

## EXHIBIT 3.22

provided by CIRQUE CORPORATION. Multiple substrate layers and thus multiple or overlapping layers of electrodes generally results in a touchpad that is mostly transparent, but can be difficult to see  
5 through. This becomes a problem of usability when the touchpad is disposed on the display screen.

It is worth noting that attempts have been made to make the substrate layers and the inks used for electrical traces to be thinner and therefore to have  
10 greater apparent transparency. The attempts so far have still resulted in a display screen that is uncomfortably dimmed by the touchpad electrodes.

Accordingly, what is needed is a touchpad providing complete touchpad functionality that is more  
15 transparent than those in the state of the art in order to provide greater viewing comfort to the user.

#### BRIEF SUMMARY OF THE INVENTION

It is an object of the present invention to  
20 provide a touchpad that includes only one active electrode and one sense electrode on a single substrate, thereby improving display screen clarity by reducing the total number of electrodes used in the touchpad.

25 It is another object to provide the one active electrode in a plurality of different locations within the sensor area of the touchpad.

It is another object to provide the one active electrode and the one sense electrode on a generally  
30 transparent substrate.

It is another object to provide the one active electrode and the one sense electrode as generally transparent ITO ink.

It is another object to provide the single-layer touchpad wherein the touchpad is capable of detecting an object touching a zone, and determining in which zone the object has been detected.

5 It is another object to provide the single-layer touchpad wherein the touchpad is capable of simultaneously detecting the presence of multiple objects touching a plurality of different zones of the touchpad.

10 It is another object to provide the single-layer touchpad wherein the one active and the sense electrodes of the touchpad are arranged in a desirable pattern, and wherein the desired pattern is made visible when viewing the display screen, but with  
15 minimal interference.

In a preferred embodiment, the present invention is a single-layer touchpad comprised of a relatively clear substrate, a first active electrode disposed thereon, and a sense electrode disposed thereon,  
20 wherein the first active electrode and the sense electrode are comprised of a conductive material, wherein the first active electrode in combination with the sense electrode are used to detect the presence of a pointing object in a zone, determining in which zone  
25 the pointing object has been detected, or the simultaneous presence of multiple pointing objects in multiple zones, and wherein the first active electrode and/or the sense electrode are made sufficiently visible so that a pattern is visually detectable to  
30 the user when looking at the display screen.

These and other objects, features, advantages and alternative aspects of the present invention will become apparent to those skilled in the art from a

consideration of the following detailed description taken in combination with the accompanying drawings.

#### BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

5           Figure 1 is a perspective view of a portable electronic appliance having a display screen and a clear touchpad disposed thereon to provide input.

          Figure 2 is an illustration of zones arranged as a column to provide scrolling input.

10           Figure 3 is an illustration of two parallel columns of zones for providing scrolling control for two different inputs.

          Figure 4 is an enlarged schematic diagram of the layout of electrodes for a clear touchpad that is made  
15 in accordance with the principles of the present invention.

          Figure 5 is an enlarged schematic diagram of a different layout of electrodes for a clear touchpad.

          Figure 6 is an enlarged cross-sectional view of a  
20 clear touchpad having mechanical dome switches disposed thereover.

#### DETAILED DESCRIPTION OF THE INVENTION

Reference will now be made to the drawings in  
25 which the various elements of the present invention will be given numerical designations and in which the invention will be discussed so as to enable one skilled in the art to make and use the invention. It is to be understood that the following description is  
30 only exemplary of the principles of the present invention, and should not be viewed as narrowing the claims which follow.

          When discussing features of touchpads, it was mentioned that cursor control is often a desired

function of complete functionality touchpads. Other desired functions include scrolling capabilities and navigation keys for moving through documents or controlling navigation through pages in a web browser.

5 However, these features are not always required in the particular device for which the touchpad is being used.

Returning to the clear touchpad that was first described, the present invention provides touch zone control in a capacitance sensitive limited  
10 functionality touchpad. Touch zone control is a useful feature wherein the clear touchpad of the present invention sends data to a device such as a portable electronic appliance having a display screen  
15 as mentioned above.

In figure 1, a clear touchpad 100 shown as various electrodes 102 is disposed over a display screen 104. The display screen 104 and clear touchpad 100 are part of a portable electronic appliance 106.  
20 The portable electronic appliance can be any mentioned previously in this document, or any other type of device having a display screen that can take advantage of touchpad input. It is noted that the various electrodes 102 are shown without the detail of the  
25 electrical connections required to make the clear touch pad functional. These electrical connections are shown in subsequent figures. Furthermore, the various electrodes 102 are shown as very dark lines on the display screen 104. This exaggeration of the  
30 darkness of the various electrodes 102 is for illustration purposes only. It should be remembered that the inks or other conductive materials being used for the various electrodes 102 are relatively transparent to the user.

The clear touchpad 100 shown in figure 1 is also notable in that it defines distinct and separate zones as will be shown in greater detail. Data sent by sensing circuitry associated with the clear touchpad 100 indicates to the portable electronic appliance 106 the detection of contact by a pointing object. The pointing object can be a finger or other object that can be detected by a capacitance sensitive clear touchpad 100. In addition, the clear touchpad 100 can also indicate in which zone the contact has occurred.

Accordingly, the present invention provides the functionality of a one dimensional input device. For example, the clear touchpad 100 can provide the input of buttons. Each separate is a single button. By detecting which zone or button has been touched, a distinct operation can be performed by the portable electronic appliance.

Another example of a one dimensional input is a slide or scroll control. Figure 2 illustrates that if the zones 108 are lined up to form a column, then movement from zone to zone can be detected as discrete steps. If more sophisticated touchpad circuitry is provided, then it may be possible to determine finer movement along the column, and thus provide smaller incremental movement along the column.

Furthermore, more than one column may be provided as shown in figure 3, so that multiple scrolling regions can be controlled by the same clear touchpad as demonstrated by columns 1 (110) and 2 (112), parallel clear touchpads, perpendicular clear touchpads, or some other arrangement of zones as may be desired. The pattern or layout of one dimensional regions or zones may be quite varied, and should not

be considered a limiting factor of the present invention.

Figure 4 is an enlarged schematic layout of the presently preferred embodiment of the invention.

5 Figure 4 shows a single-layer substrate 10 which is assumed to be the plane of the figure. Only a single active electrode (X or Y) is needed to detect touching in a zone. Assume that the electrodes 20, 22, 24, 26 are X electrodes. Figure 4 has four zones 12, 14, 16, 10 18. These four zones are defined only generally by the dotted lines that include each of the item numbers. The four zones 12, 14, 16, 18 are comprised of the corresponding electrodes 20, 22, 24, 26 and the space around them, out to the one sense electrode 30. 15 Notice that the sense electrode 30 is surrounded by a grounding ring 32 that shields the one sense electrode from signals on other electrode wires or other interference.

The present invention operates when the active 20 electrodes 20, 22, 24, 26 and the one sense electrode 30 are coupled to a touchpad sensing circuit associated with the clear touchpad 10. The touchpad sensing circuit may be the circuit sold by Cirque<sup>®</sup> Corporation in its touchpads. It is noted that a 25 touchpad sensing circuit that is designed for providing complete touchpad functionality can be used in a clear touchpad having a single layer. However, the touchpad sensing circuitry can also be modified to operate more efficiently without an input for an 30 active electrode that is not being used when only providing limited touchpad functionality.

An important aspect of the present invention is to also provide the feature of shaping the active electrode, the one sense electrode, or both the active

and the one sense electrodes in desirable patterns. It was stated earlier that it is desirable to make the electrodes as transparent to the user as possible in order to avoid dimming a display screen. However, it  
5 may be desirable to make at least a portion of the electrodes visible to a user when looking at the display screen.

Thus, an important aspect of the invention is the ability to make visible a desirable pattern as seen  
10 when looking at the display screen. Assuming that a single-layer touchpad has been disposed between the display screen and the user, or the touchpad is visible from the underside of the display screen, it may be desirable that the touchpad not be made  
15 completely transparent to the user.

For example, the electrodes of the touchpad can be made visible to the user by taking advantage of certain characteristics of the materials used in them. Consider a conductive material for the electrodes  
20 whose width or thickness can be varied in order to obtain various degrees of visibility. Furthermore, additional materials may be added to the conductive material used for the electrodes, wherein the additional materials darken or lighten the appearance  
25 of the conductive material.

The purpose of increasing the opacity of the electrodes would seem to be contrary to the goal of making the presence of the clear touchpad  
unnoticeable. However, making the electrodes at least  
30 partially visible in at least one zone enables a seller of a device to make a particular image visible to users of buyers of its product. In other words, the seller can brand the device so that there is no mistake as to the seller of the device when a logo or

other service or trademark is visually discernible to the user or buyer.

Using the illustration of figure 4, assume that the logo of the seller is the shape of one of the  
5 electrodes 20, 22, 24, or 26. One or all of these electrodes 20, 22, 24, 26 could be made slightly visible when looking at the display screen.

The number of zones that can be provided by the clear touchpad can be modified as well, depending upon  
10 the characteristics of the clear touchpad being used. The number of zones should not be considered a limiting factor, as the touchpad and its associated touchpad sensing circuitry can be modified to provide many distinct zones of desired.

15 Figure 5 is an enlarged schematic block diagram of another clear touchpad of the present invention. Note that the shape of the active electrodes 40, 42, 44, 46 are different from those of figure 4. This is simply to make it plain that the shape of the  
20 electrodes can be modified to be many desirable shapes and patterns.

Another important aspect of the invention is that the functionality of the clear touchpad can be combined with other mechanical features. For example,  
25 one desirable mechanical feature might be a dome button. Figure 6 is an enlarged and cross-sectional illustration of this concept, wherein a touchpad substrate 50 is shown. The substrate 50 has disposed thereon a desired pattern or layout of electrodes 52  
30 of the clear touchpad. Disposed over these electrodes are mechanical dome switches 54. The functionality provided by the electrodes 52 may be that of a scrolling region. The mechanical dome switches 54 would thus provide a different function in the same

space. However, the electrodes 52 might also function as buttons. Thus, there could be dual use of the same area. If the electrodes are active, then an electrode switch might be actuated. If the electrodes are  
5 inactive, then the mechanical dome switches maybe actuated to provide a different input.

It is to be understood that the above-described arrangements are only illustrative of the application of the principles of the present invention. Numerous  
10 modifications and alternative arrangements may be devised by those skilled in the art without departing from the spirit and scope of the present invention. The appended claims are intended to cover such modifications and arrangements.

15

## CLAIMS

What is claimed is:

1. A single-layer touchpad for providing input to a device having a display screen, said single-layer  
5 touchpad comprised of:
  - a first active electrode disposed in at least two discrete regions of a touch-sensitive area, wherein the first active electrode is generally transparent when disposed over a display screen;
  - 10 a sense electrode disposed adjacent to the first active electrode in the at least two discrete regions, wherein the sense electrode is generally transparent when disposed over the display screen; and
  - a touchpad sensing circuit coupled to the first  
15 active electrode and to the sense electrode, wherein the touchpad sensing circuit determines when a pointing object makes contact in the touch-sensitive area, and wherein the touchpad sensing circuit determines in which of the at least two discrete  
20 regions the pointing object has made contact.

