0080】

このようにすることにより、後述の実施例で検証するように、シール部材5 2 a、5 2 bの太さのばらつきが生じていたとしても、第1シール層5 9 a及び第2シール層5 9 bとを確実に接合して接合部5 9を形成することができる。また、シール部材5 2 a、5 2 bを全ての部分において同一のスピードで描画することが可能であり、また、書き始め部分や、書き終わり部分も液晶装置から十分離れた部分であるため複雑な制御も必要なくなる。これらの効果により描画時間は従来の $1/2 \sim 1/3$ と大幅な短縮ができ、且つ接合部5 9での液晶装置1 0 0の内側方向へのシール部材5 2 a、5 2 bの太りも解消できる。

【0081】

次に、図1 4に戻り、液晶装置の製造方法について続けて説明する。

図1 4 (b)に示すように、材料供給部6 3においてTFD基板用マザー基板1 0' がテーブル6 5上に給材されている状態で、液滴吐出ヘッド6 6から液晶5 0を滴下する。具体的には、封止面1 0' aを上側に向け、テーブル6 5を移動させつつ、液滴吐出ヘッド6 6から液晶を吐出、滴下して、封止面1 0' a上の所定位置に液晶5 0を配置する。当該液晶5 0は、複数のTFD形成領域1 1毎の環状部5 8に滴下される。

また、本実施形態において、TFD基板用マザー基板1 0' の封止面1 0' aに滴下する液晶5 0の粘度は、 $130 \text{ Pa} \cdot \text{s} \sim 250 \text{ Pa} \cdot \text{s}$ とすることが好ましい。液晶5 0の粘度を上記範囲とすることで、液晶5 0がシール部材5 2 a、5 2 bとTFD基板用マザー基板1 0' との接着領域にまで濡れ広がるのを効果的に防止することができ、マザー基板1 0'、2 0'の貼り合わせを確実にに行えるようになる。

【0082】

次に、図1 4 (c)に示すように、対向基板用マザー基板2 0' は基板給除部6 2により運搬されるとともに上下面を反転され、基板貼り合わせ部6 4の上チャック部7 1に給材される。そして、保持機構により保持面7 1 aに保持される。

一方、シール部材5 2 a、5 2 b及び液晶5 0が配置されたTFD基板用マザー基板1

0' は基板給除部62により運搬され、基板貼り合わせ部64のチャック部69に給材され、保持機構により保持面69aに保持される。

#### 【0083】

本実施形態の場合、上記対向基板用マザー基板20'の基板貼り合わせ部64への給材を、TFD基板用マザー基板10'の給材に先立って行うようになっている。これにより、TFD基板用マザー基板10'及び対向基板用マザー基板20'の封止面10'a、20'aにおける清浄性を保持しつつ、両マザー基板10'、20'の貼り合わせを行えるようになっている。下チャック部69に保持されるTFD基板用マザー基板10'の基板貼り合わせ部64への給材を先に行うと、上チャック部71への対向基板用マザー基板20'の給材時に、既に配置されているTFD基板用マザー基板10'上、及びその封止面10'aに配置された液晶50に対し異物が堆積するおそれがあり好ましくない。

#### 【0084】

なお、本実施形態では、単一の材料供給部63によりTFD基板用マザー基板10'上へのシール部材52a、52bの配置工程、液晶50の配置工程を行うこととしているが、2台の材料供給部63を用いて上記シール部材52a、52b及び液晶50の配置工程を行うこともできる。この場合、上記2工程を並行して行うことができるため、スループットを向上させることができる。

また、本実施形態においては、TFD基板用マザー基板10'にシール部材52a、52bを形成しているが、対向基板用マザー基板20'にシール部材52a、52bを形成してもよい。この場合、シール部材52a、52bの各々は、複数の対向電極形成領域21と相互境界部22とを跨ぐように連続かつ一括に形成される。また、この場合、基板給除部62による対向基板用マザー基板20'の反転動作は、材料供給部63からの基板排出後、直ちに行うことが好ましい。シール部材52a、52bは、塗布後の時間経過とともに対向基板用マザー基板20'上で広がり、塗布高さが低くなる。特に、シール部材52の粘度が20万cps以下である場合、上記塗布高さの変化が顕著になる。そこで、シール部材52a、52bの塗布後に直ちに対向基板用マザー基板20'を反転させて保持しておくことで、シール部材52a、52bの広がりを抑え、シール材料の「だれ」を低減することができる。その結果、対向基板用マザー基板20'とTFD基板用マザー基板10'との貼り合わせ強度を保持することができ、信頼性に優れた液晶装置を製造することが可能になる。

また、シール部材52a、52bのうち一方をTFD基板用マザー基板10'に形成し、他方を対向基板用マザー基板20'に形成してもよい。この場合においても、上記のようにシール材料の「だれ」を低減させつつ、TFD基板用マザー基板10'と対向基板用マザー基板20'とが貼り合わされる。また、当該貼り合わせの際には、シール部材52a、52bの位置が合うよう位置決めが施された後に行われる。

#### 【0085】

その後、図15(a)に示すように、真空チャンバ70を下降させて下チャック部69に当接させ、収容空間70bを密封状態に閉塞する。収容空間70bが密封状態となったら、排気部76から負圧吸引して収容空間70b内を略真空状態( $1.33\text{ Pa} \sim 1.33 \times 10^{-2}\text{ Pa}$ )とする。

#### 【0086】

収容空間70b内が略真空状態となったら、図15(b)に示すように、対向基板用マザー基板20'とTFD基板用マザー基板10'とに形成されたアライメントマーク(図示せず)を貼り合わせ用顕微鏡74、74を用いて拡大してCCDカメラ81に取り込む。CCDカメラ81に取り込まれたアライメントマークの画像データは、画像処理部83に入力され、画像処理部83にて対向基板用マザー基板20'とTFD基板用マザー基板10'との相対位置が検出される。制御部84は、画像処理部83により検出された相対位置に基づきテーブル68を駆動して対向基板用マザー基板20'を水平移動させ、TFD基板用マザー基板10'との相対位置のズレが $\pm 10\text{ }\mu\text{ m}$ 以内になるように粗位置決めする。

【0087】

なお、上記収容空間70b内の真空引きと、マザー基板10'、20'の粗位置決めとは、同時に併行して実施してもよいし、粗位置決めを先に実施して真空引きを後から実施してもよい。真空引きと粗位置決めとを同時に実施した場合は、製造時間を短縮することができる。

また、上チャック部71には、貼り合わせ用顕微鏡74及び覗き窓70aの直下の位置に貫通孔71bが形成されており、この貫通孔71bを介して各マザー基板10'、20'のアライメントマークを検出するようになっている。

【0088】

マザー基板10'、20'が粗位置決めされたら、図15(c)に示すように、下降機構72により上チャック部71を下降(相対移動)させて対向するマザー基板10'、20'を貼り合わせる。更に、上チャック部71を下チャック部69に向けて下降させ、マザー基板10'、20'に加圧してシール部材52を所定厚さまで圧縮する。

マザー基板10'、20'の貼り合わせが完了すると、UV照射ユニット82により紫外線を照射してシール部材52を仮硬化させ、シール材料の粘度を高める。

【0089】

なお、マザー基板10'、20'を貼り合わせた後の加圧は、製造のプロセスおよびシール部材52a、52bなどの選択によっては実施しなくてもよい。また、UV照射ユニット82によるシール部材52の仮硬化も同様にシール部材52によっては実施しなくてもよい。

また、貼り合わせ後から後述する精密位置合わせまでの間に、両基板の位置ズレの発生が予想され、そのズレ幅、方向が統計的に予想される場合には、位置ズレ発生後のマザー基板10'、20'の位置関係が上述した範囲内に収まるように、あらかじめオフセットさせて粗位置決めしてもよい。

【0090】

この後、収容空間70b内に大気が導入され、略真空状態から大気圧に戻される。真空チャンバ70の収容空間70bが大気圧になると、圧力差により両マザー基板10'、20'は押圧されてシール部材52は更に圧縮される。その後、上チャック部71と下チャック部69との保持を解除し、図16(a)に示すように、真空チャンバ70を上昇させる。そして、下チャック部69に非保持状態で載置されている基板(この場合はマザー基板10'、20'が貼り合わされた液晶装置100)を基板給除部62により除材する。

【0091】

貼り合わされた両マザー基板10'、20'は基板給除部62により精密アライメント部164へ運搬され、図16(b)に示すように、対向基板用マザー基板20'が上チャック部171側に、TFD基板用マザー基板10'が下チャック部169側になるように給材される。上チャック部171と下チャック部169とは、それぞれ設けられた吸着機構により対向基板用マザー基板20'とTFD基板用マザー基板10'とを真空吸着する。

TFD基板用マザー基板10'と対向基板用マザー基板20'との保持が完了すると、大気圧下において、両マザー基板10'、20'に形成されたアライメントマーク(図示せず)をアライメント用顕微鏡174、174を介してCCDカメラ181、181に取り込む。CCDカメラ181に取り込まれたアライメントマークの画像データは、画像処理部183に入力され、対向基板用マザー基板20'とTFD基板用マザー基板10'との相対位置が検出される。制御部184は、画像処理部183により検出された相対位置に基づき、テーブル168を駆動して対向基板用マザー基板20'とTFD基板用マザー基板10'との相対位置のズレが±1μm以内になるように精密位置決めする。

また、上チャック部171には、アライメント用顕微鏡174の直下の位置に貫通孔171bが形成されており、この貫通孔171bを介して各マザー基板10'、20'のアライメントマークを検出するようになっている。

【0092】

両マザー基板10'、20'が精密位置決めされたら、加圧機構172により上チャック部171を更に下降（相対移動）させて対向配置されているマザー基板10'、20'を加圧する。すると、シール部材52は更に圧縮され、シール部材52a、52bに含まれるギャップ制御材52cがマザー基板10'、20'に当接し、両マザー基板10'、20'の間隔が略3 $\mu$ m以下になるように調節される。

なお、加圧機構172による加圧方法は、一括して押圧力を加える加圧方法や、段階的に押圧力を上げる加圧方法、連続的に押圧力を上げる加圧方法、押圧してその押圧力を一時保持しその後押し圧力を上げるS字加圧など、さまざまな加圧方法で加圧してもよい。

#### 【0093】

また、上チャック部171と下チャック部169とが対向基板用マザー基板20'とTFD基板用マザー基板10'と接触して押圧する領域は、接触している面全体で押圧してもよいし、シール部材52に含まれているギャップ制御材52cが配置されている領域のみに接触して押圧してもよい。ギャップ制御材52cが配置されている領域のみを押圧する方法では、ギャップ制御材52cが配置されていない領域を押圧しないので、両マザー基板10'、20'の撓みによる基板の狭ギャップ化や、基板上に配置されたスペーサによる構成部材の破損を防ぐことができる。

#### 【0094】

両マザー基板10'、20'のギャップが調節されると、UVランプ182により紫外線をシール部材52に照射して硬化させ、両マザー基板10'、20'のギャップを保持させる。

なお、UVランプ182の照射は、加圧機構172の押圧力が所定圧力に到達した直後から照射したり、所定時間放置し、液晶50がTFD形成領域11のすみずみまで行き渡るまで待ってから照射したりするなど、さまざまなタイミングで照射を行ってもよい。また、使用するシール材料によっては、必要な接着力を得るために、シール部材硬化の工程を更に追加してもよい。

#### 【0095】

シール部材52a、52bの硬化が完了すると、上チャック部171と下チャック部169とによる保持を上下順次または同時に開放し、下チャック部69に非保持状態で載置されている液晶装置100を基板給除部62により除材する。

そして、図7(c)のようにマザー基板10'、20'を切り出すことにより、液晶装置100の製造が完了する。

#### 【0096】

なお、本実施形態においては、デバイス製造装置61を利用して、次の[1]～[8]に示す貼り合わせ工程を行っている。

- [1] マザー基板10'、20'をテーブルにセット
- [2] 収容空間70bにおいて真空引き
- [3] マザー基板10'、20'を粗位置決め
- [4] UV照射による仮固定
- [5] 収容空間70bを大気開放
- [6] 精密アライメント部164へ移載
- [7] マザー基板10'、20'を精密位置決め
- [8] UV照射による固定

また、本発明は、このような貼り合わせ工程を限定するものではない。例えば、次の[1]～[11]に示す貼り合わせ工程を行ってもよい。

- [1] マザー基板10'、20'をテーブルにセット
- [2] 収容空間70bにおいて真空引き
- [3] 一定の位置まで上チャック部71を下降
- [4] マザー基板10'、20'を粗位置決め
- [5] 更に上チャック部71を下降
- [6] マザー基板10'、20'を精密位置決め

- [7] 加圧固定
- [8] UV照射による仮固定
- [9] 静電チャックOFF、上チャック部71を上昇
- [10] 収容空間70bを大気開放
- [11] UV照射による固定

このような[1]～[11]の貼り合わせ工程においては、大気中で精密アライメントを行っていないが、確実にマザー基板10'、20'を貼り合わせることが可能となる。

#### 【0097】

上述したように、本実施形態の液晶装置100、及びその製造方法においては、シール部材52a、52bは、環状部58と接合部59とを構成するので、接合部59の一部によって環状部58を閉塞し、接合部59からの液晶層50の漏れを抑制でき、液晶装置100の信頼性を向上させることができる。また、接合部59は環状部58の外側に向けて形成されているので、貼り合わせ工程を施した際に環状部58の外側において接合部59の幅が広がるだけで済み、環状部58の内部にシール部材52a、52bが突出するのを抑制できる。また、環状部58の内部のセルギャップに影響を与えることがなく、当該セルギャップを均一に保持できる。

また、従来技術と比較して、環状部58及び接合部59の各々の部材幅を調整する必要がなく、同一幅の部材で環状部58及び接合部59を形成することができ、容易にシール部材52a、52bを形成できる。従って、ディスペンサの制御が容易になり、シール部材52a、52bの描画を短時間で終了させることができる。また、ディスペンサの中に残存するシール材料の量のばらつきや、シール材料のロット間の粘度ばらつきを問題視する必要がなく、シール部材52a、52bの形状の管理を容易にできる。

#### 【0098】

また、導電性シール部材52bは、導通パッド54とCOM電極57とを導通させているので、環状部58の内側に液晶層50を保持するだけでなく、導通パッド54とCOM電極57とを導通させることができる。また、絶縁性シール部材52aは、引き回し配線55及びSEG電極56の表面上の非導通領域に形成されているので、環状部58の内側に液晶層50を保持するだけでなく、当該非導通領域において電気的絶縁性を得ることができる。

#### 【0099】

また、絶縁性シール部材52aと導電性シール部材52bとによって、導電性と電気絶縁性を有する環状部58を形成することができ、導電性と電気絶縁性の部材が接合された接合部59を形成できる。また、この場合、導通領域と非導通領域との間に接合部59が形成されることとなるが、当該接合部59は環状部58の外側に向けて形成されているので、貼り合わせ工程を施した際に環状部58の外側において接合部59の幅が広がるだけで済み、環状部58の内部にシール部材52a、52bが突出するのを抑制できる。また、環状部58の内部のセルギャップに影響を与えることがなく、当該セルギャップを均一に保持できる。

#### 【0100】

また、上記の(数15)～(数18)の関係が成立していることから、シール部材52a、52bの太さのばらつきに関係なく、第1シール層59a及び第2シール層59bとを確実に接合して接合部59を形成することができる。また、従来の方法では、接合部59においてシール部材52a、52bの太りが発生したり、太りを最小限に抑制するために重ね部分の距離を長くしたりする必要があり、また、装置の制御も複雑になってシール部材の描画時間が長くなるという課題があった。これに対して、本実施形態においては、シール部材52a、52bを全ての部分において同一のスピードで描画することができる。また、書き始め部分や、書き終わり部分も液晶装置100から十分離れた部分であるため複雑な制御も不要にすることができる。従って、描画時間を大幅に短縮でき、且つ接合部59での液晶装置100の内側方向への52a、52bの太りも解消できる。

#### 【0101】

また、液晶装置100は、TFD基板用マザー基板10'と、対向基板用マザー基板20'とを貼り合せた後に切り出して製造されるので、液晶装置100を複数取り出すことができ、生産性が優れた製造方法を実現できる。

また、液晶装置100の製造方法において、TFD形成領域11及び相互境界部12を跨ぐように絶縁性シール部材52aが連続かつ一括して塗布し、更に、導電性シール部材52bも連続かつ一括して塗布しているので、従来よりも優れた効果が得られる。

具体的には、導電性シール部材52bの描画開始から描画終了までの単工程、絶縁性シール部材52aの描画開始から描画終了までの単工程によって、複数のTFD形成領域11の配列方向に対してシール部材52a、52bを一括形成できる。これにより、容易かつ迅速にシール部材52a、52bを形成することができ、生産性が優れた製造方法を実現できる。

一方、従来のように複数のTFD形成領域11の各々にシール部材52a、52bを形成する場合では、各TFD形成領域11に対してシール部材52a、52bの描画開始と描画終了を行わなければならない、従って、より多くの描画開始と描画終了を繰り返さなければならない。これにより、シール材料の吐出、非吐出が連続して生じるので、ディスペンサ内においてシール材料を安定して流動させることが困難となり、吐出するシール材料の量のばらつきが生じやすくなる。また、ディスペンサをTFD基板用マザー基板10'上に走査しなければならない、ディスペンサの動作が煩雑化してしまう。

これに対して、本実施形態においては、TFD形成領域11の配列方向に向けて連続して一括に、導電性シール部材52b及び絶縁性シール部材52aを形成しているので、TFD形成領域11の列又は行毎に描画開始と描画終了を行うだけでよく、従って、描画開始数と描画終了数を少なくすることができる。これにより、ディスペンサ内のシール材料を安定して流動させながら、導電性シール部材52b及び絶縁性シール部材52aを連続かつ一括に形成できる。また、短時間でシール部材52a、52bを形成することができる。また、ディスペンサが非吐出状態でTFD基板用マザー基板10'上を走査することがないので、ディスペンサに充填されたシール材料が不用意に滴下するのを防止できる。従って、ディスペンサの動作を簡素化でき、シール材料の粘度ばらつきや、吐出量ばらつきを抑制できる。

また、このような方法によって形成されたTFD形成領域11の各々のシール部材52a、52bは、接合部59を介して接続されているので、相互境界部12において液晶50が漏れるのを防止できる。

#### 【0102】

次に、液晶装置の製造方法の第2～第4実施形態について説明する。

以下の説明においては、上記の実施形態と異なる部分について説明し、同一構成や同一工程については同一符号を付して説明を省略している。

#### 【0103】

##### (第2実施形態)

図19は、本発明の第2実施形態に係る液晶装置の製造方法を説明するための図である。また、当該図19は、シール部材52の形成方法を説明するための平面図である。また、当該図19は、図18は図18(b)における符号Fを拡大した図である。

#### 【0104】

上記の第1実施形態においては、第1シール層59a及び第2シール層59bが曲線部59cを有する構成となっているが、これに対して本実施形態は、第1シール層59a及び第2シール層59bが傾斜部59dを有する構成となっている。そして、上記に説明したように、TFD基板用マザー基板10'と対向基板用マザー基板20'とが貼り合わされることによって、第1シール層59a及び第2シール層59bが押し潰されて接合し、上記の図4に示す接合部59が形成されるようになっている。

#### 【0105】

次に、図19を参照して、第1シール層59a及び第2シール層59bの形状寸法について説明する。以下では、

c 2 : 傾斜部 5 9 d の面取り量

d 2 : 第 1 シール層 5 9 a、第 2 シール層 5 9 b が最も近接する領域における中心線間の距離

w 2 : 貼り合わせ工程の後のシール部材 5 2 a、5 2 b の幅と定義する。すると、

本実施形態においては、

【数 1 9】

$$0 \leq d2 \leq 0.8 \times w2$$

の関係が成立している。また、

【数 2 0】

$$(c2/w2) \leq -0.5 \times (d2/w2) + 1.2$$

の関係が成立している。更には、

【数 2 1】

$$(c2/w2) \leq -0.5 \times (d2/w2) + 0.7$$

【数 2 2】

$$(c2/w2) \geq -0.5 \times (d2/w2) + 0.3$$

の関係が成立している。

【0 1 0 6】

このようにすることにより、後述の実施例で検証するように、シール部材 5 2 a、5 2 b の太さのばらつきが生じていたとしても、第 1 シール層 5 9 a 及び第 2 シール層 5 9 b とを確実に接合して接合部 5 9 を形成することができる。また、シール部材 5 2 a、5 2 b を全ての部分において同一のスピードで描画することが可能であり、また、書き始め部分や、書き終わり部分も液晶装置から十分離れた部分であるため複雑な制御も必要なくなる。これらの効果により描画時間は従来の  $1/2 \sim 1/3$  と大幅な短縮ができ、且つ接合部 5 9 での液晶装置 1 0 0 の内側方向へのシール部材 5 2 a、5 2 b の太りも解消できる。

【0 1 0 7】

(第 3 実施形態)

図 2 0 は、本発明の第 3 実施形態に係る液晶装置の製造方法を説明するための図である。また、当該図 2 0 は、液晶装置の各構成要素を対向基板側から見た平面図である。図 2 1 は図 2 0 の符号 C の領域を拡大して示した平面図である。図 2 2 はシール部材の構成を詳述するための平面図である。

【0 1 0 8】

図 2 0 ～図 2 2 に示すように、本実施形態の液晶装置 1 0 0 においては、絶縁性シール部材（第 2 シール部材）5 2 a が紙面上下方向に向けて直線上に形成されている。また、点 O、R において、絶縁性シール部材 5 2 a と導電性シール部材（第 1 シール部材）5 2 b とが接続されている。

更に、絶縁性シール部材 5 2 a 及び導電性シール部材 5 2 b が図 2 2 に示すようなパターンに形成されることによって、液晶層 5 0 を内側で保持する一重の環状部 5 8 と、絶縁性シール部材 5 2 a と導電性シール部材 5 2 b とが接合されている接合部 5 9 と、が構成される。このようなパターンで形成されたシール部材 5 2 は、TFD 基板 1 0 の面内の領域において閉ざされた枠状に形成されたものであり、液晶注入口を備えないものとなって



いる。

#### 【0109】

環状部58においては、絶縁性シール部材52aは図22中の点ROを通過するように形成されており、また、導電性シール部材52bは図22中の点OPQRを通過するように形成されている。

接合部59においては、絶縁性シール部材52aと導電性シール部材52bが点O、Rで接合されている。従って、接合部59は環状部の辺OPの端部に一箇所、及び辺QRの端部に一箇所、各々形成されている。換言すれば、接合部59は、環状部58の対向する辺の各々に形成されている。

また、接合部59は、環状部58に連設して形成されており、点O、Rにおいて環状部58を閉塞させている。これによって、環状部58の内側に保持される液晶層50がシール部材52の外部に漏れるのを防止することが可能となる。また、接合部59の一部分は当該点O、Rにおいて、環状部58と一体となっており、接合部59の他の部分は環状部58の外側に形成されている。また、換言すれば、接合部59は、環状部58を閉塞させている部分（点O、R）から、環状部58の外側に向けて形成されたものとなっている。従って、環状部58に対して接合部59が重なって形成されたものではなく、接合部59の一部のみが環状部58を接合させ、その他の部分が環状部58の外側に向けて形成されたものとなっている。

また、接合部59は、図21に示すように、導通パッド54の端（符号A）から、引き回し配線55がシール部材52を横断する最も端の部分（符号B）までの間、即ち符号Lに示す部分の中に形成される。本実施形態の液晶装置100においては、符号Lの距離が2mm以下に設定されている。

また、接合部59は、後述するように、ディスペンサから絶縁性シール部材52a及び導電性シール部材52bを非接触状態に対向させて描画形成した後に、貼り合わせ工程によって当該シール部材52a、52bを押圧し、互いに接触、接合させて形成されたものである。

#### 【0110】

次に、本実施形態の液晶装置の製造方法について説明する。

図23はシール部材52の形成方法を説明するための平面図である。図24はマザー基板上に形成されたシール部材52を示す平面図であり、図24（a）はマザー基板の外観を示す図、図24（b）は図24（a）における符号Eを拡大した図、図24（c）は図24（b）における符号Fを拡大した図である。

#### 【0111】

図23（a）に示すように、TFD基板用マザー基板10'上に絶縁性シール部材52aを符号Uに示す方向に塗布する（第2シール部材形成工程）。ここで、上記のようにTFD基板用マザー基板10'上には予め複数のTFD形成領域11と相互境界部12が形成されており、これらを跨ぐように絶縁性シール部材52aが連続かつ一括して塗布される。また、符号Uが示す方向とは、複数のTFD形成領域11が配列する方向と同一方向を示している。

ここで、絶縁性シール部材52aが塗布形成されることにより、TFD形成領域11の側方に環状部58の一部となる第1辺58aが形成され、相互境界部12には、第1辺58aに連続して形成される第1シール層59aが形成される。ここで、第1シール層59aは、相互境界部12において第1辺58aと同軸直線上（符号U）に形成されたものとなっている。

#### 【0112】

次に、図23（b）に示すように、TFD基板用マザー基板10'上に導電性シール部材52bを符号Vに示す方向に塗布する（第1シール部材形成工程）。この工程においても、先と同様に複数のTFD形成領域11及び相互境界部12を跨ぐように導電性シール部材52bが連続かつ一括して塗布される。また、符号Vが示す方向とは、複数のTFD形成領域11が配列する方向と同一方向を示している。

ここで、導電性シール部材 5 2 b が塗布形成されることにより、第 1 辺 5 8 a の延在軸（符号 V）に直交する軸方向に向けて、環状部 5 8 の一部となる第 2 辺 5 8 b が形成され、TFD 形成領域 1 1 の側方に第 1 辺 5 8 a と対向する第 3 辺 5 8 c が形成される。また、相互境界部 1 2 には、第 2 辺 5 8 b に連続して形成される第 2 シール層 5 9 b が形成される。ここで、第 2 シール層 5 9 b は、相互境界部 1 2 において第 3 辺 5 8 c の延在軸方向よりも TFD 形成領域 1 1 の側に凹んでいる凹部 X に形成されたものとなっている。当該凹部 X は、所謂「コの字」状となっている。

【0 1 1 3】

そして、第 1 シール層 5 9 a 及び第 2 シール層 5 9 b は、互いに対向するように形成される。従って、第 1 辺 5 8 a と同軸直線上に形成された第 1 シール層 5 9 a と、コの字状に形成された凹部 X は、互いに向き合うこととなる。また、上記のように形成された絶縁性シール部材 5 2 a は環状部 5 8 の一部を構成し、導電性シール部材 5 2 b は、環状部 5 8 の残部を構成するものとなる。更に、第 1 シール層 5 9 a 及び第 2 シール層 5 9 b は、後述する貼り合わせ工程が施されることによって、相互境界部 1 2 に形成される接合部 5 9 となるものである。

【0 1 1 4】

このようなシール部材 5 2 の形成方法によって、図 2 4（a）に示す TFD 基板用マザー基板 1 0' 上に、絶縁性シール部材 5 2 a 及び導電性シール部材 5 2 b が塗布形成された複数の TFD 形成領域 1 1 が形成される。更に、図 2 4（b）に示すように、TFD 形成領域 1 1 の一部が絶縁性シール部材 5 2 a によって形成され、その残部が導電性シール部材 5 2 b によって形成される。これによって当該シール部材 5 2 a、5 2 b からなる上記の環状部 5 8 が形成される。また、図 2 4（c）に示すように、絶縁性シール部材 5 2 a 及び導電性シール部材 5 2 b の各々は、互いに対向する第 1 シール層 5 9 a 及び第 2 シール層 5 9 b を有している。そして、TFD 基板用マザー基板 1 0' と対向基板用マザー基板 2 0' とが貼り合わされることによって、第 1 シール層 5 9 a 及び第 2 シール層 5 9 b が押し潰されて接合し、上記の図 2 2 に示す接合部 5 9 が形成されるようになっている。

【0 1 1 5】

次に、図 2 4（c）を参照して、第 1 シール層 5 9 a 及び第 2 シール層 5 9 b の形状寸法について説明する。以下では、

R 1：曲線部 5 9 c の半径

d 1：第 1 シール層 5 9 a、第 2 シール層 5 9 b が最も近接する領域における中心線間の距離

w 1：貼り合わせ工程の後のシール部材 5 2 a、5 2 b の幅と定義する。すると、

本実施形態においては、

【数 2 3】

$$0 \leq d1 \leq 0.8 \times w1$$

の関係が成立している。また、

【数 2 4】

$$(R1/w1) \leq -2.0 \times (d1/w1) + 3.0$$

の関係が成立している。更には、

【数 2 5】

$$(R1/w1) \leq -1.7 \times (d1/w1) + 2.0$$

【数 2 6】

$$(R1/w1) \geq -1.2 \times (d1/w1) + 1.0$$

の関係が成立している。

【0 1 1 6】

このようにすることにより、後述の実施例で検証するように、シール部材 5 2 a、5 2 b の太さのばらつきが生じていたとしても、第 1 シール層 5 9 a 及び第 2 シール層 5 9 b とを確実に接合して接合部 5 9 を形成することができる。また、シール部材 5 2 a、5 2 b を全ての部分において同一のスピードで描画することが可能であり、また、書き始め部分や、書き終わり部分も液晶装置から十分離れた部分であるため複雑な制御も必要なくなる。これらの効果により描画時間は従来の  $1/2 \sim 1/3$  と大幅な短縮ができ、且つ接合部 5 9 での液晶装置 1 0 0 の内側方向へのシール部材 5 2 a、5 2 b の太りも解消できる。

また、同軸直線上に第 1 シール層 5 9 a と第 1 辺 5 8 a を形成するので、曲線や傾斜線を描きながら第 1 シール層 5 9 a を形成する場合と比較して、描画時間を短縮することができる。

【0 1 1 7】

(第 4 実施形態)

図 2 5 は、本発明の第 4 実施形態に係る液晶装置の製造方法を説明するための図である。また、当該図 2 5 は、シール部材 5 2 の形成方法を説明するための平面図である。また、当該図 2 5 は、図 1 8 は図 1 8 (b) における符号 F を拡大した図である。

【0 1 1 8】

上記の第 3 実施形態においては、第 2 シール層 5 9 b が曲線部 5 9 c を有する構成となっているが、これに対して本実施形態は、第 2 シール層 5 9 b が傾斜部 5 9 d を有する構成となっている。そして、上記に説明したように、TFD 基板用マザー基板 1 0' と対向基板用マザー基板 2 0' とが貼り合わされることによって、第 1 シール層 5 9 a 及び第 2 シール層 5 9 b が押し潰されて接合し、上記の図 2 2 に示す接合部 5 9 が形成されるようになる。

【0 1 1 9】

次に、図 2 5 を参照して、第 1 シール層 5 9 a 及び第 2 シール層 5 9 b の形状寸法について説明する。以下では、

c 1 : 傾斜部 5 9 d の面取り量

d 1 : 第 1 シール層 5 9 a、第 2 シール層 5 9 b が最も近接する領域における中心線間の距離

w 1 : 貼り合わせ工程の後のシール部材 5 2 a、5 2 b の幅と定義する。すると、

本実施形態においては、

【数 2 7】

$$0 \leq d1 \leq 0.8 \times w1$$

の関係が成立している。また、

【数 2 8】

$$(c1/w1) \leq -0.5 \times (d1/w1) + 1.2$$

の関係が成立している。更には、

【数 2 9】

$$(c1/w1) \leq -0.5 \times (d1/w1) + 0.7$$

【数 3 0】

$$(c1/w1) \geq -0.5 \times (d1/w1) + 0.3$$

の関係が成立している。

【0 1 2 0】

このようにすることにより、後述の実施例で検証するように、シール部材 5 2 a、5 2 b の太さのばらつきが生じていたとしても、第 1 シール層 5 9 a 及び第 2 シール層 5 9 b とを確実に接合して接合部 5 9 を形成することができる。また、シール部材 5 2 a、5 2 b を全ての部分において同一のスピードで描画することが可能であり、また、書き始め部分や、書き終わり部分も液晶装置から十分離れた部分であるため複雑な制御も必要なくなる。これらの効果により描画時間は従来の 1 / 2 ~ 1 / 3 と大幅な短縮ができ、且つ接合部 5 9 での液晶装置 1 0 0 の内側方向へのシール部材 5 2 a、5 2 b の太りも解消できる。

【0 1 2 1】

なお、上記の実施形態においては、面取り量 c 1、c 2 によって傾斜部 5 9 d が形成されている。換言すれば、傾斜部 5 9 d は、第 2 シール層 5 9 b の中心線方向に対して 4 5 ° の角度で傾斜して形成されているものである。本発明は、このように 4 5 ° の角度で傾斜部 5 9 d を形成することを限定するものではない。4 5 ° よりも鋭角側又は鈍角側に角度を振って傾斜部 5 9 d を形成してもよい。

【0 1 2 2】

また、上記の実施形態においては、シール部材 5 2 a、5 2 b の太さを同じにしているが、これを異ならせてもよい。例えば、絶縁性シール部材 5 2 a を 0. 5 mm、また、導電性シール部材 5 2 b を 0. 7 mm とし、導電性シール部材 5 2 b を絶縁性シール部材 5 2 a よりも太くしてもよい。

【0 1 2 3】

次に、液晶装置の第 5 ~ 第 9 実施形態について説明する。

以下の説明においては、上記の実施形態と異なる部分について説明し、同一構成には同一符号を付して説明を省略している。なお、第 5 ~ 第 9 実施形態に示す液晶装置は、上記の第 1 ~ 第 4 実施形態のいずれかの製造方法を利用して製造されたものである。

【0 1 2 4】

(第 5 実施形態)

まず、本発明の第 5 実施形態に係る液晶装置について説明する。

図 2 6 は、本実施形態に係る液晶装置の各構成要素を対向基板側から見た平面図である。本実施形態においては、画像表示領域 4 と走査信号駆動回路 1 1 0 との間に導電性シール部材 5 2 b が形成され、接合部 5 9 を介して導電性シール部材 5 2 b の反対側に絶縁性シール部材 5 2 a が形成された構成となっている。即ち、上記の第 1 実施形態と比較すると、絶縁性シール部材 5 2 a と導電性シール部材 5 2 b との位置が反対となった構成となっている。

【0 1 2 5】

また、TFD 基板 1 0 上においては、導通パッド 5 4 は、データ信号駆動回路 1 2 0 の側方に形成され、引き回し配線 5 5 を介してデータ信号駆動回路 1 2 0 と接続されている。一方、対向基板 2 0 においては、COM 電極 5 7 は、画像表示領域 4 の外部に形成されていると共に、導通パッド 5 4 に向けて延在している。そして、導電性シール部材 5 2 b は、COM 電極 5 7 と導通パッド 5 4 とによって挟持されることにより、導電性粒子が COM 電極 5 7 と導通パッド 5 4 とを電氣的に接続させている。ここで、導電性シール部材

5 2 bがSEG電極5 6の配線上に形成されるので、SEG電極5 6の配線の隣接配線とのショートが配慮されたものとなっている。

このように、画像表示領域4と走査信号駆動回路1 1 0との間に導電性シール部材5 2 bが形成された場合においても、上記の実施形態と同様の効果が得られる。

【0 1 2 6】

(第6実施形態)

次に、本発明の第6実施形態に係る液晶装置について説明する。

図2 7は、本実施形態に係る液晶装置の各構成要素を対向基板側から見た平面図である。本実施形態は、第5実施形態と同様に、画像表示領域4と走査信号駆動回路1 1 0との間に導電性シール部材5 2 bが形成され、接合部5 9を介して導電性シール部材5 2 bの反対側に絶縁性シール部材5 2 aが形成された構成となっている。

【0 1 2 7】

また、本実施形態は、第1～第5実施形態とは異なり、対向基板2 0に走査信号駆動回路1 1 0とデータ信号駆動回路1 2 0とが形成されている。従って、走査信号駆動回路1 1 0は、接続パッド5 4を介してSEG電極5 6に接続されたものとなっている。

従って、対向基板2 0においては、導通パッド5 4は、走査信号駆動回路1 1 0の側方に形成され、引き回し配線6 0を介して走査信号駆動回路1 1 0と接続されている。また、データ信号駆動回路1 2 0は、COM電極5 7を介して画素電極9に接続されている。一方、TFD基板1 0においては、SEG電極5 6は、画像表示領域4の外側に形成されていると共に、導通パッド5 4に向けて延在している。そして、導電性シール部材5 2 bは、SEG電極5 6と導通パッド5 4とによって挟持されることにより、導電性粒子がSEG電極5 6と導通パッド5 4とを電氣的に接続させている。ここで、導電性シール部材5 2 bがCOM電極5 7の配線上に形成されるので、COM電極5 7の配線の隣接配線とのショートに配慮されたものとなっている。

このように、画像表示領域4と走査信号駆動回路1 1 0との間に導電性シール部材5 2 bが形成された場合においても、上記の実施形態と同様の効果が得られる。

なお、上記の第1～第6実施形態に示した液晶装置は、TFD素子4 0をスイッチング素子として備えたアクティブマトリクス型であるが、本発明はこれを限定することなく、パッシブ型の液晶装置においても適用できる。

【0 1 2 8】

(第7実施形態)

次に、本発明の第7実施形態に係る液晶装置について説明する。

本実施形態の液晶装置は、スイッチング素子として薄膜トランジスタ(Thin Film Transistor、以下、TFTと略記する)を用いたアクティブマトリクス型の液晶装置である。図2 8は、本実施形態に係る液晶装置の各構成要素を対向基板側から見た平面図である。

【0 1 2 9】

ここで、第1～第6実施形態に示したTFDを備えた液晶装置においては、TFD基板1 0のSEG電極5 6から画素電極3 1に電位が付与され、かつ、対向基板2 0のCOM電極5 7から画素電極9に電位が付与されることによって、画素電極3 1、9の間の液晶層5 0に電圧を印加させている。即ち、TFDは、2端子素子からなるものである。

一方、本実施形態に示すTFTを備えた液晶装置においては、TFT基板に形成されたデータ線及びゲート線から付与される信号によって画素電極に電位を付与し、全面に電極が形成された対向電極との間に生じる電圧を液晶層5 0に印加させている。即ち、TFTは、3端子素子からなるものである。

【0 1 3 0】

図2 8に示すように、液晶装置1 0 1は、TFT基板1 0 2上にデータ引き回し配線8 5、ゲート引き回し配線8 6、絶縁性シール部材5 2 a、導電性シール部材5 2 b、及び打点導通部(第1導通部、導通領域)8 7を備えている。ここで、絶縁性シール部材5 2 aは符号Yに示す部分よりも左側に形成されたものであり、また、導電性シール部材5 2 bは符号Yに示す部分よりも右側に形成されたものである。そして、これらのシール部材

52a、52bによって囲まれた環状部58の内側に液晶層50が保持され、画像表示領域4が形成されている。また、符号Yの線上に接合部59が形成されている。更に、導電性シール部材52bは、打点導通部87上を延在している。即ち、TFT基板102と対向基板とが貼り合わされることによって、TFT基板102は打点導通部87を介して対向基板と電氣的に接続される。

このように、TFTを用いた液晶装置101においては、打点導通部87上に導電性シール部材52bを形成することにより、従来まで用いられていた上下基板の導通用の打点シールを不要にすることができる。

#### 【0131】

(第7実施形態の変形例)

図29は、上記の第7実施形態の変形例を示す図であって、液晶装置の各構成要素を対向基板側から見た平面図である。

本変形例においては、図29に示すように画像表示領域4の一方の側部のみゲート引き回し配線86が形成されている。

このような構成においても、上記の第7実施形態と同様の効果が得られる。

#### 【0132】

(第8実施形態)

次に、本発明の第8実施形態に係る液晶装置について説明する。

図30は、本実施形態に係る液晶装置の各構成要素を対向基板側から見た平面図である。また、本実施形態の液晶装置は、上記の第7実施形態と同様にTFTを備えるものである。

図30に示すように液晶装置101は、環状部58において、絶縁性シール部材52aと導電性シール部材52bの長さが等しくなっている。また、他の構成は、上記の第7実施形態と同様となっている。具体的には、接合部59は環状部58の一辺の略中央部に配置しており、符号Zに示す部分より右側に導電性シール部材52bが形成され、その左側に絶縁性シール部材52aが形成されている。これによって、絶縁性シール部材52aと導電性シール部材52bとの長さが等しくなっている。

#### 【0133】

このような構成においては、シール部材52a、52bの各々を別のディスペンサで描画する際、装置のタクトタイムを揃えることができ、効率的に液晶装置101を生産することができる。また、TFT基板102と対向基板とは、打点導通部87上に形成された導電性シール部材52bによって電氣的に接続される。

#### 【0134】

なお、上記の第5～第8実施形態は、第1及び第2実施形態に示した製造方法を用いて、製造された液晶装置である。具体的には、環状部58の第1辺58aが延在する軸とは異なる中心線上に第1シール層59aを形成し、当該第1シール層59aに対向するように第2シール層59bを形成したものである。上記の第5～第8実施形態は、このような製造方法によって形成された液晶装置を限定するものではなく、第3及び第4実施形態に示した製造方法を用いて、製造された液晶装置であってもよい。具体的には、環状部58の第1辺58aと第1シール層59aとを同一の直線上に形成し、当該第1シール層59aに対向するように第2シール層59bを形成してもよい。

#### 【0135】

(第9実施形態)

次に、本発明の第9実施形態に係る液晶装置について説明する。

図31は、本実施形態に係る液晶装置の各構成要素を対向基板側から見た平面図である。また、本実施形態の液晶装置は、上記の第7実施形態と同様にTFTを備えるものであり、更に、大型テレビ等の大型ディスプレイに用いることが可能となるものである。

図31に示すように、液晶装置103は、一のシール部材52を備えている。具体的には、第1～第8実施形態においては、導電性シール部材と絶縁性シール部材の両者によってシール部材52が形成されていたが、本実施形態においては全て絶縁性シール部材によ

って形成されたものとなっている。

#### 【0136】

また、液晶層103においては、環状部58はその内側に液晶層50を有し、接合部59は一箇所において環状部58を閉塞させている。これら環状部58及び接合部59は、連続かつ一括に形成されたものであり、所謂「一筆書き」でシール部材52を塗布することによって形成されたものである。また、換言すれば、シール部材52は、一の部材の一端から他端に向けて形成したものであり、当該一端と他端とを接合して接合部59を形成している。更に、一の部材によって囲まれた環状部58の内側に液晶層50を保持している。ここで、接合部59は、環状部58の外側に向けて形成されており、環状部58の経路上において重ね合って形成されたものではない。

また、打点導通部87には、シール部材52とは異なる部材である導通性部材が形成されており、当該打点導通部87においてTF基板102と対向基板との導通が得られている。

このようにすれば、シール部材52の一端と他端とを1箇所で接合させた接合部59によって環状部58が閉塞するので、接合部59を最小数にすることができ、接合部59が複数設けられた場合と比較して、セルギャップ不良がより確実に抑制された液晶装置を実現できる。更に、接合部59は環状部58の外側に向けて形成されているので、貼り合わせ工程を施した際に環状部58の外側において接合部59の幅が広がるだけで済み、環状部58の内部にシール部材52a、52bが突出するのを抑制できる。また、環状部58の内部のセルギャップに影響を与えることがなく、当該セルギャップを均一に保持できる。

#### 【実施例】

##### 【0137】

次に、本発明の実施例について説明する。

本実施例においては、次の<1>～<4>に示した、第1及び第2シール層59a、59bの形状について、パネル（液晶装置）の信頼性、貼り合わせ工程によって形成された接合部59の形状、くぼみ深さとシール部材の幅の比、及びパネルの状態、を検証した結果を示している。

<1> 凹部W、Xにおいて、第1及び第2シール層59a、59bが曲線部59cを有する場合（図18（c）、上記の第1実施形態）

<2> 凹部W、Xにおいて、第1及び第2シール層59a、59bが傾斜部59dを有する場合（図19、上記の第2実施形態）

<3> 環状部58の第1辺58aと第1シール層59aが直線、第2シール層59bが曲線部59cを有する場合（図24（c）、上記の第3実施形態）

<4> 環状部58の第1辺58aと第1シール層59aが直線、第2シール層59bが傾斜部59dを有する場合（図25、上記の第4実施形態）

##### 【0138】

<1> 凹部W、Xにおいて、第1及び第2シール層59a、59bが曲線部59cを有する場合（図18（c）、上記の第1実施形態）

表1は、第1実施形態における第1シール層及び第2シール層59a、59bの形状について、パネルの信頼性を調査した結果を示している。

##### 【0139】

【表 1】

| w2    | R2     | d2    | h2     | h2/w2 | 信頼性 | △  | ×  |
|-------|--------|-------|--------|-------|-----|----|----|
| 0.5mm | 0.4mm  | 0.2mm | 0.23mm | 0.47  | ○   | 0% | 0% |
| 0.5mm | 0.5mm  | 0.2mm | 0.30mm | 0.60  | △   | 1% | 0% |
| 0.5mm | 0.75mm | 0.2mm | 0.47mm | 0.95  | △   | 6% | 0% |
| 0.5mm | 0.8mm  | 0.2mm | 0.51mm | 1.02  | ×   | 8% | 2% |
| 0.7mm | 0.3mm  | 0.5mm | 0.30mm | 0.43  | ○   | 0% | 0% |
| 0.7mm | 0.45mm | 0.5mm | 0.41mm | 0.59  | △   | 1% | 0% |
| 0.7mm | 0.75mm | 0.5mm | 0.64mm | 0.92  | △   | 4% | 0% |
| 0.7mm | 0.9mm  | 0.5mm | 0.76mm | 1.09  | ×   | 6% | 1% |

## 【0140】

表1において、w2は貼り合わせ後のシール部材の幅、R2は曲線部59cの半径、d2はシール部材の中心線距離、h2は環状部58の内側から接合部59の凹み部分までのくぼみの深さ（図32）を示している。従って、換言すれば、R2及びd2は、シール部材を描画する際のパターン形状となるパラメータであり、w2及びh2は貼り合わせ工程を施したことによって得られる値である。また、表1は、60℃90%RHの雰囲気下、1000時間放置において得られた評価結果である。また、表1の「信頼性」の欄において、「○」は全く変化が無く良好であることを意味し、「△」は若干の閾値変動が認められるが許容範囲内であることを示し、「×」は不良レベルのムラの発生が認められたことを意味する。

## 【0141】

表1の結果から、シール部材の幅w2、曲線部59cの半径R2、シール部材の中心間距離d2の値に依らず、くぼみの深さh2とシール部材の幅w2との比（h2/w2）が信頼性に影響することが確認された。そして、h2/w2が1.0以下では不良が発生しないことになり、0.5以下になるとムラが全く認められないことが確認された。

## 【0142】

表2は、第1実施形態における第1シール層及び第2シール層59a、59bの形状について、貼り合わせ工程によって形成された接合部59の形状を調査した結果を示している。

## 【0143】

【表2】

| w2    | R2     | d2     | h2     | h2/w2 | 接合部凸 | △  | ×  |
|-------|--------|--------|--------|-------|------|----|----|
| 0.5mm | 0mm    | 0mm    | 0.00mm | 0.00  | △    | 4% | 0% |
| 0.5mm | 0.2mm  | 0mm    | 0.05mm | 0.09  | △    | 1% | 0% |
| 0.5mm | 0.05mm | 0.25mm | 0.06mm | 0.11  | ○    | 0% | 0% |
| 0.7mm | 0mm    | 0.1mm  | 0.01mm | 0.01  | △    | 0% | 0% |
| 0.7mm | 0.3mm  | 0mm    | 0.07mm | 0.10  | ○    | 0% | 0% |
| 0.7mm | 0.15mm | 0.2mm  | 0.07mm | 0.10  | ○    | 0% | 0% |
| 0.7mm | 0mm    | 0.4mm  | 0.06mm | 0.09  | △    | 1% | 0% |

## 【0144】

表2において、w2は貼り合わせ後のシール部材の幅、R2は曲線部59cの半径、d2はシール部材の中心線距離、h2は接合部59のくぼみの深さ（図32）を示している。また、表2の「接合部凸」の欄において、「○」は凸部が形成されず良好な形状であることを意味し、「△」は凸部が形成されるものの、不良にはならないレベルであることを意味し、「×」は凸部の盛り上がり量がシール部材の太さの2割を超えた不良レベルであることを意味する。なお、一般的にシール部材の太さはディスペンサで塗布形成した場合では、約10%ばらつくことが知られている。その結果、h2/w2の平均が0.09の様に、平均的には接合部59が凹形状となる場合でも、1%程度ではあるが接合部59が



凹部状にならずに盛り上がってしまうものがある（図33）。盛り上がりの大きさは $w_2 = 0.5\text{ mm}$ 、 $R_2 = 0\text{ mm}$ 、 $d_2 = 0\text{ mm}$ のとき最も大きくなるが、シール部材の幅に対し2割以下の為、実用上問題となるレベルではない。しかし、シール太さのばらつきも含め接合部59の膨らみを完全に無くするためには、 $h_2/w_2$ は0.1以下であることが好ましいことが確認された。

【0145】

表3は、第1実施形態における第1シール層及び第2シール層59a、59bの形状について、貼り合わせ後のシール部材の幅 $w_2$ を0.5mmに固定し、曲線部59cの半径 $R_2$ とシール部材の中心線距離 $d_2$ を変化させたときの、くぼみの深さ $h_2$ 、シール部材の幅 $w_2$ の比 $h_2/w_2$ 、及びパネル状態、を調査した結果を示している。

【0146】

【表3】

| d2(d2/w2)<br>R2 (R2/w2) | ※2        |               |               |               | ※3            |               |               |             |
|-------------------------|-----------|---------------|---------------|---------------|---------------|---------------|---------------|-------------|
|                         | 0 mm<br>0 | 0.10mm<br>0.2 | 0.20mm<br>0.4 | 0.25mm<br>0.5 | 0.30mm<br>0.6 | 0.40mm<br>0.8 | 0.45mm<br>0.9 | 0.50mm<br>1 |
| 0.00mm (0.0)            | 0.00      | 0.01          | 0.04          | 0.07          | 0.10          | 0.20          | 0.28          | 0.50        |
| 0.05mm (0.1)            | 0.01      | 0.03          | 0.08          | 0.11          | 0.15          | 0.27          | 0.36          | 0.60        |
| 0.10mm (0.2)            | 0.03      | 0.07          | 0.13          | 0.16          | 0.21          | 0.34          | 0.44          | 0.70        |
| 0.20mm (0.4)            | 0.09      | 0.15          | 0.23          | 0.28          | 0.33          | 0.49          | 0.60          | 0.90        |
| 0.25mm (0.5)            | 0.13      | 0.20          | 0.29          | 0.34          | 0.40          | 0.56          | 0.69          |             |
| 0.30mm (0.6)            | 0.18      | 0.25          | 0.35          | 0.40          | 0.47          | 0.64          | 0.77          |             |
| 0.40mm (0.8)            | 0.28      | 0.36          | 0.47          | 0.53          | 0.61          | 0.80          | 0.94          |             |
| 0.50mm (1.0)            | 0.38      | 0.48          | 0.60          | 0.67          | 0.75          | 0.96          | 1.12          |             |
| 0.60mm (1.2)            | 0.50      | 0.60          | 0.74          | 0.81          | 0.90          | 1.13          | 1.29          |             |
| 0.70mm (1.4)            | 0.62      | 0.73          | 0.88          | 0.96          | 1.05          |               |               |             |
| 0.75mm (1.5)            | 0.68      | 0.80          | 0.95          | 1.03          | 1.13          |               |               |             |
| 0.80mm (1.6)            | 0.74      | 0.87          | 1.02          | 1.11          |               |               |               |             |
| 0.90mm (1.8)            | 0.87      | 1.00          | 1.16          |               |               |               |               |             |
| 1.00mm (2.0)            | 1.00      | 1.14          |               |               |               |               |               |             |
| 1.10mm (2.2)            | 1.13      |               |               |               |               |               |               |             |

※1

【0147】

表3において、※1の部分は接合部59のくぼみ深さ $h_2$ とシール部材の幅 $w_2$ との比（ $h_2/w_2$ ）が1.0以下であり、パネルの信頼性を確保できる範囲である。また、※2の部分は、接合部59において実用上問題となるレベルではないが、シール部材が凹にならず、若干の盛り上がりが生じてしまう範囲である。また、※3の部分は、 $h_2/w_2$ が0.1より大きく、0.5以下となり、理想的な範囲である。 $d_2/w_2$ が0.9を超える部分では、シール部材の太さのばらつき等によりシール部材が接触せず（図34）、液晶の漏れ等が発生することがあった。

【0148】

また、表3において、信頼性を確保できる境界、及び接合部で凸が発生する境界の $d_2/w_2$ 、 $R_2/w_2$ をプロットすると、図35のようになり、略直線に乗る。ここで、境界となる $h_2/w_2$ が0.1、0.5、及び1.0となるときの $R_2/w_2$ の値は補間により求めた。

【0149】

次に、表4は、第1実施形態における第1シール層及び第2シール層59a、59bの形状について、貼り合わせ後のシール部材の幅 $w_2$ を0.7mmに固定し、曲線部59cの半径 $R_2$ と、シール部材の中心線距離 $d_2$ を変化させたときの、くぼみの深さ $h_2$ 、シール部材の幅 $w_2$ の比 $h_2/w_2$ 、及びパネル状態、を調査した結果を示している。

【0150】

【表4】

|                 | ※2   |         | ※3      |         |         |         |         |        |
|-----------------|------|---------|---------|---------|---------|---------|---------|--------|
| d2(d2/w2)       | 0 mm | 0.10mm  | 0.20mm  | 0.30mm  | 0.40mm  | 0.50mm  | 0.60mm  | 0.70mm |
| R2 (R2/w2)      | 0    | 0.14286 | 0.28571 | 0.42857 | 0.57143 | 0.71429 | 0.85714 | 1      |
| 0.00mm ( 0.00 ) | 0.00 | 0.01    | 0.02    | 0.05    | 0.09    | 0.15    | 0.24    | 0.50   |
| 0.15mm ( 0.21 ) | 0.03 | 0.06    | 0.10    | 0.14    | 0.20    | 0.29    | 0.40    | 0.71   |
| 0.30mm ( 0.43 ) | 0.10 | 0.15    | 0.20    | 0.26    | 0.34    | 0.43    | 0.57    | 0.93   |
| 0.45mm ( 0.64 ) | 0.20 | 0.25    | 0.31    | 0.39    | 0.48    | 0.59    | 0.75    |        |
| 0.60mm ( 0.86 ) | 0.30 | 0.37    | 0.44    | 0.52    | 0.63    | 0.75    | 0.92    |        |
| 0.75mm ( 1.07 ) | 0.42 | 0.49    | 0.57    | 0.67    | 0.78    | 0.92    | 1.10    |        |
| 0.90mm ( 1.29 ) | 0.55 | 0.63    | 0.71    | 0.82    | 0.94    | 1.09    | 1.29    |        |
| 1.05mm ( 1.50 ) | 0.68 | 0.76    | 0.86    | 0.97    | 1.10    |         |         |        |
| 1.20mm ( 1.71 ) | 0.81 | 0.90    | 1.01    | 1.13    |         |         |         |        |
| 1.35mm ( 1.93 ) | 0.95 | 1.05    | 1.16    |         |         |         |         |        |
| 1.50mm ( 2.14 ) | 1.10 | 1.20    |         |         |         |         |         |        |

※1

【0151】

表4において、※1の部分は接合部59のくぼみ深さh2とシール部材の幅w2との比(h2/w2)が1.0以下であり、パネルの信頼性を確保できる範囲である。また、※2の部分は、接合部59において実用上問題となるレベルではないが、シール部材が凹にならず、若干の盛り上がりが生じてしまう範囲である。また、※3の部分は、h2/w2がh2/w2が0.1より大きく、0.5以下となり、理想的な範囲である。d2/w2が0.85を超える部分では、シール部材の太さのばらつき等によりシール部材が接触せず(図34)、液晶の漏れ等が発生することがあった。

【0152】

また、表4において、信頼性を確保できる境界、及び接合部で凸が発生する境界のd2/w2、R2/w2をプロットすると、図36のようになり、略直線に乗る。

ここで、シール部材の幅w2が0.5mmの場合と、0.7mmの場合において、信頼性を確保できる境界と、接合部で凸が発生する境界について、d2/w2、R2/w2の境界(図35、図36)を同一グラフ上にプロットすると、図37のようになる。

図37に示すように、貼り合わせ後のシール部材の幅w2が0.5mmの場合でも、0.7mmの場合でも、同一線に乗ることから当該w2がそれ以外の幅であっても、図37の線上に乗る。

【0153】

図37より、d2/w2、R2/w2の関係をプロットするとシール部材の幅によらず同一直線上に乗ることが分かる。

これより、シール部材の太さによらずに信頼性を確保するためには、

【数31】

$$(R2/w2) \leq -1.2 \times (d2/w2) + 2.0$$

となり、理想的には、

【数32】

$$(R2/w2) \leq -(d2/w2) + 1.2$$

を満たす必要があることになる。

【0154】

また、接合部におけるシール部材の凸（太り）は、シール部材の幅に対して2割以下のため実用上問題となるレベルではない。しかし、シール部材の太さのばらつきを含めて接合部の膨らみを完全に無くするためには、

【数33】

$$(R2/w2) \geq -0.6 \times (d2/w2) + 0.4$$

とすることが理想となる。

更に、接合部でのシール部材の太さのばらつき等により、シール部材が接触せず、液晶の漏れ等を防止するためには、

【数34】

$$d2/w2 \leq 0.8$$

を満たすのが理想となる。

【0155】

このように第1シール層及び第2シール層59a、59bの形状を規定することにより、上記の実施形態と同様の効果が得られる。一方、従来の方法では、接合部においてシール部材の太りが発生したり、太りを最小限に抑制するために重ね部分の距離を長くしたりする必要があり、また、装置の制御も複雑になってシール部材の描画時間が長くなるという課題があった。これに対し、本実施例の方法では全ての部分において同一のスピードでシール部材の描画が可能であり、また、書き始め部分や、書き終わり部分もパネルから十分離れた部分であるため複雑な制御も必要なくなる。これら効果により描画時間は従来の1/2～1/3と大幅な短縮ができ、且つシール部材の接合部でのパネル内側方向へのシール部材の太りも解消できた。

【0156】

<2> 凹部W、Xにおいて、第1及び第2シール層59a、59bが傾斜部59dを有する場合（図19、上記の第2実施形態）

表5は、第2実施形態における第1シール層及び第2シール層59a、59bの形状について、貼り合わせ後のシール部材の幅w2を0.5mmに固定し、傾斜部59dの面取り量c2とシール部材の中心線距離d2を変化させたときの、くぼみの深さh2、シール部材の幅w2の比h2/w2、及びパネル状態、を調査した結果を示している。

【0157】

【表5】

| d2(d2/w2)     | ※2 ※3 |        |        |        |        |        |        |
|---------------|-------|--------|--------|--------|--------|--------|--------|
|               | 0 mm  | 0.10mm | 0.20mm | 0.30mm | 0.40mm | 0.45mm | 0.50mm |
| c2 (c2/w2)    | 0     | 0.2    | 0.4    | 0.6    | 0.8    | 0.9    | 1      |
| 0.00mm (0.00) | 0.00  | 0.01   | 0.04   | 0.10   | 0.20   | 0.28   | 0.50   |
| 0.10mm (0.20) | 0.04  | 0.10   | 0.19   | 0.29   | 0.40   | 0.48   | 0.70   |
| 0.20mm (0.40) | 0.19  | 0.29   | 0.39   | 0.49   | 0.60   | 0.68   | 0.90   |
| 0.30mm (0.60) | 0.39  | 0.49   | 0.59   | 0.69   | 0.80   | 0.88   |        |
| 0.40mm (0.80) | 0.59  | 0.69   | 0.79   | 0.89   | 1.00   | 1.08   |        |
| 0.50mm (1.00) | 0.79  | 0.89   | 0.99   | 1.09   | 1.20   | 1.28   |        |
| 0.60mm (1.20) | 0.99  | 1.09   | 1.19   |        |        |        |        |
| 0.70mm (1.40) | 1.19  |        |        |        |        |        |        |

※1

【0158】

表5において、※1の部分は接合部59のくぼみ深さ $h_2$ とシール部材の幅 $w_2$ との比( $h_2/w_2$ )が1.0以下であり、パネルの信頼性を確保できる範囲である。また、※2の部分は、接合部59において実用上問題となるレベルではないが、シール部材が凹にならず、若干の盛り上がりが生じてしまう範囲である。また、※3の部分は、 $h_2/w_2$ が0.1より大きく、0.5以下となり、理想的な範囲である。 $d_2/w_2$ が0.9を超える部分では、シール部材の太さのばらつき等によりシール部材が接触せず(図34)、液晶の漏れ等が発生することがあった。

【0159】

また、表5において、信頼性を確保できる境界、及び接合部で凸が発生する境界の $d_2/w_2$ 、 $c_2/w_2$ をプロットすると、図38のようになり、略直線に乗る。ここで、境界となる $h_2/w_2$ が0.5、及び1.0となるときの $c_2/w_2$ の値は補間により求めた。

【0160】

次に、表6は、第2実施形態における第1シール層及び第2シール層59a、59bの形状について、貼り合わせ後のシール部材の幅 $w_2$ を0.7mmに固定し、傾斜部59dの面取り量 $c_2$ と、シール部材の中心線距離 $d_2$ を変化させたときの、くぼみの深さ $h_2$ の変化と、パネル状態を調査した結果を示している。

【0161】

【表6】

|                | ※2 ※3 |         |         |         |         |         |         |        |
|----------------|-------|---------|---------|---------|---------|---------|---------|--------|
| $d_2(d_2/w_2)$ | 0 mm  | 0.10mm  | 0.20mm  | 0.30mm  | 0.40mm  | 0.50mm  | 0.60mm  | 0.70mm |
| $c_2(c_2/w_2)$ | 0     | 0.14286 | 0.28571 | 0.42857 | 0.57143 | 0.71429 | 0.85714 | 1      |
| 0.00mm (0.00)  | 0.00  | 0.01    | 0.02    | 0.05    | 0.09    | 0.15    | 0.24    | 0.50   |
| 0.10mm (0.14)  | 0.02  | 0.05    | 0.09    | 0.15    | 0.22    | 0.29    | 0.39    | 0.64   |
| 0.20mm (0.29)  | 0.09  | 0.15    | 0.22    | 0.29    | 0.36    | 0.44    | 0.53    | 0.79   |
| 0.30mm (0.43)  | 0.22  | 0.29    | 0.36    | 0.44    | 0.51    | 0.58    | 0.67    |        |
| 0.40mm (0.57)  | 0.36  | 0.44    | 0.51    | 0.58    | 0.65    | 0.72    | 0.81    |        |
| 0.50mm (0.71)  | 0.51  | 0.58    | 0.65    | 0.72    | 0.79    | 0.86    | 0.96    |        |
| 0.60mm (0.86)  | 0.65  | 0.72    | 0.79    | 0.86    | 0.94    | 1.01    | 1.10    |        |
| 0.70mm (1.00)  | 0.79  | 0.86    | 0.94    | 1.01    | 1.08    | 1.15    |         |        |
| 0.80mm (1.14)  | 0.94  | 1.01    | 1.08    | 1.15    |         |         |         |        |
| 0.90mm (1.29)  | 1.08  | 1.15    |         |         |         |         |         |        |
| 1.00mm (1.43)  | 1.22  |         |         |         |         |         |         |        |

※1

【0162】

表6において、※1の部分は接合部59のくぼみ深さ $h_2$ とシール部材の幅 $w_2$ との比( $h_2/w_2$ )が1.0以下であり、パネルの信頼性を確保できる範囲である。また、※2の部分は、接合部59において実用上問題となるレベルではないが、シール部材が凹にならず、若干の盛り上がりが生じてしまう範囲である。また、※3の部分は、 $h_2/w_2$ が $h_2/w_2$ が0.1より大きく、0.5以下となり、理想的な範囲である。 $d_2/w_2$ が0.85を超える部分では、シール部材の太さのばらつき等によりシール部材が接触せず(図34)、液晶の漏れ等が発生することがあった。

【0163】

また、表6において、信頼性を確保できる境界、及び接合部で凸が発生する境界の $d_2/w_2$ 、 $c_2/w_2$ をプロットすると、図39のようになり、略直線に乗る。ここで、境界となる $h_2/w_2$ が0.1、0.5、及び1.0となるときの $c_2/w_2$ の値は補間により求めた。

ここで、シール部材の幅 $w_2$ が0.5mmの場合と、0.7mmの場合において、信頼性を確保できる境界の $d_2/w_2$ 、 $c_2/w_2$ の境界(図38、図39)を同一グラフ上

にプロットすると、図40のようになる。

図40に示すように、貼り合わせ後のシール部材の幅 $w_2$ が0.5mmの場合でも、0.7mmの場合でも、同一線に乗ることから当該 $w_2$ がそれ以外の幅であっても、図40の線上に乗る。

【0164】

図40より、 $d_2/w_2$ 、 $c_2/w_2$ の関係をプロットするとシール部材の幅によらず同一直線上に乗ることが分かる。

これより、シール部材の太さによらずに信頼性を確保するためには、

【数35】

$$(c_2/w_2) \leq -0.5 \times (d_2/w_2) + 1.2$$

となり、理想的には、

【数36】

$$(c_2/w_2) \leq -0.5 \times (d_2/w_2) + 0.7$$

を満たす必要があることになる。

【0165】

また、接合部におけるシール部材の凸（太り）は、シール部材の幅に対して2割以下のため実用上問題となるレベルではない。しかし、シール部材の太さのばらつきを含めて接合部の膨らみを完全に無くすためには、

