

IN THE CLAIMS:

Please cancel claims **1 – 20** without prejudice.

1 - 20. (canceled)

Please add the following new claims.

21. (new) A portable wireless computer system, comprising:

- a top surface comprising a touch sensitive display, the top surface containing no movable button;
- a processor;
- a transceiver for sending and receiving wireless signals over a communications network;
- a solid-state memory storing computer instructions configured to:
 - enable the portable wireless computer system to run a plurality of applications, the applications comprising a telephone, chat or SMS, a calculator, a camera, an alarm, a clock, a music player, and email;
 - and
 - cause the portable wireless computer system (a) to highlight a first item corresponding to a current position of an object gliding over a linear list of items on said display and to select a second item from the list at least partially based on where the object stops gliding and is lifted from said display, and (b) to present a plurality of communication options on said display for a given contact, wherein the communication options comprise call, email, and chat or SMS; and
- a housing surrounding said display and enclosing said processor, said transceiver, and said solid-state memory.

22. (new) The portable wireless computer system of claim **21**, wherein the plurality of applications comprise: (a) a first application providing options on said display for editing, deleting and sending a picture, (b) a second application and a third application capable of running simultaneously, the second application capable of being presented on top of the third application on said display, and (c) a fourth application and a fifth application capable of running simultaneously, the fourth application being a music player, and the fifth application being email, chat or SMS.

23. (new) The portable wireless computer system of claim **22**, wherein the portable wireless computer system is a mobile phone, and the computer instructions are configured to enable the portable wireless computer system to present a user interface, the user interface comprising at least two states, namely: (a) a tap-present state, wherein a plurality of tap-activatable icons for activating a plurality of corresponding pre-designated applications, functions, services, settings or tasks are present, each of the plurality of pre-designated applications, functions, services, settings or tasks being activated in response to a tap on its corresponding icon, and (b) a tap-absent state, wherein the plurality of tap-activatable icons are absent, the tap-absent state configured to be transitioned to the tap-present state in response to a multi-step user gesture comprising the object: (i) touching an edge area of said display, and then (ii) gliding on said display away from the edge area.

24. (new) The portable wireless computer system of claim **23**, wherein the plurality of tap-activatable icons represent applications comprising a telephone, chat or SMS, a camera, a music player and email.

25. (new) The portable wireless computer system of claim **22**, wherein the computer instructions are configured to activate a function in response to a multi-step user gesture comprising the object touching said display at a location corresponding to a demarcated representation of the function followed by the object gliding away from the location along said display, wherein the maximum diagonal dimension of the representation is less than a thumb's width, the representation represents only the function, and is not relocated during the multi-step user gesture, and the function is not activated differently based on a direction of the gliding.

26. (new) The portable wireless computer system of claim **25**, wherein the function is a member of the group consisting of an application, and a menu for configuring services or settings for an operations system or an application, and wherein the maximum diagonal dimension of the representation is less than one inch.

27. (new) The portable wireless computer system of claim **26**, wherein the computer instructions are configured (a) to enable the portable wireless computer system to scroll content on said display in response to the object touching a first location on said display and gliding up or down on said display from the first location, and (b) to enable the portable wireless computer system to move an application, a function, a service or a setting one step forward or backward or to close or remove an application, a function, a service or a setting on said display in response to the object touching a second location on said display and gliding to the right or to the left from the second location.

28. (new) The portable wireless computer system of claim **25**, wherein the function activated in response to the multi-step user gesture

presents one or more alphanumeric characters in a keyboard user interface on said display.

29. (new) The portable wireless computer system of claim **22**, wherein the computer instructions are configured to enable the portable wireless computer system:

(a) to enable a graphical user interface for accessing a plurality of gadgets, each gadget comprising an area containing at least a portion of dynamically generated data related to that gadget, wherein the user interface:

(i) arranges the plurality of gadgets in a layout that is larger than said display, whereby some of the gadgets are in said display and others of the gadgets are out of said display;

(ii) expands one of the gadgets in said display beyond an edge of said display to show more data therein by shifting other gadgets; and

(iii) pans the layout within said display to bring some of the gadgets into said display and/or to move some of the gadgets out of said display, in response to the object touching one of the gadgets on said display, and then the object gliding along said display away from the touched location; and

(b) to detect an object touching with hard pressure an on-screen element selected from the group consisting of a gadget, a letter, a key, a button or an icon and then to activate the on-screen element, thereby resulting in: (i) enlarging the on-screen element, (ii) displaying a callout balloon with a copy of the on-screen element inside, or (iii) a combination thereof.

30. (new) A mobile phone system, comprising:

a top surface comprising a touch sensitive display, the top surface having no movable button;

a processor coupled to said display;

a transceiver for sending and receiving wireless signals over a communications network;

a solid-state memory storing computer instructions configured to enable the mobile phone system: (a) to activate a function in response to a first multi-step user gesture comprising an object touching an area corresponding to a demarcated representation of the function followed by gliding away from the area on said display, wherein the demarcated representation represents only the function and does not relocate during the first multi-step user gesture, and the function is not activated differently based on a direction of the gliding, (b) to present a plurality of functions, applications, services or settings in response to a second multi-step user gesture comprising the object touching an edge area of said display followed by gliding within said display away from the edge area, (c) to highlight a first item corresponding to a current position of the object gliding over a linear list of items on said display and to select a second item from the list at least partially based on where the object stops gliding and is lifted from said display, (d) to run a first application wherein a touch keyboard presented on said display enables a user to edit or save text in the first application, (e) to run a second application configured to provide options for editing, deleting and sending a picture on said display, (f) to present a plurality of communication options for a given contact, the communication options comprising call, email, and chat or SMS, (g) to scroll content on said display in response to the object touching a first location on said display and gliding up or down on said display from the first location, and (h) to move an application, a function, a service or a setting one step forward or backward or to close or remove an application, a function, a

service or a setting on said display in response to the object touching a second location on said display and gliding to the right or to the left from the second location; and

a housing surrounding said display and enclosing said processor, said transceiver, and said solid-state memory.

31. (new) The mobile phone system of claim **30**, wherein the computer instructions are configured to enable the mobile phone system to present a user interface, the user interface comprising at least two states, namely, (a) a tap-present state, wherein a plurality of tap-activatable icons for activating a plurality of corresponding pre-designated applications, functions, services, settings or tasks are present, each of the plurality of pre-designated applications, functions, services, settings or tasks being activated in response to a tap on its corresponding icon, and (b) a tap-absent state, wherein the plurality of tap-activatable icons are absent, the tap-absent state configured to be transitioned to the tap-present state in response to a third multi-step user gesture comprising: the object (i) touching an edge area of said display, and then (ii) gliding on said display away from the edge area.

32. (new) The mobile phone system of claim **31**, wherein the plurality of tap-activatable icons represent applications comprising a telephone, chat or SMS, a camera, a music player and email.

33. (new) The mobile phone system of claim **30**, wherein the computer instructions are configured to enable the mobile phone system to run a plurality of applications, the applications comprising: (a) a telephone, chat or SMS, a calculator, a camera, an alarm, a clock, a music player, and email; (b) a third application and a fourth application capable of running

simultaneously, the third application capable of being presented on top of the fourth application on said display; and (c) a fifth application and a sixth application capable of running simultaneously, the fifth application being a music player and the sixth application being email, chat or SMS.

34. (new) The mobile phone system of claim **30**, wherein the text saved in the first application is configured for use as an address, a telephone number, or a message in phone call, email, chat or SMS.

35. (new) The mobile phone system of claim **30**, wherein the function activated in response to the first multi-step user gesture enables an alphanumeric character to be entered using a keyboard presented on said display.

36. (new) The mobile phone system of claim **30**, wherein the computer instructions are configured to enable the mobile phone system:

(1) to enable a graphical user interface for accessing a plurality of gadgets, each gadget comprising an area containing at least a portion of dynamically generated data related to that gadget, wherein the user interface:

(a) arranges the plurality of gadgets in a layout that is larger than said display, whereby some of the gadgets are in said display and others of the gadgets are out of said display;

(b) expands one of the gadgets in said display to show more data therein by shifting other gadgets; and

(c) pans the layout within said display to bring some of the gadgets into said display and/or to move some of the gadgets out of said display, in response to (i) the object touching one of the gadgets on

said display, and then (ii) the object gliding along said display away from the touched location; and

(2) to detect an object touching with hard pressure an on-screen element from the group consisting of a gadget, a letter, a key, a button or an icon and then to activate the on-screen element, thereby resulting in (a) enlarging the on-screen element, (b) displaying a callout balloon with a copy of the on-screen element inside, or (c) a combination thereof.

37. (new) A mobile phone system, comprising:

a top surface comprising a touch sensitive display, the top surface containing no movable button;

a processor;

a transceiver for sending and receiving wireless signals over a communications network;

a solid-state memory storing computer instructions configured to enable the mobile phone system: (1) to highlight a first item corresponding to a current position of an object gliding over a linear list of items on said display and to select a second item from the list at least partially based on where the object stops gliding and thereafter is lifted from said display, and (2) to provide a user interface, the user interface comprising at least two states, namely: (a) a tap-present state, wherein a plurality of tap-activatable icons for activating a plurality of corresponding pre-designated applications, functions, services, settings or tasks are present, each of the plurality of pre-designated applications, functions, services, settings or tasks being activated in response to a tap on its corresponding icon, and (b) a tap-absent state, wherein the plurality of tap-activatable icons are absent, the tap-absent state configured to be transitioned to the tap-present state in response to a first multi-step user gesture comprising: the

object (i) touching an edge area of said display, and then (ii) gliding on said display away from the edge area; and

a housing surrounding said display and enclosing said processor, said transceiver, and said solid-state memory.

38. (new) The mobile phone system of claim **37**, wherein the computer instructions are further configured to enable the mobile phone system to run a plurality of applications, the applications comprising a phone, chat or SMS, a calculator, a camera, an alarm, a clock, a music player, and email, the plurality of applications comprising: (a) a first application wherein a touch keyboard presented on said display enables a user to edit or save text in the first application, (b) a second application providing options for editing, deleting and sending a picture on said display, (c) a third application and a fourth application capable of running simultaneously, the third application capable of being presented on top of the fourth application on said display, and (d) a fifth application and a sixth application capable of running simultaneously, the fifth application being a music player, and the sixth application being email, chat or SMS, and (e) a seventh application providing a plurality of communication options for a given contact, the communication options comprising call, email, and chat or SMS.

39. (new) The mobile phone system of claim **38**, wherein the instructions are configured to enable the mobile phone system: (a) to scroll content on said display in response to the object touching a first location on said display and gliding up or down on said display from the first location, (b) to move an application, a function, a service or a setting one step forward or backward or to close or remove an application, a function, a service or a setting on said display in response to the object touching a

second location on said display and gliding to the right or to the left from the second location, and (c) to activate a function in response to a second multi-step user gesture comprising the object touching an area corresponding to a demarcated representation of the function followed by gliding away from the area on said display, wherein the demarcated representation represents only the function and does not relocate during the second multi-step user gesture, and the function is not activated differently based on a direction of the gliding.

40. (new) The mobile phone system of claim **39**, wherein the computer instructions are configured to enable the mobile phone system:

(a) to enable a graphical user interface for accessing a plurality of gadgets, each gadget comprising an area containing at least a portion of dynamically generated data related to that gadget, wherein the user interface:

(i) arranges the plurality of gadgets in a layout that is larger than said display, whereby some of the gadgets are in said display and others of the gadgets are out of said display;

(ii) expands one of the gadgets in said display to show more data therein by shifting other gadgets; and

(iii) pans the layout within said display to bring some of the gadgets into said display and/or to move some of the gadgets out of said display, in response to the object touching one of the gadgets on said display, and then the object gliding along said display away from the touched location; and

(b) to detect an object hard-pressing an on-screen element from the group consisting of a gadget, a letter, a key, a button or an icon, and then to activate the on-screen element, thereby resulting in (i) enlarging

the on-screen element, (ii) displaying a callout balloon with a copy of the on-screen element inside, or (iii) a combination thereof.

REMARKS

Applicant has canceled claims **1** – **20**, and has added new claims **21** - **40**. No new matter has been introduced, and support for the new claims is provided below. Claims **21** - **40** are presented for examination.

Support for New Claims in Original Specification

New independent claim **21** for a portable wireless computer system is supported in priority document U.S. Serial No. 10/315,250, filed on December 10, 2002, at least by the text and figures listed in the table below.

Claim 21 feature	Priority document U.S. Serial No. 10/315,250	
	Description	FIGS.
a top surface comprising a touch sensitive display, the top surface containing no movable button	Page 9, lines 1 – 3.	FIG. 13 shows opening 51 for touch sensitive display 3, and no movable buttons, on the top surface of enclosure 5.
a processor	Page 5, lines 12 – 18; Page 9, lines 12 - 15	FIG. 14 shows computer 6.
a transceiver for sending and receiving wireless signals over a communications network	Page 3, lines 19 – 21; Page 6, lines 30 – 34.	FIG. 6 shows phone, SMS, chat and email applications.
a solid-state memory storing computer instructions configured to enable the portable wireless computer system to run a plurality of applications	Page 9, lines 10 – 15.	FIG. 14.
the applications comprising a telephone, chat or SMS, a calculator, a	Page 6, line 10 mentions "clock" and "alarm".	FIG. 3 shows alarm icon 215. FIG. 6 shows telephone, chat, SMS,

Claim 21 feature	Priority document U.S. Serial No. 10/315,250	
	Description	FIGS.
camera, an alarm, a clock, a music player, and email		calculator, camera, music player and email applications.
cause the portable wireless computer system (a) to highlight a first item corresponding to a current position of an object gliding over a linear list of items on said display and to select a second item from the list at least partially based on where the object stops gliding and is lifted from said display	Page 7, lines 1 – 15 and 27 – 30.	FIGS. 6 – 8.
to present a plurality of communication options on said display for a given contact, wherein the communication options comprise call, email, and chat or SMS	According to page 5, line 28 – page 6, line 7, when the current application handles a contact, then the icons that are shown when the first function is activated are services such as call, email, chat or SMS. Page 6, lines 30 – 34 discusses providing the options: call, email, and SMS, for inputted text.	
a housing surrounding said display and enclosing said processor, said transceiver, and said solid-state memory.	Page 2, lines 16 and 17; Page 9, lines 1 and 2.	FIG. 13.

New dependent claim **22** is supported in priority document U.S. Serial No. 10/315,250, filed on December 10, 2002, at least by the text and figures listed in the table below.

Claim 22 feature	Priority document U.S. Serial No. 10/315,250	
	Description	FIGS.
a first application providing options on said display for editing, deleting and sending a picture	Page 6, lines 4 – 7.	
a second application and a third application capable of running simultaneously, the second application capable of being presented on top of the third application on said display	Page 5, lines 12 – 14.	
a fourth application and a fifth application capable of running simultaneously, the fourth application being a music player, and the fifth application being email, chat or SMS	Page 5, lines 12 – 18.	FIG. 6 shows that music player, email, chat and SMS are available applications.

New dependent claim **23** is supported in priority document U.S. Serial No. 10/315,250, filed on December 10, 2002, at least by the text and figures listed in the table below.

Claim 23 feature	Priority document U.S. Serial No. 10/315,250	
	Description	FIGS.
wherein the portable wireless computer system is a mobile phone	Page 7, lines 16 – 18.	FIG. 6 shows a phone application.
a tap-present state, wherein a plurality of tap-activatable icons for activating a plurality of corresponding pre-designated applications, functions, services, settings or tasks are present, each of the plurality of pre-designated applications, functions, services, settings or tasks being activated in response to a tap on its corresponding icon	Page 2, line 29 – page 3, line 4; Page 5, lines 28 – 30, and page 6, lines 12 and 13; Page 7, lines 1 – 3.	FIGS. 3, 4 and 6.
a tap-absent state, wherein the plurality of tap-activatable icons are absent		FIG. 1.
the tap-absent state configured to be transitioned to the tap-present state in response to a multi-step user gesture comprising the object: (i) touching an edge area of said display, and then (ii) gliding	Page 2, lines 25 – 32; Page 5, lines 24 – 30; Page 8, lines 21 and 22.	FIGS. 1 – 3.

Claim 23 feature	Priority document U.S. Serial No. 10/315,250	
	Description	FIGS.
on said display away from the edge area.		

New dependent claim **24** is supported in priority document U.S. Serial No. 10/315,250, filed on December 10, 2002, at least by the text and figures listed in the table below.

Claim 24 feature	Priority document U.S. Serial No. 10/315,250	
	Description	FIGS.
the plurality of tap-activatable icons represent applications comprising a telephone, chat or SMS, a camera, a music player and email.	Page 7, lines 1 – 10.	FIGS. 6 and 7.

New dependent claim **25** is supported in priority document U.S. Serial No. 10/315,250, filed on December 10, 2002, at least by the text and figures listed in the table below.

Claim 25 feature	Priority document U.S. Serial No. 10/315,250	
	Description	FIGS.
the computer instructions are configured to activate a function in response to a multi-step user gesture comprising the object touching said display at a location corresponding to a demarcated representation of the function followed by the object gliding away from the location along said display,	Page 2, lines 25 – 27; Page 5, lines 19 – 27.	FIGS. 1 – 3, 5 and 6.
the maximum diagonal dimension of the representation is less than a thumb's width,	Page 9, lines 3 and 4.	FIGS. 1, 2, 8, 9 and 11 – 13.
the representation represents only the function, and is not relocated during the multi-step user gesture, and the function is not activated differently based on a direction of the gliding.	Page 5, lines 19 – 27; Page 8, lines 31 – 33;	

New dependent claim **26** is supported in priority document U.S. Serial No. 10/315,250, filed on December 10, 2002, at least by the text and figures listed in the table below.

Claim 26 feature	Priority document U.S. Serial No. 10/315,250	
	Description	FIGS.
wherein the function is a member of the group consisting of an application, and a menu for configuring services or settings for an operations system or an application,	Page 5, lines 21 – 23 and 28 – 30; Page 6, lines 8 – 10.	
wherein the maximum diagonal dimension of the representation is less than one inch.	Page 9, lines 3 and 4.	FIGS. 1, 2, 8, 9 and 11 – 13.


New dependent claim **27** is supported in priority document U.S. Serial No. 10/315,250, filed on December 10, 2002, at least by the text and figures listed in the table below.

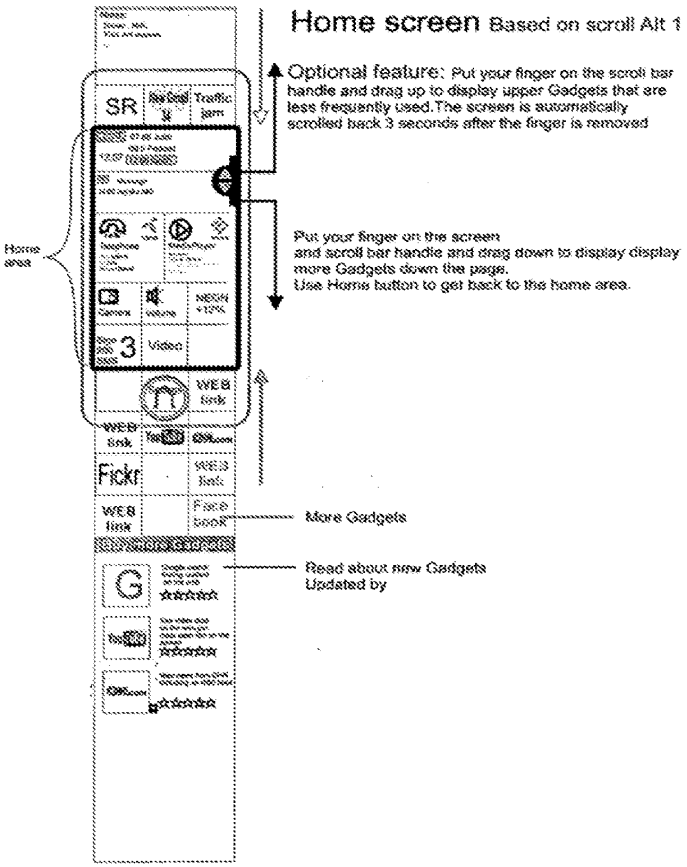
Claim 27 feature	Priority document U.S. Serial No. 10/315,250	
	Description	FIGS.
the computer instructions are configured to scroll content on said display in response to the object touching a first location on said display and gliding up or down on said display from the first location,	Page 7, line 27 – page 8, line 10.	FIGS. 8 and 9.
the computer instructions are configured to move an application, a function, a service or a setting one step forward or backward or to close or remove an application, a function, a service or a setting on said display in response to the object touching a second location on said display and gliding to the right or to the left from the second location.	Page 8, lines 15 – 20.	FIGS. 11 and 12.

New dependent claim **28** is supported in priority document U.S. Serial No. 10/315,250, filed on December 10, 2002, at least by the text and figures listed in the table below.

Claim 28 feature	Priority document U.S. Serial No. 10/315,250	
	Description	FIGS.
the function activated in response to the multi-step user gesture presents one or more alphanumeric characters in a keyboard user interface on said display.	Page 6, lines 17 – 20.	

New dependent claim **29** is supported in priority document U.S. Serial No. 61/132,469, filed on June 19, 2008, at least by the text and figures pasted in the table below.

Claim 29 feature	Page from U.S. Serial No. 61/132,469
<p>enable a graphical user interface for accessing a plurality of gadgets, each gadget comprising an area containing at least a portion of dynamically generated data related to that gadget</p>	<div style="text-align: center;">  </div> <p>A gadget is an application running on the phone. In their icon like state Gadgets are also running showing information like latest incoming message, current song played, currency, wheather etc. A gadget can be any type of application.</p> <ul style="list-style-type: none"> -Streaming Radio -Note book -Web mail -Phone application -Clock etc. <p>A Gadget can be updated with information both from the phone (new SMS) or from a third party over the internet (RSS Feed)</p> <p>A Gadget in icon state at the home screen can only take a defined space</p> <p>In most cases a gadget can be expanded either displayed like an overlay directly on the home screen like the volume control or displayed as a full screen application like the camera.</p>

<p>Claim 29 feature</p>	<p>Page from U.S. Serial No. 61/132,469</p>
<p>arranges the plurality of gadgets in a layout that is larger than said display, whereby some of the gadgets are in said display and others of the gadgets are out of said display</p>	 <p>Home screen Based on scroll Alt 1</p> <p>Optional feature: Put your finger on the scroll bar handle and drag up to display upper Gadgets that are less frequently used. The screen is automatically scrolled back 3 seconds after the finger is removed</p> <p>Put your finger on the screen and scroll bar handle and drag down to display display more Gadgets down the page. Use Home button to get back to the home area.</p> <p>More Gadgets</p> <p>Read about new Gadgets Updated by</p> <p>Nero II 2007-12-10 Magnus Goertz Neonode</p>

<p>Claim 29 feature</p>	<p>Page from U.S. Serial No. 61/132,469</p>
<p>expands one of the gadgets in said display beyond an edge of said display to show more data therein by shifting other gadgets, and pans the layout within said display to bring some of the gadgets into said display and/or to move some of the gadgets out of said display, in response to the object touching one of the gadgets on said display, and then the object gliding along said display away from the touched location</p>	<div style="text-align: right;"> <p>Neonode 2008-04-20 Magnus Goertz</p> <p>Problem: Only one browser session can be opened at a time. How can we tell the user that in an intuitive way and still stay in the same screen and keep important information at the top?</p> <p>Solution: Always open the browser to the bottom of the screen and keep content above the browser Gadget.</p> </div> <p>Home screen Post home screen</p> <p>Open gadget / browser Open gadget / browser Open gadget / browser</p> <p>Panning Gadget Panning Gadget Panning Web Panning Web</p> <p>Push/Tip and release a Gadget to open/closeable</p> <p>When this Gadget is activated, all gadgets beneath Web Gadget slide back and disappear, instead the browser takes the scene</p> <p>Panning above browser window will result in changing color of browser window.</p> <p>Panning inside browser window will result in panning browser content.</p>

<p>Claim 29 feature</p>	<p>Page from U.S. Serial No. 61/132,469</p>
<p>to detect an object touching with hard pressure an on-screen element selected from the group consisting of a gadget, a letter, a key, a button or an icon and then to activate the on-screen element, thereby resulting in (i) enlarging the on-screen element, (ii) displaying a callout balloon with a copy of the on-screen element inside, or (iii) a combination thereof.</p>	<p>Neonode 2008-04-20 Magnus Goertz</p> <p>Problem: It is hard to fit the right item on a touch display because when you move the finger to and touch the surface it is often easy to miss it or to overshoot the intended especially when used with one hand.</p> <p>Solution: Use a conventional touch technology to find the object in X-Y position. Add tactile or graphical feedback when your finger is and use a force sensor to the display to read the activation.</p>

New independent claim **30** for a mobile phone system is supported in priority document U.S. Serial No. 10/315,250, filed on December 10, 2002, at least by the text and figures listed in the table below.

Claim 30 feature	Priority document U.S. Serial No. 10/315,250	
	Description	FIGS.
a top surface comprising a touch sensitive display, the top surface containing no movable button	Page 9, lines 1 – 3.	FIG. 13 shows opening 51 for touch sensitive display 3, and no movable buttons, on the top surface of enclosure 5.
a processor	Page 5, lines 12 – 18; Page 9, lines 12 – 15.	FIG. 14 shows computer 6.
a transceiver for sending and receiving wireless signals over a communications network	Page 3, lines 19 – 21; Page 6, lines 30 – 34.	FIG. 6 shows phone, SMS, chat and email applications.
a solid-state memory storing computer instructions configured to enable the mobile phone system	Page 9, lines 10 – 15.	FIG. 14.
to activate a function in response to a first multi-step user gesture comprising an object touching an area corresponding to a demarcated representation of the function followed by gliding away from the area on said display	Page 2, lines 25 – 27; Page 5, lines 19 – 27.	FIGS. 1 – 3, 5 and 6.
wherein the demarcated representation represents only the function and does not relocate during the first multi-step user gesture, and the	Page 5, lines 19 – 27; Page 9, lines 3 and 4.	FIGS. 1, 2 and 13.

Claim 30 feature	Priority document U.S. Serial No. 10/315,250	
	Description	FIGS.
function is not activated differently based on a direction of the gliding		
to present a plurality of functions, applications, services or settings in response to a second multi-step user gesture comprising the object touching an edge area of said display followed by gliding within said display away from the edge area,	Page 2, lines 25 – 32; Page 5, lines 24 – 30; Page 7, lines 1 – 3; Page 8, lines 21 and 22.	FIGS. 1 – 3 and 6.
to highlight a first item corresponding to a current position of the object gliding over a linear list of items on said display and to select a second item from the list at least partially based on where the object stops gliding and is lifted from said display,	Page 7, lines 1 – 15 and 27 – 30.	FIGS. 6 – 8.
to run a first application wherein a touch keyboard presented on said display enables a user to edit or save text in the first application,	Page 6, lines 14 – 29.	FIG. 5.
to run a second application configured to provide options for editing, deleting and sending a picture on said display,	Page 6, lines 4 – 7.	
to present a plurality of communication options for a given	According to page 5, line 28 – page 6, line 7, when the current	

Claim 30 feature	Priority document U.S. Serial No. 10/315,250	
	Description	FIGS.
contact, the communication options comprising call, email, and chat or SMS	<p>application handles a contact, then the icons that are shown when the first function is activated are services such as call, email, chat or SMS.</p> <p>Page 6, lines 30 – 34 discusses providing the options: call, email, and SMS, for inputted text.</p>	
to scroll content on said display in response to the object touching a first location on said display and gliding up or down on said display from the first location,	Page 7, line 27 – page 8, line 10.	FIGS. 8 and 9.
to move an application, a function, a service or a setting one step forward or backward or to close or remove an application, a function, a service or a setting on said display in response to the object touching a second location on said display and gliding to the right or to the left from the second location	Page 8, lines 15 – 20.	FIGS. 11 and 12.
a housing surrounding said display and enclosing said processor, said transceiver, and said solid-state memory.	Page 2, lines 16 and 17; Page 9, lines 1 and 2.	FIG. 13.

New dependent claim **31** is supported in priority document U.S. Serial No. 10/315,250, filed on December 10, 2002, at least by the text and figures listed in the table below.

Claim 31 feature	Priority document U.S. Serial No. 10/315,250	
	Description	FIGS.
a tap-present state, wherein a plurality of tap-activatable icons for activating a plurality of corresponding pre-designated applications, functions, services, settings or tasks are present, each of the plurality of pre-designated applications, functions, services, settings or tasks being activated in response to a tap on its corresponding icon	Page 2, line 29 – page 3, line 4; Page 5, lines 28 – 30; Page 6, lines 12 and 13.	FIGS. 3 and 4.
a tap-absent state, wherein the plurality of tap-activatable icons are absent		FIG. 1.
the tap-absent state configured to be transitioned to the tap-present state in response to a third multi-step user gesture comprising: the object (i) touching an edge area of said display, and then (ii) gliding on said display away from the edge area.	Page 2, lines 25 – 32; Page 5, lines 24 – 30; Page 8, lines 21 and 22.	FIGS. 1 – 3.

New dependent claim **32** is supported in priority document U.S. Serial No. 10/315,250, filed on December 10, 2002, at least by the text and figures listed in the table below.

Claim 32 feature	Priority document U.S. Serial No. 10/315,250	
	Description	FIGS.
the plurality of tap-activatable icons represent applications comprising a telephone, chat or SMS, a camera, a music player and email.	Page 7, lines 1 – 10.	FIGS. 6 and 7.

New dependent claim **33** is supported in priority document U.S. Serial No. 10/315,250, filed on December 10, 2002, at least by the text and figures listed in the table below.

Claim 33 feature	Priority document U.S. Serial No. 10/315,250	
	Description	FIGS.
the applications comprising a telephone, chat or SMS, a calculator, a camera, an alarm, a clock, a music player, and email	Page 6, line 10 mentions "clock" and "alarm".	FIG. 3 shows alarm icon 215. FIG. 6 shows telephone, chat, SMS, calculator, camera, music player and email applications.
a third application and a fourth application capable of running simultaneously, the third application capable of being presented on top of the fourth application on said display	Page 5, lines 12 – 14.	
a fifth application and a sixth application capable of running simultaneously, the fifth application being a music player and the sixth application being email, chat or SMS.	Page 5, lines 12 – 18.	FIG. 6 shows that music player, email, chat and SMS are available applications.


New dependent claim **34** is supported in priority document U.S. Serial No. 10/315,250, filed on December 10, 2002, at least by the text and figures listed in the table below.

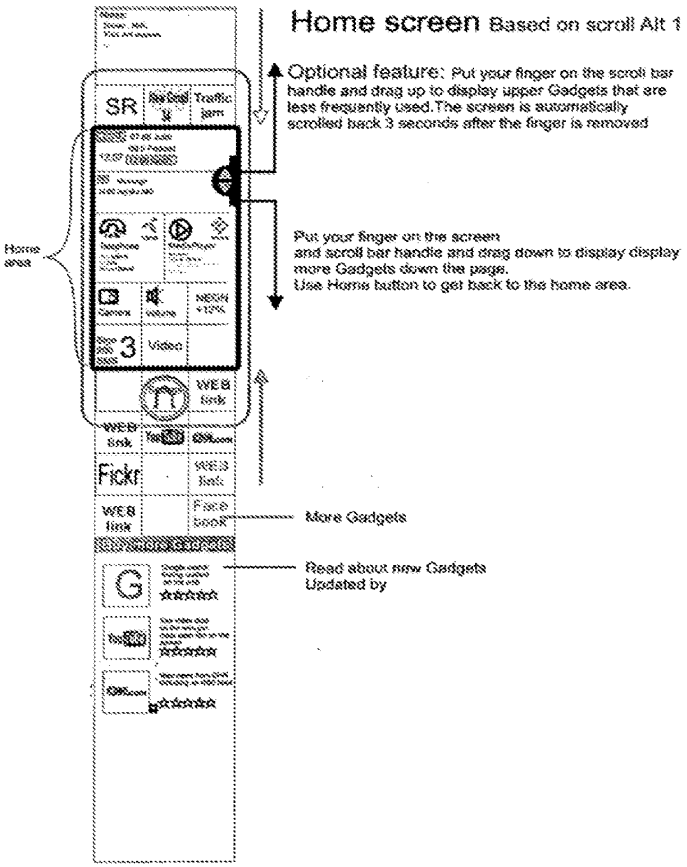
Claim 34 feature	Priority document U.S. Serial No. 10/315,250	
	Description	FIGS.
wherein the text saved in the first application is configured for use as an address, a telephone number, or a message in phone call, email, chat or SMS.	Page 3, lines 5 – 21; Page 6, lines 30 – 34; Page 7, lines 16 and 17.	

New dependent claim **35** is supported in priority document U.S. Serial No. 10/315,250, filed on December 10, 2002, at least by the text and figures listed in the table below.

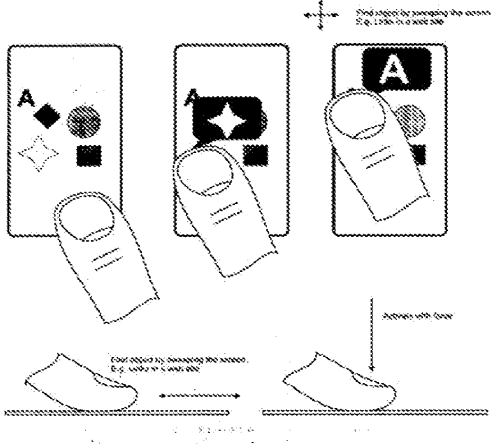
Claim 35 feature	Priority document U.S. Serial No. 10/315,250	
	Description	FIGS.
the function activated in response to the first multi-step user gesture enables an alphanumeric character to be entered using a keyboard presented on said display	Page 3, lines 5 – 21; Page 6, lines 13 – 34.	FIG. 5

New dependent claim **36** is supported in priority document U.S. Serial No. 61/132,469, filed on June 19, 2008, at least by the text and figures pasted in the table below.

Claim 36 feature	Page from U.S. Serial No. 61/132,469
<p>to enable a graphical user interface for accessing a plurality of gadgets, each gadget comprising an area containing at least a portion of dynamically generated data related to that gadget</p>	<div style="text-align: center;">  </div> <p>A gadget is an application running on the phone. In their icon like state Gadgets are also running showing information like latest incoming message, current song played, currency, weather etc. A gadget can be any type of application.</p> <ul style="list-style-type: none"> -Streaming Radio -Note book -Web mail -Phone application -Clock etc. <p>A Gadget can be updated with information both from the phone (new SMS) or from a third party over the internet (RSS Feed)</p> <p>A Gadget in icon state at the home screen can only take a defined space</p> <p>In most cases a gadget can be expanded either displayed like an overlay directly on the home screen like the volume control or displayed as a full screen application like the camera.</p>

Claim 36 feature	Page from U.S. Serial No. 61/132,469
<p>arranges the plurality of gadgets in a layout that is larger than said display, whereby some of the gadgets are in said display and others of the gadgets are out of said display</p>	 <p>The diagram shows a vertical mobile home screen with various widgets. At the top, there is a status bar with 'SR', 'Signal', and 'Traffic jam'. Below it are several widgets: a clock, a weather widget, a 'More Gadgets' button, a 'Read about new Gadgets Updated by' section, and several 'WEB link' widgets. A scroll bar is visible on the right side of the screen. Annotations include: 'Home screen Based on scroll Alt 1' pointing to the top of the screen; 'Optional feature: Put your finger on the scroll bar handle and drag up to display upper Gadgets that are less frequently used. The screen is automatically scrolled back 3 seconds after the finger is removed' with an upward arrow; 'Put your finger on the screen and scroll bar handle and drag down to display display more Gadgets down the page. Use Home button to get back to the home area.' with a downward arrow; 'More Gadgets' pointing to a button; and 'Read about new Gadgets Updated by' pointing to a text area.</p> <p style="text-align: right;">Nero II 2007-12-10 Magnus Goertz Neonode</p>

<p>Claim 36 feature</p>	<p>Page from U.S. Serial No. 61/132,469</p>
<p>expands one of the gadgets in said display to show more data therein by shifting other gadgets, and pans the layout within said display to bring some of the gadgets into said display and/or to move some of the gadgets out of said display, in response to the object touching one of the gadgets on said display, and then the object gliding along said display away from the touched location</p>	<div style="text-align: right;"> <p>Neonode 2008-04-20 Magnus Goertz</p> <p>Problem: Only one browser session can be opened at a time. How can we tell the user that in an intuitive way and still stay in the same screen and keep important information at the top?</p> <p>Solution: Always open the browser to the bottom of the screen and keep content above the browser Gadget.</p> </div>

<p>Claim 36 feature</p>	<p>Page from U.S. Serial No. 61/132,469</p>
<p>to detect an object touching with hard pressure an on-screen element from the group consisting of a gadget, a letter, a key, a button or an icon and then to activate the on-screen element, thereby resulting in (i) enlarging the on-screen element, (ii) displaying a callout balloon with a copy of the on-screen element inside, or (iii) a combination thereof.</p>	<p>Neonode 2008-04-20 Magnus Goertz</p> <p>Problem: It is hard to hit the right spot on a touch display because when you move the finger to and touch the surface it is often easy to miss it or to overshoot the intended especially when used with one hand.</p> <p>Solution: Use a conventional touch technology to find the object in X-Y position. Add tactile or graphical illustration near your finger to and use a force sensor to the display to read the activation.</p>  <p>The diagram illustrates a touch interface with force feedback. It shows three stages of a finger touching a screen with a callout balloon. Below, a cross-section shows a finger pressing on a screen with a force sensor, with labels for 'Force sensor' and 'Screen with force'.</p>

New independent claim **37** for a mobile phone system is supported in priority document U.S. Serial No. 10/315,250, filed on December 10, 2002, at least by the text and figures listed in the table below.

Claim 37 feature	Priority document U.S. Serial No. 10/315,250	
	Description	FIGS.
a top surface comprising a touch sensitive display, the top surface containing no movable button	Page 9, lines 1 – 3.	FIG. 13 shows opening 51 for touch sensitive display 3, and no movable buttons, on the top surface of enclosure 5.
a processor	Page 5, lines 12 – 18; Page 9, lines 12 – 15.	FIG. 14 shows computer 6.
a transceiver for sending and receiving wireless signals over a communications network	Page 3, lines 19 – 21; Page 6, lines 30 – 34.	FIG. 6 shows phone, SMS, chat and email applications.
a solid-state memory storing computer instructions configured to enable the mobile phone system	Page 9, lines 10 – 15.	FIG. 14.
to highlight a first item corresponding to a current position of the object gliding over a linear list of items on said display and to select a second item from the list at least partially based on where the object stops gliding and is lifted from said display,	Page 7, lines 1 – 15 and 27 – 30.	FIGS. 6 – 8.
a tap-present state, wherein a plurality of tap-activatable icons for activating a plurality of corresponding pre-	Page 2, line 29 – page 3, line 4; Page 5, lines 28 – 30; Page 6, lines 12 and 13.	FIGS. 3 and 4.

Claim 37 feature	Priority document U.S. Serial No. 10/315,250	
	Description	FIGS.
designated applications, functions, services, settings or tasks are present, each of the plurality of pre-designated applications, functions, services, settings or tasks being activated in response to a tap on its corresponding icon		
a tap-absent state, wherein the plurality of tap-activatable icons are absent		FIG. 1.
the tap-absent state configured to be transitioned to the tap-present state in response to a first multi-step user gesture comprising: the object (i) touching an edge area of said display, and then (ii) gliding on said display away from the edge area	Page 2, lines 25 - 32; Page 5, lines 24 - 30; Page 8, lines 21 and 22.	FIGS. 1 - 3.
a housing surrounding said display and enclosing said processor, said transceiver, and said solid-state memory.	Page 2, lines 16 and 17; Page 9, lines 1 and 2.	FIG. 13.

New dependent claim **38** is supported in priority document U.S. Serial No. 10/315,250, filed on December 10, 2002, at least by the text and figures listed in the table below.

Claim 38 feature	Priority document U.S. Serial No. 10/315,250	
	Description	FIGS.
the applications comprising a telephone, chat or SMS, a calculator, a camera, an alarm, a clock, a music player, and email	Page 6, line 10 mentions "clock" and "alarm".	FIG. 3 shows alarm icon 215. FIG. 6 shows telephone, chat, SMS, calculator, camera, music player and email applications.
a first application wherein a touch keyboard presented on said display enables a user to edit or save text in the first application	Page 6, lines 14 – 29.	FIG. 5
a second application providing options for editing, deleting and sending a picture on said display	Page 6, lines 4 – 7.	
a third application and a fourth application capable of running simultaneously, the third application capable of being presented on top of the fourth application on said display	Page 5, lines 12 – 14.	
a fifth application and a sixth application capable of running simultaneously, the fifth application being a music player, and the sixth application being email, chat or SMS	Page 5, lines 12 – 18.	FIG. 6 shows that music player, email, chat and SMS are available applications.


Claim 38 feature	Priority document U.S. Serial No. 10/315,250	
	Description	FIGS.
a seventh application providing a plurality of communication options for a given contact, the communication options comprising call, email, and chat or SMS	<p>According to page 5, line 28 – page 6, line 7, when the current application handles a contact, then the icons that are shown when the first function is activated are services such as call, email, chat or SMS.</p> <p>Page 6, lines 30 – 34 discusses providing the options: call, email, and SMS, for inputted text.</p>	
a housing surrounding said display and enclosing said processor, said transceiver, and said solid-state memory.	<p>Page 2, lines 16 and 17; Page 9, lines 1 and 2.</p>	FIG. 13.

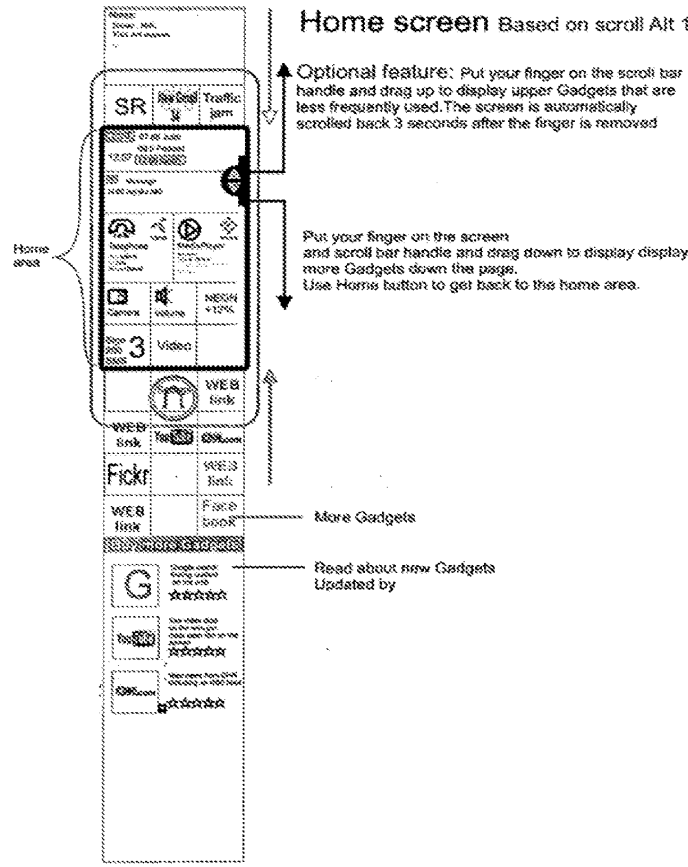
New dependent claim **39** is supported in priority document U.S. Serial No. 10/315,250, filed on December 10, 2002, at least by the text and figures listed in the table below.

Claim 39 feature	Priority document U.S. Serial No. 10/315,250	
	Description	FIGS.
to scroll content on said display in response to the object touching a first location on said display and gliding up or down on said display from the first location	Page 7, line 27 – page 8, line 10.	FIGS. 8 and 9.
to move an application, a function, a service or a setting one step forward or backward or to close or remove an application, a function, a service or a setting on said display in response to the object touching a second location on said display and gliding to the right or to the left from the second location	Page 8, lines 15 – 20.	FIGS. 11 and 12.
to activate a function in response to a second multi-step user gesture comprising an object touching an area corresponding to a demarcated representation of the function followed by gliding away from the area on said display	Page 2, lines 25 – 27; Page 5, lines 19 – 27.	FIGS. 1 – 3, 5 and 6.

Claim 39 feature	Priority document U.S. Serial No. 10/315,250	
	Description	FIGS.
wherein the demarcated representation represents only the function and does not relocate during the second multi-step user gesture, and the function is not activated differently based on a direction of the gliding.	Page 5, lines 19 – 27; Page 9, lines 3 and 4.	FIGS. 1, 2 and 13.

New dependent claim **40** is supported in priority document U.S. Serial No. 61/132,469, filed on June 19, 2008, at least by the text and figures pasted in the table below.

Claim 40 feature	Page from U.S. Serial No. 61/132,469
<p>enable a graphical user interface for accessing a plurality of gadgets, each gadget comprising an area containing at least a portion of dynamically generated data related to that gadget</p>	<div style="text-align: center;">  </div> <p>A gadget in icon state at the home screen can only take a defined space</p> <p>In most cases a gadget can be expanded either displayed like an overlay directly on the home screen like the volume control or displayed as a full screen application like the camera.</p> <p>A gadget is an application running on the phone. In their icon like state Gadgets are also running showing information like latest incoming message, current song played, currency, weather etc. A gadget can be any type of application.</p> <ul style="list-style-type: none"> -Streaming Radio -Note book -Web mail -Phone application -Clock etc. <p>A Gadget can be updated with information both from the phone (new SMS) or from a third party over the internet (RSS Feed)</p>

<p>Claim 40 feature</p>	<p>Page from U.S. Serial No. 61/132,469</p>
<p>arranges the plurality of gadgets in a layout that is larger than said display, whereby some of the gadgets are in said display and others of the gadgets are out of said display</p>	 <p>Home screen Based on scroll Alt 1</p> <p>Optional feature: Put your finger on the scroll bar handle and drag up to display upper Gadgets that are less frequently used. The screen is automatically scrolled back 3 seconds after the finger is removed</p> <p>Put your finger on the screen and scroll bar handle and drag down to display display more Gadgets down the page. Use Home button to get back to the home area.</p> <p>More Gadgets</p> <p>Read about new Gadgets Updated by</p> <p>Nero II 2007-12-10 Magnus Goertz Neonode</p>

<p>Claim 40 feature</p>	<p>Page from U.S. Serial No. 61/132,469</p>
<p>expands one of the gadgets in said display to show more data therein by shifting other gadgets, and pans the layout within said display to bring some of the gadgets into said display and/or to move some of the gadgets out of said display, in response to the object touching one of the gadgets on said display, and then the object gliding along said display away from the touched location</p>	<div style="text-align: right;"> <p>Neonode 2008-04-20 Magnus Goertz</p> <p>Problem: Only one browser session can be opened at a time. How can we tell the user that in an intuitive way and still stay in the same screen and keep important information at the top?</p> <p>Solution: Always open the browser to the bottom of the screen and keep content above the browser Gadget.</p> </div>

<p>Claim 40 feature</p>	<p>Page from U.S. Serial No. 61/132,469</p>
<p>to detect an object touching with hard pressure an on-screen element from the group consisting of a gadget, a letter, a key, a button or an icon and then to activate the on-screen element, thereby resulting in (i) enlarging the on-screen element, (ii) displaying a callout balloon with a copy of the on-screen element inside, or (iii) a combination thereof.</p>	<p>Neonode 2008-04-20 Magnus Goertz</p> <p>Problem: It is hard to fit the right icon on a touch display because when you move the finger to and touch the surface it is often easy to miss it or to overshoot the intended especially when used with one hand.</p> <p>Solution: Use a conventional touch technology to find the object in X-Y position. Add tactile or graphical illustration when your finger is and use a force sensor to the display to read the activation.</p>

Favorable allowance of the application is respectfully requested.

If any matters can be resolved by telephone, Applicant requests that the Patent and Trademark Office please contact Applicant's representative at the telephone number listed below.

Respectfully submitted,
SOQUEL GROUP LLC

Dated: February 20, 2020

/Marc A. Berger/
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Electronic Patent Application Fee Transmittal				
Application Number:				
Filing Date:				
Title of Invention:		TOUCH SCREEN ELECTRONIC DEVICE AND ASSOCIATED USER INTERFACE		
First Named Inventor/Applicant Name:		Magnus Goertz		
Filer:		Marc Aron Berger		
Attorney Docket Number:		AEQUITAS.P001		
Filed as Small Entity				
Filing Fees for Track I Prioritized Examination - Nonprovisional Application under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
UTILITY FILING FEE (ELECTRONIC FILING)	4011	1	75	75
UTILITY SEARCH FEE	2111	1	330	330
UTILITY EXAMINATION FEE	2311	1	380	380
REQUEST FOR PRIORITIZED EXAMINATION	2817	1	2000	2000
Pages:				
Claims:				
Miscellaneous-Filing:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
PUBL. FEE- EARLY, VOLUNTARY, OR NORMAL	1504	1	0	0
PROCESSING FEE, EXCEPT PROV. APPLS.	2830	1	70	70
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				2855

Electronic Acknowledgement Receipt	
EFS ID:	38649740
Application Number:	16796880
International Application Number:	
Confirmation Number:	1091
Title of Invention:	TOUCH SCREEN ELECTRONIC DEVICE AND ASSOCIATED USER INTERFACE
First Named Inventor/Applicant Name:	Magnus Goertz
Customer Number:	75660
Filer:	Marc Aron Berger
Filer Authorized By:	
Attorney Docket Number:	AEQUITAS.P001
Receipt Date:	20-FEB-2020
Filing Date:	
Time Stamp:	21:14:45
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	\$2855
RAM confirmation Number	E20202JL16273489
Deposit Account	
Authorized User	

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

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	TrackOne Request	AEQUITAS-P001_TrackOneRequest_02-20-2020.pdf	129219	no	2
			f80754714aaccae81565b8abb0d244a9fe6a6a3f1		
Warnings:					
Information:					
2	Application Data Sheet	AEQUITAS-P001_ApplicationDataSheet_02-20-2020.pdf	1819514	no	7
			5859db39cb2b2c5672d2d61d17e943f05b3cc2d		
Warnings:					
Information:					
3	Specification	AEQUITAS-P001_Specification.pdf	1210474	no	28
			09e8c712deb94e24f9f5a8475a12a788c8409a7		
Warnings:					
Information:					
4	Claims	AEQUITAS-P001_Claims.pdf	120350	no	4
			9b8f11da7330abd7b9392fad2fc37a3da258f6f3		
Warnings:					
Information:					
5	Abstract	AEQUITAS-P001_Abstract.pdf	27747	no	1
			53f1c502f08363e2110d9a9799cefbae413fcf647		
Warnings:					
Information:					
6	Drawings-only black and white line drawings	AEQUITAS-P001_Drawings.pdf	6610338	no	61
			eab3dccc1b1bbf4c2893efee084e717d22a07c767		
Warnings:					
Information:					

7	Oath or Declaration filed	AQUITAS-P001_ExecutedDeclarations.pdf	278547 1a6e7199c679d39c514660eb0cdb80ba079228	no	2
Warnings:					
Information:					
8		AQUITAS-P001_PreliminaryAmendment_02-20-2020.pdf	1201438 17ee0e4e3b36107f1c9ad3918fdad626c9381e4b	yes	47
Multipart Description/PDF files in .zip description					
Document Description		Start	End		
Preliminary Amendment		1	1		
Claims		2	12		
Applicant Arguments/Remarks Made in an Amendment		13	47		
Warnings:					
Information:					
9	Fee Worksheet (SB06)	fee-info.pdf	39996 625bd066c46ee451a1c89bb7417dae0bddbb3efa	no	2
Warnings:					
Information:					
Total Files Size (in bytes):			11437623		
<p>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.</p> <p><u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p>					

**CERTIFICATION AND REQUEST FOR PRIORITIZED EXAMINATION
 UNDER 37 CFR 1.102(e) (Page 1 of 1)**

First Named Inventor:	Magnus Goertz	Nonprovisional Application Number (if known):	
Title of Invention:	TOUCH SCREEN ELECTRONIC DEVICE AND ASSOCIATED USER INTERFACE		

APPLICANT HEREBY CERTIFIES THE FOLLOWING AND REQUESTS PRIORITIZED EXAMINATION FOR THE ABOVE-IDENTIFIED APPLICATION.

1. The processing fee set forth in 37 CFR 1.17(i)(1) and the prioritized examination fee set forth in 37 CFR 1.17(c) have been filed with the request. The publication fee requirement is met because that fee, set forth in 37 CFR 1.18(d), is currently \$0. The basic filing fee, search fee, and examination fee are filed with the request or have been already been paid. I understand that any required excess claims fees or application size fee must be paid for the application.
2. I understand that the application may not contain, or be amended to contain, more than four independent claims, more than thirty total claims, or any multiple dependent claims, and that any request for an extension of time will cause an outstanding Track I request to be dismissed.
3. The applicable box is checked below:

I. Original Application (Track One) - Prioritized Examination under § 1.102(e)(1)

- i. (a) The application is an original nonprovisional utility application filed under 35 U.S.C. 111(a). This certification and request is being filed with the utility application via EFS-Web.
 ---OR---
 (b) The application is an original nonprovisional plant application filed under 35 U.S.C. 111(a). This certification and request is being filed with the plant application in paper.
- ii. An executed inventor's oath or declaration under 37 CFR 1.63 or 37 CFR 1.64 for each inventor, or the application data sheet meeting the conditions specified in 37 CFR 1.53(f)(3)(i) is filed with the application.

II. Request for Continued Examination - Prioritized Examination under § 1.102(e)(2)

- i. A request for continued examination has been filed with, or prior to, this form.
- ii. If the application is a utility application, this certification and request is being filed via EFS-Web.
- iii. The application is an original nonprovisional utility application filed under 35 U.S.C. 111(a), or is a national stage entry under 35 U.S.C. 371.
- iv. This certification and request is being filed prior to the mailing of a first Office action responsive to the request for continued examination.
- v. No prior request for continued examination has been granted prioritized examination status under 37 CFR 1.102(e)(2).

Signature /Marc A. Berger/	Date February 20, 2020
Name (Print/Typed) Marc A. Berger	Practitioner Registration Number 44029
Note: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. Submit multiple forms if more than one signature is required.*	
<input type="checkbox"/> *Total of _____ forms are submitted.	

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	AEQUITAS.P001
	Application Number	
Title of Invention	TOUCH SCREEN ELECTRONIC DEVICE AND ASSOCIATED USER INTERFACE	
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	Magnus		Goertz		
Residence Information (Select One) US Residency <input type="radio"/> Non US Residency Active US Military Service					
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Inventor	2				Remove
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	Joseph		Shain		
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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	AEQUITAS.P001
		Application Number	
Title of Invention	TOUCH SCREEN ELECTRONIC DEVICE AND ASSOCIATED USER INTERFACE		

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Title of the Invention	TOUCH SCREEN ELECTRONIC DEVICE AND ASSOCIATED USER INTERFACE		
Attorney Docket Number	AEQUITAS.P001	Small Entity Status Claimed	<input checked="" type="checkbox"/>
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	61	Suggested Figure for Publication (if any)	50

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Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country

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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	AEQUITAS.P001
		Application Number	
Title of Invention	TOUCH SCREEN ELECTRONIC DEVICE AND ASSOCIATED USER INTERFACE		

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Prior Application Status	Pending				Remove
Application Number	Continuity Type		Prior Application Number	Filing Date (YYYY-MM-DD)	
	Continuation of		14886048	2015-10-17	
Prior Application Status	Patented				Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
14886048	Continuation of	12486033	2009-06-17	9164654	2015-10-20
Prior Application Status	Expired				Remove
Application Number	Continuity Type		Prior Application Number	Filing Date (YYYY-MM-DD)	
12486033	Claims benefit of provisional		61132469	2008-06-19	
Prior Application Status	Patented				Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
12486033	Continuation in part of	10315250	2002-12-10	8095879	2012-01-10
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Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Access Code ⁱ (if applicable)
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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	AEQUITAS.P001
		Application Number	
Title of Invention	TOUCH SCREEN ELECTRONIC DEVICE AND ASSOCIATED USER INTERFACE		

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

- This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	AEQUITAS.P001
	Application Number	
Title of Invention	TOUCH SCREEN ELECTRONIC DEVICE AND ASSOCIATED USER INTERFACE	

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Mailing Address Information For Applicant:		
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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	AEQUITAS.P001
		Application Number	
Title of Invention	TOUCH SCREEN ELECTRONIC DEVICE AND ASSOCIATED USER INTERFACE		

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First Name	Marc	Last Name	Berger	Registration Number	44029

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7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
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APPLICATION FOR UNITED STATES LETTERS PATENT

For

USER INTERFACE FOR MOBILE COMPUTER UNIT

Inventors:

Magnus Goertz

Joseph Shain

USER INTERFACE FOR MOBILE COMPUTER UNIT

CROSS REFERENCES TO RELATED APPLICATIONS

[0001] This application is a continuation of U.S. Serial No. 12/486,033, filed on June 17, 2009, now U.S. Patent No. 9,164,654, entitled USER INTERFACE FOR MOBILE COMPUTER UNIT, by inventors Magnus Goertz and Joseph Shain. U.S. Serial No. 12/486,033 is a continuation-in-part of U.S. Serial No. 10/315,250, now U.S. Patent No. 8,095,879, filed on December 10, 2002, entitled USER INTERFACE FOR MOBILE HANDHELD COMPUTER UNIT by inventor Magnus Goertz. U.S. Serial No. 12/486,033 claims priority from provisional application No. 61/132,469, filed on June 19, 2008, entitled KEYPAD FOR CHINESE CHARACTERS by inventors Magnus Goertz, Robert Pettersson, Staffan Gustafsson and Johann Gerell.

FIELD OF THE INVENTION

[0002] The field of the present invention is user interfaces for electronic devices and, more particularly, to touch screen user interfaces.

BACKGROUND OF THE INVENTION

[0003] Touch screens provide user interfaces through which a user enters input to a computing device by touching a screen at a selected location, with a stylus or with his finger.

[0004] Conventional touch screens are limited as to the types of user inputs that they can recognize. For example, conventional touch screens are unable to distinguish between a soft tap and a hard press. In some prior art embodiments users initially select an item on the screen, and then subsequently activate the selected item. However, because prior art touch screens do not distinguish between degrees of pressure, the user is required to remove his finger or stylus from the screen and activate his selection with a second tap. It would be advantageous to produce touch screens that distinguish between varying amounts of pressure applied to the screen so that a user can select an item by touching its location on the screen, and then

[1]

activate the item by applying additional pressure to the touch location without having to first remove his finger or stylus from the screen.

[0005] In conventional touch screens the keys are often small relative to the touch area, especially in handheld devices. The keys are also often situated close together. This can make it difficult to determine which key is being pressed by the user. It would be advantageous to clearly indicate to the user which key the user has selected, and furthermore, to allow the user to accept or reject the selected key without first removing his finger or stylus from the screen in order to perform a second tap.

[0006] Current user interfaces are basic and often require navigation through a series of menus in order to perform a desired operation. The present invention presents a user interface that is versatile in providing the user with many options, while requiring only few selections to activate a desired function. To further enhance user experience, certain functions are performed automatically without requiring the user to enter a selection.

SUMMARY OF THE DESCRIPTION

[0007] Aspects of the present invention relate to user interfaces designed for use with a touch screen. The present invention relates to computer readable media storing computer programs with computer program code, which, when read by a computer unit, allows the computer to present a user interface for the computer unit.

[0008] In accordance with embodiments of the present invention, the computer unit features a touch sensitive display area. According to preferred embodiments an initial display configuration presents a plurality of gadgets on the display. These gadgets are small areas of the screen that indicate which functions each gadget will perform when activated by the user. When a gadget is activated, typically by the user touching the area of the display on which the gadget is displayed, the gadget increases in size and provides the user with icons and information about the gadget's functions. Significantly, the gadget

[2]

does not cover the entire display area. Thus, when a gadget, or even a plurality of gadgets, is active, the primary display of all available gadgets is still accessible. This primary display can be compared to a desktop in computer operating system user interfaces. However, this primary display in the user interface of the present invention is not the same as a desktop where active windows can cover icons on the desktop. In the present invention, gadgets are arranged in a manner that open gadgets do not cover other gadgets. Rather, when an open gadget expands in size, other gadgets are shifted to make room for the expanded gadget. This allows the user to scroll the primary display or desktop to view any gadget. In the context of the present invention, this primary display area that includes both open and closed gadgets is called the home window. The user scrolls the home window to view gadgets that are shifted beyond the viewable area of the display. An expanded, or activated, gadget has an expanded window, but often it is not large enough to display everything contained in that gadget window. To view contents of the gadget not displayed in the visible portion of the gadget window, the user scrolls the gadget window. Thus, two different scroll operations are provided: scrolling the home window and scrolling a gadget window. According to one embodiment, scrolling is executed by gliding a finger or stylus along the touch screen to shift the active display area of the home window or of the gadget. The scrolling affects the home window if the finger glide began in an area of the screen that does not belong to an active gadget; the scroll affects an active gadget window if the finger glide began inside that active gadget window.

[0009] Various embodiments of the invention support several methods of scrolling a window. According to one embodiment, scrolling is done when the user touches the display inside the window area, for example at an edge of the window, or on an icon, such as an arrow or scrollbar, indicating a scroll operation. According to another embodiment, scrolling is done by the user touching the window with a finger or stylus and then gliding the finger or

[3]

stylus along the touch sensitive screen in a direction indicating the desired direction of the scroll. When the content of the home display is larger in two dimensions than the actual display screen, this operation is like panning an image or map. When it is larger along only one axis (e.g., only vertically), the scrolling only scrolls in the one axis even when the glide is not orthogonal along the one axis.

[0010] Another aspect of the present invention relates to computer readable media storing a computer program with computer program code, which, when read by a mobile handheld computer unit, allows the computer to present a user interface for the mobile handheld computer unit. The user interface features a touch sensitive area in which representations of a plurality of keys are displayed, and each key is mapped to a corresponding location in the touch sensitive area at which the representation of the key is displayed. A key in this context includes, inter alia, alphabetic keys such as in a QWERTY keypad, numeric keys and also icons representing programs or functions. A key is selected, but not activated, when an object touches the corresponding location. This intermediate status of being selected but not activated facilitates the user to subsequently activate a desired key and avoid activating a neighboring key that the user selected but does not wish to activate. A selected key is activated when the object touching it applies additional pressure to the key location.

[0011] According to preferred embodiments of the invention, when a key is selected, the user interface generates a secondary representation of the key, such as a callout balloon containing the key representation. The callout balloon is placed away from the key location (being touched) so that the user can easily view which key is selected without lifting his finger. According to another embodiment, an audio representation of the selected key is generated so the user hears which key was selected.

[0012] According to still further features in preferred embodiments of the invention, the user touches the screen (with a finger or stylus) at a first

[4]

location, for example selecting a first key. The user then glides his finger or stylus over the screen to additional locations. At each additional location a new key is selected and the previously selected key is deselected. The user can activate any selected key by applying additional pressure to the screen. The user does not have to remove the object from the screen to glide and select additional keys even after activating a first key.

[0013] Additional touch pressure is detected in various ways according to several embodiments. According to one embodiment, the touch sensitive area is a light-based touch screen operable to detect different levels of touch pressure. For example, light-based touch screens typically include a calculating unit operable to identify the size, shape and contours of an area being touched based on a pattern of obstructed light. See applicant's U.S. patent application no. 10/494,055, now U.S. Patent No. 7,880,732, titled ON A SUBSTRATE FORMED OR RESTING DISPLAY ARRANGEMENT, the contents of which are incorporated herein by reference. When a finger or flexible object is used as a touch object, as additional pressure is applied to the touch surface, the contact area of the finger or object touching the screen increases. Thus, additional pressure is detected when an increase in the contours of the covered touch area is detected.

[0014] Alternatively, or in combination with the above, the touch sensitive area features both a touch screen operable to identify a touch location on the screen and a pressure sensor operable to detect pressure applied to the screen but not sensitive to the location of the object applying the pressure.

[0015] Other aspects of the present invention relate to convenient arrangement and function of icons to perform popular functions within a user interface. Thus, a camera gadget features a multimedia messaging service (MMS) button facilitating sending an active photo in an MMS message; a keylock gadget locks the computer and displays an instrumental keypad for entering a musical code to unlock the computer; a reporting gadget displays information for a first period of time and is then automatically deactivated.

[5]

Several reporting gadgets are provided, including a gadget that displays the time of day; a gadget displays a weather forecast; a gadget that displays stock market information.

[0016] According to still further features in preferred embodiments the reporting gadget continues to display its information for a second period of time if the gadget is touched during the first period of time. I.e., automatic deactivation after the first period of time is canceled.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] The present invention will be more fully understood and appreciated from the following detailed description, taken in conjunction with the drawings in which:

[0018] **FIGS. 1A – 1K** are a series of screens illustrating Chinese stroke input, in accordance with an embodiment of the present invention;

[0019] **FIGS. 2A – 2M** are a series of screens illustrating Chinese Pinyin input, in accordance with an embodiment of the present invention;

[0020] **FIGS. 3** is a screen of a handheld terminal displaying a plurality of gadgets, in accordance with an embodiment of the present invention;

[0021] **FIGS. 4 – 6** are diagrams illustrating selection of elements displayed on a touch screen. A selected element is displayed in a callout as shown in **Figs. 5 - 6**. The user does not lift his finger off the screen between selection of different elements, as in figures **5** and **6**. The use simply glides his finger along the screen. This is shown in **Fig. 7**. To activate a selected element the user presses on the screen without first lifting his finger off the screen as shown in **Fig. 8** and in the series of **Figs. 7-8**, all in accordance with an embodiment of the present invention;

[0022] **Figs. 7-8** illustrate a side view of a user selecting and activating an on-screen element, in accordance with an embodiment of the present invention;

[6]

[0023] **Figs. 9-11** illustrate turning a phone on and off. **Fig. 9** illustrates pressing the home key on a turned-off phone. **Fig. 10** illustrates the phone when it is turned on. **Fig. 11** illustrates pressing the home key to turn a phone off.

[0024] **Figs. 12-15** illustrate locking and unlocking a phone. **Fig. 12** illustrates activating a lock gadget onscreen to lock the phone. **Fig. 13** illustrates pressing the home button on a locked phone to unlock the phone. **Fig. 14** illustrates the unlocked phone. **Fig. 15** shows pressing the home key on a locked phone to display a keypad for entering a security code to unlock the phone.

[0025] **Figs. 16-17** illustrate pressing the home key to return to the home display screen. **Fig. 16** shows an open active calling gadget. Pressing the home button presents the home screen shown in **Fig. 17**.

[0026] **Figs. 18-21** illustrate scrolling options. In the phone shown in **Fig. 18** scrolling is done by gliding a finger or stylus along the touch sensitive screen. **Fig. 19** illustrates a scrollbar along one edge of the screen for scrolling up and down. **Figs. 20-21** illustrate arrow buttons for scrolling up and down.

[0027] **Fig 22** illustrates scrolling the home display screen, in accordance with an embodiment of the present invention;

[0028] **Figs. 23-24** illustrate a Fav5 gadget, in accordance with an embodiment of the present invention;

[0029] **Figs. 25-26** illustrate a History gadget, in accordance with an embodiment of the present invention;

[0030] **Figs. 27-28** illustrate a Calling gadget, in accordance with an embodiment of the present invention;

[0031] **Figs. 29-30** illustrate placing a call using a Calling gadget, in accordance with an embodiment of the present invention; **Fig. 30** illustrates the shortcut buttons presented when an incoming call is received (i.e., when the phone is ringing).

[7]

[0032] **Figs. 31-32** illustrate volume control, in accordance with an embodiment of the present invention;

[0033] **Figs. 33-34** illustrate an MP3 player gadget, in accordance with an embodiment of the present invention;

[0034] **Figs. 35-37** illustrate an operator promotion gadget, in accordance with an embodiment of the present invention;

[0035] **Figs. 38-39** illustrate a video player gadget, in accordance with an embodiment of the present invention;

[0036] **Figs. 40-42** illustrate a camera gadget and shortcut buttons provided when the camera gadget is activated, in accordance with an embodiment of the present invention;

[0037] **Figs. 43-45** illustrate an SMS gadget and shortcut buttons provided when the SMS gadget is activated, in accordance with an embodiment of the present invention; **Fig. 45** illustrates how related SMS messages are displayed as a conversation in an active SMS gadget; and

[0038] **Figs. 46-54** illustrate scrolling the home display screen and gadget windows, in accordance with an embodiment of the present invention.

DETAILED DESCRIPTION

[0039] Touch screen keypads offer great flexibility in keypad interface design – flexibility that cannot be achieved with electro-mechanical keypads. Custom design keypads can be generated on a touch screen, where the markings on each key and the functions that each key provides are optimized for a designated application. Moreover, touch screen keypads can change modes, from one pad of keys and associated functions to a different pad of keys and associated functions. Custom keypads are of particular advantage for multi-lingual applications.

[0040] A general description of touch screen keypad interfaces, in accordance with embodiments of the present invention, and several examples thereof, are described in detail hereinbelow.

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[0041] Embodiments of the present invention relate to improved keypads for inputting Chinese characters using XT9 stroke input, and using Chinese Pinyin. XT9 stroke input builds Chinese characters using six basic strokes, and offers selection of possible characters and phrases based on a set of strokes that have been input. Chinese Pinyin uses Latin characters that transliterate a sound or a syllable, in combination with a digit that represents an intonation or inflection. E.g., Ma in a rising tone is m-a-1, and Ma in a descending tone is m-a-2.

[0042] Reference is now made to **FIGS. 1A – 1K**, which illustrate an improved stroke-based keypad for entering Chinese characters by inputting strokes, in accordance with an embodiment of the present invention. Shown in **FIGS. 1A – 1K** is a keypad **100**, used for inputting basic strokes. Also shown in **FIGS. 1A – 1K** is a sequence of strokes **101 – 106** that are successively input by a user, and a corresponding sequence of Chinese characters **111 – 114** that are entered in a message being composed.

[0043] In accordance with an embodiment of the present invention, keypad **100** is generated and displayed on a touch screen. Keypad **100** has fewer than the standard 12 keys in a touch pad, allowing more room on screen for displaying characters.

[0044] Further in accordance with an embodiment of the present invention, the keys of keypad **100** are customized so that they contain only relevant information. For example, a prior art keypad displays a digit, 3 - 4 characters, and a basic Chinese stroke, all inside one key, even though in XT9 stroke mode the basic Chinese stroke is the only useful one. The custom keys of the present invention display only the basic Chinese strokes, or the strokes and numbers, but no characters.

[0045] There are two types of key presses supported by keypad **100** – regular and long. A regular key press adds the stroke shown on the key to the series of strokes **101 – 106** already pressed. As strokes are successively entered, a numbered array **121** of Chinese characters or phrases is

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dynamically displayed along the top of the keypad. These characters or phrases are predicted based on the key presses already entered. In order to select one of the numbered elements of array **121**, the user performs a long key press on that number. Alternatively, the user may keep entering strokes until only one option remains.

[0046] Often, however, more predicted characters or phrases exist than can be displayed along the top of the keypad. The N2 phone, manufactured by Neonode of Stockholm, Sweden, has a joystick button at the bottom of the phone. Twitching the joystick up/down displays different sets of predicted characters or phrases. When the intended character or phrase is displayed and associated with a given digit, a long press on that digit serves to select the intended character or phrase.

