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(54) WARNING SYSTEM FOR BREAKING TOUCH SCREEN OR DISPLAY

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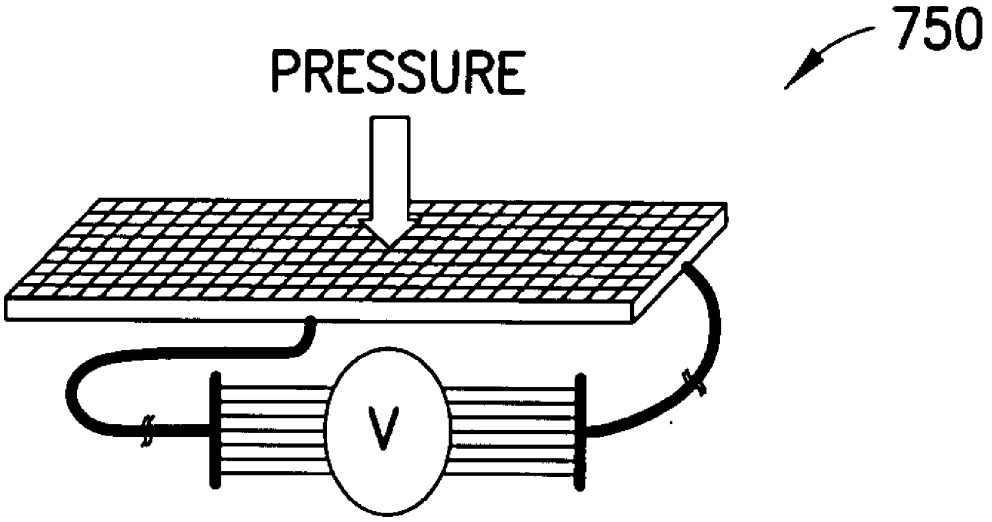
(52) **U.S. Cl.** **340/665**; 345/173

(57) **ABSTRACT**

Disclosed herein are apparatus, method, and computer program whereby a signal generated by a touch screen device is received in response to a tactile input from a user on an input surface of the touch screen panel. In response, presenting information to a user, the information comprising a warning that the user is exerting an excessive amount of force on a surface of the touch screen panel.

DISPLAY INTEGRATED TOUCH SCREEN



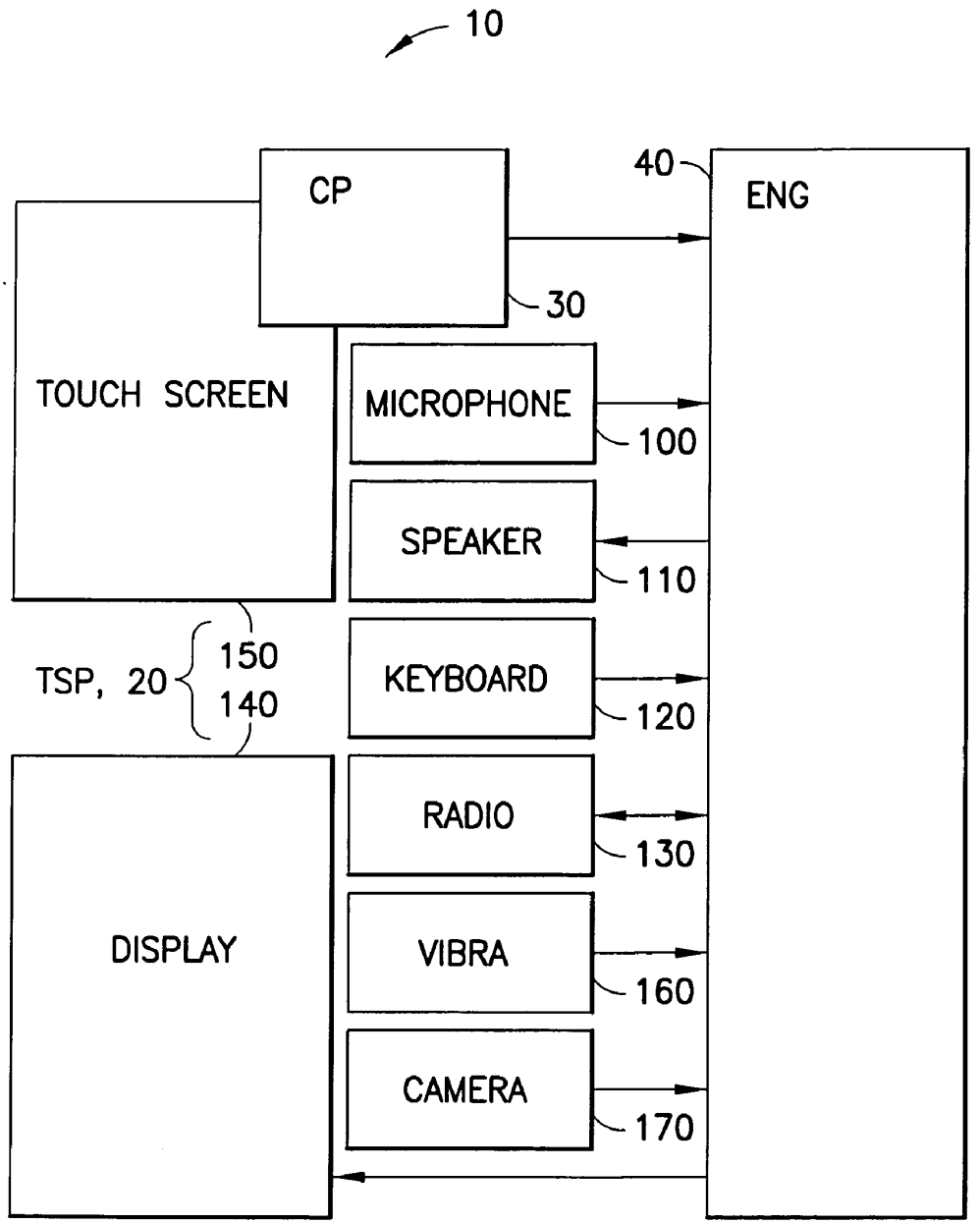

10
CP
40
ENG
30
TOUCH SCREEN
MICROPHONE
100
SPEAKER
110
TSP, 20
150
140
KEYBOARD
120
RADIO
130
DISPLAY
VIBRA
160
CAMERA
170

FIG. 1

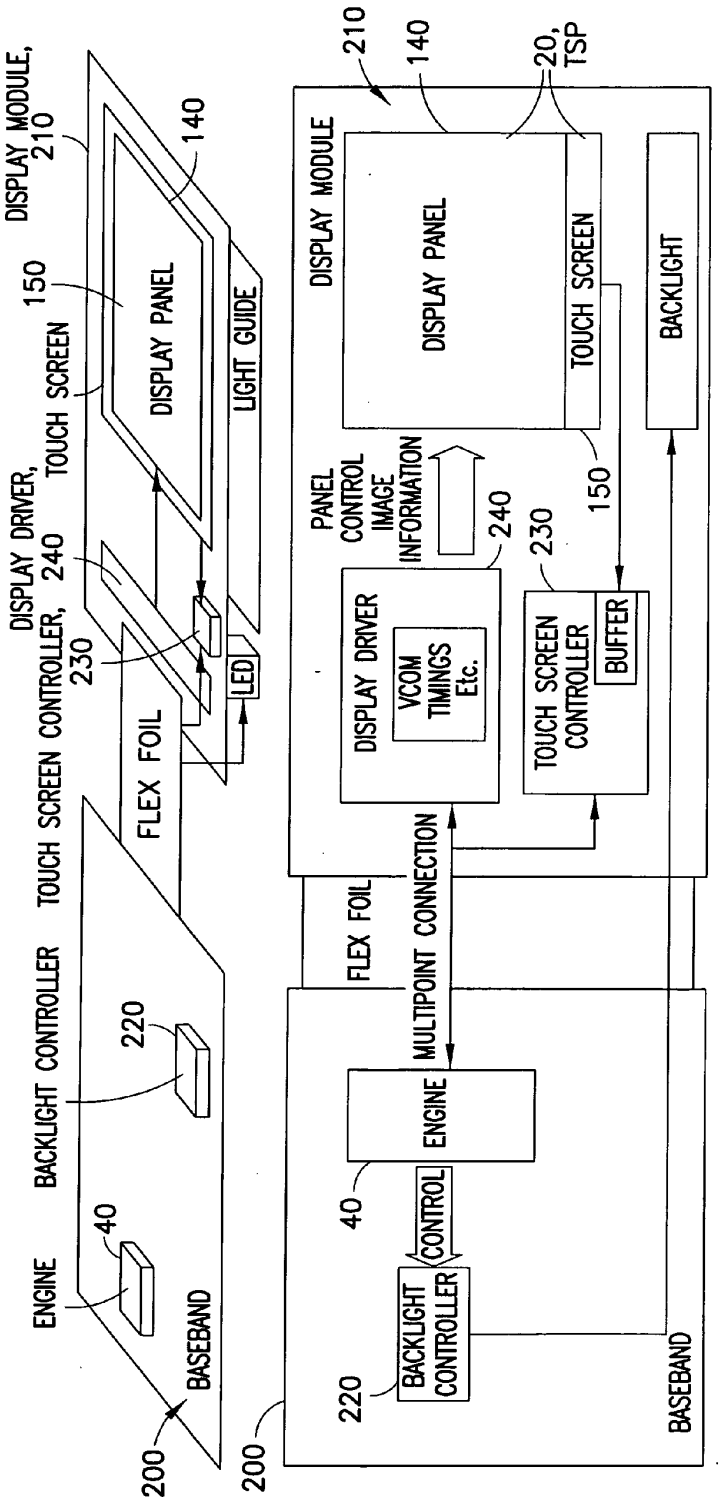

DISPLAY MODULE, 210
140
150
TOUCH SCREEN
DISPLAY PANEL
LIGHT GUIDE
DISPLAY DRIVER, 240
TOUCH SCREEN CONTROLLER, 230
LED
FLEX FOIL
BACKLIGHT CONTROLLER
220
ENGINE
40
BASEBAND
200
210
140
20, TSP
DISPLAY MODULE
DISPLAY PANEL
TOUCH SCREEN
BACKLIGHT
PANEL CONTROL IMAGE INFORMATION
240
230
150
DISPLAY DRIVER
VCOM TIMINGS Etc.
TOUCH SCREEN CONTROLLER
BUFFER
FLEX FOIL
MULTIPOINT CONNECTION
ENGINE
40
CONTROL
BACKLIGHT CONTROLLER
220
BASEBAND
200