【数37】

$$(c_2/w_2) \geq -0.5 \times (d_2/w_2) + 0.3$$

とすることが理想となる。

更に、接合部でのシール部材の太さのばらつき等により、シール部材が接触せず、液晶の漏れ等を防止するためには、

【数38】

$$d_2/w_2 \leq 0.8$$

を満たすのが理想となる。

【0166】

このように、第1シール層及び第2シール層59a、59bの形状を規定することにより、上記の実施形態と同様の効果が得られる。即ち、全ての部分において同一のスピードでシール部材の描画が可能であり、また、書き始め部分や、書き終わり部分もパネルから十分離れた部分であるため複雑な制御も必要なくなる。これら効果により描画時間は従来の $1/2 \sim 1/3$ と大幅な短縮ができ、且つシール部材の接合部でのパネル内側方向へのシール部材の太りも解消できた。

【0167】

<3> 環状部58の第1辺58aと第1シール層59aが直線、第2シール層59bが曲線部59cを有する場合（図24（c）、上記の第3実施形態）

表7は、第3実施形態における第1シール層及び第2シール層59a、59bの形状について、貼り合わせ後のシール部材の幅 $w_1$ を0.5mmに固定し、曲線部59cの半径 $R_1$ とシール部材の中心線距離 $d_1$ を変化させたときの、くぼみの深さ $h_1$ 、シール部材の幅 $w_1$ の比 $h_1/w_1$ 、及びパネル状態、を調査した結果を示している。

【0168】

【表 7】

|                |           | ※2   |        |        |        |        | ※3     |        |
|----------------|-----------|------|--------|--------|--------|--------|--------|--------|
| R1 (R1/w1)     | d1(d1/w1) | 0 mm | 0.05mm | 0.10mm | 0.20mm | 0.30mm | 0.40mm | 0.50mm |
|                |           | 0    | 0.1    | 0.2    | 0.4    | 0.6    | 0.8    | 1      |
| 0.00mm ( 0.0 ) |           | 0.00 | 0.00   | 0.00   | 0.00   | 0.01   | 0.10   | 0.50   |
| 0.20mm ( 0.4 ) |           | 0.00 | 0.00   | 0.01   | 0.05   | 0.15   | 0.33   | 0.90   |
| 0.40mm ( 0.8 ) |           | 0.04 | 0.06   | 0.10   | 0.20   | 0.36   | 0.61   | 1.30   |
| 0.60mm ( 1.2 ) |           | 0.15 | 0.20   | 0.26   | 0.40   | 0.60   | 0.90   |        |
| 0.80mm ( 1.6 ) |           | 0.31 | 0.38   | 0.45   | 0.63   | 0.87   | 1.21   |        |
| 1.00mm ( 2.0 ) |           | 0.50 | 0.58   | 0.67   | 0.88   | 1.14   |        |        |
| 1.20mm ( 2.4 ) |           | 0.71 | 0.80   | 0.90   | 1.13   |        |        |        |
| 1.40mm ( 2.8 ) |           | 0.93 | 1.04   | 1.15   |        |        |        |        |

【0 1 6 9】

表 7 において、※ 1 の部分は接合部 5 9 のくぼみ深さ  $h_1$  とシール部材の幅  $w_1$  との比 ( $h_1 / w_1$ ) が 1. 0 以下であり、パネルの信頼性を確保できる範囲である。また、※ 2 の部分は、接合部 5 9 において実用上問題となるレベルではないが、シール部材が凹にならず、若干の盛り上がりが生じてしまう範囲である。また、※ 3 の部分は、 $h_1 / w_1$  が 0. 1 より大きく、0. 5 以下となり、理想的な範囲である。 $d_1 / w_1$  が 0. 9 を超える部分では、シール部材の太さのばらつき等によりシール部材が接触せず (図 3 4)、液晶の漏れ等が発生することがあった。

また、表 7 において、信頼性を確保できる境界、及び接合部で凸が発生する境界の  $d_1 / w_1$ 、 $R_1 / w_1$  をプロットすると、図 4 1 のようになり、略直線に乗る。

【0 1 7 0】

次に、表 8 は、第 3 実施形態における第 1 シール層及び第 2 シール層 5 9 a、5 9 b の形状について、貼り合わせ後のシール部材の幅  $w_1$  を 0. 7 mm に固定し、曲線部 5 9 c の半径  $R_1$  と、シール部材の中心線距離  $d_1$  を変化させたときの、くぼみの深さ  $h_1$  の変化と、パネル状態を調査した結果を示している。

【0 1 7 1】

【表 8】

|                 |           | ※2   |         |         |         |         | ※3     |  |
|-----------------|-----------|------|---------|---------|---------|---------|--------|--|
| R1 (R1/w1)      | d1(d1/w1) | 0 mm | 0.20mm  | 0.40mm  | 0.50mm  | 0.60mm  | 0.70mm |  |
|                 |           | 0    | 0.28571 | 0.57143 | 0.71429 | 0.85714 | 1      |  |
| 0.00mm ( 0.00 ) |           | 0.00 | 0.00    | 0.01    | 0.05    | 0.15    | 0.50   |  |
| 0.20mm ( 0.29 ) |           | 0.00 | 0.00    | 0.09    | 0.18    | 0.33    | 0.79   |  |
| 0.40mm ( 0.57 ) |           | 0.00 | 0.06    | 0.21    | 0.34    | 0.54    | 1.07   |  |
| 0.60mm ( 0.86 ) |           | 0.05 | 0.16    | 0.37    | 0.52    | 0.75    |        |  |
| 0.80mm ( 1.14 ) |           | 0.13 | 0.29    | 0.54    | 0.72    | 0.97    |        |  |
| 1.00mm ( 1.43 ) |           | 0.24 | 0.43    | 0.72    | 0.92    | 1.20    |        |  |
| 1.20mm ( 1.71 ) |           | 0.36 | 0.59    | 0.90    | 1.13    |         |        |  |
| 1.40mm ( 2.00 ) |           | 0.50 | 0.75    | 1.10    |         |         |        |  |

【0 1 7 2】

表 8 において、※ 1 の部分は接合部 5 9 のくぼみ深さ  $h_1$  とシール部材の幅  $w_1$  との比 ( $h_1 / w_1$ ) が 1. 0 以下であり、パネルの信頼性を確保できる範囲である。また、※ 2 の部分は、接合部 5 9 において実用上問題となるレベルではないが、シール部材が凹に

ならず、若干の盛り上がりが生じてしまう範囲である。また、※3の部分は、 $h1/w1$ が $h1/w1$ が0.1より大きく、0.5以下となり、理想的な範囲である。 $d1/w1$ が0.85を超える部分では、シール部材の太さのばらつき等によりシール部材が接触せず（図34）、液晶の漏れ等が発生することがあった。

【0173】

また、表8において、信頼性を確保できる境界、及び接合部で凸が発生する境界の $d1/w1$ 、 $R1/w1$ をプロットすると、図42のようになり、略直線に乗る。

ここで、シール部材の幅 $w1$ が0.5mmの場合と、0.7mmの場合において、信頼性を確保できる境界及び接合部で凸が発生する境界の $d1/w1$ 、 $R1/w1$ の境界（図41、図42）を同一グラフ上にプロットすると、図43のようになる。

図43に示すように、貼り合わせ後のシール部材の幅 $w1$ が0.5mmの場合でも、0.7mmの場合でも、同一線に乗ることから当該 $w1$ がそれ以外の幅であっても、図43の線上に乗る。

【0174】

図43より、 $d1/w1$ 、 $R1/w1$ の関係をプロットするとシール部材の幅によらず同一直線上に乗ることが分かる。

これより、シール部材の太さによらずに信頼性を確保するためには、

【数39】

$$(R1/w1) \leq -2.0 \times (d1/w1) + 3.0$$

となり、理想的には、

【数40】

$$(R1/w1) \leq -1.7 \times (d1/w1) + 2.0$$

を満たす必要があることになる。

【0175】

また、接合部におけるシール部材の凸（太り）は、シール部材の幅に対して2割以下のため実用上問題となるレベルではない。しかし、シール部材の太さのばらつきを含めて接合部の膨らみを完全に無くするためには、

【数41】

$$(R1/w1) \geq -1.2 \times (d1/w1) + 1.0$$

とすることが理想となる。

更に、接合部でのシール部材の太さのばらつき等により、シール部材が接触せず、液晶の漏れ等を防止するためには、

【数42】

$$d1/w1 \leq 0.8$$

を満たすのが理想となる。

【0176】

このように、第1シール層及び第2シール層59a、59bの形状を規定することにより、上記の実施形態と同様の効果が得られる。即ち、全ての部分において同一のスピードでシール部材の描画が可能であり、また、書き始め部分や、書き終わり部分もパネルから十分離れた部分であるため複雑な制御も必要なくなる。これら効果により描画時間は従来の $1/2 \sim 1/3$ と大幅な短縮ができ、且つシール部材の接合部でのパネル内側方向へのシール部材の太りも解消できた。

【0177】

＜4＞ 環状部58の第1辺58aと第1シール層59aが直線、第2シール層59bが傾斜部59dを有する場合（図25、上記の第4実施形態）

表9は、第4実施形態における第1シール層及び第2シール層59a、59bの形状について、貼り合わせ後のシール部材の幅w1を0.5mmに固定し、傾斜部59dの面取り量c1とシール部材の中心線距離d1を変化させたときの、くぼみの深さh1、シール部材の幅w1の比h1/w1、及びパネル状態、を調査した結果を示している。

【0178】

【表9】

| d1(d1/w1)<br>c1(c1/w1) | 0 mm | 0.10mm | 0.20mm | 0.30mm | ※2<br>0.40mm | ※3<br>0.50mm |
|------------------------|------|--------|--------|--------|--------------|--------------|
|                        | 0    | 0.2    | 0.4    | 0.6    | 0.8          | 1            |
| 0.00mm (0.00)          | 0.00 | 0.00   | 0.00   | 0.01   | 0.10         | 0.50         |
| 0.15mm (0.30)          | 0.00 | 0.00   | 0.04   | 0.19   | 0.39         | 0.80         |
| 0.30mm (0.60)          | 0.01 | 0.10   | 0.29   | 0.49   | 0.69         | 1.10         |
| 0.45mm (0.90)          | 0.19 | 0.39   | 0.59   | 0.79   | 0.99         | 1.40         |
| 0.60mm (1.20)          | 0.49 | 0.69   | 0.89   | 1.09   | 1.29         | 1.70         |
| 0.75mm (1.50)          | 0.79 | 0.99   | 1.19   | 1.39   | 1.59         | 2.00         |
| 0.90mm (1.80)          | 1.09 | 1.29   | 1.49   | 1.69   | 1.89         | 2.30         |

※1

【0179】

表9において、※1の部分は接合部59のくぼみ深さh1とシール部材の幅w1との比(h1/w1)が1.0以下であり、パネルの信頼性を確保できる範囲である。また、※2の部分は、接合部59において実用上問題となるレベルではないが、シール部材が凹にならず、若干の盛り上がりが生じてしまう範囲である。また、※3の部分は、h1/w1が0.1より大きく、0.5以下となり、理想的な範囲である。d1/w1が0.9を超える部分では、シール部材の太さのばらつき等によりシール部材が接触せず（図34）、液晶の漏れ等が発生することがあった。

また、表9において、信頼性を確保できる境界、及び接合部で凸が発生する境界のd1/w1、c1/w1をプロットすると、図44のようになり、略直線に乗る。

【0180】

次に、表10は、第4実施形態における第1シール層及び第2シール層59a、59bの形状について、貼り合わせ後のシール部材の幅w1を0.7mmに固定し、傾斜部59dの面取り量c1と、シール部材の中心線距離d1を変化させたときの、くぼみの深さh1の変化と、パネル状態を調査した結果を示している。

【0181】



【表 1 0】

|                 | ※2   |         |         |         |         | ※3      |         |        |
|-----------------|------|---------|---------|---------|---------|---------|---------|--------|
| d1(d1/w1)       | 0 mm | 0.10mm  | 0.20mm  | 0.30mm  | 0.40mm  | 0.50mm  | 0.60mm  | 0.70mm |
| c1(c1/w1)       | 0    | 0.14286 | 0.28571 | 0.42857 | 0.57143 | 0.71429 | 0.85714 | 1      |
| 0.00mm ( 0.00 ) | 0.00 | 0.00    | 0.00    | 0.00    | 0.01    | 0.05    | 0.15    | 0.50   |
| 0.15mm ( 0.21 ) | 0.00 | 0.00    | 0.00    | 0.02    | 0.09    | 0.22    | 0.36    | 0.71   |
| 0.30mm ( 0.43 ) | 0.00 | 0.01    | 0.05    | 0.15    | 0.29    | 0.44    | 0.58    | 0.93   |
| 0.45mm ( 0.64 ) | 0.02 | 0.09    | 0.22    | 0.36    | 0.51    | 0.65    | 0.79    |        |
| 0.60mm ( 0.86 ) | 0.15 | 0.29    | 0.44    | 0.58    | 0.72    | 0.86    | 1.01    |        |
| 0.75mm ( 1.07 ) | 0.36 | 0.51    | 0.65    | 0.79    | 0.94    | 1.08    | 1.22    |        |
| 0.90mm ( 1.29 ) | 0.58 | 0.72    | 0.86    | 1.01    | 1.15    |         |         |        |
| 1.05mm ( 1.50 ) | 0.79 | 0.94    | 1.08    |         |         |         |         |        |
| 1.20mm ( 1.71 ) | 1.01 | 1.15    |         |         |         |         |         |        |

※1

【0 1 8 2】

表 1 0 において、※ 1 の部分は接合部 5 9 のくぼみ深さ h 1 とシール部材の幅 w 1 との比 (h 1 / w 1) が 1. 0 以下であり、パネルの信頼性を確保できる範囲である。また、※ 2 の部分は、接合部 5 9 において実用上問題となるレベルではないが、シール部材が凹にならず、若干の盛り上がりが生じてしまう範囲である。また、※ 3 の部分は、h 1 / w 1 が h 1 / w 1 が 0. 1 より大きく、0. 5 以下となり、理想的な範囲である。d 1 / w 1 が 0. 8 5 を超える部分では、シール部材の太さのばらつき等によりシール部材が接触せず (図 3 4)、液晶の漏れ等が発生することがあった。

【0 1 8 3】

また、表 1 0 において、信頼性を確保できる境界、及び接合部で凸が発生する境界の d 1 / w 1、c 1 / w 1 をプロットすると、図 4 5 のようになり、略直線に乗る。

ここで、シール部材の幅 w 1 が 0. 5 mm の場合と、0. 7 mm の場合において、信頼性を確保できる境界の d 1 / w 1、c 1 / w 1 の境界 (図 4 4、図 4 5) を同一グラフ上にプロットすると、図 4 6 のようになる。

図 4 6 に示すように、貼り合わせ後のシール部材の幅 w 1 が 0. 5 mm の場合でも、0. 7 mm の場合でも、同一線に乗ることから当該 w 1 がそれ以外の幅であっても、図 4 6 の線上に乗る。

【0 1 8 4】

図 4 6 より、d 1 / w 1、c 1 / w 1 の関係をプロットするとシール部材の幅によらず同一直線上に乗ることが分かる。

これより、シール部材の太さによらずに信頼性を確保するためには、

【数 4 3】

$$(c1/w1) \leq -0.5 \times (d1/w1) + 1.2$$

となり、理想的には、

【数 4 4】

$$(c1/w1) \leq -0.5 \times (d1/w1) + 0.7$$

を満たす必要があることになる。

【0 1 8 5】

また、接合部におけるシール部材の凸 (太り) は、シール部材の幅に対して 2 割以下のため実用上問題となるレベルではない。しかし、シール部材の太さのばらつきを含めて接合部の膨らみを完全に無くすためには、

【数 4 5】

$$(c1/w1) \geq -0.5 \times (d1/w1) + 0.3$$

とすることが理想となる。

更に、接合部でのシール部材の太さのばらつき等により、シール部材が接触せず、液晶の漏れ等を防止するためには、

【数 4 6】

$$d1/w1 \leq 0.8$$

を満たすのが理想となる。

【0 1 8 6】

このように、第 1 シール層及び第 2 シール層 5 9 a、5 9 b の形状を規定することにより、上記の実施形態と同様の効果が得られる。即ち、全ての部分において同一のスピードでシール部材の描画が可能であり、また、書き始め部分や、書き終わり部分もパネルから十分離れた部分であるため複雑な制御も必要なくなる。これら効果により描画時間は従来の  $1/2 \sim 1/3$  と大幅な短縮ができ、且つシール部材の接合部でのパネル内側方向へのシール部材の太りも解消できた。

【0 1 8 7】

(電子機器)

次に、本発明の電子機器の具体例について説明する。

図 4 7 (a) は、携帯電話の一例を示した斜視図である。図 4 7 (a) において、7 0 0 は携帯電話本体を示し、7 0 1 は上記実施形態の液晶装置を備えた液晶表示部を示している。

図 4 7 (b) は、ワープロ、パソコンなどの携帯型情報処理装置の一例を示した斜視図である。図 4 7 (b) において、8 0 0 は情報処理装置、8 0 1 はキーボードなどの入力部、8 0 3 は情報処理本体、8 0 2 は上記実施形態の液晶装置を備えた液晶表示部を示している。

図 4 7 (c) は、腕時計型電子機器の一例を示した斜視図である。図 4 7 (c) において、9 0 0 は時計本体を示し、9 0 1 は上記実施形態の液晶装置を備えた液晶表示部を示している。

図 4 7 (a) ~ (c) に示す電子機器は、上記実施形態の液晶装置を備えたものである。信頼性に優れ、高品質の表示が得られる表示部を有する電子機器となる。

【図面の簡単な説明】

【0 1 8 8】

【図 1】 本発明の第 1 実施形態に係る液晶装置の平面図。

【図 2】 本発明の第 1 実施形態に係る液晶装置の H-H' 線に沿う断面構成図。

【図 3】 本発明の第 1 実施形態に係る液晶装置の要部の平面図。

【図 4】 本発明の第 1 実施形態に係る液晶装置の要部の平面図。

【図 5】 本発明の第 1 実施形態に係る液晶装置の等価回路図。

【図 6】 本発明の第 1 実施形態に係る液晶装置の各種素子の平面図。

【図 7】 本発明の液晶装置の製造方法を概略説明するための図。

【図 8】 本発明の液晶装置の製造方法で用いるデバイス製造装置の構成図。

【図 9】 本発明の液晶装置の製造方法で用いる基板給除部及び材料供給部の構成図。

【図 1 0】 本発明の液晶装置の製造方法で用いる基板貼り合わせ部の構成図。

【図 1 1】 本発明の液晶装置の製造方法で用いる精密アライメント部の構成図。

【図 1 2】 本発明の液晶装置の製造方法で用いる液滴吐出ヘッドの一例を示す構成図。

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【図 1 3】 図 1 2 の液滴吐出ヘッドの圧電素子の駆動電圧波形と、動作を示す説明図。

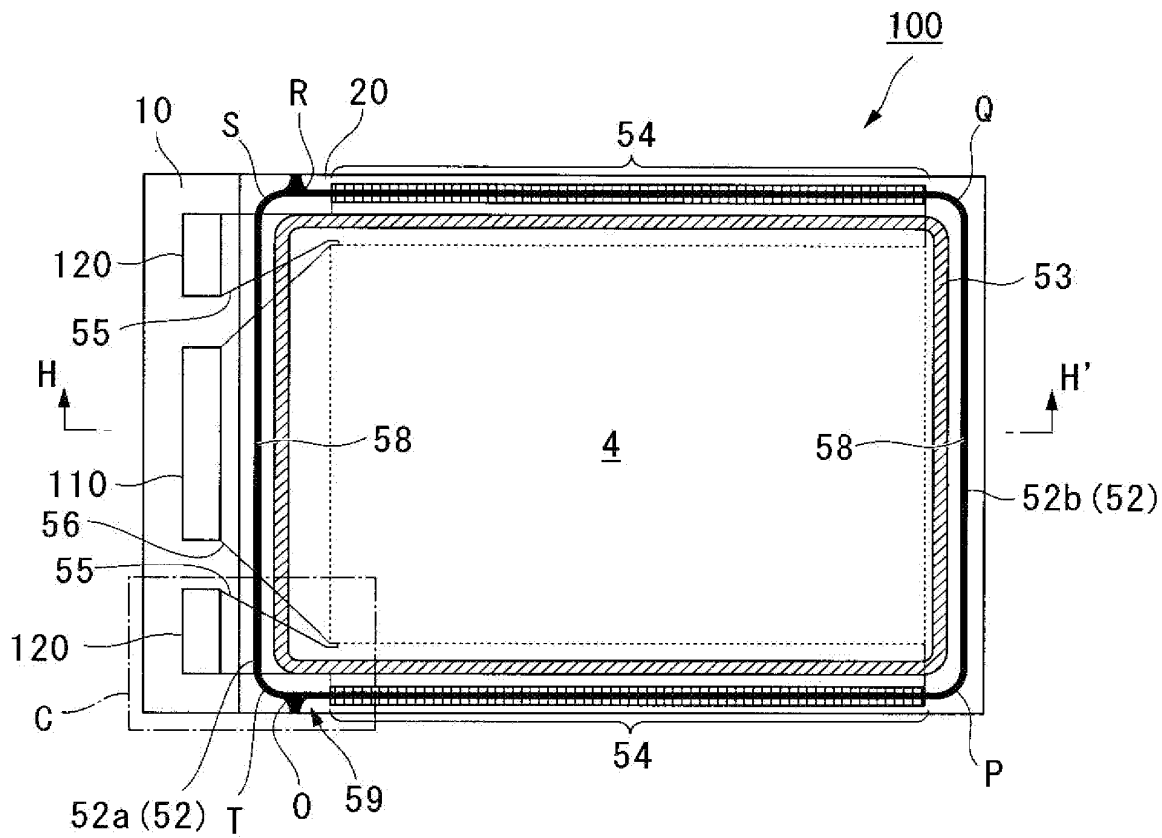
- 【図 1 4】 本発明の液晶装置の製造方法を説明するための図。
- 【図 1 5】 本発明の液晶装置の製造方法を説明するための図。
- 【図 1 6】 本発明の液晶装置の製造方法を説明するための図。
- 【図 1 7】 本発明の液晶装置の製造方法におけるシール部材の形成方法を示す図。
- 【図 1 8】 本発明の液晶装置の製造方法におけるマザー基板の外観図。
- 【図 1 9】 本発明の第 2 実施形態に係る液晶装置のシール部材の要部を示す平面図。
- 【図 2 0】 本発明の第 3 実施形態に係る液晶装置の平面図。
- 【図 2 1】 本発明の第 3 実施形態に係る液晶装置の要部の平面図。
- 【図 2 2】 本発明の第 3 実施形態に係る液晶装置の要部の平面図。
- 【図 2 3】 本発明の第 3 実施形態に係る液晶装置のシール部材の形成方法を示す図。
- 【図 2 4】 本発明の第 3 実施形態に係る液晶装置のシール部材の要部を示す平面図。
- 【図 2 5】 本発明の第 4 実施形態に係る液晶装置のシール部材の要部を示す平面図。
- 【図 2 6】 本発明の第 5 実施形態に係る液晶装置の平面図。
- 【図 2 7】 本発明の第 6 実施形態に係る液晶装置の平面図。
- 【図 2 8】 本発明の第 7 実施形態に係る液晶装置の平面図。
- 【図 2 9】 本発明の第 7 実施形態の変形例に係る液晶装置の平面図。
- 【図 3 0】 本発明の第 8 実施形態に係る液晶装置の平面図。
- 【図 3 1】 本発明の第 9 実施形態に係る液晶装置の平面図。
- 【図 3 2】 本発明の実施例を説明するための図。
- 【図 3 3】 本発明の実施例を説明するための図。
- 【図 3 4】 本発明の実施例を説明するための図。
- 【図 3 5】 本発明の実施例を説明するための図。
- 【図 3 6】 本発明の実施例を説明するための図。
- 【図 3 7】 本発明の実施例を説明するための図。
- 【図 3 8】 本発明の実施例を説明するための図。
- 【図 3 9】 本発明の実施例を説明するための図。
- 【図 4 0】 本発明の実施例を説明するための図。
- 【図 4 1】 本発明の実施例を説明するための図。
- 【図 4 2】 本発明の実施例を説明するための図。
- 【図 4 3】 本発明の実施例を説明するための図。
- 【図 4 4】 本発明の実施例を説明するための図。
- 【図 4 5】 本発明の実施例を説明するための図。
- 【図 4 6】 本発明の実施例を説明するための図。
- 【図 4 7】 本発明の電子機器を示す斜視図。
- 【図 4 8】 従来技術を説明するための図。
- 【図 4 9】 従来技術を説明するための図。
- 【図 5 0】 従来技術を説明するための図。

【符号の説明】

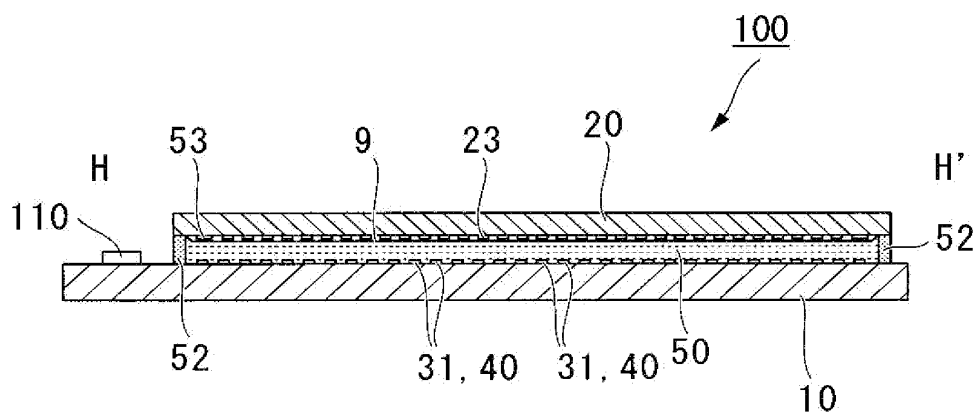
【0 1 8 9】

1 0 T F D 基板（第 1 基板）、 1 0' T F D 基板用マザー基板（第 1 母材）、 1 1 T F D 形成領域（第 1 素子領域）、 1 2、2 2 相互境界部、 2 0 対向基板（第 2 基板）、 2 0' 対向基板用マザー基板（第 2 母材）、 2 1 対向電極形成領域（第 2 素子領域）、 5 0 液晶層、 5 2 シール部材、 5 2 a 絶縁性シール部材（第 2 シール部材）、 5 2 b 導電性シール部材（第 1 シール部材）、 5 8 環状部、 5 9 接合部、 5 9 a 第 1 シール層、 5 9 b 第 2 シール層、 5 8 a 第 1 辺、 5 8 b 第 2 辺、 5 9 c 曲線部、 5 9 d 傾斜部、 1 0 0、1 0 1、1 0 3 液晶装置、 7 0 0、8 0 0、9 0 0 電子機器

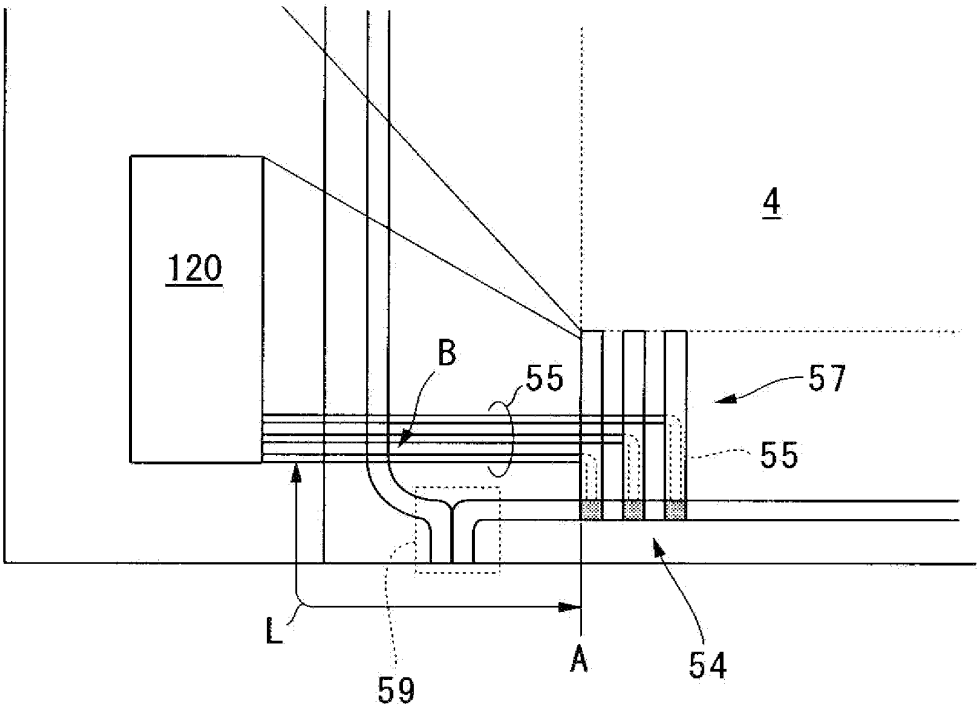
【図 1】



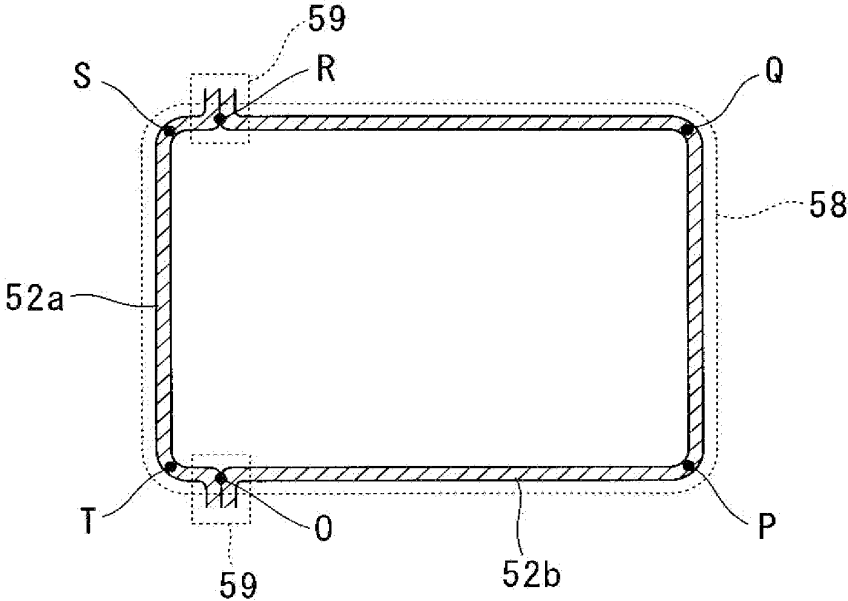
【图 2】



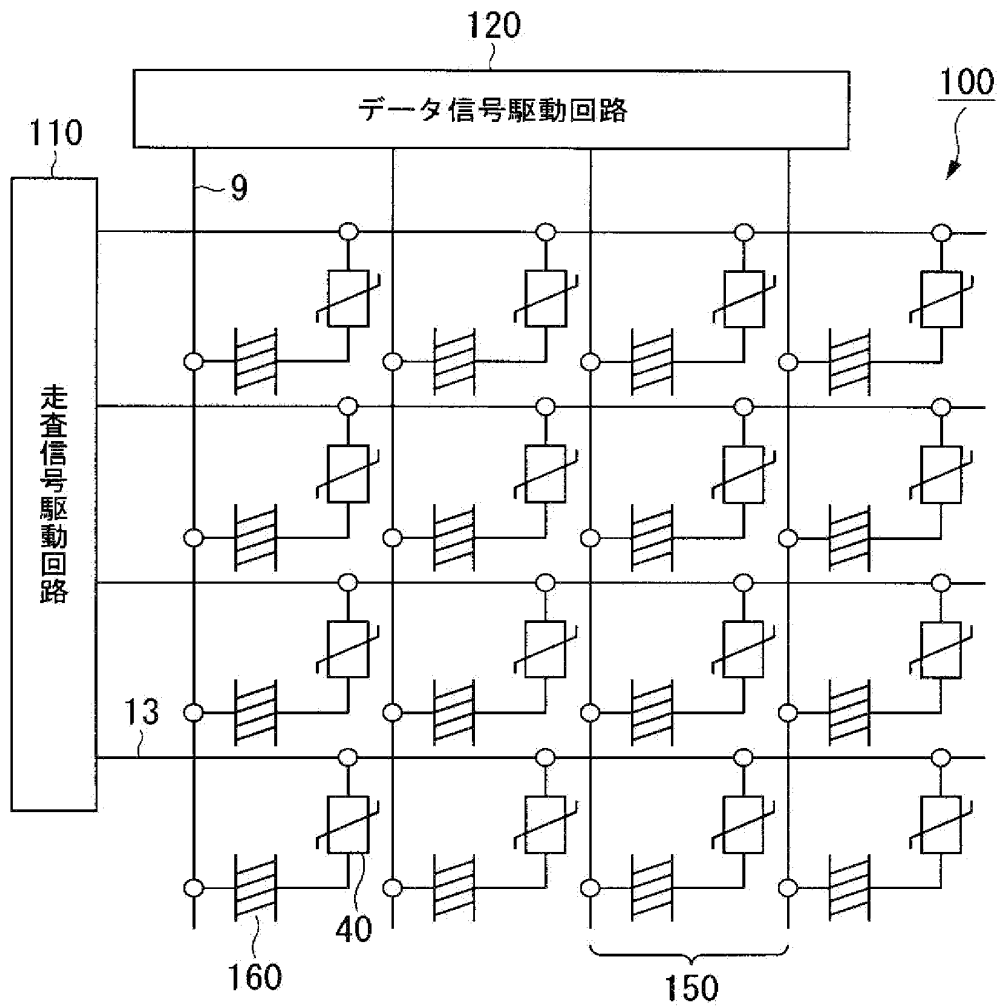
【図3】



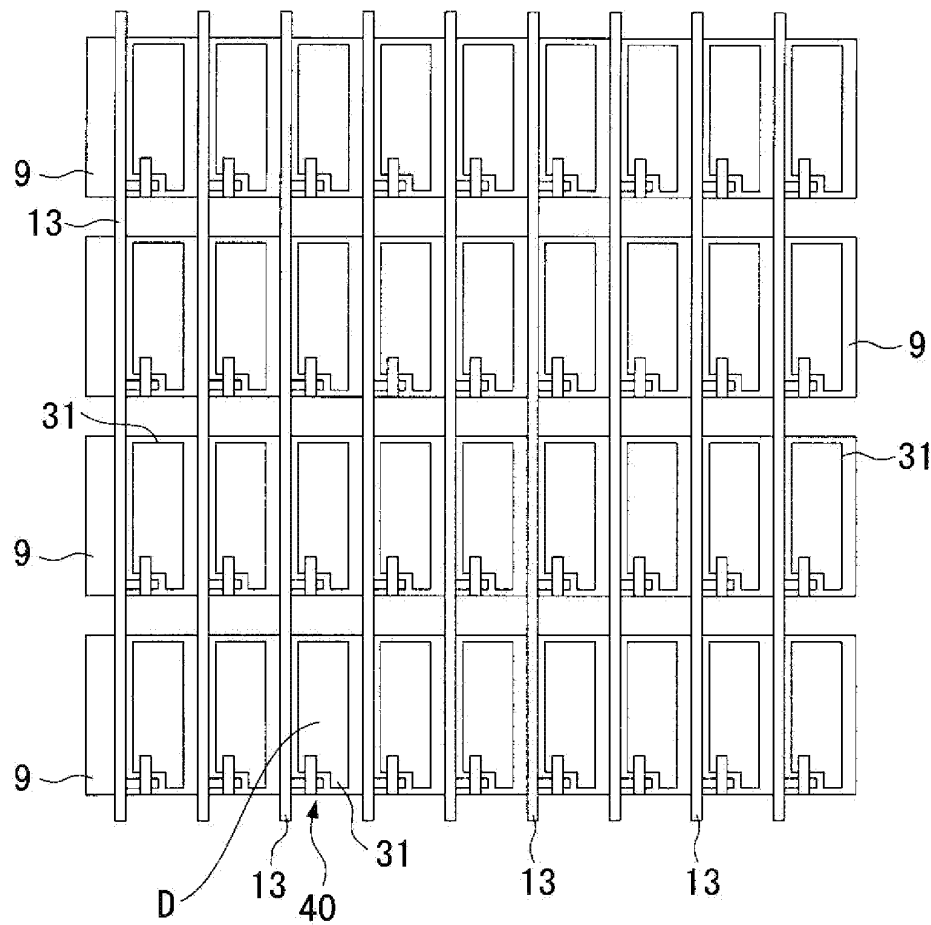
【図4】



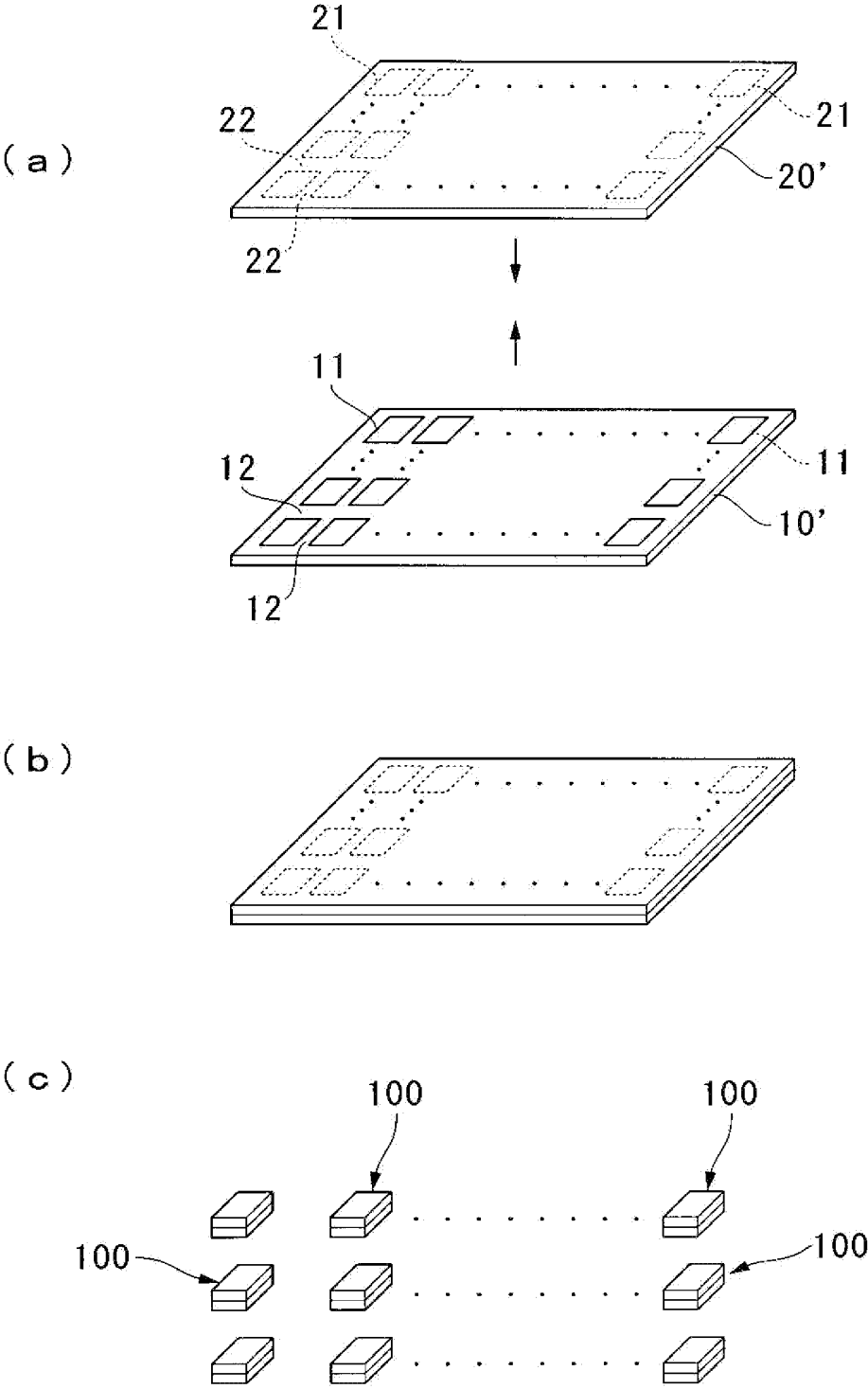
【図 5】



【図6】

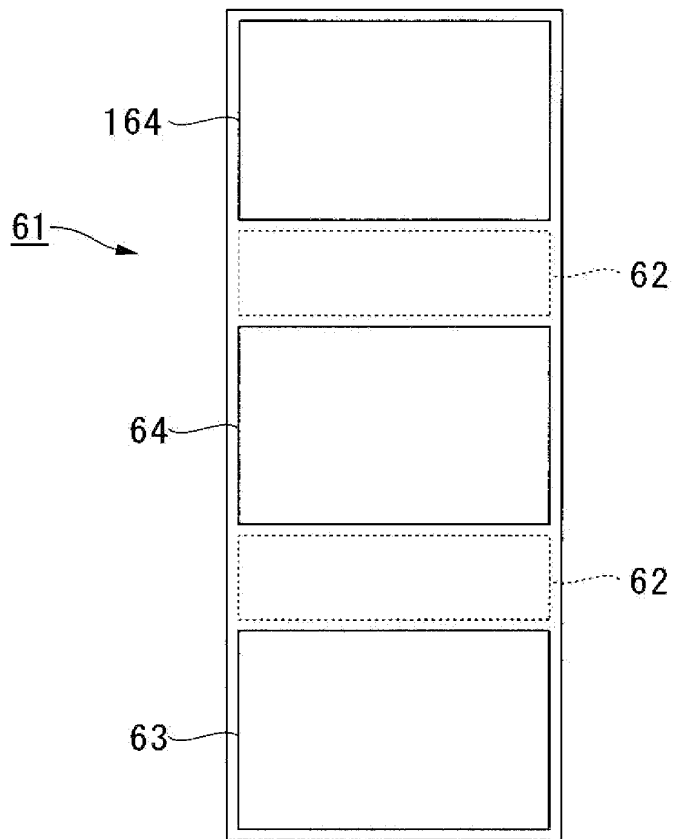


【図 7】

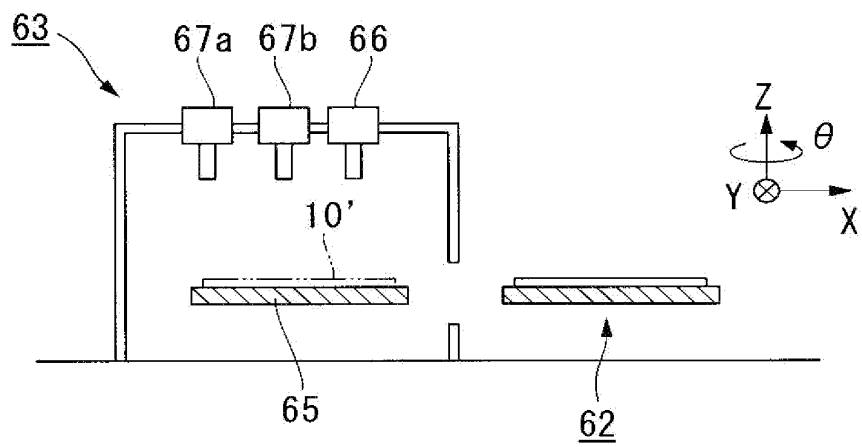




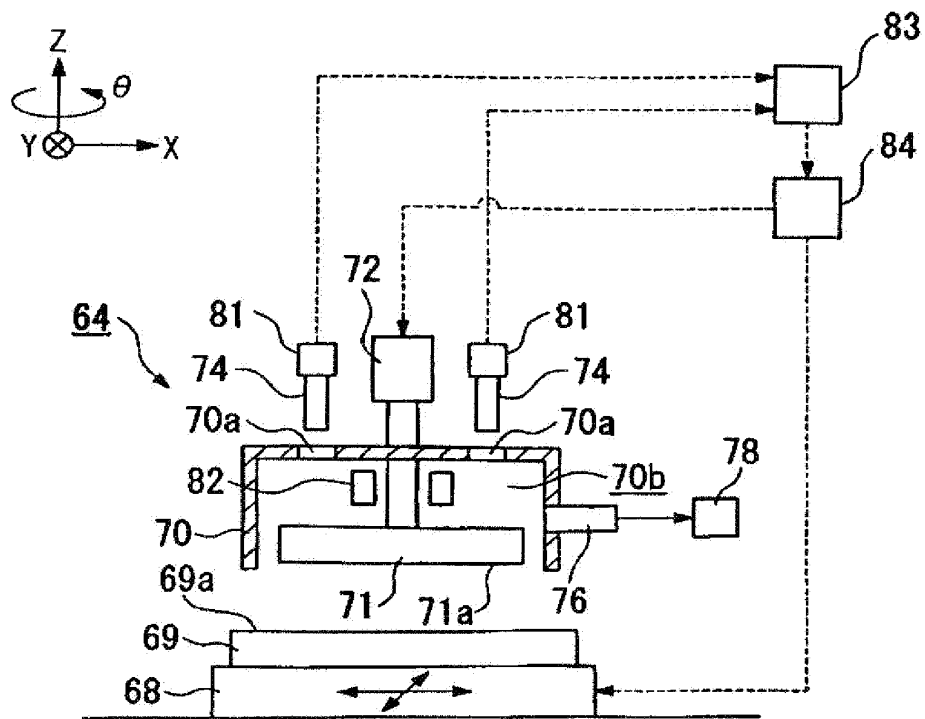
【図 8】



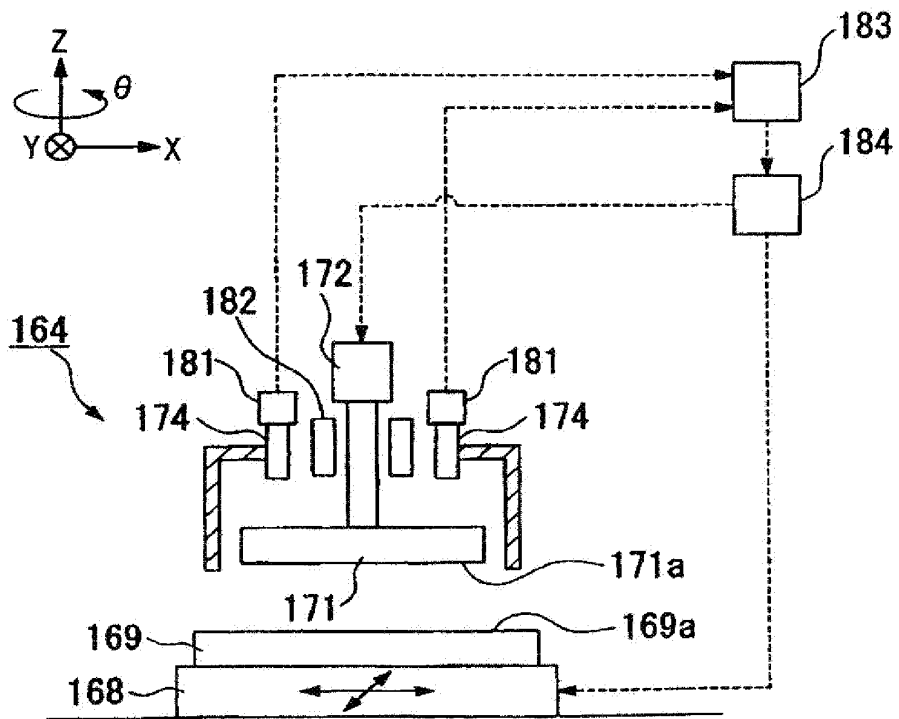
【図 9】



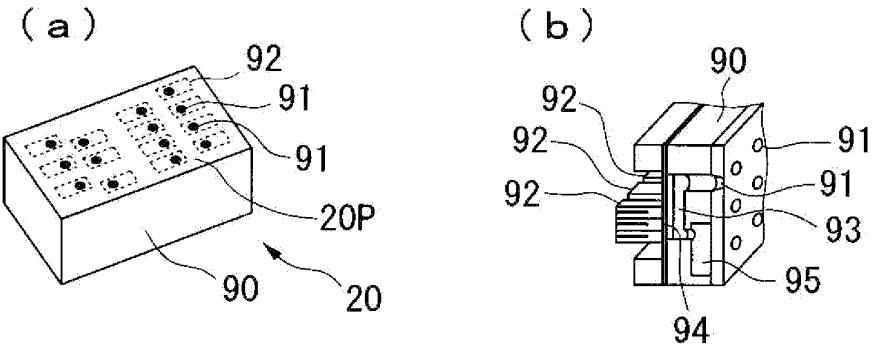
【図 10】



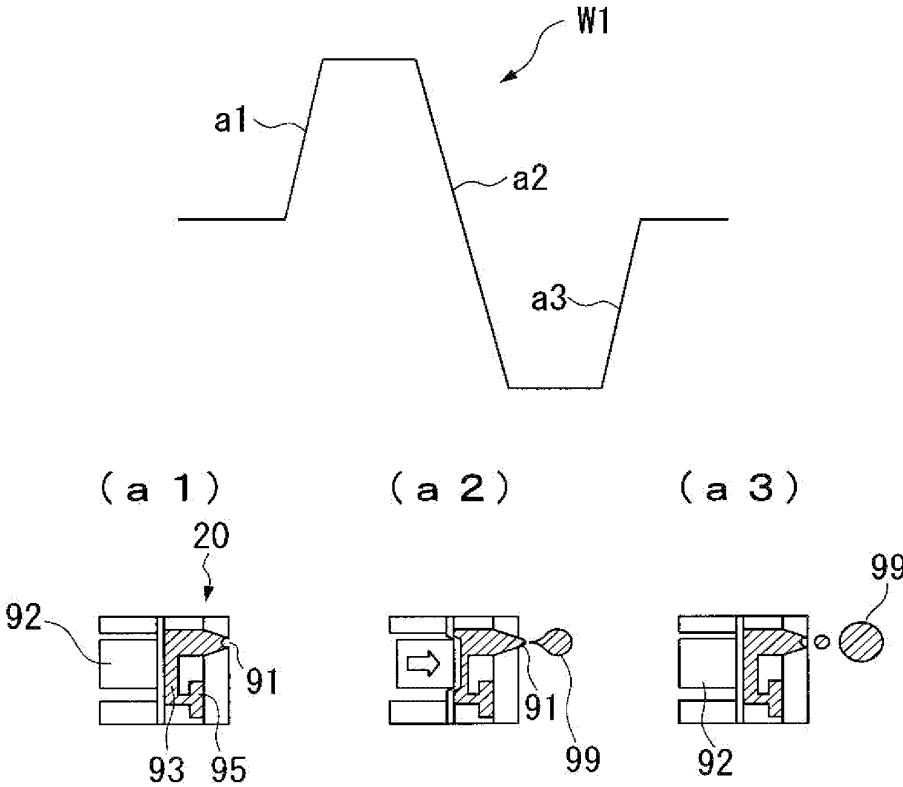
【図 11】



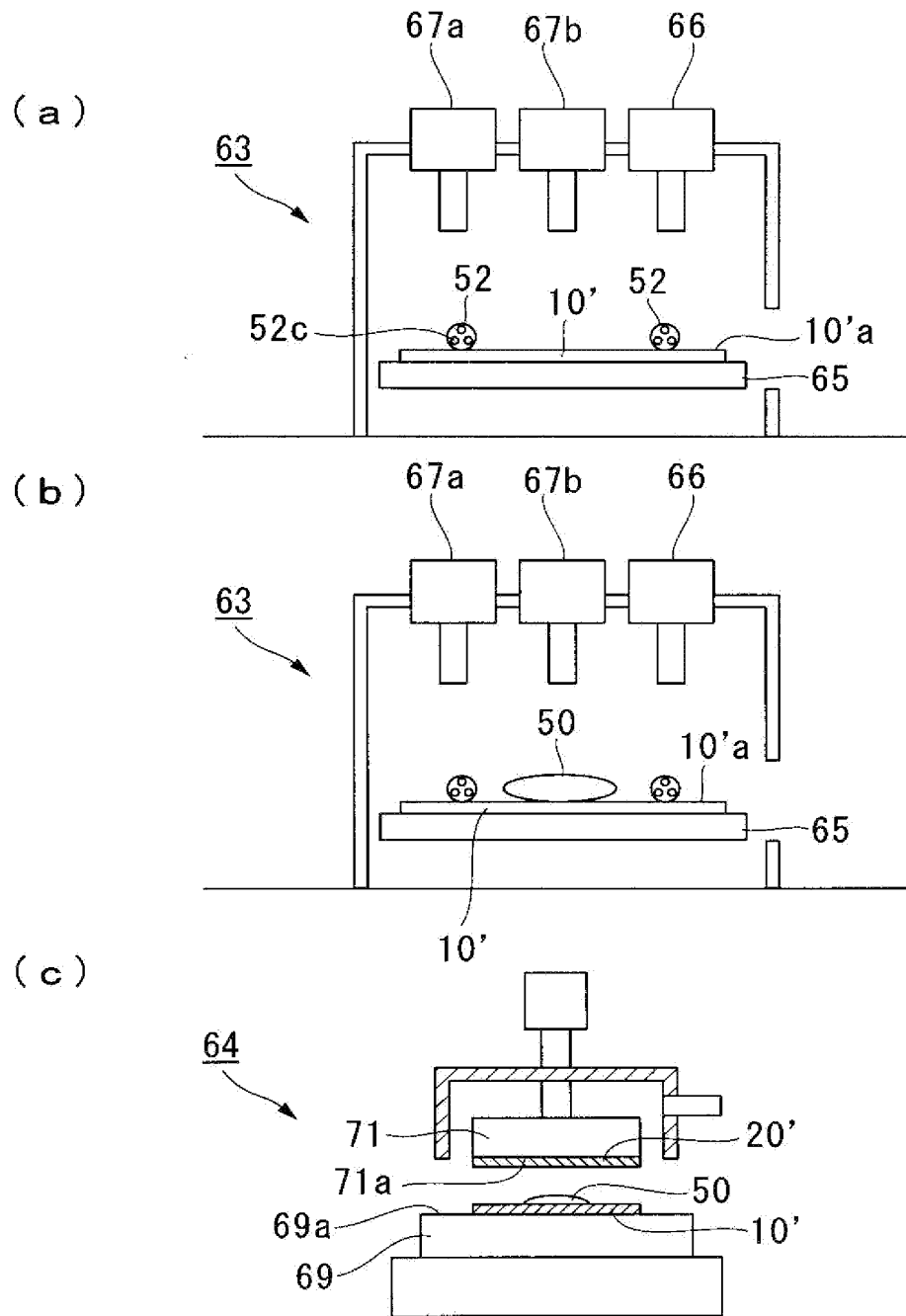
【図 1 2】



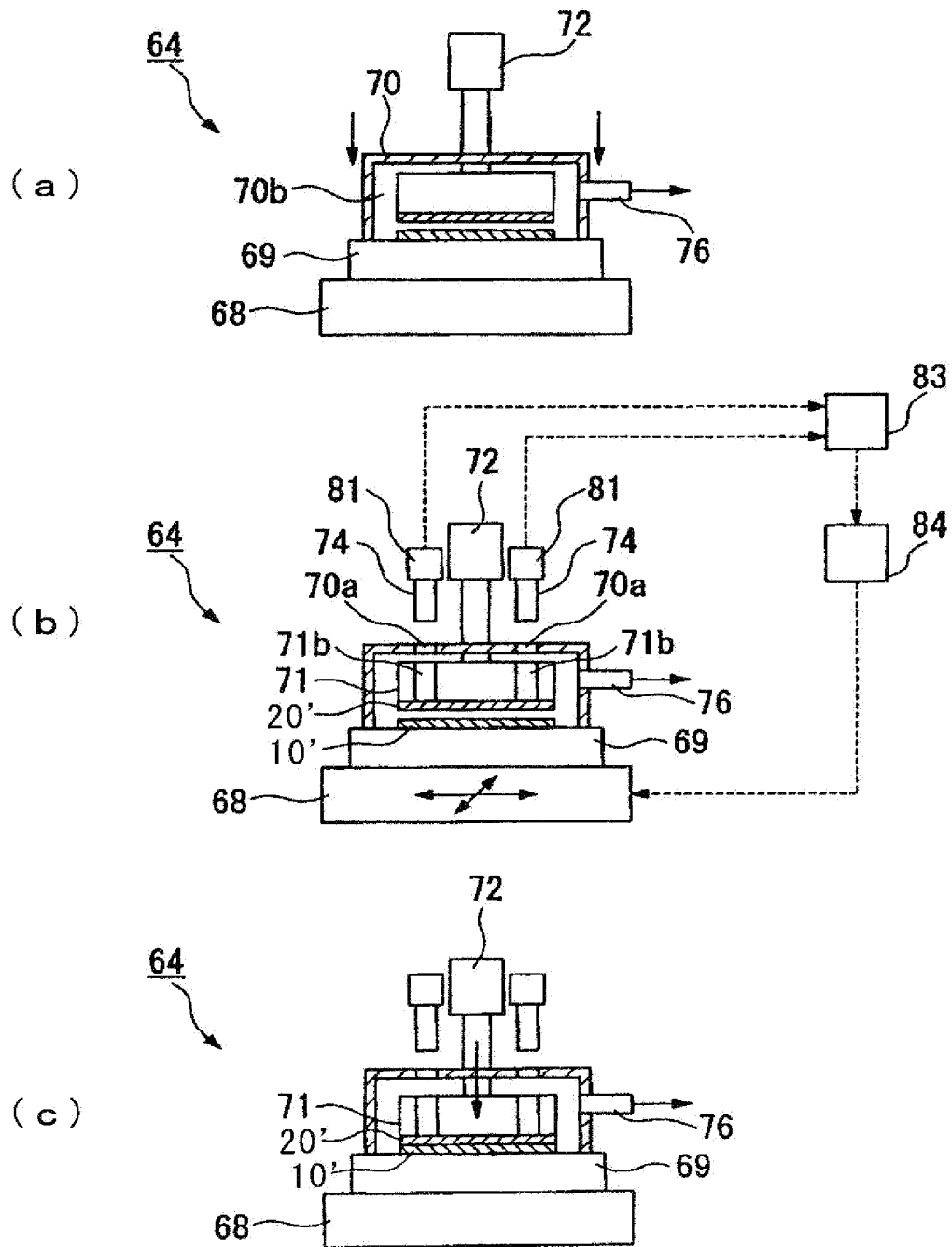
【図 1 3】



【図 14】

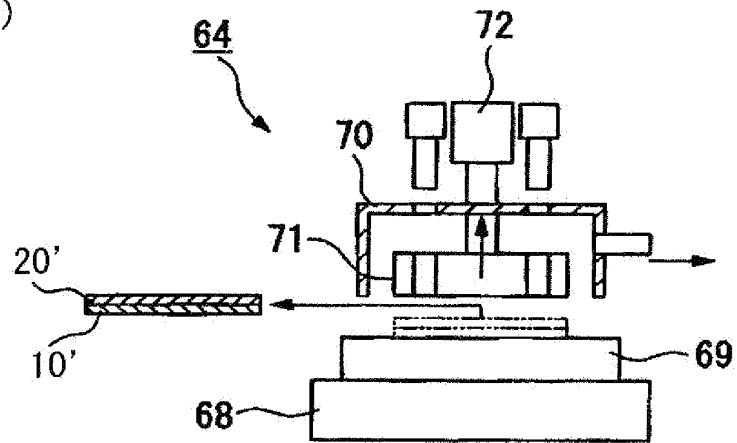


【図 15】

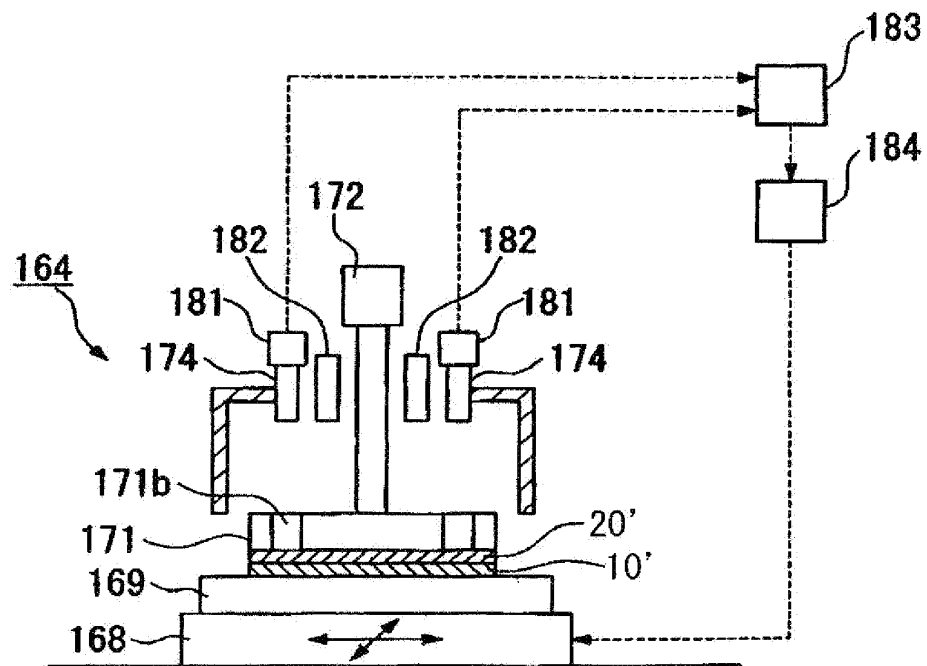


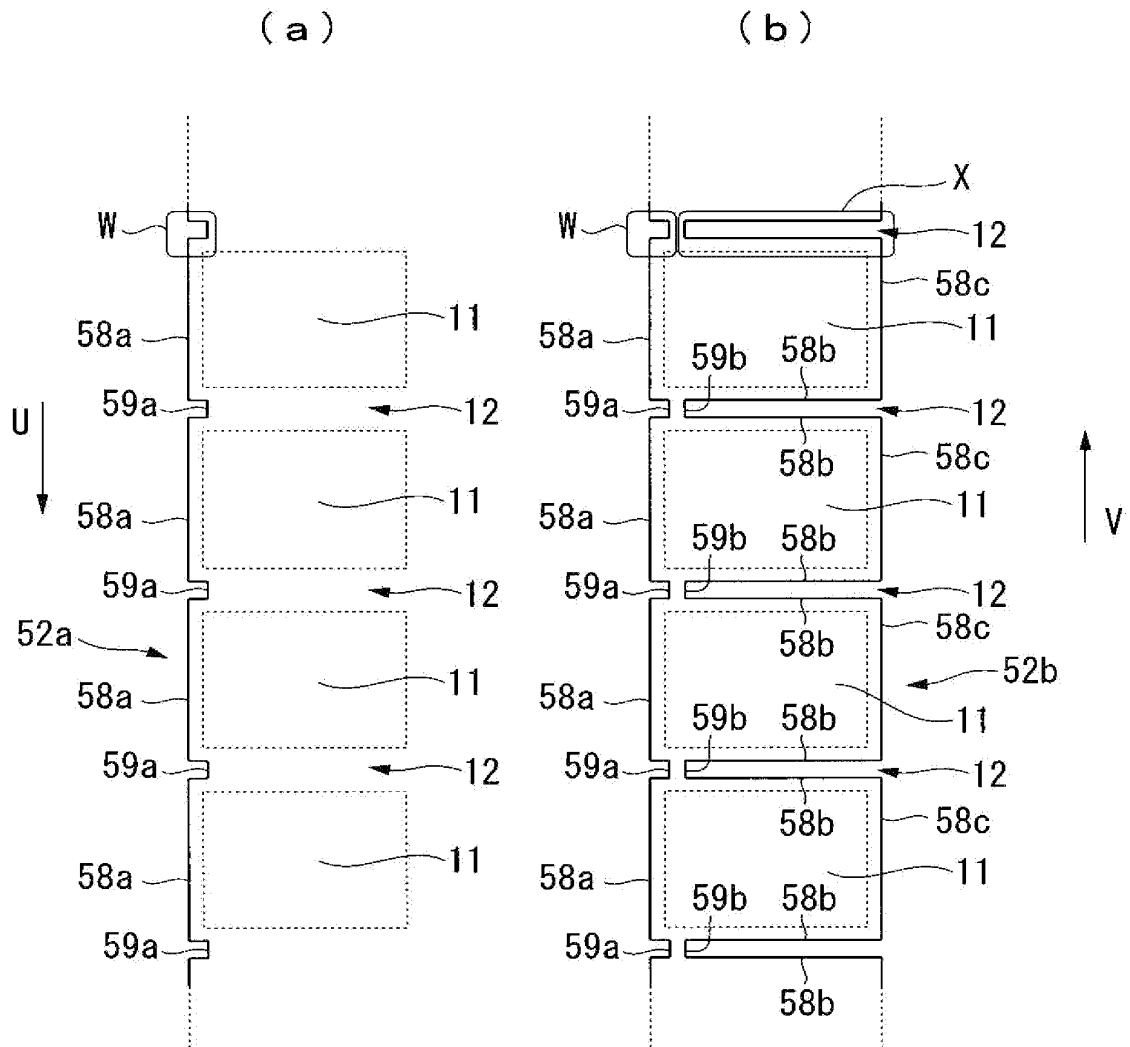
【図 16】

(a)

