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Sleeman et al.

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(54) **CAPACITIVE TOUCH SCREEN WITH NOISE SUPPRESSION**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 1196 days.

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G01D 5/24 (2006.01)
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(52) **U.S. Cl.**
CPC **G06F 3/044** (2013.01); **G01B 7/003** (2013.01); **G01D 5/2405** (2013.01); **G06F 1/16** (2013.01);
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(58) **Field of Classification Search**
CPC G06F 3/044
(Continued)

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,730,165 A 3/1998 Philipp
6,452,514 B1 9/2002 Philipp
(Continued)

FOREIGN PATENT DOCUMENTS

CN 101101525 1/2008 G06F 3/042
EP 1821175 A1 8/2007
(Continued)

OTHER PUBLICATIONS

“2009—Conductive Inkjet Technology”, [online]. [retrieved Apr. 20, 2010]. Retrieved from the Internet: <URL: http://www.conductiveinkjet.com/about-us/latest-news/2009.aspx>, 1 pg.

(Continued)

Primary Examiner — Amare Mengistu

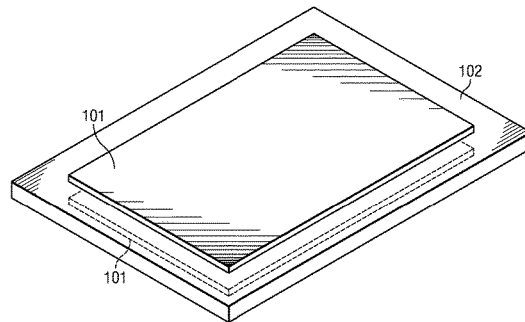
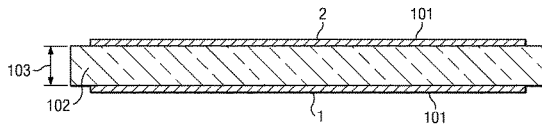
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(57) **ABSTRACT**

A capacitive touch sensor wherein the touch sensitive panel has drive electrodes arranged on the lower side of a substrate and sense electrodes arranged on the upper side. The drive electrodes are shaped and dimensioned to substantially entirely cover the touch sensitive area with individual drive electrodes being separated from each other by small gaps, the gaps being so small as to be practically invisible. The near blanket coverage by the drive electrodes also serves to screen out interference from noise sources below the drive electrode layer, such as drive signals for an underlying display, thereby suppressing noise pick-up by the sense electrodes that are positioned above the drive electrodes.

3 Claims, 10 Drawing Sheets



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

OTHER PUBLICATIONS

- (52) **U.S. Cl.**
 CPC **G06F 3/0412** (2013.01); **G06F 3/0416** (2013.01); **H03K 17/9622** (2013.01); **H05K 1/0296** (2013.01); **G01B 2210/58** (2013.01); **G06F 2203/04111** (2013.01); **G06F 2203/04112** (2013.01)

“Cambrios Technologies Corporation Awarded Department of Defense Contract for Flexible Solar Cells”, [online]. [retrieved Apr. 20, 2010]. Retrieved from the Internet: <URL: <http://www.cambrios.com/200/DOD_Release.htm>, (Apr. 12, 2010), 2 pgs.

“New Silver Conductive Inks Target High-Growth Touch Screen and OLED Markets”, [online]. [retrieved Apr. 20, 2010]. Retrieved from the Internet: <URL: http://www2.dupont.com/MCM/en_US/news_events/article20100413.html>, (Apr. 13, 2010), 3 pgs.

- (58) **Field of Classification Search**
 USPC 178/18; 345/173
 See application file for complete search history.

“Printing of Antennas and Flexible Circuits”, Core Applications & Technologies, © 2009 Conductive Inkjet Technology Ltd., (Oct. 2009), 23 pgs.

