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

APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/314,858	08/09/2016	9411472	080900.1238	7360

12323 7590 07/20/2016

Baker Botts L.L.P.
2001 Ross Avenue, 6th Floor
Dallas, TX 75201

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 189 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):

Martin John Simmons, Southampton, UNITED KINGDOM;
Darren Golbourn, Southampton, UNITED KINGDOM;
Daniel Pickett, Southampton, UNITED KINGDOM;

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.

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)

12323 7590 04/07/2016
Baker Botts L.L.P.
2001 Ross Avenue, 6th Floor
Dallas, TX 75201

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.
13/314,858	12/08/2011	Martin John Simmons	080900.1238	7360

TITLE OF INVENTION: TOUCH SENSOR WITH ADAPTIVE TOUCH DETECTION THRESHOLDING

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	07/07/2016

EXAMINER	ART UNIT	CLASS-SUBCLASS
WILSON, DOUGLAS M	2694	345-174000

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 Baker Botts L.L.P.
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: Atmel Corporation
(B) RESIDENCE: (CITY and STATE OR COUNTRY): San Jose, CA

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 020384 (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
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.
☐ Applicant asserting small entity status. See 37 CFR 1.27
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.
☐ Applicant changing to regular undiscounted fee 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 7/6/16
Typed or printed name Chad D. Terrell Registration No. 52,279

PTOL-85 Part B (10-13) Approved for use through 10/31/2013. OMB 0651-0033 U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

IPR2020-01287
Apple EX1002 Page 2

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	Martin John Simmons, et al.
Serial No.:	13/314,858
Filed:	December 8, 2011
Group No.:	2694
Examiner:	Douglas M. Wilson
Notice of Allowance Mailed:	April 7, 2016
Confirmation No.:	7360
Title:	Touch Sensor with Adaptive Touch Detection Thresholding

Mail Stop Issue Fee
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

COMMENTS ON STATEMENT OF REASONS FOR ALLOWANCE

Applicants appreciate the Examiner's allowance of Claims 1-23. Pursuant to 37 C.F.R. § 1.104, Applicants respectfully issue a statement commenting on the Examiner's reasons for allowance. Applicants respectfully disagree with the Examiner's reasons for allowance to the extent that they are inconsistent with applicable case law, statutes, and regulations. Furthermore, Applicants do not admit to any characterization or limitation of the claims or to any characterization of a reference by the Examiner, particularly any that are inconsistent with the language of the claims considered in their entirety and including all of their constituent limitations.

Respectfully submitted,
BAKER BOTTS L.L.P.
Attorneys for Applicants

Chad D. Terrell
Registration No. 52,279

Date: July 6, 2016
CUSTOMER NO. 12323

IPR2020-01287
Apple EX1002 Page 3

Electronic Patent Application Fee Transmittal

Application Number:	13314858
Filing Date:	08-Dec-2011
Title of Invention:	TOUCH SENSOR WITH ADAPTIVE TOUCH DETECTION THRESHOLDING
First Named Inventor/Applicant Name:	Martin John Simmons
Filer:	Harrison G. Rich/mary johnson
Attorney Docket Number:	080900.1238

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:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
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

EFS ID:	26263328
Application Number:	13314858
International Application Number:	
Confirmation Number:	7360
Title of Invention:	TOUCH SENSOR WITH ADAPTIVE TOUCH DETECTION THRESHOLDING
First Named Inventor/Applicant Name:	Martin John Simmons
Customer Number:	12323
Filer:	Harrison G. Rich/mary johnson
Filer Authorized By:	Harrison G. Rich
Attorney Docket Number:	080900.1238
Receipt Date:	06-JUL-2016
Filing Date:	08-DEC-2011
Time Stamp:	09:44:20
Application Type:	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	070616INTEFSW00008024020384
Deposit Account	020384
Authorized User	Mary Johnson

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

37 CFR 1.16 (National application filing, search, and examination fees)

37 CFR 1.17 (Patent application and reexamination processing fees)

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)	0809001238issuefee.PDF	101324 f331a3018524bcf4057f9352aa8b867f8a3596be	no	1
Warnings:					
Information:					
2	Post Allowance Communication - Incoming	0809001238comments.PDF	45539 3bf51e9615b70c9cda8e0c6ae3787b86af5bef0f	no	1
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	30804 d5b535fab8dbdfb6cc55526c5a39a8edc84001e4	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	177667		

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.

<u>New Applications Under 35 U.S.C. 111</u>
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.

<u>National Stage of an International Application under 35 U.S.C. 371</u>
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.

<u>New International Application Filed with the USPTO as a Receiving Office</u>
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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www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

12323 7590 04/07/2016

Baker Botts L.L.P.
2001 Ross Avenue, 6th Floor
Dallas, TX 75201

EXAMINER
WILSON, DOUGLAS M

ART UNIT	PAPER NUMBER
2694	

DATE MAILED: 04/07/2016

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/314,858	12/08/2011	Martin John Simmons	080900.1238	7360

TITLE OF INVENTION: TOUCH SENSOR WITH ADAPTIVE TOUCH DETECTION THRESHOLDING

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	07/07/2016

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.

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Apple EX1002 Page 8

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

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CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

12323 7590 04/07/2016
Baker Botts L.L.P.
2001 Ross Avenue, 6th Floor
Dallas, TX 75201

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.
13/314,858	12/08/2011	Martin John Simmons	080900.1238	7360

TITLE OF INVENTION: TOUCH SENSOR WITH ADAPTIVE TOUCH DETECTION THRESHOLDING

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	07/07/2016

EXAMINER	ART UNIT	CLASS-SUBCLASS
WILSON, DOUGLAS M	2694	345-174000

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 _____
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 — 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.
- ❑ Applicant asserting small entity status. See 37 CFR 1.27 — 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.
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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. _____

IPR2020-01287
Apple EX1002 Page 9

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
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www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/314,858	12/08/2011	Martin John Simmons	080900.1238	7360

12323 7590 04/07/2016

Baker Botts L.L.P.
2001 Ross Avenue, 6th Floor
Dallas, TX 75201

EXAMINER	
WILSON, DOUGLAS M	

ART UNIT	PAPER NUMBER
2694	

DATE MAILED: 04/07/2016

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.

Notice of Allowability	Application No. 13/314,858	Applicant(s) SIMMONS ET AL.	
	Examiner Douglas M. Wilson	Art Unit 2694	AIA (First Inventor to File) Status 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 *papers filed 04 February 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 *1-23*. 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 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)

1. ☒ Notice of References Cited (PTO-892)
2. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
5. ☐ Examiner's Amendment/Comment
6. ☒ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/Douglas M. Wilson/ Examiner, Art Unit 2694	/KATHY WANG-HURST/ Supervisory Patent Examiner, Art Unit 2694

DETAILED ACTION

Notice of Pre-AIA or AIA Status

1. The present application is being examined under the pre-AIA first to invent provisions.

Allowable Subject Matter

2. The following is an Examiner's Statement of Reasons for Allowance:

Claim 1 is directed towards a non-obvious improvement to a touch sensor comprising a controller communicatively coupled to the plurality of sense electrodes, the controller configured to:

after adjusting the stored threshold value based on the determined grounding status of the touch sensor:

determine that the external object has not touched the touch sensor within a predetermined amount of time; and

change the stored threshold value back to an original value, the original value comprising a value of the stored threshold value before it was adjusted based on the determined grounding status of the touch sensor.

Claim 7 is directed towards a non-obvious improvement to a method of detecting a capacitive touch comprising the steps of:

after adjusting the stored threshold value based on the determined grounding status of the touch sensor;

determine that the external object has not touched the touch sensor within a predetermined amount of time; and

change the stored threshold value back to an original value, the original value comprising a value of the stored threshold value before it was adjusted based on the determined grounding status of the touch sensor.

Claim 13 is directed towards a non-obvious improvement to a touch-sensitive device comprising a controller communicatively coupled to a plurality of sense electrodes, the controller configured to:

after adjusting the stored threshold value based on the determined grounding status of the touch sensor;

determine that the external object has not touched the touch sensor within a predetermined amount of time; and

change the stored threshold value back to an original value, the original value comprising a value of the stored threshold value before it was adjusted based on the determined grounding status of the touch sensor.

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

3. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Douglas M. Wilson whose telephone number is (571)272-5640. The examiner can normally be reached on 1000 - 1800. If attempts to

reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kathy Wang-Hurst can be reached on 571-270-5371. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

4. 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.

/Douglas M. Wilson/
Examiner, Art Unit 2694

Notice of References Cited	Application/Control No. 13/314,858	Applicant(s)/Patent Under Reexamination SIMMONS ET AL.	
	Examiner Douglas M. Wilson	Art Unit 2694	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-2008/0158146 A1	07-2008	Westerman; Wayne Carl	G06T7/401	345/156
*	B	US-7,663,607 B2	02-2010	Hotelling; Steve	G06F3/0416	178/18.01
*	C	US-2010/0073301 A1	03-2010	Yousefpor; Marduke	G06F3/044	345/173
*	D	US-2011/0015889 A1	01-2011	LAND; Brian Richards	G06F3/0418	702/104
*	E	US-2011/0012840 A1	01-2011	HOTELLING; Steven Porter	G06F3/0418	345/173
*	F	US-2011/0074725 A1	03-2011	WESTERMAN; Wayne Carl	G06F3/0418	345/174
*	G	US-7,920,129 B2	04-2011	Hotelling; Steve Porter	G06F3/0416	178/18.01
*	H	US-8,031,174 B2	10-2011	Hamblin; Mark Arthur	G06F1/1626	345/158
*	I	US-8,031,094 B2	10-2011	Hotelling; Steven Porter	H03M3/494	341/139
*	J	US-8,049,732 B2	11-2011	Hotelling; Steve Porter	G06F3/044	178/18.01
*	K	US-8,339,286 B2	12-2012	Cordeiro; Craig A.	G06F3/0418	341/20
	L	US-				
	M	US-				

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
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	Q					
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	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13314858	SIMMONS ET AL.
	Examiner	Art Unit
	DOUGLAS M WILSON	2694

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES		
Search Notes	Date	Examiner
See attached EAST search history		
Updated Search based on Amendment	6/10/2014	/D.M.W./
Updated search for prior art (detailed results attached)	12/23/2014	/D.M.W./
Updated search for prior art (detailed results attached)	6/27/2015	/D.M.W./
Updated search for prior art based on amendment (detailed results attached)	10/25/2015	/DMW/
Discussed allowance of application with Primary Examiner Patrick Moon	3/31/2016	/DMW/

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner

/DOUGLAS M WILSON/ Examiner.Art Unit 2694	

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INTERFERENCE SEARCH			
US Class/ CPC Symbol	**US Subclass / CPC Group**	**Date**	**Examiner**
Conducted an interference search using EAST and the US-PGPUB and USPAT databases. (detailed search parameters attached)	No Interferences	3/31/2016	/DMW/

/DOUGLAS M WILSON/ Examiner.Art Unit 2694	

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Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13314858	SIMMONS ET AL.
	Examiner	**Art Unit**
	DOUGLAS M WILSON	2694

CPC						
Symbol					**Type**	**Version**
G06F		3	/	044	F	2013-01-01
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CPC Combination Sets							
Symbol					**Type**	**Set**	**Ranking**	**Version**
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			/					

/DOUGLAS M WILSON/ Examiner.Art Unit 2694	03/31/2016	**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	23	
/KATHY WANG-HURST/ Supervisory Patent Examiner.Art Unit 2694	04/01/2016	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	7

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13314858	SIMMONS ET AL.
	Examiner	**Art Unit**
	DOUGLAS M WILSON	2694

US ORIGINAL CLASSIFICATION		INTERNATIONAL CLASSIFICATION										
CLASS	SUBCLASS	CLAIMED					NON-CLAIMED					
345	174	G	0	6	F	3 / 045 (2006.01.01)						
CROSS REFERENCE(S)												
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)											

/DOUGLAS M WILSON/ Examiner.Art Unit 2694	03/31/2016	**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	23	
/KATHY WANG-HURST/ Supervisory Patent Examiner.Art Unit 2694	04/01/2016	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	7

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13314858	SIMMONS ET AL.
	Examiner	**Art Unit**
	DOUGLAS M WILSON	2694

☒ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
	1		17												
	2		18												
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/DOUGLAS M WILSON/ Examiner.Art Unit 2694	03/31/2016	**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	23	
/KATHY WANG-HURST/ Supervisory Patent Examiner.Art Unit 2694	04/01/2016	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	7

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	39	("7920129" | "20110074725" | "20110012840" | "8077160" | "20110015889" | "20110074725" | "7663607" | "8031174" | "8049732" | "8339286" | "20100060608" | "20080158146" | "20100073301" | "8031094" | "20110015889" | "20110012840" | "20100073301").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2016/03/31 17:03
S1	1	"13314858"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/02/25 15:05
S2	9	"8339286"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/02/25 15:06
S3	958	charge adj return	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/02/25 15:08
S4	0	S3 and 345/173.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/02/25 15:09
S5	14	S3 and "345".clas.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/02/25 15:09
S6	2	"12504639"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/12 10:46
S7	20	(poor$2 NEAR3 ground$3) NEAR5 (finger touch digit) AND 345/173-175.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/12 10:49
S8	62	("6323846" | "7184064" | "4825374" | "6531885" | "20050219228" | "20080165115" | "5488207" | "5880411" | "5825352" | "6310610" | "20050179671" | "5335230" | "5463379" | "20090174688" | "7663607" | "20070074913" |	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/12 11:17

		"20070200831" | "3552687" | "20090194341" | "20090251423" | "20090174676" | "5835079" | "6690387" | "7015894" | "6188391" | "7069357" | "20070050646" | "20100060608" | "6504269" | "20060197753" | "20090160787" | "7254775" | "5483261" | "7180508" | "8482544" | "20060026521" | "20060097991" | "20080267462" | "20060238522" | "20090012657" | "20090284495" | "20060166702" | "20090181719" | "20080165116").PN.				
S9	20	(poor$2 NEAR3 ground$3) NEAR5 (finger touch digit) AND 345/173-175.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/12 18:00
S10	15	S9 and @ad <"20111208"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/12 18:00
S11	10	S10 and threshold	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/12 18:01
S12	8	(US-20110012840-$ or US-20110175823-$ or US-20110074725-$ or US-20100073301-$ or US-20100060608-$ or US-20090174676-$ or US-20090160787-$).did. or (US-8339286-$).did.	US-PGPUB; USPAT	OR	ON	2014/06/12 18:06
S13	8	S12 and threshold	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/12 18:07
S14	8	S13 and time	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/12 18:07
S15	4	S13 and maximum	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/12 18:07
S16	3	S15 and adapt	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/12 18:12
S17	13038	negative near5 pixel	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 11:48
S18	377616	(procedure process) near5 (calculate	US-PGPUB;	OR	ON	2014/06/13

		determine)	USPAT; USOCR; FPRS; EPO; JPO			11:49
S19	1262	S17 and S18	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 12:07
S20	9	S19 and 345/173.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 12:07
S21	9	S20 and @ad<"20111208"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 12:08
S22	62	("6323846" | "7184064" | "4825374" | "6531885" | "20050219228" | "20080165115" | "5488207" | "5880411" | "5825352" | "6310610" | "20050179671" | "5335230" | "5463379" | "20090174688" | "7663607" | "20070074913" | "20070200831" | "3552687" | "20090194341" | "20090251423" | "20090174676" | "5835079" | "6690387" | "7015894" | "6188391" | "7069357" | "20070050646" | "20100060608" | "6504269" | "20060197753" | "20090160787" | "7254775" | "5483261" | "7180508" | "8482544" | "20060026521" | "20060097991" | "20080267462" | "20060238522" | "20090012657" | "20090284495" | "20060166702" | "20090181719" | "20080165116").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 12:15
S23	20	(poor$2 NEAR3 ground$3) NEAR5 (finger touch digit) AND 345/173-175.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 12:15
S24	4	S22 and S23	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 12:15
S25	8	(US-20110012840-$ or US-20110175823-$ or US-20110074725-$ or US-20090174676-$ or US-20100060608-$ or US-20090160787-$ or US-20100073301-$).did. or (US-8339286-$).did.	US-PGPUB; USPAT	OR	ON	2014/06/13 12:25
S26	7	S25 and node	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 12:25
S27	8	"11756211"	US-PGPUB;	OR	ON	2014/06/13

			USPAT; USOCR; FPRS; EPO; JPO			12:46
S28	3652	pixel near3 calibration	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 14:33
S29	290	S28 and touch near3 (sensor panel device screen)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 14:34
S30	39	S29 and 345/173.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 14:34
S31	37	S30 and @ad < "20111208"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 14:34
S32	9	(US-20110012840-$ or US-20110175823-$ or US-20110074725-$ or US-20090174676-$ or US-20100060608-$ or US-20090160787-$ or US-20100073301-$ or US-20080309622-$).did. or (US-8339286-$).did.	US-PGPUB; USPAT	OR	ON	2014/06/13 14:58
S33	3652	pixel near3 calibration	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 14:58
S34	290	S33 and touch near3 (sensor panel device screen)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 14:58
S35	39	S34 and 345/173.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 14:58
S36	37	S35 and @ad < "20111208"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 14:58
S37	3	S36 and node	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 14:58
S38	62	("6323846" | "7184064" | "4825374" | "6531885" | "20050219228" | "20080165115" | "5488207" | "5880411" | "5825352" | "6310610" | "20050179671" | "5335230" |	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 14:59

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S39	217	(finger object) near4 over near2 node	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 15:40
S40	21	S39 and 345/173-178.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 15:41
S41	19	S40 and @ad <"20111218"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 15:41
S42	33	("6888536" | "7920129" | "20070268269" | "20100083109" | "8040326" | "20070177804" | "20070257890" | "20080062148" | "20070109279" | "20060250377" | "20080165141" | "5463388" | "20090021489" | "5825352" | "6452514" | "7663607" | "8049732" | "20090315854" | "8179381" | "20060097991" | "20070152979" | "20080246496" | "7875814" | "20070152984").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 16:06
S43	33	S42 and @ad <"20111208"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 16:06
S44	3	(US-20110074725-$ or US-20110012840-$ or US-20100097329-$).did.	US-PGPUB	OR	ON	2014/06/15 16:24
S45	2	S44 and predetermined	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/15 16:24
S46	12	(US-20110012840-$ or US-20110175823-$ or US-20110074725-$ or US-20090174676-$ or US-20100060608-$ or US-20090160787-$ or US-20100073301-$ or US-20080309622-$ or US-20100097329-$ or US-20100097328-	US-PGPUB; USPAT	OR	ON	2014/06/15 16:48

		$ or US-20090273573-$).did. or (US-8339286-$).did.				
S47	0	S46 and predetermined near5 time	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/15 16:48
S48	84	negative near2 pixel same2 predetermined near4 time	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/15 16:49
S49	80	S48 and @ad <"20111208"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/15 16:50
S50	0	S49 and 345/173-178.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/15 16:50
S51	57	periodic near4 (baseline threshold) near4 adjustment	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/15 16:51
S52	10	S51 and 345/173.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/15 16:52
S53	8	S52 and @ad <"20111208"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/15 16:52
S54	4	(US-20110074725-$ or US-20110012840-$ or US-20100097329-$).did. or (US-8077160-$).did.	US-PGPUB; USPAT	OR	ON	2014/06/15 18:28
S55	2	S54 and (graph table)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/15 18:29
S56	8	S46 and (graph table)	US-PGPUB; USPAT	OR	ON	2014/06/15 18:32
S57	5	12/208,324	US-PGPUB; USPAT	OR	ON	2014/06/15 18:53
S58	1	(US-20130147752-$).did.	US-PGPUB	OR	ON	2014/12/22 13:29
S59	3	("8482544").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/12/22 14:00
S60	12	("20050179671" | "20060166702" |	US-PGPUB;	OR	ON	2014/12/22

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		"20090181719" | "20090194341" | "20090251423" | "7180508").PN.	USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			14:00
S61	31	("20070074913" | "20070200831" | "20090012657" | "20090284495" | "20100060608" | "3552687" | "4825374" | "5335230" | "6504269" | "6531885").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/12/22 14:01
S62	46	S59 S60 S61	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/12/22 14:01
S63	45	S62 and @ad <"20111208"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/12/22 14:02
S64	0	S63 and adjust near3 (threshold baseline)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/12/22 14:03
S65	9	S63 and adjust	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/12/22 14:03
S66	5	(US-20110074725-$ or US-20110012840-$ or US-20100073301-$ or US-20070074913-$).did. or (US-8077160-$).did.	US-PGPUB; USPAT	OR	ON	2014/12/22 14:08
S67	254002	(threshold baseline reference) near3 (calculate adjust determine)	US-PGPUB; USPAT	OR	ON	2014/12/22 14:09
S68	2	S66 and S67	US-PGPUB; USPAT	OR	ON	2014/12/22 14:09
S69	1	(US-20110074725-$).did.	US-PGPUB	OR	ON	2014/12/22 15:17
S70	565	(G06F3/0418 and G06F3/044).CPC.	US-PGPUB	OR	ON	2014/12/22 15:18
S71	291	S70 and ground	US-PGPUB	OR	ON	2014/12/22 15:18
S72	6	S71 and adjust near3 threshold	US-PGPUB	OR	ON	2014/12/22 15:19
S73	4	S72 and @ad <"20111208"	US-PGPUB	OR	ON	2014/12/22 15:19

S74	1	S73 and periodic	US-PGPUB	OR	ON	2014/12/22 15:26
S75	2	S73 and (return drift)	US-PGPUB	OR	ON	2014/12/22 15:28
S76	7	"20110015889"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/12/22 15:34
S77	15	(US-20110012840-$ or US-20110175823-$ or US-20110074725-$ or US-20090174676-$ or US-20100060608-$ or US-20090160787-$ or US-20100073301-$ or US-20080309622-$ or US-20100097329-$ or US-20100097328-$ or US-20090273573-$ or US-20070074913-$ or US-20110261005-$ or US-20110115717-$).did. or (US-8339286-$).did.	US-PGPUB; USPAT	OR	ON	2015/07/01 14:25
S78	7	S77 and self	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/07/01 14:25
S79	4	(US-20110012840-$ or US-20110015889-$ or US-20110074725-$ or US-20100060608-$).did.	US-PGPUB	OR	ON	2015/10/25 16:47
S80	9326	(G06F3/0418 OR G06F3/044 OR G06F2203/04104).CPC.	US-PGPUB	OR	ON	2015/10/25 16:49
S81	95	(G06F3/0418 and G06F3/044 and G06F2203/04104).CPC.	US-PGPUB	OR	ON	2015/10/25 16:49
S82	42	S81 and @ad < "20111208"	US-PGPUB	OR	ON	2015/10/25 16:49
S83	19	S82 and ground	US-PGPUB	OR	ON	2015/10/25 16:50
S84	32	S82 and threshold	US-PGPUB	OR	ON	2015/10/25 16:57
S85	366	negative adj (touch pixel) and threshold	US-PGPUB	OR	ON	2015/10/25 17:05
S86	75	S85 and capacitance	US-PGPUB	OR	ON	2015/10/25 17:05
S87	40	S86 and @ad < "20111208"	US-PGPUB	OR	ON	2015/10/25 17:05
S88	26	(US-20110012840-$ or US-20110175823-$ or US-20110074725-$ or US-20090174676-$ or US-20100060608-$ or US-20090160787-$ or US-20100073301-$ or US-20080309622-$ or US-20100097329-$ or US-20100097328-$ or US-20090273573-$ or US-20070074913-$ or US-20110261005-$ or US-20110115717-$ or US-20120075248-$ or US-20120075250-$ or US-20120062474-$ or US-20110310040-$ or US-20110221701-$ or US-20110061949-	US-PGPUB; USPAT	OR	ON	2015/10/25 17:18

		$ or US-20080158185-$ or US-20100090967-$ or US-20080158147-$ or US-20080158146-$ or US-20110015889-$).did. or (US-8339286-$).did.				
S89	13	S88 and (adjust change set reset shift) near3 threshold	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/10/25 17:18
S90	0	S85 and compare adj graph	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/10/25 18:51
S91	116	S85 and graph	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/10/25 18:52
S92	74	S91 and @ad < "20111208"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/10/25 18:52

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L2	7006	(touch adj sensor).clm.	US-PGPUB; USPAT	OR	ON	2016/03/31 17:05
L3	123434	(threshold adj value).clm.	US-PGPUB; USPAT	OR	ON	2016/03/31 17:06
L5	380	(ground near3 (status strength)).clm.	US-PGPUB; USPAT	OR	ON	2016/03/31 17:07
L7	25	(adjust near3 stored near3 threshold).clm.	US-PGPUB; USPAT	OR	ON	2016/03/31 17:08
L8	0	2 and 3 and 5 and 7	US-PGPUB; USPAT	OR	ON	2016/03/31 17:08

3/31/2016 17:09:21
C:\Users\dwilson1\Documents\EAST\Workspaces\13314858.wsp

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Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13314858	SIMMONS ET AL.
	Examiner	**Art Unit**
	DOUGLAS M WILSON	2694

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☒ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	08/02/2013	02/26/2014	06/15/2014	12/22/2014	06/29/2015	10/25/2015	03/31/2016		
	1	✓	✓	✓	✓	✓	✓	=		
	2	✓	✓	✓	✓	✓	✓	=		
	3	✓	✓	✓	✓	✓	✓	=		
	4	✓	✓	✓	✓	✓	✓	=		
	5	✓	✓	✓	✓	✓	✓	=		
	6	✓	✓	✓	✓	✓	✓	=		
	7	✓	✓	✓	✓	✓	✓	=		
	8	✓	✓	✓	✓	✓	✓	=		
	9	✓	✓	✓	✓	✓	✓	=		
	10	✓	✓	✓	✓	✓	✓	=		
	11	✓	✓	✓	✓	✓	✓	=		
	12	✓	✓	✓	✓	✓	✓	=		
	13	✓	✓	✓	✓	✓	✓	=		
	14	✓	✓	✓	✓	✓	✓	=		
	15	✓	✓	✓	✓	✓	✓	=		
	16	✓	✓	✓	✓	✓	✓	=		
	17	✓	✓	✓	✓	✓	✓	=		
	18	✓	✓	✓	✓	✓	✓	=		
	19	O	O	✓	✓	✓	✓	=		
	20	O	O	O	O	O	O	=		
	21							=		
	22							=		
	23							=		

PTO/SB/30 (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

Address to:
Mail Stop RCE
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Application Number	13/314,858
Filing Date	December 8, 2011
First Named Inventor	Martin John Simmons
Art Unit	2694; confirm #7360
Examiner Name	Douglas M. Wilson
Attorney Docket Number	080900.1238

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. See Instruction Sheet for RCEs (not to be submitted to the USPTO) on page 2.

1. 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).

   a. ☐ 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.

      i. ☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on _____

      ii. ☐ Other _____

   b. ☑ Enclosed

      i. ☑ Amendment/Reply

      ii. ☐ Affidavit(s)/ Declaration(s)

      iii. ☐ Information Disclosure Statement (IDS)

      iv. ☐ Other _____

2. Miscellaneous

   a. ☐ 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)

   b. ☐ Other _____

3. Fees The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.

   a. ☑ The Director is hereby authorized to charge the following fees, any underpayment of fees, or credit any overpayments, to Deposit Account No. 02-0384.

      i. ☑ RCE fee required under 37 CFR 1.17(e)

      ii. ☐ Extension of time fee (37 CFR 1.136 and 1.17)

      iii. ☑ Other Each claim in excess of 20 fee (37 CFR 1.16(i))

   b. ☐ Check in the amount of $ _____ enclosed

   c. ☐ Payment by credit card (Form PTO-2038 enclosed)

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

Signature	/Bradley J. Birchfield/	Date	February 4, 2016
Name (Print/Type)	Bradley J. Birchfield	Registration No.	65,521

CERTIFICATE OF MAILING OR TRANSMISSION

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Mail Stop RCE, Commissioner for Patents, P. O. Box 1450, Alexandria, VA 22313-1450 or facsimile transmitted to the U.S. Patent and Trademark Office on the date shown below.

Signature			
Name (Print/Type)		Date	

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. DO NOT SE ND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Mail Stop RCE, 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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Named Inventor:	Martin John Simmons
Application No.:	13/314,858
Filing Date:	December 8, 2011
Art Unit:	2694
Confirmation No.:	7360
Examiner:	Douglas M. Wilson
Title:	TOUCH SENSOR WITH ADAPTIVE TOUCH DETECTION THRESHOLDING

Commissioner of Patents
PO Box 1450
Alexandria, VA 22313-1450

Dear Sir:

RESPONSE ACCOMPANYING REQUEST FOR CONTINUED EXAMINATION

In response to the Final Office Action dated November 4, 2015, Applicants respectfully request the Examiner to reconsider the rejections of the claims in view of the amendments and comments set forth below. Please amend the application as follows.

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In the Claims:

1. **(Currently Amended)** A touch sensor comprising:

a plurality of sense electrodes; and

a controller communicatively coupled to the plurality of sense electrodes, the controller configured to:

receive a plurality of signals from the plurality of sense electrodes associated with an interaction with the touch sensor by an external object, the plurality of signals indicative of an amount of capacitance between the touch sensor and the external object;

access a stored threshold value, the threshold value indicating a threshold magnitude of capacitance;

determine a grounding status of the touch sensor based on a strength of a charge return path between the touch sensor and a ground;

adjust the stored threshold value based on the determined grounding status of the touch sensor; ~~and~~

after adjusting the stored threshold value, determine whether to process the interaction as a touch by the external object based on a comparison of the amount of capacitance with the adjusted threshold ~~value, wherein:~~**value; and**

~~if the amount of capacitance is greater than the adjusted threshold value, the interaction with the touch sensor by the external object is processed as a touch by the external object; and~~

~~if the amount of capacitance is less than the adjusted threshold value, the interaction with the touch sensor by the external object is not processed as a touch by the external object.~~

after adjusting the stored threshold value based on the determined grounding status of the touch sensor:

determine that the external object has not touched the touch sensor within a predetermined amount of time; and

change the stored threshold value back to an original value, the original value comprising a value of the stored threshold value before it

was adjusted based on the determined grounding status of the touch sensor.

2. (Original) The touch sensor of Claim 1, wherein:

the plurality of sense electrodes comprises a plurality of x-axis sense electrodes and a plurality of y-axis sense electrodes;

the plurality of x-axis sense electrodes visually intersect the plurality of y-axis sense electrodes; and

the visual intersections of the x-axis sense electrodes and the y-axis sense electrodes comprises a plurality of nodes.

3. (Previously Presented) The touch sensor of Claim 2, wherein determining the grounding status of the touch sensor based on the strength of the charge return path between the touch sensor and ground comprises:

determining that the external object has touched the touch sensor at a location that at least partially covers a particular one of the nodes;

determining a maximum magnitude of a particular signal received from sense electrodes associated with the particular node; and

calculating a new threshold value using the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node.

4. (Previously Presented) The touch sensor of Claim 3, wherein:

calculating the new threshold value comprises multiplying the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node by a predetermined percentage; and

adjusting the stored threshold value based on the determined grounding status of the touch sensor comprises storing the calculated new threshold value as the stored threshold value.

5. (**Currently Amended**) The touch sensor of Claim 1, **wherein changing the stored threshold value back to the original value comprises**~~the controller further configured to, after adjusting the stored threshold value based on the determined grounding status of the touch sensor:~~

~~determine that the external object has not touched the touch sensor within a predetermined amount of time; and~~

periodically ~~drift~~**drifting**, at a predetermined rate, the stored threshold value back to ~~an~~ **the** original value~~, the original value comprising a value of the stored threshold value before it was adjusted based on the determined grounding status of the touch sensor~~.

6. (Previously Presented) The touch sensor of Claim 1, wherein:

adjusting the stored threshold value based on the determined grounding status of the touch sensor comprises replacing the stored threshold value with a new threshold value; and

the stored threshold value is adjusted at a predetermined rate.

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7. **(Currently Amended)** A method comprising:

receiving, by a controller coupled to a touch sensor, a plurality of signals from a plurality of sense electrodes associated with an interaction with the touch sensor by an external object, the plurality of signals indicative of an amount of capacitance between the touch sensor and the external object;

accessing, by the controller, a stored threshold value, the threshold value indicating a threshold magnitude of capacitance;

determining, by the controller, a grounding status of the touch sensor based on a strength of a charge return path between the touch sensor and a ground;

adjusting, by the controller, the stored threshold value based on the determined grounding status of the touch sensor; ~~and~~

after adjusting the stored threshold value, determining, by the controller, whether to process the interaction as a touch by the external object based on a comparison of the amount of capacitance with the adjusted threshold ~~value, wherein:~~**value; and**

~~if the amount of capacitance is greater than the adjusted threshold value, the interaction with the touch sensor by the external object is processed as a touch by the external object; and~~

~~if the amount of capacitance is less than the adjusted threshold value, the interaction with the touch sensor by the external object is not processed as a touch by the external object.~~

after adjusting the stored threshold value based on the determined grounding status of the touch sensor:

determining, by the controller, that the external object has not touched the touch sensor within a predetermined amount of time; and

changing, by the controller, the stored threshold value back to an original value, the original value comprising a value of the stored threshold value before it was adjusted based on the determined grounding status of the touch sensor.

8. (Original) The method of Claim 7, wherein:

the plurality of sense electrodes comprises a plurality of x-axis sense electrodes and a plurality of y-axis sense electrodes;

the plurality of x-axis sense electrodes visually intersect the plurality of y-axis sense electrodes; and

the visual intersections of the x-axis sense electrodes and the y-axis sense electrodes comprises a plurality of nodes.

9. (Previously Presented) The method of Claim 8, wherein determining the grounding status of the touch sensor based on the strength of the charge return path between the touch sensor and ground comprises:

determining that the external object has touched the touch sensor at a location that at least partially covers a particular one of the nodes;

determining a maximum magnitude of a particular signal received from sense electrodes associated with the particular node; and

calculating a new threshold value using the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node.

10. (Previously Presented) The method of Claim 9, wherein:

calculating the new threshold value comprises multiplying the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node by a predetermined percentage; and

adjusting the stored threshold value based on the determined grounding status of the touch sensor comprises storing the calculated new threshold value as the stored threshold value.

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11. (**Currently Amended**) The method of Claim 7, **wherein changing the stored threshold value back to the original value comprises** ~~further comprising, after adjusting the stored threshold value based on the determined grounding status of the touch sensor:~~

~~determining that the external object has not touched the touch sensor within a predetermined amount of time; and~~

periodically drifting, at a predetermined rate, the stored threshold value back to ~~an~~ **the** original value~~, the original value comprising a value of the stored threshold value before it was adjusted based on the determined grounding status of the touch sensor~~.

12. (Previously Presented) The method of Claim 7, wherein:

adjusting the stored threshold value based on the determined grounding status of the touch sensor comprises replacing the stored threshold value with a new threshold value; and

the stored threshold value is adjusted at a predetermined rate.

13. **(Currently Amended)** A touch-sensitive device comprising a controller, the controller communicatively coupled to a plurality of sense electrodes, the controller operable to:

receive a plurality of signals from the plurality of sense electrodes associated with an interaction with the touch sensor by an external object, the plurality of signals indicative of an amount of capacitance between the touch-sensitive device and the external object;

access a stored threshold value, the threshold value indicating a threshold magnitude of capacitance;

determine a grounding status of the touch sensor based on a strength of a charge return path between the touch-sensitive device and a ground;

adjust the stored threshold value based on the determined grounding status of the touch sensor; ~~and~~

after adjusting the stored threshold value, determine whether to process the interaction as a touch by the external object based on a comparison of the amount of capacitance with the adjusted threshold ~~value, wherein:~~**value; and**

~~if the amount of capacitance is greater than the adjusted threshold value, the interaction with the touch sensor by the external object is processed as a touch by the external object; and~~

~~if the amount of capacitance is less than the adjusted threshold value, the interaction with the touch sensor by the external object is not processed as a touch by the external object.~~

after adjusting the stored threshold value based on the determined grounding status of the touch sensor:

determine that the external object has not touched the touch sensor within a predetermined amount of time; and

change the stored threshold value back to an original value, the original value comprising a value of the stored threshold value before it was adjusted based on the determined grounding status of the touch sensor.

14. (Original) The touch-sensitive device of Claim 13, wherein:

the plurality of sense electrodes comprises a plurality of x-axis sense electrodes and a plurality of y-axis sense electrodes;

the plurality of x-axis sense electrodes visually intersect the plurality of y-axis sense electrodes; and

the visual intersections of the x-axis sense electrodes and the y-axis sense electrodes comprises a plurality of nodes.

15. (Previously Presented) The touch-sensitive device of Claim 14, wherein determining the grounding status of the touch sensor based on the strength of the charge return path between the touch sensor and ground comprises:

determining that the external object has touched the touch sensor at a location that at least partially covers a particular one of the nodes;

determining a maximum magnitude of a particular signal received from sense electrodes associated with the particular node; and

calculating a new threshold value using the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node.

16. (Previously Presented) The touch-sensitive device of Claim 15, wherein:

calculating the new threshold value comprises multiplying the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node by a predetermined percentage; and

adjusting the stored threshold value based on the determined grounding status of the touch sensor comprises storing the calculated new threshold value as the stored threshold value.

17. (**Currently Amended**) The touch-sensitive device of Claim 13, **wherein changing the stored threshold value back to the original value comprises**~~the controller further operable to, after adjusting the stored threshold value based on the determined grounding status of the touch sensor:~~

~~determine that the external object has not touched the touch sensor within a predetermined amount of time; and~~

periodically ~~drift~~**drifting**, at a predetermined rate, the stored threshold value back to ~~an~~ **the** original value~~, the original value comprising a value of the stored threshold value before it was adjusted based on the determined grounding status of the touch sensor~~.

18. (Previously Presented) The touch-sensitive device of Claim 13, wherein:

adjusting the stored threshold value determined grounding status of the touch sensor comprises replacing the stored threshold value with a new threshold value; and

the stored threshold value is adjusted at a predetermined rate.

19. (Previously Presented) The touch-sensitive device of Claim 13, wherein determining the grounding status of the touch sensor based on the strength of the charge return path between the touch sensor and ground comprises analyzing shapes of one or more capacitance graphs.

20. (Original) The touch-sensitive device of Claim 19, wherein analyzing shapes of one or more capacitance graphs comprises:

comparing a capacitance graph derived from plurality of signals indicative of an amount of capacitance between the touch-sensitive device and an external object with a plurality of stored capacitance graphs, the stored capacitance graphs comprising:

a grounded capacitance graph indicative of a typical touch when the touch-sensitive device is grounded; and

a floating capacitance graph indicative of a typical touch when the touch-sensitive device is floating;

determining, based on the comparison, that the touch-sensitive device is grounded if the capacitance graph matches the grounded capacitance graph; and

determining, based on the comparison, that the touch-sensitive device is floating if the capacitance graph matches the floating capacitance graph.

21. **(New)** The touch sensor of Claim 1, wherein the stored threshold value is adjusted after a predetermined number of interactions with the touch sensor by the external object.

22. **(New)** The touch sensor of Claim 1, wherein:

if the amount of capacitance is greater than the adjusted threshold value, the interaction with the touch sensor by the external object is processed as a touch by the external object; and

if the amount of capacitance is less than the adjusted threshold value, the interaction with the touch sensor by the external object is not processed as a touch by the external object.

23. **(New)** The touch sensor of Claim 1, wherein the stored threshold value is changed back to the original value only if it is determined that the external object has not touched the touch sensor within the predetermined amount of time.

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REMARKS

This Application has been carefully reviewed in light of the Final Office Action dated November 4, 2015 ("Office Action"). Applicants appreciate the Examiner's consideration of the Application. Claims 1-20 are currently pending. Claims 1-19 stand rejected, and Claim 20 stands objected to. To advance prosecution of this application, Applicants amend Claims 1, 5, 7, 11, 13 and 17. In addition, Applicants add Claims 21-23, which do not add any new subject matter. Applicants do not admit that the amendments are necessary due to the cited references or any of the Examiner's rejections. Applicants respectfully traverse the rejections and request reconsideration and allowance of all pending claims and consideration and allowance of all new claims.

Allowable Subject Mater

Applicants note with appreciation the Examiner's indication that Claim 20 would be allowable if rewritten in independent form. However, due to Applicants' belief that the independent claim from which Claim 20 depends is allowable, as demonstrated below, Applicants have chosen not to rewrite Claim 20 in independent form at this time.

Section 103 Rejections

The Office Action rejects Claims 1-2, 6-8, 12-14, and 18 under 35 U.S.C. §103(a) as allegedly being unpatentable over U.S. Patent Application Publication No. 2011/0012840 ("*Hotelling*") in view of U.S. Patent Application Publication No. 2008/0158146 ("*Westerman*"). The Office Action rejects Claims 5, 11, and 17 under 35 U.S.C. §103(a) as allegedly being unpatentable over *Hotelling* in view of *Westerman* and U.S. Patent Application Publication No. 2011/0015889 ("*Land*"). The Office Action rejects the remaining dependent claims under 35 U.S.C. 103(a) as allegedly being unpatentable over *Hotelling* in view of *Westerman* and other references. Applicants respectfully traverse these rejections and discuss amended independent Claim 1 below as an example.

Applicants respectfully submit that amended independent Claim 1 is allowable at least because the proposed *Hotelling-Westerman* combination fails to disclose, teach, or suggest at least the following features recited in amended Claim 1:

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after adjusting the stored threshold value based on the determined grounding status of the touch sensor:

determine that the external object has not touched the touch sensor within a predetermined amount of time; and

change the stored threshold value back to an original value, the original value comprising a value of the stored threshold value before it was adjusted based on the determined grounding status of the touch sensor.

The Office Action relies on figure 8d, "table 1," and 16:15-55 of *Land* for a previous version of this portion of Claim 1 with respect to dependent Claim 5. (Office Action, pages 11-12.) Specifically, the Office Action states that the cited portion of *Land* "teaches reducing sensor offset by Q where Q is a predetermined number, step 828 teaches increasing sensor offset by P where P is a predetermined number, since sensor baseline+ sensor offset= sensor output the effect of raising or lowering the sensor offset is equivalent to raising or lowering the touch threshold." (*Id.*) However, this is incorrect. While the cited portions of *Land* may disclose a periodic baseline adjustment algorithm, they do not disclose, teach, or suggest a controller that is configured to "after adjusting the stored threshold value based on the determined grounding status of the touch sensor: ***determine that the external object has not touched the touch sensor within a predetermined amount of time***; and change the stored threshold value ***back to an original value***, the original value comprising a value of the stored threshold value ***before it was adjusted based on the determined grounding status of the touch sensor***," as recited in amended Claim 1. According to the cited portions of *Land*:

FIG. 8 d illustrates an exemplary periodic baseline adjustment algorithm according to some embodiments of this invention. The periodic baseline adjustment algorithm can increment or decrement individual baseline sensor output values by one count or unit, or some small value. This periodic baseline adjustment algorithm can be implemented independent of any other baseline algorithm described above. One purpose of this adjustment mode is to provide periodic fine-tuning of the baseline to track temperature drift.

To perform periodic baseline adjustment, at step 822 a scan of the sensor panel is performed after a dynamic adjustment time interval has passed. This time interval is generally much longer than the frame rate (the time it takes to scan the entire sensor panel one time). Previously computed offset values are subtracted from the sensor output values to normalize them at step 824, and all normalized sensor output values that are positive and negative are identified at step 826. For any normalized sensor values that are positive, the offset values are incremented by P at step 828, where P may be one count, or a small value,

or a percentage of the positive value. For any normalized sensor values that are negative, the offset values are decremented by Q at step 830, where Q may be one count, or a small value, or a percentage of the negative value. The adjustment interval may be modified at step 832, and then the algorithm waits the duration of the adjustment period before scanning the panel again at step 822.

The adjustment interval can vary. Dynamic adjustment intervals allow quick recovery for slight baseline inversions (e.g. heating on columns w/ negative temperature coefficient) without adapting out far-field or touch objects very quickly. Adjustment intervals can depend on an average of background (non-patch) sensor output values (similar to far-field measurement but linear), computed on a periodic basis than is generally much faster then the adjustment interval. This background average represents the average sensor output values in non-touch or non-hover areas (i.e. outside of "patch" areas apparently caused by touch or hover events). One exemplary algorithm for modifying the adjustment interval in step 832 is as follows, although it should be clearly understood that the values listed therein are for purposes of illustration only, and other values can be used in accordance with the invention:

```
If background average negative
    adjust interval = 250 ms (handles fast warm-up);
else if background average took > 1 second to drift positive
    adjust interval = 1 second (to handle fast cool-down);
else if background average neutral or suddenly positive
    if Small Hover detected in previous frame
        adjust interval = 8 seconds,
    else if Finger Touch detected in previous frame
        adjust interval = 256 seconds,
    else
        adjust interval = 4 seconds (default).
```


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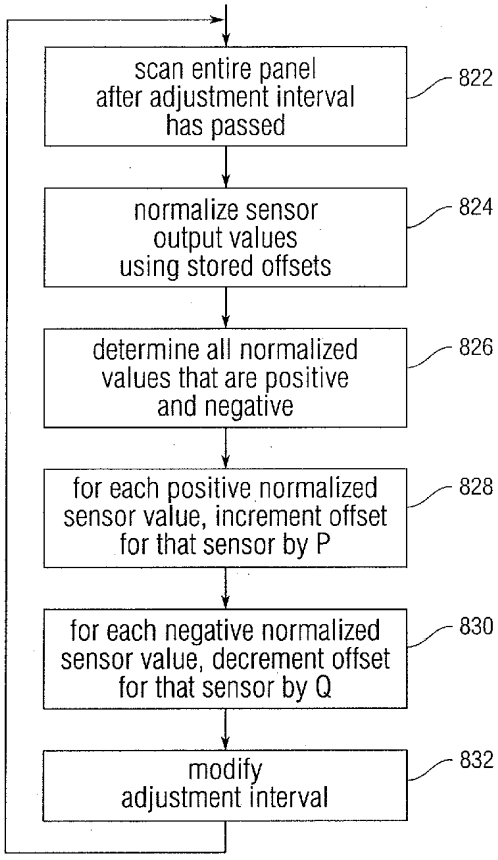


Fig. 8d

(*Land*, figure 8d, "table 1," and 16:15-55.) That is, while the cited portions of *Land* may disclose a periodic baseline adjustment algorithm where values are incremented or decremented, they do not disclose, teach, or suggest a controller that is configured to "after adjusting the stored threshold value based on the determined grounding status of the touch sensor: ***determine that the external object has not touched the touch sensor within a predetermined amount of time***; and change the stored threshold value ***back to an original value***, the original value comprising a value of the stored threshold value ***before it was adjusted based on the determined grounding status of the touch sensor***," as recited in amended Claim 1. The cited portions of *Hotelling* and *Westerman* do not cure these deficiencies of *Land*. Consequently, the proposed combination fails to disclose, teach, or suggest each and every element of amended Claim 1.

For at least these reasons, amended independent Claim 1 and its dependent claims are allowable. For at least certain analogous reasons, amended independent Claims 7 and 13 and their dependent claims are also allowable. Accordingly, Applicants respectfully request reconsideration and allowance of all pending claims.

No Waiver

Applicants' arguments and amendments are made without prejudice or disclaimer. By not responding to additional statements made by the Examiner, Applicants do not acquiesce to the additional statements. The distinctions between the applied references and the claims are provided as examples only and are sufficient to overcome the rejections. Applicants reserve the right to discuss additional or other distinctions in a later response or on appeal, if appropriate.

Request for Evidentiary Support

Should any of the above asserted rejections be maintained, Applicants respectfully request appropriate evidentiary support. Additionally, if the Examiner is relying upon "common knowledge" or "well known" principles to establish a rejection, Applicants request that a reference be provided in support of this position pursuant to M.P.E.P. § 2144.03. Furthermore, to the extent that the Examiner maintains any rejection based on an "Official Notice" or other information within the Examiner's personal knowledge, Applicants respectfully request that the Examiner cite a reference as documentary evidence in support of this position or provide an affidavit in accordance with M.P.E.P. § 2144.03 and 37 C.F.R. 1.104(d)(2).

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CONCLUSION

Applicants have made an earnest attempt to place this case in condition for allowance. For the foregoing reasons and for other reasons clearly apparent, Applicants respectfully request reconsideration and full allowance of all pending claims.

If the Examiner feels that a telephone conference would advance prosecution of this application in any manner, the Examiner is invited to contact Bradley J. Birchfield, Attorney for Applicants, at the Examiner's convenience at brad.birchfield@bakerbotts.com or Telephone 214.953.6570.

The Commissioner is hereby authorized to charge the fee of $240.00 for amending the claims to include three additional claims over twenty. The Commissioner is hereby authorized to charge any necessary fees and credit any overpayments to Deposit Account No. 02-0384 of BAKER BOTTS L.L.P.

Respectfully submitted,

BAKER BOTTS L.L.P.
Attorneys for Applicants



Bradley J. Birchfield
Reg. No. 65,521
Tel. 214-953-6570

Date: February 4, 2016

Correspondence Address:
Customer Number: **12323**

Electronic Patent Application Fee Transmittal

Application Number:	13314858
Filing Date:	08-Dec-2011
Title of Invention:	Touch Sensor With Adaptive Touch Detection Thresholding
First Named Inventor/Applicant Name:	Martin John Simmons
Filer:	Chad D Terrell/Sue LeRoy
Attorney Docket Number:	080900.1238

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:				
Claims in Excess of 20	1202	3	80	240
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**240**

Electronic Acknowledgement Receipt

EFS ID:	24825452
Application Number:	13314858
International Application Number:	
Confirmation Number:	7360
Title of Invention:	Touch Sensor With Adaptive Touch Detection Thresholding
First Named Inventor/Applicant Name:	Martin John Simmons
Customer Number:	12323
Filer:	Chad D Terrell/Sue LeRoy
Filer Authorized By:	Chad D Terrell
Attorney Docket Number:	080900.1238
Receipt Date:	04-FEB-2016
Filing Date:	08-DEC-2011
Time Stamp:	16:08:06
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$240
RAM confirmation Number	2906
Deposit Account	020384
Authorized User	BAKER & BOTTS, LLP

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 CFR 1.16 (National application filing, search, and examination fees)

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)	1238RCEtrans.pdf	86251 85d41d0b80ab5174e0cece81fd21d94f8fd0ed43	no	1
Warnings:					
This is not a USPTO supplied RCE SB30 form.					
Information:					
2		1238AmdRespRCE.pdf	305058 9a5d11654f2472fd7cde8bc33ed35c90c4f5c1d3	yes	17

	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	17

Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	30212 757096231ec3e664e7d0c3a7c08faf2148894bf3	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	421521	

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.

Electronic Patent Application Fee Transmittal

Application Number:	13314858
Filing Date:	08-Dec-2011
Title of Invention:	Touch Sensor With Adaptive Touch Detection Thresholding
First Named Inventor/Applicant Name:	Martin John Simmons
Filer:	Chad D Terrell/Sue LeRoy
Attorney Docket Number:	080900.1238

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:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
RCE- 2nd and Subsequent Request	1820	1	1700	1700
		Total in USD ($)		**1700**

Electronic Acknowledgement Receipt

EFS ID:	24826569
Application Number:	13314858
International Application Number:	
Confirmation Number:	7360
Title of Invention:	Touch Sensor With Adaptive Touch Detection Thresholding
First Named Inventor/Applicant Name:	Martin John Simmons
Customer Number:	12323
Filer:	Chad D Terrell/Sue LeRoy
Filer Authorized By:	Chad D Terrell
Attorney Docket Number:	080900.1238
Receipt Date:	04-FEB-2016
Filing Date:	08-DEC-2011
Time Stamp:	16:46:50
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$1700
RAM confirmation Number	3764
Deposit Account	020384
Authorized User	BAKER & BOTTS, LLP

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 CFR 1.16 (National application filing, search, and examination fees)

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	Fee Worksheet (SB06)	fee-info.pdf	30191 012bdb035c33deeba0061e9b02a3084040 1ad615	no	2

Warnings:

Information:

Total Files Size (in bytes):	30191

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.

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 13/314,858	Filing Date 12/08/2011	☐ To be Mailed

ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =	
☐ APPLICATION SIZE FEE (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).			
☐ 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	

APPLICATION AS AMENDED – PART II

AMENDMENT **02/04/2016**

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 23	Minus	** 20	= 3	X $80 =	240
Independent (37 CFR 1.16(h))	* 3	Minus	***3	= 0	X $420 =	0
☐ Application Size Fee (37 CFR 1.16(s))						
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
					TOTAL ADD'L FEE	**240**

AMENDMENT

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =	
☐ Application Size Fee (37 CFR 1.16(s))						
☐ 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.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

LIE
/KAREN VESTAL/

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.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/314,858	12/08/2011	Martin John Simmons	080900.1238	7360

12323 7590 11/04/2015

Baker Botts L.L.P.
2001 Ross Avenue, 6th Floor
Dallas, TX 75201

EXAMINER
WILSON, DOUGLAS M

ART UNIT	PAPER NUMBER
2694	

NOTIFICATION DATE	DELIVERY MODE
11/04/2015	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):

ptomail1@bakerbotts.com
ptomail2@bakerbotts.com

Office Action Summary	Application No. 13/314,858	Applicant(s) SIMMONS ET AL.	
	Examiner Douglas Wilson	Art Unit 2694	AIA (First Inventor to File) Status 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 *15 October 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) *1-19* is/are rejected.

8)☒ Claim(s) *20* 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 or send an inquiry to 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 _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

4) ☐ Other: _____.

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DETAILED ACTION

Notice of Pre-AIA or AIA Status

1. The present application is being examined under the pre-AIA first to invent provisions.

Response to Amendment

2. Applicant's claim amendments files 15 October 2015 have been entered. Claims 1-20 are pending.

Response to Arguments

3. Applicant's arguments have been considered but are moot because the arguments do not apply to the combination of references used in the current rejection.

Claim Rejections - 35 USC § 103

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 negatived by the manner in which the invention was made.

4. This application currently names joint inventors. In considering patentability of the claims under pre-AIA 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation

under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of pre-AIA 35 U.S.C. 103(c) and potential pre-AIA 35 U.S.C. 102(e), (f) or (g) prior art under pre-AIA 35 U.S.C. 103(a).

5. Claims 1, 2, 6-8, 12-14, and 18 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Hotelling (US 2011/0012840) modified by Westerman (US 2008/0158146).

Regarding **Claim 1** (Currently Amended), Hotelling teaches a touch sensor comprising:

a plurality of sense electrodes [¶0062, fig. 8 @86b]; and

a controller [fig. 8 @84] communicatively coupled to the plurality of sense electrodes [fig. 8 @86b], the controller configured to:

receive a plurality of signals from the plurality of sense electrodes associated with an interaction with the touch sensor by an external object, the plurality of signals indicative of an amount of capacitance [¶0023 teaches C_{SIG}] between the touch sensor and the external object [¶0023];

access a stored threshold value [¶0059 teaches negative pixel compensation is accessed from a lookup table], the threshold value indicating threshold magnitude of capacitance [¶0023 teaches negative pixel compensation ($-C_{neg}$) where C_{neg} is the undesired capacitance induced by a poorly grounded system]

determine a grounding status of the touch sensor based on a strength of a charge return path [¶0055 teaches determining an analog value indicating the degree of grounding] between the touch sensor and a ground [¶0052, fig. 7 @73 teaches determining grounding status of touch panel];

adjust the stored threshold value based on the determined grounding status of the touch sensor [¶0058 teaches adjusting the negative pixel compensation by the analog value of the ground, ¶0059 teaches the negative pixel compensation can be stored in a lookup table]; and

after adjusting the stored threshold value, determine [¶0060, fig. 7 @76 teaches processing the results of the comparison of the original touch image and the adjusted negative pixel compensation to obtain touch information] whether to process the interaction as a touch by the external object based on a comparison [fig. 7 @75 teaches comparing (construed as determining the difference) the original capacitance (touch image) with adjusted compensation threshold (adjusted negative pixel compensation)] of the amount of capacitance [fig. 7 @71 teaches capturing the total capacitance from the external object touching panel] with the adjusted threshold value [fig. 7 @74 teaches determining adjusted compensation threshold (adjusted negative pixel compensation)].

Hotelling does not teach <u>if the amount of capacitance is greater than the adjusted threshold value, the interaction with the touch sensor by the external object is processed as a touch by the external object; and</u>

if the amount of capacitance is less than the adjusted threshold value, the interaction with the touch sensor by the external object is not processed as a touch by the external object.

Westerman teaches if the amount of capacitance [measured touch image] is greater than the adjusted threshold value [negative pixel compensation or noise threshold; ¶0020 and Table 1 teach the pixel capacitance is measured touch image minus noise threshold, a positive number], the interaction with the touch sensor by the external object is processed as a touch by the external object [fig. 1 @110-130 illustrates further processing of CNST]; and

if the amount of capacitance is less than the adjusted threshold value [Table 1 teaches pixel capacitance is equal to the background value; ¶0020 teaches background value is set at zero], the interaction with the touch sensor by the external object is not processed as a touch by the external object. [CNST of zero is not processed because there is nothing to process]

At the time of the invention it would have been obvious to modify the touch detection controller, taught by Hotelling, so that if the amount of capacitance is greater than the adjusted threshold value, the interaction with the touch sensor by the external object is processed as a touch by the external object and if the amount of capacitance is less than the adjusted threshold value, the interaction with the touch sensor by the external object is not processed as a touch by the external object, as taught by Westerman, in order to smooth a touch image prior to segmentation, reduce the number of spurious peaks and help reduce over segmentation [Westerman: ¶0019]

Regarding **Claim 2** (Original), Hotelling modified by Westerman teaches the touch sensor of Claim 1, wherein:

the plurality of sense electrodes comprises a plurality of x-axis sense electrodes and a plurality of y-axis sense electrodes [Hotelling: ¶0041 teaches self-capacitance mode with multiple sense electrodes];

the plurality of x-axis sense electrodes visually intersect the plurality of y-axis electrodes [Hotelling: fig. 8 @86]; and the visual intersection of the x-axis sense electrodes and the y-axis electrodes comprises a plurality of nodes [fig. 8 @86a]

Regarding **Claim 6** (Previously Presented), Hotelling modified by Westerman teaches the touch sensor of Claim 1, wherein: adjusting the stored threshold value based on the determined grounding status of the touch sensor comprises

replacing the stored threshold value with a new threshold value [Hotelling: fig. 7 element 75, ¶0058, teaches adjusting the negative pixel compensation (threshold value) and fig. 7 element 76 teaches then using the new negative pixel compensation (threshold value) to process the touch image]; and

the stored threshold value is adjusted at a predetermined rate [Hotelling: Stored negative pixel compensation (stored threshold value) is adjusted at the rate the grounding status is determined (fig. 7 @73)].

Regarding **Claim 7** (Currently Amended), method Claim 7 is discussed in the rejection of apparatus Claim 1, therefore Claim 7 is rejected for the same reasons as Claim 1.

Regarding **Claim 8** (Original), method Claim 8 is discussed in the rejection of apparatus Claim 2, therefore Claim 8 is rejected for the same reasons as Claim 2.

Regarding **Claim 12** (Previously Presented), method Claim 12 is discussed in the rejection of apparatus Claim 6, therefore Claim 12 is rejected for the same reasons as Claim 6.

Regarding **Claim 13** (Currently Amended), apparatus Claim 13 is discussed in the rejection of apparatus Claim 1, therefore Claim 13 is rejected for the same reasons as Claim 1.

Regarding **Claim 14** (Original), apparatus Claim 14 is discussed in the rejection of apparatus Claim 2, therefore Claim 14 is rejected for the same reasons as Claim 2.

Regarding **Claim 18** (Previously Presented), apparatus Claim 18 is discussed in the rejection of apparatus Claim 6, therefore Claim 18 is rejected for the same reasons as Claim 6.

6. Claims 3-4, 9-10, and 15-16 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Hotelling modified by Westerman modified by Westerman '725 (US 2011/0074725).

Regarding **Claim 3** (Previously Presented), Hotelling modified by Westerman teaches the touch sensor of Claim 2, wherein determining the grounding status of the touch sensor based on the strength of the charge return path between the touch sensor and ground comprises:

Hotelling modified by Westerman does not teach determining that the external object has touched the touch sensor at a location that at least partially covers a particular one of the nodes

determining a maximum magnitude of a particular signal received from sense electrodes associated with the particular node; and

calculating a new threshold value using the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node.

Westerman '725 teaches determining that the external object has touched the touch sensor at a location that at least partially covers a particular one of the nodes [¶0028 teaches an object touching a touch panel causing a touch signal which indicates the particular node where the touch occurred]

determining a maximum magnitude of a particular signal received from sense electrodes associated with the particular node [¶0039 teaches calculating the actual touch signal value ($\Delta C_{sig(i,j)}$)at a node from the measured ($\Delta C_{sig\ m(i,j)}$)]; and

calculating a new threshold value using the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node. [¶0039 teaches determining the negative pixel compensation as a function of ($\Delta C_{sig\ m(i,j)}$)].

At the time of the invention it would have been obvious to one of ordinary skill in the art to modify the touch panel taught by Hotelling modified by Westerman so that determining that the external object has touched the touch sensor at a location that at least partially covers a particular one of the nodes, determining a maximum magnitude of a particular signal received from sense electrodes associated with the particular node, and calculating a new threshold value using the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node, as taught by Westerman '725, in order to determine the threshold signal from the measured signals.

Regarding **Claim 4** (Previously Presented), Hotelling modified by Westerman modified by Westerman '725 teaches the touch sensor of Claim 3, wherein:

calculating the new threshold value comprises multiplying the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node by a predetermined percentage [Hotelling: ¶0057 teaches multiplying the maximum pixel signal by a scaling factor based on the extent of the device grounding]; and

adjusting the stored threshold value based on the determined grounding status of the touch sensor comprises storing the calculated new threshold value as the stored threshold value [¶0058 teaches determining an adjusted negative pixel compensation (threshold), fig. 8@84c indicates storage where the newly determined negative pixel compensation is stored until used in fig. 7 @75]

Regarding **Claim 9** (Previously Presented), method Claim 9 is discussed in the rejection of apparatus Claim 3, therefore Claim 9 is rejected for the same reasons as Claim 3.

Regarding **Claim 10** (Previously Presented), method Claim 10 is discussed in the rejection of apparatus Claim 4, therefore Claim 10 is rejected for the same reasons as Claim 4.

Regarding **Claim 15** (Previously Presented), apparatus Claim 15 is discussed in the rejection of apparatus Claim 3, therefore Claim 15 is rejected for the same reasons as Claim 3.

Regarding **Claim 16** (Previously Presented), apparatus Claim 16 is discussed in the rejection of apparatus Claim 4, therefore Claim 16 is rejected for the same reasons as Claim 4.

7. Claims 5, 11, and 17 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Hotelling modified by Westerman modified by Land (US 2011/0015889).

Regarding **Claim 5** (Previously Presented), Hotelling modified by Westerman teaches the touch sensor of Claim 1, the controller further configured to, after adjusting the stored threshold value based on the determined grounding status of the touch sensor:

Hotelling modified by Westerman does not teach determining that the external object has not touched the touch sensor within a predetermined amount of time; and

periodically drift, at a predetermined rate, the stored threshold value back to an original value, the original value comprising a value of the stored threshold value before it was adjusted based on the determined grounding status of the touch sensor.

However, Land teaches determining that the external object has not touched the touch sensor within a predetermined amount of time; and [table 1 indicates background adjustment rate of every 4 seconds unless a touch occurs]

periodically drift, at a predetermined rate, the stored threshold value back to an original value, the original value comprising a value of the stored threshold value before it was adjusted based on the determined grounding status of the touch sensor. [col. 16 lines 15-55, fig. 8d step 830 teaches reducing sensor offset by Q where Q is a predetermined number, step 828 teaches increasing sensor offset by P where P is a

predetermined number, since sensor baseline + sensor offset = sensor output the effect of raising or lowering the sensor offset is equivalent to raising or lowering the touch threshold]

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the touch controller taught by Hotelling modified by Westerman to determine that the external object has not touched the touch sensor within a predetermined amount of time and periodically drift, at a predetermined rate, the stored threshold value back to an original value, the original value comprising a value of the stored threshold value before it was adjusted based on the determined grounding status of the touch sensor, as taught by Land, in order to allow periodic adjustment of the magnitude of a detected signal required to cause a touch detection.

Regarding **Claim 11** (Previously Presented), method Claim 11 is discussed in the rejection of apparatus Claim 5, therefore Claim 11 is rejected for the same reasons as Claim 5.

Regarding **Claim 17** (Previously Presented), apparatus Claim 17 is discussed in the rejection of apparatus Claim 5, therefore Claim 17 is rejected for the same reasons as Claim 5.

8. Claim 19 is rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Hotelling modified by Westerman modified by Yousefpor (US 2010/0073301).

Regarding **Claim 19** (Previously Presented), Hotelling modified by Westerman teaches the touch-sensitive device of Claim 13

Hotelling does not teach determining the grounding status of the touch sensor based on the strength of the charge return path between the touch sensor and ground comprises: analyzing shapes of one or more capacitance graphs.

Yousefpor teaches determining the grounding status of the touch sensor based on the strength of the charge return path between the touch sensor and ground comprises: analyzing shapes of one or more capacitance graphs [fig. 6, ¶0067]

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the touch controller taught by Hotelling to determining the grounding status of the touch sensor based on the strength of the charge return path between the touch sensor and ground comprises: analyzing shapes of one or more capacitance graphs, as taught by Yousefpor, in order to determine grounding status of a device by measuring capacitance.

Allowable Subject Matter

9. Claim 20 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

10. 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.

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Douglas Wilson whose telephone number is (571)272-5640. The examiner can normally be reached on 0900 - 1700. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kathy Wang-Hurst

can be reached on 571-270-5371. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

12. 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.

/Douglas Wilson/
Examiner, Art Unit 2694

/KATHY WANG-HURST/
Supervisory Patent Examiner, Art Unit 2694

Notice of References Cited	Application/Control No. 13/314,858	Applicant(s)/Patent Under Reexamination SIMMONS ET AL.	
	Examiner Douglas Wilson	Art Unit 2694	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-2008/0158146 A1	07-2008	Westerman; Wayne Carl	G06T7/401	345/156
*	B	US-2010/0073301 A1	03-2010	Yousefpor; Marduke	G06F3/044	345/173
*	C	US-2011/0012840 A1	01-2011	HOTELLING; Steven Porter	G06F3/044	345/173
*	D	US-2011/0015889 A1	01-2011	LAND; Brian Richards	G06F3/0418	702/104
*	E	US-2011/0074725 A1	03-2011	WESTERMAN; Wayne Carl	G06F3/0418	345/174
	F	US-				
	G	US-				
	H	US-				
	I	US-				
	J	US-				
	K	US-				
	L	US-				
	M	US-				

FOREIGN PATENT DOCUMENTS

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NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
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*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13314858	SIMMONS ET AL.
	Examiner	Art Unit
	DOUGLAS M WILSON	2694

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES		
Search Notes	Date	Examiner
See attached EAST search history		
Updated Search based on Amendment	6/10/2014	/D.M.W./
Updated search for prior art (detailed results attached)	12/23/2014	/D.M.W./
Updated search for prior art (detailed results attached)	6/27/2015	/D.M.W./
Updated search for prior art based on amendment (detailed results attached)	10/25/2015	/DMW/

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner

/DOUGLAS M WILSON/ Examiner.Art Unit 2694	

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EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	4	(US-20110012840-$ or US-20110015889-$ or US-20110074725-$ or US-20100060608-$).did.	US-PGPUB	OR	ON	2015/10/25 16:47
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L5	19	4 and ground	US-PGPUB	OR	ON	2015/10/25 16:50
L6	32	4 and threshold	US-PGPUB	OR	ON	2015/10/25 16:57
L7	366	negative adj (touch pixel) and threshold	US-PGPUB	OR	ON	2015/10/25 17:05
L8	75	7 and capacitance	US-PGPUB	OR	ON	2015/10/25 17:05
L9	40	8 and @ad <"20111208"	US-PGPUB	OR	ON	2015/10/25 17:05
L10	26	(US-20110012840-$ or US-20110175823-$ or US-20110074725-$ or US-20090174676-$ or US-20100060608-$ or US-20090160787-$ or US-20100073301-$ or US-20080309622-$ or US-20100097329-$ or US-20100097328-$ or US-20090273573-$ or US-20070074913-$ or US-20110261005-$ or US-20110115717-$ or US-20120075248-$ or US-20120075250-$ or US-20120062474-$ or US-20110310040-$ or US-20110221701-$ or US-20110061949-$ or US-20080158185-$ or US-20100090967-$ or US-20080158147-$ or US-20080158146-$ or US-20110015889-$).did. or (US-8339286-$).did.	US-PGPUB; USPAT	OR	ON	2015/10/25 17:18
L11	13	10 and (adjust change set reset shift) near3 threshold	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/10/25 17:18
L15	0	7 and compare adj graph	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/10/25 18:51

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S2	9	"8339286"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/02/25 15:06
S3	958	charge adj return	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/02/25 15:08
S4	0	S3 and 345/173.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/02/25 15:09
S5	14	S3 and "345".clas.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/02/25 15:09
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S14	8	S13 and time	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/12 18:07
S15	4	S13 and maximum	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/12 18:07
S16	3	S15 and adapt	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/12 18:12
S17	13038	negative near5 pixel	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 11:48
S18	377616	(procedure process) near5 (calculate determine)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 11:49
S19	1262	S17 and S18	US-PGPUB;	OR	ON	2014/06/13

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S26	7	S25 and node	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 12:25
S27	8	"11756211"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 12:46
S28	3652	pixel near3 calibration	US-PGPUB;	OR	ON	2014/06/13

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S29	290	S28 and touch near3 (sensor panel device screen)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 14:34
S30	39	S29 and 345/173.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 14:34
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		"6690387" | "7015894" | "6188391" | "7069357" | "20070050646" | "20100060608" | "6504269" | "20060197753" | "20090160787" | "7254775" | "5483261" | "7180508" | "8482544" | "20060026521" | "20060097991" | "20080267462" | "20060238522" | "20090012657" | "20090284495" | "20060166702" | "20090181719" | "20080165116").PN.				
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S41	19	S40 and @ad <"20111218"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 15:41
S42	33	("6888536" | "7920129" | "20070268269" | "20100083109" | "8040326" | "20070177804" | "20070257890" | "20080062148" | "20070109279" | "20060250377" | "20080165141" | "5463388" | "20090021489" | "5825352" | "6452514" | "7663607" | "8049732" | "20090315854" | "8179381" | "20060097991" | "20070152979" | "20080246496" | "7875814" | "20070152984").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 16:06
S43	33	S42 and @ad <"20111208"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 16:06
S44	3	(US-20110074725-$ or US-20110012840-$ or US-20100097329-$).did.	US-PGPUB	OR	ON	2014/06/15 16:24
S45	2	S44 and predetermined	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/15 16:24
S46	12	(US-20110012840-$ or US-20110175823-$ or US-20110074725-$ or US-20090174676-$ or US-20100060608-$ or US-20090160787-$ or US-20100073301-$ or US-20080309622-$ or US-20100097329-$ or US-20100097328-$ or US-20090273573-$).did. or (US-8339286-$).did.	US-PGPUB; USPAT	OR	ON	2014/06/15 16:48
S47	0	S46 and predetermined near5 time	US-PGPUB; USPAT; USOCR;	OR	ON	2014/06/15 16:48

			FPRS; EPO; JPO			
S48	84	negative near2 pixel same2 predetermined near4 time	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/15 16:49
S49	80	S48 and @ad <"20111208"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/15 16:50
S50	0	S49 and 345/173-178.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/15 16:50
S51	57	periodic near4 (baseline threshold) near4 adjustment	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/15 16:51
S52	10	S51 and 345/173.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/15 16:52
S53	8	S52 and @ad <"20111208"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/15 16:52
S54	4	(US-20110074725-$ or US-20110012840-$ or US-20100097329-$).did. or (US-8077160-$).did.	US-PGPUB; USPAT	OR	ON	2014/06/15 18:28
S55	2	S54 and (graph table)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/15 18:29
S56	8	S46 and (graph table)	US-PGPUB; USPAT	OR	ON	2014/06/15 18:32
S57	5	12/208,324	US-PGPUB; USPAT	OR	ON	2014/06/15 18:53
S58	1	(US-20130147752-$).did.	US-PGPUB	OR	ON	2014/12/22 13:29
S59	3	("8482544").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/12/22 14:00
S60	12	("20050179671" | "20060166702" | "20090181719" | "20090194341" | "20090251423" | "7180508").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT;	OR	ON	2014/12/22 14:00

			IBM_TDB			
S61	31	("20070074913" | "20070200831" | "20090012657" | "20090284495" | "20100060608" | "3552687" | "4825374" | "5335230" | "6504269" | "6531885").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/12/22 14:01
S62	46	S59 S60 S61	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/12/22 14:01
S63	45	S62 and @ad <"20111208"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/12/22 14:02
S64	0	S63 and adjust near3 (threshold baseline)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/12/22 14:03
S65	9	S63 and adjust	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/12/22 14:03
S66	5	(US-20110074725-$ or US-20110012840-$ or US-20100073301-$ or US-20070074913-$).did. or (US-8077160-$).did.	US-PGPUB; USPAT	OR	ON	2014/12/22 14:08
S67	254002	(threshold baseline reference) near3 (calculate adjust determine)	US-PGPUB; USPAT	OR	ON	2014/12/22 14:09
S68	2	S66 and S67	US-PGPUB; USPAT	OR	ON	2014/12/22 14:09
S69	1	(US-20110074725-$).did.	US-PGPUB	OR	ON	2014/12/22 15:17
S70	565	(G06F3/0418 and G06F3/044).CPC.	US-PGPUB	OR	ON	2014/12/22 15:18
S71	291	S70 and ground	US-PGPUB	OR	ON	2014/12/22 15:18
S72	6	S71 and adjust near3 threshold	US-PGPUB	OR	ON	2014/12/22 15:19
S73	4	S72 and @ad <"20111208"	US-PGPUB	OR	ON	2014/12/22 15:19
S74	1	S73 and periodic	US-PGPUB	OR	ON	2014/12/22 15:26
S75	2	S73 and (return drift)	US-PGPUB	OR	ON	2014/12/22 15:28

S76	7	"20110015889"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/12/22 15:34
S77	15	(US-20110012840-$ or US-20110175823-$ or US-20110074725-$ or US-20090174676-$ or US-20100060608-$ or US-20090160787-$ or US-20100073301-$ or US-20080309622-$ or US-20100097329-$ or US-20100097328-$ or US-20090273573-$ or US-20070074913-$ or US-20110261005-$ or US-20110115717-$).did. or (US-8339286-$).did.	US-PGPUB; USPAT	OR	ON	2015/07/01 14:25
S78	7	S77 and self	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/07/01 14:25

10/ 25/ 2015 19:08:40
C:\ Users\ dwilson1\ Documents\ EAST\ Workspaces\ 13314858.wsp

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Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13314858	SIMMONS ET AL.
	Examiner	Art Unit
	DOUGLAS M WILSON	2694

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	08/02/2013	02/26/2014	06/15/2014	12/22/2014	06/29/2015	10/25/2015			
	1	✓	✓	✓	✓	✓	✓			
	2	✓	✓	✓	✓	✓	✓			
	3	✓	✓	✓	✓	✓	✓			
	4	✓	✓	✓	✓	✓	✓			
	5	✓	✓	✓	✓	✓	✓			
	6	✓	✓	✓	✓	✓	✓			
	7	✓	✓	✓	✓	✓	✓			
	8	✓	✓	✓	✓	✓	✓			
	9	✓	✓	✓	✓	✓	✓			
	10	✓	✓	✓	✓	✓	✓			
	11	✓	✓	✓	✓	✓	✓			
	12	✓	✓	✓	✓	✓	✓			
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	18	✓	✓	✓	✓	✓	✓			
	19	O	O	✓	✓	✓	✓			
	20	O	O	O	O	O	O			

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Named Inventor:	Martin John Simmons
Application No.:	13/314,858
Filing Date:	December 8, 2011
Art Unit:	2694
Confirmation No.:	7360
Examiner:	Douglas M. Wilson
Title:	TOUCH SENSOR WITH ADAPTIVE TOUCH DETECTION THRESHOLDING

Commissioner of Patents
PO Box 1450
Alexandria, VA 22313-1450

Dear Sir:

Response Pursuant to 37 C.F.R. § 1.111

In response to the non-final Office Action dated July 15, 2015, Applicants respectfully request the Examiner to reconsider the rejection of the claims in view of the comments and amendments set forth below. Please amend the application as follows.