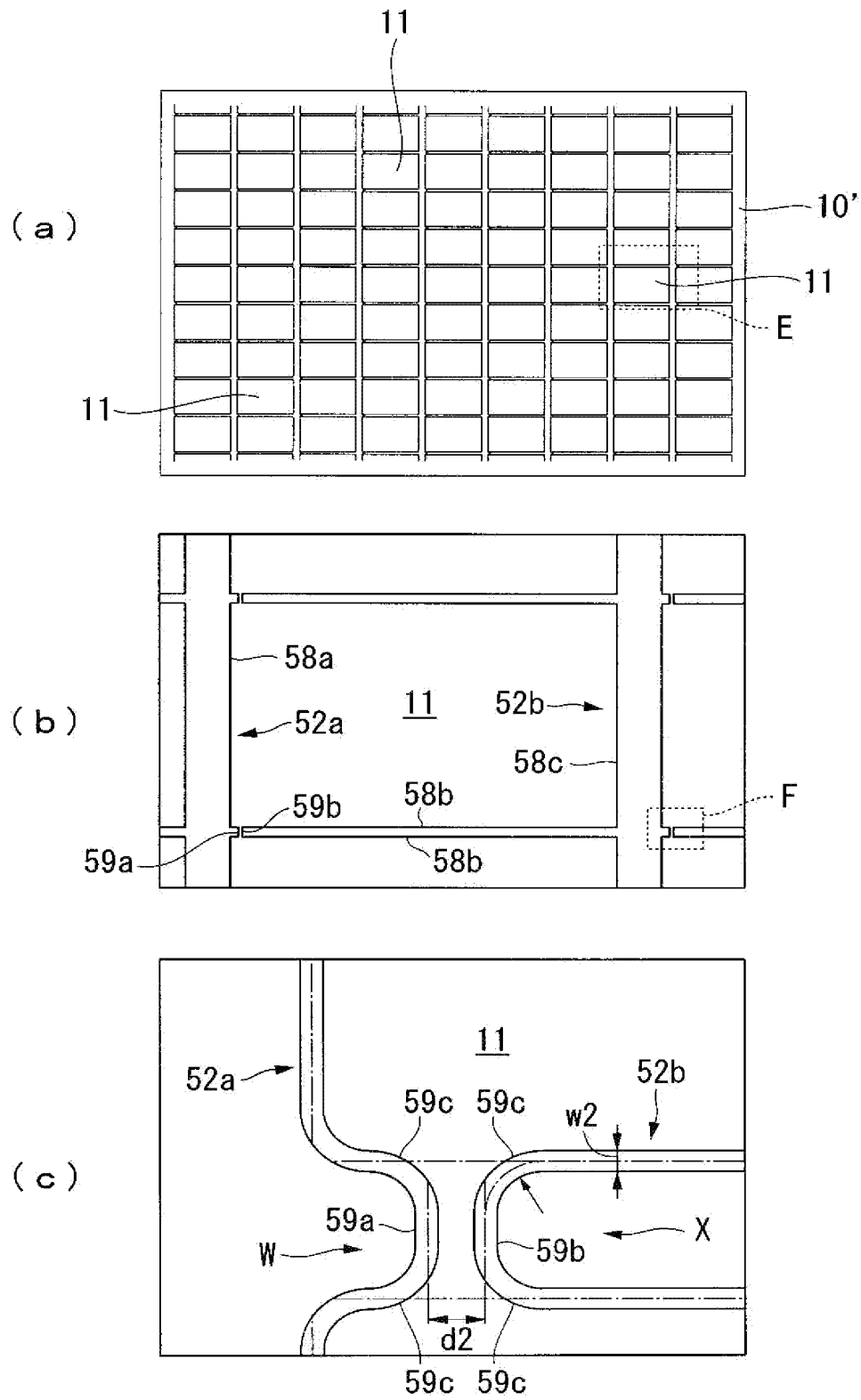


(b)





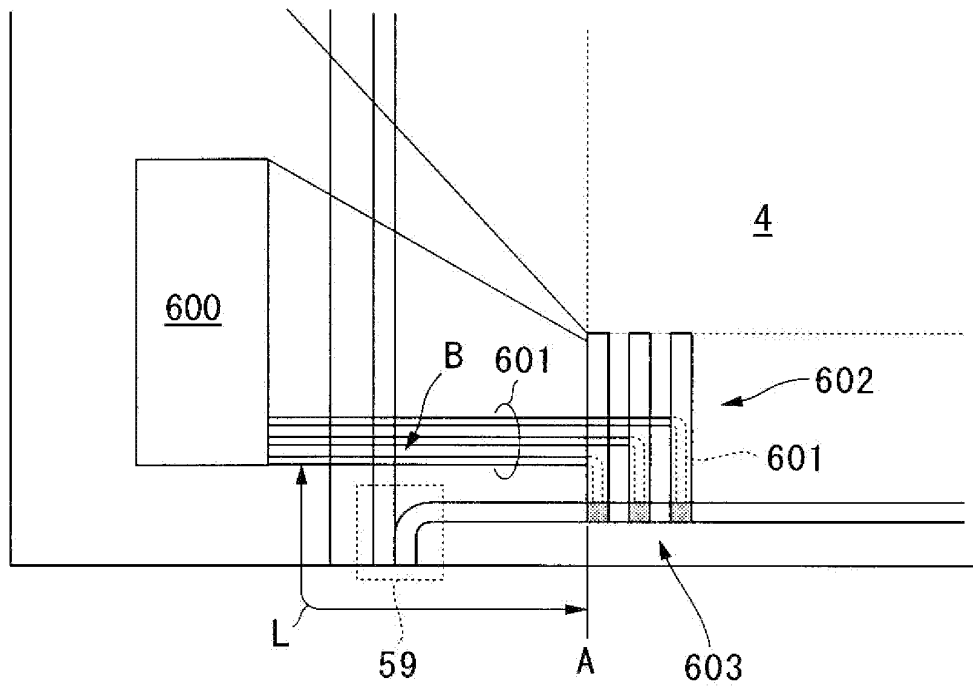
【図 18】



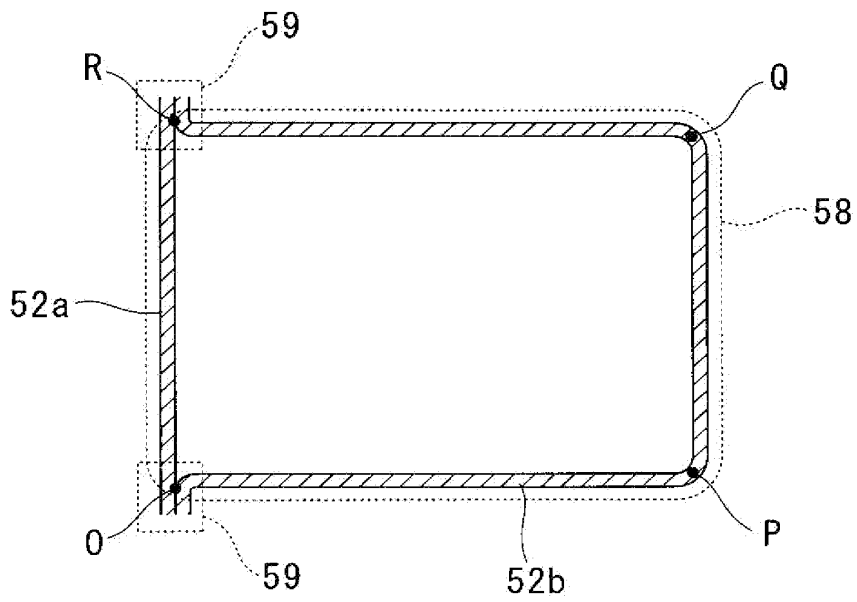




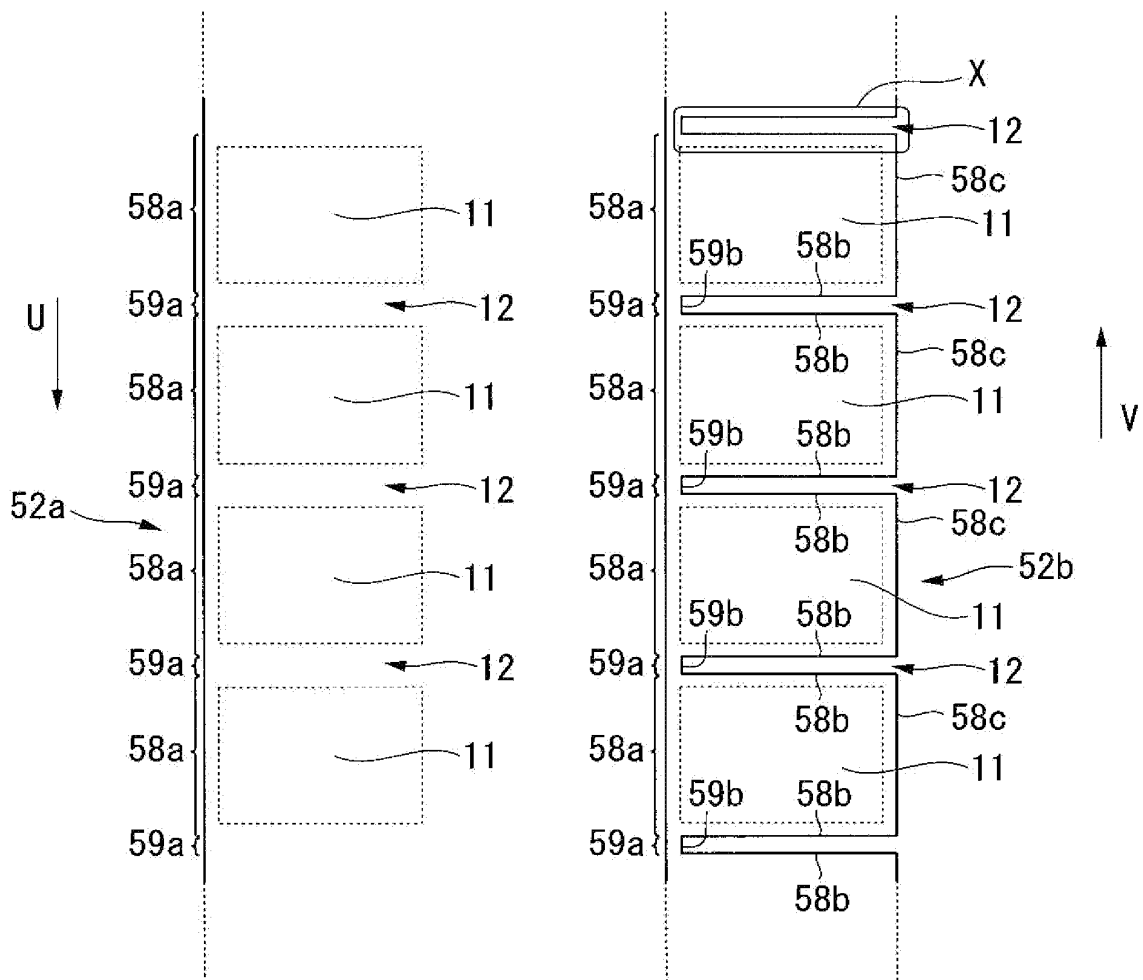
【図 2 1】



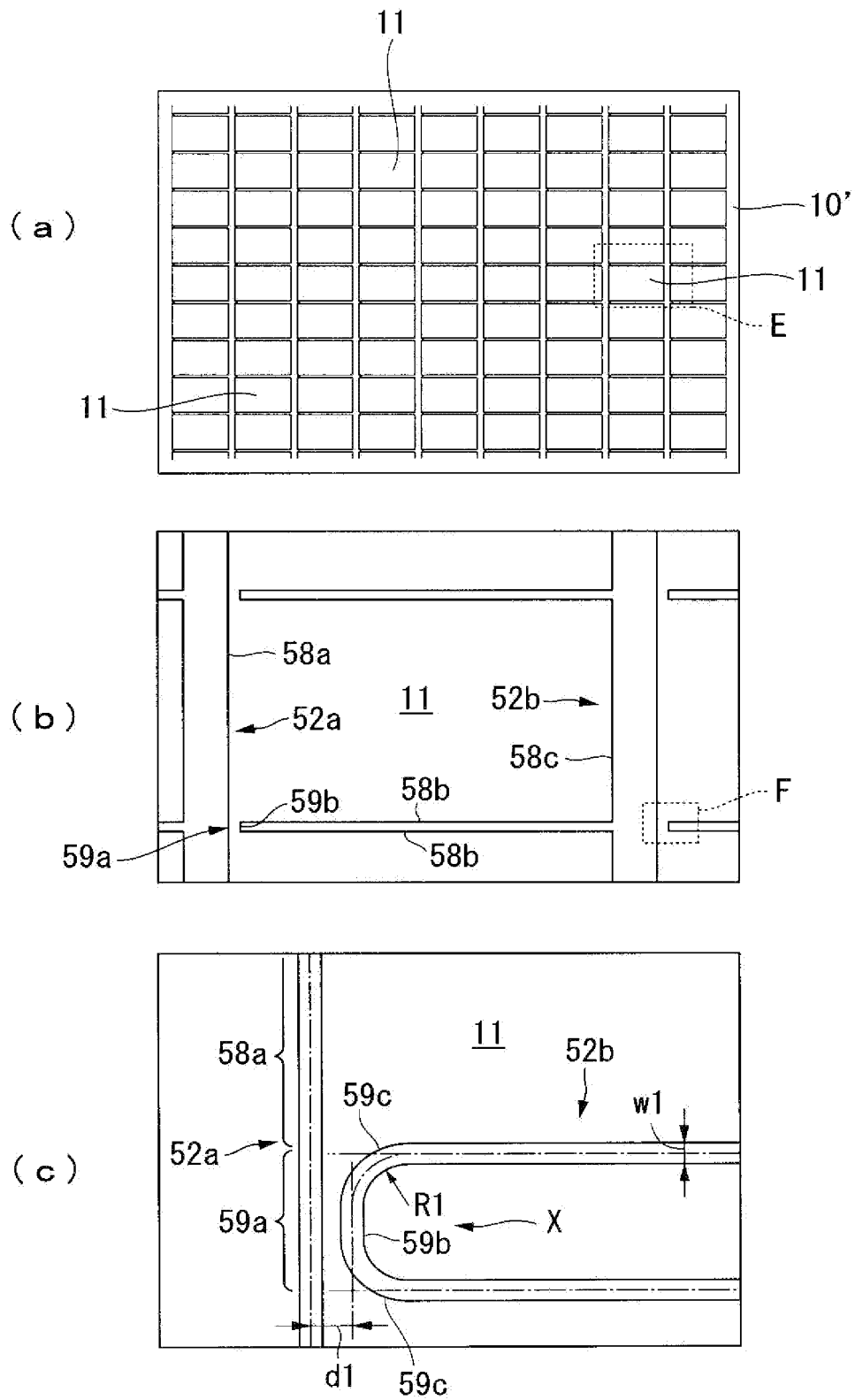
【図 2 2】



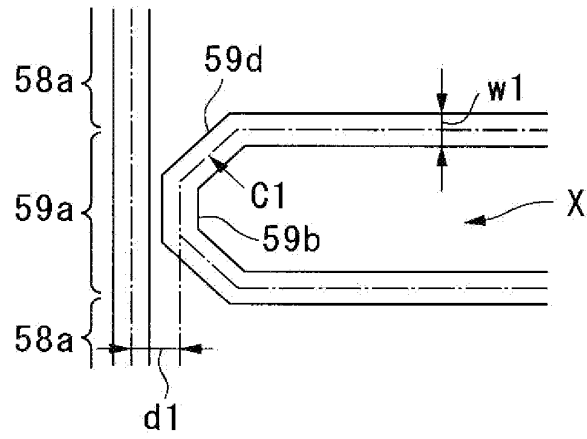
(b)



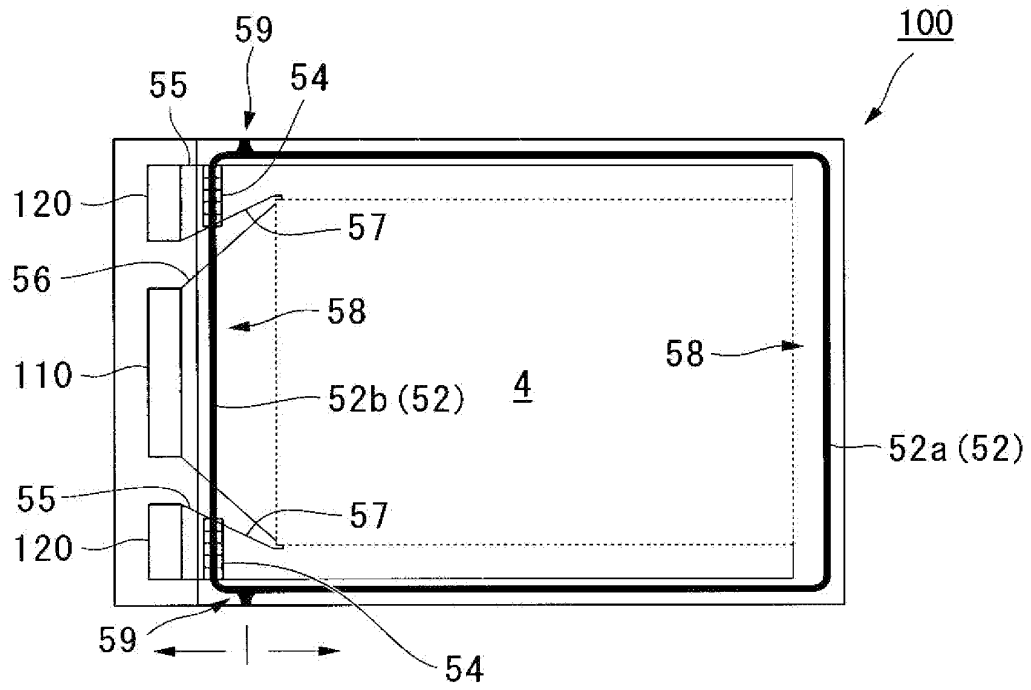
【図 24】



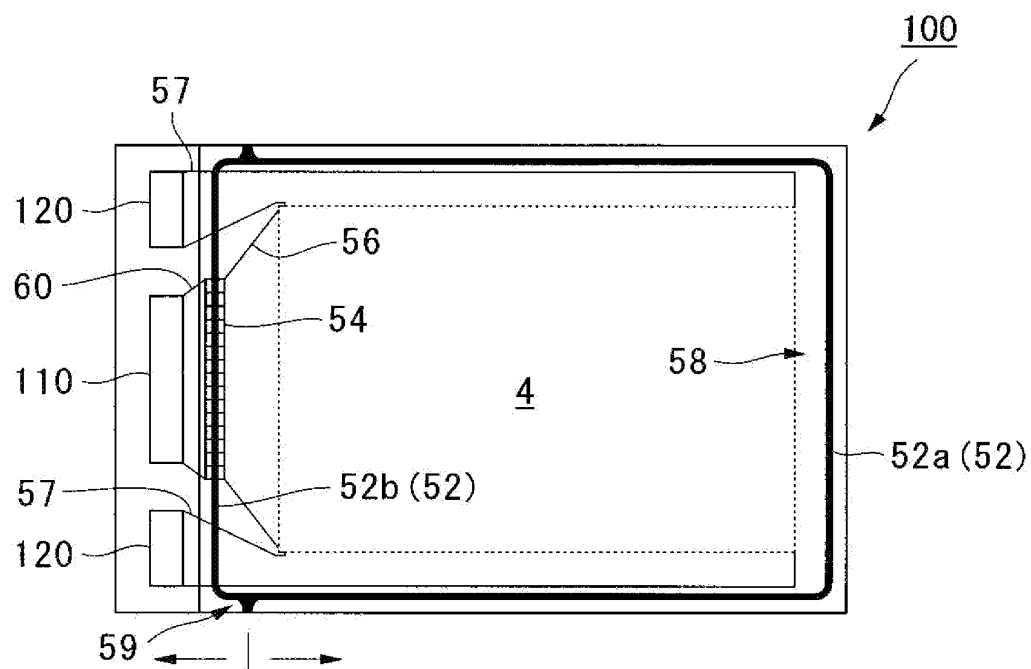
【图 2 5】



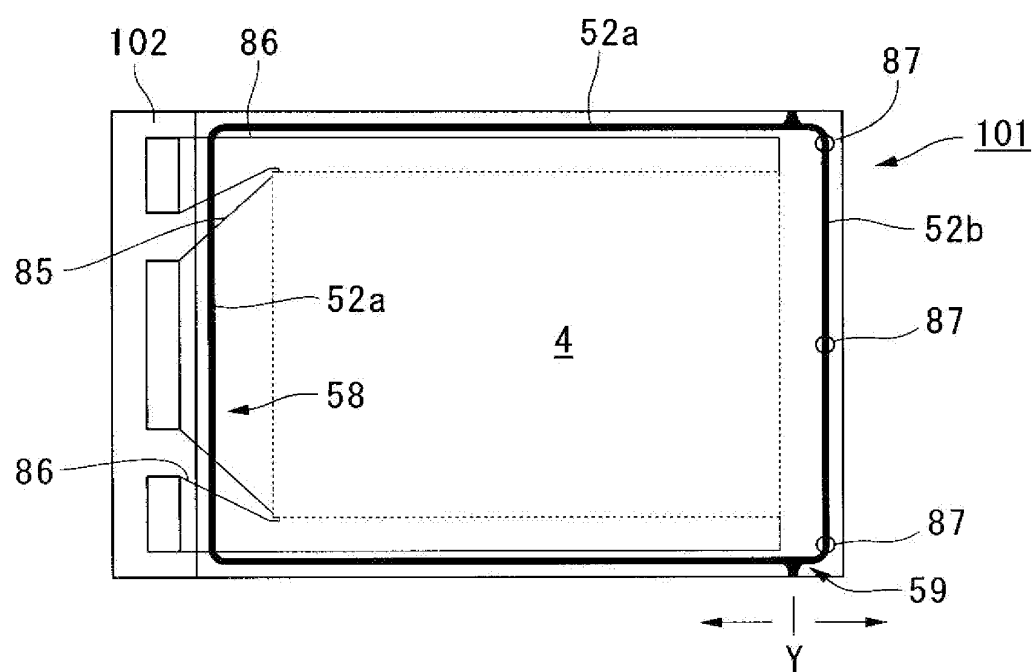
【图 2 6】



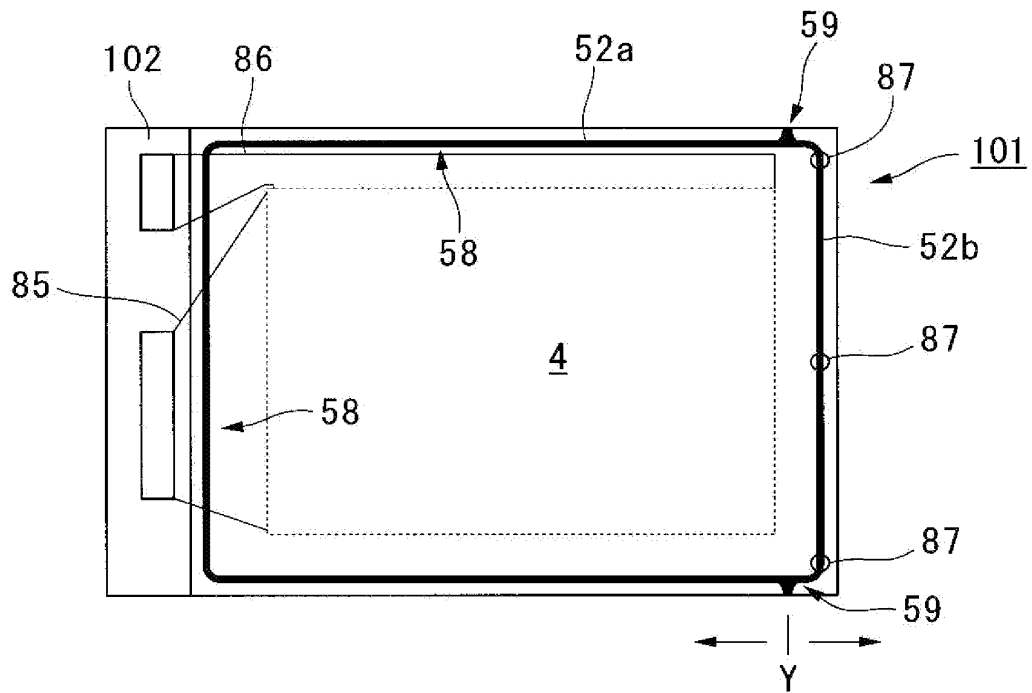
【图 2 7】



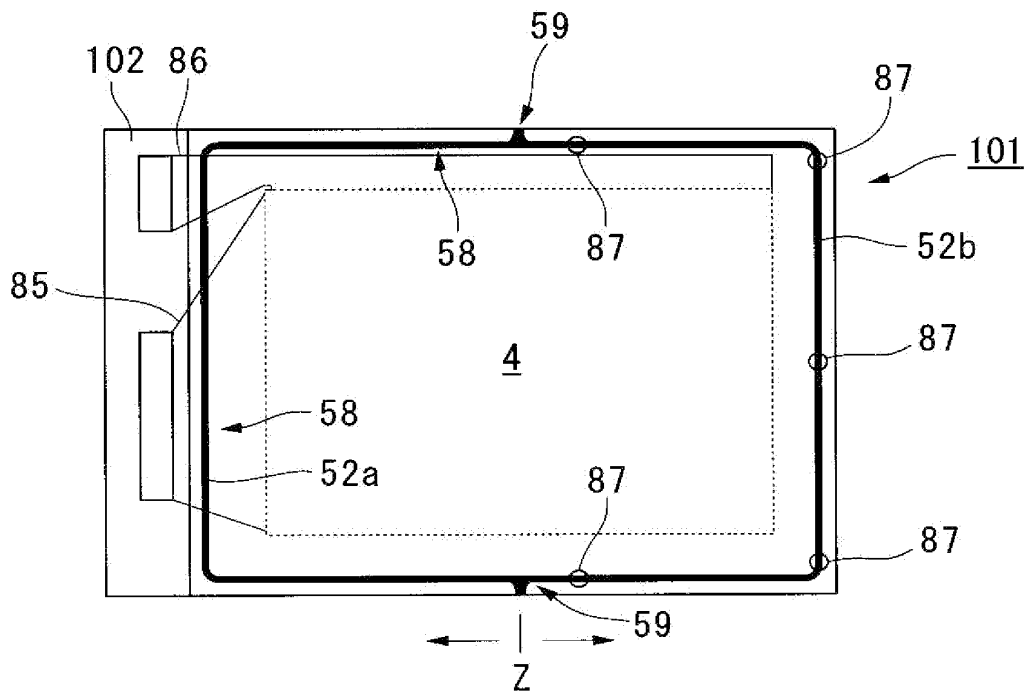
【图 28】



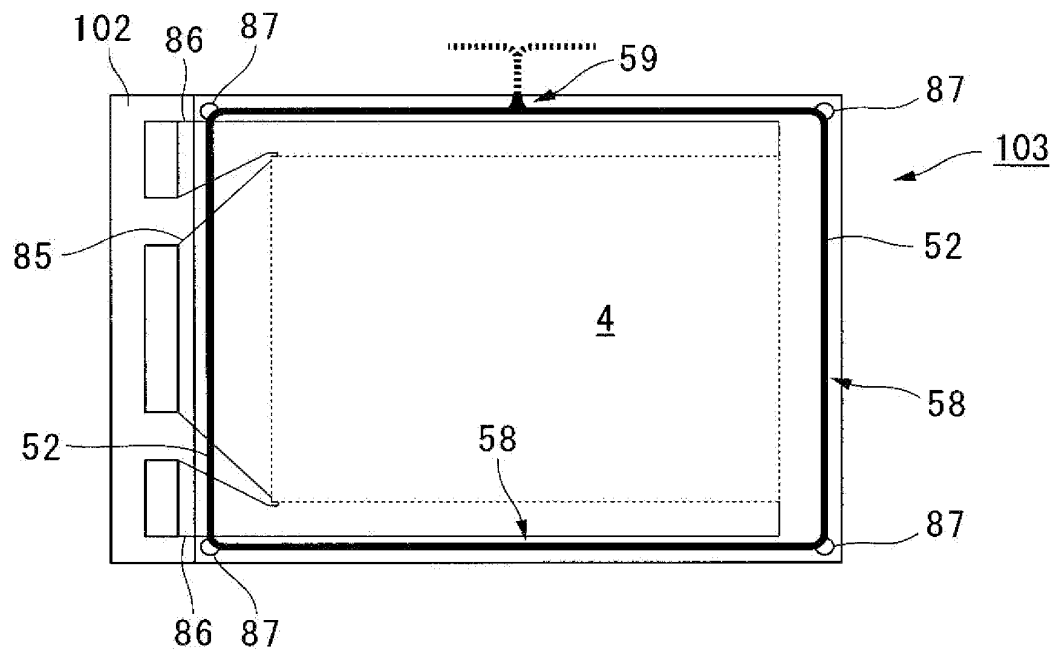
【図 29】



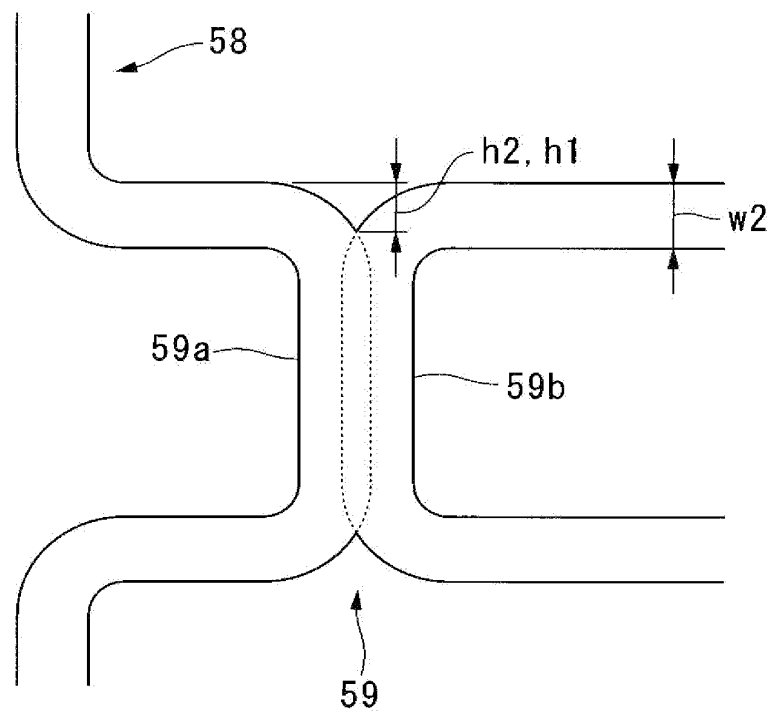
【図 30】



【図 3 1】

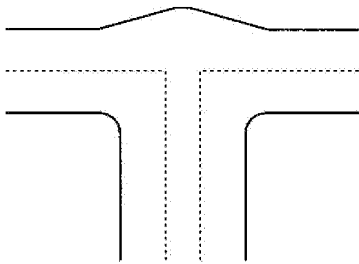


【図 3 2】

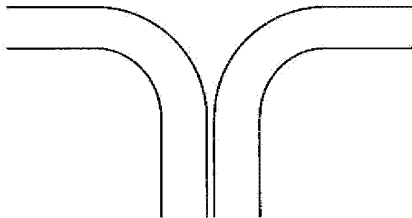




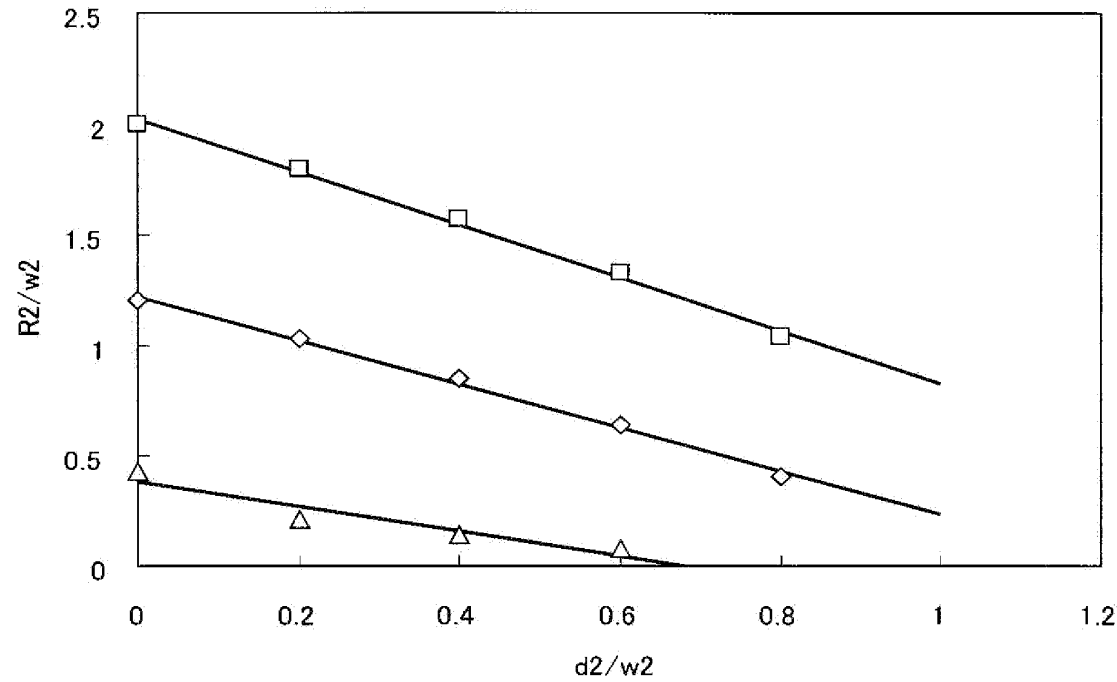
【图 3 3】



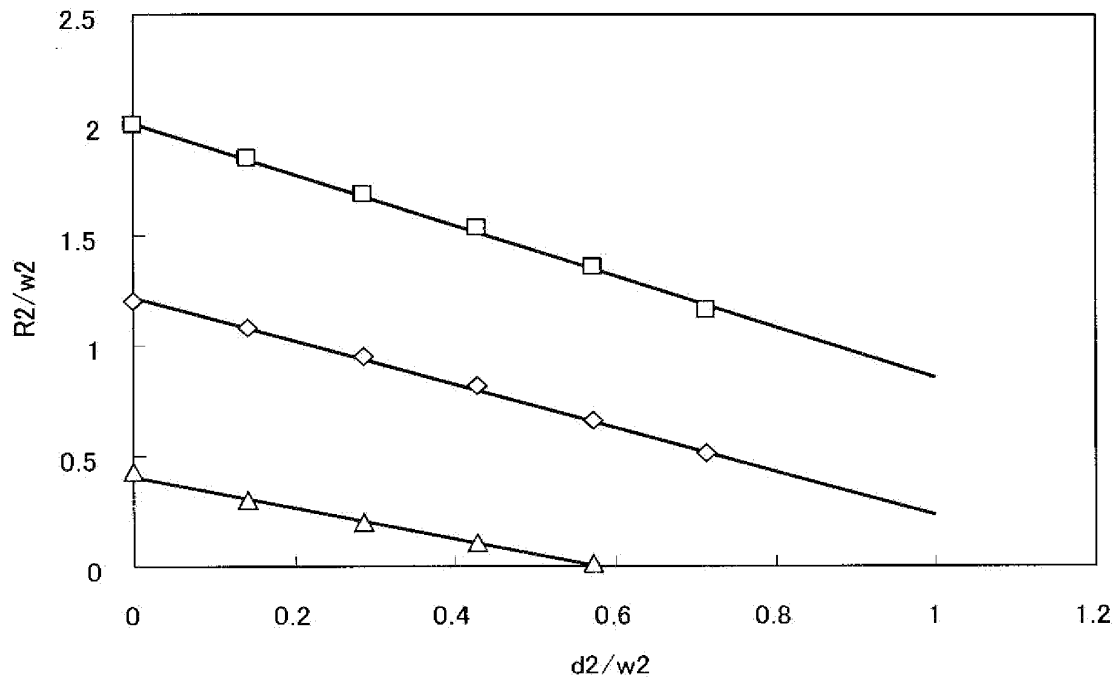
【图 3 4】



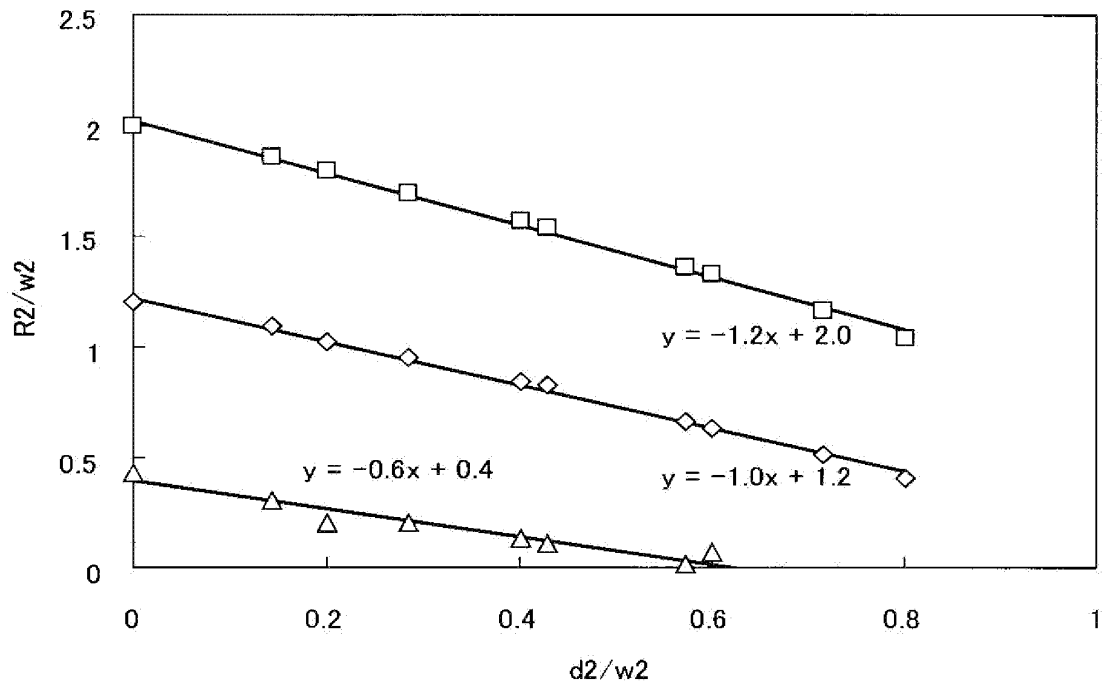
【图 3 5】



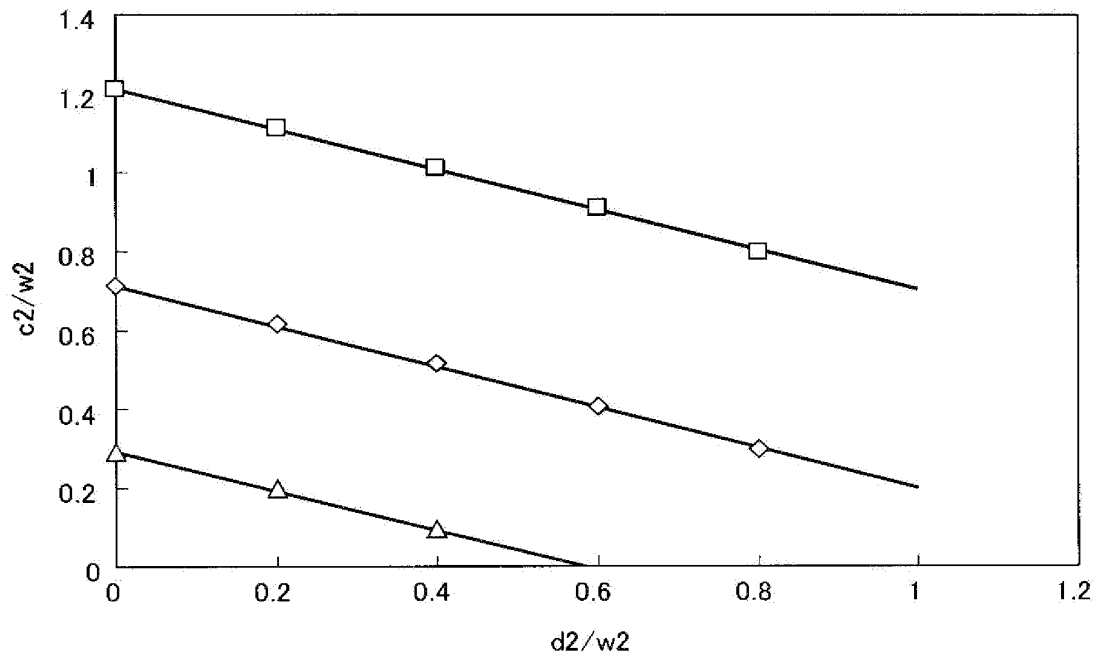
【図 3 6】



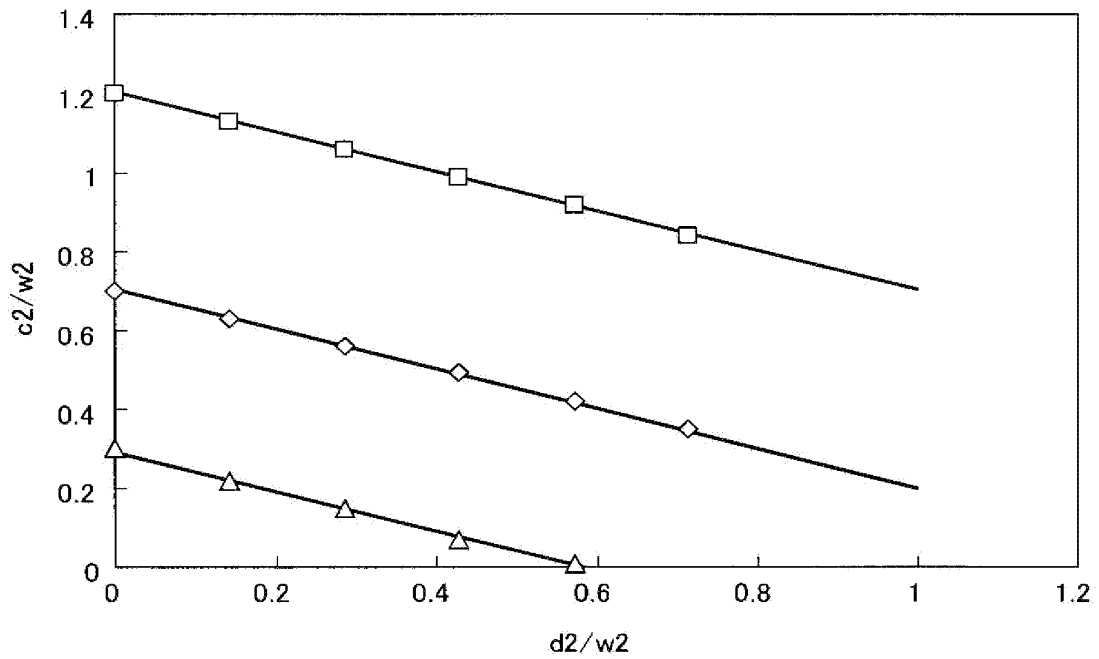
【図 3 7】



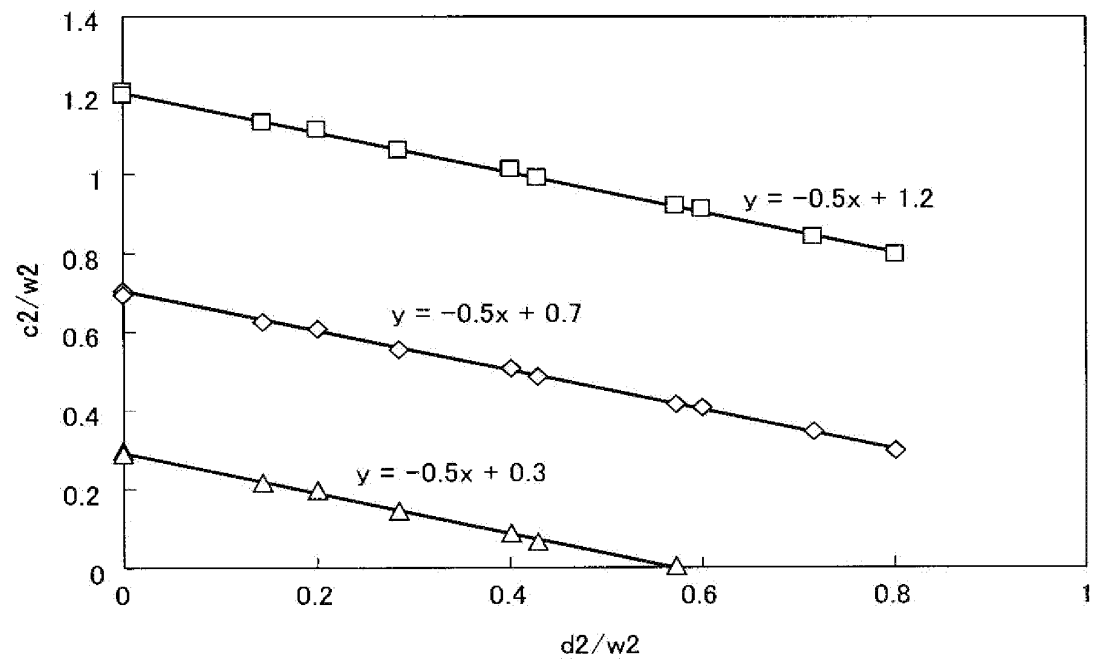
【図 3 8】



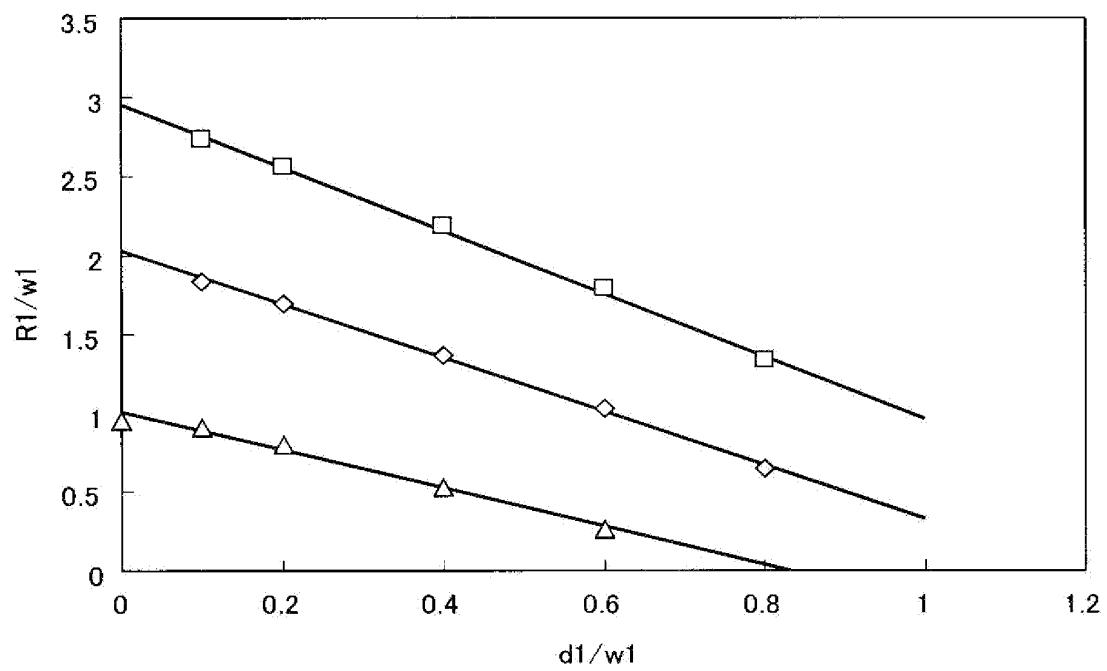
【図 3 9】



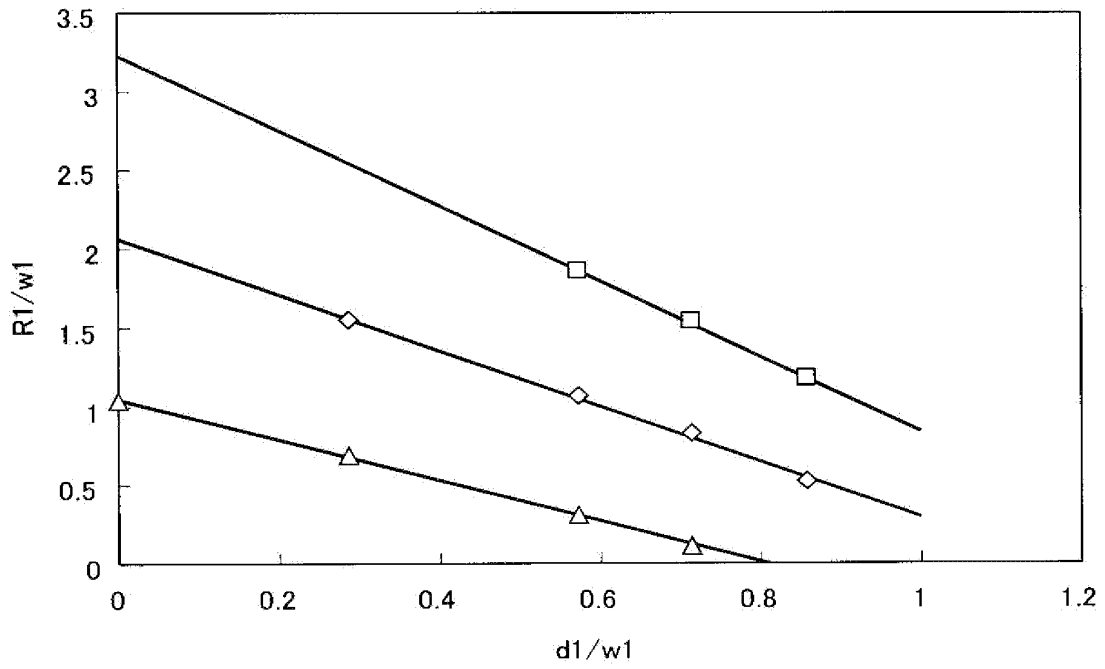
【図 4 0】



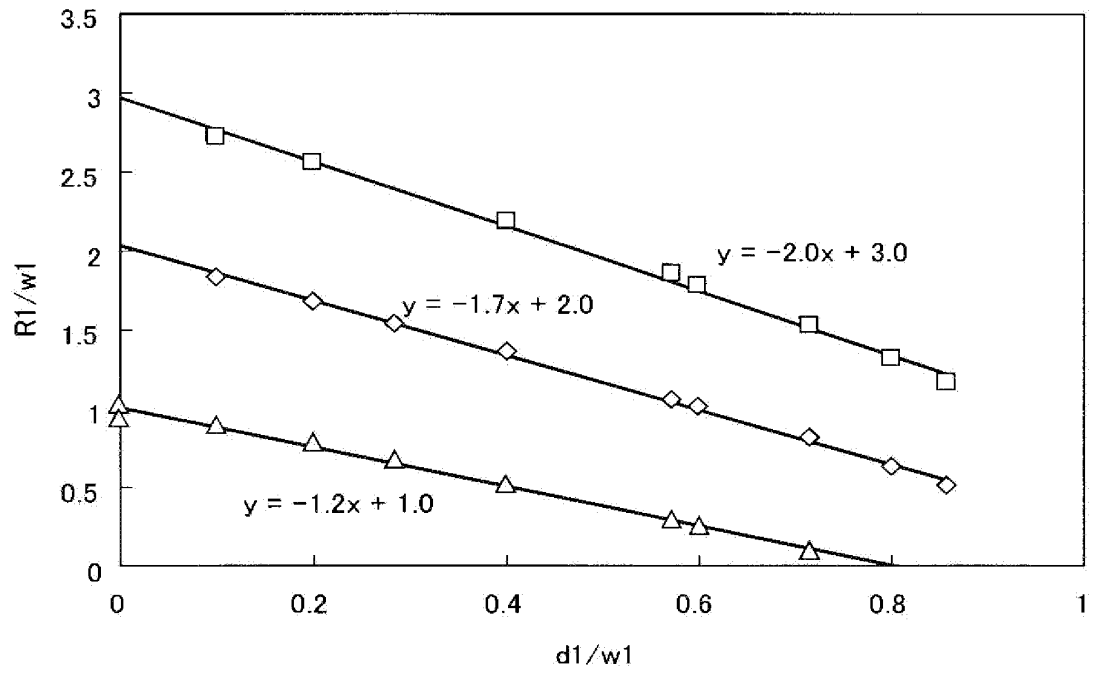
【図 4 1】



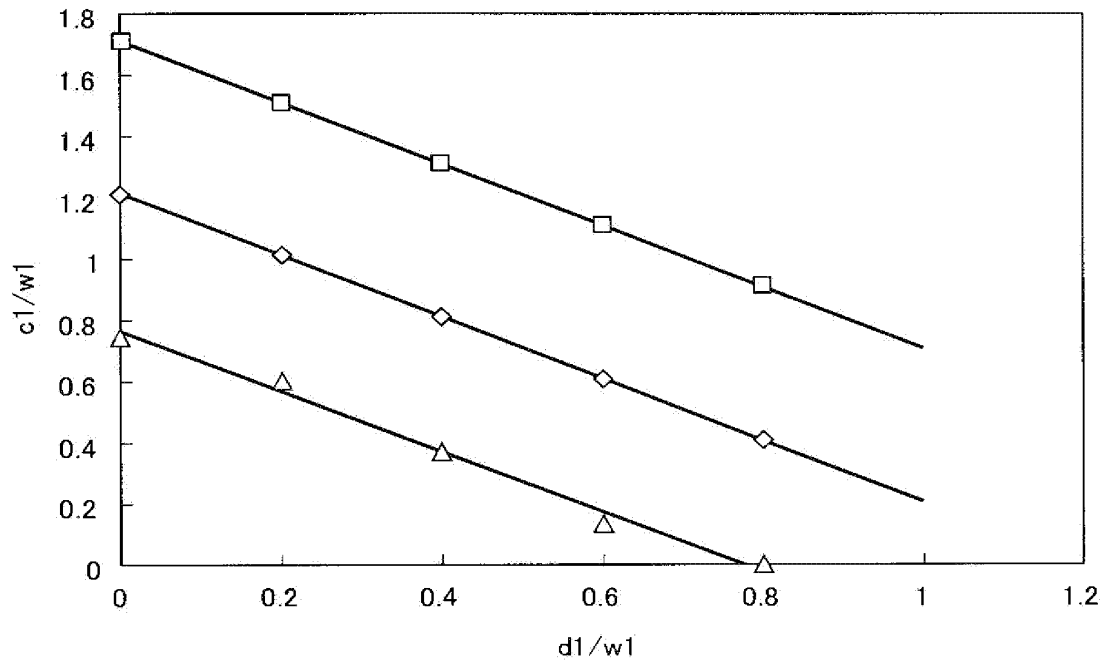
【図 4 2】



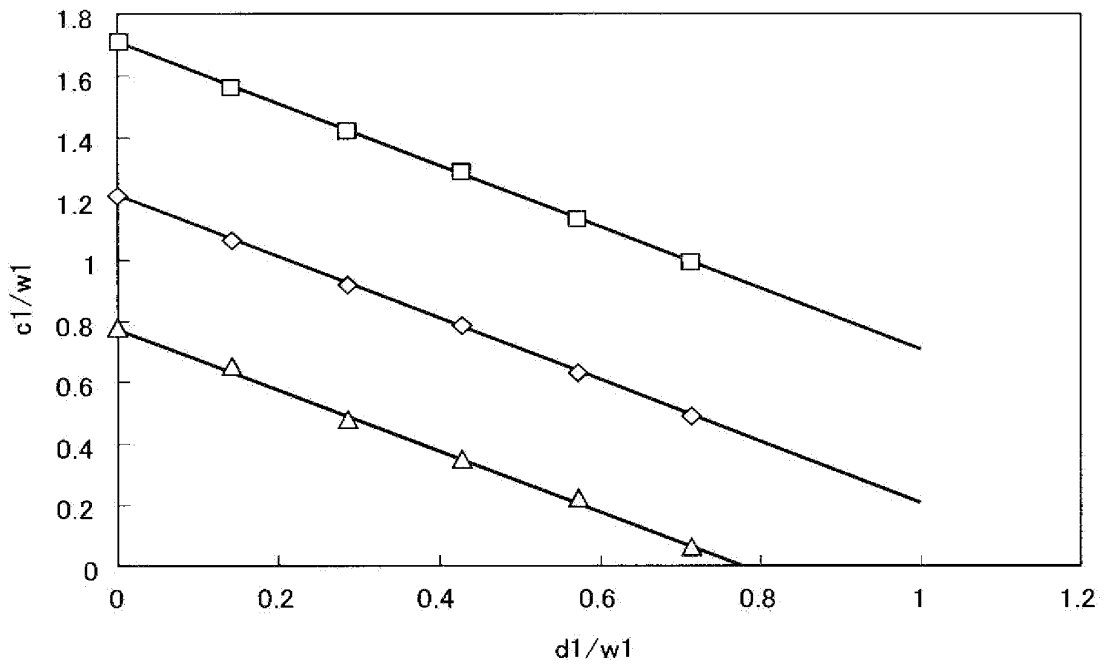
【図 4 3】



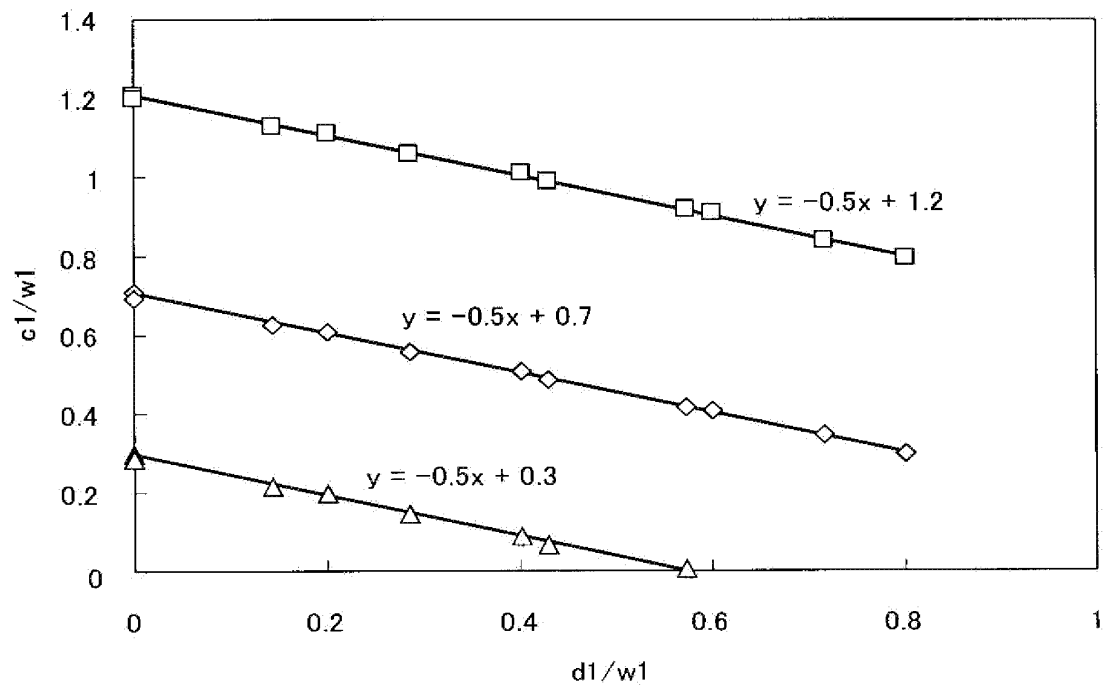
【図 4 4】



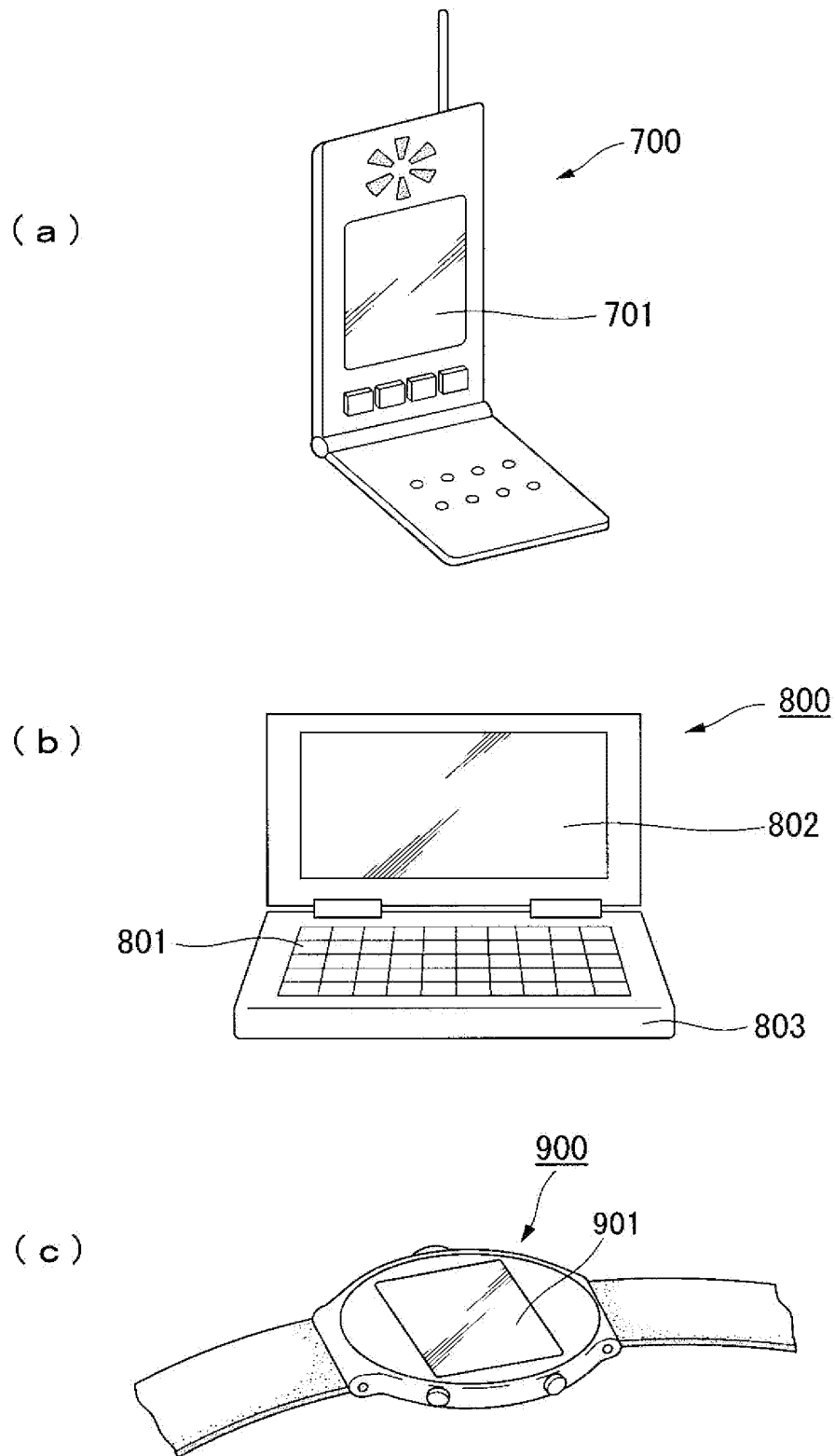
【図 4 5】



【図 4 6】

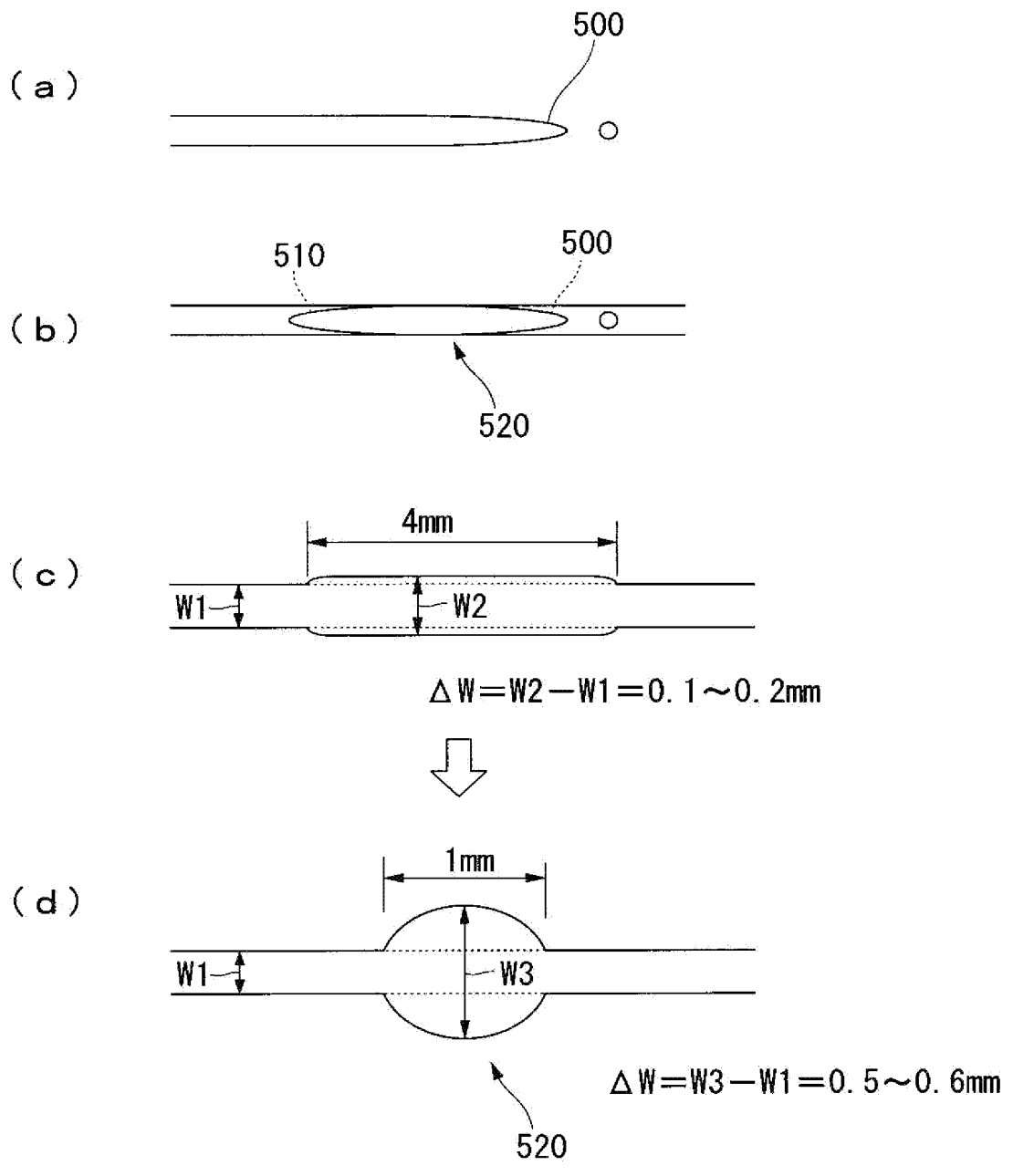


【図47】

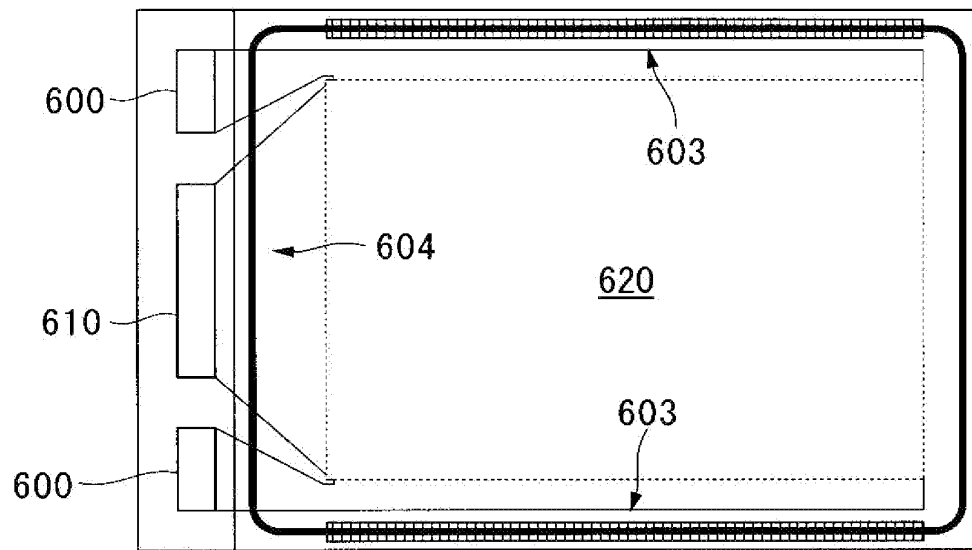




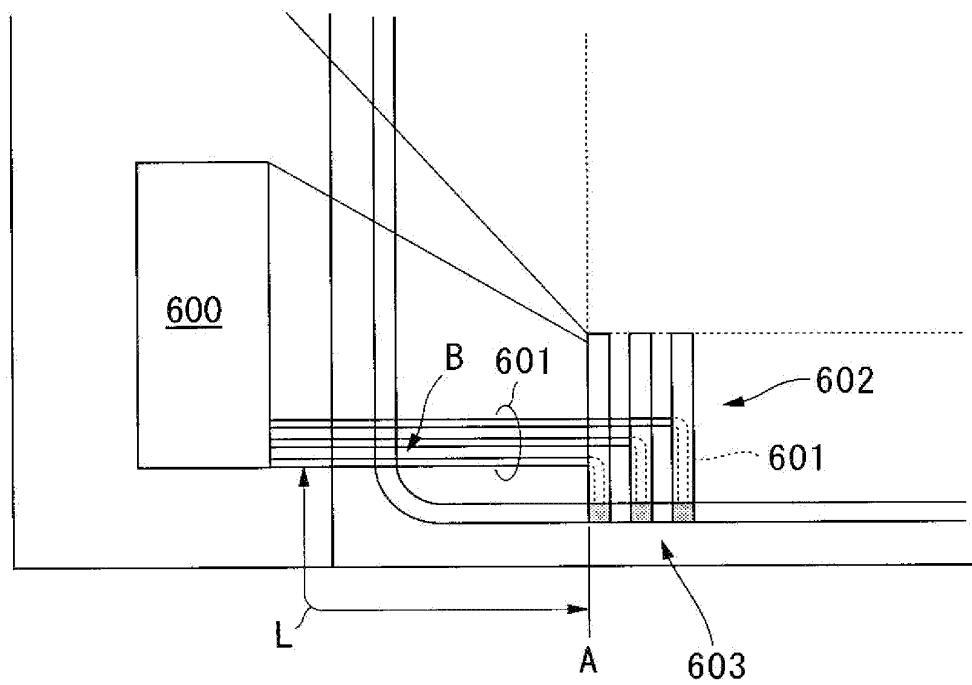
【図48】



【図 49】



【図 50】



【書類名】 要約書

【要約】

【課題】 均一なセルギャップを実現できる液晶装置の製造方法、液晶装置、及び電子機器を提供する。

【解決手段】 液晶層を挟持して対向配置された第 1 基板及び第 2 基板と、当該両基板の周縁部に形成されたシール部材とを具備する液晶装置の製造方法であって、シール部材を形成するシール部材形成工程と、シール部材の内側に液晶層を形成する液晶層形成工程と、第 1 基板と第 2 基板とを貼り合わせる貼り合わせ工程と、を含み、シール部材形成工程は、シール部材の内側に液晶層をシールする環状部と、シール部材が相互に離間して対向する第 1 シール層 5 9 a 及び第 2 シール層 5 9 b と、を形成し、貼り合わせ工程は、第 1 及び第 2 シール層 5 9 a、5 9 b を押圧し、環状部の外側に、第 1 及び第 2 シール層を接合して環状部を形成する接合部を形成すること、を特徴とする。