(56) **References Cited**

U.S. PATENT DOCUMENTS

| | | | | |
|--------------|-----|---------|------------------|---------|
| 7,148,704 | B2 | 12/2006 | Philipp | |
| 7,511,702 | B2* | 3/2009 | Hotelling | 345/173 |
| 7,663,607 | B2 | 2/2010 | Hotelling | |
| 7,864,503 | B2 | 1/2011 | Chang | |
| 7,875,814 | B2 | 1/2011 | Chen | |
| 7,920,129 | B2 | 4/2011 | Hotelling | |
| 8,031,094 | B2 | 10/2011 | Hotelling | |
| 8,031,174 | B2 | 10/2011 | Hamblin | |
| 8,040,326 | B2 | 10/2011 | Hotelling | |
| 8,049,732 | B2 | 11/2011 | Hotelling | |
| 8,179,381 | B2 | 5/2012 | Frey | |
| 8,217,902 | B2 | 7/2012 | Chang | |
| 2007/0062739 | A1 | 3/2007 | Philipp | |
| 2007/0257894 | A1* | 11/2007 | Philipp | 345/173 |
| 2008/0062139 | A1* | 3/2008 | Hotelling et al. | 345/173 |
| 2008/0309635 | A1 | 12/2008 | Matsuo | |
| 2009/0315854 | A1 | 12/2009 | Matsuo | |
| 2012/0242588 | A1 | 9/2012 | Myers | |
| 2012/0242592 | A1 | 9/2012 | Rothkopf | |
| 2012/0243151 | A1 | 9/2012 | Lynch | |
| 2012/0243719 | A1 | 9/2012 | Franklin | |
| 2013/0076612 | A1 | 3/2013 | Myers | |

Hörteis, M., et al., “Fine Line Printed and Plated Contacts on High OHMIC Emitters Enabling 20% Cell Efficiency”, 2009 34th IEEE Photovoltaic Specialists Conference (PVSC), (2009), 000060-00065.

Atmel Corporation, “Touch Sensors Design Guide” ; Jan. 22, 2009; http://www.atmel.com/dyn/resources/prod_documents/doc10620.pdf.

Chinese First Office Action and English Translation of the Text of the First Office Action for Application No. 200910134421.2; 15 pages, dated Jul. 17, 2012.

Questel English Translation of Chinese Patent No. CN 101101525; 9 pages, dated Aug. 21, 2012.

U.S. Appl. No. 61/454,936, filed Mar. 21, 2011, Myers.

U.S. Appl. No. 61/454,950, filed Mar. 21, 2011, Lynch.

U.S. Appl. No. 61/454,894, filed Mar. 21, 2011, Rothkopf.

The Patent Office of the People’s Republic of China; Second Office Action and English Translation of Text of the Second Office Action for Chinese Patent Application No. 200910134421.2; 15 pages, dated May 9, 2013.

Chinese Fifth Office Action and English Translation of the Text of the *Fifth Office Action Issued by State Intellectual Property Office* for Application No. 200910134421.2, 14 pages, dated Dec. 22, 2014.

Taiwan Office Action and English Translation of the Text of the *Office Action Issued by Intellectual Property Office* for Application No. 098112108, 12 pages, dated Apr. 9, 2015.

FOREIGN PATENT DOCUMENTS

| | | | | | |
|----|------------|----|---------|-------|------------|
| EP | 1 840 714 | A1 | 10/2007 | | G06F 3/041 |
| WO | 2009007704 | A1 | 1/2009 | | |