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In the Claims:

1. **(Currently Amended)** A touch sensor comprising:

a plurality of sense electrodes; and

a controller communicatively coupled to the plurality of sense electrodes, the controller configured to:

receive a plurality of signals from the plurality of sense electrodes associated with an interaction with the touch sensor by an external object, the plurality of signals indicative of an amount of capacitance between the touch sensor and the external object;

access a stored threshold value, the threshold value indicating a threshold magnitude of capacitance;

determine a grounding status of the touch sensor based on a strength of a charge return path between the touch sensor and a ground;

adjust the stored threshold value based on the determined grounding status of the touch sensor; and

after adjusting the stored threshold value, determine whether to process the interaction as a touch by the external object based on a comparison of the amount of capacitance with the adjusted threshold ~~value.~~**value, wherein:**

if the amount of capacitance is greater than the adjusted threshold value, the interaction with the touch sensor by the external object is processed as a touch by the external object; and

if the amount of capacitance is less than the adjusted threshold value, the interaction with the touch sensor by the external object is not processed as a touch by the external object.

2. (Original) The touch sensor of Claim 1, wherein:

the plurality of sense electrodes comprises a plurality of x-axis sense electrodes and a plurality of y-axis sense electrodes;

the plurality of x-axis sense electrodes visually intersect the plurality of y-axis sense electrodes; and

the visual intersections of the x-axis sense electrodes and the y-axis sense electrodes comprises a plurality of nodes.

3. (Previously Presented) The touch sensor of Claim 2, wherein determining the grounding status of the touch sensor based on the strength of the charge return path between the touch sensor and ground comprises:

determining that the external object has touched the touch sensor at a location that at least partially covers a particular one of the nodes;

determining a maximum magnitude of a particular signal received from sense electrodes associated with the particular node; and

calculating a new threshold value using the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node.

4. (Previously Presented) The touch sensor of Claim 3, wherein:

calculating the new threshold value comprises multiplying the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node by a predetermined percentage; and

adjusting the stored threshold value based on the determined grounding status of the touch sensor comprises storing the calculated new threshold value as the stored threshold value.

5. (Previously Presented) The touch sensor of Claim 1, the controller further configured to, after adjusting the stored threshold value based on the determined grounding status of the touch sensor:

determine that the external object has not touched the touch sensor within a predetermined amount of time; and

periodically drift, at a predetermined rate, the stored threshold value back to an original value, the original value comprising a value of the stored threshold value before it was adjusted based on the determined grounding status of the touch sensor.

6. (Previously Presented) The touch sensor of Claim 1, wherein:

adjusting the stored threshold value based on the determined grounding status of the touch sensor comprises replacing the stored threshold value with a new threshold value; and

the stored threshold value is adjusted at a predetermined rate.

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7. **(Currently Amended)** A method comprising:

receiving, by a controller coupled to a touch sensor, a plurality of signals from a plurality of sense electrodes associated with an interaction with the touch sensor by an external object, the plurality of signals indicative of an amount of capacitance between the touch sensor and the external object;

accessing, by the controller, a stored threshold value, the threshold value indicating a threshold magnitude of capacitance;

determining, by the controller, a grounding status of the touch sensor based on a strength of a charge return path between the touch sensor and a ground;

adjusting, by the controller, the stored threshold value based on the determined grounding status of the touch sensor; and

after adjusting the stored threshold value, determining, by the controller, whether to process the interaction as a touch by the external object based on a comparison of the amount of capacitance with the adjusted threshold ~~value.~~**value, wherein:**

if the amount of capacitance is greater than the adjusted threshold value, the interaction with the touch sensor by the external object is processed as a touch by the external object; and

if the amount of capacitance is less than the adjusted threshold value, the interaction with the touch sensor by the external object is not processed as a touch by the external object.

8. (Original) The method of Claim 7, wherein:

the plurality of sense electrodes comprises a plurality of x-axis sense electrodes and a plurality of y-axis sense electrodes;

the plurality of x-axis sense electrodes visually intersect the plurality of y-axis sense electrodes; and

the visual intersections of the x-axis sense electrodes and the y-axis sense electrodes comprises a plurality of nodes.

9. (Previously Presented) The method of Claim 8, wherein determining the grounding status of the touch sensor based on the strength of the charge return path between the touch sensor and ground comprises:

determining that the external object has touched the touch sensor at a location that at least partially covers a particular one of the nodes;

determining a maximum magnitude of a particular signal received from sense electrodes associated with the particular node; and

calculating a new threshold value using the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node.

10. (Previously Presented) The method of Claim 9, wherein:

calculating the new threshold value comprises multiplying the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node by a predetermined percentage; and

adjusting the stored threshold value based on the determined grounding status of the touch sensor comprises storing the calculated new threshold value as the stored threshold value.

11. (Previously Presented) The method of Claim 7, further comprising, after adjusting the stored threshold value based on the determined grounding status of the touch sensor:

determining that the external object has not touched the touch sensor within a predetermined amount of time; and

periodically drifting, at a predetermined rate, the stored threshold value back to an original value, the original value comprising a value of the stored threshold value before it was adjusted based on the determined grounding status of the touch sensor.

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12. (Previously Presented) The method of Claim 7, wherein:

adjusting the stored threshold value based on the determined grounding status of the touch sensor comprises replacing the stored threshold value with a new threshold value; and

the stored threshold value is adjusted at a predetermined rate.

13. (**Currently Amended**) A touch-sensitive device comprising a controller, the controller communicatively coupled to a plurality of sense electrodes, the controller operable to:

receive a plurality of signals from the plurality of sense electrodes associated with an interaction with the touch sensor by an external object, the plurality of signals indicative of an amount of capacitance between the touch-sensitive device and the external object;

access a stored threshold value, the threshold value indicating a threshold magnitude of capacitance;

determine a grounding status of the touch sensor based on a strength of a charge return path between the touch-sensitive device and a ground;

adjust the stored threshold value based on the determined grounding status of the touch sensor; and

after adjusting the stored threshold value, determine whether to process the interaction as a touch by the external object based on a comparison of the amount of capacitance with the adjusted threshold ~~value.~~**value, wherein:**

if the amount of capacitance is greater than the adjusted threshold value, the interaction with the touch sensor by the external object is processed as a touch by the external object; and

if the amount of capacitance is less than the adjusted threshold value, the interaction with the touch sensor by the external object is not processed as a touch by the external object.

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14. (Original) The touch-sensitive device of Claim 13, wherein:

the plurality of sense electrodes comprises a plurality of x-axis sense electrodes and a plurality of y-axis sense electrodes;

the plurality of x-axis sense electrodes visually intersect the plurality of y-axis sense electrodes; and

the visual intersections of the x-axis sense electrodes and the y-axis sense electrodes comprises a plurality of nodes.

15. (Previously Presented) The touch-sensitive device of Claim 14, wherein determining the grounding status of the touch sensor based on the strength of the charge return path between the touch sensor and ground comprises:

determining that the external object has touched the touch sensor at a location that at least partially covers a particular one of the nodes;

determining a maximum magnitude of a particular signal received from sense electrodes associated with the particular node; and

calculating a new threshold value using the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node.

16. (Previously Presented) The touch-sensitive device of Claim 15, wherein:

calculating the new threshold value comprises multiplying the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node by a predetermined percentage; and

adjusting the stored threshold value based on the determined grounding status of the touch sensor comprises storing the calculated new threshold value as the stored threshold value.

17. (Previously Presented) The touch-sensitive device of Claim 13, the controller further operable to, after adjusting the stored threshold value based on the determined grounding status of the touch sensor:

determine that the external object has not touched the touch sensor within a predetermined amount of time; and

periodically drift, at a predetermined rate, the stored threshold value back to an original value, the original value comprising a value of the stored threshold value before it was adjusted based on the determined grounding status of the touch sensor.

18. (Previously Presented) The touch-sensitive device of Claim 13, wherein:

adjusting the stored threshold value determined grounding status of the touch sensor comprises replacing the stored threshold value with a new threshold value; and

the stored threshold value is adjusted at a predetermined rate.

19. (Previously Presented) The touch-sensitive device of Claim 13, wherein determining the grounding status of the touch sensor based on the strength of the charge return path between the touch sensor and ground comprises analyzing shapes of one or more capacitance graphs.

20. (Original) The touch-sensitive device of Claim 19, wherein analyzing shapes of one or more capacitance graphs comprises:

comparing a capacitance graph derived from plurality of signals indicative of an amount of capacitance between the touch-sensitive device and an external object with a plurality of stored capacitance graphs, the stored capacitance graphs comprising:

a grounded capacitance graph indicative of a typical touch when the touch-sensitive device is grounded; and

a floating capacitance graph indicative of a typical touch when the touch-sensitive device is floating;

determining, based on the comparison, that the touch-sensitive device is grounded if the capacitance graph matches the grounded capacitance graph; and

determining, based on the comparison, that the touch-sensitive device is floating if the capacitance graph matches the floating capacitance graph.

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REMARKS

This Application has been carefully reviewed in light of the Office Action dated July 15, 2015 ("Office Action"). Applicants appreciate the Examiner's consideration of the Application. Claims 1-20 are currently pending. To advance prosecution of this application, Applicants amend independent Claims 1, 7, and 13. Applicants do not admit that the amendments are necessary due to the cited references or any of the Examiner's rejections. Applicants respectfully traverse the rejections and request reconsideration and allowance of all pending claims.

Allowable Subject Mater

Applicants note with appreciation the Examiner's indication that Claim 20 would be allowable if rewritten in independent form. However, due to Applicants' belief that the independent claim from which Claim 20 depends is allowable, as demonstrated below, Applicants have chosen not to rewrite Claim 20 in independent form at this time.

Section 102 and 103 Rejections

The Office Action rejects Claims 1-2, 6-8, 12-14, and 18 under 35 U.S.C. §102 as being anticipated by U.S. Patent Publication No. 2011/0012840 ("*Hotelling*"). The Office Action rejects Claims 3-4, 9-10, and 15-16 under 35 U.S.C. 103(a) as being unpatentable over *Hotelling* in view of U.S. Patent Publication No. 2011/0074725 ("*Westerman*"). The Office Action rejects the remaining dependent claims under 35 U.S.C. 103(a) as being unpatentable over *Hotelling* in view of other references. Applicants respectfully traverse these rejections and discuss amended independent Claim 1 below as an example.

Applicants respectfully submit that amended independent Claim 1 is allowable at least because *Hotelling* fails to disclose, teach, or suggest at least the following features recited in amended Claim 1:

> after adjusting the stored threshold value, determine whether to process the interaction as a touch by the external object based on ***a comparison of the amount of capacitance with the adjusted threshold value***, wherein:

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> ***if the amount of capacitance is greater than the adjusted threshold value, the interaction with the touch sensor by the external object is processed as a touch by the external object; and***
>
> ***if the amount of capacitance is less than the adjusted threshold value, the interaction with the touch sensor by the external object is not processed as a touch by the external object.***

The Office Action relies on Fig. 7 and ¶ 60 of *Hotelling* for a previous version of this portion of Claim 1. (Office Action, page 6.) Specifically, the Office Action equates *Hotelling's* "negative pixel compensation" to the claimed "adjusted threshold value" of Claim 1, stating that "Hotelling teaches comparing (subtracting) the adjusted negative pixel compensation with the captured touch image (C_{sig})." (Office Action, pages 4-6.) Whether or not those statements and rejections were appropriate (which Applicants do not admit), the cited portions of *Hotelling* do not disclose, teach, or suggest a controller that is configured to "determine whether to process the interaction as a touch by the external object based on ***a comparison of the amount of capacitance with the adjusted threshold value***, wherein: ***if the amount of capacitance is greater than the adjusted threshold value, the interaction with the touch sensor by the external object is processed as a touch by the external object; and if the amount of capacitance is less than the adjusted threshold value, the interaction with the touch sensor by the external object is not processed as a touch by the external object***," as recited in amended Claim 1 (emphasis added). According to cited portions of *Hotelling*:

> [0060] The determined **negative pixel compensation can be applied to the touch image to adjust the touch signals**, thereby reducing or eliminating any negative pixel effects and providing more accurate touch signals (75). The adjusted touch image can be further processed to get touch information for use by the device (76).

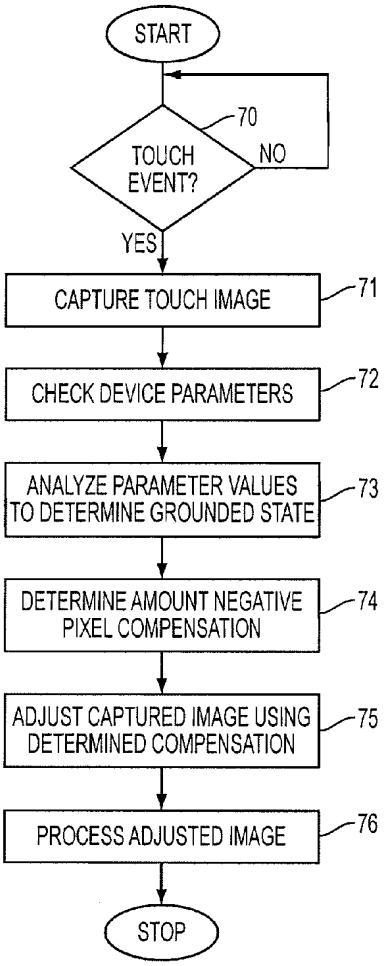


FIG. 7

(*Hotelling*, Fig. 7 and ¶ 60, emphasis added.) That is, while the cited portions of *Hotelling* may disclose a negative pixel compensation value that may be **applied** to adjust touch signals, they do not disclose, teach, or suggest a controller that is configured to "determine whether to process the interaction as a touch by the external object based on ***a comparison of the amount of capacitance with the adjusted threshold value***, wherein: ***if the amount of capacitance is greater than the adjusted threshold value, the interaction with the touch sensor by the external object is processed as a touch by the external object; and if the amount of capacitance is less than the adjusted threshold value, the interaction with the touch sensor by the external object is not processed as a touch by the external object***," as recited in amended Claim 1 (emphasis added). Indeed, the Office Action agrees that the

negative pixel compensation value is a value that is **applied** (e.g., subtracted) by stating that "Hotelling teaches that negative pixel compensation is **applied** to eliminate the undesirable negative capacitance (C_{neg})" and "Hotelling teaches comparing (**subtracting**) the adjusted negative pixel compensation with the captured touch image (C_{sig})." (Office Action, pages 3-4, emphasis added.) Consequently, *Hotelling* fails to disclose, teach, or suggest each and every element of amended Claim 1.

For at least these reasons, amended independent Claim 1 and its dependent claims are allowable. For at least certain analogous reasons, amended independent Claims 7 and 13 and their dependent claims are also allowable. Accordingly, Applicants respectfully request reconsideration and allowance of all pending claims.

No Waiver

Applicants' arguments and amendments are made without prejudice or disclaimer. By not responding to additional statements made by the Examiner, Applicants do not acquiesce to the additional statements. The distinctions between the applied references and the claims are provided as examples only and are sufficient to overcome the rejections. Applicants reserve the right to discuss additional or other distinctions in a later response or on appeal, if appropriate.

Request for Evidentiary Support

Should any of the above asserted rejections be maintained, Applicants respectfully request appropriate evidentiary support. Additionally, if the Examiner is relying upon "common knowledge" or "well known" principles to establish a rejection, Applicants request that a reference be provided in support of this position pursuant to M.P.E.P. § 2144.03. Furthermore, to the extent that the Examiner maintains any rejection based on an "Official Notice" or other information within the Examiner's personal knowledge, Applicants respectfully request that the Examiner cite a reference as documentary evidence in support of this position or provide an affidavit in accordance with M.P.E.P. § 2144.03 and 37 C.F.R. 1.104(d)(2).

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CONCLUSION

Applicants have made an earnest attempt to place this case in condition for allowance. For the foregoing reasons and for other reasons clearly apparent, Applicants respectfully request reconsideration and full allowance of all pending claims.

If the Examiner feels that a telephone conference would advance prosecution of this application in any manner, the Examiner is invited to contact Bradley J. Birchfield, Attorney for Applicants, at the Examiner's convenience at 214.953.6570 or brad.birchfield@bakerbotts.com.

Applicants believe no fees to be currently due. However, the Commissioner is hereby authorized to charge any necessary fees and credit any overpayments to Deposit Account No. 02-0384 of BAKER BOTTS L.L.P.

Respectfully submitted,

BAKER BOTTS L.L.P.
Attorneys for Applicant



Bradley J. Birchfield
Reg. No. 65,521
Tel. 214-953-6570

Date: October 15, 2015

Correspondence Address:

Customer Number: **12323**

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Electronic Acknowledgement Receipt

EFS ID:	23798854
Application Number:	13314858
International Application Number:	
Confirmation Number:	7360
Title of Invention:	Touch Sensor With Adaptive Touch Detection Thresholding
First Named Inventor/Applicant Name:	Martin John Simmons
Customer Number:	12323
Filer:	David Gerald Wille/Sue LeRoy
Filer Authorized By:	David Gerald Wille
Attorney Docket Number:	080900.1238
Receipt Date:	15-OCT-2015
Filing Date:	08-DEC-2011
Time Stamp:	17:17:17
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		1238AmdResp.pdf	230365 c30b37f3461e6fc7f6009e072ede202eee6d6db7	yes	15

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Amendment/Req. Reconsideration-After Non-Final Reject	1	1
	Claims	2	10
	Applicant Arguments/Remarks Made in an Amendment	11	15
Warnings:			
Information:			
	Total Files Size (in bytes):	230365	

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.

PTO/SB/06 (09-11)
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 13/314,858	Filing Date 12/08/2011	☐ To be Mailed

ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =	
☐ APPLICATION SIZE FEE (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).			
☐ 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	

APPLICATION AS AMENDED – PART II

AMENDMENT **10/15/2015**

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) 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
☐ Application Size Fee (37 CFR 1.16(s))						
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
					TOTAL ADD'L FEE	0

AMENDMENT

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =	
☐ Application Size Fee (37 CFR 1.16(s))						
☐ 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.

** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

LIE
/MARCUS PRIDGEN/

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.
13/314,858	12/08/2011	Martin John Simmons	080900.1238	7360

12323 7590 07/15/2015

Baker Botts L.L.P.
2001 Ross Avenue, 6th Floor
Dallas, TX 75201

EXAMINER	
WILSON, DOUGLAS M	

ART UNIT	PAPER NUMBER
2694	

NOTIFICATION DATE	DELIVERY MODE
07/15/2015	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):

ptomail1@bakerbotts.com
ptomail2@bakerbotts.com

Office Action Summary	Application No. 13/314,858	Applicant(s) SIMMONS ET AL.	
	Examiner Douglas M. Wilson	Art Unit 2694	AIA (First Inventor to File) Status 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 *31 March 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) *1-19* is/are rejected.

8)☒ Claim(s) *20* 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 or send an inquiry to 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 _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

4) ☐ Other: _____.

DETAILED ACTION

Notice of Pre-AIA or AIA Status

1. The present application is being examined under the pre-AIA first to invent provisions.

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 31 March 2015 has been entered.

Response to Arguments

3. Applicant's arguments filed 31 March 2015 have been fully considered but they are not persuasive.

Applicant presents three assertions supporting an argument that Hotelling (US 2011/0012840) does not teach the amended Claim 1 limitation "after adjusting the stored threshold value, determine whether to process the interaction as a touch by the external object based on a comparison of the amount of capacitance with the adjusted threshold value"

First, Applicant asserts that Hotelling teaches fig. 7 @70 (determining whether a touch event has occurred) is the touch determination required by the Claim 1 limitation "determine whether to process the interaction as a touch by the external object".

The Examiner respectfully disagrees with Applicant's first assertion. In ¶0023 Hotelling teaches correcting the detected mutual capacitance (C_{sig}) to determine a "true touch event". In fig. 7, Hotelling teaches a method of detecting a total capacitance (C_{sig}) (fig. 7 @70) that is corrected by removing the undesirable charge coupling negative capacitance (C_{neg}) (fig. 7 @75) and then the resultant is processed to provide touch information for the device (fig. 7 @76). The touch information provided to the device is the "touch" required by Claim 1.

Second, Applicant asserts that Hotelling fails to teach the amended Claim 1 limitation "access a stored threshold value, the threshold value indicating a threshold magnitude of capacitance".

The Examiner respectfully disagrees with the Applicant's second assertion. In ¶0059 Hotelling teaches the negative pixel compensation can be stored in a lookup table. In ¶0023 Hotelling teaches that negative pixel compensation is applied to eliminate the undesirable negative capacitance (C_{neg}). The compensation applied to remove a negative capacitance is a positive capacitance. Therefore pixel compensation is equivalent to a value of capacitance.

Third, Applicant asserts that Hotelling does not teach the Claim 1 limitation "a threshold value indicating a threshold magnitude of capacitance".

The Examiner respectfully disagrees with Applicant's third assertion. As discussed above the stored negative pixel compensation is a magnitude of capacitance. A threshold value is one that is compared with a second value to determine if any magnitude of the second value exists. In fig. 7 @75 Hotelling teaches comparing (subtracting) the adjusted negative pixel compensation with the captured touch image (C_{sig}). Any resultant from that comparison is processed as touch data for the device in fig. 7 @76. Therefore the stored negative pixel compensation can be considered a threshold value.

Therefore, the steps discussed above and taught by Hotelling in fig. 7, are equivalent to the Claim 1 limitation "after adjusting the stored threshold value, determine whether to process the interaction as a touch by the external object based on a comparison of the amount of capacitance with the adjusted threshold value".

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of pre-AIA 35 U.S.C. §102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

4. Claims 1, 2, 6, 7, 8, 12, 13, 14, and 18 are rejected under pre-AIA 35 U.S.C. §102(e) as being anticipated by Hotelling (US 2011/0012840).

Regarding **Claim 1** (Currently Amended), Hotelling teaches a touch sensor comprising:

a plurality of sense electrodes [¶0062, fig. 8 @86b]; and

a controller [fig. 8 @84] communicatively coupled to the plurality of sense electrodes [fig. 8 @86b], the controller configured to:

receive a plurality of signals from the plurality of sense electrodes associated with an interaction with the touch sensor by an external object, the plurality of signals indicative of an amount of capacitance [¶0023 teaches C_{SIG}] between the touch sensor and the external object [¶0023];

access a stored threshold value [¶0059 teaches negative pixel compensation is accessed from a lookup table], the threshold value indicating threshold magnitude of capacitance [¶0023 teaches negative pixel compensation ($-C_{neg}$) where C_{neg} is the undesired capacitance induced by a poorly grounded system]

determine a grounding status of the touch sensor based on a strength of a charge return path [¶0055 teaches determining an analog value indicating the degree of grounding] between the touch sensor and a ground [¶0052, fig. 7 @73 teaches determining grounding status of touch panel];

adjust the stored threshold value based on the determined grounding status of the touch sensor [¶0058 teaches adjusting the negative pixel compensation by the analog value of the ground, ¶0059 teaches the negative pixel compensation can be stored in a lookup table]; and

after adjusting the stored threshold value, determine [¶0060, fig. 7 @76 teaches processing the results of the comparison of the original touch image and the adjusted negative pixel compensation to obtain touch information] whether to process the interaction as a touch by the external object based on a comparison [fig. 7 @75 teaches comparing (construed as determining the difference) the original capacitance (touch image) with adjusted compensation threshold (adjusted negative pixel compensation)] of the amount of capacitance [fig. 7 @71 teaches capturing the total capacitance from the external object touching panel] with the adjusted threshold value [fig. 7 @74 teaches determining adjusted compensation threshold (adjusted negative pixel compensation)].

Regarding **Claim 2** (Original), Hotelling teaches the touch sensor of Claim 1, wherein:

the plurality of sense electrodes comprises a plurality of x-axis sense electrodes and a plurality of y-axis sense electrodes [¶0041 teaches self-capacitance mode with multiple sense electrodes];

the plurality of x-axis sense electrodes visually intersect the plurality of y-axis electrodes [fig. 8 @86]; and the visual intersection of the x-axis sense electrodes and the y-axis electrodes comprises a plurality of nodes [fig. 8 @86a]

Regarding **Claim 6** (Previously Presented), Hotelling teaches the touch sensor of Claim 1, wherein: adjusting the stored threshold value based on the determined grounding status of the touch sensor comprises

replacing the stored threshold value with a new threshold value [fig. 7 element 75, ¶0058, teaches adjusting the negative pixel compensation (threshold value) and fig. 7 element 76 teaches then using the new negative pixel compensation (threshold value) to process the touch image]; and

the stored threshold value is adjusted at a predetermined rate [Stored negative pixel compensation (stored threshold value) is adjusted at the rate the grounding status is determined (fig. 7 @73)].

Regarding **Claim 7** (Currently Amended), method Claim 7 is discussed in the rejection of apparatus Claim 1, therefore Claim 7 is rejected for the same reasons as Claim 1.

Regarding **Claim 8** (Original), method Claim 8 is discussed in the rejection of apparatus Claim 2, therefore Claim 8 is rejected for the same reasons as Claim 2.

Regarding **Claim 12** (Previously Presented), method Claim 12 is discussed in the rejection of apparatus Claim 6, therefore Claim 12 is rejected for the same reasons as Claim 6.

Regarding **Claim 13** (Currently Amended), apparatus Claim 13 is discussed in the rejection of apparatus Claim 1, therefore Claim 13 is rejected for the same reasons as Claim 1.

Regarding **Claim 14** (Original), apparatus Claim 14 is discussed in the rejection of apparatus Claim 2, therefore Claim 14 is rejected for the same reasons as Claim 2.

Regarding **Claim 18** (Previously Presented), apparatus Claim 18 is discussed in the rejection of apparatus Claim 6, therefore Claim 18 is rejected for the same reasons as Claim 6.

Claim Rejections - 35 USC § 103

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 negatived by the manner in which the invention was made.

5. This application currently names joint inventors. In considering patentability of the claims under pre-AIA 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of pre-AIA 35 U.S.C. 103(c) and potential pre-AIA 35 U.S.C. 102(e), (f) or (g) prior art under pre-AIA 35 U.S.C. 103(a).

6. Claim 3, 4, 9, 10, 15, and 16 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Hotelling modified by Westerman (US 2011/0074725).

Regarding **Claim 3** (Previously Presented), Hotelling teaches the touch sensor of Claim 2, wherein determining the grounding status of the touch sensor based on the strength of the charge return path between the touch sensor and ground comprises:

Hotelling does not teach determining that the external object has touched the touch sensor at a location that at least partially covers a particular one of the nodes

determining a maximum magnitude of a particular signal received from sense electrodes associated with the particular node; and

calculating a new threshold value using the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node.

Westerman teaches determining that the external object has touched the touch sensor at a location that at least partially covers a particular one of the nodes [¶0028 teaches an object touching a touch panel causing a touch signal which indicates the particular node where the touch occurred]

determining a maximum magnitude of a particular signal received from sense electrodes associated with the particular node [¶0039 teaches calculating the actual touch signal value ($\Delta C_{sig(i,j)}$)at a node from the measured ($\Delta C_{sig\ m(i,j)}$)]; and

calculating a new threshold value using the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node.

[¶0039 teaches determining the negative pixel compensation as a function of ($\Delta C_{sig\ m(i,j)}$)].

At the time of the invention it would have been obvious to one of ordinary skill in the art to modify the touch panel taught by Hotelling so that determining that the external object has touched the touch sensor at a location that at least partially covers a particular one of the nodes, determining a maximum magnitude of a particular signal received from sense electrodes associated with the particular node, and calculating a new threshold value using the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node, as taught by Westerman, in order to determine the threshold signal from the measured signals.

Regarding **Claim 4** (Previously Presented), Hotelling modified by Westerman teaches the touch sensor of Claim 3, wherein:

calculating the new threshold value comprises multiplying the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node by a predetermined percentage [Hotelling: ¶0057 teaches multiplying the maximum pixel signal by a scaling factor based on the extent of the device grounding]; and

adjusting the stored threshold value based on the determined grounding status of the touch sensor comprises storing the calculated new threshold value as the stored threshold value [¶0058 teaches determining an adjusted negative pixel compensation

(threshold), fig. 8@84c indicates storage where the newly determined negative pixel compensation is stored until used in fig. 7 @75]

Regarding **Claim 9** (Previously Presented), method Claim 9 is discussed in the rejection of apparatus Claim 3, therefore Claim 9 is rejected for the same reasons as Claim 3.

Regarding **Claim 10** (Previously Presented), method Claim 10 is discussed in the rejection of apparatus Claim 4, therefore Claim 10 is rejected for the same reasons as Claim 4.

Regarding **Claim 15** (Previously Presented), apparatus Claim 15 is discussed in the rejection of apparatus Claim 3, therefore Claim 15 is rejected for the same reasons as Claim 3.

Regarding **Claim 16** (Previously Presented), apparatus Claim 16 is discussed in the rejection of apparatus Claim 4, therefore Claim 16 is rejected for the same reasons as Claim 4.

7. Claims 5, 11, and 17 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Hotelling modified by Land (US 2011/0015889).

Regarding **Claim 5** (Previously Presented), Hotelling teaches the touch sensor of Claim 1, the controller further configured to, after adjusting the stored threshold value based on the determined grounding status of the touch sensor:

Hotelling does not teach determining that the external object has not touched the touch sensor within a predetermined amount of time; and

periodically drift, at a predetermined rate, the stored threshold value back to an original value, the original value comprising a value of the stored threshold value before it was adjusted based on the determined grounding status of the touch sensor.

However, Land teaches determining that the external object has not touched the touch sensor within a predetermined amount of time; and [table 1 indicates background adjustment rate of every 4 seconds unless a touch occurs]

periodically drift, at a predetermined rate, the stored threshold value back to an original value, the original value comprising a value of the stored threshold value before it was adjusted based on the determined grounding status of the touch sensor. [col. 16 lines 15-55, fig. 8d step 830 teaches reducing sensor offset by Q where Q is a predetermined number, step 828 teaches increasing sensor offset by P where P is a predetermined number, since sensor baseline + sensor offset = sensor output the effect of raising or lowering the sensor offset is equivalent to raising or lowering the touch threshold]

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the touch controller taught by Hotelling to determine that the external object has not touched the touch sensor within a predetermined amount of time and

periodically drift, at a predetermined rate, the stored threshold value back to an original value, the original value comprising a value of the stored threshold value before it was adjusted based on the determined grounding status of the touch sensor, as taught by Land, in order to allow periodic adjustment of the magnitude of a detected signal required to cause a touch detection.

Regarding **Claim 11** (Previously Presented), method Claim 11 is discussed in the rejection of apparatus Claim 5, therefore Claim 11 is rejected for the same reasons as Claim 5.

Regarding **Claim 17** (Previously Presented), apparatus Claim 17 is discussed in the rejection of apparatus Claim 5, therefore Claim 17 is rejected for the same reasons as Claim 5.

8. Claim 19 is rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Hotelling modified by Yousefpor (US 2010/0073301).

Regarding **Claim 19** (Previously Presented), Hotelling teaches the touch-sensitive device of Claim 13

Hotelling does not teach determining the grounding status of the touch sensor based on the strength of the charge return path between the touch sensor and ground comprises: analyzing shapes of one or more capacitance graphs.

However, Yousefpor teaches determining the grounding status of the touch sensor based on the strength of the charge return path between the touch sensor and ground comprises: analyzing shapes of one or more capacitance graphs [fig. 6, ¶0067]

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the touch controller taught by Hotelling to determining the grounding status of the touch sensor based on the strength of the charge return path between the touch sensor and ground comprises: analyzing shapes of one or more capacitance graphs, as taught by Yousefpor, in order to determine grounding status of a device by measuring capacitance.

Allowable Subject Matter

9. Claim 20 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Douglas M. Wilson whose telephone number is (571)272-5640. The examiner can normally be reached on 0900 - 1700. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kathy Wang-Hurst can be reached on 571-270-5371. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

11. 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.

/Douglas M Wilson/
Examiner, Art Unit 2694

/KATHY WANG-HURST/
Supervisory Patent Examiner, Art Unit 2694

Notice of References Cited	Application/Control No. 13/314,858	Applicant(s)/Patent Under Reexamination SIMMONS ET AL.	
	Examiner Douglas M. Wilson	Art Unit 2694	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-2010/0060608 A1	03-2010	YOUSEFPOR, Marduke	345/174
*	B	US-2011/0015889 A1	01-2011	LAND et al.	702/104
*	C	US-2011/0012840 A1	01-2011	HOTELLING et al.	345/173
*	D	US-2011/0074725 A1	03-2011	WESTERMAN et al.	345/174
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	1	"13314858"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/02/25 15:05
S2	9	"8339286"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/02/25 15:06
S3	958	charge adj return	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/02/25 15:08
S4	0	S3 and 345/173.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/02/25 15:09
S5	14	S3 and "345".clas.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/02/25 15:09
S6	2	"12504639"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/12 10:46
S7	20	(poor$2 NEAR3 ground$3) NEAR5 (finger touch digit) AND 345/173-175.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/12 10:49
S8	62	("6323846" | "7184064" | "4825374" | "6531885" | "20050219228" | "20080165115" | "5488207" | "5880411" | "5825352" | "6310610" | "20050179671" | "5335230" | "5463379" | "20090174688" | "7663607" | "20070074913" | "20070200831" | "3552687" | "20090194341" | "20090251423" | "20090174676" | "5835079" | "6690387" | "7015894" | "6188391" | "7069357" | "20070050646" | "20100060608" | "6504269" | "20060197753" | "20090160787" | "7254775" | "5483261" | "7180508" |	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/12 11:17

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		"8482544" | "20060026521" | "20060097991" | "20080267462" | "20060238522" | "20090012657" | "20090284495" | "20060166702" | "20090181719" | "20080165116").PN.				
S9	20	(poor$2 NEAR3 ground$3) NEAR5 (finger touch digit) AND 345/173-175.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/12 18:00
S10	15	S9 and @ad <"20111208"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/12 18:00
S11	10	S10 and threshold	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/12 18:01
S12	8	(US-20110012840-$ or US-20110175823-$ or US-20110074725-$ or US-20100073301-$ or US-20100060608-$ or US-20090174676-$ or US-20090160787-$).did. or (US-8339286-$).did.	US-PGPUB; USPAT	OR	ON	2014/06/12 18:06
S13	8	S12 and threshold	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/12 18:07
S14	8	S13 and time	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/12 18:07
S15	4	S13 and maximum	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/12 18:07
S16	3	S15 and adapt	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/12 18:12
S17	13038	negative near5 pixel	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 11:48
S18	377616	(procedure process) near5 (calculate determine)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 11:49
S19	1262	S17 and S18	US-PGPUB; USPAT; USOCR; FPRS;	OR	ON	2014/06/13 12:07

			EPO; JPO			
S20	9	S19 and 345/173.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 12:07
S21	9	S20 and @ad<"20111208"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 12:08
S22	62	("6323846" | "7184064" | "4825374" | "6531885" | "20050219228" | "20080165115" | "5488207" | "5880411" | "5825352" | "6310610" | "20050179671" | "5335230" | "5463379" | "20090174688" | "7663607" | "20070074913" | "20070200831" | "3552687" | "20090194341" | "20090251423" | "20090174676" | "5835079" | "6690387" | "7015894" | "6188391" | "7069357" | "20070050646" | "20100060608" | "6504269" | "20060197753" | "20090160787" | "7254775" | "5483261" | "7180508" | "8482544" | "20060026521" | "20060097991" | "20080267462" | "20060238522" | "20090012657" | "20090284495" | "20060166702" | "20090181719" | "20080165116").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 12:15
S23	20	(poor$2 NEAR3 ground$3) NEAR5 (finger touch digit) AND 345/173-175.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 12:15
S24	4	S22 and S23	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 12:15
S25	8	(US-20110012840-$ or US-20110175823-$ or US-20110074725-$ or US-20090174676-$ or US-20100060608-$ or US-20090160787-$ or US-20100073301-$).did. or (US-8339286-$).did.	US-PGPUB; USPAT	OR	ON	2014/06/13 12:25
S26	7	S25 and node	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 12:25
S27	8	"11756211"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 12:46
S28	3652	pixel near3 calibration	US-PGPUB; USPAT; USOCR; FPRS;	OR	ON	2014/06/13 14:33

			EPO; JPO			
S29	290	S28 and touch near3 (sensor panel device screen)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 14:34
S30	39	S29 and 345/173.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 14:34
S31	37	S30 and @ad <"20111208"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 14:34
S32	9	(US-20110012840-$ or US-20110175823-$ or US-20110074725-$ or US-20090174676-$ or US-20100060608-$ or US-20090160787-$ or US-20100073301-$ or US-20080309622-$).did. or (US-8339286-$).did.	US-PGPUB; USPAT	OR	ON	2014/06/13 14:58
S33	3652	pixel near3 calibration	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 14:58
S34	290	S33 and touch near3 (sensor panel device screen)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 14:58
S35	39	S34 and 345/173.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 14:58
S36	37	S35 and @ad <"20111208"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 14:58
S37	3	S36 and node	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 14:58
S38	62	("6323846" | "7184064" | "4825374" | "6531885" | "20050219228" | "20080165115" | "5488207" | "5880411" | "5825352" | "6310610" | "20050179671" | "5335230" | "5463379" | "20090174688" | "7663607" | "20070074913" | "20070200831" | "3552687" | "20090194341" | "20090251423" | "20090174676" | "5835079" | "6690387" | "7015894" | "6188391" | "7069357" | "20070050646" | "20100060608" | "6504269" |	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 14:59

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		"20060197753" | "20090160787" | "7254775" | "5483261" | "7180508" | "8482544" | "20060026521" | "20060097991" | "20080267462" | "20060238522" | "20090012657" | "20090284495" | "20060166702" | "20090181719" | "20080165116").PN.				
S39	217	(finger object) near4 over near2 node	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 15:40
S40	21	S39 and 345/173-178.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 15:41
S41	19	S40 and @ad <"20111218"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 15:41
S42	33	("6888536" | "7920129" | "20070268269" | "20100083109" | "8040326" | "20070177804" | "20070257890" | "20080062148" | "20070109279" | "20060250377" | "20080165141" | "5463388" | "20090021489" | "5825352" | "6452514" | "7663607" | "8049732" | "20090315854" | "8179381" | "20060097991" | "20070152979" | "20080246496" | "7875814" | "20070152984").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 16:06
S43	33	S42 and @ad <"20111208"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 16:06
S44	3	(US-20110074725-$ or US-20110012840-$ or US-20100097329-$).did.	US-PGPUB	OR	ON	2014/06/15 16:24
S45	2	S44 and predetermined	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/15 16:24
S46	12	(US-20110012840-$ or US-20110175823-$ or US-20110074725-$ or US-20090174676-$ or US-20100060608-$ or US-20090160787-$ or US-20100073301-$ or US-20080309622-$ or US-20100097329-$ or US-20100097328-$ or US-20090273573-$).did. or (US-8339286-$).did.	US-PGPUB; USPAT	OR	ON	2014/06/15 16:48
S47	0	S46 and predetermined near5 time	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/15 16:48

S48	84	negative near2 pixel same2 predetermined near4 time	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/15 16:49
S49	80	S48 and @ad <"20111208"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/15 16:50
S50	0	S49 and 345/173-178.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/15 16:50
S51	57	periodic near4 (baseline threshold) near4 adjustment	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/15 16:51
S52	10	S51 and 345/173.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/15 16:52
S53	8	S52 and @ad <"20111208"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/15 16:52
S54	4	(US-20110074725-$ or US-20110012840-$ or US-20100097329-$).did. or (US-8077160-$).did.	US-PGPUB; USPAT	OR	ON	2014/06/15 18:28
S55	2	S54 and (graph table)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/15 18:29
S56	8	S46 and (graph table)	US-PGPUB; USPAT	OR	ON	2014/06/15 18:32
S57	5	12/208,324	US-PGPUB; USPAT	OR	ON	2014/06/15 18:53
S58	1	(US-20130147752-$).did.	US-PGPUB	OR	ON	2014/12/22 13:29
S59	3	("8482544").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/12/22 14:00
S60	12	("20050179671" | "20060166702" | "20090181719" | "20090194341" | "20090251423" | "7180508").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/12/22 14:00
S61	31	("20070074913" | "20070200831" |	US-PGPUB;	OR	ON	2014/12/22

		"20090012657" | "20090284495" | "20100060608" | "3552687" | "4825374" | "5335230" | "6504269" | "6531885").PN.	USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			14:01
S62	46	S59 S60 S61	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/12/22 14:01
S63	45	S62 and @ad <"20111208"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/12/22 14:02
S64	0	S63 and adjust near3 (threshold baseline)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/12/22 14:03
S65	9	S63 and adjust	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/12/22 14:03
S66	5	(US-20110074725-$ or US-20110012840-$ or US-20100073301-$ or US-20070074913-$).did. or (US-8077160-$).did.	US-PGPUB; USPAT	OR	ON	2014/12/22 14:08
S67	254002	(threshold baseline reference) near3 (calculate adjust determine)	US-PGPUB; USPAT	OR	ON	2014/12/22 14:09
S68	2	S66 and S67	US-PGPUB; USPAT	OR	ON	2014/12/22 14:09
S69	1	(US-20110074725-$).did.	US-PGPUB	OR	ON	2014/12/22 15:17
S70	565	(G06F3/0418 and G06F3/044).CPC.	US-PGPUB	OR	ON	2014/12/22 15:18
S71	291	S70 and ground	US-PGPUB	OR	ON	2014/12/22 15:18
S72	6	S71 and adjust near3 threshold	US-PGPUB	OR	ON	2014/12/22 15:19
S73	4	S72 and @ad <"20111208"	US-PGPUB	OR	ON	2014/12/22 15:19
S74	1	S73 and periodic	US-PGPUB	OR	ON	2014/12/22 15:26
S75	2	S73 and (return drift)	US-PGPUB	OR	ON	2014/12/22 15:28
S76	7	"20110015889"	US-PGPUB; USPAT;	OR	ON	2014/12/22 15:34

			USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			

6/29/2015 15:25:07
C:\Users\dwilson1\Documents\EAST\Workspaces\13314858.pts

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Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13314858	SIMMONS ET AL.
	Examiner	**Art Unit**
	DOUGLAS M WILSON	2694

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	08/02/2013	02/26/2014	06/15/2014	12/22/2014	06/29/2015				
	1	✓	✓	✓	✓	✓				
	2	✓	✓	✓	✓	✓				
	3	✓	✓	✓	✓	✓				
	4	✓	✓	✓	✓	✓				
	5	✓	✓	✓	✓	✓				
	6	✓	✓	✓	✓	✓				
	7	✓	✓	✓	✓	✓				
	8	✓	✓	✓	✓	✓				
	9	✓	✓	✓	✓	✓				
	10	✓	✓	✓	✓	✓				
	11	✓	✓	✓	✓	✓				
	12	✓	✓	✓	✓	✓				
	13	✓	✓	✓	✓	✓				
	14	✓	✓	✓	✓	✓				
	15	✓	✓	✓	✓	✓				
	16	✓	✓	✓	✓	✓				
	17	✓	✓	✓	✓	✓				
	18	✓	✓	✓	✓	✓				
	19	O	O	✓	✓	✓				
	20	O	O	O	O	O				

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13314858	SIMMONS ET AL.
	Examiner	Art Unit
	DOUGLAS M WILSON	2694

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES		
Search Notes	Date	Examiner
See attached EAST search history		
Updated Search based on Amendment	6/10/2014	/D.M.W./
Updated search for prior art (detailed results attached)	12/23/2014	/D.M.W./
Updated search for prior art (detailed results attached)	6/27/2015	/D.M.W./

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner

/DOUGLAS M WILSON/ Examiner.Art Unit 2694	

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PTO/SB/30 (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

Address to:
Mail Stop RCE
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Application Number	13/314,858
Filing Date	December 8, 2011
First Named Inventor	Simmons
Art Unit	2694 (confirm #7360)
Examiner Name	Douglas M Wilson
Attorney Docket Number	080900.1238

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. See Instruction Sheet for RCEs (not to be submitted to the USPTO) on page 2.

1. 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).

   a. ☐ 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.

      i. ☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on _____

      ii. ☐ Other _____

   b. ☑ Enclosed

      I. ☑ Amendment/Reply

      ii. ☐ Affidavit(s)/ Declaration(s)

      iii. ☐ Information Disclosure Statement (IDS)

      iv. ☐ Other _____

2. Miscellaneous

   a. ☐ 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)

   b. ☐ Other _____

3. Fees The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.

   a. ☑ The Director is hereby authorized to charge the following fees, any underpayment of fees, or credit any overpayments, to Deposit Account No. 02-0384.

      i. ☑ RCE fee required under 37 CFR 1.17(e)

      ii. ☐ Extension of time fee (37 CFR 1.136 and 1.17)

      iii. ☐ Other _____

   b. ☐ Check in the amount of $ _____ enclosed

   c. ☐ Payment by credit card (Form PTO-2038 enclosed)

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

Signature	/Bradley J. Birchfield/	Date	03/31/2015
Name (Print/Type)	Bradley J. Birchfield	Registration No.	65,521

CERTIFICATE OF MAILING OR TRANSMISSION

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Mail Stop RCE, Commissioner for Patents, P. O. Box 1450, Alexandria, VA 22313-1450 or facsimile transmitted to the U.S. Patent and Trademark Office on the date shown below.

Signature			
Name (Print/Type)		Date	

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. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Mail Stop RCE, 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.

Instruction Sheet for RCEs

(not to be submitted to the USPTO)

NOTES:

An RCE is not a new application, and filing an RCE will not result in an application being accorded a new filing date.

Filing Qualifications:

The application must be a utility or plant application filed on or after June 8, 1995. The application cannot be a provisional application, a utility or plant application filed before June 8, 1995, a design application, or a patent under reexamination. See 37 CFR 1.114(e).

Filing Requirements:

Prosecution in the application must be closed. Prosecution is closed if the application is under appeal, or the last Office action is a final action, a notice of allowance, or an action that otherwise closes prosecution in the application (e.g., an Office action under *Ex parte Quayle*). See 37 CFR 1.114(b).

A submission and a fee are required at the time the RCE is filed. If reply to an Office action under 35 U.S.C. 132 is outstanding (e.g., the application is under final rejection), the submission must meet the reply requirements of 37 CFR 1.111. If there is no outstanding Office action, the submission can be an information disclosure statement, an amendment, new arguments, or new evidence. See 37 CFR 1.114(c). The submission may be a previously filed amendment (e.g., an amendment after final rejection).

WARNINGS:

Request for Suspension of Action:

All RCE filing requirements must be met before suspension of action is granted. A request for a suspension of action under 37 CFR 1.103(c) does not satisfy the submission requirement and does not permit the filing of the required submission to be suspended.

Improper RCE will NOT toll Any Time Period:

Before Appeal - If the RCE is improper (e.g., prosecution in the application is not closed or the submission or fee has not been filed) and the application is not under appeal, the time period set forth in the last Office action will continue to run and the application will be abandoned after the statutory time period has expired if a reply to the Office action is not timely filed. No additional time will be given to correct the improper RCE.

Under Appeal - If the RCE is improper (e.g., the submission or the fee has not been filed) and the application is under appeal, the improper RCE is effective to withdraw the appeal. Withdrawal of the appeal results in the allowance or abandonment of the application depending on the status of the claims. If there are no allowed claims, the application is abandoned. If there is at least one allowed claim, the application will be passed to issue on the allowed claim(s). See MPEP 1215.01.

See MPEP 706.07(h) for further information on the RCE practice.

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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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Named Inventor:	Martin John Simmons et al.
Application No.:	13/314,858
Filing Date:	December 8, 2011
Art Unit:	2694
Confirmation No.:	7360
Examiner:	Douglas M. Wilson
Title:	TOUCH SENSOR WITH ADAPTIVE TOUCH DETECTION THRESHOLDING

Commissioner of Patents
PO Box 1450
Alexandria, VA 22313-1450

Dear Sir:

AMENDMENT FILED WITH REQUEST FOR CONTINUED EXAMINATION

In response to the final Office Action dated December 31, 2014, Applicants respectfully request the Examiner to reconsider the rejection of the claims in view of the comments and amendments set forth below. Please amend the application as follows.

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In the Claims:

1. (**Currently Amended**) A touch sensor comprising:

a plurality of sense electrodes; and

a controller communicatively coupled to the plurality of sense electrodes, the controller configured to:

receive a plurality of signals from the plurality of sense electrodes **associated with an interaction with the touch sensor by an external object**, the plurality of signals indicative of an amount of capacitance between the touch sensor and ~~an~~ **the** external object;

access a stored threshold value, the threshold value indicating a threshold magnitude of **capacitance**~~the signals from the plurality of sense electrodes to process as a touch by the external object~~;

determine a grounding status of the touch sensor based on a strength of a charge return path between the touch sensor and a ground; ~~and~~

adjust the stored threshold value based on the determined grounding status of the touch ~~sensor.~~**sensor; and**

after adjusting the stored threshold value, determine whether to process the interaction as a touch by the external object based on a comparison of the amount of capacitance with the adjusted threshold value.

2. (Original) The touch sensor of Claim 1, wherein:

the plurality of sense electrodes comprises a plurality of x-axis sense electrodes and a plurality of y-axis sense electrodes;

the plurality of x-axis sense electrodes visually intersect the plurality of y-axis sense electrodes; and

the visual intersections of the x-axis sense electrodes and the y-axis sense electrodes comprises a plurality of nodes.

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3. (Previously Presented) The touch sensor of Claim 2, wherein determining the grounding status of the touch sensor based on the strength of the charge return path between the touch sensor and ground comprises:

determining that the external object has touched the touch sensor at a location that at least partially covers a particular one of the nodes;

determining a maximum magnitude of a particular signal received from sense electrodes associated with the particular node; and

calculating a new threshold value using the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node.

4. (Previously Presented) The touch sensor of Claim 3, wherein:

calculating the new threshold value comprises multiplying the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node by a predetermined percentage; and

adjusting the stored threshold value based on the determined grounding status of the touch sensor comprises storing the calculated new threshold value as the stored threshold value.

5. (Previously Presented) The touch sensor of Claim 1, the controller further configured to, after adjusting the stored threshold value based on the determined grounding status of the touch sensor:

determine that the external object has not touched the touch sensor within a predetermined amount of time; and

periodically drift, at a predetermined rate, the stored threshold value back to an original value, the original value comprising a value of the stored threshold value before it was adjusted based on the determined grounding status of the touch sensor.

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6. (Previously Presented) The touch sensor of Claim 1, wherein:

adjusting the stored threshold value based on the determined grounding status of the touch sensor comprises replacing the stored threshold value with a new threshold value; and

the stored threshold value is adjusted at a predetermined rate.

7. (**Currently Amended**) A method comprising:

receiving, by a controller coupled to a touch sensor, a plurality of signals from a plurality of sense electrodes **associated with an interaction with the touch sensor by an external object**, the plurality of signals indicative of an amount of capacitance between the touch sensor and ~~an~~ **the** external object;

accessing, by the controller, a stored threshold value, the threshold value indicating a threshold magnitude of **capacitance**~~the signals from the plurality of sense electrodes to process as a touch by the external object~~;

determining, by the controller, a grounding status of the touch sensor based on a strength of a charge return path between the touch sensor and a ground; ~~and~~

adjusting, by the controller, the stored threshold value based on the determined grounding status of the touch ~~sensor.~~**sensor; and**

after adjusting the stored threshold value, determining, by the controller, whether to process the interaction as a touch by the external object based on a comparison of the amount of capacitance with the adjusted threshold value.

8. (Original) The method of Claim 7, wherein:

the plurality of sense electrodes comprises a plurality of x-axis sense electrodes and a plurality of y-axis sense electrodes;

the plurality of x-axis sense electrodes visually intersect the plurality of y-axis sense electrodes; and

the visual intersections of the x-axis sense electrodes and the y-axis sense electrodes comprises a plurality of nodes.

9. (Previously Presented) The method of Claim 8, wherein determining the grounding status of the touch sensor based on the strength of the charge return path between the touch sensor and ground comprises:

determining that the external object has touched the touch sensor at a location that at least partially covers a particular one of the nodes;

determining a maximum magnitude of a particular signal received from sense electrodes associated with the particular node; and

calculating a new threshold value using the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node.

10. (Previously Presented) The method of Claim 9, wherein:

calculating the new threshold value comprises multiplying the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node by a predetermined percentage; and

adjusting the stored threshold value based on the determined grounding status of the touch sensor comprises storing the calculated new threshold value as the stored threshold value.

11. (Previously Presented) The method of Claim 7, further comprising, after adjusting the stored threshold value based on the determined grounding status of the touch sensor:

determining that the external object has not touched the touch sensor within a predetermined amount of time; and

periodically drifting, at a predetermined rate, the stored threshold value back to an original value, the original value comprising a value of the stored threshold value before it was adjusted based on the determined grounding status of the touch sensor.

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12. (Previously Presented) The method of Claim 7, wherein:

adjusting the stored threshold value based on the determined grounding status of the touch sensor comprises replacing the stored threshold value with a new threshold value; and

the stored threshold value is adjusted at a predetermined rate.

13. (**Currently Amended**) A touch-sensitive device comprising a controller, the controller communicatively coupled to a plurality of sense electrodes, the controller operable to:

receive a plurality of signals from the plurality of sense electrodes **associated with an interaction with the touch sensor by an external object**, the plurality of signals indicative of an amount of capacitance between the touch-sensitive device and ~~an~~ **the** external object;

access a stored threshold value, the threshold value indicating a threshold magnitude of **capacitance**~~the signals from the plurality of sense electrodes to process as a touch of the touch-sensitive device by the external object~~;

determine a grounding status of the touch sensor based on a strength of a charge return path between the touch-sensitive device and a ground; ~~and~~

adjust the stored threshold value based on the determined grounding status of the touch ~~sensor.~~**sensor; and**

after adjusting the stored threshold value, determine whether to process the interaction as a touch by the external object based on a comparison of the amount of capacitance with the adjusted threshold value.

14. (Original) The touch-sensitive device of Claim 13, wherein:

the plurality of sense electrodes comprises a plurality of x-axis sense electrodes and a plurality of y-axis sense electrodes;

the plurality of x-axis sense electrodes visually intersect the plurality of y-axis sense electrodes; and

the visual intersections of the x-axis sense electrodes and the y-axis sense electrodes comprises a plurality of nodes.

15. (Previously Presented) The touch-sensitive device of Claim 14, wherein determining the grounding status of the touch sensor based on the strength of the charge return path between the touch sensor and ground comprises:

determining that the external object has touched the touch sensor at a location that at least partially covers a particular one of the nodes;

determining a maximum magnitude of a particular signal received from sense electrodes associated with the particular node; and

calculating a new threshold value using the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node.

16. (Previously Presented) The touch-sensitive device of Claim 15, wherein:

calculating the new threshold value comprises multiplying the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node by a predetermined percentage; and

adjusting the stored threshold value based on the determined grounding status of the touch sensor comprises storing the calculated new threshold value as the stored threshold value.

17. (Previously Presented) The touch-sensitive device of Claim 13, the controller further operable to, after adjusting the stored threshold value based on the determined grounding status of the touch sensor:

determine that the external object has not touched the touch sensor within a predetermined amount of time; and

periodically drift, at a predetermined rate, the stored threshold value back to an original value, the original value comprising a value of the stored threshold value before it was adjusted based on the determined grounding status of the touch sensor.

18. (Previously Presented) The touch-sensitive device of Claim 13, wherein:

adjusting the stored threshold value determined grounding status of the touch sensor comprises replacing the stored threshold value with a new threshold value; and

the stored threshold value is adjusted at a predetermined rate.

19. (Previously Presented) The touch-sensitive device of Claim 13, wherein determining the grounding status of the touch sensor based on the strength of the charge return path between the touch sensor and ground comprises analyzing shapes of one or more capacitance graphs.

20. (Original) The touch-sensitive device of Claim 19, wherein analyzing shapes of one or more capacitance graphs comprises:

comparing a capacitance graph derived from plurality of signals indicative of an amount of capacitance between the touch-sensitive device and an external object with a plurality of stored capacitance graphs, the stored capacitance graphs comprising:

a grounded capacitance graph indicative of a typical touch when the touch-sensitive device is grounded; and

a floating capacitance graph indicative of a typical touch when the touch-sensitive device is floating;

determining, based on the comparison, that the touch-sensitive device is grounded if the capacitance graph matches the grounded capacitance graph; and

determining, based on the comparison, that the touch-sensitive device is floating if the capacitance graph matches the floating capacitance graph.

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REMARKS

This Application has been carefully reviewed in light of the final Office Action dated December 31, 2014 ("Office Action"). Applicants appreciate the Examiner's consideration of the Application. Claims 1-20 are currently pending. To advance prosecution of this application, Applicants amend independent Claims 1, 7, and 13. Applicants do not admit that the amendments are necessary due to the cited references or any of the Examiner's rejections. Applicants respectfully traverse the rejections and request reconsideration and allowance of all pending claims.

Summary of Interview

Applicants, through its attorney, Bradley J. Birchfield (Reg. No. 65,521), interviewed Examiners Wilson and Wang-Hurst on February 26, 2015. Applicants appreciate the Examiners' courtesy and professionalism during the interview. During the interview, the participants generally discussed the application, cited references, and potential amendments to the claims. The independent claims have been amended consistent with the discussion in the interview. The Examiners indicated that they believed the subject matter of these amendments should overcome the current rejections.

Allowable Subject Mater

Applicants note with appreciation the Examiner's indication that Claim 20 would be allowable if rewritten in independent form. However, due to Applicants' belief that the independent claim from which Claim 20 depends is allowable, as demonstrated below, Applicants have chosen not to rewrite Claim 20 in independent form at this time.

Section 103 Rejections

The Office Action rejects Claims 1-4, 6-10, 12-16, and 18 under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent Publication No. 2011/0074725 ("*Westerman*") in view of U.S. Patent Publication No. 2011/0012840 ("*Hotelling*"). The Office Action rejects dependent claims 5, 11, 17, and 19 under 35 U.S.C. 103(a) as being unpatentable over *Westerman* in view of *Hotelling* and other references. Applicants respectfully traverse these rejections and discuss amended independent Claim 1 below as an example.

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Applicants respectfully submit that amended independent Claim 1 is allowable at least because the proposed *Westerman-Hotelling* combination fails to disclose, teach, or suggest at least the following features recited in amended Claim 1:

> after adjusting the stored threshold value, determine whether to process the interaction as a touch by the external object based on a comparison of the amount of capacitance with the adjusted threshold value.

The Office Action states that *Westerman* does not disclose "adjust the stored threshold value based on the determined grounding status of the touch sensor" of a previous version of Claim 1 and instead relies on Fig. 7, elements 73-74 and ¶0057 of *Hotelling*. (Office Action, pages 5-6.) Specifically, the Office Action states that "the negative pixel compensation is the amount by which the touch threshold is adjusted." (*Id.*) Whether or not those statements and rejections were appropriate (which Applicants do not admit), the cited portions of *Hotelling* do not disclose, teach, or suggest a controller that is configured to "***after adjusting the stored threshold value, determine whether to process the interaction as a touch by the external object based on a comparison of the amount of capacitance with the adjusted threshold value***," as recited in amended Claim 1 (emphasis added). According to the cited portions of *Hotelling*:

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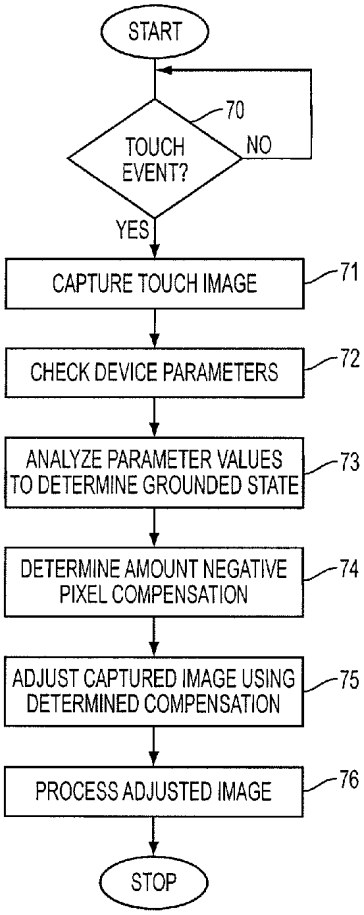


FIG. 7

[0052] FIG. 7 illustrates an exemplary method for detecting a grounded state of a touch sensitive device according to various embodiments. In the example of FIG. 7, **a determination can be made whether a touch event has occurred at a touch sensitive device (70)**. If so, a touch image of the touch event can be captured by the device (71). Various parameters of the device can be checked (72). For example, the parameters as described in FIGS. 1 through 6 can be checked. **The parameters' values can be analyzed to determine the grounded state of the device (73)**.

[0057] **Based on the determined grounded state of the device, a determination can be made whether to selectively apply negative pixel compensation and how much, e.g., fully, partially, or not at all (74).** If the determined grounded state is well grounded, negative pixel compensation can be deactivated or reduced, if currently active, or can otherwise remain inactive. If the determined grounded state is anything else, negative pixel compensation can be adjusted, if currently active, or activated, if currently inactive. In terms of how much to apply, in some embodiments where the

> grounded state is a binary value, the amount of negative pixel compensation can also be a binary value, e.g., if the grounded state is "yes," the negative pixel compensation can be omitted or not applied at all, and if the grounded state is "no," the negative pixel compensation can be applied fully.

(*Hotelling*, Fig. 72 and ¶¶ [0052] and [0057], emphasis added.) That is, while the cited portions of *Hotelling* may disclose determining whether a touch event has occurred (step 70) **before** determining a grounding state (step 73) and whether to adjust and apply a negative pixel compensation (step 74), they do not disclose, teach, or suggest a controller that is configured to "***after adjusting the stored threshold value, determine whether to process the interaction as a touch by the external object based on a comparison of the amount of capacitance with the adjusted threshold value***," as recited in amended Claim 1 (emphasis added). The cited portions of *Westerman* do not cure these deficiencies of *Hotelling*. Consequently, the proposed *Westerman-Hotelling* combination fails to disclose, teach, or suggest each and every element of amended Claim 1.

For at least these reasons, amended independent Claim 1 and its dependent claims are allowable. For at least certain analogous reasons, amended independent Claims 7 and 13 and their dependent claims are also allowable. Accordingly, Applicants respectfully request reconsideration and allowance of all pending claims.

Applicants respectfully submit that amended independent Claim 1 is additionally allowable at least because the proposed *Westerman-Hotelling* combination fails to disclose, teach, or suggest at least the following features recited in amended Claim 1 (emphasis added):

> access a stored threshold value, ***the threshold value indicating a threshold magnitude of capacitance***.

The Office Action relies on ¶ [0038] of *Westerman* for a previous version of this portion of Claim 1. (Office Action, page 5.) Specifically, the Office Action states that this portion of *Westerman* "teaches a touch magnitude is the sum of touch image pixels above a threshold." (*Id.*) Whether or not those statements and rejections were appropriate (which Applicants do not admit), the cited portions of *Westerman* do not disclose, teach, or suggest a "***threshold***

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value indicating a threshold magnitude of capacitance," as recited in amended Claim 1 (emphasis added). According to the cited portion of *Westerman*:

> [0038] FIG. 5 illustrates an exemplary method for compensating for negative pixel effect according to various embodiments. In the example of FIG. 5, a touch can be detected at a touch sensor panel and captured in a touch image. A determination can be made whether more than one finger (or other objects) is touching the panel based on the captured touch image (501). Various metrics can be used to make this determination. **For example, a touch magnitude can be measured from the touch image, where the magnitude can be indicative of the number of fingers making the touch at the panel. That is, a certain magnitude range can indicate one finger touching and another magnitude range can indicate more than one finger touching. The touch magnitude can be calculated as the sum of touch image pixel values above a particular threshold, such as a background noise threshold, for example.** If more than one finger is touching, the touch sensor panel may be more likely to experience a negative pixel effect for which the touch image can be compensated. Conversely, if one finger is touching, the touch sensor panel may be less likely to experience a negative pixel effect such that touch image compensation can be omitted. Accordingly, if only one finger is touching, the captured touch image can be used for further processing without negative pixel compensation (515). It should be noted that, in some embodiments, one flattened finger touching the touch sensor panel can create a negative pixel effect similar to multiple touching fingers, such that the touch image can be compensated. Therefore, a one-flat-finger touch can be treated as a multi-finger touch.

(*Westerman*, ¶ [0038], emphasis added.) That is, while the cited portion of *Westerman* may disclose a touch magnitude which is the **sum of touch image pixel values above a threshold**, they do not disclose, teach, or suggest a "***threshold value indicating a threshold magnitude of capacitance***," as recited in amended Claim 1 (emphasis added). The cited portions of *Hotelling* do not cure these deficiencies of *Westerman*. Consequently, the proposed *Westerman-Hotelling* combination fails to disclose, teach, or suggest each and every element of amended Claim 1.

For at least these additional reasons, amended independent Claim 1 and its dependent claims are allowable. For at least certain analogous reasons, amended independent Claims 7 and 13 and their dependent claims are also allowable. Accordingly, Applicants respectfully request reconsideration and allowance of all pending claims.

No Waiver

Applicants' arguments and amendments are made without prejudice or disclaimer. By not responding to additional statements made by the Examiner, Applicants do not acquiesce to the additional statements. The distinctions between the applied references and the claims are provided as examples only and are sufficient to overcome the rejections. Applicants reserve the right to discuss additional or other distinctions in a later response or on appeal, if appropriate.

Request for Evidentiary Support

Should any of the above asserted rejections be maintained, Applicants respectfully request appropriate evidentiary support. Additionally, if the Examiner is relying upon "common knowledge" or "well known" principles to establish a rejection, Applicants request that a reference be provided in support of this position pursuant to M.P.E.P. § 2144.03. Furthermore, to the extent that the Examiner maintains any rejection based on an "Official Notice" or other information within the Examiner's personal knowledge, Applicants respectfully request that the Examiner cite a reference as documentary evidence in support of this position or provide an affidavit in accordance with M.P.E.P. § 2144.03 and 37 C.F.R. 1.104(d)(2).

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CONCLUSION

Applicants have made an earnest attempt to place this case in condition for allowance. For the foregoing reasons and for other reasons clearly apparent, Applicants respectfully request reconsideration and full allowance of all pending claims.

If the Examiner feels that a telephone conference would advance prosecution of this application in any manner, the Examiner is invited to contact Bradley J. Birchfield, Attorney for Applicants, at the Examiner's convenience at 214.953.6570 or brad.birchfield@bakerbotts.com.

The Commissioner is hereby authorized to charge the $1,700.00 RCE fee, and to the extent necessary, charge any additional required fees or credit any overpayments to Deposit Account No. 02-0384 of BAKER BOTTS L.L.P.

Respectfully submitted,

BAKER BOTTS L.L.P.
Attorneys for Applicant



Bradley J. Birchfield
Reg. No. 65,521
Tel. 214-953-6570

Date: March 31, 2015

Correspondence Address:

Customer Number: **12323**

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Apple EX1002 Page 150

Electronic Patent Application Fee Transmittal

Application Number:	13314858
Filing Date:	08-Dec-2011
Title of Invention:	Touch Sensor With Adaptive Touch Detection Thresholding
First Named Inventor/Applicant Name:	Martin John Simmons
Filer:	Chad Christian Walters/Wendy Flottman
Attorney Docket Number:	080900.1238

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:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
RCE- 2nd and Subsequent Request	1820	1	1700	1700
		Total in USD ($)		**1700**

Electronic Acknowledgement Receipt

EFS ID:	21929078
Application Number:	13314858
International Application Number:	
Confirmation Number:	7360
Title of Invention:	Touch Sensor With Adaptive Touch Detection Thresholding
First Named Inventor/Applicant Name:	Martin John Simmons
Customer Number:	12323
Filer:	Chad Christian Walters/Wendy Flottman
Filer Authorized By:	Chad Christian Walters
Attorney Docket Number:	080900.1238
Receipt Date:	31-MAR-2015
Filing Date:	08-DEC-2011
Time Stamp:	14:54:08
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$1700
RAM confirmation Number	1252
Deposit Account	020384
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)

Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)

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	Request for Continued Examination (RCE)	Transmittal.pdf	1406267 d13f43876c0bc9033daf0309c712d3116c26daef	no	3
Warnings:					
This is not a USPTO supplied RCE SB30 form.					
Information:					
2		RCE.pdf	86185 84ee4fdff93b24383f8db00f2c3ff132b6546509	yes	15

Multipart Description/PDF files in .zip description		
Document Description	**Start**	**End**
Amendment Submitted/Entered with Filing of CPA/RCE	1	1
Claims	2	8
Applicant Arguments/Remarks Made in an Amendment	9	15

Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	30201 0e68492c412158707d09bf770e98e2aae4cdc2ef	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	1522653	

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.

Electronic Acknowledgement Receipt

EFS ID:	21929078
Application Number:	13314858
International Application Number:	
Confirmation Number:	7360
Title of Invention:	Touch Sensor With Adaptive Touch Detection Thresholding
First Named Inventor/Applicant Name:	Martin John Simmons
Customer Number:	12323
Filer:	Chad Christian Walters/Wendy Flottman
Filer Authorized By:	Chad Christian Walters
Attorney Docket Number:	080900.1238
Receipt Date:	31-MAR-2015
Filing Date:	08-DEC-2011
Time Stamp:	14:54:08
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$1700
RAM confirmation Number	1252
Deposit Account	020384
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)

Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)

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	Request for Continued Examination (RCE)	Transmittal.pdf	1406267 d13f43876c0bc9033daf0309c712d3116c26daef	no	3
Warnings:					
This is not a USPTO supplied RCE SB30 form.					
Information:					
2		RCE.pdf	86185 84ee4fdff93b24383f8db00f2c3ff132b6546509	yes	15

Multipart Description/PDF files in .zip description		
Document Description	**Start**	**End**
Amendment Submitted/Entered with Filing of CPA/RCE	1	1
Claims	2	8
Applicant Arguments/Remarks Made in an Amendment	9	15

Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	30201 0e68492c412158707d09bf770e98e2aae4cdc2ef	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	1522653	

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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.

PTO/SB/06 (09-11)
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 13/314,858	Filing Date 12/08/2011	☐ To be Mailed

ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =	
☐ APPLICATION SIZE FEE (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).			
☐ 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	

APPLICATION AS AMENDED – PART II

AMENDMENT **03/31/2015**

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) 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
☐ Application Size Fee (37 CFR 1.16(s))						
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
					TOTAL ADD'L FEE	0

AMENDMENT

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =	
☐ Application Size Fee (37 CFR 1.16(s))						
☐ 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.

** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

LIE
/Davina Butler/

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.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/314,858	12/08/2011	Martin John Simmons	080900.1238	7360

12323 7590 03/06/2015

Baker Botts L.L.P.
2001 Ross Avenue, 6th Floor
Dallas, TX 75201

EXAMINER
WILSON, DOUGLAS M

ART UNIT	PAPER NUMBER
2694	

NOTIFICATION DATE	DELIVERY MODE
03/06/2015	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):

ptomail1@bakerbotts.com
ptomail2@bakerbotts.com

Applicant-Initiated Interview Summary	Application No.	Applicant(s)	
	13/314,858	SIMMONS ET AL.	
	Examiner	Art Unit	
	Douglas M. Wilson	2694	

All participants (applicant, applicant's representative, PTO personnel):

(1) *Douglas M. Wilson*.

(3) *Brad Birchfield*.

(2) *Kathy Wang-Hurst*.

(4)_____.

Date of Interview: *26 February 2015*.

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: *Westerman (US 2011/0074725) and Hotelling (US 2011/0012840)*.

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...)

See Continuation Sheet.

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

/Douglas M. Wilson/ Examiner, Art Unit 2694	/KATHY WANG-HURST/ Supervisory Patent Examiner, Art Unit 2694

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.

Continuation of Substance of Interview including description of the general nature of what was agreed to if an agreement was reached, or any other comments:

1. Applicant provided the following proposed amendment to Claim 1:
Claim 1: (Currently Amended) A touch sensor comprising:
a plurality of sense electrodes; and
a controller communicatively coupled to the plurality of sense electrodes , the controller configured to:
receive a plurality of signals from the plurality of sense electrodes associated with an interaction with the touch sensor by an external object, the plurality of signals indicative of an amount of capacitance between the touch sensor and the external object;
access a stored threshold value, the threshold value indicating a threshold magnitude of capacitance;
determine whether to process the interaction as a touch by the external object based on a comparison of the amount of capacitance with the threshold magnitude of capacitance;
determine a grounding status of the touch sensor based on a strength of a charge return path between the touch sensor and a ground; and
adjust the stored threshold value based on the determined grounding status of the touch sensor.

2. Examiner stated he felt that proposed amendment would not overcome current art rejection.

3. Applicant argued that his application determined and corrected the threshold capacitance before the existence of a touch was evaluated while the prior art references determine the touch before adjusting the threshold capacitance.

4. Examiner stated that adding temporal language to Claim 1 that emphasized Applicant's argument would overcome the current art rejection and if Examiner rejects Applicant's RCE amendments using the same references, the Examiner will initiate a telephone interview before releasing the next Office Action..

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/314,858	12/08/2011	Martin John Simmons	080900.1238	7360

12323 7590 12/31/2014

Baker Botts L.L.P.
2001 Ross Avenue, 6th Floor
Dallas, TX 75201

EXAMINER
WILSON, DOUGLAS M

ART UNIT	PAPER NUMBER
2694	

NOTIFICATION DATE	DELIVERY MODE
12/31/2014	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):

ptomail1@bakerbotts.com
ptomail2@bakerbotts.com

Office Action Summary	Application No. 13/314,858	Applicant(s) SIMMONS ET AL.	
	Examiner Douglas M. Wilson	Art Unit 2694	AIA (First Inventor to File) Status 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 *08 October 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) *1-19* is/are allowed.

7)☐ Claim(s) _____ is/are rejected.

8)☒ Claim(s) *20* 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 or send an inquiry to 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 _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

4) ☐ Other: _____.

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Apple EX1002 Page 165

DETAILED ACTION

Notice of Pre-AIA or AIA Status

1. The present application is being examined under the pre-AIA first to invent provisions. Claims 1-20 are pending.

Response to Arguments

2. Applicant's arguments filed 08 October 2014 have been fully considered but they are not persuasive.

The Applicant's assert Hotelling does not teach the Claim 1 limitation "adjust the stored threshold value based on the determined grounding status of the touch sensor".

The Examiner respectfully disagrees with Applicant's assertion. Hotelling teaches that an initial touch image is compensated by negative pixel compensation to provide a processed touch image [fig. 7 @71, 74, and 75]. The adjusted touch image is processed by the device into touch information such as touch location. From the initial touch image the only signals that comprise the adjusted touch image are those that exceeded the amount of negative pixel compensation determined. The threshold value defined in Claim 1 is the magnitude sensed signal required to be processed as a touch signal by the device. Based on the above Hotelling teaches the negative pixel compensation is the threshold value. In fig. 7 @73 Hotelling teaches determining the grounded state and then in fig. 7 @74 determining the negative pixel compensation from the grounded state. So Hotelling teaches the negative pixel compensation is proportional to the grounding state of the device. Since the pixel compensation is

applied to correct the initial touch image it a stored threshold value. In ¶0023 Hotelling teaches “When a well-grounded touch sensitive device receives a touch by an object, such as a user's fingers, the device's mutual signal capacitance Csig at the touch location can be properly changed to produce a pixel touch output value indicative of a true touch event. However, when a poorly grounded touch sensitive device receives a touch by an object, such as a user's fingers, undesirable charge coupling called negative capacitance Cneg can be introduced into the device to cause the pixel touch output value to be in the opposite direction of the intended mutual capacitance change. As such, a pixel experiencing touch under poor grounding conditions can appear to detect less of a touch than is actually present, known as a "negative pixel." Negative pixel compensation can be selectively applied to the negative pixel touch output value to reduce or eliminate the negative pixel effect.”

In ¶0061 Hotelling teaches the method of fig. 7 can be run each time a touch event occurs, therefore for each touch event the stored threshold value (negative pixel compensation) is adjusted based on the grounding status of the touch sensor (amount of negative pixel compensation determined).

