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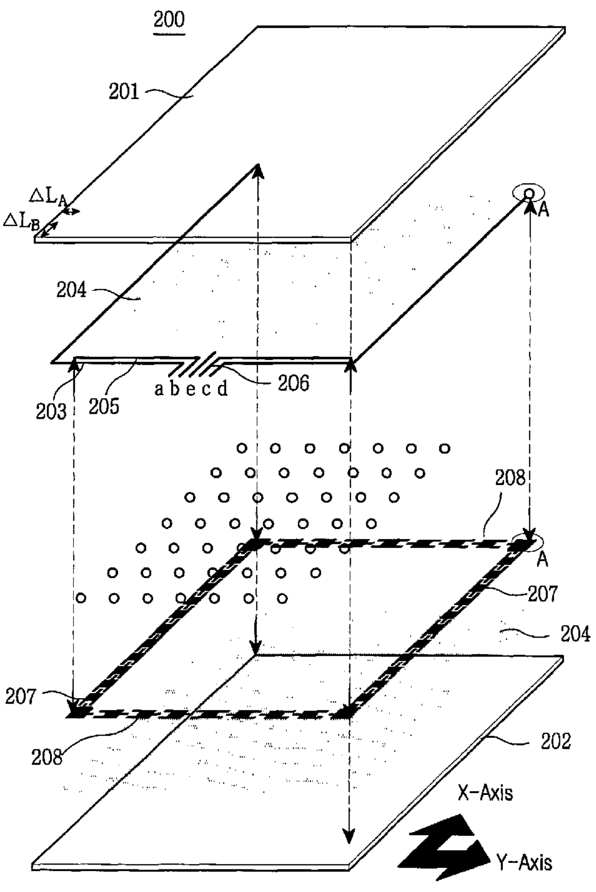
[Continued on next page]

(54) Title: SUBSTRATE WIRING STRUCTURE IN TOUCH PANEL



(57) Abstract: A five-wire resistive touch panel. A lower plate has a lower transparent conductive film and four X-axis and Y-axis potential compensation electrodes with predetermined resistance values arranged on the lower transparent conductive film along X and Y axes. An upper plate has an upper transparent conductive film corresponding to the lower transparent conductive film and a signal applying wire and a signal sensing wire arranged along the X and Y axes, for sensing a position signal from the potential compensation electrodes. Dot spacers are interposed between the upper and lower conductive films in an active region, for isolating the upper and lower conductive films from each other. A contact terminal is disposed along the signal applying wire and the signal sensing wire, for making contact between the signal applying wire and the electrode compensation electrodes.

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— *with international search report*

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SUBSTRATE WIRING STRUCTURE IN TOUCH PANEL

TECHNICAL FIELD

The present invention relates generally to a five-wire resistive touch panel, and in particular, to a wiring structure for plates in a touch panel, in which signal sensing wires and signal applying wires are designed differently in order to provide a wide active region and realize a compact touch panel.

BACKGROUND ART

PCs (Personal Computers), portable transmitting devices, and other personal information processing devices process text and graphic data using a variety of input devices such as keyboards, mouse, and digitizers.

The proliferation of PCs for wide use has brought with it a demand for simpler, more reliable, more user-friendly portable input devices that also allow manual character input, in place of a keyboard and a mouse having limitations in keeping breast of the rapid development of the PCs. At present, interest in such novel input devices is directed toward high reliability, new functions, durability, and fine manufacture technology in material, design and processing, beyond the level of implementing functions for ordinary use.

A major example of those input devices is a touch panel characterized by simplicity, a low probability of malfunction, portability, easy input, and capability of text input without the aid of an additional input device. The detection mechanism, structure and operation of the touch panel are well known.

A resistive touch panel has two resistance component sheets facing each other with spacers interposed. The two sheets are brought into contact by pressure applied onto the upper sheet. In addition to resistive films, touch panels use ultrasonic, optical (infrared), static capacitance, electromagnetic induction and other types of films. They differ in signal amplification, resolution, and difficulty in designing and processing technology. Therefore, they are selectively used considering their durability and cost-effectiveness as well as their optical, electrical, and mechanical characteristics, immunity to environmental changes, and input characteristics.

Resistive touch panels are becoming widespread as an input device in connection with LCDs (Liquid Crystal Displays) for electronic diaries/organizers, PDAs (Personal Digital Assistants), and laptops. The resistive touch panels are designed to be thin, small and lightweight, and operate with low power. The resistive type includes analog touch panels and matrix touch panels. They are comprised of a 0.1 to 0.2mm thick film, a 0.2 to 2mm thick glass sheet, and a 1 to 2mm thick plastic sheet as upper and lower electrodes. According to wiring, the analog touch panels are divided into four-wire, five-wire, and eight-wire touch panels.

A brief description will be made of the basic structure, input position, detection principle, characteristic requirements, linearity, and exterior of a five-wire resistive analog touch panel, particularly user-demanded characteristics and trouble shooting in connection with the present invention.

FIG. 1 is a sectional view of a typical resistive touch panel 10. Referring to FIG. 1, an upper plate 20 as a mobile electrode plate and a lower plate 30 as a fixed electrode plate are matched using a 75 to 200μm thick adhesive 40 in such a way that transparent conductive films 22 of the upper and lower plates 20 and 30 face each other. The upper plate 20 is brought into contact with the lower plate 30 by finger-touch or pen-touch.

A flexible PET (Polyester) film or a thin glass plate 21 is used as the upper plate 20. Use of a thin glass plate with a polarization plate attached thereto reduces surface reflection caused by the optical isotropy of glass. Optically isotropic plastic films are also on the market now but they are yet to be improved in terms of cost, processing, and physical characteristics.

FIGs. 2A, 2B and 2C illustrate the operation of the touch panel shown in FIG. 1. Referring to FIGs. 2A, 2B and 2C, dot spacers 50 are inserted between the upper and lower plates 20 and 30 to space them from each other by a distance of 100 to 300μm. In this structure, an input signal is extracted by a connector tail. When a point A is touched by a finger or a pen B, the upper plate 20 comes into contact with the lower plate 30. and with application of a voltage Vx between electrodes 70 in the lower plate 30, potential gradients are generated on the resistance surface between the electrodes 70. Electrodes 80 in the upper plate 20 read the voltage and then a controller calculates the X-axis position of the touched point A.

A voltage Vy is applied between the electrodes 80 in the upper plate 20 and the electrodes 70 of the lower plate 30 read the voltage. Then, the Y-axis position of the touched point A is obtained and the point A is displayed on the screen. By repeating this procedure at high speed, input positions can be displayed successively so that characters or lines can be written or drawn.

Characteristic requirements are characteristics demanded by users as touch panels are used in a wide variety of equipment. All characteristic requirements cannot be met, especially by use of resistive touch panels alone. Therefore, an optimum touch panel should be chosen according to structure and detection mechanism.

For example, resistive touch panels are suited for daily use due to character input, low-cost and high throughput. Touch panels utilizing acoustic waves are intended for industrial use, considering their durability and optical, insulation characteristics.

LCDs are widely used as a display and divided into a monochrome type and a color type, a transmissive type and a reflective type, or an STN type and a TFT type according to classification criteria. Increased use of TFT LCDs and improved color yield of reflective LCDs have increased a demand for touch panels to be mounted on the LCDs.

A non-active region is defined as the length from the outermost line of a visible area to the periphery of a touch panel. As product miniaturization, the increase of the effective aspect ratio of a display, and the decrease of LCD margin are required, touch panels have problems with the linearity and insulation shield of electrodes and experience noise due to easy introduction of electronic waves and electrostatic electricity.

In other words, while the resistive touch panels are suitable for daily use, they have room for development to come up to performance expectations and meet other characteristic requirements when used together with LCDs.