【選択図】 図 1 7

【書類名】 手続補正書  
 【提出日】 平成20年 9月12日  
 【あて先】 特許庁長官 殿  
 【事件の表示】  
     【出願番号】 特願2004-375697  
 【補正をする者】  
     【識別番号】 000002369  
     【氏名又は名称】 セイコーエプソン株式会社  
 【代理人】  
     【識別番号】 100107836  
     【弁理士】  
     【氏名又は名称】 西 和哉  
 【手続補正1】  
     【補正対象書類名】 特許請求の範囲  
     【補正対象項目名】 全文  
     【補正方法】 変更  
     【補正の内容】  
         【書類名】 特許請求の範囲  
         【請求項 1】

液晶層を挟持して対向配置された第1基板及び第2基板と、当該両基板の周縁部に形成され前記液晶層をシールする環状部を含むシール部材とを具備する液晶装置の製造方法であって、

それぞれ前記環状部の一部をなす第1シール部材と第2シール部材とを、前記第1シール部材の両端部に曲線部を介して接続された第1シール層と、第2部材の両端部に曲線部を介して接続された第2シール部材とが相互に離間するとともに対向した状態となるように形成する工程と、

前記第1シール部材及び前記第2シール部材により囲まれる領域の内側に前記液晶層を形成する工程と、

前記第1基板と前記第2基板とを貼り合わせる際、前記第1及び第2シール層を押圧して前記第1シール部材と前記第2シール部材とを接合させる接合部を前記環状部の外側に形成する工程と、を含み、

前記基板の貼り合せ工程前における前記曲線部の半径を $R_2$ 、前記基板の貼り合せ工程前における前記第1シール層及び前記第2シール層が最も近接する領域における中心線間の距離を $d_2$ 、前記基板の貼り合せ工程後における前記第1シール部材及び前記第2シール部材の幅を $w_2$ とすると、

式(1)～(3)の関係が成立していることを特徴とする液晶装置の製造方法。

$$(R_2/w_2) \leq -1.2 \times (d_2/w_2) + 2.0 \quad \cdots \text{式(1)}$$

$$(R_2/w_2) \geq -0.6 \times (d_2/w_2) + 0.4 \quad \cdots \text{式(2)}$$

$$0 \leq d_2 \leq 0.8 \times w_2 \quad \cdots \text{式(3)}$$

【請求項2】

さらに式(4)の関係が成立していることを特徴とする請求項1に記載の液晶装置の製造方法。

$$(R_2/w_2) \leq -(d_2/w_2) + 1.2 \quad \cdots \text{式(4)}$$

【請求項3】

液晶層を挟持して対向配置された第1基板及び第2基板と、当該両基板の周縁部に形成され前記液晶層をシールする環状部を含むシール部材とを具備する液晶装置の製造方法であって、

それぞれ前記環状部の一部をなす第1シール部材と第2シール部材とを、前記第1シール部材の両端部に傾斜部を介して接続された第1シール層と、第2部材の両端部に傾斜部を介して接続された第2シール部材とが相互に離間するとともに対向した状態となるよう

に形成する工程と、

前記第 1 シール部材及び前記第 2 シール部材により囲まれる領域の内側に前記液晶層を形成する工程と、

前記第 1 基板と前記第 2 基板とを貼り合わせる際、前記第 1 及び第 2 シール層を押圧して前記第 1 シール部材と前記第 2 シール部材とを接合させる接合部を前記環状部の外側に形成する工程と、を含み、

前記基板の貼り合せ工程前における前記傾斜部の面取り量を  $c_2$ 、前記基板の貼り合せ工程前における前記第 1 シール層及び前記第 2 シール層が最も近接する領域における中心線間の距離を  $d_2$ 、前記基板の貼り合せ工程後における前記第 1 シール部材及び前記第 2 シール部材の幅を  $w_2$  とすると、

式 (5) ~ (7) の関係が成立していることを特徴とする液晶装置の製造方法。

$$(c_2/w_2) \leq -0.5 \times (d_2/w_2) + 1.2 \quad \text{…式 (5)}$$

$$(c_2/w_2) \geq -0.5 \times (d_2/w_2) + 0.3 \quad \text{…式 (6)}$$

$$0 \leq d_2 \leq 0.8 \times w_2 \quad \text{…式 (7)}$$

【請求項 4】

さらに式 (8) の関係が成立していることを特徴とする請求項 3 に記載の液晶装置の製造方法。

$$(c_2/w_2) \leq -0.5 \times (d_2/w_2) + 0.7 \quad \text{…式 (8)}$$

【請求項 5】

液晶層を挟持して対向配置された第 1 基板及び第 2 基板と、当該両基板の周縁部に形成され前記液晶層をシールする環状部を含むシール部材とを具備する液晶装置の製造方法であって、

それぞれ前記環状部の一部をなす第 1 シール部材と第 2 シール部材とを、直線状に形成される前記第 1 シール部材の両端部に設けられる第 1 シール層と、第 2 部材の両端部に曲線部を介して接続された第 2 シール部材とが相互に離間するとともに対向した状態となるように形成する工程と、

前記第 1 シール部材及び前記第 2 シール部材により囲まれる領域の内側に前記液晶層を形成する工程と、

前記第 1 基板と前記第 2 基板とを貼り合わせる際、前記第 1 及び第 2 シール層を押圧して前記第 1 シール部材と前記第 2 シール部材とを接合させる接合部を前記環状部の外側に形成する工程と、を含み、

前記基板の貼り合せ工程前における前記曲線部の半径を  $R_1$ 、前記基板の貼り合せ工程前における前記第 1 シール層及び前記第 2 シール層が最も近接する領域における中心線間の距離を  $d_1$ 、前記基板の貼り合せ工程後における前記第 1 シール部材及び前記第 2 シール部材の幅を  $w_1$  とすると、

式 (9) ~ (11) の関係が成立していることを特徴とする液晶装置の製造方法。

$$(R_1/w_1) \leq -2.0 \times (d_1/w_1) + 3.0 \quad \text{…式 (9)}$$

$$(R_1/w_1) \geq -1.2 \times (d_1/w_1) + 1.0 \quad \text{…式 (10)}$$

$$0 \leq d_1 \leq 0.8 \times w_1 \quad \text{…式 (11)}$$

【請求項 6】

さらに式 (12) の関係が成立していることを特徴とする請求項 5 に記載の液晶装置の製造方法。

$$(R_1/w_1) \leq -1.7 \times (d_1/w_1) + 2.0 \quad \text{…式 (12)}$$

【請求項 7】

液晶層を挟持して対向配置された第 1 基板及び第 2 基板と、当該両基板の周縁部に形成され前記液晶層をシールする環状部を含むシール部材とを具備する液晶装置の製造方法であって、

それぞれ前記環状部の一部をなす第 1 シール部材と第 2 シール部材とを、直線状に形成される前記第 1 シール部材の両端部に設けられる第 1 シール層と、第 2 部材の両端部に傾斜部を介して接続された第 2 シール部材とが相互に離間するとともに対向した状態となる

ように形成する工程と、

前記第 1 シール部材及び前記第 2 シール部材により囲まれる領域の内側に前記液晶層を形成する工程と、

前記第 1 基板と前記第 2 基板とを貼り合わせる際、前記第 1 及び第 2 シール層を押圧して前記第 1 シール部材と前記第 2 シール部材とを接合させる接合部を前記環状部の外側に形成する工程と、を含み、

前記基板の貼り合せ工程前における前記傾斜部の面取り量を  $c_1$ 、前記基板の貼り合せ工程前における前記第 1 シール層及び前記第 2 シール層が最も近接する領域における中心線間の距離を  $d_1$ 、前記基板の貼り合せ工程後における前記第 1 シール部材及び前記第 2 シール部材の幅を  $w_1$  とすると、

式 (13) ~ (15) の関係が成立していることを特徴とする液晶装置の製造方法。

$$(c_1 / w_1) \leq -0.5 \times (d_1 / w_1) + 1.2 \quad \cdots \text{式 (13)}$$

$$(c_1 / w_1) \geq -0.5 \times (d_1 / w_1) + 0.3 \quad \cdots \text{式 (14)}$$

$$0 \leq d_1 \leq 0.8 \times w_1 \quad \cdots \text{式 (15)}$$

【請求項 8】

さらに式 (16) の関係が成立していることを特徴とする請求項 7 に記載の液晶装置の製造方法。

$$(c_1 / w_1) \leq -0.5 \times (d_1 / w_1) + 0.7 \quad \cdots \text{式 (16)}$$

【請求項 9】

前記第 1 基板は、複数の第 2 素子領域を有する第 1 母材を、当該複数の第 1 素子領域の相互境界部において分割して、前記第 1 素子領域毎に得られたものであり、

前記第 2 基板は、複数の第 2 素子領域を有する第 2 母材を、当該複数の第 2 素子領域の相互境界部において分割して、前記第 2 素子領域毎に得られたものであり、

前記第 1 シール部材及び前記第 2 シール部材は、前記第 1 母材又は前記第 2 母材のいずれか一方に連続して形成されること、

を特徴とする請求項 1 ~ 8 のいずれか一項に記載の液晶装置の製造方法。

【請求項 10】

液晶層を挟持して対向配置された第 1 基板及び第 2 基板と、当該両基板の周縁部に形成され前記液晶層をシールする環状部を含むシール部材とを具備する液晶装置の製造方法であって、

複数の第 1 素子領域を有する第 1 母材に、前記複数の第 1 素子領域の配列方向に沿って連続して前記シール部材の一部をなす第 1 シール部材を形成する工程と、

前記第 1 母材又は複数の第 2 素子領域を有する第 2 母材に、前記複数の第 1 素子領域の配列方向及び前記複数の第 2 素子領域の配列方向のいずれかに沿って連続かつ一括して前記シール部材の残部をなす第 2 シール部材を形成する工程と、

前記第 1 シール部材及び前記第 2 シール部材により囲まれる領域の内側に前記液晶層を形成する工程と、

前記第 1 母材と前記第 2 母材とを貼り合わせる工程と、

貼り合わされた前記第 1 母材及び前記第 2 母材を分割する工程と、

を含み、

前記第 1 シール部材の形成工程は、前記複数の第 1 素子領域の相互境界部に第 1 シール層を形成し、

前記第 2 シール部材の形成工程は、前記複数の第 1 素子領域の相互境界部及び前記複数の第 2 素子領域の相互境界部のいずれかに前記第 1 シール層と離れて対向する第 2 シール層を形成し、

前記貼り合せ工程は、前記第 1 及び第 2 シール層を押圧して前記第 1 シール部材と前記第 2 シール部材とを接合させる接合部を形成するとともに各素子領域毎に前記環状部を形成し、

前記母材の分割工程は、前記相互境界部に形成された前記接合部において前記第 1 母材及び前記第 2 母材を分割して前記第 1 基板及び前記第 2 基板を形成すること、

を特徴とする液晶装置の製造方法。

【請求項 1 1】

前記第 1 シール部材の形成工程は、前記第 1 シール層を、前記第 1 素子領域の配列方向に沿って形成される前記第 1 シール部材の延在方向に対し、前記第 1 素子領域側に凹んでいる凹部に形成することを特徴とする請求項 1 0 に記載の液晶装置の製造方法。

【請求項 1 2】

前記第 2 シール部材の形成工程は、前記第 2 シール層を、前記第 1 素子領域及び前記第 2 素子領域のいずれかの配列方向に沿って形成される前記第 2 シール部材の延在方向に対し、素子領域側に凹んでいる凹部に形成することを特徴とする請求項 1 0 又は 1 1 に記載の液晶装置の製造方法。

【請求項 1 3】

液晶層を挟持して対向配置された第 1 基板及び第 2 基板と、当該両基板の周縁部に形成されたシール部材とを具備する液晶装置であって、

請求項 1 から請求項 9 のいずれか一項に記載の製造方法によって製造されたことを特徴とする液晶装置。

【請求項 1 4】

請求項 1 3 に記載の液晶装置を具備すること、  
を特徴とする電子機器。

【書類名】 手続補正書  
 【提出日】 平成21年 5月18日  
 【あて先】 特許庁長官 殿  
 【事件の表示】  
     【出願番号】 特願2004-375697  
 【補正をする者】  
     【識別番号】 000002369  
     【氏名又は名称】 セイコーエプソン株式会社  
 【代理人】  
     【識別番号】 100107836  
     【弁理士】  
     【氏名又は名称】 西 和哉  
 【手続補正1】  
     【補正対象書類名】 特許請求の範囲  
     【補正対象項目名】 全文  
     【補正方法】 変更  
     【補正の内容】  
         【書類名】 特許請求の範囲  
         【請求項 1】

液晶層を挟持して対向配置された第1基板及び第2基板と、当該両基板の周縁部に形成され前記液晶層をシールする環状部を含むシール部材とを具備する液晶装置の製造方法であって、

それぞれ前記環状部の一部となる第1シール部材と第2シール部材とを、前記第1シール部材の両端部に曲線部を介して接続された第1シール層と、第2シール部材の両端部に曲線部を介して接続された第2シール層とが相互に離間するとともに対向した状態となるように形成する工程と、

前記第1シール部材及び前記第2シール部材により囲まれる領域の内側に前記液晶層を形成する工程と、

前記第1基板と前記第2基板とを貼り合わせる際、前記第1及び第2シール層を押圧することで当該第1及び第2シール層が接合されてなる接合部を形成するとともに前記接合部を介して前記第1シール部材と前記第2シール部材とを接続させる工程と、を含み、

前記基板の貼り合せ工程前における前記曲線部の半径を $R_2$ 、前記基板の貼り合せ工程前における前記第1シール層及び前記第2シール層が最も近接する領域における中心線間の距離を $d_2$ 、前記基板の貼り合せ工程後における前記第1シール部材及び前記第2シール部材の幅を $w_2$ とすると、

式(1)～(3)の関係が成立していることを特徴とする液晶装置の製造方法。

$$(R_2/w_2) \leq -1.2 \times (d_2/w_2) + 2.0 \quad \cdots \text{式(1)}$$

$$(R_2/w_2) \geq -0.6 \times (d_2/w_2) + 0.4 \quad \cdots \text{式(2)}$$

$$0 \leq d_2 \leq 0.8 \times w_2 \quad \cdots \text{式(3)}$$

【請求項2】

さらに式(4)の関係が成立していることを特徴とする請求項1に記載の液晶装置の製造方法。

$$(R_2/w_2) \leq -(d_2/w_2) + 1.2 \quad \cdots \text{式(4)}$$

【請求項3】

液晶層を挟持して対向配置された第1基板及び第2基板と、当該両基板の周縁部に形成され前記液晶層をシールする環状部を含むシール部材とを具備する液晶装置の製造方法であって、

それぞれ前記環状部の一部となる第1シール部材と第2シール部材とを、前記第1シール部材の両端部に曲線部を介して接続された第1シール層と、第2シール部材の両端部に曲線部を介して接続された第2シール層とが相互に離間するとともに対向した状態となる



ように形成する工程と、

前記第1シール部材及び前記第2シール部材により囲まれる領域の内側に前記液晶層を形成する工程と、

前記第1基板と前記第2基板とを貼り合わせる際、前記第1及び第2シール層を押圧することで当該第1及び第2シール層が接合されてなる接合部を形成するとともに前記接合部を介して前記第1シール部材と前記第2シール部材とを接続させる工程と、を含み、

前記基板の貼り合せ工程前における前記傾斜部の面取り量を $c_2$ 、前記基板の貼り合せ工程前における前記第1シール層及び前記第2シール層が最も近接する領域における中心線間の距離を $d_2$ 、前記基板の貼り合せ工程後における前記第1シール部材及び前記第2シール部材の幅を $w_2$ とすると、

式(5)～(7)の関係が成立していることを特徴とする液晶装置の製造方法。

$$(c_2/w_2) \leq -0.5 \times (d_2/w_2) + 1.2 \quad \text{…式(5)}$$

$$(c_2/w_2) \geq -0.5 \times (d_2/w_2) + 0.3 \quad \text{…式(6)}$$

$$0 \leq d_2 \leq 0.8 \times w_2 \quad \text{…式(7)}$$

【請求項4】

さらに式(8)の関係が成立していることを特徴とする請求項3に記載の液晶装置の製造方法。

$$(c_2/w_2) \leq -0.5 \times (d_2/w_2) + 0.7 \quad \text{…式(8)}$$

【請求項5】

液晶層を挟持して対向配置された第1基板及び第2基板と、当該両基板の周縁部に形成され前記液晶層をシールする環状部を含むシール部材とを具備する液晶装置の製造方法であって、

それぞれ前記環状部の一部となる第1シール部材と第2シール部材とを、前記第1シール部材の両端部に曲線部を介して接続された第1シール層と、第2シール部材の両端部に曲線部を介して接続された第2シール層とが相互に離間するとともに対向した状態となるように形成する工程と、

前記第1シール部材及び前記第2シール部材により囲まれる領域の内側に前記液晶層を形成する工程と、

前記第1基板と前記第2基板とを貼り合わせる際、前記第1及び第2シール層を押圧することで当該第1及び第2シール層が接合されてなる接合部を形成するとともに前記接合部を介して前記第1シール部材と前記第2シール部材とを連続的に接続させる工程と、を含み、

前記基板の貼り合せ工程前における前記曲線部の半径を $R_1$ 、前記基板の貼り合せ工程前における前記第1シール層及び前記第2シール層が最も近接する領域における中心線間の距離を $d_1$ 、前記基板の貼り合せ工程後における前記第1シール部材及び前記第2シール部材の幅を $w_1$ とすると、

式(9)～(11)の関係が成立していることを特徴とする液晶装置の製造方法。

$$(R_1/w_1) \leq -2.0 \times (d_1/w_1) + 3.0 \quad \text{…式(9)}$$

$$(R_1/w_1) \geq -1.2 \times (d_1/w_1) + 1.0 \quad \text{…式(10)}$$

$$0 \leq d_1 \leq 0.8 \times w_1 \quad \text{…式(11)}$$

【請求項6】

さらに式(12)の関係が成立していることを特徴とする請求項5に記載の液晶装置の製造方法。

$$(R_1/w_1) \leq -1.7 \times (d_1/w_1) + 2.0 \quad \text{…式(12)}$$

【請求項7】

液晶層を挟持して対向配置された第1基板及び第2基板と、当該両基板の周縁部に形成され前記液晶層をシールする環状部を含むシール部材とを具備する液晶装置の製造方法であって、

それぞれ前記環状部の一部となる第1シール部材と第2シール部材とを、前記第1シール部材の両端部に曲線部を介して接続された第1シール層と、第2シール部材の両端部に

曲線部を介して接続された第2シール層とが相互に離間するとともに対向した状態となるように形成する工程と、

前記第1シール部材及び前記第2シール部材により囲まれる領域の内側に前記液晶層を形成する工程と、

前記第1基板と前記第2基板とを貼り合わせる際、前記第1及び第2シール層を押圧することで当該第1及び第2シール層が接合されてなる接合部を形成するとともに前記接合部を介して前記第1シール部材と前記第2シール部材とを接続させる工程と、を含み、

前記基板の貼り合せ工程前における前記傾斜部の面取り量を $c1$ 、前記基板の貼り合せ工程前における前記第1シール層及び前記第2シール層が最も近接する領域における中心線間の距離を $d1$ 、前記基板の貼り合せ工程後における前記第1シール部材及び前記第2シール部材の幅を $w1$ とすると、

式(13)～(15)の関係が成立していることを特徴とする液晶装置の製造方法。

$$(c1/w1) \leq -0.5 \times (d1/w1) + 1.2 \quad \text{…式(13)}$$

$$(c1/w1) \geq -0.5 \times (d1/w1) + 0.3 \quad \text{…式(14)}$$

$$0 \leq d1 \leq 0.8 \times w1 \quad \text{…式(15)}$$

【請求項8】

さらに式(16)の関係が成立していることを特徴とする請求項7に記載の液晶装置の製造方法。

$$(c1/w1) \leq -0.5 \times (d1/w1) + 0.7 \quad \text{…式(16)}$$

【請求項9】

前記第1基板は、複数の第2素子領域を有する第1母材を、当該複数の第1素子領域の相互境界部において分割して、前記第1素子領域毎に得られたものであり、

前記第2基板は、複数の第2素子領域を有する第2母材を、当該複数の第2素子領域の相互境界部において分割して、前記第2素子領域毎に得られたものであり、

前記第1シール部材及び前記第2シール部材は、前記第1母材又は前記第2母材のいずれか一方に連続して形成されること、

を特徴とする請求項1～8のいずれか一項に記載の液晶装置の製造方法。

【請求項10】

液晶層を挟持して対向配置された第1基板及び第2基板と、当該両基板の周縁部に形成され前記液晶層をシールする環状部を含むシール部材とを具備する液晶装置の製造方法であって、

複数の第1素子領域を有する第1母材に、前記複数の第1素子領域の配列方向に沿って連続して前記シール部材の一部をなす第1シール部材を形成する工程と、

前記第1母材又は複数の第2素子領域を有する第2母材に、前記複数の第1素子領域の配列方向及び前記複数の第2素子領域の配列方向のいずれかに沿って連続かつ一括して前記シール部材の残部をなす第2シール部材を形成する工程と、

前記第1シール部材及び前記第2シール部材により囲まれる領域の内側に前記液晶層を形成する工程と、

前記第1母材と前記第2母材とを貼り合わせる工程と、

貼り合わされた前記第1母材及び前記第2母材を分割する工程と、

を含み、

前記第1シール部材の形成工程は、前記複数の第1素子領域の相互境界部に第1シール層を形成し、

前記第2シール部材の形成工程は、前記複数の第1素子領域の相互境界部及び前記複数の第2素子領域の相互境界部のいずれかに前記第1シール層と離れて対向する第2シール層を形成し、

前記貼り合せ工程は、前記第1及び第2シール層を押圧して前記第1シール部材と前記第2シール部材とを接合させる接合部を形成するとともに各素子領域毎に前記環状部を形成し、

前記母材の分割工程は、前記相互境界部に形成された前記接合部において前記第1母材

及び前記第 2 母材を分割して前記第 1 基板及び前記第 2 基板を形成すること、  
を特徴とする液晶装置の製造方法。

【請求項 1 1】

前記第 1 シール部材の形成工程は、前記第 1 シール層を、前記第 1 素子領域の配列方向に沿って形成される前記第 1 シール部材の延在方向に対し、前記第 1 素子領域側に凹んでいる凹部に形成することを特徴とする請求項 1 0 に記載の液晶装置の製造方法。

【請求項 1 2】

前記第 2 シール部材の形成工程は、前記第 2 シール層を、前記第 1 素子領域及び前記第 2 素子領域のいずれかの配列方向に沿って形成される前記第 2 シール部材の延在方向に対し、素子領域側に凹んでいる凹部に形成することを特徴とする請求項 1 0 又は 1 1 に記載の液晶装置の製造方法。

【請求項 1 3】

液晶層を挟持して対向配置された第 1 基板及び第 2 基板と、当該両基板の周縁部に形成されたシール部材とを具備する液晶装置であって、

請求項 1 から請求項 9 のいずれか一項に記載の製造方法によって製造されたことを特徴とする液晶装置。

【請求項 1 4】

請求項 1 3 に記載の液晶装置を具備すること、  
を特徴とする電子機器。

【書類名】 手続補正書  
 【提出日】 平成21年 8月21日  
 【あて先】 特許庁長官 殿  
 【事件の表示】  
     【出願番号】 特願2004-375697  
 【補正をする者】  
     【識別番号】 000002369  
     【氏名又は名称】 セイコーエプソン株式会社  
 【代理人】  
     【識別番号】 100107836  
     【弁理士】  
     【氏名又は名称】 西 和哉  
 【代理人】  
     【識別番号】 100064908  
     【弁理士】  
     【氏名又は名称】 志賀 正武  
 【手続補正1】  
     【補正対象書類名】 特許請求の範囲  
     【補正対象項目名】 全文  
     【補正方法】 変更  
     【補正の内容】  
         【書類名】特許請求の範囲  
         【請求項1】

液晶層を挟持して対向配置された第1基板及び第2基板と、当該両基板の周縁部に形成され前記液晶層をシールする環状部を含むシール部材とを具備する液晶装置の製造方法であって、

それぞれ前記環状部の一部となる第1シール部材と第2シール部材とを、前記第1シール部材の両端部に曲線部を介して接続された第1シール層と、第2シール部材の両端部に曲線部を介して接続された第2シール層とが相互に離間するとともに対向した状態となるように形成する工程と、

前記第1シール部材及び前記第2シール部材により囲まれる領域の内側に前記液晶層を形成する工程と、

前記第1基板と前記第2基板とを貼り合わせる際、前記第1及び第2シール層を押圧することで当該第1及び第2シール層が接合されてなる接合部を前記環状部の外側に形成するとともに前記接合部を介して前記第1シール部材と前記第2シール部材とを接続させる工程と、を含み、

前記基板の貼り合せ工程前における前記曲線部の半径を $R_2$ 、前記基板の貼り合せ工程前における前記第1シール層及び前記第2シール層が最も近接する領域における中心線間の距離を $d_2$ 、前記基板の貼り合せ工程後における前記第1シール部材及び前記第2シール部材の幅を $w_2$ とすると、

式(1)～(3)の関係が成立していることを特徴とする液晶装置の製造方法。

$$(R_2/w_2) \leq -1.2 \times (d_2/w_2) + 2.0 \quad \cdots \text{式(1)}$$

$$(R_2/w_2) \geq -0.6 \times (d_2/w_2) + 0.4 \quad \cdots \text{式(2)}$$

$$0 \leq d_2 \leq 0.8 \times w_2 \quad \cdots \text{式(3)}$$

【請求項2】

さらに式(4)の関係が成立していることを特徴とする請求項1に記載の液晶装置の製造方法。

$$(R_2/w_2) \leq -(d_2/w_2) + 1.2 \quad \cdots \text{式(4)}$$

【請求項 3】

液晶層を挟持して対向配置された第 1 基板及び第 2 基板と、当該両基板の周縁部に形成され前記液晶層をシールする環状部を含むシール部材とを具備する液晶装置の製造方法であって、

それぞれ前記環状部の一部となる第 1 シール部材と第 2 シール部材とを、前記第 1 シール部材の両端部に傾斜部を介して接続された第 1 シール層と、第 2 シール部材の両端部に傾斜部を介して接続された第 2 シール層とが相互に離間するとともに対向した状態となるように形成する工程と、

前記第 1 シール部材及び前記第 2 シール部材により囲まれる領域の内側に前記液晶層を形成する工程と、

前記第 1 基板と前記第 2 基板とを貼り合わせる際、前記第 1 及び第 2 シール層を押圧することで当該第 1 及び第 2 シール層が接合されてなる接合部を前記環状部の外側に形成するとともに前記接合部を介して前記第 1 シール部材と前記第 2 シール部材とを接続させる工程と、を含み、

前記基板の貼り合せ工程前における前記傾斜部の面取り量を  $c/2$ 、前記基板の貼り合せ工程前における前記第 1 シール層及び前記第 2 シール層が最も近接する領域における中心線間の距離を  $d/2$ 、前記基板の貼り合せ工程後における前記第 1 シール部材及び前記第 2 シール部材の幅を  $w/2$  とすると、

式 (5) ~ (7) の関係が成立していることを特徴とする液晶装置の製造方法。

$$(c/2/w/2) \leq -0.5 \times (d/2/w/2) + 1.2 \quad \text{…式 (5)}$$

$$(c/2/w/2) \geq -0.5 \times (d/2/w/2) + 0.3 \quad \text{…式 (6)}$$

$$0 \leq d/2 \leq 0.8 \times w/2 \quad \text{…式 (7)}$$

【請求項 4】

さらに式 (8) の関係が成立していることを特徴とする請求項 3 に記載の液晶装置の製造方法。

$$(c/2/w/2) \leq -0.5 \times (d/2/w/2) + 0.7 \quad \text{…式 (8)}$$

【請求項 5】

液晶層を挟持して対向配置された第 1 基板及び第 2 基板と、当該両基板の周縁部に形成され前記液晶層をシールする環状部を含むシール部材とを具備する液晶装置の製造方法であって、

それぞれ前記環状部の一部となる第 1 シール部材と第 2 シール部材とを、直線状に形成される前記第 1 シール部材の両端部に設けられる第 1 シール層と、第 2 シール部材の両端部に曲線部を介して接続された第 2 シール層とが相互に離間するとともに対向した状態となるように形成する工程と、

前記第 1 シール部材及び前記第 2 シール部材により囲まれる領域の内側に前記液晶層を形成する工程と、

前記第 1 基板と前記第 2 基板とを貼り合わせる際、前記第 1 及び第 2 シール層を押圧することで当該第 1 及び第 2 シール層が接合されてなる接合部を前記環状部の外側に形成するとともに前記接合部を介して前記第 1 シール部材と前記第 2 シール部材とを連続的に接続させる工程と、を含み、

前記基板の貼り合せ工程前における前記曲線部の半径を  $R/1$ 、前記基板の貼り合せ工程前における前記第 1 シール層及び前記第 2 シール層が最も近接する領域における中心線間の距離を  $d/1$ 、前記基板の貼り合せ工程後における前記第 1 シール部材及び前記第 2 シール部材の幅を  $w/1$  とすると、

式 (9) ~ (11) の関係が成立していることを特徴とする液晶装置の製造方法。

$$(R/1/w/1) \leq -2.0 \times (d/1/w/1) + 3.0 \quad \text{…式 (9)}$$

$$(R/1/w/1) \geq -1.2 \times (d/1/w/1) + 1.0 \quad \text{…式 (10)}$$

$$0 \leq d/1 \leq 0.8 \times w/1 \quad \text{…式 (11)}$$

【請求項 6】

さらに式（12）の関係が成立していることを特徴とする請求項 5 に記載の液晶装置の製造方法。

$$(R1/w1) \leq -1.7 \times (d1/w1) + 2.0 \quad \cdots \text{式（12）}$$

【請求項 7】

液晶層を挟持して対向配置された第 1 基板及び第 2 基板と、当該両基板の周縁部に形成され前記液晶層をシールする環状部を含むシール部材とを具備する液晶装置の製造方法であって、

それぞれ前記環状部の一部となる第 1 シール部材と第 2 シール部材とを、直線状に形成される前記第 1 シール部材の両端部に設けられる第 1 シール層と、第 2 シール部材の両端部に傾斜部を介して接続された第 2 シール層とが相互に離間するとともに対向した状態となるように形成する工程と、

前記第 1 シール部材及び前記第 2 シール部材により囲まれる領域の内側に前記液晶層を形成する工程と、

前記第 1 基板と前記第 2 基板とを貼り合わせる際、前記第 1 及び第 2 シール層を押圧することで当該第 1 及び第 2 シール層が接合されてなる接合部を前記環状部の外側に形成するとともに前記接合部を介して前記第 1 シール部材と前記第 2 シール部材とを接続させる工程と、を含み、

前記基板の貼り合せ工程前における前記傾斜部の面取り量を  $c1$ 、前記基板の貼り合せ工程前における前記第 1 シール層及び前記第 2 シール層が最も近接する領域における中心線間の距離を  $d1$ 、前記基板の貼り合せ工程後における前記第 1 シール部材及び前記第 2 シール部材の幅を  $w1$  とすると、

式（13）～（15）の関係が成立していることを特徴とする液晶装置の製造方法。

$$(c1/w1) \leq -0.5 \times (d1/w1) + 1.2 \quad \cdots \text{式（13）}$$

$$(c1/w1) \geq -0.5 \times (d1/w1) + 0.3 \quad \cdots \text{式（14）}$$

$$0 \leq d1 \leq 0.8 \times w1 \quad \cdots \text{式（15）}$$

【請求項 8】

さらに式（16）の関係が成立していることを特徴とする請求項 7 に記載の液晶装置の製造方法。

$$(c1/w1) \leq -0.5 \times (d1/w1) + 0.7 \quad \cdots \text{式（16）}$$

【請求項 9】

前記第 1 基板は、複数の第 2 素子領域を有する第 1 母材を、当該複数の第 1 素子領域の相互境界部において分割して、前記第 1 素子領域毎に得られたものであり、

前記第 2 基板は、複数の第 2 素子領域を有する第 2 母材を、当該複数の第 2 素子領域の相互境界部において分割して、前記第 2 素子領域毎に得られたものであり、

前記第 1 シール部材及び前記第 2 シール部材は、前記第 1 母材又は前記第 2 母材のいずれか一方に連続して形成されること、

を特徴とする請求項 1～8 のいずれか一項に記載の液晶装置の製造方法。

【請求項 10】

液晶層を挟持して対向配置された第 1 基板及び第 2 基板と、当該両基板の周縁部に形成され前記液晶層をシールする環状部を含むシール部材とを具備する液晶装置の製造方法であって、

複数の第 1 素子領域を有する第 1 母材に、前記複数の第 1 素子領域の配列方向に沿って連続して前記シール部材の一部をなす第 1 シール部材を形成する工程と、

前記第 1 母材又は複数の第 2 素子領域を有する第 2 母材に、前記複数の第 1 素子領域の

配列方向及び前記複数の第 2 素子領域の配列方向のいずれかに沿って連続かつ一括して前記シール部材の残部をなす第 2 シール部材を形成する工程と、

前記第 1 シール部材及び前記第 2 シール部材により囲まれる領域の内側に前記液晶層を形成する工程と、

前記第 1 母材と前記第 2 母材とを貼り合わせる工程と、

貼り合わされた前記第 1 母材及び前記第 2 母材を分割する工程と、

を含み、

前記第 1 シール部材の形成工程は、前記複数の第 1 素子領域の相互境界部に第 1 シール層を形成し、

前記第 2 シール部材の形成工程は、前記複数の第 1 素子領域の相互境界部及び前記複数の第 2 素子領域の相互境界部のいずれかに前記第 1 シール層と離れて対向する第 2 シール層を形成し、

前記貼り合せ工程は、前記第 1 及び第 2 シール層を押圧して前記第 1 シール部材と前記第 2 シール部材とを接合させる接合部を形成するとともに各素子領域毎に前記環状部を形成し、

前記母材の分割工程は、前記相互境界部に形成された前記接合部において前記第 1 母材及び前記第 2 母材を分割して前記第 1 基板及び前記第 2 基板を形成すること、

を特徴とする液晶装置の製造方法。

#### 【請求項 1 1】

前記第 1 シール部材の形成工程は、前記第 1 シール層を、前記第 1 素子領域の配列方向に沿って形成される前記第 1 シール部材の延在方向に対し、前記第 1 素子領域側に凹んでいる凹部に形成することを特徴とする請求項 1 0 に記載の液晶装置の製造方法。

#### 【請求項 1 2】

前記第 2 シール部材の形成工程は、前記第 2 シール層を、前記第 1 素子領域及び前記第 2 素子領域のいずれかの配列方向に沿って形成される前記第 2 シール部材の延在方向に対し、素子領域側に凹んでいる凹部に形成することを特徴とする請求項 1 0 又は 1 1 に記載の液晶装置の製造方法。

#### 【請求項 1 3】

液晶層を挟持して対向配置された第 1 基板及び第 2 基板と、当該両基板の周縁部に形成されたシール部材とを具備する液晶装置であって、

請求項 1 から請求項 9 のいずれか一項に記載の製造方法によって製造されたことを特徴とする液晶装置。

#### 【請求項 1 4】

請求項 1 3 に記載の液晶装置を具備すること、

を特徴とする電子機器。

出願人履歴

0 0 0 0 0 2 3 6 9

19900820

新規登録

東京都新宿区西新宿 2 丁目 4 番 1 号

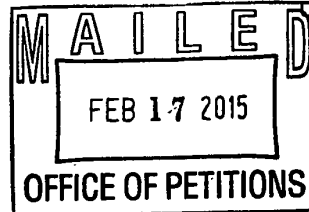
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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                             |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| <b>Decision Granting Request for<br/>Prioritized Examination<br/>(Track I or After RCE)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Application No.: 14/572,068 |
| <p>1. THE REQUEST FILED <u>December 16, 2014</u> IS <b>GRANTED</b>.</p> <p>The above-identified application has met the requirements for prioritized examination</p> <p>A. <input checked="" type="checkbox"/> for an original nonprovisional application (Track I).<br/>B. <input type="checkbox"/> for an application undergoing continued examination (RCE).</p> <p>2. <b>The above-identified application will undergo prioritized examination.</b> The application will be accorded special status throughout its entire course of prosecution until one of the following occurs:</p> <p>A. filing a <b><u>petition for extension of time</u></b> to extend the time period for filing a reply;<br/>B. filing an <b><u>amendment to amend the application to contain more than four independent claims, more than thirty total claims</u></b>, or a multiple dependent claim;<br/>C. filing a <b><u>request for continued examination</u></b>;<br/>D. filing a notice of appeal;<br/>E. filing a request for suspension of action;<br/>F. mailing of a notice of allowance;<br/>G. mailing of a final Office action;<br/>H. completion of examination as defined in 37 CFR 41.102; or<br/>I. abandonment of the application.</p> <p>Telephone inquiries with regard to this decision should be directed to Brian W. Brown at 571-272-5338.</p> <p>/Brian W. Brown/<br/>[Signature]</p> <p>Petitions Examiner, Office of Petitions<br/>(Title)</p> |                             |

| <b>PATENT APPLICATION FEE DETERMINATION RECORD</b><br>Substitute for Form PTO-875                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                               |                                    |               |                 |                    | Application or Docket Number<br>14/572,068 |                 |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|---------------|-----------------|--------------------|--------------------------------------------|-----------------|
| <b>APPLICATION AS FILED - PART I</b>                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                               |                                    |               |                 |                    |                                            |                 |
| (Column 1)                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                               | (Column 2)                         |               | SMALL ENTITY    |                    | OTHER THAN SMALL ENTITY                    |                 |
| FOR                                                                                                                                                                                                                                                                                                                                                                                                        | NUMBER FILED                                                                                                                                                                                                                  | NUMBER EXTRA                       | RATE(\$)      | FEE(\$)         |                    | RATE(\$)                                   | FEE(\$)         |
| BASIC FEE<br>(37 CFR 1.16(a), (b), or (c))                                                                                                                                                                                                                                                                                                                                                                 | N/A                                                                                                                                                                                                                           | N/A                                | N/A           |                 |                    | N/A                                        | 280             |
| SEARCH FEE<br>(37 CFR 1.16(k), (i), or (m))                                                                                                                                                                                                                                                                                                                                                                | N/A                                                                                                                                                                                                                           | N/A                                | N/A           |                 |                    | N/A                                        | 600             |
| EXAMINATION FEE<br>(37 CFR 1.16(o), (p), or (q))                                                                                                                                                                                                                                                                                                                                                           | N/A                                                                                                                                                                                                                           | N/A                                | N/A           |                 |                    | N/A                                        | 720             |
| TOTAL CLAIMS<br>(37 CFR 1.16(i))                                                                                                                                                                                                                                                                                                                                                                           | 20                                                                                                                                                                                                                            | minus 20 = *                       |               |                 |                    | x 80 =                                     | 0.00            |
| INDEPENDENT CLAIMS<br>(37 CFR 1.16(h))                                                                                                                                                                                                                                                                                                                                                                     | 3                                                                                                                                                                                                                             | minus 3 = *                        |               |                 |                    | x 420 =                                    | 0.00            |
| APPLICATION SIZE FEE<br>(37 CFR 1.16(s))                                                                                                                                                                                                                                                                                                                                                                   | If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s). |                                    |               |                 |                    |                                            | 400             |
| MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                               |                                    |               |                 |                    |                                            | 0.00            |
|                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                               |                                    | TOTAL         |                 |                    | TOTAL                                      | 2000            |
| * If the difference in column 1 is less than zero, enter "0" in column 2.                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                               |                                    |               |                 |                    |                                            |                 |
| <b>APPLICATION AS AMENDED - PART II</b>                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                               |                                    |               |                 |                    |                                            |                 |
| (Column 1)                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                               | (Column 2)                         |               | (Column 3)      |                    | SMALL ENTITY                               |                 |
| AMENDMENT A                                                                                                                                                                                                                                                                                                                                                                                                | CLAIMS REMAINING AFTER AMENDMENT                                                                                                                                                                                              | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA | RATE(\$)        | ADDITIONAL FEE(\$) |                                            | RATE(\$)        |
|                                                                                                                                                                                                                                                                                                                                                                                                            | Total<br>(37 CFR 1.16(i))                                                                                                                                                                                                     | *                                  | Minus **      | =               | x =                |                                            | x =             |
|                                                                                                                                                                                                                                                                                                                                                                                                            | Independent<br>(37 CFR 1.16(h))                                                                                                                                                                                               | *                                  | Minus ***     | =               | x =                |                                            | x =             |
|                                                                                                                                                                                                                                                                                                                                                                                                            | Application Size Fee (37 CFR 1.16(s))                                                                                                                                                                                         |                                    |               |                 |                    |                                            |                 |
|                                                                                                                                                                                                                                                                                                                                                                                                            | FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))                                                                                                                                                               |                                    |               |                 |                    |                                            |                 |
|                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                               |                                    |               | TOTAL ADD'L FEE |                    |                                            | TOTAL ADD'L FEE |
| (Column 1)                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                               | (Column 2)                         |               | (Column 3)      |                    | SMALL ENTITY                               |                 |
| AMENDMENT B                                                                                                                                                                                                                                                                                                                                                                                                | CLAIMS REMAINING AFTER AMENDMENT                                                                                                                                                                                              | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA | RATE(\$)        | ADDITIONAL FEE(\$) |                                            | RATE(\$)        |
|                                                                                                                                                                                                                                                                                                                                                                                                            | Total<br>(37 CFR 1.16(i))                                                                                                                                                                                                     | *                                  | Minus **      | =               | x =                |                                            | x =             |
|                                                                                                                                                                                                                                                                                                                                                                                                            | Independent<br>(37 CFR 1.16(h))                                                                                                                                                                                               | *                                  | Minus ***     | =               | x =                |                                            | x =             |
|                                                                                                                                                                                                                                                                                                                                                                                                            | Application Size Fee (37 CFR 1.16(s))                                                                                                                                                                                         |                                    |               |                 |                    |                                            |                 |
|                                                                                                                                                                                                                                                                                                                                                                                                            | FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))                                                                                                                                                               |                                    |               |                 |                    |                                            |                 |
|                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                               |                                    |               | TOTAL ADD'L FEE |                    |                                            | TOTAL ADD'L FEE |
| * If the entry in column 1 is less than the entry in column 2, write "0" in column 3.<br>** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".<br>*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".<br>The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1. |                                                                                                                                                                                                                               |                                    |               |                 |                    |                                            |                 |



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| APPLICATION<br>NUMBER | FILING or<br>371(c) DATE | GRP ART<br>UNIT | FIL FEE REC'D | ATTY. DOCKET NO  | TOT CLAIMS | IND CLAIMS |
|-----------------------|--------------------------|-----------------|---------------|------------------|------------|------------|
| 14/572,068            | 12/16/2014               | 2871            | 2140          | 9319S-001378-COB | 20         | 3          |

CONFIRMATION NO. 6575

27572

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BLOOMFIELD HILLS, MI 48303

## FILING RECEIPT



OC000000073370388

Date Mailed: 02/18/2015

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

### Inventor(s)

Yoichi MOMOSE, Matsumoto, JAPAN;  
Satoshi HASEGAWA, Matsumoto, JAPAN;

### Applicant(s)

Seiko Epson Corporation, Tokyo, JAPAN

**Power of Attorney:** The patent practitioners associated with Customer Number 27572

### Domestic Priority data as claimed by applicant

This application is a CON of 14/571,729 12/16/2014  
which is a DIV of 11/301,086 12/12/2005

**Foreign Applications** (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see <http://www.uspto.gov> for more information.)  
JAPAN 2004-375697 12/27/2004

Permission to Access - A proper **Authorization to Permit Access to Application by Participating Offices** (PTO/SB/39 or its equivalent) has been received by the USPTO.

Request to Retrieve - This application either claims priority to one or more applications filed in an intellectual property Office that participates in the Priority Document Exchange (PDX) program or contains a proper **Request to Retrieve Electronic Priority Application(s)** (PTO/SB/38 or its equivalent). Consequently, the USPTO will attempt to electronically retrieve these priority documents.

**If Required, Foreign Filing License Granted:** 02/11/2015

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 14/572,068**

**Projected Publication Date:** 05/28/2015

**Non-Publication Request:** No

**Early Publication Request:** No  
**Title**

METHOD OF MANUFACTURING A LIQUID CRYSTAL DEVICE

**Preliminary Class**

349

**Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications:** No

## **PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES**

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at <http://www.uspto.gov/web/offices/pac/doc/general/index.html>.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, <http://www.stopfakes.gov>. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

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**Title 35, United States Code, Section 184**  
**Title 37, Code of Federal Regulations, 5.11 & 5.15**

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The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

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No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

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|                                                                                                         |             |                      |                                 |                             |
|---------------------------------------------------------------------------------------------------------|-------------|----------------------|---------------------------------|-----------------------------|
| APPLICATION NO.                                                                                         | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO.             | CONFIRMATION NO.            |
| 14/572,068                                                                                              | 12/16/2014  | Yoichi MOMOSE        | 9319S-001378-COB                | 6575                        |
| 27572 7590 04/23/2015<br>HARNESS, DICKEY & PIERCE, P.L.C.<br>P.O. BOX 828<br>BLOOMFIELD HILLS, MI 48303 |             |                      | EXAMINER<br>NGUYEN, LAUREN      |                             |
|                                                                                                         |             |                      | ART UNIT<br>2871                | PAPER NUMBER                |
|                                                                                                         |             |                      | NOTIFICATION DATE<br>04/23/2015 | DELIVERY MODE<br>ELECTRONIC |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

troydocketing@hdp.com

|                              |                                      |                                      |                                                  |
|------------------------------|--------------------------------------|--------------------------------------|--------------------------------------------------|
| <b>Office Action Summary</b> | <b>Application No.</b><br>14/572,068 | <b>Applicant(s)</b><br>MOMOSE ET AL. |                                                  |
|                              | <b>Examiner</b><br>LAUREN NGUYEN     | <b>Art Unit</b><br>2871              | <b>AIA (First Inventor to File) Status</b><br>No |

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 2 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 12/16/2014.  
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on \_\_\_\_.
- 2a) ☐ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on \_\_\_\_; the restriction requirement and election have been incorporated into this action.
- 4) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims\***

- 5) ☒ Claim(s) 1-20 is/are pending in the application.  
5a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 6) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 7) ☐ Claim(s) \_\_\_\_ is/are rejected.
- 8) ☐ Claim(s) \_\_\_\_ is/are objected to.
- 9) ☒ Claim(s) 1-20 are subject to restriction and/or election requirement.

\* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see [http://www.uspto.gov/patents/init\\_events/pph/index.jsp](http://www.uspto.gov/patents/init_events/pph/index.jsp) or send an inquiry to [PPHfeedback@uspto.gov](mailto:PPHfeedback@uspto.gov).

**Application Papers**

- 10) ☐ The specification is objected to by the Examiner.
- 11) ☐ The drawing(s) filed on \_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

**Certified copies:**

- a) ☐ All    b) ☐ Some\*\*    c) ☐ None of the:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\*\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |                                                                                                                               |                                                                                         |
|-------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)                                                              | 3) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. ____. |
| 2) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b)<br>Paper No(s)/Mail Date ____. | 4) <input type="checkbox"/> Other: ____.                                                |

1. The present application is being examined under the pre-AIA first to invent provisions.

**DETAILED ACTION**

*Election/Restrictions*

2. This application contains claims directed to the following patentably distinct species:

Choose one of:

- A1. The first embodiment (figure 1).
- A2. The second embodiment (figure 19).
- A3. The third embodiment (figure 20).
- A4. The fourth embodiment (figure 25).
- A5. The fifth embodiment (figure 26).
- A6. The sixth embodiment (figure 27).
- A7. The seventh embodiment (figure 28).
- A8. The eight embodiment (figure 29).
- A9. The ninth embodiment (figure 30).
- A10. The tenth embodiment (figure 31).

3. The species are independent or distinct because claims to the different species recite the mutually exclusive characteristics of such species, such as the different arrangements of the seal members. In addition, these species are not obvious variants of each other based on the current record.



4. Applicant is required under 35 U.S.C. 121 to elect a single disclosed species for prosecution on the merits to which the claims shall be restricted if no generic claim is finally held to be allowable.

There is an examination and search burden for these patentably distinct species due to their mutually exclusive characteristics. The species require a different field of search (e.g., searching different classes/subclasses or electronic resources, or employing different search queries); and/or the prior art applicable to one species would not likely be applicable to another species; and/or the species are likely to raise different non-prior art issues under 35 U.S.C. 101 and/or 35 U.S.C. 112, first paragraph.

**Applicant is advised that the reply to this requirement to be complete must include (i) an election of a species to be examined** even though the requirement may be traversed (37 CFR 1.143) **and (ii) identification of the claims encompassing the elected species**, including any claims subsequently added. An argument that a claim is allowable or that all claims are generic is considered nonresponsive unless accompanied by an election.

The election of the species may be made with or without traverse. To preserve a right to petition, the election must be made with traverse. If the reply does not distinctly and specifically point out supposed errors in the election of species requirement, the election shall be treated as an election without traverse. Traversal must be presented at the time of election in order to be considered timely. Failure to timely traverse the requirement will result in the loss of right to petition under 37 CFR 1.144. If claims are added after the election, applicant must indicate which of these claims are readable on the elected species or grouping of patentably indistinct species.

Should applicant traverse on the ground that the species are not patentably distinct, applicant should submit evidence or identify such evidence now of record showing the species to be obvious variants or clearly admit on the record that this is the case. In either instance, if the examiner finds one of the species unpatentable over the prior art, the evidence or admission may be used in a rejection under 35 U.S.C. 103(a) of the other species.

Upon the allowance of a generic claim, applicant will be entitled to consideration of claims to additional species which depend from or otherwise require all the limitations of an allowable generic claim as provided by 37 CFR 1.141.

5. Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lauren Nguyen whose telephone number is (571) 270-1428. The examiner can normally be reached on M-Th, 7:30-6:00 EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Edward Glick can be reached on (571) 272-2490. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished

Art Unit: 2871

applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Lauren Nguyen/  
Primary Examiner, Art Unit 2871



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| APPLICATION NUMBER | FILING OR 371(C) DATE | FIRST NAMED APPLICANT | ATTY. DOCKET NO./TITLE |
|--------------------|-----------------------|-----------------------|------------------------|
| 14/572,068         | 12/16/2014            | Yoichi MOMOSE         | 9319S-001378-COB       |

**CONFIRMATION NO. 6575**

27572

HARNESS, DICKEY & PIERCE, P.L.C.  
P.O. BOX 828  
BLOOMFIELD HILLS, MI 48303

## PUBLICATION NOTICE



\*OC000000075414128\*

**Title:**METHOD OF MANUFACTURING A LIQUID CRYSTAL DEVICE

**Publication No.**US-2015-0146152-A1

**Publication Date:**05/28/2015

## NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at [www.uspto.gov](http://www.uspto.gov). The direct link to access the publication is currently <http://www.uspto.gov/patft/>.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Office of Public Records. The Office of Public Records can be reached by telephone at (703) 308-9726 or (800) 972-6382, by facsimile at (703) 305-8759, by mail addressed to the United States Patent and Trademark Office, Office of Public Records, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at [www.uspto.gov](http://www.uspto.gov) using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently <http://pair.uspto.gov/>. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

**PATENT**

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

Application No.: 14/572,068  
Filing Date: December 16, 2014  
First Named  
Inventor: Yoichi MOMOSE et al.  
Group Art Unit: 2871  
Examiner: Lauren Nguyen  
Title: METHOD OF MANUFACTURING A LIQUID CRYSTAL  
DEVICE  
Attorney Docket: 9319S-001378-US-COB

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Commissioner for Patents  
P.O. Box 1450  
Alexandria, Virginia 22313-1450

**RESPONSE TO SPECIES ELECTION REQUIREMENT  
AND PRELIMINARY AMENDMENT**

Commissioner:

In response to the Species/Election Requirement mailed April 23, 2015 please  
consider the following:

**Amendments to the Claims** begin on page 2 of this paper.

**Remarks** begin on page 11 of this paper.

## **AMENDMENTS TO THE CLAIMS**

The following listing of claims will replace all prior versions and listings of claims in the application.

### **LISTING OF CLAIMS**

1. (Original) A display device, comprising:
  - a first substrate including a plurality of pixel electrodes and a plurality of active elements;
  - a second substrate including a common electrode;
  - a display region in which the plurality of pixel electrodes and the plurality of active elements are aligned in a plan-view of the first substrate;
  - a seal region positioned around the display region in a plan-view of the first substrate; and
  - a seal member in the seal region and disposed between the first substrate and the second substrate so as to the common electrode faces to the plurality of pixel electrodes,

wherein the first substrate includes a protruding region which protrudes over the second substrate in the plan-view of the first substrate and a plurality of conductive portions,

the seal region forms a rectangular closed-shape so as to surround the display region, and has a first side, a second side, a third side and a fourth side, the first side is positioned between the display region and the protruding region, and opposed to the third side, and the second side is opposed to the fourth side, and

the seal member includes a first seal portion and a second seal portion,

wherein the first seal portion is disposed at least on the first side and the second seal portion is disposed at least on the third side,

the first seal portion and the second seal portion are connected in a first junction portion positioned on the second side, and

the first seal portion and the second seal portion are connected in a second junction portion positioned on the fourth side,

wherein the second seal portion includes a plurality of conductive particles and the plurality of conductive portions are disposed at least on the third side and electrically connected to the common electrode.

2. (Original) The display device, according to Claim 1,  
wherein each of the plurality of the conductive portions are spaced apart from each other.

3. (Original) The display device, according to Claim 1,  
wherein the first seal portion and the second seal portion extend from the second side toward an edge of the first substrate in the first junction portion,  
the first seal portion and the second seal portion extend from the fourth side toward an edge of the first substrate in the second junction portion, and  
the first junction portion and the second junction portion projecting in an opposite direction with respect to the pixel area..

4. (Original) The display device, according to Claim 1,  
wherein the first substrate further includes a first conductive portion on the second side,  
the second seal portion includes a first part of the seal member on the second side,  
wherein the first part of the seal member extends from one end of the seal member disposed on the third side over the first conductive portion on the second side, and the first part of the seal member includes a plurality of conductive particles, and  
the first conductive portion is electrically connected to the common electrode.

5. (Original) The display device, according to Claim 4,  
wherein the first substrate further includes a second conductive portion on the fourth side,  
the second seal portion includes a second part of the seal member on the fourth side,  
wherein the second part of the seal member extends from another end of the seal member disposed on the third side over the second conductive portion on the fourth side, and the second part of the seal member includes a plurality of conductive particles, and  
the second conductive portion is electrically connected to the common electrode.

6. (Original) An electronic device comprising the display device according to claim 1.



7. (Original) A display device, comprising:

a first substrate including a pixel region and a seal region which is defined around the pixel region on a first surface of the first substrate, the pixel region including a plurality of pixels and a plurality of active elements, and the seal region forming a rectangular ring shape; and

a second substrate including a common electrode on a second surface; and

a seal member bonding the first substrate and the second substrate so that the first surface faces the second surface,

wherein the first substrate includes a protruding region which protrudes over the second substrate in plan-view of the first substrate,

the seal region includes a first side, a second side, a third side and a fourth side, the first side is positioned between the pixel region and the protruding region, and opposed to the third side, and the second side is opposed to the fourth side,

the seal member is positioned on the first side, the second side, the third side and the fourth side continuously and forms a closed-ring shape in which the pixel region is positioned,

a first part of the seal member disposed on the third side which is opposed to the protruding region with respect to the pixel region includes a plurality of conductive particles,

a plurality of conductive portions are disposed on the third side of the first substrate, the plurality of the conductive portions are electrically connected to the common electrode, and

each of the plurality of the conductive portions are spaced apart from each other.

8. (Original) The display device, according to Claim 7,

wherein the first substrate includes a first conductive portion on the second side and the seal member includes a second part of the seal member on the second side, the second part of the seal member extends from one end of the first part of the seal member over the first conductive portion on the second side, and the second part of the seal member includes a plurality of conductive particles, and

wherein the first conductive portion is electrically connected to the common electrode.

9. (Original) The display device, according to Claim 8,

wherein the first substrate includes a second conductive portion on the fourth side and the seal member includes a third part of the seal member on the fourth side, the third part of the seal member extends from another end of the first part of the seal member over the second conductive portion on the fourth side, and the third part of the seal member includes a plurality of conductive particles, and

wherein the second conductive portion is electrically connected to the common electrode.

10. (Original) The display device, according to Claim 7,

wherein the seal member extends to a first edge of the seal region opposite to the pixel region on the second side.

11. (Original) The display device, according to Claim 10,  
wherein the seal member extends to a second edge of the seal region opposite to the pixel region on the fourth side.

12. (Original) An electronic device comprising the display device according to claim 7.

13. (Currently Amended) A display device, comprising:  
a first substrate including a plurality of pixel electrodes and a plurality of active elements;  
a second substrate including a common electrode;  
a display region in which the plurality of pixel electrodes and the plurality of active elements are aligned in a plan-view of the first substrate;  
a seal region positioned around the display region in the plan-view of the first substrate and forming a closed-ring shape in which the display region is disposed;  
a seal member in the seal region and bonding the first substrate and the second substrate so that the common electrode faces the plurality of pixel electrodes, the seal member forming a closed-ring shape in which the display region is positioned;  
wherein the first substrate includes a protruding region which protrudes over the second substrate in the plan-view of the first substrate and a plurality of conductive portions,  
the seal region includes a first portion and a second portion, the first portion is positioned at least between the display region and the protruding region, and the

second portion is positioned at least opposite to the protruding region with respect to the display region, and

the seal member includes a first part and the second part, the first part of the seal member is positioned on the first portion and the second part of the seal member is positioned on the second portion, and the ~~first~~ second part of the seal member includes a plurality of conductive particles,

wherein the plurality of conductive portions are disposed on the second portion of the first substrate, the plurality of the conductive portions are electrically connected to the common electrode,

each of the plurality of the conductive portions are spaced apart from each other.

14. (Original) The display device, according to Claim 13,

wherein no conductive portions are disposed on the first portion of the first substrate and no conductive particles are included in the first part of the seal member.

15. (Original) The display device, according to Claim 13,

wherein the seal member further includes a third part and a fourth part, the third part of the seal member extends from one end of the first part, and the fourth part of the seal member extends from one end of the second part and includes a first plurality of conductive particles.

16. (Original) The display device, according to Claim 15,  
wherein the third part and the fourth part are connected and extend to a first edge of the seal region opposite to the display region.

17. (Original) The display device, according to Claim 16,  
wherein the seal member further includes a fifth part and a sixth part, the fifth part of the seal member extends from another end of the first part, and the sixth part of the seal member extends from another end of the second part and includes a second plurality of conductive particles, and  
the fifth part and the sixth part are connected and extend to a second edge of the seal region opposite to the display region.

18. (Original) The display device, according to Claim 17,  
wherein the first edge of the seal region is positioned opposite to the second edge of the seal region with respect to the display region.

19. (Original) The display device, according to Claim 18,  
wherein the first substrate further includes a first conductive portion and a second conductive portion, different from the plurality of conductive portions, and the first conductive portion, the second conductive portion and the plurality of conductive portions are disposed apart from each other, and  
the first conductive portion is electrically connected to the common electrode through the first plurality of conductive particles and the second conductive portion is

electrically connected to the common electrode through the second plurality of conductive particles

20. (Original) An electronic device comprising the display device according to claim 13.

### **REMARKS**

In response to the Species Election Requirement mailed April 23, 2015, Applicant provisionally elects Species A9 (The ninth embodiment – Fig. 30), with traverse. Claims 1-20 are believed to read on the elected species.

The Examiner is requested to reconsider the Species Election Requirement because all of the species are drawn to subject matter which are so related to each other that an undue burden would not be placed upon the Examiner by maintaining all of the species in a single application. See, e.g., MPEP § 803.

Claim 13 has been amended to correct an error in the claim.

Favorable consideration of this application is respectfully requested.