FIG.2

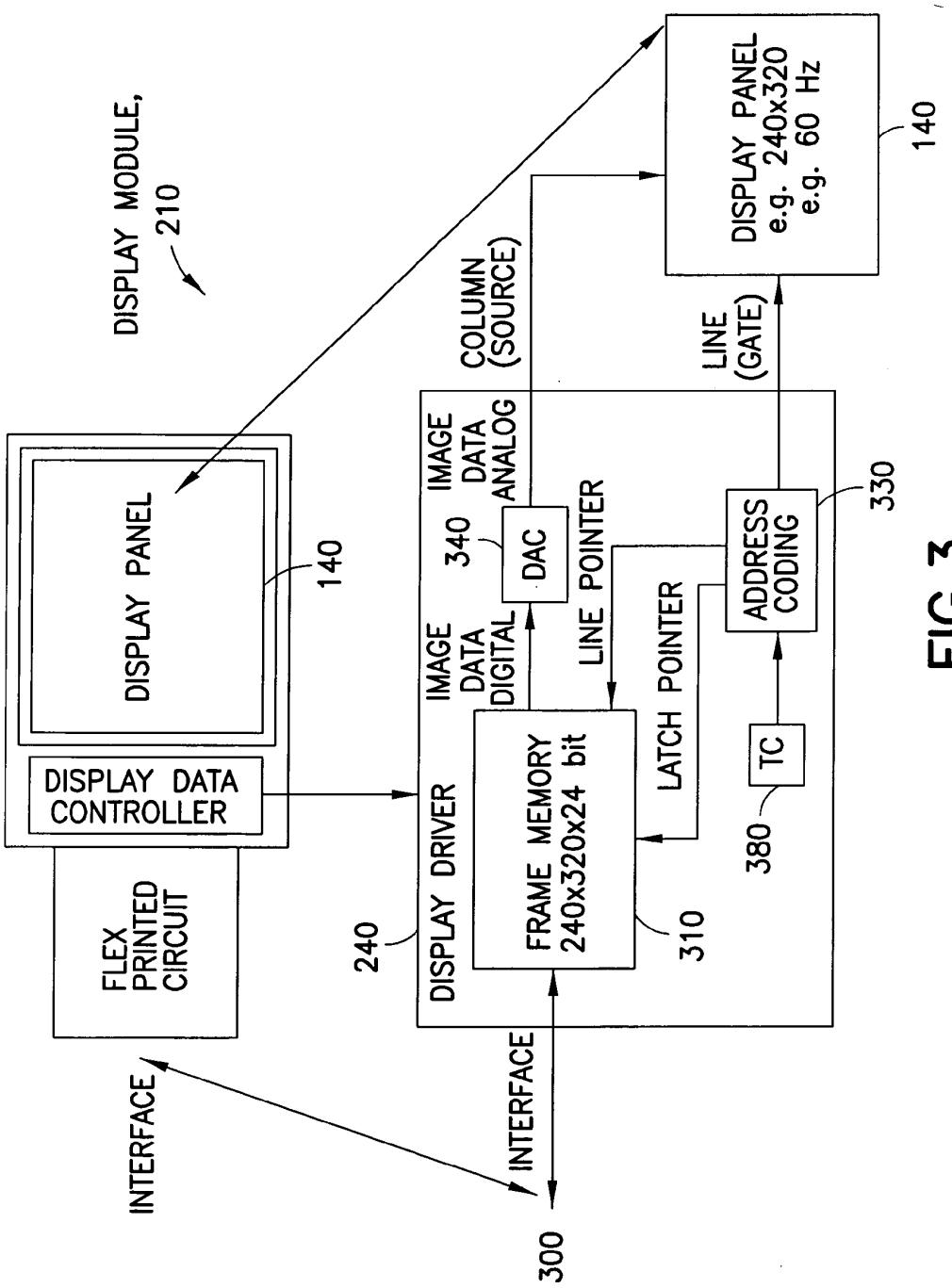

DISPLAY MODULE,
210
DISPLAY PANEL
140
DISPLAY DATA CONTROLLER
FLEX PRINTED CIRCUIT
INTERFACE
COLUMN (SOURCE)
IMAGE DATA ANALOG
340
DAC
IMAGE DATA DIGITAL
LINE POINTER
LATCH POINTER
DISPLAY DRIVER
240
FRAME MEMORY 240x320x24 bit
310
ADDRESS CODING
330
TC
380
LINE (GATE)
DISPLAY PANEL e.g. 240x320 e.g. 60 Hz
140
INTERFACE
300

FIG.3

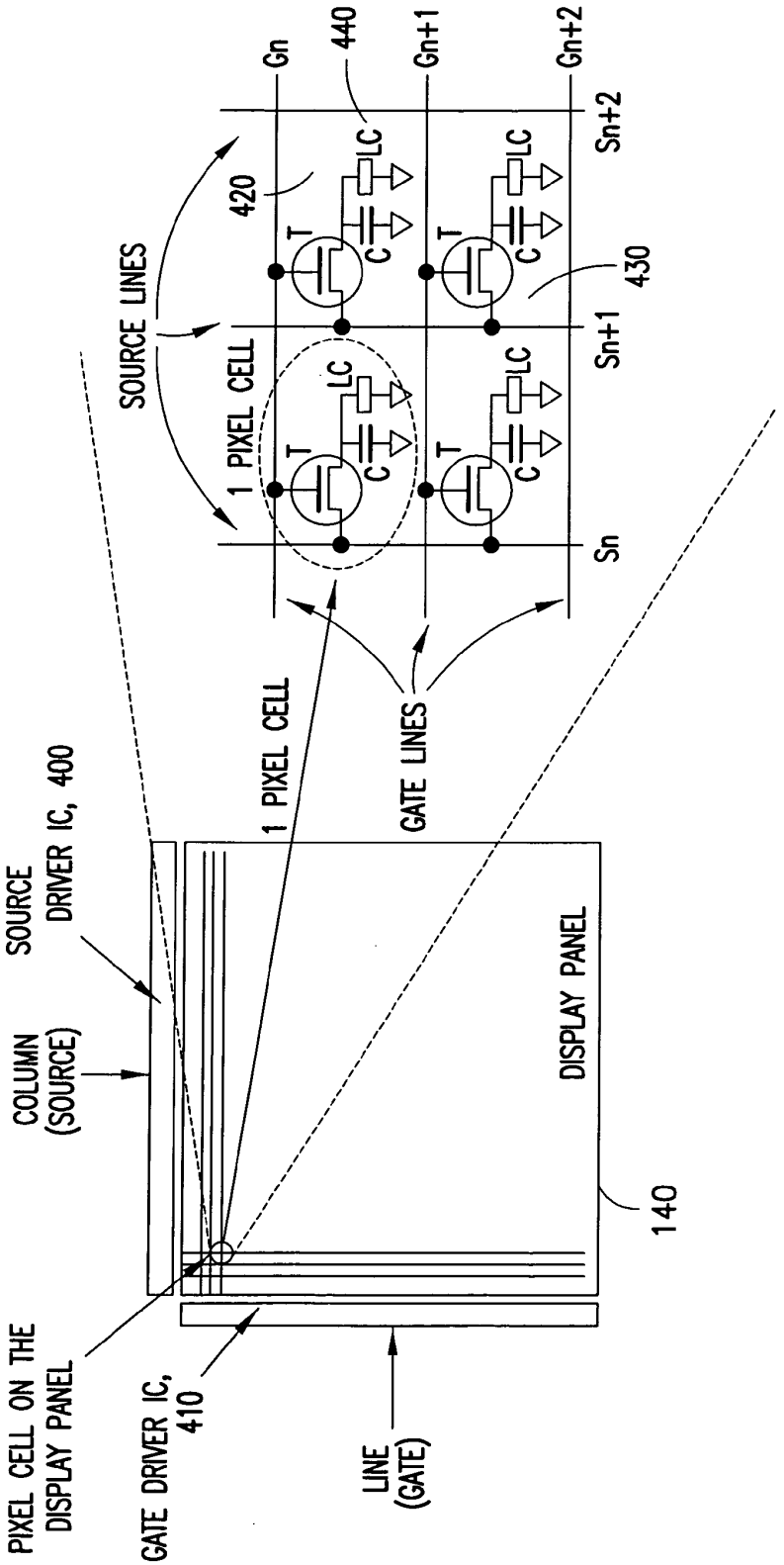

SOURCE DRIVER IC, 400
COLUMN (SOURCE)
PIXEL CELL ON THE DISPLAY PANEL
GATE DRIVER IC, 410
LINE (GATE)
1 PIXEL CELL
GATE LINES
DISPLAY PANEL
140
SOURCE LINES
1 PIXEL CELL
420
440
430
Gn
Gn+1
Gn+2
Sn
Sn+1
Sn+2
T
C
LC

FIG.4

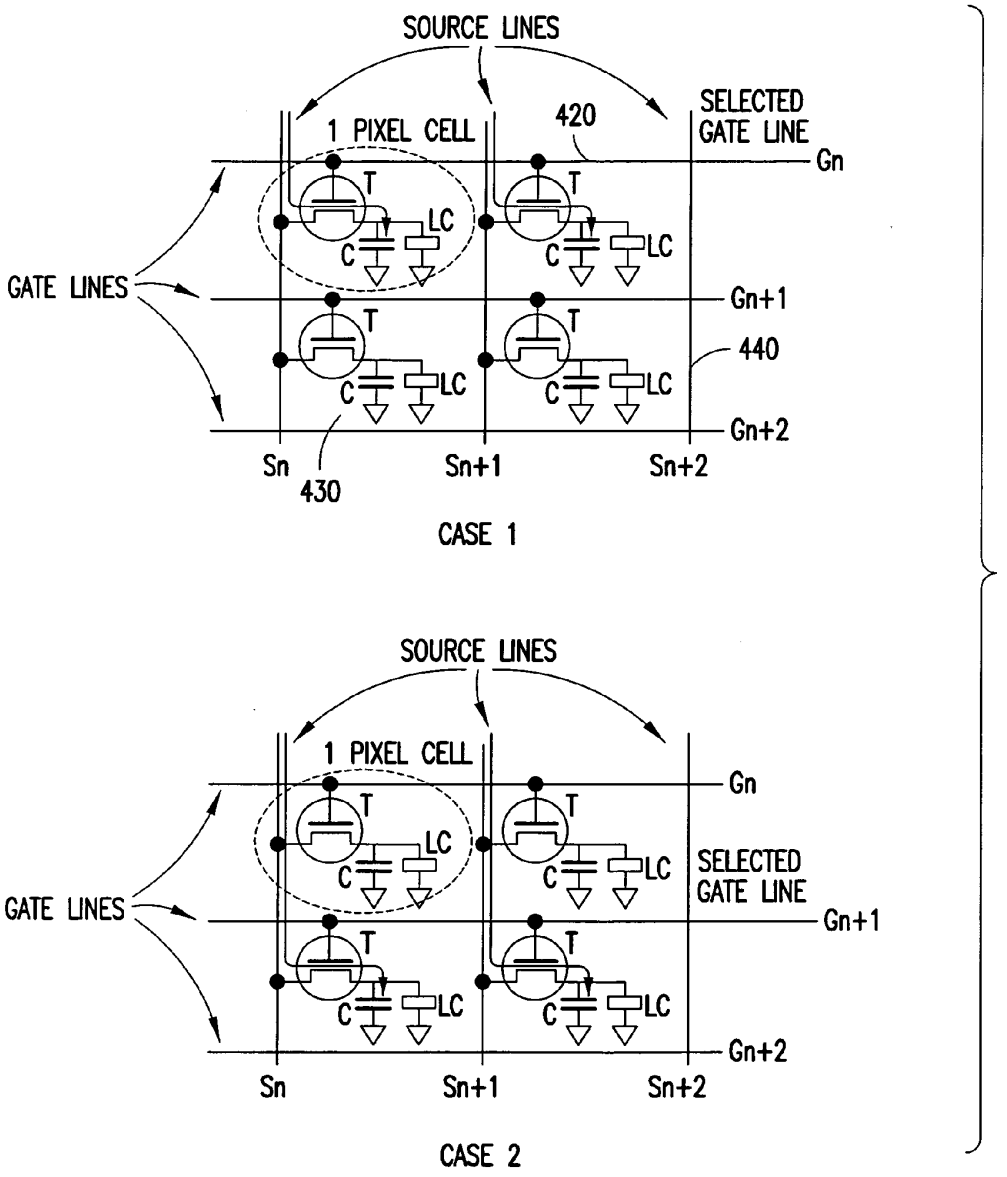

SOURCE LINES
1 PIXEL CELL
420
SELECTED GATE LINE
Gn
T
LC
C
GATE LINES
Gn+1
440
Gn+2
Sn
430
Sn+1
Sn+2
CASE 1
SOURCE LINES
1 PIXEL CELL
Gn
SELECTED GATE LINE
GATE LINES
Gn+1
Gn+2
Sn
Sn+1
Sn+2
CASE 2