[0047] Reference is now made to **FIGS. 2A – 2M**, which illustrate an improved keypad for inputting Chinese characters using Pinyin, in accordance with an embodiment of the present invention. Shown in **FIGS. 2A – 2M** is a keypad **200**, used for inputting Latin characters. Also shown in **FIGS. 2A – 2M** is a sequence of Latin characters M-o-H-S-a-n that are successively input by a user, and a corresponding sequence of Chinese characters that are entered in a message being composed.

[0048] In accordance with an embodiment of the present invention, keypad **200** uses accent characters, rather than digits, to convey an intended intonation or inflection. Further in accordance with an embodiment of the present invention, keypad **200** displays only information relevant for Pinyin input on each key; no Chinese basic strokes are shown.

[0049] There are two types of Pinyin input. A user enters a Latin transliteration of an intended word using the Latin keypad input (12 keys). For each key, several letters are possible. The list of predicted Latin syllables based on the current sequence of keypad presses is displayed. Twitching the joystick right or left selects the desired combination. Also, a series of predicted Chinese characters or phrases is displayed and selected by a long

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press on a respective digit. Twitching the joystick up/down displays other predicted Chinese characters or phrases. Entering a space after a series of letters indicates the end of a previous character or phrase.

[0050] In accordance with an embodiment of the present invention, the user is able to combine stroke and Pinyin input, and compose a sequence of at least two Chinese characters using XT9 stroke input for at least one character and Pinyin input for at least one other character. The user switches between XT9 stroke input mode and Pinyin input mode by performing a sweeping motion in relation to the touch screen, such as, *inter alia*, sweeping a finger across the top of the touch screen. The series of at least two Chinese characters may be a text message, a name, a data entry, or any other such input.

[0051] Further in accordance with an embodiment of the present invention, the user is able to compose a series of at least one Chinese character and at least one non-Chinese term, wherein the non-Chinese term includes at least one Latin character, digit, emoticon, punctuation mark, another non-Chinese symbol, or any combination thereof. The series is composed by switching input modes for each alphabet or Chinese input or digit input by sweeping across the top of the touch screen. For example, the user may input at least one Chinese character using either Pinyin or stroke input, or a combination thereof. The user may then perform a sweeping motion in relation to the touch screen to change the input mode to English. For example, the user may sweep a finger across the top of the touch screen to change the input mode to English. In this mode, the keypad presents Latin characters. The user then proceeds to input Latin characters using the Latin keypad displayed on the touch screen. Alternatively, the user may repeat a series of sweeping motions; e.g., the user sweeps a finger across the top of the touch screen, repeatedly, changing the input mode with each sweeping motion, until a digit keypad is displayed and digit input mode is active. The user may then proceed to enter at least one digit, adding the at least one digit to the series of Chinese characters already contained in the message. It will thus be

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appreciated that the user may switch between different input modes while composing a single message, a command, a name, a data entry or another such input, including at least two different types of characters, in an easy and simple and convenient manner.

[0052] Further in accordance with an embodiment of the present invention, a keypad displaying emoticons is displayed. In this mode, the user may select an emoticon to be entered into the text of a message, or such other input.

[0053] Yet further in accordance with an embodiment of the present invention, drawings, including inter alia, emoticons, are constructed in a similar manner to XT9 stroke input. In this mode, the user interface displays the basic building blocks for the drawing, such as a curve, a semicolon, a circle, and other symbols. As the user taps multiple symbols, possible drawings or emoticons that can be formed using the selected elements are displayed, and the user may either select the desired complete drawing or emoticon from the displayed list, or may continue entering additional building blocks until only one option remains. This mode of input is convenient as the number and size of the keys presented is optimized for the number of available building blocks, and each key only displays information relevant for the active input mode.

[0054] Embodiments of the present invention provide methods and systems for enabling multiple input modes, whereby the screen display in each input mode is optimized for that mode. Optimizations include (i) configuring the number of keys displayed, (ii) configuring the size, position and shape of the keys in relation to the screen, (iii) configuring the size, position and shape of the area of the display showing text already entered, (iv) configuring the size, position and shape of the area of the display showing possible completions for the current character, phrase or symbol, and (v) displaying only at least one character, symbol, digit or other figure that is relevant to the active input mode on each key.

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[0055] Embodiments of the present invention also provide methods and systems for enabling multiple input modes and switching between the input modes by performing a sweeping motion in relation to the screen. These methods and systems are easier and more convenient than using a menu interface to switch input modes. Additionally, these methods do not use up screen space to provide a switching key, to switch between input modes, and, as such, screen space may be used for information related to the current input mode and the current text. These methods and systems also enable switching between many input modes, by repeating the sweeping motions to advance through the input modes. In the N2 phone manufactured by Neonode AB, this mode of switching active keypads is used with standard 12-key keypads, for example, inter alia, switching between numeric, Swedish and English keypads. However, switching the layout of the keys is not used in the Neonode N2 phone. Moreover, other, prior art methods of switching between input modes require more than one action to advance through a list of input modes.

[0056] Reference is now made to **Figs. 3** and **9-45**, which include several exemplary touch screen interfaces. Shown in **Fig. 3** is a touch screen interface, displaying a clock dial in the lower left corner of the screen. Several gadgets are displayed in the touch screen, each gadget representing an application that runs on the phone. A gadget is an application running on the phone. In their icon like state, gadgets are also running showing information like latest incoming message, current song played, currency, weather etc. A gadget can be any type of application. Example gadgets include: streaming radio, note book, web mail, phone application, clock. A gadget can be updated with information both from the phone (new SMS) or from a third party over the Internet (RSS feed). A gadget in an icon state on the home screen can only occupy a defined space. In most cases a gadget can be expanded and either displayed as an overlay directly on the home screen like the volume control or displayed as a full screen application like the camera.

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[0057] Problem: it is hard to hit the right item on a touch display because when you move the finger to and from the surface it is also easy to move it in the X-Y direction by mistake, especially when used with one hand. According to embodiments of the present invention, the solution to this problem is to use a conventional touch technology to find the object's X-Y position, add tactile or graphical illustration of where your finger is, and add a force sensor to the display to read the activation. Thus, according to embodiments of the present invention, selection and subsequent activation of an on-screen element, such as, inter alia, a gadget, a letter, a key, a button or an icon, is implemented by two primary features. The first feature, referred to as pressure sensing, provides the touch screen with one or more pressure sensors operative to determine contact with the screen by an external object such as a finger. In one embodiment, the user places a finger or a stylus over the desired on-screen element to select it, as illustrated in **Figs. 4-7**, and then applies pressure to the screen to activate the on-screen element, as illustrated in **Fig. 8**. In another embodiment, the user selects the on-screen element by placing a finger or stylus over the position of the on-screen element but not in contact with the screen. Several touch screen devices, such as certain light-based touch screens and certain tablet personal computers, enable detection of a finger or other pointing device over a position on the screen without making actual contact. Applicant's U.S. patent application no. 12/371,609, now U.S. Patent No. 8,339,379, for LIGHT-BASED TOUCH SCREEN, filed on 15 Feb. 2009, is incorporated herein in its entirety by reference. In another embodiment, the user selects the on-screen element with a finger or other pointing device in contact with the screen and activates the on-screen element by removing his finger or pointing device from contact with the screen. In another embodiment, the user selects the on-screen element with a finger or other pointing device in contact with the screen and activates the on-screen element by increasing the pressure of contact with the screen. In this case the pressure sensor distinguishes between the initial contact and the

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subsequent high pressure contact. This is illustrated in **Figs. 7** and **8** showing a profile of a finger in contact with a display, where only the thickness of the display is shown. In **Fig. 7** the finger moves across the screen to select at least one element. Movement across the screen is indicated by a double-tipped arrow parallel to the screen surface. Once an element is selected by positioning the finger over a desired element, the element is activated by applying pressure to the screen as indicated by the down-pointing arrow in **Fig. 8**.

[0058] The second feature, referred to as callout balloons, indicates a selected on-screen element to the user by displaying a graphic, such as by (i) enlarging the on-screen element, (ii) displaying a callout balloon with a copy of the on-screen element inside, or (iii) a combination thereof. The callout balloon is illustrated in **Figs. 5** and **6**. **Fig. 5** shows a star inside a callout balloon, and **Fig. 6** shows the letter 'A' inside a callout balloon. As the user moves his finger over the screen, different callout balloons appear. Callout balloons are generated in such a manner that the user's finger and hand do not obstruct the user from viewing the callout balloon. Thus, for example, the callout balloon appears above the finger as shown in the figures. When the finger is at the top of the screen the callout balloon is displayed off to a side of the screen that is visible to the user. The user may configure the interface to display callouts to the left or right of his finger. For example, a user who operates the phone with his left hand may prefer to display callout balloons off to one side of his finger, and a user who operates the phone with his right hand may prefer that callout balloons display to the other side of his finger. These two features of pressure sensing and callout balloons can be applied separately or in combination.

[0059] In accordance with an embodiment of the present invention, touch screens for phones captioned "Power ON / Power OFF" are shown in **Figs. 9-11**. Two phones are displayed under the "Power ON" caption; namely, a first phone (**Fig. 9**) with a blank screen, indicating that power is off, and a second

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phone (**Fig. 10**) with gadgets displayed thereon, indicating that power is on. A "home key" is displayed at the bottom of the phones. Activating the home key, such as by touching the key, causes the power to be turned on. A single phone is displayed in **Fig. 11** under the "Power OFF" caption. Touching the home key for an extended period of time, such as for 5 seconds, causes the phone to power off. An "off" gadget is shown at the bottom center of the display screen. Activating the "off" gadget also causes the phone to power off.

[0060] Additionally in accordance with an embodiment of the present invention, touch screens for phones captioned "Key lock" are shown in **Figs. 12-15**. In **Fig. 12** a lock gadget is displayed in the lower right corner of the screen. Activating the lock gadget, such as by pressing on it, causes the phone to lock. When the phone is locked activation of the phone is restricted in some manner. E.g., when the phone is locked, touching the screen in a way that would activate a gadget when the phone is unlocked, does not activate the gadget when the phone is locked. In order to unlock the phone, the user activates the home key, located at the bottom center of the device, as shown in **Fig. 13**. **Fig. 14** shows the phone after it has been unlocked: gadgets are now displayed on screen and are activated in response to user input.

[0061] Further in accordance with an embodiment of the present invention, a touch screen for a phone captioned "Key lock high security" is shown in **Fig. 15**. When the home key is activated, such as by touching the home key, a keypad is displayed and a user is prompted to enter a security code. Subsequently, the phone cannot be unlocked unless the security code is entered. Optionally, additional security is implemented by use of fingerprint identification, wherein the phone cannot be unlocked unless a fingerprint is authenticated. Optionally, additional security is implemented by requiring the user to glide a finger over the screen in a designated gesture, in order to unlock the phone. The phone cannot be unlocked unless the touch screen detects the designated gesture. Examples of designated gestures include inter alia, an "S" shaped gesture, or a gesture wherein multiple corners of the

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screen are touched concurrently or in sequence. Optionally, additional security is implemented by displaying a musical keypad or keyboard and the user must play a particular tune of at least one note on the keypad or keyboard in order to unlock the phone.

[0062] Yet further in accordance with an embodiment of the present invention, a touch screen for a phone captioned "Home / return from application" is shown in **Figs. 16-17**. An application display screen is shown in **Fig. 16**, indicating that the user is running an application that substantially occupies the screen. A basic screen is shown in **Fig. 17**, for activating gadgets and applications. In order to return from the application screen (**Fig. 16**) to the basic screen (**Fig. 17**), the user activates the home key displayed at the bottom of the phone, such as by touching the home key. Tapping on the home key causes the open application to remain open, and causes the basic screen to display, thereby enabling launching additional applications. According to an alternative embodiment, tapping on the home key causes the open application to be closed.

[0063] Moreover in accordance with an embodiment of the present invention, a touch screen for a phone is shown in **Figs. 18-21**. Four phones are displayed, each phone illustrating a different method and system for a touch-based user interface scroll operation. Scrolling is useful when multiple gadgets are available for the user to activate or use, but not all of the gadgets are displayed on the screen at one time. In this case, the user can scroll to expose additional gadgets and to hide some of the previously visible gadgets. In **Fig. 18**, the user sweeps his finger or other interface input, such as inter alia a stylus, along the screen in a direction indicating that he would like to uncover additional gadgets and cover exposed gadgets. E.g., sweeping a finger across the width of the screen from right to left causes gadgets virtually located beyond the left screen border to be exposed, and causes gadgets previously located along the right screen border to be hidden. Similarly, sweeping a finger across the height of the screen from the bottom to top

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causes gadgets virtually located above the top edge of the display to be exposed, and gadgets previously located at the bottom edge of the screen to be hidden. In this embodiment, the user scrolls directly on the screen. Then we miss the possibility to touch and drag on other gadgets.

[0064] In **Fig. 19** a scroll cursor is shown along the right edge of the screen. The user touches the cursor and makes a sliding gesture along the right edge of the screen to cause gadgets virtually located beyond the bottom edge of the screen to be exposed, and causes gadgets previously situated at the upper edge of the screen to be hidden. This embodiment uses a scrollbar. The user puts a finger on the side and scrolls down to get lower down on the page.

[0065] In **Fig. 20** a button gadget is shown with two opposite arrows at the lower right corner of the screen. The user selects this gadget by touching one of the arrows, which causes the screen display to scroll according to the direction of the touched arrow. In this embodiment a drag button is provided. The user puts a finger on the button to drag the screen up or down.

[0066] In **Fig. 21** two arrow gadgets are shown at the top and bottom of the display screen. The user selects one of the two arrows, which causes the screen display to scroll according to the direction of the selected arrow. In this embodiment two drag buttons are provided that operate like the single drag button illustrated in **FIG. 20**. The user puts a finger on the lower scroll button to drag the screen up, or on the upper scroll button to drag the screen down.

[0067] Additionally in accordance with an embodiment of the present invention, a touch screen for a phone is shown in **Fig. 22** based on the scrolling with a scrollbar illustrated in **FIG. 19**. A dark border indicates the physical limits of the display screen. Gadgets are shown extending above and below the screen, indicating virtual locations of additional gadgets. By scrolling, the user causes successive display of additional gadgets, substantially in the order in which they appear in their virtual locations. The original display is denoted in the figure as the "Home area". At the bottom of

the gadget list is a series of links updated by external feeds, such as Internet websites, for installing new gadgets into the phone.

[0068] After the user scrolls to reveal additional gadgets and a specific time limit has elapsed, e.g., 3 seconds, the screen automatically returns to a default display, hiding recently exposed gadgets and revealing previously hidden gadgets. Such return to default display is of advantage for revealed gadgets that do not require extended viewing, such as, inter alia, a clock or a weather report. The return to default display obviates the need for the user to perform an action in order to return the screen to its initial display. Activating the home key after scrolling also returns the screen to its initial display, showing the originally displayed gadgets and hiding the recently revealed gadgets. Such return to initial display is graphically presented (i) by returning the original display completely, (ii) by fading in the original display over the current scrolled display, (iii) by gradually displacing the scrolled display with the original display, (iv) by graphically scrolling the display in reverse to the original display, or (v) by a combination of such presentations. The user puts a finger on the screen and scroll bar handle and drags down to display more gadgets down the page. The user uses the Home button to get back to the home area. An optional feature: the user puts a finger on the scroll bar handle and drags up to display upper gadgets that are less frequently used. The screen is automatically scrolled back three seconds after the finger is removed.

[0069] Further in accordance with an embodiment of the present invention, a touch screen for a phone captioned "Fav 5" is shown in **Figs. 23-24**. Two phones are displayed under the "Fav 5" caption. In **Fig. 23** the "Fav 5" gadget is shaded indicating that it is activated. **Fig. 24** shows what this gadget does; namely, it displays five contacts that the user previously selected as his favorite five contacts. The "Fav 5" is a speed-dial interface for placing a call or otherwise contacting a person without having to navigate multiple menus or scroll through a large contact list. Each contact is shown with three

buttons on the screen: "CALL", "SMS" and "MORE". By tapping on "CALL", a user causes initiation of a phone conversation with the contact. Similarly, by tapping on "SMS", a user causes initiation of an SMS message to the contact. By tapping on "MORE", a user is able to rearrange or edit contact details and to edit the contact's position within the "Fav 5" gadget.

[0070] Further in accordance with an embodiment of the present invention, a touch screen for a phone captioned "History" is shown in **Figs. 25-26**. Two phones are displayed under the "History" caption. A "history" gadget displays a user's call history, including incoming, outgoing and missed calls. The phone's user interface is similar to that of the "Fav 5" phone, including "CALL", "SMS" and "MORE" buttons for each contact. Optionally, an SMS history, for sent SMS messages, for received SMS messages, or for both sent and received SMS messages, is also included in the history list. The history list is generally longer than the number of contacts that fit within a single screen, and the user scrolls up and down the list to locate and select a desired contact.

[0071] Yet further in accordance with an embodiment of the present invention, a touch screen for a phone captioned "Telephone" is shown in **Figs. 27-28**. Two phones are displayed under the "Telephone" caption. A "Telephone" gadget is shown shaded in **Fig. 27**. The "Telephone" gadget displays the carrier name, signal strength and other relevant information. Activating the "Telephone" gadget, such as by tapping on the screen at the gadget location, causes the screen shown in **Fig. 28** to appear. At the top of the display an active number is shown. The active number is entered by the user (i) using the keypad shown in the bottom half of the screen, or (ii) by selecting one of the contacts shown in the contact list in the upper half of the screen. The user scrolls the contact list to display a desired contact that is not currently exposed. The user also searches for a contact by entering the contact name using the alphanumeric keypad displayed in the bottom half of the screen. The user selects one of two modes, (i) number entry, or (ii) alphabetized search, by respectively selecting "Name" or "Number" at the

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bottom center of the screen. Selecting "Name" causes an alphabetic keypad to be displayed, and selecting "Number" causes a numerical keypad to be displayed. When a number or contact is selected, the user presses "Call" at the lower right corner of the screen to initiate the call.

[0072] Moreover in accordance with an embodiment of the present invention, a touch screen for a phone captioned "Active call" is shown in **Figs. 29-30**. Two phones are displayed under the "Active call" caption. The phones are displayed during an initiated call. **Fig. 29** is presented for outgoing calls. The contact name occupies the entire upper half of the screen, for clear display of who is being called. Pressing on the "More" button enables call options such as mute and hold, and also enables editing an active contact's details, sending an SMS and other functions.

[0073] **Fig. 30** is presented for incoming calls, which are displayed as a callout overlaying the existing screen display. Such overlay may be a blended overlay, or a complete overlay. The callout stretches across the screen and is presented in an animated fashion, such as wiggling. In addition to the identity of the caller, three buttons, "ANSWER", "DENY" and "QUIET" are presented to respectively answer the call, reject the call or mute the ring.

[0074] Additionally in accordance with an embodiment of the present invention, a touch screen for a phone captioned "Volume" is shown in **Figs. 31-32**. Two phones are displayed under the "Volume" caption. **Fig. 31** includes "+" and "-" volume buttons on the left edge of the phone. When one of the buttons is pressed, a "volume" gadget appears on screen is shown in **Fig. 32**. The user scrolls within the "volume" gadget to adjust the magnitude of volume and to select a sound source. Two sound sources are shown in **Fig. 32**; namely, "Mp3" and "Call". The "volume" gadget disappears after it is not engaged by the user for a designated time period, such as four seconds. The "volume" gadget disappears with an animated flourish such as, inter alia, ducking into a corner of the screen before disappearing, fading, shimmering, or a combination thereof. When the two sound sources shown in **FIG. 32** are

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displayed, the user can select to change to another sound source. The sound source control of **FIG. 32** disappears after four seconds.

[0075] Additionally in accordance with an embodiment of the present invention, a touch screen for a phone captioned "Mp3 player" is shown in **Figs. 33-34**. Two phones are displayed under the "Mp3 player" caption. **Fig. 33** includes an "Mp3" gadget. The "Mp3 gadget" operates similarly to the "volume" gadget, in that it disappears after it is not engaged by the user for a designated time period. The "play list" button displays a playlist of songs (not shown). The active song, indicated in **Fig. 34** as "Maria C", is listed at the top, and buttons are provided for stop, play/pause, forward and backward.

[0076] Further in accordance with an embodiment of the present invention, a touch screen for a phone captioned "Operator ad" is shown in **Figs. 35-37**. The "Operator ad" screen enables presentation of advertising offerings on the phone. Two phones are displayed under the "Operator ad" caption. **Fig. 35** is presented prior to displaying an offering. **Fig. 36** is a pop-up window that is overlaid on at least a portion of the screen. The user presses "GO" to activate the offer. **Fig. 37** includes, as its topmost gadget, a display for an offering of 100 free SMS messages. The display for the offering displaces the topmost gadget that was previously displayed in **Fig. 35**, and the user may scroll the display, as described hereinabove, in order to view the displaced gadget. Tapping on the offering activates the gadget and causes inter alia an operator webpage or Java application to open. When the user activates the offering, a payment may be generated for the phone manufacturer, reseller or other vendor.

[0077] Yet further in accordance with an embodiment of the present invention, a touch screen for a phone captioned "Video" is shown in **Figs. 38-39**. Two phones are displayed under the "Video" caption. A "Video" gadget is shown shaded in **Fig. 38**. Activating the "Video" gadget causes a video display screen to open, as shown in **Fig. 39**. Video controls such as play/pause, stop, volume control and open new video file, are provided on

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screen in **Fig. 39**. When the controls are not engaged by the user for a designated time period, they disappear, either directly or with an audio or visual presentation effect such as fading, shimmering, shrinking, ducking into a corner of the screen, or a combination thereof.

[0078] Yet further in accordance with an embodiment of the present invention, a touch screen for a phone captioned "Camera" is shown in **Figs. 40-42**. Three phones are displayed under the "Camera" caption. A "camera" gadget is shown shaded in **Fig. 40**. When the user activates the "Camera" gadget, a viewfinder is presented, as shown in **Fig. 41**. The right side of the viewfinder displays controls for capturing an image, sending an image via multi-media message (MMS), and a "MORE" button for enabling additional options, such as inter alia changing camera settings, changing image resolution, setting camera effects and applying image processing functions. If the user selects "Send MMS", an interface for selecting at least one recipient for the MMS is displayed. **Fig. 42** illustrates an interface of this nature, enabling entering a phone number using the keypad in the bottom half of the screen, or selecting a contact from a list shown at the top half of the screen. The user can also access his "FAV 5" gadget to quickly access contacts, as described hereinabove. When the user selects "Send" the image is sent via MMS to the selected at least one recipient.

[0079] Yet further in accordance with an embodiment of the present invention, a touch screen for a phone captioned "Messaging SMS" is shown in **Figs. 43-45**. Three phones are displayed under the "Messaging SMS" caption. An "SMS" gadget for sending and viewing SMS messages is shown shaded in **Fig. 43**, indicating that the user has activated this gadget, for example by tapping on it. Activating the "SMS" gadget causes an interface for viewing and composing SMS messages to open, as illustrated in **Fig. 44**. The user scrolls down the list of messages arranged in an order, such as (i) by date and time received, (ii) alphabetically according to the sender name or subject, (iii) by thread of correspondence grouping all messages belonging to a single

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conversation together, or such other sorting method or combination thereof. Displayed with each message are the time of the message, the sender and the sender's phone number. To compose a new message the user activates the "Empty message button" shown at the top of the list in **Fig. 44**. To open a message the user selects it from the list and selects "Open" in the bottom right corner of the screen. To view a list of sent messages, the user selects the "Sent" button shown in the bottom center of the screen. To open drafts of messages, the user selects the "Draft" button shown at the bottom center of the screen. Selecting the "More" button shown at the bottom left of the screen causes an interface for more options to open, including inter alia (i) configuring how the list of messages is displayed, (ii) configuring how messages are sorted, (iii) deleting messages, and (iv) saving messages to designated folders. In an alternative embodiment, the interface for accessing and viewing messages operates substantially as a call history interface.

[0080] **Fig. 45** shows an interface for composing a new message. When the message being composed is a reply to a previously received message, the previously received message is displayed, for example, inside a callout graphic as shown in the rightmost phone. A QWERTY keyboard interface is provided for composing a new message. In **Fig. 45**, the new message is shown at the right side of the white area of the display following the name of the recipient, "To Amber:". Selecting the "Send" button causes the new message to be sent to the recipient. Selecting the "New" button causes a new message interface to open. Selecting "More" enables additional options. Selecting the "123" button at the bottom left of the keypad shown in the figure toggles the keypad from QWERTY to a numeric keypad. Other types of keypads are also supported and toggled by additional presses of the "123" button. Whenever a new keypad is displayed, the "123" toggle button displays an indicator of the next keyboard to be displayed. For example, when the next press of the toggle button will cause an English keypad to be presented, the toggle button will display the letters "En" instead of "123". If the next press of the toggle button

[24]

will cause an English keypad to be presented and the T9 language prediction to be turned on, the toggle button will display the characters "T9 En".

[0081] **Figs. 46-54** show a series of nine phones, to illustrate a user interface. Each phone in **Figs. 46-54** shows a finger and a phone display containing an item "G3". On a device having a limited display area, an open application, such as a web browser, occupies a large portion of the display area. This prevents displaying additional useful information to the user from other applications, gadgets and web sessions, at the same time. According to an embodiment of the present invention, gadgets are arranged in a contiguous series or stack, as shown in **Fig. 46** labeled "Home screen", with gadgets **G1-G6** displayed on screen and additional gadgets **G7-G9** virtually situated below the bottom edge of the screen. The user scrolls the sequence of gadgets, revealing gadgets previously virtually situated beyond one edge of the screen or display window, and hiding gadgets previously situated at an opposite edge of the screen or display window.

[0082] The effect of the scrolling activity is illustrated in **Fig. 47** labeled "Pan home screen". The user sweeps his finger in an upward direction along the length of the screen to cause the display to scroll, and thereby reveal gadgets virtually situated in the opposite direction of the user's finger sweep. Comparing **Fig. 47** to **Fig. 46**, it is seen that the scroll action has caused gadgets **G1** and **G2** to be hidden, and gadgets **G7** and **G8** to be revealed. **G3 - G6** are correspondingly displayed closer to the upper edge of the screen, in accordance with the scrolling action.

[0083] **FIGS. 48 - 50** illustrate how when a web gadget is activated - all gadgets beneath the web gadget slide down and disappear. Instead, the browser takes this space. When a gadget is activated, for example by tapping on the screen position associated with the gadget, the display area of the selected gadget extends in one direction, for example down-screen to the bottom of the screen or beyond the bottom of the screen. This extension is shown in **Fig. 50** labeled "open gadget / browser". In this figure, a "CNN

[25]

headlines” gadget is shown extending beyond the bottom edge of the screen. When a gadget is open, the user has two scrolling options: (i) scroll the stack of gadgets, and (ii) scroll the window of the open gadget. The initial position of the user’s scrolling finger determines which scrolling option will occur. When the initial position of the scrolling finger is at a height of the screen aligned with un-open gadgets in the stack of gadgets, the option to scroll the stack of gadgets is active. This is illustrated in **Figs. 51-52** labeled “Panning Gadget.” **Fig. 51** shows the initial scrolling finger position aligned with un-open gadgets in the gadget stack. **Fig. 52** illustrates sliding the finger in the direction of the top of the screen, thereby shifting the entire gadget stack up. It is noted that shifting also shifts the visible portion of the open gadget as an integral part of the gadget stack. The second option of scrolling only the active gadget is illustrated in **Figs. 53-54** labeled “Panning Web.” In **Fig. 53** the initial position of the scrolling finger is shown aligned with an area of the screen displaying the open gadget. **Fig. 54** illustrates the scrolling action whereby only the data inside the open gadget is shifted in response to sweeping the finger towards the top of the screen, as indicated by the arrow; the stack of unopened gadgets is not shifted. The present invention addresses the problem that only one browser session can be opened at a time. How can we tell the user that in an intuitive way and still stay in the same screen and keep important information at the top? The solution, in some embodiments of the invention, is to always open the browser towards the bottom of the screen and keep content above the browser gadget.

[0084] In the foregoing specification, the invention has been described with reference to specific exemplary embodiments thereof. It will, however, be evident that various modifications and changes may be made to the specific exemplary embodiments without departing from the broader spirit and scope of the invention as set forth in the appended claims. Accordingly, the

specification and drawings are to be regarded in an illustrative rather than a restrictive sense.

[27]

CLAIMS

What is claimed is:

- 1.** A computer readable medium storing a computer program with computer program code, which, when read by a mobile computer unit, allows the computer to present a user interface for the mobile computer unit, the user interface comprising a touch sensitive area in which a portion of a first window and a portion of a second window are displayed, and scrolling said first window when an object touches a corresponding location in the touch sensitive area at which said portion of said first window is displayed, and scrolling said second window when an object touches a corresponding location in the touch sensitive area at which said portion of said second window is displayed.
- 2.** The computer readable medium of claim **1**, wherein said first window is a gadget window and said second window is a home window.
- 3.** The computer readable medium of claim **1**, wherein said scrolling is activated by an object touching the corresponding location and then gliding along the touch sensitive area away from the location.
- 4.** The computer readable medium of claim **3**, wherein said scrolling is in a direction that corresponds to the direction of said gliding.
- 5.** A computer readable medium storing a computer program with computer program code, which, when read by a mobile computer unit, allows the computer to present a user interface for the mobile computer unit, the user interface comprising a touch sensitive area in which representations of a plurality of keys are displayed, and each key of said plurality of keys being mapped to a corresponding location in the touch sensitive area at which the

[26]

representation of the key is displayed, and being selected when an object touches the corresponding location and being activated when said object applies additional pressure to the corresponding location.

6. The computer readable medium of claim **5**, wherein when said key is selected, the user interface generates a secondary representation of said key.

7. The computer readable medium of claim **6**, wherein said secondary representation is a callout.

8. The computer readable medium of claim **7**, wherein said secondary representation is audio.

9. The computer readable medium of claim **5**, wherein said key is selected when an object in contact with said touch sensitive area at a first location is glided along said touch sensitive area to the corresponding location.

10. The computer readable medium of claim **5**, wherein said touch sensitive area comprises a light-based touch screen operable to detect said object applying said additional pressure to the corresponding location.

11. The computer readable medium of claim **10**, wherein said light-based touch screen includes a calculating unit operable to identify the size of said touch sensitive area covered by said object, said detection of said additional pressure comprising said calculating unit detecting an increase in said size.

12. The computer readable medium of claim **5**, wherein said touch sensitive area comprises a touch screen operable to identify a touch location

[27]

within said touch sensitive area and a pressure sensor operable to detect said additional pressure.

13. A computer readable medium storing a computer program with computer program code, which, when read by a mobile computer unit, allows the computer to present a user interface for the mobile computer unit, the user interface comprising a touch sensitive area in which representations of a plurality of gadgets are displayed, and each gadget of said plurality of gadgets being mapped to a corresponding location in the touch sensitive area at which the representation of the gadget is displayed, and being activated when an object touches the corresponding location.

14. The computer readable medium of claim **13**, wherein said plurality of gadgets include a camera gadget that, when activated, features a multimedia messaging service (MMS) button facilitating sending an active photo in an MMS message.

15. The computer readable medium of claim **13**, wherein said plurality of gadgets include a keylock gadget that, when activated, locks the computer and displays an instrumental keypad for entering a musical code to unlock the computer.

16. The computer readable medium of claim **13**, wherein said plurality of gadgets include a reporting gadget that, when activated, displays information for a first period of time and is then automatically deactivated.

17. The computer readable medium of claim **16**, wherein said reporting gadget displays the time of day.

[28]

18. The computer readable medium of claim **16**, wherein said reporting gadget displays a weather forecast.

19. The computer readable medium of claim **16**, wherein said reporting gadget displays stock market information.

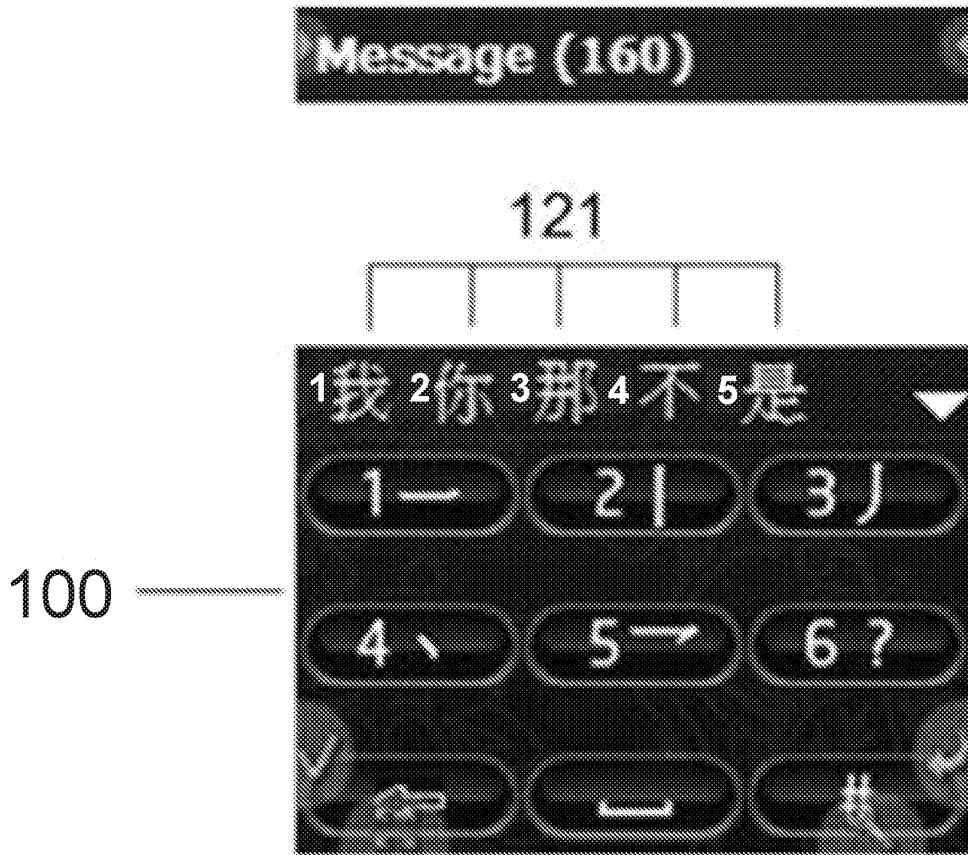
20. The computer readable medium of claim **16**, wherein said reporting gadget continues to display said information for a second period of time when an object touches the location corresponding to said displayed information during said first period of time.

[29]

ABSTRACT OF THE DISCLOSURE

An electronic device including a display, sensors detecting contact above the display, a processor receiving information from the sensors, and a user interface accessing a plurality of applications, each application running on the electronic device in an activated state and in a non-activated state whereby, in its activated state, the application presents a graphical user interface (GUI) on the display and runs interactively via the GUI, and, in its non-activated state, the application presents a gadget on the display and runs non-interactively to present, within the gadget, dynamically generated information related to the application, wherein the user interface initializes each application in its non-activated state when the electronic device is turned on, and alters the layout when an application transitions to its activated state, by displacing some gadgets from in the display to out of the display, and replacing the displaced gadgets with a window for the activated application's GUI.

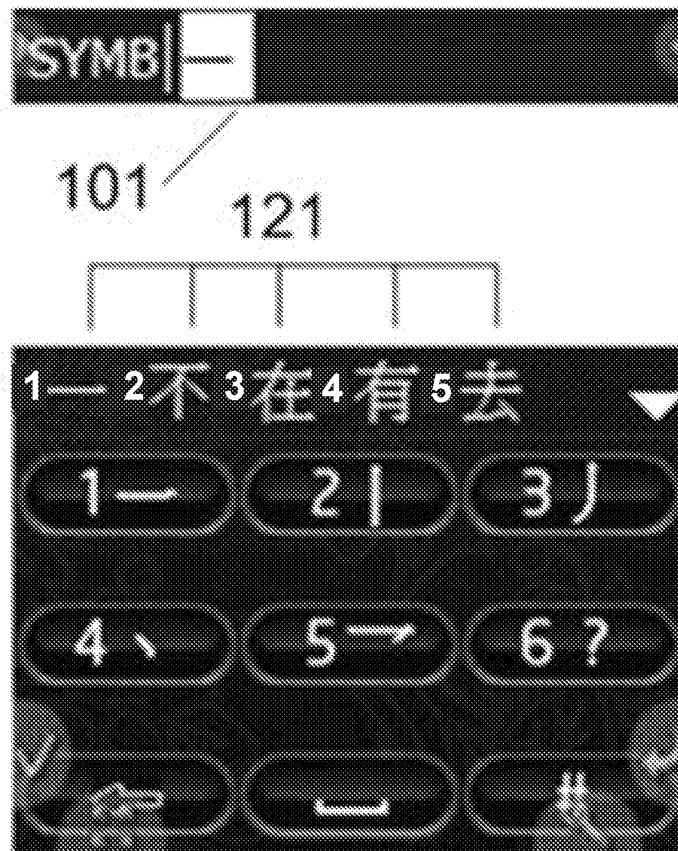
[32]



STROKE

FIG. 1A

REPLACEMENT SHEET



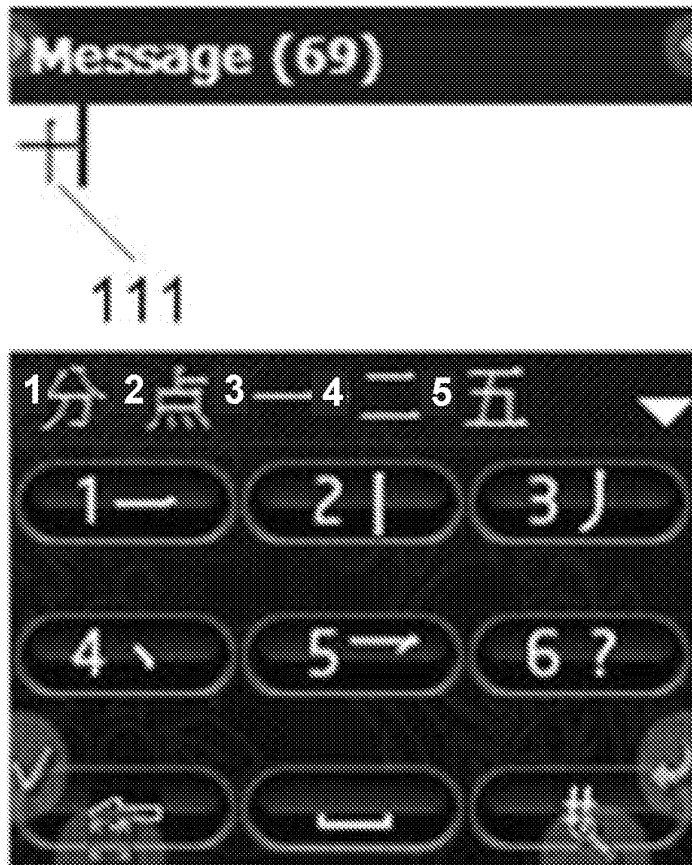
STROKE

FIG. 1B



STROKE

FIG. 1C



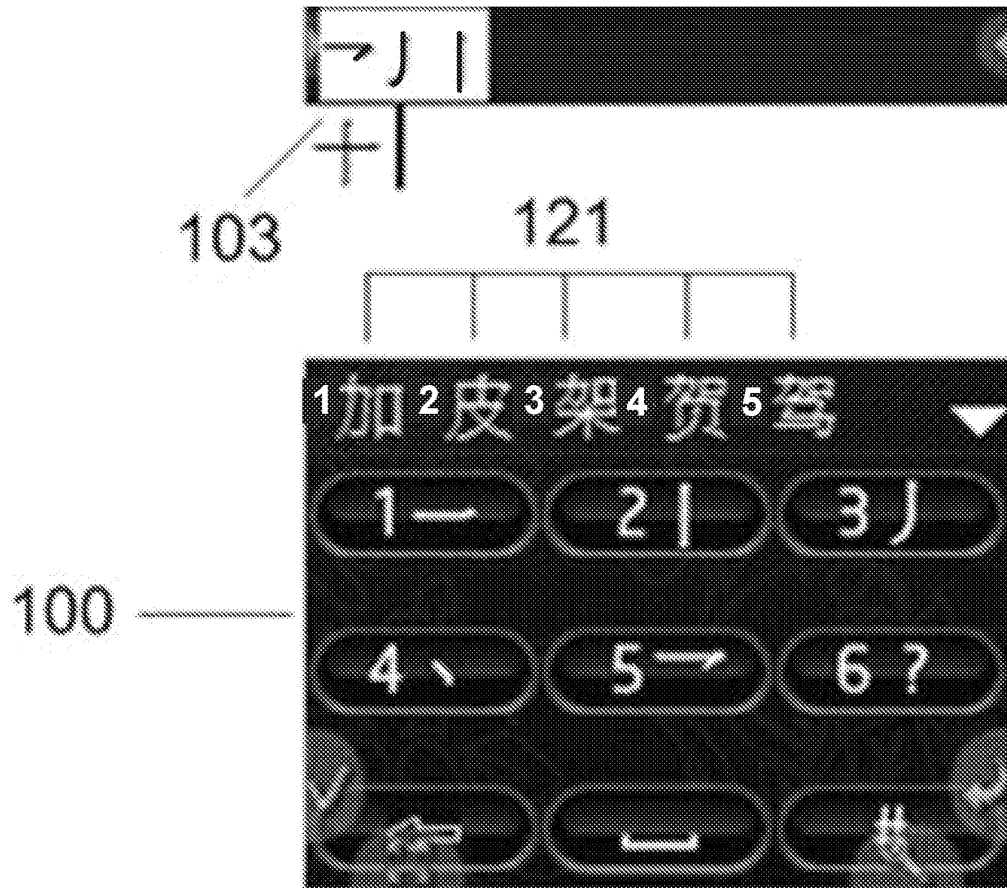
STROKE

FIG. 1D



STROKE

FIG. 1E



STROKE

FIG. 1F



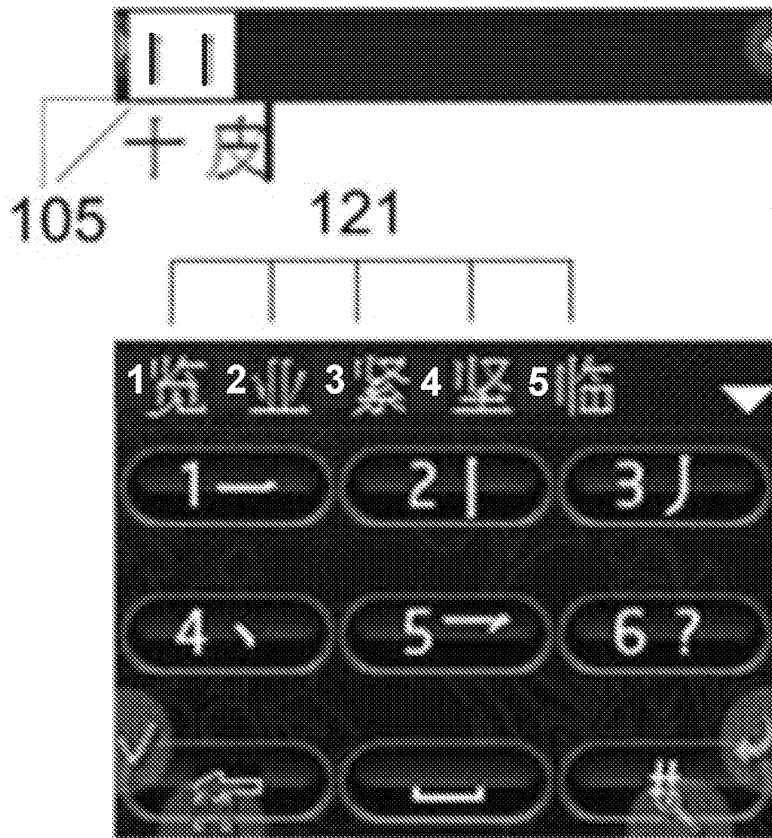
STROKE

FIG. 1G



STROKE

FIG. 1H



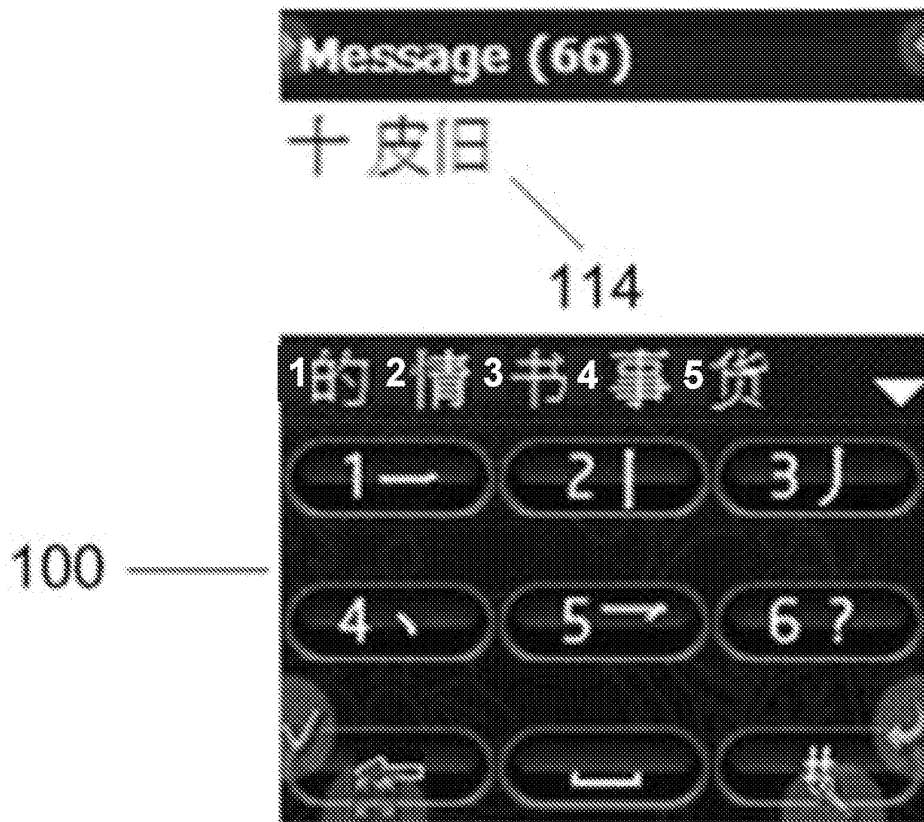
STROKE

FIG. 11



STROKE

FIG. 1J



STROKE

FIG. 1K



PINYIN

FIG. 2A

REPLACEMENT SHEET



PINYIN

FIG. 2B

REPLACEMENT SHEET



PINYIN

FIG. 2C

REPLACEMENT SHEET



PINYIN

FIG. 2D



PINYIN

FIG. 2E



PINYIN

FIG. 2F

REPLACEMENT SHEET



PINYIN

FIG. 2G



PINYIN

FIG. 2H



PINYIN

FIG. 21



PINYIN

FIG. 2J



PINYIN

FIG. 2K



PINYIN

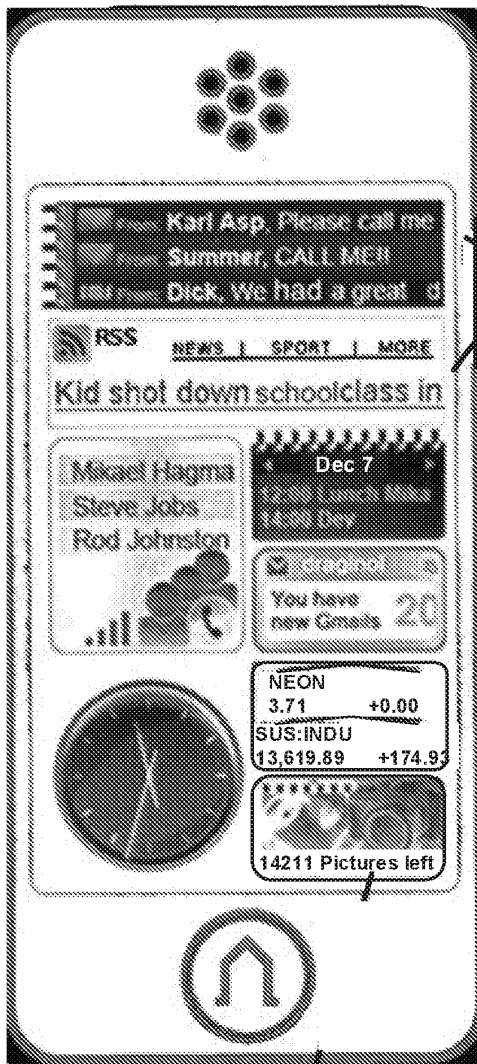
FIG. 2L

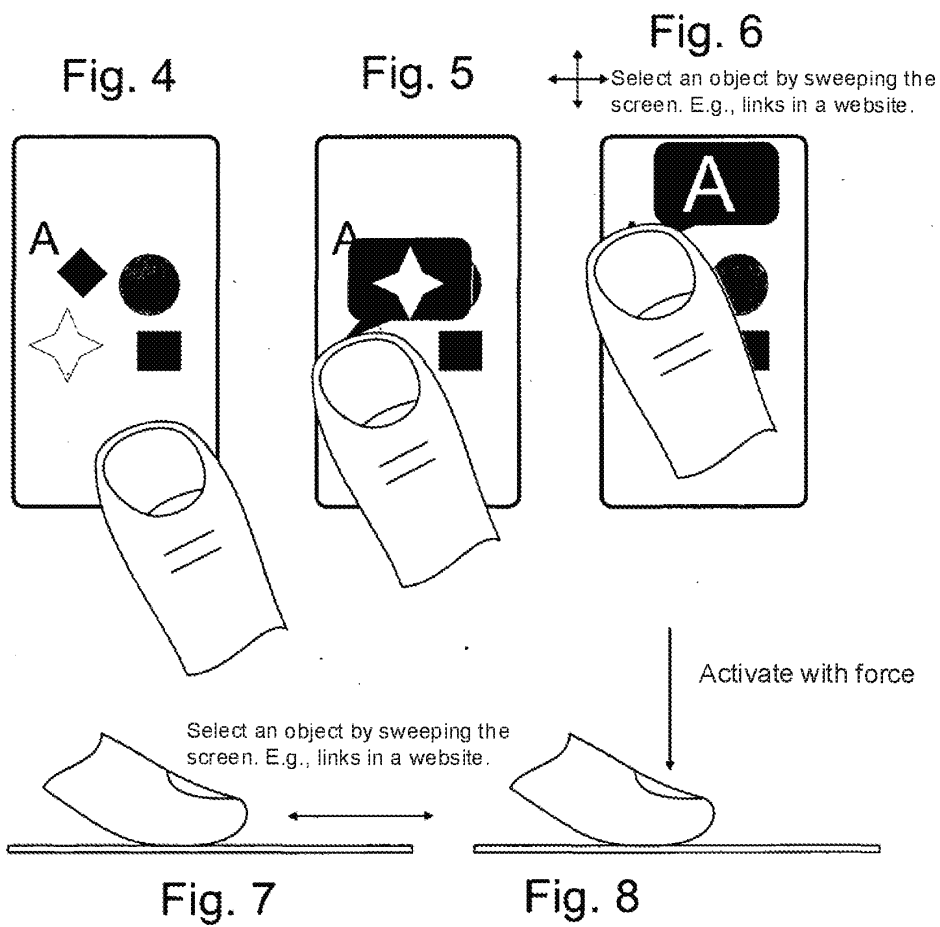


PINYIN

FIG. 2M

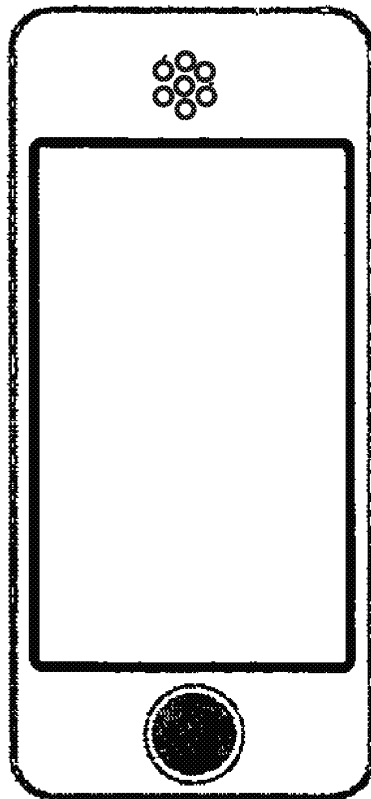
Fig. 3





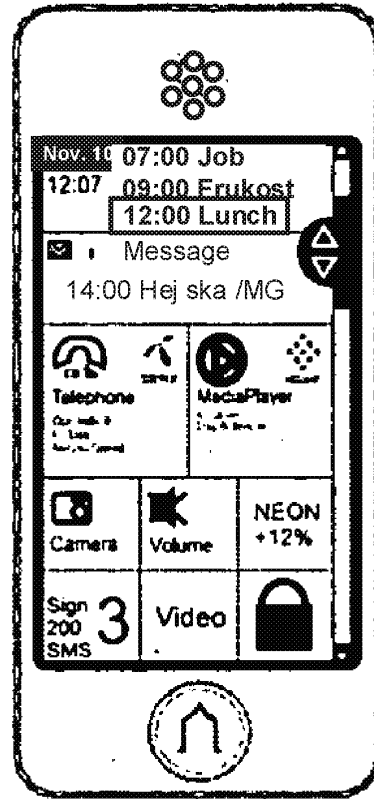
Power ON

Fig. 9



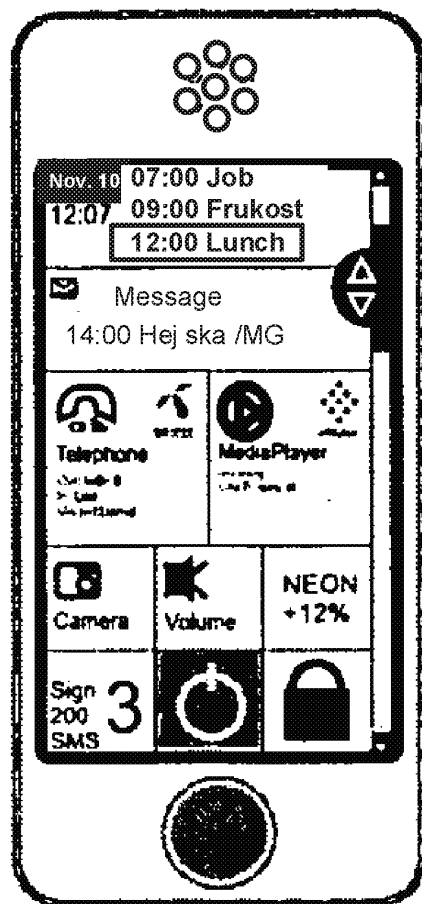
Press Home key

Fig. 10



Power OFF

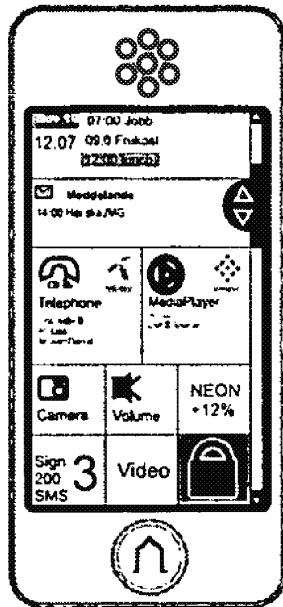
Fig. 11



Press off Gadget or
hold Home key for 5 seconds

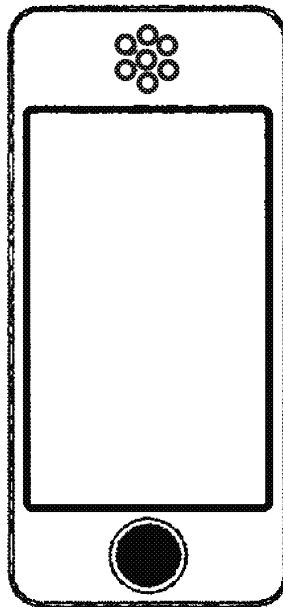
Key lock

Fig. 12



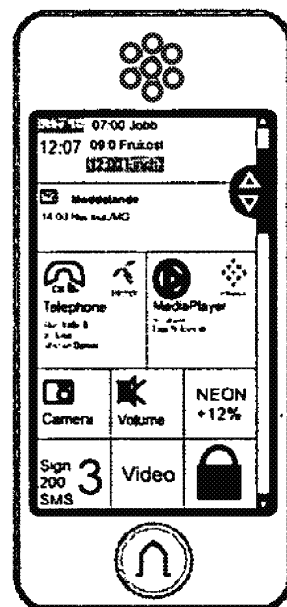
Tap key lock to lock

Fig. 13



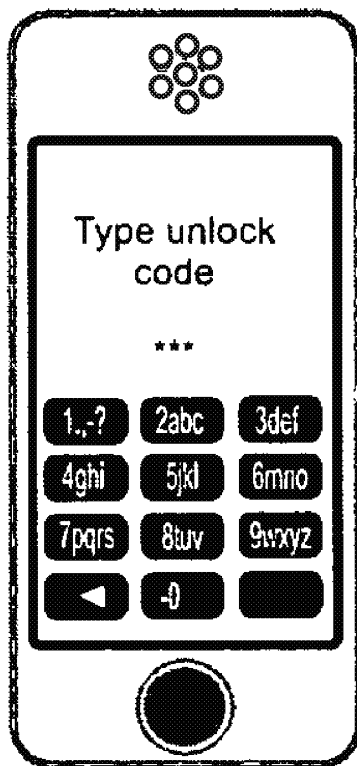
Tap home button to start

Fig. 14



Key lock high security

Fig. 15



Tap home button to start. Tap code one, two, three or four digits.

Home/ return from application

Fig. 16

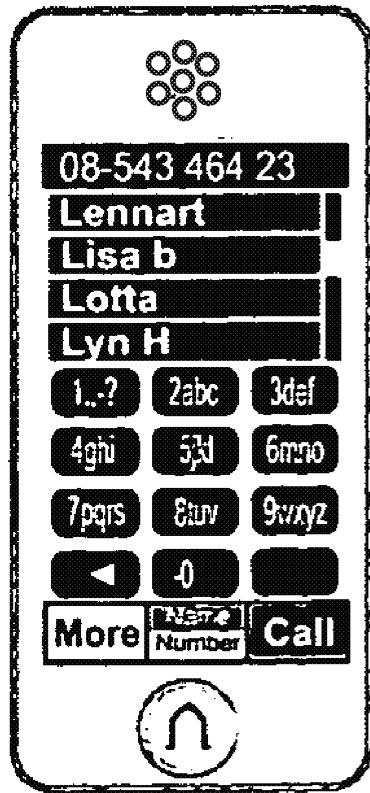
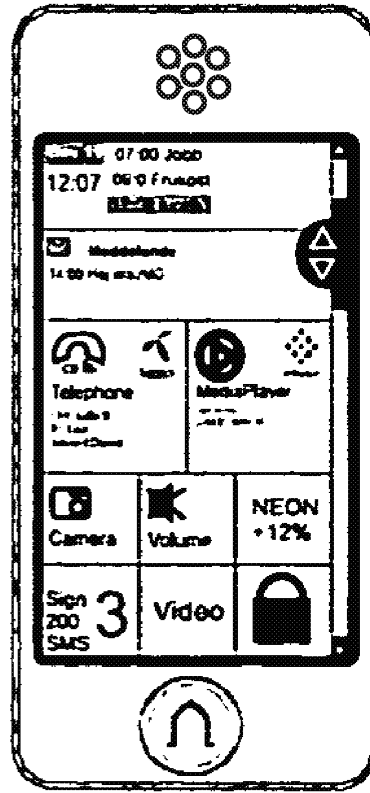
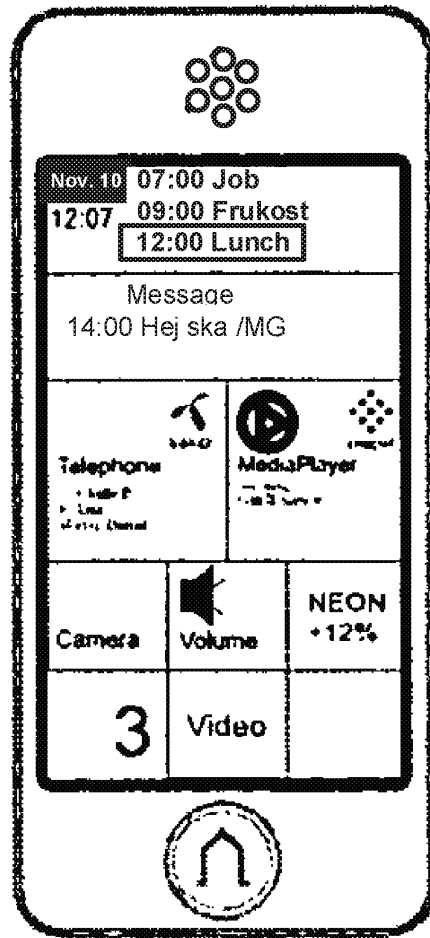


Fig. 17



Tap home

Fig. 18



REPLACEMENT SHEET

Fig. 19

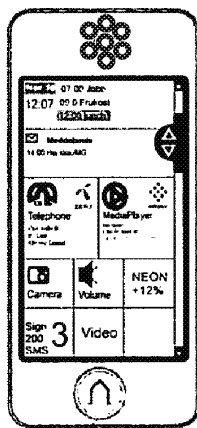


Fig. 20

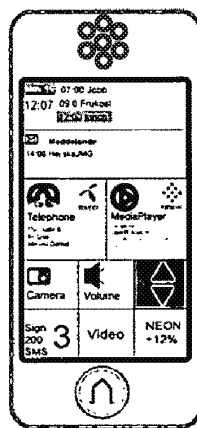
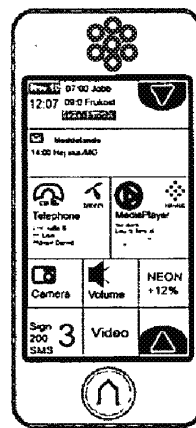


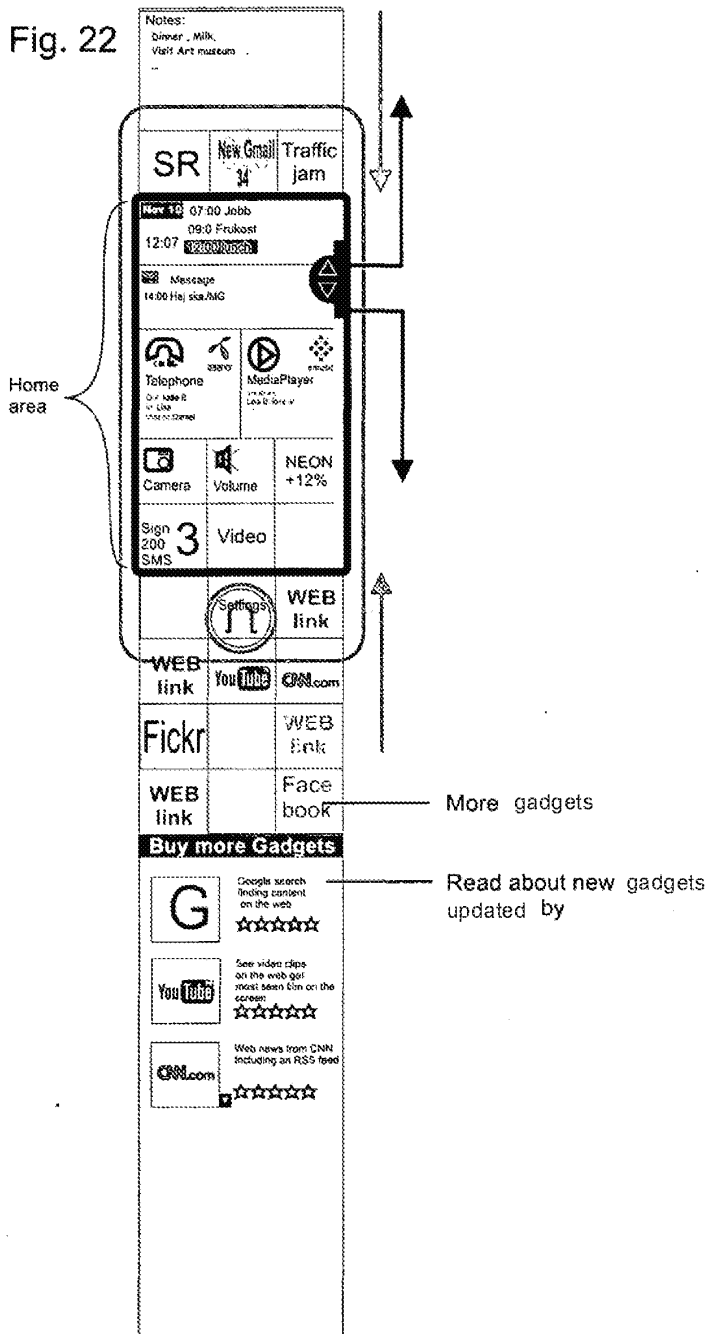
Fig. 21



Sign
200
SMS

REPLACEMENT SHEET

Fig. 22

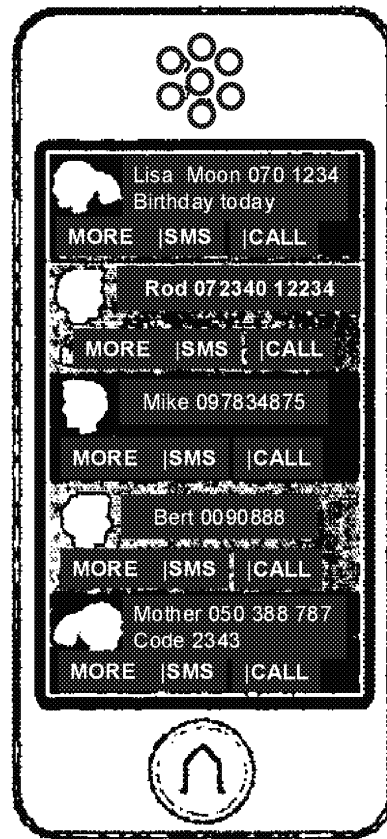


Fav 5

Fig. 23



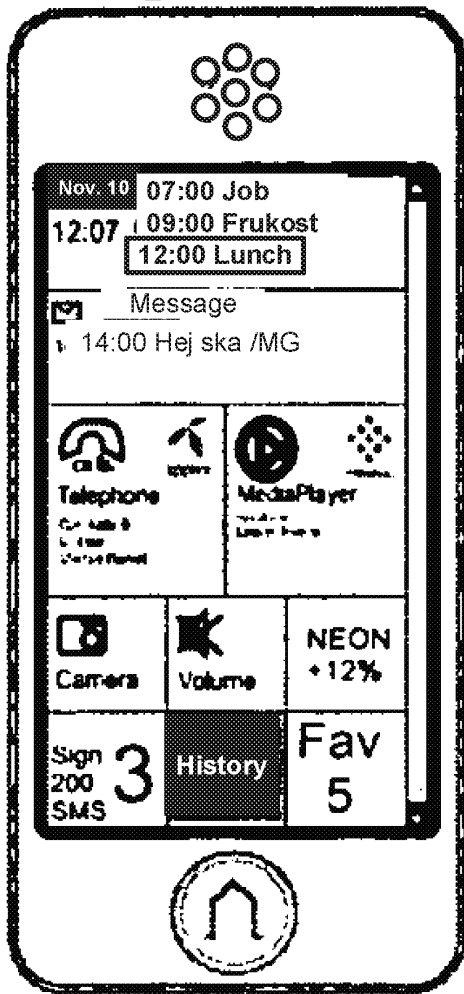
Fig. 24



Tap fav 5

History

Fig. 25



Tap history

Fig.26

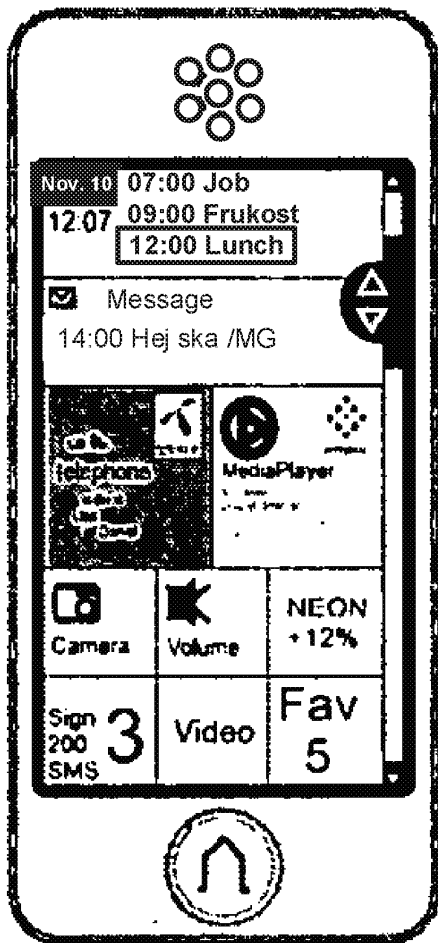


Tap to call or SMS

Telephone

Fig. 27

Fig. 28



Tap telephone



Active call

Fig. 29

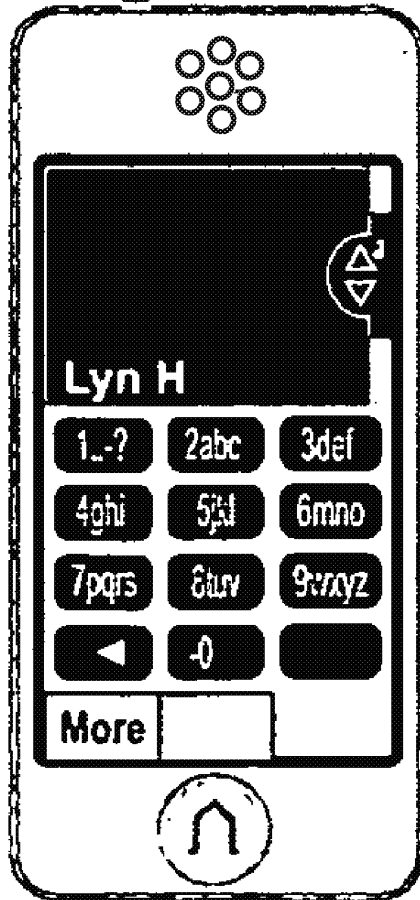
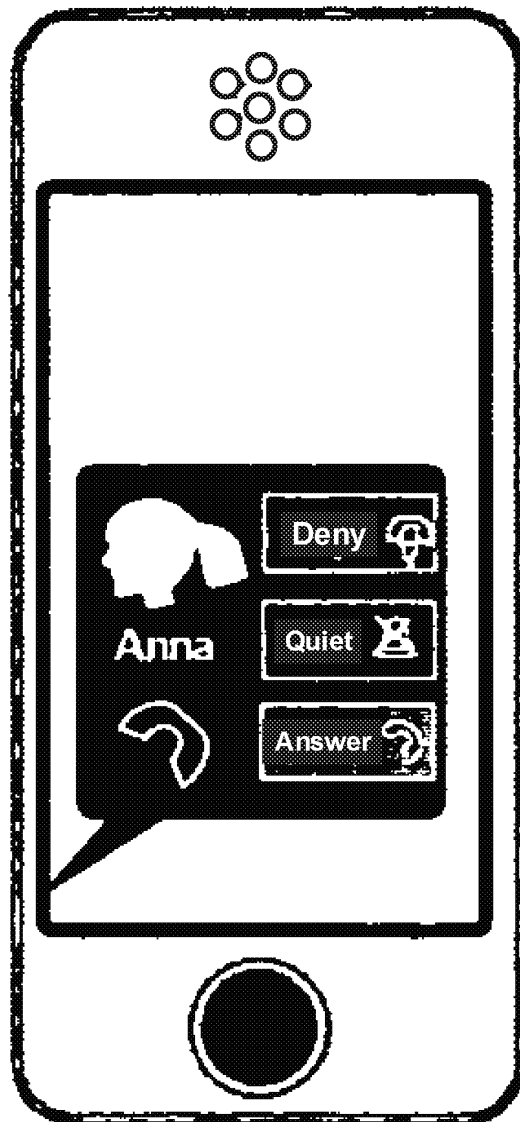


Fig. 30



Volume

Fig. 31

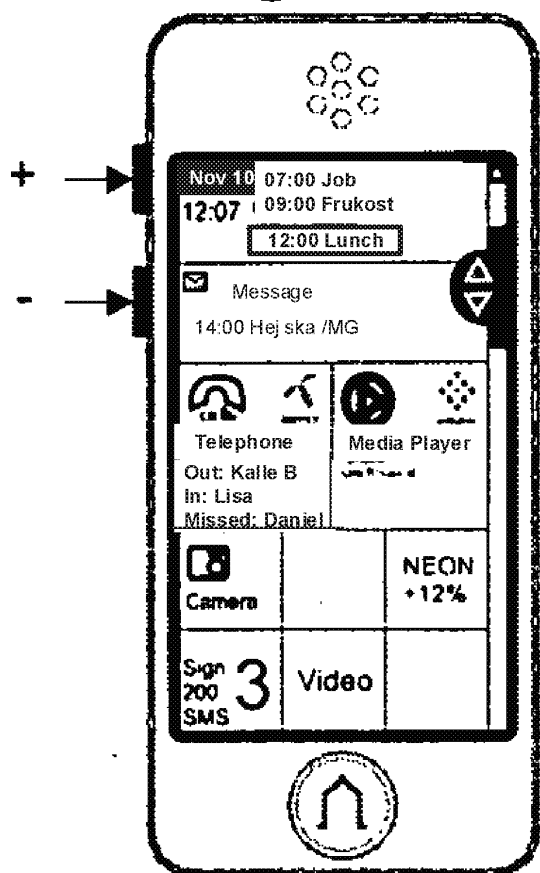
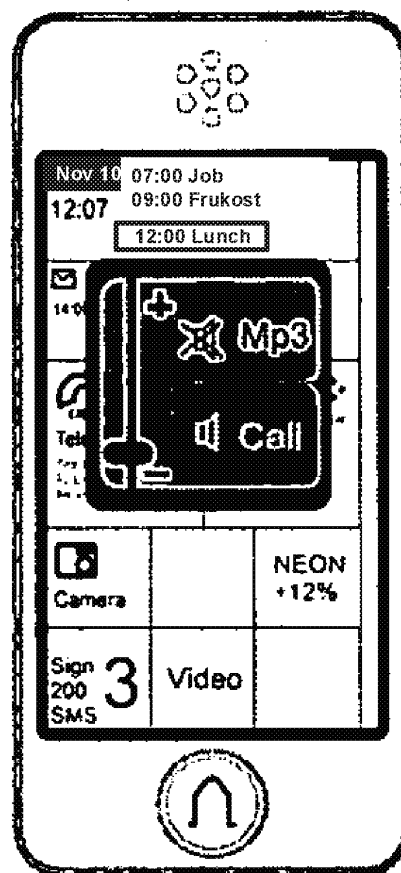


Fig. 32



Press volume button

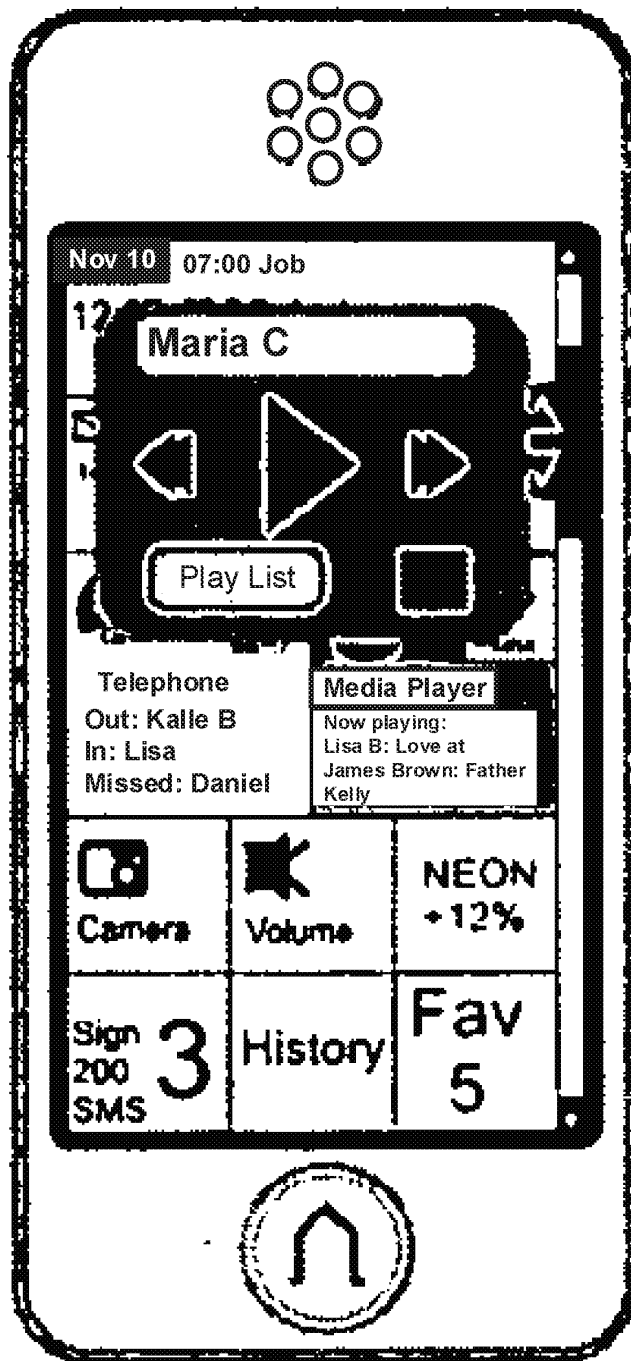
Media Player

FIG. 33



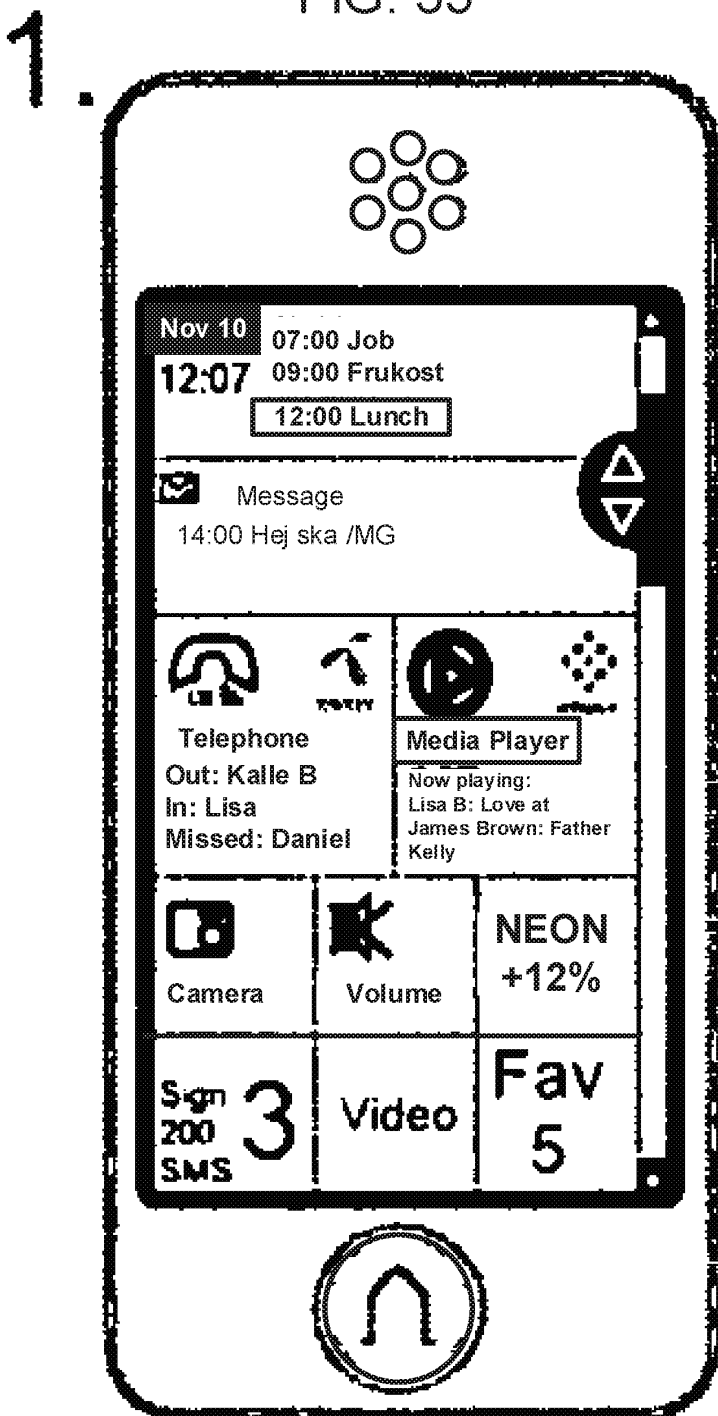
Tap player

Media Player
FIG. 34



Control disappears after 4 seconds.