* cited by examiner

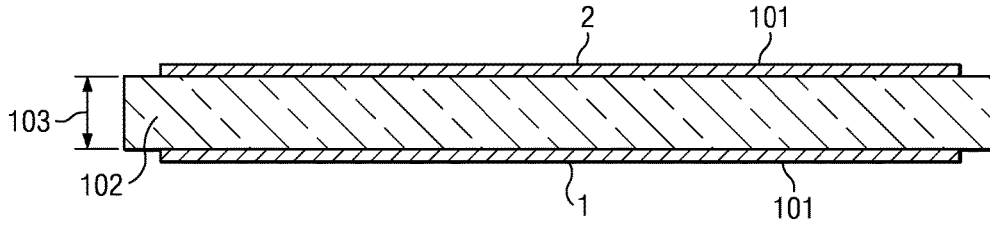


FIG. 1A

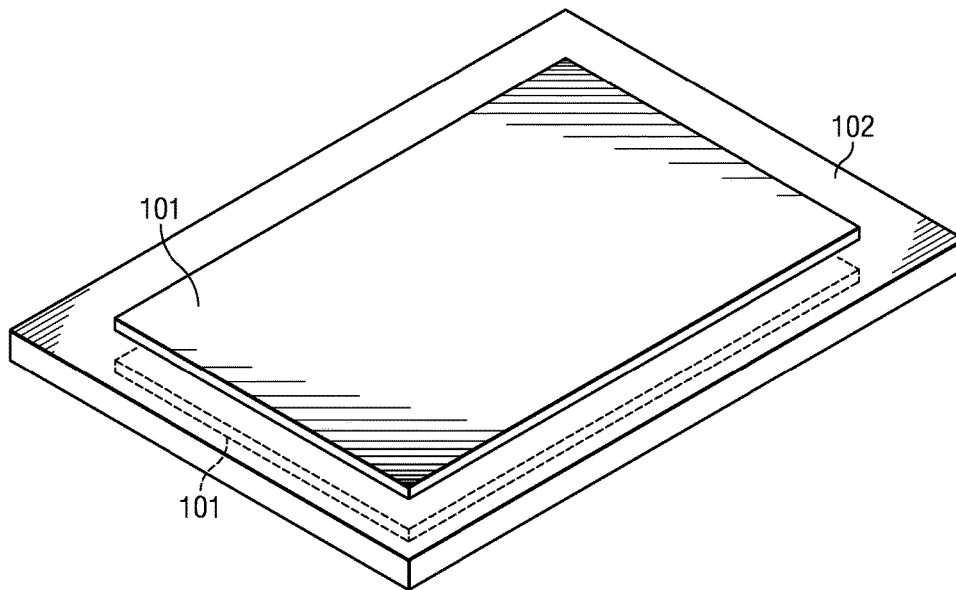


FIG. 1B