Respectfully submitted,

Dated: June 10, 2015

By: /G. Gregory Schivley/  
G. Gregory Schivley  
Reg. No. 27,382  
Bryant E. Wade  
Reg. No. 40,344

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Bloomfield Hills, Michigan 48303  
(248) 641-1600

GGG/nrk

## Electronic Acknowledgement Receipt

|                                             |                                                 |
|---------------------------------------------|-------------------------------------------------|
| <b>EFS ID:</b>                              | 22590230                                        |
| <b>Application Number:</b>                  | 14572068                                        |
| <b>International Application Number:</b>    |                                                 |
| <b>Confirmation Number:</b>                 | 6575                                            |
| <b>Title of Invention:</b>                  | METHOD OF MANUFACTURING A LIQUID CRYSTAL DEVICE |
| <b>First Named Inventor/Applicant Name:</b> | Yoichi MOMOSE                                   |
| <b>Customer Number:</b>                     | 27572                                           |
| <b>Filer:</b>                               | G. Gregory Schivley/Nicole Knabl                |
| <b>Filer Authorized By:</b>                 | G. Gregory Schivley                             |
| <b>Attorney Docket Number:</b>              | 93195-001378-COB                                |
| <b>Receipt Date:</b>                        | 10-JUN-2015                                     |
| <b>Filing Date:</b>                         | 16-DEC-2014                                     |
| <b>Time Stamp:</b>                          | 14:57:02                                        |
| <b>Application Type:</b>                    | Utility under 35 USC 111(a)                     |

### Payment information:

|                        |    |
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|------------------------|----|

### File Listing:

| Document Number | Document Description | File Name                           | File Size(Bytes)/<br>Message Digest              | Multi Part /.zip | Pages (if appl.) |
|-----------------|----------------------|-------------------------------------|--------------------------------------------------|------------------|------------------|
| 1               |                      | ResponseAndPreliminaryAmendment.PDF | 41520<br>56c8f4ab3eb83a5376f47bee94ec113b70532bb | yes              | 11               |



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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Document Description                                | Start | End |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Preliminary Amendment                               | 1     | 1   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Claims                                              | 2     | 10  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Response to Election / Restriction Filed            | 11    | 11  |
| Warnings:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                     |       |     |
| Information:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                     |       |     |
| Total Files Size (in bytes):                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                     | 41520 |     |
| <p>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</p> <p><b><u>New Applications Under 35 U.S.C. 111</u></b><br/>If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><b><u>National Stage of an International Application under 35 U.S.C. 371</u></b><br/>If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><b><u>New International Application Filed with the USPTO as a Receiving Office</u></b><br/>If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p> |                                                     |       |     |

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|                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                               |                                           |       |                                                   |               |                                  |           |                                       |  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|-------|---------------------------------------------------|---------------|----------------------------------|-----------|---------------------------------------|--|
| <b>PATENT APPLICATION FEE DETERMINATION RECORD</b><br>Substitute for Form PTO-875                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                               |                                           |       | Application or Docket Number<br><b>14/572,068</b> |               | Filing Date<br><b>12/16/2014</b> |           | <input type="checkbox"/> To be Mailed |  |
| ENTITY: <input checked="" type="checkbox"/> LARGE <input type="checkbox"/> SMALL <input type="checkbox"/> MICRO                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                               |                                           |       |                                                   |               |                                  |           |                                       |  |
| <b>APPLICATION AS FILED – PART I</b>                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                               |                                           |       |                                                   |               |                                  |           |                                       |  |
| (Column 1)                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                               | (Column 2)                                |       |                                                   |               |                                  |           |                                       |  |
| FOR                                                                                                                                                                                                                                                                                                                                                                                                                                  | NUMBER FILED                                                                                                                                                                                                                  | NUMBER EXTRA                              |       |                                                   |               |                                  | RATE (\$) | FEE (\$)                              |  |
| <input type="checkbox"/> BASIC FEE<br>(37 CFR 1.16(a), (b), or (c))                                                                                                                                                                                                                                                                                                                                                                  | N/A                                                                                                                                                                                                                           | N/A                                       |       |                                                   |               |                                  | N/A       |                                       |  |
| <input type="checkbox"/> SEARCH FEE<br>(37 CFR 1.16(k), (l), or (m))                                                                                                                                                                                                                                                                                                                                                                 | N/A                                                                                                                                                                                                                           | N/A                                       |       |                                                   |               |                                  | N/A       |                                       |  |
| <input type="checkbox"/> EXAMINATION FEE<br>(37 CFR 1.16(o), (p), or (q))                                                                                                                                                                                                                                                                                                                                                            | N/A                                                                                                                                                                                                                           | N/A                                       |       |                                                   |               |                                  | N/A       |                                       |  |
| TOTAL CLAIMS<br>(37 CFR 1.16(i))                                                                                                                                                                                                                                                                                                                                                                                                     | minus 20 =                                                                                                                                                                                                                    | *                                         |       |                                                   |               |                                  | X \$      | =                                     |  |
| INDEPENDENT CLAIMS<br>(37 CFR 1.16(h))                                                                                                                                                                                                                                                                                                                                                                                               | minus 3 =                                                                                                                                                                                                                     | *                                         |       |                                                   |               |                                  | X \$      | =                                     |  |
| <input type="checkbox"/> APPLICATION SIZE FEE<br>(37 CFR 1.16(s))                                                                                                                                                                                                                                                                                                                                                                    | If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s). |                                           |       |                                                   |               |                                  |           |                                       |  |
| <input type="checkbox"/> MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                               |                                           |       |                                                   |               |                                  |           |                                       |  |
| * If the difference in column 1 is less than zero, enter "0" in column 2.                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                               |                                           |       |                                                   |               |                                  | TOTAL     |                                       |  |
| <b>APPLICATION AS AMENDED – PART II</b>                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                               |                                           |       |                                                   |               |                                  |           |                                       |  |
| (Column 1)                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                               | (Column 2)                                |       | (Column 3)                                        |               |                                  |           |                                       |  |
| <b>AMENDMENT</b>                                                                                                                                                                                                                                                                                                                                                                                                                     | <b>06/10/2015</b>                                                                                                                                                                                                             | CLAIMS<br>REMAINING<br>AFTER<br>AMENDMENT |       | HIGHEST<br>NUMBER<br>PREVIOUSLY<br>PAID FOR       | PRESENT EXTRA | RATE (\$)                        |           | ADDITIONAL FEE (\$)                   |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                      | Total (37 CFR 1.16(i))                                                                                                                                                                                                        | * 20                                      | Minus | ** 20                                             | = 0           | X \$80 =                         |           | 0                                     |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                      | Independent (37 CFR 1.16(h))                                                                                                                                                                                                  | * 3                                       | Minus | ***3                                              | = 0           | X \$420 =                        |           | 0                                     |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                      | <input type="checkbox"/> Application Size Fee (37 CFR 1.16(s))                                                                                                                                                                |                                           |       |                                                   |               |                                  |           |                                       |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                      | <input type="checkbox"/> FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))                                                                                                                                      |                                           |       |                                                   |               |                                  |           |                                       |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                               |                                           |       |                                                   |               | TOTAL ADD'L FEE                  |           | <b>0</b>                              |  |
| (Column 1)                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                               | (Column 2)                                |       | (Column 3)                                        |               |                                  |           |                                       |  |
| <b>AMENDMENT</b>                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                               | CLAIMS<br>REMAINING<br>AFTER<br>AMENDMENT |       | HIGHEST<br>NUMBER<br>PREVIOUSLY<br>PAID FOR       | PRESENT EXTRA | RATE (\$)                        |           | ADDITIONAL FEE (\$)                   |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                      | Total (37 CFR 1.16(i))                                                                                                                                                                                                        | *                                         | Minus | **                                                | =             | X \$                             |           | =                                     |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                      | Independent (37 CFR 1.16(h))                                                                                                                                                                                                  | *                                         | Minus | ***                                               | =             | X \$                             |           | =                                     |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                      | <input type="checkbox"/> Application Size Fee (37 CFR 1.16(s))                                                                                                                                                                |                                           |       |                                                   |               |                                  |           |                                       |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                      | <input type="checkbox"/> FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))                                                                                                                                      |                                           |       |                                                   |               |                                  |           |                                       |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                               |                                           |       |                                                   |               | TOTAL ADD'L FEE                  |           |                                       |  |
| <p>* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.</p> <p>** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".</p> <p>*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".</p> <p>The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.</p> |                                                                                                                                                                                                                               |                                           |       |                                                   |               |                                  |           |                                       |  |
| LIE<br>/DORRETTA BROOKS/                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                               |                                           |       |                                                   |               |                                  |           |                                       |  |

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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|                                                                                                         |             |                      |                                 |                             |
|---------------------------------------------------------------------------------------------------------|-------------|----------------------|---------------------------------|-----------------------------|
| APPLICATION NO.                                                                                         | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO.             | CONFIRMATION NO.            |
| 14/572,068                                                                                              | 12/16/2014  | Yoichi MOMOSE        | 9319S-001378-COB                | 6575                        |
| 27572 7590 09/09/2015<br>HARNESS, DICKEY & PIERCE, P.L.C.<br>P.O. BOX 828<br>BLOOMFIELD HILLS, MI 48303 |             |                      | EXAMINER<br>NGUYEN, LAUREN      |                             |
|                                                                                                         |             |                      | ART UNIT<br>2871                | PAPER NUMBER                |
|                                                                                                         |             |                      | NOTIFICATION DATE<br>09/09/2015 | DELIVERY MODE<br>ELECTRONIC |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

troydocketing@hdp.com

|                              |                                      |                                      |                                                  |
|------------------------------|--------------------------------------|--------------------------------------|--------------------------------------------------|
| <b>Office Action Summary</b> | <b>Application No.</b><br>14/572,068 | <b>Applicant(s)</b><br>MOMOSE ET AL. |                                                  |
|                              | <b>Examiner</b><br>LAUREN NGUYEN     | <b>Art Unit</b><br>2871              | <b>AIA (First Inventor to File) Status</b><br>No |

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1) ☒ Responsive to communication(s) filed on 6/10/2015.  
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on \_\_\_\_\_.

2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.

3) ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on \_\_\_\_\_; the restriction requirement and election have been incorporated into this action.

4) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims\***

5) ☒ Claim(s) 1-20 is/are pending in the application.  
5a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.

6) ☐ Claim(s) \_\_\_\_\_ is/are allowed.

7) ☒ Claim(s) 1-20 is/are rejected.

8) ☐ Claim(s) \_\_\_\_\_ is/are objected to.

9) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

\* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see [http://www.uspto.gov/patents/init\\_events/pph/index.jsp](http://www.uspto.gov/patents/init_events/pph/index.jsp) or send an inquiry to [PPHfeedback@uspto.gov](mailto:PPHfeedback@uspto.gov).

**Application Papers**

10) ☐ The specification is objected to by the Examiner.

11) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

**Priority under 35 U.S.C. § 119**

12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

**Certified copies:**

a) ☒ All    b) ☐ Some\*\*    c) ☐ None of the:

1. ☒ Certified copies of the priority documents have been received.

2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.

3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\*\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)

2) ☒ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b)  
Paper No(s)/Mail Date 12/16/2014

3) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_

4) ☐ Other: \_\_\_\_\_

1. The present application is being examined under the pre-AIA first to invent provisions.

#### **DETAILED ACTION**

##### ***Election/Restrictions***

2. Applicant's election without traverse of **Species A9 (figure 30)**, including **claims 1-20**, in the reply filed on 06/10/2015 is acknowledged.

##### ***Specification***

3. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

##### ***Claim Rejections - 35 USC § 103***

4. The following is a quotation of pre-AIA 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented 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 art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. **Claims 1-20** rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over **Miyazaki et al. (US 6,930,745)** in view of **Tanaka et al. (US 2005/0122466)**.
6. Regarding **claim 1, Miyazaki et al.** (figures 1-2 and 16) discloses a display device, comprising:
  - a first substrate (70) including a plurality of pixel electrodes and a plurality of active elements;
  - a second substrate (80) including a common electrode (see at least figure 2);
  - a display region in which the plurality of pixel electrodes and the plurality of active elements are aligned in a plan-view of the first substrate;

- a seal region positioned around the display region in a plan-view of the first substrate;  
and
- a seal member (3) in the seal region and disposed between the first substrate and the second substrate so as to the common electrode faces to the plurality of pixel electrodes,
- the seal region (75-79 and 85-89) forms a rectangular closed-shape so as to surround the display region, and has a first side, a second side, a third side and a fourth side, the first side is positioned between the display region and the protruding region, and opposed to the third side, and the second side is opposed to the fourth side, and
- the seal member includes a first seal portion and a second seal portion (75-79 and 85-89),
- wherein the first seal portion is disposed at least on the first side and the second seal portion is disposed at least on the third side,
- the first seal portion and the second seal portion are connected in a first junction portion positioned on the second side, and
- the first seal portion and the second seal portion are connected in a second junction portion positioned on the fourth side,
- wherein the second seal portion includes a plurality of conductive particles and the plurality of conductive portions are disposed at least on the third side and electrically connected to the common electrode.

7. **Miyazaki et al.** discloses the limitations as shown in the rejection of **claim 1** above.

However, **Miyazaki et al.** is silent regarding wherein the first substrate includes a protruding region which protrudes over the second substrate in the plan-view of the first substrate and a plurality of conductive portions. **Tanaka** (figures 1-2) teaches wherein the first substrate

includes a protruding region which protrudes over the second substrate in the plan-view of the first substrate and a plurality of conductive portions. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention modify the first substrate as taught by **Tanaka** in order to control the flow directions of the liquid crystal by changing a distance between the corner and each liquid crystal filling port and opening lengths of the liquid crystal filling ports. Accordingly, the flow directions can be more parallel to the predetermined direction regardless of the predetermined direction of the alignment layer relative to the extending direction of the seal.

8. Regarding **claim 2, Miyazaki et al.** (figures 1-2 and 16) discloses each of the plurality of the conductive portions are spaced apart from each other.

9. Regarding **claim 3, Miyazaki et al.** (figures 1-2 and 16) discloses the first seal portion and the second seal portion extend from the second side toward an edge of the first substrate in the first junction portion, the first seal portion and the second seal portion extend from the fourth side toward an edge of the first substrate in the second junction portion, and the first junction portion and the second junction portion projecting in an opposite direction with respect to the pixel area.

10. Regarding **claim 4, Miyazaki et al.** (figures 1-2 and 16) discloses the first substrate further includes a first conductive portion on the second side, the second seal portion includes a first part of the seal member on the second side, wherein the first part of the seal member extends from one end of the seal member disposed on the third side over the first conductive portion on the second side, and the first part of the seal member includes a plurality of conductive particles, and the first conductive portion is electrically connected to the common electrode.

11. Regarding **claim 5, Miyazaki et al.** (figures 1-2 and 16) discloses the first substrate further includes a second conductive portion on the fourth side, the second seal portion includes a second part of the seal member on the fourth side, wherein the second part of the seal member extends from another end of the seal member disposed on the third side over the second conductive portion on the fourth side, and the second part of the seal member includes a plurality of conductive particles, and the second conductive portion is electrically connected to the common electrode.

12. Regarding **claim 6, Miyazaki et al.** (figures 1-2 and 16) discloses an electronic device comprising the display device according to claim 1.

13. Regarding **claim 7, Miyazaki et al.** (figures 1-2 and 16) discloses a display device, comprising:

- a first substrate (70) including a pixel region and a seal region which is defined around the pixel region on a first surface of the first substrate, the pixel region including a plurality of pixels and a plurality of active elements, and the seal region forming a rectangular ring shape; and
- a second substrate (80; figure 1) including a common electrode on a second surface; and
- a seal member bonding the first substrate and the second substrate so that the first surface faces the second surface,
- the seal region (75-79 and 85-89) includes a first side, a second side, a third side and a fourth side, the first side is positioned between the pixel region and the protruding region, and opposed to the third side, and the second side is opposed to the fourth side,



- the seal member is positioned on the first side, the second side, the third side and the fourth side continuously and forms a closed-ring shape in which the pixel region is positioned,
- a first part of the seal member disposed on the third side which is opposed to the protruding region with respect to the pixel region includes a plurality of conductive particles,
- a plurality of conductive portions are disposed on the third side of the first substrate, the plurality of the conductive portions are electrically connected to the common electrode, and
- each of the plurality of the conductive portions are spaced apart from each other.

14. **Miyazaki et al.** discloses the limitations as shown in the rejection of **claim 7** above.

However, **Miyazaki et al.** is silent regarding wherein the first substrate includes a protruding region which protrudes over the second substrate in the plan-view of the first substrate and a plurality of conductive portions. **Tanaka** (figures 1-2) teaches wherein the first substrate includes a protruding region which protrudes over the second substrate in the plan-view of the first substrate and a plurality of conductive portions. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention modify the first substrate as taught by **Tanaka** in order to control the flow directions of the liquid crystal by changing a distance between the corner and each liquid crystal filling port and opening lengths of the liquid crystal filling ports. Accordingly, the flow directions can be more parallel to the predetermined direction regardless of the predetermined direction of the alignment layer relative to the extending direction of the seal.

15. Regarding **claim 8, Miyazaki et al.** (figures 1-2 and 16) discloses the first substrate includes a first conductive portion on the second side and the seal member includes a second part of the seal member on the second side, the second part of the seal member extends from one end of the first part of the seal member over the first conductive portion on the second side, and the second part of the seal member includes a plurality of conductive particles, and wherein the first conductive portion is electrically connected to the common electrode.

16. Regarding **claim 9, Miyazaki et al.** (figures 1-2 and 16) discloses the first substrate includes a second conductive portion on the fourth side and the seal member includes a third part of the seal member on the fourth side, the third part of the seal member extends from another end of the first part of the seal member over the second conductive portion on the fourth side, and the third part of the seal member includes a plurality of conductive particles, and wherein the second conductive portion is electrically connected to the common electrode.

17. Regarding **claim 10, Miyazaki et al.** (figures 1-2 and 16) discloses the seal member extends to a first edge of the seal region opposite to the pixel region on the second side.

18. Regarding **claim 11, Miyazaki et al.** (figures 1-2 and 16) discloses the seal member extends to a second edge of the seal region opposite to the pixel region on the fourth side.

19. Regarding **claim 12, Miyazaki et al.** (figures 1-2 and 16) discloses an electronic device comprising the display device according to claim 7.

20. Regarding **claim 13, Miyazaki et al.** (figures 1-2 and 16) discloses a display device, comprising:

- a first substrate (70) including a plurality of pixel electrodes and a plurality of active elements;

- a second substrate (80) including a common electrode;
- a display region in which the plurality of pixel electrodes and the plurality of active elements are aligned in a plan-view of the first substrate;
- a seal region (75-79 and 85-89) positioned around the display region in the plan-view of the first substrate and forming a closed-ring shape in which the display region is disposed;
- a seal member in the seal region and bonding the first substrate and the second substrate so that the common electrode faces the plurality of pixel electrodes, the seal member forming a closed-ring shape in which the display region is positioned;
- the seal region includes a first portion and a second portion, the first portion is positioned at least between the display region and the protruding region, and the second portion is positioned at least opposite to the protruding region with respect to the display region, and
- the seal member includes a first part and the second part, the first part of the seal member is positioned on the first portion and the second part of the seal member is positioned on the second portion, and the second part of the seal member includes a plurality of conductive particles,
- wherein the plurality of conductive portions are disposed on the second portion of the first substrate, the plurality of the conductive portions are electrically connected to the common electrode,
- each of the plurality of the conductive portions are spaced apart from each other.

21. Regarding **claim 14, Miyazaki et al.** (figures 1-2 and 16) discloses no conductive portions are disposed on the first portion of the first substrate and no conductive particles are included in the first part of the seal member.
22. Regarding **claim 15, Miyazaki et al.** (figures 1-2 and 16) discloses the seal member further includes a third part and a fourth part, the third part of the seal member extends from one end of the first part, and the fourth part of the seal member extends from one end of the second part and includes a first plurality of conductive particles.
23. Regarding **claim 16, Miyazaki et al.** (figures 1-2 and 16) discloses the third part and the fourth part are connected and extend to a first edge of the seal region opposite to the display region.
24. Regarding **claim 17, Miyazaki et al.** (figures 1-2 and 16) discloses the seal member further includes a fifth part and a sixth part, the fifth part of the seal member extends from another end of the first part, and the sixth part of the seal member extends from another end of the second part and includes a second plurality of conductive particles, and the fifth part and the sixth part are connected and extend to a second edge of the seal region opposite to the display region.
25. Regarding **claim 18, Miyazaki et al.** (figures 1-2 and 16) discloses the first edge of the seal region is positioned opposite to the second edge of the seal region with respect to the display region.
26. Regarding **claim 19, Miyazaki et al.** (figures 1-2 and 16) discloses the first substrate further includes a first conductive portion and a second conductive portion, different from the plurality of conductive portions, and the first conductive portion, the second conductive portion

and the plurality of conductive portions are disposed apart from each other, and the first conductive portion is electrically connected to the common electrode through the first plurality of conductive particles and the second conductive portion is electrically connected to the common electrode through the second plurality of conductive particles.

27. Regarding **claim 20, Miyazaki et al.** (figures 1-2 and 16) discloses an electronic device comprising the display device according to claim 13.

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lauren Nguyen whose telephone number is (571) 270-1428. The examiner can normally be reached on M-Th, 7:30-6:00 EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Edward Glick can be reached on (571) 272-2490. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Lauren Nguyen/  
Primary Examiner, Art Unit 2871

Application/Control Number: 14/572,068  
Art Unit: 2871

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|                                   |                                       |                                                             |             |
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\*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)  
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| Substitute for form 1449/PTO<br><br><b>INFORMATION DISCLOSURE<br/>STATEMENT BY APPLICANT</b><br><br><i>(Use as many sheets as necessary)</i> |                       |                                                                                                              |                                | <b>Complete if Known</b>                           |                                                                                 |                |
|----------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|--------------------------------------------------------------------------------------------------------------|--------------------------------|----------------------------------------------------|---------------------------------------------------------------------------------|----------------|
|                                                                                                                                              |                       |                                                                                                              |                                | Application Number                                 | (CON of 14/571,729)                                                             |                |
|                                                                                                                                              |                       |                                                                                                              |                                | Filing Date                                        | Concurrently Herewith                                                           |                |
|                                                                                                                                              |                       |                                                                                                              |                                | First Named Inventor                               | Yoichi MOMOSE                                                                   |                |
|                                                                                                                                              |                       |                                                                                                              |                                | Art Unit                                           | 2871                                                                            |                |
| Examiner Name                                                                                                                                | Lauren Nguyen         |                                                                                                              |                                |                                                    |                                                                                 |                |
| Attorney Docket Number                                                                                                                       | 9319S-001378-COB      |                                                                                                              |                                |                                                    |                                                                                 |                |
| Sheet                                                                                                                                        | 1                     | of                                                                                                           | 2                              |                                                    |                                                                                 |                |
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| Examiner Signature | /Lauren Nguyen/ (08/19/2015) | Date Considered |  |
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| <b>INFORMATION DISCLOSURE<br/>STATEMENT BY APPLICANT</b><br><br><i>(Use as many sheets as necessary)</i> |   |    |   | Application Number       | (CON of 14/571,729)   |
|                                                                                                          |   |    |   | Filing Date              | Concurrently Herewith |
|                                                                                                          |   |    |   | First Named Inventor     | Yoichi MOMOSE         |
|                                                                                                          |   |    |   | Art Unit                 | 2871                  |
|                                                                                                          |   |    |   | Examiner Name            | Lauren Nguyen         |
| Sheet                                                                                                    | 2 | of | 2 | Attorney Docket Number   | 9319S-001378-COB      |

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| NON PATENT LITERATURE DOCUMENTS |                          |                                                                                                                                                                                                                                                                 |                |
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| Examiner<br>Initials            | Cite<br>No. <sup>1</sup> | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. | T <sup>2</sup> |
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| Examiner<br>Signature | /Lauren Nguyen/ (08/19/2015) | Date<br>Considered |  |
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## EAST Search History

## EAST Search History (Prior Art)

| Ref # | Hits | Search Query                                                                                                                                                    | DBs                                                                        | Default Operator | Plurals | Time Stamp          |
|-------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|------------------|---------|---------------------|
| L1    | 3    | ("6930745").PN.                                                                                                                                                 | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR               | OFF     | 2015/08/23<br>20:32 |
| S1    | 1    | "11301086"                                                                                                                                                      | US-PGPUB;<br>USPAT;<br>USOCR                                               | OR               | ON      | 2008/10/01<br>11:47 |
| S2    | 4    | ("5889572"   "5978060"   "6052171"  <br>"6616467").PN.                                                                                                          | US-PGPUB;<br>USPAT;<br>USOCR                                               | OR               | ON      | 2008/10/01<br>13:28 |
| S4    | 369  | 349/190.ccls. and @ad<="20041227"                                                                                                                               | US-PGPUB;<br>USPAT;<br>USOCR                                               | OR               | ON      | 2008/10/02<br>09:19 |
| S5    | 22   | ("3700306"   "3751137"   "3799649"  <br>"3866313").PN. OR ("3990782").URPN.                                                                                     | US-PGPUB;<br>USPAT;<br>USOCR                                               | OR               | ON      | 2008/10/06<br>09:53 |
| S6    | 4    | ("20020109815"   "5973763"  <br>"6335779").PN. OR ("6750937").URPN.                                                                                             | US-PGPUB;<br>USPAT;<br>USOCR                                               | OR               | ON      | 2008/10/06<br>10:00 |
| S7    | 2    | "20040239864"                                                                                                                                                   | US-PGPUB;<br>USPAT;<br>USOCR                                               | OR               | ON      | 2008/10/06<br>10:25 |
| S8    | 5    | ("20020063836"   "20050264748"  <br>"5985069"   "6144438"   "7075612").PN.<br>OR ("7369211").URPN.                                                              | US-PGPUB;<br>USPAT;<br>USOCR                                               | OR               | ON      | 2008/10/06<br>11:33 |
| S9    | 2    | "20040252270"                                                                                                                                                   | US-PGPUB;<br>USPAT;<br>USOCR                                               | OR               | ON      | 2008/10/06<br>11:51 |
| S10   | 3    | 10/649684                                                                                                                                                       | US-PGPUB;<br>USPAT;<br>USOCR                                               | OR               | ON      | 2009/09/16<br>13:10 |
| S11   | 4    | ("5798813"   "6144435"   "6678029"  <br>"6705584").PN. OR ("7042544").URPN.                                                                                     | US-PGPUB;<br>USPAT;<br>USOCR                                               | OR               | ON      | 2009/09/16<br>13:11 |
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| S13   | 8    | ("20040012744"   "20050146646"  <br>"20060017867"   "20030063080"  <br>"20060033872"   "20050078240"  <br>"20040032557"   "20050225708"  <br>"20040012744").PN. | US-PGPUB;<br>USPAT                                                         | OR               | ON      | 2011/09/30<br>13:37 |
| S15   | 2    | "20050248711"                                                                                                                                                   | US-PGPUB;<br>USPAT;<br>USOCR                                               | OR               | ON      | 2012/01/30<br>13:45 |

|     |      |                                                                                                                                                                                                                                                                                 |                                                                            |    |    |                     |
|-----|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|----|----|---------------------|
| S16 | 19   | ("20040252270"   "20050094084"   "20050099574"   "6674507"   "6930745"   "7280179"   "6525799"   "20040239864"   "20040070723"   "20030025867"   "20040125317"   "7133107"   "20020030783"   "6099672"   "6388729"   "20040070722"   "7190430"   "20050117106"   "6531329").PN. | US-PGPUB;<br>USPAT;<br>USOCR                                               | OR | ON | 2012/01/30<br>13:46 |
| S17 | 19   | ("20040252270"   "20050094084"   "20050099574"   "6674507"   "6930745"   "7280179"   "6525799"   "20040239864"   "20040070723"   "20030025867"   "20040125317"   "7133107"   "20020030783"   "6099672"   "6388729"   "20040070722"   "7190430"   "20050117106"   "6531329").PN. | US-PGPUB;<br>USPAT;<br>USOCR                                               | OR | ON | 2012/01/31<br>07:56 |
| S18 | 2    | "20110096269"                                                                                                                                                                                                                                                                   | US-PGPUB;<br>USPAT;<br>USOCR                                               | OR | ON | 2013/06/17<br>08:10 |
| S19 | 9    | ("20030025867"   "20010055827"   "6326225"   "5459597"   "5459597"   "20050094084"   "20010015786"   "5725032"   "20010055827"   "5459597"   "20040070722"   "5815231").PN.                                                                                                     | US-PGPUB;<br>USPAT;<br>USOCR                                               | OR | ON | 2013/06/17<br>08:13 |
| S20 | 27   | ("4094058"   "4526818"   "4548475"   "5080146"   "5454893"   "5706069").PN.<br>OR ("6099672").URPN.                                                                                                                                                                             | US-PGPUB;<br>USPAT;<br>USOCR                                               | OR | ON | 2013/06/17<br>08:50 |
| S22 | 20   | ("4094058"   "4526818"   "4548475"   "4820025"   "5080146"   "5359442"   "5454893"   "5459597"   "5492582"   "5706069"   "5725032"   "5815231"   "5943107"   "5946070"   "6099672").PN.<br>OR ("6844910").URPN.                                                                 | US-PGPUB;<br>USPAT;<br>USOCR                                               | OR | ON | 2013/06/17<br>09:03 |
| S23 | 916  | G02F1/133351.cpc.                                                                                                                                                                                                                                                               | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2013/11/25<br>11:29 |
| S24 | 419  | G02F1/133351.cpc. and<br>@ad<="20051212"                                                                                                                                                                                                                                        | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2013/11/25<br>11:40 |
| S26 | 1064 | G02F1/1339.cpc. and @ad<="20051212"<br>not S24                                                                                                                                                                                                                                  | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON | 2013/11/25<br>11:56 |
| S27 | 9    | ("4820025"   "5798813"   "5936695"   "6304308"   "6320638"   "6665040").PN.<br>OR ("7202932").URPN.                                                                                                                                                                             | US-PGPUB;<br>USPAT;<br>USOCR                                               | OR | ON | 2014/03/19<br>19:38 |
| S31 | 152  | (drop\$4 with liquid with crystal with                                                                                                                                                                                                                                          | US-PGPUB;                                                                  | OR | ON | 2014/03/20          |

|     |       |                                                                                                                                                                                                                                                                                                                                     |                                                                            |    |     |                     |
|-----|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|----|-----|---------------------|
|     |       | before with substrate) and<br>@ad<="20051212" and "349".clas.                                                                                                                                                                                                                                                                       | USPAT;<br>USOCR;<br>FPRS;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB              |    |     | 13:22               |
| S32 | 58    | (drop\$4 with liquid with crystal with<br>before with substrate) and<br>@pd<="20041212" and "349".clas.                                                                                                                                                                                                                             | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON  | 2014/03/20<br>13:27 |
| S33 | 21    | ("20040252270"   "20050094084"  <br>"20050099574"   "6674507"   "6567147"<br>  "6930745"   "7280179"   "6525799"  <br>"20040239864"   "20040070723"  <br>"20030025867"   "20040125317"  <br>"7133107"   "20110096269"  <br>"20020030783"   "6099672"   "6388729"<br>  "20040070722"   "7190430"  <br>"20050117106"   "6531329").PN. | US-PGPUB;<br>USPAT;<br>USOCR                                               | OR | ON  | 2015/03/24<br>20:02 |
| S34 | 8     | ("5850276"   "5854664"  <br>"5936695").PN. OR ("6930745").URPN.                                                                                                                                                                                                                                                                     | US-PGPUB;<br>USPAT;<br>USOCR                                               | OR | ON  | 2015/03/24<br>20:08 |
| S35 | 0     | 14/571729                                                                                                                                                                                                                                                                                                                           | US-PGPUB;<br>USPAT;<br>USOCR                                               | OR | ON  | 2015/03/24<br>20:13 |
| S36 | 3     | ("6930745").PN.                                                                                                                                                                                                                                                                                                                     | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | OFF | 2015/06/08<br>16:19 |
| S37 | 3     | ("6930745").PN.                                                                                                                                                                                                                                                                                                                     | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | OFF | 2015/08/19<br>15:19 |
| S38 | 2163  | (349/153-154.ccls. 349/190.ccls.) and<br>@ad<="20051212"                                                                                                                                                                                                                                                                            | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON  | 2015/08/19<br>15:27 |
| S39 | 10938 | G02F1/1341 G02F2001/13415<br>G02F1/133351                                                                                                                                                                                                                                                                                           | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON  | 2015/08/19<br>15:29 |
| S40 | 1     | 14/572068                                                                                                                                                                                                                                                                                                                           | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS;<br>EPO; JPO;                        | OR | ON  | 2015/08/19<br>15:32 |

|     |   |                     |                                                                            |    |     |                     |
|-----|---|---------------------|----------------------------------------------------------------------------|----|-----|---------------------|
|     |   |                     | DERWENT;<br>IBM_TDB                                                        |    |     |                     |
| S43 | 2 | ("20090244468").PN. | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | OFF | 2015/08/19<br>20:19 |

**8/ 23/ 2015 8:54:37 PM****C:\ Users\ Inguyen25\ Documents\ EAST\ Workspaces\ 11301086.wsp**

|                                                                                                              |                                                |                                                                     |
|--------------------------------------------------------------------------------------------------------------|------------------------------------------------|---------------------------------------------------------------------|
| <b>Search Notes</b><br><br> | <b>Application/Control No.</b><br><br>14572068 | <b>Applicant(s)/Patent Under Reexamination</b><br><br>MOMOSE ET AL. |
|                                                                                                              | <b>Examiner</b><br><br>LAUREN NGUYEN           | <b>Art Unit</b><br><br>2871                                         |

| CPC- SEARCHED |      |          |
|---------------|------|----------|
| Symbol        | Date | Examiner |
|               |      |          |

| CPC COMBINATION SETS - SEARCHED          |           |          |
|------------------------------------------|-----------|----------|
| Symbol                                   | Date      | Examiner |
| G02F1/1341; G02F2001/13415; G02F1/133351 | 8/19/2015 | LN       |

| US CLASSIFICATION SEARCHED |          |      |          |
|----------------------------|----------|------|----------|
| Class                      | Subclass | Date | Examiner |
|                            |          |      |          |

| SEARCH NOTES                     |           |          |
|----------------------------------|-----------|----------|
| Search Notes                     | Date      | Examiner |
| See attached EAST search history | 8/19/2015 | LN       |

| INTERFERENCE SEARCH     |                         |      |          |
|-------------------------|-------------------------|------|----------|
| US Class/<br>CPC Symbol | US Subclass / CPC Group | Date | Examiner |
|                         |                         |      |          |

|  |                                                   |
|--|---------------------------------------------------|
|  | /LAUREN NGUYEN/<br>Primary Examiner.Art Unit 2871 |
|--|---------------------------------------------------|

|                                                                                                          |   |    |   |                          |                        |
|----------------------------------------------------------------------------------------------------------|---|----|---|--------------------------|------------------------|
| Substitute for form 1449/PTO                                                                             |   |    |   | <b>Complete if Known</b> |                        |
| <b>INFORMATION DISCLOSURE<br/>STATEMENT BY APPLICANT</b><br><br><i>(Use as many sheets as necessary)</i> |   |    |   | Application Number       | 14/572,068-Conf. #6575 |
|                                                                                                          |   |    |   | Filing Date              | December 16, 2014      |
|                                                                                                          |   |    |   | First Named Inventor     | Yoichi MOMOSE          |
|                                                                                                          |   |    |   | Art Unit                 | 2871                   |
|                                                                                                          |   |    |   | Examiner Name            | Lauren Nguyen          |
| Sheet                                                                                                    | 1 | of | 1 | Attorney Docket Number   | 9319S-001378-COB       |

| U.S. PATENT DOCUMENTS |                          |                                          |                                |                                                    |                                                                                 |
|-----------------------|--------------------------|------------------------------------------|--------------------------------|----------------------------------------------------|---------------------------------------------------------------------------------|
| Examiner<br>Initials* | Cite<br>No. <sup>1</sup> | Document Number                          | Publication Date<br>MM-DD-YYYY | Name of Patentee or<br>Applicant of Cited Document | Pages, Columns, Lines, Where<br>Relevant Passages or Relevant<br>Figures Appear |
|                       |                          | Number-Kind Code <sup>2</sup> (if known) |                                |                                                    |                                                                                 |
|                       | AA*                      | US-2002-0080461-A1                       | 06-27-2002                     | Karasawa et al.                                    |                                                                                 |

| FOREIGN PATENT DOCUMENTS |                          |                                                                                   |                                   |                                                    |                                                                                 |                |
|--------------------------|--------------------------|-----------------------------------------------------------------------------------|-----------------------------------|----------------------------------------------------|---------------------------------------------------------------------------------|----------------|
| Examiner<br>Initials*    | Cite<br>No. <sup>1</sup> | Foreign Patent Document                                                           | Publication<br>Date<br>MM-DD-YYYY | Name of Patentee or<br>Applicant of Cited Document | Pages, Columns, Lines,<br>Where Relevant Passages<br>Or Relevant Figures Appear | T <sup>6</sup> |
|                          |                          | Country Code <sup>3</sup> -Number <sup>4</sup> -Kind Code <sup>5</sup> (if known) |                                   |                                                    |                                                                                 |                |
|                          |                          |                                                                                   |                                   |                                                    |                                                                                 |                |

\*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. \* CITE NO.: Those application(s) which are marked with an single asterisk (\*) next to the Cite No. are not supplied (under 37 CFR 1.98(a)(2)(iii)) because that application was filed after June 30, 2003 or is available in the IFW. <sup>1</sup> Applicant's unique citation designation number (optional). <sup>2</sup> See Kinds Codes of USPTO Patent Documents at [www.uspto.gov](http://www.uspto.gov) or MPEP 901.04. <sup>3</sup> Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). <sup>4</sup> For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. <sup>5</sup> Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. <sup>6</sup> Applicant is to place a check mark here if English language Translation is attached.

| NON PATENT LITERATURE DOCUMENTS |                          |                                                                                                                                                                                                                                                                 |                |
|---------------------------------|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| Examiner<br>Initials            | Cite<br>No. <sup>1</sup> | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. | T <sup>2</sup> |
|                                 |                          |                                                                                                                                                                                                                                                                 |                |

\*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

<sup>1</sup> Applicant's unique citation designation number (optional). <sup>2</sup> Applicant is to place a check mark here if English language Translation is attached.

20136315.1

|                       |  |                    |  |
|-----------------------|--|--------------------|--|
| Examiner<br>Signature |  | Date<br>Considered |  |
|-----------------------|--|--------------------|--|

BEW/kjh

**PATENT**

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

Application No.: 14/572,068  
Filing Date: December 16, 2014  
Confirmation No. 6575  
First Named Inventor: Yoichi MOMOSE  
Group Art Unit: 2871  
Examiner: Lauren Nguyen  
Title: METHOD OF MANUFACTURING A LIQUID CRYSTAL DEVICE  
Attorney Docket: 9319S-001378-COB

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Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

**INFORMATION DISCLOSURE STATEMENT**

Commissioner:

Pursuant to 37 C.F.R. §§ 1.56, 1.97 and 1.98, Applicant hereby submits an Information Disclosure Statement for consideration by the Examiner.

I. LIST OF PATENTS, PUBLICATIONS, AND OTHER INFORMATION

The patents, publications and other information requested to be considered by the Office (except unpublished U.S. patent applications) are listed on Form 1449 attached hereto.

II. COPIES

A. ☒ Submitted herewith is a legible copy of (i) each foreign patent; (ii) each publication or that portion which caused it to be listed, other than U.S. patents and U.S. patent application publications unless required by the Office; (iii) each unpublished U.S. application listed below in Section IV (i.e., including the specification, claims, and any drawing of the application, or that portion of the application which caused it to be listed, including any claims directed to that



portion), except for such applications filed on or after June 30, 2003, pursuant to the Waiver of the Copy Requirement in 37 C.F.R. 1.98 (OG Notice dated October 19, 2004); and (iv) all other information or that portion which caused it to be listed.

B. ☐ Any patents, publications or other information which are listed on Form 1449 or on the copies of PTO-892, but which are not enclosed herewith, were previously cited by or submitted to the PTO in one of the following applications which has been relied upon for an earlier filing date under 35 U.S.C. § 120:

U.S. Serial Number

U.S. Filing Date

C. ☐ This is a PCT application in the entry of the National Phase in the United States. A copy of the International Search Report is attached for the Examiner's information. The documents listed on the International Search report are listed on the attached Form 1449 for consideration by the Examiner and for listing on any patent resulting from this application. If the International Search report was from the US, EPO, or JPO search authorities, copies of these references should have been supplied to the USPTO under the trilateral agreement and are believed to be in the file of the above-identified application. (MPEP 1893.03(g).)

III. CONCISE EXPLANATION OF THE RELEVANCE (check at least one box)

A. ☒ Except as may be indicated below in (B), all of the patents, publications or other information are in the English language (concise explanation not required).

B. ☐ A concise explanation of the relevance of each patent, publication or other information listed that is not in the English language is as follows (see 37 C.F.R. § 1.98(a)(3)):

1. ☐ See the attached foreign patent office communication regarding a related foreign application in:
2. ☐ English translations are provided as follows: As indicated on attached Form 1449.
3. ☐ Other:

C. ☒ The following additional information is provided for the Examiner's consideration: The reference was cited during prosecution of a related application in the United States.

IV. CROSS REFERENCE TO RELATED APPLICATION(S)

A. ☐ The Examiner is advised that the following co-pending application(s) contain(s) subject matter that may be related to the present application. By bringing this(these) application(s) to the Examiner's attention, Applicant(s) does (do) not waive the confidentiality provisions of 35 U.S.C. § 122.

Serial No.

Filing Date

Inventor(s)

V. THIS IDS IS BEING FILED UNDER

A. ☐ **37 C.F.R. § 1.97(b):** (check only one box)

1. ☐ within three months of the filing date of a national application other than a continued prosecution application under § 1.53(d) (37 C.F.R. § 1.97(b)(1)). No fee or certification is required.

2. ☐ within three months of the date of entry of the national stage as set forth in § 1.491 in an international application (37 C.F.R. § 1.97(b)(2)). No fee or certification is required.

3. ☐ before the mailing of a first Office Action on the merits (37 C.F.R. § 1.97(b)(3)). No fee or certification is required. In the event that a first Office Action on the merits has been issued, please consider this IDS under 37 C.F.R. § 1.97(c) and see the certification under 37 C.F.R. § 1.97(e) below; or, if no certification has been made, charge our deposit account a fee in the amount of \$180.00 as required by 37 C.F.R. § 1.17(p).

4. ☐ before the mailing of a first Office Action after the filing of a request for continued examination under 37 C.F.R. § 1.114. No fee or certification is required.

B. ☒ **37 C.F.R. § 1.97(c):** (check only one box)

before the mailing date of either any Final Office Action under 37 C.F.R. § 1.113, a Notice of Allowance under 37 C.F.R. § 1.311, or an action that otherwise closes prosecution.

1. ☐ No certification; therefore, a fee in the amount of \$180.00 is required by 37 C.F.R. § 1.17(p).

2. ☒ See the certification below. No fee is required.

C. ☐ **37 C.F.R. § 1.97(d):**

after the mailing date of either a Final Office Action under 37 C.F.R. § 1.113 or a Notice of Allowance under 37 C.F.R. § 1.311, yet on or before payment of the issue fee.

1. ☐ See the certification below. A fee in the amount of \$180.00 is required by 37 C.F.R. § 1.17(p).

VI. CERTIFICATION UNDER 37 C.F.R. § 1.97(e): (check only one box)

The undersigned hereby certifies that:

A. ☐ each item of information contained in this IDS was first cited in a communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this IDS (See 37 C.F.R. § 1.97(e)(1)). See further statement under 37 C.F.R. 1.704(d) below in section VII, if applicable; or

B. ☒ no item of information contained in this IDS was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the undersigned after making reasonable inquiry, no item of information contained in this IDS was known to any individual designated in 37 C.F.R. § 1.56(c) more than three months prior to the filing of this IDS (See 37 C.F.R. § 1.97(e)(2)).

C. ☐ some of the items of information were first cited in a communication from a foreign patent office. As to this information, the undersigned hereby certifies that each item of information contained in this IDS was cited in a communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this IDS. As to the remaining information, the undersigned hereby certifies that no item of this remaining information contained in this IDS was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the undersigned after making reasonable inquiry, no item of information contained in this IDS was known to any individual designated in 37 C.F.R. § 1.56(c) more than three months prior to the filing of this IDS.

VII. STATEMENT UNDER 37 C.F.R. 1.704(d)

The undersigned hereby states that:

☐ each item of information contained in this IDS was cited in a communication from a foreign patent office in a counterpart application and this communication was not received by any individual designated in 37 C.F.R. § 1.56(c) more than thirty days prior to the filing of this IDS.

VIII. PAYMENT OF FEES (check only one box, if applicable)

A. ☐ A check in the amount of \$180.00 is enclosed for the above-identified fee.

B. ☐ Please charge Deposit Account No. 50-6518 in the amount of \$180.00 for the above-identified fee.

Please charge any additional fees or credit any overpayment pursuant to 37 C.F.R. § 1.16 or § 1.17 to Deposit Account No. 50-6518 (Seiko Epson Corporation).

The above references are being cited only in the interest of candor and without any admission that they constitute statutory prior art, contain matter which anticipates the invention, or which would render the same obvious, either singly or in combination, to a person of ordinary skill in the art. Furthermore, this Information Disclosure Statement shall not be construed as a representation that a search has been made.

If it is determined that this IDS has been filed under the wrong rule, the PTO is requested to consider this IDS under the proper rule (with a petition if necessary) and charge the appropriate fee to Deposit Account No. 50-6518 (Seiko Epson Corporation).

Respectfully submitted,

Dated: December 1, 2015

By: /Bryant E. Wade/  
G. Gregory Schivley  
Reg. No. 27,382  
Bryant E. Wade  
Reg. No. 40,344

Harness, Dickey & Pierce, P.L.C.  
P.O. Box 828  
Bloomfield Hills, Michigan 48303  
(248) 641-1600

GGG/BEW/klh

## Electronic Acknowledgement Receipt

|                                             |                                                 |
|---------------------------------------------|-------------------------------------------------|
| <b>EFS ID:</b>                              | 24223796                                        |
| <b>Application Number:</b>                  | 14572068                                        |
| <b>International Application Number:</b>    |                                                 |
| <b>Confirmation Number:</b>                 | 6575                                            |
| <b>Title of Invention:</b>                  | METHOD OF MANUFACTURING A LIQUID CRYSTAL DEVICE |
| <b>First Named Inventor/Applicant Name:</b> | Yoichi MOMOSE                                   |
| <b>Customer Number:</b>                     | 27572                                           |
| <b>Filer:</b>                               | Bryant Edward Wade/Kristy Harris                |
| <b>Filer Authorized By:</b>                 | Bryant Edward Wade                              |
| <b>Attorney Docket Number:</b>              | 93195-001378-COB                                |
| <b>Receipt Date:</b>                        | 01-DEC-2015                                     |
| <b>Filing Date:</b>                         | 16-DEC-2014                                     |
| <b>Time Stamp:</b>                          | 14:08:13                                        |
| <b>Application Type:</b>                    | Utility under 35 USC 111(a)                     |

### Payment information:

|                        |    |
|------------------------|----|
| Submitted with Payment | no |
|------------------------|----|

### File Listing:

| Document Number | Document Description                                  | File Name | File Size(Bytes)/<br>Message Digest                                | Multi Part /.zip | Pages (if appl.) |
|-----------------|-------------------------------------------------------|-----------|--------------------------------------------------------------------|------------------|------------------|
| 1               | Information Disclosure Statement (IDS)<br>Form (SB08) | 1449.PDF  | 24554<br><small>cc7c1cdb5cff6e7bbbf8fbbad82c960bbccda3373a</small> | no               | 1                |

### Warnings:

### Information:

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                    |         |                                          |       |   |
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| This is not an USPTO supplied IDS fillable form                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                    |         |                                          |       |   |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Transmittal Letter | IDS.PDF | 33229                                    | no    | 5 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                    |         | a950715cc9a9eb14315942d98332e486f60e41bd |       |   |
| <b>Warnings:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                    |         |                                          |       |   |
| <b>Information:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                    |         |                                          |       |   |
| <b>Total Files Size (in bytes):</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                    |         |                                          | 57783 |   |
| <p><b>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</b></p> <p><b><u>New Applications Under 35 U.S.C. 111</u></b><br/>         If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><b><u>National Stage of an International Application under 35 U.S.C. 371</u></b><br/>         If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><b><u>New International Application Filed with the USPTO as a Receiving Office</u></b><br/>         If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p> |                    |         |                                          |       |   |

**PATENT**

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

Application No.: 14/572,068  
Confirmation No.: 6575  
Filing Date: December 16, 2014  
First Named  
Inventor: Yoichi MOMOSE et al.  
Group Art Unit: 2871  
Examiner: Lauren Nguyen  
Title: METHOD OF MANUFACTURING A LIQUID  
CRYSTAL DEVICE  
Attorney Docket: 9319S-001378-US-COB

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Mail Stop Amendment  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, Virginia 22313-1450

**AMENDMENT**

Commissioner:

In response to the Office Action mailed September 9, 2015, please amend the application as follows and consider the remarks set forth below.

**Amendments to the Specification** begin on page 2 of this paper.

**Amendments to the Claims** begin on page 3 of this paper.

**Remarks** begin on page 12 of this paper.

### **AMENDMENTS TO THE SPECIFICATION**

Please replace the title of the invention with the following rewritten in amendment format:

~~METHOD OF MANUFACTURING~~ A LIQUID CRYSTAL DEVICE



## **AMENDMENTS TO THE CLAIMS**

The following listing of claims will replace all prior versions and listings of claims in the application.

### **LISTING OF CLAIMS**

1. (Currently Amended) A display device, comprising:

a first substrate including a plurality of pixel electrodes and a plurality of active elements, wherein the plurality of active elements are thin film transistors disposed on the first substrate;

a second substrate including a common electrode, wherein the common electrode is disposed on the second substrate opposite to the plurality of pixel electrodes disposed on the first substrate;

a display region in which the plurality of pixel electrodes and the plurality of active elements are aligned in a plan-view of the first substrate;

a seal region positioned around the display region in ~~[[a]]~~ the plan-view of the first substrate; and

a seal member in the seal region and disposed between the first substrate and the second substrate so as to the common electrode faces to the plurality of pixel electrodes,

wherein the first substrate includes a protruding region which protrudes over the second substrate in the plan-view of the first substrate and a plurality of conductive portions, the plurality of conductive portions being dot conductive points,

the seal region forms a rectangular closed-shape so as to surround the display region, and has a first side, a second side, a third side and a fourth side, the first side is positioned between the display region and the protruding region, and opposed to the third side, and the second side is opposed to the fourth side, and

the seal member includes a first seal portion and a second seal portion,  
wherein the first seal portion is disposed at least on the first side and the second seal portion is disposed at least on the third side,  
the first seal portion and the second seal portion are connected in a first junction portion positioned on the second side, and  
the first seal portion and the second seal portion are connected in a second junction portion positioned on the fourth side,  
wherein the second seal portion includes a plurality of conductive particles and the plurality of ~~dot~~ conductive portions ~~points~~ are disposed at least on the third side and all of the plurality of dot conductive points are electrically connected to the common electrode.

2. (Original) The display device, according to Claim 1,  
wherein each of the plurality of the conductive portions are spaced apart from each other.

3. (Currently Amended) The display device, according to Claim 1,  
wherein the first seal portion and the second seal portion extend from the second side toward an edge of the first substrate in the first junction portion,  
the first seal portion and the second seal portion extend from the fourth side toward an edge of the first substrate in the second junction portion, and  
the first junction portion and the second junction portion projecting in an opposite direction with respect to the ~~pixel area~~ display region.

4. (Original) The display device, according to Claim 1,  
wherein the first substrate further includes a first conductive portion on the second side,  
the second seal portion includes a first part of the seal member on the second side,  
wherein the first part of the seal member extends from one end of the seal member disposed on the third side over the first conductive portion on the second side, and the first part of the seal member includes a plurality of conductive particles, and  
the first conductive portion is electrically connected to the common electrode.

5. (Original) The display device, according to Claim 4,  
wherein the first substrate further includes a second conductive portion on the fourth side,  
the second seal portion includes a second part of the seal member on the fourth side,  
wherein the second part of the seal member extends from another end of the seal member disposed on the third side over the second conductive portion on the fourth side, and the second part of the seal member includes a plurality of conductive particles, and  
the second conductive portion is electrically connected to the common electrode.

6. (Original) An electronic device comprising the display device according to claim 1.

7. (Currently Amended) A display device, comprising:

a first substrate including a pixel region and a seal region which is defined around the pixel region on a first surface of the first substrate, the pixel region including a plurality of pixels and a plurality of active elements, and the seal region forming a rectangular ring shape, wherein the active elements are thin film transistors disposed on the first substrate; and

a second substrate including a common electrode on a second surface; and

a seal member bonding the first substrate and the second substrate so that the first surface faces the second surface and the common electrode is disposed on the second surface opposite to the plurality of pixels disposed on the first substrate,

wherein the first substrate includes a protruding region which protrudes over the second substrate in plan-view of the first substrate,

the seal region includes a first side, a second side, a third side and a fourth side, the first side is positioned between the pixel region and the protruding region, and opposed to the third side, and the second side is opposed to the fourth side,

the seal member is positioned on the first side, the second side, the third side and the fourth side continuously and forms a closed-ring shape in which the pixel region is positioned,

a first part of the seal member disposed on the third side which is opposed to the protruding region with respect to the pixel region includes a plurality of conductive particles,

a plurality of dot ~~conductive portions~~ points are disposed on the third side of the first substrate, all of the plurality of the dot ~~conductive portions~~ points are electrically connected to the common electrode, and

each of the plurality of the dot conductive ~~portions~~points are spaced apart from each other.

8. (Currently Amended) The display device, according to Claim 7, wherein the first substrate includes a first conductive ~~portion~~point on the second side and the seal member includes a second part of the seal member on the second side, the second part of the seal member extends from one end of the first part of the seal member over the first conductive ~~portion~~point on the second side, and the second part of the seal member includes a plurality of conductive particles, and

wherein the first conductive ~~portion~~point is electrically connected to the common electrode.

9. (Currently Amended) The display device, according to Claim 8, wherein the first substrate includes a second conductive ~~portion~~point on the fourth side and the seal member includes a third part of the seal member on the fourth side, the third part of the seal member extends from another end of the first part of the seal member over the second conductive ~~portion~~point on the fourth side, and the third part of the seal member includes a plurality of conductive particles, and

wherein the second conductive ~~portion~~point is electrically connected to the common electrode.

10. (Original) The display device, according to Claim 7, wherein the seal member extends to a first edge of the seal region opposite to the pixel region on the second side.

11. (Original) The display device, according to Claim 10,  
wherein the seal member extends to a second edge of the seal region  
opposite to the pixel region on the fourth side.

12. (Original) An electronic device comprising the display device  
according to claim 7.

13. (Currently Amended) A display device, comprising:  
a first substrate including a plurality of pixel electrodes and a plurality of active  
elements, wherein the plurality of active elements are thin film transistors disposed  
on the first substrate;

a second substrate including a common electrode, wherein the common  
electrode is disposed on the second substrate;

a display region in which the plurality of pixel electrodes and the plurality of  
active elements are aligned in a plan-view of the first substrate;

a seal region positioned around the display region in the plan-view of the first  
substrate and forming a closed-ring shape in which the display region is disposed;

a seal member being disposed in the seal region and bonding the first  
substrate and the second substrate so that the common electrode faces the plurality  
of pixel electrodes, the seal member forming a closed-ring shape in which the  
display region is positioned;

wherein the first substrate includes a protruding region which protrudes over  
the second substrate in the plan-view of the first substrate and a plurality of  
conductive portions,

the seal region includes a first portion and a second portion, the first portion is positioned at least between the display region and the protruding region, and the second portion is positioned at least opposite to the protruding region with respect to the display region, and

the seal member includes a first part and ~~[[the]]~~ a second part, the first part of the seal member is positioned on the first portion and the second part of the seal member is positioned on the second portion, and the second part of the seal member includes a plurality of conductive particles,

~~wherein the a plurality of dot conductive portions~~ points are disposed on the second portion of the first substrate, all of the plurality of the dot conductive ~~portions~~ points are electrically connected to the common electrode,

each of the plurality of the dot conductive ~~portions~~ points are spaced apart from each other.

14. (Original) The display device, according to Claim 13,

wherein no conductive portions are disposed on the first portion of the first substrate and no conductive particles are included in the first part of the seal member.

15. (Original) The display device, according to Claim 13,

wherein the seal member further includes a third part and a fourth part, the third part of the seal member extends from one end of the first part, and the fourth part of the seal member extends from one end of the second part and includes a first plurality of conductive particles.

16. (Original) The display device, according to Claim 15,  
wherein the third part and the fourth part are connected and extend to a first edge of the seal region opposite to the display region.

17. (Original) The display device, according to Claim 16,  
wherein the seal member further includes a fifth part and a sixth part, the fifth part of the seal member extends from another end of the first part, and the sixth part of the seal member extends from another end of the second part and includes a second plurality of conductive particles, and  
the fifth part and the sixth part are connected and extend to a second edge of the seal region opposite to the display region.

18. (Original) The display device, according to Claim 17,  
wherein the first edge of the seal region is positioned opposite to the second edge of the seal region with respect to the display region.

19. (Currently Amended) The display device, according to Claim 18,  
wherein the first substrate further includes a first conductive ~~portion~~ point and a second conductive ~~portion~~ point, different from the plurality of conductive ~~portions~~ points, and the first conductive ~~portion~~ point, the second conductive ~~portion~~ point and the plurality of conductive ~~portions~~ points are disposed apart from each other, and  
the first conductive ~~portion~~ point is electrically connected to the common electrode through the first plurality of conductive particles and the second conductive ~~portion~~ point is electrically connected to the common electrode through the second plurality of conductive particles



20. (Original) An electronic device comprising the display device according to claim 13.

### **REMARKS**

Claims 1-20 are now pending in the application. By this paper, Claims 1, 3, 7, 8, 9, 13, and 19 have been amended. The Examiner is requested to reconsider and withdraw the rejections in view of the amendments and remarks contained herein.

### **SPECIFICATION**

The specification stands objected to for certain informalities. Applicant has amended the specification according to the Examiner's suggestions. Therefore, reconsideration and withdrawal of this objection are respectfully requested.

### **REJECTION UNDER 35 U.S.C. § 103**

Claims 1-20 stand rejected under 35 U.S.C. § 103 as being unpatentable over Miyazaki et al. (U.S. Pat. No. 6,930,745) in view of Tanaka et al. (U.S. Pub. No. 2005/0122466). This rejection is respectfully traversed.

Claims 1, 7, and 13 have been amended to recite that the active elements are thin film transistors disposed on the first substrate, the common electrode is disposed on the second substrate opposite to the plurality of pixel electrodes disposed on the first substrate, a plurality of dot conductive points, and all of the conductive points are electrically connected to the common electrode. Applicant initially submits that Miyazaki fails to disclose active elements that are thin film transistors disposed on the first substrate. The device described in Miyazaki is a matrix type LCD. Therefore, Miyazaki does not include any thin film transistors and cannot disclose active elements that are thin film transistors disposed on the first substrate, as recited in Claims 1, 7, and 13. Thus, Miyazaki fails to disclose active elements that are thin film transistors disposed on the first substrate.

Applicant also submits that Miyazaki fails to disclose a common electrode that is disposed on the second substrate opposite to the plurality of pixel electrodes disposed on the first substrate. In the Office Action, the Examiner points to Miyazaki, figure 2, as a common electrode. However, Miyazaki does not include any “common electrode.” The second electrode 9b in Miyazaki is disposed on the second substrate, however, the second electrode is a scan electrode. Applicant respectfully asserts that a scan electrode is not a common electrode as recited in Claims 1, 7, and 13. Thus, Miyazaki fails to disclose a common electrode that is disposed on the second substrate opposite to the plurality of pixel electrodes disposed on the first substrate.

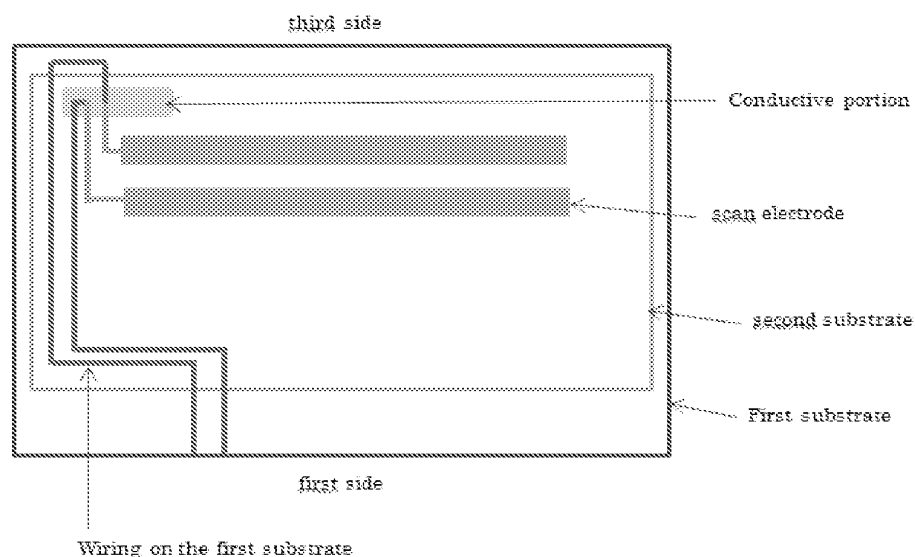
Applicant also submits that Miyazaki fails to disclose conductive portions that are dot conductive points. The conductive portion of Miyazaki does not include dot conductive points as recited in the claims. Instead, the conductive portion of Miyazaki is an area, not a dot. Tanaka fails to make up for the deficiencies of Miyazaki because, like Miyazaki, Tanaka does not disclose conductive portions that are dot conductive points. In the Office Action, the Examiner simply states that Tanaka discloses a plurality of conductive portions. However, the disclosure of Tanaka fails to disclose any dot conductive points as recited in the claims. Thus, Tanaka, like Miyazaki, fails to disclose conductive portions that are dot conductive points.

Applicant further submits that Miyazaki fails to disclose the second seal portion including a plurality of conductive particles and the plurality of dot conductive points being disposed at least on the third side and all of the plurality of dot conductive points being electrically connected to the common electrode. Because Miyazaki does not disclose a common electrode or a plurality of dot conductive

points, Miyazaki also cannot disclose all of the plurality of dot conductive points being electrically connected to a common electrode.

Further, the claims recite the conductive portion (dot conductive points) being disposed on the third side. In Miyazaki, there is no conductive portion on the third side. The reason for this in Miyazaki relates to the structure of the passive LCD panel. Positions of conductive portions in the passive LCD panel is limited to two types: (1) one where the conductive portion is disposed on the first side, like Miyazaki, and (2) one where the conductive portion is disposed on the second side and fourth side. The conductive portion of a passive LCD, as in Miyazaki, is formed to connect wiring of the first substrate and a scan electrode of the second substrate. Accordingly, the above two type designs are the only efficient layouts. Neither of these designs describes the conductive portion (dot conductive points) being disposed on the third side, as recited in the claims.

On the other hand, if one tries to dispose conductive portions on the third side in a passive LCD, such as in Miyazaki, it is frankly an irrational design. See below.



As can be seen in the figure above, if the conductive portion is disposed on the third side in Miyazaki's design, the layout of the wiring becomes very complicated and the length of the wiring becomes longer. Accordingly, this design is very unreasonable. Respectfully, a person of ordinary skill in the art would never dispose the conductive portion on a third side, even in combination with Tanaka's teachings.

For at least these reasons, Applicant respectfully asserts that Claims 1, 7, and 13 are in condition for allowance. Claims 2-6, 8-12, and 14-20 ultimately depend from one of Claims 1, 7, and 13 and are allowable for at least similar reasons. Thus, the Examiner is requested to reconsider and withdraw the rejections.

#### **CONCLUSION**

It is believed that a full and complete response has been made to the outstanding Office Action and the present application is in condition for allowance. Thus, prompt and favorable consideration of this amendment is respectfully requested. If the Examiner believes that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at (248) 641-1600.

Respectfully submitted,

Dated: December 7, 2015

By: /G. Gregory Schivley/  
G. Gregory Schivley  
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20151024.1

## Electronic Acknowledgement Receipt

|                                             |                                                 |
|---------------------------------------------|-------------------------------------------------|
| <b>EFS ID:</b>                              | 24281652                                        |
| <b>Application Number:</b>                  | 14572068                                        |
| <b>International Application Number:</b>    |                                                 |
| <b>Confirmation Number:</b>                 | 6575                                            |
| <b>Title of Invention:</b>                  | METHOD OF MANUFACTURING A LIQUID CRYSTAL DEVICE |
| <b>First Named Inventor/Applicant Name:</b> | Yoichi MOMOSE                                   |
| <b>Customer Number:</b>                     | 27572                                           |
| <b>Filer:</b>                               | G. Gregory Schivley/Michelle Kowalske           |
| <b>Filer Authorized By:</b>                 | G. Gregory Schivley                             |
| <b>Attorney Docket Number:</b>              | 93195-001378-COB                                |
| <b>Receipt Date:</b>                        | 07-DEC-2015                                     |
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| <b>Time Stamp:</b>                          | 15:17:22                                        |
| <b>Application Type:</b>                    | Utility under 35 USC 111(a)                     |

### Payment information:

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### File Listing:

| Document Number | Document Description | File Name    | File Size(Bytes)/<br>Message Digest      | Multi Part /.zip | Pages (if appl.) |
|-----------------|----------------------|--------------|------------------------------------------|------------------|------------------|
| 1               |                      | Response.PDF | 58567                                    | yes              | 15               |
|                 |                      |              | ecaa007fcb3777ef3bb5c6ba9bee9b1be080400c |                  |                  |

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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Amendment/Req. Reconsideration-After Non-Final Reject | 1     | 1   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Specification                                         | 2     | 2   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Claims                                                | 3     | 11  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Applicant Arguments/Remarks Made in an Amendment      | 12    | 15  |
| Warnings:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                       |       |     |
| Information:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                       |       |     |
| Total Files Size (in bytes):                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                       | 58567 |     |
| <p>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</p> <p><b><u>New Applications Under 35 U.S.C. 111</u></b><br/>If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><b><u>National Stage of an International Application under 35 U.S.C. 371</u></b><br/>If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><b><u>New International Application Filed with the USPTO as a Receiving Office</u></b><br/>If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p> |                                                       |       |     |



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|---------------------------------------------------------------------------------------------------------|-------------|----------------------|---------------------------------|-----------------------------|
| APPLICATION NO.                                                                                         | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO.             | CONFIRMATION NO.            |
| 14/572,068                                                                                              | 12/16/2014  | Yoichi MOMOSE        | 9319S-001378-COB                | 6575                        |
| 27572 7590 02/11/2016<br>HARNESS, DICKEY & PIERCE, P.L.C.<br>P.O. BOX 828<br>BLOOMFIELD HILLS, MI 48303 |             |                      | EXAMINER<br>NGUYEN, LAUREN      |                             |
|                                                                                                         |             |                      | ART UNIT<br>2871                | PAPER NUMBER                |
|                                                                                                         |             |                      | NOTIFICATION DATE<br>02/11/2016 | DELIVERY MODE<br>ELECTRONIC |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

troydocketing@hdp.com



|                              |                                      |                                      |                                                  |
|------------------------------|--------------------------------------|--------------------------------------|--------------------------------------------------|
| <b>Office Action Summary</b> | <b>Application No.</b><br>14/572,068 | <b>Applicant(s)</b><br>MOMOSE ET AL. |                                                  |
|                              | <b>Examiner</b><br>LAUREN NGUYEN     | <b>Art Unit</b><br>2871              | <b>AIA (First Inventor to File) Status</b><br>No |

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 12/07/2015.  
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on \_\_\_\_.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on \_\_\_\_; the restriction requirement and election have been incorporated into this action.
- 4) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims\***

- 5) ☒ Claim(s) 1-20 is/are pending in the application.  
5a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 6) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 7) ☒ Claim(s) 1-20 is/are rejected.
- 8) ☐ Claim(s) \_\_\_\_ is/are objected to.
- 9) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

\* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see [http://www.uspto.gov/patents/init\\_events/pph/index.jsp](http://www.uspto.gov/patents/init_events/pph/index.jsp) or send an inquiry to [PPHfeedback@uspto.gov](mailto:PPHfeedback@uspto.gov).