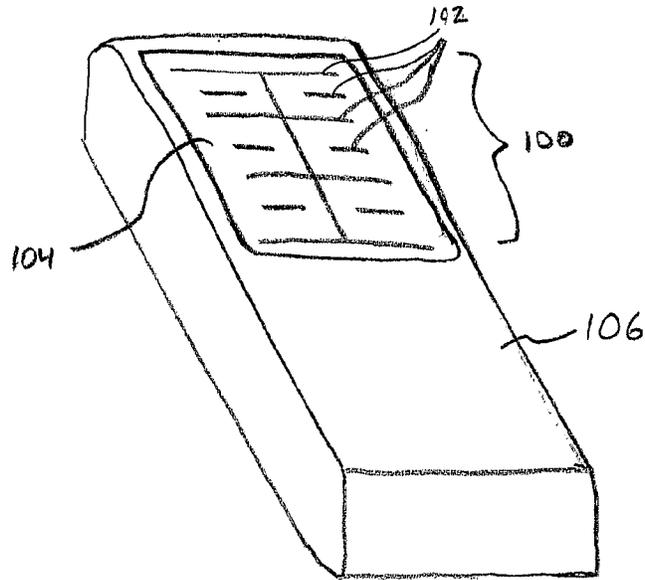


FIGURE 1

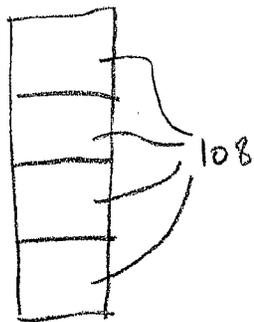


FIGURE 2

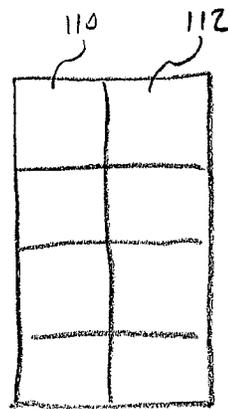
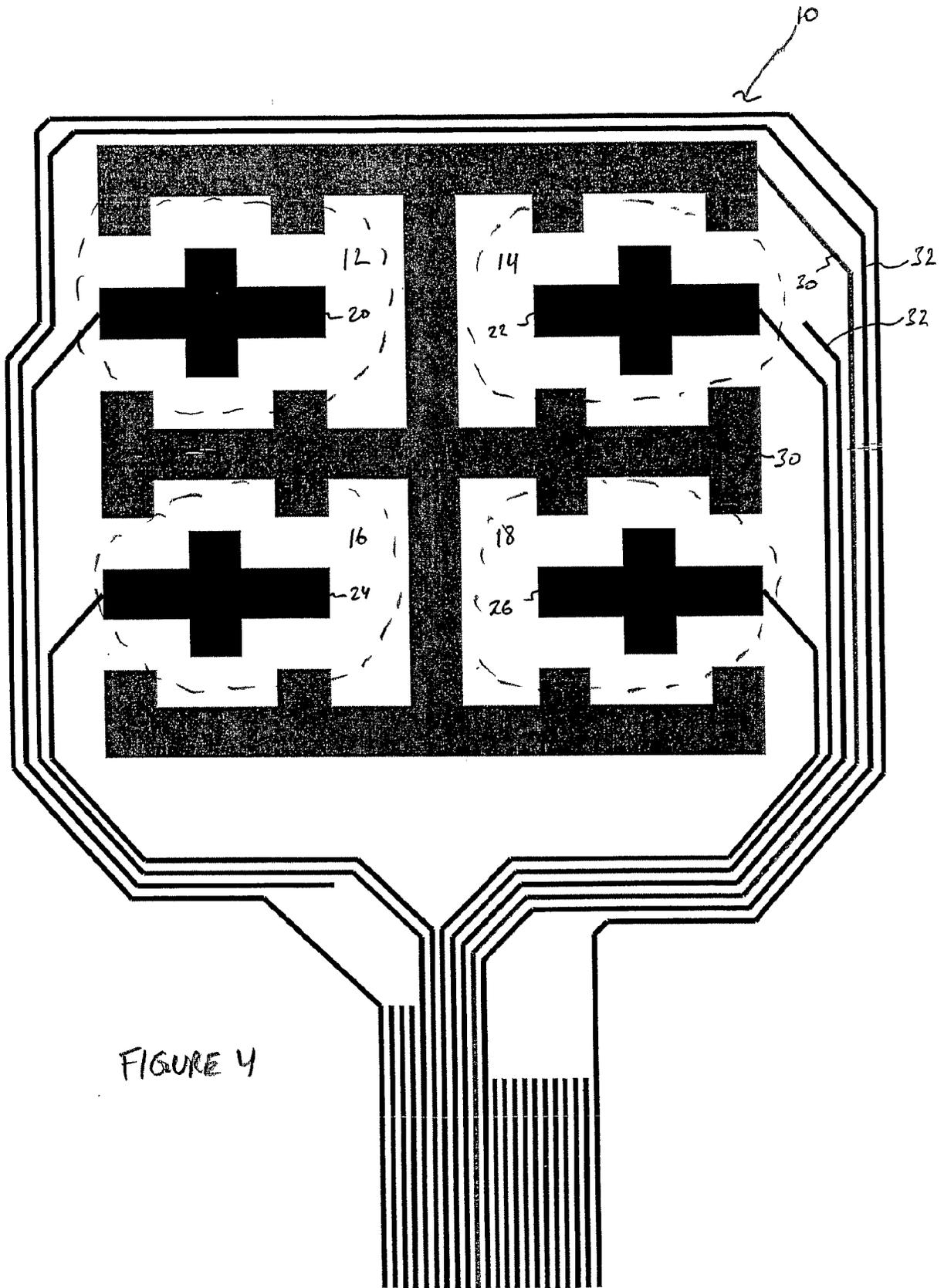


FIGURE 3



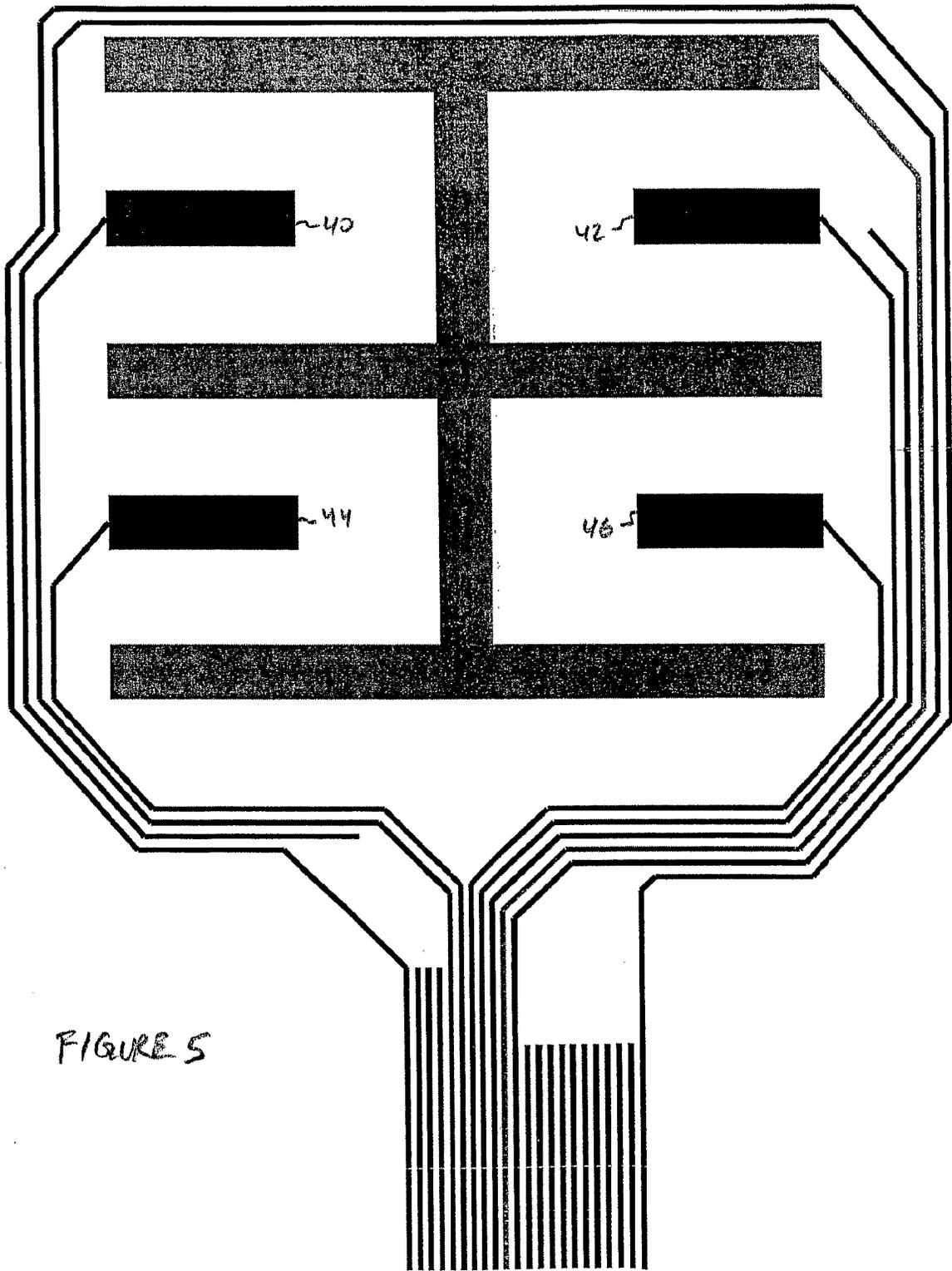


FIGURE 5

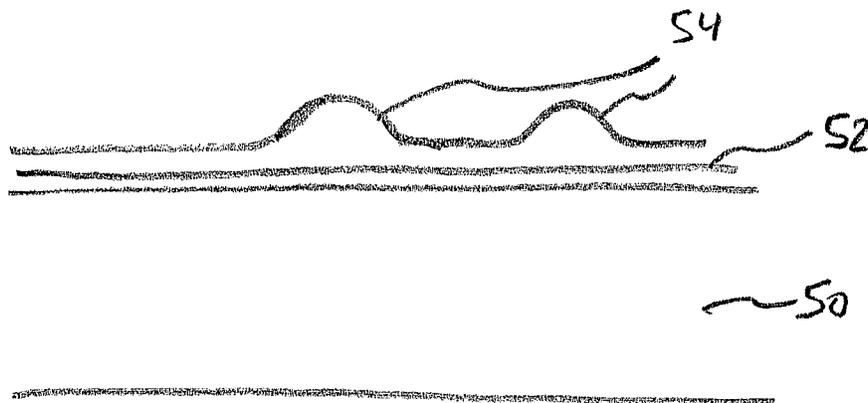


FIGURE 6

(19) World Intellectual Property Organization  
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12 February 2004 (12.02.2004)

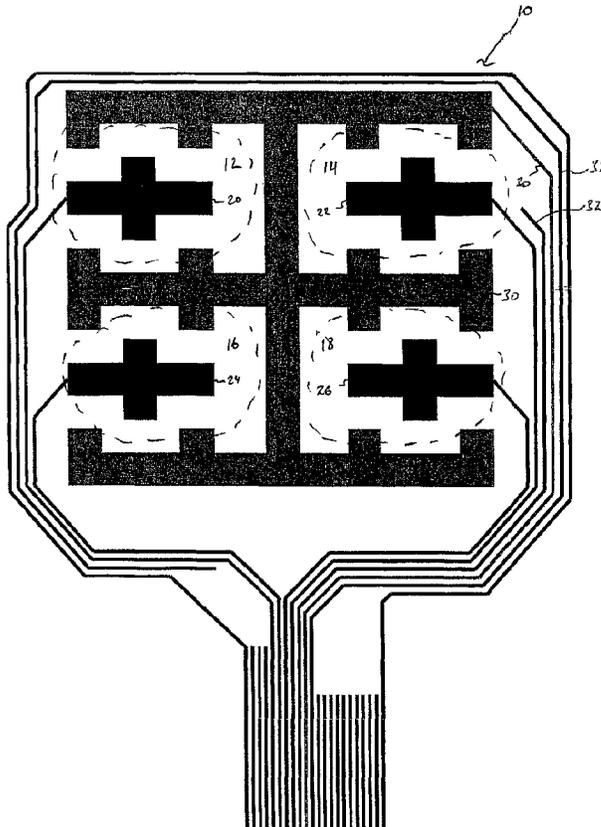
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[Continued on next page]

(54) Title: SINGLE-LAYER TOUCHPAD HAVING TOUCH ZONES



(57) Abstract: A single-layer touchpad (100) comprised of a relatively clear substrate, a first active electrode disposed thereon (20), and a sense electrode (30) disposed thereon, wherein the first active electrode and the sense electrode are comprised of a conductive material, wherein the first active electrode (20) in combination with the sense electrode (30) are used to detect the presence of a pointing object in a zone (12), determining in which zone the pointing object has been detected, or the simultaneous presence of multiple pointing objects in multiple zones, and wherein the first active electrode and/or the sense electrode are made sufficiently visible so that a pattern is visually detectable to the user when looking at the display screen (104).