FIG.5

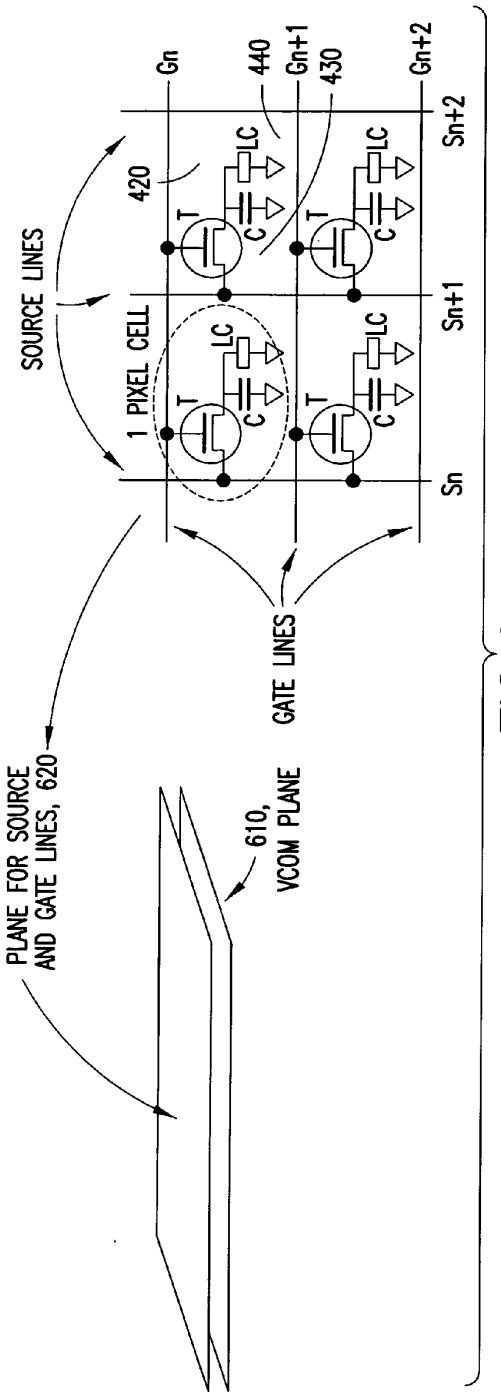
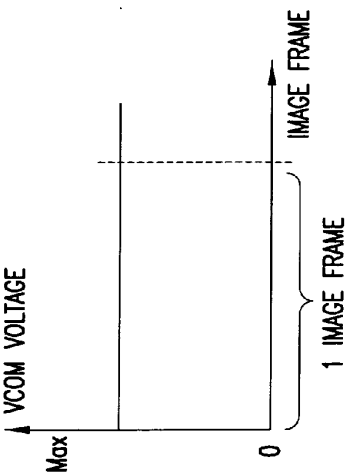
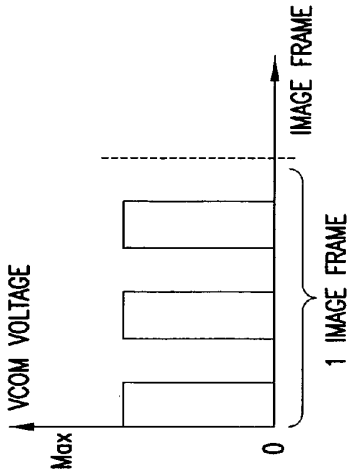


FIG.6A



CASE 1

FIG.6B



CASE 2

FIG.6C

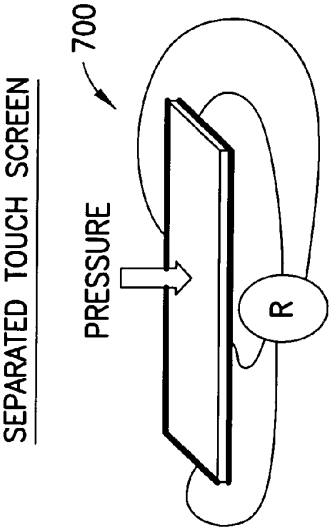


FIG.7A

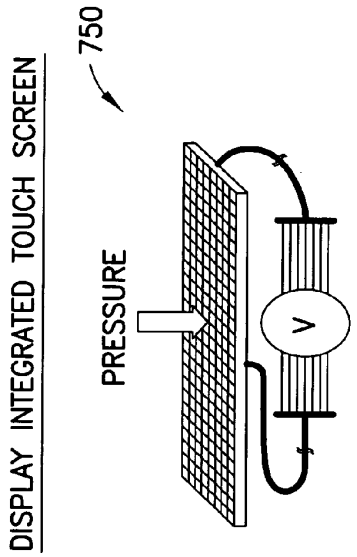


FIG.7C

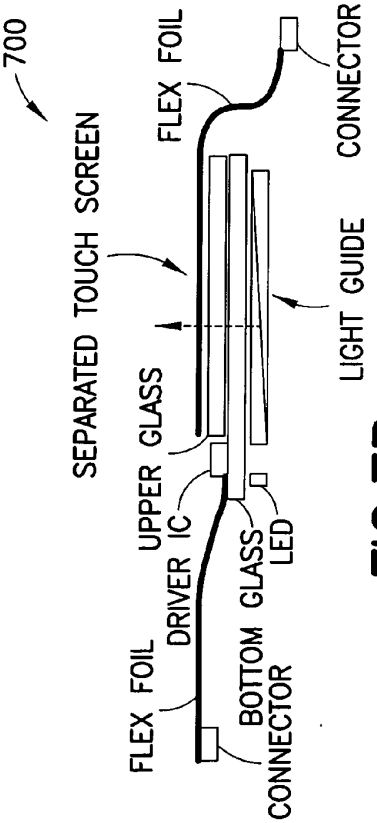


FIG.7B

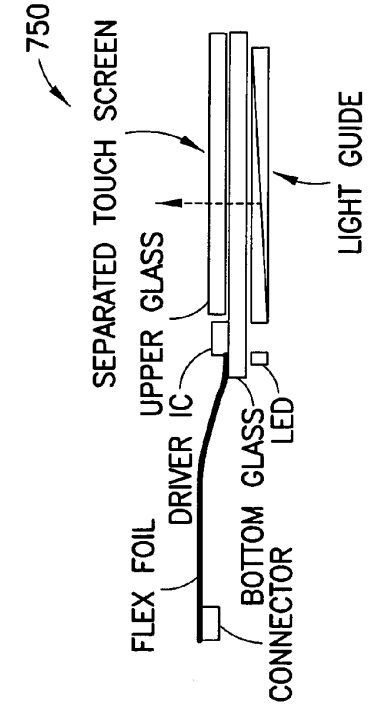


FIG.7D

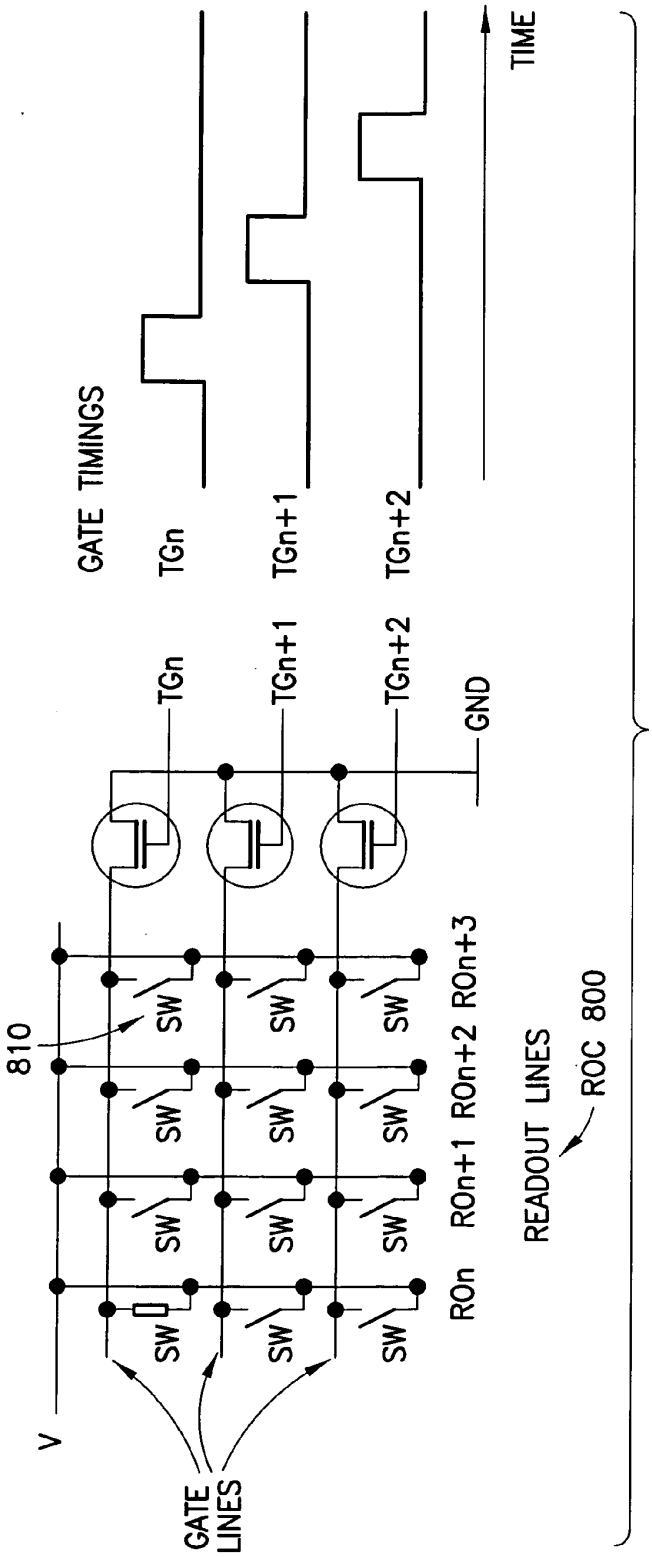

GATE TIMINGS
TGn
TGn+1
TGn+2
TIME
TGn
TGn+1
TGn+2
GND
810
SW
V
GATE LINES
ROn
ROn+1
ROn+2
ROn+3
READOUT LINES
ROC 800

FIG.8

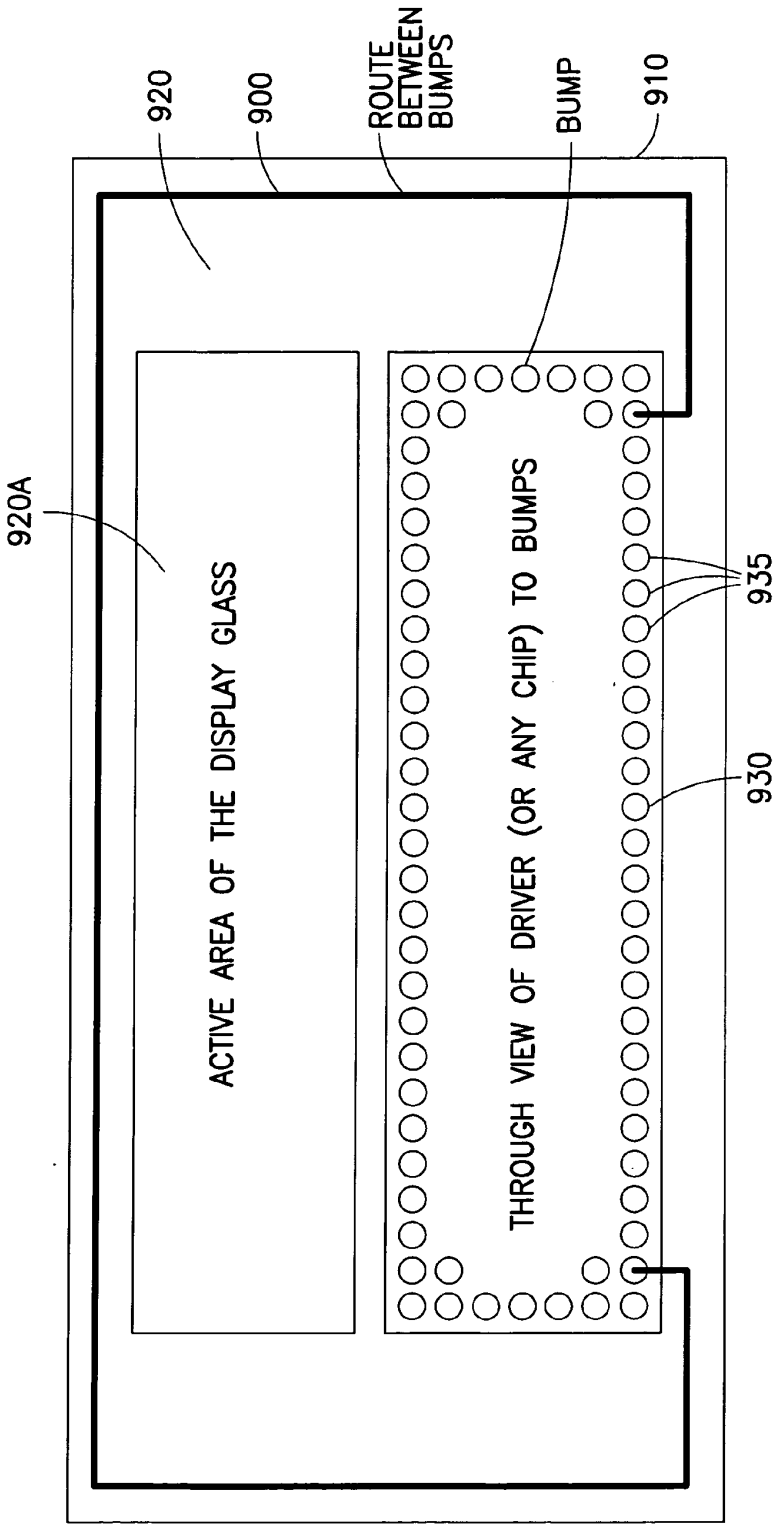

920
900
ROUTE BETWEEN BUMPS
BUMP
910
920A
ACTIVE AREA OF THE DISPLAY GLASS
THROUGH VIEW OF DRIVER (OR ANY CHIP) TO BUMPS
935
930