Operator Ad
FIG. 35



2. Operator Ad
FIG. 36



Operator screen

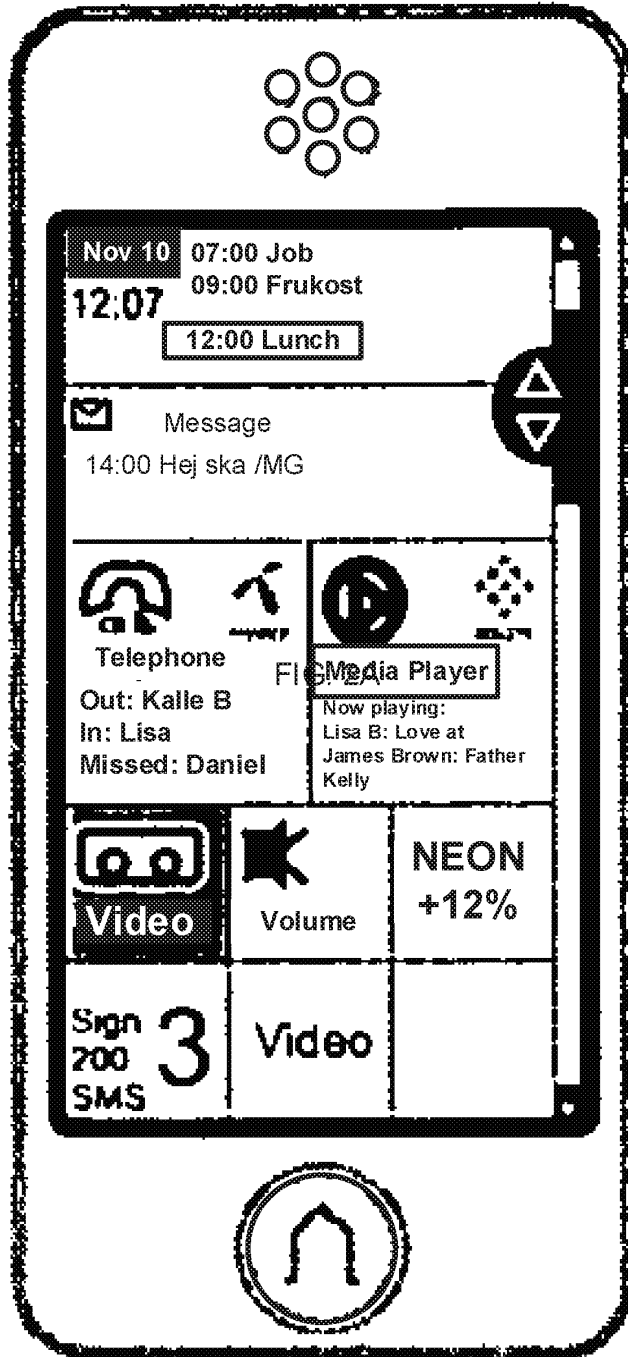
Operator Ad
FIG. 37

3.



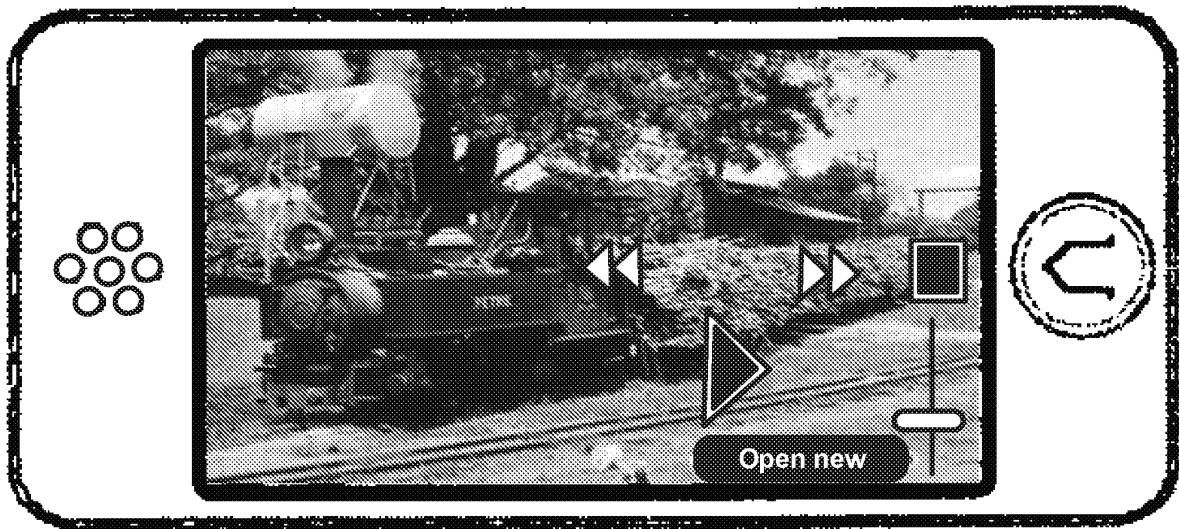
Video

FIG. 38



Tap video

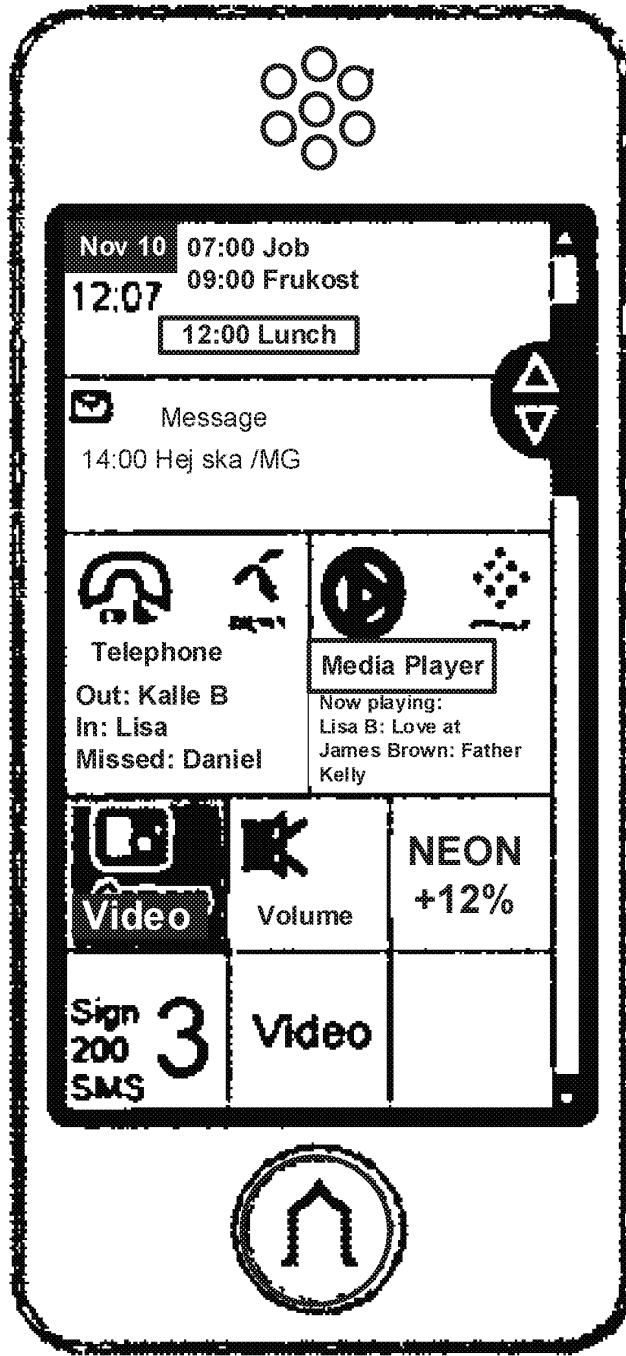
Video
FIG. 39



Tap the screen and use controls.
Controls disappear after 4 seconds.

Camera

FIG. 40



Tap Camera

Camera

FIG. 41



Use controls

Camera

FIG. 42

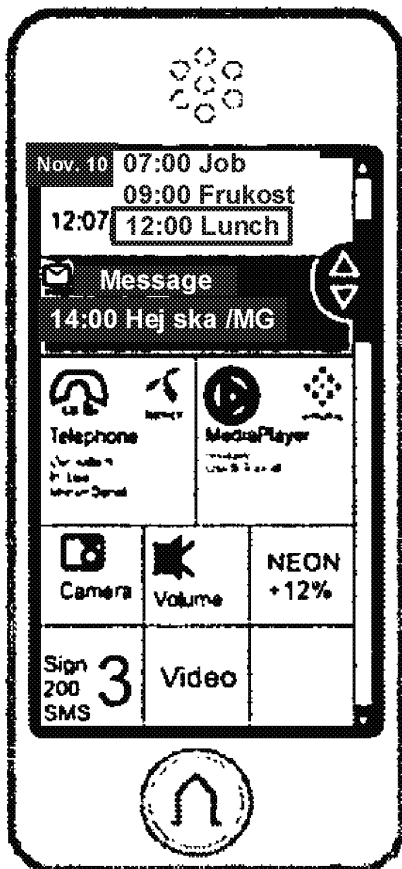


Send picture to

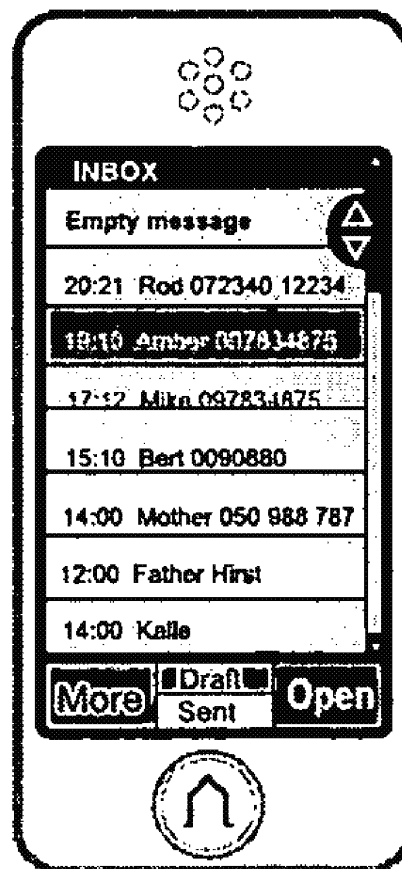
Messaging SMS

Fig. 43

Fig. 44



Tap message gadget.



Select message.

Fig. 45



FIG. 46
Home screen

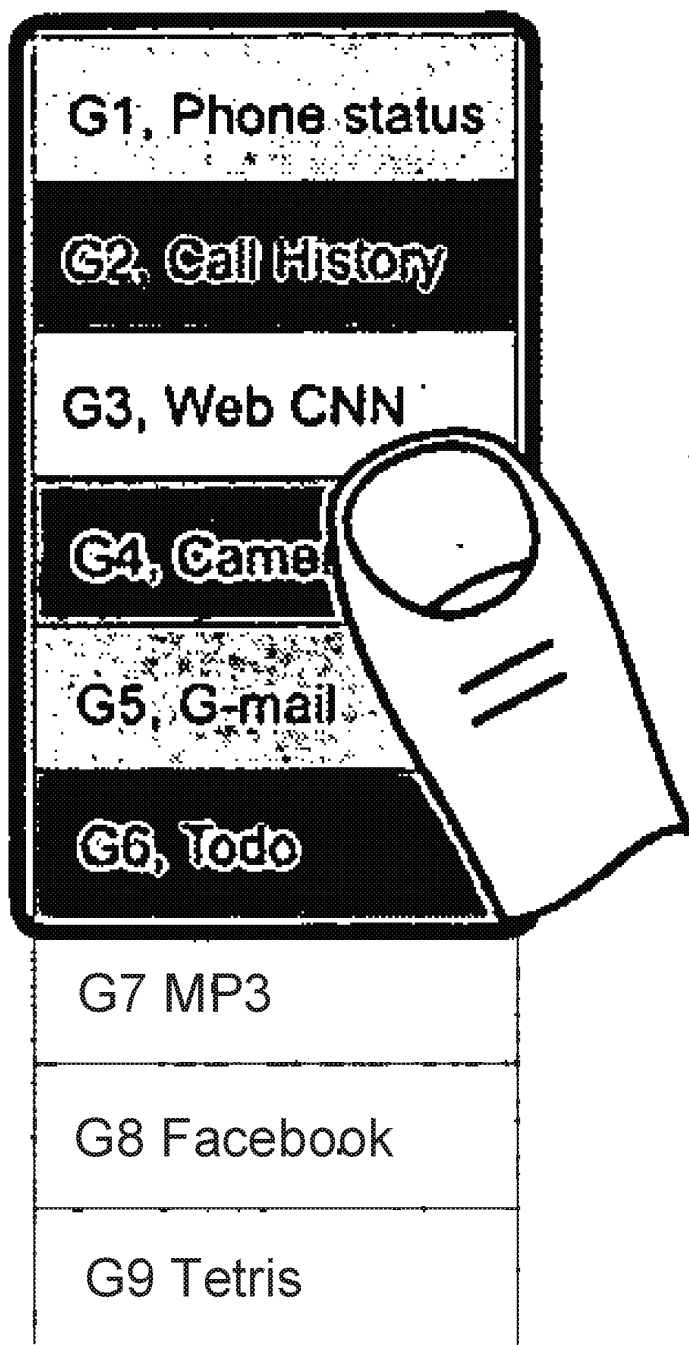


FIG. 47
Pan home screen

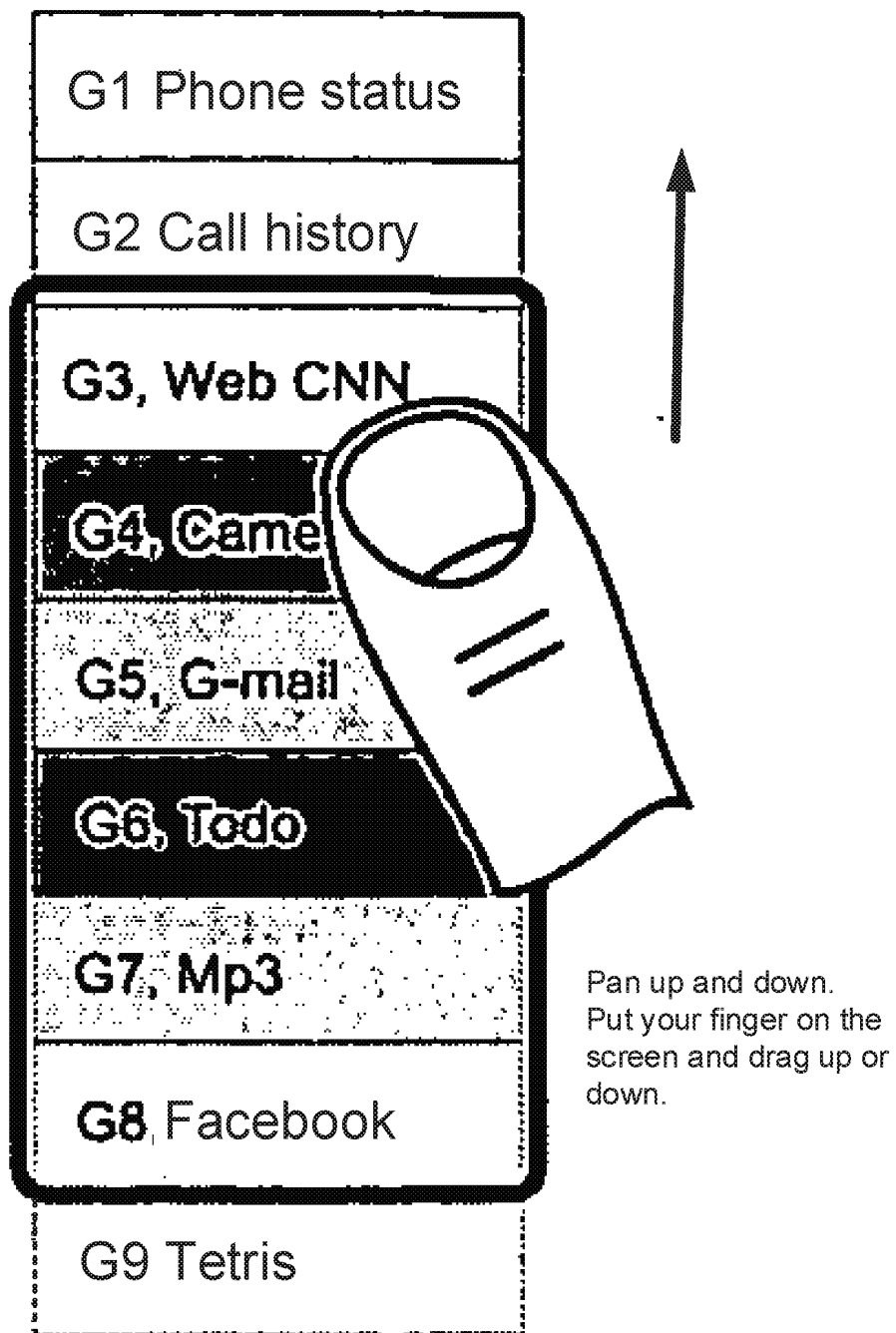


FIG. 48
Open gadget / browser

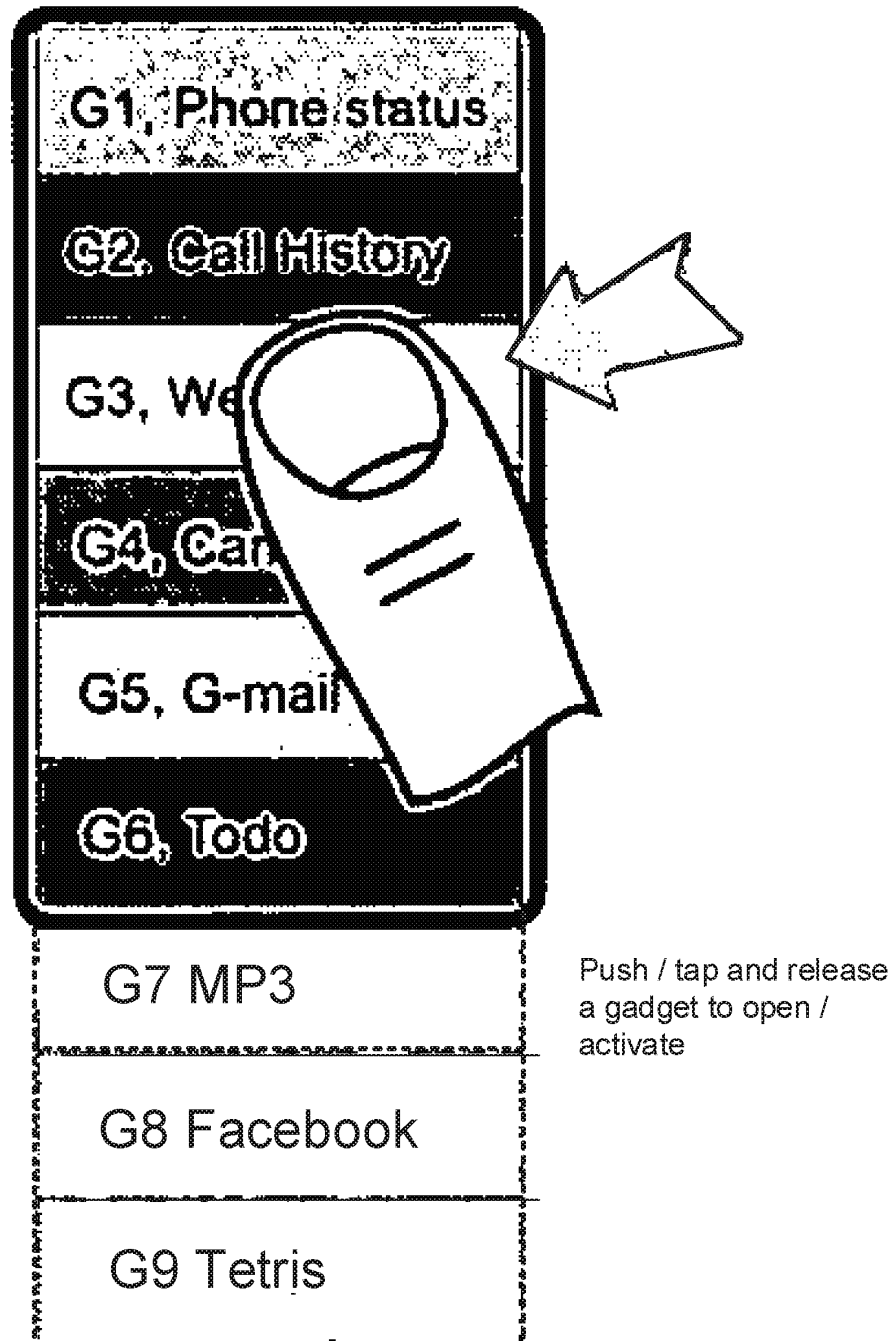


FIG. 49

Open gadget / browser

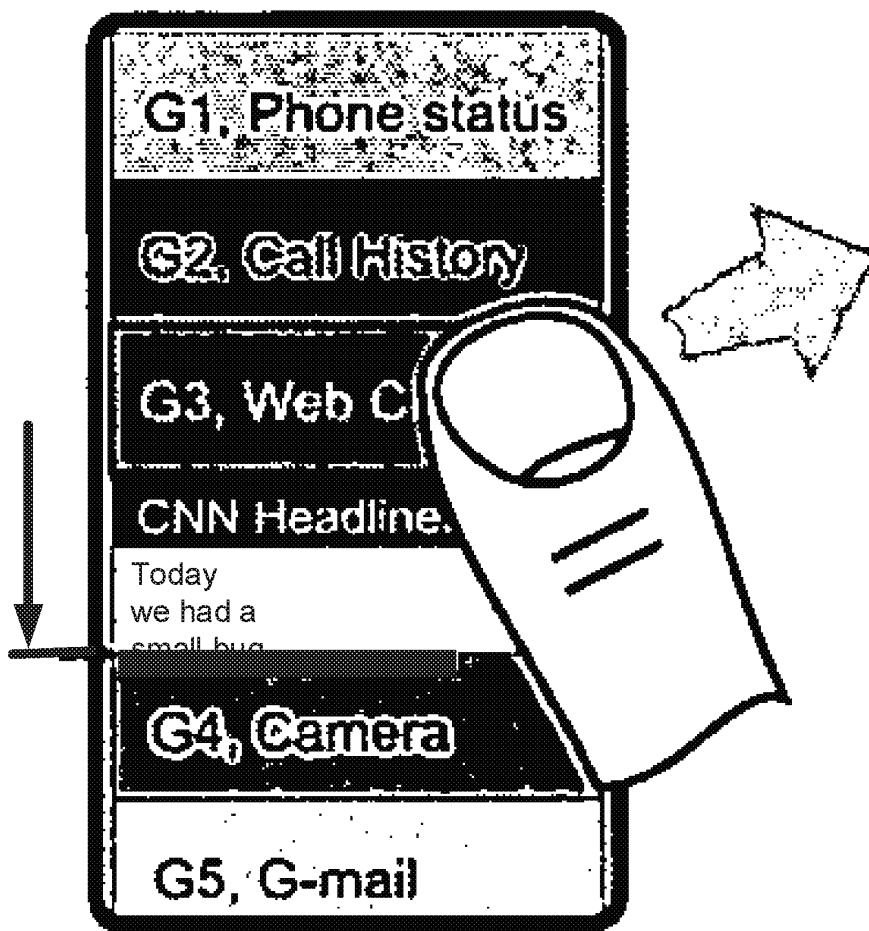


FIG. 50
Open gadget / browser



FIG. 51
Panning gadget

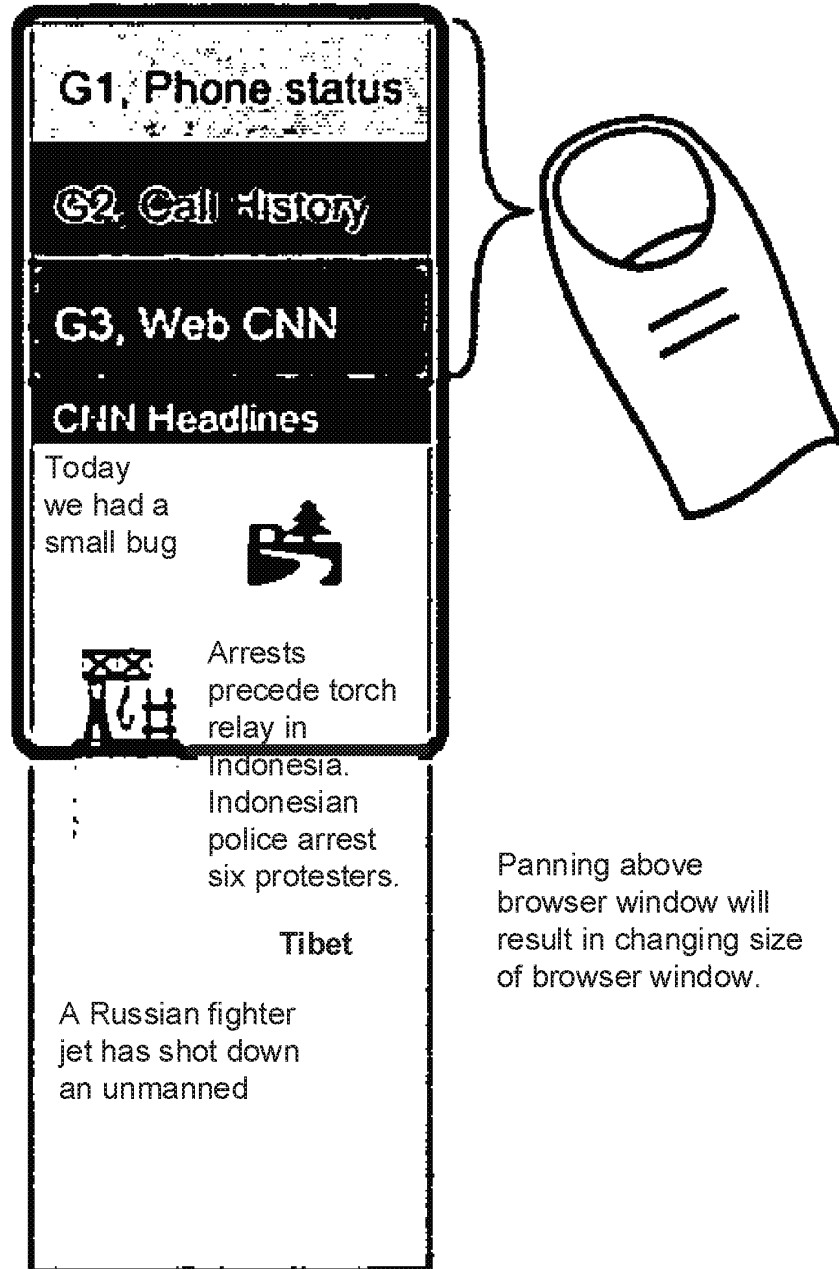


FIG. 52
Panning gadget

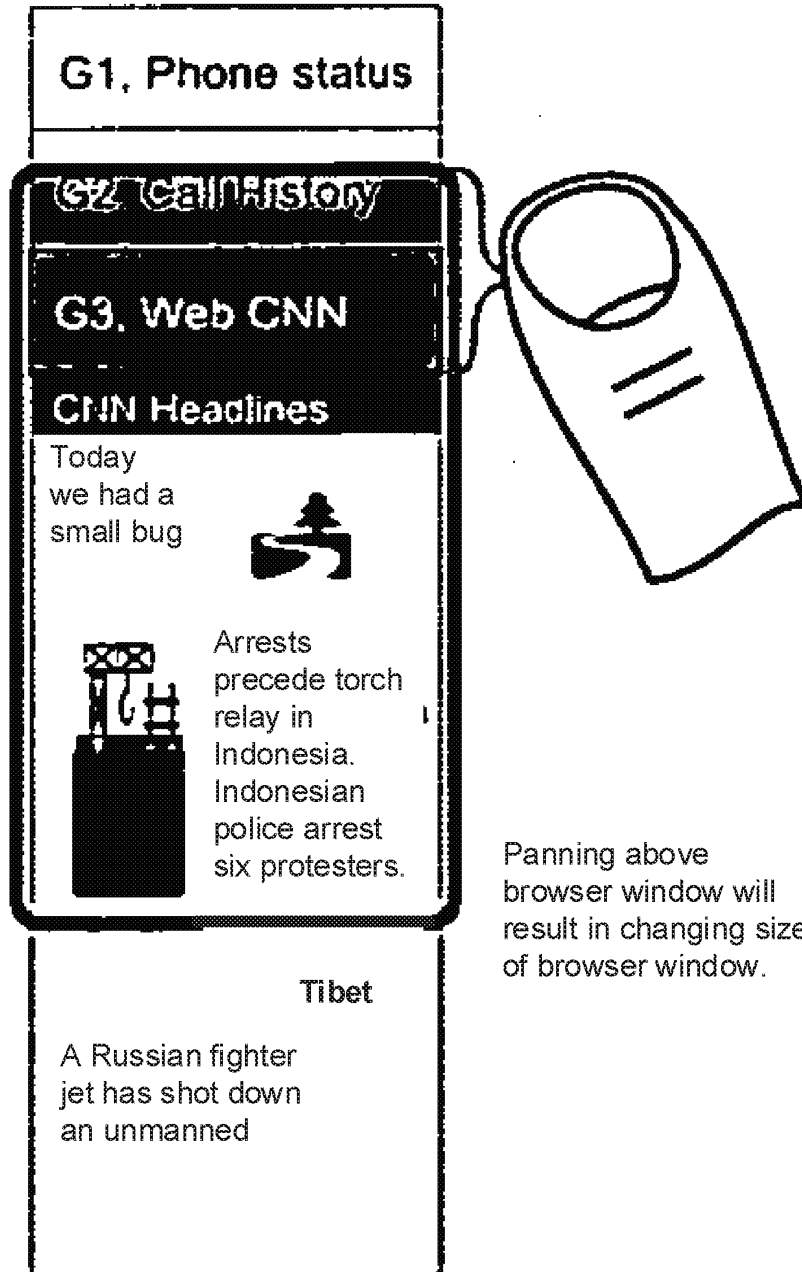


FIG. 53
Panning web

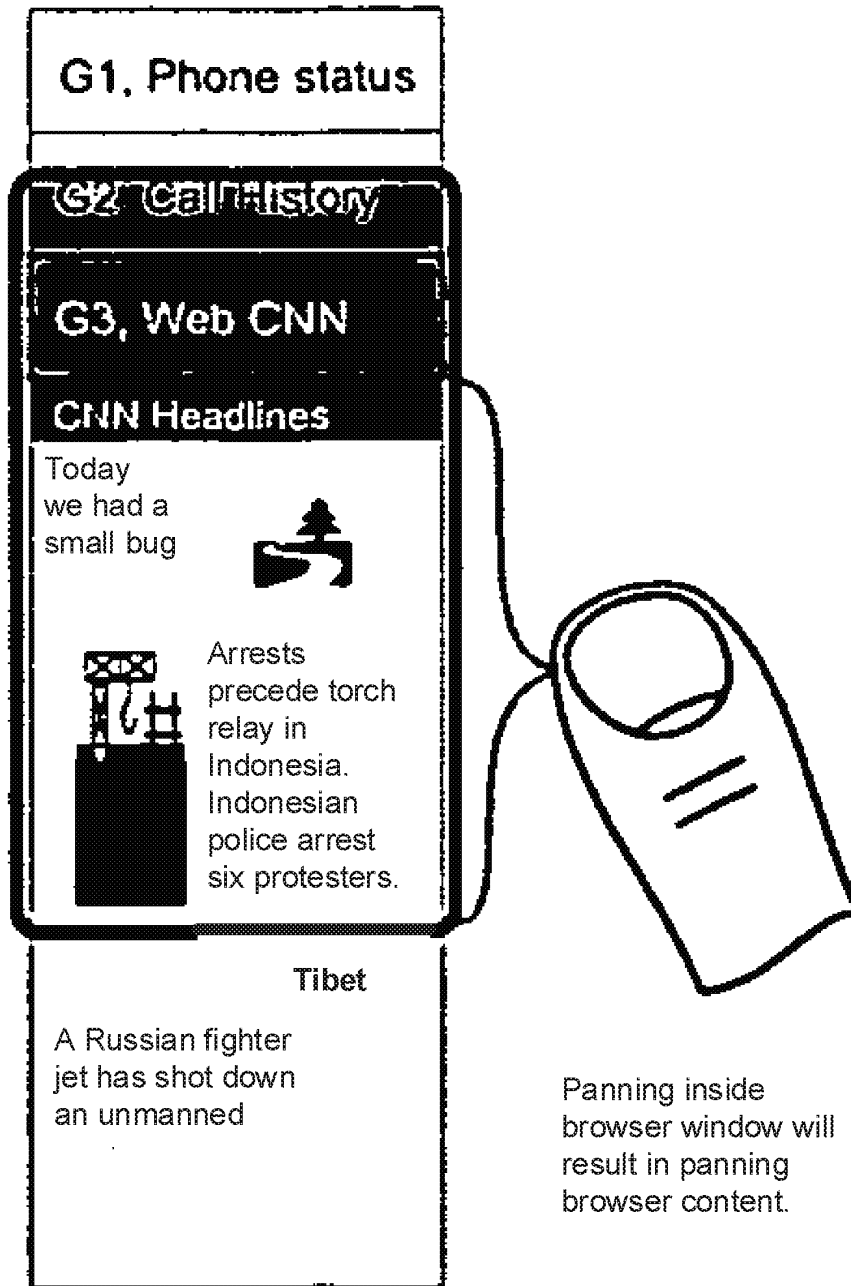
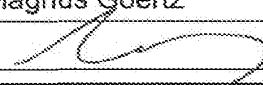


FIG. 54
Panning web



Panning inside browser window will result in panning browser content.

DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	TOUCH SCREEN ELECTRONIC DEVICE AND ASSOCIATED USER INTERFACE
As the below named inventor, I hereby declare that:	
This declaration is directed to: <input type="checkbox"/> The attached application, or <input checked="" type="checkbox"/> United States application or PCT international application number <u>14/886,048</u> filed on <u>October 17, 2015</u>	
The above-identified application was made or authorized to be made by me.	
I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.	
I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.	
WARNING:	
Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.	
LEGAL NAME OF INVENTOR	
Inventor: <u>Magnus Goertz</u>	Date (Optional): <u>2015-11-06</u>
Signature: 	
Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.	

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 1 minute to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

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

DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	TOUCH SCREEN ELECTRONIC DEVICE AND ASSOCIATED USER INTERFACE
---------------------------	---

As the below named inventor, I hereby declare that:

This declaration is directed to: The attached application, or
 United States application or PCT international application number _____
 filed on _____.

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

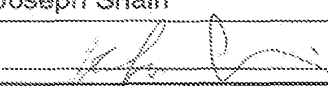
I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identify theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

LEGAL NAME OF INVENTOR

Inventor: Joseph Shain Date (Optional): 12-OCT-15

Signature: 

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 1 minute to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

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POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

I hereby revoke all previous powers of attorney given in the application identified in the attached statement under 37 CFR 3.73(c).

I hereby appoint:

Practitioners associated with Customer Number: 75660

OR

Practitioner(s) named below (if more than ten patent practitioners are to be named, then a customer number must be used):

Name	Registration Number	Name	Registration Number

As attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all patent applications assigned only to the undersigned according to the USPTO assignment records or assignment documents attached to this form in accordance with 37 CFR 3.73(c).

Please change the correspondence address for the application identified in the attached statement under 37 CFR 3.73(c) to:

The address associated with Customer Number: 75660

OR

Firm or individual name: _____

Address: _____

City: _____ State: _____ Zip: _____

Country: _____

Telephone: _____ Email: _____

Assignee name and address: Aequitas Technologies LLC
14100 Von Karman Avenue, Suite 850
Irvine, CA 92612

A copy of this form, together with a statement under 37 CFR 3.73(c) (Form PTO/AIA/96 or equivalent) is required to be filed in each application in which this form is used. The statement under 37 CFR 3.73(c) may be completed by one of the practitioners appointed in this form, and must identify the application in which this Power of Attorney is to be filed.

SIGNATURE of Assignee of Record

The individual whose signature and title is supplied below is authorized to act on behalf of the assignee.

Signature	DocuSigned by: 	Date	2/21/2020
Name	Dooyong Lee	Telephone	949 381 5373
Title	CEO		

This collection of information is required by 37 CFR 1.31, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public, which is to update (and by the USPTO to process) the file of a patent or reexamination proceeding. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.12. This collection is estimated to take 18 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450. If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

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STATEMENT UNDER 37 CFR 3.73(c)Applicant/Patent Owner: Aequitas Technologies LLCApplication No./Patent No.: 16/796,880 Filed/Issue Date: February 20, 2020Titled: TOUCH SCREEN ELECTRONIC DEVICE AND ASSOCIATED USER INTERFACEAequitas Technologies LLC, a corporation

(Name of Assignee)

(Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that, for the patent application/patent identified above, it is (choose **one** of options 1, 2, 3 or 4 below):

1. The assignee of the entire right, title, and interest.
2. An assignee of less than the entire right, title, and interest (check applicable box):
- The extent (by percentage) of its ownership interest is ____%. Additional Statement(s) by the owners holding the balance of the interest must be submitted to account for 100% of the ownership interest.
- There are unspecified percentages of ownership. The other parties, including inventors, who together own the entire right, title and interest are:

Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

3. The assignee of an undivided interest in the entirety (a complete assignment from one of the joint inventors was made). The other parties, including inventors, who together own the entire right, title, and interest are:

Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

4. The recipient, via a court proceeding or the like (e.g., bankruptcy, probate), of an undivided interest in the entirety (a complete transfer of ownership interest was made). The certified document(s) showing the transfer is attached.

The interest identified in option 1, 2 or 3 above (not option 4) is evidenced by either (choose **one** of options A or B below):

- A. An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel _____, Frame _____, or for which a copy thereof is attached.
- B. A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: Magnus Goertz and Joseph Shain (inventors) To: Neonode Inc.

The document was recorded in the United States Patent and Trademark Office at
Reel 027901, Frame 0950, or for which a copy thereof is attached.

2. From: Neonode Inc. To: Aequitas Technologies LLC

The document was recorded in the United States Patent and Trademark Office at
Reel 049099, Frame 0177, or for which a copy thereof is attached.

[Page 1 of 2]

This collection of information is required by 37 CFR 3.73(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

STATEMENT UNDER 37 CFR 3.73(c)

3. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at
Reel _____, Frame _____, or for which a copy thereof is attached.

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Reel _____, Frame _____, or for which a copy thereof is attached.

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The document was recorded in the United States Patent and Trademark Office at
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6. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at
Reel _____, Frame _____, or for which a copy thereof is attached.

Additional documents in the chain of title are listed on a supplemental sheet(s).

As required by 37 CFR 3.73(c)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

/Marc A. Berger/

Signature

/Marc A. Berger/

Printed or Typed Name

February 22, 2020

Date

44029

Title or Registration Number

[Page 2 of 2]

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Acknowledgement Receipt	
EFS ID:	38663265
Application Number:	16796880
International Application Number:	
Confirmation Number:	1091
Title of Invention:	TOUCH SCREEN ELECTRONIC DEVICE AND ASSOCIATED USER INTERFACE
First Named Inventor/Applicant Name:	Magnus Goertz
Customer Number:	75660
Filer:	Marc Aron Berger
Filer Authorized By:	
Attorney Docket Number:	AEQUITAS.P001
Receipt Date:	22-FEB-2020
Filing Date:	
Time Stamp:	14:06:28
Application Type:	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	Power of Attorney	AEQUITAS-P001_ExecutedPowerOfAttorney.pdf	582287 191cbe0ad3ae85c03daac1fe78fba0dabb9269d4	no	1

Warnings:

Information:					
2	Assignee showing of ownership per 37 CFR 3.73	AEQUITA-P001_AssigneeShowingOfOwnership_02-22-2020.pdf	119686	no	3
			afda363291b3eb5f95f03cd403454044e4897d51		
Warnings:					
Information:					
Total Files Size (in bytes):				701973	
<p>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.</p> <p><u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p>					

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	16796880
	Filing Date	2020-02-20
	First Named Inventor	Magnus Goertz
	Art Unit	N/A
	Examiner Name	N/A
	Attorney Docket Number	AEQUITAS.P001

U.S.PATENTS							Remove
Examiner Initial*	Cite No	Patent Number	Kind Code ¹	Issue Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear	
	1	4243879	A	1981-01-06	Carroll et al.		
	2	4301447	A	1981-11-17	Funk et al.		
	3	4518249	A	1985-05-21	Murata et al.		
	4	4550250	A	1985-10-29	Mueller et al.		
	5	4703316	A	1987-10-27	Sherbeck		
	6	4710760	A	1987-12-01	Kasday		
	7	4782328	A	1988-11-01	Denlinger		
	8	4790028	A	1988-12-06	Ramage		

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	First Named Inventor	Magnus Goertz	
	Art Unit		N/A
	Examiner Name	N/A	
	Attorney Docket Number		AEQUITAS.P001

9	4847606	A	1989-07-11	Beiswenger
10	4880969	A	1989-11-14	Lawrie
11	5036187	A	1991-07-30	Yoshida et al.
12	5053758	A	1991-10-01	Cornett et al.
13	5054774	A	1991-10-08	Belsito
14	5119079	A	1992-06-02	Hube et al.
15	5179369	A	1993-01-12	Person et al.
16	5194863	A	1993-03-16	Barker et al.
17	5283558	A	1994-02-01	Chan
18	5305435	A	1994-04-19	Bronson
19	5398045	A	1995-03-14	Sach et al.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		16796880	
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	Art Unit		N/A	
	Examiner Name	N/A		
	Attorney Docket Number		AEQUITAS.P001	

20	5406307	A	1995-04-11	Hirayama et al.
21	5414413	A	1995-05-09	Tamaru et al.
22	5463725	A	1995-10-31	Henckel et al.
23	5559727	A	1996-09-24	Deley et al.
24	5561758	A	1996-10-01	Hocker et al.
25	5577733	A	1996-11-26	Downing
26	5579035	A	1996-11-26	Beiswenger
27	5581681	A	1996-12-03	Tchao et al.
28	5594471	A	1997-01-14	Deeran et al.
29	5603053	A	1997-02-11	Gough et al.
30	5612719	A	1997-03-18	Beemink et al.

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	Art Unit		N/A
	Examiner Name	N/A	
	Attorney Docket Number		AEQUITAS.P001

31	5618232	A	1997-04-08	Martin
32	5644628	A	1997-07-01	Schwarzer et al.
33	5677708	A	1997-10-14	Matthews III et al.
34	5745116	A	1998-04-28	Pisutha-Amond
35	5748185	A	1998-05-05	Stephan et al.
36	5757368	A	1998-05-26	Gerpheide et al.
37	5785439	A	1998-07-28	Bowen
38	5801703	A	1998-09-01	Bowden et al.
39	5821930	A	1998-10-13	Hansen
40	5821933	A	1998-10-13	Keller et al.
41	5825352	A	1998-10-20	Bisset et al.

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	Examiner Name	N/A		
	Attorney Docket Number	AEQUITAS.P001		

42	5880462	A	1999-03-09	Hsia
43	5880743	A	1999-03-09	Moran et al.
44	5886697	A	1999-03-23	Naughton et al.
45	5889236	A	1999-03-30	Gillespie et al.
46	5898434	A	1999-04-27	Small et al.
47	5900875	A	1999-05-04	Haitani et al.
48	5905497	A	1999-05-18	Vaughan et al.
49	5907327	A	1999-05-25	Ogura et al.
50	5914709	A	1999-06-22	Graham et al.
51	5936615	A	1999-08-10	Waters
52	5943039	A	1999-08-24	Anderson et al.

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	First Named Inventor	Magnus Goertz		
	Art Unit		N/A	
	Examiner Name	N/A		
	Attorney Docket Number		AEQUITAS.P001	

53	5943044	A	1999-08-24	Martinelli et al.
54	5956030	A	1999-09-21	Conrad et al.
55	5988645	A	1999-11-23	Downing
56	6010061	A	2000-01-04	Howell
57	6031989	A	2000-02-29	Cordell
58	6037937	A	2000-03-14	Beaton et al.
59	6052279	A	2000-04-18	Friend et al.
60	6085204	A	2000-07-04	Chijiwa et al.
61	6088032	A	2000-07-11	Mackinlay
62	6208330	B1	2001-03-27	Hasegawa et al.
63	6208340	B1	2001-03-27	Amin et al.

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	First Named Inventor	Magnus Goertz		
	Art Unit		N/A	
	Examiner Name	N/A		
	Attorney Docket Number		AEQUITAS.P001	

64	6292179	B1	2001-09-18	Lee
65	6304261	B1	2001-10-16	Shields et al.
66	6310610	B1	2001-10-30	Beaton et al.
67	6323846	B1	2001-11-27	Westerman et al.
68	6340979	B1	2002-01-22	Beaton et al.
69	6346935	B1	2002-02-12	Nakajima et al.
70	6356287	B1	2002-03-12	Ruberry et al.
71	6359632	B1	2002-03-19	Eastly et al.
72	6366302	B1	2002-04-02	Crosby et al.
73	6384850	B1	2002-05-07	McNally et al.
74	6415164	B1	2002-07-02	Blanchard et al.

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	First Named Inventor	Magnus Goertz	
	Art Unit		N/A
	Examiner Name	N/A	
	Attorney Docket Number		AEQUITAS.P001

75	6421042	B1	2002-07-16	Omura et al.
76	6429857	B1	2002-08-06	Masters et al.
77	6448985	B1	2002-09-10	McNally
78	6529920	B1	2003-03-04	Arons et al.
79	6542191	B1	2003-04-01	Yonezawa
80	6549217	B1	2003-04-15	De Greef et al.
81	6570557	B1	2003-05-27	Westerman et al.
82	6573883	B1	2003-06-03	Bartlett
83	6597345	B2	2003-07-22	Hirshberg
84	6618063	B1	2003-09-09	Kurtenbach
85	6639584	B1	2003-10-28	Li

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	Art Unit		N/A	
	Examiner Name	N/A		
	Attorney Docket Number		AEQUITAS.P001	

86	6646633	B1	2003-11-11	Nicolas
87	6664983	B2	2003-12-16	Ludolph
88	6677932	B1	2004-01-13	Westerman
89	6690365	B2	2004-02-10	Hinckley et al.
90	6690387	B2	2004-02-10	Zimmerman et al.
91	6707449	B2	2004-03-16	Hinckley et al.
92	6727916	B1	2004-04-27	Ballard
93	6727917	B1	2004-04-27	Chew et al.
94	6734883	B1	2004-05-11	Wynn et al.
95	6750849	B2	2004-06-15	Potkonen
96	6757001	B2	2004-06-29	Allport

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		16796880	
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	First Named Inventor	Magnus Goertz		
	Art Unit		N/A	
	Examiner Name	N/A		
	Attorney Docket Number		AEQUITAS.P001	

97	6757002	B1	2004-06-29	Cross et al.
98	6765559	B2	2004-07-20	Hayakawa
99	6781575	B1	2004-08-24	Hawkins et al.
100	6788292	B1	2004-09-07	Nako et al.
101	6803906	B1	2004-10-12	Morrison et al.
102	6812940	B2	2004-11-02	Arnold
103	6833827	B2	2004-12-21	Lui et al.
104	6857746	B2	2005-02-22	Dyner
105	6864882	B2	2005-03-08	Newton
106	6874683	B2	2005-04-05	Keronen et al.
107	6888536	B2	2005-05-03	Westerman et al.

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	Examiner Name	N/A		
	Attorney Docket Number		AEQUITAS.P001	

108	6925611	B2	2005-08-02	SanGiovanni
109	6947032	B2	2005-09-20	Morrison et al.
110	6954197	B2	2005-10-11	Morrison et al.
111	6957397	B1	2005-10-18	Hawkins et al.
112	6972401	B2	2005-12-06	Akitt et al.
113	6977645	B2	2005-12-20	Brosnan
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	Filing Date	2020-02-20
	First Named Inventor	Magnus Goertz
	Art Unit	N/A
	Examiner Name	N/A
	Attorney Docket Number	AEQUITAS.P001

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46	Swedish Patent Application Number SE0103835-5, Pekskärm för mobiltelefon realiserad av displayenhet med ljussändande och ljuspulsmottagande enheter, filed by NEONODE AB on November 2, 2001.
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48	Notice of allowance received for US patent application no. 10/315,250 mailed on December 1, 2011, 8 pages.
49	Non-final Office action received for US patent application no. 10/315,250 mailed on June 7, 2011, 5 pages.
50	Final Office action received for US patent application no. 10/315,250 mailed on May 28, 2010, 13 pages.

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Signature	/Marc A. Berger/	Date (YYYY-MM-DD)	2020-02-24
Name/Print	Marc A. Berger	Registration Number	44029

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1	Non-final Office action received for US patent application no. 10/315,250 mailed on November 24, 2009, 11 pages.
2	Non-final Office action received for US patent application no. 10/315,250 mailed on July 8, 2009, 13 pages.
3	Non-final Office action received for US patent application no. 10/315,250 mailed on December 23, 2008, 12 pages.
4	Final Office action received for US patent application no. 10/315,250 mailed on July 11, 2008, 19 pages.
5	Non-final Office action received for US patent application no. 10/315,250 mailed on November 14, 2007, 17 pages.
6	Non-final Office action received for US patent application no. 10/315,250 mailed on May 24, 2007, 18 pages.
7	Final Office action received for US patent application no. 10/315,250 mailed on November 15, 2006, 17 pages.
8	Non-final Office action received for US patent application no. 10/315,250 mailed on March 23, 2006, 17 pages.
9	Non-final Office action received for US patent application no. 13/430,718 mailed on June 5, 2012, 13 pages.
10	Final Office action received for US patent application no. 13/430,718 mailed on October 9, 2012, 12 pages.
11	Non-final Office action received for US patent application no. 13/430,718 mailed on February 15, 2013, 12 pages.

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12	Final Office action received for US patent application no. 13/430,718 mailed on August 6, 2013, 13 pages.
13	Notice of allowance received for US patent application no. 13/430,718 mailed on December 6, 2013, 13 pages.
14	Non-final Office action received for US patent application no. 13/310,755 mailed on May 11, 2012, 18 pages.
15	Final Office action received for US patent application no. 13/310,755 mailed on September 27, 2012, 9 pages.
16	Non-final Office action received for US patent application no. 13/310,755 mailed on March 4, 2013, 9 pages.
17	Final Office action received for US patent application no. 13/310,755 mailed on July 29, 2013, 9 pages.
18	Non-final Office action received for US patent application no. 13/310,755 mailed on December 4, 2013, 10 pages.
19	Notice of allowance received for US patent application no. 13/310,755 mailed on June 2, 2014, 8 pages.
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21	Final Office action received for US patent application no. 12/486,033 mailed on March 27, 2013, 45 pages.
22	Non-final Office action received for US patent application no. 12/486,033 mailed on June 20, 2014, 46 pages.

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23	Final Office action received for US patent application no. 12/486,033 mailed on February 12, 2015, 33 pages.
24	Notice of Allowance for US patent application no. 12/486,033 mailed on July 6, 2015, 27 pages.
25	Preliminary Amendment for US patent application no. 13/310,755, filed on December 28, 2011
26	Notice of Allowance for US patent application no. 14/324,166 mailed on June 5, 2018, 7 pages.
27	Non-final Office action for US patent application no. 14/324,166 mailed on September 26, 2017, 22 pages.
28	Final Office action for US patent application no. 14/324,166 mailed on May 5, 2017, 18 pages.
29	Non-final Office action for US patent application no. 14/324,166 mailed on August 25, 2016, 11 pages.
30	Non-final Office action received for US patent application no. 14/886,048 mailed on October 4, 2018, 48 pages.
31	Final Office action received for US patent application no. 14/886,048 mailed on August 22, 2019, 39 pages.

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EUROPEAN PATENT APPLICATION

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Int. Cl.4: **G06K 11/06**

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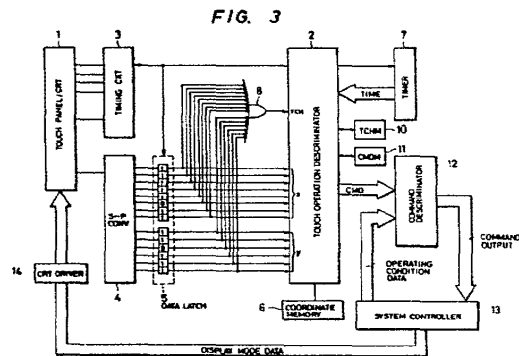
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Touch panel control device with touch time and finger direction discrimination.

EP 0 330 767 A1
In a touch panel control device for providing control signals to select an operation made for an electronic device according to how the finger touches a touch panel (1), a timer (3) starts its operation from the time instant when the finger touches the touch panel, and the direction and distance of movement of the finger in a predetermined period of time are detected, to control the operation of the electronic device or the like.



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TOUCH PANEL CONTROL DEVICE WITH TOUCH TIME AND FINGER DIRECTION DISCRIMINATION

The invention relates to a touch panel control device for acoustic equipment.

Acoustic entertainment devices for vehicles, such as a cassette tape player, compact disk player and radio tuner are installed in a considerably small space such as an in-dash console, and therefore must be small in size. Accordingly, the switches or push-buttons of the acoustic devices must also be small. These small switches or push-buttons are difficult to operate. Furthermore, the acoustic devices are used in different modes and operated in various manners. Therefore they employ a variety of switches, push-buttons, etc. Since the operator cannot easily locate them while driving, his attention to the road may be distracted when operating the acoustic devices causing a dangerous condition.

In this connection, a method has been disclosed in Japanese Patent Application (OPI) No. 89720/1986 (the term "OPI" as used herein means an "unexamined published application") in which instead of switches or push-buttons for operating acoustic devices, there is provided a touch panel, the different controls of the devices being effected by touching different positions on the touch panel.

The conventional touch panel method will be described with reference to Fig. 1. A touch panel 80 having interior detecting electrodes is scanned with a scanner 20 to detect when and at what point the touch panel 80 has been touched. The detection output data of the scanner 20 are applied to a first memory 30, where the detection output data of a scan are temporarily stored. The detection output data of one scan read out of the first memory 30 are supplied to a recognizing block 40. A touch on the touch panel is pattern-recognized by the recognizing block 40 for each scan of the scanner 20.

The output pattern data of the recognizing block 40 are applied to a second memory 50 and a data comparator 60. The second memory 50 temporarily stores the recognized pattern data produced during one scan and supplied thereto from the recognizing block 40. The data comparator 60 compares the output pattern data of the recognizing block with the pattern data of the preceding scan read out of the second memory 50, to thereby detect any change in the pattern data. The comparison output data of the data comparator 60 is supplied to a decision block 70 which output control data corresponding to the comparison output data. In response to the comparison output data, the decision block 70 refers to a data table (not shown) and outputs predetermined control data according to the touch on the touch panel 80.

As is apparent from the above description, in the conventional touch panel control device, the touch data of the present scan is merely compared with that of the preceding scan. Therefore, if the scanning speed is increased, the control device may judge no change in the touch position between two successive scans because the distance the finger can move over a scanning period is related to the scanning speed. If, on the other hand, the scanning speed is decreased, the following error may be encountered. If a finger finely touches and is removed from the panel and the part of the panel touched has not yet been scanned (for instance the right part of the panel in the case of scanning the panel in the left-to-right direction), then that touch on the panel may not be detected.

Referably, the entire panel surface should be scanned in about 10 msec to prevent a detection miss. However, if the scanning speed is set to about 10 msec, there may be an erroneous detection because, as mentioned herein before, finger speed cannot follow a rapid scanning speed.

Accordingly, an object of this invention is to eliminate the above-described difficulties with a conventional touch panel control device.

The foregoing object and other objects of the invention have been achieved by the touch panel control device of the invention for outputting control data to select an operating mode for an electronic device according to how the finger touches a touch panel. The touch panel control device of the invention comprises: touch position detecting means, arranged in matrix form on the touch panel, for detecting the coordinates of a touch position on the touch panel; scanning means for periodically scanning the touch position detecting means; memory means for storing the coordinates of an initial touch position on the touch panel or those of a touch position obtained when the control data is outputted; coordinate comparing means for comparing the coordinates stored in the memory means with those of a current touch position determined for each scan while the finger touches the panel; timer means for performing a time measuring operation with the aid of the output of the touch position detecting means; and an operation discriminator for outputting operation content data predetermined according to time measurement data of the timer means and the results of the comparison of the coordinate comparing means. The nature, principle and utility of the invention will become more apparent from the following detailed description when read in conjunction with the accompanying drawings.

In the accompanying drawings:

Fig. 1 is a block diagram showing a conventional touch panel control device;

Fig. 2 is a front view showing a touch panel in a touch panel control device according to the invention;

Fig. 3 is a block diagram showing the touch panel control device according to the invention;

Fig. 4 is a circuit diagram of one example of a touch position detecting means in the touch panel control device of the invention;

Fig. 5 is a timing chart for a description of the operation of the touch position detecting means shown in Fig. 4;

Figs. 6, 7 and 8 are three parts of a flow chart for describing the operation of the touch panel control device of the invention; and

Figs. 9(a) and 9(b) are illustrations of displays on the touch panel.

An example of a touch panel control device according to this invention will be described with reference to Fig. 2. In Fig. 2, reference numeral 1 designates a touch panel. Along the four sides of the touch panel are LEDs (light emitting diodes) 101 through 114 and light receiving means, namely, photo-transistors 201 through 214. They are alternately arranged in such a manner that the photo-transistors 201 through 214 receive light beams from the LEDs 101 through 114, respectively. The photo-transistors 201 through 214 provide "H" (high level) outputs upon reception of the light beams. The LEDs and the photo-transistors are alternately arranged along the sides of the touch panel to eliminate the possibility that a photo-transistors might erroneously detect the light beam emitted by an adjacent LED rather than its corresponding LED.

A control system for the touch panel 1 is shown in Fig. 3. The control system includes a touch operation discriminator 2. The discriminator 2 detects when the operator's finger touches the touch panel 1, and discriminates the operation to be performed from the direction of finger movement and the time period over which the finger touches the touch panel. The discriminated operation is applied to a command discriminator 12. The command discriminator 12 supplies an operation command to a system controller 13 in response to the discriminated operation. The operation command controls the operation of an electronic device such as a cassette player, radio tuner, or compact disk player, and feed back the operating condition thereof, as data, to the command discriminator 12.

The operation discriminator 2 also applies a scanning pulse signal (STB signal) to a timing circuit 3 with a period of about 10 msec as shown in a timing chart of Fig. 5. The scanning time is not

necessarily 10 msec. It should be determined on the basis of the speed of the finger scanning the panel. During the generation of the STB signal, the timing circuit 3 produces pulses for activating the LEDs 101 through 114 in Fig. 2 so that turn on input voltages are successively applied to the input terminals 301 through 314 of the LEDs 101 through 114. The light from the LEDs 101 through 114 are applied to the photo-transistors 201 through 214, respectively, the outputs of which are provided at an output terminal 400 in Fig. 4. The timing of the serial outputs is as indicated in Fig. 5. The serial outputs are applied to a serial-to-parallel converter 4, where they are converted into parallel outputs, which are latched by a data latch 5. One scanning operation is completed when the timing circuit 3 has applied the input voltages to all the LEDs. During a waiting time T, the data latched by the data latch 5 are successively transferred to the operation discriminator 2.

The timing chart of Fig. 5 represents the case where the finger touches the touch panel at a point marked with a circle in Fig. 2. In this case, the outputs of the LEDs 106 and 111 being blocked, and therefore the outputs of photo-transistors 206 and 211 are maintained at the "L" (low level). Therefore, the data latched by the data latch circuit 5 are:

1 1 1 1 1 0 1 1 in the X-direction
1 1 0 1 1 1 in the Y-direction

As apparent from the above, the coordinates of the touch position can be detected from the positions of the "O" levels in the data latch.

During the waiting time T, the output of the data latch circuit 5 are simultaneously applied to a NOR gate 8, the output of which is raised to "H" when the finger touches the panel.

With further reference to Fig. 3, reference numeral 6 designates a coordinate memory for storing the coordinates of a touch position at the start of a touch or at the end of an operation; and 7, a timer which is reset in synchronism with the storing operation of the coordinate memory 6, to start its time counting operation. The control system further comprises an arithmetic circuit (not shown) for comprising the coordinates of the present touch position with those stored in the coordinate memory 6, to detect the direction of movement of the finger on the panel 1; a touch memory 10 for storing the touch and non-touch on the touch panel 1; and a command memory 11 for storing the operation content which is discriminated by the operation discriminator 2 and applied to the command discriminator 12.

The operation discriminator 2 supplies a CMD signal representing the content of an operation given to the touch panel 1 to the command discriminator 12. In response to the CMD signal the

command discriminator 12 applies a command to the system controller 13 for operating the acoustic device.

In general, the following commands are required for acoustic devices used in vehicles:

(1) Tape deck

Fast forward, rewind, stop, repetitive playback, jump for station, and playback

(2) Tuner

Up sweep, down sweep, preset channel up, preset channel down, channel preset, and auto tuning

(3) Compact disk

Playback, partial repeat, whole repeat, skip, stop, jump for music, and disk take-out

As is apparent from the above, six or seven different commands are required for each acoustic device used in vehicles.

These commands can be issued by utilization of, for instance, seven finger operations on the touch panel; movements of the finger upwardly, downwardly, right and left (U, D, R and L), keeping the finger at a point (KEEP), touching the panel with panel with the finger twice (2HIT). The above-described seven finger operations are discriminated so that the command discriminator 12 applies commands to the concerned acoustic device separately according to the finger operations.