In particular, the wiring of electrodes in resistive analog touch panels has been developed to four wires, five wires, and eight wires to meet various characteristic requirements.

Four-wire touch panel is simple to manufacture but is vulnerable to damage. Despite relative manufacture difficulty, five-wire touch panel can be operated reliably regardless of film uniformity or damage. Eight-wire touch panel is also difficult to manufacture as compared to the four-wire and five-wire ones but is highly resistant to temperature or humidity. That is, the touch panel has there own advantages and shortcomings.

Now, a description will be made of the structure and operation of a conventional five-wire resistive touch panel designed to meet the afore-stated user requirements in comparison with a four-wire resistive touch panel.

FIGs. 3, 4 and 5 illustrate a conventional resistive touch panel. Referring to FIGs. 3, 4 and 5, a five-wire resistive type touch panel (referred to as touch panel) 100 includes an upper plate 105 and a lower plate 101. The lower plate 101 has a lower transparent conductive film 108 and four position signal applying wires 102 connected to external system connectors. X-axis potential compensation electrodes 103 and Y-axis potential compensation electrodes 104 are formed on the lower transparent conductive film 108. The upper plate 105 has an upper transparent conductive film 108 and a single position signal sensing wire 106 connected to an external system connector, for sensing position signals from the lower plate 101. While a four-wire resistive touch panel has two X- and Y-axis potential compensation wires serving also as X- and Y-axis position signal applying wires on each plate, the five-wire resistive touch panel has the X- and Y-axis potential compensation electrodes 103 and 104 along the four sides of the lower plate 101 and the single position signal sensing wire 106 in the upper plate 105 as shown in FIGs. 4 and 5.

More specifically, the transparent conductive film 108 is mounted on a lower substrate 109 and the potential compensation electrodes 103 and 104 are formed along the four sides of the transparent conductive film 108. To install the position signal applying wires 102 (terminals a to d), an area defined by ΔL_A and ΔL_B is removed from the lower transparent conductive film 108 or an insulation film is formed in that area of the lower transparent conductive film 108.

To additionally implement the function of X- and Y-axis signal application unlike the four-wire touch panel, the potential compensation electrodes 103 and 104 are separately formed on the lower transparent conductive film 108. Therefore, the resistance component between the potential compensation electrodes 103 and 104 depends dominantly on a ratio of the gap between the potential compensation electrodes to the length of an adjacent electrode. This is a design that allows control of the resistance between the potential compensation electrodes 103 and 104. The resistance is set to an appropriate value because too a low resistance value decreases the whole panel resistance, thereby adversely influencing the structure and power consumption of a driving circuit.

The potential compensation electrodes 103 for applying a signal to sense an X-axis coordinate are designed by setting the resistance between the potential compensation electrodes 104 along the Y-axis so that potential is equally distributed in a perpendicular direction to the X-axis when a voltage VH is applied to terminals A and D and a voltage VL is applied to terminals B and C (or the terminals B and C are grounded), as shown in FIG. 4. The potential compensation electrodes 104 for applying a signal to sense a Y-axis coordinate are designed by setting the resistance between the potential compensation electrodes 103 on the X-axis so that potential is equally distributed in a perpendicular direction to the Y-axis when the voltage VH is applied to the terminals A and D and the voltage VL is applied to the terminals B and C (or the terminals B and C are grounded), as shown in FIG. 5.

As illustrated in FIG. 3, the upper plate 105 includes the single position signal sensing wire 106. The position signal sensing wire 106 only senses position signals distributed on the lower plate 101. Therefore, there is no need for forming the position signal sensing wire 106 of a low-resistive metal for sensing a potential signal.

A flexible substrate is usually used for the upper plate 105, and the upper transparent conductive film 108 can be used regardless of sheet resistance, but preferably with 1000Ω/□ (sheet resistance).

The above-described upper and lower plates 105 and 101 are combined to form the touch panel as shown in FIG. 2. The upper and lower plates 105 and 101 are combined with their transparent conductive films 108 facing each other in the same manner as the four-wire resistive touch panel of FIG. 2.

Dot spacers 110 are inserted between the upper and lower transparent conductive films 108 in an active region to isolate them from each other. In the remaining area, use of an adhesive or combination of insulation components isolate the upper and lower plates 105 and 101 from each other.

The thus-constituted five-wire resistive touch panel senses contact and obtains the X and Y coordinates of a touched position in three steps.

Step 1: contact is sensed.

Upon finger-touch or pen-touch, the touch panel 100 senses the touch by applying a voltage between the upper and lower plates 105 and 101 and sensing the presence or absence of current.

Step 2: an X-axis coordinate is sensed.

Equi-potential fields are distributed in parallel to the Y-axis on the lower transparent conductive film 108 according to the sensed touch, and the potential of a finger-touched or pen-touched point P is transferred to the position signal sensing wire 106 via the transparent conductive film 108 between a position P' and the position signal sensing wire 106 (see FIGs. 3 and 5).

Step 3: a Y-axis coordinate is sensed.

Equi-potential fields are distributed in parallel to the X-axis on the lower transparent conductive film 108, and the potential of the finger-touched or pen-touched point P is transferred to the upper plate 105 by contact resistors (see FIGs. 3 and 4).

Here, if the finger touch or pen touch on the touch panel is not sensed, the touch sensing step is repeatedly performed at predetermined intervals.

The typical five-wire resistive touch panel senses pressure applied to the upper plate 105, extracts the X and Y coordinates of the touched position, and displays them in the above-described steps. Therefore, even if the upper plate 105 is partially damaged, which is encountered with the four-wire touch panel, the five-wire resistive touch panel operates normally by damage compensation. This is a characteristic requirement that the five-wire resistive touch panel satisfies unlike four- or eight-wire resistive touch panels.

The technique of realizing a visual representation by pressure sensing in a five-wire resistive touch panel to meet the above characteristic requirement is disclosed in U.S. Patent No. 4,661,655 and U.S. Patent No. 4,933,660. The major feature of this technique is that while signal sensing lead electrodes are formed in an upper plate, signal applying lead electrodes are all formed on a lower plate. As a result, the overall size of the touch panel is increased.

That is, the five-wire resistive touch panel is not suitable in structure enough to satisfy the requirements of small size, light weight, and slimness. Moreover, it has the problem of an increased non-active region, i.e., a decreased active region caused by inappropriate signal sensing and applying wires.

FIG. 6 illustrates the design of the conventional lower plate 101. It includes the transparent conductive film 108 with the potential compensation electrodes 103 and 104 arranged along the Y and X axes, respectively. The four position signal applying wires 102 are formed along the electrodes 103 and 104 in the $\Delta L_A \times \Delta L_B$ area.

Though an area a1 is a maximum active region available to the lower plate 101, the electrodes 103 and 104 are arranged in a smaller area due to the width ΔL_C of the electrodes 103 and 104 and the wiring area ΔL_A by ΔL_B.

Aside from the $\Delta L_A \times \Delta L_B$ wiring area, the width ΔL_C of the electrodes 103 and 104 produces an a2×a3 non-active region in the X and Y axes. The increase of the wiring area also increases the a2×a3 non-active region. As a result, when the width ΔL_C of the electrodes 103 and 104 is uniform, $a2=\Delta L_A+\Delta L_C$ and $a3=\Delta L_B+\Delta L_C$.

Therefore, the increased non-active region is an obstacle to maximum utilization of the active region. This implies that a small, lightweight touch panel cannot be designed.

DISCLOSURE OF THE INVENTION

It is, therefore, an object of the present invention to provide an improved five-wire resistive touch panel which overcomes problems resulting from an increase in a non-active region caused by signal line arrangement on the substrates of the touch panel.

It is another object of the present invention to provide a five-wire resistive touch panel with a wide available active region obtained by changing a signal line layout.

It is a further object of the present invention to provide a compact five-wire resistive touch panel with no increase in the overall size of the touch panel but a screen area increased.