**Application Papers**

- 10) ☐ The specification is objected to by the Examiner.
- 11) ☐ The drawing(s) filed on \_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

**Certified copies:**

- a) ☐ All    b) ☐ Some\*\*    c) ☐ None of the:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\*\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |                                                                                                           |                                                         |
|-----------------------------------------------------------------------------------------------------------|---------------------------------------------------------|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)                                          | 3) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) | Paper No(s)/Mail Date. ____.                            |
| Paper No(s)/Mail Date ____.                                                                               | 4) <input type="checkbox"/> Other: ____.                |

1. The present application is being examined under the pre-AIA first to invent provisions.

### **DETAILED ACTION**

#### ***Response to Arguments***

2. Applicant's arguments filed 12/07/2015 have been fully considered but they are not persuasive.
3. The applicant argues that none of the cited references teaches the limitation as amended in claims 1, 7, and 13. The examiner respectfully disagrees. **Tanaka** (figures 1-2) teaches (i) wherein the plurality of active elements are thin film transistors disposed on the first substrate (substrate 111; see at least paragraph 0058); a second substrate including a common electrode (substrate 121; see at least paragraph 0059), wherein the common electrode is disposed on the second substrate opposite to the plurality of pixel electrodes disposed on the first substrate; wherein the first substrate includes a protruding region which protrudes over the second substrate in the plan-view of the first substrate and a plurality of conductive portions. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention modify the first substrate as taught by **Tanaka** in order to control the flow directions of the liquid crystal by changing a distance between the corner and each liquid crystal filling port and opening lengths of the liquid crystal filling ports. Accordingly, the flow directions can be more parallel to the predetermined direction regardless of the predetermined direction of the alignment layer relative to the extending direction of the seal.
4. In addition, (ii) it would have been obvious to one having ordinary skill in the art at the time the invention was made to have dot conductive points, since it has been held that the configuration of the claimed shape of the opening was a matter of choice

which a person of ordinary skill in the art would have found obvious absent persuasive evidence that the particular configuration of the claimed shape of the opening was significant. In re Dailey, 357 F.2d 669, 149 USPQ 47 (CCPA 1966). The applicant has not provided any criticality for the shape of the conductive points to be dot.

5. Therefore, **Miyazaki et al. as modified by Tanaka et al.** teaches wherein the second seal portion includes a plurality of conductive particles and the plurality of dot conductive points are disposed at least on the third side and all of the plurality of dot conductive points are electrically connected to the common electrode.

***Claim Rejections - 35 USC § 103***

6. The following is a quotation of pre-AIA 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented 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 art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. **Claims 1-20** rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over **Miyazaki et al. (US 6,930,745)** in view of **Tanaka et al. (US 2005/0122466)**.

8. Regarding **claim 1, Miyazaki et al.** (figures 1-2 and 16) discloses a display device, comprising:

- a first substrate (70) including a plurality of pixel electrodes and a plurality of active elements;
- a second substrate (80) including an electrode (see at least figure 2);

Art Unit: 2871

- a display region in which the plurality of pixel electrodes and the plurality of active elements are aligned in a plan-view of the first substrate;
- a seal region positioned around the display region in a plan-view of the first substrate;
- and
- a seal member (3) in the seal region and disposed between the first substrate and the second substrate so as to the common electrode faces to the plurality of pixel electrodes,
- the seal region (75-79 and 85-89) forms a rectangular closed-shape so as to surround the display region, and has a first side, a second side, a third side and a fourth side, the first side is positioned between the display region and the protruding region, and opposed to the third side, and the second side is opposed to the fourth side, and
- the seal member includes a first seal portion and a second seal portion (75-79 and 85-89),
- wherein the first seal portion is disposed at least on the first side and the second seal portion is disposed at least on the third side,
- the first seal portion and the second seal portion are connected in a first junction portion positioned on the second side, and
- the first seal portion and the second seal portion are connected in a second junction portion positioned on the fourth side,
- wherein the second seal portion includes a plurality of conductive particles and the plurality of conductive portions are disposed at least on the third side and electrically connected to the common electrode.

9. **Miyazaki et al.** discloses the limitations as shown in the rejection of **claim 1** above.

However, **Miyazaki et al.** is silent regarding (i) wherein the plurality of active elements are thin

film transistors disposed on the first substrate; a second substrate including a common electrode, wherein the common electrode is disposed on the second substrate opposite to the plurality of pixel electrodes disposed on the first substrate; wherein the first substrate includes a protruding region which protrudes over the second substrate in the plan-view of the first substrate and a plurality of conductive portions; and (ii) the plurality of conductive portions being dot conductive points.

10. **Tanaka** (figures 1-2) teaches (i) wherein the plurality of active elements are thin film transistors disposed on the first substrate (substrate 111; see at least paragraph 0058); a second substrate including a common electrode (substrate 121; see at least paragraph 0059), wherein the common electrode is disposed on the second substrate opposite to the plurality of pixel electrodes disposed on the first substrate; wherein the first substrate includes a protruding region which protrudes over the second substrate in the plan-view of the first substrate and a plurality of conductive portions. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention modify the first substrate as taught by **Tanaka** in order to control the flow directions of the liquid crystal by changing a distance between the corner and each liquid crystal filling port and opening lengths of the liquid crystal filling ports. Accordingly, the flow directions can be more parallel to the predetermined direction regardless of the predetermined direction of the alignment layer relative to the extending direction of the seal.

11. In addition, (ii) it would have been obvious to one having ordinary skill in the art at the time the invention was made to have dot conductive points, since it has been held that the configuration of the claimed shape of the opening was a matter of choice which a person of ordinary skill in the art would have found obvious absent

persuasive evidence that the particular configuration of the claimed shape of the opening was significant. In re Dailey, 357 F.2d 669, 149 USPQ 47 (CCPA 1966). The applicant has not provided any criticality for the shape of the conductive points to be dot.

12. Therefore, **Miyazaki et al. as modified by Tanaka et al.** teaches wherein the second seal portion includes a plurality of conductive particles and the plurality of dot conductive points are disposed at least on the third side and all of the plurality of dot conductive points are electrically connected to the common electrode.

13. Regarding **claim 2, Miyazaki et al.** (figures 1-2 and 16) discloses each of the plurality of the conductive portions are spaced apart from each other.

14. Regarding **claim 3, Miyazaki et al.** (figures 1-2 and 16) discloses the first seal portion and the second seal portion extend from the second side toward an edge of the first substrate in the first junction portion, the first seal portion and the second seal portion extend from the fourth side toward an edge of the first substrate in the second junction portion, and the first junction portion and the second junction portion projecting in an opposite direction with respect to the pixel area.

15. Regarding **claim 4, Miyazaki et al.** (figures 1-2 and 16) discloses the first substrate further includes a first conductive portion on the second side, the second seal portion includes a first part of the seal member on the second side, wherein the first part of the seal member extends from one end of the seal member disposed on the third side over the first conductive portion on the second side, and the first part of the seal member includes a plurality of conductive particles, and the first conductive portion is electrically connected to the common electrode.

16. Regarding **claim 5, Miyazaki et al.** (figures 1-2 and 16) discloses the first substrate further includes a second conductive portion on the fourth side, the second seal portion includes a second part of the seal member on the fourth side, wherein the second part of the seal member extends from another end of the seal member disposed on the third side over the second conductive portion on the fourth side, and the second part of the seal member includes a plurality of conductive particles, and the second conductive portion is electrically connected to the common electrode.

17. Regarding **claim 6, Miyazaki et al.** (figures 1-2 and 16) discloses an electronic device comprising the display device according to claim 1.

18. Regarding **claim 7, Miyazaki et al.** (figures 1-2 and 16) discloses a display device, comprising:

- a first substrate (70) including a pixel region and a seal region which is defined around the pixel region on a first surface of the first substrate, the pixel region including a plurality of pixels and a plurality of active elements, and the seal region forming a rectangular ring shape; and
- a second substrate (80; figure 1) including a common electrode on a second surface; and
- a seal member bonding the first substrate and the second substrate so that the first surface faces the second surface,
- the seal region (75-79 and 85-89) includes a first side, a second side, a third side and a fourth side, the first side is positioned between the pixel region and the protruding region, and opposed to the third side, and the second side is opposed to the fourth side,

- the seal member is positioned on the first side, the second side, the third side and the fourth side continuously and forms a closed-ring shape in which the pixel region is positioned,
- a first part of the seal member disposed on the third side which is opposed to the protruding region with respect to the pixel region includes a plurality of conductive particles,
- a plurality of conductive portions are disposed on the third side of the first substrate, the plurality of the conductive portions are electrically connected to the common electrode.

19. **Miyazaki et al.** discloses the limitations as shown in the rejection of **claim 1** above.

However, **Miyazaki et al.** is silent regarding (i) wherein the plurality of active elements are thin film transistors disposed on the first substrate; a second substrate including a common electrode, wherein the common electrode is disposed on the second substrate opposite to the plurality of pixel electrodes disposed on the first substrate; wherein the first substrate includes a protruding region which protrudes over the second substrate in the plan-view of the first substrate and a plurality of conductive portions; and (ii) the plurality of conductive portions being dot conductive points.

20. **Miyazaki et al.** discloses the limitations as shown in the rejection of **claim 7** above.

However, **Miyazaki et al.** is silent regarding (i) wherein the plurality of active elements are thin film transistors disposed on the first substrate; a second substrate including a common electrode, wherein the common electrode is disposed on the second substrate opposite to the plurality of pixel electrodes disposed on the first substrate; wherein the first substrate includes a protruding region which protrudes over the second substrate in the plan-view of the first substrate and a



plurality of conductive portions; and (ii) the plurality of conductive portions being dot conductive points.

21. **Tanaka** (figures 1-2) teaches (i) wherein the plurality of active elements are thin film transistors disposed on the first substrate (substrate 111; see at least paragraph 0058); a second substrate including a common electrode (substrate 121; see at least paragraph 0059), wherein the common electrode is disposed on the second substrate opposite to the plurality of pixel electrodes disposed on the first substrate; wherein the first substrate includes a protruding region which protrudes over the second substrate in the plan-view of the first substrate and a plurality of conductive portions. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention modify the first substrate as taught by **Tanaka** in order to control the flow directions of the liquid crystal by changing a distance between the corner and each liquid crystal filling port and opening lengths of the liquid crystal filling ports. Accordingly, the flow directions can be more parallel to the predetermined direction regardless of the predetermined direction of the alignment layer relative to the extending direction of the seal.

22. In addition, (ii) it would have been obvious to one having ordinary skill in the art at the time the invention was made to have dot conductive points, since it has been held that the configuration of the claimed shape of the opening was a matter of choice which a person of ordinary skill in the art would have found obvious absent persuasive evidence that the particular configuration of the claimed shape of the opening was significant. In re Dailey, 357 F.2d 669, 149 USPQ 47 (CCPA 1966). The applicant has not provided any criticality for the shape of the conductive points to be dot.

23. Therefore, **Miyazaki et al. as modify by Tanaka et al.** teaches wherein the second seal portion includes a plurality of conductive particles and the plurality of dot conductive points are disposed at least on the third side and all of the plurality of dot conductive points are electrically connected to the common electrode and each of the plurality of the dot conductive points are spaced apart from each other.

24. Regarding **claim 8, Miyazaki et al.** (figures 1-2 and 16) discloses the first substrate includes a first conductive portion on the second side and the seal member includes a second part of the seal member on the second side, the second part of the seal member extends from one end of the first part of the seal member over the first conductive portion on the second side, and the second part of the seal member includes a plurality of conductive particles, and wherein the first conductive portion is electrically connected to the common electrode.

25. Regarding **claim 9, Miyazaki et al.** (figures 1-2 and 16) **as modify by Tanaka et al.** teaches the first substrate includes a second conductive point on the fourth side and the seal member includes a third part of the seal member on the fourth side, the third part of the seal member extends from another end of the first part of the seal member over the second conductive point on the fourth side, and the third part of the seal member includes a plurality of conductive particles, and wherein the second conductive point is electrically connected to the common electrode.

26. Regarding **claim 10, Miyazaki et al.** (figures 1-2 and 16) discloses the seal member extends to a first edge of the seal region opposite to the pixel region on the second side.

27. Regarding **claim 11, Miyazaki et al.** (figures 1-2 and 16) discloses the seal member extends to a second edge of the seal region opposite to the pixel region on the fourth side.

28. Regarding **claim 12, Miyazaki et al.** (figures 1-2 and 16) discloses an electronic device comprising the display device according to claim 7.

29. Regarding **claim 13, Miyazaki et al.** (figures 1-2 and 16) discloses a display device, comprising:

- a first substrate (70) including a plurality of pixel electrodes and a plurality of active elements;
- a second substrate (80) including a common electrode;
- a display region in which the plurality of pixel electrodes and the plurality of active elements are aligned in a plan-view of the first substrate;
- a seal region (75-79 and 85-89) positioned around the display region in the plan-view of the first substrate and forming a closed-ring shape in which the display region is disposed;
- a seal member in the seal region and bonding the first substrate and the second substrate so that the common electrode faces the plurality of pixel electrodes, the seal member forming a closed-ring shape in which the display region is positioned;
- the seal region includes a first portion and a second portion, the first portion is positioned at least between the display region and the protruding region, and the second portion is positioned at least opposite to the protruding region with respect to the display region, and
- the seal member includes a first part and the second part, the first part of the seal member is positioned on the first portion and the second part of the seal member is positioned on

the second portion, and the second part of the seal member includes a plurality of conductive particles,

- wherein the plurality of conductive portions are disposed on the second portion of the first substrate, the plurality of the conductive portions are electrically connected to the common electrode,
- each of the plurality of the conductive portions are spaced apart from each other.

30. **Miyazaki et al.** discloses the limitations as shown in the rejection of **claim 13** above.

However, **Miyazaki et al.** is silent regarding (i) wherein the plurality of active elements are thin film transistors disposed on the first substrate; a second substrate including a common electrode, wherein the common electrode is disposed on the second substrate opposite to the plurality of pixel electrodes disposed on the first substrate; wherein the first substrate includes a protruding region which protrudes over the second substrate in the plan-view of the first substrate and a plurality of conductive portions; and (ii) the plurality of conductive portions being dot conductive points.

31. **Tanaka** (figures 1-2) teaches (i) wherein the plurality of active elements are thin film transistors disposed on the first substrate (substrate 111; see at least paragraph 0058); a second substrate including a common electrode (substrate 121; see at least paragraph 0059), wherein the common electrode is disposed on the second substrate opposite to the plurality of pixel electrodes disposed on the first substrate; wherein the first substrate includes a protruding region which protrudes over the second substrate in the plan-view of the first substrate and a plurality of conductive portions. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention modify the first substrate as taught by **Tanaka** in order to control the

flow directions of the liquid crystal by changing a distance between the corner and each liquid crystal filling port and opening lengths of the liquid crystal filling ports. Accordingly, the flow directions can be more parallel to the predetermined direction regardless of the predetermined direction of the alignment layer relative to the extending direction of the seal.

32. In addition, (ii) it would have been obvious to one having ordinary skill in the art at the time the invention was made to have dot conductive points, since it has been held that the configuration of the claimed shape of the opening was a matter of choice which a person of ordinary skill in the art would have found obvious absent persuasive evidence that the particular configuration of the claimed shape of the opening was significant. In re Dailey, 357 F.2d 669, 149 USPQ 47 (CCPA 1966). The applicant has not provided any criticality for the shape of the conductive points to be dot.

33. Therefore, **Miyazaki et al. as modify by Tanaka et al.** teaches wherein the second seal portion includes a plurality of conductive particles and the plurality of dot conductive points are disposed at least on the third side and all of the plurality of dot conductive points are electrically connected to the common electrode and each of the plurality of the dot conductive points are spaced apart from each other.

34. Regarding **claim 14, Miyazaki et al.** (figures 1-2 and 16) discloses no conductive portions are disposed on the first portion of the first substrate and no conductive particles are included in the first part of the seal member.

35. Regarding **claim 15, Miyazaki et al.** (figures 1-2 and 16) discloses the seal member further includes a third part and a fourth part, the third part of the seal member extends from one

end of the first part, and the fourth part of the seal member extends from one end of the second part and includes a first plurality of conductive particles.

36. Regarding **claim 16, Miyazaki et al.** (figures 1-2 and 16) discloses the third part and the fourth part are connected and extend to a first edge of the seal region opposite to the display region.

37. Regarding **claim 17, Miyazaki et al.** (figures 1-2 and 16) discloses the seal member further includes a fifth part and a sixth part, the fifth part of the seal member extends from another end of the first part, and the sixth part of the seal member extends from another end of the second part and includes a second plurality of conductive particles, and the fifth part and the sixth part are connected and extend to a second edge of the seal region opposite to the display region.

38. Regarding **claim 18, Miyazaki et al.** (figures 1-2 and 16) discloses the first edge of the seal region is positioned opposite to the second edge of the seal region with respect to the display region.

39. Regarding **claim 19, Miyazaki et al.** (figures 1-2 and 16) discloses the first substrate further includes a first conductive portion and a second conductive portion, different from the plurality of conductive portions, and the first conductive portion, the second conductive portion and the plurality of conductive portions are disposed apart from each other, and the first conductive portion is electrically connected to the common electrode through the first plurality of conductive particles and the second conductive portion is electrically connected to the common electrode through the second plurality of conductive particles.

40. Regarding **claim 20, Miyazaki et al.** (figures 1-2 and 16) discloses an electronic device comprising the display device according to claim 13.

***Conclusion***

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lauren Nguyen whose telephone number is (571) 270-1428. The examiner can normally be reached on M-Th, 7:30-6:00 EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Edward Glick can be reached on (571) 272-2490. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Lauren Nguyen/  
Primary Examiner, Art Unit 2871



14572068 - GAU: 2871

Receipt date: 12/01/2015

Used in Lieu of PTO/SB/08A/B  
(Based on PTO 10-07 version)

|                                                                                                          |   |    |   |                          |                        |
|----------------------------------------------------------------------------------------------------------|---|----|---|--------------------------|------------------------|
| Substitute for form 1449/PTO                                                                             |   |    |   | <b>Complete if Known</b> |                        |
| <b>INFORMATION DISCLOSURE<br/>STATEMENT BY APPLICANT</b><br><br><i>(Use as many sheets as necessary)</i> |   |    |   | Application Number       | 14/572,068-Conf. #6575 |
|                                                                                                          |   |    |   | Filing Date              | December 16, 2014      |
|                                                                                                          |   |    |   | First Named Inventor     | Yoichi MOMOSE          |
|                                                                                                          |   |    |   | Art Unit                 | 2871                   |
|                                                                                                          |   |    |   | Examiner Name            | Lauren Nguyen          |
| Sheet                                                                                                    | 1 | of | 1 | Attorney Docket Number   | 9319S-001378-COB       |

| U.S. PATENT DOCUMENTS |                          |                                          |                                |                                                    |                                                                                 |
|-----------------------|--------------------------|------------------------------------------|--------------------------------|----------------------------------------------------|---------------------------------------------------------------------------------|
| Examiner<br>Initials* | Cite<br>No. <sup>1</sup> | Document Number                          | Publication Date<br>MM-DD-YYYY | Name of Patentee or<br>Applicant of Cited Document | Pages, Columns, Lines, Where<br>Relevant Passages or Relevant<br>Figures Appear |
|                       |                          | Number-Kind Code <sup>2</sup> (if known) |                                |                                                    |                                                                                 |
| /L.N./                | AA*                      | US-2002-0080461-A1                       | 06-27-2002                     | Karasawa et al.                                    |                                                                                 |

| FOREIGN PATENT DOCUMENTS |                          |                                                                                   |                                   |                                                    |                                                                                 |                |
|--------------------------|--------------------------|-----------------------------------------------------------------------------------|-----------------------------------|----------------------------------------------------|---------------------------------------------------------------------------------|----------------|
| Examiner<br>Initials*    | Cite<br>No. <sup>1</sup> | Foreign Patent Document                                                           | Publication<br>Date<br>MM-DD-YYYY | Name of Patentee or<br>Applicant of Cited Document | Pages, Columns, Lines,<br>Where Relevant Passages<br>Or Relevant Figures Appear | T <sup>6</sup> |
|                          |                          | Country Code <sup>3</sup> -Number <sup>4</sup> -Kind Code <sup>5</sup> (if known) |                                   |                                                    |                                                                                 |                |
|                          |                          |                                                                                   |                                   |                                                    |                                                                                 |                |

\*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. \* CITE NO.: Those application(s) which are marked with an single asterisk (\*) next to the Cite No. are not supplied (under 37 CFR 1.98(a)(2)(iii)) because that application was filed after June 30, 2003 or is available in the IFW. <sup>1</sup> Applicant's unique citation designation number (optional). <sup>2</sup> See Kinds Codes of USPTO Patent Documents at [www.uspto.gov](http://www.uspto.gov) or MPEP 901.04. <sup>3</sup> Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). <sup>4</sup> For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. <sup>5</sup> Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. <sup>6</sup> Applicant is to place a check mark here if English language Translation is attached.

| NON PATENT LITERATURE DOCUMENTS |                          |                                                                                                                                                                                                                                                                 |                |
|---------------------------------|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| Examiner<br>Initials            | Cite<br>No. <sup>1</sup> | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. | T <sup>2</sup> |
|                                 |                          |                                                                                                                                                                                                                                                                 |                |

\*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

<sup>1</sup> Applicant's unique citation designation number (optional). <sup>2</sup> Applicant is to place a check mark here if English language Translation is attached.

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|                       |                              |                    |  |
|-----------------------|------------------------------|--------------------|--|
| Examiner<br>Signature | /Lauren Nguyen/ (02/04/2016) | Date<br>Considered |  |
|-----------------------|------------------------------|--------------------|--|

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|--------------------------------------------------------------------------------------------------------|-------------|----------------------|---------------------------------|-----------------------------|
| APPLICATION NO.                                                                                        | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO.             | CONFIRMATION NO.            |
| 14/572,068                                                                                             | 12/16/2014  | Yoichi MOMOSE        | 9319S-001378-COB                | 6575                        |
| 27572 7590 04/13/2016<br>HARNES, DICKEY & PIERCE, P.L.C.<br>P.O. BOX 828<br>BLOOMFIELD HILLS, MI 48303 |             |                      | EXAMINER<br>NGUYEN, LAUREN      |                             |
|                                                                                                        |             |                      | ART UNIT<br>2871                | PAPER NUMBER                |
|                                                                                                        |             |                      | NOTIFICATION DATE<br>04/13/2016 | DELIVERY MODE<br>ELECTRONIC |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

troydocketing@hdp.com

|                                                     |                        |                     |  |
|-----------------------------------------------------|------------------------|---------------------|--|
| <b><i>Applicant-Initiated Interview Summary</i></b> | <b>Application No.</b> | <b>Applicant(s)</b> |  |
|                                                     | 14/572,068             | MOMOSE ET AL.       |  |
|                                                     | <b>Examiner</b>        | <b>Art Unit</b>     |  |
|                                                     | LAUREN NGUYEN          | 2871                |  |

All participants (applicant, applicant's representative, PTO personnel):

(1) LAUREN NGUYEN. (3) \_\_\_\_.

(2) STEPHANIA DOWDY. (4) \_\_\_\_.

Date of Interview: 06 April 2016.

Type:    ☒ Telephonic    ☐ Video Conference  
           ☐ Personal [copy given to: ☐ applicant    ☐ applicant's representative]

Exhibit shown or demonstration conducted:    ☐ Yes    ☐ No.  
           If Yes, brief description: \_\_\_\_\_.

Issues Discussed    ☐ 101    ☐ 112    ☐ 102    ☒ 103    ☐ Others  
 (For each of the checked box(es) above, please describe below the issue and detailed description of the discussion)

Claim(s) discussed: 1.

Identification of prior art discussed: Tanaka et al..

**Substance of Interview**  
 (For each issue discussed, provide a detailed description and indicate if agreement was reached. Some topics may include: identification or clarification of a reference or a portion thereof, claim interpretation, proposed amendments, arguments of any applied references etc...)

The examiner and the applicant's representative discussed the proposed claimed amendment and the cited references. However, no agreement has been reached. Further search and consideration will be necessary

.

**Applicant recordation instructions:** The formal written reply to the last Office action must include the substance of the interview. (See MPEP section 713.04). If a reply to the last Office action has already been filed, applicant is given a non-extendable period of the longer of one month or thirty days from this interview date, or the mailing date of this interview summary form, whichever is later, to file a statement of the substance of the interview

**Examiner recordation instructions:** Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

☐ Attachment

|                                                    |  |
|----------------------------------------------------|--|
| /LAUREN NGUYEN/<br>Primary Examiner, Art Unit 2871 |  |
|----------------------------------------------------|--|

## Summary of Record of Interview Requirements

### Manual of Patent Examining Procedure (MPEP), Section 713.04, Substance of Interview Must be Made of Record

A complete written statement as to the substance of any face-to-face, video conference, or telephone interview with regard to an application must be made of record in the application whether or not an agreement with the examiner was reached at the interview.

#### Title 37 Code of Federal Regulations (CFR) § 1.133 Interviews

Paragraph (b)

In every instance where reconsideration is requested in view of an interview with an examiner, a complete written statement of the reasons presented at the interview as warranting favorable action must be filed by the applicant. An interview does not remove the necessity for reply to Office action as specified in §§ 1.111, 1.135. (35 U.S.C. 132)

#### 37 CFR §1.2 Business to be transacted in writing.

All business with the Patent or Trademark Office should be transacted in writing. The personal attendance of applicants or their attorneys or agents at the Patent and Trademark Office is unnecessary. The action of the Patent and Trademark Office will be based exclusively on the written record in the Office. No attention will be paid to any alleged oral promise, stipulation, or understanding in relation to which there is disagreement or doubt.

The action of the Patent and Trademark Office cannot be based exclusively on the written record in the Office if that record is itself incomplete through the failure to record the substance of interviews.

It is the responsibility of the applicant or the attorney or agent to make the substance of an interview of record in the application file, unless the examiner indicates he or she will do so. It is the examiner's responsibility to see that such a record is made and to correct material inaccuracies which bear directly on the question of patentability.

Examiners must complete an Interview Summary Form for each interview held where a matter of substance has been discussed during the interview by checking the appropriate boxes and filling in the blanks. Discussions regarding only procedural matters, directed solely to restriction requirements for which interview recordation is otherwise provided for in Section 812.01 of the Manual of Patent Examining Procedure, or pointing out typographical errors or unreadable script in Office actions or the like, are excluded from the interview recordation procedures below. Where the substance of an interview is completely recorded in an Examiners Amendment, no separate Interview Summary Record is required.

The Interview Summary Form shall be given an appropriate Paper No., placed in the right hand portion of the file, and listed on the "Contents" section of the file wrapper. In a personal interview, a duplicate of the Form is given to the applicant (or attorney or agent) at the conclusion of the interview. In the case of a telephone or video-conference interview, the copy is mailed to the applicant's correspondence address either with or prior to the next official communication. If additional correspondence from the examiner is not likely before an allowance or if other circumstances dictate, the Form should be mailed promptly after the interview rather than with the next official communication.

The Form provides for recordation of the following information:

- Application Number (Series Code and Serial Number)
- Name of applicant
- Name of examiner
- Date of interview
- Type of interview (telephonic, video-conference, or personal)
- Name of participant(s) (applicant, attorney or agent, examiner, other PTO personnel, etc.)
- An indication whether or not an exhibit was shown or a demonstration conducted
- An identification of the specific prior art discussed
- An indication whether an agreement was reached and if so, a description of the general nature of the agreement (may be by attachment of a copy of amendments or claims agreed as being allowable). Note: Agreement as to allowability is tentative and does not restrict further action by the examiner to the contrary.
- The signature of the examiner who conducted the interview (if Form is not an attachment to a signed Office action)

It is desirable that the examiner orally remind the applicant of his or her obligation to record the substance of the interview of each case. It should be noted, however, that the Interview Summary Form will not normally be considered a complete and proper recordation of the interview unless it includes, or is supplemented by the applicant or the examiner to include, all of the applicable items required below concerning the substance of the interview.

A complete and proper recordation of the substance of any interview should include at least the following applicable items:

- 1) A brief description of the nature of any exhibit shown or any demonstration conducted,
- 2) an identification of the claims discussed,
- 3) an identification of the specific prior art discussed,
- 4) an identification of the principal proposed amendments of a substantive nature discussed, unless these are already described on the Interview Summary Form completed by the Examiner,
- 5) a brief identification of the general thrust of the principal arguments presented to the examiner,  
(The identification of arguments need not be lengthy or elaborate. A verbatim or highly detailed description of the arguments is not required. The identification of the arguments is sufficient if the general nature or thrust of the principal arguments made to the examiner can be understood in the context of the application file. Of course, the applicant may desire to emphasize and fully describe those arguments which he or she feels were or might be persuasive to the examiner.)
- 6) a general indication of any other pertinent matters discussed, and
- 7) if appropriate, the general results or outcome of the interview unless already described in the Interview Summary Form completed by the examiner.

Examiners are expected to carefully review the applicant's record of the substance of an interview. If the record is not complete and accurate, the examiner will give the applicant an extendable one month time period to correct the record.

#### Examiner to Check for Accuracy

If the claims are allowable for other reasons of record, the examiner should send a letter setting forth the examiner's version of the statement attributed to him or her. If the record is complete and accurate, the examiner should place the indication, "Interview Record OK" on the paper recording the substance of the interview along with the date and the examiner's initials.

Doc code: RCEX

Doc description: Request for Continued Examination (RCE)

PTO/SB/30EFS (07-09)

Approved for use through 07/31/2012. OMB 0651-0031

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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# **REQUEST FOR CONTINUED EXAMINATION(RCE)TRANSMITTAL** **(Submitted Only via EFS-Web)**

|                      |               |             |            |                               |                     |          |      |
|----------------------|---------------|-------------|------------|-------------------------------|---------------------|----------|------|
| Application Number   | 14572068      | Filing Date | 2014-12-16 | Docket Number (if applicable) | 9319S-001378-US-COB | Art Unit | 2871 |
| First Named Inventor | Yoichi Momose |             |            | Examiner Name                 | Lauren Nguyen       |          |      |

**This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.**

Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application. The Instruction Sheet for this form is located at WWW.USPTO.GOV

## **SUBMISSION REQUIRED UNDER 37 CFR 1.114**

**Note:** If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).

☐ Previously submitted. If a final Office action is outstanding, any amendments filed after the final Office action may be considered as a submission even if this box is not checked.

☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on \_\_\_\_\_

☐ Other \_\_\_\_\_

☒ Enclosed

☒ Amendment/Reply

☐ Information Disclosure Statement (IDS)

☐ Affidavit(s)/ Declaration(s)

☐ Other \_\_\_\_\_

## **MISCELLANEOUS**

☐ Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of months \_\_\_\_\_  
 (Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)

☐ Other \_\_\_\_\_

## **FEES**

☒ **The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.**  
 The Director is hereby authorized to charge any underpayment of fees, or credit any overpayments, to  
 Deposit Account No 506518

## **SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED**

☒ Patent Practitioner Signature  
 Applicant Signature

Doc code: RCEX

Doc description: Request for Continued Examination (RCE)

PTO/SB/30EFS (07-09)

Approved for use through 07/31/2012. OMB 0651-0031

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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| Signature of Registered U.S. Patent Practitioner |                      |                     |            |
|--------------------------------------------------|----------------------|---------------------|------------|
| Signature                                        | G. Gregory Schivley/ | Date (YYYY-MM-DD)   | 2016-05-10 |
| Name                                             | G. Gregory Schivley  | Registration Number | 27382      |

This collection of information is required by 37 CFR 1.114. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450.

*If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.*

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The information provided by you in this form will be subject to the following routine uses:

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2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

**PATENT**

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

Application No.: 14/572,068  
Confirmation No.: 6575  
Filing Date: December 16, 2014  
First Named Inventor: Yoichi MOMOSE et al.  
Group Art Unit: 2871  
Examiner: Lauren Nguyen  
Title: A LIQUID CRYSTAL DEVICE  
Attorney Docket: 9319S-001378-US-COB

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Mail Stop Amendment  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, Virginia 22313-1450

**AMENDMENT**

Commissioner:

In response to the Office Action mailed February 11, 2016, and in conjunction with the Request for Continued Examination filed concurrently herewith, please amend the application as follows and consider the remarks set forth below.

**Amendments to the Claims** begin on page 2 of this paper.

**Remarks** begin on page 12 of this paper.



## **AMENDMENTS TO THE CLAIMS**

The following listing of claims will replace all prior versions and listings of claims in the application.

### **LISTING OF CLAIMS**

1. (Currently Amended) A display device, comprising:

a first substrate including a plurality of pixel electrodes ~~and~~ a plurality of active elements and a plurality of wiring lines that connect to the plurality of active elements, wherein the plurality of active elements are thin film transistors disposed on the first substrate;

a second substrate including a common electrode, wherein the common electrode is disposed on the second substrate opposite to the plurality of pixel electrodes disposed on the first substrate;

a display region in which the plurality of pixel electrodes and the plurality of active elements are aligned in a plan-view of the first substrate;

a seal region positioned around the display region in the plan-view of the first substrate; and

a seal member in the seal region and disposed between the first substrate and the second substrate so as to the common electrode faces to the plurality of pixel electrodes,

wherein the first substrate includes a protruding region which protrudes over the second substrate in the plan-view of the first substrate and a plurality of conductive portions, the plurality of conductive portions being a plurality of dot conductive points,

the seal region forms a rectangular closed-shape so as to surround the display region, and has a first side, a second side, a third side and a fourth side, the first side is positioned between the display region and the protruding region, and opposed to the third side, and the second side is opposed to the fourth side, and

the seal member includes a first seal portion and a second seal portion, the first seal portion and the second seal portion form the rectangular closed-shape between the first substrate and the second substrate and do not protrude from the second substrate in a plan-view of the first substrate.

wherein the first seal portion is disposed at least on the first side and the second seal portion is disposed at least on the third side,

the first seal portion and the second seal portion are connected in a first junction portion positioned on the second side, and

the first seal portion and the second seal portion are connected in a second junction portion positioned on the fourth side,

wherein the second seal portion includes a plurality of conductive particles and the plurality of dot conductive points are disposed at least on the third side and all of the plurality of dot conductive points are electrically connected to the common electrode, and

the plurality of wiring lines extend onto the protruding region across the seal member without connecting to the plurality of dot conductive points.

2. (Original) The display device, according to Claim 1,

wherein each of the plurality of the conductive portions are spaced apart from each other.

3. (Previously Presented) The display device, according to Claim 1,  
wherein the first seal portion and the second seal portion extend from the second side toward an edge of the first substrate in the first junction portion,  
the first seal portion and the second seal portion extend from the fourth side toward an edge of the first substrate in the second junction portion, and  
the first junction portion and the second junction portion projecting in an opposite direction with respect to the display region.

4. (Original) The display device, according to Claim 1,  
wherein the first substrate further includes a first conductive portion on the second side,  
the second seal portion includes a first part of the seal member on the second side,  
wherein the first part of the seal member extends from one end of the seal member disposed on the third side over the first conductive portion on the second side,  
and the first part of the seal member includes a plurality of conductive particles, and  
the first conductive portion is electrically connected to the common electrode.

5. (Original) The display device, according to Claim 4,

wherein the first substrate further includes a second conductive portion on the fourth side,

the second seal portion includes a second part of the seal member on the fourth side,

wherein the second part of the seal member extends from another end of the seal member disposed on the third side over the second conductive portion on the fourth side, and the second part of the seal member includes a plurality of conductive particles, and

the second conductive portion is electrically connected to the common electrode.

6. (Original) An electronic device comprising the display device according to claim 1.

7. (Currently Amended) A display device, comprising:

a first substrate including a pixel region and a seal region which is defined around the pixel region on a first surface of the first substrate, the pixel region including a plurality of pixels and a plurality of active elements, and the seal region forming a rectangular ring shape, wherein the active elements are thin film transistors disposed on the first substrate; and

a second substrate including a common electrode on a second surface; and

a seal member bonding the first substrate and the second substrate so that the first surface faces the second surface and the common electrode is disposed on the second surface opposite to the plurality of pixels disposed on the first substrate,

wherein the first substrate includes a protruding region which protrudes over the second substrate in a plan-view of the first substrate,

the seal region includes a first side, a second side, a third side and a fourth side, the first side is positioned between the pixel region and the protruding region, and opposed to the third side, and the second side is opposed to the fourth side,

the seal member is disposed between the first substrate and the second substrate, and positioned on the first side, the second side, the third side and the fourth side continuously and forms a closed-ring shape in which the pixel region is positioned without protruding from the second substrate in the plan-view of the first substrate.

a first part of the seal member disposed on the third side which is opposed to the protruding region with respect to the pixel region includes a plurality of conductive particles,

a plurality of dot conductive points are disposed on the third side of the first substrate, all of the plurality of the dot conductive points are electrically connected to the common electrode, and

each of the plurality of the dot conductive points are spaced apart from each other,

wherein the first substrate includes a plurality of wiring lines that connect to the plurality of active elements, and the plurality of wiring lines extend onto the protruding region across the seal member without connecting to the dot conductive points.

8. (Previously Presented) The display device, according to Claim 7,

wherein the first substrate includes a first conductive point on the second side and the seal member includes a second part of the seal member on the second side, the second part of the seal member extends from one end of the first part of the seal member over the first conductive point on the second side, and the second part of the seal member includes a plurality of conductive particles, and

wherein the first conductive point is electrically connected to the common electrode.

9. (Previously Presented) The display device, according to Claim 8,

wherein the first substrate includes a second conductive point on the fourth side and the seal member includes a third part of the seal member on the fourth side, the third part of the seal member extends from another end of the first part of the seal member over the second conductive point on the fourth side, and the third part of the seal member includes a plurality of conductive particles, and

wherein the second conductive point is electrically connected to the common electrode.

10. (Original) The display device, according to Claim 7,

wherein the seal member extends to a first edge of the seal region opposite to the pixel region on the second side.

11. (Original) The display device, according to Claim 10,

wherein the seal member extends to a second edge of the seal region opposite to the pixel region on the fourth side.

12. (Original) An electronic device comprising the display device according to claim 7.

13. (Currently Amended) A display device, comprising:

- a first substrate including a plurality of pixel electrodes ~~and~~ a plurality of active elements and a plurality of wiring lines that connect to the plurality of active elements, wherein the plurality of active elements are thin film transistors disposed on the first substrate;
- a second substrate including a common electrode, wherein the common electrode is disposed on the second substrate;
- a display region in which the plurality of pixel electrodes and the plurality of active elements are aligned in a plan-view of the first substrate;
- a seal region positioned around the display region in the plan-view of the first substrate and forming a closed-ring shape in which the display region is disposed;
- a seal member being disposed in the seal region and bonding the first substrate and the second substrate so that the common electrode faces the plurality of pixel electrodes, the seal member forming a closed-ring shape in which the display region is positioned without protruding from the second substrate in the plan-view of the first substrate, and the seal member is disposed between the first substrate and the second substrate;

wherein the first substrate includes a protruding region which protrudes over the second substrate in the plan-view of the first substrate and a plurality of conductive portions,

the seal region includes a first portion and a second portion, the first portion is positioned at least between the display region and the protruding region, and the second portion is positioned at least opposite to the protruding region with respect to the display region, and

the seal member includes a first part and a second part, the first part of the seal member is positioned on the first portion and the second part of the seal member is positioned on the second portion, and the second part of the seal member includes a plurality of conductive particles,

a plurality of dot conductive points are disposed on the second portion of the first substrate, all of the plurality of the dot conductive points are electrically connected to the common electrode,

each of the plurality of the dot conductive points are spaced apart from each other, and

the plurality of wiring lines extend onto the protruding region across the seal member without connecting to the dot conductive points.

14. (Original) The display device, according to Claim 13,

wherein no conductive portions are disposed on the first portion of the first substrate and no conductive particles are included in the first part of the seal member.



15. (Original) The display device, according to Claim 13,  
wherein the seal member further includes a third part and a fourth part, the third part of the seal member extends from one end of the first part, and the fourth part of the seal member extends from one end of the second part and includes a first plurality of conductive particles.

16. (Original) The display device, according to Claim 15,  
wherein the third part and the fourth part are connected and extend to a first edge of the seal region opposite to the display region.

17. (Original) The display device, according to Claim 16,  
wherein the seal member further includes a fifth part and a sixth part, the fifth part of the seal member extends from another end of the first part, and the sixth part of the seal member extends from another end of the second part and includes a second plurality of conductive particles, and  
the fifth part and the sixth part are connected and extend to a second edge of the seal region opposite to the display region.

18. (Original) The display device, according to Claim 17,  
wherein the first edge of the seal region is positioned opposite to the second edge of the seal region with respect to the display region.

19. (Previously Presented) The display device, according to Claim 18,

wherein the first substrate further includes a first conductive point and a second conductive point, different from the plurality of conductive points, and the first conductive point, the second conductive point and the plurality of conductive points are disposed apart from each other, and

the first conductive point is electrically connected to the common electrode through the first plurality of conductive particles and the second conductive point is electrically connected to the common electrode through the second plurality of conductive particles

20. (Original) An electronic device comprising the display device according to claim 13.

### **REMARKS**

Claims 1-20 are now pending in the application. By this paper, claims 1, 7 and 13 have been amended. The Examiner is respectfully requested to reconsider and withdraw the rejection in view of the amendments and remarks contained herein.

### **INTERVIEW SUMMARY**

Applicant thanks Examiner Nguyen for the courtesies extended to Applicant's representative, Stephanie Dowdy, during the Examiner interview on April 6, 2016. During the interview, Applicant's representative clarified arguments presented in the previous response. Specifically, Applicant's representative clarified the position that the panel structure between Miyazaki and Tanaka is different than the panel structure of the claimed invention because the panels in Miyazaki and Tanaka are assembled using a known method and the panel structure of the claimed invention is assembled using the ODF method. While the Examiner agreed with the distinction, the Examiner maintained the belief that the present claims do not distinguish over the prior art.

Applicant's representative further proposed amendments to include the feature of the plurality of wiring lines at the first side that extend from inside of seal region to the protruding region, crossing the seal (the first side). Although the Examiner was unable to point to anything specifically disclosing this feature, the Examiner stated that further searching would be necessary.

**REJECTION UNDER 35 U.S.C. § 103**

Claims 1-20 stand rejected under 35 U.S.C. § 103 as being unpatentable over Miyazaki et al. (U.S. Pat. No. 6,930,745) in view of Tanaka et al. (U.S. Pub. No. 2005/0122466). This rejection is respectfully traversed.

Claim 1 has been amended to recite, in part: “a first substrate including a plurality of pixel electrodes, a plurality of active elements and a plurality of wiring lines that connect to the plurality of active elements,” “the seal member includes a first seal portion and a second seal portion, the first seal portion and the second seal portion form the rectangular closed-shape between the first substrate and the second substrate and do not protrude from the second substrate in a plan-view of the first substrate,” and “the plurality of wiring lines extend onto the protruding region across the seal member without connecting to the plurality of dot conductive points.” Applicant respectfully submits that the combination of Miyazaki and Tanaka fails to disclose the plurality of wiring lines on the first substrate extending from inside the seal region to the protruding region crossing the seal member on the first substrate without connecting to the plurality of dot conductive points. As previously stated in the interview summary, the Examiner was unable to point to any portion of Miyazaki or Tanaka specifically disclosing the feature of the plurality of wiring lines at the first side that extend from inside of seal region to the protruding region, crossing the seal (the first side).

Applicant further submits that Miyazaki and Tanaka fail to disclose the first seal portion and the second seal portion forming a rectangular closed-shape between the first substrate and the second substrate and not protruding from the second substrate in a plan-view of the first substrate. In the Office Action, the Examiner points to Miyazaki,

reference 70 as a first substrate, reference 80 as a second substrate, and reference 3 as a seal member. The Examiner also points to Tanaka, reference 111, as a first substrate and reference 121 as a second substrate. The Examiner alleges that the liquid crystal filling port (13a) of Tanaka is sealed with an end sealing material (15) such that the seal in Tanaka is continuous around the liquid crystal (130). Applicant respectfully disagrees.

In both Miyazaki and Tanaka, the sealing resin must be inserted through the filling port, so the sealing resin protrudes from an edge of the substrate at the filling port. In the present disclosure, an ODF method is used, eliminating the need for the filling port and the sealing resin, so the seal member is disposed continuously around the liquid crystal without protruding from the second substrate in a plan view. Tanaka discloses the sealing resin (15) that protrudes the second substrate (121) in Fig 3. Miyazaki mentions the sealing resin in column 11, but does not disclose any details. However, according to the methods used at the time this invention was made, the sealing resin protrudes from the second substrate in Miyazaki also.

Thus, since the sealing resin protrudes from an edge of the substrate at the filling port in both Miyazaki and Tanaka, both Miyazaki and Tanaka fail to disclose a first seal portion and a second seal portion forming a rectangular closed-shape between the first substrate and the second substrate and not protruding from the second substrate in a plan-view of the first substrate, as recited in Claim 1.

For at least these reasons, Applicant respectfully asserts that Claim 1 is in condition for allowance. Claims 7 and 13 recite similar features as Claim 1 and are allowable for at least similar reasons. Claims 2-6, 8-12, and 14-20 ultimately depend

from one of Claims 1, 7, and 13 and are therefore allowable for at least similar reasons.

Thus, the Examiner is requested to reconsider and withdraw the rejections.

#### **CONCLUSION**

It is believed that a full and complete response has been made to the outstanding Office Action and the present application is in condition for allowance. Thus, prompt and favorable consideration of this amendment is respectfully requested. If the Examiner believes that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at (248) 641-1600.

Respectfully submitted,

Dated: May 10, 2016

By: /G. Gregory Schivley/  
G. Gregory Schivley  
Reg. No. 27,382  
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20522463.1

| Electronic Patent Application Fee Transmittal        |                 |                                                 |               |                             |
|------------------------------------------------------|-----------------|-------------------------------------------------|---------------|-----------------------------|
| <b>Application Number:</b>                           |                 | 14572068                                        |               |                             |
| <b>Filing Date:</b>                                  |                 | 16-Dec-2014                                     |               |                             |
| <b>Title of Invention:</b>                           |                 | METHOD OF MANUFACTURING A LIQUID CRYSTAL DEVICE |               |                             |
| <b>First Named Inventor/Applicant Name:</b>          |                 | Yoichi MOMOSE                                   |               |                             |
| <b>Filer:</b>                                        |                 | G. Gregory Schivley/Michelle Kowalske           |               |                             |
| <b>Attorney Docket Number:</b>                       |                 | 93195-001378-COB                                |               |                             |
| Filed as Large Entity                                |                 |                                                 |               |                             |
| <b>Filing Fees for   Utility under 35 USC 111(a)</b> |                 |                                                 |               |                             |
| <b>Description</b>                                   | <b>Fee Code</b> | <b>Quantity</b>                                 | <b>Amount</b> | <b>Sub-Total in USD(\$)</b> |
| <b>Basic Filing:</b>                                 |                 |                                                 |               |                             |
| <b>Pages:</b>                                        |                 |                                                 |               |                             |
| <b>Claims:</b>                                       |                 |                                                 |               |                             |
| <b>Miscellaneous-Filing:</b>                         |                 |                                                 |               |                             |
| <b>Petition:</b>                                     |                 |                                                 |               |                             |
| <b>Patent-Appeals-and-Interference:</b>              |                 |                                                 |               |                             |
| <b>Post-Allowance-and-Post-Issuance:</b>             |                 |                                                 |               |                             |
| <b>Extension-of-Time:</b>                            |                 |                                                 |               |                             |

| Description                       | Fee Code | Quantity | Amount | Sub-Total in USD(\$) |
|-----------------------------------|----------|----------|--------|----------------------|
| <b>Miscellaneous:</b>             |          |          |        |                      |
| Request for Continued Examination | 1801     | 1        | 1200   | 1200                 |
| <b>Total in USD (\$)</b>          |          |          |        | <b>1200</b>          |



## Electronic Acknowledgement Receipt

|                                             |                                                 |
|---------------------------------------------|-------------------------------------------------|
| <b>EFS ID:</b>                              | 25737724                                        |
| <b>Application Number:</b>                  | 14572068                                        |
| <b>International Application Number:</b>    |                                                 |
| <b>Confirmation Number:</b>                 | 6575                                            |
| <b>Title of Invention:</b>                  | METHOD OF MANUFACTURING A LIQUID CRYSTAL DEVICE |
| <b>First Named Inventor/Applicant Name:</b> | Yoichi MOMOSE                                   |
| <b>Customer Number:</b>                     | 27572                                           |
| <b>Filer:</b>                               | G. Gregory Schivley/Michelle Kowalske           |
| <b>Filer Authorized By:</b>                 | G. Gregory Schivley                             |
| <b>Attorney Docket Number:</b>              | 93195-001378-COB                                |
| <b>Receipt Date:</b>                        | 10-MAY-2016                                     |
| <b>Filing Date:</b>                         | 16-DEC-2014                                     |
| <b>Time Stamp:</b>                          | 16:52:14                                        |
| <b>Application Type:</b>                    | Utility under 35 USC 111(a)                     |

### Payment information:

|                                                                                                                                                                                                                                                                                                                                                     |                             |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| Submitted with Payment                                                                                                                                                                                                                                                                                                                              | yes                         |
| Payment Type                                                                                                                                                                                                                                                                                                                                        | Deposit Account             |
| Payment was successfully received in RAM                                                                                                                                                                                                                                                                                                            | \$1200                      |
| RAM confirmation Number                                                                                                                                                                                                                                                                                                                             | 3679                        |
| Deposit Account                                                                                                                                                                                                                                                                                                                                     | 506518                      |
| Authorized User                                                                                                                                                                                                                                                                                                                                     | HARNESS DICKEY & PIERCE PLC |
| The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:<br>Charge any Additional Fees required under 37 CFR 1.16 (National application filing, search, and examination fees)<br>Charge any Additional Fees required under 37 CFR 1.17 (Patent application and reexamination processing fees) |                             |

Charge any Additional Fees required under 37 CFR 1.19 (Document supply fees)

Charge any Additional Fees required under 37 CFR 1.20 (Post Issuance fees)

Charge any Additional Fees required under 37 CFR 1.21 (Miscellaneous fees and charges)

### File Listing:

| Document Number              | Document Description                                | File Name    | File Size(Bytes)/ Message Digest         | Multi Part /.zip | Pages (if appl.) |
|------------------------------|-----------------------------------------------------|--------------|------------------------------------------|------------------|------------------|
| 1                            | Request for Continued Examination (RCE)             | RCE.PDF      | 697794                                   | no               | 3                |
|                              |                                                     |              | 15b3b2ebdd3c0216f560b172922deab74dc8f84b |                  |                  |
| Warnings:                    |                                                     |              |                                          |                  |                  |
| Information:                 |                                                     |              |                                          |                  |                  |
| 2                            |                                                     | Response.PDF | 95374                                    | yes              | 15               |
|                              |                                                     |              | 2f000bd84c46f42a5ece7c468c738b9f800d27f2 |                  |                  |
|                              | Multipart Description/PDF files in .zip description |              |                                          |                  |                  |
|                              | Document Description                                |              | Start                                    | End              |                  |
|                              | Amendment Submitted/Entered with Filing of CPA/RCE  |              | 1                                        | 1                |                  |
|                              | Claims                                              |              | 2                                        | 11               |                  |
|                              | Applicant Arguments/Remarks Made in an Amendment    |              | 12                                       | 15               |                  |
| Warnings:                    |                                                     |              |                                          |                  |                  |
| Information:                 |                                                     |              |                                          |                  |                  |
| 3                            | Fee Worksheet (SB06)                                | fee-info.pdf | 31038                                    | no               | 2                |
|                              |                                                     |              | b3c48bbd1185665e265ef4d2d2a164c3dbd7bc7c |                  |                  |
| Warnings:                    |                                                     |              |                                          |                  |                  |
| Information:                 |                                                     |              |                                          |                  |                  |
| Total Files Size (in bytes): |                                                     |              | 824206                                   |                  |                  |

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**New Applications Under 35 U.S.C. 111**

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

**National Stage of an International Application under 35 U.S.C. 371**

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

**New International Application Filed with the USPTO as a Receiving Office**

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

| Electronic Acknowledgement Receipt          |                                                 |
|---------------------------------------------|-------------------------------------------------|
| <b>EFS ID:</b>                              | 25737724                                        |
| <b>Application Number:</b>                  | 14572068                                        |
| <b>International Application Number:</b>    |                                                 |
| <b>Confirmation Number:</b>                 | 6575                                            |
| <b>Title of Invention:</b>                  | METHOD OF MANUFACTURING A LIQUID CRYSTAL DEVICE |
| <b>First Named Inventor/Applicant Name:</b> | Yoichi MOMOSE                                   |
| <b>Customer Number:</b>                     | 27572                                           |
| <b>Filer:</b>                               | G. Gregory Schivley/Michelle Kowalske           |
| <b>Filer Authorized By:</b>                 | G. Gregory Schivley                             |
| <b>Attorney Docket Number:</b>              | 93195-001378-COB                                |
| <b>Receipt Date:</b>                        | 10-MAY-2016                                     |
| <b>Filing Date:</b>                         | 16-DEC-2014                                     |
| <b>Time Stamp:</b>                          | 16:52:14                                        |
| <b>Application Type:</b>                    | Utility under 35 USC 111(a)                     |

### Payment information:

|                                                                                                                                                                                                                                                                                                                                                                    |                             |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| Submitted with Payment                                                                                                                                                                                                                                                                                                                                             | yes                         |
| Payment Type                                                                                                                                                                                                                                                                                                                                                       | Deposit Account             |
| Payment was successfully received in RAM                                                                                                                                                                                                                                                                                                                           | \$1200                      |
| RAM confirmation Number                                                                                                                                                                                                                                                                                                                                            | 3679                        |
| Deposit Account                                                                                                                                                                                                                                                                                                                                                    | 506518                      |
| Authorized User                                                                                                                                                                                                                                                                                                                                                    | HARNESS DICKEY & PIERCE PLC |
| <p>The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:</p> <p>Charge any Additional Fees required under 37 CFR 1.16 (National application filing, search, and examination fees)</p> <p>Charge any Additional Fees required under 37 CFR 1.17 (Patent application and reexamination processing fees)</p> |                             |

Charge any Additional Fees required under 37 CFR 1.19 (Document supply fees)

Charge any Additional Fees required under 37 CFR 1.20 (Post Issuance fees)

Charge any Additional Fees required under 37 CFR 1.21 (Miscellaneous fees and charges)

### File Listing:

| Document Number              | Document Description                                | File Name    | File Size(Bytes)/<br>Message Digest      | Multi Part /.zip | Pages (if appl.) |
|------------------------------|-----------------------------------------------------|--------------|------------------------------------------|------------------|------------------|
| 1                            | Request for Continued Examination (RCE)             | RCE.PDF      | 697794                                   | no               | 3                |
|                              |                                                     |              | 15b3b2ebdd3c0216f560b172922deab74dc8f84b |                  |                  |
| Warnings:                    |                                                     |              |                                          |                  |                  |
| Information:                 |                                                     |              |                                          |                  |                  |
| 2                            |                                                     | Response.PDF | 95374                                    | yes              | 15               |
|                              |                                                     |              | 2f000bd84c46f42a5ece7c468c738b9f800d27f2 |                  |                  |
|                              | Multipart Description/PDF files in .zip description |              |                                          |                  |                  |
|                              | Document Description                                |              | Start                                    | End              |                  |
|                              | Amendment Submitted/Entered with Filing of CPA/RCE  |              | 1                                        | 1                |                  |
|                              | Claims                                              |              | 2                                        | 11               |                  |
|                              | Applicant Arguments/Remarks Made in an Amendment    |              | 12                                       | 15               |                  |
| Warnings:                    |                                                     |              |                                          |                  |                  |
| Information:                 |                                                     |              |                                          |                  |                  |
| 3                            | Fee Worksheet (SB06)                                | fee-info.pdf | 31038                                    | no               | 2                |
|                              |                                                     |              | b3c48bbd1185665e265ef4d2d2a164c3dbd7bc7c |                  |                  |
| Warnings:                    |                                                     |              |                                          |                  |                  |
| Information:                 |                                                     |              |                                          |                  |                  |
| Total Files Size (in bytes): |                                                     |              | 824206                                   |                  |                  |

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

**New Applications Under 35 U.S.C. 111**

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

**National Stage of an International Application under 35 U.S.C. 371**

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

**New International Application Filed with the USPTO as a Receiving Office**

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

|                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                          |                                                                                                                                                                                                                               |                                  |                                                   |                                    |                                  |               |                                       |           |                          |                     |          |  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|---------------------------------------------------|------------------------------------|----------------------------------|---------------|---------------------------------------|-----------|--------------------------|---------------------|----------|--|
| <b>PATENT APPLICATION FEE DETERMINATION RECORD</b><br>Substitute for Form PTO-875                                                                                                                                                                                                                                                                                                                                                    |                                                                                          |                                                                                                                                                                                                                               |                                  | Application or Docket Number<br><b>14/572,068</b> |                                    | Filing Date<br><b>12/16/2014</b> |               | <input type="checkbox"/> To be Mailed |           |                          |                     |          |  |
| ENTITY: <input checked="" type="checkbox"/> LARGE <input type="checkbox"/> SMALL <input type="checkbox"/> MICRO                                                                                                                                                                                                                                                                                                                      |                                                                                          |                                                                                                                                                                                                                               |                                  |                                                   |                                    |                                  |               |                                       |           |                          |                     |          |  |
| <b>APPLICATION AS FILED – PART I</b>                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                          |                                                                                                                                                                                                                               |                                  |                                                   |                                    |                                  |               |                                       |           |                          |                     |          |  |
| (Column 1)                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                          | (Column 2)                                                                                                                                                                                                                    |                                  |                                                   |                                    |                                  |               |                                       |           |                          |                     |          |  |
| FOR                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                          | NUMBER FILED                                                                                                                                                                                                                  |                                  | NUMBER EXTRA                                      |                                    | RATE (\$)                        |               | FEE (\$)                              |           |                          |                     |          |  |
| <input type="checkbox"/> BASIC FEE<br>(37 CFR 1.16(a), (b), or (c))                                                                                                                                                                                                                                                                                                                                                                  |                                                                                          | N/A                                                                                                                                                                                                                           |                                  | N/A                                               |                                    | N/A                              |               |                                       |           |                          |                     |          |  |
| <input type="checkbox"/> SEARCH FEE<br>(37 CFR 1.16(k), (i), or (m))                                                                                                                                                                                                                                                                                                                                                                 |                                                                                          | N/A                                                                                                                                                                                                                           |                                  | N/A                                               |                                    | N/A                              |               |                                       |           |                          |                     |          |  |
| <input type="checkbox"/> EXAMINATION FEE<br>(37 CFR 1.16(o), (p), or (q))                                                                                                                                                                                                                                                                                                                                                            |                                                                                          | N/A                                                                                                                                                                                                                           |                                  | N/A                                               |                                    | N/A                              |               |                                       |           |                          |                     |          |  |
| TOTAL CLAIMS<br>(37 CFR 1.16(i))                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                          | minus 20 =                                                                                                                                                                                                                    |                                  | *                                                 |                                    | X \$ =                           |               |                                       |           |                          |                     |          |  |
| INDEPENDENT CLAIMS<br>(37 CFR 1.16(h))                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                          | minus 3 =                                                                                                                                                                                                                     |                                  | *                                                 |                                    | X \$ =                           |               |                                       |           |                          |                     |          |  |
| <input type="checkbox"/> APPLICATION SIZE FEE<br>(37 CFR 1.16(s))                                                                                                                                                                                                                                                                                                                                                                    |                                                                                          | If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s). |                                  |                                                   |                                    |                                  |               |                                       |           |                          |                     |          |  |
| <input type="checkbox"/> MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))                                                                                                                                                                                                                                                                                                                                                           |                                                                                          |                                                                                                                                                                                                                               |                                  |                                                   |                                    |                                  |               |                                       |           |                          |                     |          |  |
| * If the difference in column 1 is less than zero, enter "0" in column 2.                                                                                                                                                                                                                                                                                                                                                            |                                                                                          |                                                                                                                                                                                                                               |                                  |                                                   |                                    | TOTAL                            |               |                                       |           |                          |                     |          |  |
| <b>APPLICATION AS AMENDED – PART II</b>                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                          |                                                                                                                                                                                                                               |                                  |                                                   |                                    |                                  |               |                                       |           |                          |                     |          |  |
| (Column 1)                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                          | (Column 2)                                                                                                                                                                                                                    |                                  | (Column 3)                                        |                                    |                                  |               |                                       |           |                          |                     |          |  |
| <b>AMENDMENT</b>                                                                                                                                                                                                                                                                                                                                                                                                                     | <b>05/10/2016</b>                                                                        |                                                                                                                                                                                                                               | CLAIMS REMAINING AFTER AMENDMENT |                                                   | HIGHEST NUMBER PREVIOUSLY PAID FOR |                                  | PRESENT EXTRA |                                       | RATE (\$) |                          | ADDITIONAL FEE (\$) |          |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                      | Total (37 CFR 1.16(i))                                                                   |                                                                                                                                                                                                                               | * 20                             |                                                   | Minus ** 20                        |                                  | = 0           |                                       | X \$80 =  |                          | 0                   |          |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                      | Independent (37 CFR 1.16(h))                                                             |                                                                                                                                                                                                                               | * 3                              |                                                   | Minus *** 3                        |                                  | = 0           |                                       | X \$420 = |                          | 0                   |          |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                      | <input type="checkbox"/> Application Size Fee (37 CFR 1.16(s))                           |                                                                                                                                                                                                                               |                                  |                                                   |                                    |                                  |               |                                       |           |                          |                     |          |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                      | <input type="checkbox"/> FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) |                                                                                                                                                                                                                               |                                  |                                                   |                                    |                                  |               |                                       |           |                          |                     |          |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                          |                                                                                                                                                                                                                               |                                  |                                                   |                                    |                                  |               |                                       |           | TOTAL ADD'L FEE          |                     | <b>0</b> |  |
| (Column 1)                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                          | (Column 2)                                                                                                                                                                                                                    |                                  | (Column 3)                                        |                                    |                                  |               |                                       |           |                          |                     |          |  |
| <b>AMENDMENT</b>                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                          |                                                                                                                                                                                                                               | CLAIMS REMAINING AFTER AMENDMENT |                                                   | HIGHEST NUMBER PREVIOUSLY PAID FOR |                                  | PRESENT EXTRA |                                       | RATE (\$) |                          | ADDITIONAL FEE (\$) |          |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                      | Total (37 CFR 1.16(i))                                                                   |                                                                                                                                                                                                                               | *                                |                                                   | Minus **                           |                                  | =             |                                       | X \$ =    |                          |                     |          |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                      | Independent (37 CFR 1.16(h))                                                             |                                                                                                                                                                                                                               | *                                |                                                   | Minus ***                          |                                  | =             |                                       | X \$ =    |                          |                     |          |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                      | <input type="checkbox"/> Application Size Fee (37 CFR 1.16(s))                           |                                                                                                                                                                                                                               |                                  |                                                   |                                    |                                  |               |                                       |           |                          |                     |          |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                      | <input type="checkbox"/> FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) |                                                                                                                                                                                                                               |                                  |                                                   |                                    |                                  |               |                                       |           |                          |                     |          |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                          |                                                                                                                                                                                                                               |                                  |                                                   |                                    |                                  |               |                                       |           | TOTAL ADD'L FEE          |                     |          |  |
| <p>* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.</p> <p>** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".</p> <p>*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".</p> <p>The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.</p> |                                                                                          |                                                                                                                                                                                                                               |                                  |                                                   |                                    |                                  |               |                                       |           | LIE<br>/Theresa Dawkins/ |                     |          |  |

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

|                                                                                                          |   |    |   |                          |                        |
|----------------------------------------------------------------------------------------------------------|---|----|---|--------------------------|------------------------|
| Substitute for form 1449/PTO                                                                             |   |    |   | <b>Complete if Known</b> |                        |
| <b>INFORMATION DISCLOSURE<br/>STATEMENT BY APPLICANT</b><br><br><i>(Use as many sheets as necessary)</i> |   |    |   | Application Number       | 14/572,068-Conf. #6575 |
|                                                                                                          |   |    |   | Filing Date              | December 16, 2014      |
|                                                                                                          |   |    |   | First Named Inventor     | Yoichi MOMOSE          |
|                                                                                                          |   |    |   | Art Unit                 | 2871                   |
|                                                                                                          |   |    |   | Examiner Name            | Lauren Nguyen          |
| Sheet                                                                                                    | 1 | of | 1 | Attorney Docket Number   | 9319S-001378-COB       |

| U.S. PATENT DOCUMENTS |                          |                                          |                                |                                                    |                                                                                 |
|-----------------------|--------------------------|------------------------------------------|--------------------------------|----------------------------------------------------|---------------------------------------------------------------------------------|
| Examiner<br>Initials* | Cite<br>No. <sup>1</sup> | Document Number                          | Publication Date<br>MM-DD-YYYY | Name of Patentee or<br>Applicant of Cited Document | Pages, Columns, Lines, Where<br>Relevant Passages or Relevant<br>Figures Appear |
|                       |                          | Number-Kind Code <sup>2</sup> (if known) |                                |                                                    |                                                                                 |
|                       | AA*                      | US-2005-0219456-A1                       | 10-06-2005                     | Tadaki et al.                                      |                                                                                 |

| FOREIGN PATENT DOCUMENTS |                          |                                                                                   |                                   |                                                    |                                                                                 |                |
|--------------------------|--------------------------|-----------------------------------------------------------------------------------|-----------------------------------|----------------------------------------------------|---------------------------------------------------------------------------------|----------------|
| Examiner<br>Initials*    | Cite<br>No. <sup>1</sup> | Foreign Patent Document                                                           | Publication<br>Date<br>MM-DD-YYYY | Name of Patentee or<br>Applicant of Cited Document | Pages, Columns, Lines,<br>Where Relevant Passages<br>Or Relevant Figures Appear | T <sup>6</sup> |
|                          |                          | Country Code <sup>3</sup> -Number <sup>4</sup> -Kind Code <sup>5</sup> (if known) |                                   |                                                    |                                                                                 |                |
|                          |                          |                                                                                   |                                   |                                                    |                                                                                 |                |

\*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. \* CITE NO.: Those application(s) which are marked with an single asterisk (\*) next to the Cite No. are not supplied (under 37 CFR 1.98(a)(2)(iii)) because that application was filed after June 30, 2003 or is available in the IFW. <sup>1</sup> Applicant's unique citation designation number (optional). <sup>2</sup> See Kinds Codes of USPTO Patent Documents at [www.uspto.gov](http://www.uspto.gov) or MPEP 901.04. <sup>3</sup> Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). <sup>4</sup> For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. <sup>5</sup> Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. <sup>6</sup> Applicant is to place a check mark here if English language Translation is attached.

| NON PATENT LITERATURE DOCUMENTS |                          |                                                                                                                                                                                                                                                                 |                |
|---------------------------------|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| Examiner<br>Initials            | Cite<br>No. <sup>1</sup> | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. | T <sup>2</sup> |
|                                 |                          |                                                                                                                                                                                                                                                                 |                |

\*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

<sup>1</sup> Applicant's unique citation designation number (optional). <sup>2</sup> Applicant is to place a check mark here if English language Translation is attached.