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**Published:**

— *with international search report*

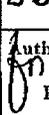
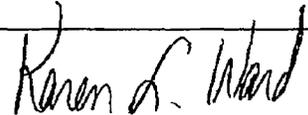
**(88) Date of publication of the international search report:**

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*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US03/24811

<p><b>A. CLASSIFICATION OF SUBJECT MATTER</b>                  IPC(7) :G09G 5/00                  US CL :345/173, 169.                  According to International Patent Classification (IPC) or to both national classification and IPC</p>														
<p><b>B. FIELDS SEARCHED</b>                  Minimum documentation searched (classification system followed by classification symbols)                  U.S. : 345/173, 169.</p> <p>Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched</p> <p>Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)                  EAST</p>														
<p><b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b></p> <table border="1"> <thead> <tr> <th>Category*</th> <th>Citation of document, with indication, where appropriate, of the relevant passages</th> <th>Relevant to claim No.</th> </tr> </thead> <tbody> <tr> <td>X</td> <td>US 2002/0093491 A1 (GILLESPIE et al) 18 July 2002, page 15, paragraphs 198-200, page 16, paragraph 216, and page 22, paragraphs 191-192.</td> <td>1</td> </tr> <tr> <td>X</td> <td>US 2002/0015024 A1 (WESTERMAN et al) 07 February 2002, page 4, paragraph 37, page 8, paragraphs 115 and 117, and page 26, paragraph 267.</td> <td>1</td> </tr> </tbody> </table>			Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	X	US 2002/0093491 A1 (GILLESPIE et al) 18 July 2002, page 15, paragraphs 198-200, page 16, paragraph 216, and page 22, paragraphs 191-192.	1	X	US 2002/0015024 A1 (WESTERMAN et al) 07 February 2002, page 4, paragraph 37, page 8, paragraphs 115 and 117, and page 26, paragraph 267.	1			
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X	US 2002/0093491 A1 (GILLESPIE et al) 18 July 2002, page 15, paragraphs 198-200, page 16, paragraph 216, and page 22, paragraphs 191-192.	1												
X	US 2002/0015024 A1 (WESTERMAN et al) 07 February 2002, page 4, paragraph 37, page 8, paragraphs 115 and 117, and page 26, paragraph 267.	1												
<p><input type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/> See patent family annex.</p>														
<table border="1"> <tr> <td>* Special categories of cited documents:</td> <td>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</td> </tr> <tr> <td>"A" document defining the general state of the art which is not considered to be of particular relevance</td> <td>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</td> </tr> <tr> <td>"E" earlier document published on or after the international filing date</td> <td>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</td> </tr> <tr> <td>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</td> <td>"A" document member of the same patent family</td> </tr> <tr> <td>"O" document referring to an oral disclosure, use, exhibition or other means</td> <td></td> </tr> <tr> <td>"P" document published prior to the international filing date but later than the priority date claimed</td> <td></td> </tr> </table>			* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention	"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone	"E" earlier document published on or after the international filing date	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art	"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"A" document member of the same patent family	"O" document referring to an oral disclosure, use, exhibition or other means		"P" document published prior to the international filing date but later than the priority date claimed	
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"O" document referring to an oral disclosure, use, exhibition or other means														
"P" document published prior to the international filing date but later than the priority date claimed														
Date of the actual completion of the international search 05 NOVEMBER 2003		Date of mailing of the international search report <b>25 NOV 2003</b>												
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-9250		Authorized officer  RICARDO OSORIO  Telephone No. (703) 305-2248												

**VIA EFS**  
Docket No. 106842009000  
Client Ref. No. P3266US1  
(PATENT)

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

In re Patent Application of:  
Steven HOTELLING et al.

Serial No.: 10/840,862

Filing Date: May 6, 2004

For: MULTI-POINT TOUCHSCREEN

Examiner: Kimnhung T. Nguyen

Group Art Unit: 2629

Confirmation No.: 8470

**SUPPLEMENTAL INFORMATION DISCLOSURE  
STATEMENT UNDER 37 C.F.R. § 1.97 & 1.98**

MS Amendment  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Dear Madam:

Pursuant to 37 C.F.R. § 1.97 and § 1.98, Applicants submit for consideration in the above-identified application the document listed on the attached Form PTO/SB/08a/b. A copy of the document is also submitted herewith. The Examiner is requested to make this document of record.

Pursuant to 37 C.F.R. § 1.704(d), I hereby certify that each item of information contained in this Information Disclosure Statement was first cited in any communication from a foreign patent office in a counterpart application and that this communication was not received by any individual designated in § 1.56(c) more than thirty days prior to the filing of this Supplemental Information Disclosure Statement.

la-1027456

APLNDC00026882

The documents listed on the attached Form PTO/SB/08a/b were cited in an Office Action mailed on April 6, 2009, directed to a counterpart international or foreign application and have not been previously cited. A certification under 37 C.F.R. § 1.97(e)(1) follows:

I hereby certify that each item of information was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this Supplemental Information Disclosure Statement.

This Supplemental Information Disclosure Statement is submitted:

- With the application; accordingly, no fee or separate requirements are required.
- Before the mailing of a first Office Action after the filing of a Request for Continued Examination under § 1.114. However, if applicable, a certification under 37 C.F.R. § 1.97 (e)(1) has been provided.
- Within three months of the application filing date or before mailing of a first Office Action on the merits; accordingly, no fee or separate requirements are required. However, if applicable, a certification under 37 C.F.R. § 1.97 (e)(1) has been provided.
- After receipt of a first Office Action on the merits but before mailing of a final Office Action or Notice of Allowance.
  - A fee is required. A check in the amount of \_\_\_ is enclosed.
  - A fee is required. Accordingly, a Fee Transmittal form (PTO/SB/17) is attached to this submission in duplicate.
  - A Certification under 37 C.F.R. § 1.97(e) is provided above; accordingly; no fee is believed to be due.
- After mailing of a final Office Action or Notice of Allowance, but before payment of the issue fee.
  - A Certification under 37 C.F.R. § 1.97(e) is provided above and a check in the amount of \_\_\_ is enclosed.
  - A Certification under 37 C.F.R. § 1.97(e) is provided above and a Fee Transmittal form (PTO/SB/17) is attached to this submission in duplicate.

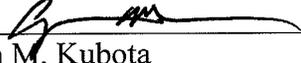
Applicants would appreciate the Examiner initialing and returning the Form PTO/SB/08a/b, indicating that the information has been considered and made of record herein.

The information contained in this Supplemental Information Disclosure Statement under 37 C.F.R. § 1.97 and § 1.98 is not to be construed as a representation that: (i) a complete search has been made; (ii) additional information material to the examination of this application does not exist; (iii) the information, protocols, results and the like reported by third parties are accurate or enabling; or (iv) the above information constitutes prior art to the subject invention.

In the unlikely event that the transmittal form is separated from this document and the Patent and Trademark Office determines that an extension and/or other relief (such as payment of a fee under 37 C.F.R. § 1.17 (p)) is required, Applicants petition for any required relief including extensions of time and authorize the Commissioner to charge the cost of such petition and/or other fees due in connection with the filing of this document to **Deposit Account No. 03-1952** referencing 106842009000.

Dated: May 9, 2009

Respectfully submitted,

By:   
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MORRISON & FOERSTER LLP  
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## Electronic Acknowledgement Receipt

<b>EFS ID:</b>	5306335
<b>Application Number:</b>	10840862
<b>International Application Number:</b>	
<b>Confirmation Number:</b>	8470
<b>Title of Invention:</b>	Multipoint touchscreen
<b>First Named Inventor/Applicant Name:</b>	Steve Hotelling
<b>Customer Number:</b>	69753
<b>Filer:</b>	Glen Masashi Kubota/Lisa Bronk
<b>Filer Authorized By:</b>	Glen Masashi Kubota
<b>Attorney Docket Number:</b>	106842009000
<b>Receipt Date:</b>	09-MAY-2009
<b>Filing Date:</b>	06-MAY-2004
<b>Time Stamp:</b>	17:49:55
<b>Application Type:</b>	Utility under 35 USC 111(a)

### Payment information:

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	Transmittal Letter	1	3
	Information Disclosure Statement (IDS) Filed (SB/08)	4	4

**Warnings:**

**Information:**

2	Foreign Reference	1_WO04013833A2A3.pdf	878773	no	20
			036c7ca00a7b0c467ecdb8c23fdbbc1c05804a25		

**Warnings:**

**Information:**

<b>Total Files Size (in bytes):</b>		1043495
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**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.**

PLUS Search Results for S/N 10840862, Searched Tue May 12 07:38:49 EDT 2009

The Patent Linguistics Utility System (PLUS) is a USPTO automated search system for U.S. Patents from 1971 to the present PLUS is a query-by-example search system which produces a list of patents that are most closely related linguistically to the application searched. This search was prepared by the staff of the Scientific and Technical Information Center, SIRA.

4853498 99	6626013 90
6138523 99	
5241308 99	
5404443 99	
5642185 99	
5917477 99	
6023265 99	
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20090066670 99	
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6229529 90	
6343519 90	
6480187 90	
6504530 90	

ALTERNATIVE TO PTO/SB/08A/B  
(Based on PTO 08-08 version)

Substitute for form 1449/PTO  <b>INFORMATION DISCLOSURE STATEMENT BY APPLICANT</b>  (Use as many sheets as necessary)			<b>Complete if Known</b>		
			Application Number	10/840,862	
			Filing Date	May 6, 2004	
			First Named Inventor	Steve P. HOTELLING	
			Art Unit	2629	
			Examiner Name	K. Nguyen	
Sheet	1	of	1	Attorney Docket Number	106842009000

U.S. PATENT DOCUMENTS						
Examiner Initials*	Cite No. <sup>1</sup>	Document Number		Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		Number-Kind Code <sup>2</sup> (if known)				
	1.	US-5,942,733		08-24-1999	Allen et al.	

FOREIGN PATENT DOCUMENTS							
Examiner Initials*	Cite No. <sup>1</sup>	Foreign Patent Document		Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages Or Relevant Figures Appear	T <sup>6</sup>
		Country Code <sup>3</sup> -Number <sup>4</sup> -Kind Code <sup>5</sup> (if known)					
	2.	WO-2005/114369-A2, A3		12-01-2005	Apple Computer, Inc.		<input type="checkbox"/>

Examiner Signature	/Kimnhung Nguyen/	Date Considered	05/29/2009
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\*EXAMINER: Initial if information considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. <sup>1</sup> Applicant's unique citation designation number (optional). <sup>2</sup> See Kinds Codes of USPTO Patent Documents at [www.uspto.gov](http://www.uspto.gov) or MPEP 901.04. <sup>3</sup> Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). <sup>4</sup> For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. <sup>5</sup> Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST. 16 if possible. <sup>6</sup> Applicant is to place a check mark here if English language Translation is attached.

NON PATENT LITERATURE DOCUMENTS			
Examiner Initials*	Cite No. <sup>1</sup>	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T <sup>2</sup>
	3.	U.S. Patent Application No. 12/267,522, filed November 7, 2008, by Hotelling et al. (copy not attached.)	<input type="checkbox"/>
	4.	U.S. Patent Application No. 12/267,532, filed November 7, 2008, by Hotelling et al. (copy not attached.)	<input type="checkbox"/>
	5.	U.S. Patent Application No. 12/267,540, filed November 7, 2008, by Hotelling et al. (copy not attached.)	<input type="checkbox"/>

Examiner Signature	/Kimnhung Nguyen/	Date Considered	05/29/2009
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\*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

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

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /K.N./



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www.uspto.gov

Table with 5 columns: APPLICATION NO., FILING DATE, FIRST NAMED INVENTOR, ATTORNEY DOCKET NO., CONFIRMATION NO.
10/840,862 05/06/2004 Steve Hotelling 106842009000 8470

69753 7590 06/02/2009
APPLE C/O MORRISON AND FOERSTER ,LLP
LOS ANGELES
555 WEST FIFTH STREET SUITE 3500
LOS ANGELES, CA 90013-1024

EXAMINER

NGUYEN, KIMNHUNG T

ART UNIT PAPER NUMBER

2629

MAIL DATE DELIVERY MODE

06/02/2009

PAPER

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.

<b>Office Action Summary</b>	<b>Application No.</b> 10/840,862	<b>Applicant(s)</b> HOTELLING ET AL.	
	<b>Examiner</b> KIMNHUNG NGUYEN	<b>Art Unit</b> 2629	

-- 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 20 February 2009.
- 2a)  This action is **FINAL**.                      2b)  This action is non-final.
- 3)  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**

- 4)  Claim(s) 1,2,4-13,15-26 and 32-50 is/are pending in the application.  
4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5)  Claim(s) 1,2,4-12 and 32-45 is/are allowed.
- 6)  Claim(s) 13 and 47-50 is/are rejected.
- 7)  Claim(s) 15-26 and 46 is/are objected to.
- 8)  Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9)  The specification is objected to by the Examiner.
- 10)  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).
- 11)  The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**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).  
a)  All    b)  Some \*    c)  None of:
1.  Certified copies of the priority documents have been received.
  2.  Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3.  Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |  |
|--|--|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date: _____. |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | 5) <input type="checkbox"/> Notice of Informal Patent Application                        |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date <u>3/18/9,5/9/09</u> . | 6) <input type="checkbox"/> Other: _____.  |

### **DETAILED ACTION**

1 This application has been examined. The claims 1, 2, 4-13, 15-26 and 32-50 are pending. The examination results are as following.

#### ***Claim Rejections - 35 USC § 103***

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 13 and 47-50 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hsu et al. (US 7,030,860) in view of Fujimoto (US 6,061,177).