To achieve the above and other objects, there is provided a five-wire resistive touch panel. In the five-wire resistive touch panel, a lower plate has a lower transparent conductive film and four X-axis and Y-axis potential compensation electrodes with predetermined resistance values arranged on the lower transparent conductive film along X and Y axes. An upper plate has an upper transparent conductive film corresponding to the lower transparent conductive film and a signal applying wire and a signal sensing wire arranged along the X and Y axes, for sensing a position signal from the potential compensation electrodes. Dot spacers are interposed between the upper and lower conductive films in an active region, for isolating the upper and lower conductive films from each other. A contact terminal is disposed along the signal applying wire and the signal sensing wire, for making contact between the signal applying wire and the electrode compensation electrodes.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects, features and advantages of the present invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings in which:

FIG. 1 is a sectional view of a typical touch panel;

FIG. 2A illustrates an input position on an upper plate of a conventional four-wire resistive touch panel;

FIG. 2B illustrates a layout of electrodes on the conventional four-wire resistive touch panel;

FIG. 2C is a diagram illustrating a contact resistance circuit for the conventional four-wire resistive touch panel;

FIG. 3 illustrates the vertical structure of a conventional five-wire resistive touch panel;

FIG. 4 illustrates an example of the lower plate shown in FIG. 3;

FIG. 5 illustrates another example of the lower plate shown in FIG. 3;

FIG. 6 illustrates a pressure sensing structure in the conventional five-wire resistive touch panel;

FIG. 7 illustrates the vertical structure of a five-wire resistive touch panel according to the present invention;

FIG. 8 is a plan view of an embodiment of an upper plate in the five-wire resistive touch panel according to the present invention;

FIG. 9 is a plan view of another embodiment of the upper plate in the five-wire resistive touch panel according to the present invention;

FIG. 10 is a sectional view of the five-wire resistive touch panel illustrated in FIG. 7, taken along line A-A'; and

FIG. 11 is a plan view of a lower plate in five-wire resistive touch panel according to the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Preferred embodiments of the present invention will be described herein below with reference to the accompanying drawings. In the following description, well-known functions or constructions are not described in detail since they would obscure the invention in unnecessary detail.

Before describing the present invention, it is to be noted that a wiring structure according to the present invention can be applied with restrictions to a four-wire or eight-wire resistive touch panel as well as a five-wire one.

The present invention provides a five-wired resistive touch panel with signal sensing wires and signal applying wires arranged together, to thereby satisfy particular characteristic requirements beyond its general functions.

Referring to FIGs. 7 to 11, a five-wire resistive touch panel 200 includes an upper plate 201 and a lower plate 202. The upper plate 201 is comprised of an upper transparent conductive film 204, signal applying wires 203 (terminals a and d) and a signal sensing wire 206 (terminal e) or signal sensing wires 206 (terminals e and f), which are arranged along the upper transparent conductive film 204, and contact terminals 205 (terminals b and c) between the signal applying wires 203 and the signal sensing wires 206. On a lower transparent conductive film 204 of the lower plate 202 are formed potential compensation electrodes 207 and 208 with appropriate resistances along X and Y axes. Dot spacers 209 are interposed between the upper and lower plates 201 and 202 in an active region in order to isolate the upper and lower transparent conductive films

24 from each other. The upper and lower plates 201 and 202 are attached in such a way that the transparent conductive films 204 face each other and the contact terminals 205 contact the potential electrodes 208.

The five-wire resistive touch panel 200, aiming at achieving predetermined characteristic requirements with general characteristics also maintained, is so designed that all wires are concentrated on the upper plate 201 to sense signals and pressure through the upper plate 201 and thus displaying data based on the sensed pressure. To achieve this goal, the contact terminals 205 for contacting the lower plate 202 are formed on the upper plate 201 in addition to the signal applying wires 203 and the signal sensing wire 206.

In the case of a single signal sensing wire 206, the signal applying wires 203 are arranged around the contour of the upper transparent conductive film 204, and the contact terminals 205 are disposed between the signal applying wires 203 and the signal sensing wire 206. The signal sensing wire 206 is positioned at the center of the wires and the terminals to contact the upper conductive film 204, as illustrated in FIG. 8.

In the case of two signal sensing wires 206, the signal applying wires 203 are arranged along the contour of the upper conductive film 204, and the contact terminals 205 are extended in both directions inside the signal applying wires 203. The signal sensing wires 206 are also extended in both directions inside the contact terminals 205, with one in contact with one side of the upper transparent conductive film 204 and the other extending along the other side of the upper transparent conductive film 204 to contact a corner thereof, as illustrated in FIG. 9.

It is preferable to concentrate the signal applying wires 203, the contact terminals 205, and the signal sensing wire 206 to facilitate connection with external devices, as illustrated in FIGs. 8 and 9.

As illustrated in FIG. 10, the dot spacers 209 are interposed between the upper and lower transparent conductive films 204 and the contact terminals 205 make contact between the potential compensation electrodes 207 and 208 and the signal applying wires 203.

The signal sensing wires 206, the contact terminals 205, and the signal sensing wires 203 are symmetrically arranged concentratedly in one area on the upper plate 201.

The upper and lower plates 201 and 202 are combined with the dot spacers 209 interposed in a general five-wire resistive touch panel fabrication process. The electrode arrangement and wiring is not a difficult process but a simple addition to the process for the upper plate 201.

With regard to a layout of the potential compensation electrodes 207 and 208 on the lower plate 202, the a2×a3 non-active region is defined by the width ΔL_C of the electrodes 207 and 208, saving the non-active region defined by ΔL_A and ΔL_B from the afore-described conventional touch panel, as illustrated in FIG. 11.

Meanwhile, if the five-wire resistive touch panel 200 is configured to have one signal sensing wire and four signal applying wires as illustrated in FIG. 8, it operates with the same characteristics as a typical five-wire resistive touch panel.

If the five-wire resistive touch panel 200 is configured to have two signal sensing wires and four signal applying wires as illustrated in FIG. 9, it can provide a variety of visual representations without deterioration of the original characteristics.

Referring to FIGs. 7, 8 and 9, step 1: upon finger touch or pen touch, it is sensed and contact resistance is measured. Current is applied to the terminals e and b and voltages are read from the terminals f and d. Then, the contact resistance between the upper and lower pates is calculated from the voltages. If the contact resistance is dropped to or below a threshold, pen touch or finger touch on the screen is sensed. Here, pressure is determined by comparing the resistance with the threshold.

Step 2: After sensing the finger touch or pen touch, equi-potential fields are distributed in parallel to the Y axis on the lower transparent conductive film 204 and potential from a touched point is transmitted to the signal sensing wires 203 on the upper plate 201 through contact resistors. Thus, the X-axis coordinate of the touched point is achieved. Here, if the finger touch or pen touch on the touch panel is not sensed, the touch sensing step is repeatedly performed at predetermined intervals.

Step 3: Equi-potential fields are distributed in parallel to the X-axis on the lower transparent conductive film 204, and the potential of the touched point is transferred to the upper plate 201 by the contact resistors. Thus, the Y-axis coordinate of the touched point is achieved.

The thus-operated touch panel illustrated in FIG. 9 has different characteristics from those of the typical five-wire resistive touch panel which senses pen touch or finger touch by applying a voltage between the upper and lower plates and determining the presence or absence of current and then directly performing steps 2 and 3.

The upper and lower plates 201 and 202 with the dot spacers 209 interposed are combined using an adhesive such that the signal sensing wires 206 contact the corners of potential compensation electrodes 207 and 208 in the conventional manner, as illustrated in FIG. 10. Here, a thin silver film is inserted between the upper and lower plates 201 and 202 in the area for the contact terminals 205.