FIG.9

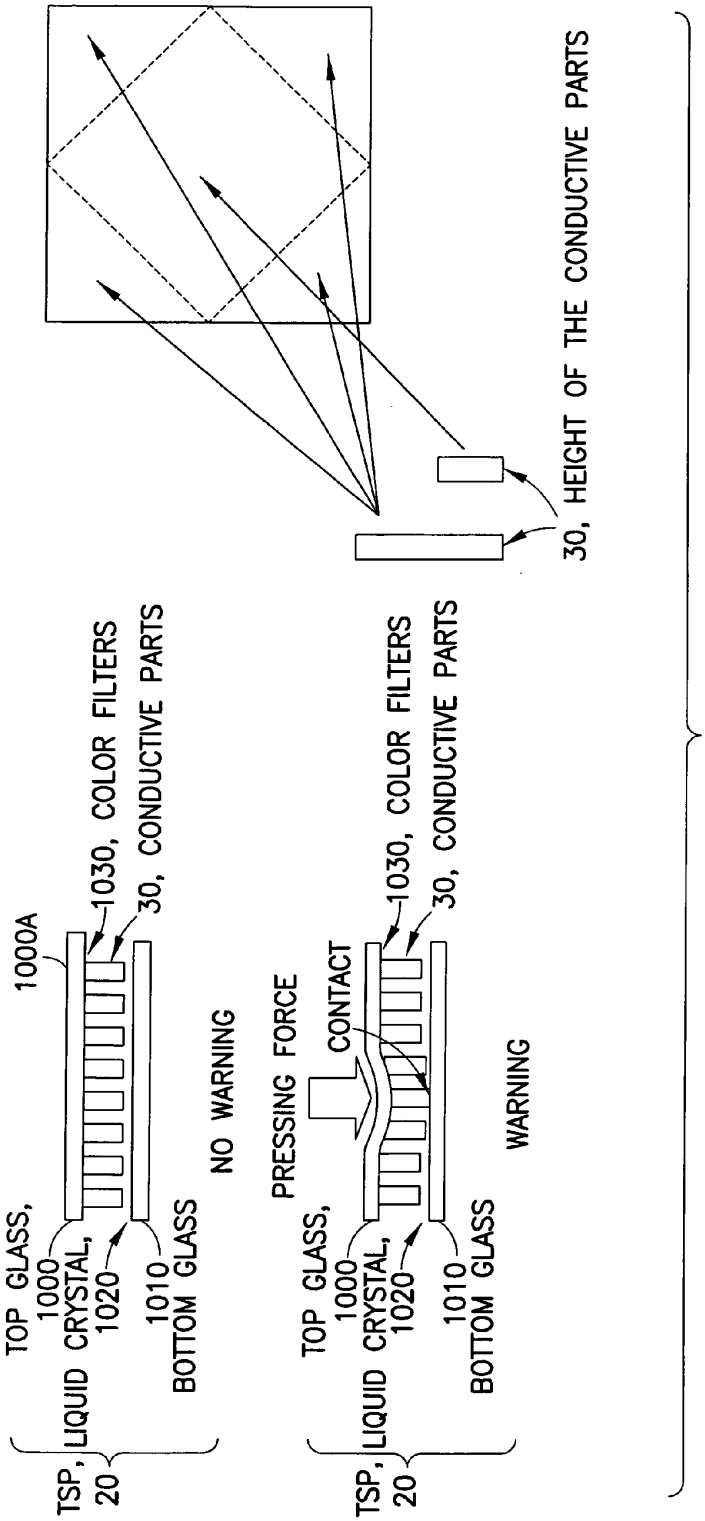

30, HEIGHT OF THE CONDUCTIVE PARTS
TSP, 20
LIQUID CRYSTAL, 1020
TOP GLASS, 1000
1000A
1030, COLOR FILTERS
30, CONDUCTIVE PARTS
1010 BOTTOM GLASS
NO WARNING
PRESSING FORCE
CONTACT
WARNING

FIG.10

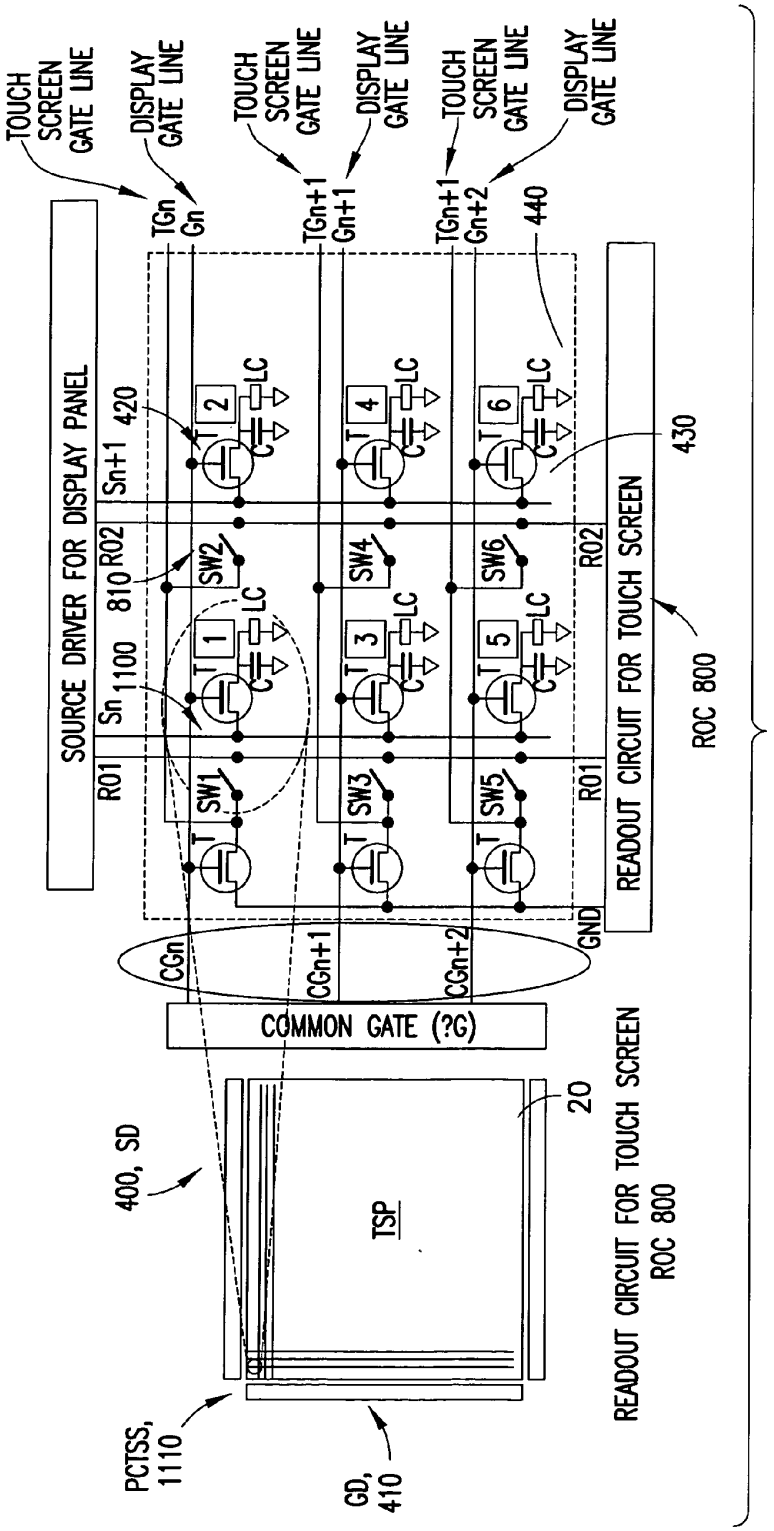

TOUCH SCREEN GATE LINE
DISPLAY GATE LINE
TOUCH SCREEN GATE LINE
DISPLAY GATE LINE
TOUCH SCREEN GATE LINE
DISPLAY GATE LINE
TGn
Gn
TGn+1
Gn+1
TGn+1
Gn+2
440
SOURCE DRIVER FOR DISPLAY PANEL
420
Sn+1
R02
810
Sn
1100
R01
SW1
SW2
SW3
SW4
SW5
SW6
1
2
3
4
5
6
LC
430
R02
R01
READOUT CIRCUIT FOR TOUCH SCREEN
ROC 800
GND
CGn
CGn+1
CGn+2
COMMON GATE (?G)
400, SD
TSP
20
READOUT CIRCUIT FOR TOUCH SCREEN
ROC 800
PCTSS,
1110
GD,
410

FIG.11

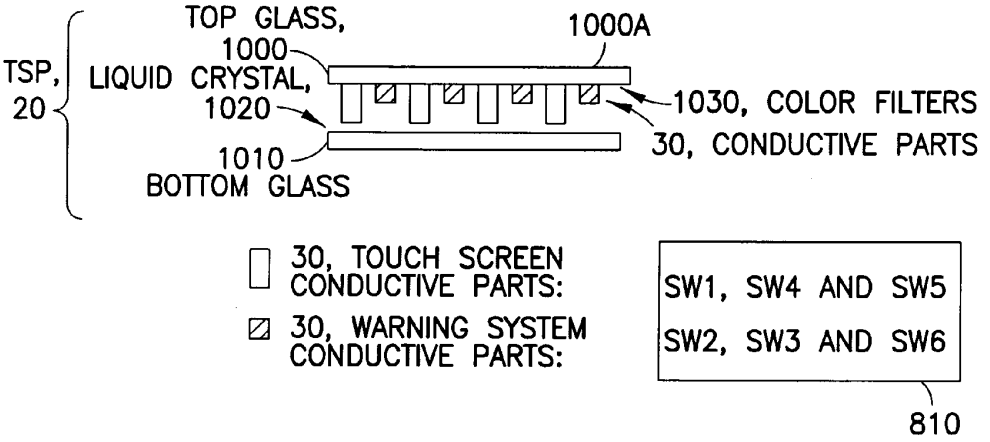

TOP GLASS,
1000
1000A
TSP,
20
LIQUID CRYSTAL,
1020
1030, COLOR FILTERS
30, CONDUCTIVE PARTS
1010
BOTTOM GLASS
30, TOUCH SCREEN CONDUCTIVE PARTS:
30, WARNING SYSTEM CONDUCTIVE PARTS:
SW1, SW4 AND SW5
SW2, SW3 AND SW6
810