The above-described seven finger operations can be discriminated not only by the contents of the aforementioned arithmetic circuit, but also based on the content of the touch memory circuit 10 in which the touch condition of the preceding scan is stored, the content of the command memory 11 which stores the command which has been applied to the command discriminator 12 before the scan, and the time count in the timer 7.

For instance, the commands can be issued as follows:

(1) When the coordinate changes are at least four a second, the commands U, D, R and L are outputted separately according to the directions of movement thereof.

(2) The command KEEP is outputted when the finger is kept on the touch panel for at least one second and moves three coordinates or less.

(3) The command HIT is output when the finger is kept on the panel for 0.5 second or less, and moves three coordinates or less.

(4) the command 2HIT is outputted when, within two seconds after the issue of the command HIT, the finger is operated in the same manner as in the case of outputting the command HIT.

A method of discriminating the above-described finger operations will be described with reference to the flow charts of Figs. 6, 7, and 8.

In these figures, steps 1 through 7 form a routine for starting when the finger touches the panel, storage of the coordinates of that position and the operation of the timer. When the operation discriminator 2 outputs a scan instruction signal (STB) in step 1, in step 2 it is determined whether or not the finger touches the panel. When it is determined that the finger has touched the touch panel, in step 3 the coordinates of that position are read. In step 4, the content of the touch memory 10, which stores the touch condition of the preceding scan, is read to determine whether or not the finger touches the panel for the first time. When it is determined that the content of the touch memory 10 has been cleared, then in step 5 "1" is written in the touch memory, in step 6 the above-described coordinates of the position are stored in the coordinate memory 6, and step 7 the timer is reset and started.

(1) Discrimination of the finger operations U, D, R and L

Discrimination of the finger operations U, D, R and L are achieved in Steps 8 through 17.

In step 8, the coordinates stored in the coordinate memory 10 are compared with the present coordinates to obtain the variations in the X- and Y-directions. In step 9, by referring to the command memory 11 which stores the operation content outputted previously, it is determined whether or not the upward, downward, rightward or leftward operation has been applied to the command discriminator 12. If it is determined that the command has been applied thereto, then it is unnecessary to discriminate the movement in that direction again, and steps 11 and 11' are effected in which, when the finger is moved eight coordinates or more, the movement in a direction perpendicular to the direction of that movement is detected so that the finger movement may not be regarded as "the finger is moved four coordinates twice". If no command is applied to the command discriminator 12, then in step 10 it is determined from the above-described variations whether the finger is moved horizontally or vertically.

In step 12, it is determined whether, in each of the X- and Y-directions, the finger is moved in the positive (+) direction or in the negative (-) direc-

tion, so that in step 13 the operation content corresponding to the direction of movement is provided.

In step 14, the operation content thus provided is applied in the command discriminator 12 (in this operation, the command discriminator 12 supplies the instruction to the system controller 13 which has been predetermined for the electronic equipment in use), and in step 15 the operation content is stored in the command memory 11.

In step 16, the coordinates stored in the coordinate memory are rewritten into those of the touch position obtained at the time of outputting the operation content. And in step 17, the timer is reset so that the following discrimination is carried out.

(2) Discrimination of the finger operation KEEP

The finger operations KEEP and HIT are distinguished from each other according to how long the finger touches the touch panel. Therefore, if the finger operation KEEP is determined merely from the time count data of the timer 7, then the determination may include the finger operation HIT. That is, in the following case:

0 to 0.5 second	HIT
0.5 to 1 second	Not applicable
More than 1 second	KEEP

while the finger operation KEEP is discriminated, the finger operation HIT may occur. In the case where the touch time is 0.5 to 1 second, no action is taken, as was listed above. This is to prevent an erroneous operation which may be caused when the finger operations are not strictly defined. Therefore, the step may be eliminated as the case may be.

Therefore, in a routine consisting of steps 18 through 25 as shown in Fig. 7, when in step 20 the time count data of the timer exceeds one (1) second and in step 22 it is determined that the finger operation KEEP has not been supplied, as the operation content, to the command discriminator 12, then it is supplied, as the operation content, to the command discriminator 12 in step 24. The reason why, in step 22, it is detected whether or not the finger operation KEEP has been supplied as the operation content is to prevent the difficulty that, when the finger touches the touch panel for more than two seconds, the finger operation KEEP may be provided as the operation content two or more times.

When in step 18 the touch time is shorter than 0.5 second, in step 19 the finger operation HIT is provided as the operation content; however, it is not applied to the command discriminator 12 yet in the flow chart.

(3) Discrimination of the finger operations HIT and 2HIT

The finger operations HIT and 2HIT can be identified as shown in a flow chart of Fig. 8.

When in step 2 of Fig. 6 it is determined that the finger is not in touch with the touch panel, then in step 26 it can be determined by referring to the touch memory 10 adapted to store the touch or non-touch detected in the preceding scan whether or not the touch was just now released. When it is determined that the touch was released just now, then the content of the touch memory 11 is "1". In step 27, the content of the touch memory 11 is cleared, and in step 29 it is determined whether or not the operation content is of the finger operation HIT. That is, if in step 19 of Fig. 7 the finger operation HIT is provided as the operation content, then step 30 is effected. In step 30, when it is determined from the content of the command memory 11 that nothing is provided, then the operation content, or HIT, is applied to the command discriminator 12. If the finger operation HIT is stored as the operation content in the command memory 11, then it is the second finger operation HIT, and therefore the finger operation 2 HIT is applied as the operation content to the command discriminator 12. If the storage data of the command memory 11 is other than that, then in a routine of steps 36 through 38 the command memory and the operation content are cleared, and the timer is stopped.

When in step 26 it is determined that the content of the touch memory 10 has been cleared since the preceding scan, then step 28 is effected. If, in step 28, the timer shows the lapse of two seconds; i.e., nothing is operated for two seconds, then the routine of steps 36, 37 and 38 is effected.

The operation discriminator 2 can apply the seven operating modes to the command discriminator 12 in the above-described manner.

In the operation discriminator 2, the above-described operation contents are converted into commands suitable for the operations of the acoustic devices to be controlled in such a manner that any one of the commands can be used for a plurality of acoustic devices - for instance the finger operation R is used for the "up direction sweep" of a tuner and also for the "fast forward" of a tape deck. The commands are applied to the system controller 13. In response to the commands are applied to the system controller 13. In response to the commands, the system controller 13 controls the operations of the acoustic devices.

In the above-described embodiment, the seven finger operations are discriminated, and in response to the seven finger operations thus discriminated the command discriminator outputs the

commands. If the seven finger operations are utilized in combination, then more commands can be issued.

For instance, in the case of a tape deck, the finger operations, may be combined as follows: When, after the "fast forward" operation is selected by the finger operation R, the finger operation U is carried out, a so-called "FF SCAN" operation can be performed in which the "fast forward" operation of the tape is carried out to detect an intermusic region, and after the sound reproduction is performed, the "fast forward" operation is carried out again. And when the finger operation R is followed by the finger operation D, the "FF music search" operation is carried out.

In this case, the system controller 13 applied data representing the operating condition of the acoustic device to the command discriminator 12 at all times, and the command provided by the command discriminator is determined according to the operating condition.

In the case of the tape deck described above, normally the finger operation R is used for the command "fast forward", and the finger operation U is for the command "volume up". However, during the "fast forward" operation, the finger operation U is used to output the command "FF scan".

If a plurality of operation contents are combined to provide a command in the above-described manner, then the finger operations can be applied to a variety of operation modes of acoustic devices mounted in a vehicle.

The touch panel 1 may comprise a picture display unit such as a cathode ray tube (CRT). The system controller 13 applies display mode data to a CRT driver 14 in correspondence to an acoustic device in use, to thereby control the display to the touch panel 1.

Figs. 9(a) and 9(b) show examples of a CRT display. more specifically, the part (a) of Fig. 9 shows a CRT display in the "tape deck" mode, and the part (b) of Fig. 9 shows a CRT display in a "tuner" mode.

In Fig. 9, the finger operations U, D, R and L are indicated by the arrows which are extended upwardly downwardly, rightwardly and leftwardly, respectively; and finger operations HIT, 2HIT and KEEP are indicated by one dot, two dots and a bar, respectively; and the compound finger operations are indicated by the bent arrows - for instance the compound finger operation R U is indicated by the arrow which is extended rightwardly and then upwardly.

Therefore, merely by moving the finger according to the indications or marks displayed on the touch panel, the commands corresponding to the finger operations can be applied to the system

controller 13.

The contents of the display on the display unit can be changed according to the operating conditions of an acoustic device to be controlled. For instance, for the "fast forward" operation of a tape deck, the mark "▷▷" is caused to flicker or its color is changed, to that the operator can detect whether or not the finger operation on the touch panel has been carried out correctly, to thereby prevent erroneous operation.

As shown in Fig. 9 the display mark "2nd" is provided for the finger operation KEEP. It can be utilized in the case where the number of finger operations is smaller than the number of commands to be issued. That is, in this case, the first picture display is switched over to the second picture display by one finger operation (KEEP in this case) so that the command discriminator 12 can provide commands different from those used when the first picture display is employed. That is, more intricate operations of electronic devices can be controlled.

As is apparent from the above description, the predetermined commands can be issued according to the distance of movement of the finger over the touch panel, the period of time for which the finger touches the touch panel, and the number of times the touch panel is touched with the finger, and one and the same touch panel can be used for a plurality of acoustic devices such as a cassette tape player and a radio tuner installed in a vehicle. Therefore, the limited space in the vehicle can be efficiently utilized, and the touch panel control device installed will never obstruct the operator's driving. Furthermore, since the touch panel serves as the display unit, the probability of erroneous operation is decreased.

Claims

1. A touch panel control device for outputting control data to select an operation mode for an electronic device according to how the finger touches a touch panel (1) comprising: touch position detecting means (101,114,201,214) in a matrix form on said touch panel, for detecting the coordinates of a touch position on the touch panel; scanning means (2) for periodically scanning said touch position detecting means; memory means (6) for storing the coordinates of at least one initial touch position on the touch panel and the coordinates of a touch position obtained when the control data is outputted; coordinate comparing means for comparing for each scan, the coordinates stored in the memory means with those of a current touch position while

the finger touches the panel;
 timer means (3) for performing a time measuring
 operation with the aid of an output of the touch
 position detecting means; and
 an operation discriminator (2) for outputting the
 operation content data predetermined accordingly
 to time measurement data of the timer means and
 the results of comparison of the coordinate com-
 paring means.

2. A touch panel control device as claimed in
 claim 1, wherein the touch position detecting
 means comprises light emitting elements (101-114)
 and light receiving elements (201-214) arranged
 along the sides of the touch panel (1) in such a
 manner that said light receiving elements receive
 light beams emitted by respective said light emit-
 ting elements.

3. A touch panel control device as claimed in
 claim 1, in which the touch panel comprises a
 picture display unit, the display content of which is
 changeable according to an electronic device to be
 controlled and operating conditions thereof.

4. A touch panel control device as claimed in
 any of claims 1 to 3, wherein the operation dis-
 criminator (2) includes means for discriminating the
 operation content data to be outputted from a plu-
 rality of predetermined operation content data
 based upon the direction and distance the finger
 moves in a predetermined period of time.

5. A touch panel control device as claimed in
 claim 4, wherein the operation discriminator (2)
 further includes means for discriminating the opera-
 tion content data based on the time duration that
 the finger touches the touch panel while moving
 less than a predetermined distance.

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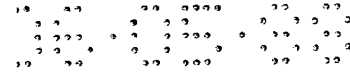
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FIG. 1

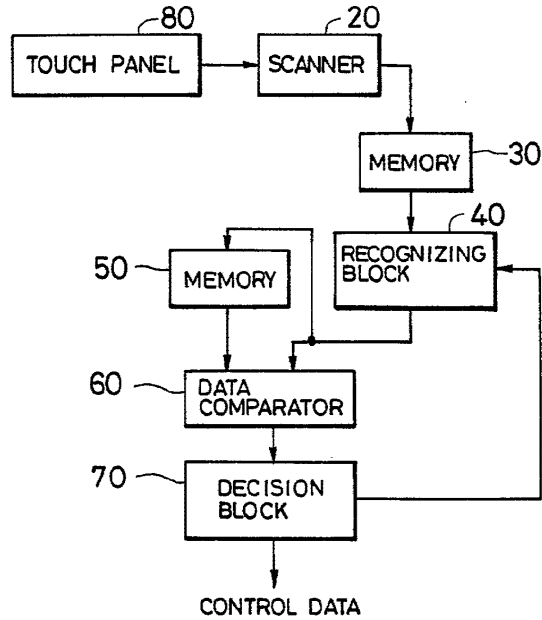


FIG. 2

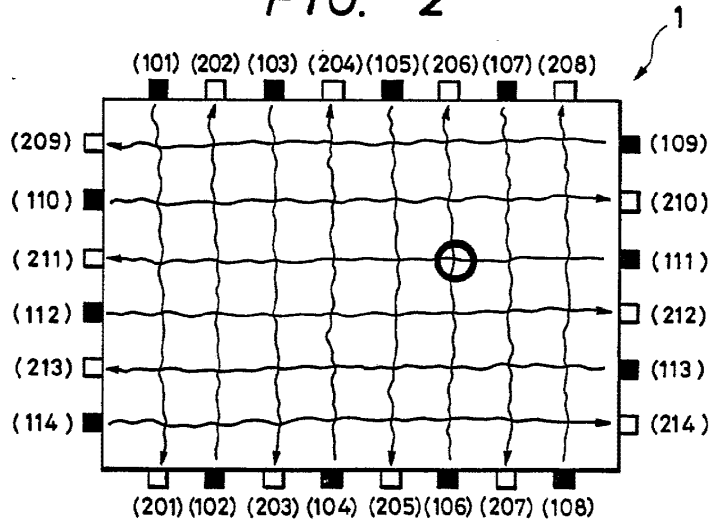
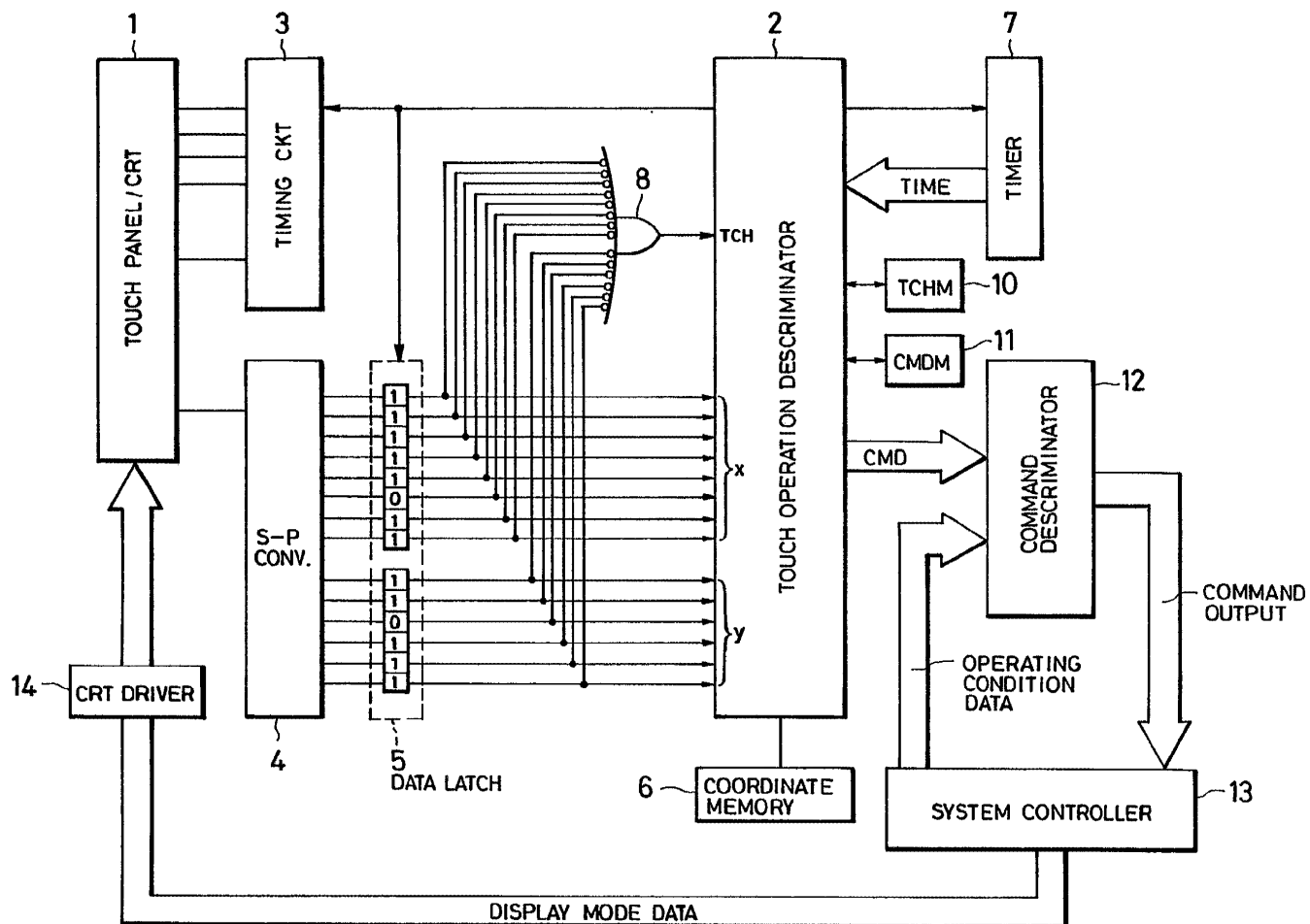
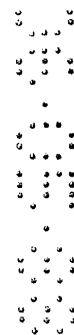


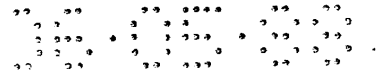
FIG. 3



Neuinger et al. / Nov. 7, 1984
 Neureinvention déposée
 (IP 251)

EP 0 330 767 A1





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FIG. 4

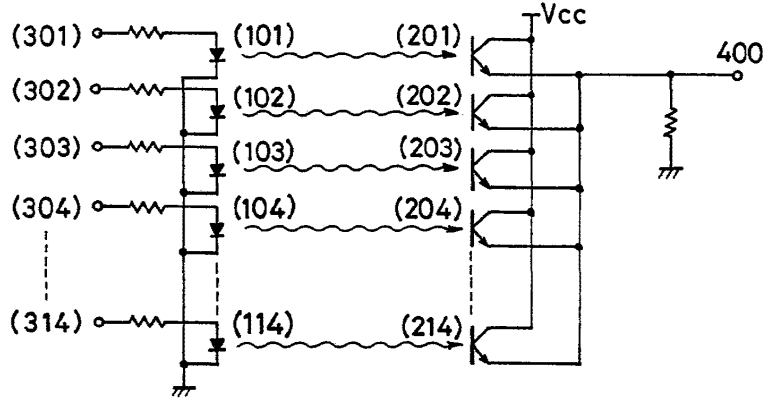
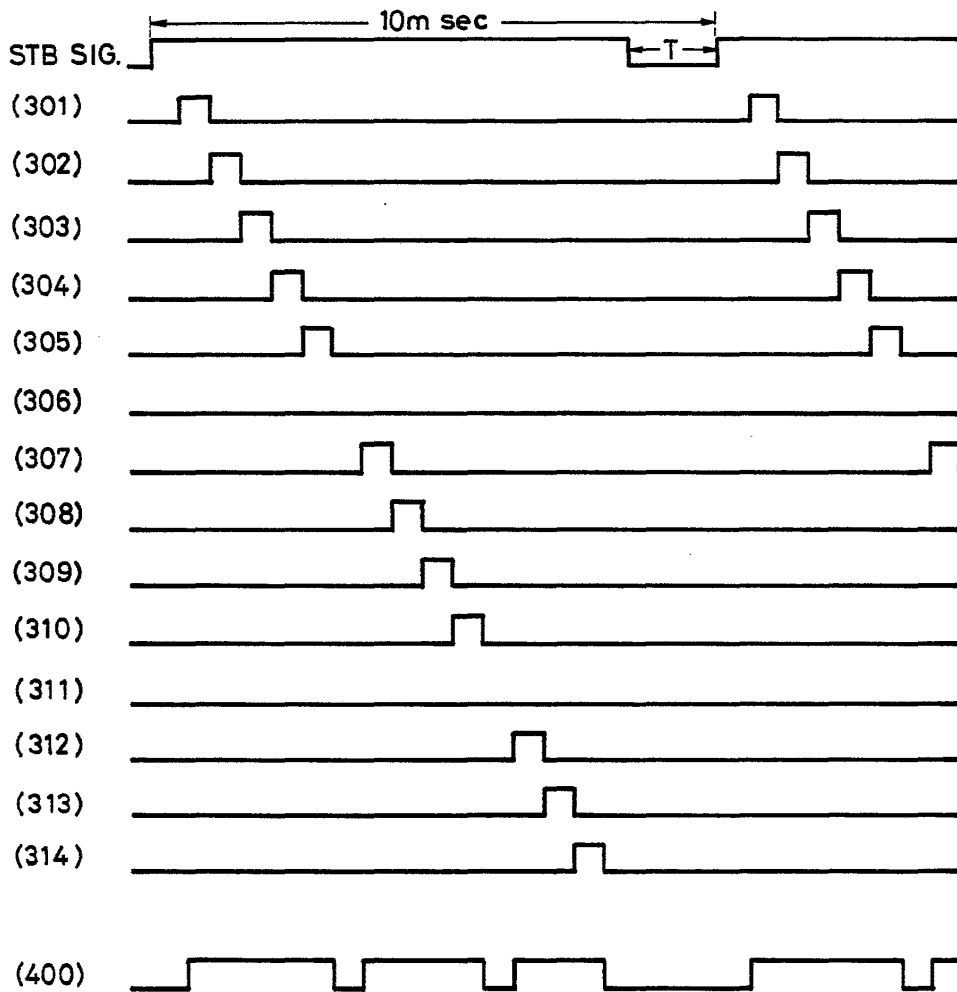


FIG. 5



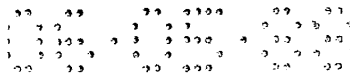
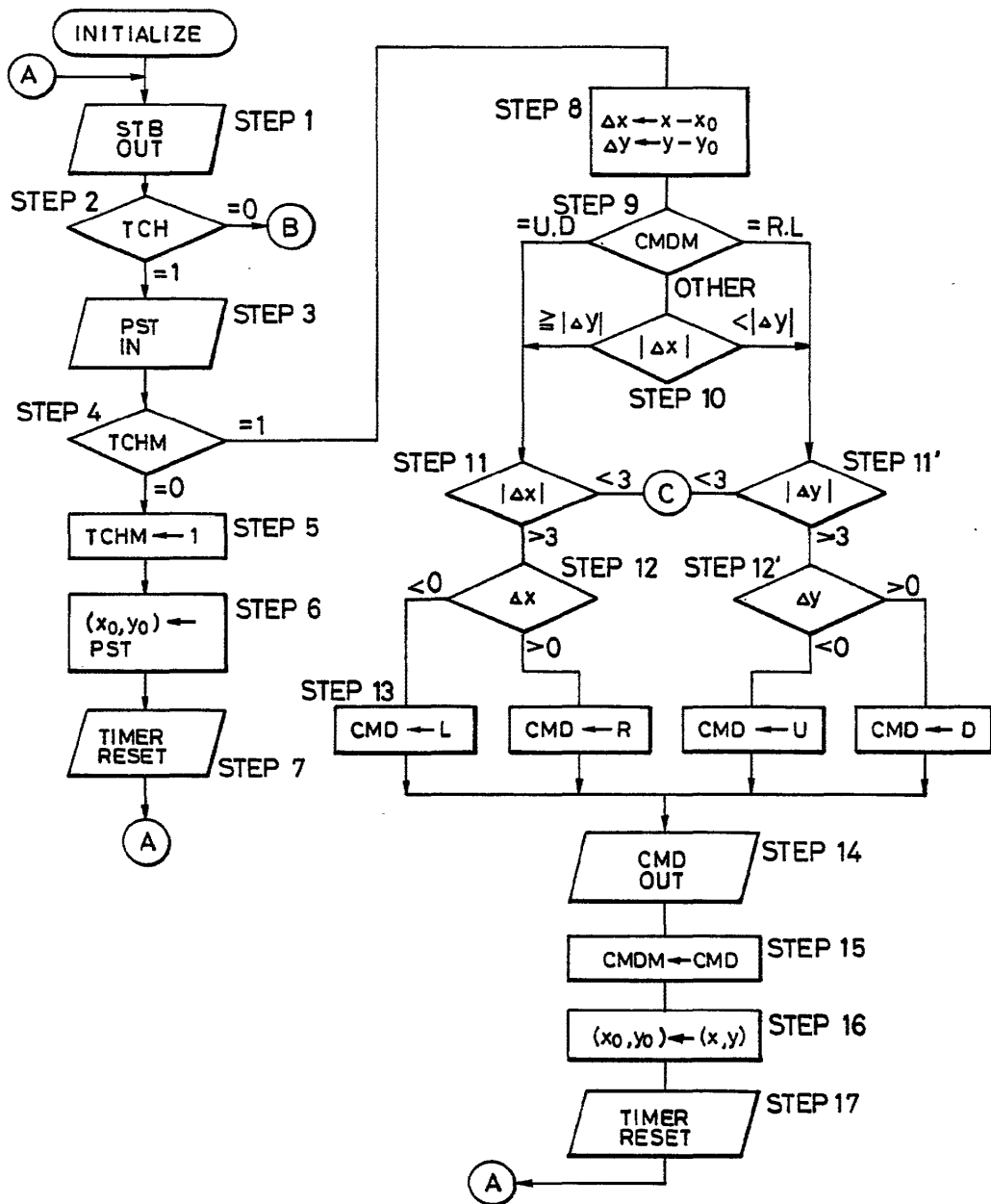


FIG. 6



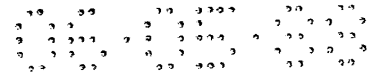


FIG. 7

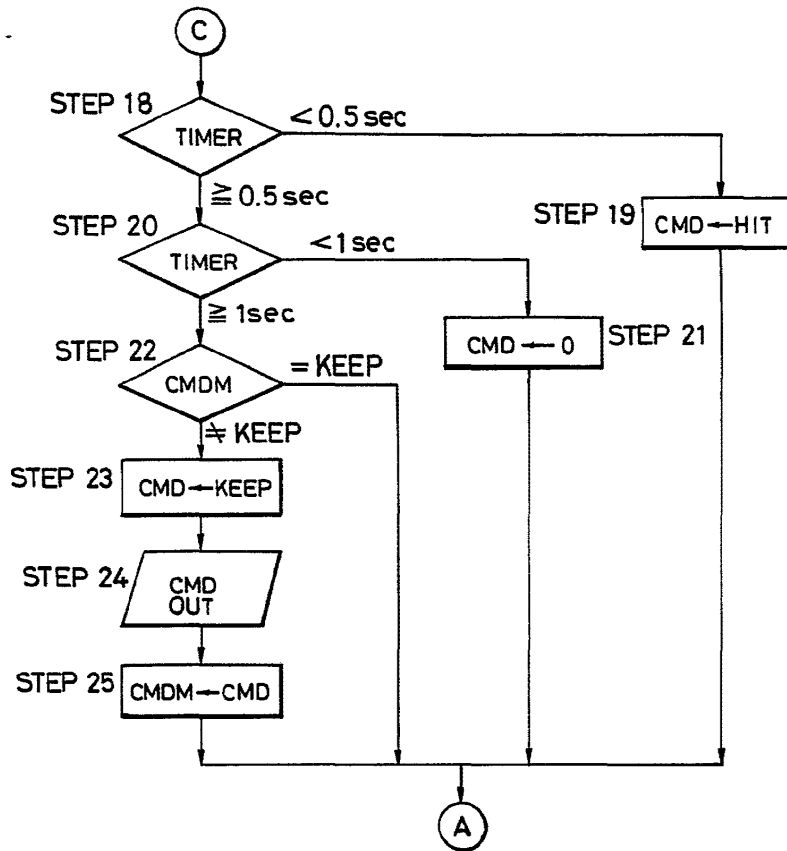


FIG. 9(a)

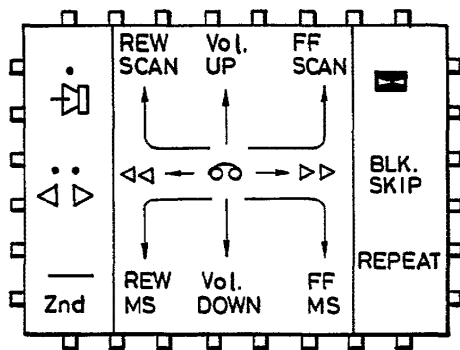
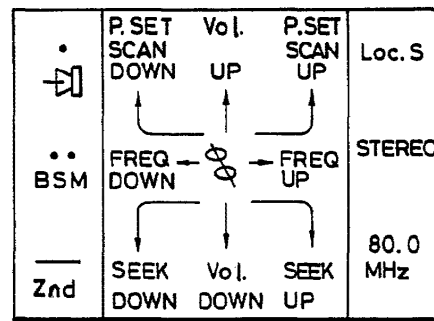


FIG. 9(b)



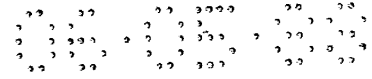
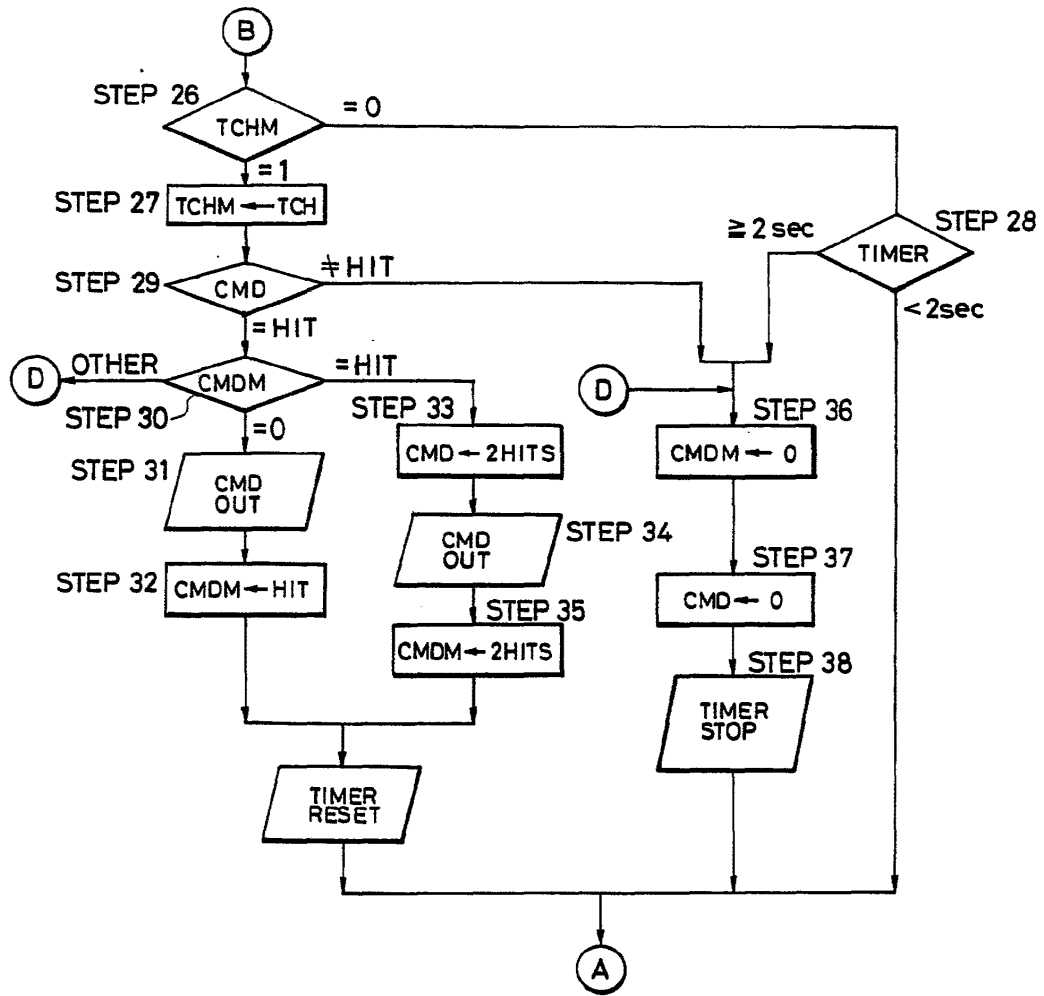


FIG. 8





DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
A	WO-A-8 505 477 (BEINING) * Figures 2,3; page 1, line 22 - page 2, line 10; page 4, lines 4-9 *	1-5	G 06 K 11/06
A	EP-A-0 150 904 (CARROLL et al.) * Figure 3; page 3, lines 11-24, line 32 - page 4, line 7; page 8, lines 1-29 *	1,2	
A	IBM TECHNICAL DISCLOSURE BULLETIN, vol. 20, no. 4, September 1977, pages 1609-1611, New York, US; T.F. CUMMINGS: "Transparent keyless keyboard for variable terminal applications" * figures 1,2; page 1609, line 1 - page 1610, line 24 *	1-3	
			TECHNICAL FIELDS SEARCHED (Int. Cl.4)
			G 06 K 11
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 21-10-1988	Examiner WEISS P.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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12 **EUROPEAN PATENT APPLICATION**

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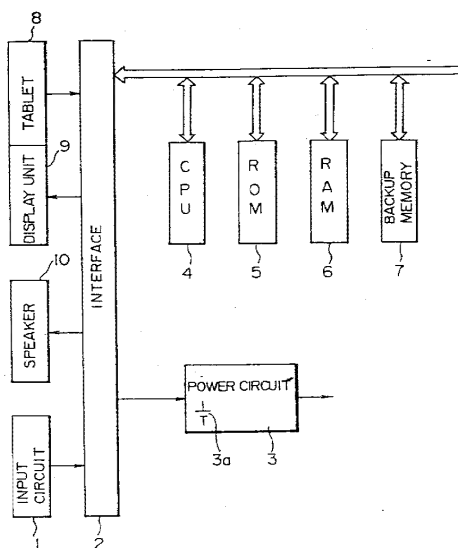
64 Designated Contracting States:
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10
W-8000 München 22(DE)

54 **Apparatus and method for inputting data.**

57 A data input apparatus comprising a pen for selectively indicating and inputting (1) desired data; a display unit (9) for displaying an image of the input data; a tablet (8) for obtaining coordinate data by indicating with the pen the position corresponding to a predetermined portion of a pattern displayed on the display unit (9); means for detecting the coordinate data in response to a downward press of the pen to the tablet (8), and further detecting the coordinate data in response to an upward lift of the pen from the tablet (8); means for setting a first region of a predetermined area in the tablet (8), and also setting a second region which includes the first region and has an area greater than that of the first region; and deciding means for accepting the input data in response to a downward press of the pen to the first region and thereafter settling the input data in response to an upward lift of the pen from the second region. The apparatus is capable of preventing unintentional cancel of the input data that may result from an accidental displacement of the pen-up region beyond the pen-down region, hence facilitating accurate input of data to consequently realize faster manipulation.

FIG. 1



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BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an apparatus and a method for inputting data by utilizing a pattern displayed on the screen of a display unit.

2. Description of the Prior Art

In an attempt to achieve dimensional reduction in a computer or the like, it has been known heretofore to employ an apparatus where a transparent tablet is stuck onto a display screen and, when a pen is brought down to a key-shaped pattern displayed on the screen, a coordinate signal corresponding to the position of the key is generated from the tablet so that the same effect as depression of the key is attained.

Fig. 8 shows an example of such apparatus, wherein the function of an electronic desk calculator is displayed on a screen, and an input accepted in accordance with a downward press of a pen to a button region is settled when the pen is lifted up from the same region. In such an apparatus, when the pen is pressed down to one button position for example, the button is displayed as a reversal image. The input is settled in response to a pen-up action while the displayed image is reversed again to the normal state, and the numerical input or input data to be processed is registered.

In case the input data is to be changed immediately after depressing the button because of an erroneous depression or some other reason, the input can be canceled by dragging the down-position pen to the outside of the button region and then lifting up the pen therefrom.

In such arrangement, the keyboard portion is displayed on the screen merely at the required time, so that it becomes possible to eliminate the necessity of the space for attaching the keyboard, to consequently form the structure in smaller dimensions. Furthermore, upon erroneous button depression or the like, the input data can be immediately canceled without the need of any particular manipulation to eventually enhance the handling convenience.

However, in a small-sized electronic notebook or the like, it is requisite to display individual buttons within a limited region due to the relationship to the display area. Particularly when the apparatus is manipulated fast, there may occur a fault that the pen-up region is deviated from the pen-down region by some shake of the user's hand and so forth. In such a case, the input is canceled contrary to the user's intention for execution of the process, and the same manipulation needs to be repeated.

OBJECT AND SUMMARY OF THE INVENTION

It is an object of the present invention to provide an improvement capable of preventing unintentional cancel of input data that may otherwise result from a deviation of a pen-up region from a pen-down region.

According to one aspect of the present invention, there is provided a data input apparatus which comprises a pen for selectively indicating and inputting desired data; a display unit for displaying an image of the input data; a tablet for obtaining coordinate data by indicating with the pen the position corresponding to a predetermined portion of a pattern displayed on the display unit; means for detecting the coordinate data in response to a downward press of the pen to the tablet, and further detecting the coordinate data in response to an upward lift of the pen from the tablet; means for setting a first region of a predetermined area in the tablet, and also setting a second region which includes the first region and has an area greater than that of the first region; and deciding means for accepting the input data in response to a downward press of the pen to the first region and thereafter settling the input data in response to an upward lift of the pen from the second region.

According to another aspect of the present invention, there is provided a method of inputting data by the use of a pen for selectively indicating and inputting desired data, a display unit for displaying an image of the input data, and a tablet for obtaining coordinate data by indicating with the pen the position corresponding to a predetermined portion of a pattern displayed on the display unit. The method comprises the steps of: detecting the coordinate data in response to a downward press of the pen to the tablet; deciding, in accordance with the result of such detection, that the indication signifies a first region corresponding to the position where a desired key is displayed on the display unit; accepting the input data in response to the result of the decision; deciding that the pen has been lifted up from a second region which includes the first region and has an area greater than that of the first region; and settling the input data in accordance with such decision.

Due to the constitution mentioned, the input data is retained when the pen pressed down to the first region is held within the second region which is wider than the first region, so that if the pen is displaced to the outside of the first region, an unintentional cancel of the input data can be prevented unless the pen is displaced beyond the second region.

The above and other features and advantages of the present invention will become apparent from the following description which will be given with

reference to the illustrative accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a block diagram of an exemplary embodiment representing the data input apparatus of the present invention;

Fig. 2 is a flow chart showing the procedure of an operation performed in the apparatus of Fig. 1;

Fig. 3 shows exemplary contents displayed on the screen prior to detection of a pen-down action;

Fig. 4 schematically illustrates a first region;

Fig. 5 schematically illustrates a second region;

Fig. 6 shows a display state where the pen has been pressed down to a button "5";

Fig. 7 shows a display state where the accepted input of the button "5" has been settled; and

Fig. 8 shows exemplary contents displayed on a screen in a conventional apparatus.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Fig. 1 is a block diagram showing the constitution of an embodiment representing an electronic notebook to which the present invention is applied. In the diagram, an input circuit 1 incorporates a variety of switches including a power switch, and signals for actuating such switches are supplied thereto from a CPU 4 via an interface 2. A DC voltage obtained by rectifying and smoothing an AC power is supplied to a power circuit 3. The power circuit 3 has a battery 3a therein, and a voltage obtained from an AC power source is used as a system operating voltage. In case no voltage is supplied from the AC power source, the voltage obtained from the battery 3a is used as the system operating voltage.

To the interface 2, there are connected a tablet 8, a display unit 9 and a loudspeaker 10. Furthermore the CPU 4, a ROM 5, a RAM 6 and a backup memory 7 are also connected thereto via a bus line.

The tablet 8 is constituted by sticking transparent touch electrodes to a face of the display unit 9, and patterns of buttons or the like visually represented on the display unit 9 are used as input buttons of the tablet 8. When the user touches any pattern such as a button seen through the transparent electrode, a coordinate signal corresponding to the touched portion is supplied to the CPU 4 so that predetermined data is inputted.

In this manner, the tablet is so formed as to generate a coordinate signal corresponding to the portion touched by the user. For generation of such

a signal, it is possible to employ either a pressure sensitive type which generates a signal in accordance with a variation in the pressure, or a capacitance type which generates a signal in accordance with a variation in the static capacitance.

Fig. 2 is a flow chart showing the procedure of a button tracing operation performed in the apparatus where the present invention is applied. In the process of the flow chart, the operation is started when the pen has been pressed down to a desired button (in an under-mentioned first region). As shown at step 100 in Fig. 2, a first region for recognizing a pen-down action is set with respect to the entire buttons, i.e., a display region is set for each button illustrated in Fig. 3. Taking a button "5" here as an example, the first region for this button is substantially rectangular as represented by a thick line in Fig. 4, and is defined by coordinates (x1, Y1) at the upper left corner and coordinates (x2, y2) at the lower right corner.

Subsequently at step 101, a second region for recognizing a pen-up action is set with respect to each of the buttons already set at step 100. As illustrated in Fig. 5, the second region includes the first region and is greater in area than the first region by a width w. The second region is shaped into a substantially rectangular pattern defined by coordinates (x3, y3) at the upper left corner and coordinates (x4, y4) at the lower right corner.

Next at step 102, a flag in each button is initialized (f = 0). In this state, a process of accepting a pen-down action is executed at step 103, where a decision is made to discriminate between a pen-down action and a pen-up action, and the coordinates (x, y) thereof are detected. In this case, the coordinates (x, y) are judged to be in which of the button regions set at step 100. (Coordinate detecting means)

The result of the detection at step 103 is decided at step 104. When the result of such decision signifies a pen-down action, a further decision is made at step 105 as to whether the coordinates detected at step 103 are within the pen-up region, i.e., the second region.

If the result of the decision at step 105 signifies that the pen-down coordinates are within the second region, another decision is made as to whether the flag is 0 or not. Since the flag has already been initialized at step 102, the flag is judged here to be 0. Therefore, at step 107, the flag is set to 1.

Then the displayed image of the button in the pen-down region (first region) is turned to a reversal image at step 108, and the operation returns to step 103. The state of the pen at this moment is detected at step 104, and if the pen-down action is continuously maintained, such state is judged at step 104. Thereafter a decision is made at step 105 as to whether the pen is still within the button-

up region or not.

Fig. 6 illustrates the displayed content in the stage of the operation mentioned. In this embodiment, there is shown an exemplary state where the button "5" is depressed and displayed as a reversal image.

Subsequently a decision is made at step 106 as to whether the flag is 0 or not. Since the flag has already been set to 1 at step 107, the flag is judged to be not 0 at this time, so that the operations returns to step 103. In this case, the displayed content remains unchanged.

During the continuous pen-down state, if the result of the decision signifies that the coordinates corresponding to the pen-down position at step 105 are outside the button-up region (second region), a further decision is made at step 115 as to whether the flag 1 is 1 or not. Since the flag is 1 at this moment as mentioned, the flag is set to 0 at step 116, and the state of the displayed content is reversed at step 108.

The displayed content is reversed to the former state of Fig. 3 by clearing the reversal display of the input data. This process is relevant to a manipulation performed when the input data is to be canceled because, for example, the pen was displaced to any position outside the first-depressed button region due to an accidental slip of the user's hand, or the data was inputted by an erroneous depression or the like. Even in such condition, the input of the preceding button can be accepted by reverting the pen from the down-position thereof to the former button-up region (second region).

Upon acceptance of the proper input, the user performs a pen-up action by lifting the pen upward from the tablet. Since the flag is set to 1 at step 107 in case the proper input is accepted, the flag is judged to be 1 at step 120, and then the displayed button is turned to a reversal image at step 121.

More specifically, the reversal image obtained by the pen-down action is reversed again to the former state, whereby the reversal display is cleared. The depression of the button is recognized through such process and, as shown in Fig. 7, the displayed image of the button "5" is reversed to the former state, while the accepted input data "5" is settled and displayed in the window 21.

Meanwhile, when the pen is shifted to any position outside the second region, the flag is set to 0 at step 116, so that if the pen is lifted up in such a state, the flag is judged to be not 1 at step 120 (deciding means). Accordingly the result of the decision signifies that no button has been depressed at this moment.

The description given above can be summarized as follows.

Upon detection of a pen-down action to the

first region of a desired button, a decision is made as to which button has been depressed, and the depressed button (first region) is displayed as a reversal image. In case any wrong button is displayed due to an erroneous depression or insufficient detection precision, the input manipulation can be canceled by first shifting the pen from the down-position to the outside of the second region and then lifting up the pen therefrom.

Even if the pen is accidentally displaced to the outside of the first region by some shake of the user's hand or the like, the selected input is retained effective unless the pen is displaced beyond the second region which is dimensionally greater than the first region. And even when the reversal image of the button is deleted with a displacement to the outside of the second region, the reversal image of the button is displayed again by reverting the pen to the first region while holding the pen in its down-state, whereby the input is accepted.

If the pen is lifted up with the input accepted, the reversal display of the button is deleted, and the input from the button is settled. At this time, even if the pen is positioned outside the first region, the input is processed as effective data unless the pen is further displaced outside the second region, so that there never occurs an unintentional cancel of the input.

According to the present invention, as described hereinabove, the input data is retained, in response to the detection of a pen-down action to a desired pattern, in the area wider than the pen-down region. Therefore, even in an apparatus having a small-sized display device, unintentional cancel of the input is hardly induced to consequently achieve an advantage of facilitating accurate input of data, whereby it is rendered possible to attain faster manipulation of the apparatus.

Claims

1. A data input apparatus with pen means comprising:
 - a pen for selectively indicating and inputting (1) desired data;
 - a display unit (9) for displaying an image of the input data;
 - a tablet (8) for obtaining coordinate data by indicating with said pen the position corresponding to a predetermined portion of a pattern displayed on said display unit (9);
 - means (2, 4) for detecting the coordinate data in response to a downward press of said pen to said tablet (8), and further detecting the coordinate data in response to an upward lift of said pen from said tablet (8);
 - means for setting a first region of a predetermined area in said tablet (8), and also

setting a second region which includes said first region and has an area greater than that of said first region; and

deciding means for accepting the input data in response to a downward press of said pen to said first region and thereafter settling said input data in response to an upward lift of said pen from said second region.

2. The apparatus according to claim 1, wherein said tablet (8) is superposed on said display unit (9) in such a manner that the displayed image on said display unit (9) is rendered visible through said tablet (8). 10
3. The apparatus according to claim 1 or 2, wherein said deciding means is so formed as not to execute said data settling process if said pen is lifted upward from any position outside said second region after the input data is accepted with the downward press of said pen to said first region, and said means executes a predetermined process without any indication of data by said pen. 15
4. The apparatus according to anyone of claims 1 to 3, wherein said predetermined portion is displayed in the shape of a key on said display unit (9), and said first region is so set as to be equal to said key-shaped portion. 20
5. The apparatus according to claim 4, further having display control means which controls the display state in such a manner that the displayed image of said key is reversed when said input data is accepted from said deciding means, and is reversed again to the former state when said input data is settled. 25
6. The apparatus according to anyone of claims 1 to 5, wherein said apparatus is a small-sized portable computer. 30
7. A method of inputting data by the use of a pen for selectively indicating and inputting (1) desired data, a display unit (9) for displaying an image of the input data, and a tablet (8) for obtaining coordinate data by indicating with said pen the position corresponding to a predetermined portion of a pattern displayed on said display unit (9), said method comprising the steps of: 45
 - detecting the coordinate data in response to a downward press of said pen to said tablet (8); 50
 - deciding, in accordance with the result of such detection, that the indication signifies a first region corresponding to the position where

a desired key is displayed on said display unit (9);

accepting the input data in response to the result of the decision;

deciding that said pen has been lifted up from a second region which includes said first region and has an area greater than that of said first region; and

settling the input data in accordance with such decision.

FIG. 1

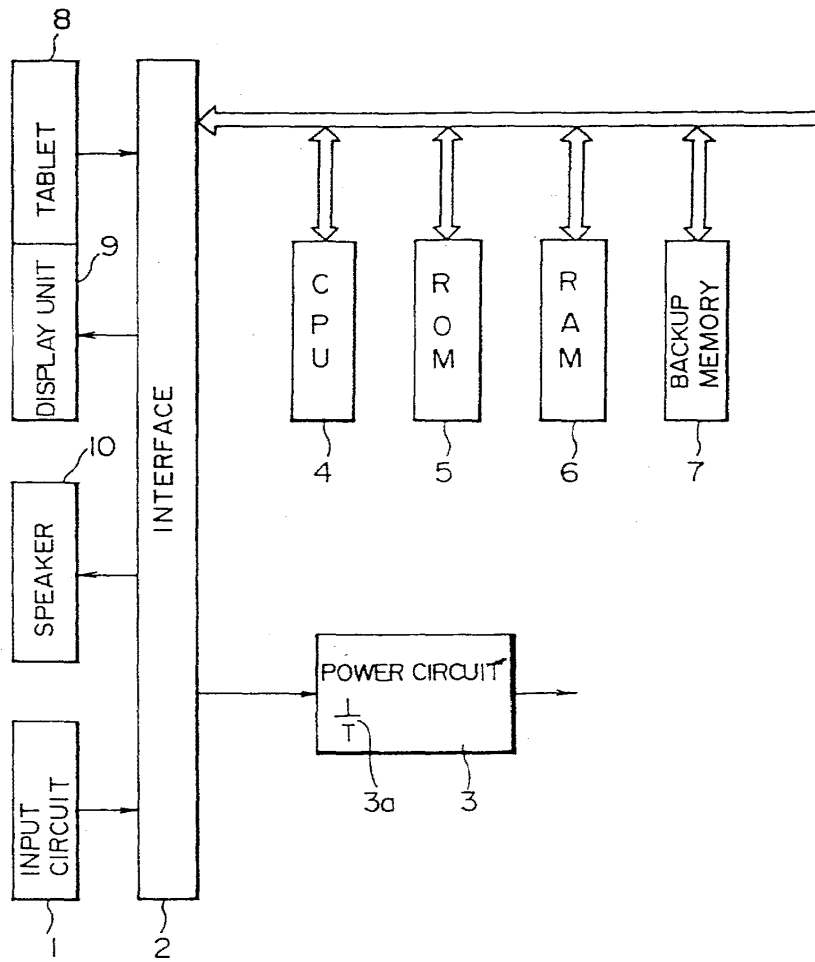


FIG. 2

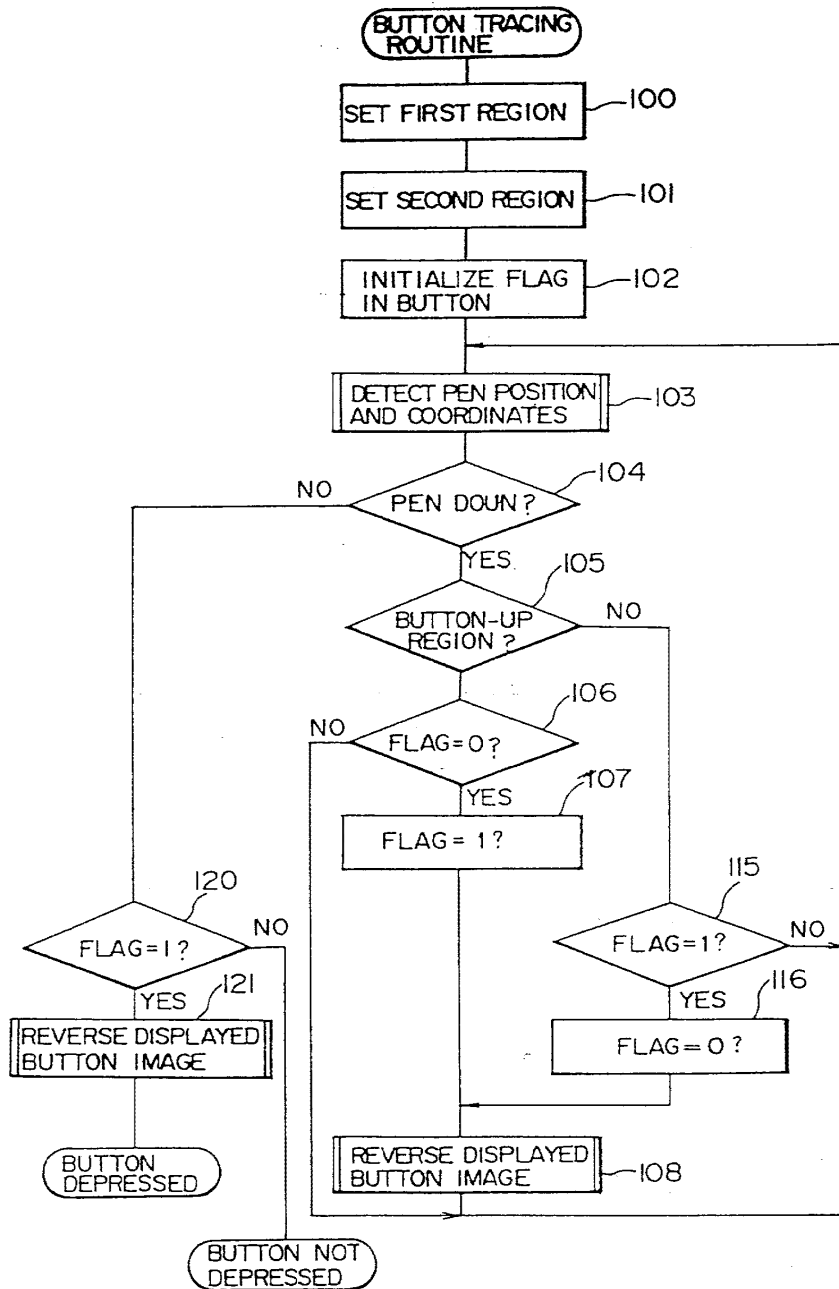


FIG. 3

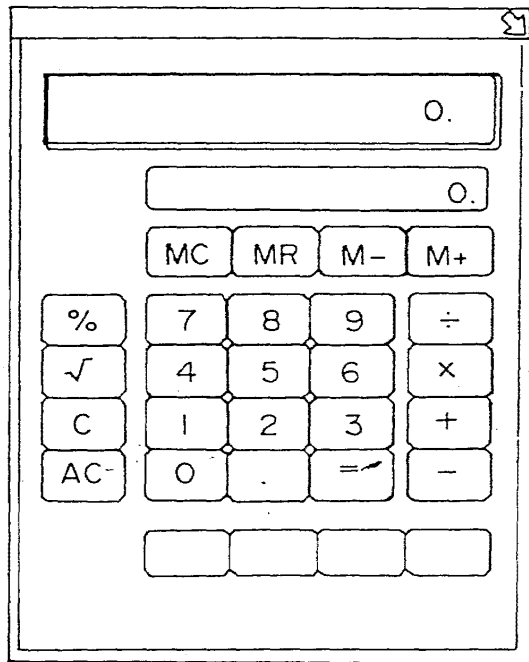


FIG. 4

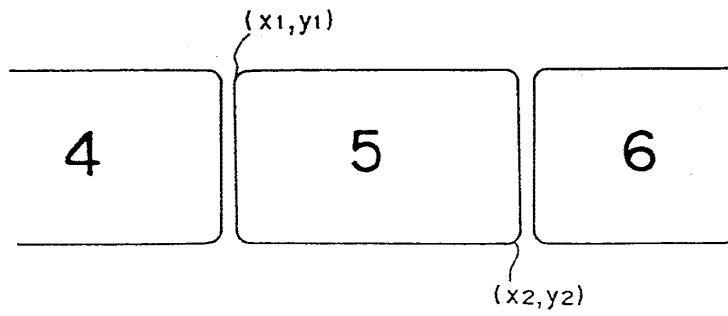


FIG. 5

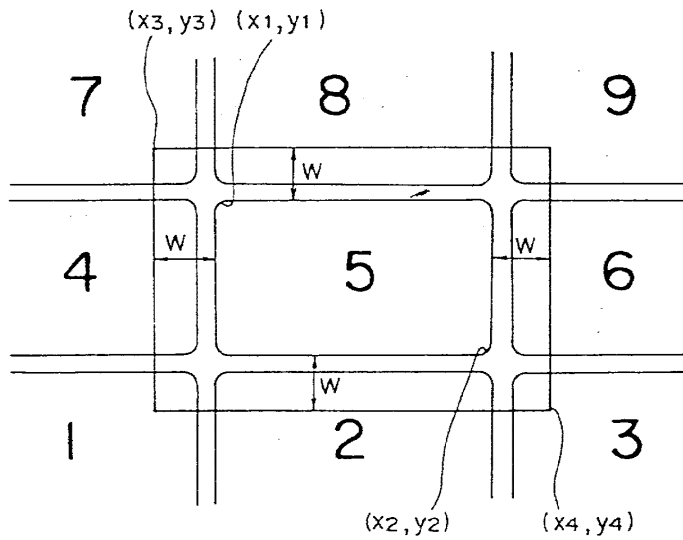


FIG. 6

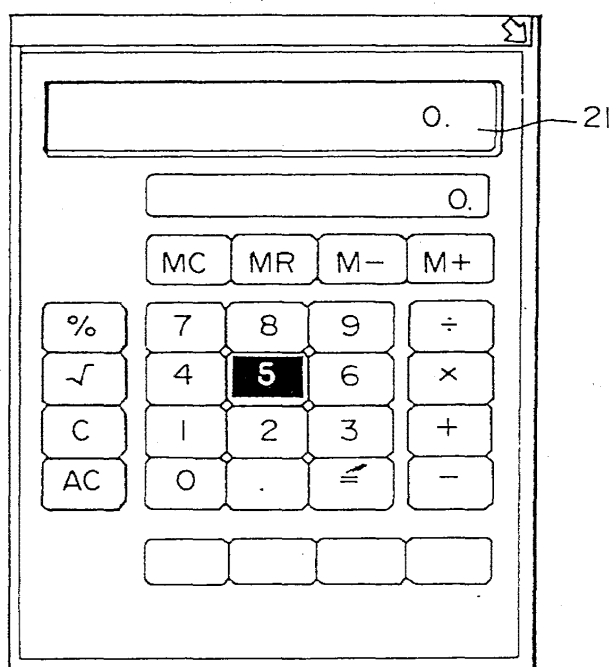


FIG. 7

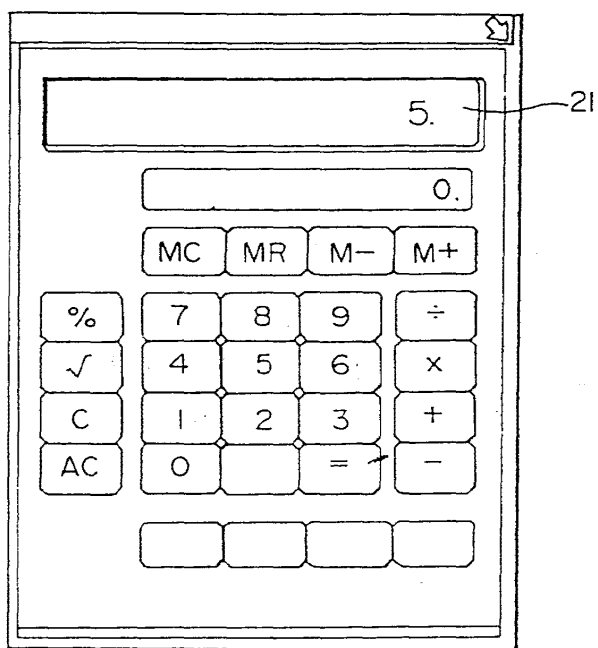
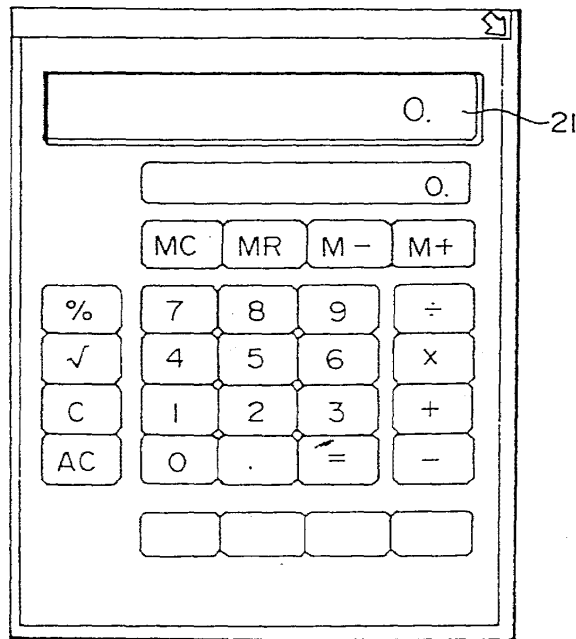


FIG. 8





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54 Dynamic touchscreen button adjustment mechanism.

57 A computer based touchscreen includes a mechanism for displaying buttons on the touchscreen indicating the location where an user has touched the touchscreen. Because different operators will view the buttons from different angles, they will touch the touchscreen in different positions. An initial button or series of buttons of the application that the user is using is configured to sense the location where the user is touching. These initial button(s) are called adjusting buttons. The button sensing regions for the remaining buttons (non-adjusting buttons) are calibrated from these initial touched locations. For example, if the user tends to press high and to the right of the adjusting button(s), the orientation of the button sensing regions for the remaining buttons is calibrated high and to the right. If multiple adjusting buttons are used, the average of the touched positions is used to calibrate the button sensing regions of the non-adjusting buttons. The adjusting buttons are not restricted to the beginning of the application. Any screen that displays buttons can be used to calibrate or recalibrate the button sensing region for subsequent non-adjusting buttons. This allows for greater accuracy should the users change their view or angle of the touchscreen as they use the application. Thus, the computer dynamically adjusts the orientation of a touchscreen button's sensing region based on the location that the user has pressed for previous buttons. This dynamic adjustment allows a high density of buttons to be displayed on the touchscreen.

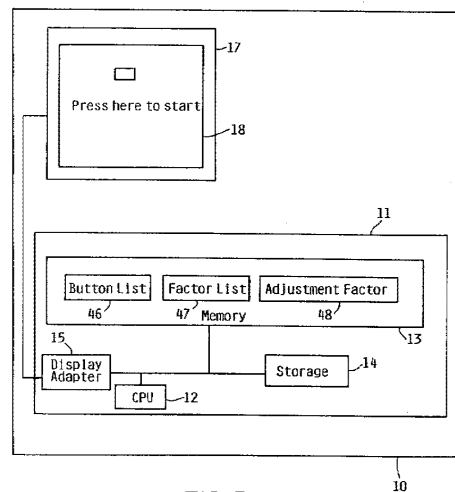


FIG. 5

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This invention relates to the data processing field. More particularly, this invention relates to a touchscreen apparatus for adjusting a sensing region based on the location that the user touches on the touchscreen, which is contained in a display.

Touchscreens are well known in the art where the user communicates a desired action to a computer by touching a touchscreen in a specific location. The computer system displays graphics on the touchscreen that represent buttons. The user interfaces to the computer system by touching the touchscreen in a displayed button's sensing region, which is the area on the touchscreen that the computer system associates with the button. The computer system detects the user's touch, maps the touched location to a particular button, and performs appropriate functions based on the button that the user selected via the touch.

Touchscreens are advantageous in that they can eliminate the need for a keyboard or other input device in applications where a separate input device would be cumbersome, expensive, or susceptible to vandalism. Also, with a touchscreen the user is not forced to read instructions in one place and hunt elsewhere, such as on a keyboard, for keys to press. Instead, the instructions that the user reads and the buttons that the user touches are in the same proximity. This close proximity of instructions and buttons is more convenient and faster for the user and reduces the chance of incorrect button selection.

However, touchscreens suffer from the problem that the buttons on the touchscreen are two dimensional, and although the buttons are visually distinct from one another, they are not physically distinct from one another. Thus, while a user of a conventional keyboard can feel when a finger is straying over the edge of the intended key and onto an adjacent, unintended key, the user of a touchscreen cannot feel when a finger is straying over the edge of a button. These problems are exacerbated by the fact that the touchscreen has thickness, so while the button is projected onto the back of the touchscreen, the user touches it from the front. This screen thickness plus the parallax effect, causes different users to perceive the same button in potentially different places. For example, tall users standing to the right of the touchscreen will tend to perceive the button as being above and to the right of the actual button position, so they will tend to touch high and to the right of the button sensing region. Analogously, short users standing to the left of the touchscreen will tend to perceive the button as being below and to the left of the actual button position, so they will tend to touch low and to the left of the button sensing region.

The cumulative effect of these problems causes users to be unsure of whether or not they have touched the intended button, especially when the buttons are small and close together. In contrast, on a conven-

tional keyboard, users can be reasonably confident that they have depressed the intended key because the key is three dimensional, moves downward when pressed, and is tactilely separate from adjacent keys.

The prior art touchscreens attempt to solve these problems by the computer system either displaying the button over a larger than desired area or utilizing a larger than desired button sensing region associated with the button. Both these solutions severely limited the density and orientation of displayed buttons on the touchscreen.

For the foregoing reasons, there is a need for a touchscreen that allows a high density of displayed buttons with accurate selection of buttons by users who are viewing the touchscreen from a variety of view angles.

It is an object of the present invention to provide an enhanced touchscreen.

It is a further object to allow a high density of displayed buttons with accurate selection of buttons to be used on a touchscreen apparatus.

It is a further object to allow accurate selection of buttons on a touchscreen apparatus by users viewing the touchscreen from all view angles.

These and other objects are achieved by the computer system dynamically adjusting the orientation of a touchscreen button's sensing region based on the location that the user has touched for a previous button or buttons.

An initial button or series of buttons of the application that the user is using is configured to sense the location where the user is touching. These initial button(s) are called adjusting buttons. The button sensing regions for the remaining buttons (non-adjusting buttons) are calibrated from these initial touched locations. For example, if the user tends to press high and to the right of the adjusting button(s), the orientation of the button sensing regions for the remaining buttons is calibrated high and to the right. If multiple adjusting buttons are used, the average of the touched positions is used to calibrate the button sensing regions of the non-adjusting buttons.

The adjusting buttons are not restricted to the beginning of the application. Any screen that displays buttons can be used to calibrate or recalibrate the button sensing region for subsequent non-adjusting buttons. This allows for greater accuracy should the users change their view or angle of the touchscreen as they use the application.

Fig. 1 shows the parallax effect, present in a touchscreen, which causes different view angles to result in different users perceiving the button at different locations;

Fig. 2 shows a prior art touchscreen button and sensing region;

Fig. 3 shows users viewing the touchscreen of the preferred embodiment, which is shown in this example as a ticket kiosk, from different angles;

Figs. 4a and 4b show an example of a seat selection screen of the preferred embodiment, which allows a high density of buttons on the screen; Fig. 5 shows a block diagram of the computer system of the preferred embodiment;

Figs. 6a, 6b, 6c, 6d, and 6e show the button list, factor list, and adjustment factor of the preferred embodiment and their relationships to the button sensing region; and

Figs. 7, 8, and 9 show the flowcharts that describe the operation of the preferred embodiment.

Fig. 1 is a side view of display 17 and shows the parallax effect, which causes different user view angles to result in different users perceiving button 20 at different locations. Touchscreen 18 in display 17 has thickness 23, which is the distance between touchscreen back 28 and touchscreen front 22. Although button 20 is projected onto the touchscreen back 28, users 24 and 26 will attempt to touch it on touchscreen front 22. Screen thickness 23 plus the parallax effect, causes different operators 24 and 26 to perceive button 20 in different places. User 24 will perceive and attempt to touch button 20 at button location 29. In contrast, user 26 will perceive and attempt to touch button 20 at button location 21, which in this example is lower on touchscreen 18 than button location 29.

Fig. 2 shows prior art display 67, touchscreen 68, touchscreen button 60, and button sensing region 64. Button sensing region 64 is the area of touchscreen 68 associated with button 60 such that if the user touches within button sensing region 64, the computer system considers button 60 to have been touched. To solve the parallax problem illustrated in Fig. 1, prior art touchscreens utilized button sensing regions 64 that were larger than their corresponding buttons 60. The prior art solution illustrated by Fig. 2 is disadvantageous in that sensing regions 64 are large and thus limit the density and orientation of buttons 60 that may be concurrently displayed on touchscreen 68.

Fig. 3 shows users 24 and 26 viewing button 20 from different angles. Button 20a is displayed on touchscreen 18 in display 17. For purposes of illustration, the application in this example is ticket kiosk 30. Because of the parallax effect and screen thickness 23 described in Fig 1., tall user 24 standing to the right of ticket kiosk 30 will tend to view and press button 20a above and to the right of its actual position. In contrast, short user 26, standing to the left of ticket kiosk 30 will tend to view and press button 20a below and to the left of its actual position. To accommodate the differences in perception of different operators, this invention dynamically adjusts the button sensing regions, as will be shown in Figs. 4a, 4b, 6a, 6b, 6c, 6d, and 6e, and explained in more detail in the flowcharts of Figs. 7, 8, and 9.

Fig. 4a illustrates display 17 and touchscreen 18

of the preferred embodiment displaying an exemplary seat selection screen. In this example, the aggregation of all buttons 20 represents a section of seats in a stadium. Users can touch a button to select the seat for which they wish to purchase a ticket. The buttons with an X through them represent seats that have already been sold. For such a seat selection application, it is critical that the buttons be small with fine enough resolution to allow many seats to be displayed close together. This invention allows a high density of buttons with fine resolution on touchscreen 18 because the button sensing regions are dynamically adjusted to suit individual users, as will be shown in Fig 4b.

Fig. 4b is a close up view of a few of buttons 20 and their corresponding button sensing regions 34. In this example, each button sensing region 34 has been adjusted up and to the right to accommodate a user who tends to touch high and to the right of button 20. Thus, button sensing region 34c is associated with button 20c. When the user touches within button sensing region 34c, the invention associates that touch with button 20c. Likewise, when the user touches within button sensing region 34d or 34e, the invention associates that touch with buttons 20d or 20e respectively. In this way a high density of buttons 20 can be displayed and selected on touchscreen 18.

Fig. 5 shows a block diagram of computer system 10 of the preferred embodiment of the invention. Computer system 10 has touchscreen 18 in display 17 connected to system unit 11. System unit 11 contains processor 12 connected to memory 13, storage 14, and display adapter 15. Processor 12 is suitably programmed to carry out this invention, as described in more detail in the flowcharts of Figs. 7, 8, and 9.

In the preferred embodiment, computer system 10 is an IBM PS/2, storage 14 is a magnetic hard disk file, display adapter 15 is an IBM VGA display adapter, and display 17 is an IBM 8516 display. Computer system 10 could also be another type of computer system, whether it be another microcomputer such as an Apple Macintosh, a minicomputer such as an IBM AS/400, or a mainframe computer such as an IBM System/390, and still fall within the spirit and scope of this invention. In addition, computer system 10 could be a microcomputer such as described above but connected to a larger computer system such as an IBM AS/400.

Button list 46 defines button sensing region 34 for each button 20. Factor list 47 contains a list of factors that represent the difference between the center of button sensing region 34 and the locations that the user has touched. In the preferred embodiment, adjustment factor 48 is the average of the factors in factor list 47. Button list 46, factor list 47, and adjustment factor 48 will be explained in more detail under the description of Figs. 6a - 6e.