In accordance with the present invention, the five-wire resistive touch panel has a lower plate with only potential compensation electrodes arranged thereon. That is, different designing of the signal sensing wires and the signal applying wires on the plates of the touch panel ensures a wide active region and make it possible to realize a compact touch panel. Furthermore, an effective screen area is increased without increasing the overall size of the touch panel. Consequently, a thin, lightweight touch panel with a wide screen can be achieved.

While the invention has been shown and described with reference to certain preferred embodiments thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention as defined by the appended claims.

CLAIMS

1. A five-wire resistive touch panel comprising:

a lower plate having a lower transparent conductive film and four X-axis and Y-axis potential compensation electrodes with predetermined resistance values arranged on the lower transparent conductive film along X and Y axes;

an upper plate having an upper transparent conductive film corresponding to the lower transparent conductive film and a signal applying wire and a signal sensing wire arranged along the X and Y axes, for sensing a position signal from the potential compensation electrodes;

a dot spacer interposed between the upper and lower conductive films in an active region, for isolating the upper and lower conductive films from each other; and

a contact terminal disposed along the signal applying wire and the signal sensing wire, for making contact between the signal applying wire and the electrode compensation electrodes.

2. The five-wire resistive touch panel of claim 1, wherein the contact terminal is formed on the upper plate.

3. The five-wire resistive touch panel of claim 1, wherein the signal sensing wire, the contact terminal, and the signal applying wire are symmetrically concentrated on the upper plate.

4. The five-wire resistive touch panel of claim 1, wherein when a single signal sensing wire is used, the signal applying wire is formed around the contour of the upper transparent conductive film, the contact terminal is inside the signal applying wire, and the signal sensing wire is inside the contact terminal to be the center of the wires and the terminal, in contact with the upper transparent conductive film.

5. The five-wire resistive touch panel of claim 1, wherein when two signal sensing wires are used, the signal applying wire is arranged around the contour of the upper transparent conductive film, the contact terminal is extended in both directions inside the signal applying wire, one of the signal sensing wire contacts one of the sides of the upper transparent conductive film, and the other signal sensing wire is extended along one side of the upper transparent conductive film to contact a corner of the upper transparent conductive film.

6. The five-wire resistive touch panel of claim 1, wherein the signal sensing wire, the contact terminal, and the signal applying wire are concentrated in an area to facilitate contact with an external system.