In response to Applicant's argument that the Examiner's conclusion of obviousness is based upon improper hindsight (or conclusory) reasoning, it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the applicant's disclosure, such a

reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971).

In the instant case, Westerman, the primary reference teaches the concept of a negative pixel effect caused by poor device grounding and the need to compensate for that effect thereby introducing negative pixel compensation. Hotelling teaches parameters that can be measured to determine the grounded state of a device and calculating the negative pixel compensation based on the grounded state. Westerman introduces the concept of compensating for poor touch device grounding and Hotelling teaches how to determine poor device grounding. One of ordinary skill in the art would recognize that Hotelling taught solutions that were applicable to the methods taught by Westerman and combined them.

Claim Rejections - 35 USC § 103

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 negatived by the manner in which the invention was made.

3. Claims 1-4, 6-10, 12-16, and 18 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Pub. No.: US 2011/0074725 A1 (Westerman et al.) hereinafter Westerman modified by Pub. No.: US 2011/0012840 A1 (Hotelling et al.) hereinafter Hotelling.

Regarding **Claim 1** (Previously Presented) Westerman teaches a touch sensor comprising:

a plurality of sense electrodes; [fig. 1 elements S1 and S2] and

a controller [fig. 12 element 1206] communicatively coupled to the plurality of sense electrodes,[fig. 12 element 1203] the controller configured to: receive a plurality of signals from the plurality of sense electrodes, [¶0026] the plurality of signals indicative of an amount of capacitance between the touch sensor and an external object; [¶0028]

access a stored threshold value, the threshold value indicating a threshold magnitude of the signals from the plurality of sense electrodes to process as a touch by the external object; [¶0038 teaches a touch magnitude is the sum of touch image pixels above a threshold]

Westerman does not teach determine a grounding status of the touch sensor based on a strength of a charge return path between the touch sensor and a ground; and

adjust the stored threshold value based on the determined grounding status of the touch sensor.

However, Hotelling teaches determine a grounding status of the touch sensor based on a strength of a charge return path between the touch sensor and a ground; [applicant does not define “strength of a charge return path” therefore Examiner broadly construes “strength of a charge return path” as the results of an analysis of data to

determine a grounding status, fig. 7 element 73 teaches analyzing data to determine the grounding status] and

adjust the stored threshold value based on the determined grounding status of the touch sensor. [¶0057, fig. 7 element 74, the negative pixel compensation is the amount by which the touch threshold is adjusted]

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the touch sensor taught by Westerman to determine a grounding status of the touch sensor based on a strength of a charge return path between the touch sensor and a ground and adjust the stored threshold value based on the determined grounding status of the touch sensor, as taught by Hotelling, in order to improve the reliability of touch indications by compensating for changing ground conditions.

Regarding **Claim 2** (Original), Westerman modified by Hotelling teaches the touch sensor of Claim 1, wherein:

the plurality of sense electrodes [Westerman, ¶0041, teaches plurality of electrodes in a self-capacitance sensing mode where both x and y electrodes are sense electrodes because a drive signal is not applied] comprises a plurality of x-axis sense electrodes [Westerman: fig. 1 element 102] and a plurality of y-axis sense electrodes; [Westerman: fig. 1 element 101]

the plurality of x-axis sense electrodes [Westerman: fig. 1 element 102] visually intersect the plurality of y-axis electrodes; [Westerman: fig. 1 element 101] and the

visual intersection of the x-axis sense electrodes [Westerman: fig. 1 element 102] and the y-axis electrodes [Westerman: fig. 1 element 101] comprises a plurality of nodes.[Westerman: fig 1 element 126]

Regarding **Claim 3** (Previously Presented), Westerman modified by Hotelling teaches the- touch sensor of Claim 2, wherein determining the grounding status of the touch sensor based on the strength of the charge return path between the touch sensor and ground comprises:

determining that the external object has touched the touch sensor at a location that at least partially covers a particular one of the nodes [Westerman: ¶0028 teaches an object touching a touch panel causing a touch signal which indicates the particular node where the touch occurred]

determining a maximum magnitude of a particular signal received from sense electrodes associated with the particular node; and [Westerman: ¶0039 teaches calculating the actual touch signal value at a node. The calculated maximum signal is larger than the measured signal]

calculating a new threshold value using the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node. [Westerman: fig. 5 elements 509 and 511, ¶0045, teaches evaluating then setting the sense signal to the higher value]

Regarding **Claim 4** (Previously Presented), Westerman modified by Hotelling teaches the touch sensor of Claim 3, wherein:

Westerman modified by Hotelling does not teach calculating the new threshold value comprises multiplying the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node by a predetermined percentage; and

adjusting the stored threshold value based on the determined grounding status of the touch sensor comprises storing the calculated new threshold value as the stored threshold value

However, Hotelling further teaches calculating the new threshold value comprises multiplying the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node by a predetermined percentage; and [¶0057 teaches multiplying the maximum pixel signal by a scaling factor based on the extent of the device grounding]

adjusting the stored threshold value based on the determined grounding status of the touch sensor: comprises storing the calculated new threshold value as the stored threshold value [fig. 7 element 75, ¶0060, teaches adjusting the threshold value and element 76 teaches using the new values to process the touch image]

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the touch controller taught by Westerman modified by Hotelling to calculating a new threshold value by multiplying the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node

by a predetermined percentage and adjusting the stored threshold value based on the determined grounding status of the touch sensor determined strength of the charge return path and storing the calculated new threshold value as the stored threshold value, as further taught by Hotelling, in order to easily calculate a new touch threshold value in situation where the grounding status can be approximated by other means.

Regarding **Claim 6** (Previously Presented), Westerman modified by Hotelling teaches the touch sensor of Claim 1, wherein:

Westerman modified by Hotelling do not teach adjusting the stored threshold value based on the determined grounding status of the touch sensor comprises replacing the stored threshold value with a new threshold value; and

the stored threshold value is adjusted at a predetermined rate.

However, Hotelling further teaches adjusting the stored threshold value based on the determined grounding status of the touch sensor comprises replacing the stored threshold value with a new threshold value; and [fig. 7 element 75, ¶0060, teaches adjusting the threshold value and fig. 7 element 76 teaches using the new values to process the touch image]

the stored threshold value is adjusted at a predetermined rate. [fig. 7 element 74, ¶0057 teaches that pixel compensation is adjusted based at a predetermined rate based on the determined state of grounding, adjusting pixel compensation is equivalent to adjusting touch threshold]

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the touch controller taught by Westerman modified by Hotelling, to adjust the stored threshold value based on the determined grounding status of the touch sensor comprises replacing the stored threshold value with a new threshold value and the stored threshold value is adjusted at a predetermined rate, as further taught by Hotelling, in order to periodically adjust the touch threshold value based on the grounding state and to limit the rate of that change to prevent large fluctuations and resultant touch inaccuracy.

Regarding **Claim 7** (Previously Presented), method Claim 7 was discussed in the rejection of apparatus Claim 1, therefore Claim 7 is rejected for the same reasons as Claim 1.

Regarding **Claim 8** (Original), method Claim 8 was discussed in the rejection of apparatus Claim 2, therefore Claim 8 is rejected for the same reasons as Claim 2.

Regarding **Claim 9** (Previously Presented), method Claim 9 was discussed in the rejection of apparatus Claim 3, therefore Claim 9 is rejected for the same reasons as Claim 3.

Regarding **Claim 10** (Previously Presented), method Claim 10 was discussed in the rejection of apparatus Claim 4, therefore Claim 10 is rejected for the same reasons as Claim 4.

Regarding **Claim 12** (Previously Presented), method Claim 12 was discussed in the rejection of apparatus Claim 6, therefore Claim 12 is rejected for the same reasons as Claim 6.

Regarding **Claim 13** (Previously Presented), apparatus Claim 13 was discussed in the rejection of apparatus Claim 1, therefore Claim 13 is rejected for the same reasons as Claim 1.

Regarding **Claim 14** (Original), apparatus Claim 14 was discussed in the rejection of apparatus Claim 2, therefore Claim 14 is rejected for the same reasons as Claim 2.

Regarding **Claim 15** (Previously Presented), apparatus Claim 15 was discussed in the rejection of apparatus Claim 3, therefore Claim 15 is rejected for the same reasons as Claim 3.

Regarding **Claim 16** (Previously Presented), method Claim 16 was discussed in the rejection of apparatus Claim 4, therefore Claim 16 is rejected for the same reasons

as Claim 4.

4. Claims 5, 11, and 17 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Westerman modified by Hotelling modified by Patent No.: US 8,077,160 B2 (Land et al.) hereinafter Land.

Regarding **Claim 5** (Previously Presented), Westerman modified by Hotelling teaches the touch sensor of Claim 1, the controller further configured to, after adjusting the stored threshold value based on the determined grounding status of the touch sensor:

Westerman modified by Hotelling do not teach determining that the external object has not touched the touch sensor within a predetermined amount of time; and

periodically drift, at a predetermined rate, the stored threshold value back to an original value, the original value comprising a value of the stored threshold value before it was adjusted based on the determined grounding status of the touch sensor.

However, Land teaches determining that the external object has not touched the touch sensor within a predetermined amount of time; and [table 1 indicates background adjustment rate of every 4 seconds unless a touch occurs]

periodically drift, at a predetermined rate, the stored threshold value back to an original value, the original value comprising a value of the stored threshold value before it was adjusted based on the determined grounding status of the touch sensor. [col. 16 lines 15-55, fig. 8d step 830 teaches reducing sensor offset by Q where Q is a

predetermined number, step 828 teaches increasing sensor offset by P where P is a predetermined number, since sensor baseline + sensor offset = sensor output the effect of raising or lowering the sensor offset is equivalent to raising or lowering the touch threshold]

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the touch controller taught by Westerman modified by Hotelling to determine that the external object has not touched the touch sensor within a predetermined amount of time and periodically drift, at a predetermined rate, the stored threshold value back to an original value, the original value comprising a value of the stored threshold value before it was adjusted based on the determined grounding status of the touch sensor, as taught by Land, in order to allow periodic adjustment of the magnitude of a detected signal required to cause a touch detection.

Regarding **Claim 11** (Previously Presented), method Claim 11 was discussed in the rejection of apparatus Claim 5, therefore Claim 7 is rejected for the same reasons as Claim 5.

Regarding **Claim 17** (Previously Presented), apparatus Claim 17 was discussed in the rejection of apparatus Claim 5, therefore Claim 17 is rejected for the same reasons as Claim 5.

Regarding **Claim 18** (Previously Presented), apparatus Claim 18 was discussed in the rejection of apparatus Claim 6, therefore Claim 18 is rejected for the same reasons as Claim 6.

5. Claim 19 is rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Westerman modified by Hotelling modified by Pub. No.: US 2010/0073301 A1 (Yousefpor et al.) hereinafter Yousefpor.

Regarding **Claim 19** (Previously Presented), Westerman modified by Hotelling teaches the touch-sensitive device of Claim 13, wherein

Westerman modified by Hotelling do not teach determining the grounding status of the touch sensor based on the strength of the charge return path between the touch sensor and ground comprises: analyzing shapes of one or more capacitance graphs.

However, Yousefpor teaches determining the grounding status of the touch sensor based on the strength of the charge return path between the touch sensor and ground comprises: analyzing shapes of one or more capacitance graphs [fig. 6, ¶0067]

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the touch controller taught by Westerman modified by Hotelling to determining the grounding status of the touch sensor based on the strength of the charge return path between the touch sensor and ground comprises: analyzing shapes of one or more capacitance graphs, as taught by Yousefpor, in order to determine

grounding status of a device by measuring capacitance.

Allowable Subject Matter

6. Claim 20 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

7. **THIS ACTION IS MADE FINAL.** 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 mailing date of this final action.

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Douglas M. Wilson whose telephone number is (571)272-5640. The examiner can normally be reached on M-F: 0900-1700. If attempts

to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kathy Wang-Hurst can be reached on 571-270-5371. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

9. 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.

/Douglas M. Wilson/
Examiner, Art Unit 2694

/JONATHAN HORNER/
Primary Examiner, Art Unit 2694

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13314858	SIMMONS ET AL.
	Examiner	Art Unit
	DOUGLAS M WILSON	2694

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES		
Search Notes	Date	Examiner
See attached EAST search history		
Updated Search based on Amendment	6/10/2014	/D.M.W./
Updated search for prior art (detailed results attached)	12/23/2014	/D.M.W./

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner

/DOUGLAS M WILSON/ Examiner.Art Unit 2694	

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Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13314858	SIMMONS ET AL.
	Examiner	**Art Unit**
	DOUGLAS M WILSON	2694

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	08/02/2013	02/26/2014	06/15/2014	12/22/2014					
	1	✓	✓	✓	✓					
	2	✓	✓	✓	✓					
	3	✓	✓	✓	✓					
	4	✓	✓	✓	✓					
	5	✓	✓	✓	✓					
	6	✓	✓	✓	✓					
	7	✓	✓	✓	✓					
	8	✓	✓	✓	✓					
	9	✓	✓	✓	✓					
	10	✓	✓	✓	✓					
	11	✓	✓	✓	✓					
	12	✓	✓	✓	✓					
	13	✓	✓	✓	✓					
	14	✓	✓	✓	✓					
	15	✓	✓	✓	✓					
	16	✓	✓	✓	✓					
	17	✓	✓	✓	✓					
	18	✓	✓	✓	✓					
	19	O	O	✓	✓					
	20	O	O	O	O					

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	1	"13314858"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/02/25 15:05
S2	9	"8339286"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/02/25 15:06
S3	958	charge adj return	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/02/25 15:08
S4	0	S3 and 345/173.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/02/25 15:09
S5	14	S3 and "345".clas.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/02/25 15:09
S6	2	"12504639"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/12 10:46
S7	20	(poor$2 NEAR3 ground$3) NEAR5 (finger touch digit) AND 345/173-175.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/12 10:49
S8	62	("6323846" | "7184064" | "4825374" | "6531885" | "20050219228" | "20080165115" | "5488207" | "5880411" | "5825352" | "6310610" | "20050179671" | "5335230" | "5463379" | "20090174688" | "7663607" | "20070074913" | "20070200831" | "3552687" | "20090194341" | "20090251423" | "20090174676" | "5835079" | "6690387" | "7015894" | "6188391" | "7069357" | "20070050646" | "20100060608" | "6504269" | "20060197753" | "20090160787" | "7254775" | "5483261" | "7180508" | "8482544" | "20060026521" |	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/12 11:17

		"20060097991" | "20080267462" | "20060238522" | "20090012657" | "20090284495" | "20060166702" | "20090181719" | "20080165116").PN.				
S9	20	(poor$2 NEAR3 ground$3) NEAR5 (finger touch digit) AND 345/173-175.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/12 18:00
S10	15	S9 and @ad <"20111208"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/12 18:00
S11	10	S10 and threshold	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/12 18:01
S12	8	(US-20110012840-$ or US-20110175823-$ or US-20110074725-$ or US-20100073301-$ or US-20100060608-$ or US-20090174676-$ or US-20090160787-$).did. or (US-8339286-$).did.	US-PGPUB; USPAT	OR	ON	2014/06/12 18:06
S13	8	S12 and threshold	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/12 18:07
S14	8	S13 and time	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/12 18:07
S15	4	S13 and maximum	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/12 18:07
S16	3	S15 and adapt	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/12 18:12
S17	13038	negative near5 pixel	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 11:48
S18	377616	(procedure process) near5 (calculate determine)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 11:49
S19	1262	S17 and S18	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 12:07

S20	9	S19 and 345/173.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 12:07
S21	9	S20 and @ad<"20111208"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 12:08
S22	62	("6323846" | "7184064" | "4825374" | "6531885" | "20050219228" | "20080165115" | "5488207" | "5880411" | "5825352" | "6310610" | "20050179671" | "5335230" | "5463379" | "20090174688" | "7663607" | "20070074913" | "20070200831" | "3552687" | "20090194341" | "20090251423" | "20090174676" | "5835079" | "6690387" | "7015894" | "6188391" | "7069357" | "20070050646" | "20100060608" | "6504269" | "20060197753" | "20090160787" | "7254775" | "5483261" | "7180508" | "8482544" | "20060026521" | "20060097991" | "20080267462" | "20060238522" | "20090012657" | "20090284495" | "20060166702" | "20090181719" | "20080165116").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 12:15
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S24	4	S22 and S23	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 12:15
S25	8	(US-20110012840-$ or US-20110175823-$ or US-20110074725-$ or US-20090174676-$ or US-20100060608-$ or US-20090160787-$ or US-20100073301-$).did. or (US-8339286-$).did.	US-PGPUB; USPAT	OR	ON	2014/06/13 12:25
S26	7	S25 and node	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 12:25
S27	8	"11756211"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 12:46
S28	3652	pixel near3 calibration	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 14:33
S29	290	S28 and touch near3 (sensor panel	US-PGPUB;	OR	ON	2014/06/13

		device screen)	USPAT; USOCR; FPRS; EPO; JPO			14:34
S30	39	S29 and 345/173.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 14:34
S31	37	S30 and @ad <"20111208"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 14:34
S32	9	(US-20110012840-$ or US-20110175823-$ or US-20110074725-$ or US-20090174676-$ or US-20100060608-$ or US-20090160787-$ or US-20100073301-$ or US-20080309622-$).did. or (US-8339286-$).did.	US-PGPUB; USPAT	OR	ON	2014/06/13 14:58
S33	3652	pixel near3 calibration	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 14:58
S34	290	S33 and touch near3 (sensor panel device screen)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 14:58
S35	39	S34 and 345/173.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 14:58
S36	37	S35 and @ad <"20111208"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 14:58
S37	3	S36 and node	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 14:58
S38	62	("6323846" | "7184064" | "4825374" | "6531885" | "20050219228" | "20080165115" | "5488207" | "5880411" | "5825352" | "6310610" | "20050179671" | "5335230" | "5463379" | "20090174688" | "7663607" | "20070074913" | "20070200831" | "3552687" | "20090194341" | "20090251423" | "20090174676" | "5835079" | "6690387" | "7015894" | "6188391" | "7069357" | "20070050646" | "20100060608" | "6504269" | "20060197753" | "20090160787" | "7254775" | "5483261" | "7180508" | "8482544" | "20060026521" |	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 14:59

		"20060097991" | "20080267462" | "20060238522" | "20090012657" | "20090284495" | "20060166702" | "20090181719" | "20080165116").PN.				
S39	217	(finger object) near4 over near2 node	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 15:40
S40	21	S39 and 345/173-178.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 15:41
S41	19	S40 and @ad <"20111218"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 15:41
S42	33	("6888536" | "7920129" | "20070268269" | "20100083109" | "8040326" | "20070177804" | "20070257890" | "20080062148" | "20070109279" | "20060250377" | "20080165141" | "5463388" | "20090021489" | "5825352" | "6452514" | "7663607" | "8049732" | "20090315854" | "8179381" | "20060097991" | "20070152979" | "20080246496" | "7875814" | "20070152984").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 16:06
S43	33	S42 and @ad <"20111208"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 16:06
S44	3	(US-20110074725-$ or US-20110012840-$ or US-20100097329-$).did.	US-PGPUB	OR	ON	2014/06/15 16:24
S45	2	S44 and predetermined	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/15 16:24
S46	12	(US-20110012840-$ or US-20110175823-$ or US-20110074725-$ or US-20090174676-$ or US-20100060608-$ or US-20090160787-$ or US-20100073301-$ or US-20080309622-$ or US-20100097329-$ or US-20100097328-$ or US-20090273573-$).did. or (US-8339286-$).did.	US-PGPUB; USPAT	OR	ON	2014/06/15 16:48
S47	0	S46 and predetermined near5 time	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/15 16:48
S48	84	negative near2 pixel same2 predetermined near4 time	US-PGPUB; USPAT;	OR	ON	2014/06/15 16:49

			USOCR; FPRS; EPO; JPO			
S49	80	S48 and @ad <"20111208"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/15 16:50
S50	0	S49 and 345/173-178.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/15 16:50
S51	57	periodic near4 (baseline threshold) near4 adjustment	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/15 16:51
S52	10	S51 and 345/173.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/15 16:52
S53	8	S52 and @ad <"20111208"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/15 16:52
S54	4	(US-20110074725-$ or US-20110012840-$ or US-20100097329-$).did. or (US-8077160-$).did.	US-PGPUB; USPAT	OR	ON	2014/06/15 18:28
S55	2	S54 and (graph table)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/15 18:29
S56	8	S46 and (graph table)	US-PGPUB; USPAT	OR	ON	2014/06/15 18:32
S57	5	12/208,324	US-PGPUB; USPAT	OR	ON	2014/06/15 18:53
S58	1	(US-20130147752-$).did.	US-PGPUB	OR	ON	2014/12/22 13:29
S59	3	("8482544").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/12/22 14:00
S60	12	("20050179671" | "20060166702" | "20090181719" | "20090194341" | "20090251423" | "7180508").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/12/22 14:00
S61	31	("20070074913" | "20070200831" | "20090012657" | "20090284495" | "20100060608" | "3552687" | "4825374"	US-PGPUB; USPAT; USOCR;	OR	ON	2014/12/22 14:01

		| "5335230" | "6504269" | "6531885").PN.	FPRS; EPO; JPO; DERWENT; IBM_TDB			
S62	46	S59 S60 S61	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/12/22 14:01
S63	45	S62 and @ad <"20111208"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/12/22 14:02
S64	0	S63 and adjust near3 (threshold baseline)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/12/22 14:03
S65	9	S63 and adjust	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/12/22 14:03
S66	5	(US-20110074725-$ or US-20110012840-$ or US-20100073301-$ or US-20070074913-$).did. or (US-8077160-$).did.	US-PGPUB; USPAT	OR	ON	2014/12/22 14:08
S67	254002	(threshold baseline reference) near3 (calculate adjust determine)	US-PGPUB; USPAT	OR	ON	2014/12/22 14:09
S68	2	S66 and S67	US-PGPUB; USPAT	OR	ON	2014/12/22 14:09
S69	1	(US-20110074725-$).did.	US-PGPUB	OR	ON	2014/12/22 15:17
S70	565	(G06F3/0418 and G06F3/044).CPC.	US-PGPUB	OR	ON	2014/12/22 15:18
S71	291	S70 and ground	US-PGPUB	OR	ON	2014/12/22 15:18
S72	6	S71 and adjust near3 threshold	US-PGPUB	OR	ON	2014/12/22 15:19
S73	4	S72 and @ad <"20111208"	US-PGPUB	OR	ON	2014/12/22 15:19
S74	1	S73 and periodic	US-PGPUB	OR	ON	2014/12/22 15:26
S75	2	S73 and (return drift)	US-PGPUB	OR	ON	2014/12/22 15:28
S76	7	"20110015889"	US-PGPUB; USPAT; USOCR; FPRS;	OR	ON	2014/12/22 15:34

			EPO; JPO; DERWENT; IBM_TDB			

12/23/2014 16:40:37
C:\Users\dwilson1\Documents\EAST\Workspaces\13314858.wsp

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Named Inventor:	Martin J. Simmons
Application No.:	13/314,858
Filing Date:	December 8, 2011
Art Unit:	2694
Confirmation No.:	7360
Examiner:	Douglas M. Wilson
Title:	*Touch Sensor with Adaptive Touch Detection Thresholding*

Commissioner of Patents
PO Box 1450
Alexandria, VA 22313-1450

Dear Sir:

Response to Office Action Pursuant to 37 C.F.R. § 1.111

In response to the Office Action dated July 8, 2014, Applicants respectfully request the Examiner to reconsider the rejection of the claims in view of the comments set forth below.

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In the Claims:

1. (Previously Presented) A touch sensor comprising:

a plurality of sense electrodes; and

a controller communicatively coupled to the plurality of sense electrodes, the controller configured to:

receive a plurality of signals from the plurality of sense electrodes, the plurality of signals indicative of an amount of capacitance between the touch sensor and an external object;

access a stored threshold value, the threshold value indicating a threshold magnitude of the signals from the plurality of sense electrodes to process as a touch by the external object;

determine a grounding status of the touch sensor based on a strength of a charge return path between the touch sensor and a ground; and

adjust the stored threshold value based on the determined grounding status of the touch sensor.

2. (Original) The touch sensor of Claim 1, wherein:

the plurality of sense electrodes comprises a plurality of x-axis sense electrodes and a plurality of y-axis sense electrodes;

the plurality of x-axis sense electrodes visually intersect the plurality of y-axis sense electrodes; and

the visual intersections of the x-axis sense electrodes and the y-axis sense electrodes comprises a plurality of nodes.

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3. (Previously Presented) The touch sensor of Claim 2, wherein determining the grounding status of the touch sensor based on the strength of the charge return path between the touch sensor and ground comprises:

determining that the external object has touched the touch sensor at a location that at least partially covers a particular one of the nodes;

determining a maximum magnitude of a particular signal received from sense electrodes associated with the particular node; and

calculating a new threshold value using the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node.

4. (Previously Presented) The touch sensor of Claim 3, wherein:

calculating the new threshold value comprises multiplying the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node by a predetermined percentage; and

adjusting the stored threshold value based on the determined grounding status of the touch sensor comprises storing the calculated new threshold value as the stored threshold value.

5. (Previously Presented) The touch sensor of Claim 1, the controller further configured to, after adjusting the stored threshold value based on the determined grounding status of the touch sensor:

determine that the external object has not touched the touch sensor within a predetermined amount of time; and

periodically drift, at a predetermined rate, the stored threshold value back to an original value, the original value comprising a value of the stored threshold value before it was adjusted based on the determined grounding status of the touch sensor.

6. (Previously Presented) The touch sensor of Claim 1, wherein:

adjusting the stored threshold value based on the determined grounding status of the touch sensor comprises replacing the stored threshold value with a new threshold value; and

the stored threshold value is adjusted at a predetermined rate.

7. (Previously Presented) A method comprising:

receiving, by a controller coupled to a touch sensor, a plurality of signals from a plurality of sense electrodes, the plurality of signals indicative of an amount of capacitance between the touch sensor and an external object;

accessing, by the controller, a stored threshold value, the threshold value indicating a threshold magnitude of the signals from the plurality of sense electrodes to process as a touch by the external object;

determining, by the controller, a grounding status of the touch sensor based on a strength of a charge return path between the touch sensor and a ground; and

adjusting, by the controller, the stored threshold value based on the determined grounding status of the touch sensor.

8. (Original) The method of Claim 7, wherein:

the plurality of sense electrodes comprises a plurality of x-axis sense electrodes and a plurality of y-axis sense electrodes;

the plurality of x-axis sense electrodes visually intersect the plurality of y-axis sense electrodes; and

the visual intersections of the x-axis sense electrodes and the y-axis sense electrodes comprises a plurality of nodes.

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9. (Previously Presented) The method of Claim 8, wherein determining the grounding status of the touch sensor based on the strength of the charge return path between the touch sensor and ground comprises:

determining that the external object has touched the touch sensor at a location that at least partially covers a particular one of the nodes;

determining a maximum magnitude of a particular signal received from sense electrodes associated with the particular node; and

calculating a new threshold value using the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node.

10. (Previously Presented) The method of Claim 9, wherein:

calculating the new threshold value comprises multiplying the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node by a predetermined percentage; and

adjusting the stored threshold value based on the determined grounding status of the touch sensor comprises storing the calculated new threshold value as the stored threshold value.

11. (Previously Presented) The method of Claim 7, further comprising, after adjusting the stored threshold value based on the determined grounding status of the touch sensor:

determining that the external object has not touched the touch sensor within a predetermined amount of time; and

periodically drifting, at a predetermined rate, the stored threshold value back to an original value, the original value comprising a value of the stored threshold value before it was adjusted based on the determined grounding status of the touch sensor.

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12. (Previously Presented) The method of Claim 7, wherein:

adjusting the stored threshold value based on the determined grounding status of the touch sensor comprises replacing the stored threshold value with a new threshold value; and

the stored threshold value is adjusted at a predetermined rate.

13. (Previously Presented) A touch-sensitive device comprising a controller, the controller communicatively coupled to a plurality of sense electrodes, the controller operable to:

receive a plurality of signals from the plurality of sense electrodes, the plurality of signals indicative of an amount of capacitance between the touch-sensitive device and an external object;

access a stored threshold value, the threshold value indicating a threshold magnitude of the signals from the plurality of sense electrodes to process as a touch of the touch-sensitive device by the external object;

determine a grounding status of the touch sensor based on a strength of a charge return path between the touch-sensitive device and a ground; and

adjust the stored threshold value based on the determined grounding status of the touch sensor.

14. (Original) The touch-sensitive device of Claim 13, wherein:

the plurality of sense electrodes comprises a plurality of x-axis sense electrodes and a plurality of y-axis sense electrodes;

the plurality of x-axis sense electrodes visually intersect the plurality of y-axis sense electrodes; and

the visual intersections of the x-axis sense electrodes and the y-axis sense electrodes comprises a plurality of nodes.

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15. (Previously Presented) The touch-sensitive device of Claim 14, wherein determining the grounding status of the touch sensor based on the strength of the charge return path between the touch sensor and ground comprises:

determining that the external object has touched the touch sensor at a location that at least partially covers a particular one of the nodes;

determining a maximum magnitude of a particular signal received from sense electrodes associated with the particular node; and

calculating a new threshold value using the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node.

16. (Previously Presented) The touch-sensitive device of Claim 15, wherein:

calculating the new threshold value comprises multiplying the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node by a predetermined percentage; and

adjusting the stored threshold value based on the determined grounding status of the touch sensor comprises storing the calculated new threshold value as the stored threshold value.

17. (Previously Presented) The touch-sensitive device of Claim 13, the controller further operable to, after adjusting the stored threshold value based on the determined grounding status of the touch sensor:

determine that the external object has not touched the touch sensor within a predetermined amount of time; and

periodically drift, at a predetermined rate, the stored threshold value back to an original value, the original value comprising a value of the stored threshold value before it was adjusted based on the determined grounding status of the touch sensor.

18. (Previously Presented) The touch-sensitive device of Claim 13, wherein:

adjusting the stored threshold value determined grounding status of the touch sensor comprises replacing the stored threshold value with a new threshold value; and

the stored threshold value is adjusted at a predetermined rate.

19. (Previously Presented) The touch-sensitive device of Claim 13, wherein determining the grounding status of the touch sensor based on the strength of the charge return path between the touch sensor and ground comprises analyzing shapes of one or more capacitance graphs.

20. (Original) The touch-sensitive device of Claim 19, wherein analyzing shapes of one or more capacitance graphs comprises:

comparing a capacitance graph derived from plurality of signals indicative of an amount of capacitance between the touch-sensitive device and an external object with a plurality of stored capacitance graphs, the stored capacitance graphs comprising:

a grounded capacitance graph indicative of a typical touch when the touch-sensitive device is grounded; and

a floating capacitance graph indicative of a typical touch when the touch-sensitive device is floating;

determining, based on the comparison, that the touch-sensitive device is grounded if the capacitance graph matches the grounded capacitance graph; and

determining, based on the comparison, that the touch-sensitive device is floating if the capacitance graph matches the floating capacitance graph.

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REMARKS

This Application has been carefully reviewed in light of the Office Action dated July 8, 2014 (the "Office Action"). Applicants appreciate the Examiner's consideration of the Application. Claims 1-20 are pending and Claims 1-19 stand rejected. Applicants believe all claims are allowable without amendment and respectfully provide the following remarks. Applicants respectfully request reconsideration and allowance of all pending claims.

Request for Subsequent Interview

If, in response to Applicants' present submission, the Examiner intends to issue a new Office Action rejecting some or all of the pending claims, in the interest of compact and efficient prosecution Applicants respectfully request that the Examiner contact Applicants' attorney prior to issuing the new Office Action to discuss a possible resolution to any outstanding issues.

Allowable Subject Matter

Applicants note with appreciation the Examiner's indication that Claim 20 would be allowable if rewritten in independent form. However, due to Applicants' belief that the independent claim from which Claim 20 depends is allowable, as demonstrated below, Applicants have chosen not to rewrite Claim 20 in independent form at this time.

Section 103 Rejections

The Office Action rejects Claims 1-4, 6-10, 12-16, and 18 under 5 U.S.C. 103(a) as being unpatentable over U.S. Patent Publication No. 2011/0074725 ("*Westerman*") in view of U.S. Patent Publication No. 2011/0012840 ("*Hotelling*"). The Office Action rejects the remaining dependent claims under 35 U.S.C. 103(a) as being unpatentable over *Westerman* in view of *Hotelling* and other references. Applicants respectfully traverse these rejections and discuss independent Claim 1 below as an example.

Applicants respectfully submit that independent Claim 1 is allowable at least because the proposed *Westerman-Hotelling* combination fails to disclose, teach, or suggest at least the following features recited in Claim 1:

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adjust the stored threshold value based on the determined grounding status of the touch sensor.

The Office Action admits that *Westerman* does not disclose this portion of Claim 1 and instead relies on Fig. 72, element 74 and ¶0057 of *Hotelling*. (Office Action, page 4.) Specifically, the Office Action states that "the negative pixel compensation is the amount by which the touch threshold is adjusted." (*Id.*) Applicants respectfully disagree, however, and submit that while the cited portions of *Hotelling* may disclose a negative pixel compensation, they do not disclose, teach, or suggest a controller that is configured to "***adjust the stored threshold value*** based on the determined grounding status of the touch sensor," as recited in Claim 1 (emphasis added). According to the cited portion of *Hotelling*:

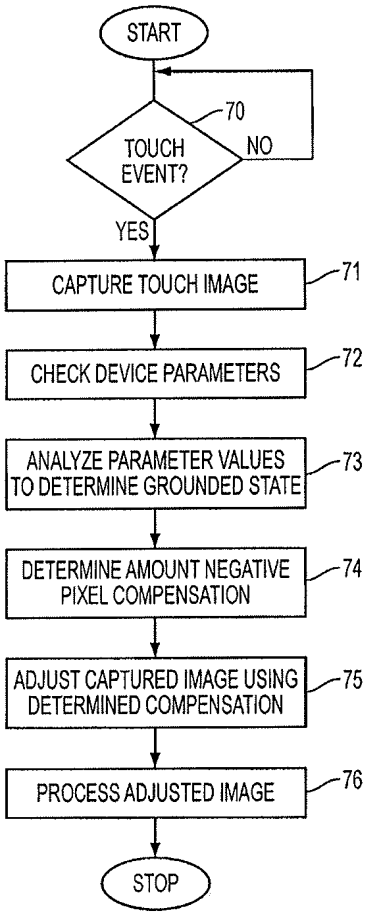


FIG. 7

> [0057] Based on the determined grounded state of the device, a determination can be made whether to selectively apply negative pixel compensation and how much, e.g., fully, partially, or not at all (74). If the determined grounded state is well grounded, negative pixel compensation can be deactivated or reduced, if currently active, or can otherwise remain inactive. If the determined grounded state is anything else, negative pixel compensation can be adjusted, if currently active, or activated, if currently inactive. In terms of how much to apply, in some embodiments where the grounded state is a binary value, the amount of negative pixel compensation can also be a binary value, e.g., if the grounded state is "yes," the negative pixel compensation can be omitted or not applied at all, and if the grounded state is "no," the negative pixel compensation can be applied fully.

(*Hotelling*, Fig. 72 and ¶0057.) That is, while the cited portions of *Hotelling* may disclose determining an amount of negative pixel compensation and whether to selectively apply the negative pixel compensation, it does not disclose, teach, or suggest a controller that is configured to "***adjust the stored threshold value*** based on the determined grounding status of the touch sensor," as recited in Claim 1 (emphasis added). For example, other portions of *Hotelling* explain that the negative pixel compensation is a value that is selectively added to a touch output value:

> [0023] When a well grounded touch sensitive device receives a touch by an object, such as a user's fingers, the device's mutual signal capacitance Csig at the touch location can be properly changed to produce a pixel touch output value indicative of a true touch event. However, when a poorly grounded touch sensitive device receives a touch by an object, such as a user's fingers, undesirable charge coupling called negative capacitance Cneg can be introduced into the device to cause the pixel touch output value to be in the opposite direction of the intended mutual capacitance change. As such, a pixel experiencing touch under poor grounding conditions can appear to detect less of a touch than is actually present, known as a "negative pixel." **Negative pixel compensation can be selectively applied to the negative pixel touch output value to reduce or eliminate the negative pixel effect.** However, to be effective, the negative pixel compensation should be applied under appropriate conditions and in appropriate amounts. Since negative capacitance Cneg can be a function of how well the touch sensitive device is grounded, the device's grounded state can be detected so that negative pixel compensation can be applied as needed. The detection can be done by monitoring various touch sensitive device parameters indicative of the device's grounding and determining the grounding based on the monitored parameters' values. FIGS. 1 through 6 illustrate exemplary device parameters and corresponding device components that determine the parameters' values which can be used for detecting a grounded state of a touch sensitive device according to various embodiments.

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(*Hotelling*, ¶0023, emphasis added.) That is, while *Hotelling* may disclose applying the negative pixel compensation amount to existing output values, it does not disclose, teach, or suggest "***adjust[ing] the stored threshold value*** based on the determined grounding status of the touch sensor," as recited in Claim 1 (emphasis added). The Office Action admits that *Westerman* does not cure these deficiencies of *Hotelling*. Consequently, the proposed *Westerman-Hotelling* combination fails to disclose, teach, or suggest each and every element of Claim 1.

For at least these reasons, independent Claim 1 and its dependent claims are allowable. For at least certain analogous reasons, independent Claims 7 and 13 and their dependent claims are also allowable. Accordingly, Applicants respectfully request reconsideration and allowance of all pending claims.

Furthermore, Applicants submit that the Office Action does not demonstrate a *prima facie* case of obviousness because the Office Action does not provide an adequate reason either in the cited references or in the knowledge generally available to one of ordinary skill in the art at the time of Applicants' invention to combine or modify the references in the manner proposed in the Office Action. For example, as allegedly providing a reason for the proposed *Westerman-Hotelling* combination, the Office Action states the following:

> It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the touch sensor taught by Westerman to determine a grounding status of the touch sensor based on a strength of a charge return path between the touch sensor and a ground and adjust the stored threshold value based on the determined grounding status of the touch sensor, as taught by Hotelling, in order to improve the reliability of touch indications by compensating for changing ground conditions.

(Office Action, pages 4-5.) Applicants respectfully submit that this statement merely provides conclusory assertions as to the reasons for the combination, which certainly do not satisfy the stringent standards for establishing a *prima facie* case of obviousness. "Rejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal

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conclusion of obviousness." *KSR Int'l Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1741, 82 U.S.P.Q.2d 1385, 1396 (2007) (citing *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)). Respectfully, the Office Action does not provide an adequate explanation as to why one of ordinary skill in the art at the time of invention would have combined the various teachings of the references in the manner proposed in the Office Action. Nor does the Office Action explain how these systems can be combined and, if combined, would be successfully combined. Thus, Applicants respectfully submit that the Office Action's attempt to combine *Westerman* and *Hotelling* appears to constitute the type of impermissible hindsight reconstruction of Applicants' claims, using Applicants' claims as a blueprint, that is specifically prohibited by the M.P.E.P. and governing Federal Circuit cases.

No Waiver

Applicants' arguments and amendments are made without prejudice or disclaimer. By not responding to additional statements made by the Examiner, Applicants do not acquiesce to the additional statements. The distinctions between the applied references and the claims are provided as examples only and are sufficient to overcome the rejections. Applicants reserve the right to discuss additional or other distinctions in a later response or on appeal, if appropriate.

Request for Evidentiary Support

Should any of the above asserted rejections be maintained, Applicants respectfully request appropriate evidentiary support. Additionally, if the Examiner is relying upon "common knowledge" or "well known" principles to establish a rejection, Applicants request that a reference be provided in support of this position pursuant to M.P.E.P. § 2144.03. Furthermore, to the extent that the Examiner maintains any rejection based on an "Official Notice" or other information within the Examiner's personal knowledge, Applicants respectfully request that the Examiner cite a reference as documentary evidence in support of this position or provide an affidavit in accordance with M.P.E.P. § 2144.03 and 37 C.F.R. 1.104(d)(2).

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CONCLUSION

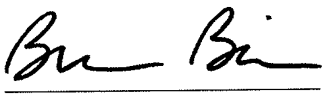
Applicants have made an earnest attempt to place this case in condition for allowance. For the foregoing reasons and for other reasons clearly apparent, Applicants respectfully request reconsideration and full allowance of all pending claims.

If the Examiner feels that a telephone conference would advance prosecution of this application in any manner, the Examiner is invited to contact Bradley J. Birchfield, Attorney for Applicants, at the Examiner's convenience at (214) 953-6570 or brad.birchfield@bakerbotts.com.

Applicants believe no fees to be currently due, however, the Commissioner is hereby authorized to charge any necessary additional fees and credit any overpayments to Deposit Account No. 02-0384 of BAKER BOTTS L.L.P.

Respectfully submitted,

BAKER BOTTS L.L.P.
Attorneys for Applicants



Bradley J. Birchfield
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Tel. 214-953-6570

Date: October 8, 2014

Correspondence Address:

Customer Number: **12323**

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Electronic Acknowledgement Receipt

EFS ID:	20362086
Application Number:	13314858
International Application Number:	
Confirmation Number:	7360
Title of Invention:	Touch Sensor With Adaptive Touch Detection Thresholding
First Named Inventor/Applicant Name:	Martin John Simmons
Customer Number:	12323
Filer:	Chad Christian Walters/Wendy Flottman
Filer Authorized By:	Chad Christian Walters
Attorney Docket Number:	080900.1238
Receipt Date:	08-OCT-2014
Filing Date:	08-DEC-2011
Time Stamp:	14:21:03
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		resp1238.PDF	636522 c89ba3f3612e24da239b61d1373f6ad06556c93a	yes	14

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Amendment/Req. Reconsideration-After Non-Final Reject	1	1
	Claims	2	8
	Applicant Arguments/Remarks Made in an Amendment	9	14
Warnings:			
Information:			
	Total Files Size (in bytes):	636522	

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.

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 13/314,858	Filing Date 12/08/2011	☐ To be Mailed

ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

	(Column 1)	(Column 2)		
FOR	NUMBER FILED	NUMBER EXTRA	RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =	
☐ APPLICATION SIZE FEE (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).			
☐ 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	

APPLICATION AS AMENDED – PART II

		(Column 1)		(Column 2)	(Column 3)		
AMENDMENT	10/08/2014	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
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	0

		(Column 1)		(Column 2)	(Column 3)		
AMENDMENT		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 $ =	
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ 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.

** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

LIE
/CAROL BARNES/

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.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/314,858	12/08/2011	Martin John Simmons	080900.1238	7360

12323 7590 07/08/2014

Baker Botts L.L.P.
2001 Ross Avenue, 6th Floor
Dallas, TX 75201

EXAMINER	
WILSON, DOUGLAS M	

ART UNIT	PAPER NUMBER
2694	

NOTIFICATION DATE	DELIVERY MODE
07/08/2014	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):

ptomail1@bakerbotts.com
ptomail2@bakerbotts.com

Office Action Summary	Application No. 13/314,858	Applicant(s) SIMMONS ET AL.	
	Examiner Douglas M. Wilson	Art Unit 2694	AIA (First Inventor to File) Status 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 *06 June 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) *1-19* is/are rejected.

8)☒ Claim(s) *20* 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 or send an inquiry to PPHfeedback@uspto.gov.

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☒ The drawing(s) filed on *08 December 2011* 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 _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

4) ☐ Other: _____.

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DETAILED ACTION

Notice of Pre-AIA or AIA Status

1. The present application is being examined under the pre-AIA first to invent provisions. Claims 1-20 are pending.

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 09 June 2014 has been entered.

Response to Arguments

3. Applicant's arguments, see pages 9-12 filed 09 June 2014, with respect to the rejection(s) of claim(s) 1-18 under 35 USC §103 have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of 35 USC S 103, Pub. No.: US 2011/0074725 A1 (Westerman et al.) and Pub. No.: US 2011/0012840 A1 (Hotelling et al.).

Claim Rejections - 35 USC § 103

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 negatived by the manner in which the invention was made.

4. Claims 1-4, 6-10, 12-16, and 18 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Pub. No.: US 2011/0074725 A1 (Westerman et al.) hereinafter Westerman modified by Pub. No.: US 2011/0012840 A1 (Hotelling et al.) hereinafter Hotelling.

Regarding **Claim 1** (Currently Amended) Westerman teaches a touch sensor comprising:

a plurality of sense electrodes; [fig. 1 elements S1 and S2] and

a controller [fig. 12 element 1206] communicatively coupled to the plurality of sense electrodes,[fig. 12 element 1203] the controller configured to: receive a plurality of signals from the plurality of sense electrodes, [¶0026] the plurality of signals indicative of an amount of capacitance between the touch sensor and an external object; [¶0028]

access a stored threshold value, the threshold value indicating a threshold magnitude of the signals from the plurality of sense electrodes to process as a touch by

the external object; [¶0038 teaches a touch magnitude is the sum of touch image pixels above a threshold]

Westerman does not teach determine a grounding status of the touch sensor based on a strength of a charge return path between the touch sensor and a ground; and

adjust the stored threshold value based on the determined grounding status of the touch sensor ~~determined strength of the charge return path~~.

However, Hotelling teaches determine a grounding status of the touch sensor based on a strength of a charge return path between the touch sensor and a ground; [applicant does not define "strength of a charge return path" therefore Examiner broadly construes "strength of a charge return path" as the results of an analysis of data to determine a grounding status, fig. 7 element 73 teaches analyzing data to determine the grounding status] and

adjust the stored threshold value based on the determined grounding status of the touch sensor ~~determined strength of the charge return path~~. [¶0057, fig. 7 element 74, the negative pixel compensation is the amount by which the touch threshold is adjusted]

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the touch sensor taught by Westerman to determine a grounding status of the touch sensor based on a strength of a charge return path between the touch sensor and a ground and adjust the stored threshold value based on the determined grounding status of the touch sensor, as taught by Hotelling, in order to

improve the reliability of touch indications by compensating for changing ground conditions.

Regarding **Claim 2** (Original), Westerman modified by Hotelling teaches the touch sensor of Claim 1, wherein:

the plurality of sense electrodes [Westerman, ¶0041, teaches plurality of electrodes in a self-capacitance sensing mode where both x and y electrodes are sense electrodes because a drive signal is not applied] comprises a plurality of x-axis sense electrodes [Westerman: fig. 1 element 102] and a plurality of y-axis sense electrodes; [Westerman: fig. 1 element 101]

the plurality of x-axis sense electrodes [Westerman: fig. 1 element 102] visually intersect the plurality of y-axis electrodes; [Westerman: fig. 1 element 101] and the visual intersection of the x-axis sense electrodes [Westerman: fig. 1 element 102] and the y-axis electrodes [Westerman: fig. 1 element 101] comprises a plurality of nodes.[Westerman: fig 1 element 126]

Regarding **Claim 3** (Currently Amended), Westerman modified by Hotelling teaches the- touch sensor of Claim 2, wherein determining the grounding status of the touch sensor based on the strength of the charge return path between the touch sensor and ground comprises:

determining that the external object has touched the touch sensor at a location that at least partially covers a particular one of the nodes [Westerman: ¶0028 teaches

an object touching a touch panel causing a touch signal which indicates the particular node where the touch occurred]

determining a maximum magnitude of a particular signal received from sense electrodes associated with the particular node; and [Westerman: ¶0039 teaches calculating the actual touch signal value at a node. The calculated maximum signal is larger than the measured signal]

calculating a new threshold value using the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node. [Westerman: fig. 5 elements 509 and 511, ¶0045, teaches evaluating then setting the sense signal to the higher value]

Regarding **Claim 4** (Currently Amended), Westerman modified by Hotelling teaches the touch sensor of Claim 3, wherein:

Westerman modified by Hotelling does not teach calculating the new threshold value comprises multiplying the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node by a predetermined percentage; and

adjusting the stored threshold value <u>based on the determined grounding status of the touch sensor</u> ~~determined strength of the charge return path~~: comprises storing the calculated new threshold value as the stored threshold value

However, Hotelling further teaches calculating the new threshold value comprises multiplying the determined maximum magnitude of the particular signal

received from sense electrodes associated with the particular node by a predetermined percentage; and [¶0057 teaches multiplying the maximum pixel signal by a scaling factor based on the extent of the device grounding]

adjusting the stored threshold value based on the determined grounding status of the touch sensor ~~determined strength of the charge return path~~: comprises storing the calculated new threshold value as the stored threshold value [fig. 7 element 75, ¶0060, teaches adjusting the threshold value and element 76 teaches using the new values to process the touch image]

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the touch controller taught by Westerman modified by Hotelling to calculating a new threshold value by multiplying the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node by a predetermined percentage and adjusting the stored threshold value based on the determined grounding status of the touch sensor determined strength of the charge return path and storing the calculated new threshold value as the stored threshold value, as further taught by Hotelling, in order to easily calculate a new touch threshold value in situation where the grounding status can be approximated by other means.

Regarding **Claim 6** (Currently Amended), Westerman modified by Hotelling teaches the touch sensor of Claim 1, wherein:

Westerman modified by Hotelling do not teach adjusting the stored threshold value based on the determined grounding status of the touch sensor ~~determined~~

~~strength of the charge return path~~ comprises replacing the stored threshold value with a new threshold value; and

the stored threshold value is adjusted at a predetermined rate.

However, Hotelling further teaches adjusting the stored threshold value based on the determined grounding status of the touch sensor ~~determined strength of the charge return path~~ comprises replacing the stored threshold value with a new threshold value; and [fig. 7 element 75, ¶0060, teaches adjusting the threshold value and fig. 7 element 76 teaches using the new values to process the touch image]

the stored threshold value is adjusted at a predetermined rate. [fig. 7 element 74, ¶0057 teaches that pixel compensation is adjusted based at a predetermined rate based on the determined state of grounding, adjusting pixel compensation is equivalent to adjusting touch threshold]

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the touch controller taught by Westerman modified by Hotelling, to adjust the stored threshold value based on the determined grounding status of the touch sensor comprises replacing the stored threshold value with a new threshold value and the stored threshold value is adjusted at a predetermined rate, as further taught by Hotelling, in order to periodically adjust the touch threshold value based on the grounding state and to limit the rate of that change to prevent large fluctuations and resultant touch inaccuracy.

Regarding **Claim 7**, method Claim 7 was discussed in the rejection of apparatus Claim 1, therefore Claim 7 is rejected for the same reasons as Claim 1.

Regarding **Claim 8**, method Claim 8 was discussed in the rejection of apparatus Claim 2, therefore Claim 8 is rejected for the same reasons as Claim 2.

Regarding **Claim 9**, method Claim 9 was discussed in the rejection of apparatus Claim 3, therefore Claim 9 is rejected for the same reasons as Claim 3.

Regarding **Claim 10**, method Claim 10 was discussed in the rejection of apparatus Claim 4, therefore Claim 10 is rejected for the same reasons as Claim 4.

Regarding **Claim 12**, method Claim 12 was discussed in the rejection of apparatus Claim 6, therefore Claim 12 is rejected for the same reasons as Claim 6.

Regarding **Claim 13** apparatus Claim 13 was discussed in the rejection of apparatus Claim 1, therefore Claim 13 is rejected for the same reasons as Claim 1.

Regarding **Claim 14**, apparatus Claim 14 was discussed in the rejection of apparatus Claim 2, therefore Claim 14 is rejected for the same reasons as Claim 2.

Regarding **Claim 15**, apparatus Claim 15 was discussed in the rejection of apparatus Claim 3, therefore Claim 15 is rejected for the same reasons as Claim 3.

Regarding **Claim 16**, method Claim 16 was discussed in the rejection of apparatus Claim 4, therefore Claim 16 is rejected for the same reasons as Claim 4.

5. Claims 5, 11, and 17 are -rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Westerman modified by Hotelling modified by Patent No.: US 8,077,160 B2 (Land et al.) hereinafter Land.

Regarding **Claim 5** (Currently Amended), Westerman modified by Hotelling teaches the touch sensor of Claim 1, the controller further configured to, after adjusting the stored threshold value based on the determined grounding status of the touch sensor ~~determined strength of the charge return path~~:

Westerman modified by Hotelling do not teach determining that the external object has not touched the touch sensor within a predetermined amount of time; and

periodically drift, at a predetermined rate, the stored threshold value back to an original value, the original value comprising a value of the stored threshold value before it was adjusted based on the determined grounding status of the touch sensor ~~determined strength of the charge return path~~.

However, Land teaches determining that the external object has not touched the touch sensor within a predetermined amount of time; and [table 1 indicates background adjustment rate of every 4 seconds unless a touch occurs]

periodically drift, at a predetermined rate, the stored threshold value back to an original value, the original value comprising a value of the stored threshold value before it was adjusted based on the determined grounding status of the touch sensor. [col. 16 lines 15-55, fig. 8d step 830 teaches reducing sensor offset by Q where Q is a predetermined number, step 828 teaches increasing sensor offset by P where P is a predetermined number, since sensor baseline + sensor offset = sensor output the effect of raising or lowering the sensor offset is equivalent to raising or lowering the touch threshold]

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the touch controller taught by Westerman modified by Hotelling to determine that the external object has not touched the touch sensor within a predetermined amount of time and periodically drift, at a predetermined rate, the stored threshold value back to an original value, the original value comprising a value of the stored threshold value before it was adjusted based on the determined grounding status of the touch sensor, as taught by Land, in order to allow periodic adjustment of the magnitude of a detected signal required to cause a touch detection.

Regarding **Claim 11**, method Claim 11 was discussed in the rejection of apparatus Claim 5, therefore Claim 7 is rejected for the same reasons as Claim 5.

Regarding **Claim 17**, apparatus Claim 17 was discussed in the rejection of apparatus Claim 5, therefore Claim 17 is rejected for the same reasons as Claim 5.

Regarding **Claim 18**, apparatus Claim 18 was discussed in the rejection of apparatus Claim 6, therefore Claim 18 is rejected for the same reasons as Claim 6.

6. Claim 19 is rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Westerman modified by Hotelling modified by Pub. No.: US 2010/0073301 A1 (Yousefpor et al.) hereinafter Yousefpor.

Regarding **Claim 19** (Currently Amended), Westerman modified by Hotelling teaches the touch-sensitive device of Claim 13, wherein

Westerman modified by Hotelling do not teach determining the grounding status of the touch sensor based on the strength of the charge return path between the touch sensor and ground comprises: analyzing shapes of one or more capacitance graphs.

However, Yousefpor teaches determining the grounding status of the touch sensor based on the strength of the charge return path between the touch sensor and ground comprises: analyzing shapes of one or more capacitance graphs [fig. 6, ¶0067]

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the touch controller taught by Westerman modified by Hotelling to determining the grounding status of the touch sensor based on the strength of the

charge return path between the touch sensor and ground comprises: analyzing shapes of one or more capacitance graphs, as taught by Yousefpor, in order to determine grounding status of a device by measuring capacitance.

Allowable Subject Matter

7. Claim 20 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Douglas M. Wilson whose telephone number is (571)272-5640. The examiner can normally be reached on M-F: 0900-1700. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Sumati Lefkowitz can be reached on 571-272-3638. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

9. 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.

/Douglas M. Wilson/
Examiner, Art Unit 2694

/SUMATI LEFKOWITZ/
Supervisory Patent Examiner, Art Unit 2694

Notice of References Cited	Application/Control No. 13/314,858	Applicant(s)/Patent Under Reexamination SIMMONS ET AL.	
	Examiner Douglas M. Wilson	Art Unit 2694	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-2010/0073301 A1	03-2010	Yousefpor et al.	345/173
*	B	US-2011/0012840 A1	01-2011	HOTELLING et al.	345/173
*	C	US-2011/0074725 A1	03-2011	WESTERMAN et al.	345/174
*	D	US-8,077,160 B2	12-2011	Land et al.	345/173
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13314858	SIMMONS ET AL.
	Examiner	Art Unit
	DOUGLAS M WILSON	2694

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	08/02/2013	02/26/2014	06/15/2014						
	1	✓	✓	✓						
	2	✓	✓	✓						
	3	✓	✓	✓						
	4	✓	✓	✓						
	5	✓	✓	✓						
	6	✓	✓	✓						
	7	✓	✓	✓						
	8	✓	✓	✓						
	9	✓	✓	✓						
	10	✓	✓	✓						
	11	✓	✓	✓						
	12	✓	✓	✓						
	13	✓	✓	✓						
	14	✓	✓	✓						
	15	✓	✓	✓						
	16	✓	✓	✓						
	17	✓	✓	✓						
	18	✓	✓	✓						
	19	O	O	✓						
	20	O	O	O						

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L6	3	(US-20110074725-$ or US-20110012840-$ or US-20100097329-$).did.	US-PGPUB	OR	ON	2014/06/15 16:24
L7	2	l6 and predetermined	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/15 16:24
L9	12	(US-20110012840-$ or US-20110175823-$ or US-20110074725-$ or US-20090174676-$ or US-20100060608-$ or US-20090160787-$ or US-20100073301-$ or US-20080309622-$ or US-20100097329-$ or US-20100097328-$ or US-20090273573-$).did. or (US-8339286-$).did.	US-PGPUB; USPAT	OR	ON	2014/06/15 16:48
L10	0	l9 and predetermined near5 time	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/15 16:48
L11	84	negative near2 pixel same2 predetermined near4 time	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/15 16:49
L12	80	l11 and @ad <"20111208"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/15 16:50
L13	0	l12 and 345/173-178.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/15 16:50
L14	57	periodic near4 (baseline threshold) near4 adjustment	US-PGPUB; USPAT; USOCR; FPRS; EPO;	OR	ON	2014/06/15 16:51

			JPO			
L15	10	l14 and 345/173.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/15 16:52
L16	8	l15 and @ad <"20111208"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/15 16:52
L17	4	(US-20110074725-$ or US-20110012840-$ or US-20100097329-$).did. or (US-8077160-$).did.	US-PGPUB; USPAT	OR	ON	2014/06/15 18:28
L19	2	l17 and (graph table)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/15 18:29
L20	8	l9 and (graph table)	US-PGPUB; USPAT	OR	ON	2014/06/15 18:32
L21	5	12/208,324	US-PGPUB; USPAT	OR	ON	2014/06/15 18:53
S1	1	"13314858"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/02/25 15:05
S2	9	"8339286"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/02/25 15:06
S3	958	charge adj return	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/02/25 15:08
S4	0	S3 and 345/173.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/02/25 15:09
S5	14	S3 and "345".clas.	US-	OR	ON	2014/02/25

			PGPUB; USPAT; USOCR; FPRS; EPO; JPO			15:09
S6	2	"12504639"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/12 10:46
S7	20	(poor$2 NEAR3 ground$3) NEAR5 (finger touch digit) AND 345/173-175.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/12 10:49
S8	62	("6323846" | "7184064" | "4825374" | "6531885" | "20050219228" | "20080165115" | "5488207" | "5880411" | "5825352" | "6310610" | "20050179671" | "5335230" | "5463379" | "20090174688" | "7663607" | "20070074913" | "20070200831" | "3552687" | "20090194341" | "20090251423" | "20090174676" | "5835079" | "6690387" | "7015894" | "6188391" | "7069357" | "20070050646" | "20100060608" | "6504269" | "20060197753" | "20090160787" | "7254775" | "5483261" | "7180508" | "8482544" | "20060026521" | "20060097991" | "20080267462" | "20060238522" | "20090012657" | "20090284495" | "20060166702" | "20090181719" | "20080165116").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/12 11:17
S9	20	(poor$2 NEAR3 ground$3) NEAR5 (finger touch digit) AND 345/173-175.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/12 18:00
S10	15	S9 and @ad <"20111208"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/12 18:00
S11	10	S10 and threshold	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/12 18:01
S12	8	(US-20110012840-$ or US-20110175823-$ or US-20110074725-$ or US-20100073301-$ or US-20100060608-$ or US-	US-PGPUB; USPAT	OR	ON	2014/06/12 18:06

		20090174676-$ or US-20090160787-$).did. or (US-8339286-$).did.				
S13	8	S12 and threshold	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/12 18:07
S14	8	S13 and time	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/12 18:07
S15	4	S13 and maximum	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/12 18:07
S16	3	S15 and adapt	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/12 18:12
S17	13038	negative near5 pixel	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 11:48
S18	377616	(procedure process) near5 (calculate determine)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 11:49
S19	1262	S17 and S18	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 12:07
S20	9	S19 and 345/173.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 12:07
S21	9	S20 and @ad<"20111208"	US-PGPUB; USPAT;	OR	ON	2014/06/13 12:08

			USOCR; FPRS; EPO; JPO			
S22	62	("6323846" | "7184064" | "4825374" | "6531885" | "20050219228" | "20080165115" | "5488207" | "5880411" | "5825352" | "6310610" | "20050179671" | "5335230" | "5463379" | "20090174688" | "7663607" | "20070074913" | "20070200831" | "3552687" | "20090194341" | "20090251423" | "20090174676" | "5835079" | "6690387" | "7015894" | "6188391" | "7069357" | "20070050646" | "20100060608" | "6504269" | "20060197753" | "20090160787" | "7254775" | "5483261" | "7180508" | "8482544" | "20060026521" | "20060097991" | "20080267462" | "20060238522" | "20090012657" | "20090284495" | "20060166702" | "20090181719" | "20080165116").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 12:15
S23	20	(poor$2 NEAR3 ground$3) NEAR5 (finger touch digit) AND 345/173-175.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 12:15
S24	4	S22 and S23	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 12:15
S25	8	(US-20110012840-$ or US-20110175823-$ or US-20110074725-$ or US-20090174676-$ or US-20100060608-$ or US-20090160787-$ or US-20100073301-$).did. or (US-8339286-$).did.	US-PGPUB; USPAT	OR	ON	2014/06/13 12:25
S26	7	S25 and node	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 12:25
S27	8	"11756211"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 12:46
S28	3652	pixel near3 calibration	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 14:33

S29	290	S28 and touch near3 (sensor panel device screen)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 14:34
S30	39	S29 and 345/173.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 14:34
S31	37	S30 and @ad <"20111208"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 14:34
S32	9	(US-20110012840-$ or US-20110175823-$ or US-20110074725-$ or US-20090174676-$ or US-20100060608-$ or US-20090160787-$ or US-20100073301-$ or US-20080309622-$).did. or (US-8339286-$).did.	US-PGPUB; USPAT	OR	ON	2014/06/13 14:58
S33	3652	pixel near3 calibration	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 14:58
S34	290	S33 and touch near3 (sensor panel device screen)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 14:58
S35	39	S34 and 345/173.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 14:58
S36	37	S35 and @ad <"20111208"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 14:58
S37	3	S36 and node	US-PGPUB; USPAT; USOCR; FPRS; EPO;	OR	ON	2014/06/13 14:58

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S38	62	("6323846" | "7184064" | "4825374" | "6531885" | "20050219228" | "20080165115" | "5488207" | "5880411" | "5825352" | "6310610" | "20050179671" | "5335230" | "5463379" | "20090174688" | "7663607" | "20070074913" | "20070200831" | "3552687" | "20090194341" | "20090251423" | "20090174676" | "5835079" | "6690387" | "7015894" | "6188391" | "7069357" | "20070050646" | "20100060608" | "6504269" | "20060197753" | "20090160787" | "7254775" | "5483261" | "7180508" | "8482544" | "20060026521" | "20060097991" | "20080267462" | "20060238522" | "20090012657" | "20090284495" | "20060166702" | "20090181719" | "20080165116").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 14:59
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S41	19	S40 and @ad <"20111218"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 15:41
S42	33	("6888536" | "7920129" | "20070268269" | "20100083109" | "8040326" | "20070177804" | "20070257890" | "20080062148" | "20070109279" | "20060250377" | "20080165141" | "5463388" | "20090021489" | "5825352" | "6452514" | "7663607" | "8049732" | "20090315854" | "8179381" | "20060097991" | "20070152979" | "20080246496" | "7875814" | "20070152984").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 16:06
S43	33	S42 and @ad <"20111208"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/13 16:06

6/15/2014 19:28:31
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Apple EX1002 Page 231

PTO/SB/08	Application Number:	First Named Inventor:
INFORMATION DISCLOSURE STATEMENT BY APPLICANT	13/314,858	Martin J. Simmons et al.
	Attorney Docket No: 080900.1238	**Art Unit:** 2691 **Conf.:** 7360 / **Filing Date:** December 8, 2011

ISSUED U.S. PATENTS AND PUBLISHED U.S. APPLICATIONS

		DOCUMENT NUMBER	PUBLICATION OR ISSUE DATE	FIRST NAMED INVENTOR
	A	7,875,814	25 January 2011	Chen
	B	8,040,326	18 October 2011	Hotelling
	C	8,179,381	15 May 2012	Frey
	D	2009/0315854	24 December 2009	Matsuo
	E	2012/0242588	27 September 2012	Myers
	F	2012/0242592	27 September 2012	Rothkopf
	G	2012/0243151	27 September 2012	Lynch
	H	2012/0243719	27 September 2012	Franklin
	I			
	J			
	K			
	L			
	M			
	N			

UNPUBLISHED U.S. APPLICATIONS

		DOCUMENT NUMBER	FILING DATE	FIRST NAMED INVENTOR
	O	61/454936	21 March 2011	Myers
	P	61/454950	21 March 2011	Lynch
	Q	61/454894	21 March 2011	Rothkopf

FOREIGN PATENT DOCUMENTS

		DOCUMENT NUMBER	PUBLICATION OR ISSUE DATE	COUNTRY	TRANSLATION (YES OR NO)
	R	WO 2012/129247	27 September 2012	PCT	
	S				

NON-PATENT LITERATURE (NPL)

		DOCUMENT (Including Author, Title, Source, and Pertinent Pages)	DATE
	T		
	U		

EXAMINER	DATE CONSIDERED
/Doug Wilson/ (08/01/2013)	08/01/2013

EXAMINER: Initial if citation 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 the applicant.

U.S. PATENT AND TRADEMARK OFFICE

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /DW/

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EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L4	20	(poor$2 NEAR3 ground$3) NEAR5 (finger touch digit) AND 345/173-175.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/12 18:00
L5	15	L4 and @ad <"20111208"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/12 18:00
L6	10	l5 and threshold	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/12 18:01
L7	8	(US-20110012840-$ or US-20110175823-$ or US-20110074725-$ or US-20100073301-$ or US-20100060608-$ or US-20090174676-$ or US-20090160787-$).did. or (US-8339286-$).did.	US-PGPUB; USPAT	OR	ON	2014/06/12 18:06
L8	8	l7 and threshold	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/12 18:07
L9	8	l8 and time	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/12 18:07
L10	4	l8 and maximum	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/12 18:07
S1	1	"13314858"	US-PGPUB; USPAT;	OR	ON	2014/02/25 15:05

			USOCR; FPRS; EPO; JPO			
S2	9	"8339286"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/02/25 15:06
S3	958	charge adj return	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/02/25 15:08
S4	0	S3 and 345/173.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/02/25 15:09
S5	14	S3 and "345".clas.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/02/25 15:09
S6	2	"12504639"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/12 10:46
S7	20	(poor$2 NEAR3 ground$3) NEAR5 (finger touch digit) AND 345/173-175.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/12 10:49
S8	62	("6323846" | "7184064" | "4825374" | "6531885" | "20050219228" | "20080165115" | "5488207" | "5880411" | "5825352" | "6310610" | "20050179671" | "5335230" | "5463379" | "20090174688" | "7663607" | "20070074913" | "20070200831" | "3552687" | "20090194341" | "20090251423" | "20090174676" | "5835079" | "6690387" | "7015894" | "6188391" | "7069357" | "20070050646" | "20100060608" | "6504269" | "20060197753" | "20090160787" | "7254775" | "5483261" | "7180508" | "8482544" | "20060026521" | "20060097991" | "20080267462" | "20060238522" | "20090012657" | "20090284495" | "20060166702" | "20090181719" |	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO	OR	ON	2014/06/12 11:17

		"20080165116").PN.					

6/ 12/ 2014 18:09:50
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Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13314858	SIMMONS ET AL.
	Examiner	Art Unit
	DOUGLAS M WILSON	2694

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES		
Search Notes	Date	Examiner
See attached EAST search history		
Updated Search based on Amendment	6/10/2014	/D.M.W./

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner

/DOUGLAS M WILSON/ Examiner.Art Unit 2694	

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PTO/SB/30 (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
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Request for Continued Examination (RCE) Transmittal

Address to:
Mail Stop RCE
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Application Number	13/314,858
Filing Date	December 8, 2011
First Named Inventor	Simmons
Art Unit	2694; confirmation 7360
Examiner Name	Douglas M. Wilson
Attorney Docket Number	080900.1238

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. See Instruction Sheet for RCEs (not to be submitted to the USPTO) on page 2.

1. 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).

   a. ☐ 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.

      i. ☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on _____

      ii. ☐ Other _____

   b. ☑ Enclosed

      i. ☑ Amendment/Reply

      ii. ☐ Affidavit(s)/ Declaration(s)

      iii. ☐ Information Disclosure Statement (IDS)

      iv. ☐ Other _____

2. Miscellaneous

   a. ☐ 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)

   b. ☐ Other _____

3. Fees The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.

   a. ☑ The Director is hereby authorized to charge the following fees, any underpayment of fees, or credit any overpayments, to Deposit Account No. 02-0384

      i. ☑ RCE fee required under 37 CFR 1.17(e)

      ii. ☐ Extension of time fee (37 CFR 1.136 and 1.17)

      iii. ☐ Other _____

   b. ☐ Check in the amount of $ _____ enclosed

   c. ☐ Payment by credit card (Form PTO-2038 enclosed)

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

Signature		Date	June 9, 2014
Name (Print/Type)	Bradley J. Birchfield	Registration No.	65,521

CERTIFICATE OF MAILING OR TRANSMISSION

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Mail Stop RCE, Commissioner for Patents, P. O. Box 1450, Alexandria, VA 22313-1450 or facsimile transmitted to the U.S. Patent and Trademark Office on the date shown below.

Signature			
Name (Print/Type)		Date	

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. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Mail Stop RCE, 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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Named Inventor:	Martin J. Simmons
Application No.:	13/314,858
Filing Date:	December 8, 2011
Art Unit:	2694
Confirmation No.:	7360
Examiner:	Douglas M. Wilson
Title:	*Touch Sensor with Adaptive Touch Detection Thresholding*

Mail Stop RCE
Commissioner of Patents
PO Box 1450
Alexandria, VA 22313-1450

Dear Sir:

RESPONSE ACCOMPANYING REQUEST FOR CONTINUED EXAMINATION

In response to the Final Office Action dated March 7, 2014, Applicant respectfully requests the Examiner to reconsider the rejections of the claims in view of the amendments and comments set forth below. Please amend the application as follows.

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In the Claims:

1. **(Currently Amended)** A touch sensor comprising:

a plurality of sense electrodes; and

a controller communicatively coupled to the plurality of sense electrodes, the controller configured to:

receive a plurality of signals from the plurality of sense electrodes, the plurality of signals indicative of an amount of capacitance between the touch sensor and an external object;

access a stored threshold value, the threshold value indicating a threshold magnitude of the signals from the plurality of sense electrodes to process as a touch by the external object;

determine **a grounding status of the touch sensor based on** a strength of a charge return path between the touch sensor and a ground; and

adjust the stored threshold value based on the **determined grounding status of the touch sensor**~~determined strength of the charge return path~~.

2. (Original) The touch sensor of Claim 1, wherein:

the plurality of sense electrodes comprises a plurality of x-axis sense electrodes and a plurality of y-axis sense electrodes;

the plurality of x-axis sense electrodes visually intersect the plurality of y-axis sense electrodes; and

the visual intersections of the x-axis sense electrodes and the y-axis sense electrodes comprises a plurality of nodes.

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3. **(Currently Amended)** The touch sensor of Claim 2, wherein determining **the grounding status of the touch sensor based on** the strength of the charge return path between the touch sensor and ground comprises:

determining that the external object has touched the touch sensor at a location that at least partially covers a particular one of the nodes;

determining a maximum magnitude of a particular signal received from sense electrodes associated with the particular node; and

calculating a new threshold value using the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node.

4. **(Currently Amended)** The touch sensor of Claim 3, wherein:

calculating the new threshold value comprises multiplying the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node by a predetermined percentage; and

adjusting the stored threshold value based on the **determined grounding status of the touch sensor**~~determined strength of the charge return path~~ comprises storing the calculated new threshold value as the stored threshold value.

5. **(Currently Amended)** The touch sensor of Claim 1, the controller further configured to, after adjusting the stored threshold value based on the **determined grounding status of the touch sensor**~~determined strength of the charge return path~~:

determine that the external object has not touched the touch sensor within a predetermined amount of time; and

periodically drift, at a predetermined rate, the stored threshold value back to an original value, the original value comprising a value of the stored threshold value before it was adjusted based on the **determined grounding status of the touch sensor**~~determined strength of the charge return path~~.

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6. **(Currently Amended)** The touch sensor of Claim 1, wherein:

adjusting the stored threshold value based on the **determined grounding status of the touch sensor**~~determined strength of the charge return path~~ comprises replacing the stored threshold value with a new threshold value; and

the stored threshold value is adjusted at a predetermined rate.

7. **(Currently Amended)** A method comprising:

receiving, by a controller coupled to a touch sensor, a plurality of signals from a plurality of sense electrodes, the plurality of signals indicative of an amount of capacitance between the touch sensor and an external object;

accessing, by the controller, a stored threshold value, the threshold value indicating a threshold magnitude of the signals from the plurality of sense electrodes to process as a touch by the external object;

determining, by the controller, **a grounding status of the touch sensor based on** a strength of a charge return path between the touch sensor and a ground; and

adjusting, by the controller, the stored threshold value based on the **determined grounding status of the touch sensor**~~determined strength of the charge return path~~.

8. (Original) The method of Claim 7, wherein:

the plurality of sense electrodes comprises a plurality of x-axis sense electrodes and a plurality of y-axis sense electrodes;

the plurality of x-axis sense electrodes visually intersect the plurality of y-axis sense electrodes; and

the visual intersections of the x-axis sense electrodes and the y-axis sense electrodes comprises a plurality of nodes.

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9. **(Currently Amended)** The method of Claim 8, wherein determining **the grounding status of the touch sensor based on** the strength of the charge return path between the touch sensor and ground comprises:

determining that the external object has touched the touch sensor at a location that at least partially covers a particular one of the nodes;

determining a maximum magnitude of a particular signal received from sense electrodes associated with the particular node; and

calculating a new threshold value using the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node.

10. **(Currently Amended)** The method of Claim 9, wherein:

calculating the new threshold value comprises multiplying the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node by a predetermined percentage; and

adjusting the stored threshold value based on the **determined grounding status of the touch sensor**~~determined strength of the charge return path~~ comprises storing the calculated new threshold value as the stored threshold value.

11. **(Currently Amended)** The method of Claim 7, further comprising, after adjusting the stored threshold value based on the **determined grounding status of the touch sensor**~~determined strength of the charge return path~~:

determining that the external object has not touched the touch sensor within a predetermined amount of time; and

periodically drifting, at a predetermined rate, the stored threshold value back to an original value, the original value comprising a value of the stored threshold value before it was adjusted based on the **determined grounding status of the touch sensor**~~determined strength of the charge return path~~.

12. (**Currently Amended**) The method of Claim 7, wherein:

adjusting the stored threshold value based on the **determined grounding status of the touch sensor**~~determined strength of the charge return path~~ comprises replacing the stored threshold value with a new threshold value; and

the stored threshold value is adjusted at a predetermined rate.

13. (**Currently Amended**) A touch-sensitive device comprising a controller, the controller communicatively coupled to a plurality of sense electrodes, the controller operable to:

receive a plurality of signals from the plurality of sense electrodes, the plurality of signals indicative of an amount of capacitance between the touch-sensitive device and an external object;

access a stored threshold value, the threshold value indicating a threshold magnitude of the signals from the plurality of sense electrodes to process as a touch of the touch-sensitive device by the external object;

determine **a grounding status of the touch sensor based on** a strength of a charge return path between the touch-sensitive device and a ground; and

adjust the stored threshold value based on the **determined grounding status of the touch sensor**~~determined strength of the charge return path~~.

14. (Original) The touch-sensitive device of Claim 13, wherein:

the plurality of sense electrodes comprises a plurality of x-axis sense electrodes and a plurality of y-axis sense electrodes;

the plurality of x-axis sense electrodes visually intersect the plurality of y-axis sense electrodes; and

the visual intersections of the x-axis sense electrodes and the y-axis sense electrodes comprises a plurality of nodes.