As to claim 13, Hsu disclose in fig. 5D, a display arrangement comprising: a display having a screen for displaying a graphical user interface (see abstract); and a transparent touch panel (transparent touch sensing, see abstract) allowing the screen to be viewed therethrough the sensor (see abstract) and capable of recognizing multiple touch events that occur at different locations on the touch panel (see finger position X/Y, that is different locations at X and Y) at a same time and to output this information to a host device to form a pixilated image (by X/Y positions); wherein the touch panel includes a multipoint sensing (X/Y positions, see abstract) arrangement configured to detect a change in capacitive coupling associate with those touch events (see col. 8, lines 38-41) and should be at distinct points across the touch panel. However, Hsu does not specifically disclose multipoint sensing configured to simultaneously detect and monitor the touch events.

Fujimoto discloses in fig. 1, a touch screen input device and method for use with a rear-mounted video. The touch screen input device operates equally well in an environment with any level of ambient light or no ambient and can simultaneously detect multiple touches (see abstract, see col. 11, 7-16).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to implement the touch screen input device operates and can simultaneously detect multiple touches as taught by Fujimoto into display system comprising graphic user interface and multipoint sensing arranged of Hsu for producing the claimed invention because this would the coordinates of the remaining, approximately finger tip-sized, touches are sent to the computer operation system as touch inputs (see col. 11, lines 13-15).

As to claims 47-50, Hsu et al. disclose further the display comprising multipoint sensing (coordinates X/Y) arrangement formed on single side of a substrate or on both sides of a single substrate (see col. 8, lines 1-21), and the transparent substrate is formed from glass (because transparent substrate always formed by glass for human eye can easily detect any systematic misalignment between the trace array patterns (see col. 8, lines 13-21).

***Allowable Subject Matter***

4. Claims 1-2, 4-12, 32-45 are allowed.
5. Claims 24-26 and 46 are 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.

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The following is a statement of reasons for the indication of allowable subject matter:

None of the cited art teaches or suggests a touch panel having a transparent capacitive sensing medium, wherein the transparent capacitive sensing medium comprises a transparent electrode layer, the electrode layer including a plurality of electrically isolated electrodes and electrode traces formed from a transparent conductive material, each of the electrodes being placed at different locations in the plane of the touch panel, each of the electrodes having an individual trace for operatively coupling to capacitive monitoring circuitry as claims 1 and 39; or a second layer spatially separated from the first layer and having a plurality of transparent second conductive lines that are electrically isolated from one another, the second conductive lines being positioned transverse to the first conductive lines, the intersection of transverse lines being positioned at different locations in the plane of the touch panel, each of the second conductive lines being operatively coupled to capacitive monitoring circuitry wherein the capacitive monitoring circuitry is configured to detect changes in charge coupling between the first conductive lines and the second conductive lines as claim 7; or wherein the multipoint sensing arrangement provides a plurality of transparent capacitive sensing nodes that work independent of one another and that represent different points on the touch as claim 15; or a glass member disposed over the screen of the display; a transparent conductive layer disposed over the glass member, the conductive layer including a pixilated array of electrically isolated electrodes; a transparent cover sheet disposed over the electrode layer; and one or more sensor integrated circuits operatively coupled to the electrodes as claim 24; or a second transparent conductive layer disposed over the second glass member, the second transparent conductive layer comprising a plurality of spaced apart parallel lines having the same pitch and linewidths, the parallel lines of

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the second transparent conductive layer being substantially perpendicular to the parallel lines of the first transparent conductive layer; a third glass member disposed over the second transparent conductive layer; and one or more sensor integrated circuits operatively coupled to the lines as claim 25; or a virtual ground charge amplifier coupled to the touch panel for detecting the touch events on the touch panel as claim 46.

***Response to Arguments***

6. Applicant's arguments with respect to claims 1-2, 4-13, 15-26 and 32-50 filed 2/20/09 have been considered but are moot in view of the new ground(s) of rejection.

***Correspondence***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to KIMNHUNG NGUYEN whose telephone number is (571)272-7698. The examiner can normally be reached on MON-FRI, FROM 8:30 AM-5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Richard Hjerpe can be reached on (571) 272-7691. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 2629

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.

/Kimnhung Nguyen/  
Examiner, Art Unit 2629

<b>Notice of References Cited</b>	Application/Control No. 10/840,862	Applicant(s)/Patent Under Reexamination HOTELLING ET AL.	
	Examiner KIMNHUNG NGUYEN	Art Unit 2629	Page 1 of 1

**U.S. PATENT DOCUMENTS**

*	Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A US-7,030,860	04-2006	Hsu et al.	345/173
*	B US-6,061,177	05-2000	Fujimoto, Kenneth Noboru	359/443
	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**

*	Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	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.

<b>Index of Claims</b>  	<b>Application/Control No.</b>  10840862	<b>Applicant(s)/Patent Under Reexamination</b>  HOTELLING ET AL.
	<b>Examiner</b>  KIMNHUNG NGUYEN	<b>Art Unit</b>  2629

✓	<b>Rejected</b>
=	<b>Allowed</b>

-	<b>Cancelled</b>
÷	<b>Restricted</b>

N	<b>Non-Elected</b>
I	<b>Interference</b>

A	<b>Appeal</b>
O	<b>Objected</b>

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

CLAIM		DATE							
Final	Original	12/20/2008	05/29/2009						
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	2	v	=						
	3	-	-						
	4	v	=						
	5	v	=						
	6	v	=						
	7	v	=						
	8	v	=						
	9	v	=						
	10	o	=						
	11	o	=						
	12	v	=						
	13	v	✓						
	14	-	-						
	15	v	O						
	16	v	O						
	17	v	O						
	18	v	O						
	19	v	O						
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	31	-	-						
	32	v	=						
	33	v	=						
	34	v	=						
	35	v	=						
	36	v	=						

<b>Index of Claims</b>  	<b>Application/Control No.</b>  10840862	<b>Applicant(s)/Patent Under Reexamination</b>  HOTELLING ET AL.
	<b>Examiner</b>  KIMNHUNG NGUYEN	<b>Art Unit</b>  2629

✓	<b>Rejected</b>
=	<b>Allowed</b>

-	<b>Cancelled</b>
÷	<b>Restricted</b>

N	<b>Non-Elected</b>
I	<b>Interference</b>

A	<b>Appeal</b>
O	<b>Objected</b>

<input type="checkbox"/> Claims renumbered in the same order as presented by applicant		<input type="checkbox"/> CPA		<input type="checkbox"/> T.D.		<input type="checkbox"/> R.1.47			
CLAIM		DATE							
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	38	v	=						
	39	v	=						
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	41	v	=						
	42	v	=						
	43	v	=						
	44	v	=						
	45	v	=						
	46	v	O						
	47	v	✓						
	48	v	✓						
	49	v	✓						
	50	v	✓						

## EAST Search History

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	12	((("20020015024") or ("3662105") or ("3798370") or ("5825351") or ("6188391") or ("6323846") or ("6570557") or ("6593916") or ("6650319") or ("6677932") or ("6856259") or ("6888536")).PN.	US-PGPUB; USPAT	OR	OFF	2008/05/09 17:09
S2	281	(touch panel) and (transparent capacitive) and (multiple touches) and traces and 345/173-179.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/05/09 17:38
S3	141	S2 and (@ad<="20040506")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/05/09 17:39
S4	2	((("5854625") or ("5872561")).PN.	USPAT	OR	OFF	2008/05/09 17:47
S5	1	("20050146511").PN.	US-PGPUB; USPAT	OR	OFF	2008/12/13 18:46
S6	1	("20050146511").PN.	US-PGPUB; USPAT	OR	OFF	2008/12/19 15:01
S7	455	((touch screen) or (touch panel)) and (transparent capacitance capacitive) and traces and 345/173	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/12/19 17:12
S8	381	S7 and (multiple touches)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/12/19 17:12
S9	186	S8 and (@ad<="20040506")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/12/19 17:13

S10	1	S9 and (transparent adj electrode adj layer)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/12/19 18:30
S11	78	S9 and electrode	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/12/19 18:31
S12	50	("4853498" "6138523" "5241308" "5404443" "5642185" "5917477" "6023265" "20060097991" "20090066670" "20090096757" "20090096758" "5404458" "5751276" "5818450" "5943043" "4623757" "4868912" "5428367" "5483261" "6028581" "6028595" "6061177" "6072475" "6232961" "4465465" "4833592" "4837430" "4888479" "4922061" "4933544" "5053757" "5313051" "5347940" "5559301" "5565658" "5580662" "5670987" "5708460" "5757359" "5777596" "5966122" "5982355" "6104443" "6118435" "6143181" "6229529" "6343519" "6480187" "6504530" "6626013" ).pn.	US-PGPUB; USPAT	OR	OFF	2009/05/28 13:32
S13	46	((("20020118848") or ("20030076301") or ("20030076303") or ("20030076306") or ("20030095096") or ("20030098858") or ("20050012723") or ("20050052425") or ("20050110768") or ("20060022956") or ("20060026535") or ("2006026536") or ("20060032680") or ("20060066582") or ("20060097991") or ("3333160") or ("3541541") or ("3622105") or ("3798370") or ("4246452") or ("4550221") or	US-PGPUB; USPAT	OR	OFF	2009/05/28 14:53

		("4672364") or ("4672558") or ("4692809") or ("4695827") or ("4733222") or ("4734685") or ("4746770") or ("4771276") or ("4788384") or ("4806846") or ("4898555") or ("4968877") or ("5003519") or ("5017030") or ("5178477") or ("5189403") or ("5194862") or ("5224861") or ("5241308") or ("5252951") or ("5281966") or ("5305017") or ("5345543") or ("5376948") or ("5398310") or ("5442742")). PN.				
S14	15	(touch panel) same (transparent sensing sensor senses) same (multiple touches) same location same (electrodes traces) same (individual trace)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/05/28 15:06
S15	6	S14 and (@ad<="20040506")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/05/28 15:07
S16	4451	(touch panel) and (transparent sensing sensor senses) and (multiple touches) and (electrodes layer) and location and traces	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/05/28 15:10
S17	282	S16 and 345/173-179.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/05/28 15:11
S18	101	S17 and (@ad<="20040506")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/05/28 15:11

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ALTERNATIVE TO PTO/SB/08A/B  
(Based on PTO 08-08 version)

Substitute for form 1449/PTO  <b>INFORMATION DISCLOSURE STATEMENT BY APPLICANT</b>  (Use as many sheets as necessary)				<b>Complete if Known</b>		
				Application Number	10/840,862	
Sheet		1	of	1	Filing Date	May 6, 2004
					First Named Inventor	Steven P. HOTELLING
					Art Unit	2629
					Examiner Name	Kimnhung T. Nguyen
					Attorney Docket Number	106842009000 <b>Client Ref. P3266US1</b>

U.S. PATENT DOCUMENTS						
Examiner Initials*	Cite No. <sup>1</sup>	Document Number		Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		Number-Kind Code <sup>2</sup> (if known)				

FOREIGN PATENT DOCUMENTS							
Examiner Initials*	Cite No. <sup>1</sup>	Foreign Patent Document		Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages Or Relevant Figures Appear	T <sup>6</sup>
		Country Code <sup>3</sup> -Number <sup>4</sup> -Kind Code <sup>5</sup> (if known)					
/K.N./	1.	WO-2004/013833-A2, A3		02-12-2004	Cirque Corporation		

Examiner Signature	/Kimnhung Nguyen/	Date Considered	05/29/2009
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\*EXAMINER: Initial if information considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. <sup>1</sup> Applicant's unique citation designation number (optional). <sup>2</sup> See Kinds Codes of USPTO Patent Documents at [www.uspto.gov](http://www.uspto.gov) or MPEP 901.04. <sup>3</sup> Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). <sup>4</sup> For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. <sup>5</sup> Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST. 16 if possible. <sup>6</sup> Applicant is to place a check mark here if English language Translation is attached.

NON PATENT LITERATURE DOCUMENTS			
Examiner Initials*	Cite No. <sup>1</sup>	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T <sup>2</sup>

Examiner Signature	/Kimnhung Nguyen/	Date Considered	05/29/2009
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\*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

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

**AMENDMENTS TO THE CLAIMS**

Claim 1 (previously presented): A touch panel having a transparent capacitive sensing medium configured to detect multiple touches or near touches that occur at a same time and at distinct locations in a plane of the touch panel and to produce distinct signals representative of a location of the touches on the plane of the touch panel for each of the multiple touches;

wherein the transparent capacitive sensing medium comprises a transparent electrode layer, the electrode layer including a plurality of electrically isolated electrodes and electrode traces formed from a transparent conductive material, each of the electrodes being placed at different locations in the plane of the touch panel, each of the electrodes having an individual trace for operatively coupling to capacitive monitoring circuitry.