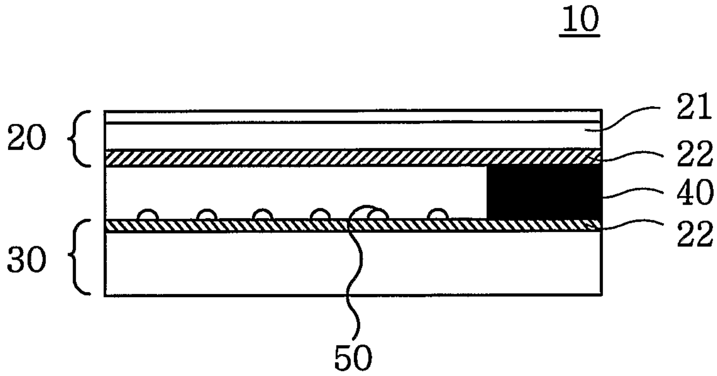

FIG.1

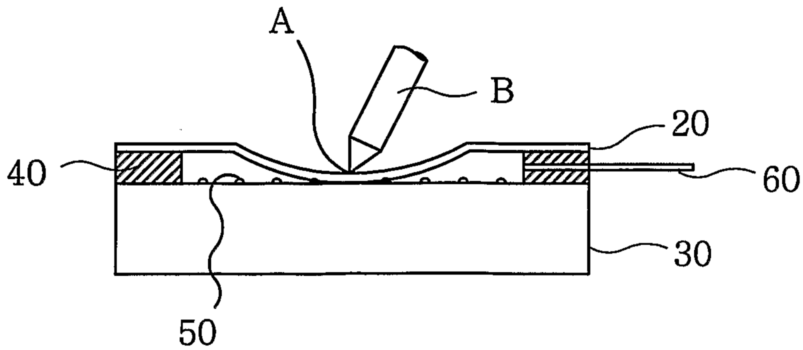

FIG.2A

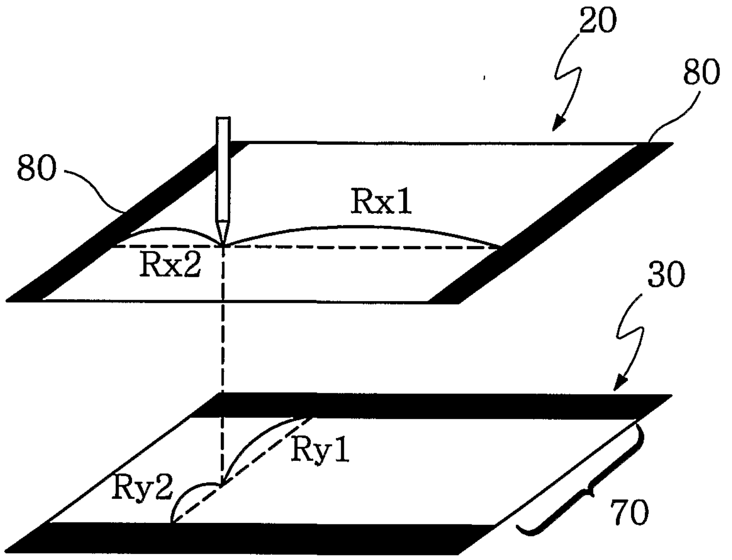

FIG.2B

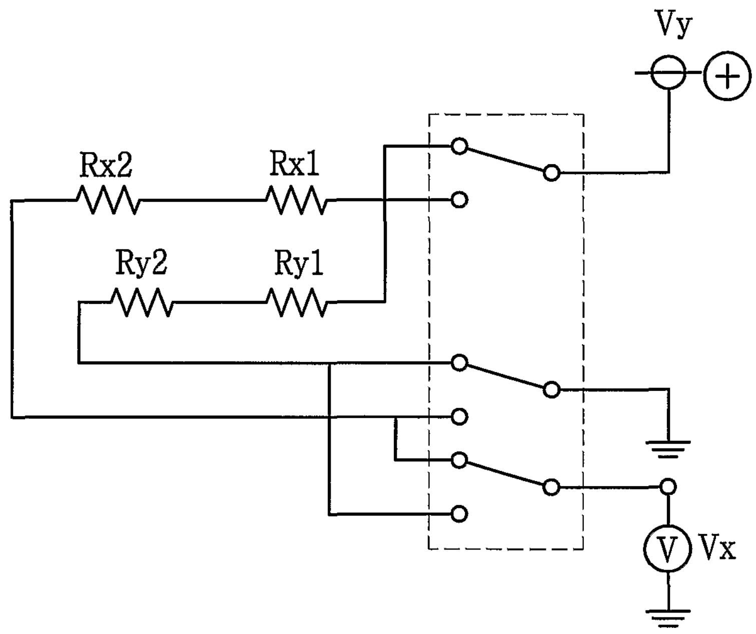

FIG.2C

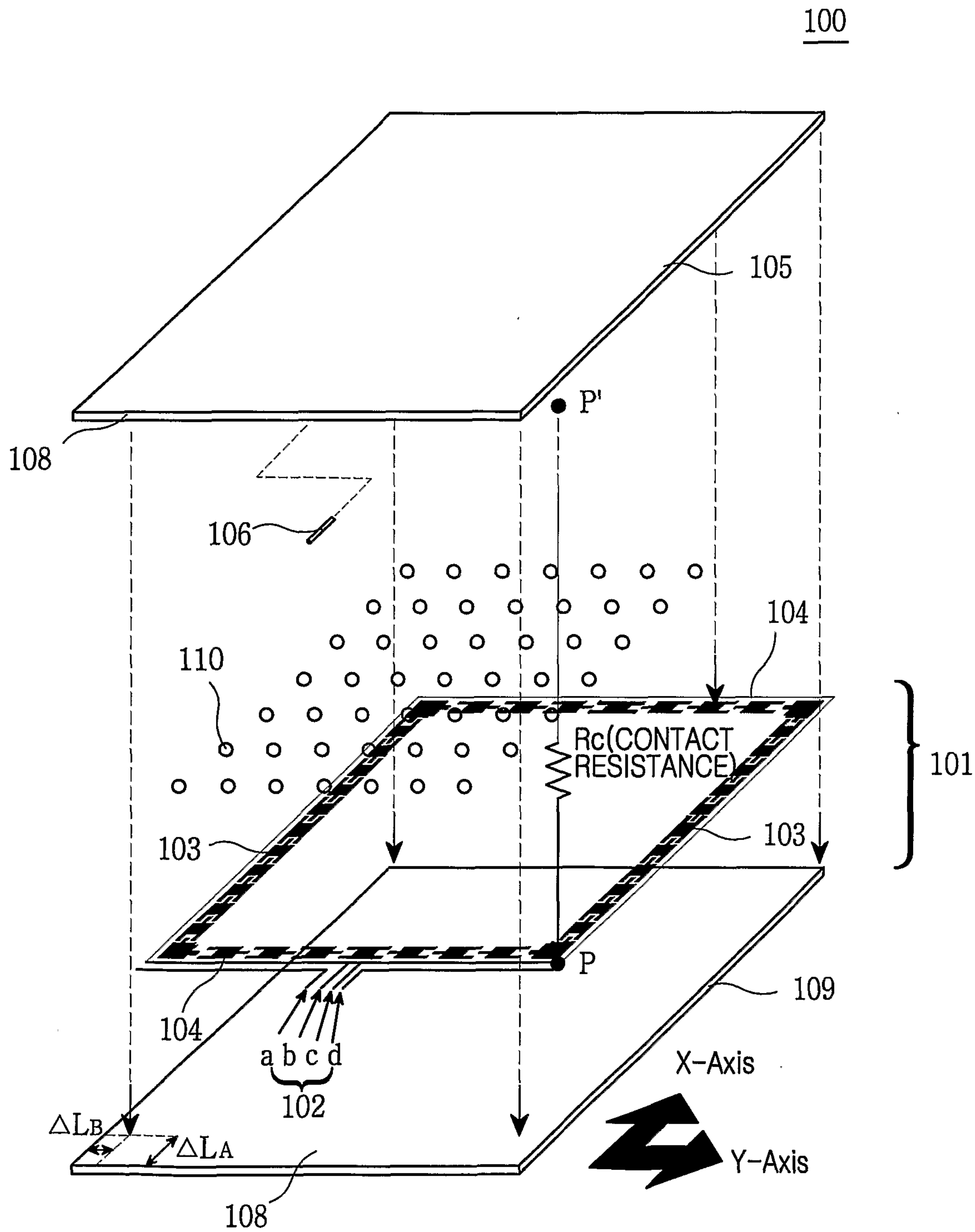
100
105
108
P'
106
104
110
Rc(CONTACT RESISTANCE)
101
103
103
P
109
104
a b c d
102
X-Axis
△LB
△LA
Y-Axis
108

FIG.3

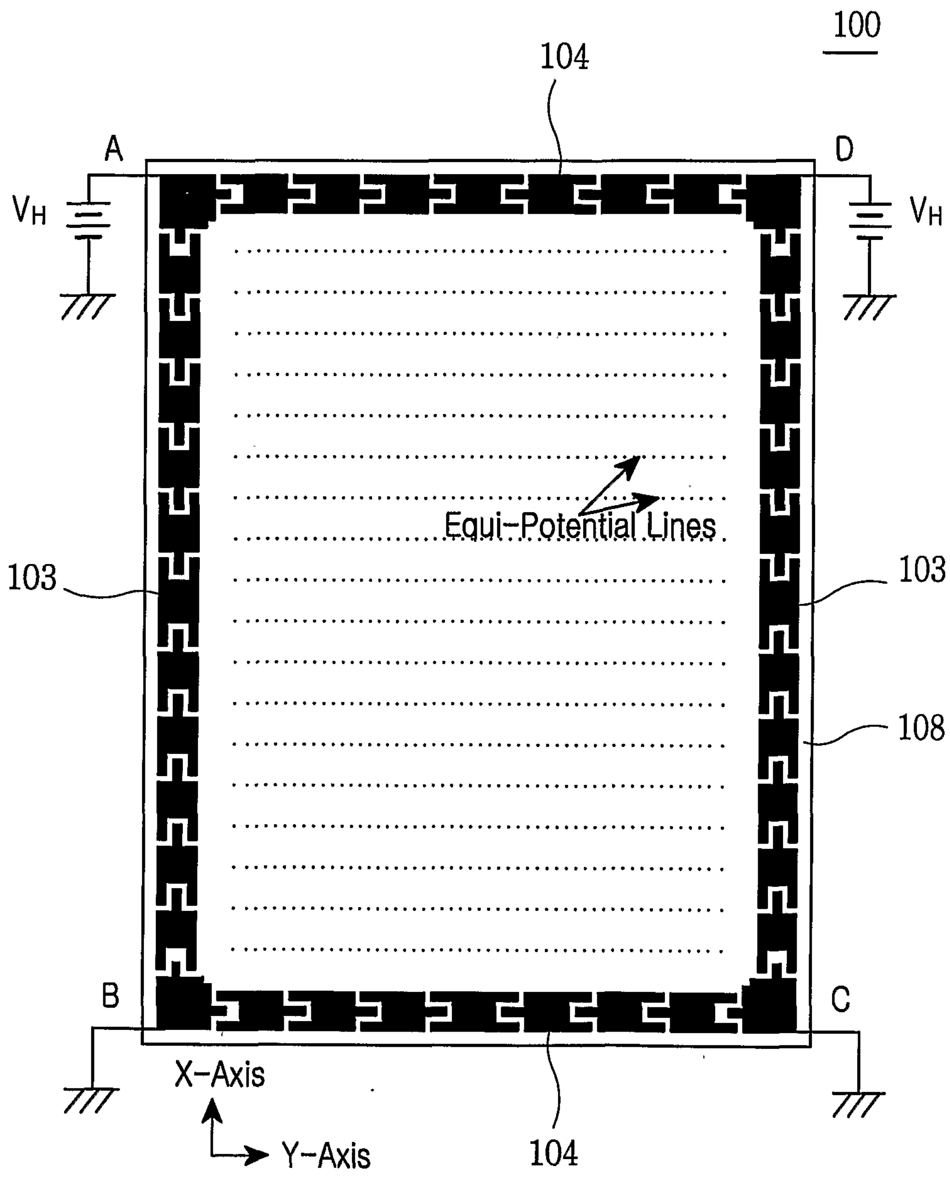
100
104
A
D
VH
VH
Equi-Potential Lines
103
103
108
B
C
X-Axis
Y-Axis
104