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15. **(Currently Amended)** The touch-sensitive device of Claim 14, wherein determining **the grounding status of the touch sensor based on** the strength of the charge return path between the touch sensor and ground comprises:

determining that the external object has touched the touch sensor at a location that at least partially covers a particular one of the nodes;

determining a maximum magnitude of a particular signal received from sense electrodes associated with the particular node; and

calculating a new threshold value using the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node.

16. **(Currently Amended)** The touch-sensitive device of Claim 15, wherein:

calculating the new threshold value comprises multiplying the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node by a predetermined percentage; and

adjusting the stored threshold value based on the **determined grounding status of the touch sensor**~~determined strength of the charge return path~~ comprises storing the calculated new threshold value as the stored threshold value.

17. **(Currently Amended)** The touch-sensitive device of Claim 13, the controller further operable to, after adjusting the stored threshold value based on the **determined grounding status of the touch sensor**~~determined strength of the charge return path~~:

determine that the external object has not touched the touch sensor within a predetermined amount of time; and

periodically drift, at a predetermined rate, the stored threshold value back to an original value, the original value comprising a value of the stored threshold value before it was adjusted based on the **determined grounding status of the touch sensor**~~determined strength of the charge return path~~.

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18. **(Currently Amended)** The touch-sensitive device of Claim 13, wherein:

adjusting the stored threshold value **determined grounding status of the touch sensor**~~based on the determined strength of the charge return path~~ comprises replacing the stored threshold value with a new threshold value; and

the stored threshold value is adjusted at a predetermined rate.

19. **(Currently Amended)** The touch-sensitive device of Claim 13, wherein determining **the grounding status of the touch sensor based on** the strength of the charge return path between the touch sensor and ground comprises analyzing shapes of one or more capacitance graphs.

20. (Original) The touch-sensitive device of Claim 19, wherein analyzing shapes of one or more capacitance graphs comprises:

comparing a capacitance graph derived from plurality of signals indicative of an amount of capacitance between the touch-sensitive device and an external object with a plurality of stored capacitance graphs, the stored capacitance graphs comprising:

a grounded capacitance graph indicative of a typical touch when the touch-sensitive device is grounded; and

a floating capacitance graph indicative of a typical touch when the touch-sensitive device is floating;

determining, based on the comparison, that the touch-sensitive device is grounded if the capacitance graph matches the grounded capacitance graph; and

determining, based on the comparison, that the touch-sensitive device is floating if the capacitance graph matches the floating capacitance graph.

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REMARKS

This Application has been carefully reviewed in light of the Final Office Action dated March 7, 2014 ("Final Office Action"). Applicant appreciates the Examiner's consideration of the Application. In the Final Office Action, Claims 1-18 are pending and stand rejected and Claims 19-20 are objected to. To advance prosecution of this application, Applicant amends Claims 1, 3-7, 9-13, and 15-19. Applicant does not admit that the amendments are necessary due to the cited references or any of the Examiner's rejections. Applicant respectfully traverses the rejections and requests reconsideration and allowance of all pending claims.

Request for Subsequent Interview

If, in response to Applicant's present submission, the Examiner intends to issue a new Office Action rejecting some or all of the pending claims, in the interest of compact and efficient prosecution Applicant respectfully requests that the Examiner contact Applicant's attorney prior to issuing the new Office Action to discuss a possible resolution to any outstanding issues.

Allowable Subject Matter

Applicant notes with appreciation the Examiner's indication that Claims 19 and 20 would be allowable if rewritten in independent form. However, due to Applicant's belief that the independent claims from which Claims 19 and 20 depend are allowable, as demonstrated below, Applicant has chosen not to rewrite Claims 19 and 20 in independent form at this time.

Section 103 Rejections

The Final Office Action rejects Claims 1-18 under 5 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 8,339,286 ("*Cordeiro*") in view of Analog Devices, Inc., Programmable Controller for Capacitance Touch Sensors AD7143, Product Data Sheet, Revision 0, January 2007 ("*AD7143*"). Applicant respectfully traverses these rejections and discusses amended independent Claim 7 below as an example.

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Applicant respectfully submits that amended independent Claim 7 is allowable at least because the proposed *Cordeiro-AD7143* combination fails to disclose, teach, or suggest at least the following features recited in Claim 7 (emphasis added):

> determining, by the controller, ***a grounding status of the touch sensor*** based on a strength of a charge return path between the touch sensor and a ground.

The Final Office Action points to Fig. 2, element 124 and Fig. 5, step 510 of *Cordeiro* as allegedly teaching a previous version of this portion of Claim 7. (Final Office Action, page 4.) Whether or not those rejections were appropriate (and Applicant respectfully submits they were not), the cited portions of *Cordeiro* do not disclose, teach, or suggest "determining, by the controller, ***a grounding status of the touch sensor*** based on a strength of a charge return path between the touch sensor and a ground," as recited in amended Claim 7 (emphasis added). According to a description of the cited portion of *Cordeiro*:

> Initially, raw count values are received for each node on the touch sensitive device (510). Such raw count values, as mentioned with respect to previous figures, may not be count values at all, depending on implementation, but may instead be some value that is a surrogate for the mutual capacitance at a given node on a touch sensor. For example, the count values may be in fact be voltage levels.

(*Cordeiro*, column 5, lines 61-67.) That is, while the cited portion of *Cordeiro* may disclose receiving raw count values such as voltage levels, merely disclosing count values and voltage levels does not disclose, teach, or suggest "determining, by the controller, ***a grounding status of the touch sensor*** based on a strength of a charge return path between the touch sensor and a ground," as recited in amended Claim 7 (emphasis added). The cited portions of *AD7143* do not cure this deficiency of *Cordeiro*, and the Final Office Action does not allege that they do. Consequently, the proposed *Cordeiro-AD7143* combination fails to disclose, teach, or suggest each and every element of amended Claim 7.

For at least these reasons, amended independent Claim 7 and its dependent claims are allowable. For at least certain analogous reasons, amended independent Claims 1 and 13 and their dependent claims are also allowable. Accordingly, Applicant respectfully requests reconsideration and allowance of all pending claims.

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Amended independent Claim 7 is additionally allowable at least because the proposed *Cordeiro-AD7143* combination fails to disclose, teach, or suggest at least the following features recited in Claim 7 (emphasis added):

> adjusting, by the controller, the stored threshold value ***based on the determined grounding status of the touch sensor***.

The Final Office Action admits that *Cordeiro* fails to disclose a previous version of this portion of Claim 7 and instead relies on ¶¶ 2-3 on page 25 of *AD7143*. (Final Office Action, page 4.) Whether or not those rejections were appropriate (and Applicant respectfully submits they were not), the cited portions of *AD7143* do not disclose, teach, or suggest "adjusting, by the controller, the stored threshold value ***based on the determined grounding status of the touch sensor***," as recited in amended Claim 7 (emphasis added). According to the cited portions of *AD7143*:

> The AD7143 provides an on-chip self-learning adaptive threshold and sensitivity algorithm. This algorithm continuously monitors the output levels of each sensor and automatically rescales the threshold levels proportionally to the sensor area covered by the user. As a result, the AD7143 maintains optimal threshold and sensitivity levels for all types of users regardless of their finger sizes.
>
> The threshold level is always referenced from the ambient level and is defined as the CDC converter output level that must be exceeded for a valid sensor contact. The sensitivity level is defined as how sensitive the sensor is before a valid contact is registered.
>
> Figure 36 provides an example of how the adaptive threshold and sensitivity algorithm works. **The positive and negative sensor threshold levels are calculated as a percentage of the STAGE_OFFSET_HIGH and STAGE_OFFSET_LOW values based on the threshold sensitivity settings and the ambient value.**
>
> On configuration, initial estimates are supplied for both STAGE_OFFSET_HIGH and STAGE_OFFSET_LOW after which the calibration engine automatically adjusts the STAGE_HIGH_THRESHOLD and STAGE_LOW THRESHOLD values for sensor response.
>
> Reference A in Figure 36 shows an under sensitive threshold level for a small finger user, demonstrating the disadvantages of a fixed threshold level. **By enabling the adaptive threshold and sensitivity algorithm, the positive and negative threshold levels are determined by the POS_ THRESHOLD SENSITIVITY and NEG_THRESHOLD_SENSITIVITY register values and the most recent average maximum sensor output value.** These

> registers can be used to select 16 different positive and negative sensitivity levels ranging between 25% and 95.32% of the most recent average maximum output level referenced from the ambient value. The smaller the sensitivity percentage setting, the easier it is to trigger a sensor activation. Reference B shows that the positive adaptive threshold level is set at almost mid-sensitivity with a 62.51% threshold level by setting POS_THRESHOLD_SENSITIVITY = 1000. Figure 36 also provides a similar example for the negative threshold level with NEG_ THRESHOLD SENSITIVITY= 0001.

(*AD7143*, page 25, ¶¶ 1-5, emphasis added.) That is, while the cited portion of *AD7143* may disclose an algorithm that adjusts a threshold based on the most recent average maximum sensor output values, it does not disclose, teach, or suggest "adjusting, by the controller, the stored threshold value ***based on the determined grounding status of the touch sensor,***" as recited in amended Claim 7 (emphasis added). The cited portions of *Cordeiro* do not cure this deficiency of *AD7143,* and the Final Office Action does not allege that they do. Consequently, the proposed *Cordeiro-AD7143* combination fails to disclose, teach, or suggest each and every element of amended Claim 7.

For at least these additional reasons, amended independent Claim 7 and its dependent claims are allowable. For at least certain analogous reasons, amended independent Claims 1 and 13 and their dependent claims are also allowable. Accordingly, Applicant respectfully requests reconsideration and allowance of all pending claims.

No Waiver

Applicant's arguments and amendments are made without prejudice or disclaimer. By not responding to additional statements made by the Examiner, Applicant does not acquiesce to the additional statements. The distinctions between the applied references and the claims are provided as examples only and are sufficient to overcome the rejections. Applicant reserves the right to discuss additional or other distinctions in a later response or on appeal, if appropriate.

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Apple EX1002 Page 249

Request for Evidentiary Support

Should any of the above asserted rejections be maintained, Applicant respectfully requests appropriate evidentiary support. Additionally, if the Examiner is relying upon "common knowledge" or "well known" principles to establish a rejection, Applicant requests that a reference be provided in support of this position pursuant to M.P.E.P. § 2144.03. Furthermore, to the extent that the Examiner maintains any rejection based on an "Official Notice" or other information within the Examiner's personal knowledge, Applicant respectfully requests that the Examiner cite a reference as documentary evidence in support of this position or provide an affidavit in accordance with M.P.E.P. § 2144.03 and 37 C.F.R. 1.104(d)(2).

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Apple EX1002 Page 250

CONCLUSION

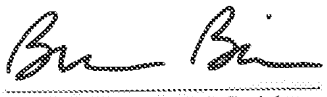
Applicant has made an earnest attempt to place this case in condition for allowance. For the foregoing reasons and for other reasons clearly apparent, Applicant respectfully requests reconsideration and full allowance of all pending claims.

If the Examiner feels that a telephone conference would advance prosecution of this application in any manner, the Examiner is invited to contact Bradley J. Birchfield, Attorney for Applicant, at the Examiner's convenience at (214) 953-6570 or brad.birchfield@bakerbotts.com.

As indicated on the accompanying RCE Transmittal form, the Commissioner is hereby authorized to charge the RCE fee of $1200 to Deposit Account No. 02-0384 of Baker Botts L.L.P. Although Applicants believe no other fees are due, the Commissioner is hereby authorized to charge any necessary additional fees and credit any overpayments to Deposit Account No. 02-0384 of BAKER BOTTS L.L.P.

Respectfully submitted,

BAKER BOTTS L.L.P.
Attorneys for Applicant



Bradley J. Birchfield
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Date: June 9, 2014

Correspondence Address:

Customer Number: **12323**

IPR2020-01287
Apple EX1002 Page 251

Electronic Patent Application Fee Transmittal

Application Number:	13314858
Filing Date:	08-Dec-2011
Title of Invention:	Touch Sensor With Adaptive Touch Detection Thresholding
First Named Inventor/Applicant Name:	Martin John Simmons
Filer:	Kurt Max Pankratz./Elizabeth Turlo
Attorney Docket Number:	080900.1238

Filed as Large Entity

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Request for Continued Examination	1801	1	1200	1200
		Total in USD ($)		**1200**

Electronic Acknowledgement Receipt

EFS ID:	19247868
Application Number:	13314858
International Application Number:	
Confirmation Number:	7360
Title of Invention:	Touch Sensor With Adaptive Touch Detection Thresholding
First Named Inventor/Applicant Name:	Martin John Simmons
Customer Number:	12323
Filer:	Kurt Max Pankratz./Elizabeth Turlo
Filer Authorized By:	Kurt Max Pankratz.
Attorney Docket Number:	080900.1238
Receipt Date:	09-JUN-2014
Filing Date:	08-DEC-2011
Time Stamp:	14:56:21
Application Type:	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	1178
Deposit Account	020384
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)

Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)

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	Request for Continued Examination (RCE)	0809001238RCETrans.PDF	121001 ecead8fbf4362db668b3c918c041ea85ff8f47e2	no	1
Warnings:					
This is not a USPTO supplied RCE SB30 form.					
Information:					
2		0809001238RCEAmend.PDF	676627 69ac332a06988319acf04268a48cc92b4ec9e176	yes	14

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Amendment Submitted/Entered with Filing of CPA/RCE	1	1
	Claims	2	8
	Applicant Arguments/Remarks Made in an Amendment	9	14

Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	30338 8f3433ea1abf4ecf872f8359354c3ba56c07009f	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	827966		

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.

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 13/314,858	Filing Date 12/08/2011	☐ To be Mailed

ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

	(Column 1)	(Column 2)		
FOR	NUMBER FILED	NUMBER EXTRA	RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =	
☐ APPLICATION SIZE FEE (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).			
☐ 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	

APPLICATION AS AMENDED – PART II

		(Column 1)		(Column 2)	(Column 3)		
	06/09/2014	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
AMENDMENT	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
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	**0**

		(Column 1)		(Column 2)	(Column 3)		
		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
AMENDMENT	Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ 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.

** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

LIE
/MARCIA GORDON/

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.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/314,858	12/08/2011	Martin John Simmons	080900.1238	7360

12323 7590 03/07/2014

Baker Botts L.L.P.
2001 Ross Avenue, 6th Floor
Dallas, TX 75201

EXAMINER	
WILSON, DOUGLAS M	

ART UNIT	PAPER NUMBER
2694	

NOTIFICATION DATE	DELIVERY MODE
03/07/2014	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):

ptomail1@bakerbotts.com
ptomail2@bakerbotts.com

Office Action Summary	Application No. 13/314,858	Applicant(s) SIMMONS ET AL.	
	Examiner Douglas M. Wilson	Art Unit 2694	AIA (First Inventor to File) Status 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 *11/18/2013*.

☐ 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) *1-18* is/are rejected.

8)☒ Claim(s) *19 and 20* 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 or send an inquiry to PPHfeedback@uspto.gov.

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☒ The drawing(s) filed on *12/08/2011* 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 _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

4) ☐ Other: _____.

DETAILED ACTION

Notice of Pre-AIA or AIA Status

1. The present application is being examined under the pre-AIA first to invent provisions. Claims 1-20 are pending.

Response to Amendment

2. Applicant's correspondence dated November 18, 2013 did not amend any part of the application.

Response to Arguments

3. Applicant's arguments filed November 18, 2013 have been fully considered but they are not persuasive.

Rejection of Independent **Claim 13,** Applicant asserts that the cited references do not disclose, teach, or suggest a controller that is operable to "determine the strength of a charge return path **between the touch sensitive device and a ground**," (emphasis added).

Examiner respectfully disagrees with applicant's assertion. Since the applicant does not specifically define any of the key terms, *strength of a charge return path, touch sensitive device, a ground*, in Claim 13 it is appropriate to give these terms their broadest reasonable interpretation, consistent with the specification. The Federal Circuit's en banc decision in Phillips v. AWH Corp., 415 F.3d 1303 (Fed. Cir. 2005)

expressly recognized that the USPTO employs the "broadest reasonable interpretation" standard.

The cited reference teaches a controller that determines capacitance at a node regardless of the grounded state of the node. The nodes are part of a touch panel which is a touch sensitive device. When a person touches a node it is capacitive coupled to a ground, the earth. Construing the strength of the charge return path as the strength of the capacitive coupling with earth, the cited device controller determines the strength of the charge return path between the touch sensitive device and a ground.

Claim Rejections - 35 USC § 103

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 negatived by the manner in which the invention was made.

4. Claims 1-18 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 8,339,286 B2 (Craig A. Cordeiro) hereinafter Cordeiro modified by Analog Devices, Inc., Programmable Controller for Capacitance Touch Sensors AD7143, Product Data Sheet, 56 pages, Revision 0, January 2007 hereinafter AD7143.

Regarding **Claim 1**, Cordeiro discloses a **touch sensor comprising:**

a plurality of sense electrodes; (Fig. 2 elements 116, 118) **and**

a controller communicatively coupled to the plurality of sense electrodes, (Fig. 2 element 114) **the controller configured to:**

receive a plurality of signals from the plurality of sense electrodes, the plurality of signals indicative of an amount of capacitance between the touch sensor and an external object; (Col. 3 lines 61-66)

access a stored threshold value, the threshold value indicating a threshold magnitude of the signals from the plurality of sense electrodes to process as a touch by the external object; (Col. 5 lines 43-45)

determine a strength of a charge return path between the touch sensor and a ground; (Fig. 2 element 124 is a node, Fig. 5 step 510, one method to determine a charge return path strength is to measure capacitance measured at a node) **and**

Cordeiro does not disclose **adjust the stored threshold value based on the determined strength of the charge return path.** However, AD7143 teaches an adaptive threshold, (Page 25 ¶ 2 and ¶3), based on the received signal, which is taken at a node, and therefore equal to the strength of the charge return path.

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the touch sensor disclosed by Cordeiro to modify the stored baseline value into a stored threshold value that is adjusted based on the strength of the charge return path as taught by AD7143 to reduce touch event errors during large variations in sensed capacitance.

Regarding **Claim 2**, Cordeiro as modified by AD7143 discloses **the touch sensor of Claim 1, wherein:**

the plurality of sense electrodes comprises a plurality of x-axis sense electrodes and a plurality of y-axis sense electrodes; (Fig. 2 elements 116, 118)

the plurality of x-axis sense electrodes visually intersect the plurality of y-axis sense electrodes; (Fig. 2 elements 116, 118) **and**

the visual intersections of the x-axis sense electrodes and the y-axis sense electrodes comprises a plurality of nodes. (Fig. 2 element 122, 124, Col. 4 lines 21-25)

Regarding **Claim 3**, Cordeiro as modified by AD7143 discloses **the touch sensor of Claim 2, wherein determining the strength of the charge return path between the touch sensor and ground comprises:**

determining that the external object has touched the touch sensor at a location that at least partially covers a particular one of the nodes; (Fig. 5 element 510, Col. 2 lines 52-59)

determining a maximum magnitude of a particular signal received from sense electrodes associated with the particular node; (Fig. 5 element 510, Col. 5 lines 61-67 **and**

Cordeiro does not disclose **calculating a new threshold value using the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node.** However AD7143 teaches

calculating and storing a new threshold value based on the max received signal value (Page 25, Fig. 36 element A, ¶ 1,¶2, ¶4).

It would have been obvious to one of ordinary skill in the art at the time of the invention to combine using the max signal value determining a new threshold value as taught by AD7143 into the touch sensor disclosed by Cordeiro to reduce false touch events during large variations in sensed capacitance.

Regarding **Claim 4**, Cordeiro as modified by AD7143 discloses **the touch sensor of Claim 3, wherein:**

calculating the new threshold value comprises Cordeiro discloses using the signal received from a particular node (Fig. 5 element 510) but does not disclose **multiplying the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node by a predetermined percentage; (However AD7143 teaches) multiplying the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node by a predetermined percentage; (Page 25, Fig. 36 elements A, B, ¶1-4) and**

adjusting the stored threshold value based on the determined strength of the charge return path comprises storing the calculated new threshold value as the stored threshold value. (Page 25 ¶ 5, Fig. 36)

It would have been obvious to one of ordinary skill in the art at the time of the invention to combine using the sensitivity setting and the max signal value in

determining a new threshold value as taught by AD7143 into the touch sensor disclosed by Cordeiro to regulate the sensor's sensitivity to indicating valid contacts.

Regarding **Claim 5,** Cordeiro as modified by AD7143 disclose **the touch sensor of Claim 1, the controller further configured to, after adjusting the stored threshold value based on the determined strength of the charge return path:**

determine that the external object has not touched the touch sensor within a predetermined amount of time; (Col. 1 lines 60-62, Fig. 5 elements 520, 530, 540, 550, 560, 570, 580, the trend duration count (Fig. 5 element 550) is reset during a touch event, trend duration count threshold (Fig. 5 element 560) is a predetermined time since last touch event) **and**

periodically (Fig. 5 element 560) **drift, at a predetermined rate** (Col. 6 lines 46-50)**, the stored threshold value back to an original value, the original value comprising a value of the stored threshold value before it was adjusted based on the determined strength of the charge return path.** Cordeiro teaches increasing or decreasing the stored value periodically, in the absence of a touch event, using a stray update procedure (Col. 6 lines 46-50). Cordeiro does not teach adjusting the stored threshold value, however AD7143 teaches adjusting a stored threshold and using the adjusted threshold as the new stored threshold.

It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the periodic adjustment of a stored value corresponding to a stored threshold disclosed by Cordeiro with the actual adjustment of a stored threshold

as taught by AD7143 in order to gradually reduce the perturbed stored threshold to its original value.

Regarding **Claim 6**, Cordeiro as modified by AD7143 disclose **the touch sensor of Claim 1, wherein:**

Cordeiro does not teach **adjusting the stored threshold value based on the determined strength of the charge return path comprises replacing the stored threshold value with a new value;** However AD7143 teaches calculating and storing a new threshold value based on the max received signal value (Page 25, Fig. 36 element A, ¶ 1, ¶2, ¶4) **and**

the stored threshold value is adjusted at a predetermined rate. (Fig. 5 elements 510, 550, 560, 570, Cordeiro discloses adjusting the stored value at a determined periodicity)

It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the periodic adjustment of a stored value corresponding to a stored threshold disclosed by Cordeiro with the actual adjustment of a stored threshold as taught by AD7143 in order to periodically sample for a change in the devices grounded state.

Regarding **Claim 7**, there are no patentably distinct limitations in the method of Claim 7 over the device of Claim 1, therefore Claim 7 is rejected for the same reasons as Claim 1.

Regarding **Claim 8**, there are no patentably distinct limitations in the method of Claim 8 over the device of Claim 2, therefore Claim 8 is rejected for the same reasons as Claim 2.

Regarding **Claim 9**, there are no patentably distinct limitations in the method of Claim 9 over the device of Claim 3, therefore Claim 9 is rejected for the same reasons as Claim 3.

Regarding **Claim 10**, there are no patentably distinct limitations in the method of Claim 10 over the device of Claim 4, therefore Claim 10 is rejected for the same reasons as Claim 4.

Regarding **Claim 11**, there are no patentably distinct limitations in the method of Claim 11 over the device of Claim 5, therefore Claim 11 is rejected for the same reasons as Claim 5.

Regarding **Claim 12**, there are no patentably distinct limitations in the method of Claim 12 over the device of Claim 6, therefore Claim 12 is rejected for the same reasons as Claim 6.

Regarding **Claim 13**, there are no patentably distinct limitations in the device of Claim 13 over the device of Claim 1, therefore Claim 13 is rejected for the same reasons as Claim 1.

Regarding **Claim 14**, there are no patentably distinct limitations in the device of Claim 14 over the device of Claim 2, therefore Claim 14 is rejected for the same reasons as Claim 2.

Regarding **Claim 15**, there are no patentably distinct limitations in the device of Claim 15 over the device of Claim 3, therefore Claim 15 is rejected for the same reasons as Claim 3.

Regarding **Claim 16**, there are no patentably distinct limitations in the device of Claim 16 over the device of Claim 4, therefore Claim 16 is rejected for the same reasons as Claim 4.

Regarding **Claim 17**, there are no patentably distinct limitations in the device of Claim 17 over the device of Claim 5, therefore Claim 17 is rejected for the same reasons as Claim 5.

Regarding **Claim 18**, there are no patentably distinct limitations in the device of Claim 18 over the device of Claim 6, therefore Claim 17 is rejected for the same reasons as Claim 6.

Allowable Subject Matter

5. Claims 19-20 are is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

6. **THIS ACTION IS MADE FINAL.** 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 mailing date of this final action.

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Douglas M. Wilson whose telephone number is (571)272-5640. The examiner can normally be reached on M-F: 0900-1700. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Sumati Lefkowitz can be reached on 571-272-3638. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

8. 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.

/Douglas M. Wilson/
Examiner, Art Unit 2694

/SUMATI LEFKOWITZ/
Supervisory Patent Examiner, Art Unit 2694

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13314858	SIMMONS ET AL.
	Examiner	**Art Unit**
	DOUGLAS M WILSON	2694

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	08/02/2013	02/26/2014							
	1	✓	✓							
	2	✓	✓							
	3	✓	✓							
	4	✓	✓							
	5	✓	✓							
	6	✓	✓							
	7	✓	✓							
	8	✓	✓							
	9	✓	✓							
	10	✓	✓							
	11	✓	✓							
	12	✓	✓							
	13	✓	✓							
	14	✓	✓							
	15	✓	✓							
	16	✓	✓							
	17	✓	✓							
	18	✓	✓							
	19	O	O							
	20	O	O							

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Named Inventor:	Martin J. Simmons
Application No.:	13/314,858
Filing Date:	December 8, 2011
Art Unit:	2694
Confirmation No.:	7360
Examiner:	Douglas M. Wilson
Title:	*Touch Sensor with Adaptive Touch Detection Thresholding*

Mail Stop Amendment
Commissioner of Patents
PO Box 1450
Alexandria, VA 22313-1450

Dear Sir:

Response Pursuant To 37 C.F.R. § 1.111

In response to the Office Action dated August 16, 2013, Applicant respectfully requests the Examiner to reconsider the rejections of the claims in view of the following amendments and remarks. Please amend the Application as follows.

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In the Claims

1. (Original) A touch sensor comprising:

a plurality of sense electrodes; and

a controller communicatively coupled to the plurality of sense electrodes, the controller configured to:

receive a plurality of signals from the plurality of sense electrodes, the plurality of signals indicative of an amount of capacitance between the touch sensor and an external object;

access a stored threshold value, the threshold value indicating a threshold magnitude of the signals from the plurality of sense electrodes to process as a touch by the external object;

determine a strength of a charge return path between the touch sensor and a ground; and

adjust the stored threshold value based on the determined strength of the charge return path.

2. (Original) The touch sensor of Claim 1, wherein:

the plurality of sense electrodes comprises a plurality of x-axis sense electrodes and a plurality of y-axis sense electrodes;

the plurality of x-axis sense electrodes visually intersect the plurality of y-axis sense electrodes; and

the visual intersections of the x-axis sense electrodes and the y-axis sense electrodes comprises a plurality of nodes.

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3. (Original) The touch sensor of Claim 2, wherein determining the strength of the charge return path between the touch sensor and ground comprises:

determining that the external object has touched the touch sensor at a location that at least partially covers a particular one of the nodes;

determining a maximum magnitude of a particular signal received from sense electrodes associated with the particular node; and

calculating a new threshold value using the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node.

4. (Original) The touch sensor of Claim 3, wherein:

calculating the new threshold value comprises multiplying the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node by a predetermined percentage; and

adjusting the stored threshold value based on the determined strength of the charge return path comprises storing the calculated new threshold value as the stored threshold value.

5. (Original) The touch sensor of Claim 1, the controller further configured to, after adjusting the stored threshold value based on the determined strength of the charge return path:

determine that the external object has not touched the touch sensor within a predetermined amount of time; and

periodically drift, at a predetermined rate, the stored threshold value back to an original value, the original value comprising a value of the stored threshold value before it was adjusted based on the determined strength of the charge return path.

6. (Original) The touch sensor of Claim 1, wherein:

adjusting the stored threshold value based on the determined strength of the charge return path comprises replacing the stored threshold value with a new threshold value; and

the stored threshold value is adjusted at a predetermined rate.

7. (Original) A method comprising:

receiving, by a controller coupled to a touch sensor, a plurality of signals from a plurality of sense electrodes, the plurality of signals indicative of an amount of capacitance between the touch sensor and an external object;

accessing, by the controller, a stored threshold value, the threshold value indicating a threshold magnitude of the signals from the plurality of sense electrodes to process as a touch by the external object;

determining, by the controller, a strength of a charge return path between the touch sensor and a ground; and

adjusting, by the controller, the stored threshold value based on the determined strength of the charge return path.

8. (Original) The method of Claim 7, wherein:

the plurality of sense electrodes comprises a plurality of x-axis sense electrodes and a plurality of y-axis sense electrodes;

the plurality of x-axis sense electrodes visually intersect the plurality of y-axis sense electrodes; and

the visual intersections of the x-axis sense electrodes and the y-axis sense electrodes comprises a plurality of nodes.

9. (Original) The method of Claim 8, wherein determining the strength of the charge return path between the touch sensor and ground comprises:

determining that the external object has touched the touch sensor at a location that at least partially covers a particular one of the nodes;

determining a maximum magnitude of a particular signal received from sense electrodes associated with the particular node; and

calculating a new threshold value using the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node.

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10. (Original) The method of Claim 9, wherein:

calculating the new threshold value comprises multiplying the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node by a predetermined percentage; and

adjusting the stored threshold value based on the determined strength of the charge return path comprises storing the calculated new threshold value as the stored threshold value.

11. (Original) The method of Claim 7, further comprising, after adjusting the stored threshold value based on the determined strength of the charge return path:

determining that the external object has not touched the touch sensor within a predetermined amount of time; and

periodically drifting, at a predetermined rate, the stored threshold value back to an original value, the original value comprising a value of the stored threshold value before it was adjusted based on the determined strength of the charge return path.

12. (Original) The method of Claim 7, wherein:

adjusting the stored threshold value based on the determined strength of the charge return path comprises replacing the stored threshold value with a new threshold value; and

the stored threshold value is adjusted at a predetermined rate.

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13. (Original) A touch-sensitive device comprising a controller, the controller communicatively coupled to a plurality of sense electrodes, the controller operable to:

receive a plurality of signals from the plurality of sense electrodes, the plurality of signals indicative of an amount of capacitance between the touch-sensitive device and an external object;

access a stored threshold value, the threshold value indicating a threshold magnitude of the signals from the plurality of sense electrodes to process as a touch of the touch-sensitive device by the external object;

determine a strength of a charge return path between the touch-sensitive device and a ground; and

adjust the stored threshold value based on the determined strength of the charge return path.

14. (Original) The touch-sensitive device of Claim 13, wherein:

the plurality of sense electrodes comprises a plurality of x-axis sense electrodes and a plurality of y-axis sense electrodes;

the plurality of x-axis sense electrodes visually intersect the plurality of y-axis sense electrodes; and

the visual intersections of the x-axis sense electrodes and the y-axis sense electrodes comprises a plurality of nodes.

15. (Original) The touch-sensitive device of Claim 14, wherein determining the strength of the charge return path between the touch sensor and ground comprises:

determining that the external object has touched the touch sensor at a location that at least partially covers a particular one of the nodes;

determining a maximum magnitude of a particular signal received from sense electrodes associated with the particular node; and

calculating a new threshold value using the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node.

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16. (Original) The touch-sensitive device of Claim 15, wherein:

calculating the new threshold value comprises multiplying the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node by a predetermined percentage; and

adjusting the stored threshold value based on the determined strength of the charge return path comprises storing the calculated new threshold value as the stored threshold value.

17. (Original) The touch-sensitive device of Claim 13, the controller further operable to, after adjusting the stored threshold value based on the determined strength of the charge return path:

determine that the external object has not touched the touch sensor within a predetermined amount of time; and

periodically drift, at a predetermined rate, the stored threshold value back to an original value, the original value comprising a value of the stored threshold value before it was adjusted based on the determined strength of the charge return path.

18. (Original) The touch-sensitive device of Claim 13, wherein:

adjusting the stored threshold value based on the determined strength of the charge return path comprises replacing the stored threshold value with a new threshold value; and

the stored threshold value is adjusted at a predetermined rate.

19. (Original) The touch-sensitive device of Claim 13, wherein determining the strength of the charge return path between the touch sensor and ground comprises analyzing shapes of one or more capacitance graphs.

20. (Original) The touch-sensitive device of Claim 19, wherein analyzing shapes of one or more capacitance graphs comprises:

comparing a capacitance graph derived from plurality of signals indicative of an amount of capacitance between the touch-sensitive device and an external object with a plurality of stored capacitance graphs, the stored capacitance graphs comprising:

a grounded capacitance graph indicative of a typical touch when the touch-sensitive device is grounded; and

a floating capacitance graph indicative of a typical touch when the touch-sensitive device is floating;

determining, based on the comparison, that the touch-sensitive device is grounded if the capacitance graph matches the grounded capacitance graph; and

determining, based on the comparison, that the touch-sensitive device is floating if the capacitance graph matches the floating capacitance graph.

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REMARKS

This Application has been carefully reviewed in light of the Office Action dated August 16, 2013 ("Office Action"). Applicant appreciates the Examiner's consideration of the Application. In the Office Action, Claims 1-18 are pending and stand rejected and Claims 19-20 are objected to. Applicant believes all claims are allowable without amendment and respectfully provides the following remarks. Applicant respectfully requests reconsideration and allowance of all pending claims.

Allowable Subject Matter

Applicant notes with appreciation the Examiner's indication that Claims 19 and 20 would be allowable if rewritten in independent form. However, due to Applicant's belief that the independent claims from which Claims 19 and 20 depend are allowable, as demonstrated below, Applicant has chosen not to rewrite Claims 19 and 20 in independent form at this time.

Section 103 Rejections

The Office Action rejects Claims 1-18 under 5 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 8,339,286 ("*Cordeiro*") and further in view of Analog Devices, Inc., Programmable Controller for Capacitance Touch Sensors AD7143, Product Data Sheet, Revision 0, January 2007 ("*AD7143*"). Applicant respectfully traverses these rejections and discusses independent Claim 13 below as an example.

Applicant respectfully submits that independent Claim 13 is allowable at least because the proposed *Cordeiro-AD7143* combination fails to disclose, teach, or suggest at least the following limitations recited in Claim 13 (emphasis added):

> determine a strength of a charge return path ***between the touch-sensitive device and a ground***.

The Office Action points to Fig. 2, element 124 and Fig. 5, step 510 of *Cordeiro* as allegedly teaching this portion of Claim 13. (Office Action, page 3.) Specifically, the Office Action states that "one method to determine a charge return path strength is to measure capacitance measured at a node." (*Id.*) Applicant respectfully disagrees, however, and submits that while

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the cited portions of *Cordeiro* may disclose raw count values for ***nodes***, they do not disclose, teach, or suggest a controller that is operable to "determine a strength of a charge return path ***between the touch-sensitive device and a ground***," as recited in Claim 13 (emphasis added). According to a description of the cited portion of *Cordeiro*:

> Initially, raw count values are received for each node on the touch sensitive device (510). Such raw count values, as mentioned with respect to previous figures, may not be count values at all, depending on implementation, but may instead be some value that is a surrogate for the mutual capacitance at a given node on a touch sensor. For example, the count values may be in fact be voltage levels.

(*Cordeiro*, column 5, lines 61-67.) That is, while the cited portion of *Cordeiro* may disclose receiving raw count values such as voltage levels for ***nodes***, merely disclosing count values for ***nodes*** does not disclose, teach, or suggest a controller that is operable to "determine a strength of a charge return path ***between the touch-sensitive device and a ground***," as recited in Claim 13 (emphasis added). The cited portions of *AD7143* do not appear to cure this deficiency of *Cordeiro*, and the Office Action does not appear to allege that they do. Consequently, the proposed *Cordeiro-AD7143* combination fails to disclose, teach, or suggest each and every element of Claim 13.

For at least these reasons, independent Claim 13 and its dependent claims are allowable. For at least certain analogous reasons, independent Claims 1 and 7 and their dependent claims are also allowable. Accordingly, Applicant respectfully requests reconsideration and allowance of all pending claims.

No Waiver

Applicant's arguments and amendments are made without prejudice or disclaimer. By not responding to additional statements made by the Examiner, Applicant does not acquiesce to the additional statements. The distinctions between the applied references and the claims are provided as examples only and are sufficient to overcome the rejections. Applicant reserves the right to discuss additional or other distinctions in a later response or on appeal, if appropriate.

Request for Evidentiary Support

Should any of the above asserted rejections be maintained, Applicant respectfully requests appropriate evidentiary support. Additionally, if the Examiner is relying upon "common knowledge" or "well known" principles to establish a rejection, Applicant requests that a reference be provided in support of this position pursuant to M.P.E.P. § 2144.03. Furthermore, to the extent that the Examiner maintains any rejection based on an "Official Notice" or other information within the Examiner's personal knowledge, Applicant respectfully requests that the Examiner cite a reference as documentary evidence in support of this position or provide an affidavit in accordance with M.P.E.P. § 2144.03 and 37 C.F.R. 1.104(d)(2).

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CONCLUSION

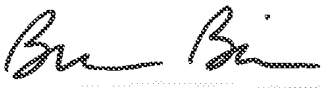
Applicant has made an earnest attempt to place this case in condition for allowance. For the foregoing reasons and for other reasons clearly apparent, Applicant respectfully requests reconsideration and full allowance of all pending claims.

If the Examiner feels that a telephone conference would advance prosecution of this application in any manner, the Examiner is invited to contact Bradley J. Birchfield, Attorney for Applicant, at the Examiner's convenience at (214) 953-6570 or brad.birchfield@bakerbotts.com.

Applicant believes that no fees are due. However, the Commissioner is hereby authorized to charge any fees or credit any overpayment to Deposit Account No. 02-0384 of Baker Botts L.L.P.

Respectfully submitted,

BAKER BOTTS L.L.P.
Attorneys for Applicant



Bradley J. Birchfield
Reg. No. 65,521

Date: November 18, 2013

Correspondence Address:

Customer Number: **12323**

IPR2020-01287
Apple EX1002 Page 284

Electronic Acknowledgement Receipt

EFS ID:	17425852
Application Number:	13314858
International Application Number:	
Confirmation Number:	7360
Title of Invention:	Touch Sensor With Adaptive Touch Detection Thresholding
First Named Inventor/Applicant Name:	Martin John Simmons
Customer Number:	12323
Filer:	Chad Christian Walters/Wendy Flottman
Filer Authorized By:	Chad Christian Walters
Attorney Docket Number:	080900.1238
Receipt Date:	18-NOV-2013
Filing Date:	08-DEC-2011
Time Stamp:	12:18:04
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		resp1238.PDF	488505 e7eb3dccc18e65950642d68a24573f18f05e833a	yes	12

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Amendment/Req. Reconsideration-After Non-Final Reject	1	1
	Claims	2	8
	Applicant Arguments/Remarks Made in an Amendment	9	12
Warnings:			
Information:			
	Total Files Size (in bytes):	488505	

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.

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 13/314,858	Filing Date 12/08/2011	☐ To be Mailed

ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =	
☐ APPLICATION SIZE FEE (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).			
☐ 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	

APPLICATION AS AMENDED – PART II

AMENDMENT **11/18/2013**

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) 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
☐ Application Size Fee (37 CFR 1.16(s))						
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
					TOTAL ADD'L FEE	0

AMENDMENT

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =	
☐ Application Size Fee (37 CFR 1.16(s))						
☐ 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.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

LIE
/PAMELA v. THERATT/

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.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/314,858	12/08/2011	Martin John Simmons	080900.1238	7360

12323 7590 08/16/2013

Baker Botts L.L.P.
2001 Ross Avenue, 6th Floor
Dallas, TX 75201

EXAMINER	
WILSON, DOUGLAS M	

ART UNIT	PAPER NUMBER
2694	

NOTIFICATION DATE	DELIVERY MODE
08/16/2013	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):

ptomail1@bakerbotts.com
ptomail2@bakerbotts.com

Office Action Summary	Application No. 13/314,858	Applicant(s) SIMMONS ET AL.	
	Examiner Douglas M. Wilson	Art Unit 2694	AIA (First Inventor to File) Status 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* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, 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 _____.

☐ 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) *1-18* is/are rejected.

8)☒ Claim(s) *19 and 20* 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 or send an inquiry to PPHfeedback@uspto.gov.

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☒ The drawing(s) filed on *08 December 2011* 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/08) Paper No(s)/Mail Date *12/8/2011,1/23/2013*.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.

4) ☐ Other: _____.

DETAILED ACTION

1. Claims 1-20 are pending in the current application. A first Office Action on the merits follows.

Priority

2. A claim for the benefit of an earlier Foreign and/or Domestic application has not been made.

Claim Rejections - 35 USC § 103

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 negatived by the manner in which the invention was made.

3. Claims 1-18 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 8,339,286 B2 (Craig A. Cordeiro) hereinafter Cordeiro as applied to Claims 1-6 above, and further in view of Analog Devices, Inc., Programmable Controller for Capacitance Touch Sensors AD7143, Product Data Sheet, 56 pages, Revision 0, January 2007 hereinafter AD7143.

Regarding **Claim 1**, Cordeiro discloses a **touch sensor comprising:**

a plurality of sense electrodes; (Fig. 2 elements 116, 118) **and**

a controller communicatively coupled to the plurality of sense electrodes, (Fig.2 element 114) **the controller configured to:**

receive a plurality of signals from the plurality of sense electrodes, the plurality of signals indicative of an amount of capacitance between the touch sensor and an external object; (Col. 3 lines 61-66)

access a stored threshold value, the threshold value indicating a threshold magnitude of the signals from the plurality of sense electrodes to process as a touch by the external object; (Col. 5 lines 43-45)

determine a strength of a charge return path between the touch sensor and a ground; (Fig. 2 element 124 is a node, Fig. 5 step 510, one method to determine a charge return path strength is to measure capacitance measured at a node) **and**

Cordeiro does not disclose **adjust the stored threshold value based on the determined strength of the charge return path.** However, AD7143 teaches an adaptive threshold, (Page 25 Paragraphs 2 and 3), based on the received signal, which is taken at a node, and therefore equal to the strength of the charge return path.

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the touch sensor disclosed by Cordeiro to modify the stored baseline value into a stored threshold value that is adjusted based on the strength of the charge return path as taught by AAD7143 to reduce touch event errors during large variations in sensed capacitance.

Regarding **Claim 2**, Cordeiro as modified by AAD7143 discloses **the touch sensor of Claim 1, wherein:**

the plurality of sense electrodes comprises a plurality of x-axis sense electrodes and a plurality of y-axis sense electrodes; (Fig. 2 elements 116, 118)

the plurality of x-axis sense electrodes visually intersect the plurality of y-axis sense electrodes; (Fig.2 elements 116, 118) **and**

the visual intersections of the x-axis sense electrodes and the y-axis sense electrodes comprises a plurality of nodes. (Fig. 2 element 122, 124, Col. 4 lines 21-25)

Regarding **Claim 3**, Cordeiro as modified by AAD7143 discloses **the touch sensor of Claim 2, wherein determining the strength of the charge return path between the touch sensor and ground comprises:**

determining that the external object has touched the touch sensor at a location that at least partially covers a particular one of the nodes; (Fig. 5 element 510, Col. 2 lines 52-59)

determining a maximum magnitude of a particular signal received from sense electrodes associated with the particular node; (Fig. 5 element 510, Col. 5 lines 61-67 **and**

Cordeiro does not disclose **calculating a new threshold value using the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node.** However AD7143 teaches

calculating and storing a new threshold value based on the max received signal value (Page 25, Fig. 36 element A, Paragraphs 1, 2, 4).

It would have been obvious to one of ordinary skill in the art at the time of the invention to combine using the max signal value determining a new threshold value as taught by AAD7143 into the touch sensor disclosed by Cordeiro to reduce false touch events during large variations in sensed capacitance.

Regarding **Claim 4**, Cordeiro as modified by AD7143 discloses **the touch sensor of Claim 3, wherein:**

calculating the new threshold value comprises Cordeiro discloses using the signal received from a particular node (Fig. 5 element 510) but does not disclose **multiplying the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node by a predetermined percentage; (However AD7143 teaches) multiplying the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node by a predetermined percentage; (Page 25, Fig. 36 elements A, B, para. 1-4) and**

adjusting the stored threshold value based on the determined strength of the charge return path comprises storing the calculated new threshold value as the stored threshold value. (Page 25 para. 5, Fig. 36)

It would have been obvious to one of ordinary skill in the art at the time of the invention to combine using the sensitivity setting and the max signal value in

determining a new threshold value as taught by AAD7143 into the touch sensor disclosed by Cordeiro to regulate the sensor's sensitivity to indicating valid contacts.

Regarding **Claim 5,** Cordeiro as modified by AD7143 disclose **the touch sensor of Claim 1, the controller further configured to, after adjusting the stored threshold value based on the determined strength of the charge return path:**

determine that the external object has not touched the touch sensor within a predetermined amount of time; (Col. 1 lines 60-62, Fig. 5 elements 520, 530, 540, 550, 560, 570, 580, the trend duration count (Fig. 5 element 550) is reset during a touch event, trend duration count threshold (Fig. 5 element 560) is a predetermined time since last touch event) **and**

periodically (Fig. 5 element 560) **drift, at a predetermined rate** (Col. 6 lines 46-50)**, the stored threshold value back to an original value, the original value comprising a value of the stored threshold value before it was adjusted based on the determined strength of the charge return path.** Cordeiro teaches increasing or decreasing the stored value periodically, in the absence of a touch event, using a stray update procedure (Col. 6 lines 46-50). Cordeiro does not teach adjusting the stored threshold value, however AD7143 teaches adjusting a stored threshold and using the adjusted threshold as the new stored threshold.

It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the periodic adjustment of a stored value corresponding to a stored threshold disclosed by Cordeiro with the actual adjustment of a stored threshold

as taught by AD7143 in order to gradually reduce the perturbed stored threshold to its original value.

Regarding **Claim 6**, Cordeiro as modified by AD7143 disclose **the touch sensor of Claim 1, wherein:**

Cordeiro does not teach **adjusting the stored threshold value based on the determined strength of the charge return path comprises replacing the stored threshold value with a new value;** However AD7143 teaches calculating and storing a new threshold value based on the max received signal value (Page 25, Fig. 36 element A, Paragraphs 1, 2, 4) **and**

the stored threshold value is adjusted at a predetermined rate. (Fig. 5 elements 510, 550, 560, 570, Cordeiro discloses adjusting the stored value at a determined periodicity)

It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the periodic adjustment of a stored value corresponding to a stored threshold disclosed by Cordeiro with the actual adjustment of a stored threshold as taught by AD7143 in order to periodically sample for a change in the devices grounded state.

Regarding **Claim 7**, there are no patentably distinct limitations in the method of Claim 7 over the device of Claim 1, therefore Claim 7 is rejected for the same reasons as Claim 1.

Regarding **Claim 8**, there are no patentably distinct limitations in the method of Claim 8 over the device of Claim 2, therefore Claim 8 is rejected for the same reasons as Claim 2.

Regarding **Claim 9**, there are no patentably distinct limitations in the method of Claim 9 over the device of Claim 3, therefore Claim 9 is rejected for the same reasons as Claim 3.

Regarding **Claim 10**, there are no patentably distinct limitations in the method of Claim 10 over the device of Claim 4, therefore Claim 10 is rejected for the same reasons as Claim 4.

Regarding **Claim 11**, there are no patentably distinct limitations in the method of Claim 11 over the device of Claim 5, therefore Claim 11 is rejected for the same reasons as Claim 5.

Regarding **Claim 12**, there are no patentably distinct limitations in the method of Claim 12 over the device of Claim 6, therefore Claim 12 is rejected for the same reasons as Claim 6.

Regarding **Claim 13**, there are no patentably distinct limitations in the device of Claim 13 over the device of Claim 1, therefore Claim 13 is rejected for the same reasons as Claim 1.

Regarding **Claim 14**, there are no patentably distinct limitations in the device of Claim 14 over the device of Claim 2, therefore Claim 14 is rejected for the same reasons as Claim 2.

Regarding **Claim 15**, there are no patentably distinct limitations in the device of Claim 15 over the device of Claim 3, therefore Claim 15 is rejected for the same reasons as Claim 3.

Regarding **Claim 16**, there are no patentably distinct limitations in the device of Claim 16 over the device of Claim 4, therefore Claim 16 is rejected for the same reasons as Claim 4.

Regarding **Claim 17**, there are no patentably distinct limitations in the device of Claim 17 over the device of Claim 5, therefore Claim 17 is rejected for the same reasons as Claim 5.

Regarding **Claim 18**, there are no patentably distinct limitations in the device of Claim 18 over the device of Claim 6, therefore Claim 17 is rejected for the same reasons as Claim 6.

Allowable Subject Matter

Claims 19-20 are is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

4. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

U.S. Pub. No. 2011/0012840 A1 (Hotelling et al.)

U.S. Patent No. 8,026,904 B2 (Wayne Carl Westerman)

U.S. Patent No. 8,248,084 B2 (Bokma et al.)

5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Douglas M. Wilson whose telephone number is 571-272-5640. The examiner can normally be reached on M-F; 0900-1700. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Sumati Lefkowitz can be reached on 571-272-3638. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

6. 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.

/Douglas M. Wilson/
Examiner, Art Unit 2694

/Seokyun Moon/
Primary Examiner, Art Unit 2694

Notice of References Cited	Application/Control No. 13/314,858	Applicant(s)/Patent Under Reexamination SIMMONS ET AL.	
	Examiner Doug Wilson	Art Unit 2694	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-8,339,286 B2	12-2012	Cordeiro, Craig A.	341/20
	B	US-			
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
*	U	Analog Devices, Inc., AD7143-Product Specification Sheet for Programmable Controller for Capacitance Touch Sensors, 56 pages, Rev 0, January 2007
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	459	(bas$3line or threshold) adj (adjust or raise or lower or set or detect$3) and 345/173.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/08/05 11:58
L2	420	l1 and @ad <"20111208"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/08/05 11:59
L3	213	l2 and ground$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/08/05 12:04
L4	4	l2 and (detect or determine or sense) near ground$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/08/05 12:05
L5	0	l2 and (ground or grounded) adj state	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/08/05 12:09
L6	213	l2 and (ground or grounded)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/08/05 12:09
L7	146	(bas$3line or threshold) adj (adjust or raise or lower or set or detect$3) and 345/174.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/08/05 12:10
L8	123	l7 and @ad <"20111208"	US-PGPUB;	OR	ON	2013/08/05

			USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			12:10
L9	78	l8 and ground$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/08/05 13:34
L10	78	l9 and @ad <"20111208"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/08/05 13:34
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S2	171	amtel.as.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/29 13:52
S3	3	(charge near return near path).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/29 13:53
S4	2093	S2 andf S3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/29 13:53
S5	0	S2 and S3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/29 13:53
S6	16199	345/173.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT;	OR	ON	2013/07/29 14:37

			IBM_TDB			
S7	24795	drive near electrode	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/29 14:38
S8	1123	capacitive near node	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/29 14:38
S9	11688	sense near electrode	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/29 14:38
S10	1645	charge near return	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/29 14:39
S11	455977	threshold near value	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/29 14:39
S12	6853	new near threshold	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/29 14:40
S13	40836	(grounded or floating) same capacitance	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/29 14:41
S14	1512	(grounded and floating) same capacitance	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/29 14:41
S15	0	S6 and S7 and S8 and S9 and S10 and S11 and S12 and S13 and S14	US-PGPUB; USPAT; USOCR; FPRS;	OR	ON	2013/07/29 14:42

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S16	1	S7 and S8 and S9 and S10 and S11 and S12 and S13 and S14	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/29 14:42
S17	1	S8 and S9 and S10 and S11 and S12 and S13 and S14	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/29 14:43
S18	1	S8 and S9 and S10 and S11 and S12 and S13	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/29 14:43
S19	1	S8 and S9 and S10 and S11 and S12	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/29 14:43
S20	1	S9 and S10 and S11 and S12	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/29 14:43
S21	3	S10 and S11 and S12	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/29 14:43
S22	1535	S7 and S11	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/29 14:44
S23	5	S22 and S10	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/29 14:45
S24	13119	drive adj electrode	US-PGPUB; USPAT;	OR	ON	2013/07/29 14:45

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S25	7727	sense adj electrode	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/29 14:45
S26	366	S13 and S25	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/29 14:46
S27	3	S10 and S26	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/29 14:46
S28	104	S26 and S6	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/29 14:47
S29	100	S28 and @ad <"20111208"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/29 14:47
S30	29	S24 and S29	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/29 14:50
S37	24795	drive near electrode	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/29 16:08
S38	1512	(grounded and floating) same capacitance	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/29 16:08

S39	58	S37 and S38 and S37	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/29 16:08
S40	44	S39 and @ad <"20111208"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/29 16:08
S41	585	touch near threshold	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/29 16:10
S42	1	S37 and S38 and S41	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/29 16:10
S43	6	S38 and S41	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/29 16:11
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S45	29	S44 and @ad <"20111208"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/29 16:15
S46	648	touch near (threshold or baseline)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/29 17:35
S47	6	S38 and S46	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	ON	2013/07/29 17:35

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S48	91878	agc or (automated adj gain adj control)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/29 17:41
S49	0	S48 and S38 and S37	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/29 17:41
S50	29	S38 and 345/173.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/29 17:42
S51	20	S50 and @ad <"20101208"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/29 17:42
S52	1646	charge near return	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/30 08:38
S53	6854	new near threshold	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/30 08:38
S54	3	S52 and S53	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/30 08:38
S55	16212	345/173.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/30 08:38
S56	1	S52 and S55	US-PGPUB; USPAT; USOCR;	OR	ON	2013/07/30 08:38

			FPRS; EPO; JPO; DERWENT; IBM_TDB			
S57	1343	S52 and @ad <"20101208"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/30 08:55
S58	39	S57 and "345".clas.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/30 08:56
S59	40848	(grounded or floating) same capacitance	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/30 09:03
S60	1512	(grounded and floating) same capacitance	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/30 09:03
S61	1512	S59 and S60	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/30 09:03
S62	29	S61 and 345/173.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/30 09:03
S63	25	S62 and @ad < "20111208"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/30 09:04
S64	40359	grounded and (floating or ungrounded)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/30 09:36
S65	108	S53 and S64	US-PGPUB;	OR	ON	2013/07/30

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S66	0	S65 and 345/173.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/30 09:37
S67	1	S65 and "345".clas.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/30 09:37
S68	29	S55 and S60	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/30 09:44
S69	112	floating near touch	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/30 09:52
S70	310	grounded near touch	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/30 09:52
S71	2	S69 and S70	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/30 09:52
S72	139361	gain near control	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/30 09:54
S73	166	S72 and 345/173.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT;	OR	ON	2013/07/30 09:55

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S74	156	S73 and @ad <"20111208"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/30 09:55
S75	96	345/204.ccls. and 345/173.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/30 10:08
S76	92	S75 and @ad <"20111208"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/30 10:08
S77	10131	capacitance same gain same control	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/30 10:25
S78	240	capacitat$4 same gain same control	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/30 10:25
S79	0	S78 and 345/173.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/30 10:26
S80	1	S78 and "345".clas.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/30 10:26
S81	18	("20090032312" | "20100085325" | "20070080940" | "7525050" | "6424338" | "20110210941" | "8094128" | "20090127003" | "20090267905").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/30 10:28
S82	16	S81 and @ad <"20101208"	US-PGPUB; USPAT; USOCR; FPRS;	OR	ON	2013/07/30 10:42

			EPO; JPO; DERWENT; IBM_TDB			
S83	1672	178/18.01.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/30 10:47
S84	874	S83 and 345/173.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/30 10:48
S85	2	S84 and S60	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/30 10:48
S86	1165	S83 and "345".clas.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/30 10:50
S87	16	S64 and S86	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/30 10:51
S88	15	S87 and @ad <"20111208"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/30 10:51
S89	19695	detection adj1 threshold	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/30 10:54
S90	13	S89 and S60	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/30 10:54
S91	11	S90 and @ad <"20111208"	US-PGPUB; USPAT;	OR	ON	2013/07/30 10:55

			USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			
S92	3354	detection adj1 threshold same (change or adjust)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/30 10:57
S93	38	S92 and 345/173.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/30 10:57
S94	30	S93 and @ad < "20111208"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/30 10:57
S95	7306	(change or set or reset or adjust) same (detection adj1 threshold)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/30 11:07
S96	66	S95 and 345/173.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/30 11:08
S97	53	S96 and @ad <"20111208"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/30 11:08
S98	22060	(floating or grounded) same detect	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/30 14:16
S99	180996	(adjust or set) near (limit or threshold or setpoint)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/30 14:18

S100	978	S98 and S99	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/30 14:18
S101	59	S100 and 345/173.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/30 14:19
S102	57	S101 and @ad <"20111208"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/30 14:19
S103	727	detect adj (floating or grounded)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/30 14:24
S104	99422	(adjust or set) adj (limit or threshold or setpoint)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/30 14:25
S105	12	S103 and S104	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/30 14:25
S106	46	S103 and 345/173.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/30 14:26
S107	45	S106 and @ad <"20111208"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/07/30 14:26
S108	50	S103 and (345/173.ccls. or 345/174.ccls.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	ON	2013/07/30 14:31

			DERWENT; IBM_TDB			
S109	22	("20040188151" | "20060267953" | "20060293864" | "20080007529" | "20080136792" | "20080158145" | "20080158146" | "20080158147" | "20090114456" | "20090135157" | "20090255737" | "20100007631" | "5572205" | "5730165" | "6452514" | "6504530" | "6730863" | "6977646" | "7400318" | "8004503" | "8026904" | "8130212").PN. OR ("8339286").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2013/07/30 15:06
S110	22	("20070074913" | "20070200831" | "20090012657" | "20090284495" | "20100060608" | "3552687" | "4825374" | "5335230" | "6504269" | "6531885").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/08/01 09:14
S111	12	("20050179671" | "20060166702" | "20090181719" | "20090194341" | "20090251423" | "7180508").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/08/01 09:15
S112	12	("20050179671" | "20060166702" | "20090181719" | "20090194341" | "20090251423" | "7180508").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/08/01 09:15
S113	1	("8482544").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/08/01 09:16
S114	0	S110 and S111 and S112 and S113	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/08/01 09:16
S115	35	S110 or S111 or S112 or S113	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/08/01 09:17
S116	34	S115 and @ad <"20111208"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/08/01 09:21

S117	22	("20040188151" | "20060267953" | "20060293864" | "20080007529" | "20080136792" | "20080158145" | "20080158146" | "20080158147" | "20090114456" | "20090135157" | "20090255737" | "20100007631" | "5572205" | "5730165" | "6452514" | "6504530" | "6730863" | "6977646" | "7400318" | "8004503" | "8026904" | "8130212").PN. OR ("8339286").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2013/08/01 09:32
S118	5	("2010/0073301").URPN.	USPAT	OR	ON	2013/08/01 09:33
S119	2	("2011/0012840").URPN.	USPAT	OR	ON	2013/08/01 09:33
S120	9	("2008/0136792").URPN.	USPAT	OR	ON	2013/08/01 09:34
S121	30	("20060026521" | "20060097991" | "20060197753" | "20070257890" | "20080012835" | "20080036742" | "20080158172" | "20080158174" | "20110015889" | "5283559" | "5483261" | "5488204" | "5825352" | "5835079" | "5880411" | "6188391" | "6310610" | "6323846" | "6583676" | "6690387" | "7015894" | "7176897" | "7184064" | "7337085" | "7443386" | "7663607" | "7692638").PN. OR ("8026904").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2013/08/01 09:35
S122	25	("2007/0074913").URPN.	USPAT	OR	ON	2013/08/01 09:35
S123	6	("2010/0060608").URPN.	USPAT	OR	ON	2013/08/01 09:36
S124	0	S116 and S117 and S118 and S119 and S120 and S121 and S122 and S123	USPAT	OR	ON	2013/08/01 09:38
S125	79	S116 or S117 or S118 or S119 or S120 or S121 or S122 or S123	USPAT	OR	ON	2013/08/01 09:38
S126	79	S125 and @ad <"20111208"	USPAT	OR	ON	2013/08/01 09:38
S127	44	S126 and 345/173.ccls.	USPAT	OR	ON	2013/08/01 09:39
S128	18	(US-20100295804-$ or US-20080278453-$ or US-20100315363-$ or US-20100073301-$ or US-20110012840-$ or US-20100007631-$ or US-20080136792-$ or US-20070074913-$ or US-20100060608-$ or US-20090284495-$).did. or (US-8339286-$ or US-8334849-$ or US-8026904-$ or US-8482544-$ or US-8300019-$ or US-8248084-$).did. or (US-20100060608-$ or US-20070074913-$).did.	US-PGPUB; USPAT; DERWENT	OR	ON	2013/08/01 11:45
S129	18	S128 and @ad <"20111208"	US-PGPUB; USPAT; DERWENT	OR	ON	2013/08/01 11:46
S130	2	S128 and drift	US-PGPUB; USPAT; DERWENT	OR	ON	2013/08/01 11:47

S131	15	S128 and electrode	US-PGPUB; USPAT; DERWENT	OR	ON	2013/08/01 11:51
S132	11	("7663607" | "7920129" | "8031094" | "8031174" | "8049732").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/08/01 12:05
S133	26	"7875814" "8040326" "8179381" 2009/0315854 2012/0242588 2012/0242592 2012/0243151 2012/0243719	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/08/01 12:10
S134	22	("20040188151" | "20060267953" | "20060293864" | "20080007529" | "20080136792" | "20080158145" | "20080158146" | "20080158147" | "20090114456" | "20090135157" | "20090255737" | "20100007631" | "5572205" | "5730165" | "6452514" | "6504530" | "6730863" | "6977646" | "7400318" | "8004503" | "8026904" | "8130212").PN. OR ("8339286").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2013/08/01 12:36
S135	18	S134 and threshold	US-PGPUB; USPAT; USOCR	OR	ON	2013/08/01 15:36
S136	2	S134 and (threshold near (change or update or raise or lower))	US-PGPUB; USPAT; USOCR	OR	ON	2013/08/01 15:39
S137	2	S134 and ((change or update or raise or lower) adj1 threshold)	US-PGPUB; USPAT; USOCR	OR	ON	2013/08/01 15:44
S138	0	S127 and ((change or update or raise or lower) adj1 threshold)	US-PGPUB; USPAT; USOCR	OR	ON	2013/08/01 15:45
S139	2	threshold adj update and 345/173.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/08/01 16:35
S140	883	threshold adj update	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/08/01 16:35
S141	18	S140 and "345".clas.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/08/01 16:36

S142	883	threshold adj1 update	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/08/01 16:37
S143	18	S142 and "345".clas.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/08/01 16:37
S144	3303	(activation or touch) adj (threshold or baseline)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/08/01 17:12
S145	173	S144 and 345/173.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/08/01 17:13
S146	159	S145 and @ad <"20111208"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/08/01 17:13
S147	4954	adaptive adj (threshold or set$3point or base$3line)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/08/02 10:49
S148	17	S147 and 345/173.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/08/02 10:50
S149	15	S148 and @ad <"20111208"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/08/02 10:50
S150	136	S147 and "345".clas.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	ON	2013/08/02 11:18

			DERWENT; IBM_TDB			
S151	129	S150 and @ad <"20111208"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/08/02 11:19
S152	6169	analog adj devices.as.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/08/02 11:43
S153	7	S152 and 345/173.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/08/02 11:43
S154	4	S153 and @ad <"20111208"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/08/02 11:44
S155	60	S152 and "345".clas.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/08/02 11:46
S156	49	S155 and @ad <"20111208"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/08/02 11:46
S157	10	(US-20110012840-$ or US-20080136792-$).did. or (US-8339286-$ or US-8248084-$ or US-8259078-$ or US-8243027-$ or US-8077160-$ or US-8054296-$ or US-8026904-$ or US-7567240-$).did.	US-PGPUB; USPAT	OR	ON	2013/08/02 14:57

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S31	1895	(Simmons or golbourn or pickett).in. and (strength same charge adj1 return)".clm"	US-PGPUB; USPAT; UPAD	OR	ON	2013/07/29 13:44
S32	1894	(Simmons same golbourn same pickett).in. and (strength same charge	US-PGPUB; USPAT;	OR	ON	2013/07/29 13:45

		adj1 return)".clm"	UPAD			
S33	20	(martin near john near Simmons or darrin near golbourn or daniel near pickett).in.	US-PGPUB; USPAT; UPAD	OR	ON	2013/07/29 13:47
S34	3	(charge near return near path).clm.	US-PGPUB; USPAT; UPAD	OR	ON	2013/07/29 13:48
S35	1	S33 and S34	US-PGPUB; USPAT; UPAD	OR	ON	2013/07/29 13:48
S36	71	amtel.as.	US-PGPUB; USPAT; UPAD	OR	ON	2013/07/29 13:53

8/ 5/ 2013 15:37:07
C:\ Users\ dwilson1\ Documents\ EAST\ Workspaces\ DW13314858.wsp

PTO/SB/08 **INFORMATION DISCLOSURE STATEMENT BY APPLICANT**	**Application Number:** 13/314,858		**First Named Inventor:** Martin J. Simmons et al.
	Attorney Docket No: 080900.1238	**Art Unit:** 2691 **Conf.:** 7360	**Filing Date:** December 8, 2011

ISSUED U.S. PATENTS AND PUBLISHED U.S. APPLICATIONS				
		DOCUMENT NUMBER	**PUBLICATION OR ISSUE DATE**	**FIRST NAMED INVENTOR**
	A	7,875,814	25 January 2011	Chen
	B	8,040,326	18 October 2011	Hotelling
	C	8,179,381	15 May 2012	Frey
	D	2009/0315854	24 December 2009	Matsuo
	E	2012/0242588	27 September 2012	Myers
	F	2012/0242592	27 September 2012	Rothkopf
	G	2012/0243151	27 September 2012	Lynch
	H	2012/0243719	27 September 2012	Franklin
	I			
	J			
	K			
	L			
	M			
	N			

UNPUBLISHED U.S. APPLICATIONS				
		DOCUMENT NUMBER	**FILING DATE**	**FIRST NAMED INVENTOR**
	O	61/454936	21 March 2011	Myers
	P	61/454950	21 March 2011	Lynch
	Q	61/454894	21 March 2011	Rothkopf

FOREIGN PATENT DOCUMENTS					
		DOCUMENT NUMBER	**PUBLICATION OR ISSUE DATE**	**COUNTRY**	**TRANSLATION (YES OR NO)**
	R	WO 2012/129247	27 September 2012	PCT	
	S				

NON-PATENT LITERATURE (NPL)			
		DOCUMENT (Including Author, Title, Source, and Pertinent Pages)	**DATE**
	T		
	U		

EXAMINER	DATE CONSIDERED
/Doug Wilson/ (08/01/2013)	08/01/2013

EXAMINER: Initial if citation 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 the applicant.

U.S. PATENT AND TRADEMARK OFFICE

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /DW/

IPR2020-01287
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Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13314858	SIMMONS ET AL.
	Examiner	Art Unit
	DOUGLAS M WILSON	2694

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
178	18.06, 18.01		
324	658, 678, 688		
341	20		
345	173, 174		
361	103		
702	57		

SEARCH NOTES		
Search Notes	Date	Examiner
See attached EAST search history		

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner

/DOUGLAS M WILSON/ Examiner.Art Unit 2694	

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Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13314858	SIMMONS ET AL.
	Examiner	**Art Unit**
	DOUGLAS M WILSON	2694

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	08/02/2013								
	1	✓								
	2	✓								
	3	✓								
	4	✓								
	5	✓								
	6	✓								
	7	✓								
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	9	✓								
	10	✓								
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	15	✓								
	16	✓								
	17	✓								
	18	✓								
	19	O								
	20	O								

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BIB DATA SHEET

CONFIRMATION NO. 7360

SERIAL NUMBER	FILING or 371(c) DATE RULE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
13/314,858	12/08/2011	345	2694	080900.1238

APPLICANTS

Martin John Simmons, Southampton, UNITED KINGDOM;
Darren Golbourn, Southampton, UNITED KINGDOM;
Daniel Pickett, Southampton, UNITED KINGDOM;

**** CONTINUING DATA ***************************

**** FOREIGN APPLICATIONS ***************************

**** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ****
12/20/2011

Foreign Priority claimed	35 USC 119(a-d) conditions met	Verified and Acknowledged	Met after Allowance	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
☐ Yes ☑ No	☐ Yes ☑ No	/DOUGLAS M WILSON/ Examiner's Signature	☐ Initials	UNITED KINGDOM	7	20	3

ADDRESS

Baker Botts L.L.P.
2001 Ross Avenue, 6th Floor
Dallas, TX 75201
UNITED STATES

TITLE

Touch Sensor With Adaptive Touch Detection Thresholding

FILING FEE RECEIVED		
1250	FEES: Authority has been given in Paper No._____ to charge/credit DEPOSIT ACCOUNT No._____ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit

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PTO/SB/08 **INFORMATION DISCLOSURE STATEMENT BY APPLICANT**	**Application Number:** Unassigned		**First Named Inventor:** Martin John Simmons et al.
	Attorney Docket No: 080900.1238	**Art Unit:** Unassigned	**Filing Date:** Herewith

ISSUED U.S. PATENTS AND PUBLISHED U.S. APPLICATIONS

		DOCUMENT NUMBER	PUBLICATION OR ISSUE DATE	FIRST NAMED INVENTOR
	A	7,663,607	02-16-2010	Hotelling
	B	7,920,129	04-05-2011	Hotelling
	C	8,031,094	10-04-2011	Hotelling
	D	8,031,174	10-04-2011	Hamblin
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		DOCUMENT NUMBER	FILING DATE	FIRST NAMED INVENTOR
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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.

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(54) Title: ELECTRONIC DEVICES WITH FLEXIBLE DISPLAYS

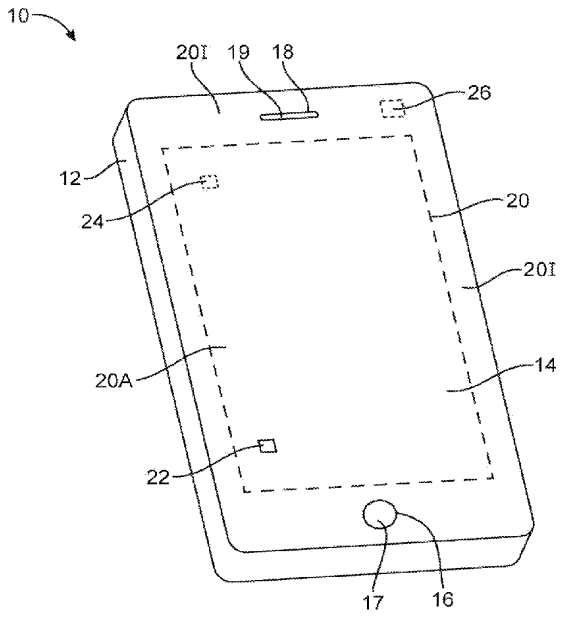


FIG. 1

(57) Abstract: Electronic devices may be provided that contain flexible displays and internal components. An internal component may be positioned under the flexible display. The internal component may be an output device such as a speaker that transmits sound through the flexible display or an actuator that deforms the display in a way that is sensed by a user. The internal component may also be a microphone or pressure sensor that receives sound or pressure information through the flexible display. Structural components may be used to permanently or temporarily deform the flexible display to provide tactile feedback to a user of the device. Electronic devices may be provided with concave displays or convex displays formed from one or more flexible layers including a flexible display layer. Portions of the flexible display may be used as speaker membranes for display-based speaker structures.

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Electronic Devices With Flexible Displays

This application claims priority to United States patent application No. 13/171,295, filed June 28, 2011, United States patent application No. 13/108,256, filed May 16, 2011, United States patent application No. 13/184,303, filed July 15, 2011, United States patent application No. 13/422,724, filed March 16, 2012, provisional patent application No. 61/454,894, filed March 21, 2011, provisional patent application No. 61/454,936, filed, March 21, 2011, and provisional patent application No. 61/454,950, filed March 21, 2011 which are hereby incorporated by reference herein in their entirety.

Background

This relates generally to flexible displays, and more particularly, to electronic devices with flexible displays .

Electronic devices such as portable computers and cellular telephones are often provided with rigid displays made from rigid display structures. For example, a liquid crystal display (LCD) may be formed from a stack of rigid display structures such as a thin-film transistor layer with display pixels for providing visual feedback to a user, a color filter layer for providing the display

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pixels with color, a touch screen panel for gathering touch input from a user, and a cover glass layer for protecting the display and internal components.

Conventional devices may also have input-output components such as buttons, microphones, speakers, and other components. Openings are commonly formed in the housing of a conventional device to accommodate operation of these input-output components. For example, openings may be formed in a device housing to accommodate speaker and microphone ports and openings may be formed in a display cover glass layer to accommodate a speaker port and menu button.

The inclusion of these openings to accommodate input-output components may not be desirable. For example, the presence of openings may be aesthetically unappealing, may raise the risk of damage from environmental exposure, and may reduce the amount of active display area that is available to display images for a user.

There is often very little real estate available for mounting these input-output components. For example, input-output components are often mounted under an inactive portion of a display or within the sidewalls of an electronic device housing.

The size and number of input-output components such as speakers may be limited by the amount of space available in these locations. For example, a conventional device may have a single speaker mounted under an inactive portion of a display. The size and quality of such a speaker may be limited by a lack of space in the inactive portion of the display. Additionally, mounting a speaker in the inactive portion of a display may add undesirable width to the inactive portion of the display.

Devices with planar cover glass layers may be prone

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to scratches and damage when dropped on a surface. Users can minimize scratches and damage from drop events using a protective case. Protective cases may not, however, be convenient or aesthetically appealing for many users.

It is often desirable to produce portable devices of minimal size. Users of portable electronic devices may find a thinner device more desirable than a thicker device. Compact portable devices are sometimes provided with convex housing shapes. A convex housing shape may increase the internal volume of a device while preserving a sleek, thin look that is aesthetically pleasing to a user.

A portable compact device with a convex housing may have a display. In conventional arrangements, the display is flat, so only the portions of the device other than the display have a convex shape. This may limit the internal volume of the device and may detract from its appearance .

It would therefore be desirable to be able to provide improved electronic devices.

Summary

Electronic devices may be provided with flexible displays. The flexible displays may be composed of one or more flexible layers and may be mounted on top of or under a cover layer. For example, a flexible display may be mounted on top of a rigid support member or may be mounted on the underside of a rigid cover layer.

Electronic devices may also be provided with user interface components (input-output components) such as buttons, microphones, speakers, piezoelectric actuators (for receiving electrical input from a user or tactile feedback to users) , or other actuators such as vibrators, pressure sensors, and other components. These components

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may be mounted under portions of a flexible display.

During operation of the electronic device, the flexibility of the display may allow a user to interact with the component through the display. For example, sound waves from a speaker or localized vibrations from an actuator in an electronic device may pass through the flexible display. The flexible display may also allow an internal microphone, pressure sensor, or force sensor (or other internal components) to receive external input. For example, a user may deflect a flexible display using a finger or other external object, barometric pressure may be monitored through the flexible display, or sound waves may be received through the flexible display.

Components may receive input or may supply output through a physically deformed portion of the flexible display (e.g., a deformation that occurs when a user presses on the display to compress the component). In some configurations, a portion of the flexible display may serve as a membrane that forms part of a microphone, speaker, pressure sensor, or other electronic component.

The ability of a user to compress a component such as a button switch by deforming the flexible display may allow the area of a device available for visual display to be enlarged. For example, the active area of a flexible display may overlap a component such as a button or speaker.

If desired, a flexible display may be deformed by an internal component to provide audio or tactile feedback to a user. For example, structures inside an electronic device may be pressed against portions of a flexible display to temporarily create an outline for a virtual on-screen button or to temporarily create a grid of ridges that serve to delineate the locations of keys in a keyboard (keypad).

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Electronic devices may be provided with concave displays. Peripheral edge portions of a concave display may be raised relative to depressed central portions of the concave display. This helps reduce scratches and other damage due to contact with the central portion of the display.