20570359.1

|                       |  |                    |  |
|-----------------------|--|--------------------|--|
| Examiner<br>Signature |  | Date<br>Considered |  |
|-----------------------|--|--------------------|--|

BEW/kih



**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

**PATENT**

Application No.: 14/572,068  
Filing Date: December 16, 2014  
Confirmation No. 6575  
First Named Inventor: Yoichi MOMOSE  
Group Art Unit: 2871  
Examiner: Lauren Nguyen  
Title: METHOD OF MANUFACTURING A LIQUID CRYSTAL DEVICE  
Attorney Docket: 9319S-001378-US-COB

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Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

**INFORMATION DISCLOSURE STATEMENT**

Commissioner:

Pursuant to 37 C.F.R. §§ 1.56, 1.97 and 1.98, Applicant hereby submits an Information Disclosure Statement for consideration by the Examiner.

**I. LIST OF PATENTS, PUBLICATIONS, AND OTHER INFORMATION**

The patents, publications and other information requested to be considered by the Office (except unpublished U.S. patent applications) are listed on Form 1449 attached hereto.

**II. COPIES**

A. ☒ Submitted herewith is a legible copy of (i) each foreign patent; (ii) each publication or that portion which caused it to be listed, other than U.S. patents and U.S. patent application publications unless required by the Office; (iii) each unpublished U.S. application listed below in Section IV (i.e., including the specification, claims, and any drawing of the application, or that portion of the application which caused it to be listed, including any claims directed to that

portion), except for such applications filed on or after June 30, 2003, pursuant to the Waiver of the Copy Requirement in 37 C.F.R. 1.98 (OG Notice dated October 19, 2004); and (iv) all other information or that portion which caused it to be listed.

B. ☐ Any patents, publications or other information which are listed on Form 1449 or on the copies of PTO-892, but which are not enclosed herewith, were previously cited by or submitted to the PTO in one of the following applications which has been relied upon for an earlier filing date under 35 U.S.C. § 120:

U.S. Serial Number

U.S. Filing Date

C. ☐ This is a PCT application in the entry of the National Phase in the United States. A copy of the International Search Report is attached for the Examiner's information. The documents listed on the International Search report are listed on the attached Form 1449 for consideration by the Examiner and for listing on any patent resulting from this application. If the International Search report was from the US, EPO, or JPO search authorities, copies of these references should have been supplied to the USPTO under the trilateral agreement and are believed to be in the file of the above-identified application. (MPEP 1893.03(g).)

III. CONCISE EXPLANATION OF THE RELEVANCE (check at least one box)

A. ☒ Except as may be indicated below in (B), all of the patents, publications or other information are in the English language (concise explanation not required).

B. ☐ A concise explanation of the relevance of each patent, publication or other information listed that is not in the English language is as follows (see 37 C.F.R. § 1.98(a)(3)):

1. ☐ See the attached foreign patent office communication regarding a related foreign application in: Europe
2. ☐ English translations are provided as follows: As indicated on attached Form 1449.
3. ☐ Other:

C. ☒ The following additional information is provided for the Examiner's consideration: The reference was cited during prosecution of a related application in the United States.

IV. CROSS REFERENCE TO RELATED APPLICATION(S)

A. ☐ The Examiner is advised that the following co-pending application(s) contain(s) subject matter that may be related to the present application. By bringing this(these) application(s) to the Examiner's attention, Applicant(s) does (do) not waive the confidentiality provisions of 35 U.S.C. § 122.

Serial No.

Filing Date

Inventor(s)

V. THIS IDS IS BEING FILED UNDER

A. ☒ **37 C.F.R. § 1.97(b):** (check only one box)

1. ☐ within three months of the filing date of a national application other than a continued prosecution application under § 1.53(d) (37 C.F.R. § 1.97(b)(1)). No fee or certification is required.

2. ☐ within three months of the date of entry of the national stage as set forth in § 1.491 in an international application (37 C.F.R. § 1.97(b)(2)). No fee or certification is required.

3. ☐ before the mailing of a first Office Action on the merits (37 C.F.R. § 1.97(b)(3)). No fee or certification is required. In the event that a first Office Action on the merits has been issued, please consider this IDS under 37 C.F.R. § 1.97(c) and see the certification under 37 C.F.R. § 1.97(e) below; or, if no certification has been made, charge our deposit account a fee in the amount of \$180.00 as required by 37 C.F.R. § 1.17(p).

4. ☒ before the mailing of a first Office Action after the filing of a request for continued examination under 37 C.F.R. § 1.114. No fee or certification is required.

B. ☐ **37 C.F.R. § 1.97(c):** (check only one box)

before the mailing date of either any Final Office Action under 37 C.F.R. § 1.113, a Notice of Allowance under 37 C.F.R. § 1.311, or an action that otherwise closes prosecution.

1. ☐ No certification; therefore, a fee in the amount of \$180.00 is required by 37 C.F.R. § 1.17(p).

2. ☐ See the certification below. No fee is required.

C. ☐ **37 C.F.R. § 1.97(d):**

after the mailing date of either a Final Office Action under 37 C.F.R. § 1.113 or a Notice of Allowance under 37 C.F.R. § 1.311, yet on or before payment of the issue fee.

1. ☐ See the certification below. A fee in the amount of \$180.00 is required by 37 C.F.R. § 1.17(p).

VI. CERTIFICATION UNDER 37 C.F.R. § 1.97(e): (check only one box)

The undersigned hereby certifies that:

A. ☐ each item of information contained in this IDS was first cited in a communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this IDS (See 37 C.F.R. § 1.97(e)(1)). See further statement under 37 C.F.R. 1.704(d) below in section VII, if applicable; or

B. ☒ no item of information contained in this IDS was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the undersigned after making reasonable inquiry, no item of information contained in this IDS was known to any individual designated in 37 C.F.R. § 1.56(c) more than three months prior to the filing of this IDS (See 37 C.F.R. § 1.97(e)(2)).

C. ☐ some of the items of information were first cited in a communication from a foreign patent office. As to this information, the undersigned hereby certifies that each item of information contained in this IDS was cited in a communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this IDS. As to the remaining information, the undersigned hereby certifies that no item of this remaining information contained in this IDS was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the undersigned after making reasonable inquiry, no item of information contained in this IDS was known to any individual designated in 37 C.F.R. § 1.56(c) more than three months prior to the filing of this IDS.

VII. STATEMENT UNDER 37 C.F.R. 1.704(d)

The undersigned hereby states that:

☐ each item of information contained in this IDS was cited in a communication from a foreign patent office in a counterpart application and this communication was not received by any individual designated in 37 C.F.R. § 1.56(c) more than thirty days prior to the filing of this IDS.

VIII. PAYMENT OF FEES (check only one box, if applicable)

A. ☐ A check in the amount of \$180.00 is enclosed for the above-identified fee.

B. ☐ Please charge Deposit Account No. 50-6518 in the amount of \$180.00 for the above-identified fee.

Please charge any additional fees or credit any overpayment pursuant to 37 C.F.R. § 1.16 or § 1.17 to Deposit Account No. 50-6518 (Seiko Epson Corporation).

The above references are being cited only in the interest of candor and without any admission that they constitute statutory prior art, contain matter which anticipates the invention, or which would render the same obvious, either singly or in combination, to a person of ordinary skill in the art. Furthermore, this Information Disclosure Statement shall not be construed as a representation that a search has been made.

If it is determined that this IDS has been filed under the wrong rule, the PTO is requested to consider this IDS under the proper rule (with a petition if necessary) and charge the appropriate fee to Deposit Account No. 50-6518 (Seiko Epson Corporation).

Respectfully submitted,

Dated: May 12, 2016

By: /Bryant E. Wade/  
G. Gregory Schivley  
Reg. No. 27,382  
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GGG/BEW/klh

## Electronic Acknowledgement Receipt

|                                             |                                                 |
|---------------------------------------------|-------------------------------------------------|
| <b>EFS ID:</b>                              | 25755529                                        |
| <b>Application Number:</b>                  | 14572068                                        |
| <b>International Application Number:</b>    |                                                 |
| <b>Confirmation Number:</b>                 | 6575                                            |
| <b>Title of Invention:</b>                  | METHOD OF MANUFACTURING A LIQUID CRYSTAL DEVICE |
| <b>First Named Inventor/Applicant Name:</b> | Yoichi MOMOSE                                   |
| <b>Customer Number:</b>                     | 27572                                           |
| <b>Filer:</b>                               | Bryant Edward Wade/Kristy Harris                |
| <b>Filer Authorized By:</b>                 | Bryant Edward Wade                              |
| <b>Attorney Docket Number:</b>              | 93195-001378-COB                                |
| <b>Receipt Date:</b>                        | 12-MAY-2016                                     |
| <b>Filing Date:</b>                         | 16-DEC-2014                                     |
| <b>Time Stamp:</b>                          | 11:39:15                                        |
| <b>Application Type:</b>                    | Utility under 35 USC 111(a)                     |

### Payment information:

|                        |    |
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### File Listing:

| Document Number | Document Description                                  | File Name | File Size(Bytes)/<br>Message Digest                   | Multi Part /.zip | Pages (if appl.) |
|-----------------|-------------------------------------------------------|-----------|-------------------------------------------------------|------------------|------------------|
| 1               | Information Disclosure Statement (IDS)<br>Form (SB08) | 1449.PDF  | 24552<br>0f3c2a4949548404bedff455010d7de83f31<br>1e2f | no               | 1                |

### Warnings:

### Information:

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| This is not an USPTO supplied IDS fillable form                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                    |         |                                          |       |   |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Transmittal Letter | IDS.PDF | 33243                                    | no    | 5 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                    |         | 0b4cb634bd7039110b1bfc209293fc68349db74c |       |   |
| <b>Warnings:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                    |         |                                          |       |   |
| <b>Information:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                    |         |                                          |       |   |
| Total Files Size (in bytes):                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                    |         |                                          | 57795 |   |
| <p><b>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</b></p> <p><b><u>New Applications Under 35 U.S.C. 111</u></b><br/>         If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><b><u>National Stage of an International Application under 35 U.S.C. 371</u></b><br/>         If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><b><u>New International Application Filed with the USPTO as a Receiving Office</u></b><br/>         If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p> |                    |         |                                          |       |   |



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|                                                                                                         |             |                      |                                 |                             |
|---------------------------------------------------------------------------------------------------------|-------------|----------------------|---------------------------------|-----------------------------|
| APPLICATION NO.                                                                                         | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO.             | CONFIRMATION NO.            |
| 14/572,068                                                                                              | 12/16/2014  | Yoichi MOMOSE        | 9319S-001378-COB                | 6575                        |
| 27572 7590 05/19/2016<br>HARNESS, DICKEY & PIERCE, P.L.C.<br>P.O. BOX 828<br>BLOOMFIELD HILLS, MI 48303 |             |                      | EXAMINER<br>NGUYEN, LAUREN      |                             |
|                                                                                                         |             |                      | ART UNIT<br>2871                | PAPER NUMBER                |
|                                                                                                         |             |                      | NOTIFICATION DATE<br>05/19/2016 | DELIVERY MODE<br>ELECTRONIC |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

troy@mailroom@hdp.com



|                              |                                      |                                      |                                                  |
|------------------------------|--------------------------------------|--------------------------------------|--------------------------------------------------|
| <b>Office Action Summary</b> | <b>Application No.</b><br>14/572,068 | <b>Applicant(s)</b><br>MOMOSE ET AL. |                                                  |
|                              | <b>Examiner</b><br>LAUREN NGUYEN     | <b>Art Unit</b><br>2871              | <b>AIA (First Inventor to File) Status</b><br>No |

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 5/12/2016.  
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on \_\_\_\_.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on \_\_\_\_; the restriction requirement and election have been incorporated into this action.
- 4) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims\***

- 5) ☒ Claim(s) 1-20 is/are pending in the application.  
5a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 6) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 7) ☒ Claim(s) 1-20 is/are rejected.
- 8) ☐ Claim(s) \_\_\_\_ is/are objected to.
- 9) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

\* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see [http://www.uspto.gov/patents/init\\_events/pph/index.jsp](http://www.uspto.gov/patents/init_events/pph/index.jsp) or send an inquiry to [PPHfeedback@uspto.gov](mailto:PPHfeedback@uspto.gov).

**Application Papers**

- 10) ☐ The specification is objected to by the Examiner.
- 11) ☐ The drawing(s) filed on \_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

**Certified copies:**

- a) ☐ All    b) ☐ Some\*\*    c) ☐ None of the:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\*\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |                                                                                                                                          |                                                                                         |
|------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)                                                                         | 3) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. ____. |
| 2) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b)<br>Paper No(s)/Mail Date ____. | 4) <input type="checkbox"/> Other: ____.                                                |

1. The present application is being examined under the pre-AIA first to invent provisions.

#### **DETAILED ACTION**

##### ***Continued Examination Under 37 CFR 1.114***

2. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 05/12/2016 has been entered.

##### ***Response to Amendment***

3. Applicant's arguments filed 05/12/2016 have been fully considered but they are not persuasive.
4. The applicant argues that none of the cited references teaches the limitation as amended in claims 1, 7, and 13. The examiner respectfully disagrees. **Miyazaki et al.** (figures 1-5 and 16) discloses a display device as claimed including wherein the first substrate includes a plurality of conductive portions (3b), the plurality of conductive portions being a plurality of dot conductive points and the plurality of wiring lines extend onto the protruding region across the seal member without connecting to the plurality of dot conductive points (11a and 3b).
5. In addition, **Tanaka** (figures 1-2) teaches (i) wherein the plurality of active elements are thin film transistors disposed on the first substrate (substrate 111; see at least paragraph 0058); a second substrate including a common electrode (substrate 121; see at least paragraph 0059), wherein the common electrode is disposed on the second substrate opposite to the plurality of pixel electrodes disposed on the first substrate; wherein the first substrate includes a protruding

region which protrudes over the second substrate in the plan-view of the first substrate and a plurality of conductive portions. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention modify the first substrate as taught by **Tanaka** in order to control the flow directions of the liquid crystal by changing a distance between the corner and each liquid crystal filling port and opening lengths of the liquid crystal filling ports. Accordingly, the flow directions can be more parallel to the predetermined direction regardless of the predetermined direction of the alignment layer relative to the extending direction of the seal.

6. The claim language therefore does not patentably distinguish over the applied reference[s], and the previous rejections are maintained.

***Claim Rejections - 35 USC § 112***

7. Claims 1-20 are rejected under 35 U.S.C. 112(a) or 35 U.S.C. 112 (pre-AIA), first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor or a joint inventor, or for pre-AIA the inventor(s), at the time the application was filed, had possession of the claimed invention. The specific limitation “the first seal portion and the second seal portion ... do not protrude from the second substrate in a plan-view of the first substrate” is not supported by the originally filed specification. As shown in figure 30 of the instant application, the first and second seal portions 52a-52b both protrude from the substrate at the junction portion 59. In addition, the seal portions can protrude from all sides of the substrate, e.g. x, y, z directions. The applicant is required to explain what is being claimed. Appropriate correction is required.

***Claim Rejections - 35 USC § 103***

8. The following is a quotation of pre-AIA 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented 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 art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. **Claims 1-20** rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over **Miyazaki et al. (US 6,930,745)** in view of **Tanaka et al. (US 2005/0122466)**.

10. Regarding **claim 1, Miyazaki et al.** (figures 1-5 and 16) discloses a display device, comprising:

- a first substrate (70) including a plurality of pixel electrodes, a plurality of active elements and a plurality of wiring lines (11a) that connect to the plurality of active elements;
- a second substrate (80) including a common electrode (9b);
- a display region in which the plurality of pixel electrodes and the plurality of active elements are aligned in a plan-view of the first substrate;
- a seal region positioned around the display region in a plan-view of the first substrate;
- and
- a seal member (3) in the seal region and disposed between the first substrate and the second substrate so as to the common electrode faces to the plurality of pixel electrodes,
- wherein the first substrate includes a plurality of conductive portions (3b), the plurality of conductive portions being a plurality of dot conductive points,

- the seal region (75-79 and 85-89) forms a rectangular closed-shape so as to surround the display region, and has a first side, a second side, a third side and a fourth side, the first side is positioned between the display region and the protruding region, and opposed to the third side, and the second side is opposed to the fourth side, and
- the seal member includes a first seal portion and a second seal portion (75-79 and 85-89), the first seal portion and the second seal portion form the rectangular closed-shape between the first substrate and the second substrate and do not protrude from the second substrate in a plan-view of the first substrate,
- wherein the first seal portion is disposed at least on the first side and the second seal portion is disposed at least on the third side,
- the first seal portion and the second seal portion are connected in a first junction portion positioned on the second side, and
- the first seal portion and the second seal portion are connected in a second junction portion positioned on the fourth side,
- wherein the second seal portion includes a plurality of conductive particles and the plurality of conductive portions are disposed at least on the third side and electrically connected to the common electrode, and
- the plurality of wiring lines extend onto the protruding region across the seal member without connecting to the plurality of dot conductive points (11a and 3b).

11. **Miyazaki et al.** discloses the limitations as shown in the rejection of **claim 1** above.

However, **Miyazaki et al.** is silent regarding (i) wherein the plurality of active elements are thin film transistors disposed on the first substrate; a second substrate including a common electrode,

wherein the common electrode is disposed on the second substrate opposite to the plurality of pixel electrodes disposed on the first substrate; wherein the first substrate includes a protruding region which protrudes over the second substrate in the plan-view of the first substrate and a plurality of conductive portions; and (ii) the plurality of conductive portions being dot conductive points.

12. **Tanaka** (figures 1-2) teaches (i) wherein the plurality of active elements are thin film transistors disposed on the first substrate (substrate 111; see at least paragraph 0058); a second substrate including a common electrode (substrate 121; see at least paragraph 0059), wherein the common electrode is disposed on the second substrate opposite to the plurality of pixel electrodes disposed on the first substrate; wherein the first substrate includes a protruding region which protrudes over the second substrate in the plan-view of the first substrate and a plurality of conductive portions. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention modify the first substrate as taught by **Tanaka** in order to control the flow directions of the liquid crystal by changing a distance between the corner and each liquid crystal filling port and opening lengths of the liquid crystal filling ports. Accordingly, the flow directions can be more parallel to the predetermined direction regardless of the predetermined direction of the alignment layer relative to the extending direction of the seal.

13. In addition, (ii) it would have been obvious to one having ordinary skill in the art at the time the invention was made to have dot conductive points, since it has been held that the configuration of the claimed shape of the opening was a matter of choice which a person of ordinary skill in the art would have found obvious absent persuasive evidence that the particular configuration of the claimed shape of the

opening was significant. In re Dailey, 357 F.2d 669, 149 USPQ 47 (CCPA 1966).

The applicant has not provided any criticality for the shape of the conductive points to be dot.

14. Therefore, **Miyazaki et al. as modified by Tanaka et al.** teaches wherein the second seal portion includes a plurality of conductive particles and the plurality of dot conductive points are disposed at least on the third side and all of the plurality of dot conductive points are electrically connected to the common electrode.

15. Regarding **claim 2, Miyazaki et al.** (figures 1-5 and 16) discloses each of the plurality of the conductive portions are spaced apart from each other.

16. Regarding **claim 3, Miyazaki et al.** (figures 1-5 and 16) discloses the first seal portion and the second seal portion extend from the second side toward an edge of the first substrate in the first junction portion, the first seal portion and the second seal portion extend from the fourth side toward an edge of the first substrate in the second junction portion, and the first junction portion and the second junction portion projecting in an opposite direction with respect to the pixel area.

17. Regarding **claim 4, Miyazaki et al.** (figures 1-5 and 16) discloses the first substrate further includes a first conductive portion on the second side, the second seal portion includes a first part of the seal member on the second side, wherein the first part of the seal member extends from one end of the seal member disposed on the third side over the first conductive portion on the second side, and the first part of the seal member includes a plurality of conductive particles, and the first conductive portion is electrically connected to the common electrode.

18. Regarding **claim 5, Miyazaki et al.** (figures 1-5 and 16) discloses the first substrate further includes a second conductive portion on the fourth side, the second seal portion includes a second part of the seal member on the fourth side, wherein the second part of the seal member extends from another end of the seal member disposed on the third side over the second conductive portion on the fourth side, and the second part of the seal member includes a plurality of conductive particles, and the second conductive portion is electrically connected to the common electrode.

19. Regarding **claim 6, Miyazaki et al.** (figures 1-5 and 16) discloses an electronic device comprising the display device according to claim 1.

20. Regarding **claim 7, Miyazaki et al.** (figures 1-5 and 16) discloses a display device, comprising:

- a first substrate (70) including a pixel region and a seal region which is defined around the pixel region on a first surface of the first substrate, the pixel region including a plurality of pixels and a plurality of active elements, and the seal region forming a rectangular ring shape; and
- a second substrate (80; figure 1) including a common electrode on a second surface; and
- a seal member bonding the first substrate and the second substrate so that the first surface faces the second surface,
- the seal region (75-79 and 85-89) includes a first side, a second side, a third side and a fourth side, the first side is positioned between the pixel region and the protruding region, and opposed to the third side, and the second side is opposed to the fourth side,



- the seal member is disposed between the first substrate and the second substrate, and positioned on the first side, the second side, the third side and the fourth side continuously and forms a closed-ring shape in which the pixel region is positioned without protruding from the second substrate in the plan-view of the first substrate,
- a first part of the seal member disposed on the third side which is opposed to the protruding region with respect to the pixel region includes a plurality of conductive particles,
- a plurality of conductive portions are disposed on the third side of the first substrate, the plurality of the conductive portions are electrically connected to the common electrode,
- wherein the first substrate includes a plurality of wiring lines that connect to the plurality of active elements, and the plurality of wiring lines extend onto the protruding region across the seal member without connecting to the dot conductive points.

21. **Miyazaki et al.** discloses the limitations as shown in the rejection of **claim 1** above.

However, **Miyazaki et al.** is silent regarding (i) wherein the plurality of active elements are thin film transistors disposed on the first substrate; a second substrate including a common electrode, wherein the common electrode is disposed on the second substrate opposite to the plurality of pixel electrodes disposed on the first substrate; wherein the first substrate includes a protruding region which protrudes over the second substrate in the plan-view of the first substrate and a plurality of conductive portions; and (ii) the plurality of conductive portions being dot conductive points.

22. **Miyazaki et al.** discloses the limitations as shown in the rejection of **claim 7** above.

However, **Miyazaki et al.** is silent regarding (i) wherein the plurality of active elements are thin

film transistors disposed on the first substrate; a second substrate including a common electrode, wherein the common electrode is disposed on the second substrate opposite to the plurality of pixel electrodes disposed on the first substrate; wherein the first substrate includes a protruding region which protrudes over the second substrate in the plan-view of the first substrate and a plurality of conductive portions; and (ii) the plurality of conductive portions being dot conductive points.

23. **Tanaka** (figures 1-2) teaches (i) wherein the plurality of active elements are thin film transistors disposed on the first substrate (substrate 111; see at least paragraph 0058); a second substrate including a common electrode (substrate 121; see at least paragraph 0059), wherein the common electrode is disposed on the second substrate opposite to the plurality of pixel electrodes disposed on the first substrate; wherein the first substrate includes a protruding region which protrudes over the second substrate in the plan-view of the first substrate and a plurality of conductive portions. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention modify the first substrate as taught by **Tanaka** in order to control the flow directions of the liquid crystal by changing a distance between the corner and each liquid crystal filling port and opening lengths of the liquid crystal filling ports. Accordingly, the flow directions can be more parallel to the predetermined direction regardless of the predetermined direction of the alignment layer relative to the extending direction of the seal.

24. In addition, (ii) it would have been obvious to one having ordinary skill in the art at the time the invention was made to have dot conductive points, since it has been held that the configuration of the claimed shape of the opening was a matter of choice which a person of ordinary skill in the art would have found obvious absent

persuasive evidence that the particular configuration of the claimed shape of the opening was significant. In re Dailey, 357 F.2d 669, 149 USPQ 47 (CCPA 1966). The applicant has not provided any criticality for the shape of the conductive points to be dot.

25. Therefore, **Miyazaki et al. as modify by Tanaka et al.** teaches wherein the second seal portion includes a plurality of conductive particles and the plurality of dot conductive points are disposed at least on the third side and all of the plurality of dot conductive points are electrically connected to the common electrode and each of the plurality of the dot conductive points are spaced apart from each other.

26. Regarding **claim 8, Miyazaki et al.** (figures 1-5 and 16) discloses the first substrate includes a first conductive portion on the second side and the seal member includes a second part of the seal member on the second side, the second part of the seal member extends from one end of the first part of the seal member over the first conductive portion on the second side, and the second part of the seal member includes a plurality of conductive particles, and wherein the first conductive portion is electrically connected to the common electrode.

27. Regarding **claim 9, Miyazaki et al.** (figures 1-5 and 16) **as modify by Tanaka et al.** teaches the first substrate includes a second conductive point on the fourth side and the seal member includes a third part of the seal member on the fourth side, the third part of the seal member extends from another end of the first part of the seal member over the second conductive point on the fourth side, and the third part of the seal member includes a plurality of conductive particles, and wherein the second conductive point is electrically connected to the common electrode.

28. Regarding **claim 10, Miyazaki et al.** (figures 1-5 and 16) discloses the seal member extends to a first edge of the seal region opposite to the pixel region on the second side.
29. Regarding **claim 11, Miyazaki et al.** (figures 1-5 and 16) discloses the seal member extends to a second edge of the seal region opposite to the pixel region on the fourth side.
30. Regarding **claim 12, Miyazaki et al.** (figures 1-5 and 16) discloses an electronic device comprising the display device according to claim 7.
31. Regarding **claim 13, Miyazaki et al.** (figures 1-5 and 16) discloses a display device, comprising:
- a first substrate (70) including a plurality of pixel electrodes and a plurality of active elements and a plurality of wiring lines that connect to the plurality of active elements;
  - a second substrate (80) including a common electrode;
  - a display region in which the plurality of pixel electrodes and the plurality of active elements are aligned in a plan-view of the first substrate;
  - a seal region (75-79 and 85-89) positioned around the display region in the plan-view of the first substrate and forming a closed-ring shape in which the display region is disposed;
  - a seal member in the seal region and bonding the first substrate and the second substrate so that the common electrode faces the plurality of pixel electrodes, the seal member forming a closed-ring shape in which the display region is positioned without protruding from the second substrate in the plan-view of the first substrate, and the seal member is disposed between the first substrate and the second substrate;

- the seal region includes a first portion and a second portion, the first portion is positioned at least between the display region and the protruding region, and the second portion is positioned at least opposite to the protruding region with respect to the display region, and
- the seal member includes a first part and the second part, the first part of the seal member is positioned on the first portion and the second part of the seal member is positioned on the second portion, and the second part of the seal member includes a plurality of conductive particles,
- wherein the plurality of conductive portions are disposed on the second portion of the first substrate, the plurality of the conductive portions are electrically connected to the common electrode,
- each of the plurality of the conductive portions are spaced apart from each other, and
- the plurality of wiring lines extend onto the protruding region across the seal member without connecting to the dot conductive points.

32. **Miyazaki et al.** discloses the limitations as shown in the rejection of **claim 13** above.

However, **Miyazaki et al.** is silent regarding (i) wherein the plurality of active elements are thin film transistors disposed on the first substrate; a second substrate including a common electrode, wherein the common electrode is disposed on the second substrate opposite to the plurality of pixel electrodes disposed on the first substrate; wherein the first substrate includes a protruding region which protrudes over the second substrate in the plan-view of the first substrate and a plurality of conductive portions; and (ii) the plurality of conductive portions being dot conductive points.

33. **Tanaka** (figures 1-2) teaches (i) wherein the plurality of active elements are thin film transistors disposed on the first substrate (substrate 111; see at least paragraph 0058); a second substrate including a common electrode (substrate 121; see at least paragraph 0059), wherein the common electrode is disposed on the second substrate opposite to the plurality of pixel electrodes disposed on the first substrate; wherein the first substrate includes a protruding region which protrudes over the second substrate in the plan-view of the first substrate and a plurality of conductive portions. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention modify the first substrate as taught by **Tanaka** in order to control the flow directions of the liquid crystal by changing a distance between the corner and each liquid crystal filling port and opening lengths of the liquid crystal filling ports. Accordingly, the flow directions can be more parallel to the predetermined direction regardless of the predetermined direction of the alignment layer relative to the extending direction of the seal.

34. In addition, (ii) it would have been obvious to one having ordinary skill in the art at the time the invention was made to have dot conductive points, since it has been held that the configuration of the claimed shape of the opening was a matter of choice which a person of ordinary skill in the art would have found obvious absent persuasive evidence that the particular configuration of the claimed shape of the opening was significant. In re Dailey, 357 F.2d 669, 149 USPQ 47 (CCPA 1966). The applicant has not provided any criticality for the shape of the conductive points to be dot.

35. Therefore, **Miyazaki et al. as modify by Tanaka et al.** teaches wherein the second seal portion includes a plurality of conductive particles and the plurality of dot conductive points

are disposed at least on the third side and all of the plurality of dot conductive points are electrically connected to the common electrode and each of the plurality of the dot conductive points are spaced apart from each other.

36. Regarding **claim 14, Miyazaki et al.** (figures 1-5 and 16) discloses no conductive portions are disposed on the first portion of the first substrate and no conductive particles are included in the first part of the seal member.

37. Regarding **claim 15, Miyazaki et al.** (figures 1-5 and 16) discloses the seal member further includes a third part and a fourth part, the third part of the seal member extends from one end of the first part, and the fourth part of the seal member extends from one end of the second part and includes a first plurality of conductive particles.

38. Regarding **claim 16, Miyazaki et al.** (figures 1-5 and 16) discloses the third part and the fourth part are connected and extend to a first edge of the seal region opposite to the display region.

39. Regarding **claim 17, Miyazaki et al.** (figures 1-5 and 16) discloses the seal member further includes a fifth part and a sixth part, the fifth part of the seal member extends from another end of the first part, and the sixth part of the seal member extends from another end of the second part and includes a second plurality of conductive particles, and the fifth part and the sixth part are connected and extend to a second edge of the seal region opposite to the display region.

40. Regarding **claim 18, Miyazaki et al.** (figures 1-5 and 16) discloses the first edge of the seal region is positioned opposite to the second edge of the seal region with respect to the display region.

41. Regarding **claim 19, Miyazaki et al.** (figures 1-5 and 16) discloses the first substrate further includes a first conductive portion and a second conductive portion, different from the plurality of conductive portions, and the first conductive portion, the second conductive portion and the plurality of conductive portions are disposed apart from each other, and the first conductive portion is electrically connected to the common electrode through the first plurality of conductive particles and the second conductive portion is electrically connected to the common electrode through the second plurality of conductive particles.

42. Regarding **claim 20, Miyazaki et al.** (figures 1-5 and 16) discloses an electronic device comprising the display device according to claim 13.

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lauren Nguyen whose telephone number is (571) 270-1428. The examiner can normally be reached on M-Th, 7:30-6:00 EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Edward Glick can be reached on (571) 272-2490. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would



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like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Lauren Nguyen/  
Primary Examiner, Art Unit 2871

14572068 - GAU: 2871

Receipt date: 05/12/2016

Used in Lieu of PTO/SB/08A/B  
(Based on PTO 10-07 version)

|                                                                                                                                              |   |    |   |                          |                        |
|----------------------------------------------------------------------------------------------------------------------------------------------|---|----|---|--------------------------|------------------------|
| Substitute for form 1449/PTO<br><br><b>INFORMATION DISCLOSURE<br/>STATEMENT BY APPLICANT</b><br><br><i>(Use as many sheets as necessary)</i> |   |    |   | <b>Complete if Known</b> |                        |
|                                                                                                                                              |   |    |   | Application Number       | 14/572,068-Conf. #6575 |
|                                                                                                                                              |   |    |   | Filing Date              | December 16, 2014      |
|                                                                                                                                              |   |    |   | First Named Inventor     | Yoichi MOMOSE          |
|                                                                                                                                              |   |    |   | Art Unit                 | 2871                   |
|                                                                                                                                              |   |    |   | Examiner Name            | Lauren Nguyen          |
| Sheet                                                                                                                                        | 1 | of | 1 | Attorney Docket Number   | 9319S-001378-COB       |

| U.S. PATENT DOCUMENTS |                          |                                          |                                |                                                    |                                                                                 |
|-----------------------|--------------------------|------------------------------------------|--------------------------------|----------------------------------------------------|---------------------------------------------------------------------------------|
| Examiner<br>Initials* | Cite<br>No. <sup>1</sup> | Document Number                          | Publication Date<br>MM-DD-YYYY | Name of Patentee or<br>Applicant of Cited Document | Pages, Columns, Lines, Where<br>Relevant Passages or Relevant<br>Figures Appear |
|                       |                          | Number-Kind Code <sup>2</sup> (if known) |                                |                                                    |                                                                                 |
| /L.N./                | AA*                      | US-2005-0219456-A1                       | 10-06-2005                     | Tadaki et al.                                      |                                                                                 |

| FOREIGN PATENT DOCUMENTS |                          |                                                                                   |                                   |                                                    |                                                                                 |                |
|--------------------------|--------------------------|-----------------------------------------------------------------------------------|-----------------------------------|----------------------------------------------------|---------------------------------------------------------------------------------|----------------|
| Examiner<br>Initials*    | Cite<br>No. <sup>1</sup> | Foreign Patent Document                                                           | Publication<br>Date<br>MM-DD-YYYY | Name of Patentee or<br>Applicant of Cited Document | Pages, Columns, Lines,<br>Where Relevant Passages<br>Or Relevant Figures Appear | T <sup>6</sup> |
|                          |                          | Country Code <sup>3</sup> -Number <sup>4</sup> -Kind Code <sup>5</sup> (if known) |                                   |                                                    |                                                                                 |                |
|                          |                          |                                                                                   |                                   |                                                    |                                                                                 |                |

\*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. \* CITE NO.: Those application(s) which are marked with an single asterisk (\*) next to the Cite No. are not supplied (under 37 CFR 1.98(a)(2)(iii)) because that application was filed after June 30, 2003 or is available in the IFW. <sup>1</sup> Applicant's unique citation designation number (optional). <sup>2</sup> See Kinds Codes of USPTO Patent Documents at [www.uspto.gov](http://www.uspto.gov) or MPEP 901.04. <sup>3</sup> Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). <sup>4</sup> For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. <sup>5</sup> Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. <sup>6</sup> Applicant is to place a check mark here if English language Translation is attached.

| NON PATENT LITERATURE DOCUMENTS |                          |                                                                                                                                                                                                                                                                 |                |
|---------------------------------|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| Examiner<br>Initials            | Cite<br>No. <sup>1</sup> | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. | T <sup>2</sup> |
|                                 |                          |                                                                                                                                                                                                                                                                 |                |

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<sup>1</sup> Applicant's unique citation designation number (optional). <sup>2</sup> Applicant is to place a check mark here if English language Translation is attached.

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|                       |                              |                    |  |
|-----------------------|------------------------------|--------------------|--|
| Examiner<br>Signature | /Lauren Nguyen/ (05/15/2016) | Date<br>Considered |  |
|-----------------------|------------------------------|--------------------|--|

BEW/kih

## EAST Search History

## EAST Search History (Prior Art)

| Ref # | Hits | Search Query                                                                                 | DBs                                                                        | Default Operator | Plurals | Time Stamp          |
|-------|------|----------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|------------------|---------|---------------------|
| L3    | 1055 | ((yoichi with momose) (satoshi with hasegawa)).in.                                           | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB | OR               | OFF     | 2016/02/04<br>19:01 |
| L5    | 296  | (seal\$4 and continuous\$4 and side and opposite and (display LCD)).clm.                     | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB | OR               | OFF     | 2016/02/04<br>19:09 |
| S1    | 1    | "11301086"                                                                                   | US-PGPUB;<br>USPAT;<br>USOCR                                               | OR               | ON      | 2008/10/01<br>11:47 |
| S2    | 4    | ("5889572"   "5978060"   "6052171"   "6616467").PN.                                          | US-PGPUB;<br>USPAT;<br>USOCR                                               | OR               | ON      | 2008/10/01<br>13:28 |
| S4    | 369  | 349/190.ccls. and @ad<="20041227"                                                            | US-PGPUB;<br>USPAT;<br>USOCR                                               | OR               | ON      | 2008/10/02<br>09:19 |
| S5    | 22   | ("3700306"   "3751137"   "3799649"   "3866313").PN. OR ("3990782").URPN.                     | US-PGPUB;<br>USPAT;<br>USOCR                                               | OR               | ON      | 2008/10/06<br>09:53 |
| S6    | 4    | ("20020109815"   "5973763"   "6335779").PN. OR ("6750937").URPN.                             | US-PGPUB;<br>USPAT;<br>USOCR                                               | OR               | ON      | 2008/10/06<br>10:00 |
| S7    | 2    | "20040239864"                                                                                | US-PGPUB;<br>USPAT;<br>USOCR                                               | OR               | ON      | 2008/10/06<br>10:25 |
| S8    | 5    | ("20020063836"   "20050264748"   "5985069"   "6144438"   "7075612").PN. OR ("7369211").URPN. | US-PGPUB;<br>USPAT;<br>USOCR                                               | OR               | ON      | 2008/10/06<br>11:33 |
| S9    | 2    | "20040252270"                                                                                | US-PGPUB;<br>USPAT;<br>USOCR                                               | OR               | ON      | 2008/10/06<br>11:51 |
| S10   | 3    | 10/649684                                                                                    | US-PGPUB;<br>USPAT;<br>USOCR                                               | OR               | ON      | 2009/09/16<br>13:10 |
| S11   | 4    | ("5798813"   "6144435"   "6678029"   "6705584").PN. OR ("7042544").URPN.                     | US-PGPUB;<br>USPAT;<br>USOCR                                               | OR               | ON      | 2009/09/16<br>13:11 |
| S12   | 4    | ("5798813"   "6705584").PN. OR ("6940576").URPN.                                             | US-PGPUB;<br>USPAT;<br>USOCR                                               | OR               | ON      | 2009/09/16<br>13:14 |
| S13   | 8    | ("20040012744"   "20050146646"                                                               | US-PGPUB;                                                                  | OR               | ON      | 2011/09/30          |

|     |      |                                                                                                                                                                                                                                                                                                         |                                                                            |    |     |                     |
|-----|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|----|-----|---------------------|
|     |      | "20060017867"   "20030063080"  <br>"20060033872"   "20050078240"  <br>"20040032557"   "20050225708"  <br>"20040012744").PN.                                                                                                                                                                             | USPAT                                                                      |    |     | 13:37               |
| S15 | 2    | "20050248711"                                                                                                                                                                                                                                                                                           | US-PGPUB;<br>USPAT;<br>USOCR                                               | OR | ON  | 2012/01/30<br>13:45 |
| S16 | 19   | ("20040252270"   "20050094084"  <br>"20050099574"   "6674507"   "6930745"<br>  "7280179"   "6525799"  <br>"20040239864"   "20040070723"  <br>"20030025867"   "20040125317"  <br>"7133107"   "20020030783"   "6099672"<br>  "6388729"   "20040070722"  <br>"7190430"   "20050117106"  <br>"6531329").PN. | US-PGPUB;<br>USPAT;<br>USOCR                                               | OR | ON  | 2012/01/30<br>13:46 |
| S17 | 19   | ("20040252270"   "20050094084"  <br>"20050099574"   "6674507"   "6930745"<br>  "7280179"   "6525799"  <br>"20040239864"   "20040070723"  <br>"20030025867"   "20040125317"  <br>"7133107"   "20020030783"   "6099672"<br>  "6388729"   "20040070722"  <br>"7190430"   "20050117106"  <br>"6531329").PN. | US-PGPUB;<br>USPAT;<br>USOCR                                               | OR | ON  | 2012/01/31<br>07:56 |
| S18 | 2    | ("20020080461").PN.                                                                                                                                                                                                                                                                                     | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB | OR | OFF | 2015/09/20<br>15:31 |
| S19 | 2    | ("20020080461").PN.                                                                                                                                                                                                                                                                                     | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB | OR | OFF | 2015/10/29<br>09:31 |
| S20 | 2    | ("20020080461").PN.                                                                                                                                                                                                                                                                                     | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB | OR | OFF | 2016/02/04<br>13:03 |
| S21 | 3    | ("6930745").PN.                                                                                                                                                                                                                                                                                         | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB | OR | OFF | 2016/02/04<br>13:26 |
| S22 | 5    | ((("20020080461") or<br>("20050122466"))).PN.                                                                                                                                                                                                                                                           | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB | OR | OFF | 2016/02/04<br>14:13 |
| S23 | 3053 | (349/153.ccls. 349/190.ccls)                                                                                                                                                                                                                                                                            | US-PGPUB;                                                                  | OR | OFF | 2016/02/04          |

## EAST Search History

|     |     |                                                                                                                              |                                                                            |    |     |                     |
|-----|-----|------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|----|-----|---------------------|
|     |     |                                                                                                                              | USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB              |    |     | 15:54               |
| S24 | 757 | S23 AND ( (G02F1/1339 OR G02F1/1341<br>OR G02F1/13394 OR G02F2001/13415<br>OR G02F2001/133325).CPC. ) and<br>@ad<="20041227" | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB | OR | OFF | 2016/02/04<br>15:55 |

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|                                                                                                        |             |                      |                                 |                             |
|--------------------------------------------------------------------------------------------------------|-------------|----------------------|---------------------------------|-----------------------------|
| APPLICATION NO.                                                                                        | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO.             | CONFIRMATION NO.            |
| 14/572,068                                                                                             | 12/16/2014  | Yoichi MOMOSE        | 9319S-001378-COB                | 6575                        |
| 27572 7590 06/27/2016<br>HARNES, DICKEY & PIERCE, P.L.C.<br>P.O. BOX 828<br>BLOOMFIELD HILLS, MI 48303 |             |                      | EXAMINER<br>NGUYEN, LAUREN      |                             |
|                                                                                                        |             |                      | ART UNIT<br>2871                | PAPER NUMBER                |
|                                                                                                        |             |                      | NOTIFICATION DATE<br>06/27/2016 | DELIVERY MODE<br>ELECTRONIC |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

troy@mailroom@hdp.com

|                                                     |                        |                     |  |
|-----------------------------------------------------|------------------------|---------------------|--|
| <b><i>Applicant-Initiated Interview Summary</i></b> | <b>Application No.</b> | <b>Applicant(s)</b> |  |
|                                                     | 14/572,068             | MOMOSE ET AL.       |  |
|                                                     | <b>Examiner</b>        | <b>Art Unit</b>     |  |
|                                                     | LAUREN NGUYEN          | 2871                |  |

All participants (applicant, applicant's representative, PTO personnel):

(1) LAUREN NGUYEN. (3) \_\_\_\_.

(2) Stephanie Dowdy. (4) \_\_\_\_.

Date of Interview: 6/21/2016.

Type:    ☒ Telephonic    ☐ Video Conference  
           ☐ Personal [copy given to:    ☐ applicant    ☐ applicant's representative]

Exhibit shown or demonstration conducted:    ☐ Yes    ☐ No.  
           If Yes, brief description: \_\_\_\_.

Issues Discussed    ☐ 101    ☐ 112    ☐ 102    ☐ 103    ☐ Others  
 (For each of the checked box(es) above, please describe below the issue and detailed description of the discussion)

Claim(s) discussed: 1.

Identification of prior art discussed: Miyazaki et al..

**Substance of Interview**  
 (For each issue discussed, provide a detailed description and indicate if agreement was reached. Some topics may include: identification or clarification of a reference or a portion thereof, claim interpretation, proposed amendments, arguments of any applied references etc...)

The examiner and the applicant's representative discussed the proposed claimed amendment and the cited references. However, no agreement has been reached. Further search and consideration will be necessary

.

**Applicant recordation instructions:** The formal written reply to the last Office action must include the substance of the interview. (See MPEP section 713.04). If a reply to the last Office action has already been filed, applicant is given a non-extendable period of the longer of one month or thirty days from this interview date, or the mailing date of this interview summary form, whichever is later, to file a statement of the substance of the interview

**Examiner recordation instructions:** Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

☐ Attachment

|                                                    |  |
|----------------------------------------------------|--|
| /LAUREN NGUYEN/<br>Primary Examiner, Art Unit 2871 |  |
|----------------------------------------------------|--|

## Summary of Record of Interview Requirements

### Manual of Patent Examining Procedure (MPEP), Section 713.04, Substance of Interview Must be Made of Record

A complete written statement as to the substance of any face-to-face, video conference, or telephone interview with regard to an application must be made of record in the application whether or not an agreement with the examiner was reached at the interview.

#### Title 37 Code of Federal Regulations (CFR) § 1.133 Interviews

Paragraph (b)

In every instance where reconsideration is requested in view of an interview with an examiner, a complete written statement of the reasons presented at the interview as warranting favorable action must be filed by the applicant. An interview does not remove the necessity for reply to Office action as specified in §§ 1.111, 1.135. (35 U.S.C. 132)

#### 37 CFR §1.2 Business to be transacted in writing.

All business with the Patent or Trademark Office should be transacted in writing. The personal attendance of applicants or their attorneys or agents at the Patent and Trademark Office is unnecessary. The action of the Patent and Trademark Office will be based exclusively on the written record in the Office. No attention will be paid to any alleged oral promise, stipulation, or understanding in relation to which there is disagreement or doubt.

The action of the Patent and Trademark Office cannot be based exclusively on the written record in the Office if that record is itself incomplete through the failure to record the substance of interviews.

It is the responsibility of the applicant or the attorney or agent to make the substance of an interview of record in the application file, unless the examiner indicates he or she will do so. It is the examiner's responsibility to see that such a record is made and to correct material inaccuracies which bear directly on the question of patentability.

Examiners must complete an Interview Summary Form for each interview held where a matter of substance has been discussed during the interview by checking the appropriate boxes and filling in the blanks. Discussions regarding only procedural matters, directed solely to restriction requirements for which interview recordation is otherwise provided for in Section 812.01 of the Manual of Patent Examining Procedure, or pointing out typographical errors or unreadable script in Office actions or the like, are excluded from the interview recordation procedures below. Where the substance of an interview is completely recorded in an Examiners Amendment, no separate Interview Summary Record is required.

The Interview Summary Form shall be given an appropriate Paper No., placed in the right hand portion of the file, and listed on the "Contents" section of the file wrapper. In a personal interview, a duplicate of the Form is given to the applicant (or attorney or agent) at the conclusion of the interview. In the case of a telephone or video-conference interview, the copy is mailed to the applicant's correspondence address either with or prior to the next official communication. If additional correspondence from the examiner is not likely before an allowance or if other circumstances dictate, the Form should be mailed promptly after the interview rather than with the next official communication.

The Form provides for recordation of the following information:

- Application Number (Series Code and Serial Number)
- Name of applicant
- Name of examiner
- Date of interview
- Type of interview (telephonic, video-conference, or personal)
- Name of participant(s) (applicant, attorney or agent, examiner, other PTO personnel, etc.)
- An indication whether or not an exhibit was shown or a demonstration conducted
- An identification of the specific prior art discussed
- An indication whether an agreement was reached and if so, a description of the general nature of the agreement (may be by attachment of a copy of amendments or claims agreed as being allowable). Note: Agreement as to allowability is tentative and does not restrict further action by the examiner to the contrary.
- The signature of the examiner who conducted the interview (if Form is not an attachment to a signed Office action)

It is desirable that the examiner orally remind the applicant of his or her obligation to record the substance of the interview of each case. It should be noted, however, that the Interview Summary Form will not normally be considered a complete and proper recordation of the interview unless it includes, or is supplemented by the applicant or the examiner to include, all of the applicable items required below concerning the substance of the interview.

A complete and proper recordation of the substance of any interview should include at least the following applicable items:

- 1) A brief description of the nature of any exhibit shown or any demonstration conducted,
- 2) an identification of the claims discussed,
- 3) an identification of the specific prior art discussed,
- 4) an identification of the principal proposed amendments of a substantive nature discussed, unless these are already described on the Interview Summary Form completed by the Examiner,
- 5) a brief identification of the general thrust of the principal arguments presented to the examiner,  
(The identification of arguments need not be lengthy or elaborate. A verbatim or highly detailed description of the arguments is not required. The identification of the arguments is sufficient if the general nature or thrust of the principal arguments made to the examiner can be understood in the context of the application file. Of course, the applicant may desire to emphasize and fully describe those arguments which he or she feels were or might be persuasive to the examiner.)
- 6) a general indication of any other pertinent matters discussed, and
- 7) if appropriate, the general results or outcome of the interview unless already described in the Interview Summary Form completed by the examiner.

Examiners are expected to carefully review the applicant's record of the substance of an interview. If the record is not complete and accurate, the examiner will give the applicant an extendable one month time period to correct the record.

#### Examiner to Check for Accuracy

If the claims are allowable for other reasons of record, the examiner should send a letter setting forth the examiner's version of the statement attributed to him or her. If the record is complete and accurate, the examiner should place the indication, "Interview Record OK" on the paper recording the substance of the interview along with the date and the examiner's initials.



**PATENT**

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

Application No.: 14/572,068  
Confirmation No.: 6575  
Filing Date: December 16, 2014  
First Named  
Inventor: Yoichi MOMOSE et al.  
Group Art Unit: 2871  
Examiner: Lauren Nguyen  
Title: A LIQUID CRYSTAL DEVICE  
Attorney Docket: 9319S-001378-US-COB

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Mail Stop Amendment  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, Virginia 22313-1450

**AMENDMENT**

Commissioner:

In response to the Office Action mailed May 19, 2016, please amend the application as follows and consider the remarks set forth below.

**Amendments to the Claims** begin on page 2 of this paper.

**Remarks** begin on page 13 of this paper.

## **AMENDMENTS TO THE CLAIMS**

The following listing of claims will replace all prior versions and listings of claims in the application.

### **LISTING OF CLAIMS**

1. (Currently Amended) A display device, comprising:

a first substrate including a plurality of pixel electrodes, a plurality of active elements and a plurality of wiring lines that connect to the plurality of active elements, wherein the plurality of active elements are thin film transistors disposed on the first substrate;

a second substrate including a common electrode, wherein the common electrode is disposed on the second substrate opposite to the plurality of pixel electrodes disposed on the first substrate;

a display region in which the plurality of pixel electrodes and the plurality of active elements are aligned in a plan-view of the first substrate;

a seal region positioned around the display region in the plan-view of the first substrate; and

a seal member in the seal region and disposed between the first substrate and the second substrate so as to the common electrode faces to the plurality of pixel electrodes, and the seal member is formed continuously around the entire display region without the use of a plug.

wherein the first substrate includes a protruding region which protrudes over the second substrate in the plan-view of the first substrate and a plurality of conductive portions, the plurality of conductive portions being a plurality of dot conductive points,

the seal region forms a rectangular closed-shape so as to surround the display region, and has a first side, a second side, a third side and a fourth side, the first side is positioned between the display region and the protruding region, and opposed to the third side, and the second side is opposed to the fourth side, and

the seal member includes a first seal portion and a second seal portion, the first seal portion and the second seal portion form the rectangular closed-shape between the first substrate and the second substrate and do not protrude from the second substrate in a plan-view of the first substrate,

wherein the first seal portion is disposed at least on the first side and the second seal portion is disposed at least on the third side,

the first seal portion and the second seal portion are connected in a first junction portion positioned on the second side, and

the first seal portion and the second seal portion are connected in a second junction portion positioned on the fourth side,

wherein the second seal portion includes a plurality of conductive particles and the plurality of dot conductive points are disposed at least on the third side and all of the plurality of dot conductive points are electrically connected to the common electrode, and

the plurality of wiring lines extend onto the protruding region across the seal member without connecting to the plurality of dot conductive points.

2. (Original) The display device, according to Claim 1,

wherein each of the plurality of the conductive portions are spaced apart from each other.

3. (Previously Presented) The display device, according to Claim 1,  
wherein the first seal portion and the second seal portion extend from the second side toward an edge of the first substrate in the first junction portion,  
the first seal portion and the second seal portion extend from the fourth side toward an edge of the first substrate in the second junction portion, and  
the first junction portion and the second junction portion projecting in an opposite direction with respect to the display region.

4. (Original) The display device, according to Claim 1,  
wherein the first substrate further includes a first conductive portion on the second side,  
the second seal portion includes a first part of the seal member on the second side,  
wherein the first part of the seal member extends from one end of the seal member disposed on the third side over the first conductive portion on the second side,  
and the first part of the seal member includes a plurality of conductive particles, and  
the first conductive portion is electrically connected to the common electrode.

5. (Original) The display device, according to Claim 4,

wherein the first substrate further includes a second conductive portion on the fourth side,

the second seal portion includes a second part of the seal member on the fourth side,

wherein the second part of the seal member extends from another end of the seal member disposed on the third side over the second conductive portion on the fourth side, and the second part of the seal member includes a plurality of conductive particles, and

the second conductive portion is electrically connected to the common electrode.

6. (Original) An electronic device comprising the display device according to claim 1.

7. (Currently Amended) A display device, comprising:

a first substrate including a pixel region and a seal region which is defined around the pixel region on a first surface of the first substrate, the pixel region including a plurality of pixels and a plurality of active elements, and the seal region forming a rectangular ring shape, wherein the active elements are thin film transistors disposed on the first substrate; and

a second substrate including a common electrode on a second surface; and

a seal member bonding the first substrate and the second substrate so that the first surface faces the second surface and the common electrode is disposed opposite to the plurality of pixels,

wherein the first substrate includes a protruding region which protrudes over the second substrate in a plan-view of the first substrate,

the seal region includes a first side, a second side, a third side and a fourth side, the first side is positioned between the pixel region and the protruding region, and opposed to the third side, and the second side is opposed to the fourth side,

the seal member is disposed between the first substrate and the second substrate, and positioned on the first side, the second side, the third side and the fourth side continuously, [[and]] forms a closed-ring shape in which the pixel region is positioned without protruding from the second substrate in the plan-view of the first substrate, and is formed continuously around the entire pixel region without the use of a plug,

a first part of the seal member disposed on the third side which is opposed to the protruding region with respect to the pixel region includes a plurality of conductive particles,

a plurality of dot conductive points are disposed on the third side of the first substrate, all of the plurality of the dot conductive points are electrically connected to the common electrode, and

each of the plurality of the dot conductive points are spaced apart from each other,

wherein the first substrate includes a plurality of wiring lines that connect to the plurality of active elements, and the plurality of wiring lines extend onto the protruding region across the seal member without connecting to the dot conductive points.

8. (Previously Presented) The display device, according to Claim 7,  
wherein the first substrate includes a first conductive point on the second side  
and the seal member includes a second part of the seal member on the second side,  
the second part of the seal member extends from one end of the first part of the seal  
member over the first conductive point on the second side, and the second part of the  
seal member includes a plurality of conductive particles, and

wherein the first conductive point is electrically connected to the common  
electrode.

9. (Previously Presented) The display device, according to Claim 8,  
wherein the first substrate includes a second conductive point on the fourth side  
and the seal member includes a third part of the seal member on the fourth side, the  
third part of the seal member extends from another end of the first part of the seal  
member over the second conductive point on the fourth side, and the third part of the  
seal member includes a plurality of conductive particles, and

wherein the second conductive point is electrically connected to the common  
electrode.

10. (Original) The display device, according to Claim 7,  
wherein the seal member extends to a first edge of the seal region opposite to  
the pixel region on the second side.

11. (Original) The display device, according to Claim 10,

wherein the seal member extends to a second edge of the seal region opposite to the pixel region on the fourth side.

12. (Original) An electronic device comprising the display device according to claim 7.

13. (Currently Amended) A display device, comprising:

a first substrate including a plurality of pixel electrodes, a plurality of active elements and a plurality of wiring lines that connect to the plurality of active elements, wherein the plurality of active elements are thin film transistors disposed on the first substrate;

a second substrate including a common electrode, wherein the common electrode is disposed on the second substrate;

a display region in which the plurality of pixel electrodes and the plurality of active elements are aligned in a plan-view of the first substrate;

a seal region positioned around the display region in the plan-view of the first substrate and forming a closed-ring shape in which the display region is disposed;

a seal member being disposed in the seal region and bonding the first substrate and the second substrate so that the common electrode faces the plurality of pixel electrodes, the seal member forming a closed-ring shape in which the display region is positioned without protruding from the second substrate in the plan-view of the first substrate, [[and]] the seal member is disposed between the first substrate and the



second substrate, and the seal member is formed continuously around the entire display region without the use of a plug;

wherein the first substrate includes a protruding region which protrudes over the second substrate in the plan-view of the first substrate and a plurality of conductive portions,

the seal region includes a first portion and a second portion, the first portion is positioned at least between the display region and the protruding region, and the second portion is positioned at least opposite to the protruding region with respect to the display region, and

the seal member includes a first part and a second part, the first part of the seal member is positioned on the first portion and the second part of the seal member is positioned on the second portion, and the second part of the seal member includes a plurality of conductive particles,

a plurality of dot conductive points are disposed on the second portion of the first substrate, all of the plurality of the dot conductive points are electrically connected to the common electrode,

each of the plurality of the dot conductive points are spaced apart from each other, and

the plurality of wiring lines extend onto the protruding region across the seal member without connecting to the dot conductive points.

14. (Original) The display device, according to Claim 13,

wherein no conductive portions are disposed on the first portion of the first substrate and no conductive particles are included in the first part of the seal member.

15. (Original) The display device, according to Claim 13,  
wherein the seal member further includes a third part and a fourth part, the third part of the seal member extends from one end of the first part, and the fourth part of the seal member extends from one end of the second part and includes a first plurality of conductive particles.

16. (Original) The display device, according to Claim 15,  
wherein the third part and the fourth part are connected and extend to a first edge of the seal region opposite to the display region.

17. (Original) The display device, according to Claim 16,  
wherein the seal member further includes a fifth part and a sixth part, the fifth part of the seal member extends from another end of the first part, and the sixth part of the seal member extends from another end of the second part and includes a second plurality of conductive particles, and  
the fifth part and the sixth part are connected and extend to a second edge of the seal region opposite to the display region.

18. (Original) The display device, according to Claim 17,

wherein the first edge of the seal region is positioned opposite to the second edge of the seal region with respect to the display region.

19. (Previously Presented) The display device, according to Claim 18, wherein the first substrate further includes a first conductive point and a second conductive point, different from the plurality of conductive points, and the first conductive point, the second conductive point and the plurality of conductive points are disposed apart from each other, and

the first conductive point is electrically connected to the common electrode through the first plurality of conductive particles and the second conductive point is electrically connected to the common electrode through the second plurality of conductive particles

20. (Original) An electronic device comprising the display device according to claim 13.

21. (New) A display device, comprising:  
a first substrate including a plurality of pixel electrodes;  
a second substrate including a common electrode;  
a display region in which the plurality of pixel electrodes are aligned;  
a seal region positioned around the display region; and

a seal member disposed in the seal region so as to bond the first substrate and the second substrate and formed continuously around entire the display region without the use of a plug,

wherein the first substrate includes a plurality of dot conductive portions,

the seal member includes a first side, a second side, a third side and a fourth side, the first side is positioned opposed to the third side, and the second side is opposed to the fourth side, and

wherein the third side includes a plurality of conductive particles, and the plurality of dot conductive portions are electrically connected to the common electrode through the plurality of conductive particles.

### **REMARKS**

Claims 1-21 are now pending in the application. By this paper, Claims 1, 7, and 13 have been amended and Claim 21 is added as new. Support for the amendments and new claim can be found throughout the Specification and figures. The Examiner is respectfully requested to reconsider and withdraw the rejections in view of the amendments and remarks contained herein.

### **INTERVIEW SUMMARY**

Applicant thanks Examiner Nguyen for the courtesies extended to Applicant's representative, Stephanie Dowdy, during the Examiner interview on June 21, 2016. During the interview, Applicant's representative and the Examiner discussed the amendments and new claim provided herein. The Examiner agreed that the amendments would overcome the cited references because each of the references requires a plug to complete the continuous seal around the display region. Although the Examiner believes that this feature will place the claims in condition for allowance over the cited prior art, the Examiner would not agree to issue a notice of allowance without additional searching.

Applicant's representative and the Examiner also discussed the 35 U.S.C. § 112 rejection. Applicant's representative presented arguments that the phrase "the first seal portion and the second seal portion form the rectangular closed-shape between the first substrate and the second substrate and does not protrude from the second substrate in a plan-view of the first substrate" is clear. For example, at least Figure 2 and paragraph [0151] of the originally filed specification describe this feature. The first seal portion and

second seal portion (52a, 52b) form a rectangular closed shape as illustrated at least in Figures 1, 4, and 30. Paragraph [0161]. The seal member 52 (having the first and second seal portions 52a, 52b) is formed in peripheral portions of the TFD substrate 10 and the counter substrate 20 to be interposed between both substrates. Paragraph [0151]. When assembled, as shown in Figure 2, the sealing member 52 does not protrude out from the cell gap between the first substrate 10 and the second substrate 20, such that when viewed in a plan view (for example, Figures 1 and 30), none of the sealing member 52 is visible outside of (or protrudes outside of) the second substrate 20. Thus, the feature “the first seal portion and the second seal portion form the rectangular closed-shape between the first substrate and the second substrate and does not protrude from the second substrate in a plan-view of the first substrate,” as recited in Claim 1, is clear.

Based on the Applicant’s arguments, the Examiner stated that she needed additional time to consider the clarity of this feature and instructed Applicant to present these arguments in the response. The Examiner did agree that after the discussion, the feature was much clearer.

#### **REJECTION UNDER 35 U.S.C. § 112**

Claims 1-20 stand rejected under 35 U.S.C. § 112, first paragraph, for containing subject matter that is not supported or enabled by the specification as originally filed. This rejection is respectfully traversed.

During the interview, summarized above, Applicant’s representative made arguments that the phrase “the first seal portion and the second seal portion form the

rectangular closed-shape between the first substrate and the second substrate and does not protrude from the second substrate in a plan-view of the first substrate” is clear. Applicant’s arguments have been summarized in the interview summary. Based on the Applicant’s arguments, the Examiner stated that she needed additional time to consider the clarity of this feature and instructed Applicant to present these arguments in the response. The Examiner did agree, however, that after the discussion, the feature was much clearer. Thus, Applicant respectfully submits that the feature “the first seal portion and the second seal portion form the rectangular closed-shape between the first substrate and the second substrate and does not protrude from the second substrate in a plan-view of the first substrate” is clear.

For at least these reasons, Applicant asserts that Claims 1-20 are in condition for allowance. Thus, the Examiner is requested to reconsider and withdraw the rejection.

#### **REJECTION UNDER 35 U.S.C. § 103**

Claims 1-20 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Miyazaki et al. (U.S. Pat. No. 6,930,745) in view of Tanaka et al. (U.S. Pub. No. 2005/0122466). This rejection is respectfully traversed.