Claim 2 (original): The touch panel as recited in claim 1 wherein the transparent sensing medium includes a pixilated array of transparent capacitance sensing nodes.

Claim 3 (canceled)

Claim 4 (previously presented): The touch panel as recited in claim 1 further including one or more integrated circuits for monitoring the capacitance at each of the electrodes, the integrated circuits being operatively coupled to the electrodes via the traces.

Claim 5 (previously presented): The touch panel as recited in claim 1 wherein the electrodes are placed in rows and columns.

Claim 6 (previously presented): The touch panel as recited in claim 1 wherein the electrodes and traces are formed from indium tin oxide (ITO).

Claim 7 (previously presented): A touch panel comprising a transparent capacitive sensing medium configured to detect multiple touches or near touches that occur at a same time and at distinct locations in a plane of the touch panel and to produce distinct signals representative of a location of the touches on the plane of the touch panel for each of the multiple touches, wherein the transparent capacitive sensing medium comprises:

a first layer having a plurality of transparent first conductive lines that are electrically isolated from one another; and

a second layer spatially separated from the first layer and having a plurality of transparent second conductive lines that are electrically isolated from one another, the second conductive lines being positioned transverse to the first conductive lines, the intersection of transverse lines being positioned at different locations in the plane of the touch panel, each of the second conductive lines being operatively coupled to capacitive monitoring circuitry;

wherein the capacitive monitoring circuitry is configured to detect changes in charge coupling between the first conductive lines and the second conductive lines.

Claim 8 (original): The touch panel as recited in claim 7 wherein the conductive lines on each of the layers are substantially parallel to one another.

Claim 9 (original): The touch panel as recited in claim 8 wherein the conductive lines on different layers are substantially perpendicular to one another.

Claim 10 (currently amended): The touch panel as recited in claim 7 wherein the transparent first conductive lines of the first layer are disposed on a first glass member, and wherein the transparent second conductive lines of the second layer are disposed on a second glass member, the first glass member being disposed over the second glass member.

Claim 11 (original): The touch panel as recited in claim 10 further including a third glass member disposed over the first glass member, the first and second glass members being attached to one another via an adhesive layer, the third glass member being attached to the first glass member via another adhesive layer.

Claim 12 (original): The touch panel as recited in claim 7 wherein the conductive lines are formed from indium tin oxide (ITO).

Claims 13 and 14 (canceled)

Claim 15 (currently amended): ~~The display arrangement as recited in claim 13~~A display arrangement comprising:

a display having a screen for displaying a graphical user interface; and  
a transparent touch panel allowing the screen to be viewed therethrough and capable of recognizing multiple touch events that occur at different locations on the touch panel at a same time and to output this information to a host device to form a pixilated image;

wherein the touch panel includes a multipoint sensing arrangement configured to simultaneously detect and monitor the touch events and a change in capacitive coupling associated with those touch events at distinct points across the touch panel; and

wherein the multipoint sensing arrangement provides a plurality of transparent capacitive sensing nodes that work independent of one another and that represent different points on the touch ~~screen~~panel.

Claim 16 (original): The display arrangement as recited in claim 15 wherein the capacitive sensing nodes are formed with a transparent conductive medium.

Claim 17 (original): The display arrangement as recited in claim 16 wherein the transparent conductive medium corresponds to indium tin oxide (ITO).

Claim 18 (original): The display arrangement as recited in claim 16 wherein the capacitive sensing nodes are based on self capacitance.

Claim 19 (currently amended): The display arrangement as recited in claim 18 wherein the transparent conductive medium is patterned into electrically isolated electrodes and traces, each electrode representing a different coordinate in the plane of the touch ~~screen~~panel, and the traces connecting the electrodes to a capacitive sensing circuit.

Claim 20 (original): The display arrangement as recited in claim 16 wherein the capacitive sensing nodes are based on mutual capacitance.

Claim 21 (currently amended): The display arrangement as recited in claim ~~[[18]]~~20 wherein the transparent conductive medium is patterned into a group of spatially separated lines formed on two different layers, driving lines are formed on a first layer and sensing lines are formed on a second layer, the sensing lines being configured to traverse across the driving lines in order to form a capacitive sensing node, the driving lines being connected to a voltage source and the sensing lines being connected to a capacitive sensing circuit, the voltage source driving a current through one driving line at a time and because of capacitive coupling, the current is carried through to the sensing lines at each of the capacitive sensing nodes.

Claim 22 (original): The display arrangement as recited in claim 16 wherein the capacitive sensing nodes are coupled to a capacitive sensing circuit, and wherein the capacitive sensing circuit monitors changes in capacitance that occurs at each of the capacitive sensing nodes, the position where changes occur and the magnitude of those changes being used to help recognize the multiple touch events.

Claim 23 (currently amended): The display arrangement as recited in claim 22 wherein the capacitive sensing circuit comprises:

a multiplexer (MUX) that receives signals from each of the capacitive sensing nodes at the same time, stores all the signals and sequentially releases the signals one at a time through an output channel;

an analog to digital converter operatively coupled to the MUX through the output channel, the analog to digital converter being configured to convert the ~~incoming analog~~ signals into outgoing digital signals;

a digital signal processor (DSP) operatively coupled to the analog to digital converter, the DSP filtering noise events from ~~the raw data~~, calculating ~~the touch boundaries~~ for each touch event that occurs on the touch ~~screen~~panel at the same time and thereafter determining the coordinates for each touch event.

Claim 24 (currently amended): ~~The display arrangement as recited in claim 13-A~~ display arrangement comprising:

a display having a screen for displaying a graphical user interface; and

a transparent touch panel allowing the screen to be viewed therethrough and capable of recognizing multiple touch events that occur at different locations on the touch panel at a same time and to output this information to a host device to form a pixilated image;

wherein the touch panel includes a multipoint sensing arrangement configured to simultaneously detect and monitor the touch events and a change in capacitive coupling associated with those touch events at distinct points across the touch panel; and

wherein the touch panel comprises:

a glass member disposed over the screen of the display;

a transparent conductive layer disposed over the glass member, the conductive layer including a pixilated array of electrically isolated electrodes;

a transparent cover sheet disposed over the ~~electrode~~conductive layer; and  
one or more sensor integrated circuits operatively coupled to the electrodes.

Claim 25 (currently amended): ~~The display arrangement as recited in claim 13-A~~  
display arrangement comprising:

a display having a screen for displaying a graphical user interface; and  
a transparent touch panel allowing the screen to be viewed therethrough and capable of  
recognizing multiple touch events that occur at different locations on the touch panel at a same  
time and to output this information to a host device to form a pixilated image;

wherein the touch panel includes a multipoint sensing arrangement configured to  
simultaneously detect and monitor the touch events and a change in capacitive coupling  
associated with those touch events at distinct points across the touch panel; and

wherein the touch panel comprises:

a first glass member disposed over the screen of the display;

a first transparent conductive layer disposed over the first glass member, the first transparent conductive layer comprising a plurality of spaced apart parallel lines having the same pitch and linewidths;

a second glass member disposed over the first transparent conductive layer;

a second transparent conductive layer disposed over the second glass member, the second transparent conductive layer comprising a plurality of spaced apart parallel lines having the same pitch and linewidths, the parallel lines of the second transparent conductive layer being substantially perpendicular to the parallel lines of the first transparent conductive layer;

a third glass member disposed over the second transparent conductive layer; and  
one or more sensor integrated circuits operatively coupled to the lines.

Claim 26 (original): The display arrangement as recited in claim 25 further including dummy features disposed in the space between the parallel lines, the dummy features optically improving the visual appearance of the touch screen by more closely matching the optical index of the lines.

Claims 27-31 (canceled)

Claim 32 (previously presented): The touch panel as recited in claim 1, further comprising a virtual ground charge amplifier coupled to the touch panel for detecting the touches on the touch panel.

Claim 33 (previously presented): The touch panel as recited in claim 1, the transparent capacitive sensing medium formed on a single side of a substrate.

Claim 34 (previously presented): The touch panel as recited in claim 1, the transparent capacitive sensing medium formed on a transparent substrate.

Claim 35 (previously presented): The touch panel as recited in claim 34, wherein the transparent substrate is formed from glass.

Claim 36 (previously presented): The touch panel as recited in claim 7, wherein the capacitive sensing medium is a mutual capacitance sensing medium.

Claim 37 (previously presented): The touch panel as recited in claim 7, the transparent capacitive sensing medium formed on both sides of a single substrate.

Claim 38 (previously presented): The touch panel as recited in claim 36, further comprising a virtual ground charge amplifier coupled to the touch panel for detecting the touches on the touch panel.

Claim 39 (previously presented): A touch panel having a transparent capacitive sensing medium configured to detect multiple touches or near touches that occur at a same time and at distinct locations in a plane of the touch panel and to produce distinct signals representative of a location of the touches on the plane of the touch panel for each of the multiple touches;

wherein the transparent capacitive sensing medium comprises a transparent electrode layer, the electrode layer including a plurality of electrically isolated electrodes and electrode traces formed from a transparent conductive material, each of the electrodes being placed at different locations in the plane of the touch panel, each of the electrodes operatively couplable to capacitive monitoring circuitry.

Claim 40 (previously presented): The touch panel as recited in claim 39, further comprising a virtual ground charge amplifier coupled to the touch panel for detecting the touches on the touch panel.

Claim 41 (previously presented): The touch panel as recited in claim 39, the transparent capacitive sensing medium formed on a single side of a substrate.

Claim 42 (previously presented): The touch panel as recited in claim 39, the transparent capacitive sensing medium formed on a transparent substrate.

Claim 43 (previously presented): The touch panel as recited in claim 42, wherein the transparent substrate is formed from glass.

Claim 44 (previously presented): The touch panel as recited in claim 39, wherein the capacitive sensing medium is a mutual capacitance sensing medium.

Claim 45 (previously presented): The touch panel as recited in claim 39, the transparent capacitive sensing medium formed on both sides of a single substrate.

Claim 46 (currently amended): ~~The display arrangement as recited in claim 13,~~ A display arrangement comprising:

a display having a screen for displaying a graphical user interface; and

a transparent touch panel allowing the screen to be viewed therethrough and capable of recognizing multiple touch events that occur at different locations on the touch panel at a same time and to output this information to a host device to form a pixilated image;

wherein the touch panel includes a multipoint sensing arrangement configured to simultaneously detect and monitor the touch events and a change in capacitive coupling associated with those touch events at distinct points across the touch panel; and

further comprising a virtual ground charge amplifier coupled to the touch panel for detecting the touch events on the touch panel.

Claims 47-50 (canceled)

VIA EFS  
Docket No.: 106842009000  
Client Ref. P3266US1  
(PATENT)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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In re Patent Application of:  
Steve HOTELLING et al.

Application No.: 10/840,862

Confirmation No.: 8470

Filed: May 6, 2004

Art Unit: 2629

For: MULTI-POINT TOUCHSCREEN

Examiner: Kimnhung T. Nguyen

**AMENDMENT UNDER 37 CFR 1.111**

MS Amendment  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Dear Madam:

**INTRODUCTORY COMMENTS**

This is in response to the non-final Office Action dated June 2, 2009, for which a response is due on September 2, 2009. Reconsideration and allowance of the pending claims, as amended, in light of the remarks presented herein are respectfully requested.

There are no amendments to the specification or drawings.

**Amendments to the Claims** are reflected in the listing of claims which begins on page 2 of this paper.

**Remarks/Arguments** begin on page 11 of this paper.

**REMARKS**

Claims 1, 2, 4-13, 15-26 and 32-50 were pending in the application, with claims 27, 28, 30 and 31 previously withdrawn from consideration, and claims 3, 14 and 29 previously canceled. Claims 13 and 47-50 were rejected under 35 U.S.C. §103(a) as being unpatentable over Hsu et al. in view of Fujimoto. Claims 1, 2, 4-12 and 32-45 have been allowed. Claims 24-26 and 46 were objected to as being dependent upon a rejected base claim, but were indicated to be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Claims 10, 15, 19, 21, 23, 24, 25 and 46 have been amended, and claims 13, 27, 28, 30, 31 and 47-50 have been canceled, leaving claims 1, 2, 4-12, 15-26 and 32-46 presently under consideration. Reexamination and reconsideration of the application in view of the amendments and following remarks is respectfully requested.

**Claims 13 and 47-50 were rejected under 35 U.S.C. §103(a) as being unpatentable over Hsu in view of Fujimoto.** Claims 13 and 47-50 have now been canceled, making their rejections moot.

**Claims 1, 2, 4-12 and 32-45 have been allowed.** The Applicants thank the Examiner for the indication of allowable subject matter.

**Claims 24-26 and 46 were objected to as being dependent upon a rejected base claim, but were indicated to be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.** Claims 24, 25 and 46 have been amended to independent form, including all of the limitations of the base claim (claim 13). There were no intervening claims. As such, claims 24-26 and 46 are now allowable.