Figs. 6a, 6b, 6c, 6d, and 6e show factor list 47, ad-

justment factor 48, and the relationship of button list 46 to button 20 and button sensing region 34 in more detail. Button list 46 is a list of button entries. Each entry in button list 46 defines a button sensing region 34 for a button 20 on touchscreen 18 via fields 49, 50, 51, and 52. In the preferred embodiment, there is a separate button list for every screen of buttons displayed, but there could be just one button list for the entire application without departing from the invention. In the preferred embodiment, buttons are displayed as rectangles on the touchscreen, but the buttons could be any geometric shape including, but not limited to, circles, ovals, or polygons with any number of sides. Field 50 defines the upper left point of button sensing region 34. Field 51 defines the lower right point of button sensing region 34. Field 52 defines the center of the button sensing region 34. In this example, locations on touchscreen 18 are defined by a (X,Y) coordinate system with X representing the horizontal axis and Y representing the vertical axis and location (0,0) representing the lower left hand corner of touchscreen 18. However, other methods of defining locations on touchscreen 18 could be used without departing from the invention. Note that in this example since button sensing region 34 is a rectangle, it would not be necessary to include field 52 in button list 46 since it could be calculated from field 50 and field 51.

In one preferred embodiment, there are two types of button entries in button list 46 associated with the two types of buttons. Type 49 in the button entry indicates whether the button entry is associated with an adjusting button or a non-adjusting button. In one preferred embodiment, the locations that the user touches associated with adjusting buttons are used to calibrate the button sensing regions of subsequent non-adjusting buttons. In an alternative embodiment, the locations that the user touches associated with adjusting buttons are used to remap subsequent touched locations into the button sensing regions of non-adjusting buttons. In this example, buttons 20a and 20b are adjusting buttons, while buttons 20c, 20d, and 20e are non-adjusting buttons. In the preferred embodiment, adjusting buttons have button sensing regions that are larger than their associated buttons, and the button sensing regions for adjusting buttons do not move. In the preferred embodiment, non-adjusting buttons have button sensing regions that are the same size and shape as their associated buttons and the button sensing regions for the non-adjusting buttons are calibrated based on where the user touched on the adjusting buttons. However, the button sensing regions could be other sizes or shapes without departing from the invention.

In this example, button list 46 contains button entries 53, 54, 55, 56, and 57, which correspond to buttons 20a, 20b, 20c, 20d, and 20e, and button sensing regions 34a, 34b, 34c, 34d, and 34e, respectively. In

one preferred embodiment, adjusting buttons are displayed to the user first, but adjusting and non-adjusting buttons could be displayed to the user in any order. Adjusting and non-adjusting buttons could share the same screen or be on different screens.

Factor list 47 contains the differences between the location that the user touched on an adjusting button and the center of button sensing region 34. In this example, factor list 47 contains two factors because there are two adjusting buttons in button list 46, each of which was touched once by the user. However, an application could have the user touch an adjusting button more than once, in which case there would not be a one-to-one correspondence between the number of factors in the factor list and the number of adjusting buttons in the button list.

In one preferred embodiment, adjustment factor 48 is set to be the average of all factors in factor list. However, other methods of setting the adjustment factor could be used, including using the mean of the factors or weighting the recent factors more than the remote factors.

The operation of one preferred embodiment, as shown in the flowcharts of Figs. 7-9, will now be described in more detail. Referring to Fig. 7, block 601 displays buttons on the touchscreen to the user. The number and configuration of the buttons displayed are dependent on the particular application that the user is accessing. When the user touches the touchscreen, block 605 determines the location that the user touched. Touchscreens are well known in the art that provide the coordinates of the touched location via sensors on the touchscreen such as light emitting diodes and photo detectors. This invention is independent of the method of touched location determination. Block 610 determines which button the user touched by calling the Determine Button Touched subroutine, which is described in detail in Fig. 8.

Referring to Fig. 8, block 701 gets a button entry from button list 46. Block 705 checks to see if this button entry is for an adjusting button. This check is accomplished by examining type field 49 in the button entry. If this button entry is an adjusting button and the location that the user touched is within the button sensing region for this button entry, blocks 705 and 710 are answered affirmatively. A new adjustment factor is computed by calling the Compute Adjustment Factor subroutine, which is described in Fig. 9.

Referring to Fig. 9, block 765 computes a factor from the difference between the center of the sensing region and the touched location. If block 770 determines that factor list 47 is full, the oldest factor from factor list 47 is removed in block 775. This is necessary because the memory available to store factors is finite. The newly calculated factor is inserted in factor list 47 in block 780. Adjustment factor 48 is set to be the average of all factors in factor list 47 in block 785. Although the preferred embodiment sets the adjust-

ment factor to the average of the factors in the factor list, alternative embodiments could use another method, such as giving recent factors more weight than remote factors or using the mean of the factors. Block 790 returns control from the Compute Adjustment Factor Subroutine to block 730 in Fig. 8. Block 730 returns an indication of which button was touched to block 615 of Fig. 7.

Referring to Fig. 8, if block 710 determines that the touched location is not within the sensing region for the button entry and if block 740 determines that there are button entries left in button list 46, then the next button entry in button list 46 is processed in block 701. If block 740 determines that there are no button entries left in button list 46, then the user has touched a location on the screen that is not associated with any button, so an indication that no button was touched is returned in block 735 to block 615 in Fig. 7.

Referring to Fig. 8, if block 705 determines that the button entry is for a non-adjusting button, then block 715 checks to see whether remap mode (alternative embodiment) or calibrate mode (preferred embodiment) is desired. If block 715 determines that calibrate mode is desired, block 717 sets the sensing region to be the button location modified by adjustment factor 48. If block 715 determines remap mode is desired, block 719 modifies the touched location by the negative of adjustment factor 48. If block 725 determines that the touched location is within the sensing region for the button list entry, then an indication of which button was touched is returned in block 730 to block 615 of Fig. 7. If block 725 determines that the touched location is not within the button sensing region for the button list entry, then if block 740 determines that there are button entries left in the button list, then the next button entry in button list 46 is processed in block 701. If block 740 determines that there are no button entries left in button list 46, then the user has touched a location on the screen that is not associated with any button, so an indication that no button was touched is returned in block 735 to block 615 in Fig. 7.

Referring again to Fig. 7, if block 610 returned an indication that a button was touched, then block 615 is answered affirmatively, so the appropriate processing is performed for the touched button by the application that the user is accessing in block 620. If block 610 returned an indication that no button was touched, then the user has touched a location on the touchscreen that is not associated with any button, so block 615 is answered negatively and block 625 displays an error message to the user. In either event, block 601 displays a new screen of buttons on the touchscreen.

While this invention has been described with respect to the preferred and alternative embodiments, it will be understood by those skilled in the art that va-

rious changes in detail may be made therein without departing from the spirit, scope, and teaching of the invention. For example, the type of applications that use a touchscreen may change from what is known today. In addition, touchscreen technology may become widely employed in consumer applications such as operator panels for consumer electronics, appliances, and automobiles. Accordingly, the herein disclosed invention is to be limited only as specified in the following claims.

Claims

1. A touchscreen apparatus for receiving instructions from a user, comprising:

means for displaying a first button on the touchscreen, the first button having a first sensing region;

means for receiving an indication that the user touched the touchscreen at a first location;

means for determining that the first location is within the first sensing region of the first button;

means for calculating an adjustment factor from the first button and the first location; and

means for displaying a second button on the touchscreen, the second button having a second sensing region calibrated from the adjustment factor.

2. The touchscreen apparatus of claim 1 wherein the calculating means further comprises:

means for computing the difference between the center of the first sensing region and the touched location.

3. The touchscreen apparatus of claim 1, further comprising:

means for receiving an indication that the user touched the touchscreen at a second location; and

means for determining that the second location is within the second sensing region.

4. The touchscreen apparatus of claim 3, further comprising:

means for calculating a second factor based on the distance of the second location from the center of the second sensing region;

means for computing an adjustment factor by taking the average of the first factor and the second factor; and

means for displaying a third button on the touchscreen, the third button having a third sensing region calibrated from the adjustment factor.

5. The touchscreen apparatus of claim 4, further comprising:

means for receiving an indication that the user touched the touchscreen at a third location; and

means for determining that the third location is within the sensing region of the third button; and

means for performing processing in response to the user pressing the third button.

9. The touchscreen apparatus of claim 1, 3 or 5, wherein determining means further comprises: means for detecting that said location is within said sensing region, but not within said button, and reporting that said button has been touched.

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7. The touchscreen apparatus of claim 1, 3 or 5, wherein determining means further comprises: means for detecting that said location is within said sensing region and is also within said button, and reporting that said button has been touched.

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8. The touchscreen apparatus of claim 1, 3 or 5, wherein determining means further comprises: means for detecting that said location is within said button but is not within said sensing region, and reporting that said button has not been touched.

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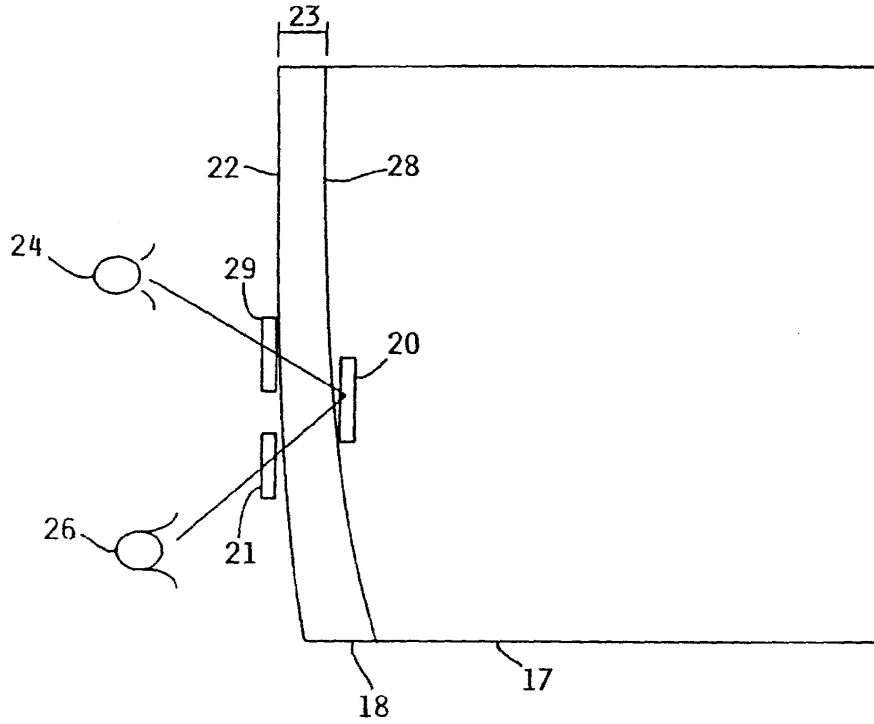


FIG. 1

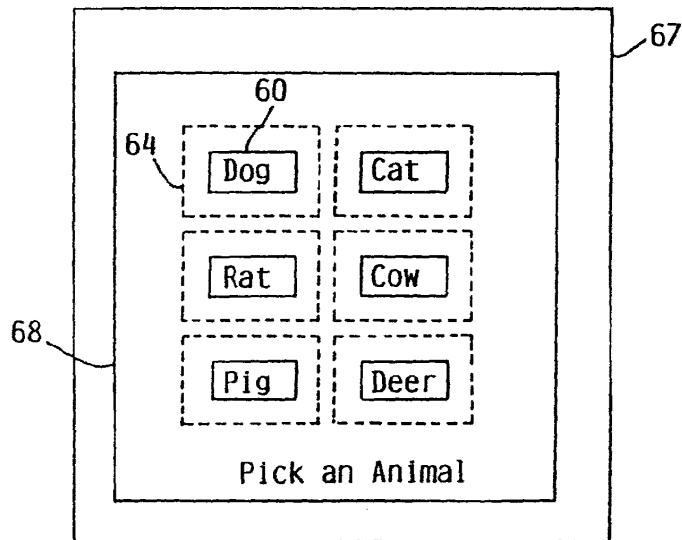


FIG. 2 (PRIOR ART)

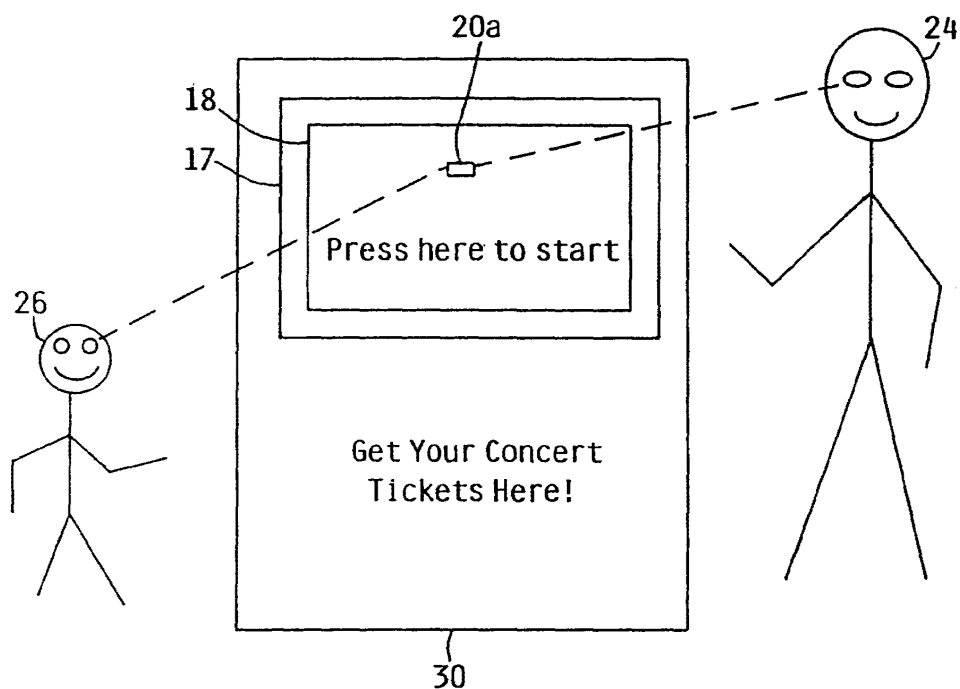


FIG. 3

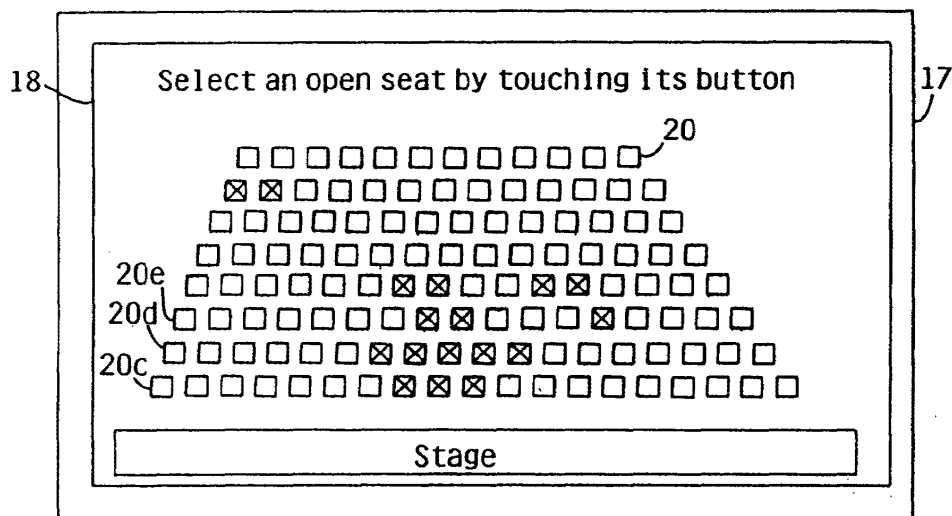


FIG. 4a

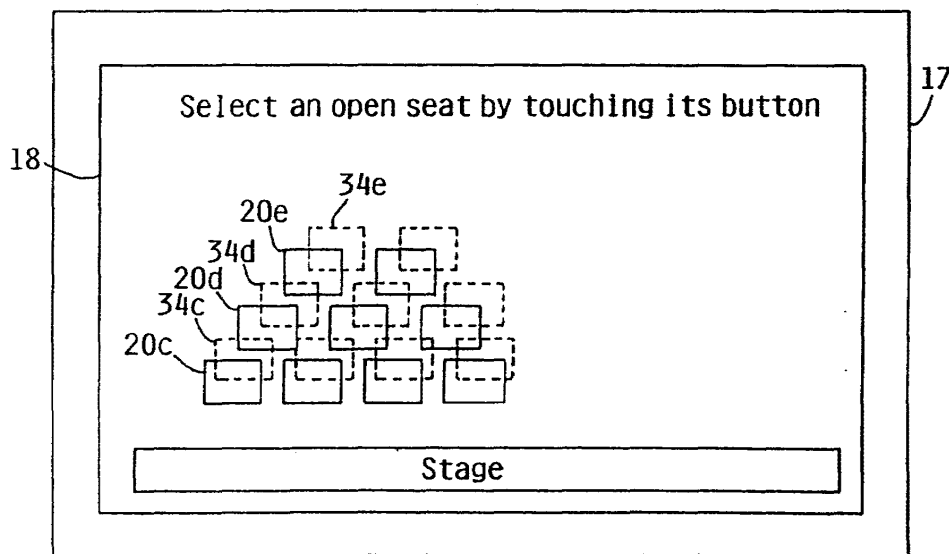


FIG. 4b

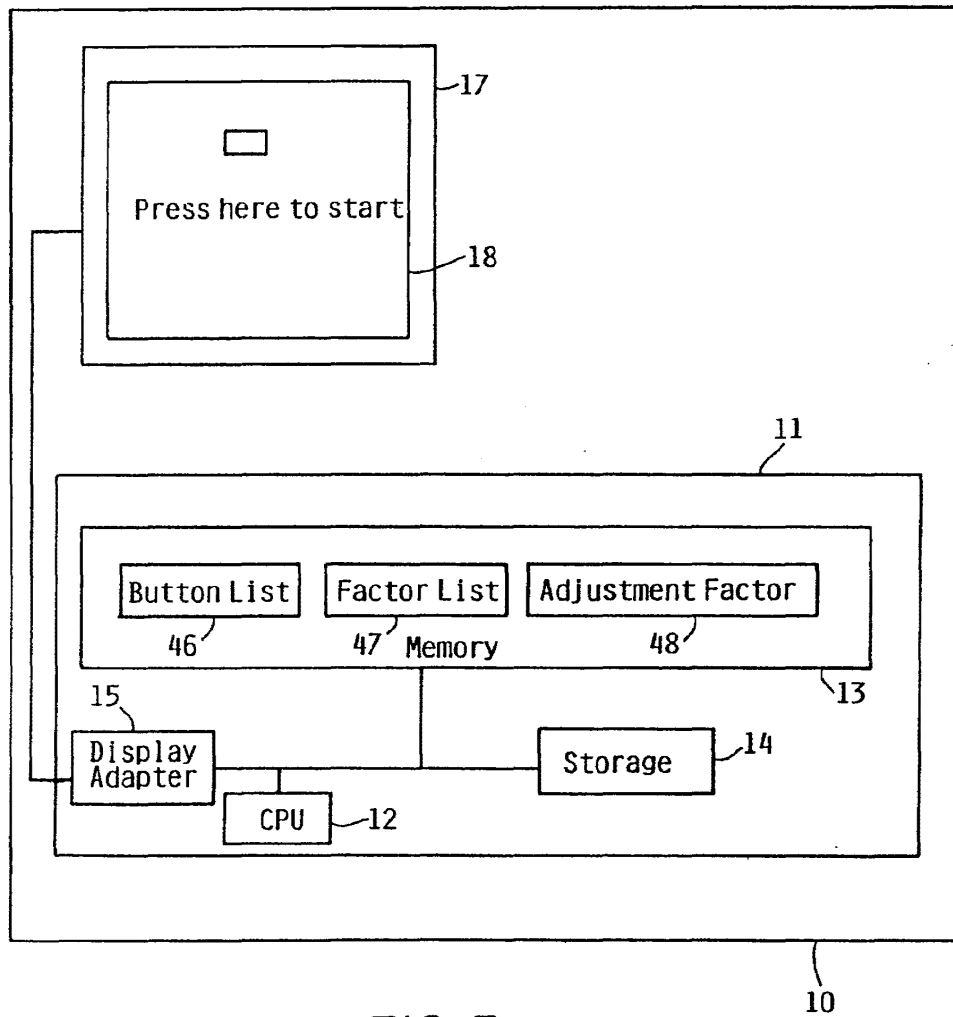


FIG. 5

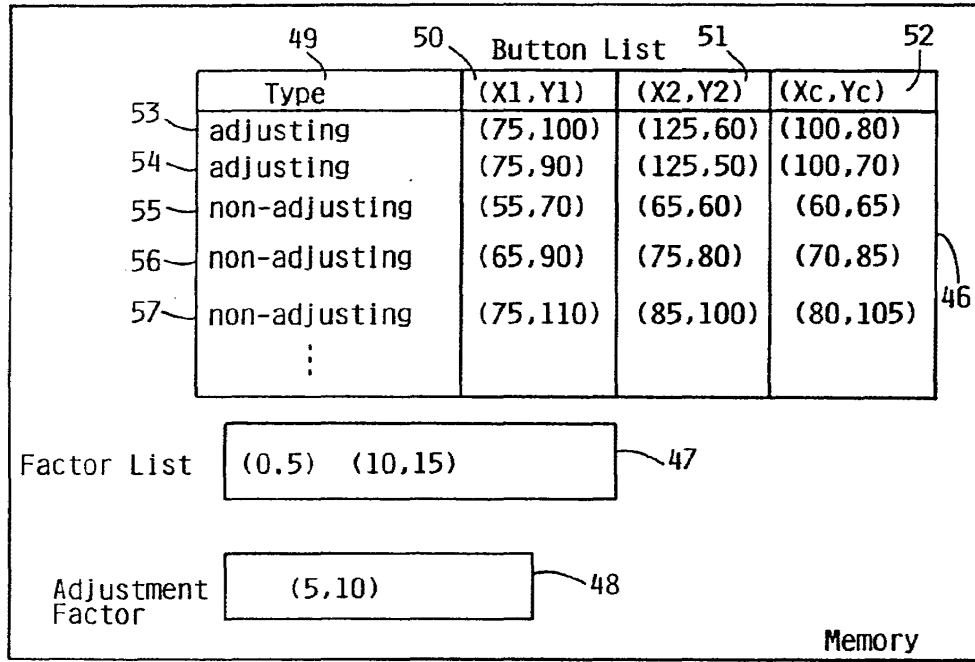


FIG. 6a

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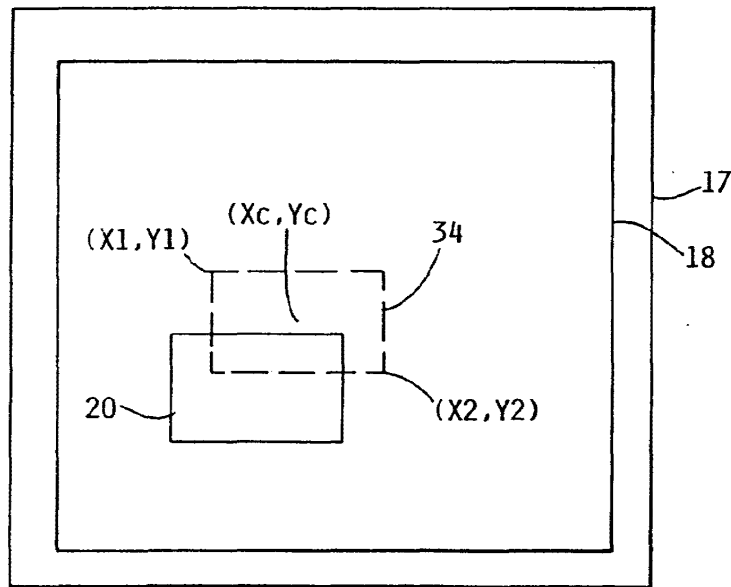


FIG. 6b

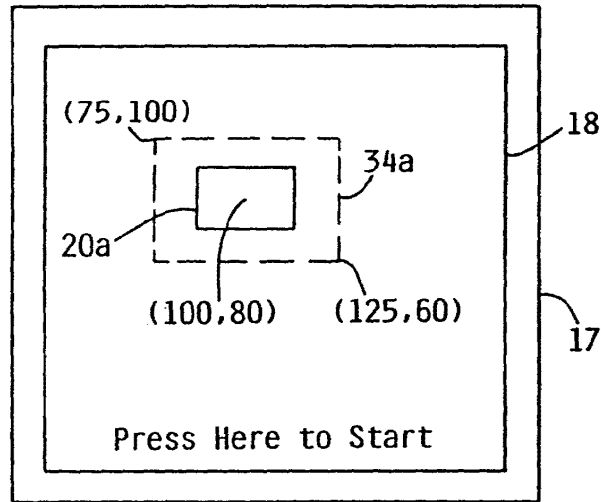


FIG. 6c

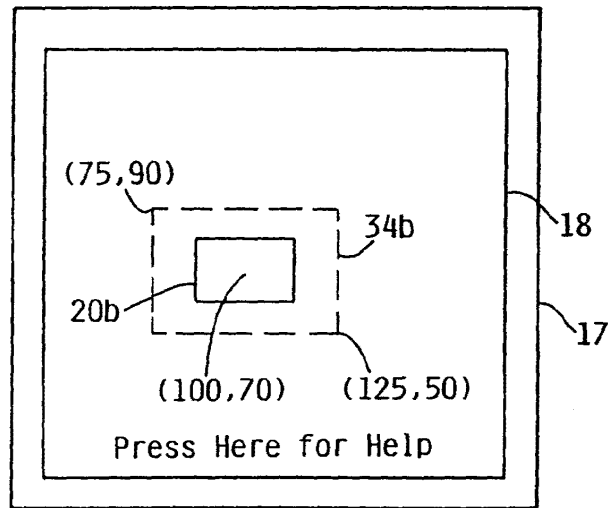


FIG. 6d

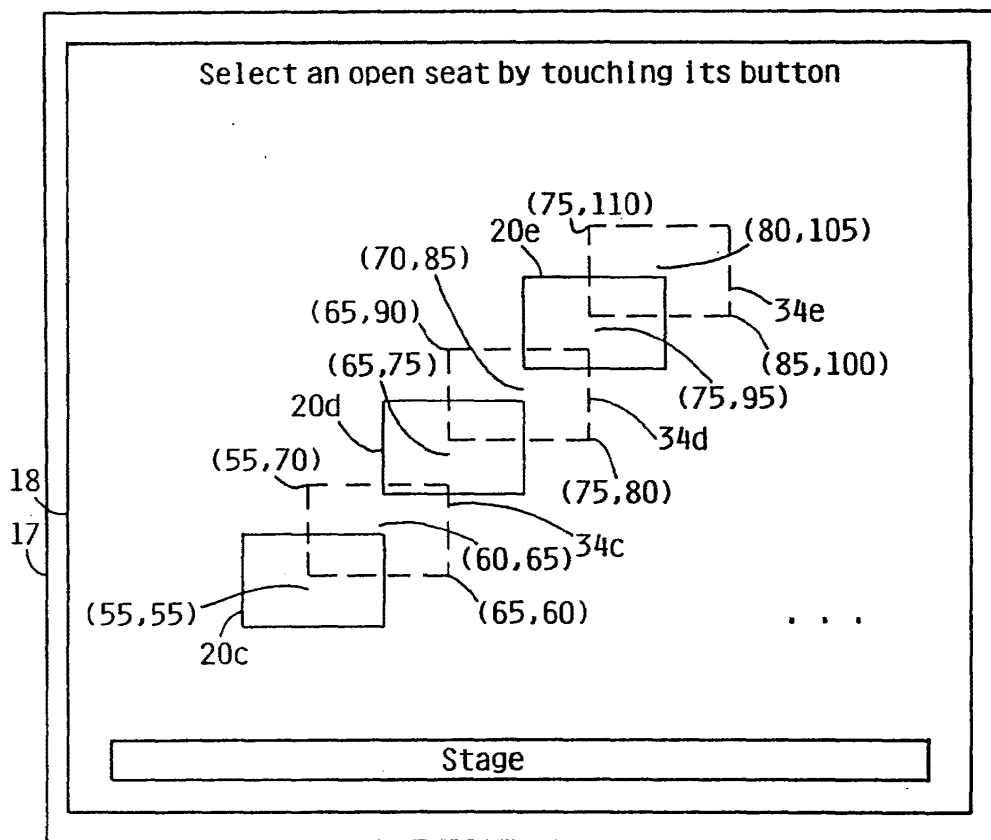
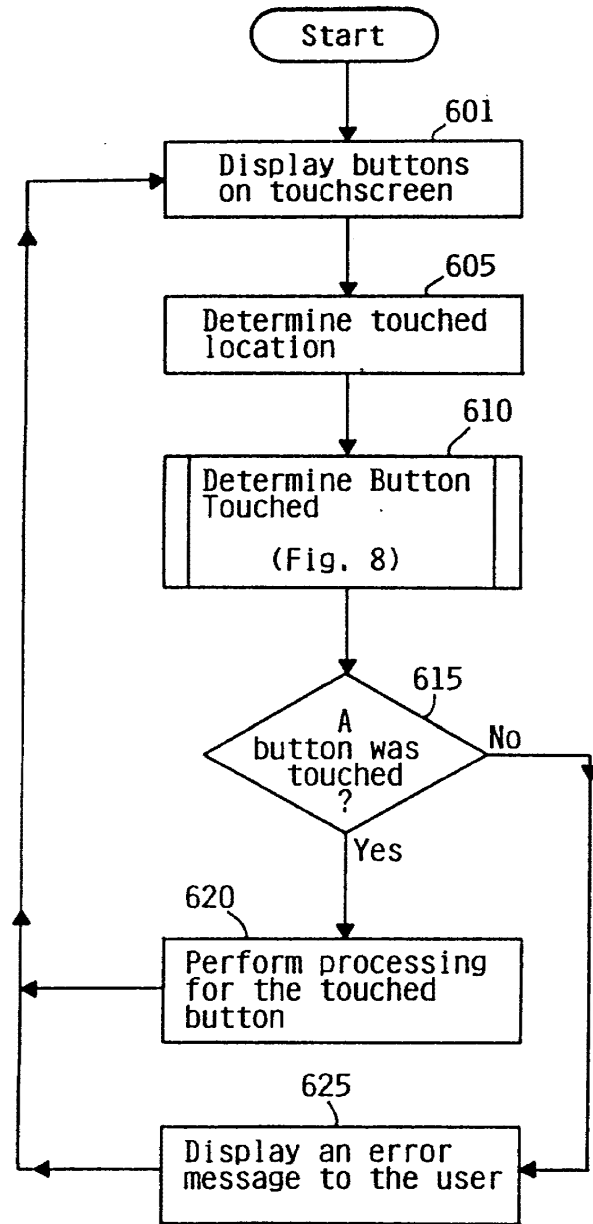


FIG. 6e



Display Touchscreen

FIG. 7

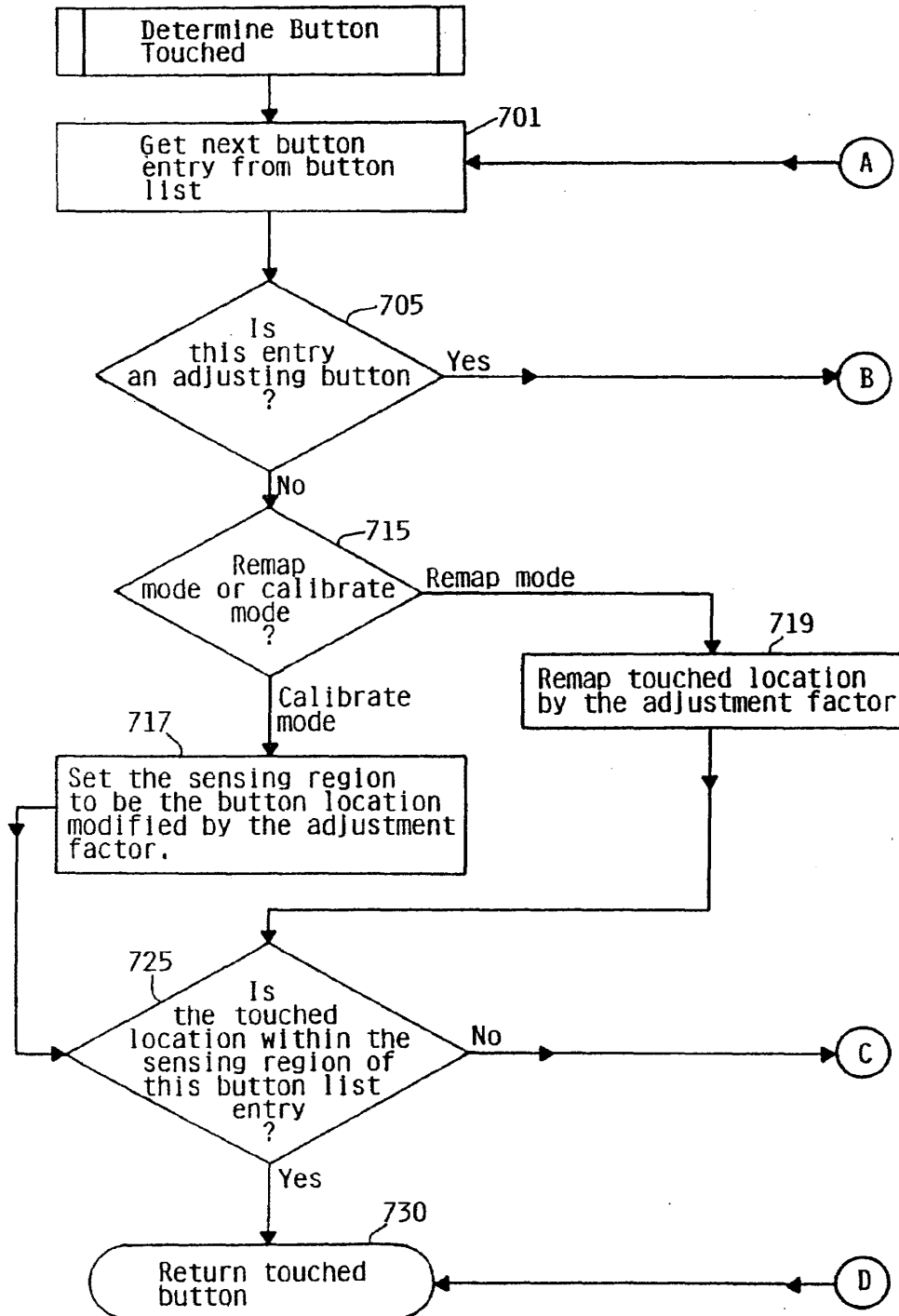
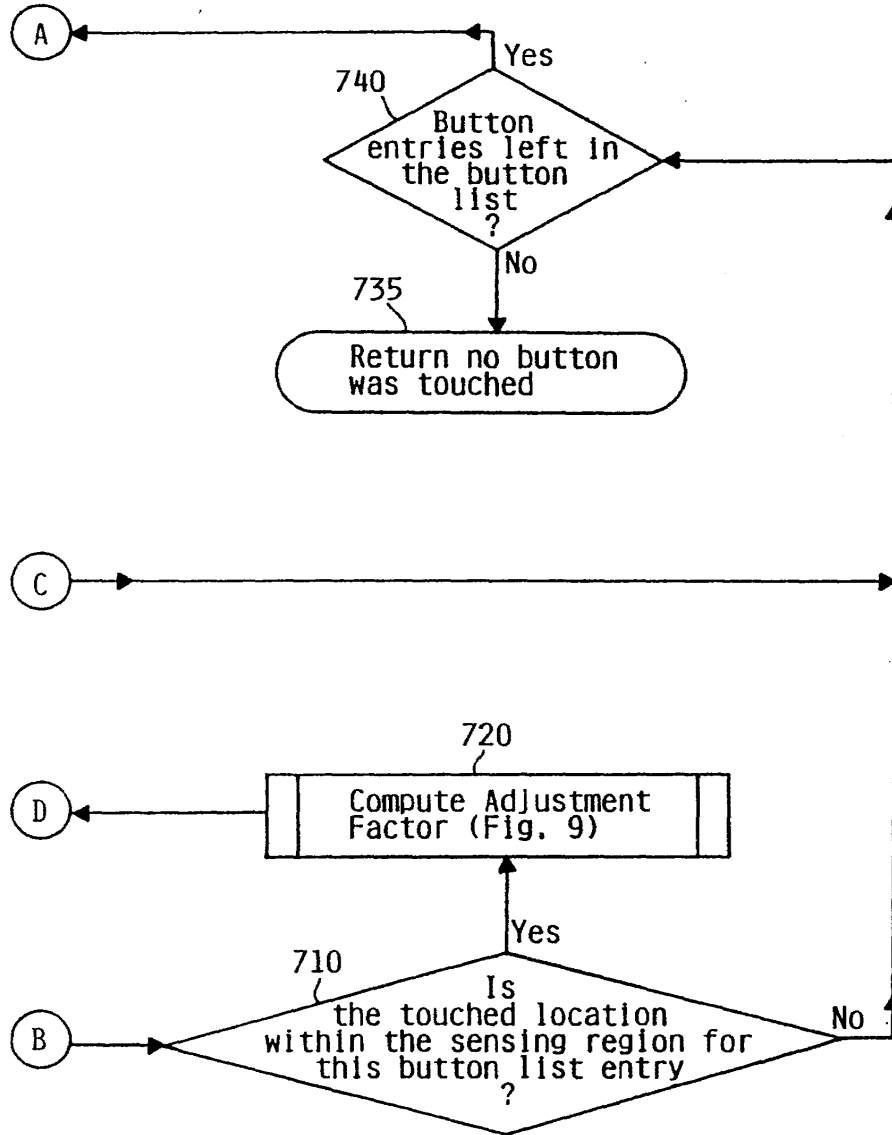
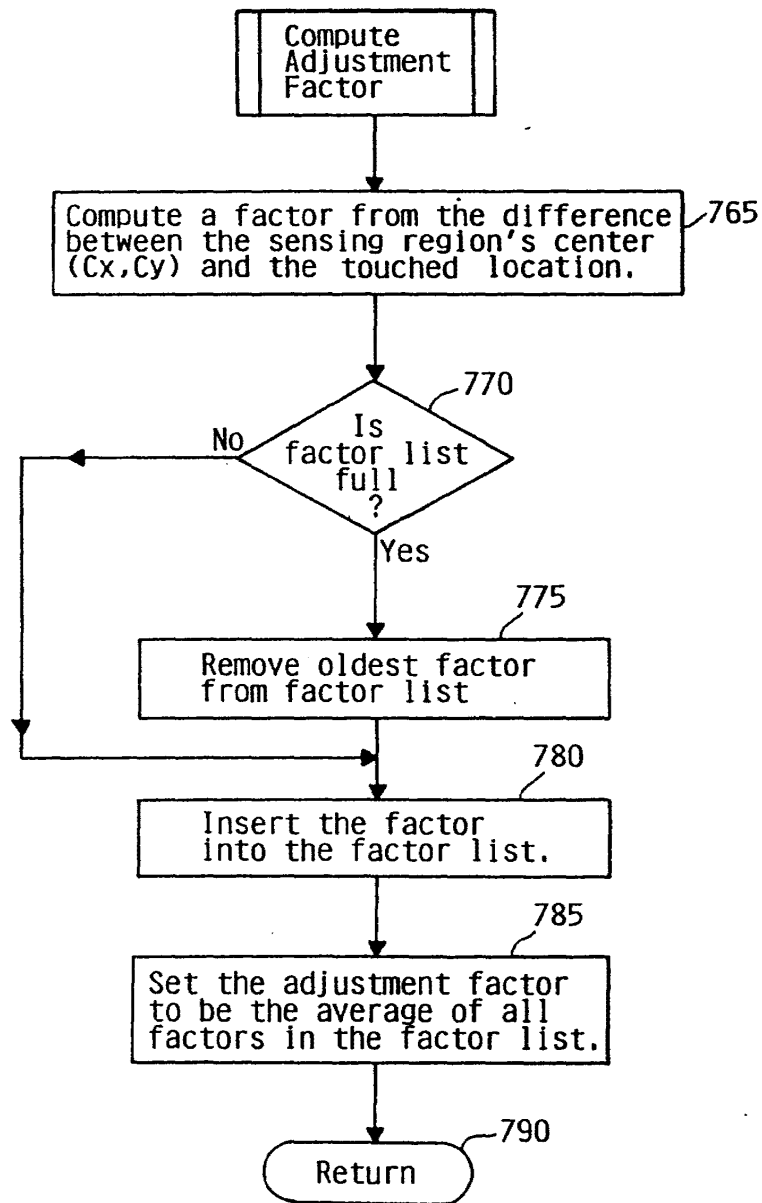


FIG. 8a Determine Button Touched Subroutine



Determine Button Touched Subroutine

FIG. 8b



Compute Adjustment
Factor Subroutine

FIG. 9



European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 94 48 0019

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.5)
Y	IBM TECHNICAL DISCLOSURE BULLETIN vol. 32, no. 9B , February 1990 , NEW YORK US pages 250 - 253 XP82330 'METHOD TO IMPROVE THE USABILITY OF TOUCH-SCREEN PANELS FOR COMPUTER APPLICATIONS' * the whole document * ---	1-7	G06F3/033
Y	EP-A-0 324 306 (IBM) * column 3, line 27 - column 4, line 5 * ---	1-7	
A	IBM TECHNICAL DISCLOSURE BULLETIN vol. 33, no. 10A , March 1991 , NEW YORK US pages 223 - 227 XP110024 'ALGORITHM FOR DECREASING THE ERROR RATE OF DATA ENTERED ON A TOUCH SENSITIVE TERMINAL' * figure 4 * ---	8	
A	US-A-5 189 732 (KONDO H.) * column 3, line 10 - column 4, line 56 * -----	1,6,7	TECHNICAL FIELDS SEARCHED (Int.Cl.5) G06F
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 19 July 1994	Examiner Bailas, A
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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(54) **Touch display type information input system**

(57) A reaction area in a display can be enlarged from one directly above a switch display in the operator's eyesight direction. Specifically, the operator's position is determined from the driver's position or the like, and when the display is looked at to the right and upward, for

instance, the reaction area is enlarged to the right and downward of a switch on the front side in the eyesight direction. Thus, operability can be improved in both cases when the display is looked at obliquely and directly from the front.

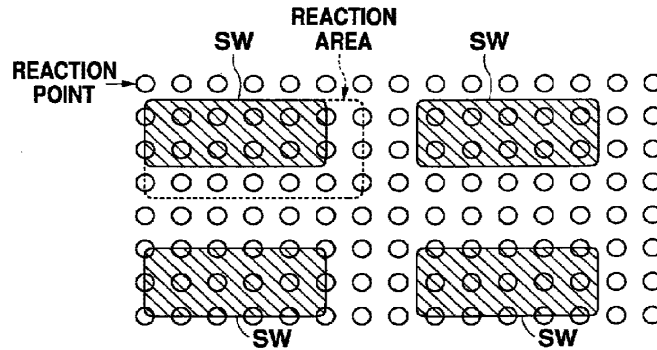


Fig. 8

EP 0 703 525 A1

Description**BACKGROUND OF THE INVENTION****Field of the Invention**

This invention relates to a display touch type information input system for inputting operating information by detecting the touching of a switch displayed on screen.

Prior Art

Heretofore, radio sets, audio sets, air conditioners and many other accessory units which have no direct bearing on the running of vehicles have been mounted in vehicles, and there is a trend for an increasing number of these accessory units. Among these accessory units are navigation units, and vehicles with navigation units mounted therein are increasing in number.

The navigation unit serves to assist driving by displaying the present location on a map, and there are many navigation units which undertake route guidance by displaying the route to a destination when the destination is input.

Such a navigation unit requires a display for the map display. In addition, various operations are necessary for the input of the destination and other purposes. However, the space available within a vehicle is limited, and it is impossible to provide exclusive switches for respective necessary operations. Usually, therefore, the display surface is utilized as a touch switch panel, that is, it is utilized as a switch. Also, there are many cases in which the same display is utilized as a switch for operating an air conditioner, an audio set, etc., thus dispensing with some of the dedicated switches.

There are many different types of touch switch panel, such as an electrostatic capacitance type, an optical type, etc. In many cases, however, irrespective of the type of touch switch panel used, the touch detection area is slightly above the actual display surface.

For example, in the electrostatic capacitance type, use is made of deformation of a film provided on the display surface, and in the optical type blocking of light beam provided along the display surface is detected. Therefore, the actual detection area is above the display surface. This leads to a problem that an error is produced between a switch displayed on the display and the actual detection position.

Particularly, in the optical type an acrylic acid resin sheet for screen protection and an LCF (light control film) for suppressing reflection of light by the screen surface are provided between the switch display on the screen and a detection light beam. The thickness thus provided constitutes a corresponding distance between switch display and reaction point. In the optical type, therefore, the problem noted above is particularly pronounced.

Meanwhile, the display that is provided in the vehicle can not be disposed right directly in front of the driver's

seat. That is, it has to be disposed at an intermediate position between the driver seat and the passenger seat. Inevitably, therefore, the driver's eyesight is directed obliquely with respect to the display. This leads to an error between the switch display on the display and directly above the touch reaction point (shown shaded), as shown in Fig. 1, and it is impossible to obtain correct detection of the driver's point of touch.

Japanese Utility Model Publication No. 121641/1987 shows precluding the deviation between display switch and reaction area due to a deviation of the driver's eyesight direction by shifting a switch display position (i.e., the whole display on the screen) according to the operator's position. Particularly, in a system disclosed in this publication seating detection switches are provided on the driver and passenger seats, and the switch display position is shifted by specifying the operator from the status of the seating detection switches. More specifically, when the driver alone is present, the display position is shifted to the left, while when both the driver and a passenger are present it is held at the center.

In this prior art example, however, sufficient improvement is not made because what is done is merely to shift the display itself. For example, there is such a problem that when the system is operated with the driver's face brought to the front right of the display, sufficient reaction can not be obtained due to a display deviation.

Particularly, while the touch of the touch switch panel is detected with respect to a plurality of spaced-apart reaction points, the reaction points can not be arranged very closely. Therefore, where a plurality of switches are displayed, the switch display may be comparatively small, and the number of reaction points of the switch display may be considerably small. By way of example, where the area defined by reaction points and the shape of switch display are in accord as shown in Fig. 2, the effect of the eyesight deviation is not so much. However, there is a case when the switch display and reaction points are deviated as shown in Fig. 3. In this example, while switches a and b are equal in size, the switch a is constituted by two reaction points, while the switch b is constituted by four reaction points. In such a case, if the eyesight direction is oblique with respect to the switch a, there is a high possibility that reaction points which do not belong to the switch a are operated by the driver's finger. If this is the case, sufficient reaction can not be obtained.

SUMMARY OF THE INVENTION

An object of the invention is to provide a screen touch type information input system, which can realize sufficient improvement in operability.

In the screen touch type information input system according to the invention, a reaction area corresponding to a display switch is enlarged from the consideration of the operator's eyesight direction. It is thus possible to increase the accuracy of detection of switch operation made by looking at the display obliquely, while maintain-

ing the operability when the display is viewed from the front right thereof.

Further, it is possible to attain sufficient reaction area enlargement with respect to the eyesight direction in a range free from erroneous operation by determining the extent of enlargement from consideration of the distance between adjacent switch displays.

In a further aspect, in a screen display in a vehicle, there are switches which can not be operated during driving of the vehicle. When such a switch is present as an adjacent switch, the reaction area is enlarged to a somewhat greater extent from the consideration of this fact. Thus, it is possible to improve the switch operation recognition factor.

Further, reaction area enlargement in the case of the presence of a switch which can not be operated during driving of the vehicle, as an adjacent switch is made even when no consideration is given to the eyesight deviation. Again in this case, the switch operation recognition factor can be improved.

Further, where a switch operable in the parked state of a vehicle is always found on the eyesight direction side of an operated switch, the reaction area is effectively enlarged in the eyesight direction.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a view showing the relationship between eyesight direction and reaction points;

Fig. 2 is a view showing an example of the relationship between switch display and reaction points;

Fig. 3 is a view showing different examples of relationships between switch display and reaction points;

Fig. 4 is a block diagram showing an embodiment of the invention;

Fig. 5 is a view showing a touch panel;

Fig. 6 is a view showing an array of reaction points in a touch panel;

Fig. 7 is a flow chart illustrating the operation of the embodiment;

Fig. 8 is a view showing an example of enlarging a normal reaction area;

Fig. 9 is a view showing an example of enlarging a reaction area with consideration of inter-switch interval;

Fig. 10 is a view showing an example of enlarging an area in the case when the use of an adjacent switch is prohibited;

Fig. 11 is a flow chart illustrating operation in the case when there is a switch, the use of which is prohibited;

Fig. 12 is a view showing an example of display in the case when there is a switch, the use of which is prohibited;

Fig. 13 is a schematic showing the entire system structure;

Fig. 14 is a flow chart illustrating the operation of the embodiment;

Fig. 15 is a view showing a storage state of a memory;

Fig. 16 is a view showing a destination setting method choice display;

Fig. 17 is a view showing a facility name choice display;

Fig. 18 is a view showing a prefectural district list display;

Fig. 19 is a view showing a facility list display;

Fig. 20 is a view showing a facility neighborhood map display;

Fig. 21 is a view showing a position change display;

Fig. 22 is a view showing a search condition confirmation display;

Fig. 23 is a view showing a passing point setting display;

Fig. 24 is a view showing another search condition confirmation display;

Fig. 25 is a view showing a mute search state display;

Fig. 26 is a view showing a whole route guide display;

Fig. 27 is a view showing a route guide state display;

Fig. 28 is a view showing a guide display in the case of departure from the route;

Fig. 29 is a view showing an enlarged-scale intersection neighborhood display;

Fig. 30 is a view showing a guide road list display;

Fig. 31 is a view showing a route change display;

Fig. 32 is a view showing a route correction display; and

Fig. 33 is a view showing a destination arrival guide display.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Now, an embodiment of the invention will be described with reference to the drawings. The overall structure of the embodiment is shown in the block diagram of Fig. 4.

As shown, the embodiment of the system comprises a touch panel 10, which includes an LCD display 10a and an optical touch panel 10b provided on the surface of the LCD display 10a. The LCD display 10a is connected via a driver 20 to a display ECU (electronic control unit) 22. The display ECU impresses a predetermined voltage via the driver 20 on liquid crystal of the LCD display 10a at a desired position thereof for display. The touch panel 10b is also connected to the display ECU 22, and it detects touch to some of the reaction points arranged in a matrix array.

A main ECU 30 is connected to the display ECU 22. According to a signal from the main ECU 30, the display ECU 22 determines the contents of display on the LCD display 22. In this embodiment, the main ECU 30 feeds an RGB signal (i.e., color television signal) about the display on the LCD display 10a, and according to this signal the display ECU 22 controls the voltage output of the

driver 20 to obtain a desired color display. Meanwhile, on-off information (i.e., touch information) about the individual reaction points on the touch panel 10b is directly transmitted to the touch panel 10b. The main ECU 30 detects an on-off state of the display switch from the display on the LCD display 10a and reaction point on-off information.

In this embodiment, the display and touch detection are made on the display ECU. However, it is possible that such processes are executed by the main ECU 30. As a further alternative, a separate ECU may be provided, which executes only the processes of touch detection and judgment. As a yet further alternative, a logic circuit for touch judgment may be constructed by hardware.

To the main ECU 30 are connected a GPS (global positioning system) 32 for detecting the absolute position (i.e., latitude, altitude and height) of the vehicle by receiving radio waves from an artificial satellite, a CD-ROM 34 for reproducing optical disk with map information stored therein, a vehicle speed sensor 36 for detecting the running speed of the vehicle, a geo-magnetic sensor for detecting the bearing of the vehicle, and a parking switch 40 for detecting the parking state of the vehicle.

The main ECU 30 thus feeds signals concerning about display by determining the present position from the absolute position detected by the GPS 32 and covered distance obtained from the vehicle speed and geomagnetism sensors 36 and 38, etc. and determining the content of display on the LCD display 10a from a map obtained from the CD-ROM 34, etc. Further, when displaying switches to be operated, the main ECU 30 determines the relationship between display switch and reaction points on the touch panel 10b. Further, a TV tuner is connected to the main ECU 22. It is thus possible to produce a TV display on the LCD display 10a. Further, it is possible to operate an air conditioner, etc. with the touch panel 10.

The optical touch panel 10b in this embodiment is shown in Fig. 5. It has light-emitting and light-receiving element rows disposed around the LCD display 10a. More specifically, along the right and upper side of the LCD display 10a a plurality of infrared LEDs (light-emitting diodes) 12 are provided in a row. Along the left and upper sides a plurality of photo-transistors 14 are provided in a row. Infrared radiation from the light-emitting diodes 12 is thus received by the respectively opposing photo-transistors 14.

By touching the LCD display 10a with a finger, certain light beams are blocked by the finger. Two-dimensional coordinates of the finger are thus specified from the positions of the photo-transistors 14 which can no longer receive light.

Thus, the light-emitting diodes 12 and light-receiving transistors 14 form a matrix of a corresponding number of reaction points as shown in Fig. 6. In the example of Fig. 6, 13 by 13 = 169 reaction points are formed.

The main ECU 30 sets the reaction area of a switch displayed on the LCD display 10a in correspondence to the shape of the switch. It detects the touch to the reac-

tion points in the reaction area to determine the on-off state of the switch.

The detection of the on-off state of switch will now be described with reference to the flow chart of Fig. 7. In this example, the area directly above the display of the switch is set directly as a reaction area, and the reaction area is enlarged in the judging process.

First, when the touch panel 10b is touched in the presence of the switch display (step S11), the Nos. (1 to 169) of the touched reaction points are detected by the display ECU 22 and taken in to the main ECU 30 (step S12).

Then, the main ECU 30 checks whether there is any meaningless reaction point (i.e., a reaction point not corresponding to any reaction area) (step S13). If no meaningless reaction point is found, it is determined that a switch corresponding to meaningful reaction point (i.e., reaction point corresponding to a reaction area) has been operated (step S14).

There is always one meaningless reaction point between two adjacent switches.

Usually, there is no possibility that a reaction point corresponding to two switches will be touch in the absence of any meaningless reaction point. There may occur a converse state due to such cause as touching the touch panel 10 with two fingers. Such a state may be regarded to be an abnormal switch operation or to be an absence of switch operation.

If a meaningless reaction point is found in the step S13, a check is made as to whether there is any reaction point in a reaction area corresponding to a switch (step S15).

If no such reaction point is detected, it is determined that a switch of a reaction area located at a reaction point of the No. smaller by one than that of the touched meaningless reaction point (i.e., a reaction point on the left side of the touched meaningless reaction point) has been touched (step S16). The left side reaction point is selected on the assumption that the operator is the driver seated in the right side seat. If it is known that preference is given to the left side seat, a switch of the No. larger by one (i.e., right side reaction point) may be determined. With the left end reaction point, this process is null because the reaction point with a No. smaller by one is on the right end. In many cases of usual operation, there is only a single switch located on the left side of a meaningless reaction point. When there are two or more such switches, the numbers of reaction points corresponding to these switches may be referred to for verification.

If it is found in the step S15 that there is a reaction point in a reaction area corresponding to a switch, the numbers of such reaction points and meaningless reaction points are compared (step S17). If the number of reaction points in the reaction area corresponding to the switch is greater, it is determined that the switch corresponding to these reaction points has been operated (step S18).

If it is found in the step S17 that the number of meaningless reaction points is greater, a check is made of the

position relationship between the meaningless reaction points and the reaction area corresponding to the switch (step S19). According to the result of this check, switch operation is determined as follows. If the meaningless reaction points are located under a reaction area corresponding to a switch, it is determined that a switch immediately over the meaning reaction points has been operated (step S20). If the meaningless reaction points are located over the reaction area corresponding to a switch, it is determined that a switch immediately under the meaningless reaction points has been operated (step S21). If the meaningless reaction points are located on the right side of the reaction area corresponding to a switch, it is determined that a switch on the immediate left side of the meaningless reaction points has been operated (step S22). If the meaningless reaction points are located on the left side of the reaction area corresponding to a switch, it is determined that a switch on the immediate right side of the meaningless reaction points has been operated (step S23). The result of the check of the position relationship in the step S19 may be from a map or from operational processing of arithmetic formulas.

In the above way, the touch to a meaningless reaction point may be regarded to be the touch to a nearby reaction point. In the above flow, initially an area directly over a switch display was set directly as a reaction area, and the reaction area was changed when and only when the touch to a predetermined meaningless reaction point was detected. In this way, various reaction areas can be comparatively readily set. In addition, it is comparatively readily possible to set a reaction area afresh.

However, the main ECU 30 has internally memorized display switch positions, and it is possible to set a reaction area to an enlarged scale in advance. Further, it is possible to further enlarge a reaction area in the manner as shown in Fig. 7 as described at the time of detection of the touch to a meaningless reaction point in a check executed after the setting of the enlarged reaction area.

In the case of vehicles, the operator is usually the driver. Thus, the driver should be assumed to be the operator unless otherwise specified. In this case, it is effective to enlarge a reaction area not in all directions but in a particular direction only. In this case, reaction areas may be allotted to displayed switches as shown in Figs. 8 to 10.

When the eyesight is directed from the right and downward with respect to the switch arrangement displayed on the LCD display 10a, as shown in Fig. 8, a reaction area is set which includes the entire top of the display switch and is enlarged to the right and downward. The touch of a reaction point in this reaction area is judged to be a switch operation. With such enlargement of the reaction area it is possible to preclude the error between the reaction points and the switch arrangement display when viewed from the operator, and the switch operation can be effectively detected. In addition, since the reaction area is merely enlarged, correct detection

can also be obtained when the switch operation is made with the operator's face brought to the front of the screen.

When the display switch interval is comparatively large as shown in Fig. 9, the enlarged reaction area is made greater according to the interval. This is done because the possibility of erroneous detection due to reaction area enlargement is low. By determining the extent of reaction area enlargement according to the display switch interval, the switch operation can be detected more effectively.

In a navigation display or the like, switches which can not be operated during driving are also displayed. In a specific example, the setting of a destination or the like is made according to the input of the kind of destination (such as department store, golfing place, station, etc.), address, telephone No., etc. Such an operation is comparatively complicated and is executed by watching the display. During driving of the vehicle, such a switch is displayed in thin form (as shown shaded in the Figures) so such as it can not be operated. If such a switch is operated, the operation is made null, while displaying a message that "the switch can not be operated during driving of the vehicle, so please use the switch after parking." Thus, with such a display the possibility of operating a switch which can not be operated is low.

Accordingly, in this embodiment the reaction area is further enlarged as shown in Fig. 10, so that the enlarged reaction area of the switch covers up to reaction points adjacent to a switch which can not be operated during driving of the vehicle.

More specifically, where two adjacent switches are operable, it is necessary to avoid erroneous judgment by setting at least one line of reaction points between the two switches, which reaction points belong to neither of the switches and are hence meaningless. However, if the adjacent switch is not operable, the switch operation recognition factor can be increased by allotting all the reaction points between the two switches to the reaction area of the operable switch.

Now, operation during driving of the vehicle will be described with reference to Fig. 11. When a destination display is produced by choosing a destination setting during driving, any inoperable switch is torn down (step S31). Specifically, of the display switches as shown in Fig. 12 the "TELEPHONE NO." switch for setting the destination from a telephone No., the "ADDRESS" switch for setting a destination from an address, facility name switches for setting a destination from a facility name, the "MEMORIZED POINT" switch for setting destination among memorized points, and a "PREVIOUS DEPARTURE POINT" switch are toned down. Thus, only the "HOME" switch is held operable without toning it down. (In the Figure, only the "HOME" switch is shown shaded). This is done because the destination can be set by merely touching the "HOME" switch, the operation being thus simple and capable of execution without any trouble during driving. Afterwards, the area covering the reaction points corresponding to the operable switch is enlarged (step S32).

The running state of the vehicle may be detected with reference to zero vehicle speed. In the case of an automatic vehicle, the parking position of a shift lever may be detected using a parking position switch 40. Further, the parking state of the vehicle may be detected through detection of an "on" state of the side brake. Further, the routine shown in Fig. 11 is called by an interrupt when the running state of the vehicle is detected.

In this embodiment, it is a presumption that the display itself is fixed. However, among various available displays are those which are capable of angle adjustment. That is, there are displays which can be directed toward the driver's seat in some cases and toward the passenger seat in other cases. With such a display, whether the operator is the driver or the passenger can be determined from the display installation angle. It is thus possible to provide a display position detector (which may detect rotation of the display as the display is usually rotated about its center line) and determine the reaction area enlargement direction by specifying the operator according to the result of detection.

The method of the operator's eyesight direction estimation is not limited to the above display angle adjustment, and the same effects are obtainable with other methods.

A conceivable different method, for instance, is such that an "PASSENGER SEAT OPERATION" key is displayed, and that if this key is touched, it is determined that the operator's eyesight direction is from the passenger seat.

(Description of another structural embodiment)

Now, another structural embodiment of the invention applied to a navigation system will be described. This structural example concerns a map call/display system for a navigation system, which can call and display maps concerning specified items of call.

Usually, driving carried out to various destinations. When utilizing a navigation system, it is accordingly necessary to input and set information about the destination. It is possible to memorize a place which recurrently constitutes the destination, such as home, place of work, etc. As for general destinations, however, it is necessary to set information whenever a specific destination is chosen. In the usual navigation system, a map of the neighborhood of a destination is called and displayed for determining the final destination when information of a place as an indication of for destination setting is input or for confirming destination when information of the final destination is input. For other purposes than the destination setting, it is possible to call and display desired maps by inputting place-specifying information.

A map may be called by specifying a facility name such as a golfing place name, a station name, etc., specifying a telephone No. or an address, or specifying a memorized place as noted before. Prior art navigation systems can call maps according to such input. As an example, when the home of an acquaintance which is

located behind a certain golfing place is chosen as a destination, first the name of the golfing place is input as a facility name. Then, a map of the neighborhood of the golfing place is called and displayed. On the displayed map, the final destination is set, and a route search is made.

When setting a destination according to a telephone No. or an address, a pertinent map may be called and displayed by inputting comparatively rough information, such as a city name, an urban telephone exchange name, etc., and the final destination may be set on the displayed map.

However, a map which is called in the above way according to the input information may sometimes be of a scale which is not suited to the setting of the final destination. For example, the same scale of display is not suitable when calling a private shop having a small installation area and when calling a golfing place having a vast area. In other words, if the map showing the golfing place is called with a scale that permits adequate display of the private shop, the called map can not be contained within the screen.

According to Japanese Patent Laid-open Publication No. 94132/1993, if the called map can not be contained within the screen, this is displayed, and the direction in which the locality that can not be displayed is present is displayed with an arrow. In this case, it is made possible to scroll the screen in the direction of the arrow. Thus, when the called subject is not satisfactorily displayed, it is possible to permit observation of the whole subject. It is thus possible to permit the setting of destination or the like by utilizing the called map.

In the above prior art example, however, it is necessary to scroll the display in order to observe the whole subject called. Therefore, the operability is inferior. For example, when setting a destination, scrolling of the display is needed to obtain information of nearby roads and so forth. Further, when the destination is an acquaintance's house behind a golfing place as noted above, difficulty may be encountered in the search of the destination due to absence of the intended location in the display or lack of the display of the whole golfing place.

The instant structural example seeks to solve the above problems.

Fig. 13 is a schematic showing the entire structure of the example of a map call/display system. A display/touch system 110 as shown serves as map display means.

It includes an LCD (liquid crystal display) and a touch panel provided on the surface of the LCD. In addition to displaying various maps, it also has a role of detecting the touching of a displayed switch. An electro multi-television ECU 112 is connected to the display/touch panel 110. The electro multi-television ECU 112 has roles of providing displays and detecting the touching of the touch panel. A CD-ROM changer 114 is connected to the electro multi-television ECU 112. A map CD-ROM 114b is connected via magazine 114a to the CD-ROM

changer 114. The map CD-ROM 114b serves as memory means for storing map data. The electro multi-television ECU 112 serves as map call means for obtaining desired map information from the CD-ROM changer 114.

A GPS receiver 120 is connected to the electro multi-television ECU 112. The GPS receiver 120 receives signals from an artificial satellite via a GPS antenna 120a to detect the absolute position (altitude and latitude) of the vehicle and supplies detection data to the electro multi-television ECU 112. The absolute position of the vehicle can thus be detected in the electro multi-television ECU 112. Various sensors 122 for detecting the running state of the vehicle are connected to the electro multi-television ECU 112. The running condition thus can be ascertained at all times. In this example, the sensors 122 are a geo-magnetism sensor 122a, a wheel sensor 122b, a steering sensor 122d and a distance sensor 122d. The electro multi-television ECU 112 can thus grasp the bearing, speed and steering angle of the vehicle and distance covered thereby from the results of detection by the sensors 122. The electro multi-television ECU always calculates the present position from the detection signals from the sensors 122, and makes higher accuracy detection of the present position by combining the result of detection from the GPS receiver 20 with the calculated present position.

The electro multi-television ECU 112 is further supplied with detection signals from various switches 124. In this example, signals from an accessory switch 122a, an ignition switch 124b, a parking brake switch 124c, an alternator 124d and a check terminal 124e are supplied to the electro multi-television ECU 122. Thus, the electro multi-television ECU 112 can ascertain running conditions of the vehicle, such as whether the ignition key is "on", whether the vehicle is parked with the parking brake operated, whether the electricity generation state is satisfactory, and whether various accessories mounted in the vehicle are normal.

Further, a loudspeaker 126 is connected to the electro multi-television ECU 112. A guidance voice for route guidance is output from the loudspeaker 126.

Further, in this system a TV tuner 130 is provided to permit display of a television signal intercepted by a TV antenna 130a built into the window glass on the screen of the display/touch panel 110. An air conditioner ECU 132 is further connected to the display/touch panel 110.

The air conditioner can thus be operated by a switch displayed on the display/touch panel 110.

Further, the system includes an audio CD changer 134b for reproducing data from a CD-ROM 134c. CD-ROM 134c data for sight-seeing guides, etc. is stored.

Thus, video data can be supplied from the CD-ROM 134c to the electro multi-television ECU 112 to display sight-seeing guide displays on the display/touch panel 110. Further, voice data from a music CD 134b and CD-ROM 134c can be supplied through an audio amplifier 136 to loudspeakers 138 to output predetermined voices. Further, an audio head unit 140 is connected to the audio amplifier 136 to permit signals from an FM

radio unit, an AM radio unit, etc. to be output to the loudspeakers 38.

Now, the above system will be described in connection with reading out a map for destination setting with reference to Fig. 14. In this case, information for the destination setting is first input by operating the display/touch panel 110. As an example, it is assumed that the destination is set according to an address. For example, information "Toyoda City, Akita Prefecture" is input, and it is determined to be the final choice item (step S101).

According to this input, the electro multi-television ECU 112 determines the center position of the input "Toyoda City" and the scale of the display from data stored in the map CD-ROM 114b (step S102). As the center position adopted may be the center position of the area (i.e., administrative area) of Toyoda City, the location of the administrative office of the city, etc. The scale of the display has been determined from the area and shape of the pertinent city (i.e., Toyoda City in this case), and this information has been stored. When displaying the area, a scale is required which permits maximum enlargement of the area without a non-display portion. This data is stored together with data of the item (i.e., Toyoda City in this case) in the CD-ROM 114b.

When the final choice item is determined in the step S101, the data has already been read out from the CD-ROM 114b into a memory of the electro multi-television ECU 112.

An example of the configuration of this data is shown in Fig. 15. As shown, the group name, name (i.e., kanji name in the case of a Japanese name), altitude and latitude of the destination and the scale of the display are stored. As the scale of display one is stored which is best suited, in both the altitude and latitude scales to the display of the area as described above. The group is the kind of item, such as golfing place, amusement park, etc. (corresponding to the facility name), and it represents the kind of call subject together with the name. In this way, the scale of display is stored in the CD-ROM as shown in Fig. 15. However, it is also possible to provide a ROM in the ECU 112 and store a table listing call subject kinds and display scales in one-to-one correspondence in the ROM. In this case, the data amount in the CD-ROM 114b may be reduced.

Since the center position of display and the display scale are determined in the above way, the pertinent map data are read out (step S103). The read-out map data are displayed on the display/touch panel (step S104).

As shown, in this example the best suited display scale is determined according to the kind of final choice item as determined in the step S101. If the final choice item determined in the step S101 is not at the level of city, town or village but specifies the address, the display scale is determined under the assumption that the area of the pertinent address is to be displayed. If an urban telephone exchange No. or a golfing place name is specified, a display scale corresponding to the final choice item is read out. Thus, the map call is always made on

the basis of the best display scale, and the best map display is carried out.

For example, if a golfing place is displayed on a map with a scale of 1/100,000, it is partly displayed on the screen. When such a display is provided, the operator wishes to search for a desired place, for instance a club house parking area, in the golfing place. Previously, if the club house parking area be found correctly, the destination could be set correctly.

However, if the destination could not be found, it would be set to be a different place, for instance a parking area on the opposite side of the club house. Meanwhile, in this navigation system, when merely the name of the golfing place is specified, the destination is usually set to be the club house parking area which the general driver decides to be the destination. This means that by setting the destination directly on the display, correct destination setting can be obtained. In this example, the golfing place as a destination is set in an optimum size, i.e., a size which is not excessively large or small.

The destination setting can thus be completed at a level intending to find golfing place. In other words, the destination setting can be obtained without a change in the predetermined club house position. In this way, in this example correct destination setting can be obtained.

It will be seen that there is a correlation between the display scale and the operator's sense. When the operator wishes to obtain display of a map in a certain scale, he or she obtains information which is available from that scale. In other words, for a detailed map detailed information is sought, while for a broad area map only a very rough positional relationship is sought. Thus, by obtaining display of a map in a scale adequate for the size and shape of the subject as in this example, the operator can confirm only the presence of the pertinent facility or the like, and he or she can promptly carry out correct destination setting without the need to set greater details.

Now, the actual operation of the navigation system will be described with reference to display examples. It is assumed that the set destination is among "OTHER FACILITIES" and that a point is set which has been set in advance as a memorized point on the route to the destination.

(Setting of Destination)

Fig. 16 shows a display for choosing a method of destination setting. As shown, the display includes "TELEPHONE NO." and "ADDRESS" keys. It also includes "GOLFING PLACE" and "OTHER FACILITIES" keys for facility names (or groups). It further includes "HOME", "MEMORIZED POINT" and "PREVIOUS DEPARTURE POINT" keys for registered points. When this display is provided, a navigation message saying "You can call and set a map of destination neighborhood from telephone No. or facility name." is produced. In this example, the "OTHER FACILITIES" key is touched. As a result, a destination facility name choice display as shown in Fig. 17

is provided. At this time, a navigation message saying "Please choose destination facility name." is also produced. The operator thus chooses and touches a desired key among "AMUSEMENT PARK", "SKIING PLACE", etc. keys. As a result, a prefectural district list display as shown in Fig. 18 is provided. At this time, a navigation message saying "Please choose prefecture name corresponding to destination." is produced. In this example, the "AMUSEMENT PARK" key is touched as facility name.