Concave displays may include one or more flexible display layers and may be mounted on top of or under a cover layer. For example, a flexible display layer may be mounted on top of a rigid support member or may be mounted on the underside of a rigid cover layer

Concave displays may also include touch-sensitive capabilities by stacking a touch sensor array layer on top of or under flexible display layers. Rigid concave displays may be formed from a flexible display layer, a touch-sensitive layer, and a rigid cover layer or rigid support structure.

Devices having concave displays formed from curved flexible display layers may help maximize the use of the internal volume of an electronic device.

Electronic devices may be provided with convex displays. The convex displays may include one or more flexible display layers and may be mounted on top of or under a cover layer with a curved shape. For example, a flexible display layer may be mounted on top of a rigid support member having a convex surface or may be mounted on the concave underside of a rigid convex display cover layer .

Convex displays may be provided with touch-sensitive capabilities by stacking a touch sensor array on top of or under flexible display layers. Rigid convex displays may be formed from a flexible display layer, a touch-sensitive layer, and a rigid cover layer or support structure .

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Devices having convex displays formed from curved flexible display layers may help maximize the use of the internal volume of an electronic device.

A display cover such as a cover glass layer may be mounted over a flexible display. The flexible display may be an organic light-emitting diode display having a flexible substrate formed from one or more sheets of polymer. The flexible display may include a touch sensor layer having an array of capacitive touch sensor electrodes.

There may be one or more display-based speaker structures in the electronic device. The display-based speaker structures may be mounted under the flexible display. Portions of the flexible display may be used as speaker membranes for the display-based speaker structures .

The flexible display may have an active area that is configured to display images to a user. Speaker membranes may be formed from the active portion of the flexible display. The display-based speaker structures may be driven by transducers that receive an electrical audio signal input from circuitry in the electronic device. Piezoelectric transducers or transducers formed from coils and magnets may be used to drive the display-based speaker structures.

A stiffening structure may be used to stiffen a portion of a flexible display that is used as a speaker membrane. The stiffening structure may be formed from a layer of foam interposed between sheets of stiffening material. The stiffening structure may form a stiff and lightweight support structure that allows the speaker membrane to respond accurately to the transducer.

A suspension structure may be used to attach a display-based speaker structure to surrounding housing

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structures. The suspension structure may form a pliant interface between the speaker structure and the surrounding housing structures. The suspension structure may allow the speaker structure to vibrate during speaker operation while inhibiting lateral motion of the speaker structure .

Speaker structures may be configured to achieve a desired frequency response. The electronic device housing in which a speaker structure is mounted may be provided with an acoustic port to tune speaker frequency response. The type of transducer that is used in a speaker may be selected to tune speaker frequency response. The size and placement of internal device components that affect speaker volume and speaker mass may also be selected to tune speaker frequency response.

An electronic device may be provided with an array of display-based speaker structures. The speaker membrane for each speaker structure may be stiffened with an associated stiffening structure. Each stiffened speaker membrane may be surrounded by a ring of flexible display that is configured to absorb lateral vibrations and thus prevent interference between neighboring speakers .

Further features of the invention, its nature and various advantages will be more apparent from the accompanying drawings and the following detailed description of the preferred embodiments.

Brief Description of the Drawings

FIG. 1 is a perspective view of an illustrative electronic device with a flexible display and internal components in accordance with an embodiment of the present invention .

FIG. 2 is a diagram of an illustrative set of

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display layers that may be used to form a flexible display in accordance with an embodiment of the present invention.

FIG. 3 is a cross-sectional side view of a portion of an illustrative electronic device in the vicinity of an internal user interface component in accordance with an embodiment of the present invention.

FIG. 4 is a cross-sectional side view of a portion of an illustrative electronic device in the vicinity of a button in accordance with an embodiment of the present invention.

FIG. 5 is a cross-sectional side view of another embodiment of a portion of an illustrative electronic device in the vicinity of a button in accordance with an embodiment of the present invention.

FIG. 6 is a cross-sectional side view of a portion of an illustrative electronic device in the vicinity of an audio component in accordance with an embodiment of the present invention.

FIG. 7 is a cross-sectional side view of another embodiment of a portion of an illustrative electronic device in the vicinity of an audio component in accordance with an embodiment of the present invention.

FIG. 8 is a cross-sectional side view of yet another embodiment of a portion of an illustrative electronic device in the vicinity of an audio component in accordance with an embodiment of the present invention.

FIG. 9 is a cross-sectional side view of a portion of an illustrative electronic device in the vicinity of an actuator such as a piezoelectric actuator in accordance with an embodiment of the present invention.

FIG. 10 is a cross-sectional side view of a portion of an illustrative electronic device in the vicinity of an internal structural component in accordance with an embodiment of the present invention.

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FIG. 11 is a cross-sectional side view of a portion of an illustrative electronic device in the vicinity of a combined internal interface component in accordance with an embodiment of the present invention.

FIG. 12 is a perspective view of a portion of an illustrative electronic device with a flexible display and a combined internal interface component in accordance with an embodiment of the present invention.

FIG. 13 is a perspective view of a portion of an illustrative electronic device with a flexible display and a combined internal interface component mounted to actuator stage in accordance with an embodiment of the present invention.

FIG. 14 is a cross-sectional side view of a portion of an illustrative electronic device in the vicinity of an internal structural component mounted to an actuator stage in accordance with an embodiment of the present invention.

FIG. 15 is a cross-sectional side view of a portion of an illustrative electronic device with a cover and an internal structural component mounted to an actuator in accordance with an embodiment of the present invention .

FIG. 16 is a cross-sectional side view of a portion of an illustrative electronic device in the vicinity of a pressure sensor in accordance with an embodiment of the present invention.

FIG. 17 is a perspective view of an illustrative electronic device with a concave display and a bezel in accordance with an embodiment of the present invention.

FIG. 18 is a cross-sectional side view of an illustrative electronic device having a concave display with a flexible display layer that conforms to the concave shape of a support structure in accordance with an

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embodiment of the present invention.

FIG. 19 is a cross-sectional side view of a portion of an illustrative electronic device having a cover layer and a flexible display layer joined by an adhesive layer in accordance with an embodiment of the present invention.

FIG. 20 is a cross-sectional side view of a portion of an illustrative electronic device having a flexible display layer, a flexible touch-sensitive layer, and a cover layer joined by adhesive layers in accordance with an embodiment of the present invention.

FIG. 21 is a cross-sectional side view of an illustrative electronic device having a concave display with a radius of curvature chosen to protect the device from a drop surface in accordance with an embodiment of the present invention.

FIG. 22 is a perspective view of an illustrative electronic device with a convex display and a bezel formed from a housing structure in accordance with an embodiment of the present invention.

FIG. 23 is a cross-sectional side view of an illustrative electronic device with a convex display and internal components in accordance with an embodiment of the present invention.

FIG. 24 is a cross-sectional side view of a portion of an illustrative electronic device having a convex display with a flexible display layer that conforms to a support structure in accordance with an embodiment of the present invention.

FIG. 25 is a cross-sectional side view of a portion of an illustrative electronic device having a convex cover layer and a flexible display layer joined by an adhesive layer in accordance with an embodiment of the present invention.

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FIG. 26 is a cross-sectional side view of a portion of an illustrative electronic device having a flexible display layer, a touch-sensitive layer and a convex cover layer joined by adhesive layers in accordance with an embodiment of the present invention.

FIG. 27 is a cross-sectional perspective view of an illustrative electronic device having a convex display and a connector port arranged to use the internal volume of the device in accordance with an embodiment of the present invention.

FIG. 28 is a cross-sectional perspective view of an illustrative electronic device having a convex display and internal components in accordance with an embodiment of the present invention.

FIG. 29 is a cross-sectional side view of an illustrative electronic device substantially surrounded by a convex display in accordance with an embodiment of the present invention.

FIG. 30 is a diagram of an illustrative electronic device such as a portable computer having a display and one or more speaker structures in accordance with an embodiment of the present invention.

FIG. 31 is a diagram of an illustrative electronic device such as a cellular telephone or other handheld device having a display and one or more speaker structures in accordance with an embodiment of the present invention .

FIG. 32 is a diagram of an illustrative electronic device such as a tablet computer having a display and one or more speaker structures in accordance with an embodiment of the present invention.

FIG. 33 is a diagram of an illustrative electronic device such as a computer monitor with a built-in computer having a display and one or more speaker

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structures in accordance with an embodiment of the present invention .

FIG. 34 is a diagram of an illustrative set of display layers that may be used to form a flexible display in accordance with an embodiment of the present invention.

FIG. 35 is a diagram of an illustrative set of layers that may be used to form an organic light-emitting diode display in accordance with an embodiment of the present invention.

FIG. 36 is a cross-sectional side view of a portion of an illustrative electronic device in which a flexible display forms part of a speaker structure in accordance with an embodiment of the present invention.

FIG. 37 is a cross-sectional side view of a portion of an illustrative electronic device in which a flexible display forms part of a speaker structure in accordance with an embodiment of the present invention.

FIG. 38 is a cross-sectional side view of a portion of an illustrative electronic device in which a flexible display forms part of a speaker structure in accordance with an embodiment of the present invention.

FIG. 39 is a perspective view of an illustrative electronic device of the type shown in FIG. 38 having a cover layer with speaker openings in accordance with an embodiment of the present invention.

FIG. 40 is a cross-sectional side view of a portion of an illustrative electronic device in which a flexible display is stiffened with a support structure in accordance with an embodiment of the present invention.

FIG. 41 is a cross-sectional side view of a portion of an illustrative electronic device having a curved flexible display with a curved support structure in accordance with an embodiment of the present invention.

FIG. 42 is a cross-sectional side view of a

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portion of an illustrative electronic device in which a flexible display forms part of a single speaker structure in accordance with an embodiment of the present invention.

FIG. 43 is a cross-sectional side view of a portion of an illustrative electronic device in which a flexible display forms part of an array of speaker structures in accordance with an embodiment of the present invention .

FIG. 44 is a bottom view of an illustrative electronic device of the type shown in FIG. 43 having a flexible display that forms part of an array of speaker structures in accordance with an embodiment of the present invention .

Detailed Description

Electronic devices may be provided with flexible displays. A flexible display may include one or more flexible layers. If desired, the flexible display may include a display cover layer such as a flexible or rigid display cover layer.

In some configurations, an electronic device may be provided with a flexible display and user interface components that are positioned behind, abutted against or integrated into the flexible display. FIGS. 1-16 show examples of configurations in which user interface components may be positioned behind, abutted against or integrated into the flexible display.

In some configurations, an electronic device may be provided with a concave display having one or more flexible display layers. FIGS. 1, 2, and 17-21 show examples of configurations in which an electronic device may be provided with a concave display having one or more flexible display layers.

In some configurations, an electronic device may

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be provided with a convex display having one or more flexible display layers. FIGS. 1, 2, and 22-29 show examples of configurations in which an electronic device may be provided with a convex display having one or more flexible display layers.

In some configurations, a portion of the flexible display may form a membrane structure of an electronic component such as a speaker, a microphone, a laser microphone or a pressure sensor. FIGS. 30-44 show examples of configurations in which a portion of the flexible display may form a membrane structure of an electronic component.

As shown in the examples of FIGS. 1-16, an electronic device may be provided with a flexible display and user interface components. User interface components may include buttons, switches, microphones, actuators such as solenoids, motors, and piezoelectric actuators, connector ports, touch screens, proximity sensors and other components for accepting input from, or transmitting information to, a user or the surrounding environment.

Flexible displays may be formed from flexible layers such as a flexible display layer (e.g., a flexible organic light-emitting diode array), a flexible touch-sensitive layer (e.g., a sheet of polymer with an array of transparent capacitor electrodes for a capacitive touch sensor), a flexible substrate layer, etc. These flexible layers may, if desired, be covered by a flexible or rigid cover layer (sometimes referred to as a cover glass) or may be supported by a support structure (e.g., a rigid support structure on the underside of the flexible layers). In electronic devices with flexible displays that are covered by rigid cover layers, the cover layers may be provided with openings that provide access to the flexible layers of the display in the vicinity of a user

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interface device. For example, a cover glass layer may have an opening that allows a button member to move relative to the cover glass layer. As the button member moves within the opening, underlying portions of the flexible display may be deformed (e.g., to allow actuation of an associated switch).

To maximize the area of the portion of the flexible display that is available for displaying visual information to the user, user interface components may be positioned behind, abutted against or integrated into the flexible display. The deformable nature of the flexible display may allow a user to interact with the user interface components (input-output components) by moving the display into contact with the user interface components or by otherwise allowing the display to locally flex (e.g., to allow sound to pass through the flexible display or to allow a barometric pressure measurements of the exterior environment to be made by an internal pressure sensor). If desired, a portion of the flexible display may form a membrane portion of an electrical component. Components that may be provided with a membrane that is formed from a portion of a flexible display include microphones, laser microphones, pressure sensors, speakers, etc.

An illustrative electronic device of the type that may be provided with a flexible display is shown in FIG. 1.

Electronic device 10 may be a portable electronic device or other suitable electronic device. For example, electronic device 10 may be a laptop computer, a tablet computer, a somewhat smaller device such as a wrist-watch device, pendant device, or other wearable or miniature device, a cellular telephone, a media player, etc.

Device 10 may include a housing such as housing

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12. Housing 12, which may sometimes be referred to as a case, may be formed of plastic, glass, ceramics, fiber composites, metal (e.g., stainless steel, aluminum, etc.), other suitable materials, or a combination of these materials. In some situations, parts of housing 12 may be formed from dielectric or other low-conductivity material. In other situations, housing 12 or at least some of the structures that make up housing 12 may be formed from metal elements.

Device 10 may have a flexible display such as flexible display 14. Flexible display 14 may be formed from multiple layers of material. These layers may include a touch sensor layer such as a layer on which a pattern of indium tin oxide (ITO) electrodes or other suitable transparent electrodes have been deposited to form a capacitive touch sensor array. These layers may also include a layer that contains an array of display pixels. The touch sensor layer and the display layer may be formed using flexible sheets of polymer or other substrates having thicknesses of 10 microns to 0.5 mm or other suitable thicknesses (as an example).

The display pixel array may be, for example, an organic light-emitting diode (OLED) array. Other types of flexible display pixel arrays may also be formed (e.g., electronic ink displays, etc.). The use of OLED technology to form flexible display 14 is sometimes described herein as an example. This is, however, merely illustrative. Flexible display 14 may be formed using any suitable flexible display technology. The use of flexible displays that are based on OLED technology is merely illustrative.

In addition to these functional display layers (i.e., the OLED array and the optional touch sensor array), display 14 may include one or more structural

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layers. For example, display 14 may be covered with a flexible or rigid cover layer and/or may be mounted on a support structure (e.g., a rigid support). Layers of adhesive may be used in attaching flexible display layers to each other and may be used in mounting flexible display layers to rigid and flexible structural layers.

In configurations for display 14 in which the cover layer for display 14 is flexible, input-output components that rely on the presence of flexible layers may be mounted at any suitable location under the display (e.g., along peripheral portions of the display, in a central portion of the display, etc.) . In configurations for display 14 in which the flexible layers are covered by a rigid cover glass layer or other rigid cover layer, the rigid layer may be provided with one or more openings and the electronic components may be mounted under the openings. For example, a rigid cover layer may have openings such as a circular opening 16 for button 17 and a speaker port opening such as speaker port opening 18 (e.g., for an ear speaker for a user) . Device 10 may also have other openings (e.g., openings in display 14 and/or housing 12 for accommodating volume buttons, ringer buttons, sleep buttons, and other buttons, openings for an audio jack, data port connectors, removable media slots, etc .) .

In some embodiments, portions of flexible display 14 such as peripheral regions 201 may be inactive and portions of display 14 such as rectangular central portion 20A (bounded by dashed line 20) may correspond to the active part of display 14. In active display region 20A, an array of image pixels may be used to present text and images to a user of device 10. In active region 20A, display 14 may include touch sensitive components for input and interaction with a user of device 10. If

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desired, regions such as regions 201 and 20A in FIG. 1 may both be provided with display pixels (i.e., all or substantially all of the entire front planar surface of a device such as device 10 may be covered with display pixels).

Device 10 may, if desired, have internal user interface components such as buttons 17 or speaker component 19 that occupy openings such as openings 16 and 18 respectively in an optional rigid cover layer of flexible display 14. Buttons 17 may be based on dome switches or other switch circuitry. Buttons 17 may include button members that form push buttons (e.g., momentary buttons), slider switches, rocker switches, etc. Device 10 may include internal structural components such as structural component 22 that add a raised structure to a portion of flexible display 14. Device 10 may include components such as interface components 24 and 26 that may be fully internal to device 10, but that receive input from the user or from the surrounding environment through physical interaction with flexible display 14. Interface components 22, 24, and 26 may be positioned in active region 20A or inactive region 201 of flexible display 14. Interface components 22, 24, and 26 may be positioned separately from one another or may be commonly located to form a combined component with structural and internal features. Interface components 24 and 26 may be positioned underneath flexible display 14 so that flexible display 14 must be deformed in order to contact components 24 or 26 or, if desired may be positioned to remain in constant contact with flexible display 14.

An exploded perspective view of an illustrative display is shown in FIG. 2. As shown in FIG. 2, flexible display 14 may be formed by stacking multiple layers including flexible display layer 14A, touch-sensitive

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layer 14B, and cover layer 14C. Flexible display 14 may also include other layers of material such as adhesive layers, optical films, or other suitable layers. Flexible display layer 14 may include image pixels formed form light-emitting diodes (LEDs), organic LEDs (OLEDs), plasma cells, electronic ink elements, liquid crystal display (LCD) components, or other suitable image pixel structures compatible with flexible displays.

Touch-sensitive layer 14B may incorporate capacitive touch electrodes such as horizontal transparent electrodes 32 and vertical transparent electrodes 34. Touch-sensitive layer 14B may, in general, be configured to detect the location of one or more touches or near touches on touch-sensitive layer 14B based on capacitive, resistive, optical, acoustic, inductive, or mechanical measurements, or any phenomena that can be measured with respect to the occurrences of the one or more touches or near touches in proximity to touch sensitive layer 14B.

Software and/or hardware may be used to process the measurements of the detected touches to identify and track one or more gestures. A gesture may correspond to stationary or non-stationary, single or multiple, touches or near touches on touch-sensitive layer 14B. A gesture may be performed by moving one or more fingers or other objects in a particular manner on touch-sensitive layer 14B such as tapping, pressing, rocking, scrubbing, twisting, changing orientation, pressing with varying pressure and the like at essentially the same time, contiguously, or consecutively. A gesture may be characterized by, but is not limited to a pinching, sliding, swiping, rotating, flexing, dragging, or tapping motion between or with any other finger or fingers. A single gesture may be performed with one or more hands, by one or more users, or any combination thereof.

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Cover layer 14C may be formed from plastic or glass (sometimes referred to as display cover glass) and may be flexible or rigid. If desired, the interior surface of peripheral inactive portions 201 of cover layer 14C may be provided with an opaque masking layer on such as black ink.

Touch-sensitive flexible display section 14AB may be formed from display pixel array layer 14A and optional touch sensor layer 14B.

FIG. 3 is a cross-sectional side view of a portion of flexible display 14 in the vicinity of internal user interface component 24. Flexible display 14 may be deformed away from its natural shape under pressure. For example, flexible display 14 may be deflected by pressure exerted by a user or by other external forces in direction 40. As shown in FIG. 3, pressure in direction 40 may cause flexible display 40 to deform as indicated by dashed lines 44. Internal component 24 may be configured to receive input due to deformation of flexible display 14. Internal component 24 may also provide a temporary return (restoring) pressure in direction 42.

Pressure in direction 42 may cause flexible display 14 to temporarily deform outward of device 10 as indicated by dashed lines 46. Pressure in direction 42 may, if desired, be formed by an internal actuator that deforms display 14 to provide a desired tactile sensation on the surface of display 14 to a user of device 10. Flexible display 14 may have a natural resiliency that, following deformation as indicated by dashed lines 44, causes flexible display to temporarily deform outward of device 10 as indicated by dashed lines 46 before returning to its natural shape. Internal component 24 may be a button, an actuator such as a motor, solenoid, vibrator, or piezoelectric actuator, a pressure sensor, an audio

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component such as a microphone or speaker, or other component. Because display 14 is flexible, these components may operate effectively, even when covered by display 14. For example, audio components such as microphones and speakers may receive and transmit sound through flexible display 14. A barometric pressure sensor or a force sensor may also receive input through flexible display 14. Components such as actuators may be used to temporarily create raised ridges or other external features on the surface of the flexible display (e.g., to indicate to a user where an on-screen button or group of buttons is located). The portion of display 14 under which components 24 are mounted may be active (i.e., a portion of the display that contains OLED pixels or other display pixels) or inactive (i.e., a peripheral portion of the display outside of the active region).

FIG. 4 is a cross-sectional side view of a portion of device 10 in the vicinity of button 17 of device 10. As shown in FIG. 4, button 17 may have a button member such as button member 52 that reciprocates within opening 16 of cover layer 14C. When a user presses the exterior of button member 52 in direction 58, button member 52 may press against touch-sensitive flexible display section (layer) 14AB. Touch-sensitive flexible display section 14AB may be deformed to depress a dome switch such as dome switch 56 or other switch mechanism, thereby activating the switch (e.g., shorting internal switch terminals together to close the switch). Dome switches such as dome switch 56 may, if desired, be mounted to printed circuits such as printed circuit 54. Dome switch 56 may have a dome-shaped biasing member that pushes touch-sensitive flexible display section 14AB outward in direction 60 when the user releases pressure from button member 52. Dome switch 54 and printed circuit

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54 may be recessed in a support structure such as support structure 50 behind flexible display 14. Other types of switches may used if desired, such as switches with spring-based biasing members or other biasing structures that bias button members such as button member 52. The use of a dome switch with a dome-shaped biasing structure is merely illustrative.

FIG. 5 is a cross-sectional side view of a portion of device 10 in the vicinity of button 17 of device 10. The illustrative embodiment of FIG. 5 differs from the illustrative embodiment of FIG. 4 in that cover layer 14C of flexible display 14 is not a rigid cover layer, but a flexible cover layer. In an embodiment in which flexible display 14 contains a flexible cover layer 14C, button 17 includes dome switch 56 and printed circuit 54. In the embodiment of FIG. 5, a user may press the exterior of flexible display 14 in direction 58. Flexible display 14 may be deformed to depress dome switch 56 or other switch mechanism, thereby activating the switch. As in FIG. 4, dome switches such as dome switch 56 may, if desired, be mounted to printed circuits such as printed circuit 54. Dome switch 56 may have a dome-shaped biasing member that pushes flexible display 14 outward in direction 60 when the user releases pressure from button member 52. Dome switch 54 and printed circuit 54 may be mounted in support structures 50 behind flexible display 14. Other types of switches may use spring-based biasing members or other biasing structures to bias button members such as button member 52. The use of a dome switch with a dome-shaped biasing structure is merely illustrative.

Providing device 10 with flexible display 14 without the need for an opening in flexible display 14 to access button 17 allows flexible display 14 to extend over button 17 without disruption. In both the FIG. 4 and FIG.

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configurations, the portion of the flexible display that overlaps the button may be an active display portion or an inactive display portion. When an active display portion is configured so as to overlap buttons and other components, there is generally more area available for the active display portion. The presence of flexible display 14 over button 17 (or other components) may also reduce the risk of moisture or dirt entering into the interior of device 10.

FIG. 6 is a cross-sectional side view of a portion of device 10 in the vicinity of audio component 19. Audio component 19 may be recessed in a chassis 50 behind flexible display 14. Audio component 19 may be a speaker for providing sound to a user of device 10 or a microphone for receiving input from a user or the external environment. In the embodiment shown in FIG. 6, sound may be transmitted through flexible display 14 to a microphone or from a speaker. The portion of flexible display 14 that overlaps audio component 19 may be active or inactive. Arrangements in which component 19 is covered with part of the active area of display 14 may allow the size of active region 20A of flexible display 14 to be increased. The presence of flexible display 14 over audio component 19 may also reduce the risk of moisture or dirt entering into the interior of device 10.

FIG. 7 is a cross-sectional side view of a portion of device 10 in the vicinity of another embodiment of audio component 19. In the illustrative embodiment of FIG. 7, audio component 19 may be a speaker or microphone that contains a diaphragm such as diaphragm 70. Diaphragm 70 may be formed from a separate structure that is attached to the underside of flexible display 14 or may be formed from a part of flexible display 14. As in the embodiment shown in FIG. 6, audio component 19 may be

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mounted within support structures 50. Audio component 19 may include a magnet such as magnet 74 and a coil such as coil 72 in which current may flow. If audio component 19 is a speaker, current may be driven through coil 72 to induce motion in diaphragm 70 and thereby emit sound through flexible display 14. If audio component 19 is a microphone, sound waves originating from the exterior of device 10 may induce vibrations in flexible display 14 which are transmitted to diaphragm 70 and ultimately to coil 72 in which current may be induced. The current produced in coil 72 may be used to transmit sound information to device 10. Diaphragm 70 may be a separate member in contact with flexible display 14 or may be an integral part of flexible display 14.

FIG. 8 is a cross-sectional side view of a portion of device 10 in the vicinity of another possible embodiment of audio component 19. As shown in FIG. 8, audio component 19 may be a laser microphone which uses vibrations in flexible display 14 induced by sound originating external to device 10 to produce an signal to be transmitted to device 10. As shown in FIG. 8, audio component 19 may be recessed in support structures 50. Audio component 19 may include a light emitting component such as laser component 80. Laser component 80 may emit a laser beam such as laser beam 84 in the direction of flexible display 14. Laser beam 84 may reflect off of flexible display 14 and a reflected laser beam such as reflected laser beam 86 may be absorbed by a laser absorbing component 82.

Laser beam 84 and reflected laser beam 86 may be used in combination with laser 80 and photosensitive element 82 to monitor variations in distance 88 from flexible display 14 to component 80 and component 82. Sound waves originating external to device 10 may induce

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vibrations in flexible display 14 causing distance 88 to oscillate. The oscillations in distance 88 may be converted into sound-related information by device 10.

FIG. 9 is a cross-sectional side view of a portion of device 10 in the vicinity of a component such as component 22 of FIG. 1. In the embodiment shown in FIG. 9, component 22 may contain an actuator such as a piezoelectric (actuator 90). Piezoelectric actuators such as piezoelectric actuator 90 may vary in shape (e.g., thickness) in response to applied control voltages and may produce an output voltage when compressed (i.e., the piezoelectric element in actuator 90 may serve as a force sensor in addition to serving as a controllable actuator). A user of device 10 may exert force on flexible display 14 in direction 92. Flexible display 14 may be deformed to exert a mechanical pressure on piezoelectric element 90 or other force sensor, inducing a voltage which may be transmitted to device 10. Conversely, piezoelectric actuator 90 may be used to provide tactile feedback to a user of device 10. A voltage difference applied to the surfaces of piezoelectric actuator 90 may induce an expansion of piezoelectric actuator 90. Piezoelectric actuator 90 may then deform flexible display 90 in direction 94 providing tactile feedback to a user of device 10.

FIG. 10 is a cross-sectional side view of a portion of device 10 in the vicinity of structural component 22 of device 10. Structural component 22 may cause a permanent deformation such as deformation 102 in flexible display 14 to indicate the location of portion 101 of touch-sensitive layer 14B in display 14 to the user of device 10. Portion 101 may be, for example, a letter key or other button in a virtual keypad (keyboard) displayed on flexible display 14. A touch sensor array

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associated with display 14 may be used to gather user input (i.e., the touch sensor array may be used to determine when a user has pressed the virtual key associated with portion 101). The location of portion 101 may also be indicated visually using associated display pixels in flexible display 14. At times, a user may desire to be able to locate portion 101 without having to look at flexible display 14. Deforming flexible display 14 in the vicinity of portion 101 using structural component 22 may allow a user to locate portion 101 without visual aid. Structural component 22 may be an isolated component indicating the location of a single portion 101 of touch-sensitive layer 14B or may be one of an array of components 22 indicating the locations of an array of portions 101 (e.g., the array of letter, number, and symbol keys in a virtual keypad displayed on display 14). Structural component 10 may be a separate component mounted to support structures 50 or may be an integral part of support structures 50.

FIG. 11 is a cross-sectional side view of a portion of device 10 in the vicinity of a hybrid component such as component 100. Component 100 may include both an internal interface component such as internal component 24 and a structural component such as structural component 22. Structural component 22 may cause a permanent deformation such as deformation 102 in flexible display 14 in the vicinity of internal component 24 to indicate the location of internal component 22 to the user of device 10. The presence of flexible display 14 between the user of device 10 and internal component 24 may obscure the location of internal interface component 24. The location of interface component 24 may be indicated visually using display pixels in flexible display 14. The deformation of flexible display 14 in the vicinity of interface component

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24 using structural component 22 may also allow the user to locate interface component 24 without visual aid. Component 100 may be an isolated component indicating the location of a single interface component 24 of touch-sensitive layer 14B or may be one of an array of components 100 indicating the locations of an array of interface components 24.

FIG. 12 is a perspective view of an embodiment of device 10 in which internal component 24 is a button such as button 17. In the embodiment of FIG. 12, as in FIG. 11, component 100 includes internal component 24 and structural component 22 (shown in FIG. 11). As shown in FIG. 12, a ridge or other deformation such as deformation 102 in flexible display 14 may be used to indicate the location of button 17.

FIG. 13 is a cross-sectional side view of a portion of device 10 in the vicinity of another illustrative embodiment of a hybrid component such as component 100 which includes an internal interface component such as internal component 24 and a structural component such as structural component 22 mounted to an actuator such as actuator stage 110. Component 100 may be recessed in chassis 50. Actuator stage 110 may be electrically or mechanically raised in direction 112 to temporarily produce deformations such as deformations 102 in flexible display 14. Deformations 102 in flexible display 14 may indicate the location of internal interface device 24 to a user of device 10. Actuator stage 110 may be electrically or mechanically lowered in direction 114 to remove deformations 102 in flexible display 14 returning flexible display 14 to its original shape. Component 100 may be an isolated component indicating the location of a single interface component 24 of touch-sensitive layer 14B or may be one of an array of

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components 100 indicating the locations of an array of respective interface components 24.

FIG. 14 is a cross-sectional side view of a portion of device 10 in the vicinity of another illustrative embodiment of a component such as structural component 22. In the arrangement of FIG. 14, structural component 22 is mounted an actuator such as actuator stage 110. Some modes of operating device 10 may require visual interaction with a user of device 10 (e.g., a mode involving the display of images or video). In these visual modes, the location of portion 101 of touch-sensitive layer 14B of flexible display 14 may be indicated visually using display pixels in flexible display 14.

In other modes of operation of device 10, a user of device 10 may wish to determine the location of portion 101 without visual aid. In the embodiment shown in FIG. 14, component 22 may be recessed in support structures 50. Actuator stage 110 may be electrically or mechanically raised in direction 112 to move structural component 22 into contact with flexible display 14 to temporarily produce deformations such as deformations 102 in flexible display 14. Deformations 102 may indicate the location of portion 101 to a user of device 10. When no longer needed for tactile interaction (e.g., upon switching to a video display mode), actuator 110 may be electrically or mechanically moved in direction 114 to lower structural component 22 and remove deformations 102 in flexible display 14.

FIG. 15 is a cross-sectional side view of an embodiment of device 10 in which device 10 includes housing 12 and cover member 122. Cover member 122 may be formed of plastic, glass, ceramics, fiber composites, metal (e.g., stainless steel, aluminum, etc.), other

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suitable materials, or a combination of these materials. Cover member 122 may be a single structure or may include multiple cover structures. In order to facilitate lifting of cover 122 by a user of device 10, structural component 22 may be coupled to an actuator 130 which may be used to lift structural component 122 in direction 134. When lifted, structural component 134 may cause a deformation such as deformation 102 in flexible display 14. Flexible display 14 may exert a pressure on cover member 122, lifting cover member 122 in direction 134 allowing the user to grip cover member 122 in order to lift cover member 122 to an open position such as open position 140. Actuator 130 may then be used to lower structural component 22 in direction 132 in order to allow flexible display 14 to return to its original shape. Actuator 130 may be activated in response to a control signal produced by the user using actuator switch 124 or by a control signal from other suitable control circuitry.

FIG. 16 is a cross-sectional side view of a portion of device 10 in the vicinity of another illustrative embodiment of internal interface component 24. In the embodiment shown in FIG. 16, interface component 24 may be a pressure sensor that includes a pressure sensing module 140. Pressure sensing module 140 may be coupled between a contact member such as contact member 142 (which is in contact with flexible display 14) and electrical contacts 144. Pressure may be exerted on flexible display 14 (e.g., by a user of device 10 or due to atmospheric pressure changes in the surrounding environment of device 10). Pressure exerted on flexible display 14 may be transmitted to pressure sensing module 140 by contact member 142. Pressure information may be transmitted to device 10 through electrical contacts 144. Pressure sensing module 140 may sense pressure changes

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using piezoelectric, capacitive, inductive, resistive, optical or other mechanisms. Providing device 10 with flexible display 14 allows flexible display 14 to extend over interface component 24, increasing the area of active region 20A of flexible display 14. The presence of flexible display 14 over interface component 24 may also reduce the risk of moisture or dirt entering into the interior of device 10.

In accordance with an embodiment, an electronic device is provided that includes a flexible display and an internal component, where the flexible display may be deformed by an action external to the device and deformation of the flexible display creates a response from the internal component.

In accordance with another embodiment, the flexible display includes a flexible display layer and a touch-sensitive layer.

In accordance with another embodiment, the flexible display layer of the flexible display includes an active display region and the internal component is covered with a portion of the active display region of the flexible display.

In accordance with another embodiment, the internal component includes a button and deformation of the flexible display compresses the button.

In accordance with another embodiment, the flexible display further includes a rigid cover layer having at least one opening.

In accordance with another embodiment, the opening includes a hole in the rigid cover layer, the button further includes a button member in the opening, the button member moves within the hole in the rigid cover layer, and the movement of the button member in the opening causes deformation of the flexible display.

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In accordance with another embodiment, the internal component includes a pressure sensor and deformation of the flexible display exerts a mechanical pressure on the pressure sensor.

In accordance with another embodiment, the pressure sensor includes a piezoelectric actuator and the mechanical pressure induces a voltage on the piezoelectric actuator .

In accordance with another embodiment, the internal component includes a laser microphone for detecting a sound originating external to the electronic device and detecting the sound includes, with a laser, detecting deformation of the flexible display.

In accordance with an embodiment, an electronic device is provided that includes a flexible display and an audio component that transmits or receives sound through the flexible display.

In accordance with another embodiment, the flexible display includes an active display region and the audio component is mounted behind the active display region of the flexible display.

In accordance with another embodiment, the flexible display includes a flexible display layer and a touch-sensitive layer.

In accordance with another embodiment, the audio component includes a diaphragm and the diaphragm is mounted in contact with the flexible display.

In accordance with another embodiment, an electronic device is provides that includes a housing, a flexible display mounted on the housing, and a first internal component mounted under a portion of the flexible display, where the first internal component is configured to deform the portion of the flexible display.

In accordance with another embodiment, the first

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internal component includes a piezoelectric actuator, where a voltage applied to the piezoelectric actuator causes an expansion of the piezoelectric actuator and the portion of the flexible display deforms in response to the expansion of the piezoelectric actuator.

In accordance with another embodiment, the first internal component includes a structural component, where the portion of the flexible display deforms in response to physical contact with the structural component and deformation of the portion of the flexible display causes the portion of the flexible display to conform to a surface of the structural component.

In accordance with another embodiment, the electronic device further includes a second internal component mounted under the portion of the flexible display, where the portion of the flexible display that conforms to the surface of the structural component indicates the location of the second internal component.

In accordance with another embodiment, the second internal component includes a button, where the portion of the flexible display is configured to be further deformed by an action external to the electronic device and further deformation of the portion of the flexible display compresses the button.

In accordance with another embodiment, the first internal component further includes an actuator, where the structural component is mounted on the actuator, where raising the actuator moves the structural component into contact with the portion of the flexible display, and where lowering the actuator moves the structural component out of contact with the flexible display.

In accordance with another embodiment, the flexible display includes a touch-sensitive layer, where deformation of the portion of the flexible display

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conforming to the surface of the structural component indicates the location of a portion of the touch-sensitive layer of the flexible display.

In accordance with another embodiment, the electronic device further includes a second internal component mounted on the actuator and deformation of the portion of the flexible display conforming to the surface of the structural component indicates the location of the second internal component.

In accordance with another embodiment, the electronic device further includes a cover member and an actuator switch coupled to the actuator, where deformation of the flexible display exerts a pressure on the cover member and the pressure on the cover member lifts the cover member.

The foregoing is merely illustrative of the principles of this invention and various modifications can be made by those skilled in the art without departing from the scope and spirit of the invention.

As shown in the examples of FIGS. 1, 2 and 17-21, an electronic device may be provided with a concave display. The concave display may include a flexible display layer that has been bent to curve the display.

Concave displays may be formed from flexible layers such as a flexible display layer (e.g., a flexible organic light-emitting diode array), a flexible touch-sensitive layer (e.g., a sheet of polymer with an array of transparent capacitor electrodes for a capacitive touch sensor), a flexible substrate layer, etc. These flexible layers may, if desired, be covered by a flexible or rigid cover layer (sometimes referred to as a cover glass) or may be supported by a support structure (e.g., a rigid support structure on the underside of the flexible layers). In electronic devices with concave displays that

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are covered by rigid cover layers, the cover layers may be provided with openings that provide access to the flexible layers of the display. For example, a cover glass layer may have an opening that allows a button member to move relative to the cover glass layer. As the button member moves within the opening, underlying portions of the flexible display may be deformed (e.g., to allow actuation of an associated switch).

Electronic devices may also be provided with user interface components (input-output components) such as buttons, microphones, speakers, piezoelectric actuators or (for receiving electrical input from a user or tactile feedback to users), other actuators such as vibrators, pressure sensors, and other components. These components may be mounted under portions of a flexible display.

User interface components may be mounted under the flexible display or may be integrated into the flexible display. The deformable nature of the flexible display may allow a user to interact with the user interface components (input-output components) by moving the display into contact with the user interface components or by otherwise allowing the display to locally flex (e.g., to allow sound to pass through the flexible display or to allow barometric pressure measurements of the exterior environment to be made by an internal pressure sensor). If desired, a portion of the flexible display may form a membrane portion of an electrical component. Components that may be provided with a membrane that is formed from a portion of a flexible display include microphones, laser microphones, pressure sensors, speakers, etc.

Concave displays formed from flexible and rigid layers that all have concave shapes (i.e., displays formed from a collection of layers in which no layer of the

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display is planar) may provide reduced vulnerability to damage during a drop event in which an electronic device strikes the ground or other external objects while maximizing the internal volume of the device that is available to hold electrical and mechanical device components .

An illustrative electronic device of the type that may be provided with a concave display is shown in FIG. 1. Electronic device 10 may be a portable electronic device or other suitable electronic device. For example, electronic device 10 may be a laptop computer, a tablet computer, a somewhat smaller device such as a wrist-watch device, pendant device, or other wearable or miniature device, a cellular telephone, a media player, etc.

Device 10 may include a housing such as housing 12. Housing 12, which may sometimes be referred to as a case, may be formed of plastic, glass, ceramics, fiber composites, metal (e.g., stainless steel, aluminum, etc.), other suitable materials, or a combination of these materials. In some situations, parts of housing 12 may be formed from dielectric or other low-conductivity material. In other situations, housing 12 or at least some of the structures that make up housing 12 may be formed from metal elements.

Device 10 may have a concave display such as concave display 14. Concave display 14 may be formed from multiple layers of material. These layers may include a touch sensor layer such as a layer on which a pattern of indium tin oxide (ITO) electrodes or other suitable transparent electrodes have been deposited to form a capacitive touch sensor array or a touch sensor layer formed using other touch technologies (e.g., resistive touch, acoustic touch, optical touch, etc.). These layers may also include a layer that contains an array of display

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pixels. The touch sensor layer and the display layer may be formed using flexible sheets of polymer or other substrates having thicknesses of 10 microns to 0.5 mm or other suitable thicknesses (as an example).

The display pixel array may be, for example, an organic light-emitting diode (OLED) array containing rows and columns of OLED display pixels. Other types of flexible display pixel arrays may also be formed (e.g., electronic ink displays, etc.). The use of OLED technology to form flexible display 14 is sometimes described herein as an example. This is, however, merely illustrative. Flexible display 14 may be formed using any suitable flexible display technology. The use of flexible displays that are based on OLED technology is merely illustrative.

In addition to these functional display layers (i.e., the OLED array and the optional touch sensor array), display 14 may include one or more structural layers. For example, display 14 may be covered with a flexible or rigid cover layer and/or may be mounted on a support structure (e.g., a rigid support). Layers of adhesive may be used in attaching flexible display layers to each other and may be used in mounting flexible display layers to rigid and flexible structural layers.

In configurations for display 14 in which the cover layer for display 14 is flexible, input-output components that rely on the presence of flexible layers may be mounted at any suitable location under the display (e.g., along peripheral portions of the display, in a central portion of the display, etc.). In configurations for display 14 in which the flexible layers are covered by a rigid cover glass layer or other rigid cover layer, the rigid layer may be provided with one or more openings and the electronic components may be mounted under the

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openings. For example, a rigid cover layer may have openings such as a circular opening 16 for button 17 and a speaker port opening such as speaker port opening 18 (e.g., for an ear speaker for a user). Device 10 may also have other openings (e.g., openings in display 14 and/or housing 12 for accommodating volume buttons, ringer buttons, sleep buttons, and other buttons, openings for an audio jack, data port connectors, removable media slots, etc.).

In some embodiments, portions of concave display 14 such as peripheral regions 201 may be inactive and portions of display 14 such as rectangular central portion 20A (bounded by dashed line 20) may correspond to the active part of display 14. In active display region 20A, an array of image pixels may be used to present text and images to a user of device 10. In active region 20A, display 14 may include touch sensitive components for input and interaction with a user of device 10. If desired, regions such as regions 201 and 20A in FIG. 1 may both be provided with display pixels (i.e., all or substantially all of the entire front planar surface of a device such as device 10 may be covered with display pixels).

Device 10 may, if desired, have internal user interface components such as buttons 17 or speaker component 19 that occupy openings such as openings 16 and 18 respectively in an optional rigid cover layer of concave display 14. Buttons 17 may be based on dome switches or other switch circuitry. Buttons 17 may include button members that form push buttons (e.g., momentary buttons), slider switches, rocker switches, etc. Device 10 may include internal structural components such as structural component 22 that add a raised structure to a portion of concave display 14. Device 10 may include

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components such as interface components 24 and 26 that may be fully internal to device 10, but that receive input from the user or from the surrounding environment through physical interaction with concave display 14. Interface components 22, 24, and 26 may be positioned in active region 20A or inactive region 201 of concave display 14. Interface components 22, 24, and 26 may be positioned separately from one another or may be commonly located to form a combined component with structural and internal features. Interface components 24 and 26 may be positioned underneath concave display 14 so that concave display 14 must be deformed in order to contact components 24 or 26 or, if desired may be positioned to remain in constant contact with concave display 14.

An exploded perspective view of an illustrative display is shown in FIG. 2. As shown in FIG. 2, concave display 14 may be formed by stacking multiple layers including flexible display layer 14A, touch-sensitive layer 14B, and cover layer 14C. Display 14 may also include other layers of material such as adhesive layers, optical films, or other suitable layers. Flexible display layer 14 may include image pixels formed form light-emitting diodes (LEDs), organic LEDs (OLEDs), plasma cells, electronic ink elements, liquid crystal display (LCD) components, or other suitable image pixel structures compatible with flexible displays.

Touch-sensitive layer 14B may incorporate capacitive touch electrodes such as horizontal transparent electrodes 32 and vertical transparent electrodes 34. Touch-sensitive layer 14B may, in general, be configured to detect the location of one or more touches or near touches on touch-sensitive layer 14B based on capacitive sensors, resistive sensors, optical sensors, acoustic sensors, inductive sensors, or force sensors.

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Software and/or hardware may be used to process the measurements of the detected touches to identify and track one or more gestures. A gesture may correspond to stationary or non-stationary, single or multiple, touches or near touches on touch-sensitive layer 14B. A gesture may be performed by moving one or more fingers or other objects in a particular manner on touch-sensitive layer 14B such as tapping, pressing, rocking, scrubbing, twisting, changing orientation, pressing with varying pressure and the like at essentially the same time, contiguously, or consecutively. A gesture may be characterized by, but is not limited to a pinching, sliding, swiping, rotating, flexing, dragging, or tapping motion between or with any other finger or fingers. A single gesture may be performed with one or more hands, by one or more users, or any combination thereof.

Cover layer 14C may be formed from plastic or glass (sometimes referred to as display cover glass) and may be flexible or rigid. If desired, the interior surface of peripheral inactive portions 201 of cover layer 14C may be provided with an opaque masking layer on such as black ink.

Touch-sensitive flexible display section 14AB may be formed from display pixel array layer 14A and optional touch sensor layer 14B.

FIG. 17 is perspective view of an illustrative embodiment of device 10 with concave display 14 in which device 10 is provided with a bezel such as bezel 200 surrounding the periphery of concave display 14. In the illustrative embodiment shown in FIG. 17, housing 12 of device 10 has an opening 204 that may provide access to a data port. The surface of bezel 200 may be formed in-plane with the surface of display 14 (i.e., so that bezel 200 and display 14 form a single smooth surface) or may be

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formed at a right angle to the walls of housing 12 (as examples). Bezel 200 may be a separate bezel member or may be formed as a portion of housing 12. As shown in FIG. 17, top and bottom portions 202 of bezel 200 may have a concave (curved) shape that matches the cross-sectional curved shape of concave display 14.

FIG. 18 is a cross-sectional side view of an illustrative embodiment of device 10 in which concave display 14 is formed by mounting flexible display layer 14A to a concave support structure such as support structure 210 (e.g., a rigid support structure having at least a concave external surface such as a metal, glass, or plastic support structure) using a layer of adhesive material such as adhesive layer 212. As shown in FIG. 18, the internal volume of device 10, defined by housing 12, bezel 202 and concave display 14 may include volume 216 above a plane (indicated by dashed line 214) defined by the deepest point in the curvature of display 14. This is because the inner surface of support structure 210 is convex (in the FIG. 18 example). Volume 216 provides space in addition to rectangular volume 218 in which internal components such as component 220 (e.g., printed circuit boards, antennas or other components) may be positioned. The ability to bend flexible display 14 into the concave shape of FIG. 18 may therefore help maximize the interior space that is available within device 10 to mount device components.

FIG. 19 is a cross-sectional side view of a portion of device 10. In the illustrative embodiment of FIG. 19, concave display 14 is formed from flexible display layer 14A, adhesive layer 212, and rigid cover layer 14C (e.g., a layer of rigid plastic or a layer of rigid cover glass having a concave external surface and a convex inner surface to which flexible display layer 14A

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conforms) . Concave display 14 may be formed adjacent to bezel portion 200 of housing 12 or may be joined to housing 12 by an additional mounting member. The concave shape of cover layer 14C of display 14 may provide reduced susceptibility to damage if device 10 is dropped. Forming flexible display layer 14A in a shape that matches the concave shape of cover layer 14C (i.e., so that layer 14A conforms to the convex inner surface of layer 14C) may provide additional internal volume 216 to device 10.

FIG. 20 is a cross-sectional side view of a portion of another embodiment of device 10. In the illustrative embodiment of FIG. 20, concave display 14 is formed from flexible display layer 14A attached to optional touch-sensitive layer 14B by adhesive layer 212. Touch-sensitive layer 14B may further be attached to rigid cover layer 14C (e.g., a glass or plastic layer) using adhesive layer 230 such that all layers (212, 14B, 230, and 14C) of display 14 conform to the concave shape of cover layer 14C. Concave display 14 may be directly adjacent to bezel portion 200 of housing 12 or may be joined to housing 212 by an additional mounting member. The concave shape of all layers (14A, 212, 14B, 230, and 14C) of display 14 may provide reduced susceptibility to damage in the event that device 10 is dropped and may provide additional internal volume 216.

FIG. 21 is a cross-sectional side view of device 10 and a common drop surface such as drop surface 240 (e.g., sidewalk concrete, asphalt, tile, or any other surface) on which device 10 may be dropped. Drop surface 240 may have a surface roughness due to surface features such as surface features 242. Surface features 242 may have a characteristic height such as height 244 (e.g., 1-2 mm for a concrete surface) . As shown in FIG. 21, device 10 may be provided with concave display 14. Concave

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display 14 may be provided with a curvature defined by maximum depth 248 defined by the distance from the outermost surface of device 10, indicated by dashed line 246 and the deepest point in the curvature of display 14 (indicated by dashed line 214) . The outermost surface of device 10 may be defined by bezel 200, or, in the absence of bezel 200, may be defined by juncture point 250 at which the peripheral edges of display 14 meet housing 12.

Maximum depth 248 may be chosen to be larger than characteristic size 244 of surface features 242 of common drop surface 240. Providing device 10 with a concave display having curvature chosen to provide a maximum depth (depth 248) that is larger than characteristic height 244 may significantly reduce the risk of damage (e.g., scratches or other damage) to device 10 during a drop event.

Providing concave display 14 with flexible display layer 14A capable of conforming to the shape of cover layer 14C allows all layers of display 14 to be conformed to same concave shape. Providing device 10 with concave display 14 in which all layers of concave display 14 conform to the same concave shape may reduce the susceptibility of device 10 to damage when dropped on common drop surface 240 while providing additional internal volume 216 in which internal components may be positioned .

Electronic devices may be provided with concave displays that reduce the risk of damage in the event of a drop while maximizing the internal volume of the device. Concave displays may be formed from one or more flexible layers including a flexible display layer. The flexible display layer may be mounted to a rigid support structure or a rigid cover layer. Flexible display layers that conform to the curved shape of a rigid cover structure

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provide additional internal volume in which internal components of the device may be positioned.

In accordance with an embodiment, an electronic device is provided that includes a housing and a concave display mounted in the housing, where the concave display has a rigid internal support structure having a concave surface and a flexible display layer attached to the rigid internal support structure that conforms to the concave surface of the rigid support structure.

In accordance with another embodiment, the concave display further includes a first adhesive layer and the first adhesive layer attaches the flexible display layer to the concave surface of the rigid internal support structure .

In accordance with another embodiment, the concave display further includes a touch-sensitive layer.

In accordance with another embodiment, the concave display further includes first and second adhesive layers, where the first adhesive layer attaches the flexible display layer to the touch-sensitive layer and where the second adhesive layer attaches the flexible display layer to the rigid internal support structure.

In accordance with another embodiment, the housing includes a bezel and the bezel surrounds a periphery of the concave display.

In accordance with another embodiment, the rigid internal support structure has a convex inner surface and the electronic device further includes at least one internal component mounted adjacent to the convex inner surface.

In accordance with another embodiment, the rigid internal support structure has at least one opening.

In accordance with another embodiment, the at least one opening includes a hole in the rigid internal

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support structure and the at least one internal component is mounted in the hole in the rigid internal support structure .

In accordance with another embodiment, an electronic device is provided that includes a housing and a concave display mounted in the housing, where the concave display includes a rigid cover layer having at least one concave outer surface and at least one corresponding convex inner surface and includes a flexible display layer, where the flexible display layer conforms to the convex inner surface of the rigid cover layer.

In accordance with another embodiment, the flexible display layer includes image pixels formed from organic light-emitting diodes.

In accordance with another embodiment, the concave display further includes a first adhesive layer, where the first adhesive layer attaches the flexible display layer to the convex inner surface of the rigid cover layer.

In accordance with another embodiment, the rigid cover layer has at least one opening, where the electronic device further includes an internal component and where the internal component is mounted adjacent to the flexible display layer under the at least one opening in the rigid cover layer.

In accordance with another embodiment, the internal component includes a speaker and the speaker transmits sound through the flexible display layer.

In accordance with another embodiment, the internal component includes a button, where the electronic device further includes a button member in the at least one opening in the rigid cover layer, where the button member moves within the at least one opening in the rigid cover layer, and where the movement of the button member

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compresses the button.

In accordance with another embodiment, an electronic device is provided that includes an electronic device housing and a concave display mounted in the electronic device housing, where the concave display includes a rigid cover layer having a concave outer surface and a convex inner surface, a flexible display layer, and a touch-sensitive layer, where the flexible display layer and the touch-sensitive layer each conform to the convex inner surface of the rigid cover layer.

In accordance with another embodiment, the concave display further includes first and second adhesive layers, where the flexible display layer is attached to the touch-sensitive layer with the first adhesive layer and where the touch-sensitive layer is attached to the convex inner surface of the rigid cover layer with the second adhesive layer.

In accordance with another embodiment, the electronic device further includes at least one internal component mounted adjacent to the flexible display layer of the concave display.

In accordance with another embodiment, the rigid cover layer of the convex display has at least one opening, where the at least one internal component is an audio component, and where the audio component is mounted under the at least one opening in the rigid cover layer.

In accordance with another embodiment, the concave outer surface of the concave display has a curvature and peripheral edges, where the curvature has a deepest point, where the deepest point and at least some of the peripheral edges define a maximum depth associated with the curvature of the concave display and where the maximum depth of the concave display is between 0.5 millimeter and 20 millimeters.

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In accordance with another embodiment, the electronic device further includes an internal component, where the internal component is mounted at a distance from the peripheral edges of the concave outer surface, and where the distance is smaller than the maximum depth.

The foregoing is merely illustrative of the principles of this invention and various modifications can be made by those skilled in the art without departing from the scope and spirit of the invention.

As shown in the examples of FIGS. 1, 2 and 22-29, an electronic device may be provided with a convex display. The convex display may include a flexible display layer that has been bent to form a curved surface.

Convex displays may be formed from flexible layers such as a flexible display layer (e.g., a flexible organic light-emitting diode array), a flexible touch-sensitive layer (e.g., a sheet of polymer with an array of transparent capacitor electrodes for a capacitive touch sensor), a flexible substrate layer, etc. These flexible layers may, if desired, be covered by a flexible or rigid cover layer (sometimes referred to as a cover glass) or may be supported by a support structure (e.g., a rigid support structure on the underside of the flexible layers). In electronic devices with convex displays partially covered by rigid cover layers, the cover layers may be provided with openings that provide access to the flexible layers of the display. For example, a cover glass layer may have an opening that allows a button member to move relative to the cover glass layer. As the button member moves within the opening, underlying portions of the flexible display may be deformed (e.g., to allow actuation of an associated switch).

Electronic devices may also be provided with user interface components (input-output components) such

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as buttons, microphones, speakers, piezoelectric actuators or (for receiving electrical input from a user or tactile feedback to users), other actuators such as vibrators, pressure sensors, and other components. These components may be mounted under portions of a flexible display.

User interface components may be mounted under the flexible display or may be integrated into the flexible display. The deformable nature of the flexible display may allow a user to interact with the user interface components (input-output components) by moving the display into contact with the user interface components or by otherwise allowing the display to locally flex (e.g., to allow sound to pass through the flexible display or to allow a barometric pressure measurements of the exterior environment to be made by an internal pressure sensor). If desired, a portion of the flexible display may form a membrane portion of an electrical component. Components that may be provided with a membrane that is formed from a portion of a flexible display include microphones, laser microphones, pressure sensors, speakers, etc.

Convex displays formed from flexible and rigid layers that all have convex shapes i.e., displays formed from a collection of layers in which no layer of the display is planar) may provide an aesthetically desirable external appearance while maximizing the internal volume of the device that is available to hold electrical and mechanical device components.

An illustrative electronic device of the type that may be provided with a convex display is shown in FIG. 1.

Electronic device 10 may be a portable electronic device or other suitable electronic device. For example, electronic device 10 may be a laptop computer, a tablet

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computer, a somewhat smaller device such as a wrist-watch device, pendant device, or other wearable or miniature device, a cellular telephone, a media player, etc.

Device 10 may include a housing such as housing 12. Housing 12, which may sometimes be referred to as a case, may be formed of plastic, glass, ceramics, fiber composites, metal (e.g., stainless steel, aluminum, etc.), other suitable materials, or a combination of these materials. In some situations, parts of housing 12 may be formed from dielectric or other low-conductivity material. In other situations, housing 12 or at least some of the structures that make up housing 12 may be formed from metal elements.

Device 10 may have a convex display such as convex display 14. Convex display 14 may be formed from multiple layers of material. These layers may include a touch sensor layer such as a layer on which a pattern of indium tin oxide (ITO) electrodes or other suitable transparent electrodes have been deposited to form a capacitive touch sensor array or a touch sensor layer formed using other touch technologies (e.g., resistive touch, acoustic touch, optical touch, etc.). These layers may also include layer that contains an array of display pixels. The touch sensor layer and the display layer may be formed using flexible sheets of polymer or other substrates having thicknesses of 10 microns to 0.5 mm or other suitable thicknesses (as an example) .

The display pixel array may be, for example, an organic light-emitting diode (OLED) array containing rows and columns of OLED display pixels. Other types of flexible display pixel arrays may also be formed (e.g., electronic ink displays, etc.) . The use of OLED technology to form flexible display 14 is sometimes described herein as an example. This is, however, merely

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illustrative. Flexible display 14 may be formed using any suitable flexible display technology. The use of flexible displays that are based on OLED technology is merely illustrative .

In addition to these functional display layers (i.e., the OLED array and the optional touch sensor array) , display 14 may include one or more structural layers. For example, display 14 may be covered with a flexible or rigid cover layer and/or may be mounted on a support structure (e.g., a rigid support). Layers of adhesive may be used in attaching flexible display layers to each other and may be used in mounting flexible display layers to rigid and flexible structural layers.

In configurations for display 14 in which the cover layer for display 14 is flexible, input-output components that rely on the presence of flexible layers may be mounted at any suitable location under the display (e.g., along peripheral portions of the display, in a central portion of the display, etc.) . In configurations for display 14 in which the flexible layers are covered by a rigid cover glass layer or other rigid cover layer, the rigid layer may be provided with one or more openings and the electronic components may be mounted under the openings. For example, a rigid cover layer may have openings such as a circular opening 16 for button 17 and a speaker port opening such as speaker port opening 18 (e.g., for an ear speaker for a user) . Device 10 may also have other openings (e.g., openings in display 14 and/or housing 12 for accommodating volume buttons, ringer buttons, sleep buttons, and other buttons, openings for an audio jack, data port connectors, removable media slots, etc .) .

In some embodiments, portions of convex display 14 such as peripheral regions 201 may be inactive and

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portions of display 14 such as rectangular central portion 20A (bounded by dashed line 20) may correspond to the active part of display 14. In active display region 20A, an array of image pixels may be used to present text and images to a user of device 10. In active region 20A, display 14 may include touch sensitive components for input and interaction with a user of device 10. If desired, regions such as regions 201 and 20A in FIG. 1 may both be provided with display pixels (i.e., all or substantially all of the entire front planar surface of a device such as device 10 may be covered with display pixels) .

Device 10 may, if desired, have internal user interface components such as buttons 17 or speaker component 19 that occupy openings such as openings 16 and 18 respectively in an optional rigid cover layer of convex display 14. Buttons 17 may be based on dome switches or other switch circuitry. Buttons 17 may include button members that form push buttons (e.g., momentary buttons), slider switches, rocker switches, etc. Device 10 may include internal structural components such as structural component 22 that add a raised structure to a portion of convex display 14. Device 10 may include components such as interface components 24 and 26 that may be fully internal to device 10, but that receive input from the user or from the surrounding environment through physical interaction with convex display 14. Interface components 22, 24, and 26 may be positioned in active region 20A or inactive region 201 of convex display 14. Interface components 22, 24, and 26 may be positioned separately from one another or may be commonly located to form a combined component with structural and internal features. Interface components 24 and 26 may be positioned underneath convex display 14 so that convex display 14

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must be deformed in order to contact components 24 or 26 or, if desired may be positioned to remain in constant contact with convex display 14.

An exploded perspective view of an illustrative display is shown in FIG. 2. As shown in FIG. 2, convex display 14 may be formed by stacking multiple layers including flexible display layer 14A, touch-sensitive layer 14B, and cover layer 14C. Display 14 may also include other layers of material such as adhesive layers, optical films, or other suitable layers. Flexible display layer 14 may include image pixels formed form light-emitting diodes (LEDs), organic LEDs (OLEDs), plasma cells, electronic ink elements, liquid crystal display (LCD) components, or other suitable image pixel structures compatible with flexible displays.

Touch-sensitive layer 14B may incorporate capacitive touch electrodes such as horizontal transparent electrodes 32 and vertical transparent electrodes 34. Touch-sensitive layer 14B may, in general, be configured to detect the location of one or more touches or near touches on touch-sensitive layer 14B based on capacitive sensors, resistive sensors, optical sensors, acoustic sensors, inductive sensors, or force sensors.

Software and/or hardware may be used to process the measurements of the detected touches to identify and track one or more gestures. A gesture may correspond to stationary or non-stationary, single or multiple, touches or near touches on touch-sensitive layer 14B. A gesture may be performed by moving one or more fingers or other objects in a particular manner on touch-sensitive layer 14B such as tapping, pressing, rocking, scrubbing, twisting, changing orientation, pressing with varying pressure and the like at essentially the same time, contiguously, or consecutively. A gesture may be

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characterized by, but is not limited to a pinching, sliding, swiping, rotating, flexing, dragging, or tapping motion between or with any other finger or fingers. A single gesture may be performed with one or more hands, by one or more users, or any combination thereof.

Cover layer 14C may be formed from plastic or glass (sometimes referred to as display cover glass) and may be flexible or rigid. If desired, the interior surface of peripheral inactive portions 201 of cover layer 14C may be provided with an opaque masking layer on such as black ink.

Touch-sensitive flexible display section 14AB may be formed from display pixel array layer 14A and optional touch sensor layer 14B.

FIG. 22 is perspective view of an exemplary embodiment of device 10 with convex display 14 and convex housing 12 in which housing 12 has an opening 300 that may provide access to, e.g., an audio port. A portion of housing 12 may form a bezel such as bezel 304. Bezel 304 may be formed so that bezel 304 and display 14 form a common smooth surface or may be formed raised above or depressed below the outer surface of display 14. Bezel 304 may be a separate bezel member or may be formed as a portion of housing 12. As shown in FIG. 22, top and bottom portions 306 of bezel 200 may have a convex (curved) shape that matches the cross-sectional curved shape of convex display 14.

FIG. 23 is a cross-sectional side view of an illustrative embodiment of device 10 taken along line 302 of FIG. 22 and viewed in direction 303. As shown in FIG. 23, device 10 has a convex shape formed by convex housing 12 and convex display 14. Device 10 may also include internal components such as battery 310 and components 312. The convex shape of housing 12 and display 14 of

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device 10 may provide device 10 with a thin appearance while providing an interior space that is able to accommodate internal components such as battery 310.

FIG. 24 is a cross-sectional side view of an illustrative embodiment of device 10 in which convex display 14 is formed by mounting flexible display layer 14A to a convex support structure such as support structure 320 (e.g., a rigid support structure having at least a convex external surface such as a metal, glass, or plastic support structure) using a layer of adhesive material such as adhesive layer 322. As shown in FIG. 24, the internal volume of device 10, defined by housing 12 and convex display 14 may include volume 326 above plane 324 (defined by inner edges 328 of display 14) and below inner surface 330 of display 14. This is because inner surface 330 of support structure 320 is concave (in the FIG. 24 example). Volume 326 provides space which may be used for placement of internal components such as component 332 (e.g., printed circuit boards, antennas or other components). The ability to bend flexible display layer 14A into the convex shape of FIG. 24 that matches the convex outer surface of support structure 320 may therefore help maximize the interior space that is available within device 10 to mount device components.

FIG. 25 is a cross-sectional side view of a portion of device 10. In the illustrative embodiment of FIG. 25, convex display 14 is formed from flexible display layer 14A, adhesive layer 322, and rigid cover layer 14C (e.g., a layer of rigid plastic or a layer of rigid cover glass having a convex external surface and a concave inner surface to which flexible display layer 14A conforms). Convex display 14 may be formed adjacent to bezel portion housing 12 or may be joined to housing 12 by an additional mounting member. Providing device 10 with a layer such as

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flexible display layer 14A that conforms to the convex shape of cover layer 14C (i.e., so that layer 14A conforms to the concave inner surface of layer 14C) may provide additional internal volume 326 between plane 324 (defined by inner edges 328 of display 14) and inner surface 330 of display 14.

FIG. 26 is a cross-sectional side view of a portion of another embodiment of device 10. In the illustrative embodiment of FIG. 26, convex display 14 is formed from flexible display layer 14A attached to optional touch-sensitive layer 14B by adhesive layer 322. Touch-sensitive layer 14B may further be attached to rigid cover layer 14C (e.g., a glass or plastic layer) using adhesive layer 340 such that all layers (322, 14B, 340, and 14C) of display 14 conform to the convex shape of cover layer 14C (i.e., so that layers 14A and 14B conform to the concave inner surface of cover layer 14C). Convex display 14 may be formed adjacent to housing 12 or may be joined to housing 212 by an additional mounting member. The convex shape of all layers (14A, 322, 14B, 340, and 14C) may combine with convex housing 12 to provide a thin appearance for device 10 and may provide additional internal volume 326 between plane 324 (defined by inner edges 328 of display 14) and inner surface 330 of display 14.

FIG. 27 is a cross-sectional perspective view of an illustrative electronic device 10 in the vicinity of a connecting structure such as connecting structure 350 (e.g. an audio port or other female connector). As shown in FIG. 27, audio port 350 may have electrical contacts 352 for mating with contacts 356 of a connector such as mating connector 354 (e.g., a mating audio plug or other male connector). In the embodiment of FIG. 27, a portion of audio port 350 may occupy a portion of internal volume

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326 above plane 324 (defined by inner edges 328 of display 14). The convex shape of display 14 of device 10 may provide a thin appearance and may provide additional internal volume 326 between plane 324 (defined by inner edges 328 of display 14) and inner surface 330 of display 14 in which a portion of mating connectors such as connector 350 may be mounted.

FIG. 28 is a cross-sectional side view of an illustrative electronic device 10 in the vicinity of a stack of components 360 such as printed circuit boards (PCBs), sensors, switches, connectors, battery structures, or other electronic components. In the embodiment shown in FIG. 28, some components 360 may be mounted partially or completely in a portion of internal volume 326 above plane 324 (defined by inner edges 328 of display 14). The convex shape of display 14 of device 10 may provide a thin appearance and may provide additional internal volume 326 between plane 324 (defined by inner edges 328 of display 14) and inner surface 330 of display 14 in which PCBs and other components 360 may be mounted. The example of FIG. 29 in which components 360 are mounted in volume 326 is merely illustrative. Other components or structures may occupy volume 326, if desired.

FIG. 29 is a cross-sectional side view of an illustrative electronic device in which display 14 of device 10 completely surrounds device 10. As shown in FIG. 29, device 10 may have convex front (upper) and rear (lower) surfaces that are joined along curved sidewalls. Display 14 may cover the front, rear, and sidewall surfaces of device 10 so as to completely surround electrical components 360 (e.g., printed circuit boards, integrated circuits, switches, sensors, etc.). Edges 372 may be joined by a joining member such as joining member 370. Member 370 may be a separate member formed of

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plastic, glass, ceramics, fiber composites, metal (e.g., stainless steel, aluminum, etc.), other suitable materials, or a combination of these materials, or may be formed from an adhesive material.

In the example of FIG. 29, display 14 may be formed by stacking multiple layers including flexible display layer 14A, touch-sensitive layer 14B, and cover layer 14C. Display 14 may also include other layers of material such as adhesive layers, optical films, or other suitable layers. As an example, display 14 may be formed by mounting flexible display layer 14A to a rigid convex support structure having one or more convex outer surfaces and one or more associated concave inner surfaces that completely surrounds device 10. In another configuration, display 14 may be formed from flexible display layer 14A, adhesive layer 322, and rigid cover layer 14C (e.g., a rigid cover layer with one or more convex outer surfaces and one or more associated concave inner surfaces) . In another possible configuration, convex display 14 may be formed by attaching flexible display layer 14A to optional touch-sensitive layer 14B using adhesive layer 322. Touch-sensitive layer 14B may further be attached to rigid cover layer 14C (e.g., a glass or plastic layer) using adhesive layer 340 so that all layers (322, 14B, 340, and 14C) of display 14 conform to the convex shape of cover layer 14C. These examples are merely illustrative and other configurations of display 14 may be used.

The convex shape of display 14 of device 10 may provide a thin appearance for device 10 and may help to maximize the internal volume of the device in which components such as battery 310, PCBs 360 or other components such as component 312 may be mounted. Surrounding device 10 completely with convex display 14 may allow the area of a device available for visual

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display to be enlarged.

The foregoing is merely illustrative of the principles of this invention and various modifications can be made by those skilled in the art without departing from the scope and spirit of the invention.

Electronic devices may be provided with convex displays. A convex display may be used to maximize the internal volume of a device. Convex displays may be formed from one or more flexible layers. A flexible display layer may be mounted to a rigid support structure or a rigid cover layer. Flexible display layers that conform to the curved shape of a rigid structure may provide additional internal volume in which internal components of the device may be positioned.

In accordance with another embodiment, an electronic device is provided including a housing and a display mounted in the housing, where the display has a flexible display layer that conforms to a convex outer surface of a rigid support structure.

In accordance with another embodiment, the display further includes an adhesive layer and the adhesive layer attaches the flexible display layer to the convex outer surface of the rigid support structure.

In accordance with another embodiment, the display further includes a touch-sensitive layer.

In accordance with another embodiment, the display further includes first and second adhesive layers, where the first adhesive layer attaches the flexible display layer to the touch-sensitive layer and the second adhesive layer attaches the flexible display layer to the convex outer surface of the rigid support structure.

In accordance with another embodiment, the flexible display layer includes image pixels formed from organic light-emitting diodes.

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In accordance with another embodiment, the housing has at least one opening, where the opening is associated with a connector port and the electronic device further includes a connector structure mounted in the connector port.

In accordance with another embodiment, an electronic device is provided that includes a housing and a display mounted in the housing, where the display includes a rigid cover layer having at least one convex outer surface and having at least one associated concave inner surface and includes a flexible display layer that conforms to the concave inner surface.

In accordance with another embodiment, the display further includes an adhesive layer and the adhesive layer bonds the flexible display layer to the concave inner surface of the rigid cover layer.

In accordance with another embodiment, the rigid cover layer includes glass.

In accordance with another embodiment, the flexible display layer includes image pixels formed from organic light-emitting diodes.

In accordance with another embodiment, the flexible display layer includes image pixels formed from organic light-emitting diodes.

In accordance with another embodiment, the display further includes a touch sensor layer that conforms to the concave inner surface.

In accordance with another embodiment, the concave display further includes first and second adhesive layers, where the first adhesive layer attaches the flexible display layer to the touch sensor layer and the second adhesive layer attaches the touch sensor layer to the concave inner surface of the display.

In accordance with another embodiment, the touch

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sensor layer includes indium-tin-oxide electrodes.

In accordance with another embodiment, the electronic device further includes an internal component, where the concave inner surface of the display provides an additional internal volume for the electronic device and where the internal component is mounted at least partially in the additional internal volume.

In accordance with another embodiment, an electronic device is provided having at least a front surface and a rear surface and including electronic components interposed between the front and rear surfaces and a display that substantially covers at least the front and rear surfaces and that surrounds the electronic components, where the display includes a rigid cover layer having at least one inner surface and a flexible display layer that is bent to conform to the inner surface.

In accordance with another embodiment, the display further includes a touch-sensitive layer attached to at least a portion of the flexible display layer.

In accordance with another embodiment, the inner surface includes a concave inner surface and the electronic device further includes a connector structure and a housing having an opening, where the connector structure is mounted in the opening to form a connector port.

In accordance with another embodiment, the electronic device has at least two sidewall surfaces and the display substantially covers the two sidewall surfaces .

In accordance with another embodiment, the display has at least two edges and the edges of the display are joined by a joining member.

The foregoing is merely illustrative of the principles of this invention and various modifications can

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be made by those skilled in the art without departing from the scope and spirit of the invention. The foregoing embodiments may be implemented individually or in any combination .

As shown in the examples of FIGS. 30-44, an electronic device may be provided with a flexible display and other user interface components. The user interface components may include buttons, switches, microphones, actuators such as solenoids, motors, and piezoelectric actuators, connector ports, touch screens, proximity sensors and other components for accepting input from, or transmitting information to, a user of the electronic device .

Flexible displays may be formed from flexible layers such as a flexible display layer (e.g., a flexible organic light-emitting diode array) , a flexible touch-sensitive layer (e.g., a sheet of polymer with an array of transparent capacitor electrodes for a capacitive touch sensor), a flexible substrate layer, etc. These flexible layers may, if desired, be covered by a flexible or rigid cover layer (sometimes referred to as a cover glass) or may be supported by a support structure (e.g., a rigid support structure on the underside of the flexible layers) . In electronic devices with flexible displays that are covered by rigid cover layers, the cover layers may be provided with openings that provide access to the flexible layers of the display in the vicinity of a user interface device. For example, a cover glass layer may have an opening that allows a button member to move relative to the cover glass layer. As another example, a cover glass layer may have one or more speaker openings through which sound may pass.

To maximize the area of the portion of the flexible display that is available for displaying visual

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information to the user, user interface components may be positioned behind, abutted against, or integrated into the flexible display. The deformable nature of the flexible display may allow a user to interact with the user interface components (input-output components) by moving the display into contact with the user interface components or by otherwise allowing the display to locally flex (e.g., to allow sound to pass through the flexible display or to allow barometric pressure measurements of the exterior environment to be made by an internal pressure sensor) .

If desired, a portion of the flexible display may form a membrane structure for an electrical component. For example, a portion of the flexible display may form a speaker membrane for a speaker component. Components that may be provided with a membrane structure formed from a portion of a flexible display include speakers, microphones, laser microphones, pressure sensors, etc.

An illustrative electronic device of the type that may be provided with a flexible display is shown in FIG. 30. Electronic device 10 may be a computer such as a computer that is integrated into a display. For example, electronic device 10 may be a computer monitor, a laptop computer, a tablet computer, a somewhat smaller portable device such as a wrist-watch device, pendant device, or other wearable or miniature device, a cellular telephone, a media player, a tablet computer, a gaming device, a speaker device, a navigation device, a computer monitor, a television, or other electronic equipment.

Device 10 may include a housing such as housing 412. Housing 412, which may sometimes be referred to as a case, may be formed of plastic, glass, ceramics, fiber composites, metal (e.g., stainless steel, aluminum, etc.), other suitable materials, or a combination of these

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materials. In some situations, parts of housing 412 may be formed from dielectric or other low-conductivity material. In other situations, housing 412 or at least some of the structures that make up housing 412 may be formed from metal elements.

Housing 412 may be formed using a unibody configuration in which some or all of housing 412 is machined or molded as a single structure or may be formed using multiple structures (e.g., an internal frame structure, one or more structures that form exterior housing surfaces, etc.).

As shown in FIG. 30, housing 412 may have multiple parts. For example, housing 412 may have upper portion 412A and lower portion 412B. Upper portion 412A may be coupled to lower portion 412B using a hinge that allows portion 412A to rotate about rotational axis 416 relative to portion 412B. A keyboard such as keyboard 418 and a touch pad such as touch pad 420 may be mounted in housing portion 412B.

Device 10 may have a flexible display such as flexible display 414. Flexible display 414 may be formed from multiple layers of material. These layers may include a touch sensor layer such as a layer on which a pattern of indium tin oxide (ITO) electrodes or other suitable transparent electrodes have been deposited to form a capacitive touch sensor array. These layers may also include a display layer that contains an array of display pixels. The touch sensor layer and the display layer may be formed using flexible sheets of polymer (e.g., polyimide) or other substrates having thicknesses of 10 microns to 0.5 mm, having thicknesses of less than 0.2 mm, or having other suitable thicknesses (as examples).

The display pixel array may be an organic light-

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emitting diode (OLED) array, for example. Other types of flexible display pixel arrays may also be formed (e.g., electrowetting displays, electrophoretic displays, flexible liquid crystal displays, flexible electrochromic displays, etc.). The use of OLED technology to form flexible display 414 is sometimes described herein as an example. This is, however, merely illustrative. In general, any suitable type of flexible display technology may be used in forming display 414.