**Claims 27, 28, 30 and 31 had been previously withdrawn from consideration.** Claims 27, 28, 30 and 31 have now been canceled.

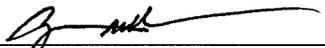
In view of the above, each of the presently pending claims in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to

withdraw the outstanding rejection of the claims and to pass this application to issue. If it is determined that a telephone conference would expedite the prosecution of this application, the Examiner is invited to telephone the undersigned at the number given below.

In the event the U.S. Patent and Trademark Office determines that an extension and/or other relief is required, applicant petitions for any required relief including extensions of time and authorizes the Commissioner to charge the cost of such petitions and/or other fees due in connection with the filing of this document to Deposit Account No. 03-1952 referencing Docket No. 106842009000.

Dated: July 1, 2009

Respectfully submitted,

By   
\_\_\_\_\_  
Glenn M. Kubota  
Registration No.: 44,197  
MORRISON & FOERSTER LLP  
555 West Fifth Street, 35<sup>th</sup> Floor  
Los Angeles, CA 90013-1024  
(213) 892-5752

## Electronic Acknowledgement Receipt

<b>EFS ID:</b>	5629103
<b>Application Number:</b>	10840862
<b>International Application Number:</b>	
<b>Confirmation Number:</b>	8470
<b>Title of Invention:</b>	Multipoint touchscreen
<b>First Named Inventor/Applicant Name:</b>	Steve Hotelling
<b>Customer Number:</b>	69753
<b>Filer:</b>	Glen Masashi Kubota/Lisa Bronk
<b>Filer Authorized By:</b>	Glen Masashi Kubota
<b>Attorney Docket Number:</b>	106842009000
<b>Receipt Date:</b>	01-JUL-2009
<b>Filing Date:</b>	06-MAY-2004
<b>Time Stamp:</b>	17:21:07
<b>Application Type:</b>	Utility under 35 USC 111(a)

### Payment information:

Submitted with Payment	no
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### File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Miscellaneous Incoming Letter	2009000TRANS.pdf	39778 <small>1c5f4752ce8aa77a9db2f9264976d40f40d03af9</small>	no	1

### Warnings:

### Information:

2		2009000AMEND.pdf	487403	yes	12
			f532c1df41dc0b14e416ff4532ea4df2984d778b		

<b>Multipart Description/PDF files in .zip description</b>			
	<b>Document Description</b>	<b>Start</b>	<b>End</b>
	Amendment/Req. Reconsideration-After Non-Final Reject	1	1
	Claims	2	10
	Applicant Arguments/Remarks Made in an Amendment	11	12

**Warnings:**

**Information:**

<b>Total Files Size (in bytes):</b>	527181
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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.**

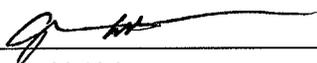
**National Stage of an International Application under 35 U.S.C. 371**  
**If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application 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.**

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

<b>TRANSMITTAL FORM</b>  <i>(to be used for all correspondence after initial filing)</i>	Application Number	10/840,862
	Filing Date	May 6, 2004
	First Named Inventor	Steve HOTELLING
	Art Unit	2629
	Examiner Name	Kimnhung T. Nguyen
Total Number of Pages in This Submission	13	Attorney Docket Number <b>106842009000</b> <b>Client Ref. P3266US1</b>

<b>ENCLOSURES (Check all that apply)</b>				
<input type="checkbox"/> Fee Transmittal Form <input type="checkbox"/> Fee Attached <input checked="" type="checkbox"/> Amendment/Reply <input type="checkbox"/> After Final <input type="checkbox"/> Affidavits/declaration(s) <input type="checkbox"/> Extension of Time Request <input type="checkbox"/> Express Abandonment Request <input type="checkbox"/> Information Disclosure Statement <input type="checkbox"/> Certified Copy of Priority Document(s) <input type="checkbox"/> Reply to Missing Parts/Incomplete Application <input type="checkbox"/> Reply to Missing Parts under 37 CFR 1.52 or 1.53	<input type="checkbox"/> Drawing(s) <input type="checkbox"/> Licensing-related Papers <input type="checkbox"/> Petition <input type="checkbox"/> Petition to Convert to a Provisional Application <input type="checkbox"/> Power of Attorney, Revocation Change of Correspondence Address <input type="checkbox"/> Terminal Disclaimer <input type="checkbox"/> Request for Refund <input type="checkbox"/> CD, Number of CD(s) _____ <input type="checkbox"/> Landscape Table on CD	<input type="checkbox"/> After Allowance Communication to TC <input type="checkbox"/> Appeal Communication to Board of Appeals and Interferences <input type="checkbox"/> Appeal Communication to TC (Appeal Notice, Brief, Reply Brief) <input type="checkbox"/> Proprietary Information <input type="checkbox"/> Status Letter <input type="checkbox"/> Other Enclosure(s) (please identify below):		
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50px; text-align: center;">Remarks</td> <td style="height: 40px;"></td> </tr> </table>			Remarks	
Remarks				

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT			
Firm Name	MORRISON & FOERSTER LLP (Customer No. 69753)		
Signature			
Printed name	Glenn M. Kubota		
Date	July 1, 2009	Reg. No.	44,197

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

<b>PATENT APPLICATION FEE DETERMINATION RECORD</b> Substitute for Form PTO-875	Application or Docket Number <b>10/840,862</b>	Filing Date <b>05/06/2004</b>	<input type="checkbox"/> To be Mailed
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APPLICATION AS FILED – PART I			OTHER THAN				
FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY <input type="checkbox"/>	OR	SMALL ENTITY	RATE (\$)	FEE (\$)
<input type="checkbox"/> BASIC FEE <small>(37 CFR 1.16(a), (b), or (c))</small>	N/A	N/A				N/A	
<input type="checkbox"/> SEARCH FEE <small>(37 CFR 1.16(k), (l), or (m))</small>	N/A	N/A				N/A	
<input type="checkbox"/> EXAMINATION FEE <small>(37 CFR 1.16(o), (p), or (q))</small>	N/A	N/A				N/A	
TOTAL CLAIMS <small>(37 CFR 1.16(i))</small>	minus 20 =	*				X \$ =	
INDEPENDENT CLAIMS <small>(37 CFR 1.16(h))</small>	minus 3 =	*				X \$ =	
<input type="checkbox"/> APPLICATION SIZE FEE <small>(37 CFR 1.16(s))</small>	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$250 (\$125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						
<input type="checkbox"/> MULTIPLE DEPENDENT CLAIM PRESENT <small>(37 CFR 1.16(j))</small>							
* If the difference in column 1 is less than zero, enter "0" in column 2.						TOTAL	

APPLICATION AS AMENDED – PART II					OTHER THAN			
	(Column 1)	(Column 2)	(Column 3)	SMALL ENTITY	OR	SMALL ENTITY	RATE (\$)	ADDITIONAL FEE (\$)
<b>AMENDMENT</b>	<b>07/01/2009</b>	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA			RATE (\$)	ADDITIONAL FEE (\$)
	Total <small>(37 CFR 1.16(i))</small>	* 38	Minus	** 47	=	0	X \$ =	0
	Independent <small>(37 CFR 1.16(h))</small>	* 7	Minus	***7	=	0	X \$ =	0
	<input type="checkbox"/> Application Size Fee <small>(37 CFR 1.16(s))</small>							
<input type="checkbox"/> FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM <small>(37 CFR 1.16(j))</small>								
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.							TOTAL ADD'L FEE	0

	(Column 1)	(Column 2)	(Column 3)	SMALL ENTITY	OR	SMALL ENTITY	RATE (\$)	ADDITIONAL FEE (\$)
<b>AMENDMENT</b>		CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA			RATE (\$)	ADDITIONAL FEE (\$)
	Total <small>(37 CFR 1.16(i))</small>	*	Minus	**	=		X \$ =	
	Independent <small>(37 CFR 1.16(h))</small>	*	Minus	***	=		X \$ =	
	<input type="checkbox"/> Application Size Fee <small>(37 CFR 1.16(s))</small>							
<input type="checkbox"/> FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM <small>(37 CFR 1.16(j))</small>								
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.							TOTAL ADD'L FEE	
** 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.								

Legal Instrument Examiner:  
 /WANDA D. MITCHELL/

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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## Electronic Acknowledgement Receipt

<b>EFS ID:</b>	5835267
<b>Application Number:</b>	10840862
<b>International Application Number:</b>	
<b>Confirmation Number:</b>	8470
<b>Title of Invention:</b>	Multipoint touchscreen
<b>First Named Inventor/Applicant Name:</b>	Steve Hotelling
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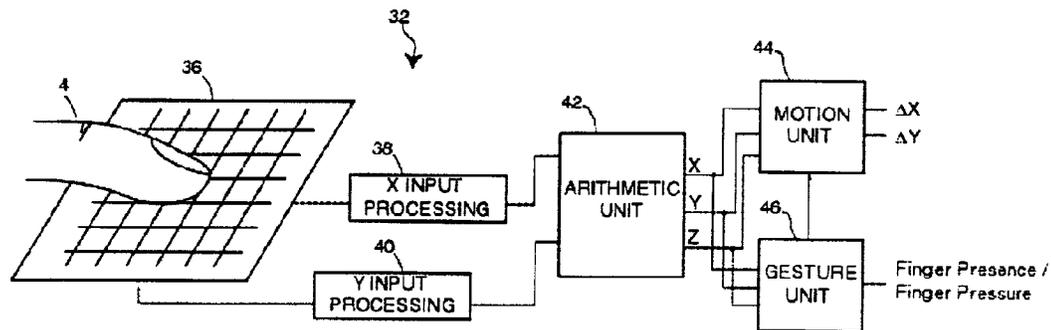
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(54) Title: A FLEXIBLE TRANSPARENT TOUCH SENSING SYSTEM FOR ELECTRONIC DEVICES



(57) Abstract: A transparent, capacitive sensing system particularly well suited for input to electronic devices is described. The sensing system can be used to emulate physical buttons or slider switches that are either displayed on an active display device or printed on an underlying surface. The capacitive sensor can further be used as an input device for a graphical user interface, especially if overlaid on top of an active display device like an LCD screen to sense finger position (X/Y position) and contact area (Z) over the display. In addition, the sensor can be made with flexible material for touch sensing on a three-dimensional surface. Because the sensor is substantially transparent, the underlying surface can be viewed through the sensor. This allows the underlying area to be used for alternative applications that may not necessarily be related to the sensing system. Examples include advertising, an additional user interface display, or apparatus such as a camera or a biometric security device.

WO 01/027868 A1

**A FLEXIBLE TRANSPARENT TOUCH SENSING SYSTEM  
FOR ELECTRONIC DEVICES**

5

**BACKGROUND OF THE INVENTION**

**Field of the Invention**

10           The present invention relates to touch sensing transducers and systems. More particularly, the present invention relates to flexible and transparent object position recognition devices useful in applications such as cursor movement and user input for computing devices and other applications.

15           **Description of the Related Field**

          Touch sensing technology can be used to provide a variety of input to electronic devices, from emulating physical buttons or slider switches to more sophisticated recognition of patterns or gestures. For example, United States Patent No. 5,880,411 to Gillespie, which is hereby  
20           incorporated in its entirety for its teaching of touch sensor technology, discloses a capacitive sensor trace array object position detector with edge motion feature and gesture recognition. United States Patent No. 5,305,017 to Gerpheide teaches an object position detector using capacitive sensing and is also incorporated in its entirety by reference for  
25           its teaching of touch sensor technology. Another example of capacitive touchpads is United States Patent No. 5,543,588 to Bisset.

          However, in many applications it is desirable to display the surface underlying the touchpad. For example, the touchpad can be overlaid on an active display such as a LCD or CRT screen to facilitate input to a  
30           graphical user interface (GUI). Alternatively, it may be desired to have

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the underlying surface display static information such as a button pattern to guide user input or advertising. Neither Gillespie nor Bisset disclose or suggest the ability to display a surface underlying the touchpad sensor.

The general strategy employed by the prior art to provide

5 transparent touch sensing technology for portable devices utilizes a resistive pad. A typical resistive pad consists of two substantially transparent substrates separated by a thin air gap, typically about 0.006 inches. One substrate is deformable, such as a polyester film, while the other is typically rigid, such as glass or polycarbonate plastic. Both

10 substrates are coated with a substantially transparent, conductive coating like Indium Tin Oxide on the surface where they face one another. On the ITO-coated surfaces, one substrate contains conductors at its left and right edges while the other substrate contains conductors at its top and bottom. To measure position in one axis, a voltage gradient is applied to

15 one set of conductors while voltage is measured on the other set. When an object deforms the resistive pad so that one substrate contacts the other, the point of contact will contain a voltage proportional to the distance from the conductor where the voltage was applied. To measure position in the other axis, the conductors for voltage application and

20 measurement are switched.