FIG.12

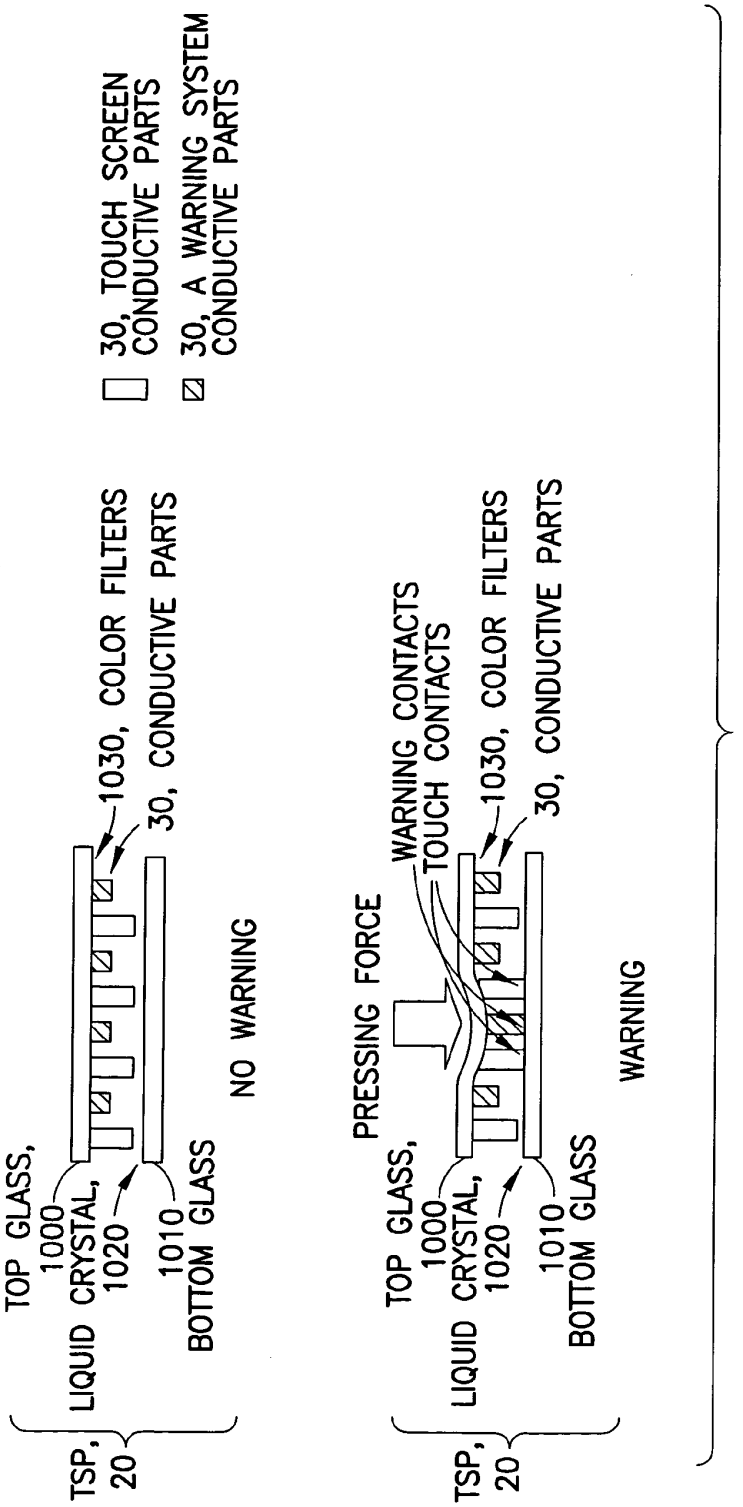

30, TOUCH SCREEN CONDUCTIVE PARTS
30, A WARNING SYSTEM CONDUCTIVE PARTS
TSP, 20
TOP GLASS, 1000
LIQUID CRYSTAL, 1020
1010 BOTTOM GLASS
1030, COLOR FILTERS
30, CONDUCTIVE PARTS
NO WARNING
PRESSING FORCE
WARNING CONTACTS
TOUCH CONTACTS
WARNING

FIG. 13

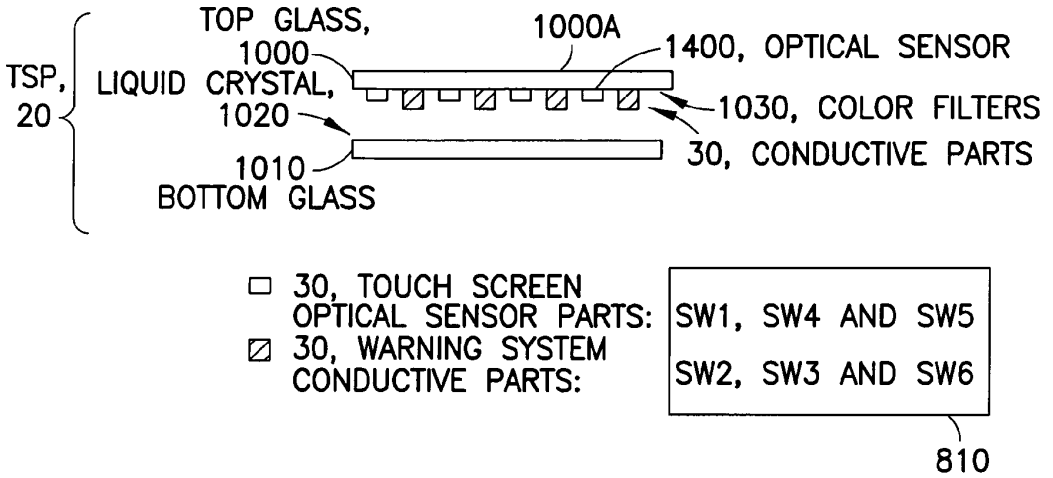

TSP, 20
TOP GLASS, 1000
LIQUID CRYSTAL, 1020
1010 BOTTOM GLASS
1000A
1400, OPTICAL SENSOR
1030, COLOR FILTERS
30, CONDUCTIVE PARTS
30, TOUCH SCREEN OPTICAL SENSOR PARTS:
30, WARNING SYSTEM CONDUCTIVE PARTS:
SW1, SW4 AND SW5
SW2, SW3 AND SW6
810

FIG. 14

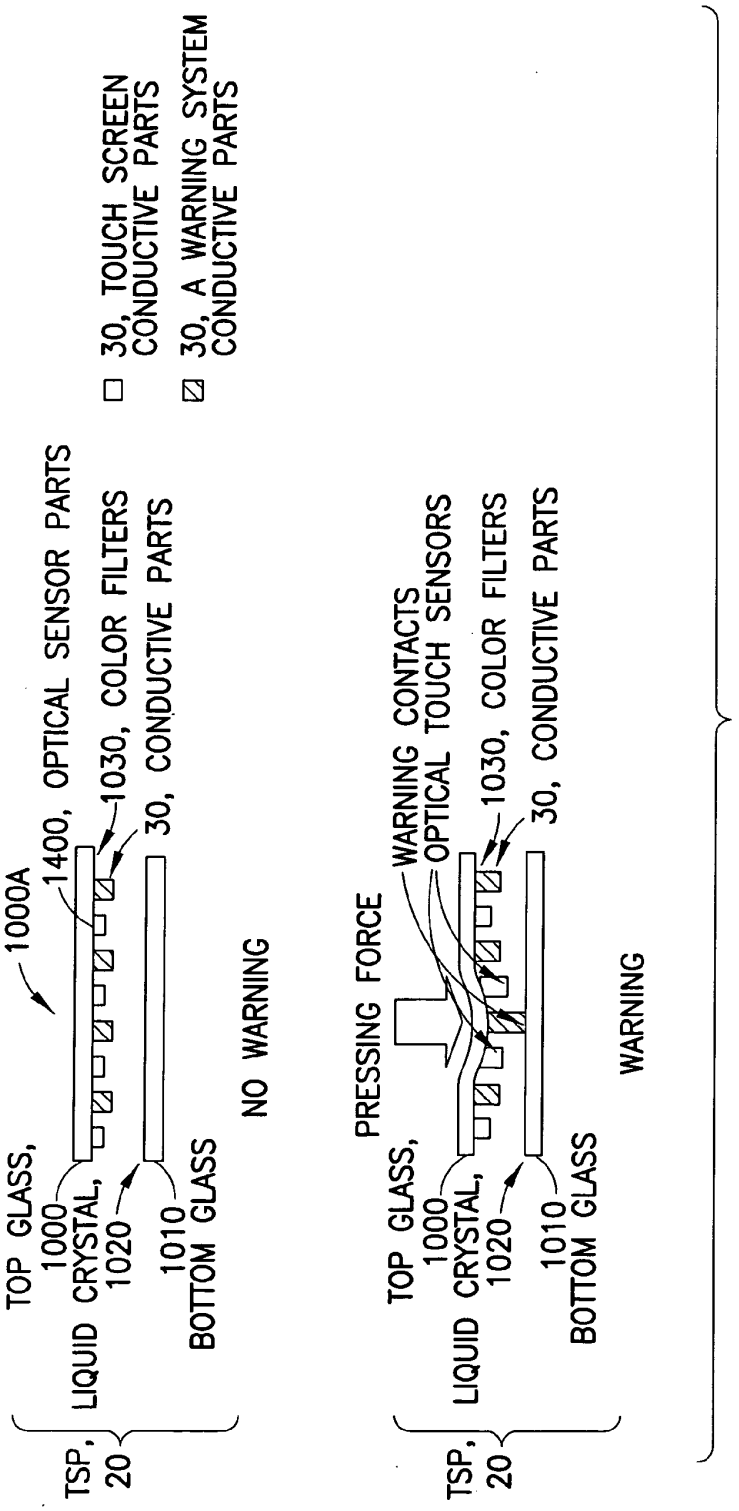

30, TOUCH SCREEN CONDUCTIVE PARTS
30, A WARNING SYSTEM CONDUCTIVE PARTS
1000A
1400, OPTICAL SENSOR PARTS
1030, COLOR FILTERS
30, CONDUCTIVE PARTS
TOP GLASS, 1000
LIQUID CRYSTAL, 1020
1010 BOTTOM GLASS
TSP, 20
NO WARNING
PRESSING FORCE
WARNING CONTACTS
OPTICAL TOUCH SENSORS
1030, COLOR FILTERS
30, CONDUCTIVE PARTS
TOP GLASS, 1000
LIQUID CRYSTAL, 1020
1010 BOTTOM GLASS
TSP, 20
WARNING

FIG.15

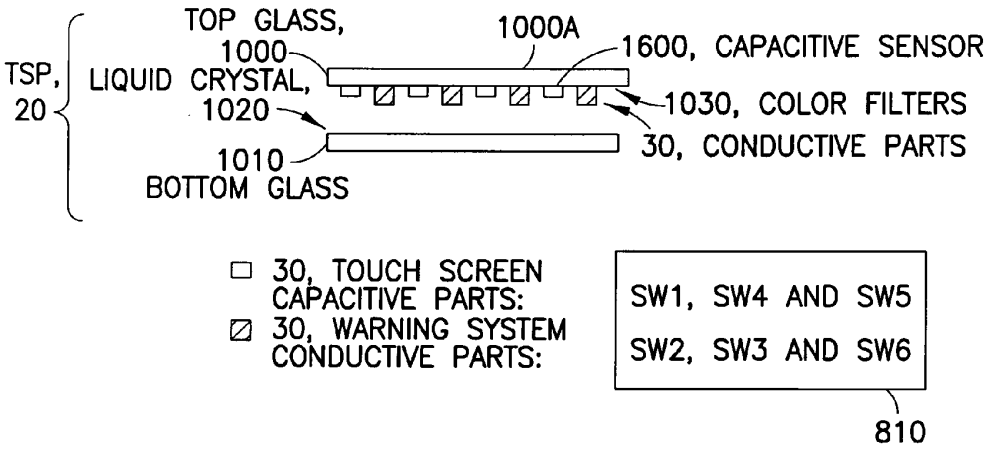

TOP GLASS,
1000
1000A
1600, CAPACITIVE SENSOR
TSP,
20
LIQUID CRYSTAL,
1020
1030, COLOR FILTERS
30, CONDUCTIVE PARTS
1010
BOTTOM GLASS
30, TOUCH SCREEN CAPACITIVE PARTS:
30, WARNING SYSTEM CONDUCTIVE PARTS:
SW1, SW4 AND SW5
SW2, SW3 AND SW6
810