In addition to these functional display layers (i.e., the OLED array and the optional touch sensor array), display 414 may include one or more structural layers. For example, display 414 may be covered with a flexible or rigid cover layer and/or may be mounted on a support structure (e.g., a rigid support). If desired, layers of adhesive may be used to attach flexible display layers to each other and/or to mount flexible display layers to rigid and flexible structural layers.

In some embodiments, display 414 may have an active area such as active area AA and an inactive area such as area IA. In active display region AA, an array of image pixels may be used to present text and images to a user of device 10. In active region AA, display 414 may include touch sensitive components for input and interaction with a user of device 10. If desired, both central portion AA and peripheral portion IA may be provided with display pixels (i.e., all or substantially all of the entire front planar surface of upper housing portion 412A may be provided with display pixels).

In the example of FIG. 31, device 10 has been implemented using a housing that is sufficiently small to fit within a user's hand (e.g., device 10 of FIG. 31 may be a handheld electronic device such as a cellular telephone). As show in FIG. 31, device 10 may include a

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display such as display 414 mounted on the front of housing 412. Display 414 may be substantially filled with active display pixels or may have an inactive portion such as inactive portion IA that surrounds an active portion such as active portion AA. Display 414 may have openings (e.g., openings in inactive region IA or active region AA of display 414) such as an opening to accommodate button 422 and an opening to accommodate speaker port 424.

FIG. 32 is a perspective view of electronic device 10 in a configuration in which electronic device 10 has been implemented in the form of a tablet computer. As shown in FIG. 32, display 414 may be mounted on the upper (front) surface of housing 412. An opening may be formed in display 414 to accommodate button 422 (e.g., an opening may be formed in inactive region IA surrounding active region AA) .

FIG. 33 is a perspective view of electronic device 10 in a configuration in which electronic device 10 has been implemented in the form of a television or in the form of a computer integrated into a computer monitor. As shown in FIG. 33, display 414 may be mounted on the front surface of housing 412. Stand 426 may be used to support housing 412. Display 414 may include an inactive region such as inactive region IA that surrounds active region AA.

An exploded perspective view of an illustrative display is shown in FIG. 34. As shown in FIG. 34, flexible display 414 may be formed by stacking multiple layers including flexible display layer 414A and touch-sensitive layer 414B. An optional cover layer such as cover layer 462 may be formed over flexible display 414. Cover layer 462 may be a layer of glass, plastic, or other protective display layer.

Flexible display 414 may also include other

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layers of material such as adhesive layers, optical films, sealant layers, or other suitable layers. Flexible display layer 414A may include image pixels formed from light-emitting diodes (LEDs), organic LEDs (OLEDs), plasma cells, electrowetting display elements, electrophoretic display elements, liquid crystal display (LCD) components, or other suitable image pixel structures compatible with flexible displays.

Touch-sensitive layer 414B may incorporate capacitive touch electrodes such as horizontal transparent electrodes 432 and vertical transparent electrodes 434. Touch-sensitive layer 414B may, in general, be configured to detect the location of one or more touches or near touches on touch-sensitive layer 414B based on capacitive, resistive, optical, acoustic, inductive, or mechanical measurements, or any phenomena that can be measured with respect to the occurrences of the one or more touches or near touches in proximity to touch sensitive layer 414B.

Flexible display 414 may be formed from display pixel array layer 414A and optional touch sensor layer 414B. In the example of FIG. 34, touch-sensitive layer 414B is interposed between cover layer 462 and flexible display layer 414A. This arrangement is merely illustrative. If desired, flexible display layer 414A may be interposed between cover layer 462 and touch-sensitive layer 414B (e.g., flexible display layer 414A may be arranged on top of touch-sensitive layer 414B). If desired, touch-sensitive layer 414B and flexible display layer 414A may be integrated as a single layer. For example, capacitive touch electrodes such as electrodes 432 and 434 and display pixels such as display pixels 430 may be formed on a common substrate, if desired.

FIG. 35 is a cross-sectional side view of a

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portion of flexible display layer 414A. As shown in FIG. 35, flexible display layer 414A may contain multiple sublayers. For example, display layer 414A may include a substrate layer such as substrate layer 415. Substrate layer 415 may be formed from a flexible or rigid dielectric such as glass, ceramic, or plastic. As an example, substrate layer 415 may be formed from one or more flexible sheets of polymer (e.g., polyimide). Substrate layer 415 may have a thickness of 10 microns to 0.5 mm, may have a thickness of less than 0.2 mm, or may have other suitable thickness (as examples).

A thin-film transistor (TFT) layer such as TFT layer 417 may include a layer of thin-film transistor structures (e.g., polysilicon transistors and/or amorphous silicon transistors) formed on substrate layer 415.

An organic emissive layer such as OLED layer 419 may be formed over TFT layer 417. OLED layer 419 may include a light-emitting material such as an array of organic light-emitting diode structures that are used to form display pixels such as display pixels 430 of FIG. 34.

A sealant layer such as sealant layer 421 may be formed over OLED layer 419 to protect the structures of OLED layer 419 and TFT layer 417. Sealant layer 421 may be formed from one or more layers of polymer (e.g., one or more layers of polymer that are deposited onto OLED layer 419), metal foil (e.g., a layer of metal foil that is laminated, sputtered, evaporated, or otherwise applied onto OLED layer 419), or other suitable coating or conformal covering.

Electronic device 10 may be provided with one or more speaker structures for providing sound to a user of electronic device 10. FIG. 36 is a cross-sectional side view of a portion of electronic device 10 in the vicinity of a speaker structure such as speaker structure 448.

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Sound produced by speaker structure 448 may be transmitted through flexible display 414 to the exterior of device 10. Flexible display 414 may be used as a speaker membrane structure for speaker 448. Portions such as portion 414M that serve as a speaker membrane for speaker 448 may be located in an active or inactive portion of display 414. Arrangements in which speaker membrane 414M forms an active display area may allow the size of the active region of flexible display 414 to be increased relative to its inactive region.

As shown in FIG. 36, speaker structure 448 may be driven by a transducer such as transducer 450. Transducer 450 may be configured to receive electrical audio signal input from circuitry in device 10 and to convert the electrical signal into sound. In the example of FIG. 36, transducer 450 is formed from a magnet such as magnet 440 surrounded by coils such as coils 442. Magnet 440 may be a permanent magnet formed from ferrite material, ceramic material, iron alloy material, rare earth material, other suitable material, or a combination of these materials. Coils 442 may be formed from copper, aluminum, silver, other suitable materials, etc. If desired, there may be one or more sets of coils surrounding magnet 440.

When current passes through coils 442, a magnetic field is produced. This allows coils 442 to act as a variable electromagnet with a magnetic field that interacts with the constant magnetic field produced by permanent magnet 440. For example, the negative pole of the electromagnet may be repelled by the negative pole of permanent magnet 440. The magnetic force created by this repulsion will force magnet 440 away from coils 442. When the current flowing through coils 442 changes direction, the polarity of the variable electromagnet reverses.

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Magnet 440 may be pushed back and forth rapidly (along the z-axis) as the current in coils 442 alternates directions.

Portions of flexible display 414 such as portion 414M may form a speaker membrane for speaker 448. As magnet 440 moves back and forth along the z-axis, attached speaker membrane 414M will in turn vibrate the air in front of speaker membrane 414M, creating sound waves.

In some arrangements, an optional support structure such as support structure 446 (sometimes referred to as a stiffening structure or stiffener) may be interposed between transducer 450 and speaker membrane 414M. Support structure 446 may be used to stiffen speaker membrane portion 414M of display 414. Support structure 446 may be formed from a metal plate, from specialized composite structures (e.g., a layer of foam interposed between layers of stiffener, etc.), from other support materials or stiffening structures, or from a combination of these materials. Using a support structure such as support structure 446 may allow speaker membrane 414M to respond more accurately to the movement of magnet 440. In arrangements where optional support structure 446 is not used, magnet 440 may be configured to stiffen portion 414M of display 414 that serves as a speaker membrane structure.

There may be one or more speaker structures 448 in device 10. Some or all of speaker structures 448 in device 10 may have speaker membranes that are formed from flexible display 414. If desired, some, all, or substantially all of flexible display 414 may be used as a speaker membrane for one speaker, for two speakers, for three speakers, or for more than three speakers.

A suspension structure such as suspension structure 454 may be used to attach portions of flexible display 414 to a rigid support structure such as housing

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412. Suspension structure 454 may prevent speaker membrane 414M from moving laterally along the x-axis and/or the y-axis, but may allow free motion of speaker membrane 414M along the z-axis as speaker 448 produces sound. Suspension structure 454 may be formed from an elastomeric material, foam material, resin coated material, other suitable materials, or a combination of these materials. As shown in the example of FIG. 36, suspension structure 454 may form a pliant interface between speaker membrane 414M and housing sidewalls 412S. This is merely illustrative. If desired, suspension structure 454 may form a pliant interface between speaker membrane 414M and any suitable surrounding housing structure or any suitable rigid support structure.

If desired, other suspension structures may be incorporated into speaker structure 448. For example, there may be one or more suspension structures attached to magnet 440. This type of suspension structure may provide a restoring force that returns magnet 440 to an equilibrium position after being displaced by magnetic forces .

The desired range of frequencies produced by speaker 448 may depend on several factors. For example, the desired range of frequencies produced by speaker 448 may depend on the type of electronic device in which speaker 448 is implemented, may depend on the location of speaker 448 in device 10, may depend on the other speaker structures that are being used in combination with speaker structure 448, etc. Design choices may be made to obtain a desired frequency response from speaker 448. For example, materials used in forming speaker 448 may be selected based on the desired frequency response.

The type of enclosure that surrounds speaker 448 may also be selected based on the desired frequency

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response. For example, the enclosure that surrounds the speaker may be ported. As shown in FIG. 36, housing 412 may optionally be provided with an opening or port such as acoustic port 452 (sometimes referred to as a funnel, horn, vent, hole, etc.) . Port 452 may be used to equalize the pressure between the inside of housing 412 and the outside of housing 412. This may in turn augment the sound waves produced by speaker 448. A ported enclosure such as the ported enclosure shown in the example of FIG. 36 may increase the magnitude of low-frequency sound waves produced by speaker 448 (e.g., a speaker with a ported enclosure may have a higher bass output than a speaker with a sealed enclosure) .

As shown in FIG. 36, port 452 may have a portion such as portion 452P that protrudes into the enclosure. The size and shape of protruding portion 452P may be customized to obtain a desired frequency response. For example, protruding portion 452P of port 452 may have a "horn" shape, in which the diameter of opening 452 varies along the length of portion 452P. Protruding portion 452P may have a curved shape, if desired. In general, protruding portion 452P may have any suitable shape, and opening 452 may have any suitable size. The characteristics of port 452 will depend on the desired frequency response of speaker 448, the structure of device 10, etc., and may be modified accordingly. The example shown in FIG. 36 is merely illustrative.

If desired, speaker 448 may be provided with a sealed enclosure that does not have a port. The example of FIG. 36 in which housing 412 is provided with port 452 is merely illustrative. The type of enclosure into which speaker 448 is implemented (e.g., a sealed enclosure, a ported enclosure, etc.) will depend on the desired frequency response of speaker 448, the structure of device

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10, etc., and may be modified accordingly.

Electronic device 10 may have internal components or structures such as internal component 456. Internal components such as internal component 456 may optionally be used to tune the resonant frequency of speaker 448. Internal component 456 may be a battery or other internal structure. If desired, optional component 456 may be omitted or may otherwise not be used to tune the resonant frequency of speaker 448.

If desired, housing 412 may have one or more raised edges such as optional raised portion 412'. Raised portion 412' may have an upper surface that lies above the upper surface of display 414 (e.g., the upper surface of raised portion 412' may protrude above the upper surface of flexible display 414 in vertical dimension z). Optional raised housing 412' may allow a user to hold device 10 in hand without disrupting the speaker functionality of display 414. Raised portion 412' of housing 412 may surround the entire periphery of display 414, or may be located on one side of display 414, on two sides of display 414, on three sides of display 414, or on all four sides of display 414. Raised portion 412' may be formed as an integral part of housing 412 or may be formed as a separate structure in contact with housing 412.

FIG. 37 is a cross-sectional side view of a portion of electronic device 10 in the vicinity of another possible embodiment of speaker structure 448. As shown in FIG. 37, speaker structure 448 may be driven by a transducer such as transducer 450. In the example of FIG. 37, transducer 450 may be formed from one or more central sets of coils 442 surrounded by a magnet such as magnet 440. In some arrangements, inner portion 444 of coils 442 may also contain a magnet structure (e.g., coils 442 may surround a magnet structure). Magnet structures that are

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formed within inner portion 444 of coils 442 may be formed as an integral part of outer magnet 440 (e.g., may be joined above and/or below coils 442) or may be a separate magnet structure. If desired, inner portion 444 of coils 442 may be free of magnet structures.

As with the transducer of FIG. 36, transducer 450 of FIG. 37 may be configured to receive electrical audio signal input from circuitry in device 10 and to convert the electrical signal into sound. As current passes through coils 442, a magnetic field is produced. The magnetic field produced by coils 442 interacts with the constant magnetic field produced by permanent magnet 440. The interaction of the electromagnet with the constant magnetic field will create a magnetic force between coils 442 and magnet 440 (e.g., an attractive or repulsive force). When the current flowing through coils 442 changes direction, the polarity of the variable electromagnet (and thus the direction of magnetic force) is reversed. Coils 442 may be pushed back and forth (along the z-axis) by the varying magnetic force as the current in coils 442 alternates directions.

As coils 442 move back and forth, attached speaker membrane 414M will in turn vibrate the air in front of speaker membrane 414M, creating sound waves. Support structure 446 may be used to stiffen speaker membrane 414M so that membrane portion 414M of flexible display 414 responds accurately to the movement of transducer 450.

In the example of FIG. 37, speaker 448 may be provided with a sealed enclosure that does not have a port. This is merely illustrative. Any suitable type of enclosure (e.g., a sealed enclosure, a ported enclosure, etc.) may be used. The type of enclosure into which speaker 448 is implemented will depend on the desired

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frequency response of speaker 448, the structure of device 10, etc., and may be modified accordingly.

FIG. 38 is a cross-sectional side view of a portion of device 10 in the vicinity of another possible embodiment of speaker structure 448. In the example of FIG. 38, speaker 448 is supported by a rigid structure within device 10 such as rigid structure 466. Rigid structure 466 may be formed from housing structures or internal components, or may be a dedicated structure used to form a frame (sometimes referred to as a chassis or "basket") or other rigid support structure for speaker 448. Suspension structure 454 may be used to form a pliant interface between speaker 448 and rigid structure 466. As with the suspension structure of FIGS. 7 and 8 (in which suspension structure 454 is attached to housing sidewalls 412S), suspension structure 454 of FIG. 38 may prevent speaker membrane portions 414M of display 414 from moving laterally along the x-axis and/or the y-axis, but may allow free motion of speaker membrane 414M along the z-axis as speaker 448 produces sound. Suspension structure 454 may be attached to any suitable portion of speaker 448 (e.g., support structure 446, magnet 440, speaker membrane portion 414M, etc.)

The type of arrangement shown in FIG. 38 may be beneficial for configurations in which speaker 448 is not in the vicinity of housing sidewalls 412S or in other configurations in which speaker 448 is not attached to housing 412. For example, speaker 448 may be located in the central portion of a large display. In this type of configuration, a rigid structure such as rigid structure 466 of FIG. 38 may be used to support speaker 448, if desired .

There may be one or more speakers 448 in device 10. Multiple speakers 448 may be attached to a common

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rigid structure 466 or each speaker 448 may be attached to a separate rigid structure 466.

If desired, a cover layer such as optional cover layer 462 may be formed over flexible display 414. Cover layer 462 may be formed from glass, plastic, or other suitable material. Cover layer 462 may allow a user to hold device 10 in hand without disrupting the speaker functionality of display 414. Cover layer 462 may also serve to protect display 414 and other parts of device 10 while still allowing speaker membrane 414M to move freely along the z-axis as speaker 448 produces sound. Cover layer 462 may be in contact with display 414 or there may be a gap 463 interposed between cover layer 462 and display 414. Gap 463 may be filled with air or may include a layer of material such as a layer of sealant (as an example) .

One or more holes such as holes 464 (sometimes referred to as openings or speaker openings) may be formed in cover layer 462 so that sound may pass from speaker 448 to the exterior of device 10.

A perspective view of device 10 showing how holes 464 may be formed in cover layer 462 is shown in FIG. 39. As shown in FIG. 39, holes 464 may be formed in a "speaker grill" fashion in which an array of openings is formed in front of one or more speakers. Holes 464 may be formed in cover layer 462 in any suitable location. For example, holes 464 may be formed in localized areas of cover layer 462 that overlap a speaker structure, or holes 464 may be formed in a uniform array that covers some, all, or substantially all of the front surface of display 414. Holes 464 may have any suitable size. For example, holes 464 may have a diameter between .25 mm and .5 mm, between .5 mm and 1 mm, between 1 mm and 1.5 mm, more than 1.5 mm, less than 1.5 mm, etc. The size, shape, and

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number of openings 464 formed in cover layer 462 may depend on the type and number of speakers 448 in device 10.

FIG. 40 is a cross-sectional side view of device 10 in the vicinity of support structure 446. Support structure 446 may be used to stiffen portions of flexible display 414. As discussed in connection with FIG. 36, stiffening structure 446 may be formed from a metal plate, from fiber-based composite materials, from laminated layers of one or more materials, or from other suitable materials. As shown in the example of FIG. 40, stiffening structure 446 may be formed from a layer of foam 474 interposed between first and second stiffening sheets 472. Sheets 472 may be formed from polymer, metal, glass, ceramic, fiber-based composites, or other suitable materials. This type of structure may provide a stiff and lightweight support structure for display 414. If desired, support structure 446 may be used to stiffen speaker membrane portions 414M of display 414, may be used to stiffen other portions of display 414, or may be used to stiffen all or substantially all of display 414.

Support structure 446 may be shaped in any desired fashion. For example, support structure 446 may be curved, may be planar, or may have a combination of curved and planar portions.

FIG. 41 is a cross-sectional side view of device 10 in the vicinity of curved support structure 446. As shown in FIG. 41, flexible display 414 may conform to the shape of stiffening structure 446. In the example of FIG. 41 stiffening structure 446 has a curved shape so that flexible display 414 is concave. This is, however, merely illustrative. In general, stiffening structure 446 and the attached portion of display 414 may have any suitable shape. For example, stiffening structure 446 may have a

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curved shape so that flexible display 414 is convex. The example of FIG. 41 in which display 414 has a concave shape may be suitable for configurations in which display 414 forms a speaker membrane for speaker 448. A concave shaped speaker membrane may improve the quality of sound produced by speaker 448. Speakers with convex membranes may also be used.

FIG. 42 is a cross-sectional side view of device 10 in the vicinity of a single speaker structure. As shown in FIG. 42, portion 414M of flexible display 414 may form a speaker membrane for speaker structure 448. Transducer 450 for speaker 448 may be any suitable type of transducer (e.g., one or more sets of coils surrounded by a magnet, one or more sets of coils surrounding a magnet, a piezoelectric transducer, a microphone transducer, a sensor, an actuator, etc.). Speaker 448 may be the only speaker in device 10 or may be one of a plurality of speakers in device 10. Display-based speaker structure 448 may be used in conjunction with speaker structures that are not display-based. For example, there may be other speakers in device 10 which do not use display 414 as a speaker membrane. Speaker structure 448 of FIG. 42 may use all or substantially all of display 414 as a speaker membrane (e.g., the entire front face of device 10 may be occupied by a speaker), or may use only a portion of display 414 as a speaker membrane.

In the example of FIG. 43, an array of transducers 450 may be used to form a plurality of display-based speakers 448. Display-based speaker structures 448 may be used in conjunction with speaker structures that are not display-based. Each display-based speaker 448 may have an associated transducer 450. Each associated transducer 450 may be any suitable type of transducer (e.g., one or more sets of coils surrounded by

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a magnet, one or more sets of coils surrounding a magnet, a piezoelectric transducer, a microphone transducer, a sensor, an actuator, etc.) . The type of transducer 450 used may be different for each speaker 448 (e.g., the array of speakers 448 in FIG. 43 may include different types of transducers, if desired) . Providing speakers 448 with different types of transducers, different structures, and different characteristics may give device 10 the ability to produce sound with a wider range of frequencies.

FIG. 44 is a bottom view of a portion of device 10 showing how an array of display-based speakers such as the array shown in FIG. 43 may be implemented in device 10. In the example of FIG. 44, support structure 446 is formed on the underside of display 414. Support structure 446 may be used to stiffen speaker membrane portions 414M of display 414 (e.g., support structure 446 may be interposed between transducer 450 and display 414) . Support structure 446 may also be used to stiffen portions of display 414 between adjacent speakers 448.

Each speaker 448 may be surrounded by a ring 414' of flexible display 414 that is not stiffened by support structure 446. Flexible ring-shaped portions 414' of flexible display 414 may provide a barrier structure around each speaker 448 that prevents interference between adjacent speakers 448. For example, as speaker membrane 414M vibrates, ring 414' (which is surrounded by support structure 446) may absorb vibrations moving laterally in display 414 (e.g., in directions along the x-axis and/or y-axis) . This may allow adjacent speakers 448 to operate independently without being disrupted by the vibrations of a neighboring speaker.

If desired, speakers 448 may include a variety of speaker types. Examples of speaker types that may be

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used for speakers 448 include subwoofers, woofers, mid-range speakers, tweeters, supertweeters , etc. If desired, different channels of audio input may be routed to each speaker. For example, speakers 448 may include a center channel speaker, a left channel speaker, a right channel speaker, a surround channel speaker, etc. Any suitable characteristic of speakers 448 (e.g., size, type, location, input channel, etc.) may be modified to achieve a desired frequency response and/or to accommodate the structure of device 10.

Electronic devices that contain flexible displays and one or more display-based speaker structures may be provided. The speaker structures may be positioned under the flexible display. Portions of the flexible display may be used as speaker membranes for the speaker structures. The speaker structures may be driven by transducers that convert electrical audio signal input into sound. Piezoelectric transducers or transducers formed from coils and magnets may be used to drive the speaker structures. Speaker membranes may be formed from active display areas of the flexible display. Some, all, or substantially all of the flexible display may be used as a speaker membrane for one or more display-based speaker structures. An optional cover layer may be provided with speaker openings so that sound may pass from the display-based speaker structures to the exterior of the device.

In accordance with another embodiment, an electronic device is provided including a flexible display and a speaker structure having a speaker membrane, where the speaker membrane is formed from a portion of the flexible display.

In accordance with another embodiment, the electronic device further includes a stiffening structure

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configured to stiffen the portion of the flexible display that forms the speaker membrane.

In accordance with another embodiment, the stiffening structure includes a layer of foam.

In accordance with another embodiment, the stiffening structure includes first and second stiffening sheets that are attached to opposing first and second sides of the layer of foam.

In accordance with another embodiment, the flexible display includes an active portion configured to display images and the speaker membrane is formed from the active portion of the flexible display.

In accordance with another embodiment, the electronic device further includes a rigid structure and a suspension structure configured to attach portions of the speaker structure to the rigid structure.

In accordance with another embodiment, the electronic device further includes an electronic device housing in which the flexible display is mounted, where the rigid structure is formed at least partly from the electronic device housing.

In accordance with another embodiment, the electronic device further includes a cover layer formed over the flexible display, where the cover layer includes at least one opening formed over the speaker membrane.

In accordance with another embodiment, the electronic device further includes an electronic device housing in which the flexible display is mounted, where the electronic device housing has at least one acoustic port.

In accordance with another embodiment, the flexible display includes an organic light-emitting diode display having a substrate formed from a flexible sheet of polymer .

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In accordance with another embodiment an electronic device is provided including a flexible display and a plurality of speaker structures, where portions of the flexible display form speaker membranes for the plurality of speaker structures.

In accordance with another embodiment, the electronic device further includes a plurality of stiffening structures configured to stiffen the portions of the flexible display that form the speaker membranes.

In accordance with another embodiment, the flexible display includes a set of stiffened regions, where each of the stiffened regions in the set of stiffened regions forms part of a respective one of the speaker structures, flexible regions, where each of the flexible regions surrounds a respective one of the stiffened regions in the set of stiffened regions, and a surrounding stiffened region, where each of the flexible regions is surrounded by portions of the surrounding stiffened region.

In accordance with another embodiment, the speaker structures include a left channel speaker and a right channel speaker.

In accordance with another embodiment, the electronic device further includes transducers configured to drive the speaker structures, where each transducer includes coils and a magnet.

In accordance with another embodiment, the electronic device further includes piezoelectric transducers configured to drive the speaker structures.

In accordance with another embodiment, the flexible display includes an organic light-emitting diode display having a substrate formed from a flexible sheet of polymer .

In accordance with another embodiment, a

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portable electronic device is provided, including a housing, a flexible organic light-emitting diode display mounted in the housing, where the flexible organic light-emitting diode display has a substrate formed from a flexible sheet of polymer, and at least one speaker having a speaker membrane formed from a portion of the flexible sheet of polymer.

In accordance with another embodiment, the portable electronic device further includes a stiffening structure interposed between the at least one speaker and the speaker membrane, where the stiffening structure includes a composite material.

In accordance with another embodiment, the speaker membrane has a concave shape.

In accordance with another embodiment, the housing includes a rectangular housing with four peripheral edges and the flexible organic light-emitting diode display and the speaker membrane extend between the four peripheral edges.

The foregoing is merely illustrative of the principles of this invention and various modifications can be made by those skilled in the art without departing from the scope and spirit of the invention. The foregoing embodiments may be implemented individually or in any combination.

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What is Claimed is:

1. An electronic device, comprising:

a flexible display; and

an internal component, wherein the flexible display may be deformed by an action external to the device, and wherein deformation of the flexible display creates a response from the internal component.

2. The electronic device defined in claim 1 wherein the flexible display comprises:

a flexible display layer; and

a touch-sensitive layer.

3. The electronic device defined in claim 2 wherein the flexible display layer of the flexible display includes an active display region, and wherein the internal component is covered with a portion of the active display region of the flexible display.

4. The electronic device defined in claim 3 wherein the internal component comprises a button, and wherein deformation of the flexible display compresses the button.

5. The electronic device defined in claim 4 wherein the flexible display further comprises a rigid cover layer having at least one opening.

6. The electronic device defined in claim 5 wherein the opening comprises a hole in the rigid cover layer, wherein the button further comprises a button member in the opening, wherein the button member moves within the hole in the rigid cover layer, and wherein the

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movement of the button member in the opening causes deformation of the flexible display.

7. The electronic device defined in claim 3 wherein the internal component comprises a pressure sensor, and wherein deformation of the flexible display exerts a mechanical pressure on the pressure sensor.

8. The electronic device defined in claim 7 wherein the pressure sensor comprises a piezoelectric actuator, and wherein the mechanical pressure induces a voltage on the piezoelectric actuator.

9. The electronic device defined in claim 3 wherein the internal component comprises a laser microphone for detecting a sound originating external to the electronic device, and wherein detecting the sound comprises with a laser, detecting deformation of the flexible display.

10. An electronic device, comprising:

a flexible display; and

an audio component that transmits or receives sound through the flexible display.

11. The electronic device defined in claim 10 wherein the flexible display includes an active display region, and wherein the audio component is mounted behind the active display region of the flexible display.

12. The electronic device defined in claim 11 wherein the flexible display comprises:

a flexible display layer; and

a touch-sensitive layer.

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13. The electronic device defined in claim 11 wherein the audio component comprises a diaphragm, and wherein the diaphragm is mounted in contact with the flexible display.

14. An electronic device, comprising:

a housing;

a flexible display mounted on the housing; and

a first internal component mounted under a portion of the flexible display, wherein the first internal component is configured to deform the portion of the flexible display.

15. The electronic device defined in claim 14 wherein the first internal component comprises a piezoelectric actuator, wherein a voltage applied to the piezoelectric actuator causes an expansion of the piezoelectric actuator, and wherein the portion of the flexible display deforms in response to the expansion of the piezoelectric actuator.

16. The electronic device defined in claim 14 wherein the first internal component comprises a structural component, wherein the portion of the flexible display deforms in response to physical contact with the structural component, and wherein deformation of the portion of the flexible display causes the portion of the flexible display to conform to a surface of the structural component .

17. The electronic device defined in claim 16 further comprising a second internal component mounted

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under the portion of the flexible display, wherein the portion of the flexible display that conforms to the surface of the structural component indicates the location of the second internal component.

18. The electronic device defined in claim 17 wherein the second internal component comprises a button, wherein the portion of the flexible display is configured to be further deformed by an action external to the electronic device, and wherein further deformation of the portion of the flexible display compresses the button.

19. The electronic device defined in claim 16 wherein the first internal component further comprises an actuator, wherein the structural component is mounted on the actuator, wherein raising the actuator moves the structural component into contact with the portion of the flexible display, and wherein lowering the actuator moves the structural component out of contact with the flexible display .

20. The electronic device defined in claim 19 wherein the flexible display comprises a touch-sensitive layer and wherein deformation of the portion of the flexible display conforming to the surface of the structural component indicates the location of a portion of the touch-sensitive layer of the flexible display.

21. The electronic device defined in claim 19 further comprising a second internal component mounted on the actuator, and wherein deformation of the portion of the flexible display conforming to the surface of the structural component indicates the location of the second internal component.

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22. The electronic device defined in claim 19 further comprising:

a cover member; and

an actuator switch coupled to the actuator, wherein deformation of the flexible display exerts a pressure on the cover member, and wherein the pressure on the cover member lifts the cover member.

23. An electronic device, comprising:

a housing; and

a concave display mounted in the housing, wherein the concave display has a rigid internal support structure having a concave surface and a flexible display layer attached to the rigid internal support structure that conforms to the concave surface of the rigid support structure .

24. The electronic device defined in claim 23 wherein the concave display further comprises a first adhesive layer, and wherein the first adhesive layer attaches the flexible display layer to the concave surface of the rigid internal support structure.

25. The electronic device defined in claim 23 wherein the concave display further comprises a touch-sensitive layer.

26. The electronic device defined in claim 25 wherein the concave display further comprises first and second adhesive layers, wherein the first adhesive layer attaches the flexible display layer to the touch-sensitive layer, and wherein the second adhesive layer attaches the flexible display layer to the rigid internal support

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structure .

27. The electronic device defined in claim 23 wherein the housing comprises a bezel, and wherein the bezel surrounds a periphery of the concave display.

28. The electronic device defined in claim 26 wherein the rigid internal support structure has a convex inner surface and wherein the electronic device further comprises at least one internal component mounted adjacent to the convex inner surface.

29. The electronic device defined in claim 28, wherein the rigid internal support structure has at least one opening.

30. The electronic device defined in claim 29 wherein the at least one opening comprises a hole in the rigid internal support structure, and wherein the at least one internal component is mounted in the hole in the rigid internal support structure.

31. An electronic device, comprising:

a housing; and

a concave display mounted in the housing, wherein the concave display includes a rigid cover layer having at least one concave outer surface and at least one corresponding convex inner surface and includes a flexible display layer, wherein the flexible display layer conforms to the convex inner surface of the rigid cover layer.

32. The electronic device defined in claim 31 wherein the flexible display layer comprises image pixels formed from organic light-emitting diodes.

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33. The electronic device defined in claim 31 wherein the concave display further comprises a first adhesive layer, and wherein the first adhesive layer attaches the flexible display layer to the convex inner surface of the rigid cover layer.

34. The electronic device defined in claim 33 wherein the rigid cover layer has at least one opening, wherein the electronic device further comprises an internal component, and wherein the internal component is mounted adjacent to the flexible display layer under the at least one opening in the rigid cover layer.

35. The electronic device defined in claim 34 wherein the internal component comprises a speaker and wherein the speaker transmits sound through the flexible display layer.

36. The electronic device defined in claim 34 wherein the internal component comprises a button, wherein the electronic device further comprises a button member in the at least one opening in the rigid cover layer, wherein the button member moves within the at least one opening in the rigid cover layer, and wherein the movement of the button member compresses the button.

37. An electronic device, comprising:

an electronic device housing; and

a concave display mounted in the electronic device housing, wherein the concave display comprises a rigid cover layer having a concave outer surface and a convex inner surface, a flexible display layer, and a touch-sensitive layer, wherein the flexible display layer

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and the touch-sensitive layer each conform to the convex inner surface of the rigid cover layer.

38. The electronic device defined in claim 37 wherein the concave display further comprises first and second adhesive layers, wherein the flexible display layer is attached to the touch-sensitive layer with the first adhesive layer, and wherein the touch-sensitive layer is attached to the convex inner surface of the rigid cover layer with the second adhesive layer.

39. The electronic device defined in claim 38 further comprising at least one internal component mounted adjacent to the flexible display layer of the concave display .

40. The electronic device defined in claim 39 wherein the rigid cover layer of the convex display has at least one opening, wherein the at least one internal component is an audio component, and wherein the audio component is mounted under the at least one opening in the rigid cover layer.

41. The electronic device defined in claim 38 wherein the concave outer surface of the concave display has a curvature and peripheral edges, wherein the curvature has a deepest point, wherein the deepest point and at least some of the peripheral edges define a maximum depth associated with the curvature of the concave display and wherein the maximum depth of the concave display is between 0.5 millimeter and 20 millimeters.

42. The electronic device defined in claim 41 further comprising an internal component, wherein the

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internal component is mounted at a distance from the peripheral edges of the concave outer surface, and wherein the distance is smaller than the maximum depth.

43. An electronic device, comprising:

a housing; and

a display mounted in the housing, wherein the display has a flexible display layer that conforms to a convex outer surface of a rigid support structure.

44. The electronic device defined in claim 43 wherein the display further comprises an adhesive layer, and wherein the adhesive layer attaches the flexible display layer to the convex outer surface of the rigid support structure.

45. The electronic device defined in claim 43 wherein the display further comprises a touch-sensitive layer .

46. The electronic device defined in claim 45 wherein the display further comprises first and second adhesive layers, wherein the first adhesive layer attaches the flexible display layer to the touch-sensitive layer, and wherein the second adhesive layer attaches the flexible display layer to the convex outer surface of the rigid support structure.

47. The electronic device defined in claim 46 wherein the flexible display layer comprises image pixels formed from organic light-emitting diodes.

48. The electronic device defined in claim 46, wherein the housing has at least one opening, wherein the

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opening is associated with a connector port, the electronic device further comprising a connector structure mounted in the connector port.

49. An electronic device, comprising:

a housing; and

a display mounted in the housing, wherein the display includes a rigid cover layer having at least one convex outer surface and having at least one associated concave inner surface and includes a flexible display layer that conforms to the concave inner surface.

50. The electronic device defined in claim 49 wherein the display further comprises an adhesive layer, and wherein the adhesive layer bonds the flexible display layer to the concave inner surface of the rigid cover layer.

51. The electronic device defined in claim 49 wherein the rigid cover layer comprises glass.

52. The electronic device defined in claim 51 wherein the flexible display layer comprises image pixels formed from organic light-emitting diodes.

53. The electronic device defined in claim 49 wherein the flexible display layer comprises image pixels formed from organic light-emitting diodes.

54. The electronic device defined in claim 49 wherein the display further comprises a touch sensor layer that conforms to the concave inner surface.

55. The electronic device defined in claim 54

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wherein the concave display further comprises first and second adhesive layers, wherein the first adhesive layer attaches the flexible display layer to the touch sensor layer, and wherein the second adhesive layer attaches the touch sensor layer to the concave inner surface of the display .

56. The electronic device defined in claim 55 wherein touch sensor layer comprises indium-tin-oxide electrodes .

57. The electronic device defined in claim 49 further comprising an internal component, wherein the concave inner surface of the display provides an additional internal volume for the electronic device, and wherein the internal component is mounted at least partially in the additional internal volume.

58. An electronic device having at least a front surface and a rear surface, comprising:

electronic components interposed between the front and rear surfaces; and

a display that substantially covers at least the front and rear surfaces and that surrounds the electronic components, wherein the display comprises a rigid cover layer having at least one inner surface and a flexible display layer that is bent to conform to the inner surface.

59. The electronic device defined in claim 58 wherein the display further comprises a touch-sensitive layer attached to at least a portion of the flexible display layer.

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60. The electronic device defined in claim 58 wherein the inner surface comprises a concave inner surface, the electronic device further comprising a connector structure and a housing having an opening, wherein the connector structure is mounted in the opening to form a connector port.

61. The electronic device defined in claim 58 wherein the electronic device has at least two sidewall surfaces, and wherein the display substantially covers the two sidewall surfaces.

62. The electronic device defined in claim 61 wherein the display has at least two edges, and wherein the edges of the display are joined by a joining member.

63. An electronic device, comprising:

a flexible display; and

a speaker structure having a speaker membrane, wherein the speaker membrane is formed from a portion of the flexible display.

64. The electronic device defined in claim 63, further comprising:

a stiffening structure configured to stiffen the portion of the flexible display that forms the speaker membrane.

65. The electronic device defined in claim 64 wherein the stiffening structure comprises a layer of foam.

66. The electronic device defined in claim 65 wherein the stiffening structure comprises first and

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second stiffening sheets that are attached to opposing first and second sides of the layer of foam.

67. The electronic device defined in claim 63 wherein the flexible display comprises an active portion configured to display images and wherein the speaker membrane is formed from the active portion of the flexible display .

68. The electronic device defined in claim 63, further comprising:

a rigid structure; and

a suspension structure configured to attach portions of the speaker structure to the rigid structure.

69. The electronic device defined in claim 68, further comprising:

an electronic device housing in which the flexible display is mounted, wherein the rigid structure is formed at least partly from the electronic device housing .

70. The electronic device defined in claim 63, further comprising:

a cover layer formed over the flexible display, wherein the cover layer comprises at least one opening formed over the speaker membrane.

71. The electronic device defined in claim 63 further comprising an electronic device housing in which the flexible display is mounted, wherein the electronic device housing has at least one acoustic port.

72. The electronic device defined in claim 63

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wherein the flexible display comprises an organic light-emitting diode display having a substrate formed from a flexible sheet of polymer.

73. An electronic device, comprising:

a flexible display; and

a plurality of speaker structures, wherein portions of the flexible display form speaker membranes for the plurality of speaker structures.

74. The electronic device defined in claim 73, further comprising:

a plurality of stiffening structures configured to stiffen the portions of the flexible display that form the speaker membranes.

75. The electronic device defined in claim 73 wherein the flexible display comprises:

a set of stiffened regions, wherein each of the stiffened regions in the set of stiffened regions forms part of a respective one of the speaker structures;

flexible regions, wherein each of the flexible regions surrounds a respective one of the stiffened regions in the set of stiffened regions; and

a surrounding stiffened region, wherein each of the flexible regions is surrounded by portions of the surrounding stiffened region.

76. The electronic device defined in claim 73 wherein the speaker structures comprise a left channel speaker and a right channel speaker.

77. The electronic device defined in claim 73, further comprising:

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transducers configured to drive the speaker structures, wherein each transducer comprises coils and a magnet .

78. The electronic device defined in claim 73 further comprising piezoelectric transducers configured to drive the speaker structures.

79. The electronic device defined in claim 73 wherein the flexible display comprises an organic light-emitting diode display having a substrate formed from a flexible sheet of polymer.

80. A portable electronic device, comprising:

a housing;

a flexible organic light-emitting diode display mounted in the housing, wherein the flexible organic light-emitting diode display has a substrate formed from a flexible sheet of polymer; and

at least one speaker having a speaker membrane formed from a portion of the flexible sheet of polymer .

81. The portable electronic device defined in claim 80, further comprising:

a stiffening structure interposed between the at least one speaker and the speaker membrane, wherein the stiffening structure comprises a composite material.

82. The portable electronic device defined in claim 80 wherein the speaker membrane has a concave shape.

83. The portable electronic device defined in claim 80 wherein the housing comprises a rectangular

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housing with four peripheral edges and wherein the flexible organic light-emitting diode display and the speaker membrane extend between the four peripheral edges.

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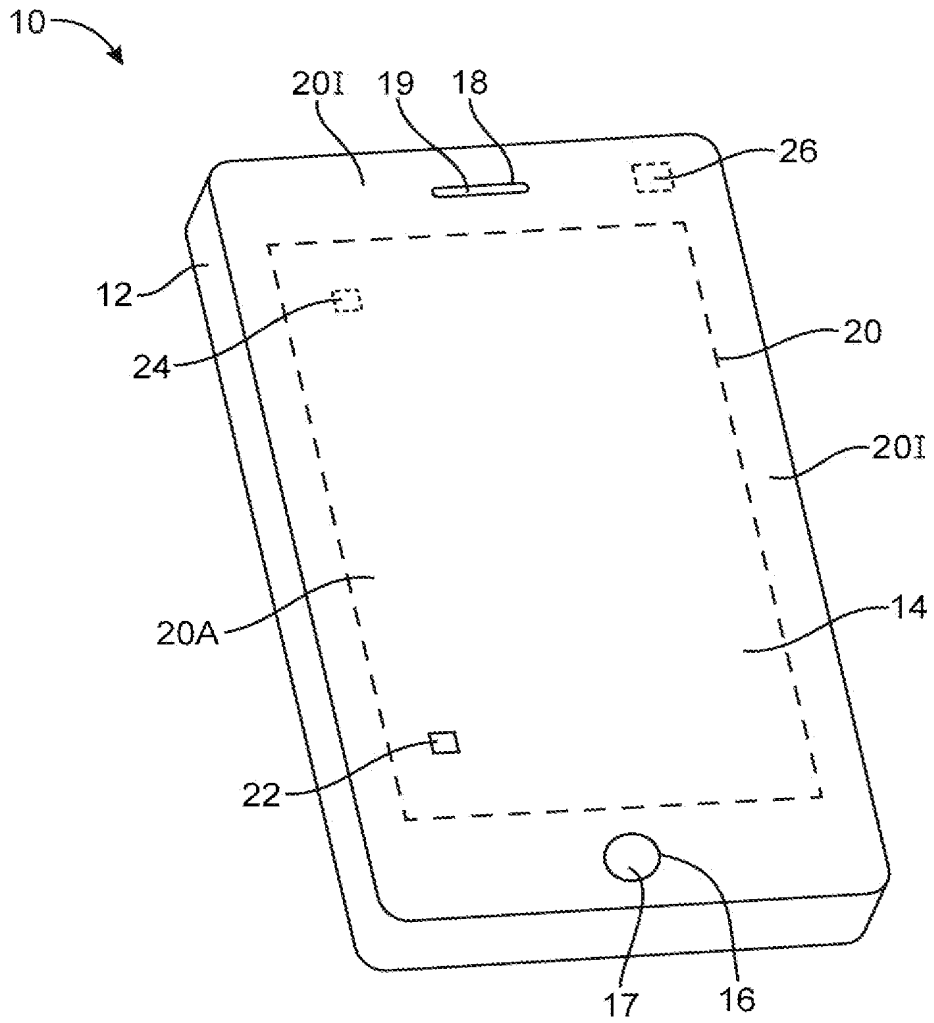