There are other variations of the previously described 4 wire resistive pad sensors. One example is a 5-wire design which alternately applies an X-axis, than Y-axis voltage gradient to the one layer and then uses the second layer simply to sense voltage.

25 Different prior art techniques deal with the difficulty of maintaining a constant air gap between the two ITO layers and the stretching of the deformable substrate as it wears. For example, substantially transparent dielectric spacer dots, usually about 0.010" in diameter, can be arranged in a regular, grid-like fashion over one of the ITO surfaces. These dots

30 help maintain the air gap to prevent the two ITO layers from accidentally

contacting. Further, the dots help counteract the decreasing performance of the deformable substrate as it wears and stretches. However, the use of these spacer dots generally reduces the resolution of the touchpad, as not all locations of such a resistive pad will necessarily generate a signal  
5 when the two substrates come in contact.

In addition to the resistive pad technologies, other examples of prior art include capacitance based technologies, stylus based technologies and pressure actuation technologies. Prior art capacitive touchpads such as United States Patent Nos. 5,457,289 to Huang and  
10 4,806,709 and 4,733,222 to Evans suffer from various drawbacks of their own. For example, Huang requires frontal shielding for its capacitive touch sensor system and the Evans '709 requires a uniformly electrically conductive surface. Stylus based pads such as United States Patent Nos. 5,381,160 to Landmeir and 4,945,348 to Ibamoto require an  
15 electromagnetic tool to provide input. Finally, pressure actuated touchpads such as United States Patent No. 4,484,038 to Dorman and 3,757,322 to Barkan have moving parts and thus suffer from drawbacks similar to the resistive pad technologies.

## 20 SUMMARY OF THE INVENTION

The invention is a capacitive sensor system comprising a sensor trace and a processor configured to detect capacitance changes in the sensor trace to determine proximity of a conductive object. Preferably, the sensor trace is a part of a first plurality of sensor traces oriented in a  
25 first direction and the processor detects capacitance changes in the sensor traces to determine proximity and positioning of the finger in the first dimension. More preferably, the system further comprises a second plurality of sensor traces oriented in a second dimension, wherein the processor is further configured to detect capacitance changes in the first  
30 plurality of sensor traces and the second plurality of sensor traces to

determine proximity and positioning of the conductive object along the first and second dimensions. The preferred conductive object for this invention is a human finger, but a conductive stylus or other suitable device can be used as well.

5           To maximize transparency, the sensor system should have a uniform density of sensor traces. Thus, preferred configurations minimize the overlap of the first plurality and the second plurality of sensor traces. For example, each sensor trace may be configured as a series of diamond shapes aligned along a common axis. Accordingly, each plurality of  
10 sensor traces thus creates a pattern of diamond shaped open spaces. By positioning the first plurality of sensor traces over the second plurality so that the diamond shaped sensor traces fall over the diamond shaped open spaces, the amount of overlap between the each plurality of sensor traces is minimized. Transparency is also maximized by utilizing materials  
15 having similar indices of refraction.

A primary object of this invention is a positioning system that uses a low-cost, highly integrated, low power, capacitive transparent sensor. This invention is suitable for many handheld electronic applications such as, but not limited to, cell phones, pagers, personal digital assistants,  
20 remote controls, and computers. Non-handheld devices that require a positioning system with a thin transparent sensor are also appropriate for this invention. Preferably, the sensor system is equipped with a processor capable of recognizing gestures such as tapping or dragging to increase the flexibility of user input.

25           The current invention described offers a number of advantages over resistive pads and the other prior art technologies. First, this art is rugged. Its performance will not degrade over time and is not subject to mechanical wear and stress, being completely solid state and having no moving parts. Because this art does not rely on deforming a substrate,  
30 the sensor can be activated with no actuation force. Second, the

resolution of sensing is determined by the density of sensor traces and the precision of the A/D converters in the processor, not the physical properties of the materials as in resistive pads. Thus, very high positioning accuracy can be achieved. Because the current invention does not require an air gap to be maintained between the sensing layers, positioning performance is hardly affected by mechanical damage or environmental conditions such as temperature, humidity or power supply voltage. Consequently, the positioning capabilities of this art require little to no user calibration. Furthermore, the lack of an air gap, with an index of refraction much different than the substrate layers, allows this art to achieve greater transparency. Finally, the ability to use flexible substrate material to build the sensor facilitates the integration of this art onto devices that require a touch-sensing system on a curved, three-dimensional surface. Alternatively, the sensor array itself can be directly applied to a rigid, curved three-dimensional surface without the requirement of a flexible substrate.

#### **BRIEF DESCRIPTION OF THE DRAWINGS**

FIG. 1 shows a schematic representation of a proximity transparent capacitive sensing system of the present invention.

FIG. 2 shows a cross sectional view of the embodiment of the proximity and one-dimensional sensor transducer shown in Fig. 1.

FIG. 3 shows a schematic representation of a one-dimensional transparent capacitive sensing system of the present invention.

FIG. 4 shows a schematic representation of a two-dimensional transparent capacitive sensing system of the present invention.

FIG. 5A is a top view of the X sensor array in the embodiment shown in FIG. 4.

FIG. 5B is a top view of the Y sensor array in the embodiment shown in FIG. 4.

FIG. 5C is a top view of the combined X and Y sensor arrays in the embodiment shown in FIG. 4.

FIG. 6 is a cross sectional view of a two-dimensional sensor transducer embodiment of the invention with a transparent ground plane to shield X and Y trace arrays from electrical noise that might arise  
5 beneath the sensor.

FIG. 7 is a cross sectional view of an alternate embodiment of the two-dimensional sensor transducer of the invention.

FIG. 8 is a cross sectional view of a two-dimensional transparent sensor transducer embodiment of the invention that allows use of a  
10 conductive stylus in addition to finger for input.

FIG. 9 is a cross sectional view of a two-dimensional sensor transparent transducer embodiment of the invention that allows use of any general stylus in addition to finger for input.

15

#### **DETAILED DESCRIPTION OF THE INVENTION**

Figure 1 is a schematic representation of a preferred embodiment of the invention, comprising a 0-dimensional, capacitive proximity sensing system 2. System 2 accurately determines the proximity and contact of  
20 finger 4 or any other conductive object to the sensor 6. Capacitance changes induced by finger 4 on the sensor trace in the sensor 6 are digitized by the input processing block 8. The digitized values of capacitance values are processed by arithmetic unit 10 and then decoded by gesture unit 12 to determine if a finger was present. Gesture unit 12  
25 also processes input signals to determine the difference between constant finger contact and a finger tap. Blocks 8-12 may also incorporate methods to suppress electrical noise that may be sensed by sensor 6. Suitable means of implementing this sensor include the technologies described in United States Patent Nos. 5,880,411 and  
30 5,305,017, which were incorporated in their entirety by reference thereto

above for these teachings. Other means of capacitive sensing technology known to those of skill in the art are also suitable.

The sensor trace in sensor 6 must be designed so that the trace provides adequate capacitive coupling to the finger. In the preferred embodiment, the sensor trace is a thin line of conductor that is drawn to the location where the finger is designed to contact. At this preferred contact area, the trace widens to a square or a circle approximately the dimensions of a typical fingerprint. This ensures that adequate capacitive coupling will occur between the sensor and the finger. Non-visible portions of the sensor can optionally be drawn with an opaque conductor with better handling properties and lower resistance. Examples of an opaque conductor include, but are not limited to, silver ink and conductive carbon ink.

Figure 2 is a cross sectional view of the preferred embodiment of the capacitive sensor 6 (and also one-dimensional capacitive sensor 20 described below). A top transparent and electrically insulating substrate 52 is adhered with an optically transparent and electrically insulating adhesive 54 to another transparent, electrically insulating substrate 58 that is coated with a transparent conductor 56. Typically, the substantially transparent conductor 56 is deposited onto the substrate 58 either by a sputtering process or by a printing method. The pattern of the transparent conductor trace 56 can be done by a photoresist and acid-etch process. Alternatively, conductor 56 may be selectively coated, either by sputtering or printing, onto a negative pattern overlaying the substrate 58. Then, removing the negative pattern leaves the appropriate transparent conductor trace pattern. Because sensor 6 only detects contact and proximity, only one sensor trace and one conductor layer is needed.

Examples of transparent, electrically insulating substrates 52 and 58 include, but are in no way limited to, polyester film, glass, and

polycarbonate plastic. One example of a transparent, electrically insulating adhesive is 3M #8142. Examples of substantially transparent conductors include, but are not limited to, Indium Tin Oxide (ITO), transparent conductive plastic, and silver, gold, aluminum alloys. Those skilled in the art will recognize that no material is completely transparent. To improve transparency of the sensor a number of techniques can be utilized. First, substrates 52 and 58 and adhesive 54 can be chosen to have similar indices of refraction. This improves transparency by minimizing the distorting effects of light traveling through materials of different refraction indices. Second, employing the sensing art described U.S. Patent No. 5,880,411 allows the use of high impedance output drivers. Hence, the resistivity of transparent conductor layer 56 can be relatively high and still be usable with such a sensing system. A high resistivity such as, but not limited to, 300  $\Omega$ /square increases transparency of the substantially transparent conductor layer 56.

Layer 60 shows the location of an opaque substrate that would be viewable through transparent layers 52-58. Examples of such a substrate include, but are not limited to, a graphical display device such as, but not limited to a Liquid Crystal Display (LCD) or Cathode Ray Tube (CRT), artwork, or additional electronics such as a fingerprint recognizer. In some embodiments, layer 60 may be omitted altogether. Alternatively, substrate 58 can be omitted and transparent conductor 56 can be patterned directly on layer 60.

In yet other alternative embodiments, layers 52-58 can be reversed without loss of functionality. Furthermore, adhesive 54 can be eliminated so long as substrate 52 is electrically insulating and self-adhering to conductor 56. One example of a self-adhering, transparent, electrically insulating substrate is transparent-coat paint.

Figure 3 shows a schematic representation of a one-dimensional position sensing system 16. Such a system can detect not just finger

contact (like proximity sensing system 2), but also the location of a finger 4 or other conductive object along the direction of the sensor trace array. In Figure 3, sensor 20 contains a plurality of traces oriented along one direction, such as the Y axis, allowing sensing system 16 to determine the position of finger 4 along that direction. Finger location is computed by measuring the capacitance of the traces and then computing finger position based on the increase in capacitance in traces covered or near the finger. Specifically, Y input processing block 22 measures trace capacitance simultaneously in all sensor traces, and digitizes the analog capacitance values. These values are then converted to position and pressure information in arithmetic block 24. Next, position and pressure data are fed into a motion block 26 and gesture block 28. Motion block 26 computes finger motion along the trace array axis based on storing a successive history of finger position values. Gesture block 28 determines if a finger is actually in contact with sensor 20 and whether the finger presence over a short period of time is considered a "tap". If a tap gesture is registered, the gesture unit suppresses the output of the motion unit. Blocks 22-28 also incorporate methods to suppress electrical noise that may be sensed by sensor 20. Suitable algorithms and means for implementing this sensor include the technologies described in United States Patent Nos. 5,880,411 and 5,305,017, incorporated in their entirety by reference thereto as described above. Those skilled in the art will recognize that such algorithms are only illustrative and in no way limiting of the capacitive sensing technology that is possible with this sensor.

The one-dimensional sensor 20 is comprised of a plurality of sensor traces equally spaced along a given axis. To achieve adequate positional resolution, spacing of each sensor trace is typically designed so that a finger 4 covers at least two traces at any given location in the sensing area to allow interpolation between the traces. A higher trace density or

higher precision A/D converters improves the resolution to which sensing system 16 can compute finger position. To maximize capacitive coupling between a trace and a finger, a trace is typically made as wide as possible (for example, slightly less than a trace spacing) without touching neighboring traces. As described above with respect to the proximity sensing system 2, non-visible portions of the sensor can optionally be drawn with an opaque conductor.

A cross-sectional view of one-dimensional position sensor 20 is shown in Figure 2, previously described. In the preferred, but not limiting embodiment, the substrate 58 is uniformly coated with the transparent conductor and then the trace array is patterned using a photoresist and acid-etch process. Alternatively, a negative photoresist pattern can be screened on transparent substrate 62 and 68, the transparent conductor deposited using a sputtering or screening process and then the photoresist pattern removed. As discussed above with respect to the proximity sensing system 2, the stack-up of one-dimensional position sensor 20 comprising layers 52-60 can be reversed and a self-adhering, insulative substrate 52 can obviate the need for adhesive 54.