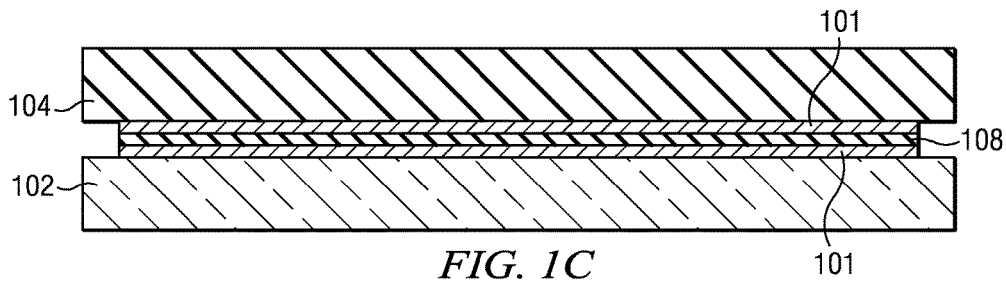
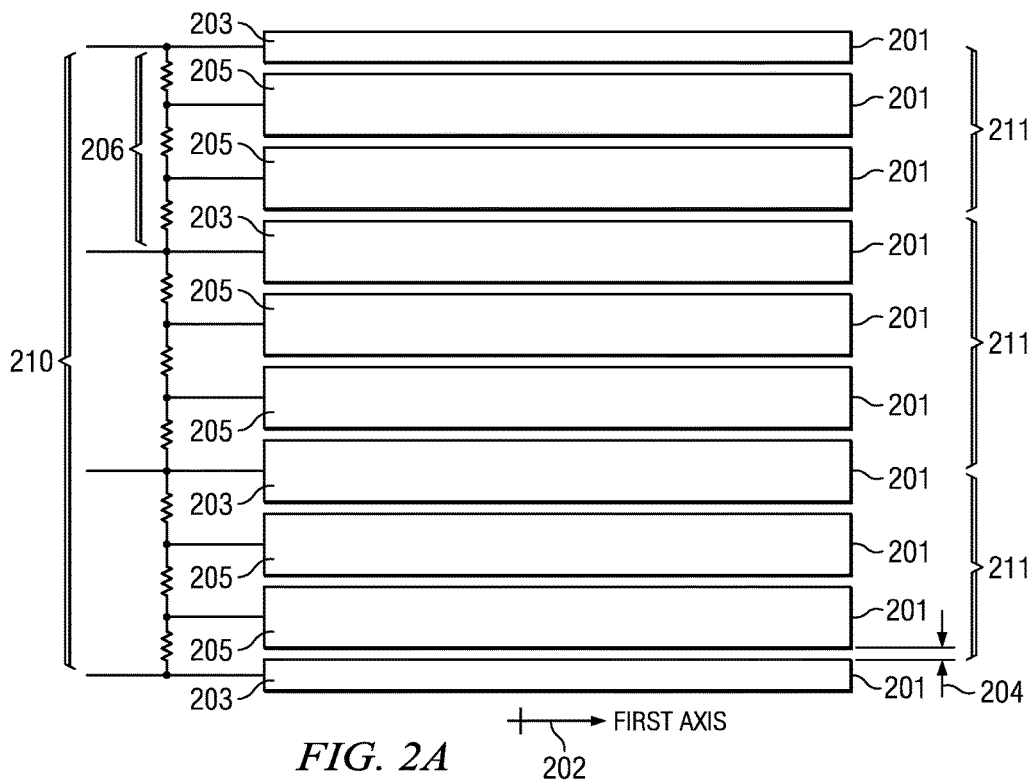
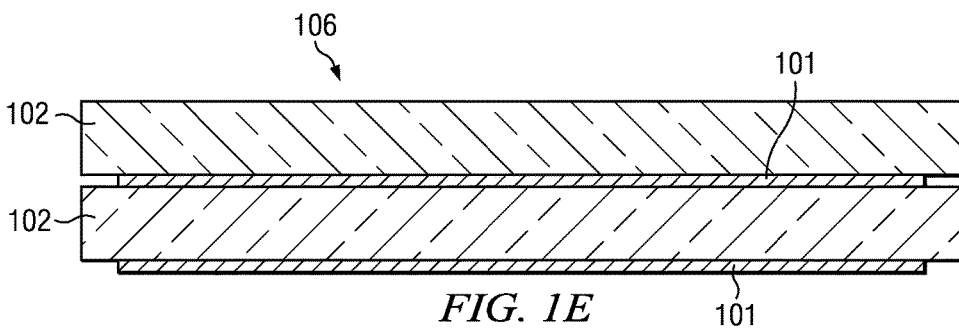
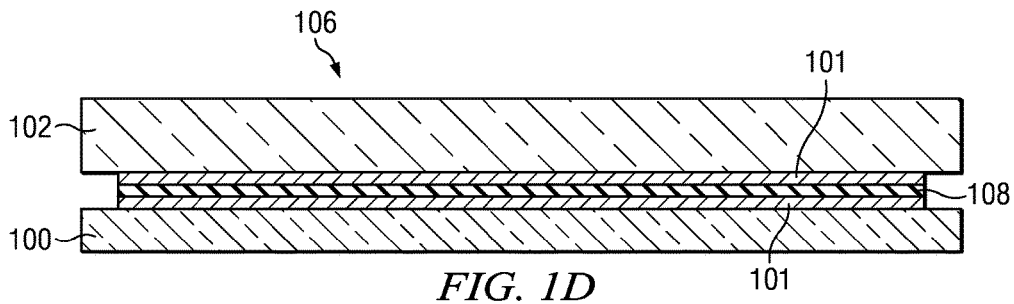