FIG. 1

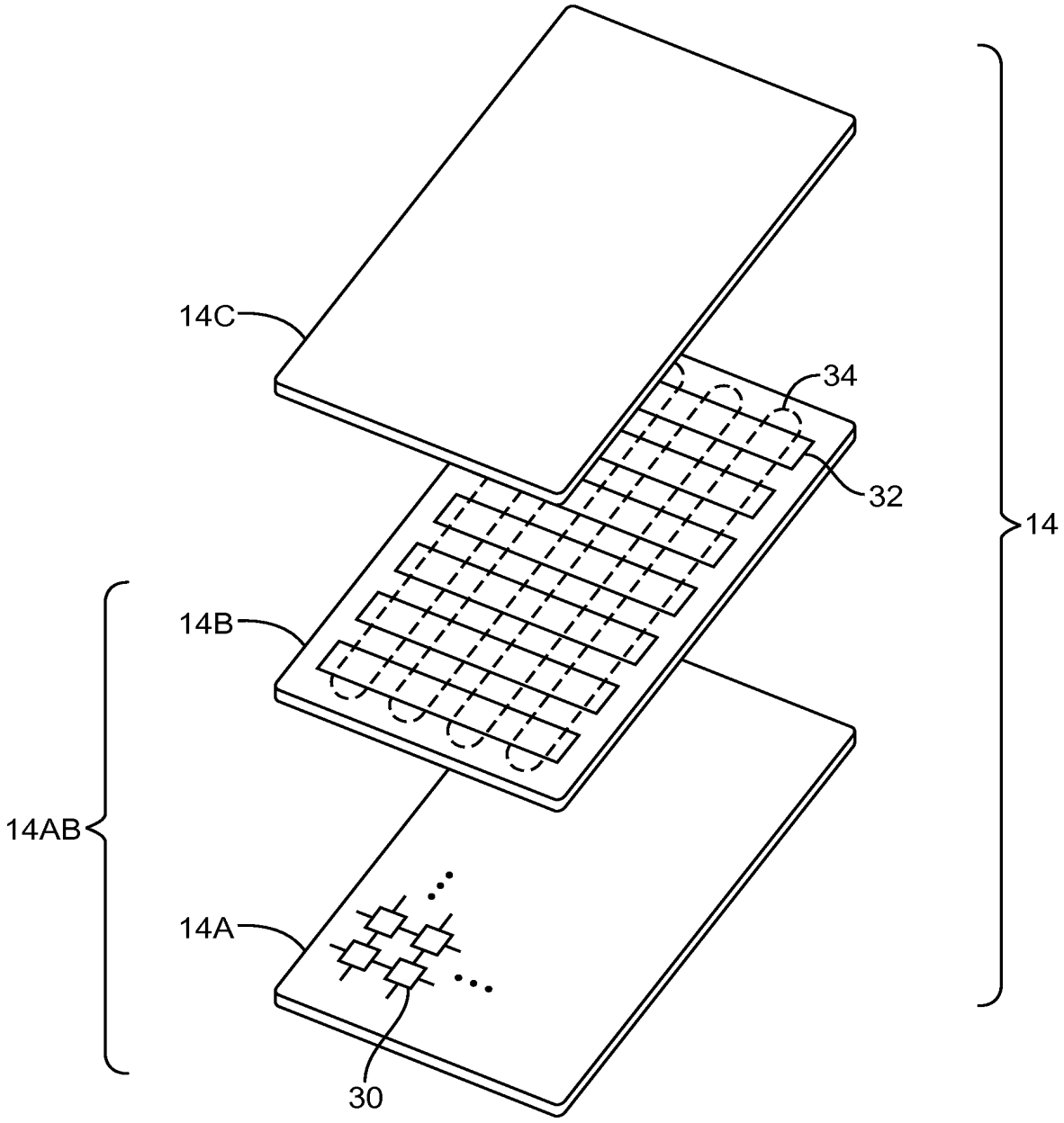


FIG. 2

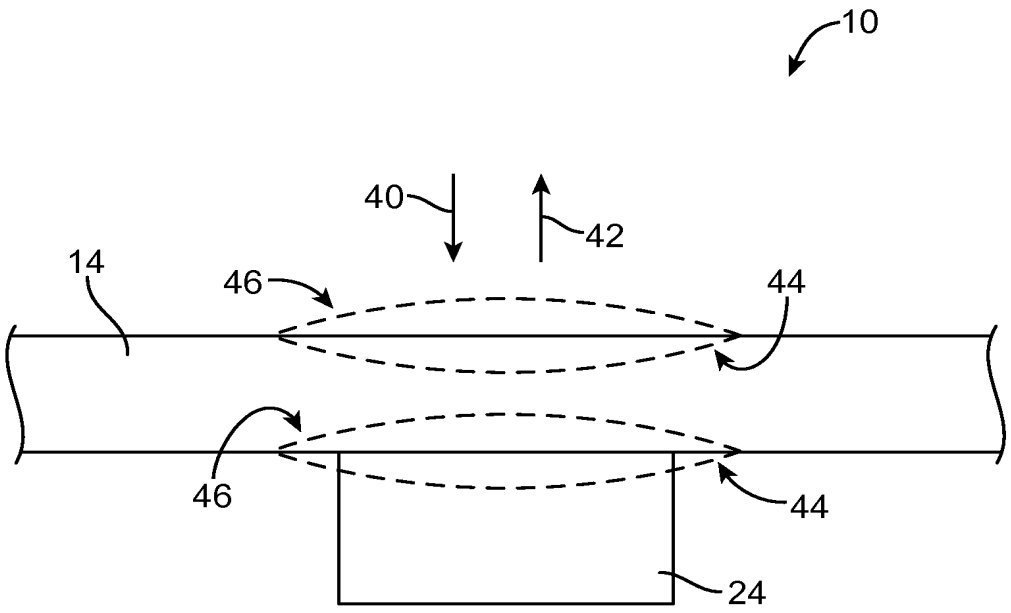


FIG. 3

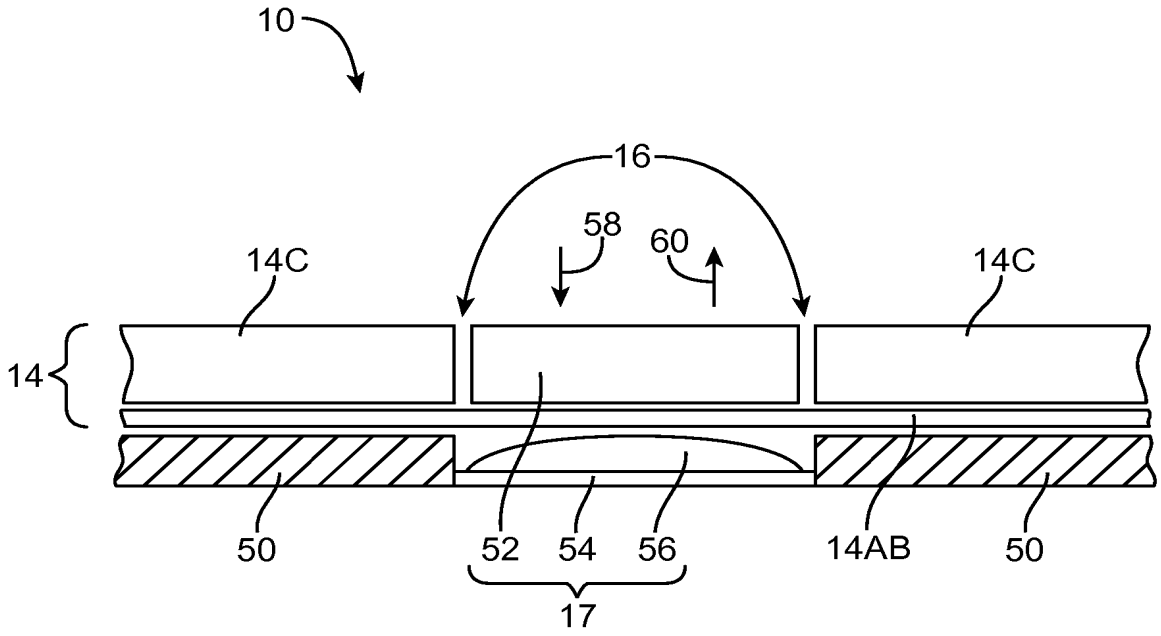


FIG. 4

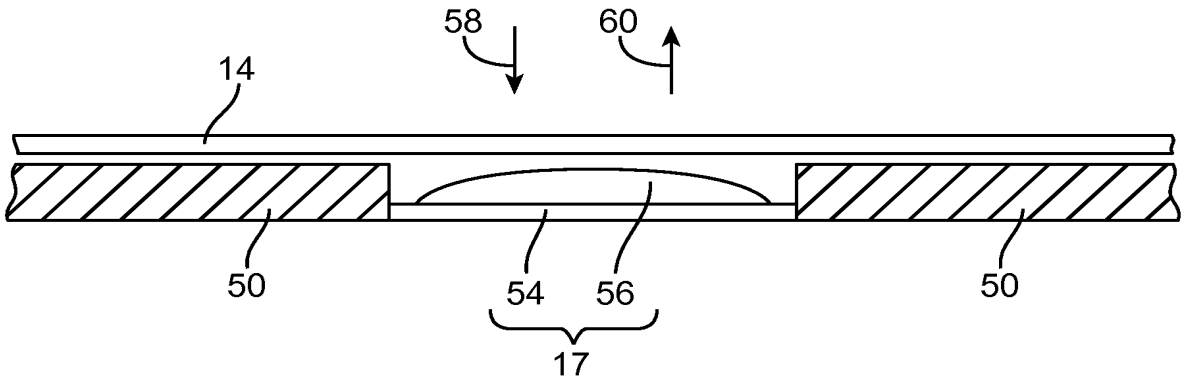


FIG. 5

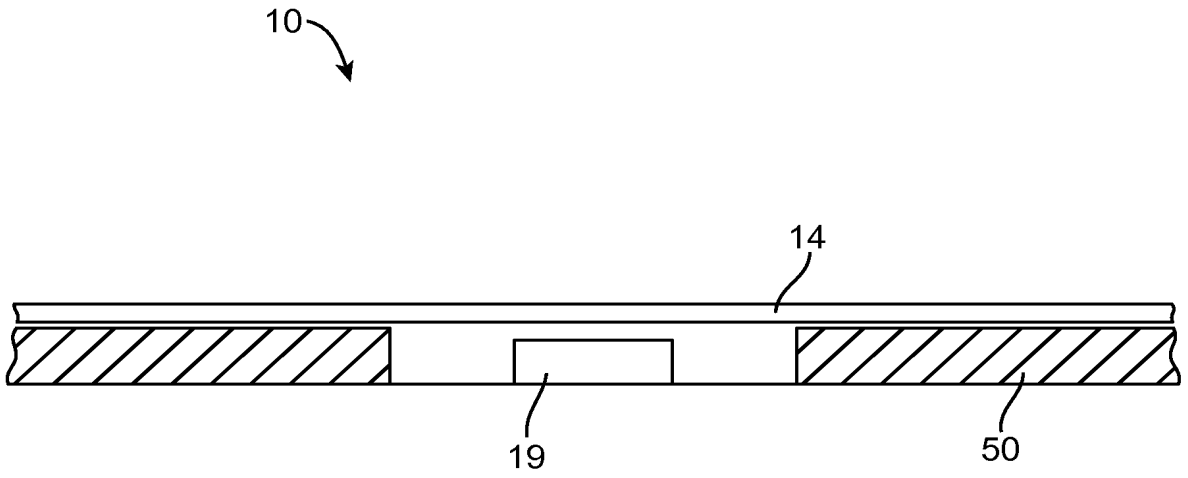


FIG. 6

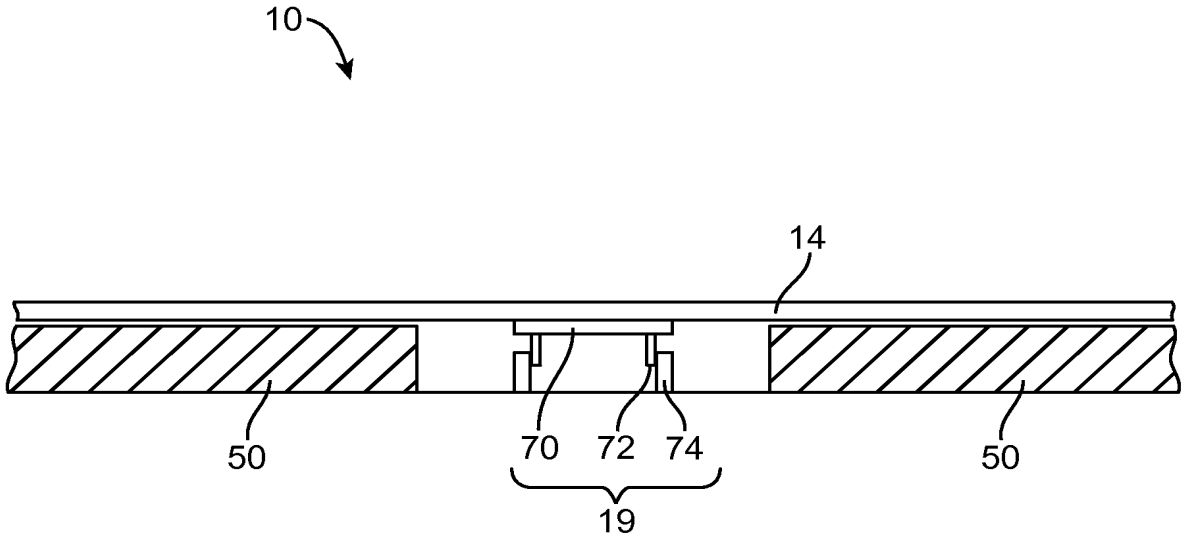


FIG. 7

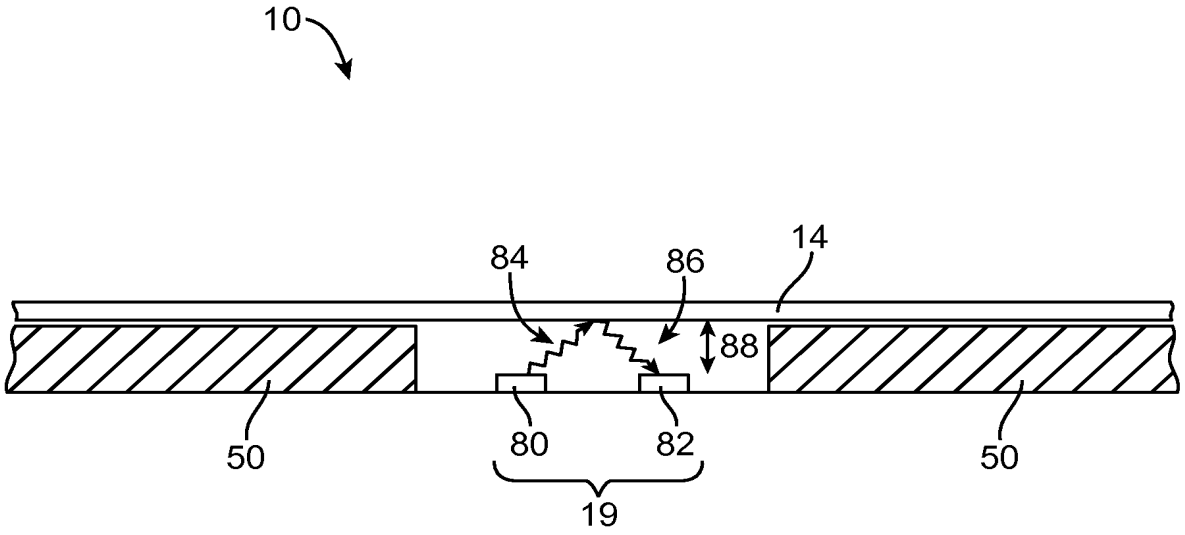


FIG. 8

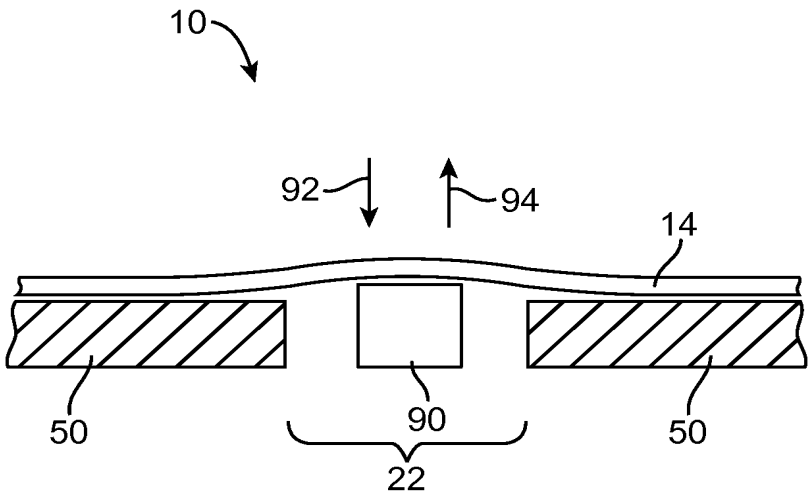


FIG. 9

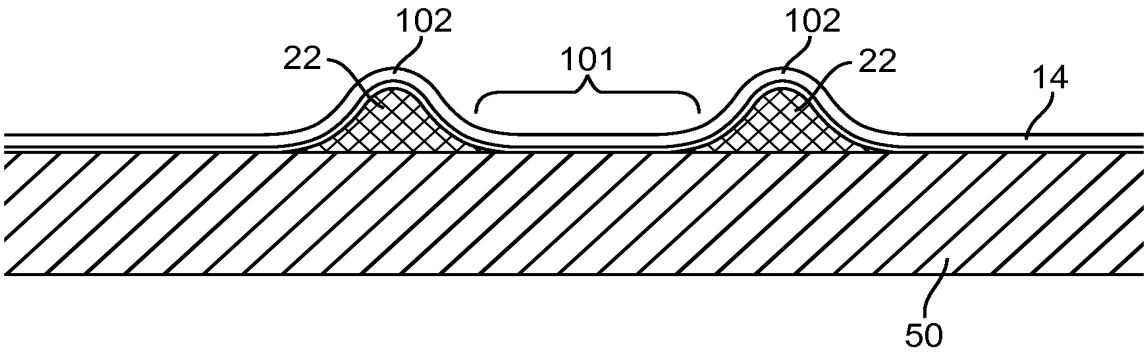


FIG. 10

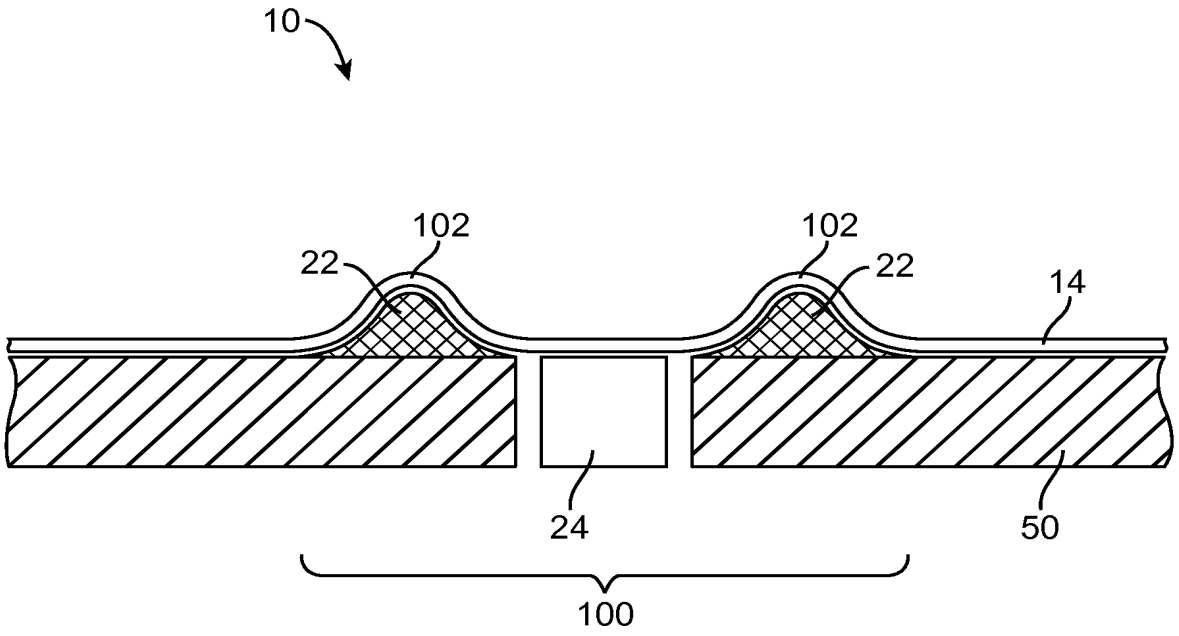


FIG. 11

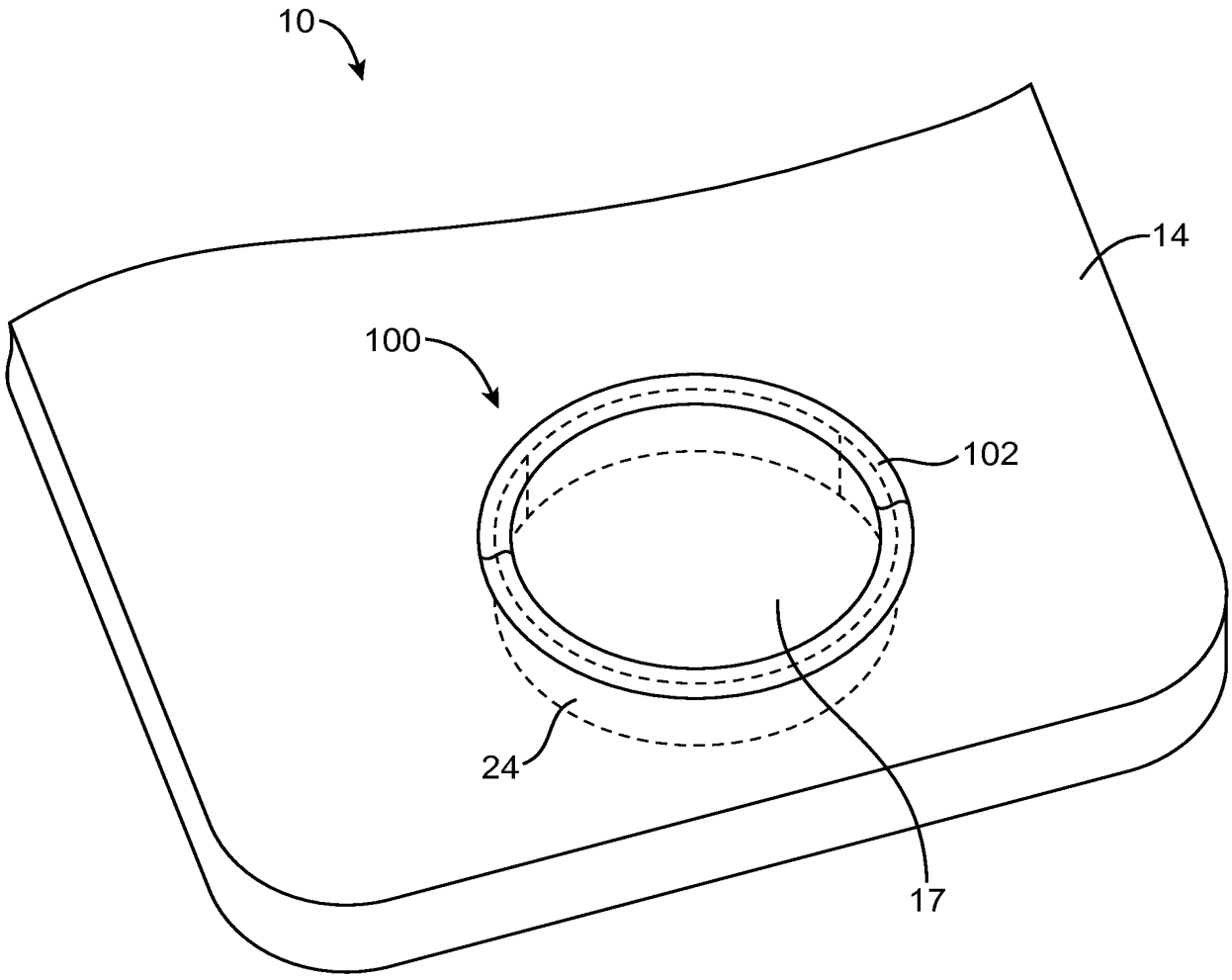


FIG. 12

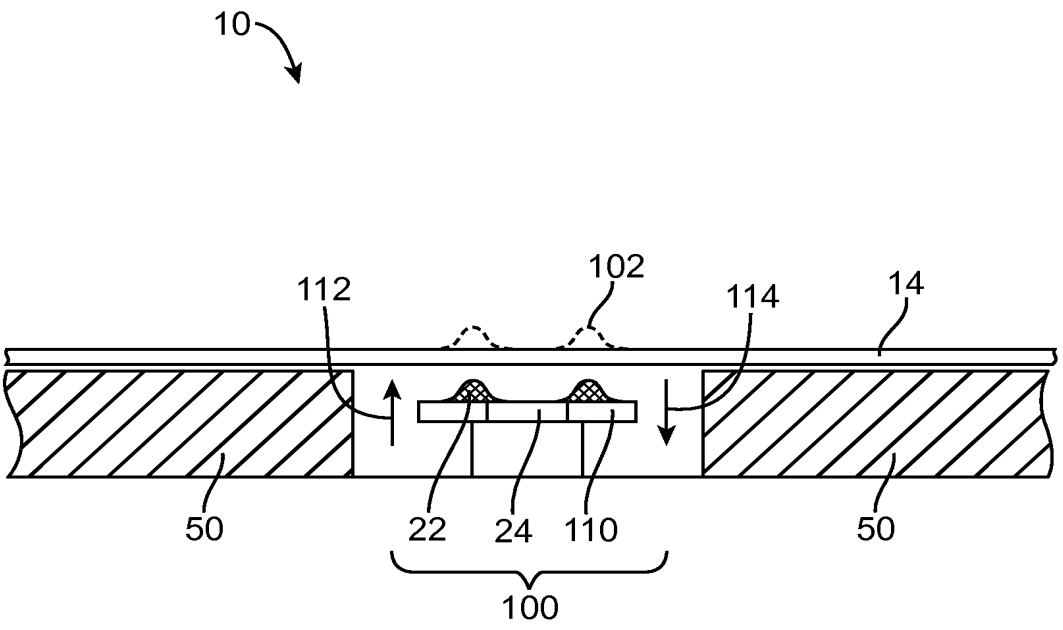


FIG. 13

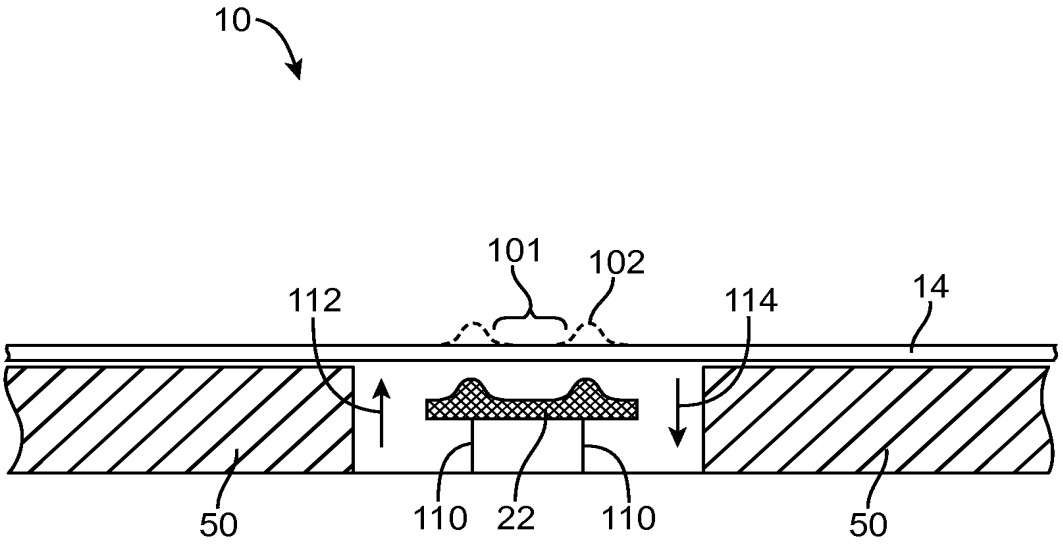


FIG. 14

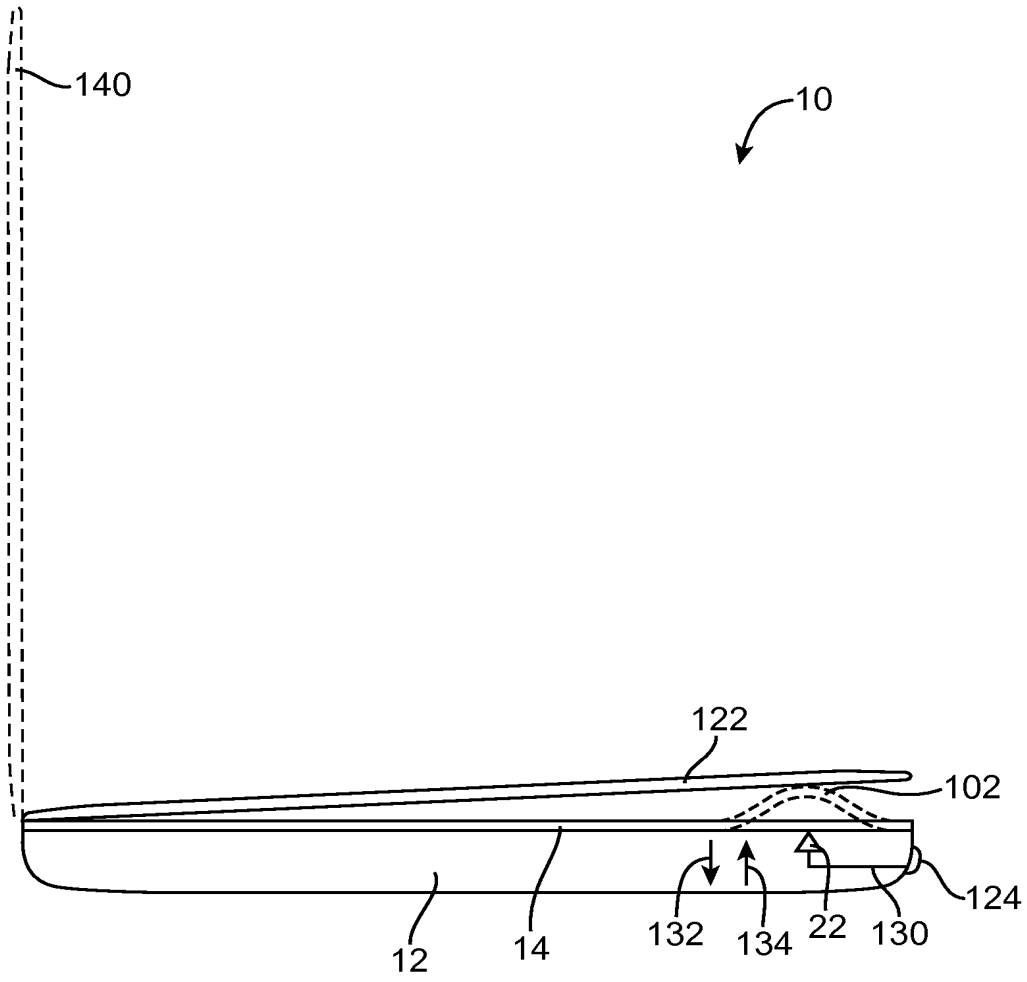


FIG. 15

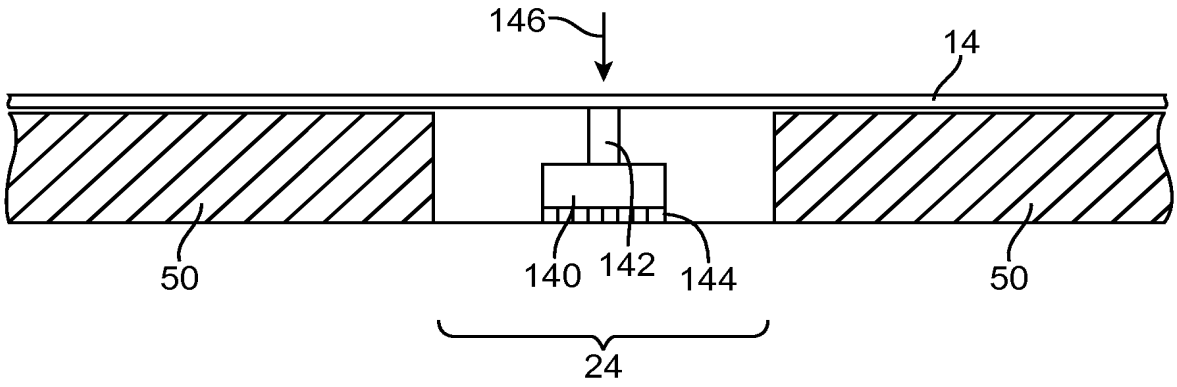


FIG. 16

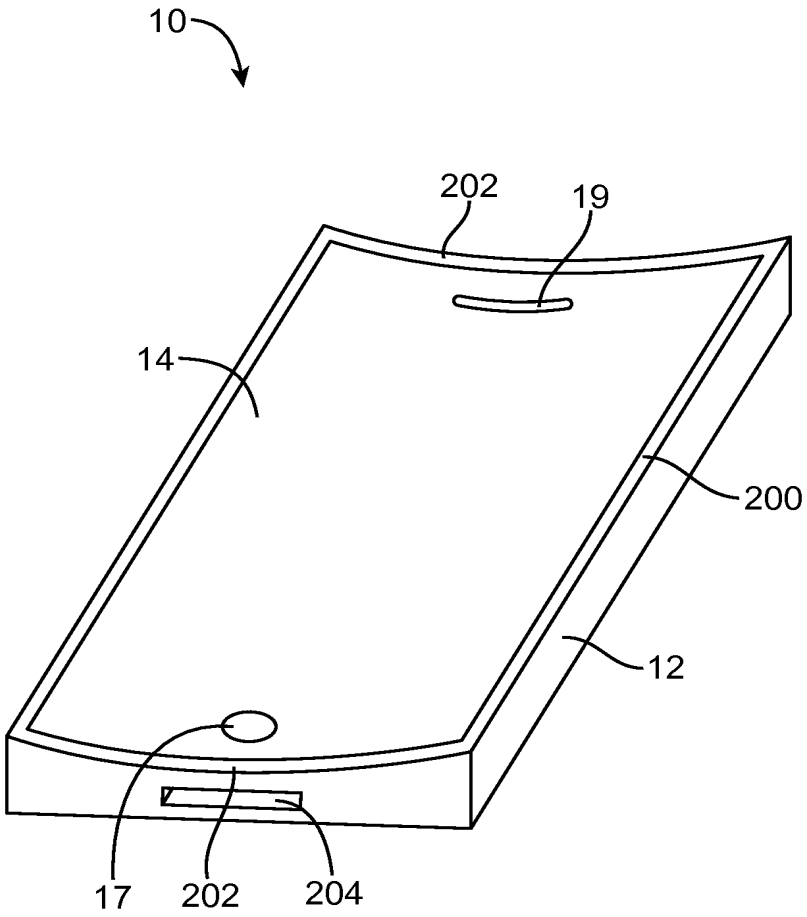


FIG. 17

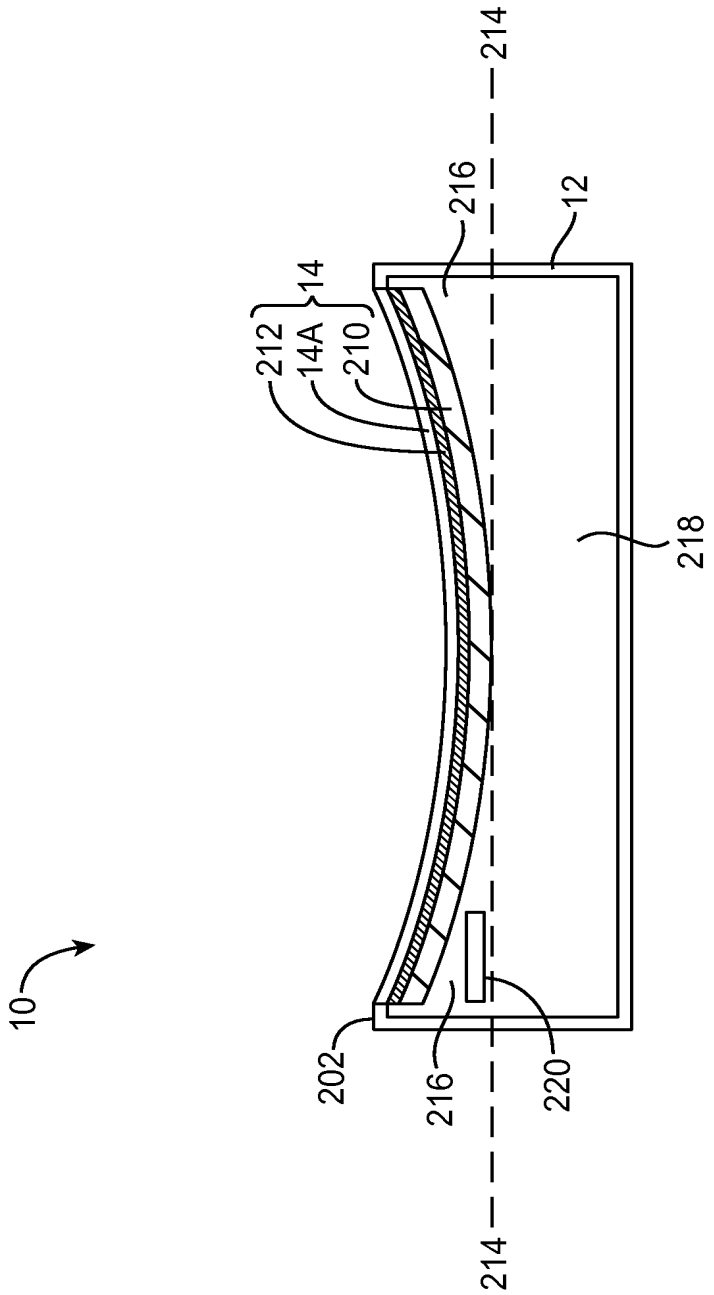


FIG. 18

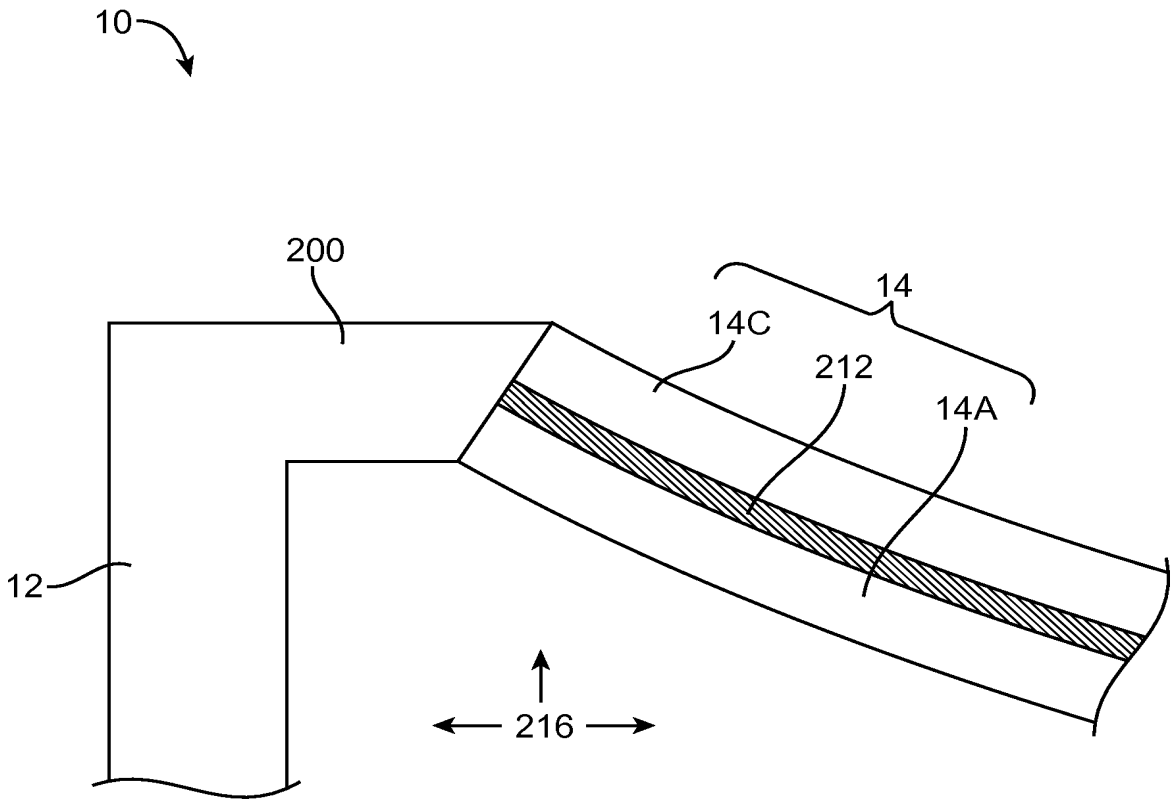


FIG. 19

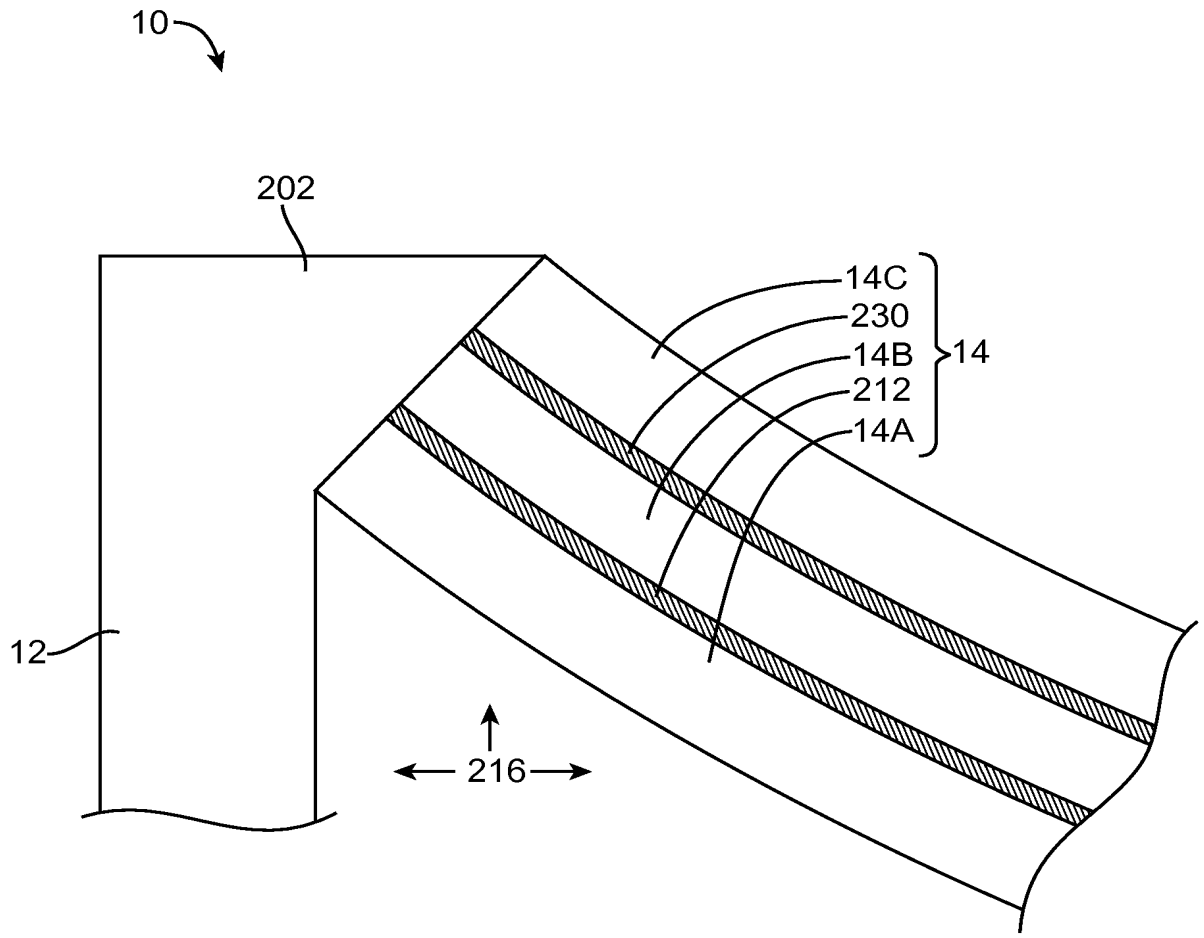


FIG. 20

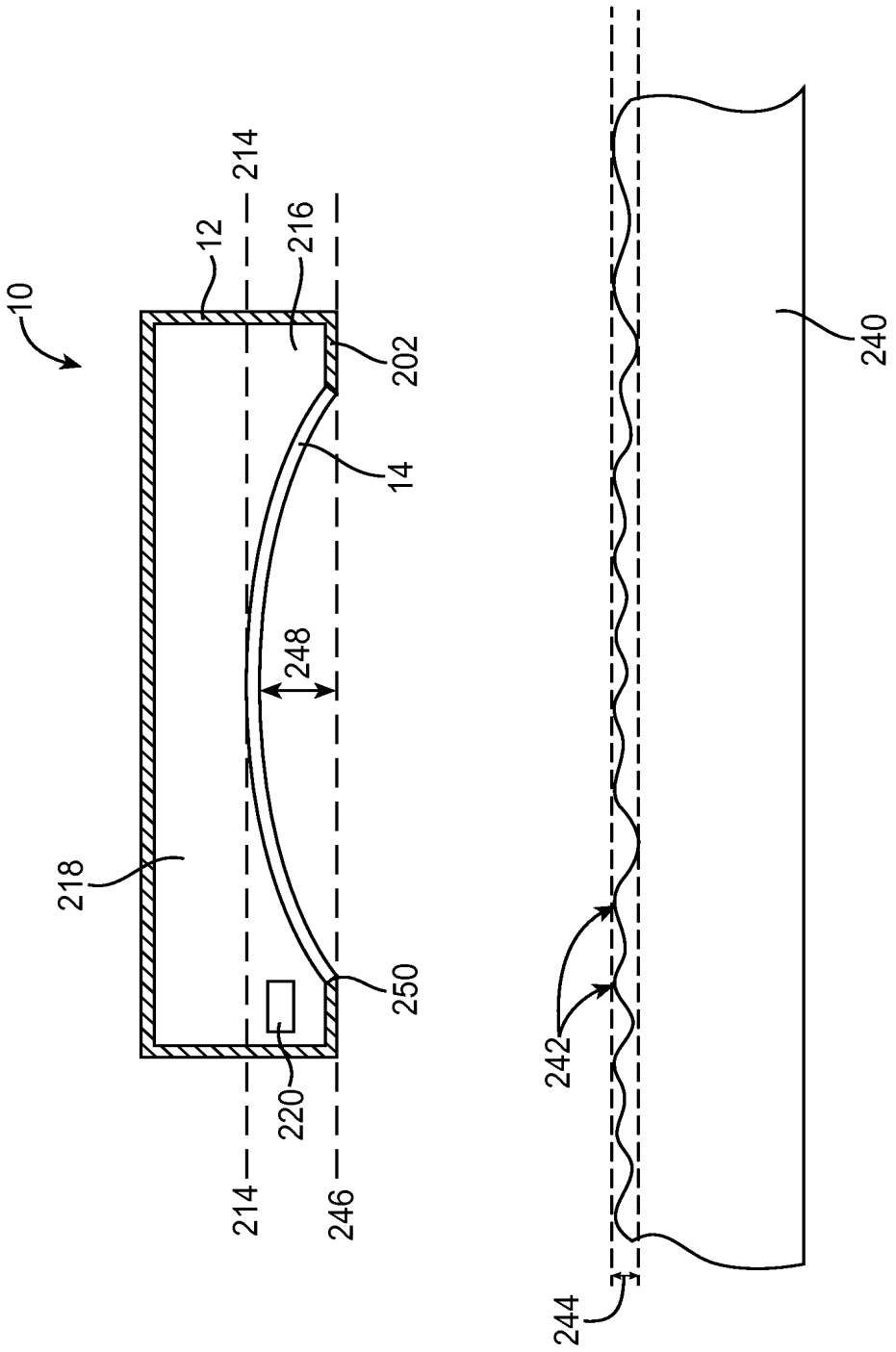


FIG. 21

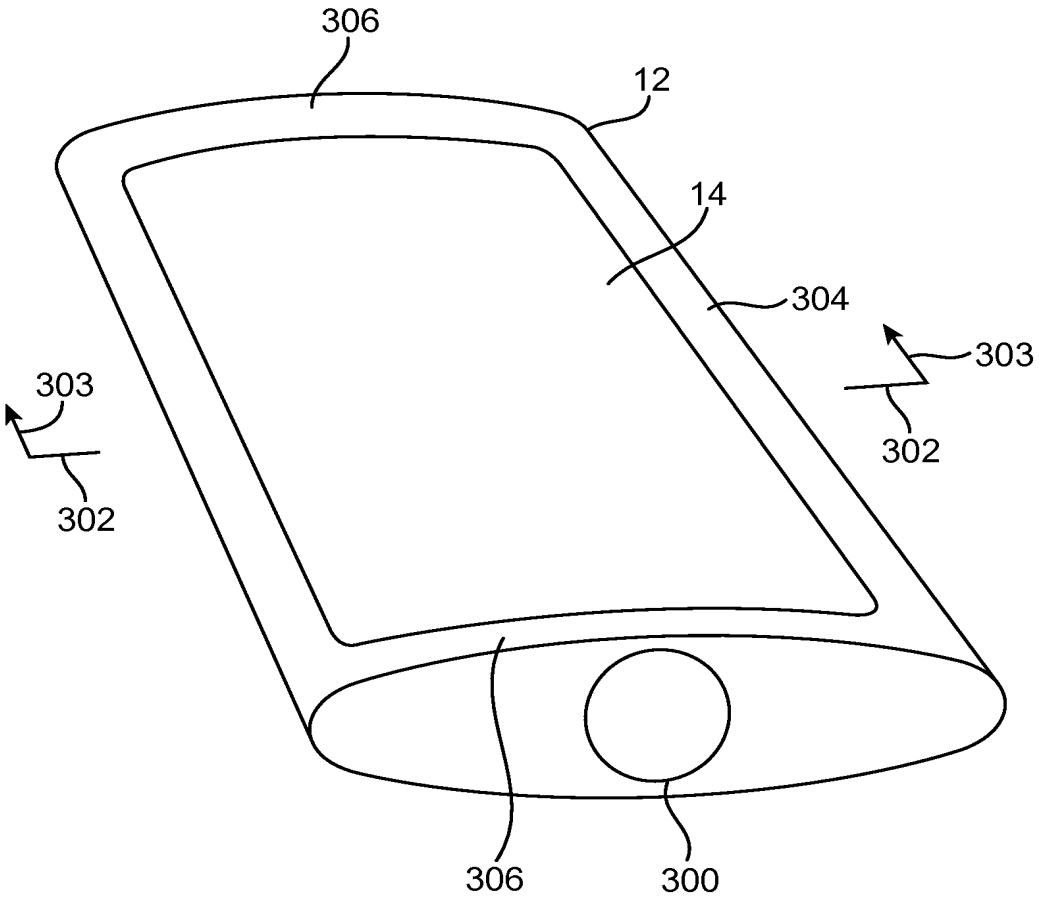


FIG. 22

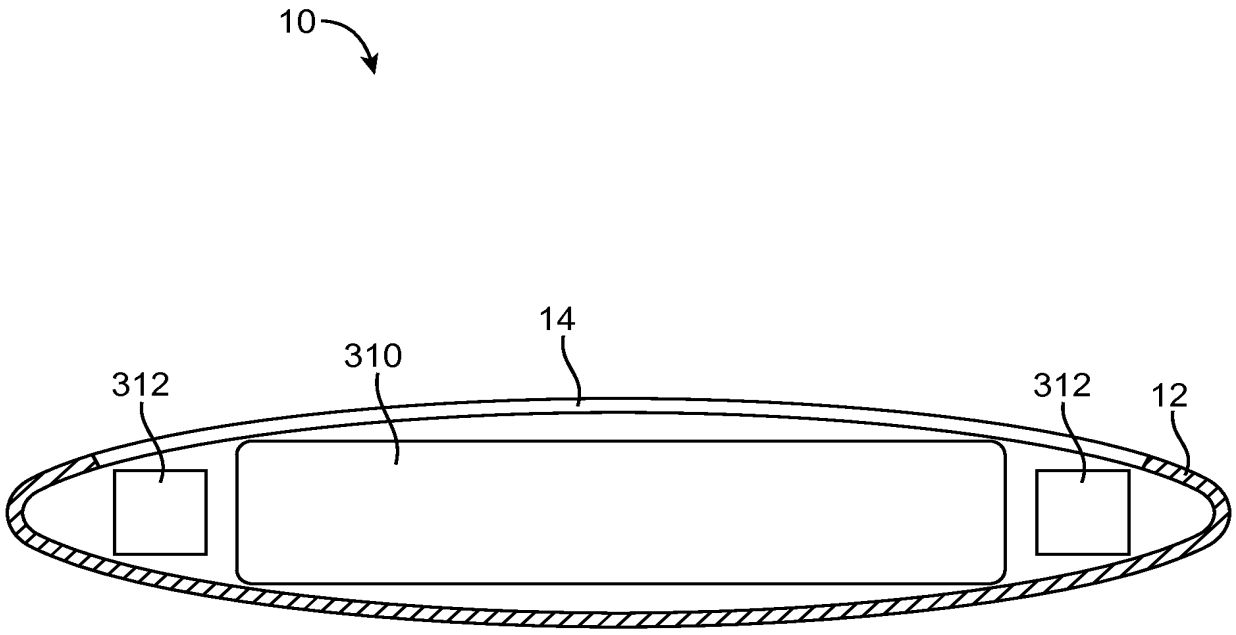


FIG. 23

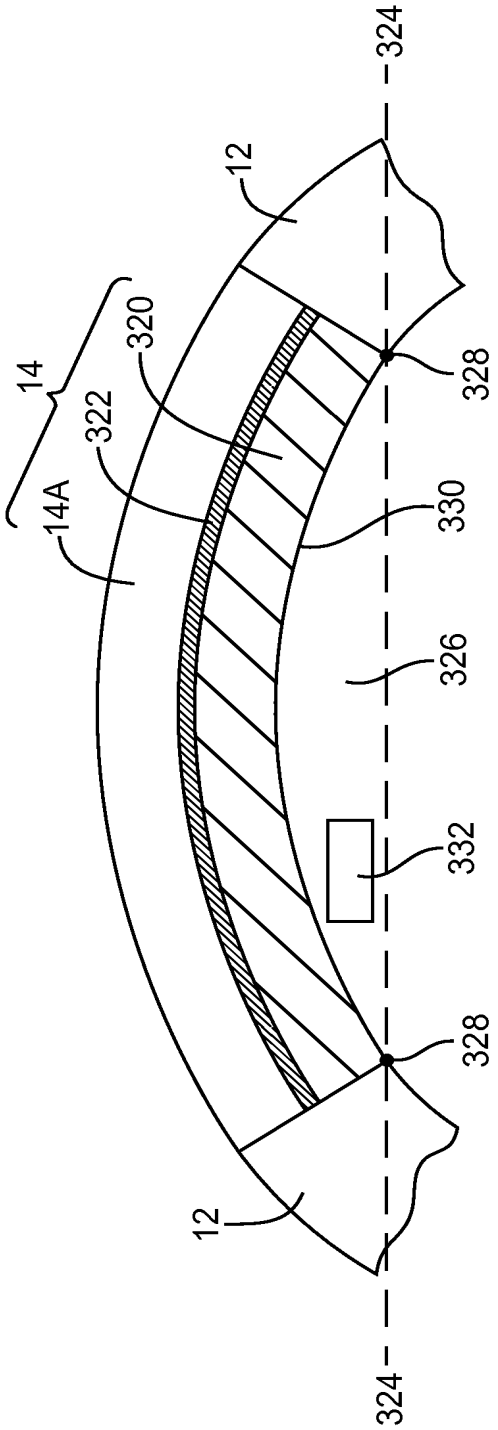


FIG. 24

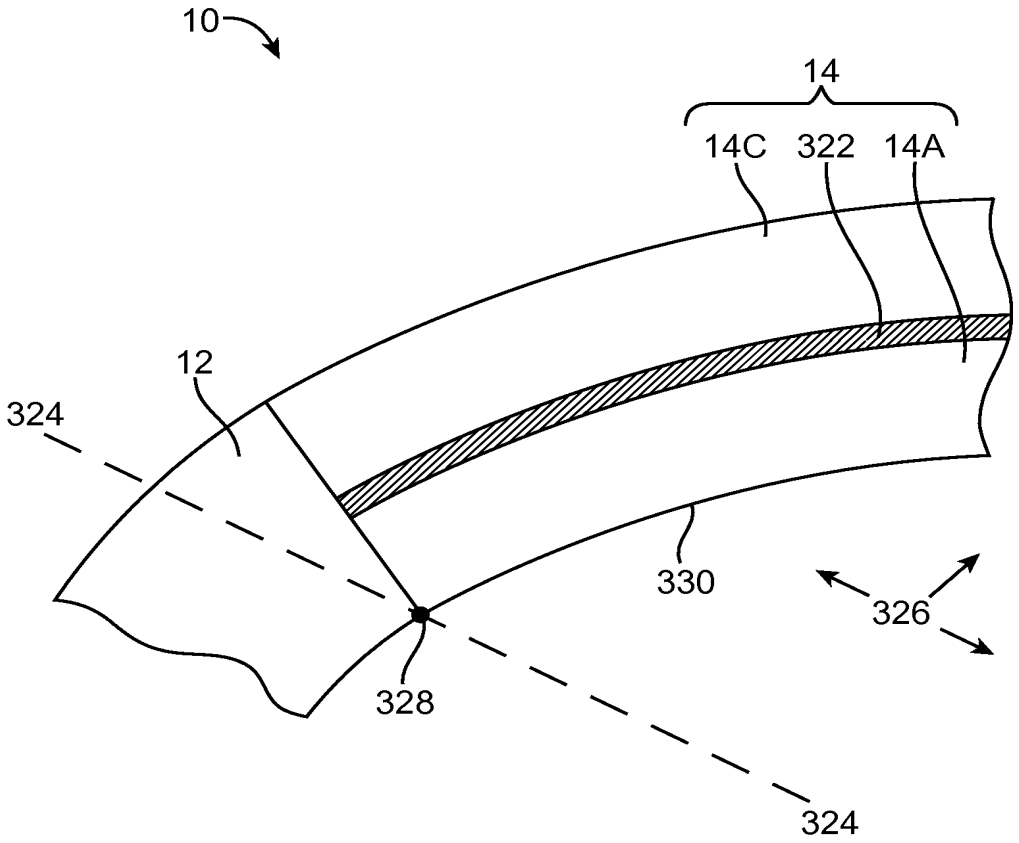


FIG. 25

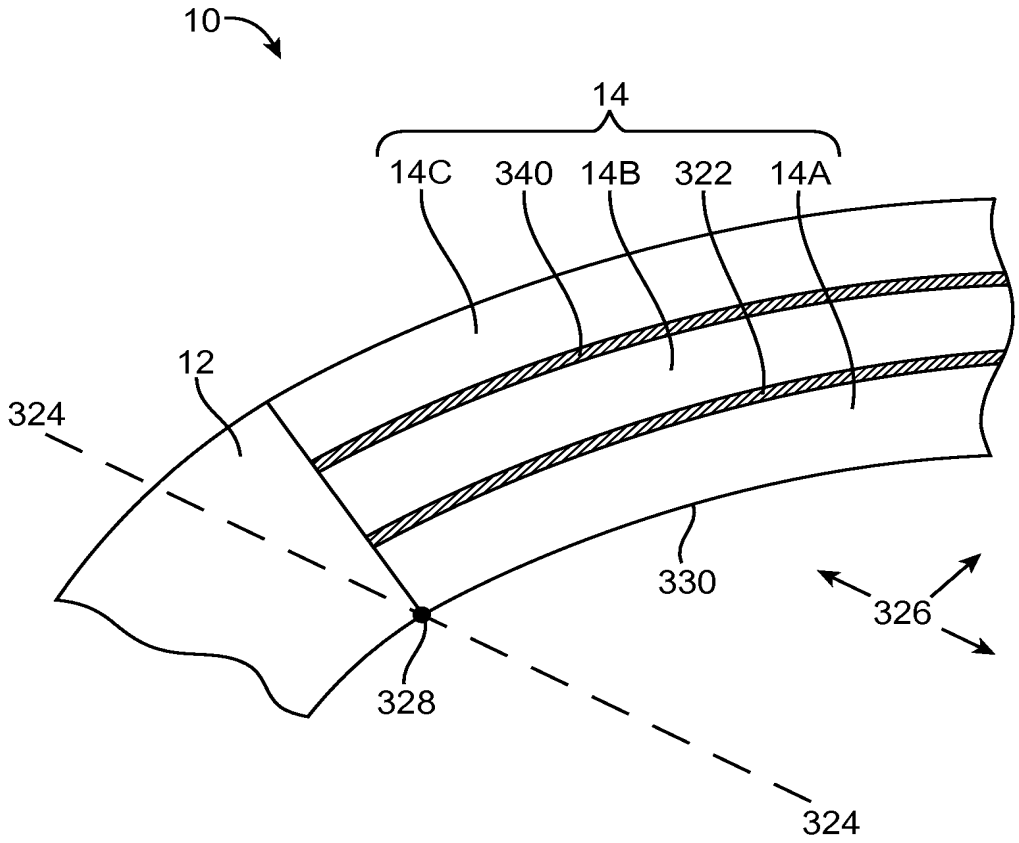


FIG. 26

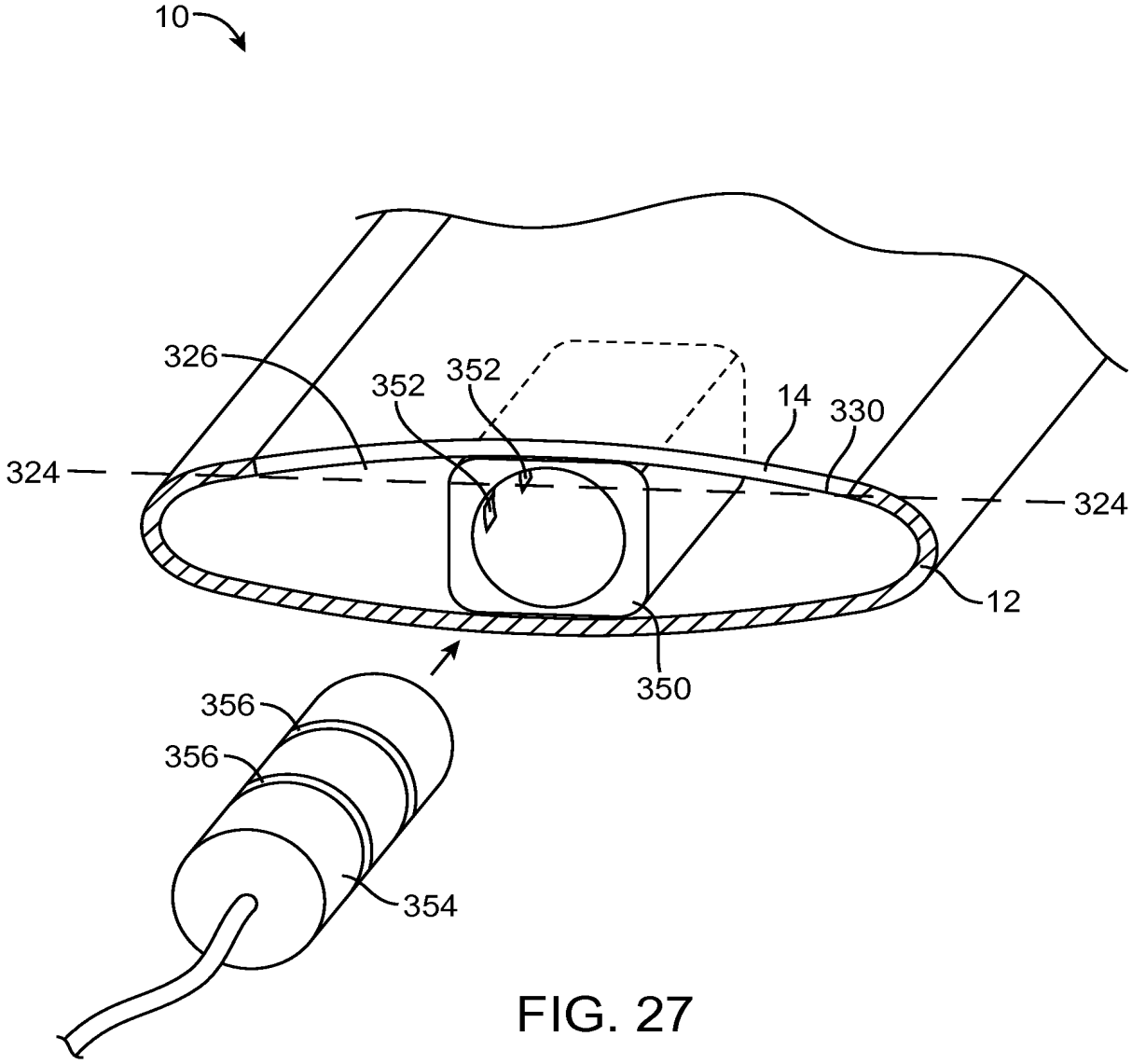


FIG. 27

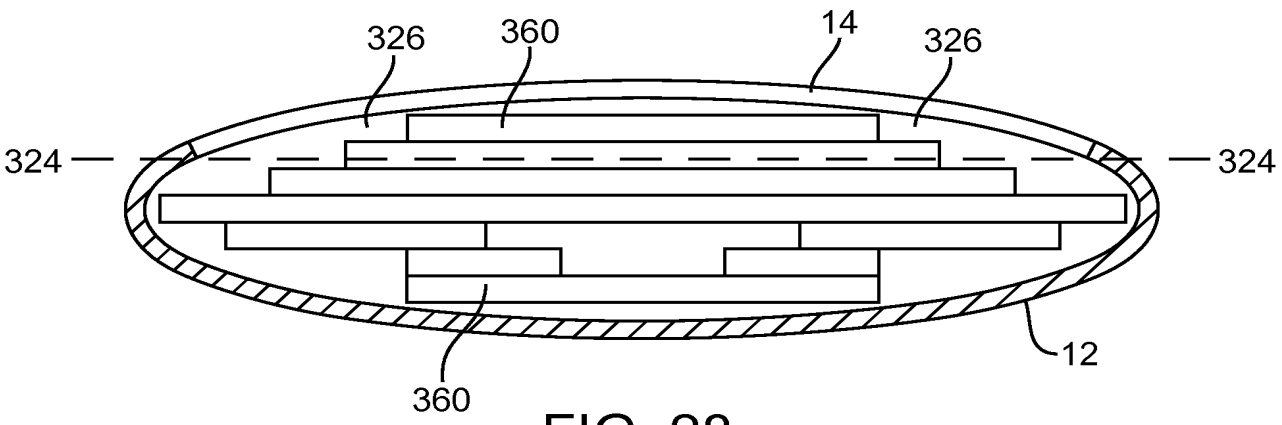


FIG. 28

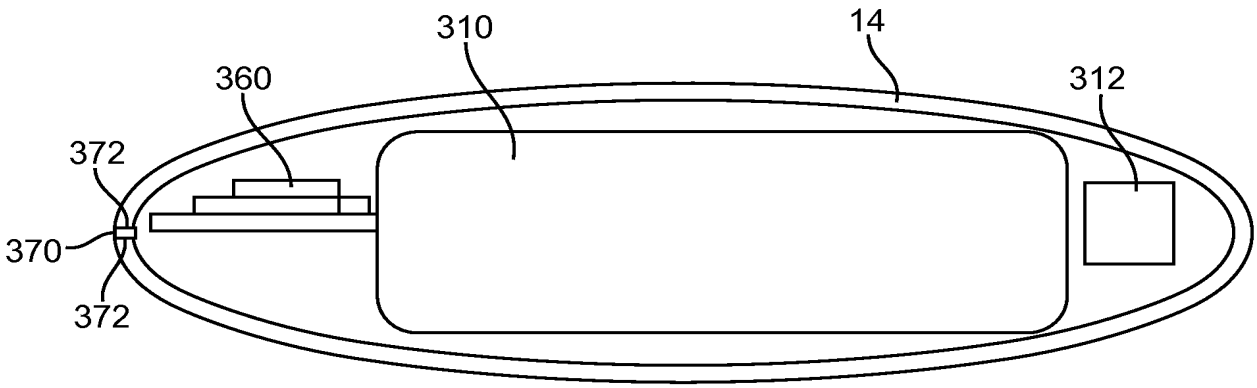


FIG. 29

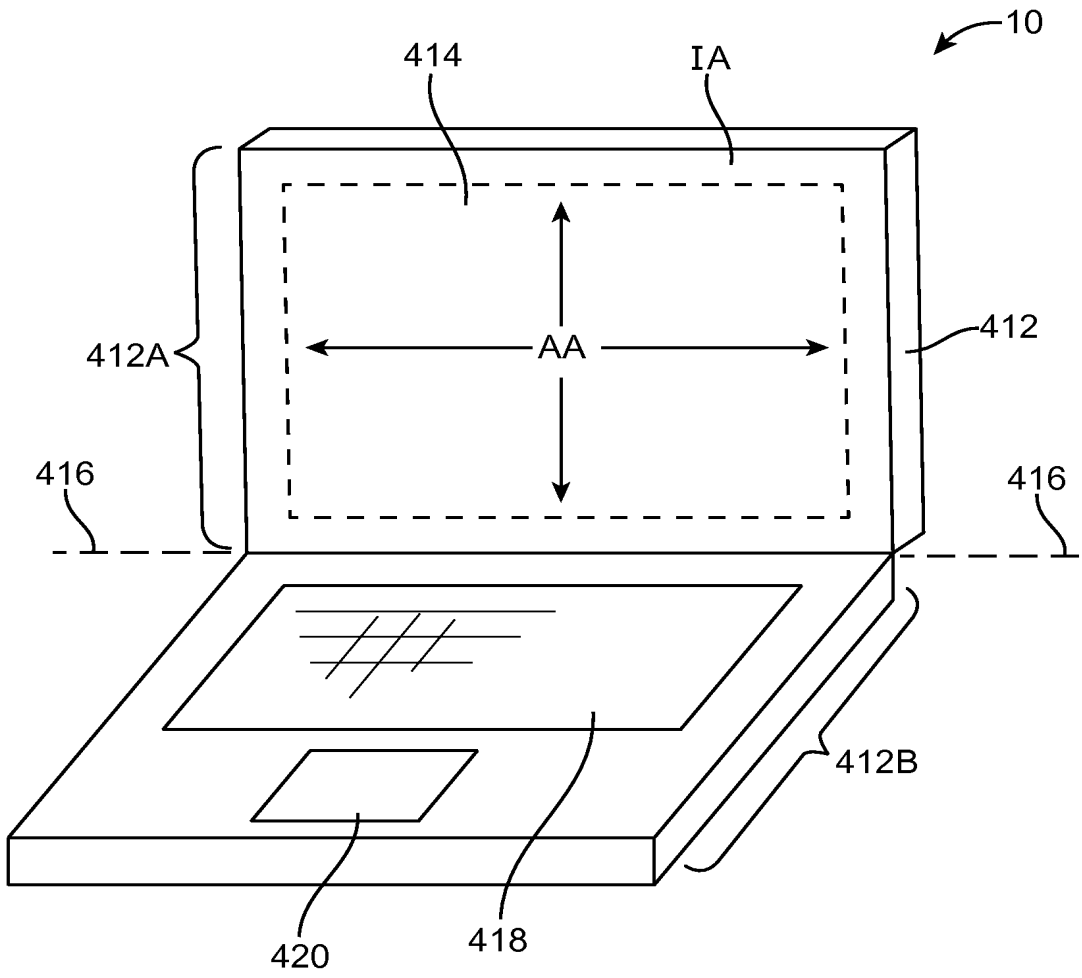


FIG. 30

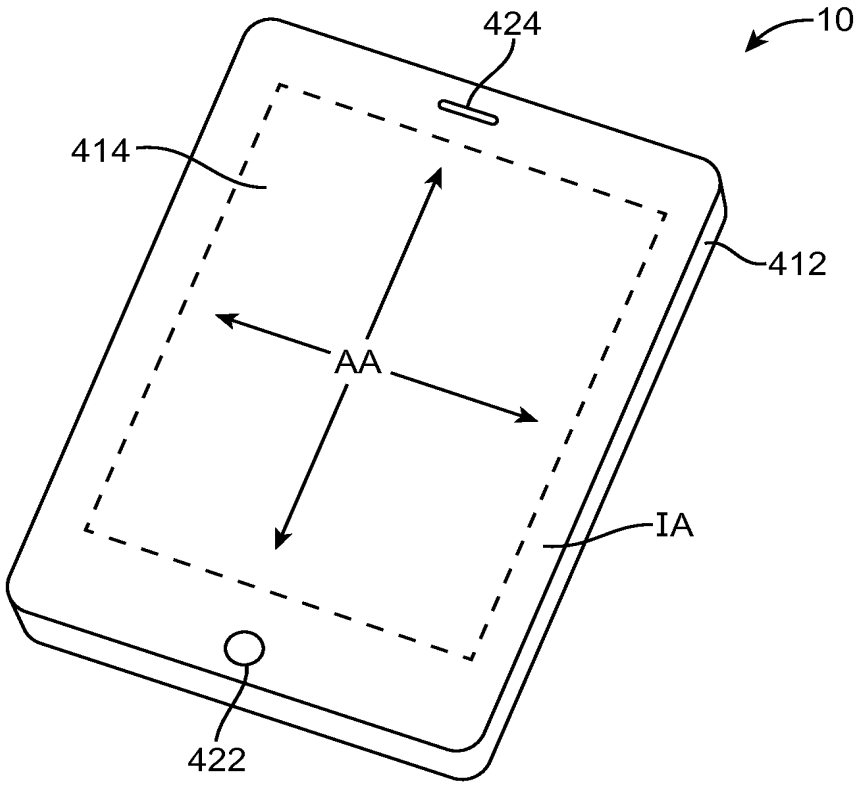


FIG. 31

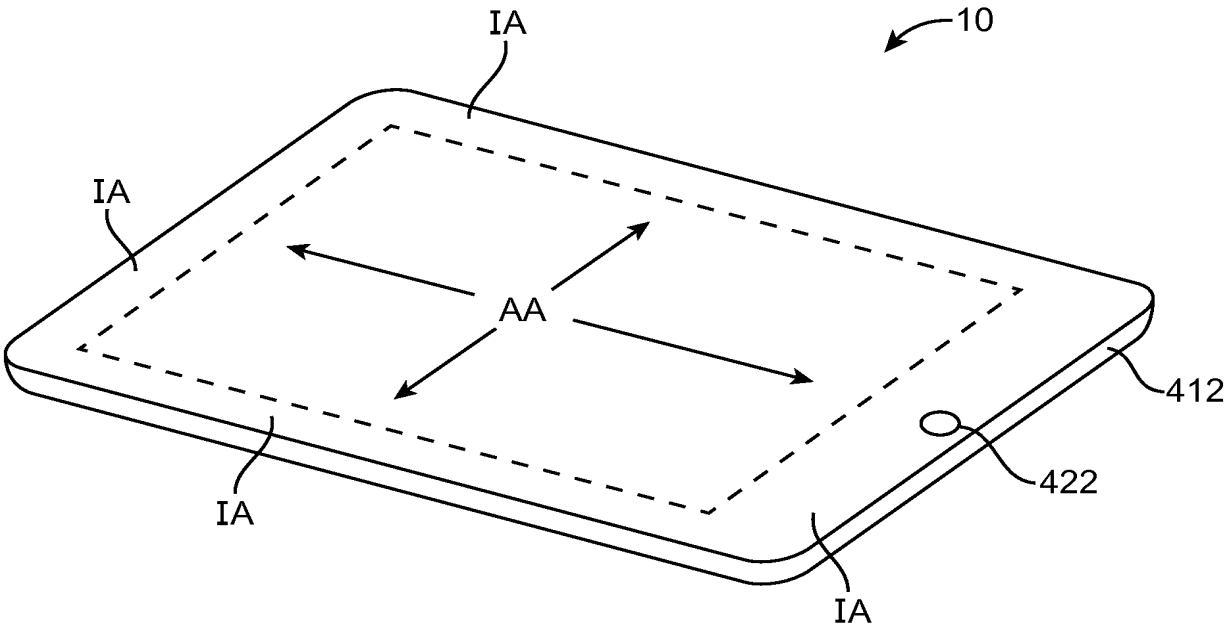


FIG. 32

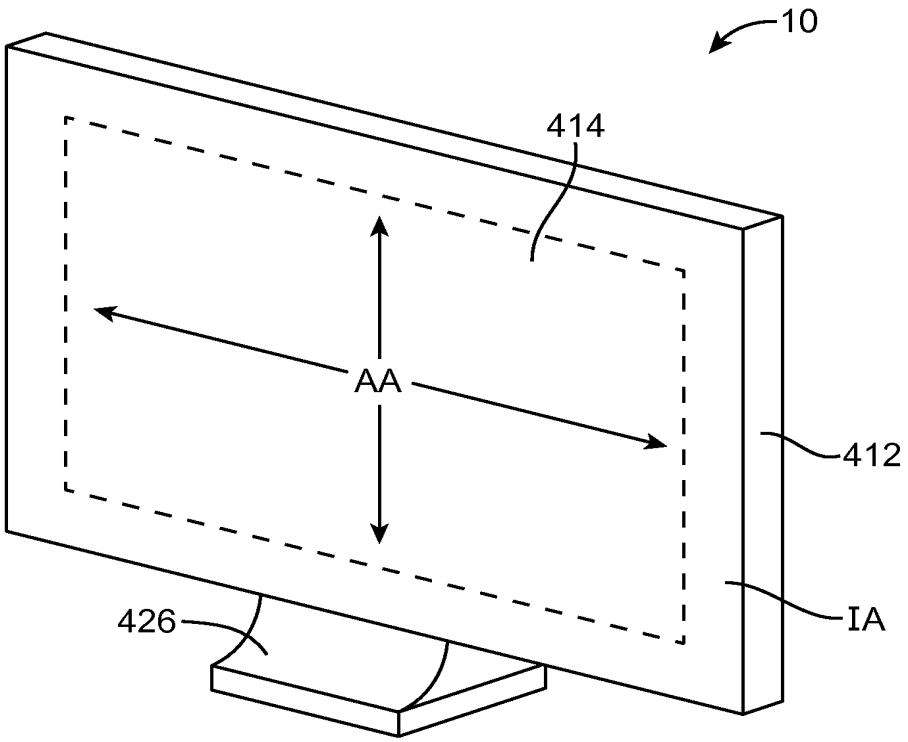


FIG. 33

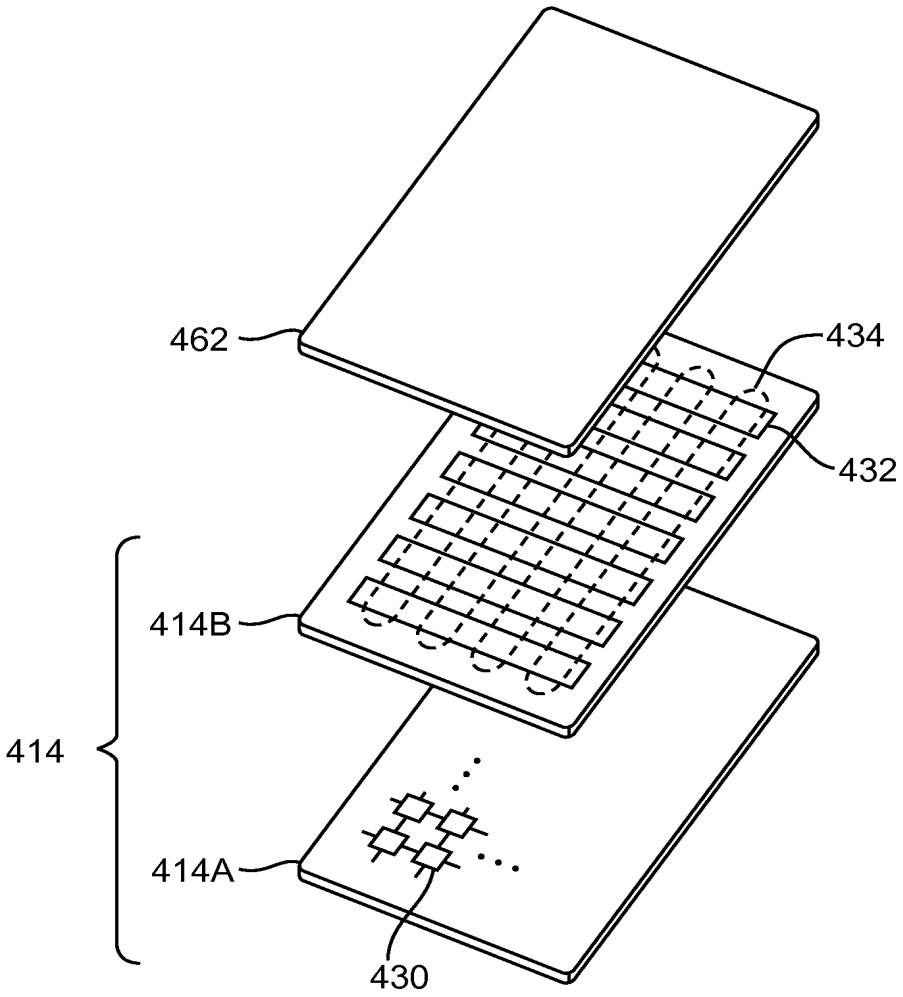


FIG. 34

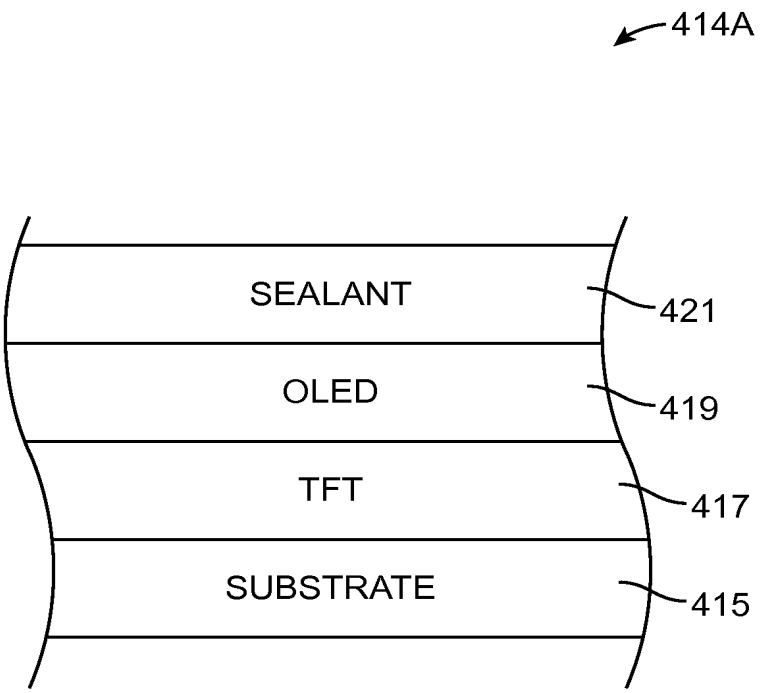


FIG. 35

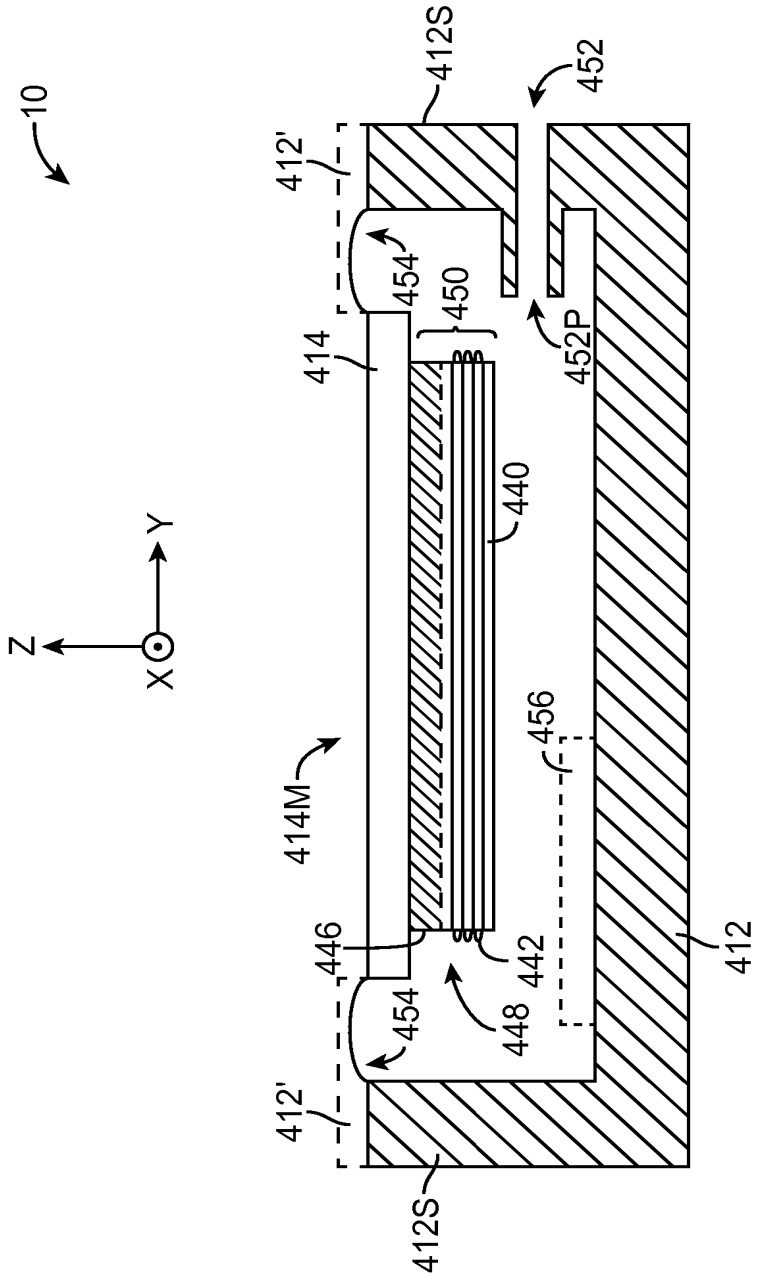

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FIG. 36

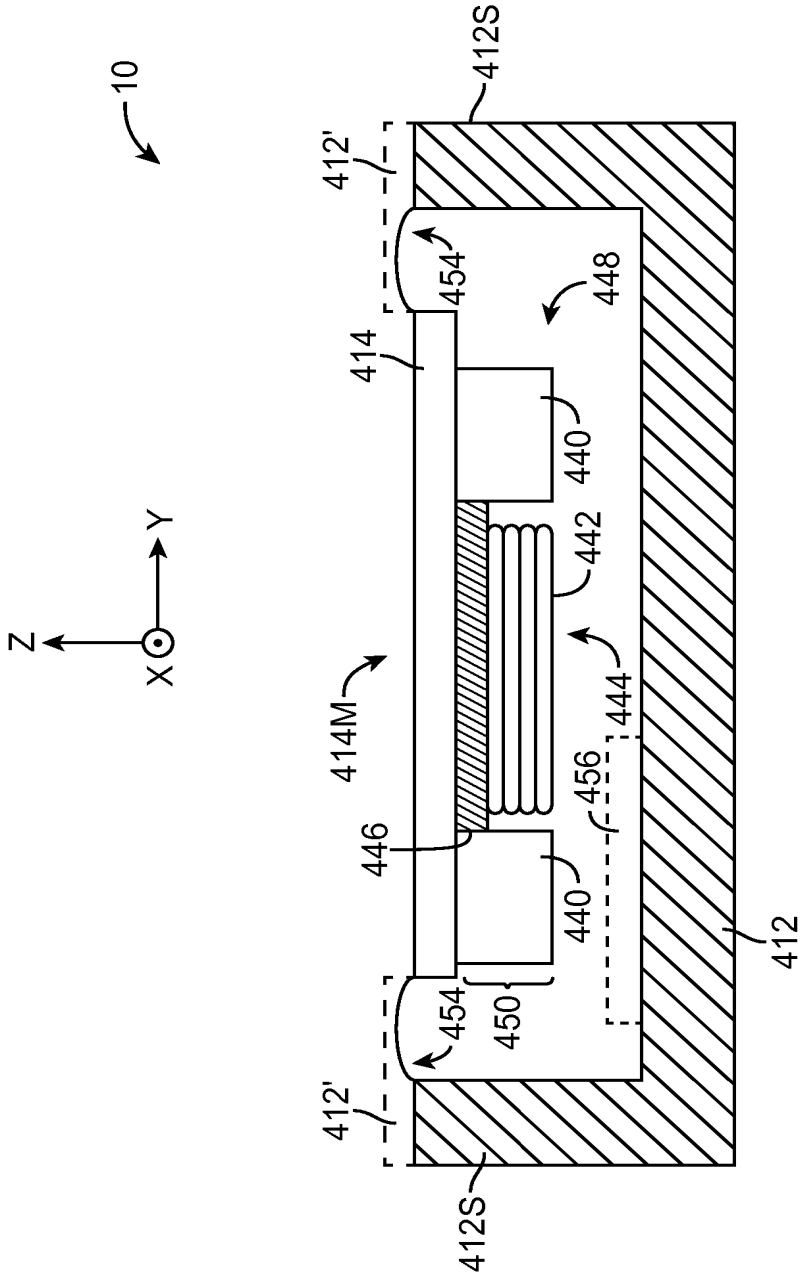

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FIG. 37

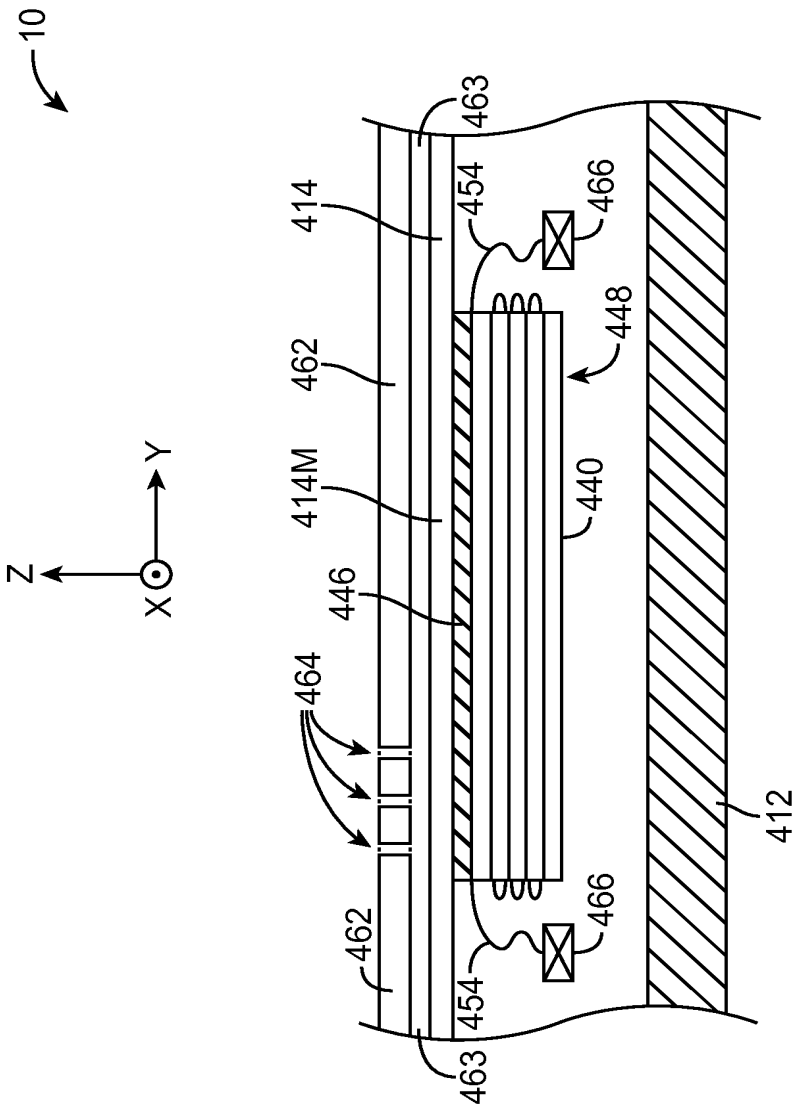

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FIG. 38

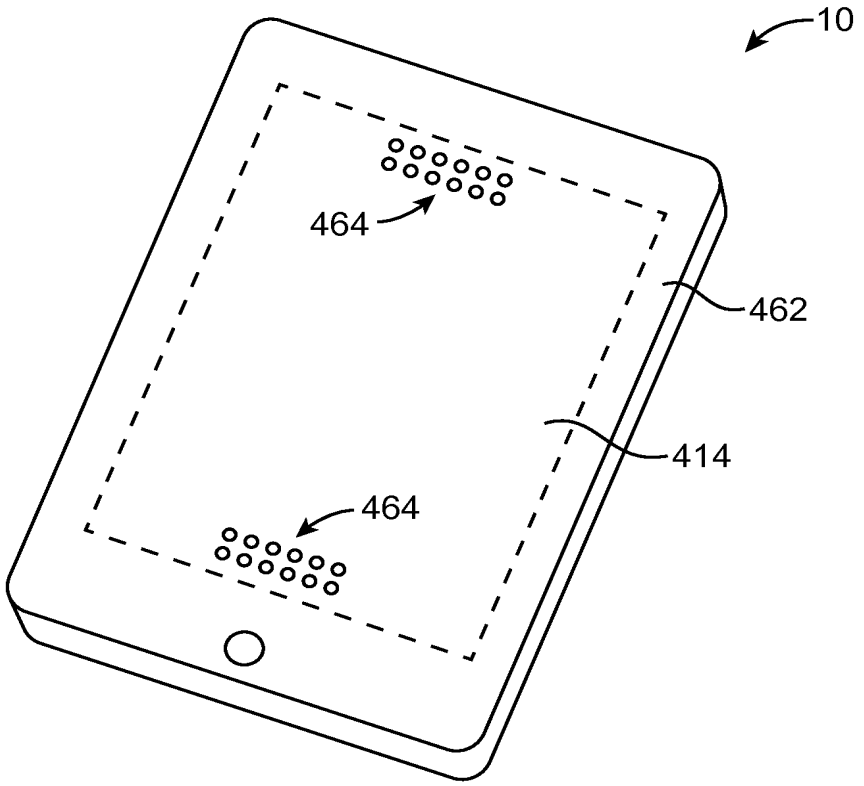


FIG. 39

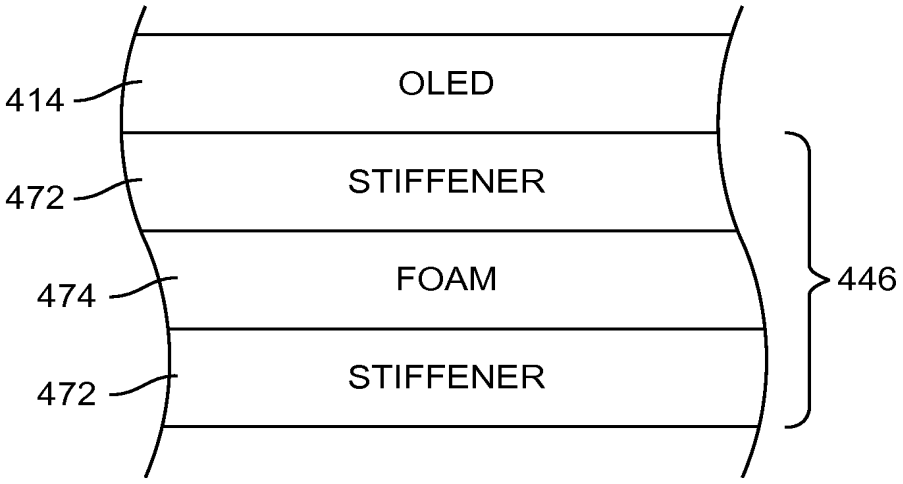


FIG. 40

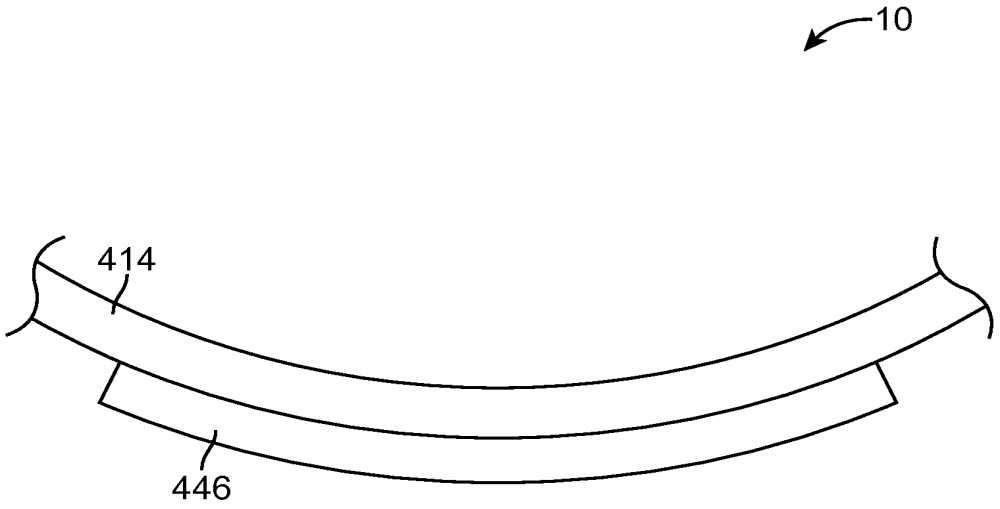


FIG. 41

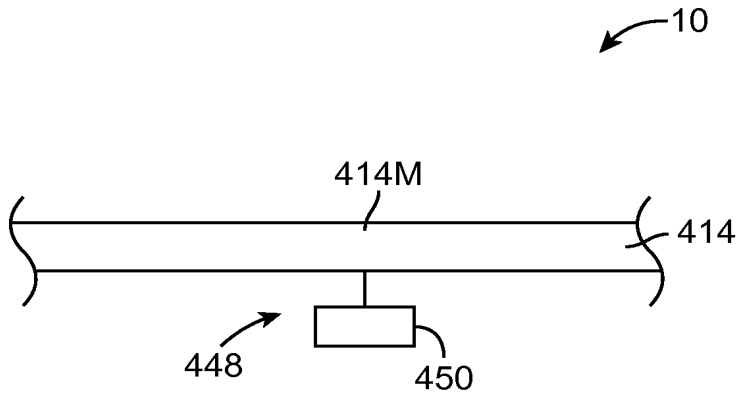


FIG. 42

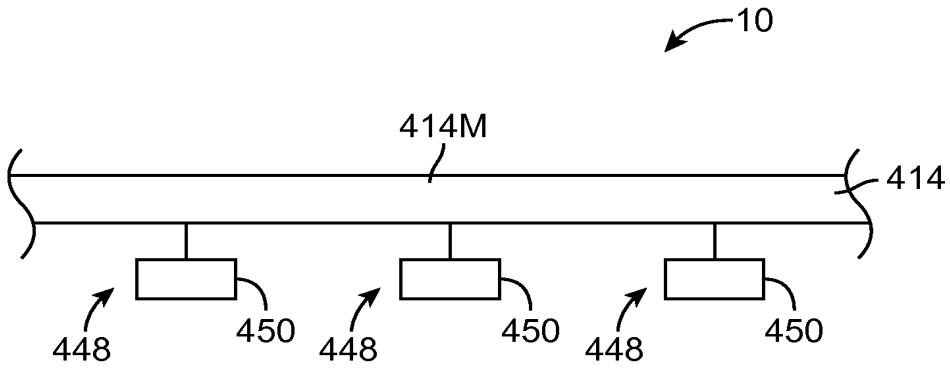


FIG. 43

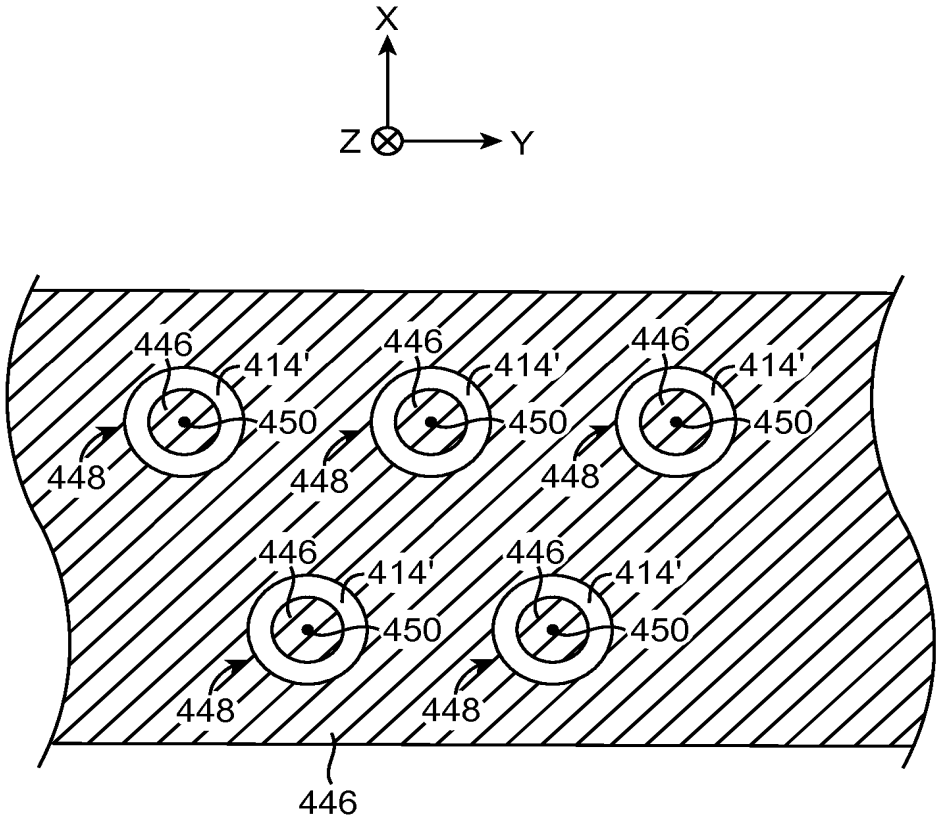

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FIG. 44

Electronic Acknowledgement Receipt

EFS ID:	14769702
Application Number:	13314858
International Application Number:	
Confirmation Number:	7360
Title of Invention:	Touch Sensor With Adaptive Touch Detection Thresholding
First Named Inventor/Applicant Name:	Martin John Simmons
Customer Number:	12323
Filer:	Bradley P Williams/Linda Henretta
Filer Authorized By:	Bradley P Williams
Attorney Docket Number:	080900.1238
Receipt Date:	23-JAN-2013
Filing Date:	08-DEC-2011
Time Stamp:	14:36:06
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		0809001238idspto1449.pdf	111635 98df9df8ddf4cc7b5d246240bd745eedb98cfe50	yes	3

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Transmittal Letter	1	2
	Information Disclosure Statement (IDS) Form (SB08)	3	3

Warnings:					
Information:					
2	Foreign Reference	0809001707WO2012129247A2.pdf	975739 f4c1615a42748493493b20f42ffaafe4d7810713	no	142
Warnings:					
Information:					
		Total Files Size (in bytes):	1087374		

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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Named Inventor:	Martin J. Simmons et al.
Application No.:	13/314,858
Filing Date:	December 8, 2011
Art Unit:	2691
Confirmation No.:	7360
Examiner:	Amr A. Awad
Title:	*Touch Sensor with Adaptive Touch Detection Thresholding*

Mail Stop Amendment
Commissioner of Patents
PO Box 1450
Alexandria, VA 22313-1450

Dear Sir:

Supplemental Information Disclosure Statement (IDS)

Applicants respectfully request, pursuant to 37 C.F.R. §§ 1.56, 1.97 and 1.98, that the documents listed on the attached Form PTO/SB/08 be considered and cited in the examination of the above-identified patent application. Pursuant to 37 C.F.R. §§ 1.97(g) and (h), Applicants make no representation that a search has been made, that these documents are material to patentability of the present application, or that these documents qualify as prior art.

Copies of U.S. patents and U.S. patent application publications have not been provided. To the extent applicable, references other than U.S. patents and U.S. patent application publications are enclosed for the convenience of the Examiner.

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Applicants believe this Supplemental Information Disclosure Statement is being submitted before the mailing of a first Office Action. Therefore, pursuant to C.F.R. § 1.97(b), no fee is believed to be due. However, the Commissioner is hereby authorized to charge any necessary additional fees and credit any overpayments to Deposit Account No. 02-0384 of Baker Botts L.L.P.

Respectfully submitted,
BAKER BOTTS L.L.P.
Attorneys for Applicants

Chad D. Terrell
Reg. No. 52,279

Date: January 23, 2013

Correspondence Address:
Customer No. **12323**

IPR2020-01287
Apple EX1002 Page 472

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 13/314,858

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	380
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	620
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	250
TOTAL CLAIMS (37 CFR 1.16(i))	20 minus 20 =	*			OR	x 60 =	0.00
INDEPENDENT CLAIMS (37 CFR 1.16(h))	3 minus 3 =	*				x 250 =	0.00
APPLICATION SIZE FEE (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).						0.00
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							0.00
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	1250

APPLICATION AS AMENDED - PART II

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT A	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE($)	ADDITIONAL FEE($)		RATE($)	ADDITIONAL FEE($)
AMENDMENT B	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.

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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

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
13/314,858	12/08/2011	2629	1250	080900.1238	20	3

CONFIRMATION NO. 7360

12323
Baker Botts L.L.P.
2001 Ross Avenue, 6th Floor
Dallas, TX 75201

FILING RECEIPT

OC00000051584727

Date Mailed: 12/23/2011

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**

Applicant(s)

Martin John Simmons, Southampton, UNITED KINGDOM;
Darren Golbourn, Southampton, UNITED KINGDOM;
Daniel Pickett, Southampton, UNITED KINGDOM;

Power of Attorney: The patent practitioners associated with Customer Number 12323

Domestic Priority data as claimed by applicant

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.)

If Required, Foreign Filing License Granted: 12/20/2011

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 13/314,858**

Projected Publication Date: 06/13/2013

Non-Publication Request: No

Early Publication Request: No

IPR2020-01287
Apple EX1002 Page 474

Title

Touch Sensor With Adaptive Touch Detection Thresholding

Preliminary Class

345

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 (1-866-999-4158).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

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

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Apple EX1002 Page 475

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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The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign AssetsControl, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

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).

SelectUSA

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, facilitate, and accelerate 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.

PTO/SB/08 **INFORMATION DISCLOSURE STATEMENT BY APPLICANT**	**Application Number:** Unassigned		**First Named Inventor:** Martin John Simmons et al.
	Attorney Docket No: 080900.1238	**Art Unit:** Unassigned	**Filing Date:** Herewith

ISSUED U.S. PATENTS AND PUBLISHED U.S. APPLICATIONS

		DOCUMENT NUMBER	PUBLICATION OR ISSUE DATE	FIRST NAMED INVENTOR
	A	7,663,607	02-16-2010	Hotelling
	B	7,920,129	04-05-2011	Hotelling
	C	8,031,094	10-04-2011	Hotelling
	D	8,031,174	10-04-2011	Hamblin
	E	8,049,732	11-01-2011	Hotelling

UNPUBLISHED U.S. APPLICATIONS

		DOCUMENT NUMBER	FILING DATE	FIRST NAMED INVENTOR
	F			
	G			
	H			
	I			

FOREIGN PATENT DOCUMENTS

		DOCUMENT NUMBER	PUBLICATION OR ISSUE DATE	COUNTRY	TRANSLATION (YES OR NO)
	J				
	K				

NON-PATENT LITERATURE (NPL)

		DOCUMENT (Including Author, Title, Source, and Pertinent Pages)	DATE
	L		
	M		
	N		
	O		
	P		
	Q		
	R		

EXAMINER	DATE CONSIDERED

EXAMINER: Initial if citation 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 the applicant.

U.S. PATENT AND TRADEMARK OFFICE

IPR2020-01287
Apple EX1002 Page 477

PTO/SB/14 (11-08)
Approved for use through 09/30/2010. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	080900.1238
	Application Number	
Title of Invention	Touch Sensor With Adaptive Touch Detection Thresholding	

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.

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.)