Claim 1 has been amended to recite, in part: “the seal member is formed continuously around the entire display region without the use of a plug.” During the interview on June 21, 2016, the Examiner agreed that the amendments would overcome the cited references because each of the references requires a plug to complete the continuous seal around the display region.

For at least these reasons, Applicant respectfully asserts that Claim 1 is in condition for allowance. Claims 7 and 13 recite similar features as Claim 1 and are therefore allowable for at least similar reasons. Claims 2-6, 8-12, and 14-20 ultimately depend from one of Claims 1, 7, and 13 and are therefore allowable for at least similar reasons. Thus, the Examiner is requested to reconsider and withdraw the rejections.

#### **NEW CLAIM**

Claim 21 has been added for consideration by the Examiner. Support for the features of Claim 21 can be found throughout the specification, figures, and original claims. Thus, no new matter has been added. Claim 21 includes similar features as Claim 1 and is therefore allowable for at least similar reasons.

#### **CONCLUSION**

It is believed that a full and complete response has been made to the outstanding Office Action and the present application is in condition for allowance. Thus, prompt and favorable consideration of this amendment is respectfully requested. If the Examiner believes that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at (248) 641-1600.

Respectfully submitted,

Dated: July 15, 2016

By: /Bryant E. Wade/  
G. Gregory Schivley  
Reg. No. 27,382  
Bryant E. Wade  
Reg. No. 40,344



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| Electronic Acknowledgement Receipt          |                                                 |
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| <b>EFS ID:</b>                              | 26364071                                        |
| <b>Application Number:</b>                  | 14572068                                        |
| <b>International Application Number:</b>    |                                                 |
| <b>Confirmation Number:</b>                 | 6575                                            |
| <b>Title of Invention:</b>                  | METHOD OF MANUFACTURING A LIQUID CRYSTAL DEVICE |
| <b>First Named Inventor/Applicant Name:</b> | Yoichi MOMOSE                                   |
| <b>Customer Number:</b>                     | 27572                                           |
| <b>Filer:</b>                               | Bryant Edward Wade/Michelle Kowalske            |
| <b>Filer Authorized By:</b>                 | Bryant Edward Wade                              |
| <b>Attorney Docket Number:</b>              | 93195-001378-COB                                |
| <b>Receipt Date:</b>                        | 15-JUL-2016                                     |
| <b>Filing Date:</b>                         | 16-DEC-2014                                     |
| <b>Time Stamp:</b>                          | 15:02:20                                        |
| <b>Application Type:</b>                    | Utility under 35 USC 111(a)                     |

### Payment information:

| Submitted with Payment |                      | no           |                                          |                  |                  |
|------------------------|----------------------|--------------|------------------------------------------|------------------|------------------|
| <b>File Listing:</b>   |                      |              |                                          |                  |                  |
| Document Number        | Document Description | File Name    | File Size(Bytes)/<br>Message Digest      | Multi Part /.zip | Pages (if appl.) |
| 1                      |                      | Response.PDF | 98342                                    | yes              | 17               |
|                        |                      |              | 945465c85fc5dbf80d495c28aadd33b129030c35 |                  |                  |

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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Claims                                                | 2     | 12  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Applicant Arguments/Remarks Made in an Amendment      | 13    | 17  |
| Warnings:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                       |       |     |
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| Total Files Size (in bytes):                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                       | 98342 |     |
| <p>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</p> <p><b><u>New Applications Under 35 U.S.C. 111</u></b><br/>If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><b><u>National Stage of an International Application under 35 U.S.C. 371</u></b><br/>If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><b><u>New International Application Filed with the USPTO as a Receiving Office</u></b><br/>If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p> |                                                       |       |     |

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| <b>PATENT APPLICATION FEE DETERMINATION RECORD</b><br>Substitute for Form PTO-875                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                               |                                  |       | Application or Docket Number<br><b>14/572,068</b> |               | Filing Date<br><b>12/16/2014</b> |  | <input type="checkbox"/> To be Mailed |  |
| ENTITY: <input checked="" type="checkbox"/> LARGE <input type="checkbox"/> SMALL <input type="checkbox"/> MICRO                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                               |                                  |       |                                                   |               |                                  |  |                                       |  |
| <b>APPLICATION AS FILED – PART I</b>                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                               |                                  |       |                                                   |               |                                  |  |                                       |  |
| (Column 1)                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                               | (Column 2)                       |       |                                                   |               |                                  |  |                                       |  |
| FOR                                                                                                                                                                                                                                                                                                                                                                                                                                  | NUMBER FILED                                                                                                                                                                                                                  | NUMBER EXTRA                     |       |                                                   | RATE (\$)     | FEE (\$)                         |  |                                       |  |
| <input type="checkbox"/> BASIC FEE<br>(37 CFR 1.16(a), (b), or (c))                                                                                                                                                                                                                                                                                                                                                                  | N/A                                                                                                                                                                                                                           | N/A                              |       |                                                   | N/A           |                                  |  |                                       |  |
| <input type="checkbox"/> SEARCH FEE<br>(37 CFR 1.16(k), (i), or (m))                                                                                                                                                                                                                                                                                                                                                                 | N/A                                                                                                                                                                                                                           | N/A                              |       |                                                   | N/A           |                                  |  |                                       |  |
| <input type="checkbox"/> EXAMINATION FEE<br>(37 CFR 1.16(o), (p), or (q))                                                                                                                                                                                                                                                                                                                                                            | N/A                                                                                                                                                                                                                           | N/A                              |       |                                                   | N/A           |                                  |  |                                       |  |
| TOTAL CLAIMS<br>(37 CFR 1.16(i))                                                                                                                                                                                                                                                                                                                                                                                                     | minus 20 =                                                                                                                                                                                                                    | *                                |       |                                                   | X \$          | =                                |  |                                       |  |
| INDEPENDENT CLAIMS<br>(37 CFR 1.16(h))                                                                                                                                                                                                                                                                                                                                                                                               | minus 3 =                                                                                                                                                                                                                     | *                                |       |                                                   | X \$          | =                                |  |                                       |  |
| <input type="checkbox"/> APPLICATION SIZE FEE<br>(37 CFR 1.16(s))                                                                                                                                                                                                                                                                                                                                                                    | If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s). |                                  |       |                                                   |               |                                  |  |                                       |  |
| <input type="checkbox"/> MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                               |                                  |       |                                                   |               |                                  |  |                                       |  |
| * If the difference in column 1 is less than zero, enter "0" in column 2.                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                               |                                  |       |                                                   | TOTAL         |                                  |  |                                       |  |
| <b>APPLICATION AS AMENDED – PART II</b>                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                               |                                  |       |                                                   |               |                                  |  |                                       |  |
| (Column 1)                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                               | (Column 2)                       |       | (Column 3)                                        |               |                                  |  |                                       |  |
| <b>AMENDMENT</b>                                                                                                                                                                                                                                                                                                                                                                                                                     | <b>07/15/2016</b>                                                                                                                                                                                                             | CLAIMS REMAINING AFTER AMENDMENT |       | HIGHEST NUMBER PREVIOUSLY PAID FOR                | PRESENT EXTRA | RATE (\$)                        |  | ADDITIONAL FEE (\$)                   |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                      | Total (37 CFR 1.16(i))                                                                                                                                                                                                        | * 21                             | Minus | ** 20                                             | = 1           | X \$80 =                         |  | 80                                    |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                      | Independent (37 CFR 1.16(h))                                                                                                                                                                                                  | * 4                              | Minus | *** 3                                             | = 1           | X \$420 =                        |  | 420                                   |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                      | <input type="checkbox"/> Application Size Fee (37 CFR 1.16(s))                                                                                                                                                                |                                  |       |                                                   |               |                                  |  |                                       |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                      | <input type="checkbox"/> FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))                                                                                                                                      |                                  |       |                                                   |               |                                  |  |                                       |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                               |                                  |       |                                                   |               | TOTAL ADD'L FEE                  |  | <b>500</b>                            |  |
| (Column 1)                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                               | (Column 2)                       |       | (Column 3)                                        |               |                                  |  |                                       |  |
| <b>AMENDMENT</b>                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                               | CLAIMS REMAINING AFTER AMENDMENT |       | HIGHEST NUMBER PREVIOUSLY PAID FOR                | PRESENT EXTRA | RATE (\$)                        |  | ADDITIONAL FEE (\$)                   |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                      | Total (37 CFR 1.16(i))                                                                                                                                                                                                        | *                                | Minus | **                                                | =             | X \$                             |  | =                                     |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                      | Independent (37 CFR 1.16(h))                                                                                                                                                                                                  | *                                | Minus | ***                                               | =             | X \$                             |  | =                                     |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                      | <input type="checkbox"/> Application Size Fee (37 CFR 1.16(s))                                                                                                                                                                |                                  |       |                                                   |               |                                  |  |                                       |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                      | <input type="checkbox"/> FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))                                                                                                                                      |                                  |       |                                                   |               |                                  |  |                                       |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                               |                                  |       |                                                   |               | TOTAL ADD'L FEE                  |  |                                       |  |
| <p>* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.</p> <p>** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".</p> <p>*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".</p> <p>The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.</p> |                                                                                                                                                                                                                               |                                  |       |                                                   |               |                                  |  |                                       |  |
| LIE<br>/AMANDA FORD/                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                               |                                  |       |                                                   |               |                                  |  |                                       |  |

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|-------|---------------------------------------------------|---------------|----------------------------------|--|---------------------------------------|--|
| <b>PATENT APPLICATION FEE DETERMINATION RECORD</b><br>Substitute for Form PTO-875                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                               |                                  |       | Application or Docket Number<br><b>14/572,068</b> |               | Filing Date<br><b>12/16/2014</b> |  | <input type="checkbox"/> To be Mailed |  |
| ENTITY: <input checked="" type="checkbox"/> LARGE <input type="checkbox"/> SMALL <input type="checkbox"/> MICRO                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                               |                                  |       |                                                   |               |                                  |  |                                       |  |
| <b>APPLICATION AS FILED – PART I</b>                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                               |                                  |       |                                                   |               |                                  |  |                                       |  |
| (Column 1)                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                               | (Column 2)                       |       |                                                   |               |                                  |  |                                       |  |
| FOR                                                                                                                                                                                                                                                                                                                                                                                                               | NUMBER FILED                                                                                                                                                                                                                  | NUMBER EXTRA                     |       |                                                   | RATE (\$)     | FEE (\$)                         |  |                                       |  |
| <input type="checkbox"/> BASIC FEE<br>(37 CFR 1.16(a), (b), or (c))                                                                                                                                                                                                                                                                                                                                               | N/A                                                                                                                                                                                                                           | N/A                              |       |                                                   | N/A           |                                  |  |                                       |  |
| <input type="checkbox"/> SEARCH FEE<br>(37 CFR 1.16(k), (l), or (m))                                                                                                                                                                                                                                                                                                                                              | N/A                                                                                                                                                                                                                           | N/A                              |       |                                                   | N/A           |                                  |  |                                       |  |
| <input type="checkbox"/> EXAMINATION FEE<br>(37 CFR 1.16(o), (p), or (q))                                                                                                                                                                                                                                                                                                                                         | N/A                                                                                                                                                                                                                           | N/A                              |       |                                                   | N/A           |                                  |  |                                       |  |
| TOTAL CLAIMS<br>(37 CFR 1.16(i))                                                                                                                                                                                                                                                                                                                                                                                  | minus 20 =                                                                                                                                                                                                                    | *                                |       |                                                   | X \$          | =                                |  |                                       |  |
| INDEPENDENT CLAIMS<br>(37 CFR 1.16(h))                                                                                                                                                                                                                                                                                                                                                                            | minus 3 =                                                                                                                                                                                                                     | *                                |       |                                                   | X \$          | =                                |  |                                       |  |
| <input type="checkbox"/> APPLICATION SIZE FEE<br>(37 CFR 1.16(s))                                                                                                                                                                                                                                                                                                                                                 | If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s). |                                  |       |                                                   |               |                                  |  |                                       |  |
| <input type="checkbox"/> MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                               |                                  |       |                                                   |               |                                  |  |                                       |  |
| * If the difference in column 1 is less than zero, enter "0" in column 2.                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                               |                                  |       |                                                   | TOTAL         |                                  |  |                                       |  |
| <b>APPLICATION AS AMENDED – PART II</b>                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                               |                                  |       |                                                   |               |                                  |  |                                       |  |
| (Column 1)                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                               | (Column 2)                       |       | (Column 3)                                        |               |                                  |  |                                       |  |
| <b>AMENDMENT</b>                                                                                                                                                                                                                                                                                                                                                                                                  | <b>07/15/2016</b>                                                                                                                                                                                                             | CLAIMS REMAINING AFTER AMENDMENT |       | HIGHEST NUMBER PREVIOUSLY PAID FOR                | PRESENT EXTRA | RATE (\$)                        |  | ADDITIONAL FEE (\$)                   |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                   | Total (37 CFR 1.16(i))                                                                                                                                                                                                        | * 20                             | Minus | ** 20                                             | = 0           | X \$80 =                         |  | 0                                     |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                   | Independent (37 CFR 1.16(h))                                                                                                                                                                                                  | * 3                              | Minus | *** 3                                             | = 0           | X \$420 =                        |  | 0                                     |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                   | <input type="checkbox"/> Application Size Fee (37 CFR 1.16(s))                                                                                                                                                                |                                  |       |                                                   |               |                                  |  |                                       |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                   | <input type="checkbox"/> FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))                                                                                                                                      |                                  |       |                                                   |               |                                  |  |                                       |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                               |                                  |       |                                                   |               | TOTAL ADD'L FEE                  |  | <b>0</b>                              |  |
| (Column 1)                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                               | (Column 2)                       |       | (Column 3)                                        |               |                                  |  |                                       |  |
| <b>AMENDMENT</b>                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                               | CLAIMS REMAINING AFTER AMENDMENT |       | HIGHEST NUMBER PREVIOUSLY PAID FOR                | PRESENT EXTRA | RATE (\$)                        |  | ADDITIONAL FEE (\$)                   |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                   | Total (37 CFR 1.16(i))                                                                                                                                                                                                        | *                                | Minus | **                                                | =             | X \$                             |  | =                                     |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                   | Independent (37 CFR 1.16(h))                                                                                                                                                                                                  | *                                | Minus | ***                                               | =             | X \$                             |  | =                                     |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                   | <input type="checkbox"/> Application Size Fee (37 CFR 1.16(s))                                                                                                                                                                |                                  |       |                                                   |               |                                  |  |                                       |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                   | <input type="checkbox"/> FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))                                                                                                                                      |                                  |       |                                                   |               |                                  |  |                                       |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                               |                                  |       |                                                   |               | TOTAL ADD'L FEE                  |  |                                       |  |
| * If the entry in column 1 is less than the entry in column 2, write "0" in column 3.<br>** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".<br>*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".<br>The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1. |                                                                                                                                                                                                                               |                                  |       |                                                   |               |                                  |  |                                       |  |
| LIE<br>/YOLANDA CHADWICK/                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                               |                                  |       |                                                   |               |                                  |  |                                       |  |

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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## NOTICE OF ALLOWANCE AND FEE(S) DUE

27572 7590 09/21/2016  
HARNESS, DICKEY & PIERCE, P.L.C.  
P.O. BOX 828  
BLOOMFIELD HILLS, MI 48303

EXAMINER

NGUYEN, LAUREN

ART UNIT

PAPER NUMBER

2871

DATE MAILED: 09/21/2016

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 14/572,068      | 12/16/2014  | Yoichi MOMOSE        | 9319S-001378-COB    | 6575             |

TITLE OF INVENTION: Liquid Crystal Display Device having Rectangular Close-shape Seal Members

| APPLN. TYPE    | ENTITY STATUS | ISSUE FEE DUE | PUBLICATION FEE DUE | PREV. PAID ISSUE FEE | TOTAL FEE(S) DUE | DATE DUE   |
|----------------|---------------|---------------|---------------------|----------------------|------------------|------------|
| nonprovisional | UNDISCOUNTED  | \$960         | \$0                 | \$0                  | \$960            | 12/21/2016 |

**THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.**

**THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.**

### HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

**IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.**



## PART B - FEE(S) TRANSMITTAL

**Complete and send this form, together with applicable fee(s), to: Mail Mail Stop ISSUE FEE  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
or Fax (571)-273-2885**

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

27572 7590 09/21/2016  
HARNESS, DICKEY & PIERCE, P.L.C.  
P.O. BOX 828  
BLOOMFIELD HILLS, MI 48303

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

### Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

|                    |
|--------------------|
| (Depositor's name) |
| (Signature)        |
| (Date)             |

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 14/572,068      | 12/16/2014  | Yoichi MOMOSE        | 9319S-001378-COB    | 6575             |

TITLE OF INVENTION: Liquid Crystal Display Device having Rectangular Close-shape Seal Members

| APPLN. TYPE    | ENTITY STATUS | ISSUE FEE DUE | PUBLICATION FEE DUE | PREV. PAID ISSUE FEE | TOTAL FEE(S) DUE | DATE DUE   |
|----------------|---------------|---------------|---------------------|----------------------|------------------|------------|
| nonprovisional | UNDISCOUNTED  | \$960         | \$0                 | \$0                  | \$960            | 12/21/2016 |

| EXAMINER       | ART UNIT | CLASS-SUBCLASS |
|----------------|----------|----------------|
| NGUYEN, LAUREN | 2871     | 349-156000     |

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

- ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
- ☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

- (1) The names of up to 3 registered patent attorneys or agents OR, alternatively, 1 \_\_\_\_\_
- (2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed. 2 \_\_\_\_\_
- 3 \_\_\_\_\_

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:

- ☐ Issue Fee
- ☐ Publication Fee (No small entity discount permitted)
- ☐ Advance Order - # of Copies \_\_\_\_\_

4b. Payment of Fee(s): (Please first reapply any previously paid issue fee shown above)

- ☐ A check is enclosed.
- ☐ Payment by credit card. Form PTO-2038 is attached.
- ☐ The director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number \_\_\_\_\_ (enclose an extra copy of this form).

5. Change in Entity Status (from status indicated above)

- ☐ Applicant certifying micro entity status. See 37 CFR 1.29
- ☐ Applicant asserting small entity status. See 37 CFR 1.27
- ☐ Applicant changing to regular undiscounted fee status.

**NOTE:** Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

**NOTE:** If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

**NOTE:** Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature \_\_\_\_\_

Date \_\_\_\_\_

Typed or printed name \_\_\_\_\_

Registration No. \_\_\_\_\_



# UNITED STATES PATENT AND TRADEMARK OFFICE

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P.O. Box 1450  
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www.uspto.gov

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 14/572,068      | 12/16/2014  | Yoichi MOMOSE        | 9319S-001378-COB    | 6575             |

27572 7590 09/21/2016  
HARNESS, DICKEY & PIERCE, P.L.C.  
P.O. BOX 828  
BLOOMFIELD HILLS, MI 48303

|          |
|----------|
| EXAMINER |
|----------|

NGUYEN, LAUREN

|          |              |
|----------|--------------|
| ART UNIT | PAPER NUMBER |
|----------|--------------|

2871

DATE MAILED: 09/21/2016

## Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

## OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

### Privacy Act Statement

**The Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.



|                               |                                      |                                      |                                                  |
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| <b>Notice of Allowability</b> | <b>Application No.</b><br>14/572,068 | <b>Applicant(s)</b><br>MOMOSE ET AL. |                                                  |
|                               | <b>Examiner</b><br>LAUREN NGUYEN     | <b>Art Unit</b><br>2871              | <b>AIA (First Inventor to File) Status</b><br>No |

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--**

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to 07/15/2016.  
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on \_\_\_\_\_.
2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on \_\_\_\_\_; the restriction requirement and election have been incorporated into this action.
3. ☒ The allowed claim(s) is/are 1-20. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see [http://www.uspto.gov/patents/init\\_events/pph/index.jsp](http://www.uspto.gov/patents/init_events/pph/index.jsp) or send an inquiry to PPHfeedback@uspto.gov.
4. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

**Certified copies:**

- a) ☒ All    b) ☐ Some    \*c) ☐ None of the:
  1. ☒ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

\* Certified copies not received: \_\_\_\_\_.

Applicant has **THREE MONTHS FROM THE "MAILING DATE"** of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in **ABANDONMENT** of this application.  
**THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.**

5. ☐ CORRECTED DRAWINGS ( as "replacement sheets") must be submitted.  
☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date \_\_\_\_\_.  
**Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).**
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

**Attachment(s)**

- |                                                                                                              |                                                                                      |
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| 1. <input type="checkbox"/> Notice of References Cited (PTO-892)                                             | 5. <input checked="" type="checkbox"/> Examiner's Amendment/Comment                  |
| 2. <input type="checkbox"/> Information Disclosure Statements (PTO/SB/08),<br>Paper No./Mail Date _____      | 6. <input checked="" type="checkbox"/> Examiner's Statement of Reasons for Allowance |
| 3. <input type="checkbox"/> Examiner's Comment Regarding Requirement for Deposit<br>of Biological Material   | 7. <input type="checkbox"/> Other _____.                                             |
| 4. <input checked="" type="checkbox"/> Interview Summary (PTO-413),<br>Paper No./Mail Date <u>9/1/2016</u> . |                                                                                      |

/LAUREN NGUYEN/  
Primary Examiner, Art Unit 2871

1. The present application is being examined under the pre-AIA first to invent provisions.

#### **DETAILED ACTION**

##### ***Examiner's Amendment***

2. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.
3. The application has been amended as follows:
4. Authorization for the examiner's amendment to claim 21 was given in a telephone interview with Attorney Bryant Wade, on 09/09/2016.

##### **In the Claims:**

Claim 21 has been cancelled.

##### **In the Specification:**

The title has been changed to: "Liquid Crystal Display Device having Rectangular Close-shape Seal Members".

**End of examiner's amendment.**

##### ***Reasons for Allowance***

5. **Claims 1-20** are allowed.
6. The following is an examiner's statement of reasons for allowance:
7. Regarding claim 1: The closest prior art, **Miyazaki et al.**, discloses all of the limitations set forth in the previous Office Action. However, **Miyazaki et al.**, either alone or in combination with other prior arts, fail to disclose the combination of elements cited in claim 1,

and in particular fails to disclose or make obvious, “*a seal member in the seal region and disposed between the first substrate and the second substrate so as to the common electrode faces to the plurality of pixel electrodes, and the seal member is formed continuously around the entire display region without the use of a plug*”. Therefore, claim 1 is deemed non-obvious and inventive over the prior art and are allowed.

8. As to claims 2-6: Since claims 2-6 depend either directly or indirectly on the allowed claim 1, claims 2-6 are also allowed.

9. The following is an examiner’s statement of reasons for allowance:

10. Regarding claim 7: The closest prior art, **Miyazaki et al.**, discloses all of the limitations set forth in the previous Office Action. However, **Miyazaki et al.**, either alone or in combination with other prior arts, fail to disclose the combination of elements cited in claim 7, and in particular fails to disclose or make obvious, “*the seal member is disposed between the first substrate and the second substrate, and positioned on the first side, the second side, the third side and the fourth side continuously forms a closed-ring shape in which the pixel region is positioned without protruding from the second substrate in the plan-view of the first substrate, and is formed continuously around the entire pixel region without the use of a plug*”. Therefore, claim 7 is deemed non-obvious and inventive over the prior art and are allowed.

11. As to claims 8-12: Since claims 8-12 depend either directly or indirectly on the allowed claim 7, claims 8-12 are also allowed.

12. Regarding claim 13: The closest prior art, **Miyazaki et al.**, discloses all of the limitations set forth in the previous Office Action. However, **Miyazaki et al.**, either alone or in combination with other prior arts, fail to disclose the combination of elements cited in claim 13,

Art Unit: 2871

and in particular fails to disclose or make obvious, “*a seal member being disposed in the seal region and bonding the first substrate and the second substrate so that the common electrode faces the plurality of pixel electrodes, the seal member forming a closed-ring shape in which the display region is positioned without protruding from the second substrate in the plan-view of the first substrate, the seal member is disposed between the first substrate and the second substrate, and the seal member is formed continuously around the entire display region without the use of a plug*”. Therefore, claim 13 is deemed non-obvious and inventive over the prior art and are allowed.

13. As to claims 14-20: Since claims 14-20 depend either directly or indirectly on the allowed claim 13, claims 14-20 are also allowed.

14. Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled “Comments on Statement of Reasons for Allowance.”

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lauren Nguyen whose telephone number is (571) 270-1428. The examiner can normally be reached on M-F, 7:30-5:00 EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner’s supervisor, Edward Glick can be reached on (571) 272-2490. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.



Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Lauren Nguyen/  
Primary Examiner, Art Unit 2871



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| <b>Issue Classification</b><br> | <b>Application/Control No.</b><br>14572068 | <b>Applicant(s)/Patent Under Reexamination</b><br>MOMOSE ET AL. |  |
|                                                                                                                  | <b>Examiner</b><br>LAUREN NGUYEN           | <b>Art Unit</b><br>2871                                         |  |

| CPC    |  |   |        |      |            |
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| NONE<br><br>(Assistant Examiner) _____ (Date) _____                                            |  | <b>Total Claims Allowed:</b><br>20         |                         |
| /LAUREN NGUYEN/<br>Primary Examiner.Art Unit 2871<br><br>(Primary Examiner) _____ (Date) _____ |  | 09/01/2016<br><br>O.G. Print Claim(s)<br>1 | O.G. Print Figure<br>30 |

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| <b>Issue Classification</b><br> | <b>Application/Control No.</b><br>14572068 | <b>Applicant(s)/Patent Under Reexamination</b><br>MOMOSE ET AL. |  |
|                                                                                                                  | <b>Examiner</b><br>LAUREN NGUYEN           | <b>Art Unit</b><br>2871                                         |  |

| US ORIGINAL CLASSIFICATION |                                   |          |  |  |  | INTERNATIONAL CLASSIFICATION |   |   |   |                       |             |  |  |  |  |  |  |  |  |  |
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| CROSS REFERENCE(S)         |                                   |          |  |  |  | G                            | 0 | 2 | F | 1 / 1343 (2006.0)     |             |  |  |  |  |  |  |  |  |  |
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| NONE<br><br>(Assistant Examiner) _____ (Date) _____                                            |  | <b>Total Claims Allowed:</b><br>20 |                          |
| /LAUREN NGUYEN/<br>Primary Examiner.Art Unit 2871<br><br>(Primary Examiner) _____ (Date) _____ |  | 09/01/2016<br><br>(Date) _____     | O.G. Print Claim(s)<br>1 |
|                                                                                                |  |                                    | O.G. Print Figure<br>30  |

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| <b>Issue Classification</b><br> | <b>Application/Control No.</b><br>14572068 | <b>Applicant(s)/Patent Under Reexamination</b><br>MOMOSE ET AL. |
|                                                                                                                  | <b>Examiner</b><br>LAUREN NGUYEN           | <b>Art Unit</b><br>2871                                         |

| <input type="checkbox"/> Claims renumbered in the same order as presented by applicant |          |       |          |       |          |       |          |       |          |       |          |       |          |       |          |
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|                                                                                        | 9        |       |          |       |          |       |          |       |          |       |          |       |          |       |          |
|                                                                                        | 10       |       |          |       |          |       |          |       |          |       |          |       |          |       |          |
|                                                                                        | 11       |       |          |       |          |       |          |       |          |       |          |       |          |       |          |
|                                                                                        | 12       |       |          |       |          |       |          |       |          |       |          |       |          |       |          |
|                                                                                        | 13       |       |          |       |          |       |          |       |          |       |          |       |          |       |          |
|                                                                                        | 14       |       |          |       |          |       |          |       |          |       |          |       |          |       |          |
|                                                                                        | 15       |       |          |       |          |       |          |       |          |       |          |       |          |       |          |
|                                                                                        | 16       |       |          |       |          |       |          |       |          |       |          |       |          |       |          |

|                                                   |            |                              |                   |
|---------------------------------------------------|------------|------------------------------|-------------------|
| NONE                                              |            | <b>Total Claims Allowed:</b> |                   |
| (Assistant Examiner)                              | (Date)     | 20                           |                   |
| /LAUREN NGUYEN/<br>Primary Examiner.Art Unit 2871 | 09/01/2016 | O.G. Print Claim(s)          | O.G. Print Figure |
| (Primary Examiner)                                | (Date)     | 1                            | 30                |

## EAST Search History

## EAST Search History (Prior Art)

| Ref # | Hits | Search Query                                                                                                                                                                                                                                     | DBs                          | Default Operator | Plurals | Time Stamp          |
|-------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|------------------|---------|---------------------|
| S1    | 1    | "11301086"                                                                                                                                                                                                                                       | US-PGPUB;<br>USPAT;<br>USOCR | OR               | ON      | 2008/10/01<br>11:47 |
| S2    | 4    | ("5889572"   "5978060"   "6052171"  <br>"6616467").PN.                                                                                                                                                                                           | US-PGPUB;<br>USPAT;<br>USOCR | OR               | ON      | 2008/10/01<br>13:28 |
| S4    | 369  | 349/190.ccls. and @ad<="20041227"                                                                                                                                                                                                                | US-PGPUB;<br>USPAT;<br>USOCR | OR               | ON      | 2008/10/02<br>09:19 |
| S5    | 22   | ("3700306"   "3751137"   "3799649"  <br>"3866313").PN. OR ("3990782").URPN.                                                                                                                                                                      | US-PGPUB;<br>USPAT;<br>USOCR | OR               | ON      | 2008/10/06<br>09:53 |
| S6    | 4    | ("20020109815"   "5973763"  <br>"6335779").PN. OR ("6750937").URPN.                                                                                                                                                                              | US-PGPUB;<br>USPAT;<br>USOCR | OR               | ON      | 2008/10/06<br>10:00 |
| S7    | 2    | "20040239864"                                                                                                                                                                                                                                    | US-PGPUB;<br>USPAT;<br>USOCR | OR               | ON      | 2008/10/06<br>10:25 |
| S8    | 5    | ("20020063836"   "20050264748"  <br>"5985069"   "6144438"  <br>"7075612").PN. OR ("7369211").URPN.                                                                                                                                               | US-PGPUB;<br>USPAT;<br>USOCR | OR               | ON      | 2008/10/06<br>11:33 |
| S9    | 2    | "20040252270"                                                                                                                                                                                                                                    | US-PGPUB;<br>USPAT;<br>USOCR | OR               | ON      | 2008/10/06<br>11:51 |
| S10   | 3    | 10/649684                                                                                                                                                                                                                                        | US-PGPUB;<br>USPAT;<br>USOCR | OR               | ON      | 2009/09/16<br>13:10 |
| S11   | 4    | ("5798813"   "6144435"   "6678029"  <br>"6705584").PN. OR ("7042544").URPN.                                                                                                                                                                      | US-PGPUB;<br>USPAT;<br>USOCR | OR               | ON      | 2009/09/16<br>13:11 |
| S12   | 4    | ("5798813"   "6705584").PN. OR<br>("6940576").URPN.                                                                                                                                                                                              | US-PGPUB;<br>USPAT;<br>USOCR | OR               | ON      | 2009/09/16<br>13:14 |
| S13   | 8    | ("20040012744"   "20050146646"  <br>"20060017867"   "20030063080"  <br>"20060033872"   "20050078240"  <br>"20040032557"   "20050225708"  <br>"20040012744").PN.                                                                                  | US-PGPUB;<br>USPAT           | OR               | ON      | 2011/09/30<br>13:37 |
| S15   | 2    | "20050248711"                                                                                                                                                                                                                                    | US-PGPUB;<br>USPAT;<br>USOCR | OR               | ON      | 2012/01/30<br>13:45 |
| S16   | 19   | ("20040252270"   "20050094084"  <br>"20050099574"   "6674507"   "6930745"<br>"7280179"   "6525799"  <br>"20040239864"   "20040070723"  <br>"20030025867"   "20040125317"  <br>"7133107"   "20020030783"   "6099672"<br>"6388729"   "20040070722" | US-PGPUB;<br>USPAT;<br>USOCR | OR               | ON      | 2012/01/30<br>13:46 |

|     |      |                                                                                                                                                                                                                                                                                 |                                                                            |    |     |                     |
|-----|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|----|-----|---------------------|
|     |      | "7190430"   "20050117106"   "6531329").PN.                                                                                                                                                                                                                                      |                                                                            |    |     |                     |
| S17 | 19   | ("20040252270"   "20050094084"   "20050099574"   "6674507"   "6930745"   "7280179"   "6525799"   "20040239864"   "20040070723"   "20030025867"   "20040125317"   "7133107"   "20020030783"   "6099672"   "6388729"   "20040070722"   "7190430"   "20050117106"   "6531329").PN. | US-PGPUB;<br>USPAT;<br>USOCR                                               | OR | ON  | 2012/01/31<br>07:56 |
| S18 | 2    | ("20020080461").PN.                                                                                                                                                                                                                                                             | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB | OR | OFF | 2015/09/20<br>15:31 |
| S19 | 2    | ("20020080461").PN.                                                                                                                                                                                                                                                             | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB | OR | OFF | 2015/10/29<br>09:31 |
| S20 | 2    | ("20020080461").PN.                                                                                                                                                                                                                                                             | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB | OR | OFF | 2016/02/04<br>13:03 |
| S21 | 3    | ("6930745").PN.                                                                                                                                                                                                                                                                 | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB | OR | OFF | 2016/02/04<br>13:26 |
| S22 | 5    | ((("20020080461") or ("20050122466")).PN.                                                                                                                                                                                                                                       | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB | OR | OFF | 2016/02/04<br>14:13 |
| S23 | 3053 | (349/153.ccls. 349/190.ccls)                                                                                                                                                                                                                                                    | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB | OR | OFF | 2016/02/04<br>15:54 |
| S24 | 757  | S23 AND ( (G02F1/1339 OR G02F1/1341 OR G02F1/13394 OR G02F2001/13415 OR G02F2001/133325).CPC. ) and @ad<="20041227"                                                                                                                                                             | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB | OR | OFF | 2016/02/04<br>15:55 |
| S25 | 1055 | ((yoichi with momose) (satoshi with                                                                                                                                                                                                                                             | US-PGPUB;                                                                  | OR | OFF | 2016/02/04          |

|     |     |                                                                                                                                                                                                                                                                                                                                                          |                                                                            |    |     |                     |
|-----|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|----|-----|---------------------|
|     |     | hasegawa)).in.                                                                                                                                                                                                                                                                                                                                           | USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB              |    |     | 19:01               |
| S26 | 296 | (seal\$4 and continuous\$4 and side and opposite and (display LCD)).clm.                                                                                                                                                                                                                                                                                 | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB | OR | OFF | 2016/02/04<br>19:09 |
| S27 | 22  | ("20020030783"   "20020080461"  <br>"20030025867"   "20040070722"  <br>"20040070723"   "20040125317"  <br>"20040239864"   "20040252270"  <br>"20050094084"   "20050099574"  <br>"20050117106"   "20050122466"  <br>"20110096269"   "6099672"   "6388729"<br>"6525799"   "6531329"   "6567147"  <br>"6930745"   "7133107"   "7190430"  <br>"7280179").PN. | US-PGPUB;<br>USPAT;<br>USOCR                                               | OR | ON  | 2016/04/30<br>11:38 |
| S28 | 1   | 14/955601                                                                                                                                                                                                                                                                                                                                                | US-PGPUB;<br>USPAT;<br>USOCR                                               | OR | ON  | 2016/04/30<br>11:49 |
| S29 | 82  | ("3882349"   "4138626"   "4394067"  <br>"4401537"   "4431270"   "4586789"  <br>"4629942"   "4810061"   "4826297"  <br>"4836651"   "4896946"   "4917466"  <br>"5076667"   "5130832"   "5133036"  <br>"5148301"   "5179460"   "5202778"  <br>"5233451"   "5233452"  <br>"5349226").PN. OR ("5517344").URPN.                                                | US-PGPUB;<br>USPAT;<br>USOCR                                               | OR | OFF | 2016/04/30<br>14:50 |
| S30 | 45  | ("3600061"   "4362771"   "4394067"  <br>"4688074"   "4826297"   "5076667"  <br>"5130832"   "5130833"   "5148301"  <br>"5200847"   "5247375"   "5278682"  <br>"5278685"   "5436744"   "5442470"  <br>"5460983"   "5517344"  <br>"5710612").PN. OR ("6236444").URPN.                                                                                       | US-PGPUB;<br>USPAT;<br>USOCR                                               | OR | OFF | 2016/04/30<br>14:52 |
| S31 | 17  | ("20030025868"   "20030071959"  <br>"20030128327"   "20040160566"  <br>"5517344"   "5539546"   "6184967"  <br>"6567147"   "6717640"  <br>"6724458").PN. OR ("7362404").URPN.                                                                                                                                                                             | US-PGPUB;<br>USPAT;<br>USOCR                                               | OR | OFF | 2016/04/30<br>15:08 |
| S32 | 27  | ("3990782"   "4158485"   "4469410"  <br>"5037185"   "5202778"   "5359442"  <br>"5492582"   "5699138"  <br>"5725032").PN. OR ("5893625").URPN.                                                                                                                                                                                                            | US-PGPUB;<br>USPAT;<br>USOCR                                               | OR | OFF | 2016/04/30<br>15:12 |
| S33 | 20  | ("4095876"   "4610510"  <br>"4645306").PN. OR ("5037185").URPN.                                                                                                                                                                                                                                                                                          | US-PGPUB;<br>USPAT;<br>USOCR                                               | OR | OFF | 2016/04/30<br>15:15 |
| S34 | 2   | ("20050219456").PN.                                                                                                                                                                                                                                                                                                                                      | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB | OR | OFF | 2016/04/30<br>15:23 |



|     |      |                                                                                                                           |                                                                            |    |     |                     |
|-----|------|---------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|----|-----|---------------------|
| S35 | 1    | 14/955654                                                                                                                 | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB | OR | OFF | 2016/04/30<br>15:29 |
| S36 | 6    | ((("6930745") or ("20050122466"))).PN.                                                                                    | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB | OR | OFF | 2016/05/15<br>18:31 |
| S37 | 2    | ("20050219456").PN.                                                                                                       | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB | OR | OFF | 2016/05/15<br>18:42 |
| S38 | 3066 | (349/153.ccls. 349/190.ccls)                                                                                              | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB | OR | OFF | 2016/05/27<br>22:23 |
| S39 | 845  | S38 AND ( (G02F1/1339 OR G02F1/1341<br>OR G02F1/13394 OR G02F2001/13415<br>OR G02F2202/023).CPC. ) and<br>@ad<="20051212" | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB | OR | OFF | 2016/05/27<br>22:24 |
| S40 | 2    | ("20050219456").PN.                                                                                                       | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB | OR | OFF | 2016/05/27<br>22:25 |
| S41 | 1069 | ((yoichi with momose) (satoshi with<br>hasegawa)).in.                                                                     | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB | OR | OFF | 2016/05/27<br>22:37 |
| S42 | 31   | (junction and seal\$4 and extend\$4 and<br>liquid and crystal).clm.                                                       | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB | OR | OFF | 2016/05/27<br>22:41 |
| S43 | 2    | ("20050219456").PN.                                                                                                       | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;                        | OR | OFF | 2016/06/01<br>14:30 |

|     |        |                                                                                                                                                  |                                                                            |    |     |                     |
|-----|--------|--------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|----|-----|---------------------|
|     |        |                                                                                                                                                  | DERWENT;<br>IBM_TDB                                                        |    |     |                     |
| S44 | 2      | ("20050219456").PN.                                                                                                                              | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB | OR | OFF | 2016/06/14<br>15:26 |
| S45 | 6      | ((("6930745") or ("20050122466")).PN.                                                                                                            | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB | OR | OFF | 2016/06/21<br>09:53 |
| S46 | 3091   | (349/153.ccls. 349/190.ccls)                                                                                                                     | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB | OR | OFF | 2016/09/01<br>15:26 |
| S48 | 3      | S46 AND ( (G02F1/1339 OR G02F1/1341<br>OR G02F1/13394 OR G02F2001/13415<br>OR G02F2202/023).CPC. ) and<br>@ad<="20051212" and<br>@pd>="20160210" | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB | OR | OFF | 2016/09/01<br>15:27 |
| S49 | 24     | ((yoichi with momose) (satoshi with<br>hasegawa)).in. and @pd>="20160210"                                                                        | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB | OR | OFF | 2016/09/01<br>15:28 |
| S50 | 21     | (junction and seal\$4 and (plug cap\$4)<br>and liquid and crystal).clm.                                                                          | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB | OR | OFF | 2016/09/01<br>15:29 |
| S52 | 529840 | seiko.as,aanm.                                                                                                                                   | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB | OR | OFF | 2016/09/01<br>15:40 |
| S53 | 1159   | seiko.as,aanm. and seal\$4 and<br>junction\$4                                                                                                    | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB | OR | OFF | 2016/09/01<br>15:40 |
| S55 | 170    | (junction and (seal\$4 (plug cap\$4)) and<br>liquid and crystal).clm.                                                                            | US-PGPUB;<br>USPAT;<br>USOCR;                                              | OR | OFF | 2016/09/01<br>17:14 |

EAST Search History

|  |  |  |                                           |  |  |  |
|--|--|--|-------------------------------------------|--|--|--|
|  |  |  | FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB |  |  |  |
|--|--|--|-------------------------------------------|--|--|--|

**9/ 1/ 2016 8:53:54 PM**

**H:\ EAST\ Workspaces\ 11301086.wsp**

|                                                                                                              |                                                |                                                                     |
|--------------------------------------------------------------------------------------------------------------|------------------------------------------------|---------------------------------------------------------------------|
| <b>Search Notes</b><br><br> | <b>Application/Control No.</b><br><br>14572068 | <b>Applicant(s)/Patent Under Reexamination</b><br><br>MOMOSE ET AL. |
|                                                                                                              | <b>Examiner</b><br><br>LAUREN NGUYEN           | <b>Art Unit</b><br><br>2871                                         |

| CPC- SEARCHED |      |          |
|---------------|------|----------|
| Symbol        | Date | Examiner |
|               |      |          |

| CPC COMBINATION SETS - SEARCHED                                                  |           |          |
|----------------------------------------------------------------------------------|-----------|----------|
| Symbol                                                                           | Date      | Examiner |
| G02F1/1341; G02F2001/13415; G02F1/133351                                         | 8/19/2015 | LN       |
| (G02F1/1339 OR G02F1/1341 OR G02F1/13394 OR G02F2001/13415 OR G02F2202/023).CPC. | 9/2/2016  | LN       |

| US CLASSIFICATION SEARCHED |          |      |          |
|----------------------------|----------|------|----------|
| Class                      | Subclass | Date | Examiner |
|                            |          |      |          |

| SEARCH NOTES                     |           |          |
|----------------------------------|-----------|----------|
| Search Notes                     | Date      | Examiner |
| See attached EAST search history | 8/19/2015 | LN       |
| See attached EAST search history | 9/2/2016  | LN       |

| INTERFERENCE SEARCH     |                                                                    |          |          |
|-------------------------|--------------------------------------------------------------------|----------|----------|
| US Class/<br>CPC Symbol | US Subclass / CPC Group                                            | Date     | Examiner |
|                         | (junction and (seal\$4 (plug cap\$4)) and liquid and crystal).clm. | 9/2/2016 | LN       |

|  |                                                   |
|--|---------------------------------------------------|
|  | /LAUREN NGUYEN/<br>Primary Examiner.Art Unit 2871 |
|--|---------------------------------------------------|



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## BIB DATA SHEET

CONFIRMATION NO. 6575

| SERIAL NUMBER                                                                                                                                                                                                                                                                                                                                                                                                                                    | FILING or 371(c)<br>DATE                                                                                          | CLASS                                                             | GROUP ART UNIT                       | ATTORNEY DOCKET<br>NO.                                                                                                                                                                                                                                                    |                               |                                    |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|--------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|------------------------------------|
| 14/572,068                                                                                                                                                                                                                                                                                                                                                                                                                                       | 12/16/2014                                                                                                        | 349                                                               | 2871                                 | 9319S-001378-COB                                                                                                                                                                                                                                                          |                               |                                    |
| <b>APPLICANTS</b><br>Seiko Epson Corporation, Tokyo, JAPAN;<br><b>INVENTORS</b><br>Yoichi MOMOSE, Matsumoto, JAPAN;<br>Satoshi HASEGAWA, Matsumoto, JAPAN;<br><b>** CONTINUING DATA *****</b><br>This application is a CON of 14/571,729 12/16/2014<br>which is a DIV of 11/301,086 12/12/2005<br><b>** FOREIGN APPLICATIONS *****</b><br>JAPAN 2004-375697 12/27/2004<br><b>** IF REQUIRED, FOREIGN FILING LICENSE GRANTED **</b><br>02/11/2015 |                                                                                                                   |                                                                   |                                      |                                                                                                                                                                                                                                                                           |                               |                                    |
| Foreign Priority claimed <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No<br>35 USC 119(a-d) conditions met <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No<br>Verified and /LAUREN NGUYEN/<br>Acknowledged Examiner's Signature                                                                                                                                                                          |                                                                                                                   | <input type="checkbox"/> Met after<br>Allowance<br>LN<br>Initials | <b>STATE OR<br/>COUNTRY</b><br>JAPAN | <b>SHEETS<br/>DRAWINGS</b><br>31                                                                                                                                                                                                                                          | <b>TOTAL<br/>CLAIMS</b><br>20 | <b>INDEPENDENT<br/>CLAIMS</b><br>3 |
| <b>ADDRESS</b><br>HARNESS, DICKEY & PIERCE, P.L.C.<br>P.O. BOX 828<br>BLOOMFIELD HILLS, MI 48303<br>UNITED STATES                                                                                                                                                                                                                                                                                                                                |                                                                                                                   |                                                                   |                                      |                                                                                                                                                                                                                                                                           |                               |                                    |
| <b>TITLE</b><br>Liquid Crystal Display Device having Rectangular Close-shape Seal Members                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                   |                                                                   |                                      |                                                                                                                                                                                                                                                                           |                               |                                    |
| <b>FILING FEE<br/>RECEIVED</b><br>2640                                                                                                                                                                                                                                                                                                                                                                                                           | FEES: Authority has been given in Paper<br>No. _____ to charge/credit DEPOSIT ACCOUNT<br>No. _____ for following: |                                                                   |                                      | <input type="checkbox"/> All Fees<br><input type="checkbox"/> 1.16 Fees (Filing)<br><input type="checkbox"/> 1.17 Fees (Processing Ext. of time)<br><input type="checkbox"/> 1.18 Fees (Issue)<br><input type="checkbox"/> Other _____<br><input type="checkbox"/> Credit |                               |                                    |

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|                    |
|--------------------|
| (Depositor's name) |
| (Signature)        |
| (Date)             |

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 14/572,068      | 12/16/2014  | Yoichi MOMOSE        | 9319S-001378-COB    | 6575             |

TITLE OF INVENTION: LIQUID CRYSTAL DISPLAY DEVICE HAVING RECTANGULAR CLOSE-SHAPE SEAL MEMBERS

| APPLN. TYPE    | ENTITY STATUS | ISSUE FEE DUE | PUBLICATION FEE DUE | PREV. PAID ISSUE FEE | TOTAL FEE(S) DUE | DATE DUE   |
|----------------|---------------|---------------|---------------------|----------------------|------------------|------------|
| nonprovisional | UNDISCOUNTED  | \$960         | \$0                 | \$0                  | \$960            | 12/21/2016 |

| EXAMINER       | ART UNIT | CLASS-SUBCLASS |
|----------------|----------|----------------|
| NGUYEN, LAUREN | 2871     | 349-156000     |

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

- ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
- ☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. Use of a Customer Number is required.

2. For printing on the patent front page, list

- (1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
- (2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 Harness, Dickey & Pierce, P.L.C.

2 \_\_\_\_\_

3 \_\_\_\_\_

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Seiko Epson Corporation

Japan

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☒ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:

- ☒ Issue Fee
- ☐ Publication Fee (No small entity discount permitted)
- ☐ Advance Order - # of Copies \_\_\_\_\_

4b. Payment of Fee(s): (Please first reapply any previously paid issue fee shown above)

- ☐ A check is enclosed.
- ☐ Payment by credit card. Form PTO-2038 is attached.
- ☒ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number 50-6518 (enclose an extra copy of this form).

5. Change in Entity Status (from status indicated above)

- ☐ Applicant certifying micro entity status. See 37 CFR 1.29
- ☐ Applicant asserting small entity status. See 37 CFR 1.27
- ☐ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.33 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature \_\_\_\_\_

Date December 19, 2016

Typed or printed name G. Gregory Schivley

Registration No. 27,382

21053880.1

PTOL-85 Part B (10-13) Approved for use through 4/31/2013.

OMB 0651-0033

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

GGS/kjh

| Electronic Patent Application Fee Transmittal        |                 |                                                                           |               |                             |
|------------------------------------------------------|-----------------|---------------------------------------------------------------------------|---------------|-----------------------------|
| <b>Application Number:</b>                           |                 | 14572068                                                                  |               |                             |
| <b>Filing Date:</b>                                  |                 | 16-Dec-2014                                                               |               |                             |
| <b>Title of Invention:</b>                           |                 | Liquid Crystal Display Device having Rectangular Close-shape Seal Members |               |                             |
| <b>First Named Inventor/Applicant Name:</b>          |                 | Yoichi MOMOSE                                                             |               |                             |
| <b>Filer:</b>                                        |                 | G. Gregory Schivley/Michele Mester                                        |               |                             |
| <b>Attorney Docket Number:</b>                       |                 | 93195-001378-COB                                                          |               |                             |
| Filed as Large Entity                                |                 |                                                                           |               |                             |
| <b>Filing Fees for   Utility under 35 USC 111(a)</b> |                 |                                                                           |               |                             |
| <b>Description</b>                                   | <b>Fee Code</b> | <b>Quantity</b>                                                           | <b>Amount</b> | <b>Sub-Total in USD(\$)</b> |
| <b>Basic Filing:</b>                                 |                 |                                                                           |               |                             |
| <b>Pages:</b>                                        |                 |                                                                           |               |                             |
| <b>Claims:</b>                                       |                 |                                                                           |               |                             |
| <b>Miscellaneous-Filing:</b>                         |                 |                                                                           |               |                             |
| <b>Petition:</b>                                     |                 |                                                                           |               |                             |
| <b>Patent-Appeals-and-Interference:</b>              |                 |                                                                           |               |                             |
| <b>Post-Allowance-and-Post-Issuance:</b>             |                 |                                                                           |               |                             |
| UTILITY APPL ISSUE FEE                               | 1501            | 1                                                                         | 960           | 960                         |

| Description        | Fee Code | Quantity | Amount | Sub-Total in USD(\$) |
|--------------------|----------|----------|--------|----------------------|
| Extension-of-Time: |          |          |        |                      |
| Miscellaneous:     |          |          |        |                      |
| Total in USD (\$)  |          |          |        | 960                  |



| Electronic Acknowledgement Receipt          |                                                                           |
|---------------------------------------------|---------------------------------------------------------------------------|
| <b>EFS ID:</b>                              | 27836309                                                                  |
| <b>Application Number:</b>                  | 14572068                                                                  |
| <b>International Application Number:</b>    |                                                                           |
| <b>Confirmation Number:</b>                 | 6575                                                                      |
| <b>Title of Invention:</b>                  | Liquid Crystal Display Device having Rectangular Close-shape Seal Members |
| <b>First Named Inventor/Applicant Name:</b> | Yoichi MOMOSE                                                             |
| <b>Customer Number:</b>                     | 27572                                                                     |
| <b>Filer:</b>                               | G. Gregory Schivley/Michele Mester                                        |
| <b>Filer Authorized By:</b>                 | G. Gregory Schivley                                                       |
| <b>Attorney Docket Number:</b>              | 93195-001378-COB                                                          |
| <b>Receipt Date:</b>                        | 19-DEC-2016                                                               |
| <b>Filing Date:</b>                         | 16-DEC-2014                                                               |
| <b>Time Stamp:</b>                          | 16:49:51                                                                  |
| <b>Application Type:</b>                    | Utility under 35 USC 111(a)                                               |

### Payment information:

|                                                                                                                                                                                                                                                                                |                             |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| Submitted with Payment                                                                                                                                                                                                                                                         | yes                         |
| Payment Type                                                                                                                                                                                                                                                                   | DA                          |
| Payment was successfully received in RAM                                                                                                                                                                                                                                       | \$ 960                      |
| RAM confirmation Number                                                                                                                                                                                                                                                        | 122016INTEFSW00004458506518 |
| Deposit Account                                                                                                                                                                                                                                                                | 506518                      |
| Authorized User                                                                                                                                                                                                                                                                | Michele Mester              |
| <p>The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:</p> <p>37 CFR 1.16 (National application filing, search, and examination fees)</p> <p>37 CFR 1.17 (Patent application and reexamination processing fees)</p> |                             |

37 CFR 1.19 (Document supply fees)  
 37 CFR 1.20 (Post Issuance fees)  
 37 CFR 1.21 (Miscellaneous fees and charges)

# File Listing:

| Document Number | Document Description        | File Name   | File Size(Bytes)/ Message Digest         | Multi Part /.zip | Pages (if appl.) |
|-----------------|-----------------------------|-------------|------------------------------------------|------------------|------------------|
| 1               | Issue Fee Payment (PTO-85B) | PTOL_85.PDF | 94452                                    | no               | 1                |
|                 |                             |             | 0a3e196bf4f408bede54fd9d17819536c869ad64 |                  |                  |

## Warnings:

## Information:

|   |                      |              |                                          |    |   |
|---|----------------------|--------------|------------------------------------------|----|---|
| 2 | Fee Worksheet (SB06) | fee-info.pdf | 30885                                    | no | 2 |
|   |                      |              | fb130c47f7dbc889e3a9495705993e136c45eab5 |    |   |

## Warnings:

## Information:

**Total Files Size (in bytes):** 125337

**This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.**

### **New Applications Under 35 U.S.C. 111**

**If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.**

### **National Stage of an International Application under 35 U.S.C. 371**

**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.**

### **New International Application Filed with the USPTO as a Receiving Office**

**If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.**



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
[www.uspto.gov](http://www.uspto.gov)

| APPLICATION NO. | ISSUE DATE | PATENT NO. | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|------------|------------|---------------------|------------------|
| 14/572,068      | 01/31/2017 | 9557606    | 9319S-001378-COB    | 6575             |

27572 7590 01/11/2017  
HARNESS, DICKEY & PIERCE, P.L.C.  
P.O. BOX 828  
BLOOMFIELD HILLS, MI 48303

## ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

### **Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)** (application filed on or after May 29, 2000)

The Patent Term Adjustment is 0 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (<http://pair.uspto.gov>).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site <http://pair.uspto.gov> for additional applicants):

Yoichi MOMOSE, Matsumoto, JAPAN;  
Seiko Epson Corporation, Tokyo, JAPAN;  
Satoshi HASEGAWA, Matsumoto, JAPAN;

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The USA offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to encourage and facilitate business investment. To learn more about why the USA is the best country in the world to develop technology, manufacture products, and grow your business, visit [SelectUSA.gov](http://SelectUSA.gov).

## TRANSMITTAL FOR POWER OF ATTORNEY TO ONE OR MORE REGISTERED PRACTITIONERS

NOTE: This form is to be submitted with the Power of Attorney by Applicant form (PTO/AIA/82B) to identify the application to which the Power of Attorney is directed, in accordance with 37 CFR 1.5, unless the application number and filing date are identified in the Power of Attorney by Applicant form. If neither form PTO/AIA/82A nor form PTO/AIA/82B identifies the application to which the Power of Attorney is directed, the Power of Attorney will not be recognized in the application.

|                        |                                                                           |
|------------------------|---------------------------------------------------------------------------|
| Application Number     | 14/572,068                                                                |
| Filing Date            | 12/16/2014                                                                |
| First Named Inventor   | Yoichi MOMOSE                                                             |
| Title                  | Liquid Crystal Display Device having Rectangular Close-shape Seal Members |
| Art Unit               | 2871                                                                      |
| Examiner Name          | LAUREN NGUYEN                                                             |
| Attorney Docket Number | ZJ0113970US03                                                             |

### SIGNATURE of Applicant or Patent Practitioner

|                                                    |                                   |                     |       |
|----------------------------------------------------|-----------------------------------|---------------------|-------|
| Signature                                          | /Michael Bartholomew/             | Date (Optional)     |       |
| Name                                               | Michael Bartholomew               | Registration Number | 60225 |
| Title (if Applicant is a juristic entity)          | Attorney for Applicant            |                     |       |
| Applicant Name (if Applicant is a juristic entity) | 138 EAST LCD ADVANCEMENTS LIMITED |                     |       |

**NOTE:** This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. If more than one applicant, use multiple forms.

☐

\*Total of \_\_\_\_\_ forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Doc Code: PA..

Document Description: Power of Attorney

PTO/AIA/82B (07-13)

Approved for use through 01/31/2018, OMB 0651-0035

U.S. Patent and Trademark Office, U.S. DEPARTMENT OF COMMERCE

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## POWER OF ATTORNEY BY APPLICANT

I hereby revoke all previous powers of attorney given in the application identified in either the attached transmittal letter or the boxes below.

Application Number

Filing Date

(Note: The boxes above may be left blank if information is provided on form PTO/AIA/82A.)



I hereby appoint the Patent Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above:

36491

OR



I hereby appoint Practitioner(s) named in the attached list (form PTO/AIA/82C) as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the patent application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above. (Note: Complete form PTO/AIA/82C.)

Please recognize or change the correspondence address for the application identified in the attached transmittal letter or the boxes above to:



The address associated with the above-mentioned Customer Number

OR



The address associated with Customer Number:

OR



Firm or Individual Name

Address

City

State

Zip

Country

Telephone

Email

I am the Applicant (if the Applicant is a juristic entity, list the Applicant name in the box):

138 East LCD Advancements Limited



Inventor or Joint Inventor (title not required below)



Legal Representative of a Deceased or Legally Incapacitated Inventor (title not required below)



Assignee or Person to Whom the Inventor is Under an Obligation to Assign (provide signer's title if applicant is a juristic entity)



Person Who Otherwise Shows Sufficient Proprietary Interest (e.g., a petition under 37 CFR 1.46(b)(2) was granted in the application or is concurrently being filed with this document) (provide signer's title if applicant is a juristic entity)

### SIGNATURE of Applicant for Patent

The undersigned (whose title is supplied below) is authorized to act on behalf of the applicant (e.g., where the applicant is a juristic entity).

Signature

Date (Optional)

Name

Garrett Dempsey

Title

Director, 138 East LCD Advancements Limited

**NOTE:** Signature - This form must be signed by the applicant in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. If more than one applicant, use multiple forms.



Total of 1 forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

**STATEMENT UNDER 37 CFR 3.73(c)**

Applicant/Patent Owner: 138 EAST LCD ADVANCEMENTS LIMITED

Application No./Patent No.: 14/572,068 Filed/Issue Date: 12/16/2014

Titled: Liquid Crystal Display Device having Rectangular Close-shape Seal Members

138 EAST LCD ADVANCEMENTS LIMITED, a Corporation

(Name of Assignee)

(Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that, for the patent application/patent identified above, it is (choose **one** of options 1, 2, 3 or 4 below):

1. ☒ The assignee of the entire right, title, and interest.
2. ☐ An assignee of less than the entire right, title, and interest (check applicable box):
- ☐ The extent (by percentage) of its ownership interest is \_\_\_\_%. Additional Statement(s) by the owners holding the balance of the interest must be submitted to account for 100% of the ownership interest.
- ☐ There are unspecified percentages of ownership. The other parties, including inventors, who together own the entire right, title and interest are:

Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

3. ☐ The assignee of an undivided interest in the entirety (a complete assignment from one of the joint inventors was made). The other parties, including inventors, who together own the entire right, title, and interest are:

Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

4. ☐ The recipient, via a court proceeding or the like (e.g., bankruptcy, probate), of an undivided interest in the entirety (a complete transfer of ownership interest was made). The certified document(s) showing the transfer is attached.

The interest identified in option 1, 2 or 3 above (not option 4) is evidenced by either (choose **one** of options A or B below):

- A. ☐ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel \_\_\_\_\_, Frame \_\_\_\_\_, or for which a copy thereof is attached.
- B. ☒ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: SEIKO EPSON CORPORATION To: 138 EAST LCD ADVANCEMENTS LIMITED

The document was recorded in the United States Patent and Trademark Office at  
Reel 046153, Frame 0397, or for which a copy thereof is attached.

2. From: \_\_\_\_\_ To: \_\_\_\_\_

The document was recorded in the United States Patent and Trademark Office at  
Reel \_\_\_\_\_, Frame \_\_\_\_\_, or for which a copy thereof is attached.

[Page 1 of 2]

This collection of information is required by 37 CFR 3.73(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

*If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.*

**STATEMENT UNDER 37 CFR 3.73(c)**

3. From: \_\_\_\_\_ To: \_\_\_\_\_

The document was recorded in the United States Patent and Trademark Office at  
Reel \_\_\_\_\_, Frame \_\_\_\_\_, or for which a copy thereof is attached.

4. From: \_\_\_\_\_ To: \_\_\_\_\_

The document was recorded in the United States Patent and Trademark Office at  
Reel \_\_\_\_\_, Frame \_\_\_\_\_, or for which a copy thereof is attached.

5. From: \_\_\_\_\_ To: \_\_\_\_\_

The document was recorded in the United States Patent and Trademark Office at  
Reel \_\_\_\_\_, Frame \_\_\_\_\_, or for which a copy thereof is attached.

6. From: \_\_\_\_\_ To: \_\_\_\_\_

The document was recorded in the United States Patent and Trademark Office at  
Reel \_\_\_\_\_, Frame \_\_\_\_\_, or for which a copy thereof is attached.

☐ Additional documents in the chain of title are listed on a supplemental sheet(s).

☐ As required by 37 CFR 3.73(c)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

/Michael Bartholomew/

Signature

Michael Bartholomew

Printed or Typed Name

2023-02-13

Date

60225

Title or Registration Number

## Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.



| Electronic Acknowledgement Receipt          |                                                                           |
|---------------------------------------------|---------------------------------------------------------------------------|
| <b>EFS ID:</b>                              | 47525799                                                                  |
| <b>Application Number:</b>                  | 14572068                                                                  |
| <b>International Application Number:</b>    |                                                                           |
| <b>Confirmation Number:</b>                 | 6575                                                                      |
| <b>Title of Invention:</b>                  | Liquid Crystal Display Device having Rectangular Close-shape Seal Members |
| <b>First Named Inventor/Applicant Name:</b> | Yoichi MOMOSE                                                             |
| <b>Customer Number:</b>                     | 27572                                                                     |
| <b>Filer:</b>                               | Michael Lee Bartholomew/Mary Keshishian                                   |
| <b>Filer Authorized By:</b>                 | Michael Lee Bartholomew                                                   |
| <b>Attorney Docket Number:</b>              | 93195-001378-COB                                                          |
| <b>Receipt Date:</b>                        | 13-FEB-2023                                                               |
| <b>Filing Date:</b>                         | 16-DEC-2014                                                               |
| <b>Time Stamp:</b>                          | 17:48:39                                                                  |
| <b>Application Type:</b>                    | Utility under 35 USC 111(a)                                               |

### Payment information:

|                        |    |
|------------------------|----|
| Submitted with Payment | no |
|------------------------|----|

### File Listing:

| Document Number | Document Description | File Name             | File Size(Bytes)/<br>Message Digest     | Multi Part /.zip | Pages (if appl.) |
|-----------------|----------------------|-----------------------|-----------------------------------------|------------------|------------------|
| 1               | Power of Attorney    | POA_ZJ0113970US03.pdf | 565512                                  | no               | 2                |
|                 |                      |                       | 878b94e11cde1af16f85a88fae487d9ed1e0a4f |                  |                  |

### Warnings:

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                               |                                |                                             |        |   |
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| <b>Information:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                               |                                |                                             |        |   |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Assignee showing of ownership per 37 CFR 3.73 | Statement373_ZJ0113970US03.pdf | 123176                                      | no     | 3 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                               |                                | b771867602cc8877bbcfecadd06fd52999b<br>b151 |        |   |
| <b>Warnings:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                               |                                |                                             |        |   |
| <b>Information:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                               |                                |                                             |        |   |
| <b>Total Files Size (in bytes):</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                               |                                |                                             | 688688 |   |
| <p><b>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</b></p> <p><b><u>New Applications Under 35 U.S.C. 111</u></b><br/> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><b><u>National Stage of an International Application under 35 U.S.C. 371</u></b><br/> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><b><u>New International Application Filed with the USPTO as a Receiving Office</u></b><br/> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p> |                                               |                                |                                             |        |   |



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| APPLICATION NUMBER | FILING OR 371(C) DATE | FIRST NAMED APPLICANT | ATTY. DOCKET NO./TITLE |
|--------------------|-----------------------|-----------------------|------------------------|
| 14/572,068         | 12/16/2014            | Yoichi MOMOSE         | ZJ0113970US03          |

**CONFIRMATION NO. 6575**

**POA ACCEPTANCE LETTER**



36491  
Kunzler Bean & Adamson  
50 W. Broadway  
Suite 1000  
Salt Lake City, UT 84101

Date Mailed: 02/15/2023

**NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY**

This is in response to the Power of Attorney filed 02/13/2023.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at (571) 272-4000 or (571) 272-4200 or 1-888-786-0101.

/nrhayden/



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|--------------------|-----------------------|-----------------------|------------------------|
| 14/572,068         | 12/16/2014            | Yoichi MOMOSE         | 9319S-001378-COB       |

**CONFIRMATION NO. 6575**

**POWER OF ATTORNEY NOTICE**



27572  
HARNESS DICKEY (TROY)  
5445 Corporate Dr.  
Suite 200  
Troy, MI 48098

Date Mailed: 02/15/2023

**NOTICE REGARDING CHANGE OF POWER OF ATTORNEY**

This is in response to the Power of Attorney filed 02/13/2023.

- The Power of Attorney to you in this application has been revoked by the assignee who has intervened as provided by 37 CFR 3.71. Future correspondence will be mailed to the new address of record(37 CFR 1.33).

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at (571) 272-4000 or (571) 272-4200 or 1-888-786-0101.

/nrhayden/