FIG.16

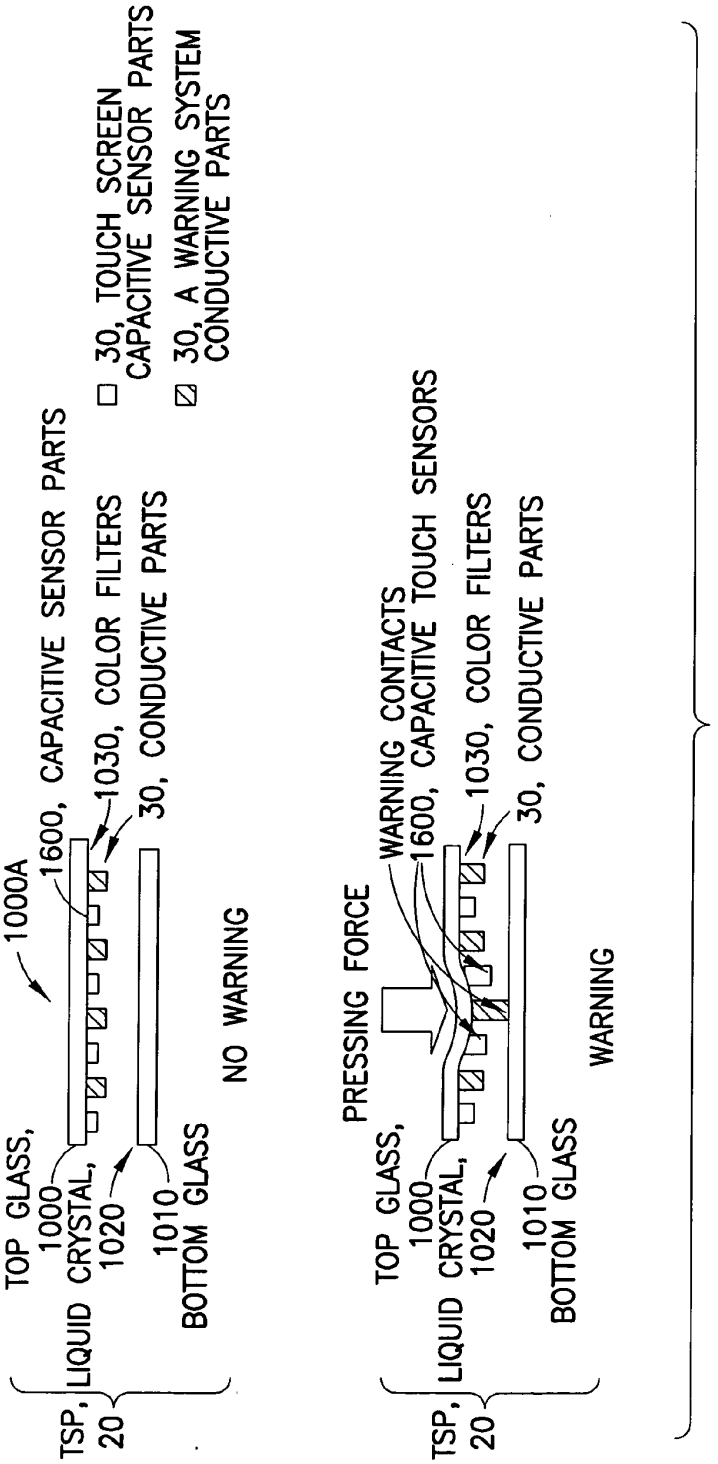

30, TOUCH SCREEN CAPACITIVE SENSOR PARTS
30, A WARNING SYSTEM CONDUCTIVE PARTS
1000A
1600, CAPACITIVE SENSOR PARTS
1030, COLOR FILTERS
30, CONDUCTIVE PARTS
NO WARNING
TOP GLASS, 1000
LIQUID CRYSTAL, 1020
1010 BOTTOM GLASS
TSP, 20
PRESSING FORCE
WARNING CONTACTS
1600, CAPACITIVE TOUCH SENSORS
1030, COLOR FILTERS
30, CONDUCTIVE PARTS
WARNING
TOP GLASS, 1000
LIQUID CRYSTAL, 1020
1010 BOTTOM GLASS
TSP, 20

FIG.17

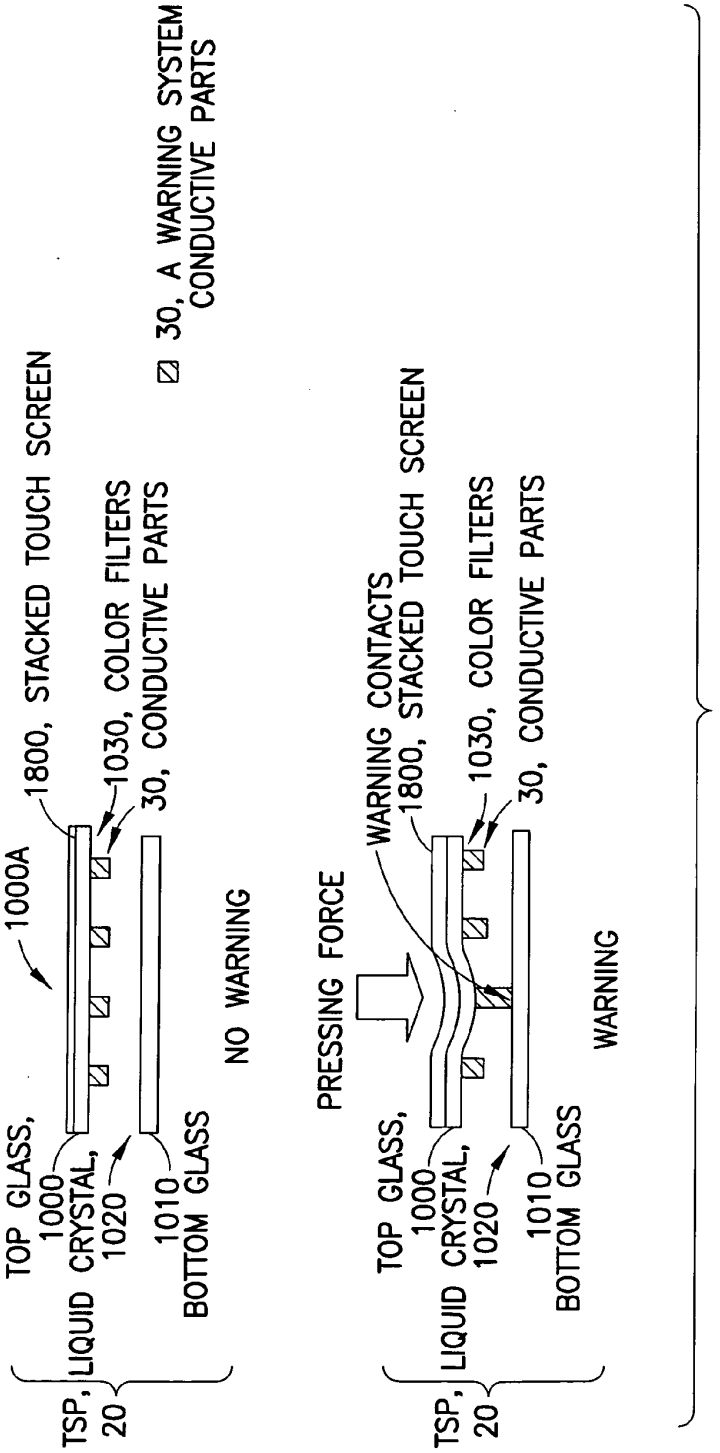

30, A WARNING SYSTEM CONDUCTIVE PARTS
1800, STACKED TOUCH SCREEN
1030, COLOR FILTERS
30, CONDUCTIVE PARTS
1000A
TOP GLASS, 1000
LIQUID CRYSTAL, 1020
1010 BOTTOM GLASS
TSP, 20
NO WARNING
PRESSING FORCE
WARNING CONTACTS
1800, STACKED TOUCH SCREEN
1030, COLOR FILTERS
30, CONDUCTIVE PARTS
TOP GLASS, 1000
LIQUID CRYSTAL, 1020
1010 BOTTOM GLASS
TSP, 20
WARNING

FIG.18

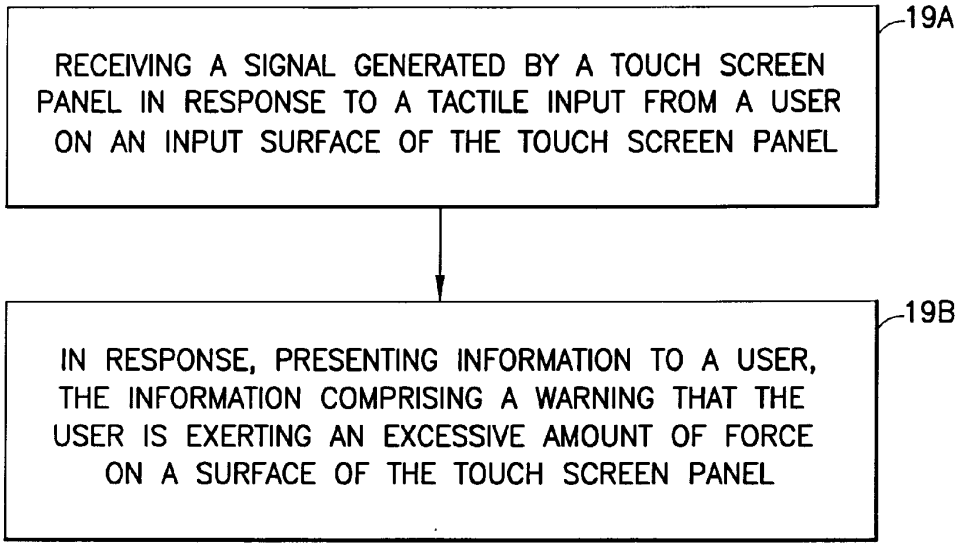

RECEIVING A SIGNAL GENERATED BY A TOUCH SCREEN PANEL IN RESPONSE TO A TACTILE INPUT FROM A USER ON AN INPUT SURFACE OF THE TOUCH SCREEN PANEL
19A
IN RESPONSE, PRESENTING INFORMATION TO A USER, THE INFORMATION COMPRISING A WARNING THAT THE USER IS EXERTING AN EXCESSIVE AMOUNT OF FORCE ON A SURFACE OF THE TOUCH SCREEN PANEL
19B

FIG.19

WARNING SYSTEM FOR BREAKING TOUCH SCREEN OR DISPLAY

TECHNICAL FIELD

[0001] The exemplary and non-limiting embodiments of this invention relate generally to touch screen devices and techniques to avoid inadvertent breakage of the touch screen device.

BACKGROUND

[0002] Various abbreviations that appear in the specification and/or in the drawing figures are defined as follows:
[0003] CP conductive parts
[0004] DAC digital to analog converter
[0005] GD gate driver
[0006] LCD liquid crystal display
[0007] LED light emitting diode
[0008] PCTSS pixel cells with touch screen sensors
[0009] RO readout
[0010] ROC readout circuit
[0011] SD source driver
[0012] TC timing controller
[0013] TSC touch screen controller
[0014] TSP touch screen panel
[0015] VCOM voltage common
[0016] Touch screen display devices have become increasingly popular and are commonly implemented in many types of devices, including mobile communication devices. A touch screen may include a display which can detect the presence and location of a touch within a display area. Here, a touch is often thought of either as a force by hand or stylus pen. The implementation of a touch screen can be done in a number of ways including, but not limited to, the use of capacitive, resistive, and optical technology.
[0017] In these touch screen display devices a user controls the operation of the device via the user's own touch. In some devices that implement touch screen functions the users only method to operate the device is through touch. It can then be seen how the user's ability to navigate the touch screen display and apply proper amounts of force is of importance to the sustainability of the device.
[0018] A problem can arise due to the user being unaware of potentially applying an excessive amount of force on the touch screen/display panel.