Figure 4 is a schematic representation of a two-dimensional position sensing system 32. Such a system can determine finger presence as finger position along two direction axes. Finger 4 capacitively couples to sensor traces in sensor 36. X input processing block 38 and Y input processing block 40 measure capacitance values of sensor traces in the X and Y trace arrays and digitize the capacitance values. Arithmetic unit 42 computes position and pressure coordinates based on the digitized capacitance values. Next position and pressure coordinates are fed into motion unit 44 and gesture unit 46. Motion unit 44 computes relative movement of the finger compared to the previous position of the finger. Gesture unit 46 determines the finger presence over time and whether it constitutes a gesture such as a tap. If gesture

unit 46 recognizes a particular gesture, it will suppress the output of the motion unit 44. Blocks 38-46 also incorporate methods to suppress electrical noise that may be sensed by sensor 36. Suitable algorithms and means for implementing this sensor include the technologies  
5 described in United States Patent Nos. 5,880,411 and 5,305,017, incorporated in their entirety by reference thereto as described above. Those skilled in the art will recognize that such algorithms are only illustrative and in no way limiting of the capacitive sensing technology that is possible with this sensor.

10 Figure 5A shows the preferred embodiment for the array of sensor traces used to compute position in the X-axis in sensor 36. Each trace 64 is a transparent conductor, equally spaced on a transparent, electrically insulating substrate 62. Each diamond 66 increases the trace area and also leaves a pattern of diamond-shaped regions containing no  
15 conductive material. Figure 5B is the corresponding preferred embodiment for the array of sensor traces used to compute position in the Y-axis for sensor 36. Each trace 70 is also a transparent conductor, equally spaced on transparent, electrically insulating substrate 68. Diamonds such as diamond 72 increase trace area and leave a diamond-  
20 shaped region where there is no conductive material.

The actual number of sensor arrays and the presence of two axes of sensors will depend on the positioning area and resolution requirements of a particular device. To achieve adequate positional resolution, spacing of each sensor trace is typically designed so that a  
25 finger 4 covers at least two traces in each axis at any given location in the sensing area. A higher trace density or more precise A/D converters improves the resolution that sensing system 32 can compute finger position. In some embodiments of the art, fewer X and Y traces will suffice to achieve the desired sensing resolution. Non-visible portions of

the sensor can optionally be drawn with an opaque conductor such as, but not limited to, silver ink.

In the preferred, but not limiting embodiment, substrates 62 and 68 are uniformly coated with the transparent conductor and then patterned using a photoresist and acid-etch process. Alternately, a negative photoresist pattern can be screened on transparent substrate 62 and 68, the transparent conductor deposited using a sputtering or screening process and then the photoresist pattern removed.

Figure 5C is a top view of sensor 36 with Y-axis traces from substrate 68 on top and X-axis traces from substrate 62 on the bottom. X-traces 66 are positioned so that their trace diamonds 72 fill diamond spaces between the Y axis traces 70. For illustrative purposes, Y-axis trace diamonds 72 are reduced in size to visually distinguish the diamonds in the two different arrays. In the preferred embodiment, these diamonds are enlarged to the size of the spaces between X traces 66 so that sensor 36 appears to have a single uniform layer of transparent conductive material (except for the small regions where an X trace 64 overlaps a Y trace 70). Filling the entire active area with at least one layer of transparent conductor is desirable, but not limiting for the overall transparency of sensor 36 since transparent conductive material such as (but not limited to) Indium Tin Oxide (ITO), gold, and silver are not perfectly transparent. Any region not covered with at least one layer of conductor in sensor 36 may be seen because it will have greater transmissivity compared to a region covered with a conductor.

Figure 5D shows a cross sectional view of the preferred embodiment of two-dimensional sensor 36. This stack-up can be reversed in order without loss of functionality. X-axis transparent, electrically insulating substrate 62 is the top surface that the finger or conductive object touches. The bottom side of the transparent, electrically insulating substrate 62 is the transparent conductor traces 64.

A thin, transparent, preferably adhesive, insulator 74 separates X conductive traces 64 from Y conductive traces 70. Similar to X traces, Y conductive traces are coated on transparent, electrically insulating substrate 68.

- 5           Examples of transparent substrates 62 and 68, insulator 74, and conductive layers 64 and 70 have been described for Figure 2 and are equally applicable for the two-dimensional sensor. Similarly, the same techniques to improve transparency such as, but not limited to, matching indices of refraction among layers, and using a relatively thin layer of
- 10 transparent conductor, can also be applied to the two-dimensional sensor. Similar to Figure 2, layer 60 is an optional opaque layer that can be viewed through the transparent sensor. . In some embodiments, layer 60 may be omitted altogether. Alternatively, in some embodiments, substrate 68 can be omitted and transparent conductor 70 can be
- 15 patterned directly on layer 60.

A number of additional alternative embodiments of the invention are possible. For example, electrical shielding may be required to isolate sensor traces from electrical noise that arises from electrical circuits that are present below the sensor. One preferred, but not limiting  
5 embodiment is shown in Figure 6 on two-dimensional sensor 36. Layers 62-68 are the same art as described in Figure 5D. Beneath transparent substrate 68, another layer of transparent insulator 74 attaches another layer of transparent conductor 78 and substrate 80. Unlike transparent conductor layers 64 and 70, transparent conductor 78 is a uniform layer  
10 of conductor that is connected to an electrical ground. Grounding transparent conductor 78 provides sensor 36 with electrical shielding from electrical noise sources that might radiate from the opaque layer 60 or below. Examples of materials suitable for transparent conductor 78 and substrate 80 have already been described in Figure 2.

15 Adding a transparent ground plane using layers 74-80 can also be applied to the contact and one-dimensional sensor stack-ups shown in Figure 2 if such a layer were inserted between layers 58 and 60.

In yet another embodiment, Figure 7 shows a two-dimensional transparent capacitive sensor 36. Transparent substrate 84 is adhered  
20 using transparent insulator 74 to transparent conductor layer 64. Transparent conductor 64 contains the X trace pattern as shown in Figure 5A and is coated onto transparent substrate 86. On the other surface of transparent substrate 86, transparent conductor layer 70 contains Y trace array shown Figure 5B. Finally, transparent substrate 88  
25 is adhered to transparent conductor 70 with transparent insulator 74. This particular embodiment, with substrate 86 coated on both sides with transparent conductor layers may allow for less error when aligning diamonds in the X trace array and the Y trace array. Because substrate 86 contains both conductor layers 64 and 70, the alignment of trace  
30 arrays can occur prior to the etching/deposition of the trace arrays with

the opaque photoresist pattern, greatly simplifying pattern alignment of X and Y traces. Proper alignment of the X and Y trace arrays is critical to the overall transparency of two-dimensional sensor 36 because the human eye can easily detect any systematic misalignment between the trace array patterns.

Examples of transparent, electrically insulating substrates 84,86, and 88 have been described in previous embodiments of two-dimensional sensor 36 and one-dimensional sensor 20. Additionally, for electrical shielding, transparent substrate 88 can be replaced with layers 78 and 80 as shown in Figure 6.

This invention may also be adapted for use with a stylus in addition to the human finger. One method for doing so is to enlarge the contact area for a conductive stylus until its contact area is similar to that of a finger. This has the obvious disadvantage of the stylus needing to be both conductive and the contact area needing to be large enough to capacitively couple to enough sensor traces. To reduce the contact area of the conductive input, one method is to increase the trace density so that even a fine, pointed conductive stylus can capacitively couple to at least two sensor traces. Alternatively, A/D converter precision can also be increased to detect minute capacitance changes in sensor traces that result from a pointed stylus.

One preferred alternative method that removes the restriction of a large contact area involves a resistive transparent coating applied to the top surface of the sensor array, resulting in the stack-up of layers shown in Figure 8. For two-dimensional position sensor 92, the X and Y trace arrays are identical to that described in Figures 5A, 5B, and 5C. The stack-up of layers 62-68 is identical to that described in Figure 5D. Layer 94 is a rugged, resistive transparent coating that spreads the effective contact area of a pointed stylus, thus allowing a pointed stylus's capacitive coupling to the sensor 92 to be similar to a conductive object

with a larger contact area (such as a finger). Examples of such a layer 94 can be found, but are not limited to, those commonly used for electro-luminescent lighting surfaces. Further details of such a sensing technology can be found in co-pending United States Patent Application  
5 Serial No. 09/176,639.

An approach for a two dimensional sensor that accepts *any* stylus input is to include a transparent, deformable layer sandwiched between the bottom sensor array layer and a ground plane. Figure 9 illustrates the stack up of a preferred but not limiting embodiment of such a sensor 92.  
10 Layers 62-68 are the same as those described for a finger input two-dimensional sensor 36 as described in Figures 5A-D. The only additional requirement for this art is that substrates 62 and 68 be flexible and deformable. An example of such a substrate is, but is not limited to, polyester film.

15 Beneath transparent substrate 68 is transparent insulator 74. This adheres to a transparent, deformable dielectric layer 96. Another layer of transparent insulator 74 adheres deformable layer 96 to a transparent, conductive layer 78 and transparent substrate 80. Transparent substrate 80 is typically made of a rigid material. Examples of such a transparent  
20 rigid substrate include, but are not limited to, glass and polycarbonate plastic. Transparent conductive layer 78 is a uniform layer of transparent conductor that is electrically grounded.

Functionally, a pointed stylus input will deform the X and Y sensors in layers 62-68 as well as layer 96, bringing the point of contact closer to  
25 the ground plane. This deformation increases the capacitive coupling to ground for sensor traces near the point of contact. This capacitance increase is then detected by the sensing electronics. For finger input, capacitance is sensed by sensor layers 62-68 using traditional capacitive means. A detailed description of this art, though not in a transparent

embodiment, can be found in U.S. Patent No. 5,942,733, which is hereby incorporated in its entirety by reference thereto.

Yet another alternative method is to combine the transparent capacitive finger sensor of the present invention with a second  
5 independent stylus input device. For example, a flexible transparent capacitive pad could be overlaid on a conventional resistive pad to provide superior finger sensitivity to that achievable with a resistive pad alone. Or, a transparent capacitive pad could be overlaid on a solid  
10 state sensor such as an inductive stylus sensor (*e.g.*, U.S. Patent No. 4,848,496 to Murakami, hereby incorporated by reference thereto for this teaching) to produce a rugged sensor with high quality finger and stylus performance.

The transparent position sensing system has a number of applications for portable electronic devices. Some examples (but not an  
15 exhaustive list) of applications include:

a) Pointing device for a touchscreen in a handheld electronic device. In the simplest implementation, a transparent two-dimensional capacitive sensor is affixed directly on top of a display device like an LCD screen to detect a finger's location on the display. The X-Y position of a  
20 finger atop the sensor (and thus, the display) can then be fed to the device's main processing unit to control the user interface in the device. Such a user interface could include, but is not limited to, the control of a cursor on the screen, detection of taps for on-screen graphics that represent buttons, control of on-screen scroll bars, pull-down menu  
25 selection, and stroke or gesture recognition for text-entry.

b) Input device for a soft button array or scroll bar. In this application, the transparent sensor covers only the portion of the display device that is dedicated to displaying an array of buttons or a scroll bar. For a scroll bar application or a one-dimensional button array, the  
30 transparent sensor would only contain a plurality of sensor traces in one

axis. By implementing the input device with a transparent sensor, the underlying graphics can change to suit the functionality required by the user interface

5 c) Integration of input devices in a handheld electronic device. For some handheld devices, one surface of the device may contain a display that requires a touch sensitive positioning system while another surface may require a button array. Because this art can be made from transparent, flexible material, the same capacitive sensor could be curved over the handheld device so that one portion of the sensor's trace arrays  
10 covers the display surface while another portion of the sensor serves as the button array on another surface. This could reduce the cost of the handheld device by eliminating the need for additional mechanical contact switches.

15 d) Transparent sensor for portable computer. The transparent nature of the transparent two-dimensional position sensor allows the addition of apparatus for applications such as, but not limited to security and video to be designed into portable personal computers without consuming more real estate than a standard, opaque two-dimensional position sensor. In the case of security applications, the pointing nature  
20 of the touchpad is a logical location to embed a fingerprint-based security system. Other biometric security systems such as a retinal scanner can also be placed underneath the transparent touchpad. The electronic sensor for the biometric system can be located underneath the sensor array (*i.e.* layer 60 in Figures 2 and 5D) and will be minimally affected by  
25 the transparent sensor. Also, the transparent nature of the touchpad is also a reasonable location for a video camera since the touchpad surface protects the camera from the environment

e) Graphic underlays beneath the transparent capacitive sensor (other than a display device). In some applications, the use of a display  
30 device such as an LCD screen may not be necessary or cost-effective. In