FIG.4

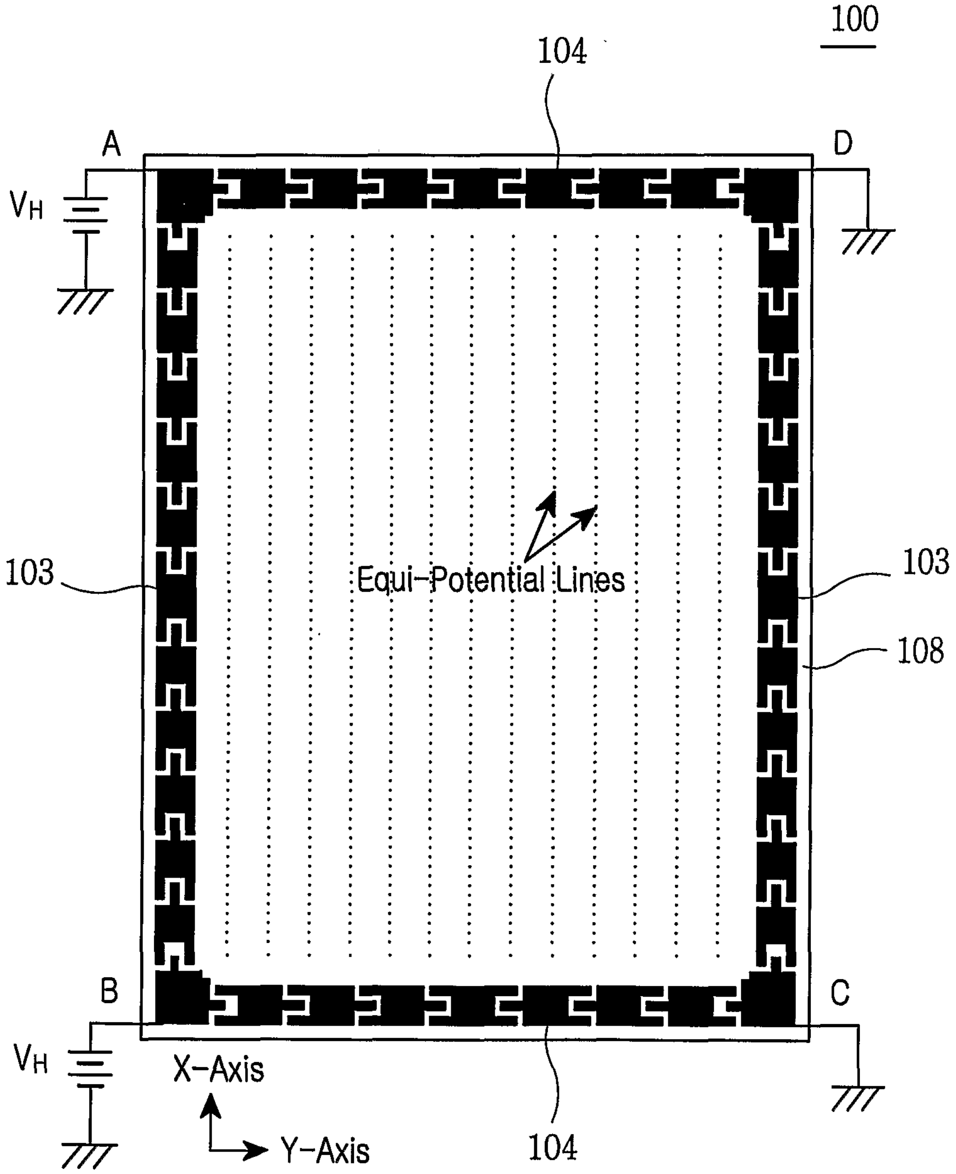
100
104
A
D
VH
103
Equi-Potential Lines
103
108
B
C
VH
X-Axis
Y-Axis
104