In this display, the prefectural district containing the pertinent amusement park is determined by touching a corresponding prefectural district key. (In the United States of America, the prefectural districts would be comparatively broad areas corresponding to the states.) The first prefectural district display part in the display has a "COUNTRY" key.

By touching this key, a display is provided in which the facilities all over the country are listed, while producing a navigation message saying "Please choose destination name, and you can call a neighborhood map." On this list display, a desired one of the facilities all over the country can be chosen. When a prefectural district is chosen, a facility choice display as shown in Fig. 19 is provided, which shows a list of amusement parks in the chosen prefectural district. On this list display, a desired facility is chosen. As a result, a map of the neighborhood of the chosen facility as shown in Fig. 20 is displayed, while a navigation message is produced which says "Please touch "SET" key, and you can set destination." By touching the "SET" key, the destination is set. In this example, the best map scale for display is stored as shown in Fig. 15 in correspondence to the area and shape of the specified facility (i.e., amusement park in this case). Thus, the called map is in the best scale, and the whole amusement park and the neighborhood thereof are displayed on the screen. By touching the "SET" key on the display shown in Fig. 20, the destination is set as the amusement park. The actual destination that is set is a parking area which is closest to the front gate of the amusement park which is usually set as a target.

Meanwhile, by touching the "POSITION CHANGE" key, eight arrow keys radially spaced-apart are displayed. At this time, a navigation message saying "Map is moved by touching an arrow, and destination can be set by touching "SET" key." is produced. When the operator touches, for instance, the upwardly directed arrow key, the destination can be moved to the north from the parking area at the front gate. Then, by touching the "SET" key at a desired point, the destination setting can be obtained. There may be cases when setting the destination from a telephone No that there is no pertinent facility but there is only a pertinent urban telephone exchange. In such a case, the pertinent map can be displayed, and a "SEARCH NEIGHBORHOOD" key can also be displayed. By touching the "SEARCH NEIGHBORHOOD" key, such item as the name of a town, intersection, etc. near the destination can be displayed. From

this display, a pertinent neighborhood map can be searched for destination setting.

When the map is displayed, the destination setting is completed by touching the "SET" key. When the destination setting is completed, data of roads near the destination or the like are confirmed. If there is no problem, a search condition confirmation display is provided for search up to the destination. Meanwhile, if there is no nearby road or the like suited for navigation after the destination setting, such a display message as "No road suited for navigation is found, so please operate again after moving the destination point to the vicinity of a trunk road" is provided. Then, an arrow mark display like that shown in Fig. 21 is provided for re-setting of the destination.

(Setting of Search Conditions)

When the destination setting is completed in the above way, a search condition confirmation display as shown in Fig. 22 is provided. At this time, a navigation message saying "Touch "SEARCH START" key, and search of route up to destination will be started on condition that preference is given to toll road." is produced. On this display, whether or not there is a designated passing point is set. Also, setting as to whether or not preference is given to a toll road is made.

If preference is to be given to a toll road in the choice of road up to the destination, a "GIVE PREFERENCE" key is touched. Otherwise, a "GIVE NO PREFERENCE" key is touched. In this way, a choice is made as to whether or not preference is to be given to a toll road.

In addition, whether or not a passing point is to be designated on the route up to the destination is chosen by key touch. When a passing point is designated, a best route passing through that point before reaching the destination is chosen in the route search.

Specifically, by touching a "DESIGNATE" key, a passing point setting choice display as shown in Fig. 23 is provided. This display resembles that for the destination setting.

Thus, the passing point can be set in a manner similar to the destination setting as described above. When the passing point setting operation is ended, the "SET" key on the display is touched. Thus, the setting of the passing point is completed, and data of the vicinity of the passing point can be confirmed. Then, a search condition choice confirmation display as shown in Fig. 24 is provided. Here, route search is started by touching a "START SEARCH" key.

(Route Search)

When the "START SEARCH" key as shown in Fig. 24 is touched, a display as shown in Fig. 25 is provided for route search. When the route search is ended, the whole route from the present point to the destination is displayed on map. At the same time, the entire distance (in km) to be covered is displayed as shown in Fig. 26.

At this time, it is informed by navigation message that navigation along a route passing through the designated passing point will be made. When it is found as a result of the search that the destination is near the present point, this is displayed, and it is instructed to drive the vehicle with reference to a map. When a point at which a route search can be made is reached, a "SEARCH" key is displayed. When this "SEARCH" key is touched, a navigation route search is made. Further, during the navigation route search a present position display can be provided by depressing a present position switch. It is thus possible to confirm the present position during the navigation. When the search is ended, the whole route and the entire distance to be covered are displayed by touching "DISPLAY ROUTE" key.

If the navigation route search could not be made, this is displayed, and also a "CON FIRM" key is displayed. Then, by touching the "CONFIRM" key, a present position display is provided. By touching the "SEARCH" key after departure and after running past the displayed present position, the navigation route search is started again. In other words, if there was no road suitable for navigation near the present position, this fact is displayed, and it is instructed to carry out a search again in the neighborhood of a trunk road. If the route search could not be made any reason other than a problem with a road in the vicinity of the present position, merely the fact that the route search could not be made is displayed, and it is instructed to undertake the operation afresh.

(Route Guidance)

After the whole route and the entire distance (in km) to be covered have been displayed after the end of the route search, route navigation up to the destination is started by touching a "START NAVIGATION" key on the display or after 15 seconds of running. That is, a route navigation display as shown in Fig. 27 is provided at this time.

As shown, the display includes a present position mark shown at the center of the display. Also, a "DURING NAVIGATION" display is provided in an upper portion of the display.

Further, the vicinity of the passing point (only when the passing point has been set) and the distance to be covered up to the destination neighborhood are displayed in a right lower portion of the display.

If it is judged during running that the vehicle position is deviated from the navigation route, the "DURING NAVIGATION" display is removed, and a "RE-SEARCH" key is displayed in a lower portion of the display as shown in Fig. 28. By touching this "RE-SEARCH" key, the route search can be made afresh.

Further, by touching a "WHOLE ROUTE" key on the route navigation display, the whole navigation route from the present position to the destination is displayed. The display of the whole navigation route is similar to the display shown in Fig. 26. In this case, however, a "RESUME NAVIGATION" key is displayed in lieu of the "START

NAVIGATION" key. By touching this "RESUME NAVIGATION" key, the usual navigation display is restored.

(Intersection Guidance)

When an intersection is approached during route navigation, it is detected, and an enlarged-scale display of the vicinity of the intersection is provided for navigation. More specifically, when an intersection is approached by the vehicle, this approach is detected, and an enlarged-scale intersection vicinity display as shown in Fig. 29 is provided. Also, the direction of proceeding along the navigation route is informed by a navigation message. That is, a navigation message saying, for instance, "Please turn to the left at so and so intersection about 300 meters ahead." is output. By touching the "DISPLAY ROUTE" key on the enlarged-scale intersection vicinity display, the usual route navigation display is provided. This display includes an "INTERSECTION" key display. By touching this "DISPLAY INTERSECTION" key, the enlarged-scale intersection vicinity display can be restored. When it is detected that the navigated intersection has been passed, the usual route navigation navigation display is restored.

(Route List)

It is possible to display the navigation route from the present position to the destination in the form of a list. Also, it is possible to display a map showing the vicinity of each point on the navigation route.

A display showing the whole navigation route from the present position to the destination has a "NAVIGATION ROAD LIST" key display. By touching this "NAVIGATION ROAD LIST" key, a display showing a navigation route list from the present position to the destination is provided. That is, a display showing the roads extending from the present position to the destination as shown in Fig. 30 is provided. In this display, the navigation route is divided at points of change in road type or at interchanges or junctions where roads are entered or left. Also, the distances between adjacent points noted above are shown as actual distances. If the route from the present position to the destination can not be shown on the same display, the display can be scrolled with "FORWARD" and "BACKWARD" keys (only the "FORWARD" key being shown in the Figure). In this way, a display of the whole route up to the destination can be obtained.

Further, by touching a "SURROUNDING AREA" key which is provided outside the navigation route list display and on one side of each of the points noted above, a map centered on that point is displayed. This display has eight arrow keys corresponding to respective directions, and map movement can be made by using these keys.

(Route Re-search)

When the navigation route is deviated from the present position on the route navigation display, it is possible to carry out navigation route re-search and display a new navigation route.

More specifically, if it is judged that the position of the running vehicle has been deviated from the navigation route while the route navigation display is provided, as described before, the "DURING NAVIGATION" display is removed, and a "RE-SEARCH" key is displayed on a lower portion of the display. By touching this "RE-SEARCH" key, a new route in the vicinity of the present position is searched. When the re-search is ended, the new navigation route from the vicinity of the present position is displayed. If the re-search could not be made, the previous navigation route is displayed again. At this time, a navigation message saying "New route could not be found, so the previous route will be displayed." is output. Also, this content is displayed.

The re-search which is instigated by touching the "RE-SEARCH" key, is a search of a route from the present position to a navigation route which has already been searched.

During the route search up to this navigation route, a "SEARCH WHOLE ROUTE" key is displayed. By touching this "SEARCH WHOLE ROUTE" key, an entire new route from the present position to the destination is searched. When the search is ended, the whole new navigation route is displayed. The display of this whole new navigation route is like the case when a route search is carried out by setting the destination. Further, when a passing point has been set at the time of the re-search, an "ERASE PASSING POINT" key is displayed simultaneously with the "SEARCH WHOLE ROUTE" key. By touching this "ERASE PASSING POINT" key, a search of a whole new route without any designated passing point is made. When the search of the whole new route after erasing of the passing point is ended, the whole new route without any designated passing point is displayed.

(Route Change)

After the end of the navigation route search, the navigation route or search condition may be changed. The whole route display (see Fig. 26) after the end of the navigation route search has a "CHANGE ROUTE" key display. By touching this "CHANGE ROUTE" key, a mute change choice display as shown in Fig. 31 is provided.

This display has a "RE-SEARCH TO SET DIFFERENT ROUTE" key. By touching this key, a whole new navigation route is searched. When the search is ended, the whole new navigation route is displayed. When the result of the search is the same as before the navigation route change, the navigation route before the navigation route change is restored.

The route change choice display also has a "CHANGE SEARCH CONDITION" key. By touching this key, a search condition confirmation display is provided.

In this case, it is possible to change the setting of any designated passing point and also to change the setting as to whether or not preference is to be given to toll roads. Further, it is possible to change the setting so as to make a further change of the navigation route.

In the presence of the route navigation display, it is possible to correct the navigation route with a change in the present position and also to correct the navigation route from toll road to general road or from general road to toll road. More specifically, by touching a "CORRECT" key on the route navigation display, a route correction display is provided.

This display, as shown in Fig. 32, has eight direction arrow keys for correcting the present position. By touching these keys the present position is changed to a new position desired on a separate route. Then a "SET" key is touched. As a result, the present position is changed, and a new navigation route from the changed position is displayed.

When a toll road is set as part of the navigation route along which the vehicle is to run, a "CORRECT ROUTE TO GENERAL ROAD" key is displayed on the route correction display. This key is touched if it is desired to use an ordinary road instead of the toll road. As a result, the route is corrected to a new one using ordinary roads only. If ordinary roads only is set as the navigation road along which the vehicle is to run, a "CORRECT ROUTE TO TOLL ROAD" key is displayed on the route correction display. This key is touched if it is desired to use toll roads. As a result, the route is corrected to a new one using toll roads.

(Navigation concerning Arrival at Designated Passing Point)

When the vicinity of a designated passing point is approached in the presence of a route navigation display with the designated passing point, it is informed by a navigation message that the present position is near the designated passing point. That is, a navigation message saying "Now, you are near the designated passing point." is output. When the passing point has been passed, a message saying "Navigation is switched to one up to destination neighborhood." is output. Also, a display of this navigation content is provided. The navigation is then switched to the one up to destination neighborhood.

(Navigation concerning Arrival at Destination)

When destination neighborhood is approached, ending navigation is provided by a navigation message. More specifically, when the destination that has been set is approached by the vehicle, a message saying "You are in the destination neighborhood, and this is an ending navigation message." is output, thus bringing an end to the navigation.

At this time, if the destination can not be displayed on the displayed map, a message that "You can confirm

destination on a wide area map." is displayed on the display. When this message is displayed, the destination can be confirmed with a wide area map displayed by a map area expanding operation. A display on which arrival at the destination is determined is shown in Fig. 33. When the destination is not shown in the display, a message that it is desired to confirm the destination on an expanded area map is displayed.

When a ferry stop is detected, arrival at the ferry stop is informed by a navigation message, and then the navigation message is interrupted.

(Other Functions)

(Map Movement)

By touching a position of a displayed map, the vicinity of that position is moved to the center of the display. Thus, a desired portion of display can be brought to the center thereof. When it is desired to obtain display of a map located adjacent to a prevailing display, the edge of the display is touched on the desired side. By so doing, the map display can be realized.

(Map inversion)

A displayed map can be inverted by touching a bearing display on it. That is, a map displayed with the north shown upward is inverted to one with the north shown downward.

(Display Switching during Running)

A map display which is too detailed can not be seen during running. Accordingly, during display a substitute display showing main roads only is provided by automatic switching. When the vehicle is parked, the detailed map display is restored.

(Features of this Structural Example)

This example is a map call-out system for a navigation system for calling out and displaying maps concerning call subjects specified according to input information, and it features that it comprises memory means for storing map data, map call-out means for calling out map data about a call subject from the memory means, and map display means for displaying the called map, the map call-out means calling out map data of a scale suited to the display according to kind of map call-out subject, the display means displaying the call-out subject map in a scale corresponding to the subject.

Thus, in this example of a map call-out system, suited map scales are stored in the memory means in correspondence to the kinds of call-out subjects. Thus, when displaying a map corresponding to a destination in destination setting or the like, the map can be displayed in a scale suited to the subject. For example, in the case of a golfing place, a scale which permits display of the

whole golfing place is set. In the case of a private house, a scale which permits sufficient specification of the private house is set. It is thus possible to avoid such a situation that it becomes impossible to obtain correct destination setting due to unnecessary operation made in map display for destination setting or similar purposes.

Alternatively, it is preferable to carry out the foregoing embodiment as described below.

(1) A relationship between items to be retrieved and map scales is stored in the form of a table. A desired map scale will be determined with reference to this table.

The table shown in Fig. 15 facilitates prompt determination of a map scale in accordance with an input item such as a name or a category of an item to be retrieved.

(2) The table covers names of destinations and a relationship between these names and map scales.

Once a destination is designated, a map thereof can be displayed on the basis of the foregoing relationship.

(3) The table also contains information on longitudes and latitudes of destinations. This information facilitates selection of a map to be displayed. For instance, if the destination is a golf course, an appropriate map scale will be selected such that the golf course is entirely displayed with its center present at the center of the screen.

The map data cover a plurality of map scales. Map data will be retrieved in accordance with a map scale read from the table.

(4) The table is stored in the memory for the map data. Thus, the map scales can be read similarly to the map data.

(5) Alternatively, the table may be stored in a memory separate from that for the map data. For instance, the table may be stored in a ROM of the ECU. This enables quick retrieval of the map scale.

A reaction area in a display can be enlarged from one directly above a switch display in the operator's eyesight direction. Specifically, the operator's position is determined from the driver's position or the like, and when the display is looked at to the right and upward, for instance, the reaction area is enlarged to the right and downward of a switch on the front side in the eyesight direction. Thus, operability can be improved in both cases when the display is looked at obliquely and directly from the front.

Claims

1. A display touch type input system for inputting information by detecting touching of a switch part of a display, comprising:
 - a display means for displaying a switch image in a switch display area;

a touch panel provided above the display means and having a number of reaction points, the touching of the reaction points by the operator being detected;

and switch operation detecting means for setting an area covering certain ones of the reaction switches, the touching of the area being judged to be the touching of a corresponding switch displayed on the display means;

the switch operation detecting means being capable of setting a reaction area by enlarging a switch display area, in which a switch image is displayed, in the direction of the eyesight of the operator.

2. The system according to claim 1, wherein:
 - the switch operation detecting means includes a computer unit for performing arithmetic operations and detecting the touching of a switch from an instruction of the display of the switch on the display means and the result of detection of touching of to the touch panel.
3. The system according to claim 2, wherein:
 - the computer unit compares a reaction area corresponding to a switch display area and a touched reaction point and judges the switch that has been touched by enlarging the reaction area when it is found as the result of comparison that a meaningless reaction point outside the reaction area has been touched.
4. The system according to claim 1, wherein:
 - the switch operation detecting means changes the size of a reaction area to be enlarged in the operator's eyesight direction on the side of an adjacent switch in the eyesight direction according to the distance between the reaction area and the adjacent switch.
5. A display touch type input system for a vehicle, said system being mounted in the vehicle and detecting information by detecting the touching of a switch part of a display, comprising:
 - a display means for displaying images of a normal switch operable at all times and a parking time operable switch, the operation of which is prohibited during running of the vehicle, in respective switch display areas;
 - a touch panel provided above the display means and having a number of reaction points, the touching of the reaction points by the operator being detected;
 - switch operation detecting means for setting an area covering certain ones of the reaction switches, the touching of the area being judged to be the touching of a corresponding switch displayed on the display means, the touching of the switch being detected from the result of detection of the

touching of the touch panel; and
 running condition detecting means for detecting vehicle running conditions;

the switch operation detecting means enlarging the reaction area corresponding to the normally operable switch toward the parking time operable switch in the running state of the vehicle when the parking time operable switch is displayed adjacent to the normally operable switch.

6. A display touch type input system for a vehicle, said system being mounted in the vehicle and inputting information by detecting the touching of a switch part of a display, comprising:

a display means for displaying images of a normally operable switch and a parking time operable switch, the operation of which is prohibited during running of the vehicle, in respective switch display areas;

a touch panel provided above the display means and having a number of reaction points, the touching of the reaction points by the operator being detected;

switch operation detecting means for setting an area covering certain ones of the reaction points, the touching of said area being judged to be the touching of a corresponding switch displayed on the display means, the touching of the switch being detected from the result of detection of the touching of the touch panel; and

running condition detecting means for detecting vehicle running conditions;

the switch operation detecting means setting reaction points in an area including a switch display area and enlarged in the operator's eyesight direction to be a reaction area of reaction points, the touching of which is judged to be the touching of the displayed switch, and enlarges a reaction area corresponding to a normally operable switch normally operable during running of the vehicle toward a parking time operable switch when the parking time operable switch is displayed adjacent to the normally operable switch.

7. The system according to claim 6, wherein:

the switch operation detecting means includes a computer for performing arithmetic operations and detects the touching of a switch from an instruction of display of a switch on the display means and the result of detection of the touching of the touch panel.

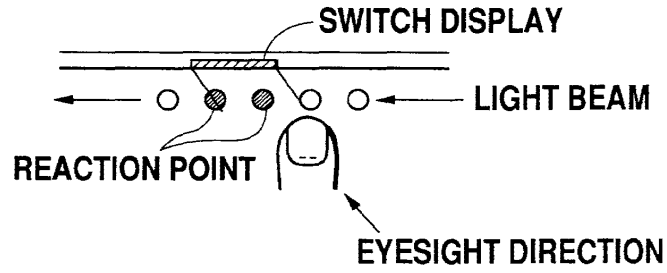
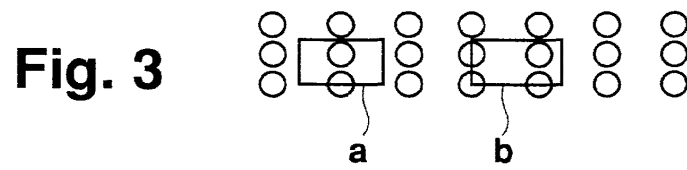
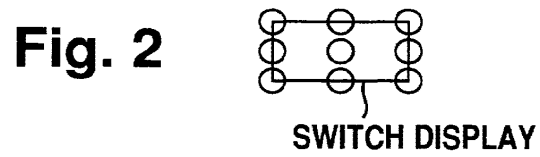
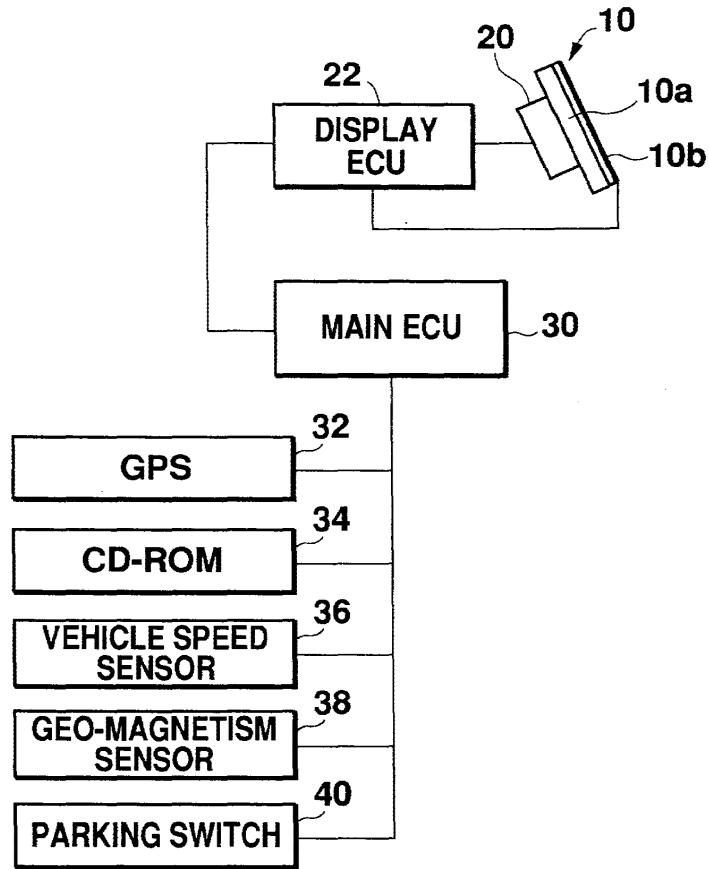


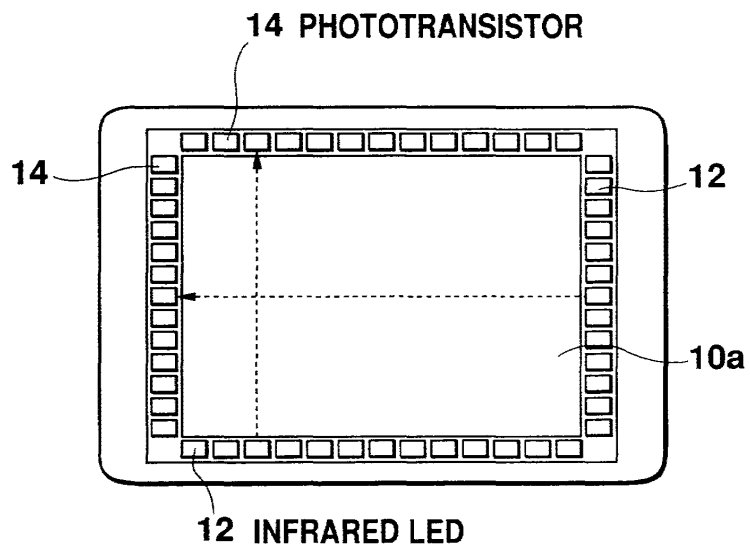
Fig. 1





OVERALL STRUCTURE OF EMBODIMENT

Fig. 4



STRUCTURE OF TOUCH PANEL

Fig. 5

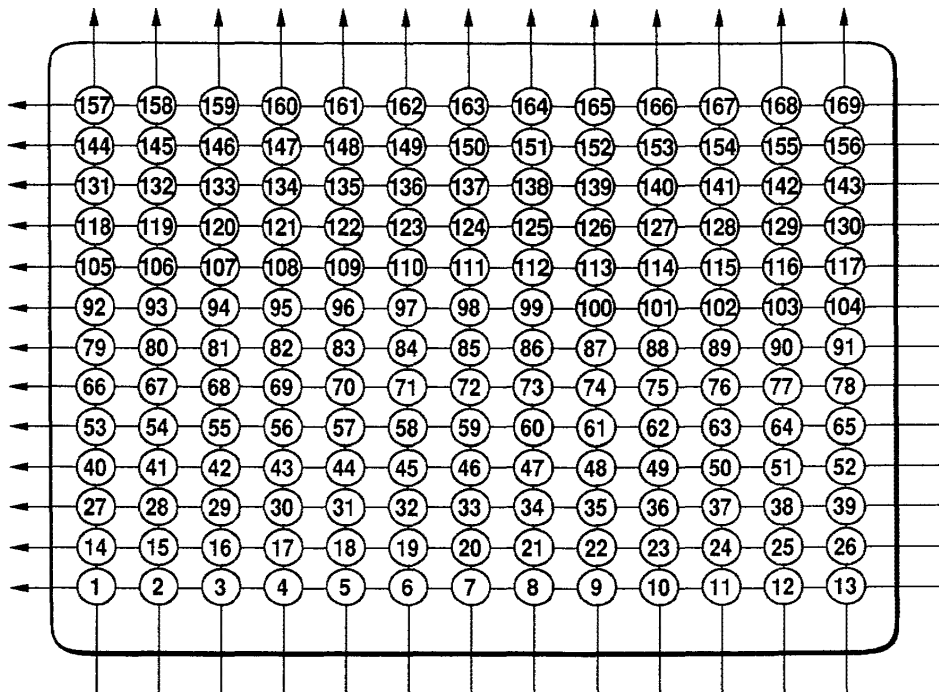


Fig. 6

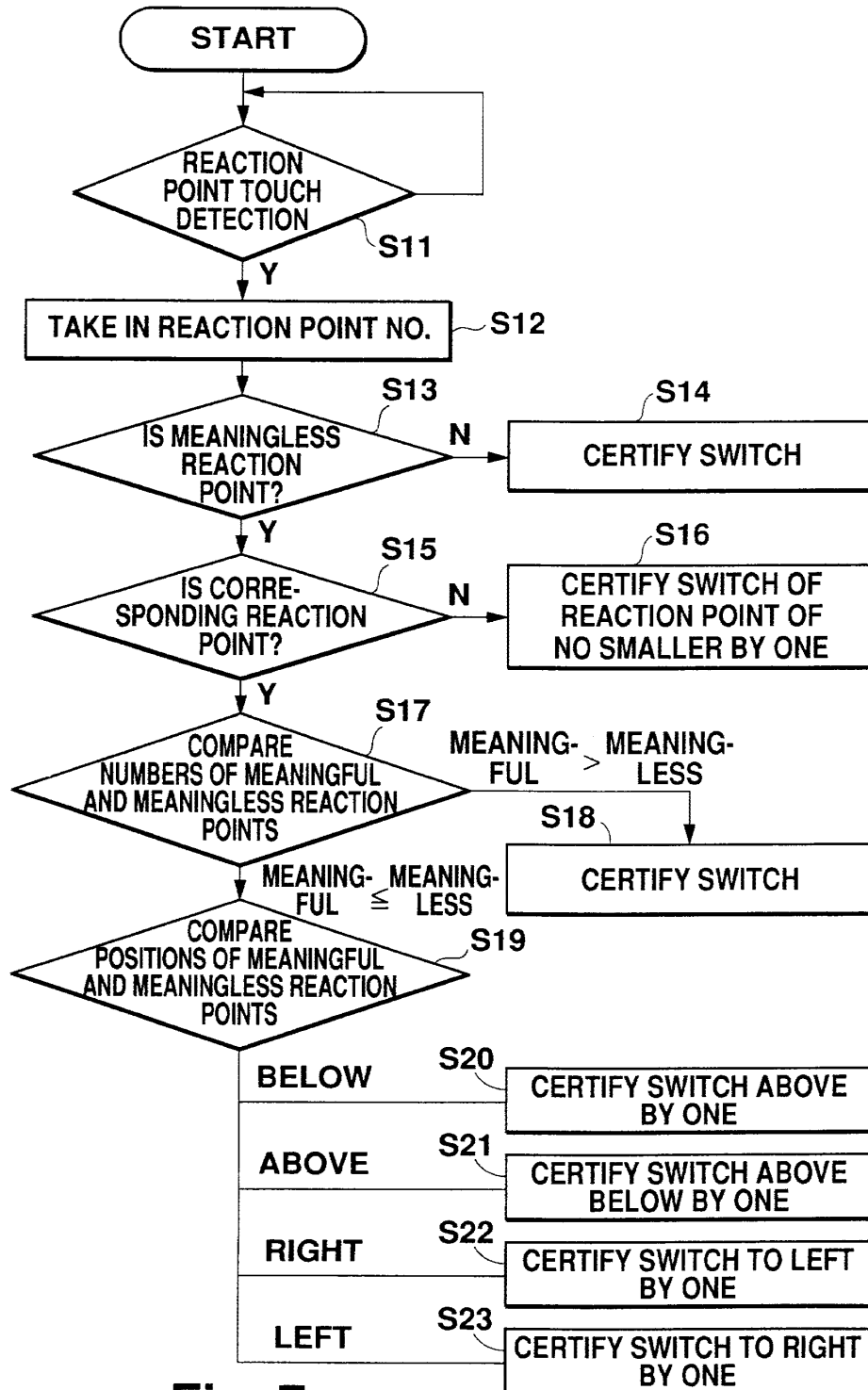


Fig. 7

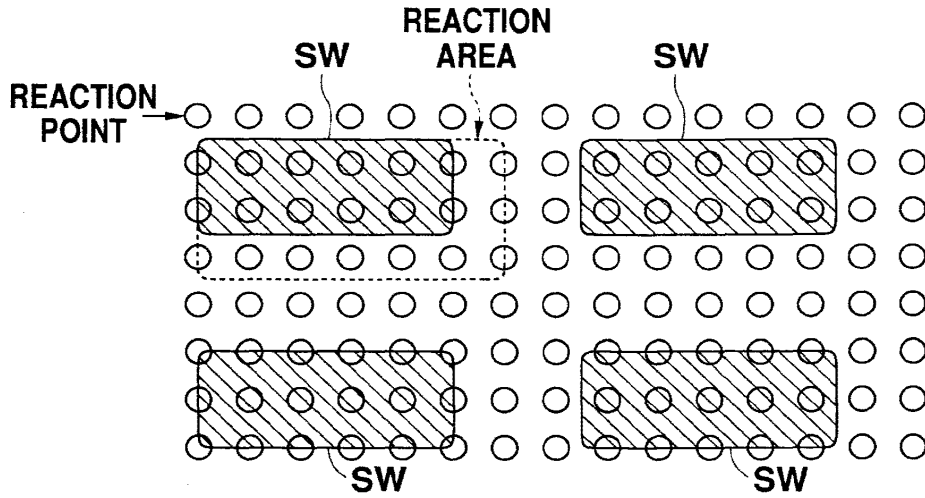


Fig. 8

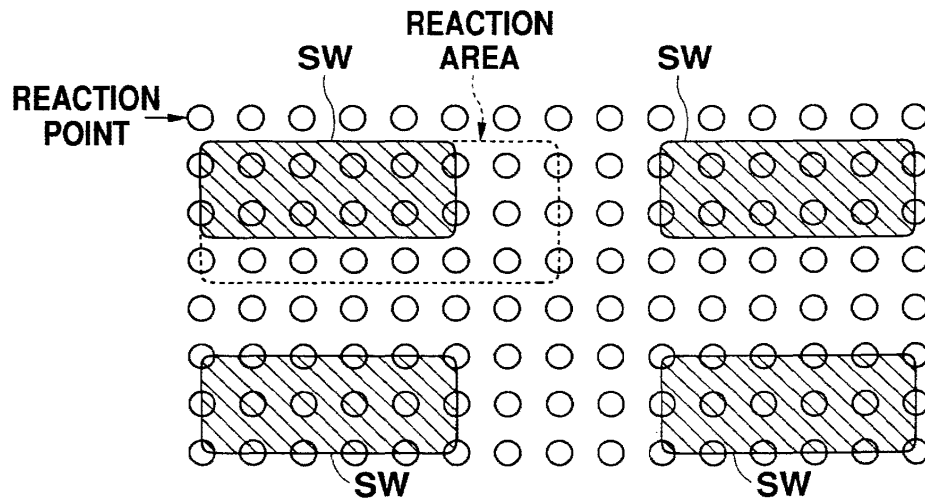


Fig. 9

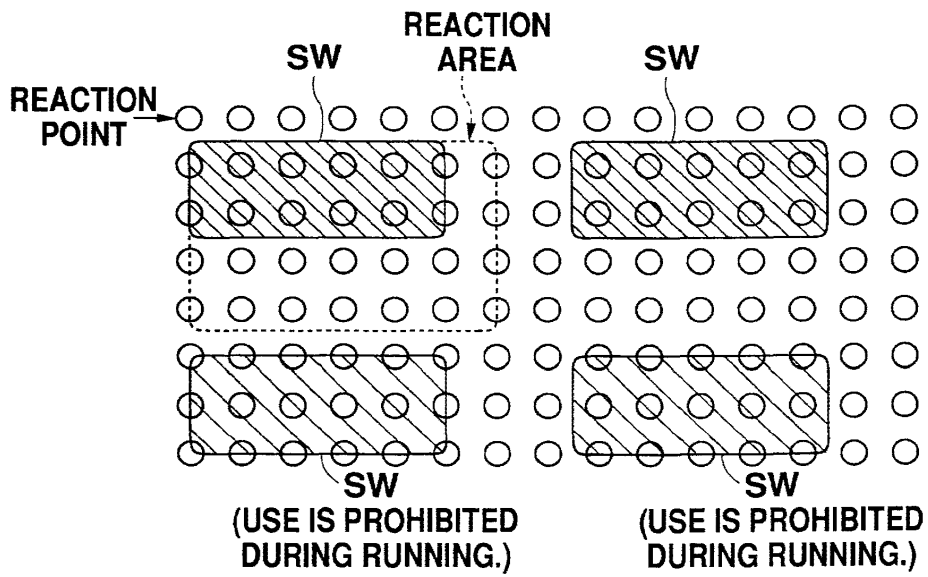
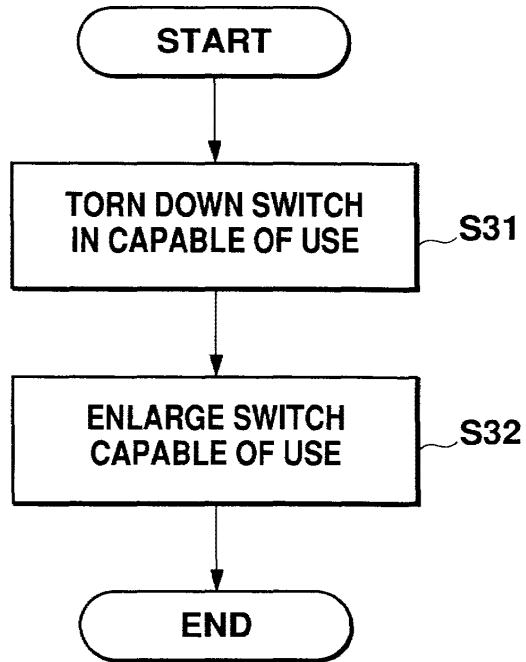


Fig. 10



PROCESS IN CASE WHEN THERE IS SWITCH INCAPABLE OF USE

Fig. 11



OPERATION EXPLANATION DISPLAY	DESTINATION SETTING	
 PLEASE TOUCH DESIRED KEY		
TELEPHONE NO.	ADDRESS	
FACILITY NAME		
GOLFING PLACE	OTHER FACILITIES	
REGISTERED POINTS		
 HOME	MEMORIZED POINT	PREVIOUS DEPARTURE POINT

Fig. 12

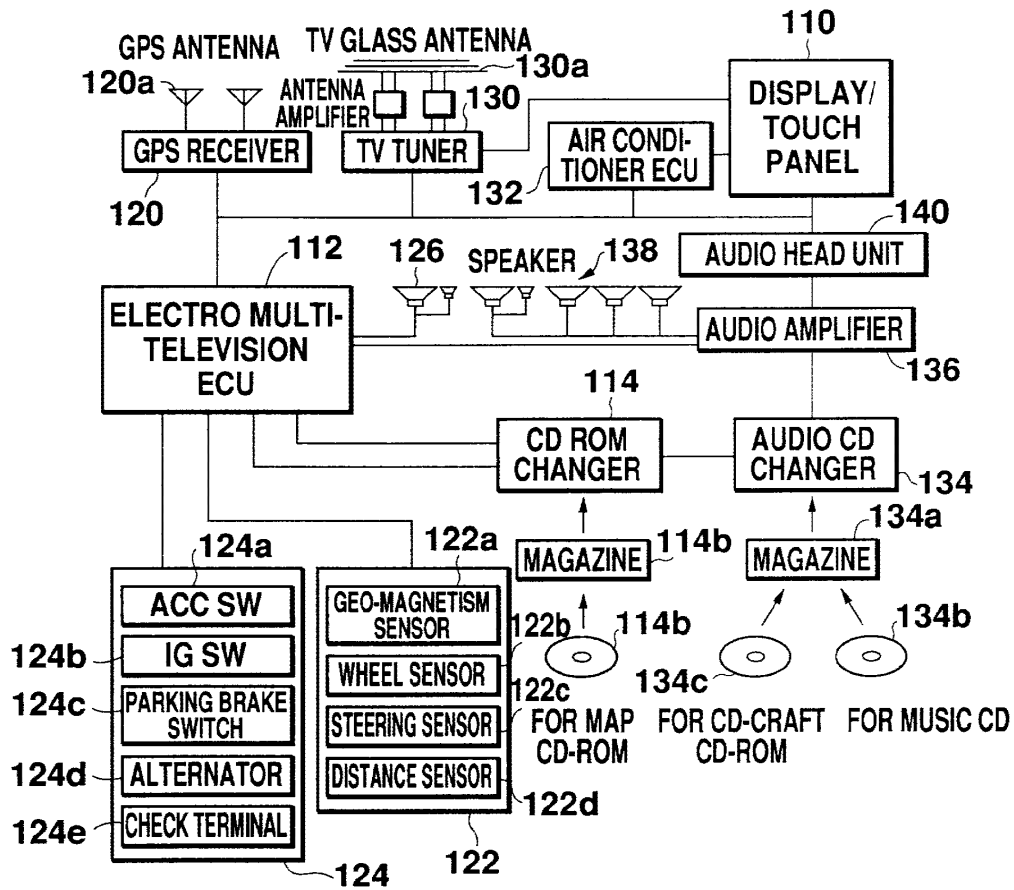


Fig. 13

OPERATION FLOW

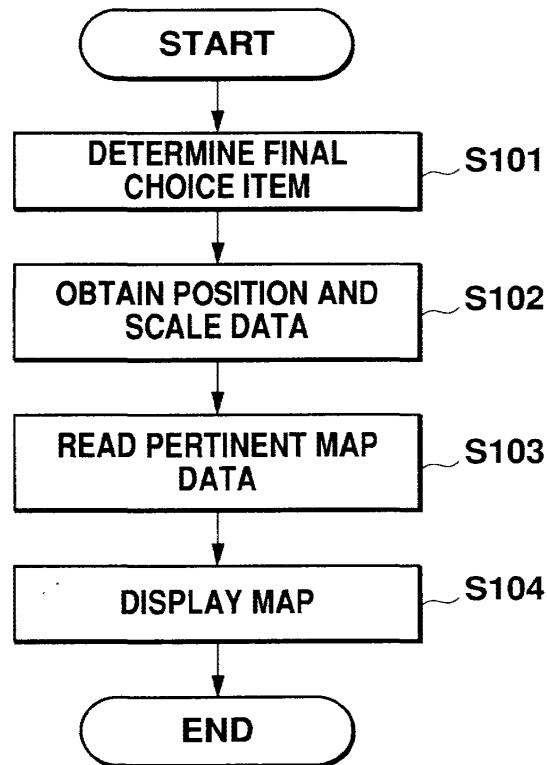


Fig. 14

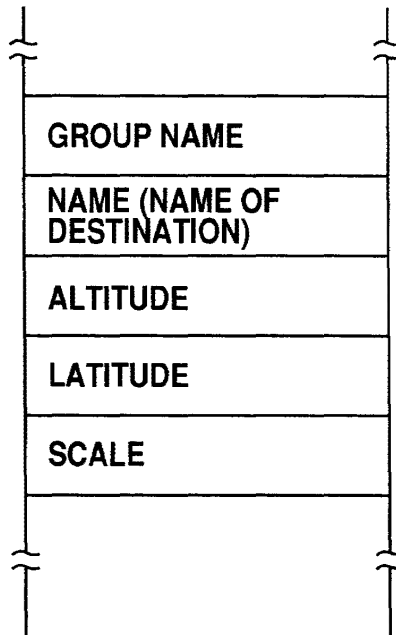


Fig. 15

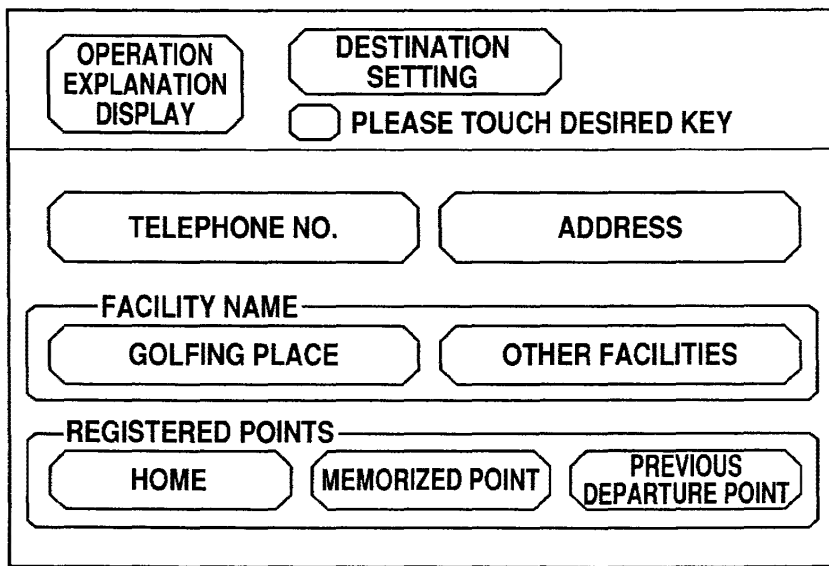


Fig. 16

FACILITY NAME		RETURN
PLEASE TOUCH DESIRED KEY		
ABUSEMENT PARK	SKI CITE	PARK
ANIMAL AND PLANT PARK	SPLING SITE	CAMPING PLACE
FAMOUS PLACE/ CASTHLE	MUSEUM	SHRINE/ TEMPLE
1/3 PAGE		NEXT

Fig. 17

AMUSEMENT PARK		RETURN
PLEASE TOUCH DESIRED KEY		
FOR- WARD	COUN- TRY	AMUSEMENT PARKS OVER THE COUNTRY
	A	AMUSEMENT PARKS IN AICHI
		AMUSEMENT PARKS IN AOMORI
		AMUSEMENT PARKS IN AKITA
NEXT	I	AMUSEMENT PARKS IN ISHIKAWA

Fig. 18

AMUSEMENT PARK		RETURN
PLEASE TOUCH DESIRED KEY		
FOR- WARD	A	SO AND SO AMUSEMENT PARK
	I	
NEXT		

Fig. 19

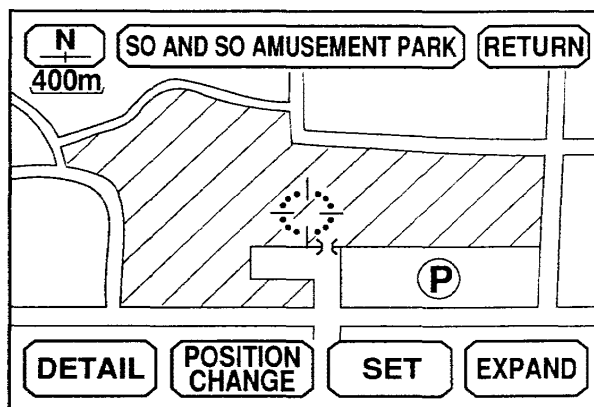


Fig. 20

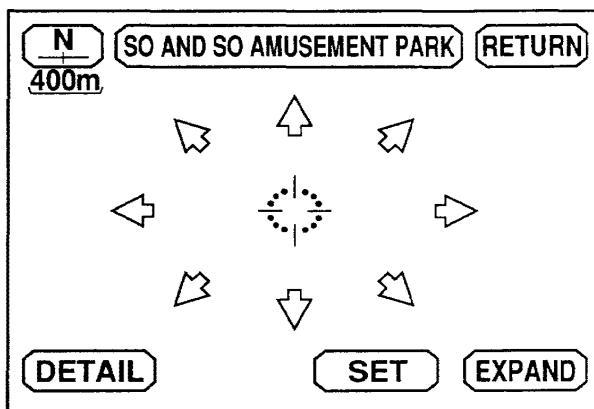


Fig. 21

CONFIRM SEARCH CONDITION		RETURN
PLEASE TOUCH DESIRED KEY		
PASSING POINT		
<input checked="" type="checkbox"/>	DESIGNATE	<input type="checkbox"/> NOT
TOLL ROAD		
<input checked="" type="checkbox"/>	GIVE PREFERENCE	<input type="checkbox"/> NOT
<input checked="" type="checkbox"/>	BLACK SQUARE MARK SHOWS WHAT HAS BEEN SET	START SEARCH

Fig. 22

SET PASSING POINT		RETURN
PLEASE TOUCH DESIRED KEY		
TELEPHONE NO.	ADDRESS	
FACILITY NAME		
GOLFING PLACE	OTHER FACILITIES	
REGISTERED POINT		
MEMORIZED POINT		

Fig. 23

CONFIRM SEARCH CONDITION		RETURN
PLEASE TOUCH DESIRED KEY		
PASSING POINT		
<input checked="" type="checkbox"/>	DESIGNATE	<input type="checkbox"/> NOT
TOLL ROAD		
UP TO PAS- SING POINT	<input checked="" type="checkbox"/> GIVE PREFERENCE	<input type="checkbox"/> NOT
FROM PAS- SING POINT	<input checked="" type="checkbox"/> GIVE PREFERENCE	<input type="checkbox"/> NOT
<input checked="" type="checkbox"/>	BLACK RECTANGULAR MARK SHOWS WHAT HAS BEEN SET	START SEARCH

Fig. 24

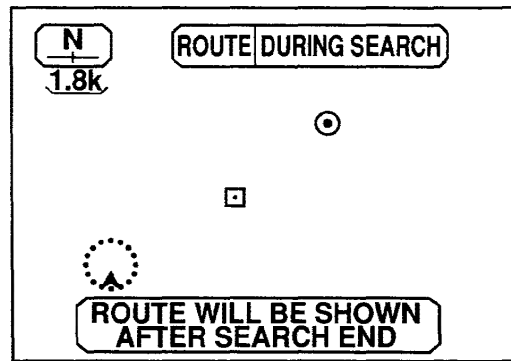


Fig. 25

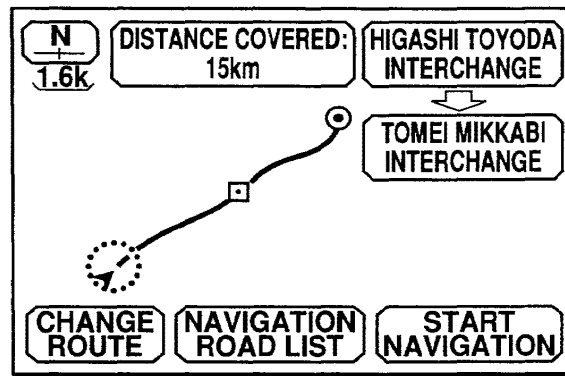


Fig. 26

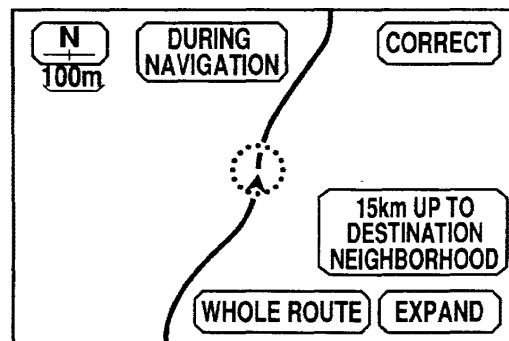


Fig. 27

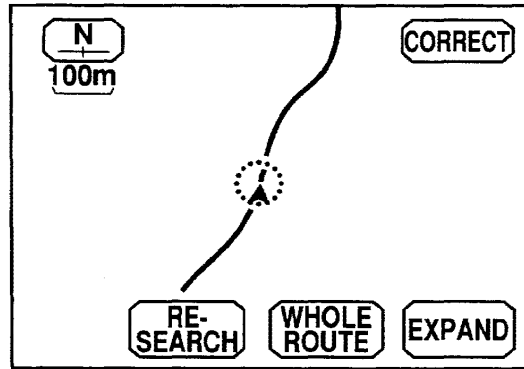


Fig. 28

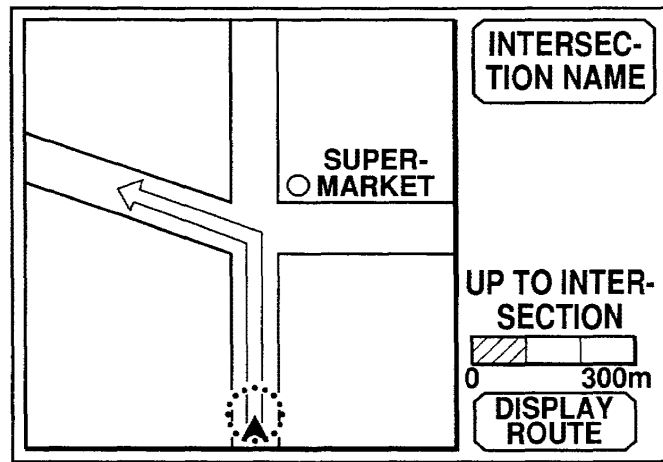


Fig. 29

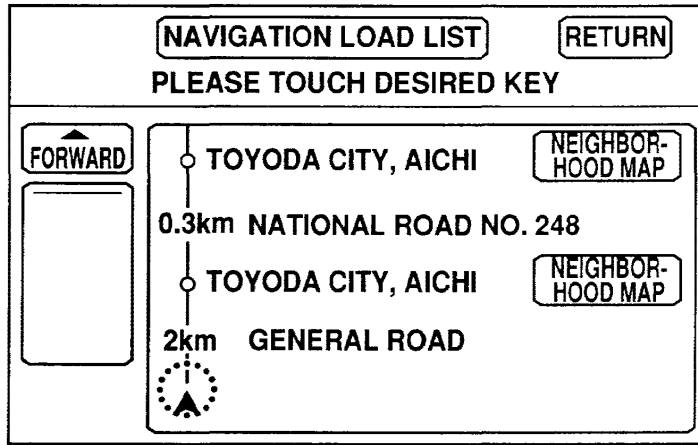


Fig. 30

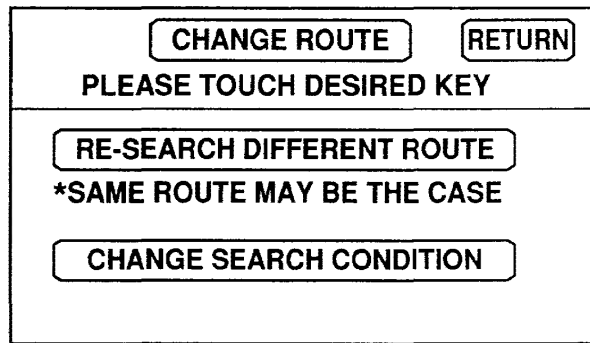


Fig. 31

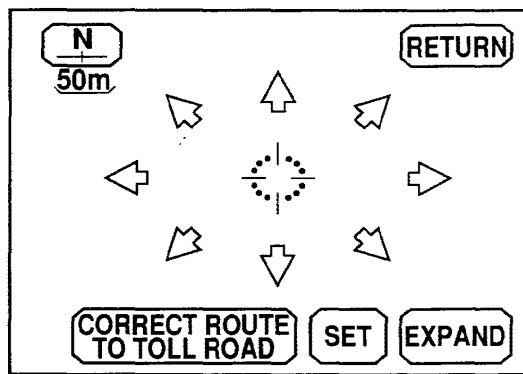


Fig. 32

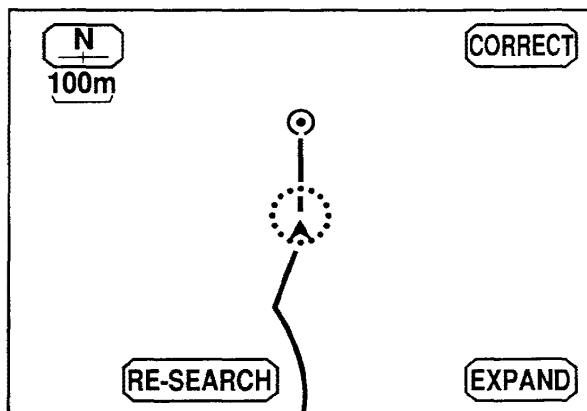


Fig. 33



European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 95 11 4749

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	IBM TECHNICAL DISCLOSURE BULLETIN, vol. 33, no. 10a, March 1991 NEW YORK US, pages 223-227, XP 000110024 'ALGORITHM FOR DECREASING THE ERROR RATE OF DATA ENTERED ON A TOUCH-SENSITIVE TERMINAL' * the whole document * ---	1, 2, 5-7	G06F3/033 G07C1/30
A	EP-A-0 476 972 (XEROX CORP) 25 March 1992 * column 8, line 48 - column 9, line 15; figure 10 * ---	1, 2, 5-7	
A	EP-A-0 171 365 (BE BO CAR TRONIC SRL) 12 February 1986 * page 4, line 18 - page 5, line 31 * ---	5-7	
A	DE-A-40 33 832 (MITSUBISHI ELECTRIC CORP) 27 June 1991 * column 6, line 44 - column 7, line 10 * -----	5, 6	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			G06F G07C
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 8 January 1996	Examiner Bailas, A
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background Q : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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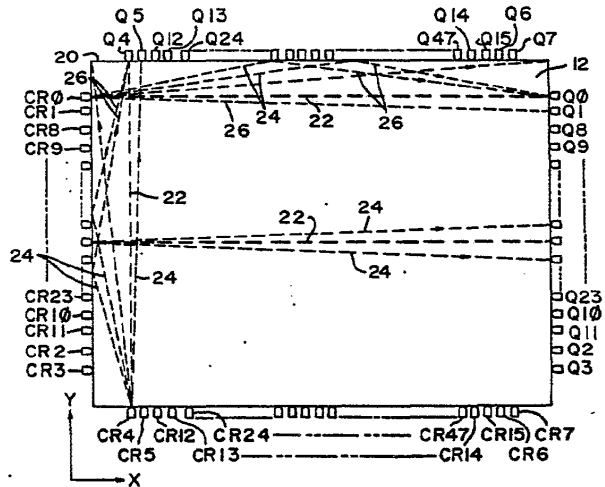
INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<p>(51) International Patent Classification⁴ : G06K 11/06</p>	<p>A1</p>	<p>(11) International Publication Number: WO 86/ 00446 (43) International Publication Date: 16 January 1986 (16.01.86)</p>
<p>(21) International Application Number: PCT/US85/00922 (22) International Filing Date: 20 May 1985 (20.05.85) (31) Priority Application Numbers: 621,575 621,586 (32) Priority Dates: 18 June 1984 (18.06.84) 18 June 1984 (18.06.84) (33) Priority Country: US (71) Applicant: AMP INCORPORATED [US/US]; P.O. Box 3608, Harrisburg, PA 17105 (US). (72) Inventors: LUCAS, Paul, Barkley ; 1504 Rutledge Drive, Urbana, IL 61801 (US). GARRETT, James, Edward ; 715 South Prairie Street, Champaign, IL 61820 (US).</p>	<p>(74) Agents: SEITCHIK, Jay, L. et al.; AMP Incorporated, P.O. Box 3608, Harrisburg, PA 17105 (US). (81) Designated States: AT (European patent), BE (European patent), CH (European patent), DE (European patent), FR (European patent), GB (European patent), IT (European patent), JP, KR, LU (European patent), NL (European patent), SE (European patent). Published <i>With international search report.</i></p>	

(54) Title: TOUCH INPUT DEVICE

(57) Abstract

An infrared touch input system is taught. Briefly stated, the system comprises a four-sided frame having an infrared transparent bezel (20) along the inside thereof and having infrared emitters (CR) along the bottom and one side of the frame with infrared detectors (Q) along the sides opposite the emitters. Darlington transistor arrays (U3, U4, U8, U9) are used as source and sink drivers for driving the LED's in an array. The I/O lines of a microprocessor are used in conjunction with the source and sink drivers to selectively energize each LED. Additional I/O lines (PB0-PB5, PC0-PC2) of the microprocessor in conjunction with BCD decoders are used to selectively energize corresponding infrared detecting phototransistors (Q) before, during and after LED turn-on. A host computer supplies a clocking signal for the microprocessor with programming in the microprocessor thereby automatically performing the selection and de-selection of emitters and detectors. A serial data stream (DATA) is outputted from the microprocessor which indicates to the host computer the location of any broken light beams (22) thereby indicating a stylus (18) hit. Further, the optical power used with emitter-detector pairs (CR0-CR7, Q0-Q7) adjacent the corners of the bezel (20) is reduced with respect to emitter-detector pairs approaching the center of the bezel. In this manner, light which is reflected (26) after striking the side of the bezel adjacent the emitter-detector pair and which is received by the emitter is of low intensity or is ignored.



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TOUCH INPUT DEVICE

The present invention is related to material disclosed in the following concurrently filed, copending U.S. patent application, which is assigned to the same assignee as the present invention,
5 given Serial No. 621,585, "Touch Input Device Having Digital Ambient Light Sampling" filed June 18, 1984.

The invention relates, generally, to a touch input device and, more particularly, to an opto-matrix frame having automatic corner glare compensation.

10 Coincident with the use of video displays has always been the problem of the man/machine interface. Traditionally, control of displayed information or cursors has been via a keyboard. Recently, however, a number of devices have been introduced which allow an operator to directly interact with the video
15 display. These types of devices have included light pens, desk-type mouse controllers, or touch input devices such as a switch matrix or opto-electronic matrices. While generally switch-type overlays which are placed adjacent a video display are inexpensive to apply and utilize, they are generally
20 susceptible to contact wear as well as distortion of the video information which is presented to the viewer, particularly in high usage environments. However, since opto-matrix schemes utilize light, which is generally in the infrared region, the switch matrix presented by the light beams is invisible to the
25 viewer and, therefore, does not distort the video information displayed to the viewer and is not subject to wear in high usage environments. A number of schemes which utilize opto-matrix frames may be found in U.S. Patent No. 4,267,443 "Photoelectric Input Apparatus", issued May 12, 1981 to Carroll et al; U.S.
30 Patent No. 4,243,879 "Touch Panel with Ambient Light Sampling", issued January 6, 1981 to Carroll et al; and U.S. Patent No. 3,764,813 "Coordinate Detection System", issued October 9, 1973 to Clement et al. These three schemes address problems inherent with opto-matrix devices such as increasing
35 frame resolution without a corresponding increase in components.

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surrounding or ambient light compensation, or optimization of emitter/detector driving and detecting networks respectively. These systems still have drawbacks in some areas such as large component usage thereby resulting in higher costs, ambient light sensing which is based on a predetermined value rather than dynamically, and difficulty in compensating for reflection or glare which may result in styli hits not being recorded.

Glare problems generally occur when an emitter is adjacent the corner of the frame or bezel such that light produced by the emitter bounces off an adjacent surface and is then detected by the detector such that any stylus which is introduced to the video display inherently blocks the majority of the light received by the detector but the reflectant light is sufficiently high for the detector and its associated circuitry to not perceive a hit. Accordingly, it is desirable to have a device which minimizes the number of components necessary for addressing and detecting emitters and detectors. Further, it is also desirable to have a device which dynamically compensates for ambient light and for variations in emitter output and detector sensitivity. Also, it is desirable to have a device which minimizes glare problems. Such a scheme is taught in the present invention.

It is a principal object of the invention to provide a touch input device for detecting at least one passive styli, comprising an opto-matrix frame having a plurality of optical emitters and oppositely positioned optical detectors disposed in the opto-matrix frame and having an optically transparent bezel adjacent thereto, characterized in that the plurality of optical emitters are electrically interconnected in a matrix such that the anodes form one side of the matrix and the cathodes form the other side of the matrix, the plurality of optical detectors are electrically interconnected in a matrix such that the anodes or the like form one side of the matrix and the cathodes or the like form the other side of said matrix, a first driving device is connected to the optical emitters for selectively energizing at least one emitter at a time, a first decoding or selecting device

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is connected to the optical detectors for selectively energizing at least one detector at a time, wherein the optical power of at least one emitter and/or sensitivity of at least one detector disposed adjacent corners of the optically transparent bezel is decreased with respect to the remainder of the emitters and detectors thereby minimizing the effects of reflected radiant energy while a microcomputer is interconnected to the first and second driving devices so as to sequentially energize the first and second driving devices, wherein the microcomputer produces a data output signal which corresponds to the presence or absence of radiant energy received by one of the optical detectors coincident with the presence or absence of the passive styli.

Reference is now made to the accompanying drawings in which:

FIGURE 1 is a representative view of an operator utilizing a video display;

FIGURES 2, 3 and 4 form a complete schematic diagram for use in conjunction with the touch input entry device of the present invention;

FIGURE 5 is a representational view of glare produced by the frame surrounding the opto-matrix devices as well as a numbering assignment of the emitters and detectors of the present invention;

FIGURES 6 through 11 are flow chart diagrams for use with the preferred embodiment of the present invention; and

FIGURE 12 is a timing diagram of the data output for use with the present invention.

Referring now to Figure 1, there is illustrated a representative view of an operator utilizing a video display. Shown is a CRT 10 having a display area 12 and which generally interacts with a keypad or keyboard 14. An operator 16 interacts with the display area 12 through the use of the stylus 18, which in the preferred embodiment of the present invention, is the finger of the operator thereby presenting a truly

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touch-type interactive system. It is to be understood, however, that other types of styli can and may be used without departing from the spirit and scope of the present invention such as, for example, pencils, pointers, or other similar types of apparatus.

5 While the keypad 14 is shown, it is one of the primary objects of the present invention to utilize the keypad 14 as little as possible, if at all, with the operator 16 utilizing the stylus 18 for direct interaction with the CRT. A touch input area is generally defined by what the operator 16 sees in the display

10 area 12. In the preferred embodiment of the present invention, this touch area utilizes emitters which are disposed on the bottom and one side of the display with detectors located on the top and opposite side thereby forming an infrared light beam matrix (shown more clearly in Figure 5). The light beams (not

15 shown) shine through the bezel 20 which is disposed around the edge of the CRT 10 and which, in the preferred embodiment of the present invention, is opaque to visible light but transparent to infrared light. It is to be understood, however, that other types of bezels which exhibit different types of light

20 transmission properties may be utilized.

Referring now to Figures 2, 3 and 4, there is illustrated a schematic for the present invention. A list of the major component designations and functions is shown in Table I below.

TABLE I

<u>Component Number</u>	<u>Component Type</u>
U1	Schmidt Trigger Inverter
U2	Microprocessor
U3, U4, U8, U9	Darlington Transistor Array
U5, U6, U7	BCD-to-Decimal Decoder
CR0-CR47	Light Emitting Diodes (Emitters)
Q0-Q47	Phototransistors (Detectors)

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Also shown is a microprocessor U2 which, in the preferred embodiment of the present invention, is an 8-bit microcomputer having on-board analog-to-digital converter as well as RAM and ROM, and is an HMOS device preferably of the 6800 family of microcomputers produced by companies such a Motorola of Austin, Texas. It is to be understood, however, that other types of microcomputers can be utilized which may be CMOS or NMOS and which have been produced by other manufacturers having different bit-byte configurations such as 16 or 32-bit bytes. These machines like the preferred 6800 family architecture are readily known and available to one skilled in the art. The design of the present invention does not require the use of all features and pins attendant to the U2 microprocessor and therefore only those utilized will be discussed and are shown. The Vcc terminal is connected to Vcc power which, in the preferred embodiment of the present invention, is +5 Volts and is also connected to terminal Vpp. Vcc supplies operating power to most of the microprocessor U2 while Vpp supplies the programming voltage for the ROM memory in the microprocessor U2 which, in the preferred embodiment of the present invention, is EPROM, although it is to be understood that masked versions of the microprocessor may be utilized with the result that Vpp is no longer necessary. The XTAL and EXTAL terminals have a crystal disposed therebetween with the EXTAL terminal having one terminal of capacitor C2 connected thereto with the remaining terminal of capacitor C2 connected to Ground (Gnd). This thereby provides a stabilized clock frequency for the entire system of the present invention. The RESET terminal is connected to one terminal of capacitor C3 with the remaining terminal of capacitor C3 also connected to Gnd. Terminal PC5, which is an I/O pin, is connected to the interrupt terminal INT and is connected to the output of the A inverter of device U1 which is a Schmidt-type trigger inverter with the input to inverter A of component U1 being connected to one terminal of R1 and one terminal of R2 as well as to the clock terminal which

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is thereafter provided by a host computer (not shown). The remaining terminals of R1 and R2 are connected to Vcc and Gnd respectively. The I/O pin PC7 is connected to the input of the B inverter of device U1 with the output of the B inverter of device U1 being a data output terminal which is also connected to a host computer (not shown). Also shown on Figure 2 is capacitor C1 which acts as a filtering capacitor and is connected such that one terminal is attached to the +5 or Vcc bus with the other terminal attached to the Gnd bus. Port B I/O lines PB0, PB1, PB2, PB3, PB4, PB5 and PB7 provide coding and decoding for the emitters and detectors of the present invention as shown more clearly in Figures 3 and 4. Pin Vrh is a voltage reference high pin which provides the high voltage reference for the analog/digital conversion portion of the microprocessor U2. The Vrl pin is a voltage reference low pin which provides the low reference voltage for the analog-to-digital portion of the microprocessor U2. Port C terminals PC0, PC1, PC2, PC3 and PC4 are I/O pins which interconnect with the coding and decoding of the emitter/detector array as shown more clearly in Figures 3 and 4. Analog-to-digital terminals AN0, AN1, AN2 and AN3 are interconnected with the detection circuitry as shown more clearly in Figure 4. The Vss terminal of the microprocessor U2 is connected to Gnd, while I/O pin PD6 is connected to one terminal of resistor R6. The remaining terminal of resistor R6 is connected to Vcc.

Referring now to Figure 3, the emitter portion of the present invention is shown. The PB0 line is connected to one terminal of resistor B of resistor network R3 as well as to the base terminal of one of the Darlington transistor pairs of component U3, a Darlington transistor array, while I/O line PB1 is connected to resistor A of resistor network R3 which is in turn connected to the base of another Darlington transistor pair of component U3. Similarly, I/O lines PB2, PB3, PB4 and PB5 are connected to resistors F, E, D and C respectively of resistor network R3 as well as to a base terminal of the Darlington

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transistor pair contained in component U4, also a Darlington transistor array. The remaining terminals of resistors A, B, C, D, E and F of resistor network R3 are tied together and thereafter to Vcc. The Vrh line is connected to one terminal of resistors R4 and R5 with the remaining terminals of resistors R4 and R5 being connected to Vcc and Gnd respectively. The I/O line PB7 is connected to the D input of component U5 which is a binary coded decimal (BCD) to decimal decoder while PC0, PC1 and PC2 (supplied by component U1, not shown) are connected to the A, B and C inputs respectively of decoder U5. The collector terminal associated with the Darlington transistor pair for I/O line PB0 is connected to one terminal of resistor R10 while the collector terminal associated with the Darlington pair for I/O line PB1 is connected to one terminal of resistor R9. The remaining terminals of resistor R9 and R10 are thereafter connected to each other and to one terminal of resistor R8 and capacitor C4 as well as to all four of the collector terminals associated with the Darlington transistor array U4. The remaining terminal of resistor R8 is connected to Vcc while the remaining terminal of capacitor C4 is connected to Gnd. The SUB terminals of Darlington transistor arrays U3 and U4 are connected to Gnd. The emitter terminal of the Darlington transistor pair associated with I/O line PB0 of component U3 is connected to the anode of emitters CR0, CR1, CR2, CR3, CR4, CR5, CR6 and CR7 while similarly the emitter of component U3 which is associated with the I/O line PB1 is connected to the anode of emitters CR8 through CR15. The emitters in the preferred embodiment of the present invention are infrared light emitting diodes although it is to be understood that other types of emitters can and may be utilized without departing from the spirit and scope of the present invention. Similarly, the emitter terminals associated with I/O lines PB2, PB3, PB4 and PB5 of Darlington transistor array U4 are connected to the anodes of emitters CR16-23, CR24-31, CR32-39 and CR40-47 respectively. The cathodes of emitters CR7, CR15, CR23, CR31, CR39 and

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CR47 are connected to the collector terminal of one of the Darlington transistor pairs of U8 which is also a Darlington transistor array with the base terminal associated with this Darlington transistor pair being connected to terminal 7 of U5, a BCD-to-decimal decoder. Similarly, the cathodes of emitters CR6, CR14, CR22, CR30, CR38 and CR46 are connected to the collector terminal of another Darlington transistor pair of component U8 with the base terminal associated therewith being connected to output pin 6 of decoder U5. The cathodes of emitters CR5, CR13, CR21, CR29, CR37, and CR45 are connected to the collector terminal of a Darlington transistor pair of component U8 with the base terminal associated therewith being connected to pin 5 of decoder U5. The cathode terminals of emitters CR4, CR12, CR20, CR28, CR36 and CR44 are connected to the collector terminal of another Darlington transistor pair of array U8 with the base terminal associated therewith being connected to output pin 4 of decoder U5. The cathodes of emitters CR3, CR11, CR19, CR27, CR35 and CR43 are connected to the collector terminal of a Darlington transistor pair from component U9 which is another Darlington transistor array with the base terminal associated therewith being connected to output pin 3 of decoder U3. The cathodes of emitters CR2, CR10, CR18, CR26, CR34 and CR42 are similarly connected to a collector terminal of another Darlington transistor pair of array U9 with the base terminal associated therewith being connected to terminal 2 of decoder U5. The cathodes of emitters CR1, CR9, CR17, CR25, CR33 and CR41 are connected to the collector terminal of another Darlington transistor pair of array U9 with the base terminal associated therewith being connected to output pin 1 of decoder U5. The cathodes of emitters CR0, CR8, CR16, CR24, CR32 and CR40 are connected to the collector of another Darlington transistor pair contained in array U9 with the base terminal associated therewith being connected to output pin 0 of decoder U5. The emitter terminals and SUB terminals of array U8 are connected together and

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thereafter to Gnd while, similarly, the emitter and SUB terminals of array U9 are also connected together and thereafter to Gnd. Accordingly, through the use of arrays U3, U4, U8 and U9, the emitters CR0 through CR47 are connected so as to form a matrix (the operation of which will be described more fully below).