SUMMARY

[0019] A first embodiment of the invention is a method comprising: receiving a signal generated by a touch screen device in response to a tactile input from a user on an input surface of the touch screen device; and in response, presenting information to a user, the information comprising a warning that the user is exerting an excessive amount of force on a surface of the touch screen device.
[0020] Another embodiment of the invention is a computer readable medium encoded with a computer program executable by a processor to perform actions comprising: receiving a signal generated by a touch screen device of the touch screen device in response to a tactile input from a user on an input surface; and in response, presenting information to a user, the information comprising a warning that the user is exerting an excessive amount of force on a surface of the touch screen device.
[0021] Another further embodiment of the invention is an apparatus comprising: an input surface configured to generate a signal in response to tactile input from a user; and an output configured to provide an output signal when the user is exerting an excessive amount of force on the input surface.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] In the attached Drawing Figures:
[0023] FIG. **1** shows a simplified block diagram of various electronic devices that are suitable for use in practicing the exemplary embodiments of this invention.
[0024] FIG. **2** shows the internal operation of a mobile device that contains a touch screen.
[0025] FIG. **3** illustrates display panel pixel cell control.
[0026] FIG. **4** is a further illustration of display panel pixel cell control.
[0027] FIG. **5** is an even further illustration of display panel pixel cell control.
[0028] FIG. **6** is a still further illustration of display panel pixel cell control. FIG. **6**A illustrates a display panel further including a VCOM plane. FIGS. **6**B and **6**C provide graphs of the VCOM voltage during image frame updating as static and dynamic voltages respectively.
[0029] FIG. **7** is an illustration of two different touch screen configurations. FIGS. **7**A and **7**B provide illustration for a separated touch screen based on a sheet structure. FIGS. **7**C and **7**D provide illustration for a display integrated touch screen based on a matrix structure.
[0030] FIG. **8** is an illustration of display integrated touch screen scanning.
[0031] FIG. **9** is an illustration of a previous attempt to implement broken panel detection.
[0032] FIG. **10** shows the use of varying heights of conductive parts to trigger a warning.
[0033] FIG. **11** shows the operation of the display panel and touch screen panel according to the device of FIG. **10**.
[0034] FIG. **12** shows the implementation of FIGS. **10** and **11** into a display integrated touch screen panel with conductive switch matrix.
[0035] FIG. **13** shows the warning trigger for the device shown in FIG. **12**.
[0036] FIG. **14** shows the implementation of FIGS. **10** and **11** into an optical sensor based touch screen panel.
[0037] FIG. **15** shows the warning trigger for the device shown in FIG. **14**.
[0038] FIG. **16** shows the implementation of FIGS. **10** and **11** into a capacitive based touch screen panel.
[0039] FIG. **17** shows the warning trigger for the device shown in FIG. **16**.
[0040] FIG. **18** shows the implementation of FIGS. **10** and **11** into a stacked touch screen along with the corresponding warning triggers.
[0041] FIG. **19** is a logic flow diagram that illustrates a method, and the result of execution of computer program instructions, at the device in accordance with exemplary embodiments of this invention.

DETAILED DESCRIPTION

[0042] Currently devices that incorporate a touch screen fail to warn the user when he/she is pressing the surface of the touch screen or display panel with excessive force such that there is a possibility of damaging the surface, e.g., cracking or breaking it.

[0043] It may be possible to provide a broken detection of the touch screen or display panel via a trace **900** as is shown in FIG. **9**. The trace **900** is routed around the border of the display panel **910**. The trace **900** may be formed of indium-tin-oxide (ITO) formed on a surface of the display glass **920**, and generally around an active area **920**A of the display glass **920**. Also shown is a through-view of a driver (or any chip) **930** to the underlying electrically conductive bumps **935**. The trace **900** is connected to at least two of the bumps **935**. Should the display glass **920** crack or break it is assumed that the electrically conductive (e.g., ITO) trace **900** will experience a break as well, and thus electrical conductivity between the two bumps **935** connected to the trace **900** is lost (an open circuit condition will exist). This open circuit condition is detectable via the two bumps **935**.

[0044] Notice, however, that this technique would not detect a break in the glass that occurs only in the active area **920**A of the display glass **920**. Furthermore, this technique would only provide an indication that the display glass breakage had already occurred, and not an indication that display glass breakage may be about to occur (i.e. no warning will be generated that excessive force is being applied to the display glass **920**).

[0045] Reference is made to FIG. **1** for illustrating a simplified block diagram of various electronic devices that are suitable for use in practicing the exemplary embodiments of this invention. In FIG. **1** a device **10** includes a display **140**, a touch screen **150**, conductive parts (CP) **30**, and an engine (ENG) **40**, and may include microphone **100**, speaker **110**, keyboard **120**, radio **130**, vibra **160**, and camera **170**. The touch screen **150** contains the CP **30**.

[0046] The microphone **100** converts audio from acoustic waves to electrical format. The speaker **110** converts audio from electrical format to acoustic waves. The keyboard **120** converts information from pressed keys to electrical format. The radio **130** converts electrical information from/to radio waves. The display **140** converts electrical information to readable format. The touch screen **150** converts physical touch to an electrical format. The vibra **160** converts electrical information to mechanical force. The camera **170** converts images based on different levels of light of the object. The device includes the ENG **40** and may also include software which controls these conversions as well as a user interface. The display **140** and the touch screen **150** may further be integrated together such as a touch screen panel (TSP) **20** that forms a part of the display module **210** shown in FIG. **2**.

[0047] The TSP **20** is capable of receiving input from a user and may further be capable of displaying information received from the ENG **40**. The TSP **20** may be coupled to a ROC **800** that has functionality as described below in regards to FIG. **11**. The TSP **20** may also include GD **410**, SD **400**, and pixel cells with touch screen sensors (PCTSS) **1110**, also shown in FIG. **11**.

[0048] The CP **30** is capable of detecting a contact. The CP **30** may be implemented between a top and a bottom glass. The implementation of CP **30** may be further implemented as described below in regards to FIG. **10**.

[0049] The ENG **40** is capable of receiving input from the TSP **20**, microphone **100**, keyboard **120**, radio **130**, vibra **160**, and camera **170**, and is further capable of outputting to the TSP **20**.

[0050] The exemplary embodiments of this invention may be implemented at least in part by computer software executable by the ENG **40** of the device **10**, or by hardware, or by a combination of software and hardware.

[0051] The device **10** may also include a base band module **200** and the display module **210**, as shown in FIG. **2**. The base band module **200** includes the ENG **40** at least a backlight controller **220**. The display module **210** contains the display panel **140**, a display driver **240**, the touch screen **150**, and a TSC **230**. The display driver **240** generates VCOM, timings, etc. The ENG **40** controls the image displayed on the display panel **140** and it can also read touch screen values via the TSC **230**. The display panel **140** and the touch screen panel **150** may be integrated together as the TSP **20**. The ENG **40** may also control the backlight controller **220** which sets the level of the display screen backlight.

[0052] The display **140** may be made of liquid crystal material and may be referred to as a LCD. FIG. **3** illustrates a diagram of the display module **210** having a display panel **140** with pixel resolution of 240×320. An interface **300**, which includes a printed circuit, is coupled to the display driver **240**. The display driver **240** includes a frame memory **310**, a TC **320**, an address coding block **330**, and a DAC **340**.

[0053] The diagram shown in FIG. **4** illustrates in greater detail the display panel **140** of FIG. **3**. Considering FIGS. **3** and **4** together, image data is inputted from the interface **300** to the frame memory **310** on the display driver **240**. The source of the image data may be the ENG **40**. The TC **320** sends timing information to the address coding block **330** where control signals are generated. Some of these control signals address the frame memory **310**. Image data read from the frame memory **310** is a digital value or, more specifically a digital grey scale value. This digital image data is inputted into the DAC **340** where the value of the data is changed to analog image data for the column (Source: Sn, Sn+1, etc.). This analog image data is inputted to the display panel **140**, where a storage location for the image data is controlled by the address coding block **330** via column (source) and line (Gate: Gn, Gn+1, Gn+2, etc) control signals. The Line (Gate) control signals are of a digital value ('0' or '1') used for selecting a line of the pixels on the display panel where the analog information of the image data from column (source) is stored.

[0054] The operation of a pixel cell, which is visible to the user, in regards to the display module of FIG. **4** is also shown in FIG. **5**. The source driver **400** outputs analog image data values on the source lines (Sn, Sn+1, Sn+2, etc.). The gate driver **410** outputs a selection corresponding to the used gate line, and then all pixel cells of the selected gate line are updated. Only one line of pixels is updated at the same time, and the pixels are not updated on other lines. This update starts on one edge of the display panel **140** and is updated every next line. The following is an example of how two rows of pixel cells are updated. The analog image data is outputted on source lines (Sn, Sn+1, Sn+2, etc). There is selected a gate line Gn, which controls a switch of the pixel cell (transistor T **420** in this case), which is closed after the gate line selection Gn. Other gate lines (not gate line Sn) maintain open switches of other pixel cells. The analog image data can flow through the switch and start to load the memory **430** (charging a capacitor in this case). This loading also controls the liquid crystal cell (LC) **440** of the pixel cell. This loading continues until there is selected another gate line (not Gn). The loaded memory **430** (Capacitor C) keeps the analog value (visible grey level of the pixel cell) until the same gate line has been re-selected and reloaded. FIG. **5** shows two cases of analog

image values loaded onto the gate lines. Case **1** shows two lines of pixels loaded onto gate line Gn while case **2** shows two line of pixels loaded onto gate line Gn+1.

[0055] FIG. **6** further details the display panel pixel cell control. In FIG. **6**A, the display panel **140** contains a VCOM plane **610**. The VCOM **610** plane is a common voltage plane that is placed under the plane **620** that carries the source and gate lines. The voltage difference between the source and gate lines plane **620** and the VCOM **610** plane may be several volts. FIG. **6**B, shows the VCOM voltage as a static voltage during image frame updating. FIG. **6**C, shows the VCOM voltage changing during image frame updating.

[0056] In reference to FIG. **7**, there is an illustration of two different touch screen panel configurations. FIG. **7**A provides for a separated touch screen **700** that is based on a sheet structure. A sheet is used as a pressure sensor and two values are measured at the end of the sheet to calculate a resistance difference. FIG. **7**B then shows the touch screen panel **700** of FIG. **7**A as implemented into a device. The touch screen panel **700** is on upper glass with a connector running to a driver IC and a connector from the touch screen panel **700**. FIG. **7**C provides for a display integrated touch screen **750** that is based on a matrix structure. Cross points on the display **750** are used as pressure sensors. All of the cross points are measured in order to calculate the voltage differences. A cross point may be implemented at every display panel pixel or, e.g., every four pixels. FIG. **7**D then shows the touch screen panel **750** of FIG. **7**C as implemented into a device. The touch screen panel **750** is between an upper and lower glass with only one connector running to the driver IC.

[0057] Reference is made to FIG. **8** to show touch screen scanning. The display integrated touch screen based on a matrix structure **750** includes gate (TG) and RO lines. Every line is selected once during scanning. The selected line is readout to a ROC **800**. The matrix touch screen **750** may operate at the same time as the display panel pixel cell control and the information is read via RO lines. The matrix based touch screen **750** may be considered to operate in the same way as a keyboard, i.e., the user presses the touch screen and switches (SW) **810** are closed.

[0058] In one exemplary embodiment of this invention display integrated touch screen panel with conductive switch matrix construction is used to detect excessive force on the display or touch screen panel such as TSP **20** and deliver a warning to the user. The TSP **20** may be arranged similar to the matrix touch screen **750**. Heights of the CP **30** are defined so that they can detect a pressure that may cause damage to the TSP **20**.