FIG.5

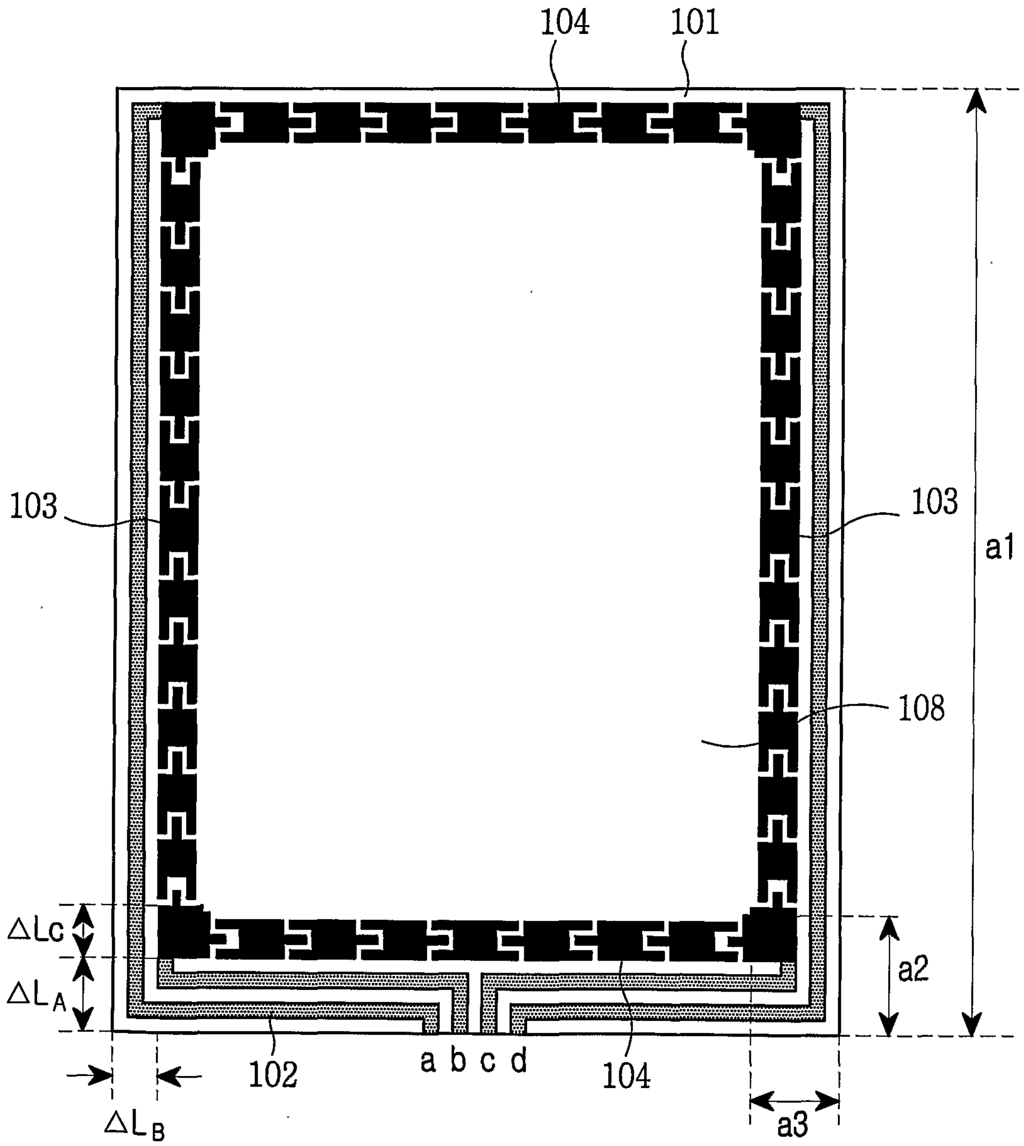

FIG.6

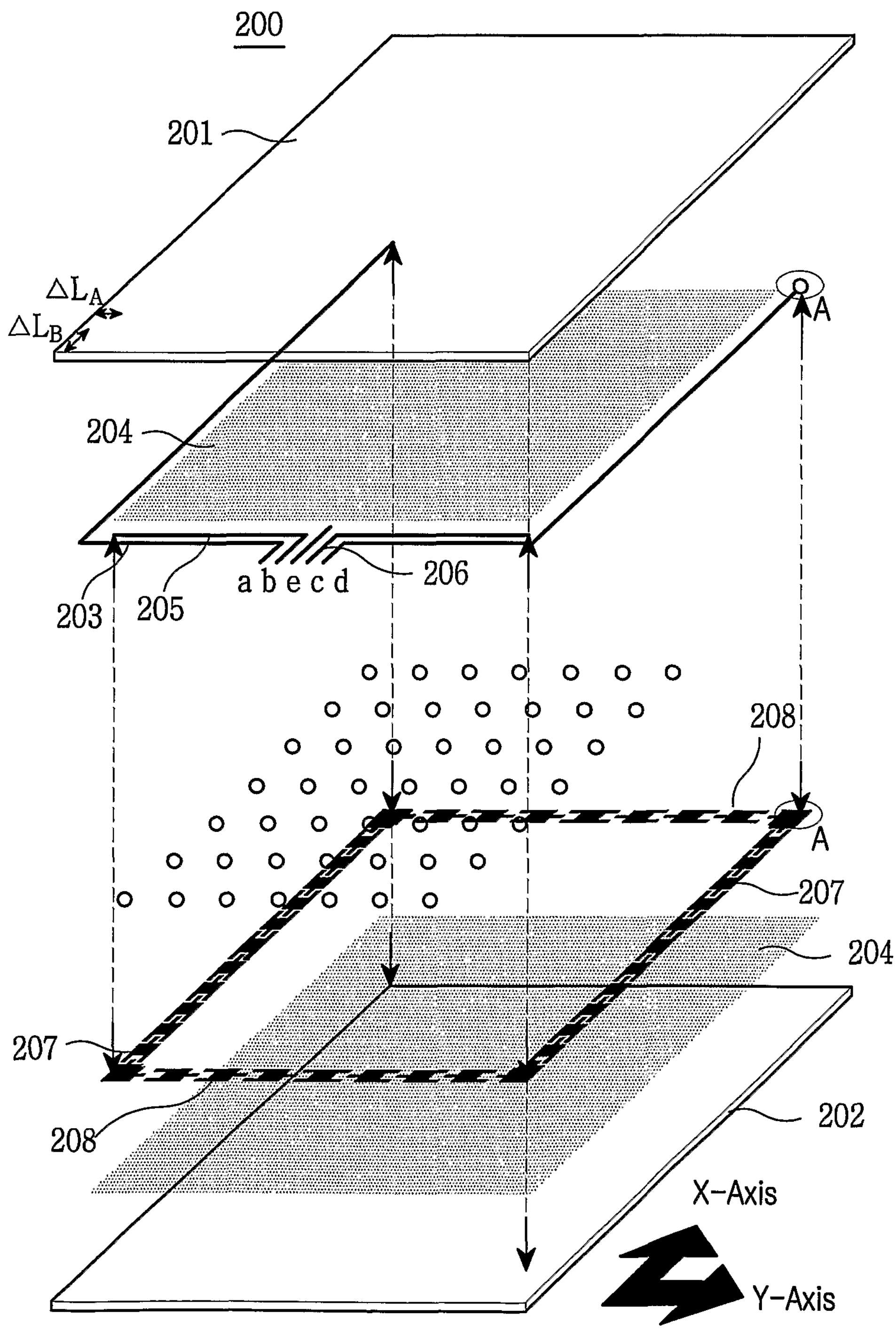
200
201
△L_A
△L_B
A
204
203
205
a b e c d
206
208
A
207
204
207
208
202
X-Axis
Y-Axis