FIG. 1C



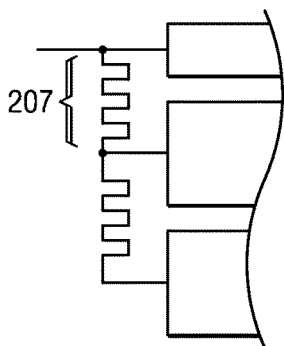


FIG. 2B

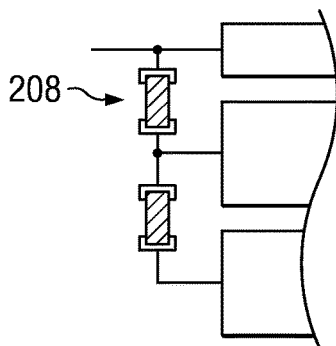


FIG. 2C

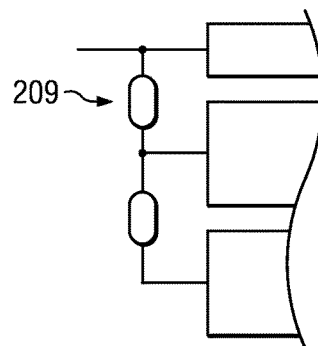


FIG. 2D

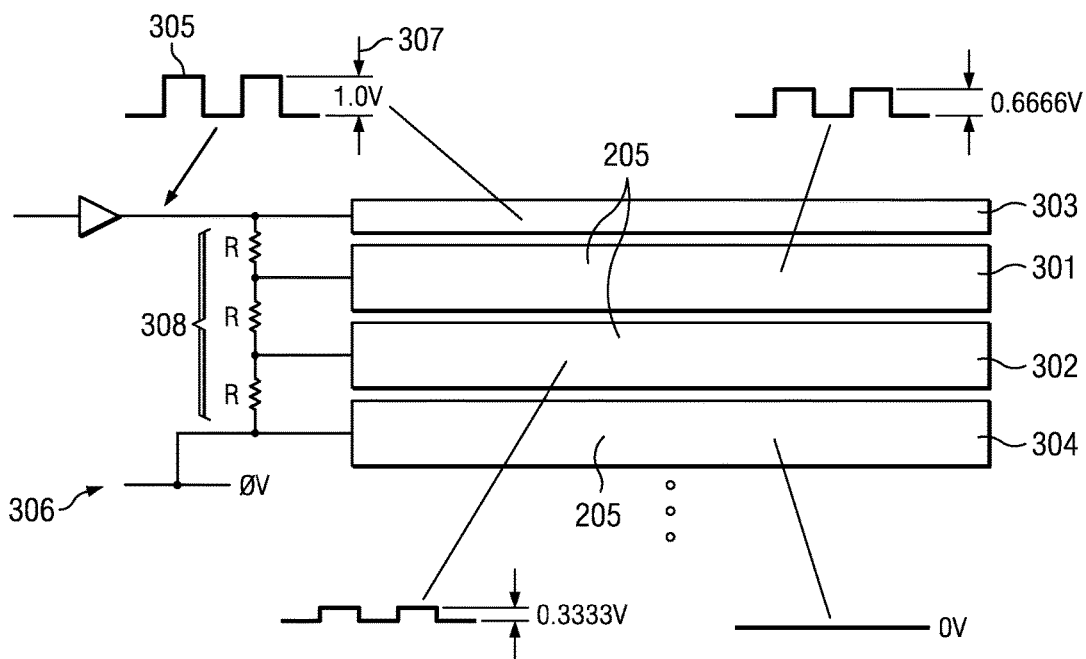


FIG. 3

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