Applicant Information:

Applicant 1

Applicant Authority	◉ Inventor	○ Legal Representative under 35 U.S.C. 117	○ Party of Interest under 35 U.S.C. 118

Prefix	Given Name	Middle Name	Family Name	Suffix
	Martin	John	Simmons	

Residence Information (Select One) ○ US Residency ◉ Non US Residency ○ Active US Military Service

City	Southampton, Hampshire	Country Of Residence	GB
Citizenship under 37 CFR 1.41(b)	GB		

Mailing Address of Applicant:

Address 1	1560 Parkway, Solent Business Park		
Address 2	Whiteley, Fareham		
City	Hampshire	State/Province	GB
Postal Code	PO15 7AG	Country	GB

Applicant 2

Applicant Authority	◉ Inventor	○ Legal Representative under 35 U.S.C. 117	○ Party of Interest under 35 U.S.C. 118

Prefix	Given Name	Middle Name	Family Name	Suffix
	Darren		Golbourn	

Residence Information (Select One) ○ US Residency ◉ Non US Residency ○ Active US Military Service

City	Southampton, Hampshire	Country Of Residence	GB
Citizenship under 37 CFR 1.41(b)	GB		

Mailing Address of Applicant:

Address 1	1560 Parkway, Solent Business Park		
Address 2	Whiteley, Fareham		
City	Southampton, Hampshire	State/Province	GB
Postal Code	PO 15 7AG	Country	GB

Applicant 3

Applicant Authority	◉ Inventor	○ Legal Representative under 35 U.S.C. 117	○ Party of Interest under 35 U.S.C. 118

Prefix	Given Name	Middle Name	Family Name	Suffix
	Daniel		Pickett	

Residence Information (Select One) ○ US Residency ◉ Non US Residency ○ Active US Military Service

City	Southampton, Hampshire	Country Of Residence	GB

PTO/SB/14 (11-08)
Approved for use through 09/30/2010. OMB 0651-0032
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	080900.1238
	Application Number	
Title of Invention	Touch Sensor With Adaptive Touch Detection Thresholding	

Citizenship under 37 CFR 1.41(b)	GB		
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Application Information:

Title of the Invention	Touch Sensor With Adaptive Touch Detection Thresholding		
Attorney Docket Number	080900.1238	**Small Entity Status Claimed**	☐
Application Type	Nonprovisional		
Subject Matter	Utility		
Suggested Class (if any)		**Sub Class (if any)**	
Suggested Technology Center (if any)			
Total Number of Drawing Sheets (if any)	7	**Suggested Figure for Publication (if any)**	

Publication Information:

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	080900.1238
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Customer Number	12323	

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Prior Application Status		Remove	
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PTO/SB/14 (11-08)
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	080900.1238
	Application Number	
Title of Invention	Touch Sensor With Adaptive Touch Detection Thresholding	

Signature				Date (YYYY-MM-DD)	2011-12-08
First Name	Bradley P.	Last Name	Williams	Registration Number	40227

This collection of information is required by 37 CFR 1.76. 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 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet 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.**

Electronic Patent Application Fee Transmittal

Application Number:	
Filing Date:	
Title of Invention:	Touch Sensor With Adaptive Touch Detection Thresholding
First Named Inventor/Applicant Name:	Martin John Simmons
Filer:	Jeffery D Baxter/Darla Rupert
Attorney Docket Number:	080900.1238

Filed as Large Entity

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Utility application filing	1011	1	380	380
Utility Search Fee	1111	1	620	620
Utility Examination Fee	1311	1	250	250
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**1250**

Electronic Acknowledgement Receipt

EFS ID:	11575626
Application Number:	13314858
International Application Number:	
Confirmation Number:	7360
Title of Invention:	Touch Sensor With Adaptive Touch Detection Thresholding
First Named Inventor/Applicant Name:	Martin John Simmons
Customer Number:	12323
Filer:	Jeffery D Baxter/Darla Rupert
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Attorney Docket Number:	080900.1238
Receipt Date:	08-DEC-2011
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Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$1250
RAM confirmation Number	3574
Deposit Account	020384
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Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		1238app.pdf	1481359 183cd96bc35f4ced4f6e28f165c11e70885f442e	yes	28

Multipart Description/PDF files in .zip description

Document Description	Start	End
Specification	1	20
Claims	21	27
Abstract	28	28

Warnings:

Information:

2	Drawings-only black and white line drawings	1238draw.pdf	231714 47d796160eb87aee5bfb82922323fb4cd65f995e	no	7

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3	Oath or Declaration filed	1238dec.pdf	166007 124f90315d8349e821c7e2f5dd8519dbb09c6829	no	5

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4	Information Disclosure Statement (IDS) Form (SB08)	1238sb08.pdf	56851 469d24c636444ca02814a6eb297fc86298955c6a	no	1

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6	Fee Worksheet (SB06)	fee-info.pdf	32734 22cfbbf9a99806846bc2aa38d5e4c950617b5adf	no	2

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TOUCH SENSOR WITH ADAPTIVE TOUCH DETECTION THRESHOLDING

TECHNICAL FIELD

[1] This disclosure generally relates to touch sensors.

BACKGROUND

[2] A touch sensor detects the presence and location of a touch or the proximity of an object (such as a user's finger or a stylus) within a touch-sensitive area of the touch sensor overlaid, for example, on a display screen. In a touch-sensitive-display application, the touch sensor enables a user to interact directly with what is displayed on the screen, rather than indirectly with a mouse or touchpad. A touch sensor may be attached to or provided as part of a desktop computer, laptop computer, tablet computer, personal digital assistant (PDA), smartphone, satellite navigation device, portable media player, portable game console, kiosk computer, point-of-sale device, or other suitable device. A control panel on a household or other appliance may include a touch sensor.

[3] There are different types of touch sensors, such as (for example) resistive touch screens, surface acoustic wave touch screens, capacitive touch screens, infrared touch screens, and optical touch screens. Herein, reference to a touch sensor encompasses a touch screen, and vice versa, where appropriate. A capacitive touch screen may include an insulator coated with a substantially transparent conductor in a particular pattern. When an object touches or comes within proximity of the surface of the capacitive touch screen, a change in capacitance occurs within the touch screen at the location of the touch or proximity. A controller processes the change in capacitance to determine the touch position(s) on the touch screen.

BRIEF DESCRIPTION OF THE DRAWINGS

[4] FIGURE 1 illustrates an example touch sensor, according to certain embodiments;

[5] FIGURE 2 illustrates an example device that utilizes the touch sensor of FIGURE 1, according to certain embodiments;

[6] FIGURE 3 illustrates an example embodiment of the touch sensor of FIGURE 1, according to certain embodiments;

[7] FIGURES 4A and 4B illustrate example grounding scenarios in which the device of FIGURE 2 may be utilized, according to certain embodiments;

[8] FIGURES 5A and 5B illustrate example capacitance graphs representing capacitance measurements by the touch sensor of FIGURE 1, according to certain embodiments;

[9] FIGURES 6A and 6B illustrate further example embodiments of the touch sensor of FIGURE 1, according to certain embodiments; and

[10] FIGURE 7 illustrates an example method that may be used in certain embodiments to provide adaptive touch detection thresholding, according to certain embodiments.

DESCRIPTION OF EXAMPLE EMBODIMENTS

[11] A touch sensor may be utilized by a device such as a tablet computer, personal digital assistant (PDA), smartphone, portable media player, or any other device to detect the presence and location of a touch or the proximity of an object (such as a user's finger or a stylus) to the device. Devices having touch sensors may be utilized in various different grounding scenarios. For example, a device with a touch sensor may be utilized in a "floating" environment (e.g., an environment where the device is not grounded at all or only has a weak path to ground) such as when a user is interacting with the touch screen of the device as it is sitting on a table or is mounted on a wall. In another scenario, a device with a touch sensor may be utilized in a "grounded" environment (e.g., an environment where the device has a good path to ground) such as when a user is holding the device with one hand and touching the touch screen of the device with the other hand, or when the device is plugged into another system while the user is touching the touch screen (i.e., the device is plugged into a power source for charging or the device is plugged into a computer system for data synchronization). Depending on factors such as the design of the touch sensor and/or size of the object touching the touch sensor, the differences in signals measured by the touch sensor may vary between floating or grounded by up to 30% or more.

[12] Typically, touch sensors are configured with a single touch detection threshold that is used to determine whether an object is touching the touch sensor. The value of this touch detection threshold is usually pre-programmed to a fixed value that is a balance between not being too high and therefore not detecting touches in the floating scenario, and not being too low and therefore detecting false touches by picking up noise in the grounded scenario. In practice, selecting a proper detection threshold can be very difficult and often results in touch sensors not accurately detecting touches in all grounding scenarios.

[13] The teachings of the disclosure recognize that it would be desirable to provide a touch sensor that has a touch detection threshold that automatically adapts to various grounding scenarios. FIGURES 1 through 7 below illustrate a touch sensor with adaptive touch detection thresholding according to the teachings of the disclosure.

[14] FIGURE 1 illustrates an example touch sensor 10 with an example controller 12. Herein, reference to a touch sensor may encompass a touch screen, and vice versa, where appropriate. Touch sensor 10 and controller 12 detect the presence and location of a touch or the proximity of an object within a touch-sensitive area of touch sensor 10. Herein, reference to a touch sensor encompasses both the touch sensor and its controller, where appropriate. Similarly, reference to a controller encompasses both the controller and its touch sensor, where appropriate. Touch sensor 10 includes one or more touch-sensitive areas, where appropriate. Touch sensor 10 includes an array of drive and sense electrodes disposed on a substrate, which in some embodiments is a dielectric material.

[15] In certain embodiments, one or more portions of the substrate of touch sensor 10 are made of polyethylene terephthalate (PET) or another suitable material. This disclosure contemplates any suitable substrate with any suitable portions made of any suitable material. In particular embodiments, the drive or sense electrodes in touch sensor 10 are made of indium tin oxide (ITO) in whole or in part. In particular embodiments, the drive or sense electrodes in touch sensor 10 are made of fine lines of metal or other conductive material. As an example and not by way of limitation, one or more portions of the conductive material are copper or copper-based and have a thickness of approximately 5 μm or less and a width of approximately 10 μm or less. As another example, one or more portions of the conductive material are silver or silver-based and similarly have a thickness of approximately 5 μm or less and a width of approximately 10 μm or less. This disclosure contemplates any suitable electrodes made of any suitable material.

[16] In certain embodiments, touch sensor 10 implements a capacitive form of touch sensing. In a mutual-capacitance implementation, touch sensor 10 includes an array of drive and sense electrodes forming an array of capacitive nodes. In certain embodiments, a drive electrode and a sense electrode form a capacitive node. The drive and sense electrodes forming the capacitive node come near each other, but do not make electrical contact with each other. Instead, the drive and sense electrodes are capacitively coupled to each other across a gap between them. A pulsed or alternating voltage applied to the drive electrode (i.e., by controller

12) induces a charge on the sense electrode, and the amount of charge induced is susceptible to external influence (such as a touch or the proximity of an object). When an object touches or comes within proximity of the capacitive node, a change in capacitance occurs at the capacitive node and controller 12 measures the change in capacitance. By measuring changes in capacitance throughout the array, controller 12 determines the position of the touch or proximity within the touch-sensitive area(s) of touch sensor 10.

[17] In particular embodiments, one or more drive electrodes together form a drive line running horizontally or vertically or in any suitable orientation. Similarly, one or more sense electrodes together form a sense line running horizontally or vertically or in any suitable orientation. In particular embodiments, drive lines run substantially perpendicular to sense lines. Herein, reference to a drive line encompasses one or more drive electrodes making up the drive line, and vice versa, where appropriate. Similarly, reference to a sense line encompasses one or more sense electrodes making up the sense line, and vice versa, where appropriate.

[18] In certain embodiments, touch sensor 10 has a single-layer configuration, with drive and sense electrodes disposed in a pattern on one side of a substrate. In such a configuration, a pair of drive and sense electrodes capacitively coupled to each other across a space between them forms a capacitive node. In a single-layer configuration for a self-capacitance implementation, electrodes of only a single type (e.g. drive) are disposed in a pattern on one side of the substrate. Although this disclosure describes particular configurations of particular electrodes forming particular nodes, this disclosure contemplates any suitable configuration of any suitable electrodes forming any suitable nodes. Moreover, this disclosure contemplates any suitable electrodes disposed on any suitable number of any suitable substrates in any suitable patterns.

[19] As described above, a change in capacitance at a capacitive node of touch sensor 10 may indicate a touch or proximity input at the position of the capacitive node. Controller 12 is operable to detect and process the change in capacitance to determine the presence and location of the touch or proximity input. Certain embodiments if controller 12 communicate information about the touch or proximity input to one or more other components (such one or

more central processing units (CPUs) or digital signal processors (DSPs)) of a device that includes touch sensor 10 and controller 12, which may respond to the touch or proximity input by initiating a function of the device (or an application running on the device) associated with it. Although this disclosure describes a particular controller having particular functionality with respect to a particular device and a particular touch sensor, this disclosure contemplates any suitable controller having any suitable functionality with respect to any suitable device and any suitable touch sensor.

[20] In certain embodiments, controller 12 is one or more integrated circuits (ICs)—such as for example general-purpose microprocessors, microcontrollers, programmable logic devices or arrays, and application-specific ICs (ASICs). In some embodiments, controller 12 is coupled to a flexible printed circuit (FPC) bonded to the substrate of touch sensor 10, as described below. Certain embodiments of controller 12 include a processor unit, a drive unit, a sense unit, and a storage unit. The drive unit supplies drive signals to the drive electrodes of touch sensor 10. The sense unit senses charge at the capacitive nodes of touch sensor 10 and provides measurement signals to the processor unit representing capacitances at the capacitive nodes. The processor unit controls the supply of drive signals to the drive electrodes by the drive unit and process measurement signals from the sense unit to detect and process the presence and location of a touch or proximity input within the touch-sensitive area(s) of touch sensor 10. The processor unit also tracks changes in the position of a touch or proximity input within the touch-sensitive area(s) of touch sensor 10. The storage unit, which includes one or more memory devices, stores programming for execution by the processor unit, including programming for controlling the drive unit to supply drive signals to the drive electrodes, programming for processing measurement signals from the sense unit, and other suitable programming, where appropriate. Although this disclosure describes a particular controller having a particular implementation with particular components, this disclosure contemplates any suitable controller having any suitable implementation with any suitable components.

[21] Tracks 14 of conductive material disposed on the substrate of touch sensor 10 couple the drive or sense electrodes of touch sensor 10 to connection pads 16, also disposed on

the substrate of touch sensor 10. As described below, connection pads 16 facilitate coupling of tracks 14 to controller 12. In certain embodiments, tracks 14 extend into or around (e.g. at the edges of) the touch-sensitive area(s) of touch sensor 10. Particular tracks 14 provide drive connections for coupling controller 12 to drive electrodes of touch sensor 10, through which the drive unit of controller 12 supplies drive signals to the drive electrodes. Other tracks 14 provide sense connections for coupling controller 12 to sense electrodes of touch sensor 10, through which the sense unit of controller 12 senses charge at the capacitive nodes of touch sensor 10. In certain embodiments, tracks 14 are made of fine lines of metal or other conductive material. As an example and not by way of limitation, the conductive material of tracks 14 are copper or copper-based and have a width of approximately 100 μm or less. As another example, the conductive material of tracks 14 are silver or silver-based and have a width of approximately 100 μm or less. In particular embodiments, tracks 14 are made of ITO in whole or in part in addition or as an alternative to fine lines of metal or other conductive material. Although this disclosure describes particular tracks made of particular materials with particular widths, this disclosure contemplates any suitable tracks made of any suitable materials with any suitable widths. In addition to tracks 14, certain embodiments of touch sensor 10 include one or more ground lines terminating at a ground connector (similar to a connection pad 16) at an edge of the substrate of touch sensor 10 (similar to tracks 14).

[22] In certain embodiments, connection pads 16 are located along one or more edges of the substrate, outside the touch-sensitive area(s) of touch sensor 10. As described above, controller 12 is on an FPC in certain embodiments. In some embodiments, connection pads 16 are made of the same material as tracks 14 and are bonded to the FPC using an anisotropic conductive film (ACF). In certain embodiments, connection 18 includes conductive lines on the FPC coupling controller 12 to connection pads 16, in turn coupling controller 12 to tracks 14 and to the drive or sense electrodes of touch sensor 10. In another embodiment, connection pads 160 are inserted into an electro-mechanical connector (such as a zero insertion force wire-to-board connector); in this embodiment, connection 180 does not need to include an FPC. This disclosure contemplates any suitable connection 18 between controller 12 and touch sensor 10.

[23] FIGURE 2 illustrates an example device 20 that utilizes touch sensor 10 of FIGURE 1. Device 20 includes any personal digital assistant, cellular telephone, smartphone, tablet computer, and the like. In certain embodiments, device 20 includes other applications such as automatic teller machines (ATMs), home appliances, personal computers, and any other such device having a touchscreen. For example, a certain embodiment of device 20 is a smartphone that includes a touchscreen display 22 occupying a significant portion of the largest surface of the device. In certain embodiments, the large size of touchscreen display 22 enables the touchscreen display 22 to present a wide variety of data, including a keyboard, a numeric keypad, program or application icons, and various other interfaces as desired. A user interacts with device 20 by touching touchscreen display 22 with a stylus, a finger, or any other appropriate object in order to interact with device 20 (i.e., select a program for execution or to type a letter on a keyboard displayed on the touchscreen display 22). In certain embodiments, a user interacts with device 20 using multiple touches to perform various operations, such as to zoom in or zoom out when viewing a document or image. In some embodiments, such as home appliances, touchscreen display 22 does not change or changes only slightly during device operation, and recognizes only single touches.

[24] FIGURE 3 illustrates an example touch sensor 30 that may be utilized as touch sensor 10 of FIGURE 1. Touch sensor 30 includes drive electrodes 32, sense electrodes 34, a substrate 35, and a panel 36. In some embodiments, panel 36 is a transparent panel. In the illustrated embodiment, substrate 35 is sandwiched between drive electrodes 32 and sense electrodes 34, and sense electrodes 34 are coupled to an underside of panel 36 with, for example, an adhesive. In other embodiments, touch sensor 30 includes any appropriate configuration and number of layers of electrodes and substrates. For example, some embodiments of touch sensor 30 include additional layers of sense electrodes 32 that run perpendicular (or any other appropriate angle) to sense electrodes 34.

[25] In certain embodiments, electrodes 32 and 34 are configured in a manner substantially similar to the drive and sense electrodes, respectively, described above with reference to FIGURE 1, and touch object 38 is capacitively coupled to ground. Touch sensor 30

determines the location of touch object 38 at least in part by using controller 12 to apply a pulsed or alternating voltage to drive electrodes 32, which induces a charge on sense electrodes 34. When touch object 38 touches or comes within proximity of an active area of touch sensor 30, a change in capacitance may occur, as depicted by electric field lines 39 in FIGURE 3. The change in capacitance is sensed by sense electrodes 34 and measured by controller 12. By measuring changes in capacitance throughout an array of sense electrodes 34, controller 12 determines the position of the touch or proximity within the touch-sensitive area(s) of touch sensor 30.

[26] As discussed above, a device 20 having a touch sensor such as touch sensor 30 may be utilized in various grounding scenarios. For example, device 20 may be lying on a surface such as a table while a user is interacting with touchscreen display 22. In this scenario, device 20 may be considered "floating" since it has no or a weak path to ground. In another scenario, device 20 may be plugged into a power or synchronization cable or may be held in a user's hand while a finger on the user's other hand is touching touchscreen display 22. In this scenario, device 20 may be considered "grounded" since it has a strong path to ground. FIGURES 4A-4B and 5A-5B below further describe various grounding scenarios in which device 20 may be utilized.

[27] FIGURES 4A and 4B illustrate example grounding scenarios in which device 20 may be utilized. In FIGURE 4A, device 20 is utilized in a grounded scenario. In this scenario, device 20 is grounded by having a strong or direct path 44 to ground 46. For example, certain embodiments of path 44 to ground 46 include a power cable connecting device 20 to a power receptacle, a synchronization cable connecting device 20 to another computer system, a hand of user 42 other than the hand of user 42 that is interacting with device 20, and the like. As described in more detail below, capacitance changes detected by touch sensor 30 of device 20 due to touch object 38 interacting with device 20 may be larger in magnitude than in scenarios where device 20 is floating.

[28] FIGURE 4B illustrates a scenario where device 20 is floating. In this scenario, device 20 is floating because it does not have a strong or direct path 44 to ground 46 (i.e., it is

not connected to a power cable or a synchronization cable). For example, device 20 may be lying on a table or other surface while user 42 is touching touchscreen display 22 of device 20. As another example, device 20 may be mounted on a wall while user 42 is touching touchscreen display 22 of device 20. As described in more detail below, capacitance changes detected by touch sensor 30 of device 20 due to touch object 38 interacting with device 20 may be smaller in magnitude than in scenarios where device 20 is grounded.

[29] FIGURE 5A illustrates an example capacitance graph 50a representing capacitance measurements by touch sensor 30 due to touch object 38 touching or coming in close proximity to touch sensor 30 while device 20 is grounded. FIGURE 5A includes an x-axis, a y-axis, and a z-axis, as illustrated. The x-axis is the y-axis sense electrodes, and the y-axis is the x-axis drive electrodes. The z-axis indicates the measured change in capacitance. Capacitance graph 50a illustrates a relatively uniform spike in measured capacitance having a maximum magnitude 54a of approximately 1200. Capacitance graph 50a also illustrates touch detection thresholds 52 (e.g., touch detection threshold 52a and 52b) which indicate a threshold magnitude of the signals from sense electrodes 34 to process as a touch by the external object. Touch detection thresholds 52 may be stored in any memory device accessible to touch sensor 30 and may be referred to herein as a "stored threshold value." For illustrative purposes only, consider touch sensor 30 having an initial touch detection threshold 52a of 100, as illustrated in FIGURE 5A. In this example, touch sensor 30 determines that the interaction with device 20 that resulted in the illustrated capacitance graph 50a is a touch of touchscreen display 22 because maximum magnitude 54a of 1200 is greater than touch detection threshold 52a of 100. Conversely, if maximum magnitude 54a is determined to be less than touch detection threshold 52a, touch sensor 30 determines that the interaction with device 20 that resulted in the illustrated capacitance graph 50a is not a touch of touchscreen display 22. However, if touch detection threshold 52 is set at too low of a value while device 20 is grounded, touch sensor 20 may falsely identify noise as a touch. Embodiments of the disclosure dynamically adjust touch threshold 52 to account for various grounding scenarios device 20 may encounter. In the illustrated capacitance graph 50a of FIGURE 5a, for example, touch sensor 30 adjusts initial touch

detection threshold 52a up to new touch detection threshold 52b when it determines device 20 is grounded in order to avoid falsely detecting noise as touches. The new touch detection threshold 52b is determined as described below and in general is a value that is high enough to avoid detecting noise as touches but low enough that the maximum magnitude of the capacitance detected by sense electrodes 34 while device 20 is grounded will be greater than new touch detection threshold 52b. As a result, embodiments of the disclosure provide improved detection of touches in all grounding scenarios.

[30] FIGURE 5B illustrates an example capacitance graph 50b representing capacitance measurements by touch sensor 30 due to touch object 38 touching or coming in close proximity to touch sensor 30 while device 20 is floating. FIGURE 5B includes an x-axis, a y-axis, and a z-axis, as illustrated. The x-axis is the y-axis sense electrodes, and the y-axis is the x-axis drive electrodes. The z-axis indicates the measured change in capacitance. Capacitance graph 50b illustrates a non-uniform spike in measured capacitance having a maximum magnitude 54b of approximately 600. In this example, touch sensor 30 determines that the interaction with device 20 that resulted in the illustrated capacitance chart 50b is not a touch of touchscreen display 22 because maximum magnitude 54b of 600 is less than initial touch detection threshold 52c of 900. However, this may result in an undetected touch if the interaction with device 20 that resulted in the illustrated capacitance chart 50b was intended to be a touch. That is, a touch of touchscreen display 22 when device 20 is floating may result in maximum magnitude 54b being less than touch detection threshold 52c. Embodiments of the disclosure, however, dynamically adjust touch threshold 52 to account for various grounding scenarios device 20 may encounter in order to correctly detect touches in floating scenarios. In the illustrated capacitance graph 50b of FIGURE 5b, for example, touch sensor 30 adjusts initial touch detection threshold 52c of 900 down to new touch detection threshold 52d of 500 when it determines device 20 is in a floating scenario in order to detect subsequent touches when device 20 is floating. As a result, embodiments of the disclosure provide improved detection of touches in all grounding scenarios.

[31] In operation of example embodiments, an external object such as touch object 38 contacts or comes within close proximity to touch sensor 30. For example, user 42 interacts with

device 20 by touching touchscreen display 22 with a finger or a stylus. As a result of the interaction, touch sensor 30 receives signals from sense electrodes 34 that indicate of an amount of capacitance between touch sensor 30 and the external object. For example, touch sensor 30 receives signals from sense electrodes 34 indicating an amount of capacitance between touch sensor 30 and a finger of user 42 that is being used to interact with device 20. In another example, touch sensor 30 receives signals from sense electrodes 34 indicating an amount of capacitance between touch sensor 30 and a stylus that is being used by user 42 to interact with device 20.

[32] In response to receiving the signals from sense electrodes 34 that indicate an amount of capacitance between touch sensor 30 and the external object, some embodiments of touch sensor 30 access a threshold value such as touch detection threshold 52 that is stored in one or more memory devices accessible to controller 12. The threshold value indicates a threshold magnitude of the signals from sense electrodes 34 to process as a touch by the external object. For example, as illustrated in FIGURES 5A and 5B, touch detection threshold 52 indicates a threshold magnitude of capacitance that is compared to the capacitance measured by sense electrodes 34. If the measured capacitance is greater than touch detection threshold 52, the interaction with device 20 is considered a touch. Conversely, if the measured capacitance is less than touch detection threshold 52, the interaction with device 20 is considered to not be a touch.

[33] In certain embodiments, touch sensor 30 determines the strength of the charge return path between touch sensor 30 and ground 46 in order to determine whether device 20 is grounded or floating and consequently whether the stored threshold value should be adjusted. For example, some embodiments of touch sensor 30 determine whether device 20 is currently connected to another device or system via a cable. In certain embodiments, touch sensor 30 communicates with software running on device 20 (i.e., an operating system of device 20) to determine whether device 20 is currently charging (and is therefore connected via a power cable to a power source) and/or if device 20 is currently connected to another computer system for synchronization (i.e., device 20 is connected to a computer via a cable such as a Universal Serial Bus (USB) cable). In certain embodiments, touch sensor 30 determines that device 20 is

grounded if it is determined that device 20 is connected to another device or system via a cable. As a result of determining that device 20 is grounded, certain embodiments of touch sensor 30 adjust the stored threshold value to accommodate higher capacitance magnitudes that are measured by sense electrodes 34 when device 20 is grounded.

[34] In some embodiments, touch sensor 30 determines the strength of the charge return path between touch sensor 30 and ground 46 by determining the location in which touch object 38 touched touchscreen display 22 and correlating the location with locations in which sense electrodes 34 and drive electrodes 32 intersect. For example, as described in more detail below in reference to FIGURES 6A and 6B, some embodiments of touch sensor 30 determine the maximum capacitance magnitude of a touch that at least partially covers the location in which sense electrodes 34 and drive electrodes 32 intersect. Some embodiments then utilize this maximum capacitance magnitude to calculate a new threshold value to use for subsequent touches.

[35] FIGURES 6A and 6B illustrate example embodiments of touch sensor 30 having a grid of x-axis drive electrodes 32 and y-axis sense electrodes 34 and illustrate a detection of a change in capacitance due to a touch object 38 touching or coming in close proximity to touch sensor 30. As illustrated in FIGURES 6A and 6B, certain embodiments of touch sensor 30 include multiple electrodes 32/34 arranged substantially parallel to either the x-axis or y-axis. In certain embodiments, the x-axis is not parallel to the y-axis (e.g. the x-axis is rotated with respect to the y-axis about an angle of approximately 90 degrees, 120 degrees, 130 degrees, or any other suitable angle). In the illustrated embodiment, electrodes 32 and 34 collectively form a substantially two-dimensional grid configuration. Electrodes 32 and 34 visually intersect each other (but do not physically touch each other) at nodes 64. For example, when viewed from above, x-axis drive electrode 32a intersects y-axis sense electrode 34d at node 64a. As another example, x-axis drive electrode 32b intersects y-axis sense electrode 34d at node 64b.

[36] Although the example touch sensors 30 of FIGURES 6A and 6B are configured as a rectangular grid, other configurations are within the scope of the invention, such as a touchwheel, a linear slider, buttons with reconfigurable displays, and other like configurations. In

certain embodiments, redundant fine line metal electrodes to provide open fault resiliency are applied to any such configuration, and the disclosure is not limited to the example configurations presented here.

[37] In operation of example embodiments of FIGURES 6A and 6B, a touch object 38 comes in close proximity to or physically touches touch sensor 30 (i.e., touchscreen display 22) at locations 62. For example, a stylus comes within close enough proximity to touch sensor 30 at location 62a to cause a detectable change in capacitance across electrodes 32/34, but does not physically contact panel 36. As another example, a finger of user 42 touches and moves across touchscreen display 22 at location 62b and thus causes a detectable change in capacitance across electrodes 32/34. Electrodes 32/34 detect the change in capacitance due to touch object 38 and communicate signals indicating the change in capacitance to controller 12. As described in more detail below, once controller 12 receives change in capacitance measurements from electrodes 32/34, some embodiments of controller 12 utilize locations 62 and nodes 64 in order to determine whether device 20 is grounded or floating and consequently whether the stored threshold value should be adjusted.

[38] In one embodiment, touch sensor 30 determines whether location 62 at least partially covers a node 64 in order to determine whether the stored threshold value should be adjusted. For example, in the illustrated embodiment of FIGURE 6A, certain embodiments of touch sensor 30 determine that location 62a does not cover any portion of any node 64 and thus determine that the capacitance measurements associated with the touch at location 62a should not be used to adjust the stored threshold value. As another example, in the illustrated embodiment of FIGURE 6B, certain embodiments of touch sensor 30 determine that at least a portion of location 62b covers at least a portion of node 64b. As a result, touch sensor 30 determines that the capacitance measurements associated with the touch at location 62b that covers node 64b should be used to adjust the stored threshold value. As an example for illustrative purposes only, if touch sensor 30 determines that the maximum magnitude of the measured capacitance associated with touch location 62b over node 64b is 1200, touch sensor 30 calculates a new threshold value by multiplying 1200 by a certain predetermined percentage (i.e.,

50%, 60%, or any other appropriate predetermined percentage). Touch sensor 30 then stores the new threshold value in memory to be used to determine whether subsequent capacitance changes detected by touch sensor 30 due to subsequent interactions with device 20 should be interpreted as touches. As a result, touch sensor 30 adjusts the stored threshold value based on the determined strength of the charge return path.

[39] In some embodiments, touch sensor 30 determines the strength of the charge return path between touch sensor 30 and ground 46 by analyzing the geometry of the shape of one or more capacitance graphs. For example, certain embodiments of touch sensor 30 determine whether device 20 is grounded or floating by comparing one or more capacitance graphs associated with one or more interactions with device 20 with a predetermined shape. For example, FIGURES 5A and 5B above illustrate example capacitance graphs that are associated with one or more interactions with device 20. As illustrated in these figures, a touch of device 20 when it is grounded (e.g. FIGURE 5A) results in a spike in measured capacitance that is larger and more concentrated than a touch of device 20 when it is floating. Conversely, when device 20 is floating, the capacitance graph of a touch (e.g. FIGURE 5B) is generally smaller in magnitude and more dispersed than when device 20 is grounded. Certain embodiments of touch sensor 30 store in memory capacitance graphs of example grounded touches and floating touches (i.e., capacitance graphs similar to the capacitance graphs illustrated in FIGURES 5A and 5B) and then compare capacitance graphs associated with subsequent interactions with device 20 with the stored capacitance graphs. In some embodiments, if a certain number of capacitance graphs of subsequent interactions with device 20 within a certain amount of time are similar in shape to a stored capacitance graph associated with device 20 being grounded (i.e., have capacitance spikes with an area that is within a certain percentage of the area of capacitance spikes in the stored capacitance graph), touch sensor 30 determines that device 20 is grounded and adjusts the stored threshold value accordingly. For example, if touch sensor 30 determines that device 20 is grounded, the stored threshold value is adjusted to a value that is a certain percentage of a maximum capacitance magnitude for known grounded touches. Conversely, if a certain number of capacitance graphs of subsequent interactions with device 20 within a certain

amount of time are similar in shape to a stored capacitance graph associated with a floating device 20, touch sensor 30 determines that device 20 is floating and adjusts the stored threshold value accordingly. For example, if touch sensor 30 determines that device 20 is floating, the stored threshold value is adjusted to a value that is a certain percentage of a maximum capacitance magnitude for known floating touches.

[40] In certain embodiments, touch sensor 30 adjusts the stored threshold value based on the determined strength of the charge return path as discussed herein. In some embodiments, adjusting the stored threshold value includes storing a calculated new threshold value as the stored threshold value. In some embodiments, adjusting the stored threshold value includes replacing the stored threshold value with a new threshold value. In certain embodiments, the stored threshold value is adjusted at a predetermined rate. For example, in certain embodiments the stored threshold value is adjusted at a periodic time interval. In certain embodiments, the stored threshold value is adjusted after a certain predetermined number of interactions with device 20.

[41] In some embodiments, touch sensor 30 periodically drifts the threshold value back to an original threshold value when touch sensor 30 is not tracking any interactions with device 20. If touch sensor 30 does not detect any interactions with device 20 within a predetermined amount of time after an initial touch detection threshold 52 has been adjusted to a new touch detection threshold 52, touch sensor 30 periodically adjusts touch detection threshold 52 back to its initial value at a predetermined rate. As an example for illustrative purposes only, consider FIGURE 5B where initial touch detection threshold 52c of 900 was adjusted to new touch detection threshold 52d of 500. In this example, certain embodiments of touch sensor 30 start a timer after initial touch detection threshold 52c is adjusted to new touch detection threshold 52d of 500. If the timer reaches a certain predetermined time without touch sensor 30 detecting any subsequent interactions with touch sensor 30, touch detection threshold 52 is periodically adjusted back to initial touch detection threshold 52c of 900 at a predetermined rate. For example, in one embodiment, touch detection threshold 52 is adjusted to 600 after one second, to 700 after two seconds, to 800 after three seconds, and finally back to 900 after four seconds if no

interactions with touch sensor 30 are detected. After adjusting touch detection threshold 52 back to initial touch detection threshold 52c of 900, touch sensor 30 stops adjusting touch detection threshold 52 until a subsequent interaction with touch sensor 30 is detected. While certain embodiments of touch sensor 30 drift the threshold value back to an initial value at the predetermined rate discussed above, the disclosure anticipates any appropriate rate of adjustment.

[42] FIGURE 7 illustrates an example method 700 that is used in certain embodiments to provide adaptive touch detection thresholding. Method 700 begins in step 710 where a plurality of signals from sense electrodes is received. In some embodiments, the received signals are indicative of an amount of capacitance between a touch sensor and an external object. In certain embodiments, the touch sensor refers to touch sensor 10 or touch sensor 30 described above. In certain embodiments, the sense electrodes refer to sense electrodes 34 described above. In some embodiments, the external object is any object that touches or comes in close proximity to the touch sensor such as a user's finger, a stylus, and the like.

[43] In step 720, a stored threshold value is accessed. In certain embodiments, the stored threshold value refers to touch detection threshold 52 described above. In some embodiments, the threshold value indicates a threshold magnitude of the signals received from the plurality of sense electrodes in step 710 to process as a touch by the external object. In certain embodiments, the stored threshold value is stored in one or more memory devices accessible to the touch sensor.

[44] In step 730, a strength of a charge return path between the touch sensor and ground is determined. In certain embodiments, the strength of the charge return path between the touch sensor and ground refers to determining whether a device is which the touch sensor resides is grounded or floating. In some embodiments, the strength of the charge return path between the touch sensor and ground is determined by determining that the external object has touched the touch sensor at a location that at least partially covers a node of the touch sensor, determining a maximum magnitude of a particular signal received from sense electrodes associated with the node, and calculating a new threshold value using the determined maximum

magnitude of the particular signal received from sense electrodes associated with the particular node. In some embodiments, the new threshold value is calculated by multiplying the determined maximum magnitude of the particular signal received from sense electrodes associated with the node by a predetermined percentage. In certain embodiments, the stored threshold value is adjusted by storing the calculated new threshold value as the stored threshold value.

[45] In some embodiments, the strength of the charge return path between the touch sensor and ground in step 730 is determined by determining whether a device such as device 20 is plugged into a cable that provides grounding for device 20. In certain embodiments, step 730 includes communicating with software running on device 20 to determine whether device 20 is currently charging via a power cable or whether device 20 is currently coupled to another computer system via a synchronization cable. In certain embodiments, if it is determined in step 730 that device 20 is currently plugged into a cable that provides grounding for device 20, it is determined that device 20 is in a grounded scenario. In some embodiments, it is determined that device 20 is floating if it is determined that device 20 is not currently plugged into a cable that provides grounding for device 20.

In step 740, the stored threshold value is adjusted based on the strength of the charge return path determined in step 730. In some embodiments, the stored threshold value is adjusted to a certain percentage of a maximum magnitude of a particular signal received from the sense electrodes. In certain embodiments, the stored threshold value is replaced with a new threshold value. In some embodiments, the stored threshold value is adjusted at a predetermined rate. After step 740, method 700 ends.

[46] Accordingly, example embodiments disclosed herein provide a touch sensor that has a touch detection threshold that is automatically adapted for various grounding scenarios. For example, certain devices automatically adjust its touch detection threshold based on a determination of whether the device is grounded or floating. Accordingly, embodiments of the disclosure provide enhanced touch detection in all possible grounding scenarios.

[47] Although the preceding examples given here generally rely on self capacitance or

mutual capacitance to operate, other embodiments of the invention will use other technologies, including other capacitance measures, resistance, or other such sense technologies.

[48] Herein, "or" is inclusive and not exclusive, unless expressly indicated otherwise or indicated otherwise by context. Therefore, herein, "A or B" means "A, B, or both," unless expressly indicated otherwise or indicated otherwise by context. Moreover, "and" is both joint and several, unless expressly indicated otherwise or indicated otherwise by context. Therefore, herein, "A and B" means "A and B, jointly or severally," unless expressly indicated otherwise or indicated otherwise by context.

[49] This disclosure encompasses all changes, substitutions, variations, alterations, and modifications to the example embodiments herein that a person having ordinary skill in the art would comprehend. Moreover, reference in the appended claims to an apparatus or system or a component of an apparatus or system being adapted to, arranged to, capable of, configured to, enabled to, operable to, or operative to perform a particular function encompasses that apparatus, system, component, whether or not it or that particular function is activated, turned on, or unlocked, as long as that apparatus, system, or component is so adapted, arranged, capable, configured, enabled, operable, or operative.

WHAT IS CLAIMED IS:

1. A touch sensor comprising:

a plurality of sense electrodes; and

a controller communicatively coupled to the plurality of sense electrodes, the controller configured to:

receive a plurality of signals from the plurality of sense electrodes, the plurality of signals indicative of an amount of capacitance between the touch sensor and an external object;

access a stored threshold value, the threshold value indicating a threshold magnitude of the signals from the plurality of sense electrodes to process as a touch by the external object;

determine a strength of a charge return path between the touch sensor and a ground; and

adjust the stored threshold value based on the determined strength of the charge return path.

2. The touch sensor of Claim 1, wherein:

the plurality of sense electrodes comprises a plurality of x-axis sense electrodes and a plurality of y-axis sense electrodes;

the plurality of x-axis sense electrodes visually intersect the plurality of y-axis sense electrodes; and

the visual intersections of the x-axis sense electrodes and the y-axis sense electrodes comprises a plurality of nodes.

3. The touch sensor of Claim 2, wherein determining the strength of the charge return path between the touch sensor and ground comprises:

determining that the external object has touched the touch sensor at a location that at least partially covers a particular one of the nodes;

determining a maximum magnitude of a particular signal received from sense electrodes associated with the particular node; and

calculating a new threshold value using the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node.

4. The touch sensor of Claim 3, wherein:

calculating the new threshold value comprises multiplying the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node by a predetermined percentage; and

adjusting the stored threshold value based on the determined strength of the charge return path comprises storing the calculated new threshold value as the stored threshold value.

5. The touch sensor of Claim 1, the controller further configured to, after adjusting the stored threshold value based on the determined strength of the charge return path:

determine that the external object has not touched the touch sensor within a predetermined amount of time; and

periodically drift, at a predetermined rate, the stored threshold value back to an original value, the original value comprising a value of the stored threshold value before it was adjusted based on the determined strength of the charge return path.

6. The touch sensor of Claim 1, wherein:

adjusting the stored threshold value based on the determined strength of the charge return path comprises replacing the stored threshold value with a new threshold value; and

the stored threshold value is adjusted at a predetermined rate.

7. A method comprising:

receiving, by a controller coupled to a touch sensor, a plurality of signals from a plurality of sense electrodes, the plurality of signals indicative of an amount of capacitance between the touch sensor and an external object;

accessing, by the controller, a stored threshold value, the threshold value indicating a threshold magnitude of the signals from the plurality of sense electrodes to process as a touch by the external object;

determining, by the controller, a strength of a charge return path between the touch sensor and a ground; and

adjusting, by the controller, the stored threshold value based on the determined strength of the charge return path.

8. The method of Claim 7, wherein:

the plurality of sense electrodes comprises a plurality of x-axis sense electrodes and a plurality of y-axis sense electrodes;

the plurality of x-axis sense electrodes visually intersect the plurality of y-axis sense electrodes; and

the visual intersections of the x-axis sense electrodes and the y-axis sense electrodes comprises a plurality of nodes.

9. The method of Claim 8, wherein determining the strength of the charge return path between the touch sensor and ground comprises:

determining that the external object has touched the touch sensor at a location that at least partially covers a particular one of the nodes;

determining a maximum magnitude of a particular signal received from sense electrodes associated with the particular node; and

calculating a new threshold value using the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node.

10. The method of Claim 9, wherein:

calculating the new threshold value comprises multiplying the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node by a predetermined percentage; and

adjusting the stored threshold value based on the determined strength of the charge return path comprises storing the calculated new threshold value as the stored threshold value.

11. The method of Claim 7, further comprising, after adjusting the stored threshold value based on the determined strength of the charge return path:

determining that the external object has not touched the touch sensor within a predetermined amount of time; and

periodically drifting, at a predetermined rate, the stored threshold value back to an original value, the original value comprising a value of the stored threshold value before it was adjusted based on the determined strength of the charge return path.

12. The method of Claim 7, wherein:

adjusting the stored threshold value based on the determined strength of the charge return path comprises replacing the stored threshold value with a new threshold value; and

the stored threshold value is adjusted at a predetermined rate.

13. A touch-sensitive device comprising a controller, the controller communicatively coupled to a plurality of sense electrodes, the controller operable to:

receive a plurality of signals from the plurality of sense electrodes, the plurality of signals indicative of an amount of capacitance between the touch-sensitive device and an external object;

access a stored threshold value, the threshold value indicating a threshold magnitude of the signals from the plurality of sense electrodes to process as a touch of the touch-sensitive device by the external object;

determine a strength of a charge return path between the touch-sensitive device and a ground; and

adjust the stored threshold value based on the determined strength of the charge return path.

14. The touch-sensitive device of Claim 13, wherein:

the plurality of sense electrodes comprises a plurality of x-axis sense electrodes and a plurality of y-axis sense electrodes;

the plurality of x-axis sense electrodes visually intersect the plurality of y-axis sense electrodes; and

the visual intersections of the x-axis sense electrodes and the y-axis sense electrodes comprises a plurality of nodes.

15. The touch-sensitive device of Claim 14, wherein determining the strength of the charge return path between the touch sensor and ground comprises:

determining that the external object has touched the touch sensor at a location that at least partially covers a particular one of the nodes;

determining a maximum magnitude of a particular signal received from sense electrodes associated with the particular node; and

calculating a new threshold value using the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node.

16. The touch-sensitive device of Claim 15, wherein:

calculating the new threshold value comprises multiplying the determined maximum magnitude of the particular signal received from sense electrodes associated with the particular node by a predetermined percentage; and

adjusting the stored threshold value based on the determined strength of the charge return path comprises storing the calculated new threshold value as the stored threshold value.

17. The touch-sensitive device of Claim 13, the controller further operable to, after adjusting the stored threshold value based on the determined strength of the charge return path:

determine that the external object has not touched the touch sensor within a predetermined amount of time; and

periodically drift, at a predetermined rate, the stored threshold value back to an original value, the original value comprising a value of the stored threshold value before it was adjusted based on the determined strength of the charge return path.

18. The touch-sensitive device of Claim 13, wherein:

adjusting the stored threshold value based on the determined strength of the charge return path comprises replacing the stored threshold value with a new threshold value; and

the stored threshold value is adjusted at a predetermined rate.

19. The touch-sensitive device of Claim 13, wherein determining the strength of the charge return path between the touch sensor and ground comprises analyzing shapes of one or more capacitance graphs.

20. The touch-sensitive device of Claim 19, wherein analyzing shapes of one or more capacitance graphs comprises:

comparing a capacitance graph derived from plurality of signals indicative of an amount of capacitance between the touch-sensitive device and an external object with a plurality of stored capacitance graphs, the stored capacitance graphs comprising:

a grounded capacitance graph indicative of a typical touch when the touch-sensitive device is grounded; and

a floating capacitance graph indicative of a typical touch when the touch-sensitive device is floating;

determining, based on the comparison, that the touch-sensitive device is grounded if the capacitance graph matches the grounded capacitance graph; and

determining, based on the comparison, that the touch-sensitive device is floating if the capacitance graph matches the floating capacitance graph.

TOUCH SENSOR WITH ADAPTIVE TOUCH DETECTION THRESHOLDING

ABSTRACT

In one embodiment, a method includes receiving, by a controller coupled to a touch sensor, a plurality of signals from a plurality of sense electrodes, the plurality of signals indicative of an amount of capacitance between the touch sensor and an external object. The method further includes accessing a stored threshold value, determining a strength of a charge return path between the touch sensor and a ground, and adjusting the stored threshold value based on the determined strength of the charge return path. The threshold value indicates a threshold magnitude of the signals from the plurality of sense electrodes to process as a touch by the external object.

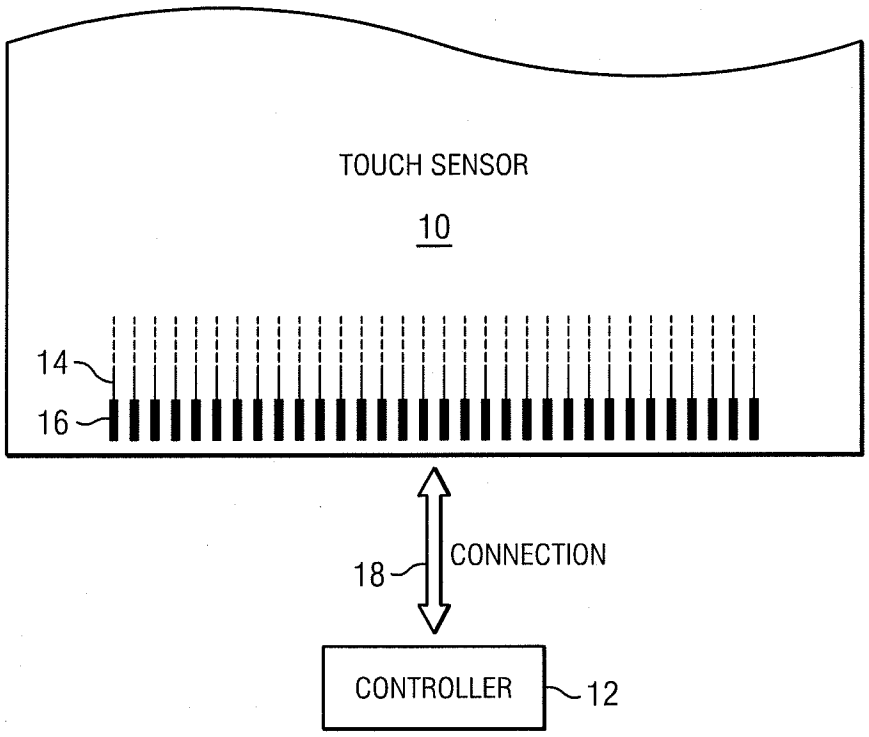


FIG. 1

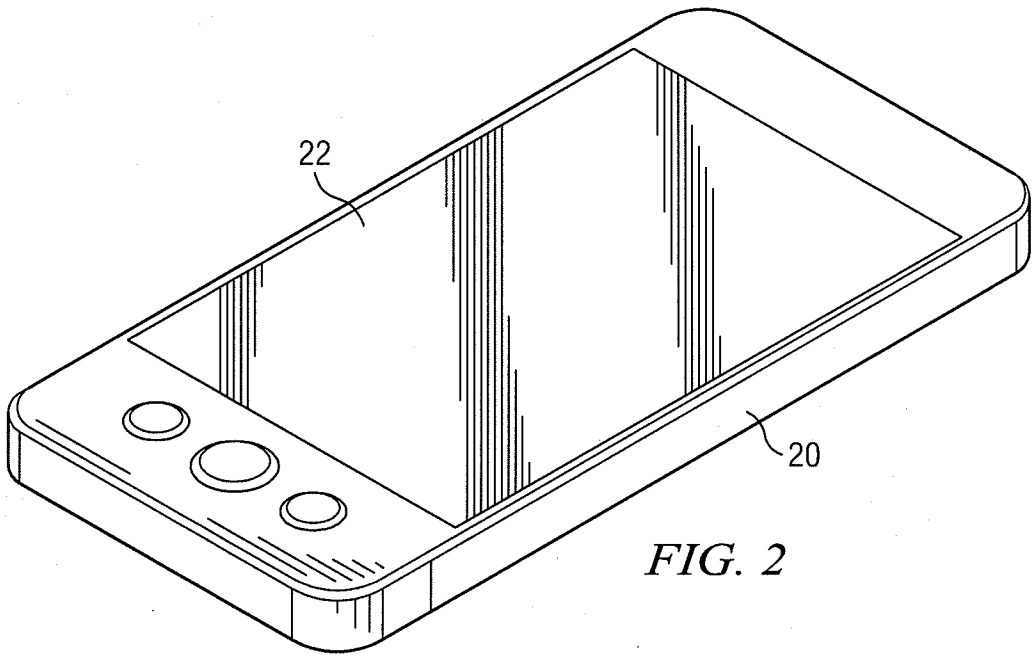
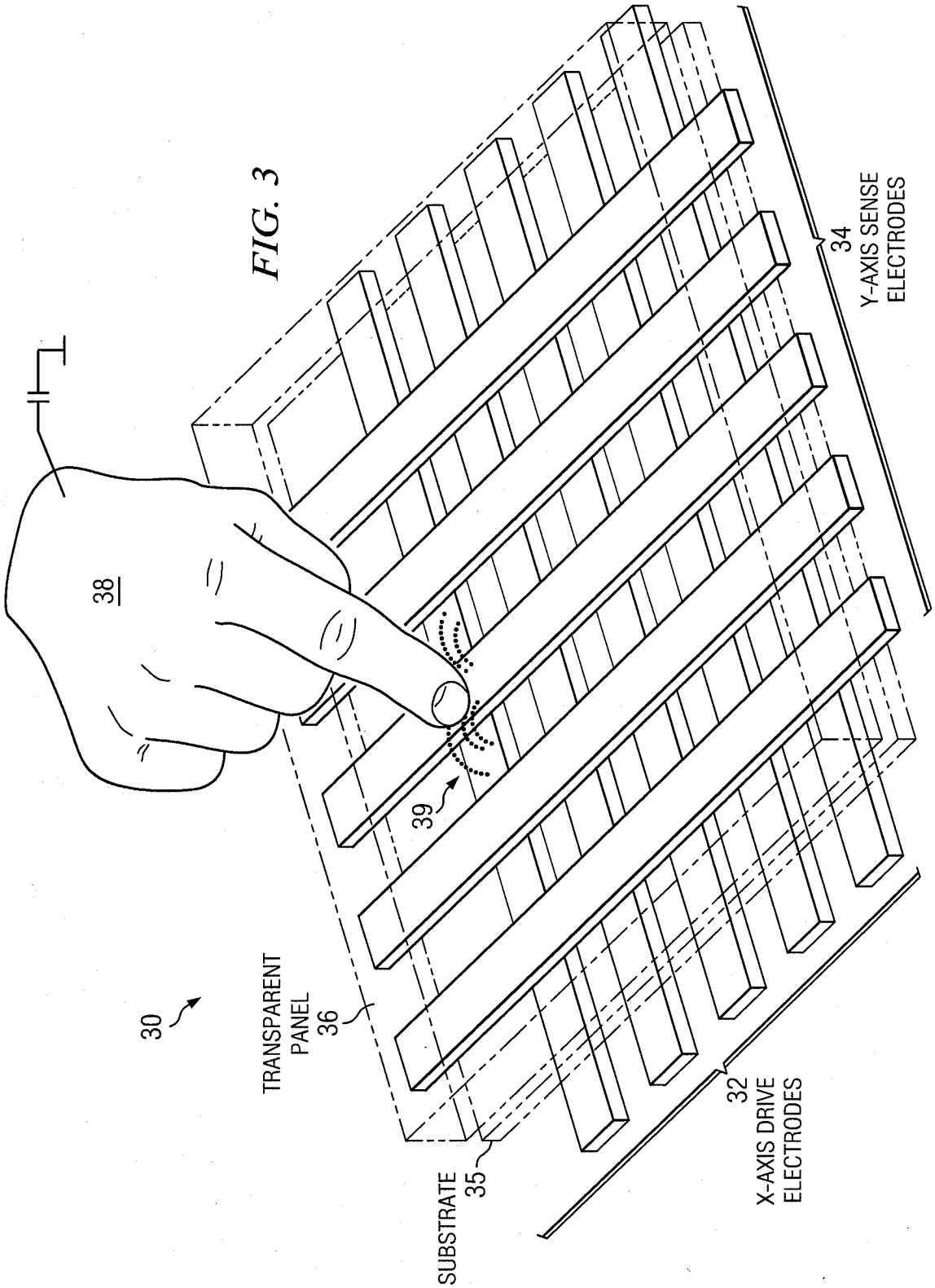


FIG. 2

FIG. 3


30
38
39
34
Y-AXIS SENSE ELECTRODES
TRANSPARENT PANEL 36
SUBSTRATE 35
32
X-AXIS DRIVE ELECTRODES

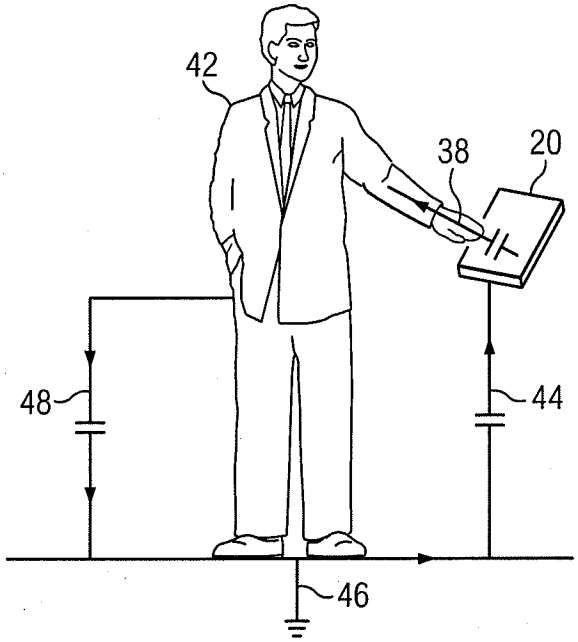


FIG. 4a

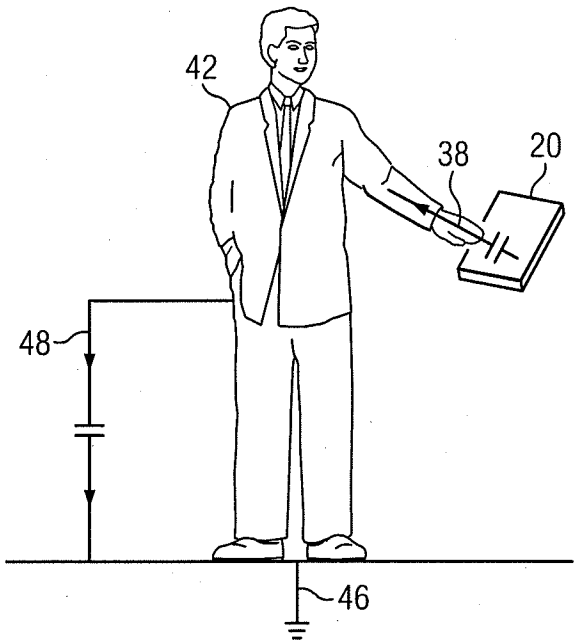


FIG. 4b

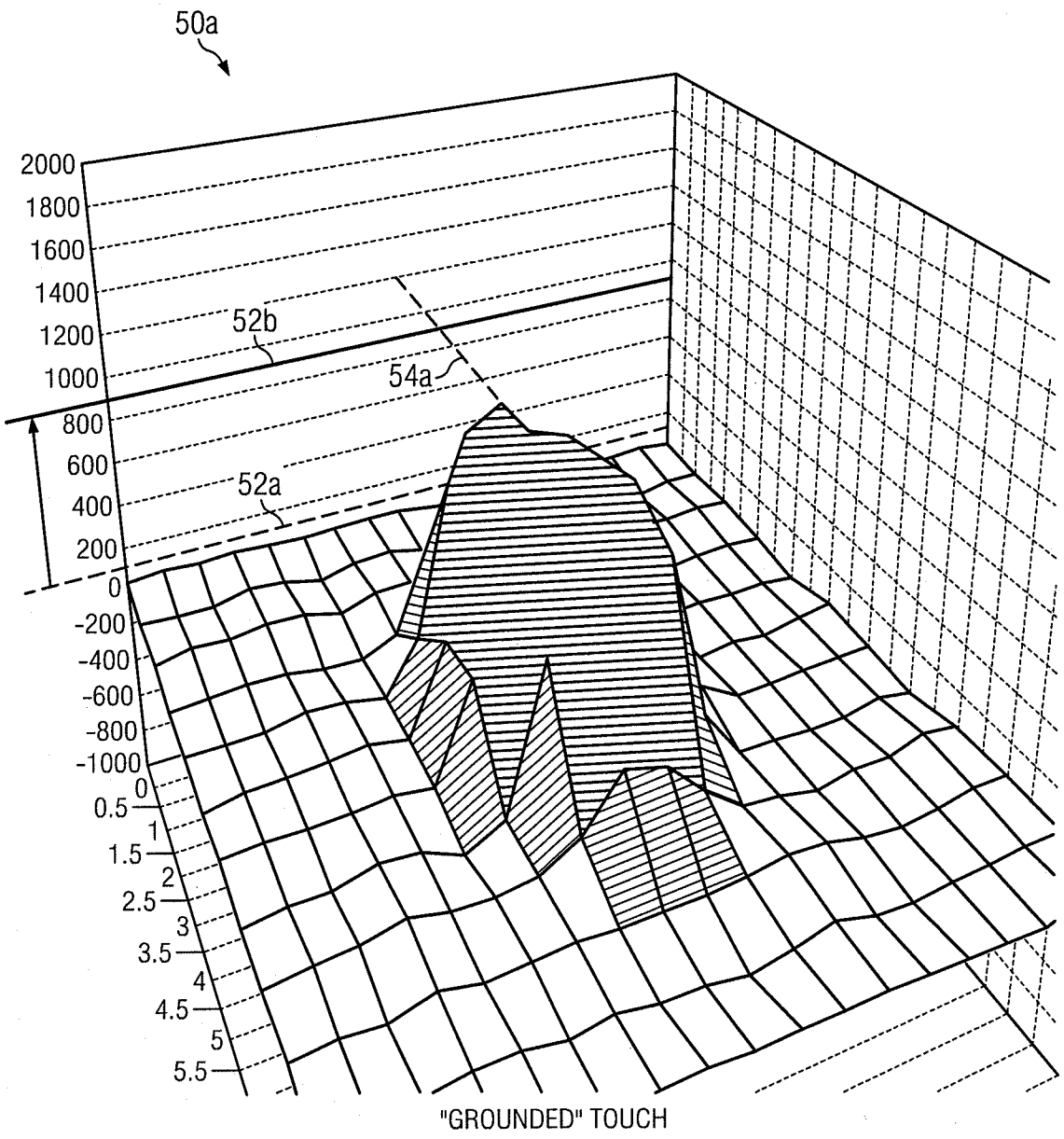

50a
2000
1800
1600
1400
1200
1000
800
600
400
200
0
-200
-400
-600
-800
-1000
52b
54a
52a
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
"GROUNDED" TOUCH

FIG. 5a

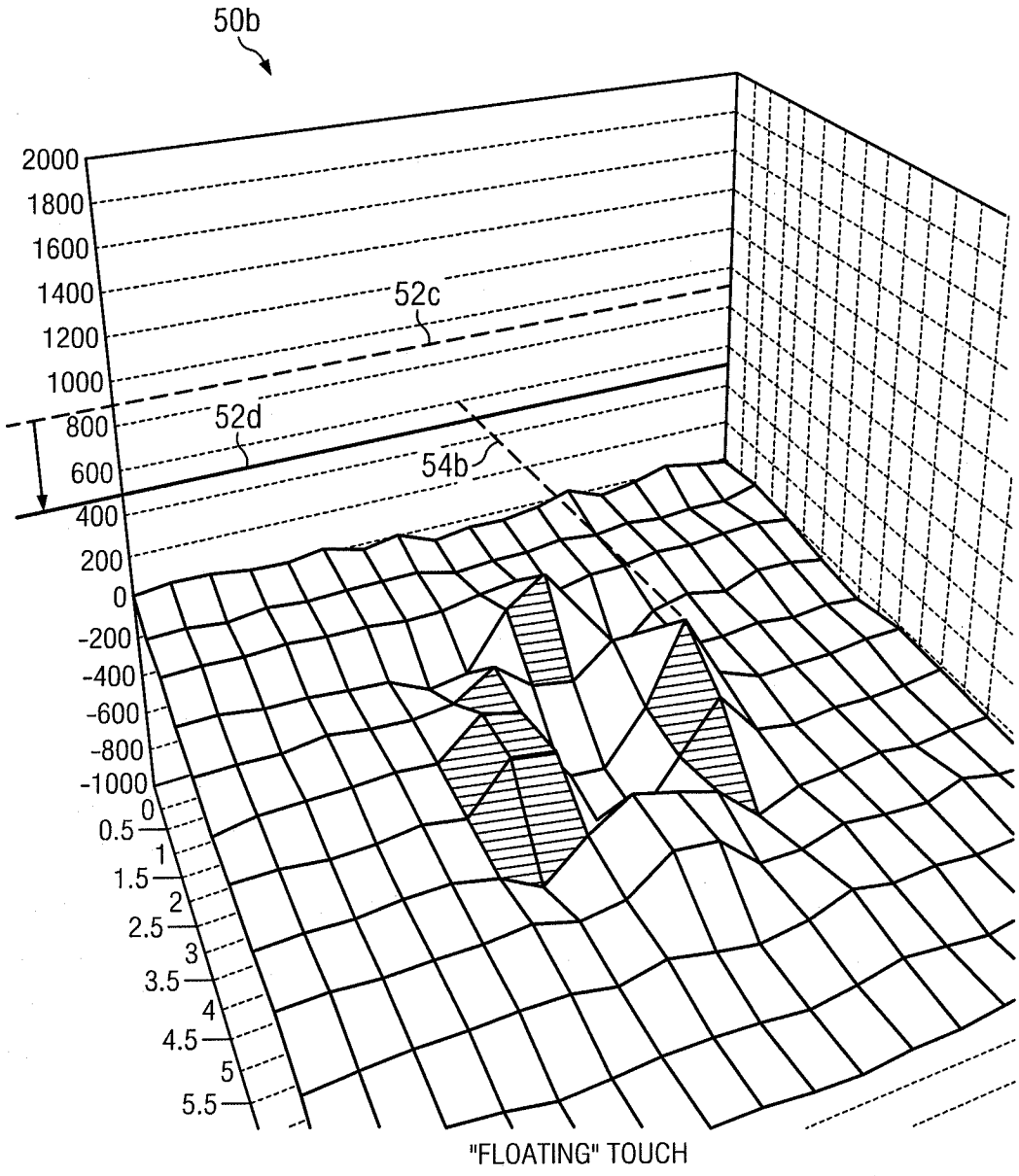

50b
2000
1800
1600
1400
1200
1000
800
600
400
200
0
-200
-400
-600
-800
-1000
52c
52d
54b
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
"FLOATING" TOUCH

FIG. 5b

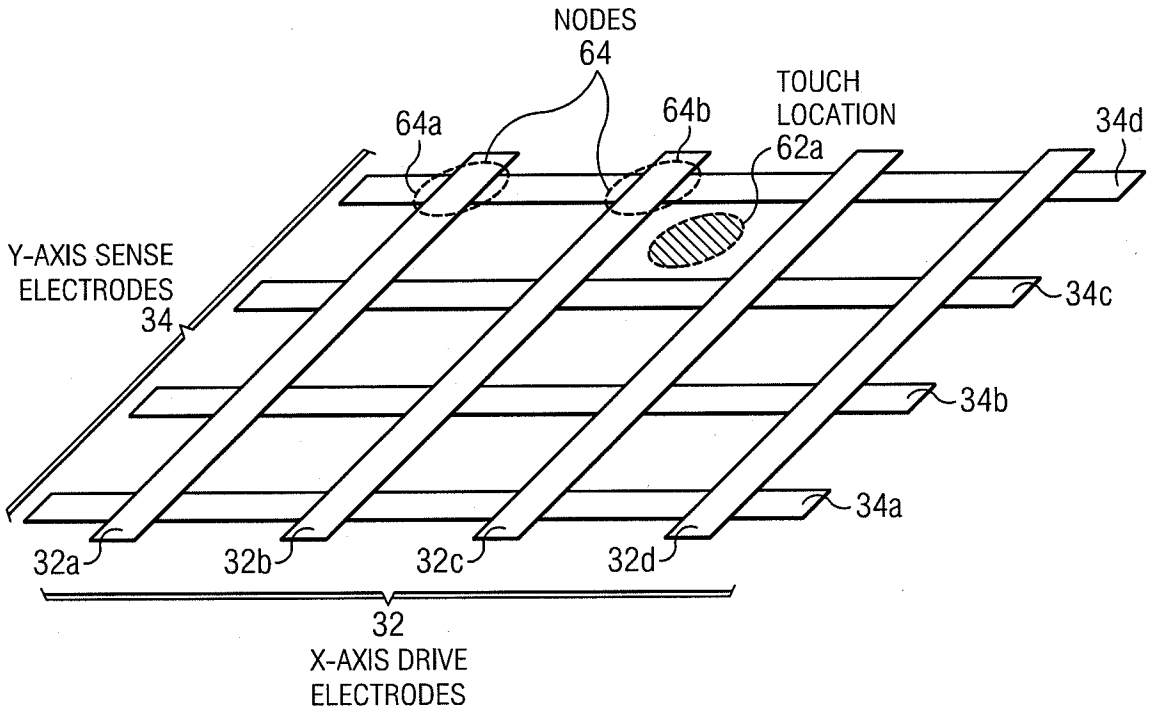

NODES
64
64a
64b
TOUCH
LOCATION
62a
34d
Y-AXIS SENSE
ELECTRODES
34
34c
34b
34a
32a
32b
32c
32d
32
X-AXIS DRIVE
ELECTRODES

FIG. 6a

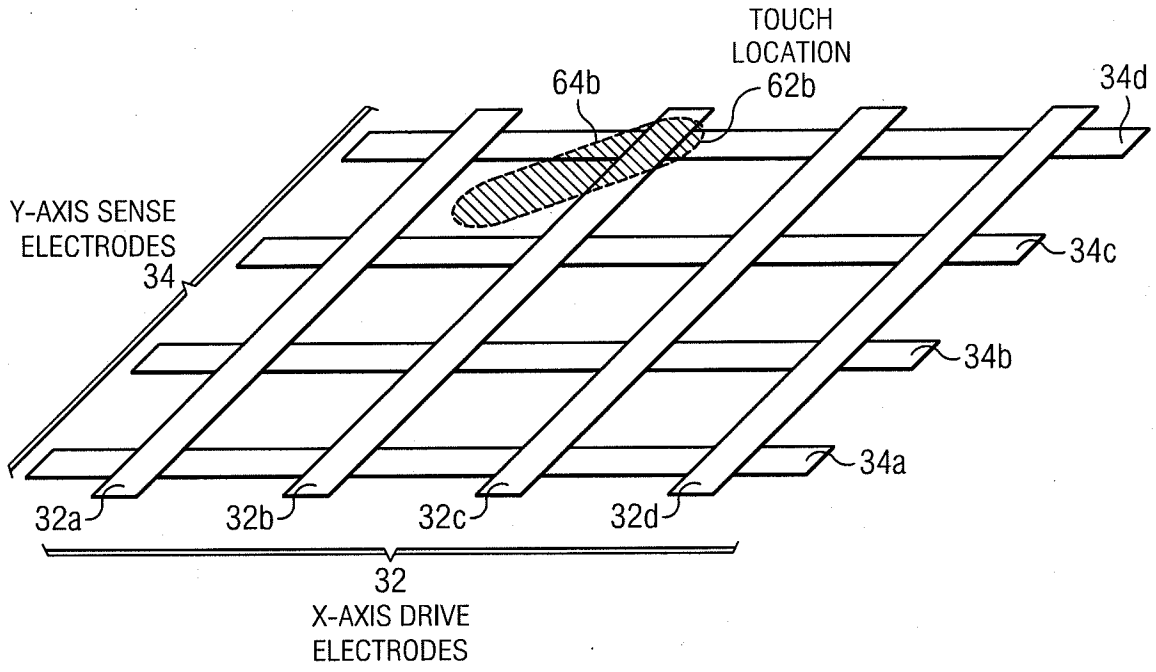

TOUCH
LOCATION
64b
62b
34d
Y-AXIS SENSE
ELECTRODES
34
34c
34b
34a
32a
32b
32c
32d
32
X-AXIS DRIVE
ELECTRODES

FIG. 6b

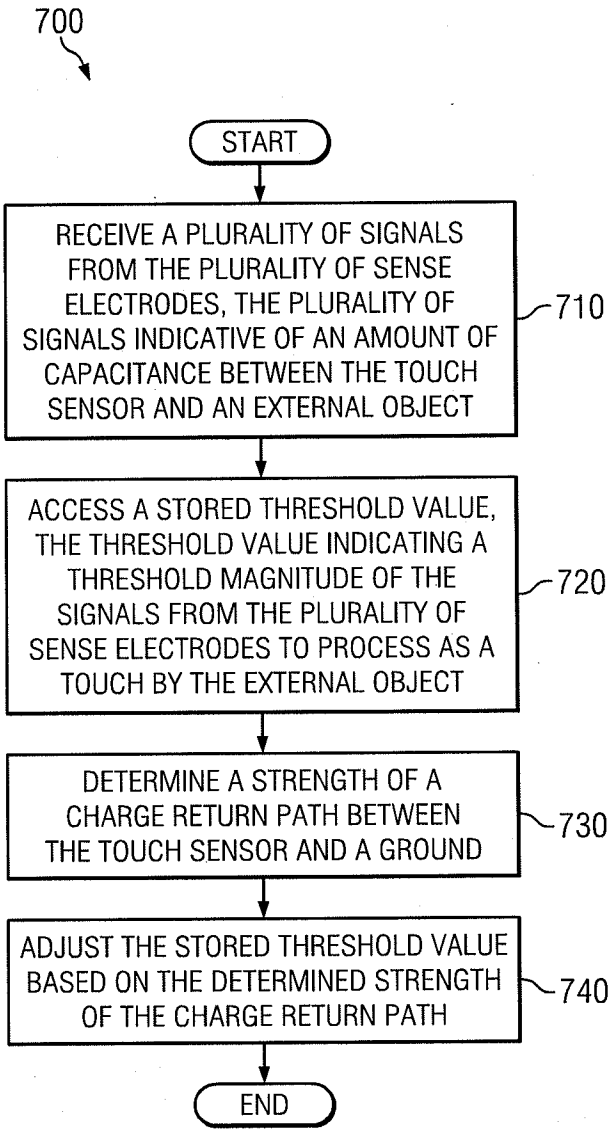

700
START
RECEIVE A PLURALITY OF SIGNALS FROM THE PLURALITY OF SENSE ELECTRODES, THE PLURALITY OF SIGNALS INDICATIVE OF AN AMOUNT OF CAPACITANCE BETWEEN THE TOUCH SENSOR AND AN EXTERNAL OBJECT
710
ACCESS A STORED THRESHOLD VALUE, THE THRESHOLD VALUE INDICATING A THRESHOLD MAGNITUDE OF THE SIGNALS FROM THE PLURALITY OF SENSE ELECTRODES TO PROCESS AS A TOUCH BY THE EXTERNAL OBJECT
720
DETERMINE A STRENGTH OF A CHARGE RETURN PATH BETWEEN THE TOUCH SENSOR AND A GROUND
730
ADJUST THE STORED THRESHOLD VALUE BASED ON THE DETERMINED STRENGTH OF THE CHARGE RETURN PATH
740
END

FIG. 7

DECLARATION AND POWER OF ATTORNEY

As a below-named inventor, I hereby declare that:

My residence, post office address, and citizenship are as stated below next to my name; I believe the named inventor or inventors are the original and first inventor or inventors of the subject matter which is claimed in and for which a patent is sought on the application entitled "*Touch Sensor With Adaptive Touch Detection Thresholding,*" which is attached hereto; and

I have reviewed and I understand the contents of the above-identified application, including the claims, as amended by any amendment specifically referred to above; I do not know and I do not believe that the above-identified subject matter was ever known or used in the United States of America before my invention or discovery thereof, patented or described in any printed publication in any country before my invention or discovery thereof or more than one year prior to the above-identified application, or in public use or on sale in the United States of America more than one year prior to the above-identified application; the above-identified subject matter has not been patented or made the subject of an inventor's certificate issued prior to the date of the above-identified application in any country foreign to the United States of America on an application filed by me or my legal representatives or assigns; and I acknowledge the duty to disclose to the U.S. Patent and Trademark Office all information known to me to be material to patentability as defined by 37 C.F.R. § 1.56, which for a continuation-in-part application includes information known to me to be material to patentability as defined by 37 C.F.R. § 1.56 that became available between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application.

I hereby claim foreign priority benefits under 35 U.S.C. § 119(a)-(d) or (f) or 35 U.S.C. § 365 of any foreign application for patent or inventor's certificate or PCT international application listed below and I have identified below, by indicating priority not claimed, any foreign application for patent or inventor's certificate or any PCT international application having a filing date before that of the application on which priority is claimed:

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Application Number	Country	Date Filed	Priority Claimed (Yes or No)
----------NONE----------			

I hereby claim the benefit under 35 U.S.C. § 120 of any United States patent application listed below:

Application Number	Date Filed	Status
----------NONE----------		

I hereby appoint the following as my attorneys or agents, with full power of substitution and revocation, to prosecute the above-identified application, to transact all business in the United States Patent and Trademark Office connected therewith, and to file and prosecute any international patent application filed thereon before any international authority.

The practitioners at Customer Number **12323**

Send correspondence to	Direct telephone calls to
Travis W. Thomas at Customer Number 12323	Travis W. Thomas at 650.739.7503

I hereby declare that all statements made herein of my own knowledge are true; that all statements made on information and belief are believed to be true; and that these statements are made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. § 1001 and any such willful false statements may jeopardize the validity of the above-identified application or any patent issuing thereon.

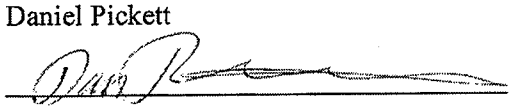
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Title of Patent Application:	*Touch Sensor With Adaptive Touch Detection Thresholding*
Name of inventor:	Martin John Simmons
Signature of inventor:	
Date:	8th December 2011
Country of citizenship:	GB
Residence:	Southampton, Hampshire, Great Britain
Mailing address:	1560 Parkway, Solent Business Park, Whiteley, Fareham, Hampshire, PO15 7AG, Great Britain

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Title of Patent Application:	*Touch Sensor With Adaptive Touch Detection Thresholding*
Name of inventor:	Darren Golbourn
Signature of inventor:	
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Title of Patent Application:	*Touch Sensor With Adaptive Touch Detection Thresholding*
Name of inventor:	Daniel Pickett
Signature of inventor:	
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