FIG.7

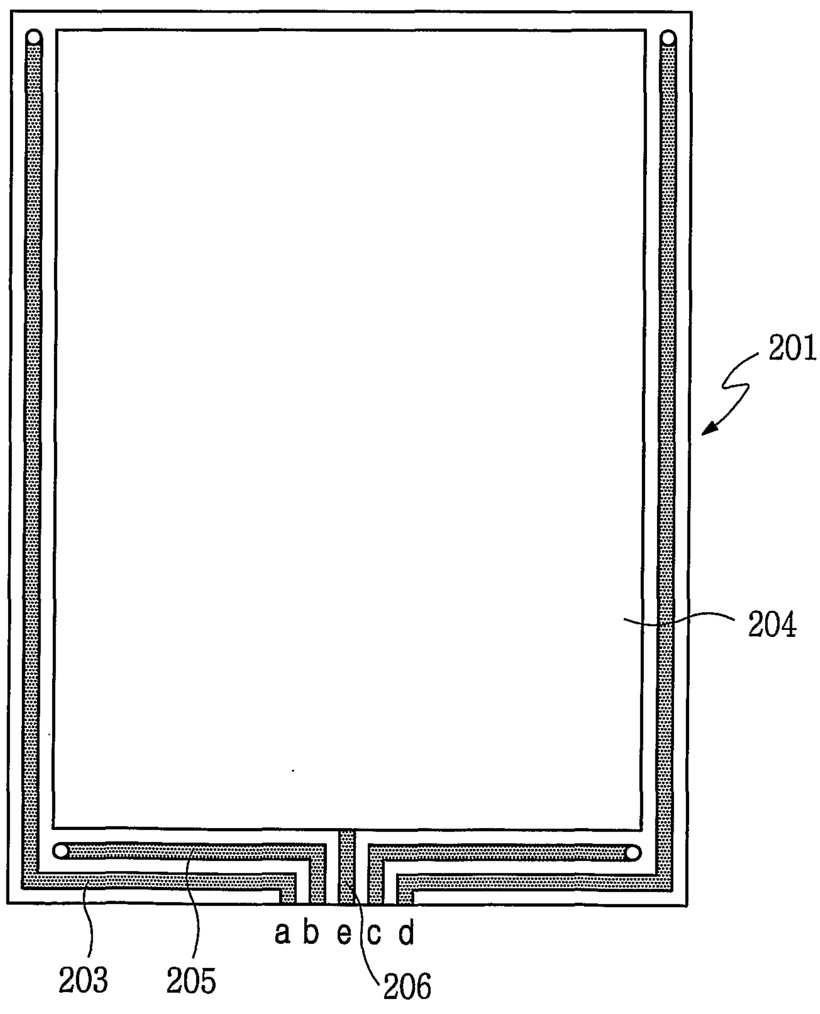

FIG.8

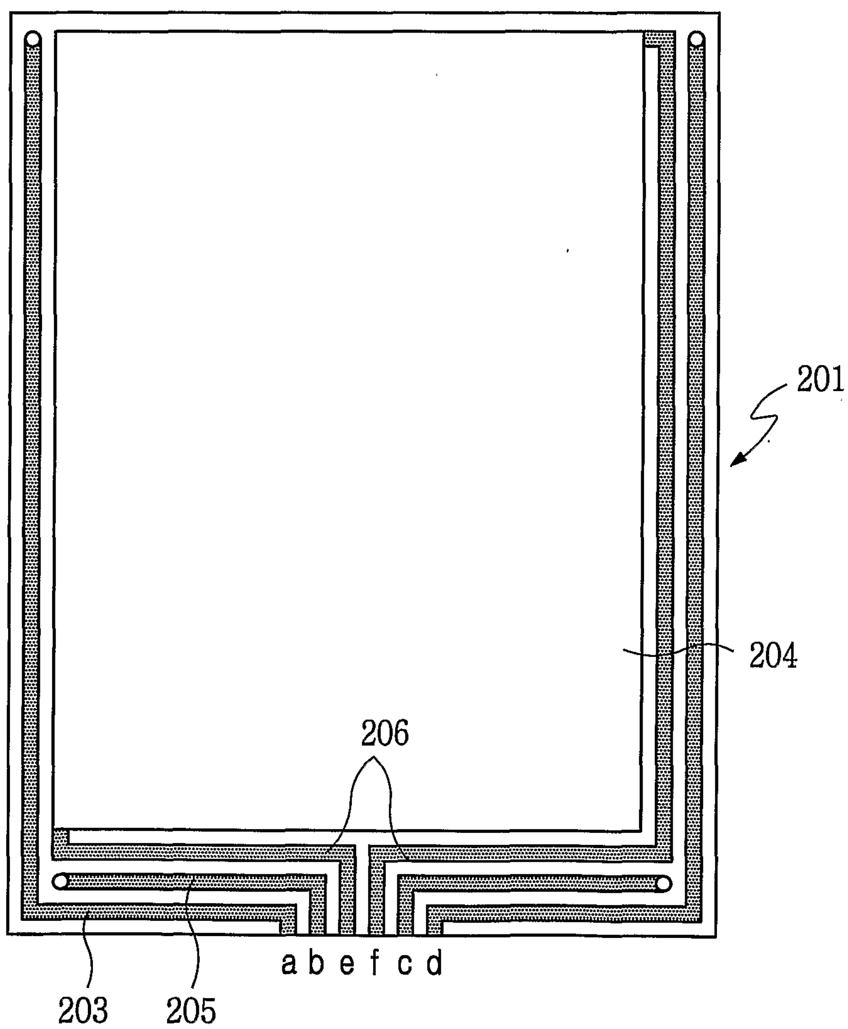

FIG.9

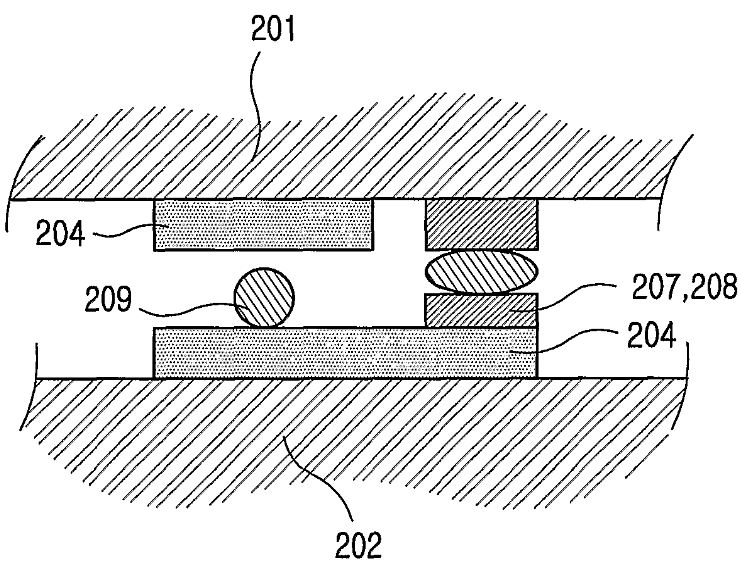

FIG.10

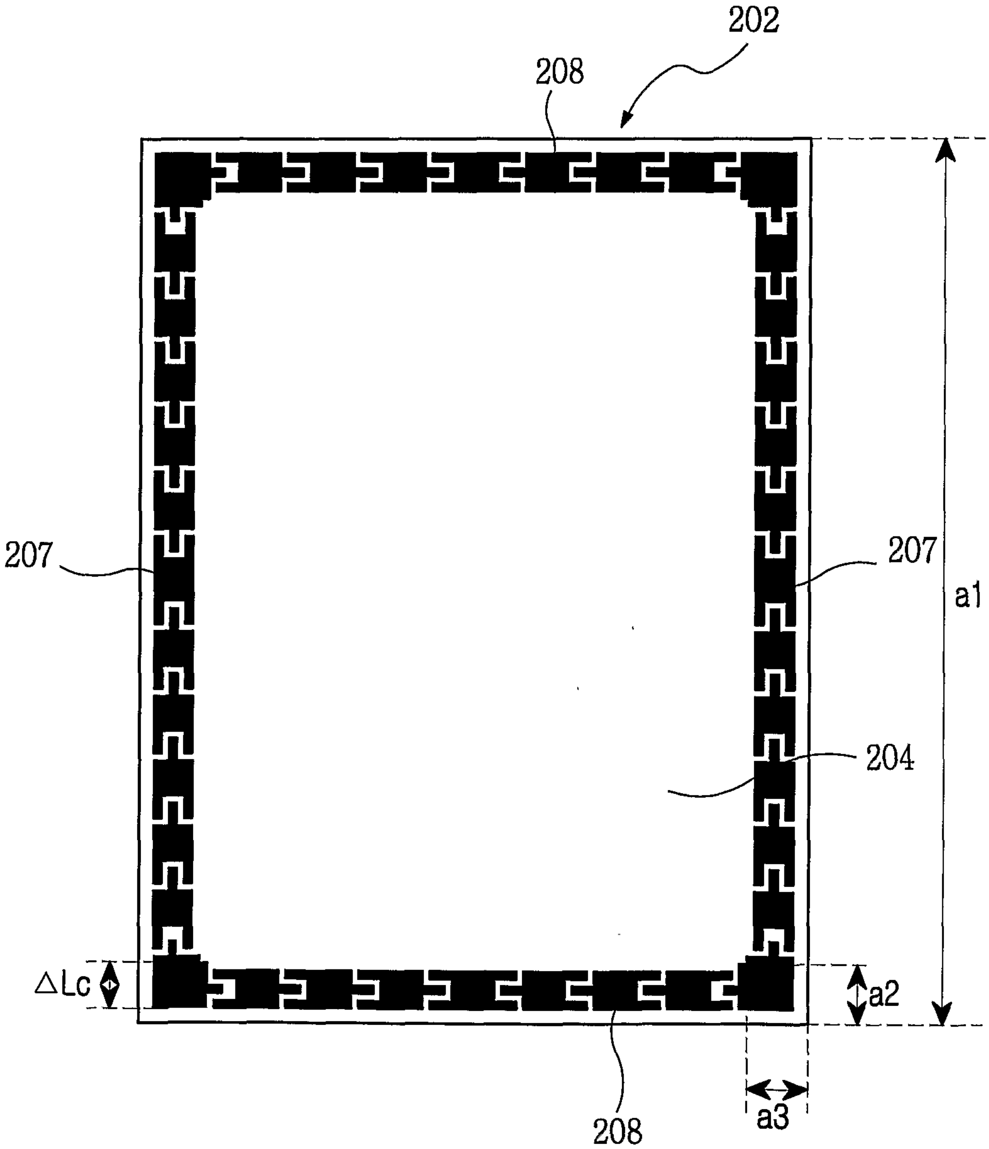

FIG.11

INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR02/01233

A. CLASSIFICATION OF SUBJECT MATTER

IPC7 G06F 3/033

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G06F 3/03 G06F 3/033

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean patents and applications for inventions since 1975

Electronic data base consulted during the intertnational search (name of data base and, where practicable, search terms used)
WPI, PAJ "touch panel" "X axis" "Y axis" "transparent conductive film" "electrode" "resistance" "conductive film" "dot spacer" "wire"

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 08-22357 A (FUJITSU LTD.) 23 JANUARY 1996	1-6
A	JP 05-265633 A (GUNZE LTD ., GRAPHICS TECHNOL CO:THE) 15 OCTOBER 1993	1-6
Y A	KR 2001-0038397 A (SAMSUNG SDI CO. LTD.) 15 MAY 2001	1 2-6
Y A	KR 2001-0003503 A (SAMSUNG SDI CO. LTD.) 15 JANUARY 2001	1 2-6
A	KR 2001-0003587 A (SAMSUNG SDI CO. LTD.) 15 JANUARY 2001	1-6
A	KR 2001-0003504 A (SAMSUNG SDI CO. LTD.) 15 JANUARY 2001	1-6
A	KR 2001-0051590 A (.GUNZE LTD .) 25 JUNE 2001	1-6
Y A	WO 0002119 A (NISSHA PRINTING CO. LTD.) 13 JANUARY 2000	1 2-6

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevence
"E" earlier application or patent but published on or after the international filing date
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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
"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
"X" document of particular relevence; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevence; 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
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
26 SEPTEMBER 2002 (26.09.2002)	26 SEPTEMBER 2002 (26.09.2002)

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Facsimile No. 82-42-472-7140	Telephone No. 82-42-481-5711