Referring now to Figure 4, there is shown the detection and decoding circuitry associated with the detectors of the present invention. The I/O line PC0 is connected to the input of inverter C of component U1 while, similarly, I/O lines PC1 and PC2 are connected to the input of inverters D and E of component U1. This thereby produces PC0, PC1 and PC2 which is connected to terminals A, B and C respectively of decoder U5 (previously mentioned) as well as to terminals A, B and C respectively of binary coded decimal-to-decimal decoders U6 and U7. Port C I/O line PC3 is connected to the D terminal of decoder U7 while I/O terminal PC4 is connected to the D terminal of decoder U6. Analog-to-digital I/O line AN0 is connected to one terminal of the A resistors of transistor arrays R6 and R7 and thereafter to the collector terminals of the phototransistors or detectors Q0, Q1, Q2, Q3, Q4, Q5, Q6, Q7 and Q16, Q17, Q18, Q19, Q20, Q21, Q22, Q23. Digital I/O line AN1 is similarly connected to one terminal of the B resistors of resistor networks R6 and R7 and thereafter connected to the collectors of detectors Q8 through Q15 and Q24 through Q31. The digital I/O line AN2 is connected to one terminal of the C resistors of resistor networks R6 and R7 and thereafter to the collectors of the detectors Q32 through Q39. Similarly, the I/O line AN3 is connected to one terminal of the D resistors of the resistor networks R6 and R7 and thereafter to the collectors of detectors Q40 through Q47. The remaining terminals of resistors A, B, C and D of R6 are connected together and thereafter to Vcc while the remaining terminals of resistors A, B, C and D of resistor network R7 are similarly connected together and thereafter to Gnd. The output pin 0 of decoder U7 is connected to the emitter terminals of detectors Q0 and Q8 while similarly the

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paired emitter terminals of detectors Q1 and Q9, Q2 and Q10, Q3 and Q11, Q4 and Q12, Q5 and Q13, Q6 and Q14, Q7 and Q15 are connected together and thereafter to terminals 1, 2, 3, 4, 5, 6 and 7 respectively of decoder U7. Additionally, the emitters of detectors Q16 and Q24 and Q32 and Q40 are connected together thereafter being connected to terminal 0 of decoder U6 while, similarly, the four emitters from detectors Q17 and Q25 and Q33 and Q41, Q18 and Q26 and Q34 and Q42, Q19 and Q27 and Q35 and Q43, Q20 and Q28 and Q36 and Q44, Q21 and Q29 and Q37 and Q45, Q22 and Q30 and Q38 and Q46, Q23 and Q31 and Q39 and Q47 are connected together and thereafter to terminals 1, 2, 3, 4, 5, 6 and 7 respectively of decoder U6. This thereby creates a matrixing scheme similar to that of the detectors of Figure 3.

Referring now to Figure 5 there is illustrated a diagrammatic representation of an opto-matrix frame and bezel. Shown are emitters CR0 through CR47 and detectors Q0 through Q47 which comprise a 16x32 matrix with 16 emitters and detectors in the Y or vertical direction and 32 emitters and detectors in the X or horizontal direction. It is to be understood that although not shown the emitters and detectors are fixedly mounted on a printed circuit board or the like for properly holding and aligning an emitter/detector pair. Also diagrammatically illustrated is the light pattern produced by an emitter and which is received by a detector. Each emitter when energized, from a diagrammatic standpoint, can be said to produce a principal light beam pattern shown generally at 22 with non-collimated light 24 dispersing further and further apart, the more distant the detector is from the emitter. This therefore causes detectors adjacent the light received by the principal light beam 22 to register some light and which must be compensated for as will be discussed more fully below. Further, when emitters such as CR0 and CR4 are adjacent the corner and thereby the bezel 20, non-collimated light 24 will have a tendency to bounce off the bezel 20. This bounced light

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produces a reflected beam shown generally at 26 with the result that some of the reflected beams 26 are received by the detector which is the object of the principal light beam 22. Therefore, should a stylus be introduced into the display area 12 and which does in fact block the principal light beam 22, some non-collimated light 24 via the reflected beams 26 is received by an associated detector such as Q0 with the result that, under certain light conditions, sufficient light is received by the detector such that a hit by a stylus is not registered as such. This problem of reflected light or glare becomes less and less prevalent as the detectors towards the center of the CRT are utilized. Due to manufacturing efficiencies, the same detectors and emitters are utilized near the corners of the bezel 20 as near the center. Accordingly it has been found that, by reducing the power and thereby light output for four emitters adjacent each corner of the bezel 20, the power of the reflected beams is reduced to an acceptable non-error-producing level. Accordingly, by reducing the power to emitters CR0, CR1, CR2, CR3, CR4, CR5, CR6, and CR7 to one level of reduced power and reducing power to emitters CR8, CR9, CR10, CR11, CR12, CR13, CR14 and CR15 to a second level of power, light output may be decreased adjacent the corners of the bezel for the first two emitters, slightly increased for the next two emitters and is at full power for the rest of the opto-matrix frame. It is to be understood, however, that more or less numbers of emitters may be given reduced power or that the detectors may similarly be treated without departing from the spirit and scope of the present invention.

Referring now to Figures 2, 3 and 4, the overall electrical operation of the present invention will be discussed. It is to be remembered that the present invention interacts with a host computer (not shown) which allows a CRT to present information over a video display area 12 which is part of an interactive relationship between the operator 16 and a program or operation such that the opto-matrix touch input screen designates operator

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5 decisions to the host computer. It is submitted that the host computer and the programs used with it are within the scope of one skilled in the art and therefore are not discussed in detail below. The host computer introduces a clock signal to the clock terminal of Figure 1, which is received by the C port I/O line PC5 and the interrupt terminal of the microprocessor U2. This clock stream produced by the host computer continues for as long as input from the opto-matrix frame may be desired with the result that upon the absence of a clock signal, an interrupt is initiated in the microprocessor U2. Accordingly, upon appropriate power up and the presence of clock signals to the microprocessor U2, the opto-matrix device begins a scan-type of sequence which causes the LED's to be fired, phototransistors to be read, and internal analysis of the information by appropriate software. Since the operation of the present device is cyclical in nature, a signal cycle will be discussed by way of example, although it is to be understood that the remainder of the devices perform in the same manner.

10 Upon power up of the microprocessor U2, a main program loop is initiated in software (Figures 6 through 11). It is submitted that the flow chart diagrams illustrated in Figures 6 through 11 taken together with the description of the preferred embodiment herewith are sufficient so as to enable one skilled in the art to write the appropriate software. This starts with the initialization of the pointers at 100, which thereby begins the X and Y beam count at a known start point of zero. Thereafter, the microprocessor waits for a preset number of synchronizing clock pulses at 110 which are received from the host computer thereby insuring complete synchronization between the microcomputer U2 and the host computer. An X phototransistor at 120 is then turned on which would be Q4 (Figure 5) as the start of the initial cycle in the present example. This turning on of the phototransistor allows the transistor to settle down or stabilize. This is accomplished by selecting the appropriate address for I/O lines PC0, PC1 and PC2 which are presented to

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decoder U7 which is then enabled by I/O line PC3 which thereby allows current to flow through Q4. The LED CR4 is then fired by energization of I/O line PB0 in conjunction with the address presented by PC0, PC1 and PC2 along with the enabling I/O line
5 PB7 which thereby enables line 4 of decoder U5. This firing of the X LED CR4 at 130 also takes into account a wait period so as to insure that the LED CR4 is completely turned on. Further, for LED's CR0 through CR7 a current-limiting resistor R10 is utilized in conjunction with the Darlington transistor array U3
10 (used as a source driver) which allows current to flow through emitter CR0 through CR7 at a decreased brightness. Similarly, for emitters CR8 through CR15, a second current-limiting resistor R9 is also utilized so as to diminish the light output of the associated emitters. The value of R9 is preferably one-half
15 of R10 thereby firing the two emitters adjacent each corner of the bezel 20 (Figure 5) at a brightness which is slightly less than the next two adjacent emitters. The remainder of the emitters which are driven by Darlington transistor array U4 do not utilize such current-limiting resistors since full brightness or
20 maximum optical power output is desirable. In this manner, and as previously mentioned, a power profiling is accomplished such that for example, emitters CR0 and 1 have a reduced optical output power which thereby reduces the reflected beams 26 with
25 CR8 and 9 having a slightly greater optical power but still less than the remainder of the emitters not adjacent the corners of the bezel 20. Resistor array R3 is provided as a pull up resistor network to insure that each emitter has minimum proper power for firing. Accordingly, when CR4 is fired, current is caused to flow through the emitter of the lower Darlington
30 transistor pair of array U3 which thereby drives a collector of Darlington transistor array U8 (used as a sink driver) such that the emitter is actively driven and the Darlington transistor array U8 and U9 are actively driven. After the LED CR4 is completely turned on a conversion is started at 140 which in this example
35 dictates that analog-to-digital line AN0 takes the value produced

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by Q4 and starts to convert this value to a digital number. This digital number is determined by a reference value which is controlled by the reference divider of Vrh contained on the microprocessor U2 with all signal voltages being ratiometrically converted relative to this reference. It has been determined that this Vrh reference value should be set to Vq where Vq is the maximum voltage input and corresponds to a deselected phototransistor or to a selected phototransistor with an extremely low ambient light level. Resistor networks R6 and R7 determine the Vq maximum reference level. During the digital conversion process at 140, the LED CR4 is turned off at 150 with the digital conversion then completed and read and stored in the microprocessor at 160. With the LED CR4 off, another reading is taken of the phototransistor Q4 which results in a ambient light reading at 170 which is then started to be converted to a digital number at 180. Thereafter a count check is utilized at 190 to determine if there are any more Y's or Y phototransistors to interrogate. This is done since X and Y phototransistors are sampled alternately and since there are less devices in the Y direction than the X, for the purpose of expeditious processing, when the maximum number of Y devices have been sampled, the remainder of the X devices are sampled starting at 440 and described more fully below.. Accordingly, in the present example there are more Y phototransistors to be sampled with the result that Y phototransistor Q0 is turned on at 200. Thereafter at 210 the ambient conversion of the X phototransistor Q4 which was read at 170 is completed with the ambient value subtracted out at 220. This therefore compares the read converted value at 160, which is the fired LED CR4 value, with the read ambient value at 170 where CR4 was off, subtracting the two and determining at 230 whether phototransistor Q4 is saturated. If Q4 is not saturated which would tend to indicate that a hit is present or something is blocking light from detector Q4 then a NO condition exists at 240 which is presented at 260. A comparison is then made which

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compares the value presented with a previously calculated and stored threshold level from 320 or 330 to determine whether the light beam is to be considered as broken or non-broken at 280 and 290 respectively. If the light beam was non-broken then a new threshold is calculated at 320. In the presence of a broken condition, a flag representing (in the present example) X4 broken is presented at 340. The new threshold and flag condition at 320 and 340 are thereafter presented as data at 350. Alternately, at 230 if a saturated condition exists, this is presented at 250 as a YES condition which is then given to 270 which is compared against a predetermined fixed minimum threshold value. If this value is less than the fixed minimum number, it is at 300 then considered as a broken flag condition which is presented to 340 and thereafter to 350. If the comparison at 270 determines that the difference is greater than or equal to a present threshold level, this is presented via 310 to 330 which calculates a new threshold level (for use at 260) which is in turn presented to 350 as a non-broken or non-hit condition. The new threshold value is computed at 320 or 330 and used by 260 as the threshold for comparison purposes. Accordingly, in this manner a continuous and dynamic sampling of ambient light is utilized and taken into account. Further, device degradation which generally occurs over a considerable period of time and which results in decreased sensitivity by the phototransistor or decreased light output by the emitter is automatically taken into account since, within predetermined absolute minimums and maximums, new thresholds are continuously calculated and utilized.

Processing of the Y axes is then started at 360 in a manner very similar to that of the X axes. This results in the Y LED CR0 being fired for a sufficiently long duration of time at 370 to insure complete LED turn-on with a digital conversion of Q0 started at 380. This conversion at 380 is possible since the Y sensor Q4 was turned on at 200. This seemingly early sampling of Q0 is done since the crystal which determines the frequency

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at which the microprocessor U2 runs is substantially greater than the clock rate or the data output rate (discussed below). Thereafter LED CR0 is turned off at 390 with the value received by Q0 read when the conversion is complete at 400. Upon
5 completion of the conversion the ambient value of Q0 is determined at 410 with the conversion to a digital number started at 420. Immediately after the start of the digital conversion at 420, the next X sensor which is Q5 is turned on at 450. During the Q5 turn on period the ambient converted value Q0 is read
10 when completed at 460 with the ambient value being subtracted out from the value determined during the firing of LED CR0 at 470. This value is then presented to 480 to determine whether detector Q0 is saturated at 480 with a NO or YES condition being presented to 490 or 500 respectively. Similarly, minimum
15 thresholds are analyzed at 510 and 520. After the comparison at 510, a broken or non-broken condition is determined at 530 and 540 with a broken Y0 flag broken indication at 590 if a broken condition does exist or a new threshold being calculated at 570 if a non-broken condition exists. Again the flag condition and new
20 threshold from 590 and 570 respectively are used to supply Y0 data at 600. The comparison made at 520 is presented by 550 as a flag at 590 if a less than minimum threshold condition exists or at 560 if a new threshold is to be calculated at 580. Thereafter, the new threshold level is calculated at 580 with this value and a
25 non-broken condition supplied to 600. At this point a processing of an X coordinate emitter/detector pair is initiated at 610 and presented as 620 to begin again at block 130 which fires the next X LED CR5 with a repetition of the processing as mentioned for Figures 6 through 9. In this manner, toggling is
30 accomplished between the X and Y axes until at box 190 it is determined that there are no more Y's to be interrogated which is then presented as a jump via 440 to box 625 which thereafter turns on the 17th X axis phototransistor, Q36. X axis LED CR36 is then fired at 630 with the process then continuing in a
35 manner substantially identical to the previously discussed X and

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Y axes processing. Thereafter at box 830 the X data is presented at 840 to 110 with the process then repeating as long as the host computer continues to send out a clock signal.

It is to be remembered that during this entire time frame the host computer upon receiving a synchronization signal from microprocessor U2 in a data stream (described more fully below) is required to know in advance the size of the touch input matrix and to keep track of the data stream so as to know which X and Y pair status is being given.

Accordingly, at 350, 600 and 830 data which represents an X or Y broken or non-broken status condition is presented onto the data line. Therefore, referring now to Figure 12 there can be seen a timing and data scheme for the present invention. Upon initialization and synchronization at 110 of Figure 6 four continuous ones are placed onto the data line for the host computer to receive. This thereby lets the host computer know that a synchronization frame has occurred and that the host computer should now start to count. Thereafter, the data is presented in 4-bit bytes with the first two bits always being zero and the third and fourth bits indicating broken or non-broken conditions for the X and Y axes respectively. If a broken condition does exist, then a 1 is placed onto the data line and if an unbroken condition exists, then a 0 is utilized. As an example, should a hit occur at the intersection of CR0 and CR4 and since these are the first X and Y pairs interrogated, the first 4-bit byte of data after synchronization will read (0011). However, had a hit occurred at the intersection of CR0 and CR5, then the first 4-bit byte would have contained (0001) and the second 4-bit byte would have contained (0010). For those frames where no Y axis detector is being interrogated, a 0 is preferably inserted as a false bit although a 1 may also be utilized. This 4-bit byte data stream is continued until all the X detectors have been interrogated with the microprocessor U2 sending out the 4-bit sync cycle at the end of the interrogation thereby indicating a new cycle or frame. Additionally, the

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present device will allow for beam averaging, the disclosure of which may be found in U.S. Patent No. 4,267,443 "Photoelectric Input Apparatus", issued May 12, 1981 to Carroll et al, incorporated by reference herein, and which allows for a stylus
5 between two emitters to be registered as a hit between two beams thereby effectively doubling the resolution or interpolation of the present system to a 32x64 matrix.

It is to be remembered that many variations of the present invention may be accomplished without departing from the spirit
10 and scope of the present invention. For example, power profiling resistors may be placed on individual emitters or detectors or at the decoders rather than at the Darlington transistor arrays without departing from the spirit and scope of the present invention. Further, the program could be utilized
15 in a different sequence without departing from the spirit and scope of the present invention. Also, other data streams may be utilized such as parallel output using additional I/O lines which are available or different types of serial data streams. Additionally, different types of arrays other than Darlington
20 transistors may be utilized while different types of decoders may be used while other types of detectors such as photodiodes may be used. It is also to be remembered that the firing or detection order of the emitters and detectors may be changed to any order desired. The present device may also be used with
25 or without a display or a CRT or with a flat panel display.

Accordingly, the present invention produces a device which accommodates for changing ambient light levels, emitter and/or
30 detector degradation and which has few components.

35

CLAIMS:

1. A touch input device having a light beam matrix consisting of an opto-matrix frame having a plurality of optical emitters (CR) and oppositely positioned optical detectors (Q) disposed in said opto-matrix frame and an optically transparent bezel (20) adjacent thereto, characterized in that:

the optical power of at least one emitter (CR0-CR7) and/or sensitivity of at least one detector (Q0-Q7) disposed adjacent corners of the optically transparent bezel (20) is decreased with respect to the remainder of the emitters and detectors thereby minimizing the effects of reflected radiant energy (26).

2. A device according to claim 1 further characterized in that the light beam matrix utilizes infrared light.

3. A device according to claim 1 further characterized in that said touch input device is disposed adjacent a cathode ray tube (12) or a flat panel display (12).

4. A touch input device for detecting at least one passive styli (18), characterized by:

a plurality of optical emitters (CR), electrically interconnected in a matrix such that the anodes form one side of the matrix and the cathodes form the other side of said matrix;

a plurality of optical detectors (Q), electrically interconnected in a matrix such that the anodes or the like form one side of the matrix and the cathodes or the like form the other side of said matrix;

first driving device (U3, U4, U8, U9) connected to the optical emitters for selectively energizing at least one emitter at a time;

first decoding or selection device (U6, U7) connected to the optical detectors for selectively energizing at least one detector at a time;

microcomputer (U2) interconnected to the first driving device and the first decoding or selection device so as to sequentially energize the first and second driving devices, wherein the microcomputer produces a data output signal (DATA)

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which corresponds to the presence or absence of radiant energy received by one of the optical detectors coincident with the presence or absence of the passive styli.

5 5. A device according to claim 4 wherein said optical emitters (CR) and optical detectors (Q) are infrared emitters and infrared detectors respectively.

6. A device according to claim 4 wherein the first driving device (U3, U4, U8, U9) are Darlington transistor arrays interconnected with the anodes or the like and cathodes or the like of the emitters.
10

7. A device according to claim 4 wherein the first decoding or selection device (U6, U7) is a BCD-to-decimal converter interconnected with the anodes or the like and cathodes or the like of the detectors.

15 8. A touch input device for detecting at least one passive styli (18), comprising:

an opto-matrix frame having a plurality of optical emitters (CR) and oppositely positioned optical detectors (Q) disposed in the opto-matrix frame and having an optically transparent bezel (20) adjacent thereto, characterized in that:
20

the plurality of optical emitters (CR) are electrically interconnected in a matrix such that the anodes form one side of the matrix and the cathodes form the other side of said matrix;

25 the plurality of optical detectors (Q) are electrically interconnected in a matrix such that the anodes or the like form one side of the matrix and the cathodes or the like form the other side of said matrix;

30 a first driving device (U3, U4, U8, U9) is connected to the optical emitters for selectively energizing at least one emitter at a time;

a first decoding or selection device (U6, U7) is connected to the optical detectors for selectively energizing at least one detector at a time;

35 the optical power of at least one emitter (CR0-CR7) and/or sensitivity of at least one detector (Q0-Q7) disposed adjacent

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corners of the optically transparent bezel is decreased with respect to the remainder of the emitters and detectors thereby minimizing the effects of reflected radiant energy (26); and

5 a microcomputer (U2) interconnected to the first driving device (U3, U4, U8, U9) and the first decoding or selection device (U6, U7) so as to sequentially energize the first and second driving devices, wherein the microcomputer produces a data output signal (DATA) which corresponds to the presence or absence of radiant energy received by one of the optical
10 detectors coincident with the presence or absence of the passive styli.

9. A device according to claim 1 wherein the optical emitters (CR) are composed of light emitting diodes and the optical detectors (Q) are composed of phototransistors.

15 10. A device according to claim 8 wherein the optical emitters (CR) are composed of light emitting diodes and the optical detectors (Q) are composed of phototransistors.

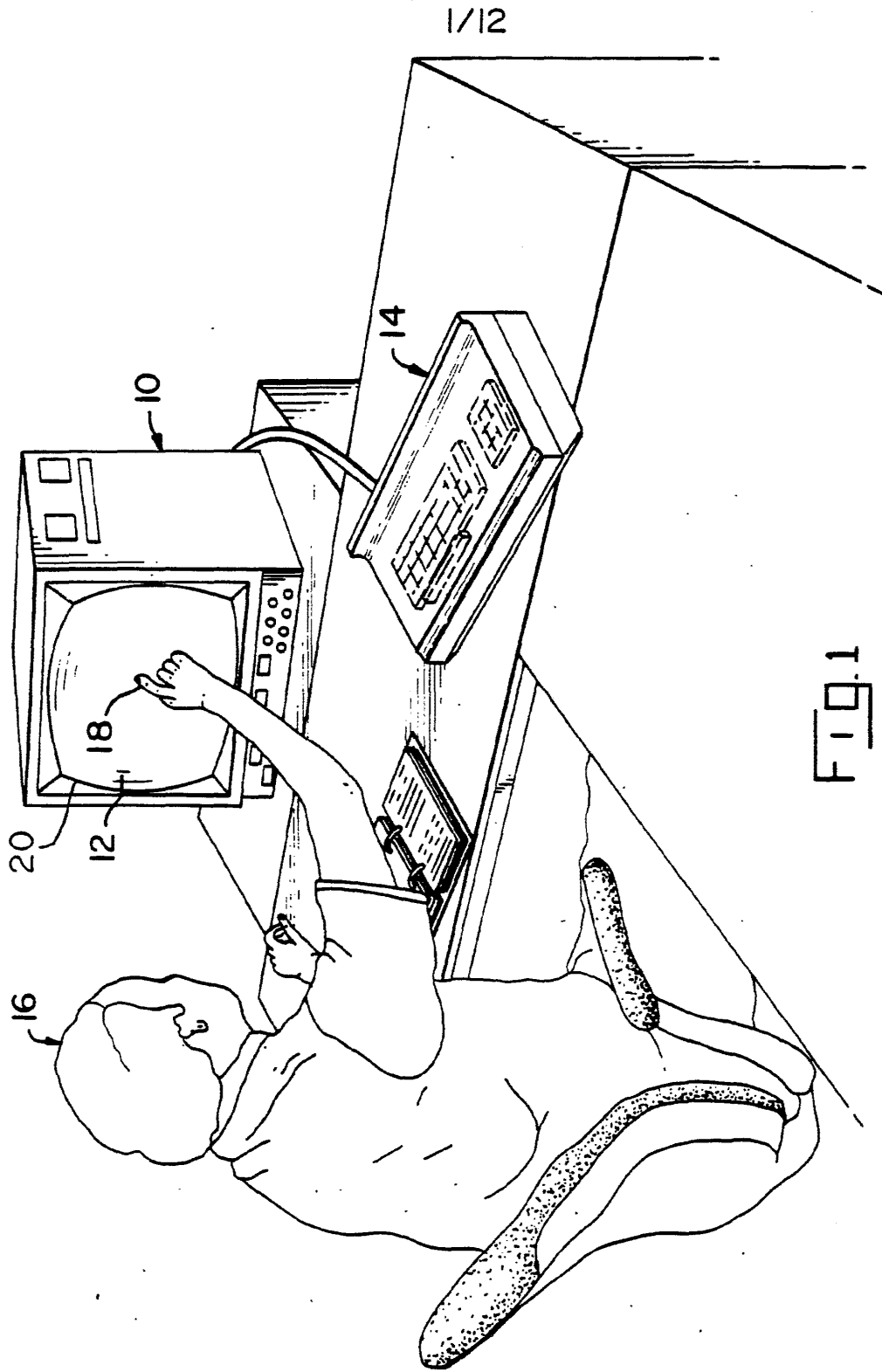
11. A device according to claim 8 wherein said optical emitters (CR) and optical detectors are infrared emitters and
20 infrared detectors respectively.

12. A device according to claim 8 wherein the first driving device (U3, U4, U8, U9) are Darlington transistor arrays interconnected with the anodes or the like and cathodes or the like of the emitters.

25 13. A device according to claim 8 wherein the first decoding or selection device (U6, U7) is a BCD-to-decimal converter interconnected with the anodes or the like and cathodes or the like of the detectors.

30

35



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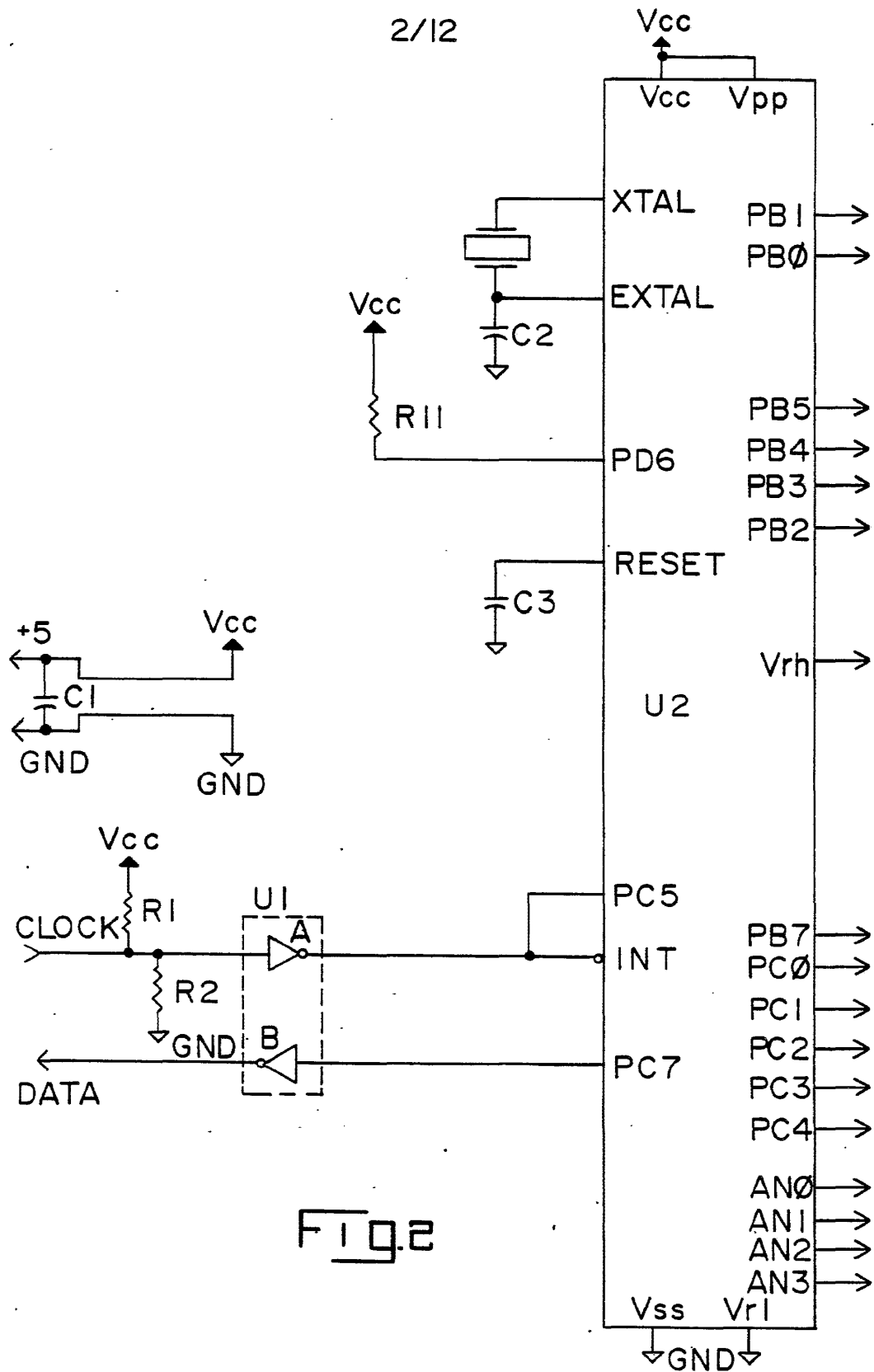


FIG. 2

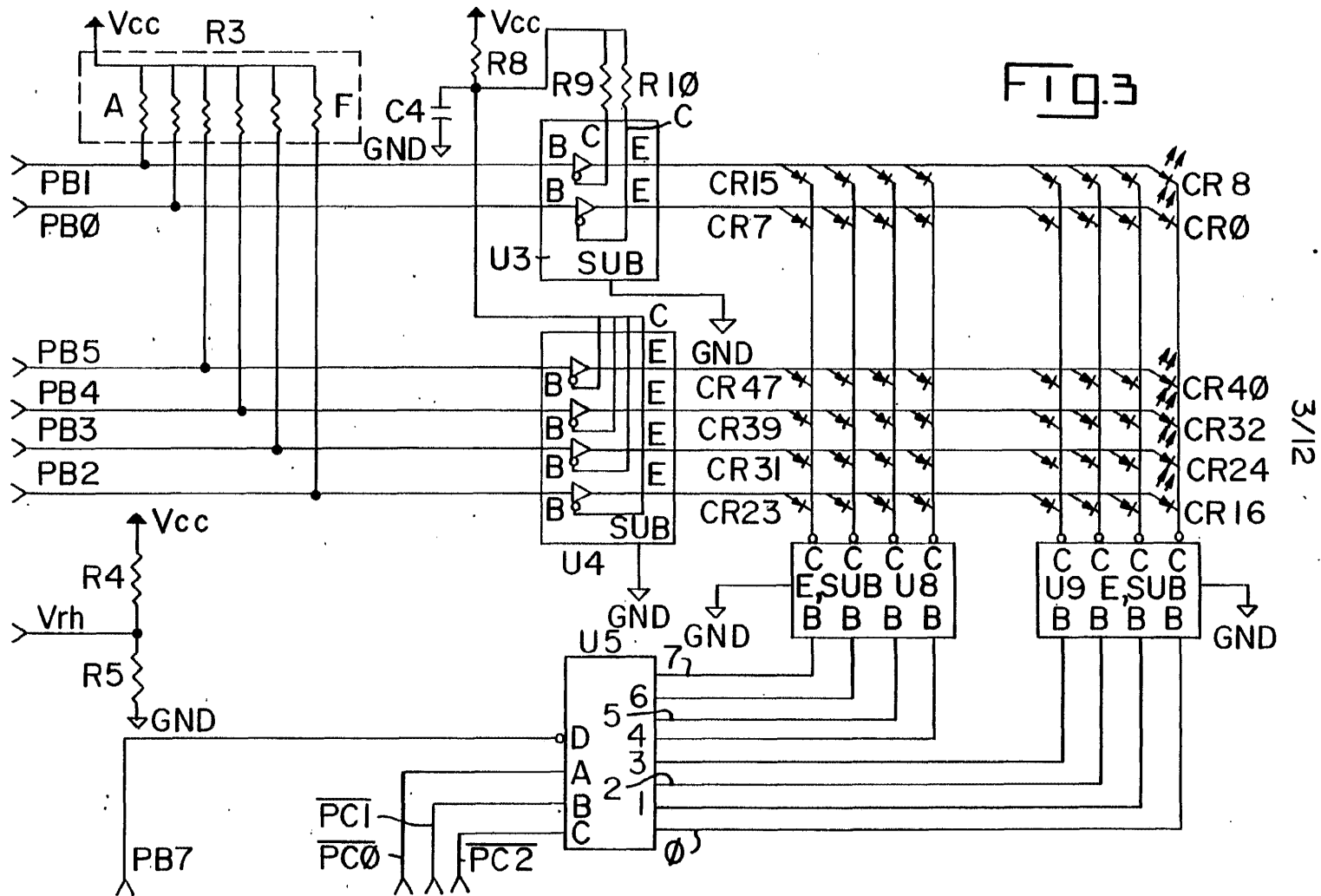


FIG. 3

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PCT/US85/00922

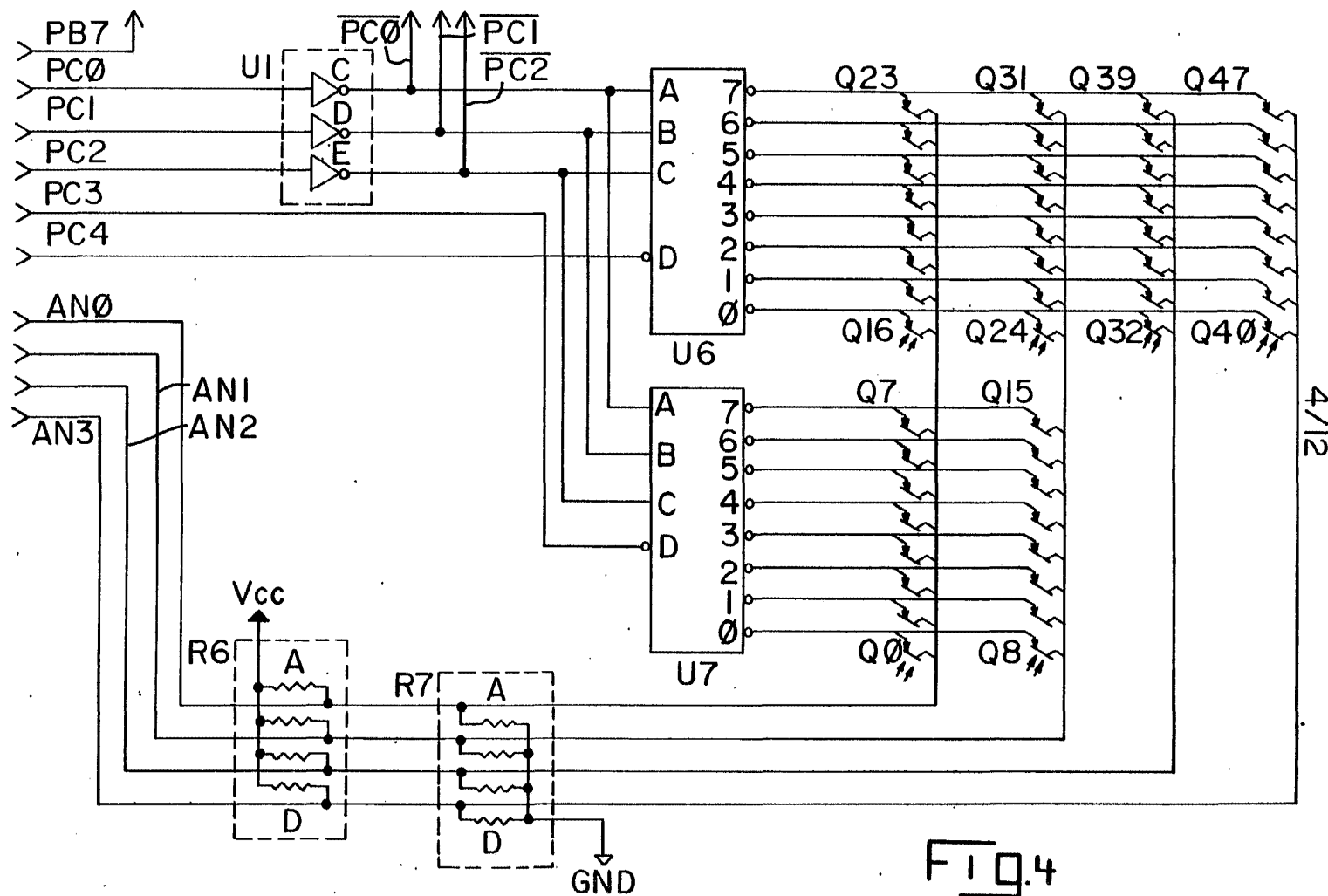
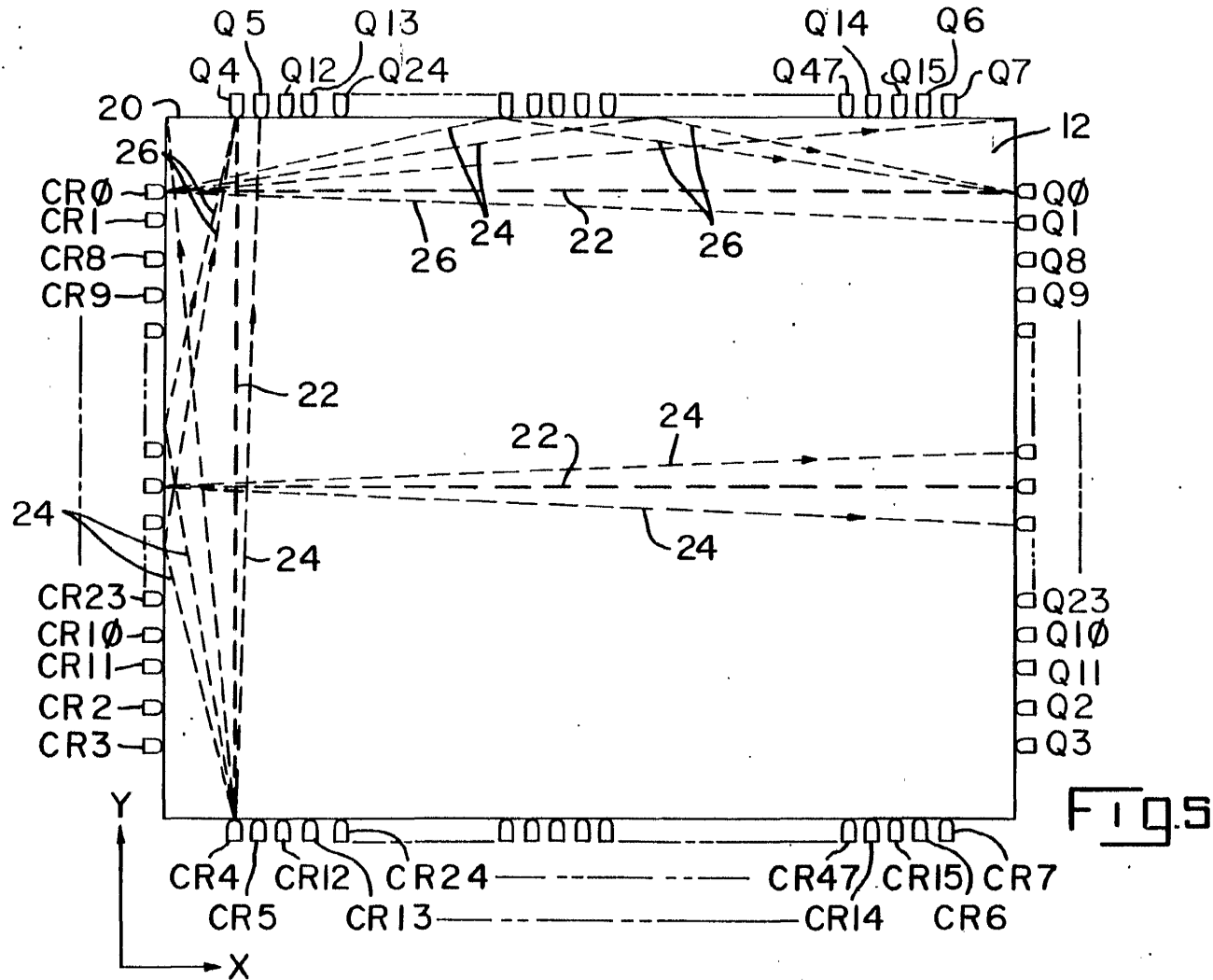
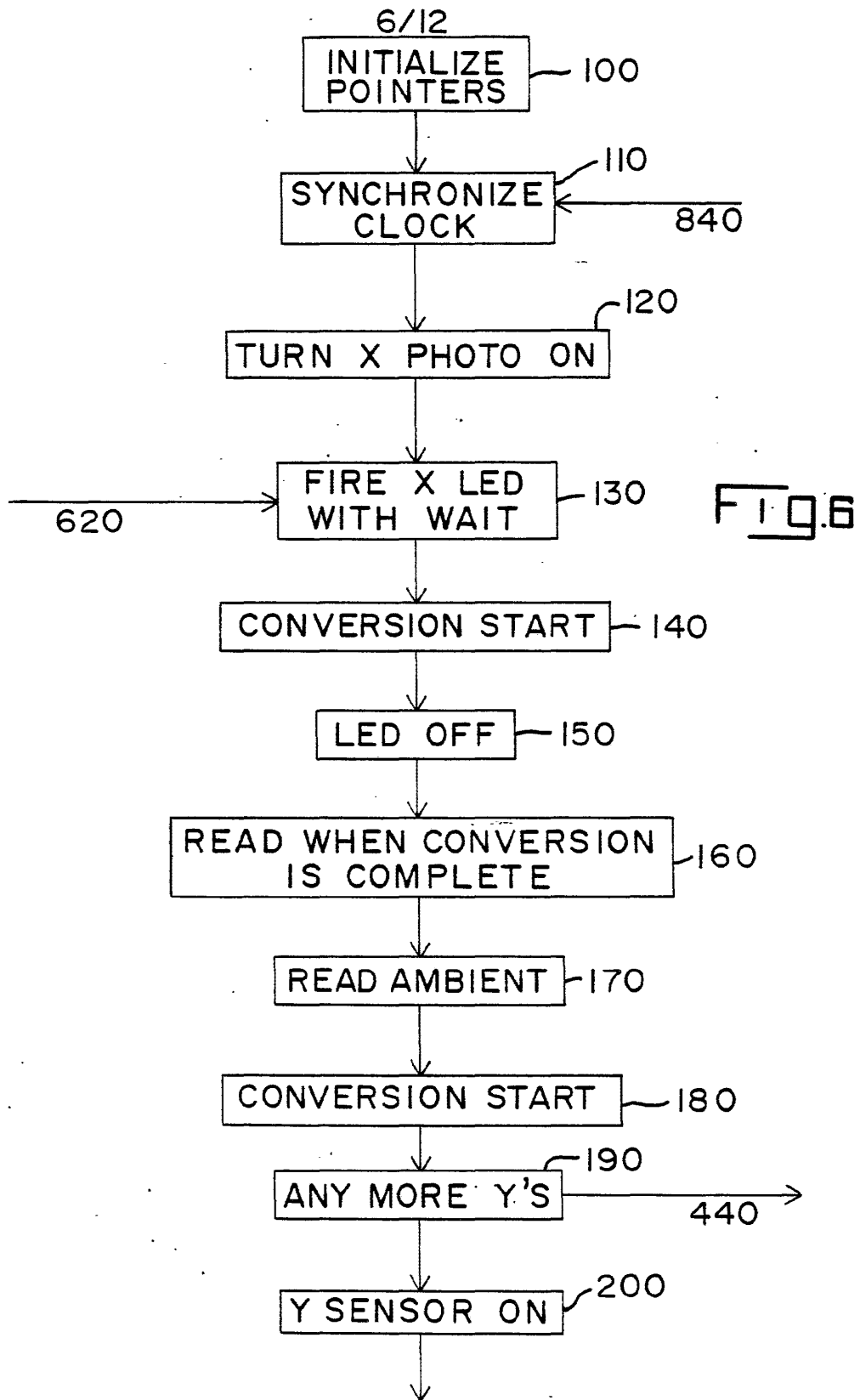


FIG. 4





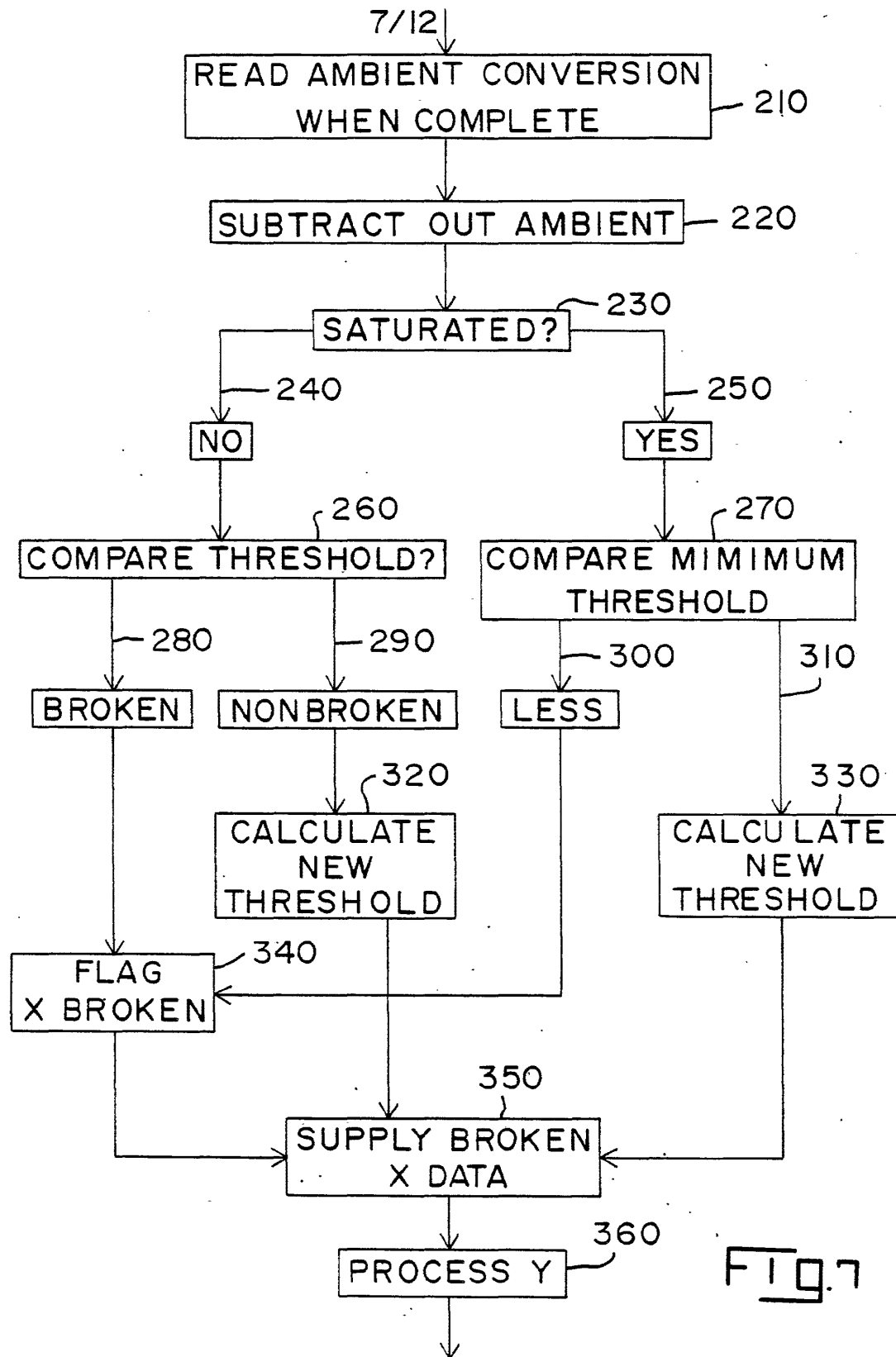


FIG. 7

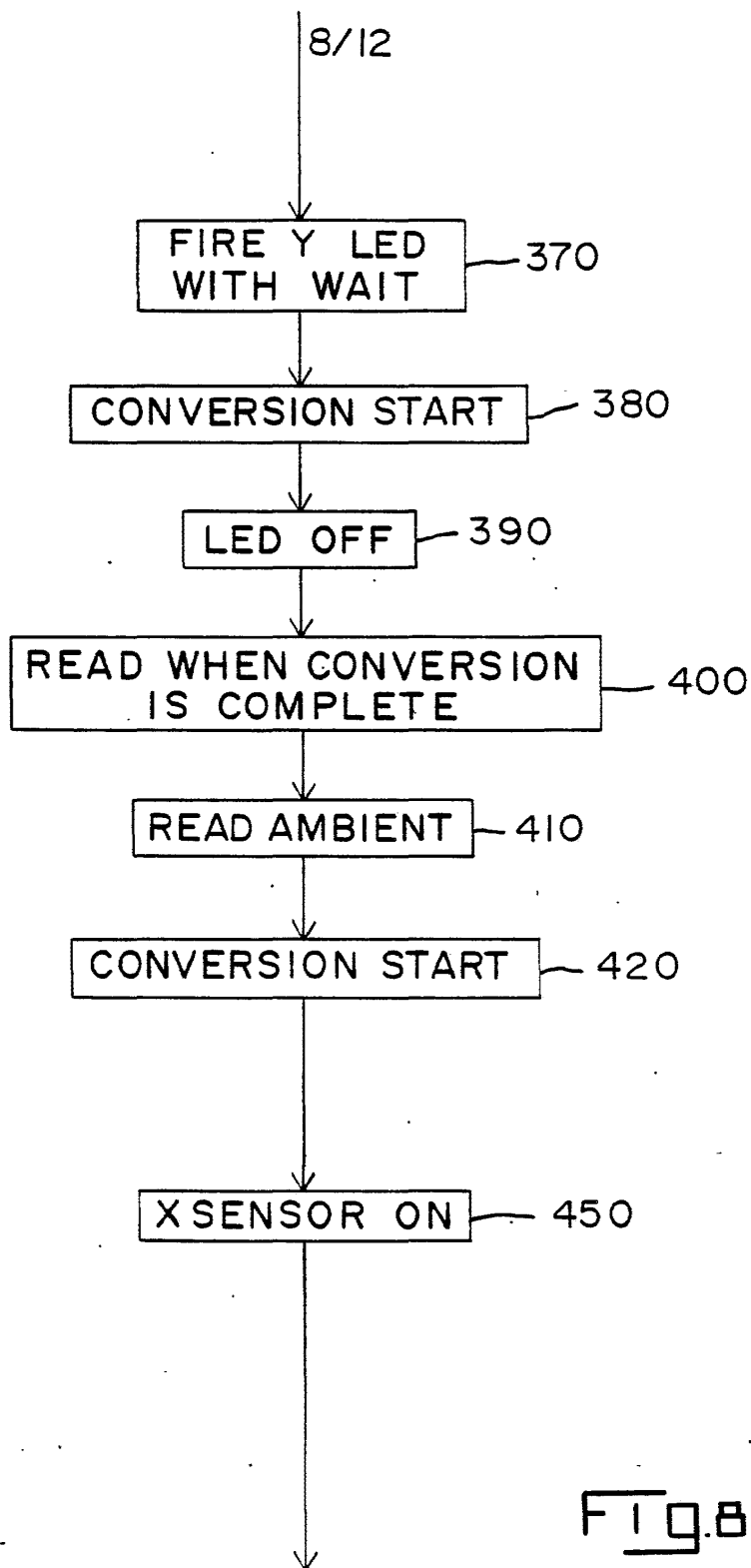


Fig. 8

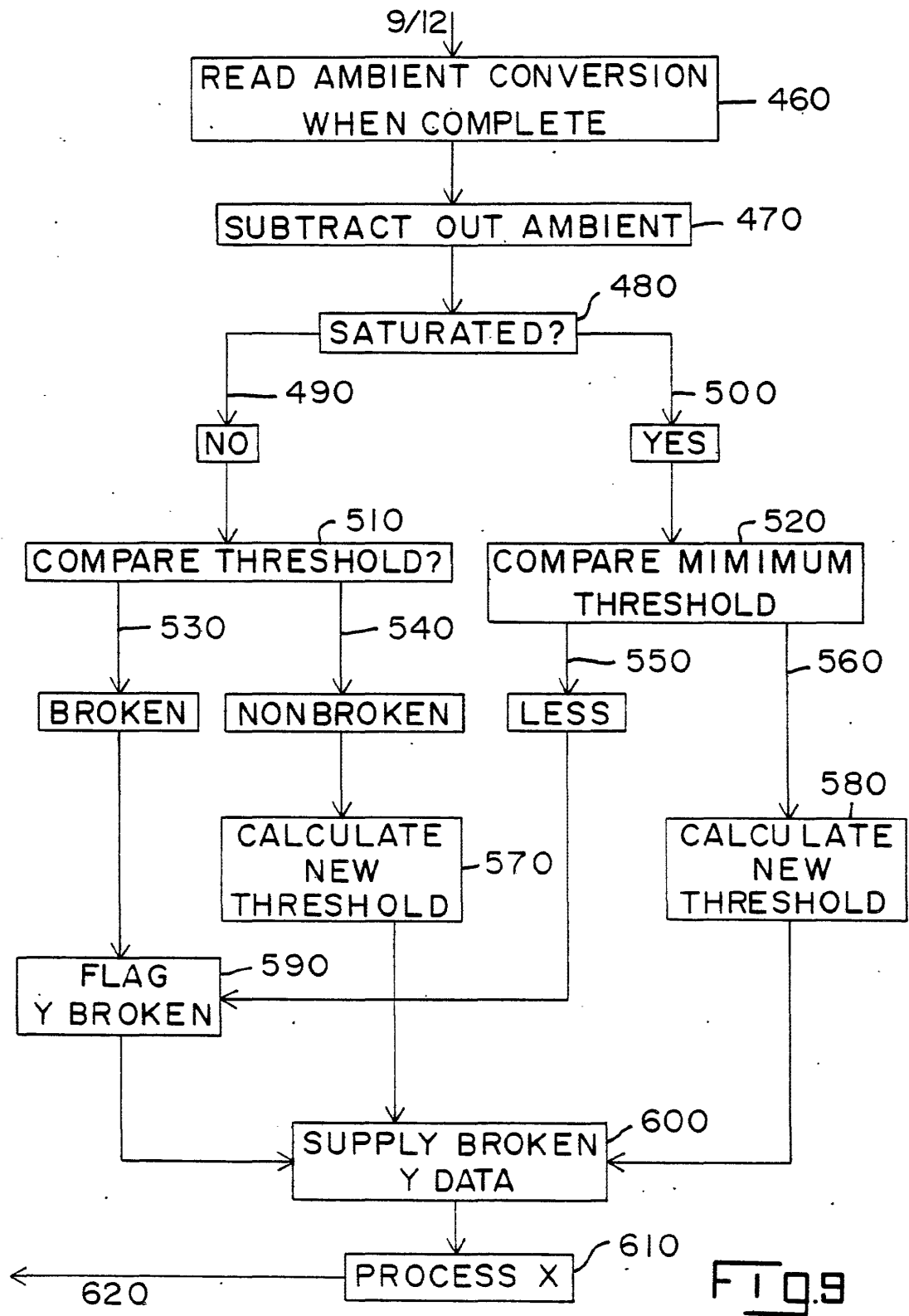


FIG. 9

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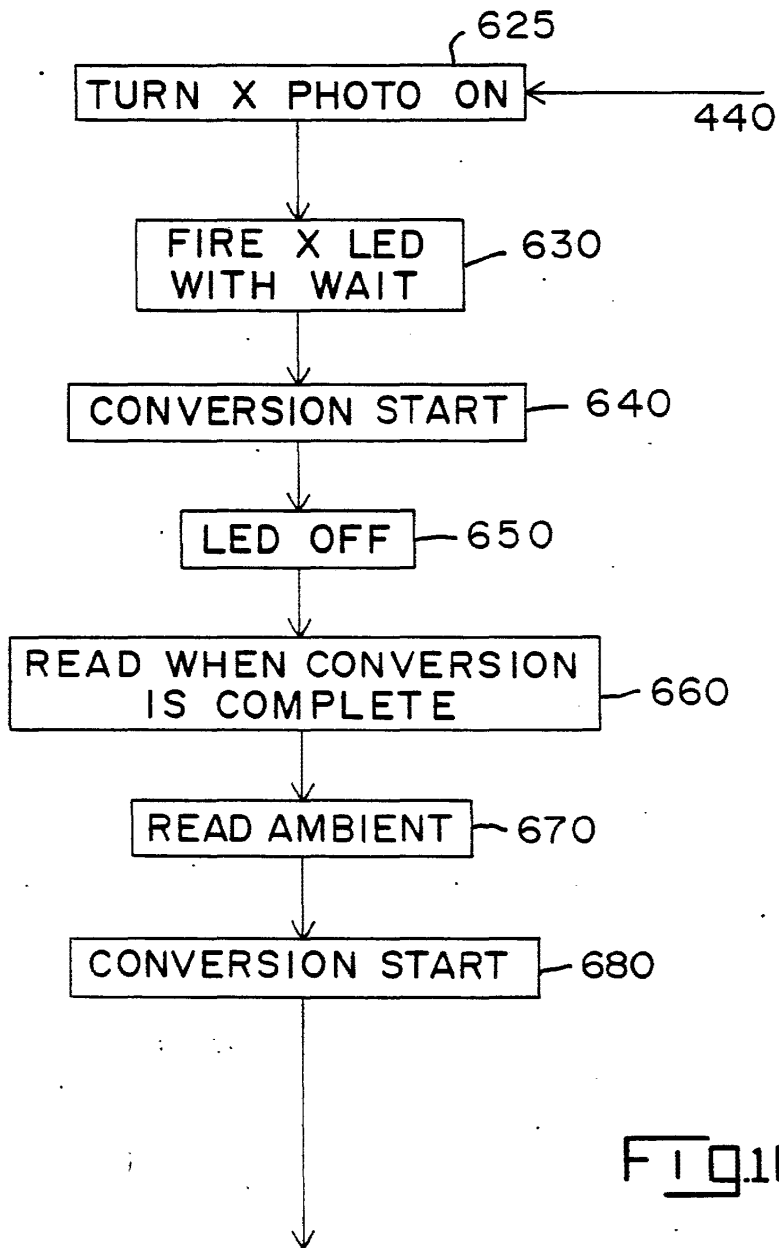


Fig. 10

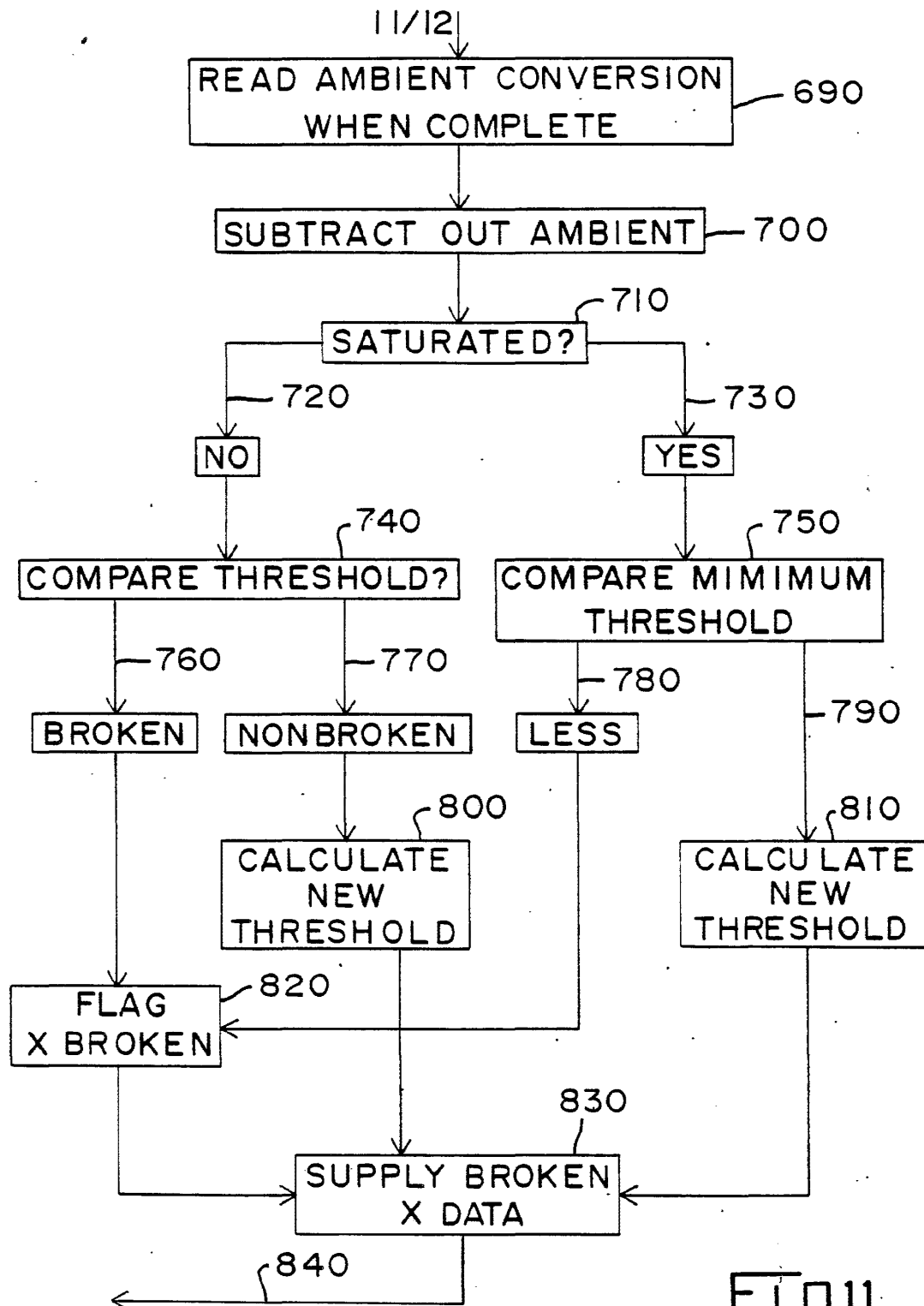


Fig. 11

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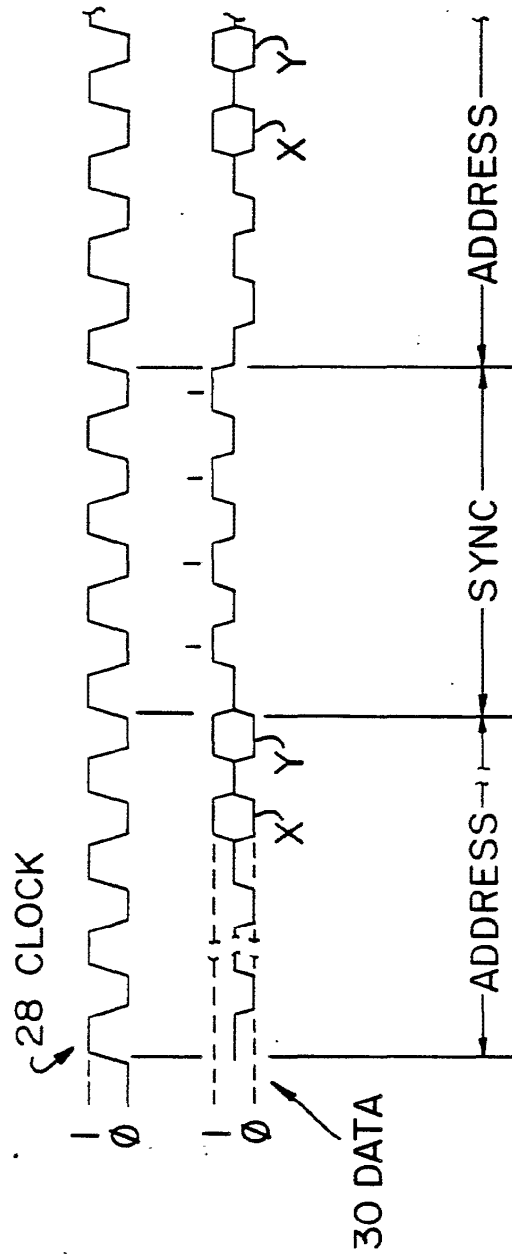
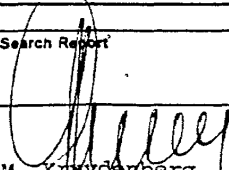


FIG. 12

INTERNATIONAL SEARCH REPORT

International Application No PCT/US 85/00922

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶		
According to International Patent Classification (IPC) or to both National Classification and IPC		
IPC ⁴ : G 06 K 11/06		
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁷		
Classification System	Classification Symbols	
IPC ⁴	G 06 K 11/06	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁸		
III. DOCUMENTS CONSIDERED TO BE RELEVANT ⁹		
Category ⁹	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
X	US, A, 3860754 (JOHNSON et al.) 14 January 1975, see column 4, line 40 - column 5, line 20; figures 2,3; column 2, lines 37-45	4,5
A	--	2,3,8,10,11
A	US, A, 3764813 (CLEMENT et al.) 9 October 1973, (cited in the application)	
A	US, A, 4243879 (CARROLL et al.) 6 January 1981, see abstract (cited in the application)	1,8,9

<p>¹⁰ Special categories of cited documents:</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"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)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"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</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"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.</p> <p>"Z" document member of the same patent-family</p>		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search		Date of Mailing of this International Search Report
29th August 1985		27 SEP 1985
International Searching Authority		Signature of Authorized Officer
EUROPEAN PATENT OFFICE		 G.L.M. Krugenberg

Form PCT/ISA/210 (second sheet) (January 1985)

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON

INTERNATIONAL APPLICATION NO. PCT/US 85/00922 (SA 9742)

This Annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 13/09/85

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US-A- 3860754	14/01/75	DE-A,C 2403270 JP-A- 50011330	28/11/74 05/02/75
US-A- 3764813	09/10/73	None	
US-A- 4243879	06/01/81	US-A- 4201295	06/05/80

For more details about this annex :
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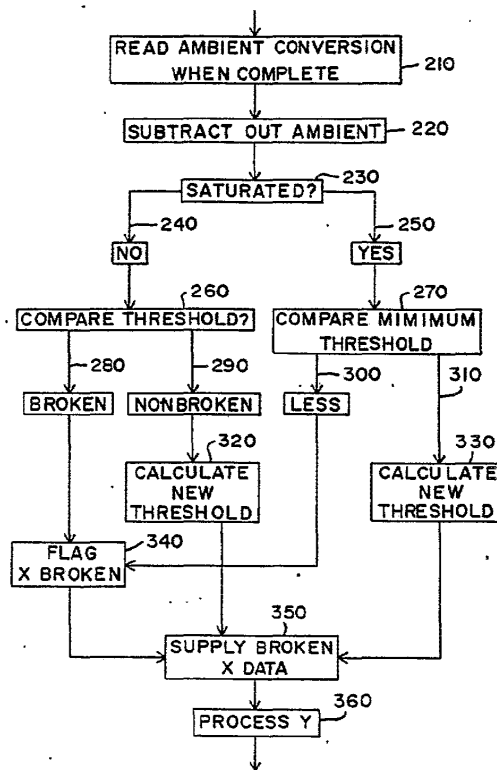
INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<p>(51) International Patent Classification⁴ : G06K 11/06</p>	<p>A1</p>	<p>(11) International Publication Number: WO 86/ 00447 (43) International Publication Date: 16 January 1986 (16.01.86)</p>
<p>(21) International Application Number: PCT/US85/00923 (22) International Filing Date: 20 May 1985 (20.05.85) (31) Priority Application Number: 621,585 (32) Priority Date: 18 June 1984 (18.06.84) (33) Priority Country: US (71) Applicant: AMP INCORPORATED [US/US]; P.O. Box 3608, Harrisburg, PA 17105 (US). (72) Inventors: CARSTEDT, John, Keith ; 1300 Oakridge Drive, Round Rock, TX 78664 (US). GARRETT, James, Edward ; 715 South Prairie Street, Champaign, IL 61820 (US). LUCAS, Paul, Barkley ; 1504 Rutledge Drive, Urbana, IL 61801 (US). MASTERS, Timothy, Elton ; 908 Alagna Street, Champaign, IL 61821 (US).</p>	<p>(74) Agents: SEITCHIK, Jay, L. et al.; AMP Incorporated, P.O. Box 3608, Harrisburg, PA 17105 (US). (81) Designated States: AT (European patent), BE (European patent), CH (European patent), DE (European patent), FR (European patent), GB (European patent), IT (European patent), JP, KR, LU (European patent), NL (European patent), SE (European patent). Published <i>With international search report.</i></p>	

(54) Title: TOUCH INPUT DEVICE HAVING DIGITAL AMBIENT LIGHT SAMPLING

(57) Abstract

A touch input device which continuously samples and digitally stores ambient light readings and compares these with previously stored readings is taught. Briefly stated, a phototransistor (Q) is turned on before, during and after an LED (CR) emitter energization. A digital ambient value (210, 460, 690) is calculated which is subtracted (220, 470, 700) from the value obtained during LED firing (130, 370, 630) so as to develop a signal indicative of the presence or absence of the LED pulse, irrespective of ambient light fluctuations. The ambient level is stored for comparison purposes (270, 520, 750) during the next sampling of the associated phototransistor/emitter pair.



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TOUCH INPUT DEVICE HAVING DIGITAL AMBIENT LIGHT SAMPLING

The present invention is related to material disclosed in the following concurrently filed, copending U.S. patent application, which is assigned to the same assignee as the present invention, given Serial No. 621,586, "Touch Input Device Having Power Profiling" filed June 18, 1984.

The invention relates, generally, to a touch input device and, more particularly, to an opto-matrix frame having automatic corner glare compensation.

Coincident with the use of video displays has always been the problem of the man/machine interface. Traditionally, control of displayed information or cursors has been via a keyboard. Recently, however, a number of devices have been introduced which allow an operator to directly interact with the video display. These types of devices have included light pens, desk-type mouse controllers, or touch input devices such as a switch matrix or opto-electronic matrices. While generally switch-type overlays which are placed adjacent a video display are inexpensive to apply and utilize, they are generally susceptible to contact wear as well as distortion of the video information which is presented to the viewer, particularly in high usage environments. However, since opto-matrix schemes utilize light, which is generally in the infrared region, the switch matrix presented by the light beams is invisible to the viewer and, therefore, does not distort the video information displayed to the viewer and is not subject to wear in high usage environments. A number of schemes which utilize opto-matrix frames may be found in U.S. Patent No. 4,267,443 "Photoelectric Input Apparatus", issued May 12, 1981 to Carroll et al; U.S. Patent No. 4,243,879 "Touch Panel with Ambient Light Sampling", issued January 6, 1981 to Carroll et al; and U.S. Patent No. 3,764,813 "Coordinate Detection System", issued October 9, 1973 to Clement et al. These three schemes address problems inherent with opto-matrix devices such as increasing frame resolution without a corresponding increase in components,

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surrounding or ambient light compensation, or optimization of emitter/detector driving and detecting networks respectively. These systems still have drawbacks in some areas such as large component usage thereby resulting in higher costs, ambient light sensing which is based on a predetermined value rather than dynamically, and difficulty in compensating for reflection or glare which may result in stylus hits not being recorded.

Glare problems generally occur when an emitter is adjacent the corner of the frame or bezel such that light produced by the emitter bounces off an adjacent surface and is then detected by the detector such that any stylus which is introduced to the video display inherently blocks the majority of the light received by the detector but the reflectant light is sufficiently high for the detector and its associated circuitry to not perceive a hit. Accordingly, it is desirable to have a device which minimizes the number of components necessary for addressing and detecting emitters and detectors. Further, it is also desirable to have a device which dynamically compensates for ambient light and for variations in emitter output and detector sensitivity. Also, it is desirable to have a device which minimizes glare problems. Such a scheme is taught in the present invention.

It is a principal object of the invention to provide a touch input device having digital ambient light sampling, comprising an opto-matrix frame having optical emitters disposed in two adjacent sides of the frame, optical detectors disposed in the two sides of the frame opposite the emitters, characterized in that at least one driver is connected to the emitters for activating at least one emitter at a time, a decoding or selection device is electrically connected to the optical detectors for sequentially sampling the light received by the detectors, a digital converter is connected to the decoding device for converting the value of the light received by the detectors to a digital value, a processor is connected to the converter for sequentially comparing the digital value of the light received by a detector for the time frame prior to and/or during and after activation of

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a corresponding emitter, thereby deriving a signal manifesting the average signal or level related to emitter output and detector reception pairs, wherein the signal is stored by the processor to be used as a comparison level for subsequent comparisons of the same emitter/detector pair and the interruption or noninterruption of the light by the emitter and introduced to the detector regardless of ambient or extraneous light.