[0059] One exemplary embodiment of this invention is shown in FIG. **10**. CP **30** are implemented between a top layer **1000** and a bottom layer **1010**. These layers may be of glass and may contain liquid crystal material **1020** and color filters **1030**. The height of the CP **30** may be different in different locations of the TSP **20**. The top layer **1000** additionally comprises input surface **1000**A, which receives tactile input from the user. The tactile input may be from a stylus pen or the user's own finger. If the CP **30** contacts the bottom layer **1010**, the presence of the contact generates a signal. This signal allows for the ENG **40** to cause a warning message to be displayed to the user cautioning that an excessive pressing force is being applied to the top glass **1000** of the TSP **20**. An excessive force herein is defined as a force that is less than the breaking threshold for the input surface **1000**A. The varying heights of the CP **30** may be implemented as longer CPs **30** alongside the border of the TSP **20** and shorter CPs **30** in the middle of the TSP **20**. This allows for a device to take advantage of greater support around the border of the TSP **20** and where there is greater tolerance to a user's applied force.

[0060] In reference to FIG. **11** there is an illustration of an exemplary embodiment of the touch screen. The touch screen is shown as a display panel with an integrated touch screen such as TSP **20** that is coupled to ROC **800**. TSP **20** may be arranged similar to that of the matrix touch screen **750**. TSP **20** includes GD **410**, ROC **800**, and PCTSS **1110**. The TSP **20** receives input from the SD **400** and from the GD **410**. The input of SD **400** is referred to as Sn and the input from the GD **410** is TGn (for a touch screen gate line) and Gn (for a display gate line). The PCTSS **1100** includes transistors (T) **420**, touch sensors embodied as switches (SWn) **810**, capacitors (C) **430**, and liquid crystal cells (LC) **440**. The GD **410** may include the same number of lines that are used for the display panel **140**, e.g., 320 lines (QVGA, 240×320). Transistors (T) **420** for the touch screen matrix may be implemented in the same way as the pixel cell transistors on the TSP **20**. The scanning occurs for (PCTSS) **1110** as follows: CGn line is active when Pixel Cells **1** and **2** are updated (Gn line for selection and Sn and Sn+1 for loading) and SW**1** and SW**2** are read out (TGn line for selection and RO**1** and RO**2** lines for reading).

[0061] FIG. **12**, according to one exemplary embodiment, shows the embodiment of FIG. **11** and specifically TSP **20** embodied as a display integrated touch screen panel with conductive switch matrix. In a display integrated touch screen panel with conductive matrix the touch screen panel sensor is integrated onto the display panel similar to the matrix touch screen **750** and is configured to function under single touch, multi-touch, and writing conditions. The CP **30** of the display integrated touch screen panel with conductive matrix are implemented with varying heights. The longest CP **30** are for a touch screen function and the shortest CP **30** are for a warning function. As a user presses down on TSP **20**, SWn **810** are switched and the specific SWn's that are switched depends on the force the user exerts and the location of the force on the TSP **20**. Depending on the SWn that are switched a warning message cautioning the user of exerting too much force may be displayed. The display of the warning message may be in one of the human senses e.g. mechanical, visual, or audible format. Mechanical format is herein defined as format that may be of tactile feeling. FIG. **13** shows the warning and no warning situations in regards to FIG. **12** as excessive force is applied to the TSP **20**.

[0062] FIG. **14** according to another exemplary embodiment, shows the embodiment of FIG. **11** and specifically TSP **20** embodied as an optical sensor based touch screen panel. The operation of FIG. **14** is similar to what was described for FIG. **12**. In an optical sensor based touch screen panel sensors **1400** detect light and operate in conjunction with CP **30**. The optical sensor parts **1400** are for a touch screen function and the CP **30** are for a warning function. FIG. **15** shows the warning and no warning situations in regards to FIG. **14** as excessive force is applied to the TSP **20**.

[0063] FIG. **16** according to a further exemplary embodiment, shows the embodiment of FIG. **11** and specifically TSP **20** embodied as a capacitive based touch screen panel. The operation of FIG. **16** is similar to what was described in FIG. **12**. In a capacitive based touch screen panel sensors **1600** detect electrical current and operate in conjunction with CP **30**. The capacitive sensor parts **1600** are for a touch screen

function and the CP **30** are for a warning function. FIG. **17** shows the warning and no warning situations in regards to FIG. **16** as excessive force is applied to the TSP **20**.

[0064] FIG. **18** according to an even further exemplary embodiment, shows the embodiment of FIG. **11**, where TSP **20** includes a stacked touch screen (resistive, capacitive, etc.) **1800**. The stacked touch screen **1800** may be on the TSP **20** when CP **30** is included only for warning purposes. The stacked touch screen **1800** may also be under the TSP **20** e.g. in a conductive touch screen case. A warning and no warning situation are also illustrated as excessive force is applied to the TSP **20**.

[0065] (A) Referring to FIG. **19**, in accordance with an exemplary method at Block **19**A, there is a step of receiving a signal generated by a touch screen panel **20** in response to a tactile input from a user on an input surface **1000**A of the touch screen panel **20**; and at Block **19**B in response, presenting information to a user, the information comprising a warning that the user is exerting an excessive amount of force on a surface of the touch screen panel **20**.

[0066] (B) The method in paragraph A, where the information is presented by at least one of mechanical, visual, or audible output.

[0067] (C) The method in paragraph A, where the signal generated by the touch screen panel **20** is the result of contact amongst conductive parts formed on a first layer and a second layer in the touch screen panel.

[0068] (D) The method in paragraph C, where the conductive parts within an area between the first layer and the second layer are of varying lengths.

[0069] (E) The method in paragraph (D), where the varying lengths of the CP **30** are divided into one of a touch screen function and a warning function, and where the signal is output only for contact amongst CP **30** and a bottom layer that are of the warning function.

[0070] (F) The method in paragraphs (D-E) where the CP **30** are implemented in a display integrated touch screen panel with conductive switch matrix.

[0071] (G) The method in paragraph (C) where the CP **30** are implemented in an optical sensor based touch screen panel.

[0072] (H) The method in paragraph (C) where the CP **30** are implemented in capacitive based touch screen panel.

[0073] (I) The method in paragraph (A) where the surface of the touch screen panel comprises a stacked touch screen.

[0074] (J) The method in paragraph (D) where the varying lengths of the conductive parts are greater along the border of the display on the touch screen panel.

[0075] It should be further appreciated that the exemplary embodiments of this invention pertain to apparatus at the touch screen panel **20**, which may be embodied as an input surface configured to generate a signal in response to tactile input from a user; and an output configured to provide an output signal when the user is exerting an excessive amount of force on the input surface.

[0076] The various blocks shown in FIG. **19** may be viewed as method steps, and/or as operations that result from operation of computer program code, and/or as a plurality of coupled logic circuit elements constructed to carry out the associated function(s).

[0077] In general, the various exemplary embodiments may be implemented in hardware or special purpose circuits, software, logic or any combination thereof. For example, some aspects may be implemented in hardware, while other aspects may be implemented in firmware or software which may be executed by a controller, microprocessor or other computing device, although the invention is not limited thereto. While various aspects of the exemplary embodiments of this invention may be illustrated and described as block diagrams, flow charts, or using some other pictorial representation, it is well understood that these blocks, apparatus, systems, techniques or methods described herein may be implemented in, as non-limiting examples, hardware, software, firmware, special purpose circuits or logic, general purpose hardware or controller or other computing devices, or some combination thereof.

[0078] Various modifications and adaptations to the foregoing exemplary embodiments of this invention may become apparent to those skilled in the relevant arts in view of the foregoing description, when read in conjunction with the accompanying drawings. However, any and all modifications will still fall within the scope of the non-limiting and exemplary embodiments of this invention.

[0079] It should be noted that the terms "connected," "coupled," or any variant thereof, mean any connection or coupling, either direct or indirect, between two or more elements, and may encompass the presence of one or more intermediate elements between two elements that are "connected" or "coupled" together. The coupling or connection between the elements can be physical, logical, or a combination thereof. As employed herein two elements may be considered to be "connected" or "coupled" together by the use of one or more wires, cables and/or printed electrical connections, as well as by the use of electromagnetic energy, such as electromagnetic energy having wavelengths in the radio frequency region, the microwave region and the optical (both visible and invisible) region, as several non-limiting and non-exhaustive examples.

[0080] Furthermore, some of the features of the various non-limiting and exemplary embodiments of this invention may be used to advantage without the corresponding use of other features. As such, the foregoing description should be considered as merely illustrative of the principles, teachings and exemplary embodiments of this invention, and not in limitation thereof.

What is claimed is:

1. A method, comprising:

receiving a signal generated by a touch screen device in response to a tactile input from a user on an input surface of the touch screen device; and

in response, presenting information to a user, the information comprising a warning that the user is exerting an excessive amount of force on a surface of the touch screen device.

2. The method as in claim **1**, where the information is presented by at least one of mechanical, visual, or audible output.

3. The method as in claim **1**, where the signal generated by a touch screen device is the result of contact between conductive parts formed on a first layer and a second layer in the touch screen device.

4. The method as in claim **3**, where the conductive parts are of varying lengths within an area between the first layer and the second layer.

5. The method as in claim **4**, where the varying lengths of the conductive parts are divided into one of a touch screen function and a warning function, and where the signal gener-

ated is for only contact amongst conductive parts and a bottom layer that are of the warning function.

6. The method as in claim **4** where the conductive parts are implemented in a display integrated touch screen panel with conductive switch matrix.

7. The method as in claim **3** where the conductive parts are implemented in an optical sensor based touch screen panel.

8. The method as in claim **3** where the conductive parts are implemented in a capacitive based touch screen panel.

9. The method as in claim **1** where the surface of the touch screen device comprises a stacked touch screen.

10. The method as in claim **4**, where the lengths of the conductive parts are greatest around a periphery of the area.

11. A computer readable medium encoded with a computer program executable by a processor to perform actions comprising:

receiving a signal generated by a touch screen device in response to a tactile input from a user on an input surface of the touch screen device; and

in response, presenting information to a user, the information comprising a warning that the user is exerting an excessive amount of force on a surface of the touch screen device.

12. The computer readable medium encoded with a computer program of claim **11**, where the information is presented by at least one of mechanical, visual, or audible output.

13. The computer readable medium encoded with a computer program of claim **11**, where the signal generated by a touch screen device is the result of contact between conductive parts formed on a first layer and a second layer in the touch screen device.

14. The computer readable medium encoded with a computer program of claim **13**, where the conductive parts are of varying lengths within an area between the first layer and the second layer.

15. The computer readable medium encoded with a computer program of claim **14**, where the varying lengths of the conductive parts are divided into one of a touch screen function and a warning function, and where the signal generated is for only contact amongst conductive parts and a bottom layer that are of the warning function.

16. The computer readable medium encoded with a computer program of claim **14**, where the conductive parts are implemented in a display integrated touch screen panel with conductive switch matrix.

17. The computer readable medium encoded with a computer program of claim **13**, where the conductive parts are implemented in an optical sensor based touch screen panel.

18. The computer readable medium encoded with a computer program of claim **13**, where the conductive parts are implemented in a capacitive based touch screen panel.

19. The computer readable medium encoded with a computer program of claim **11**, where the surface of the touch screen device comprises a stacked touch screen.

20. The computer readable medium encoded with a computer program of claim **14**, where the lengths of the conductive parts are greatest around a periphery of the area.

21. An apparatus, comprising:

an input surface configured to generate a signal in response to tactile input from a user; and

an output configured to provide an output signal when the user is exerting an excessive amount of force on the input surface.

22. The apparatus as in claim **21**, where the input surface comprises a touch screen panel and where the touch screen panel is integrated into a display panel.

23. The apparatus as in claim **22**, where the tactile input comprises conductive parts.

24. The apparatus as in claim **23**, where the conductive parts are of varying lengths within an area of the input surface.

25. The apparatus as in claim **24**, where the varying lengths of the conductive parts are divided into one of a touch screen function and a warning function, and where the signal is output only for contact amongst conductive parts that are of the warning function and a bottom layer of the tactile input.

26. The apparatus as in claim **21** implemented as a display integrated touch screen panel with conductive switch matrix.

27. The apparatus as in claim **21** implemented as an optical sensor based touch screen panel.

28. The apparatus as in claim **21** implemented as a capacitive based touch screen panel.

29. The apparatus as in claim **21** implemented as a stacked touch screen.

30. The apparatus as in claim **24** where the lengths of the conductive parts are greatest around a periphery of the area.

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