Reference is now made to the accompanying drawings in which:

FIGURE 1 is a representative view of an operator utilizing a video display;

FIGURES 2, 3 and 4 form a complete schematic diagram for use in conjunction with the touch input entry device of the present invention;

FIGURE 5 is a representational view of glare produced by the frame surrounding the opto-matrix devices as well as a numbering assignment of the emitters and detectors of the present invention;

FIGURES 6 through 11 are flow chart diagrams for use with the preferred embodiment of the present invention; and

FIGURE 12 is a timing diagram of the data output for use with the present invention.

Referring now to Figure 1, there is illustrated a representative view of an operator utilizing a video display. Shown is a CRT 10 having a display area 12 and which generally interacts with a keypad or keyboard 14. An operator 16 interacts with the display area 12 through the use of the stylus 18, which in the preferred embodiment of the present invention, is the finger of the operator thereby presenting a truly touch-type interactive system. It is to be understood, however, that other types of styli can and may be used without departing from the spirit and scope of the present invention such as, for example, pencils, pointers, or other similar types of apparatus. While the keypad 14 is shown, it is one of the primary objects of the present invention to utilize the keypad 14 as little as

possible, if at all, with the operator 16 utilizing the stylus 18 for direct interaction with the CRT. A touch input area is generally defined by what the operator 16 sees in the display area 12. In the preferred embodiment of the present invention, this touch area utilizes emitters which are disposed on the bottom and one side of the display with detectors located on the top and opposite side thereby forming an infrared light beam matrix (shown more clearly in Figure 5). The light beams (not shown) shine through the bezel 20 which is disposed around the edge of the CRT 10 and which, in the preferred embodiment of the present invention, is opaque to visible light but transparent to infrared light. It is to be understood, however, that other types of bezels which exhibit different types of light transmission properties may be utilized.

Referring now to Figures 2, 3 and 4, there is illustrated a schematic for the present invention. A list of the major component designations and functions is shown in Table I below.

TABLE I

<u>Component Number</u>	<u>Component Type</u>
U1	Schmidt Trigger Inverter
U2	Microprocessor
U3, U4, U8, U9	Darlington Transistor Array
U5, U6, U7	BCD-to-Decimal Decoder
CR0-CR47	Light Emitting Diodes (Emitters)
Q0-Q47	Phototransistors (Detectors)

Also shown is a microprocessor U2 which, in the preferred embodiment of the present invention, is an 8-bit microcomputer having on-board analog-to-digital converter as well as RAM and ROM, and is an HMOS device preferably of the 6800 family of microcomputers produced by companies such as Motorola of Austin, Texas. It is to be understood, however, that other types of microcomputers can be utilized which may be CMOS or

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NMOS and which have been produced by other manufacturers having different bit-byte configurations such as 16 or 32-bit bytes. These machines like the preferred 6800 family architecture are readily known and available to one skilled in the art. The design of the present invention does not require the use of all features and pins attendant to the U2 microprocessor and therefore only those utilized will be discussed and are shown. The Vcc terminal is connected to Vcc power which, in the preferred embodiment of the present invention, is +5 Volts and is also connected to terminal Vpp. Vcc supplies operating power to most of the microprocessor U2 while Vpp supplies the programming voltage for the ROM memory in the microprocessor U2 which, in the preferred embodiment of the present invention, is EPROM, although it is to be understood that masked versions of the microprocessor may be utilized with the result that Vpp is no longer necessary. The XTAL and EXTAL terminals have a crystal disposed therebetween with the EXTAL terminal having one terminal of capacitor C2 connected thereto with the remaining terminal of capacitor C2 connected to Ground (Gnd). This thereby provides a stabilized clock frequency for the entire system of the present invention. The RESET terminal is connected to one terminal of capacitor C3 with the remaining terminal of capacitor C3 also connected to Gnd. Terminal PC5, which is an I/O pin, is connected to the interrupt terminal INT and is connected to the output of the A inverter of device U1 which is a Schmidt-type trigger inverter with the input to inverter A of component U1 being connected to one terminal of R1 and one terminal of R2 as well as to the clock terminal which is thereafter provided by a host computer (not shown). The remaining terminals of R1 and R2 are connected to Vcc and Gnd respectively. The I/O pin PC7 is connected to the input of the B inverter of device U1 with the output of the B inverter of device U1 being a data output terminal which is also connected to a host computer (not shown). Also shown on Figure 2 is capacitor C1 which acts as a filtering capacitor and is connected

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such that one terminal is attached to the +5 or Vcc bus with the other terminal attached to the Gnd bus. Port B I/O lines PB0, PB1, PB2, PB3, PB4, PB5 and PB7 provide coding and decoding for the emitters and detectors of the present invention as shown more clearly in Figures 3 and 4. Pin Vrh is a voltage reference high pin which provides the high voltage reference for the analog/digital conversion portion of the microprocessor U2. The Vrl pin is a voltage reference low pin which provides the low reference voltage for the analog-to-digital portion of the microprocessor U2. Port C terminals PC0, PC1, PC2, PC3 and PC4 are I/O pins which interconnect with the coding and decoding of the emitter/detector array as shown more clearly in Figures 3 and 4. Analog-to-digital terminals AN0, AN1, AN2 and AN3 are interconnected with the detection circuitry as shown more clearly in Figure 4. The Vss terminal of the microprocessor U2 is connected to Gnd, while I/O pin PD6 is connected to one terminal of resistor R6. The remaining terminal of resistor R6 is connected to Vcc.

Referring now to Figure 3, the emitter portion of the present invention is shown. The PB0 line is connected to one terminal of resistor B of resistor network R3 as well as to the base terminal of one of the Darlington transistor pairs of component U3, a Darlington transistor array, while I/O line PB1 is connected to resistor A of resistor network R3 which is in turn connected to the base of another Darlington transistor pair of component U3. Similarly, I/O lines PB2, PB3, PB4 and PB5 are connected to resistors F, E, D and C respectively of resistor network R3 as well as to a base terminal of the Darlington transistor pair contained in component U4, also a Darlington transistor array. The remaining terminals of resistors A, B, C, D, E and F of resistor network R3 are tied together and thereafter to Vcc. The Vrh line is connected to one terminal of resistors R4 and R5 with the remaining terminals of resistors R4 and R5 being connected to Vcc and Gnd respectively. The I/O line PB7 is connected to the D input of component U5 which is a

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binary coded decimal (BCD) to decimal decoder while PC0, PC1 and PC2 (supplied by component U1, not shown) are connected to the A, B and C inputs respectively of decoder U5. The collector terminal associated with the Darlington transistor pair for I/O line PB0 is connected to one terminal of resistor R10 while the collector terminal associated with the Darlington pair for I/O line PB1 is connected to one terminal of resistor R9. The remaining terminals of resistor R9 and R10 are thereafter connected to each other and to one terminal of resistor R8 and capacitor C4 as well as to all four of the collector terminals associated with the Darlington transistor array U4. The remaining terminal of resistor R8 is connected to Vcc while the remaining terminal of capacitor C4 is connected to Gnd. The SUB terminals of Darlington transistor arrays U3 and U4 are connected to Gnd. The emitter terminal of the Darlington transistor pair associated with I/O line PB0 of component U3 is connected to the anode of emitters CR0, CR1, CR2, CR3, CR4, CR5, CR6 and CR7 while similarly the emitter of component U3 which is associated with the I/O line PB1 is connected to the anode of emitters CR8 through CR15. The emitters in the preferred embodiment of the present invention are infrared light emitting diodes although it is to be understood that other types of emitters can and may be utilized without departing from the spirit and scope of the present invention. Similarly, the emitter terminals associated with I/O lines PB2, PB3, PB4 and PB5 of Darlington transistor array U4 are connected to the anodes of emitters CR16-23, CR24-31, CR32-39 and CR40-47 respectively. The cathodes of emitters CR7, CR15, CR23, CR31, CR39 and CR47 are connected to the collector terminal of one of the Darlington transistor pairs of U8 which is also a Darlington transistor array with the base terminal associated with this Darlington transistor pair being connected to terminal 7 of U5, a BCD-to-decimal decoder. Similarly, the cathodes of emitters CR6, CR14, CR22, CR30, CR38 and CR46 are connected to the collector terminal of another Darlington transistor pair of

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component U8 with the base terminal associated therewith being connected to output pin 6 of decoder U5. The cathodes of emitters CR5, CR13, CR21, CR29, CR37, and CR45 are connected to the collector terminal of a Darlington transistor pair of component U8 with the base terminal associated therewith being connected to pin 5 of decoder U5. The cathode terminals of emitters CR4, CR12, CR20, CR28, CR36 and CR44 are connected to the collector terminal of another Darlington transistor pair of array U8 with the base terminal associated therewith being connected to output pin 4 of decoder U5. The cathodes of emitters CR3, CR11, CR19, CR27, CR35 and CR43 are connected to the collector terminal of a Darlington transistor pair from component U9 which is another Darlington transistor array with the base terminal associated therewith being connected to output pin 3 of decoder U3. The cathodes of emitters CR2, CR10, CR18, CR26, CR34 and CR42 are similarly connected to a collector terminal of another Darlington transistor pair of array U9 with the base terminal associated therewith being connected to terminal 2 of decoder U5. The cathodes of emitters CR1, CR9, CR17, CR25, CR33 and CR41 are connected to the collector terminal of another Darlington transistor pair of array U9 with the base terminal associated therewith being connected to output pin 1 of decoder U5. The cathodes of emitters CR0, CR8, CR16, CR24, CR32 and CR40 are connected to the collector of another Darlington transistor pair contained in array U9 with the base terminal associated therewith being connected to output pin 0 of decoder U5. The emitter terminals and SUB terminals of array U8 are connected together and thereafter to Gnd while, similarly, the emitter and SUB terminals of array U9 are also connected together and thereafter to Gnd. Accordingly, through the use of arrays U3, U4, U8 and U9, the emitters CR0 through CR47 are connected so as to form a matrix (the operation of which will be described more fully below).

Referring now to Figure 4, there is shown the detection and decoding circuitry associated with the detectors of the

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present invention. The I/O line PC0 is connected to the input of inverter C of component U1 while, similarly, I/O lines PC1 and PC2 are connected to the input of inverters D and E of component U1. This thereby produces PC0, PC1 and PC2 which is connected to terminals A, B and C respectively of decoder U5 (previously mentioned) as well as to terminals A, B and C respectively of binary coded decimal-to-decimal decoders U6 and U7. Port C I/O line PC3 is connected to the D terminal of decoder U7 while I/O terminal PC4 is connected to the D terminal of decoder U6. Analog-to-digital I/O line AN0 is connected to one terminal of the A resistors of transistor arrays R6 and R7 and thereafter to the collector terminals of the phototransistors or detectors Q0, Q1, Q2, Q3, Q4, Q5, Q6, Q7 and Q16, Q17, Q18, Q19, Q20, Q21, Q22, Q23. Digital I/O line AN1 is similarly connected to one terminal of the B resistors of resistor networks R6 and R7 and thereafter connected to the collectors of detectors Q8 through Q15 and Q24 through Q31. The digital I/O line AN2 is connected to one terminal of the C resistors of resistor networks R6 and R7 and thereafter to the collectors of the detectors Q32 through Q39. Similarly, the I/O line AN3 is connected to one terminal of the D resistors of the resistor networks R6 and R7 and thereafter to the collectors of detectors Q40 through Q47. The remaining terminals of resistors A, B, C and D of R6 are connected together and thereafter to Vcc while the remaining terminals of resistors A, B, C and D of resistor network R7 are similarly connected together and thereafter to Gnd. The output pin 0 of decoder U7 is connected to the emitter terminals of detectors Q0 and Q8 while similarly the paired emitter terminals of detectors Q1 and Q9, Q2 and Q10, Q3 and Q11, Q4 and Q12, Q5 and Q13, Q6 and Q14, Q7 and Q15 are connected together and thereafter to terminals 1, 2, 3, 4, 5, 6 and 7 respectively of decoder U7. Additionally, the emitters of detectors Q16 and Q24 and Q32 and Q40 are connected together thereafter being connected to terminal 0 of decoder U6 while, similarly, the four emitters from detectors Q17 and Q25 and Q33

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and Q41, Q18 and Q26 and Q34 and Q42, Q19 and Q27 and Q35
and Q43, Q20 and Q28 and Q36 and Q44, Q21 and Q29 and Q37
and Q45, Q22 and Q30 and Q38 and Q46, Q23 and Q31 and Q39
and Q47 are connected together and thereafter to terminals 1, 2,
5 3, 4, 5, 6 and 7 respectively of decoder U6. This thereby
creates a matrixing scheme similar to that of the detectors of
Figure 3.

Referring now to Figure 5 there is illustrated a
diagrammatic representation of an opto-matrix frame and bezel.
10 Shown are emitters CR0 through CR47 and detectors Q0 through
Q47 which comprise a 16x32 matrix with 16 emitters and detectors
in the Y or vertical direction and 32 emitters and detectors in
the X or horizontal direction. It is to be understood that
although not shown the emitters and detectors are fixedly
15 mounted on a printed circuit board or the like for properly
holding and aligning an emitter/detector pair. Also
diagrammatically illustrated is the light pattern produced by an
emitter and which is received by a detector. Each emitter when
energized, from a diagrammatic standpoint, can be said to
20 produce a principal light beam pattern shown generally at 22
with non-collimated light 24 dispersing further and further
apart, the more distant the detector is from the emitter. This
therefore causes detectors adjacent the light received by the
principal light beam 22 to register some light and which must be
25 compensated for as will be discussed more fully below. Further,
when emitters such as CR0 and CR4 are adjacent the corner and
thereby the bezel 20, non-collimated light 24 will have a
tendency to bounce off the bezel 20. This bounced light
produces a reflected beam shown generally at 26 with the result
30 that some of the reflected beams 26 are received by the detector
which is the object of the principal light beam 22. Therefore,
should a stylus be introduced into the display area 12 and which
does in fact block the principal light beam 22, some
non-collimated light 24 via the reflected beams 26 is received by
35 an associated detector such as Q0 with the result that, under

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certain light conditions, sufficient light is received by the detector such that a hit by a stylus is not registered as such. This problem of reflected light or glare becomes less and less prevalent as the detectors towards the center of the CRT are utilized. Due to manufacturing efficiencies, the same detectors and emitters are utilized near the corners of the bezel 20 as near the center. Accordingly it has been found that, by reducing the power and thereby light output for four emitters adjacent each corner of the bezel 20, the power of the reflected beams is reduced to an acceptable non-error-producing level. Accordingly, by reducing the power to emitters CR0, CR1, CR2, CR3, CR4, CR5, CR6, and CR7 to one level of reduced power and reducing power to emitters CR8, CR9, CR10, CR11, CR12, CR13, CR14 and CR15 to a second level of power, light output may be decreased adjacent the corners of the bezel for the first two emitters, slightly increased for the next two emitters and is at full power for the rest of the opto-matrix frame. It is to be understood, however, that more or less numbers of emitters may be given reduced power or that the detectors may similarly be treated without departing from the spirit and scope of the present invention.

OPERATION OF THE PRESENT DEVICE

Referring now to Figures 2, 3 and 4, the overall electrical operation of the present invention will be discussed. It is to be remembered that the present invention interacts with a host computer (not shown) which allows a CRT to present information over a video display area 12 which is part of an interactive relationship between the operator 16 and a program or operation such that the opto-matrix touch input screen designates operator decisions to the host computer. It is submitted that the host computer and the programs used with it are within the scope of one skilled in the art and therefore are not discussed in detail below. The host computer introduces a clock signal to the clock terminal of Figure 1, which is received by the C port I/O line PC5 and the interrupt terminal of the microprocessor U2. This

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clock stream produced by the host computer continues for as long as input from the opto-matrix frame may be desired with the result that upon the absence of a clock signal, an interrupt is initiated in the microprocessor U2. Accordingly, upon
5 appropriate power up and the presence of clock signals to the microprocessor U2, the opto-matrix device begins a scan-type of sequence which causes the LED's to be fired, phototransistors to be read, and internal analysis of the information by appropriate software. Since the operation of the present device is cyclical
10 in nature, a signal cycle will be discussed by way of example, although it is to be understood that the remainder of the devices perform in the same manner.

Upon power up of the microprocessor U2, a main program loop is initiated in software (Figures 6 through 11). It is
15 submitted that the flow chart diagrams illustrated in Figures 6 through 11 taken together with the description of the preferred embodiment herewith are sufficient so as to enable one skilled in the art to write the appropriate software. This starts with the initialization of the pointers at 100, which thereby begins the X
20 and Y beam count at a known start point of zero. Thereafter, the microprocessor waits for a preset number of synchronizing clock pulses at 110 which are received from the host computer thereby insuring complete synchronization between the
microcomputer U2 and the host computer. An X phototransistor
25 at 120 is then turned on which would be Q4 (Figure 5) as the start of the initial cycle in the present example. This turning on of the phototransistor allows the transistor to settle down or stabilize. This is accomplished by selecting the appropriate
address for I/O lines PC0, PC1 and PC2 which are presented to
30 decoder U7 which is then enabled by I/O line PC3 which thereby allows current to flow through Q4. The LED CR4 is then fired by energization of I/O line PB0 in conjunction with the address
presented by PC0, PC1 and PC2 along with the enabling I/O line
PB7 which thereby enables line 4 of decoder U5. This firing of
35 the X LED CR4 at 130 also takes into account a wait period so as

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to insure that the LED CR4 is completely turned on. Further, for LED's CR0 through CR7 a current-limiting resistor R10 is utilized in conjunction with the Darlington transistor array U3 (used as a source driver) which allows current to flow through emitter CR0 through CR7 at a decreased brightness. Similarly, for emitters CR8 through CR15, a second current-limiting resistor R9 is also utilized so as to diminish the light output of the associated emitters. The value of R9 is preferably one-half of R10 thereby firing the two emitters adjacent each corner of the bezel 20 (Figure 5) at a brightness which is slightly less than the next two adjacent emitters. The remainder of the emitters which are driven by Darlington transistor array U4 do not utilize such current-limiting resistors since full brightness or maximum optical power output is desirable. In this manner, and as previously mentioned, a power profiling is accomplished such that for example, emitters CR0 and 1 have a reduced optical output power which thereby reduces the reflected beams 26 with CR8 and 9 having a slightly greater optical power but still less than the remainder of the emitters not adjacent the corners of the bezel 20. Resistor array R3 is provided as a pull up resistor network to insure that each emitter has minimum proper power for firing. Accordingly, when CR4 is fired, current is caused to flow through the emitter of the lower Darlington transistor pair of array U3 which thereby drives a collector of Darlington transistor array U8 (used as a sink driver) such that the emitter is actively driven and the Darlington transistor array U8 and U9 are actively driven. After the LED CR4 is completely turned on a conversion is started at 140 which in this example dictates that analog-to-digital line AN0 takes the value produced by Q4 and starts to convert this value to a digital number. This digital number is determined by a reference value which is controlled by the reference divider of Vrh contained on the microprocessor U2 with all signal voltages being ratiometrically converted relative to this reference. It has been determined that this Vrh reference value should be set to Vq where Vq is

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the maximum voltage input and corresponds to a deselected phototransistor or to a selected phototransistor with an extremely low ambient light level. Resistor networks R6 and R7 determine the V_q maximum reference level. During the digital conversion process at 140, the LED CR4 is turned off at 150 with the digital conversion then completed and read and stored in the microprocessor at 160. With the LED CR4 off, another reading is taken of the phototransistor Q4 which results in a ambient light reading at 170 which is then started to be converted to a digital number at 180. Thereafter a count check is utilized at 190 to determine if there are any more Y's or Y phototransistors to interrogate. This is done since X and Y phototransistors are sampled alternately and since there are less devices in the Y direction than the X, for the purpose of expeditious processing, when the maximum number of Y devices have been sampled, the remainder of the X devices are sampled starting at 440 and described more fully below.. Accordingly, in the present example there are more Y phototransistors to be sampled with the result that Y phototransistor Q0 is turned on at 200. Thereafter at 210 the ambient conversion of the X phototransistor Q4 which was read at 170 is completed with the ambient value subtracted out at 220. This therefore compares the read converted value at 160, which is the fired LED CR4 value, with the read ambient value at 170 where CR4 was off, subtracting the two and determining at 230 whether phototransistor Q4 is saturated. If Q4 is not saturated which would tend to indicate that a hit is present or something is blocking light from detector Q4 then a NO condition exists at 240 which is presented at 260. A comparison is then made which compares the value presented with a previously calculated and stored threshold level from 320 or 330 to determine whether the light beam is to be considered as broken or non-broken at 280 and 290 respectively. If the light beam was non-broken then a new threshold is calculated at 320. In the presence of a broken condition, a flag representing (in the present example) X4

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broken is presented at 340. The new threshold and flag condition at 320 and 340 are thereafter presented as data at 350. Alternately, at 230 if a saturated condition exists, this is presented at 250 as a YES condition which is then given to 270 which is compared against a predetermined fixed minimum threshold value. If this value is less than the fixed minimum number, it is at 300 then considered as a broken flag condition which is presented to 340 and thereafter to 350. If the comparison at 270 determines that the difference is greater than or equal to a present threshold level, this is presented via 310 to 330 which calculates a new threshold level (for use at 260) which is in turn presented to 350 as a non-broken or non-hit condition. The new threshold value is computed at 320 or 330 and used by 260 as the threshold for comparison purposes. Accordingly, in this manner a continuous and dynamic sampling of ambient light is utilized and taken into account. Further, device degradation which generally occurs over a considerable period of time and which results in decreased sensitivity by the phototransistor or decreased light output by the emitter is automatically taken into account since, within predetermined absolute minimums and maximums, new thresholds are continuously calculated and utilized.

Processing of the Y axes is then started at 360 in a manner very similar to that of the X axes. This results in the Y LED CR0 being fired for a sufficiently long duration of time at 370 to insure complete LED turn-on with a digital conversion of Q0 started at 380. This conversion at 380 is possible since the Y sensor Q4 was turned on at 200. This seemingly early sampling of Q0 is done since the crystal which determines the frequency at which the microprocessor U2 runs is substantially greater than the clock rate or the data output rate (discussed below). Thereafter LED CR0 is turned off at 390 with the value received by Q0 read when the conversion is complete at 400. Upon completion of the conversion the ambient value of Q0 is determined at 410 with the conversion to a digital number started

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at 420. Immediately after the start of the digital conversion at 420, the next X sensor which is Q5 is turned on at 450. During the Q5 turn on period the ambient converted value Q0 is read when completed at 460 with the ambient value being subtracted out from the value determined during the firing of LED CR0 at 470. This value is then presented to 480 to determine whether detector Q0 is saturated at 480 with a NO or YES condition being presented to 490 or 500 respectively. Similarly, minimum thresholds are analyzed at 510 and 520. After the comparison at 510, a broken or non-broken condition is determined at 530 and 540 with a broken Y0 flag broken indication at 590 if a broken condition does exist or a new threshold being calculated at 570 if a non-broken condition exists. Again the flag condition and new threshold from 590 and 570 respectively are used to supply Y0 data at 600. The comparison made at 520 is presented by 550 as a flag at 590 if a less than minimum threshold condition exists or at 560 if a new threshold is to be calculated at 580. Thereafter, the new threshold level is calculated at 580 with this value and a non-broken condition supplied to 600. At this point a processing of an X coordinate emitter/detector pair is initiated at 610 and presented as 620 to begin again at block 130 which fires the next X LED CR5 with a repetition of the processing as mentioned for Figures 6 through 9. In this manner, toggling is accomplished between the X and Y axes until at box 190 it is determined that there are no more Y's to be interrogated which is then presented as a jump via 440 to box 625 which thereafter turns on the 17th X axis phototransistor, Q36. X axis LED CR36 is then fired at 630 with the process then continuing in a manner substantially identical to the previously discussed X and Y axes processing. Thereafter at box 830 the X data is presented at 840 to 110 with the process then repeating as long as the host computer continues to send out a clock signal.

It is to be remembered that during this entire time frame the host computer upon receiving a synchronization signal from microprocessor U2 in a data stream (described more fully below)

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is required to know in advance the size of the touch input matrix and to keep track of the data stream so as to know which X and Y pair status is being given.

Accordingly, at 350, 600 and 830 data which represents an X or Y broken or non-broken status condition is presented onto the data line. Therefore, referring now to Figure 12 there can be seen a timing and data scheme for the present invention. Upon initialization and synchronization at 110 of Figure 6 four continuous ones are placed onto the data line for the host computer to receive. This thereby lets the host computer know that a synchronization frame has occurred and that the host computer should now start to count. Thereafter, the data is presented in 4-bit bytes with the first two bits always being zero and the third and fourth bits indicating broken or non-broken conditions for the X and Y axes respectively. If a broken condition does exist, then a 1 is placed onto the data line and if an unbroken condition exists, then a 0 is utilized. As an example, should a hit occur at the intersection of CR0 and CR4 and since these are the first X and Y pairs interrogated, the first 4-bit byte of data after synchronization will read (0011). However, had a hit occurred at the intersection of CR0 and CR5, then the first 4-bit byte would have contained (0001) and the second 4-bit byte would have contained (0010). For those frames where no Y axis detector is being interrogated, a 0 is preferably inserted as a false bit although a 1 may also be utilized. This 4-bit byte data stream is continued until all the X detectors have been interrogated with the microprocessor U2 sending out the 4-bit sync cycle at the end of the interrogation thereby indicating a new cycle or frame. Additionally, the present device will allow for beam averaging, the disclosure of which may be found in U.S. Patent No. 4,267,443 "Photoelectric Input Apparatus", issued May 12, 1981 to Carroll et al, incorporated by reference herein, and which allows for a stylus between two emitters to be registered as a hit between two

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beams thereby effectively doubling the resolution or interpolation of the present system to a 32x64 matrix.

It is to be remembered that many variations of the present invention may be accomplished without departing from the spirit and scope of the present invention. For example, power profiling resistors may be placed on individual emitters or detectors or at the decoders rather than at the Darlington transistor arrays without departing from the spirit and scope of the present invention. Further, the program could be utilized in a different sequence without departing from the spirit and scope of the present invention. Also, other data streams may be utilized such as parallel output using additional I/O lines which are available or different types of serial data streams. Additionally, different types of arrays other than Darlington transistors may be utilized while different types of decoders may be used while other types of detectors such as photodiodes may be used. It is also to be remembered that the firing or detection order of the emitters and detectors may be changed to any order desired. The present device may also be used with or without a display or a CRT or with a flat panel display.

Accordingly, the present invention produces a device which accommodates for changing ambient light levels, emitter and/or detector degradation and which has few components.

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CLAIMS:

1. A touch input device having digital ambient or extraneous light sampling and/or compensation, comprising:
 - an opto-matrix frame having optical emitters (CR) disposed
5 in two adjacent sides of the frame;
 - optical detectors (Q) disposed in the two sides of the frame opposite the emitters, characterized in that:
 - at least one driver (U3, U4, U8, U9) is connected to the
emitters for activating at least one emitter at a time;
 - 10 a decoding or selection device (U5, U6, U7) is electrically connected to the optical detectors for sampling the light received by the detectors;
 - a digital converter (U2) connected to the decoding device
15 for converting the value of the light received by the detectors to a digital value;
 - a processor (U2) connected to the converter for comparing the digital value (210, 460, 690) of the light received by a detector for the time frame prior to (120, 200, 625) and/or during (130, 370, 630) and after (160, 400, 660) activation of a
20 corresponding emitter, thereby deriving a signal (350, 600, 830) manifesting the interruption or noninterruption of light by said emitter and introduced to said detector regardless of extraneous or ambient light.
2. A device according to claim 1, wherein the driving
25 device (U3, U4, U8, U9) is comprised of a Darlington transistor array.
3. A device according to claim 1, wherein the decoding or selection device (U5, U6, U7) is a BCD-to-decimal converter.
4. A device according to claim 1, wherein the digital
30 converter (U2) and the processor (U2) are part of a microprocessor.
5. A touch input device having digital ambient or extraneous light sampling and/or compensation, comprising:
 - an opto-matrix frame having optical emitters (CR) disposed
35 in two adjacent sides of the frame;

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optical detectors (Q) disposed in the two sides of the frame opposite the emitters, characterized in that:

at least one driver (U3, U4, U8, U9) is connected to the emitters for activating at least one emitter at a time;

5 a decoding or selection device (U5, U6, U7) is electrically connected to the optical detectors for sampling the light received by the detectors;

10 a digital converter (U2) connected to the decoding device for converting the value of the light received by the detectors to a digital value;

15 a processor (U2) connected to the converter for sequentially comparing the digital value (210, 460, 690) of the light received by a detector for the time frame prior to (120, 200, 625) and/or during (130, 370, 630) and after (160, 400, 660) activation of a corresponding emitter, thereby deriving a signal (350, 600, 830) manifesting an average signal or level related to emitter output and detector reception pairs, wherein the signal is stored by the processor to be used as a comparison level (270, 520, 750) for subsequent comparisons of the same emitter/detector pair.

20 6. A device according to claim 2, wherein the driving device (U3, U4, U8, U9) is comprised of a Darlington transistor array.

25 7. A device according to claim 2, wherein the decoding or selection device (U5, U6, U7) is a BCD-to-decimal converter.

8. A device according to claim 2, wherein the digital converter (U2) and the processor (U2) are part of a microprocessor.

30 9. A touch input device having digital ambient or extraneous light sampling and/or compensation, comprising:

an opto-matrix frame having optical emitters (CR) disposed in two adjacent sides of the frame;

optical detectors (Q) disposed in the two sides of the frame opposite the emitters, characterized in that:

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at least one driver (U3, U4, U8, U9) is connected to the emitters for activating at least one emitter at a time;

a decoding or selection device (U5, U6, U7) is electrically connected to the optical detectors for sampling the light received by the detectors;

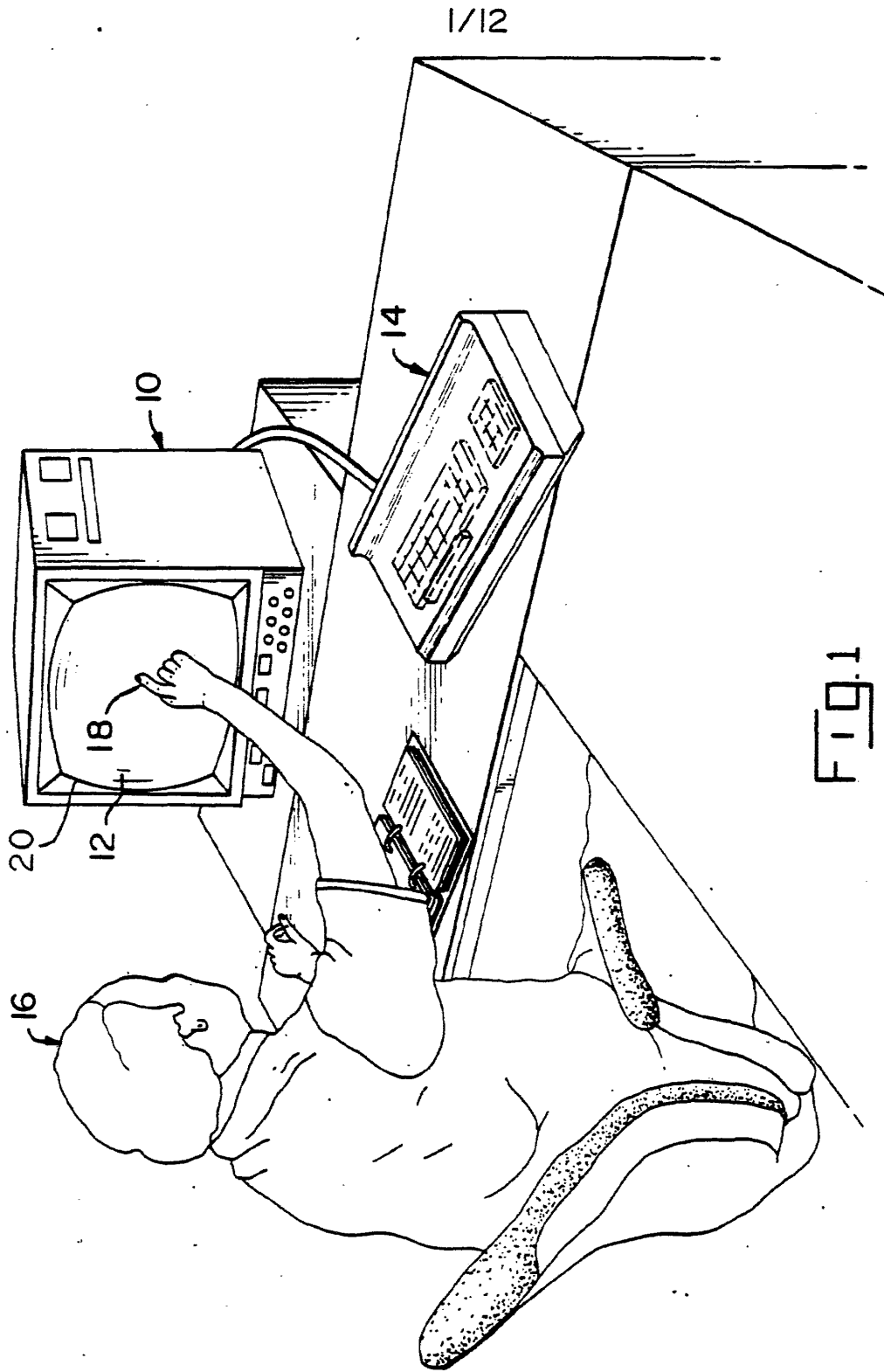
a digital converter (U2) connected to the decoding device for converting the value of the light received by the detectors to a digital value;

a processor (U2) connected to the converter for sequentially comparing the digital value (210, 460, 690) of the light received by a detector for the time frame prior to (120, 200, 625) and/or during (130, 370, 630) and after (160, 400, 660) activation of a corresponding emitter, thereby deriving a signal (350, 600, 830) manifesting an average signal or level related to emitter output and detector reception pairs, wherein the signal is stored by the processor to be used as a comparison level (270, 520, 750) for subsequent comparisons of the same emitter/detector pair and the interruption or noninterruption of light by said emitter and introduced to said detector regardless of ambient or extraneous light.

10. A device according to claim 9, wherein the driving device (U3, U4, U8, U9) is comprised of a Darlington transistor array.

11. A device according to claim 9, wherein the decoding or selection device (U5, U6, U7) is a BCD-to-decimal converter.

12. A device according to claim 9, wherein the digital converter (U2) and the processor (U2) are part of a microprocessor.



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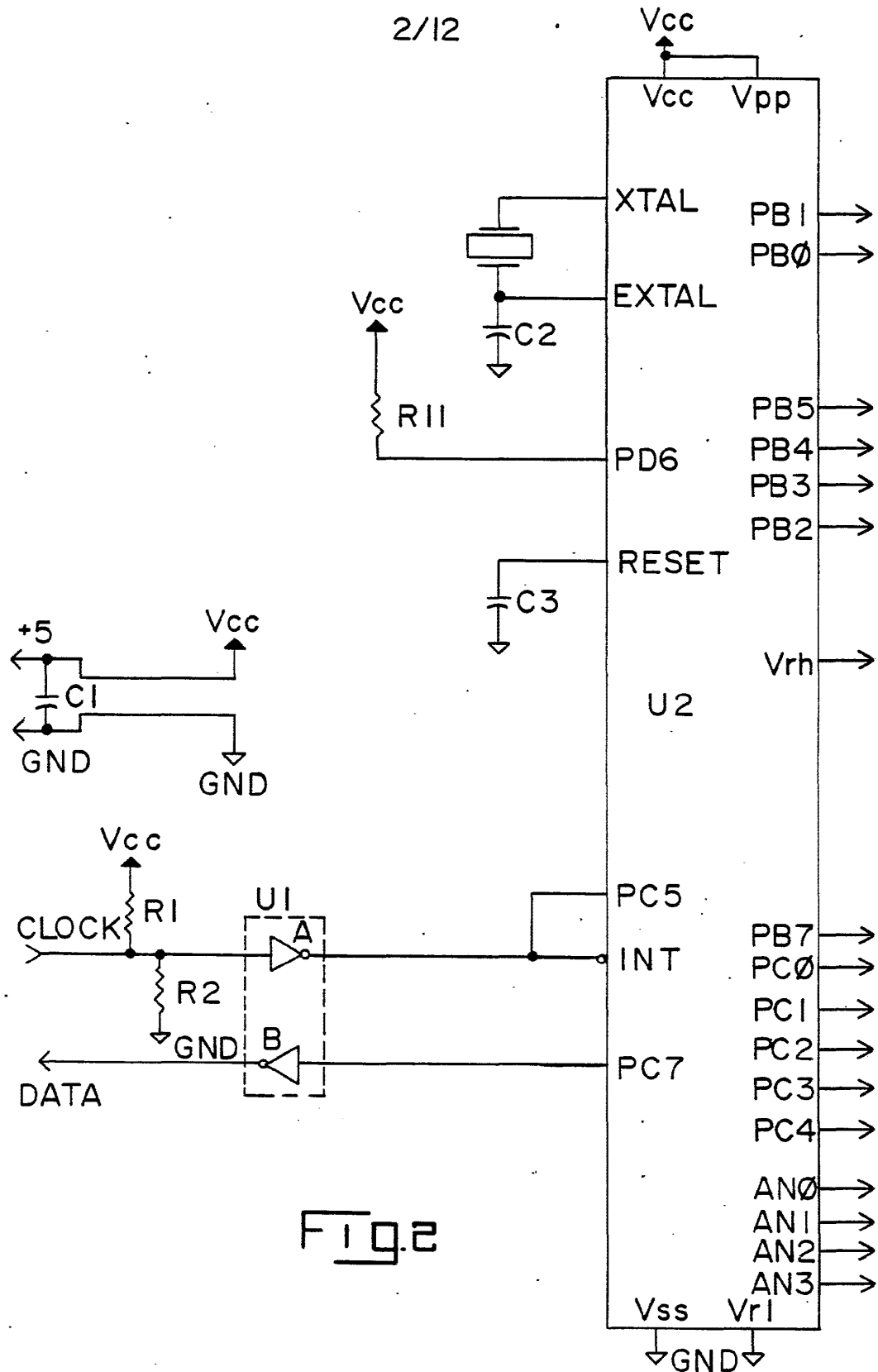
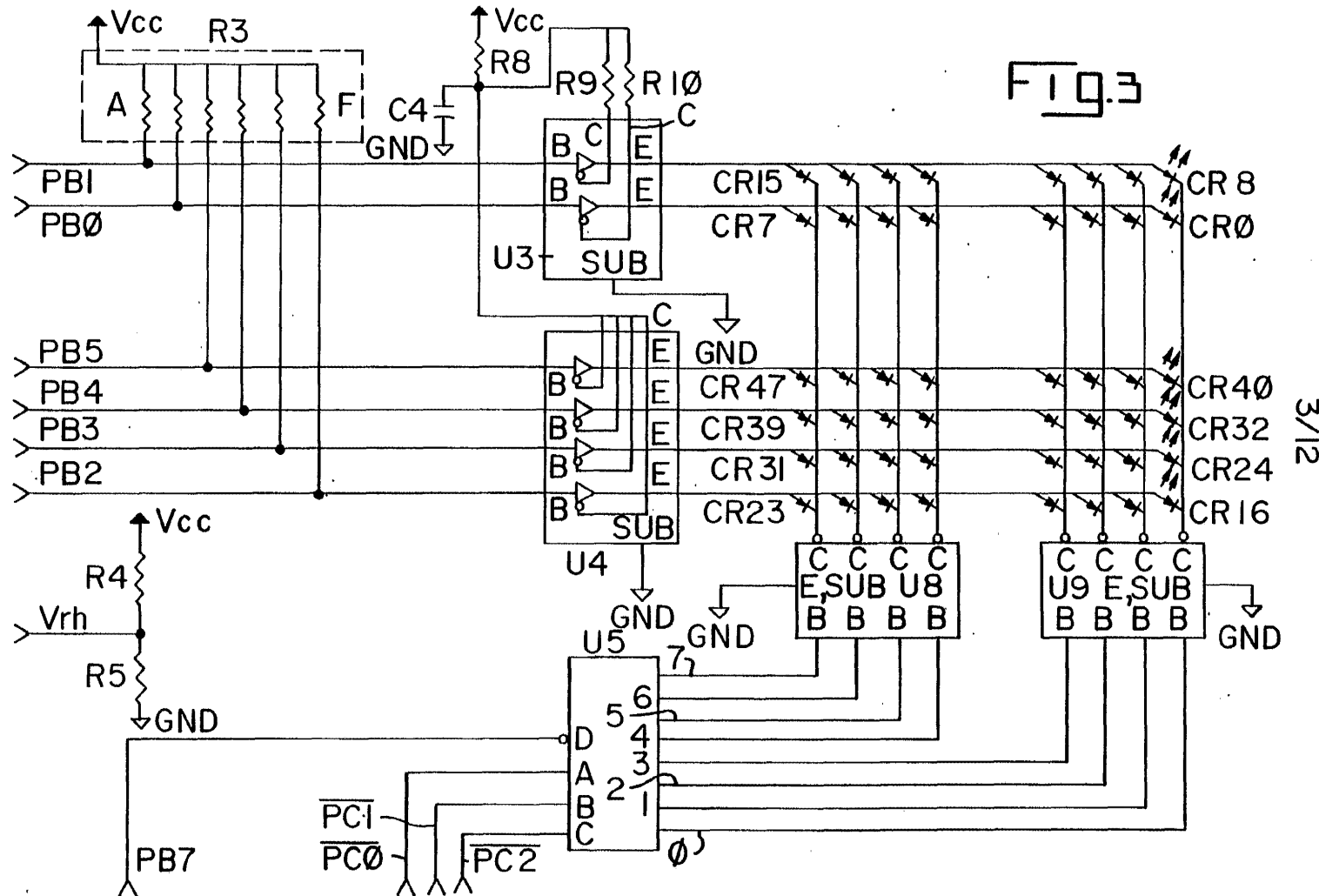
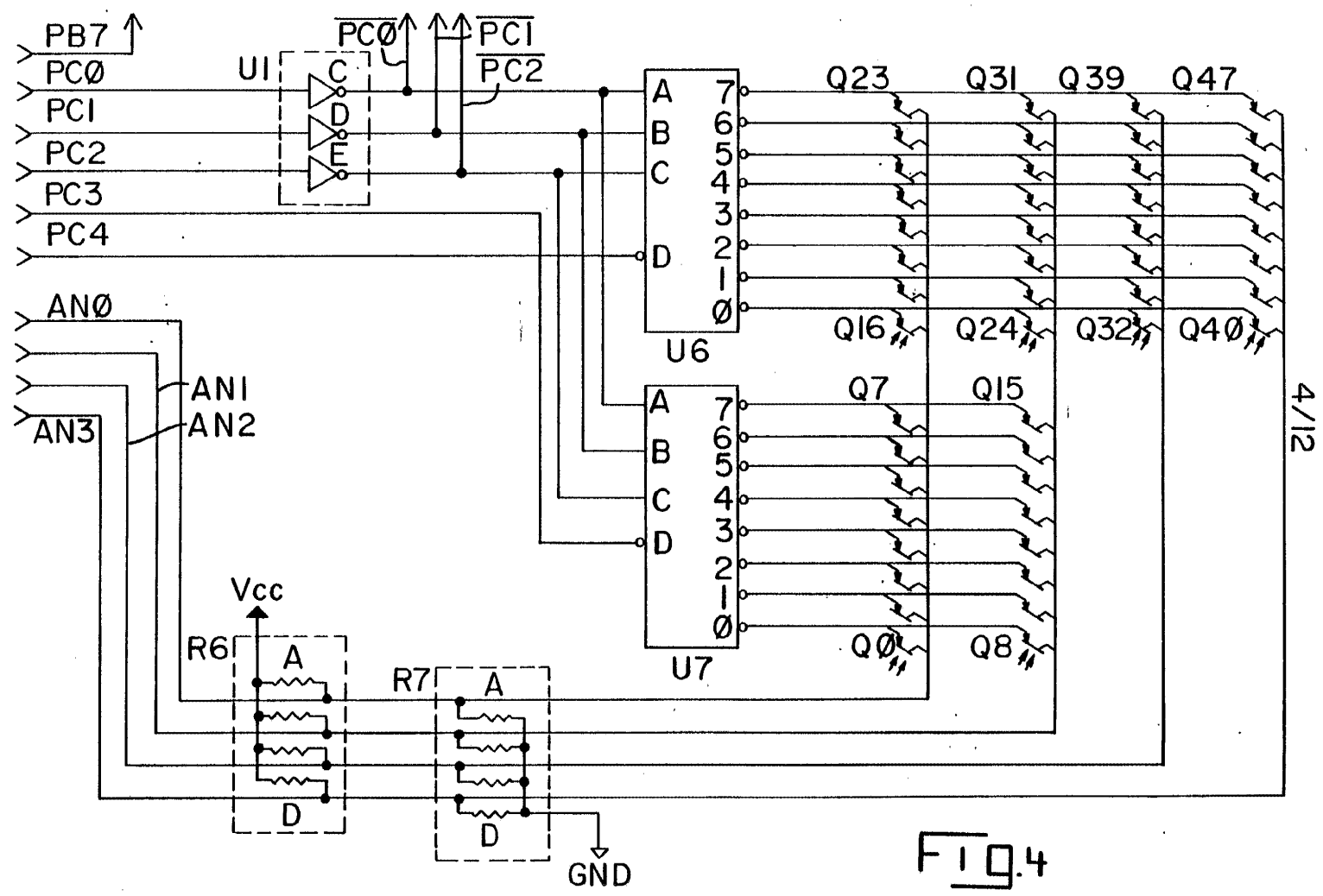
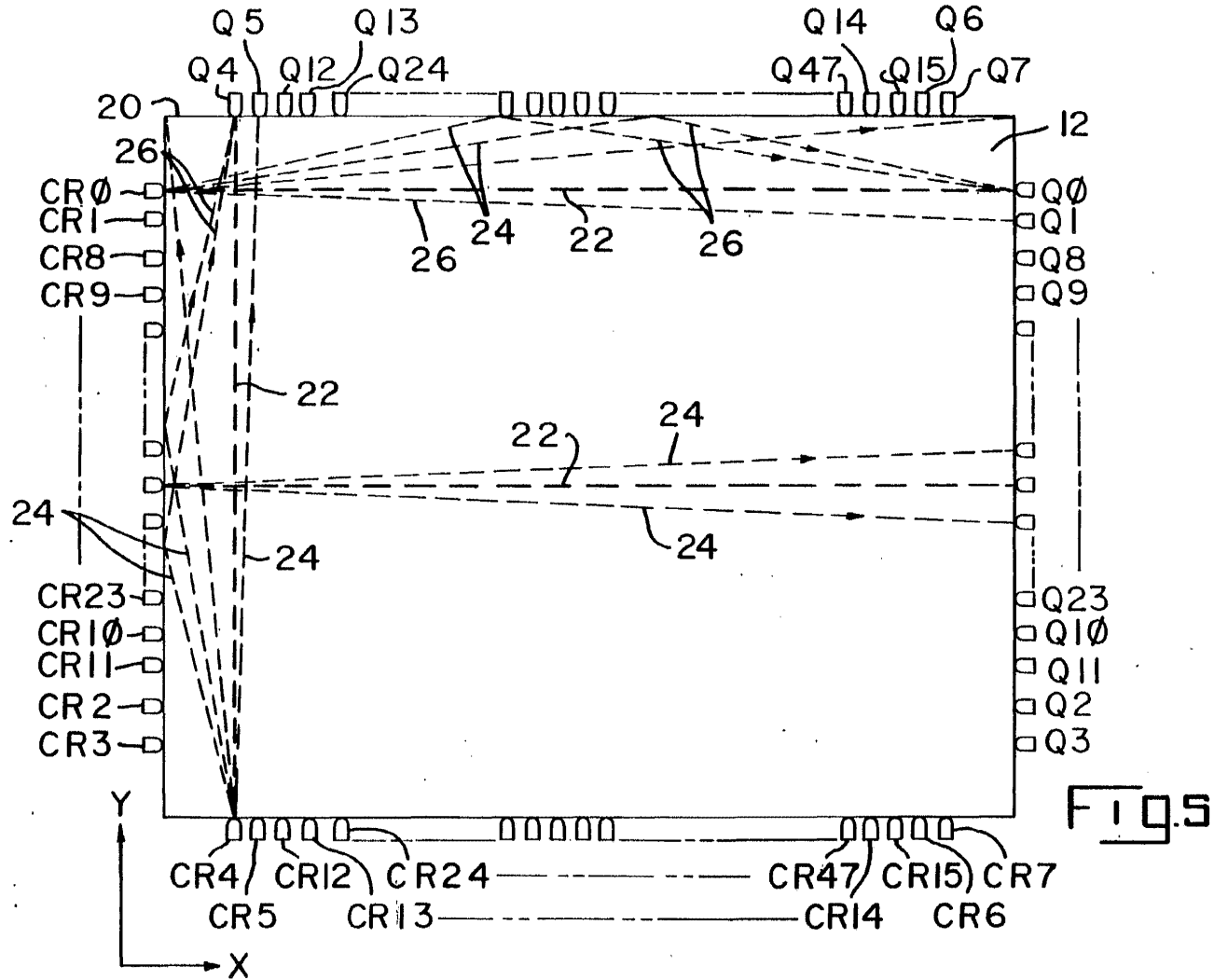
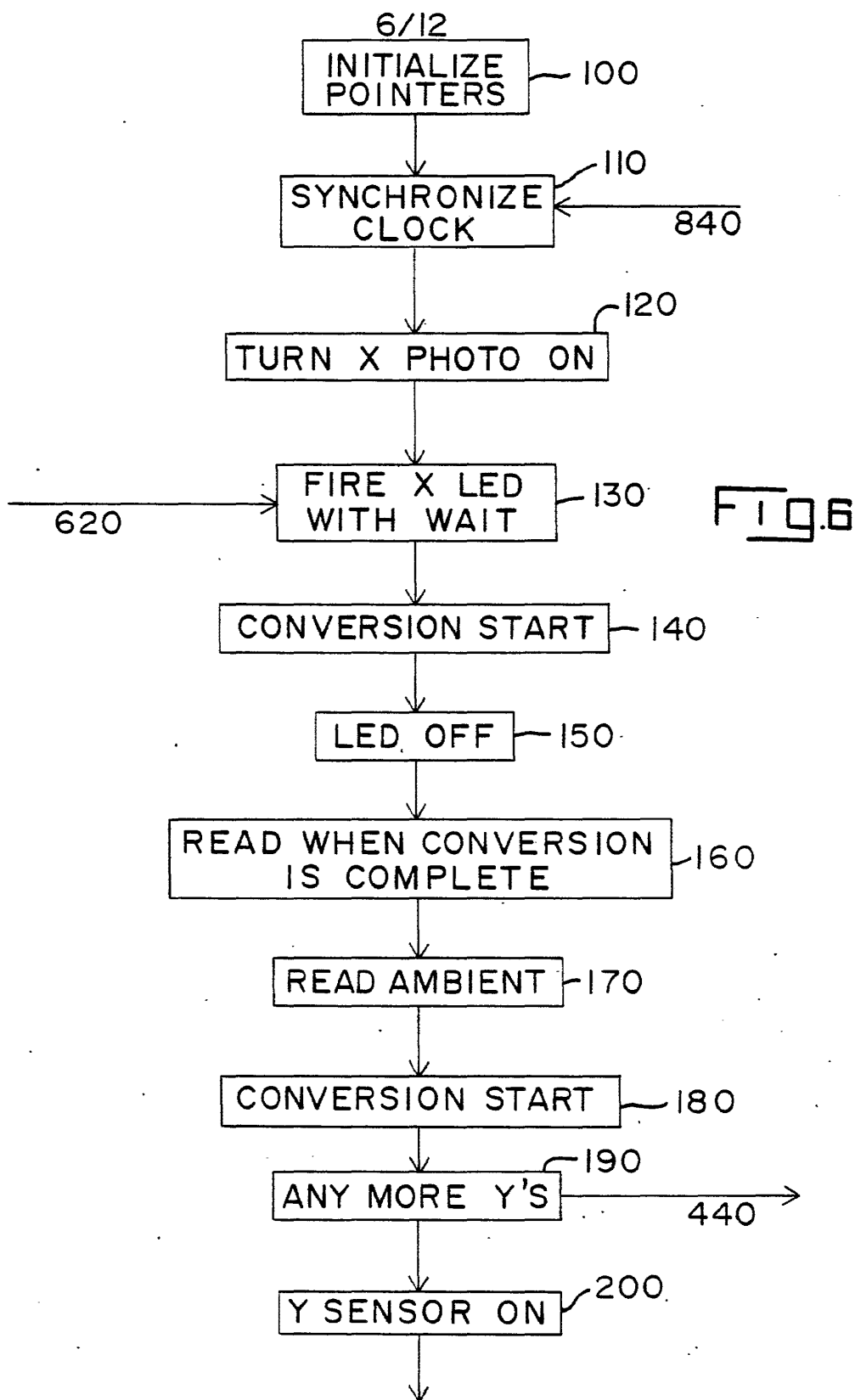


Fig. 2









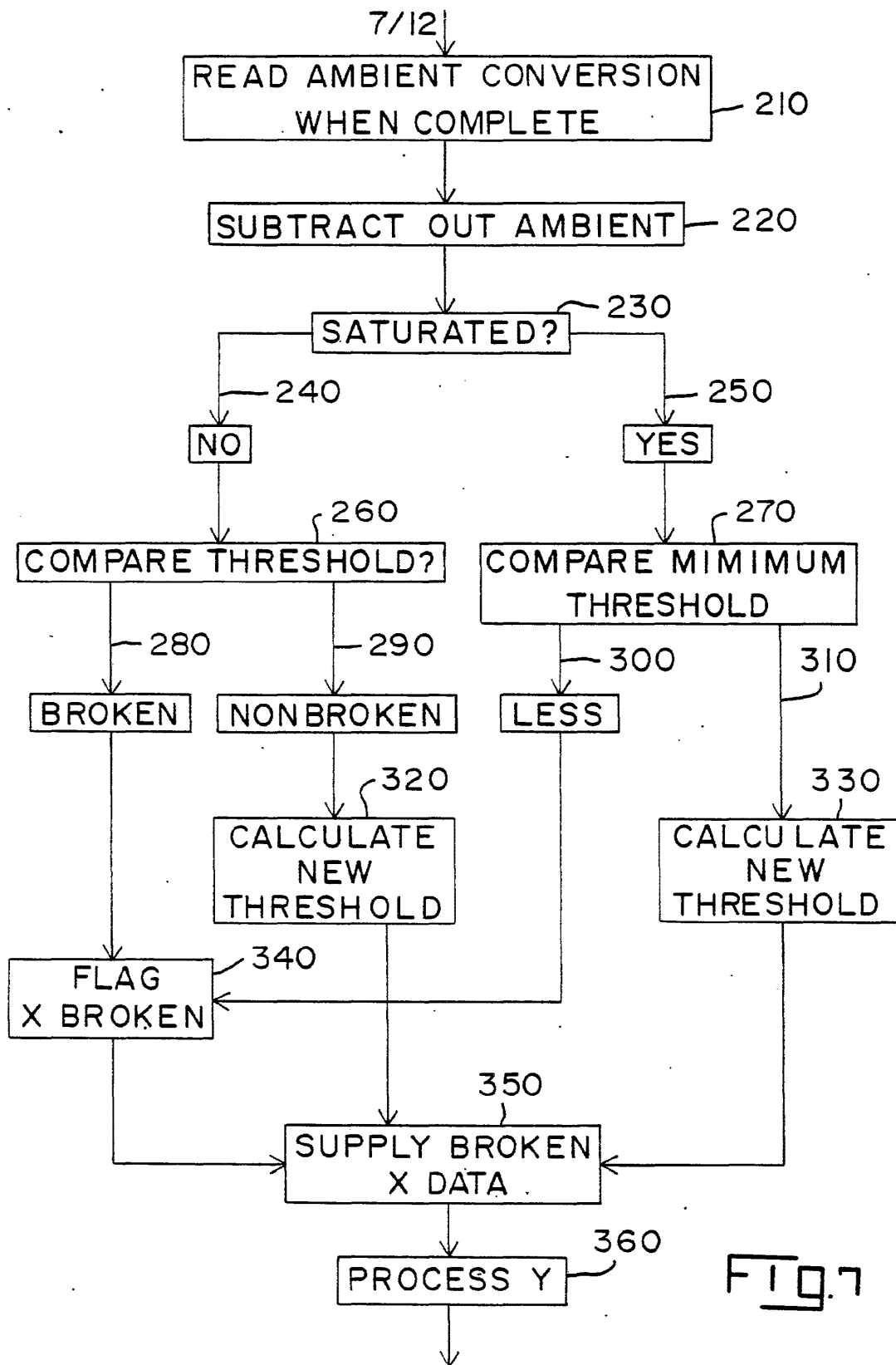


FIG. 7

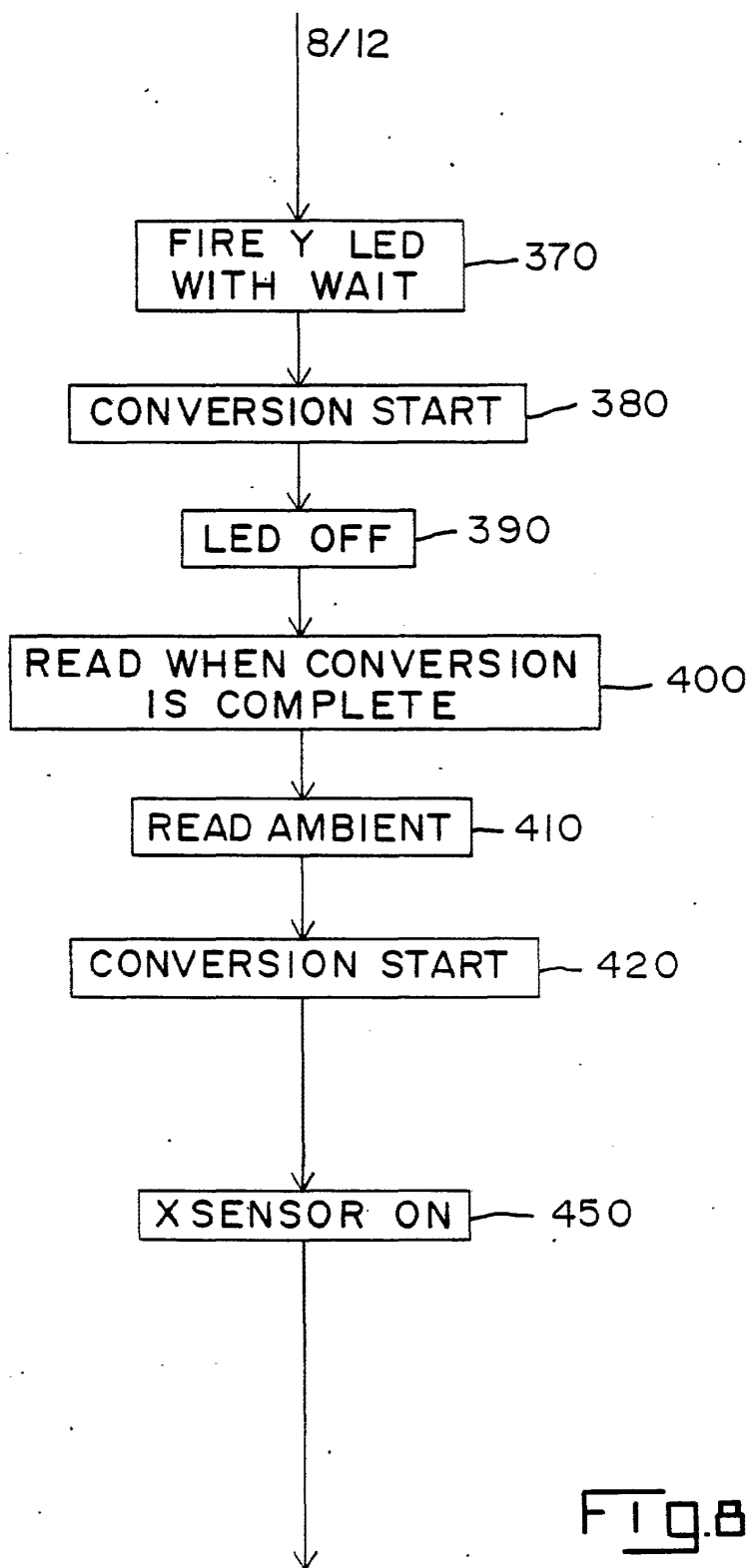
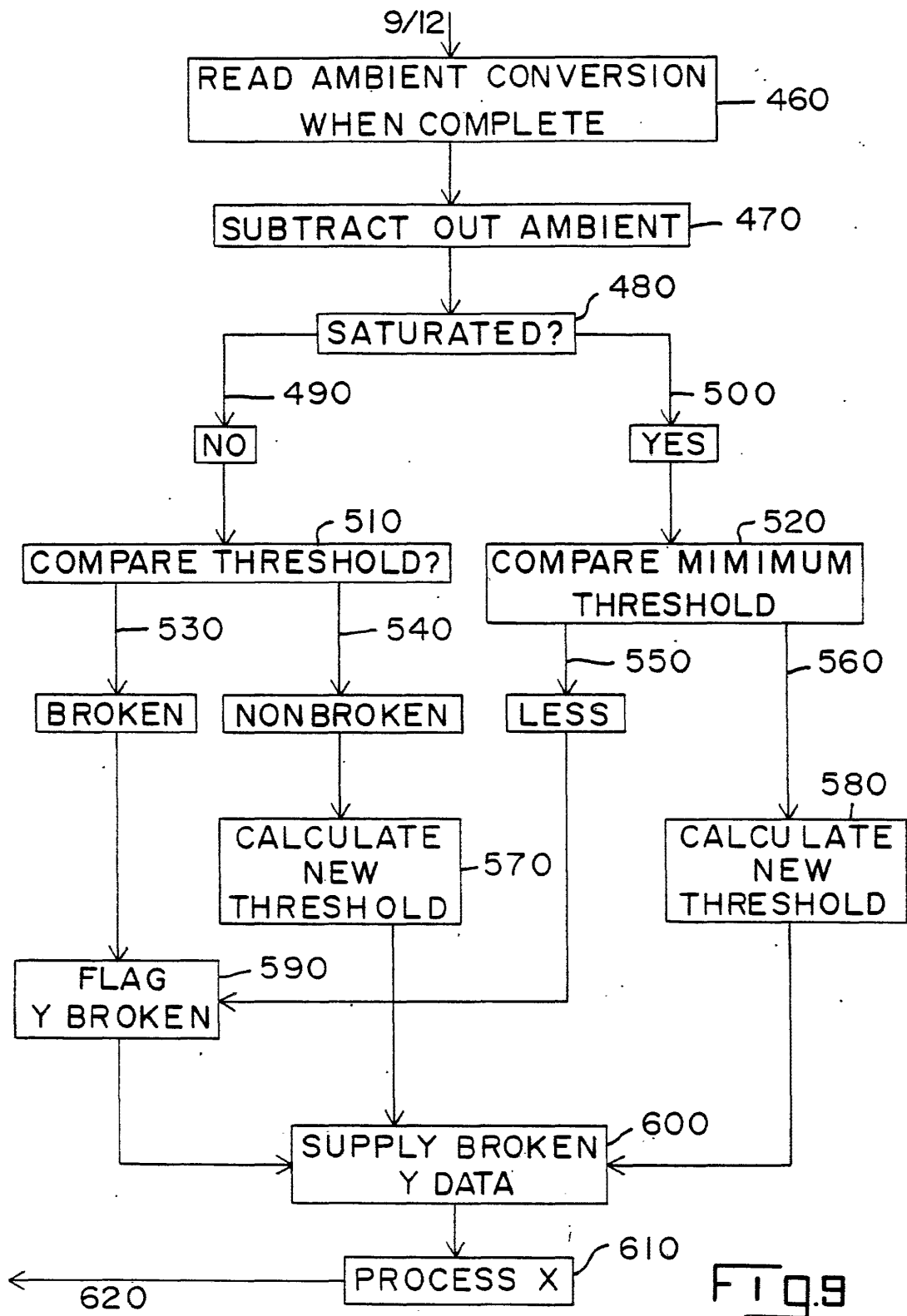


FIG. 8



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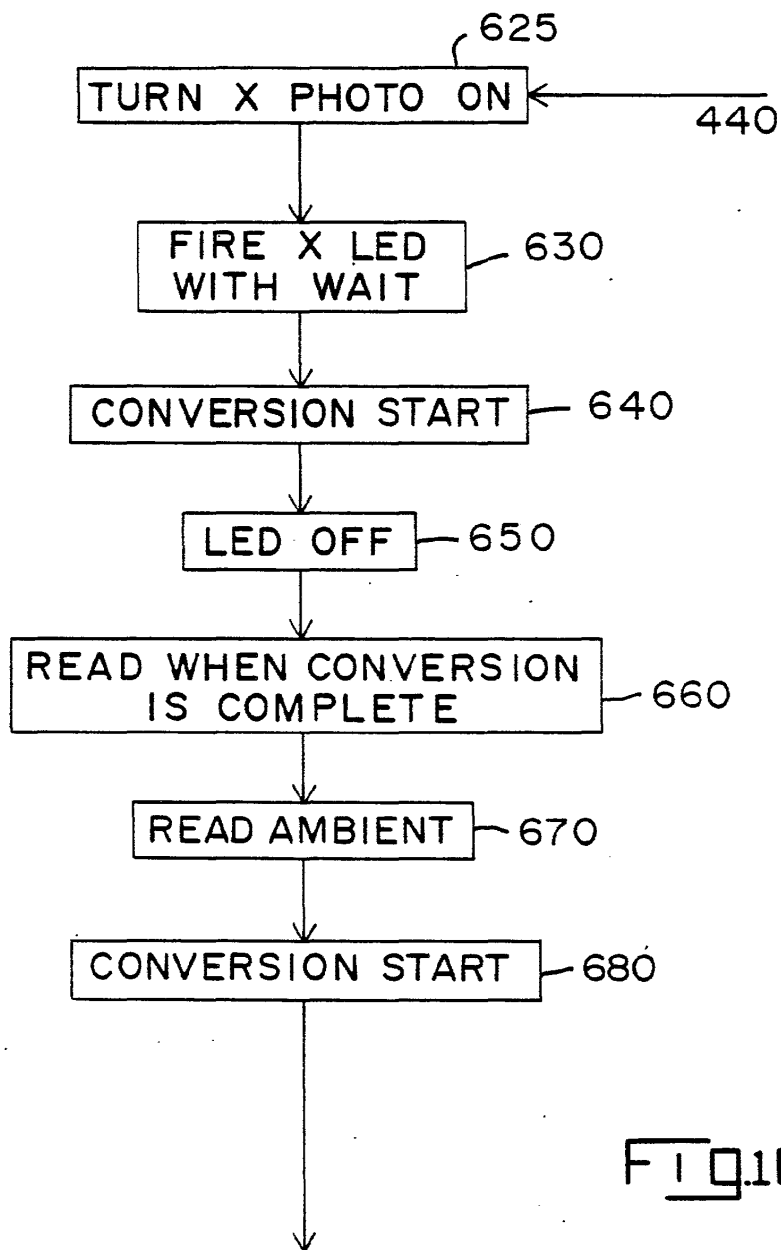


FIG. 10

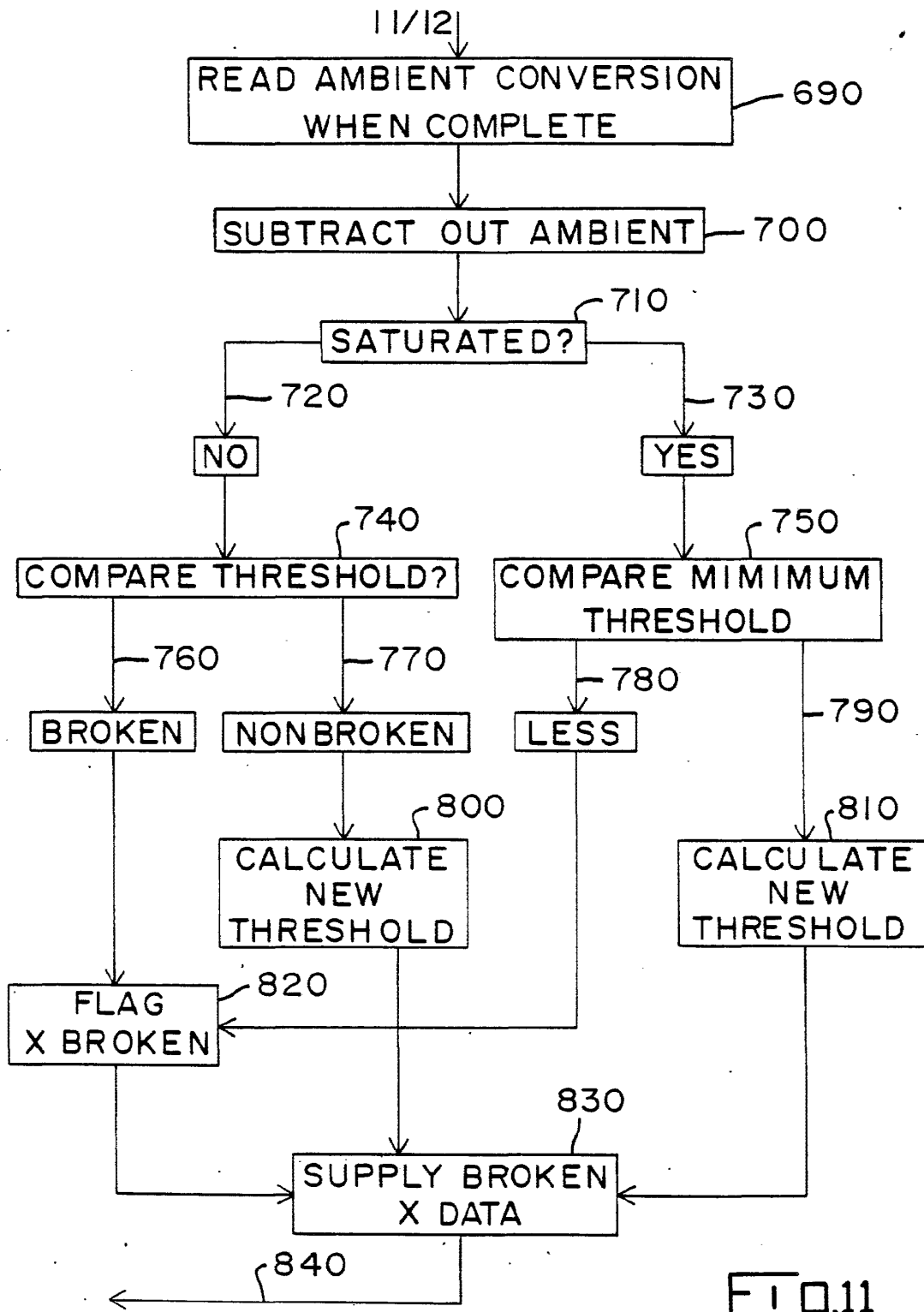


Fig.11

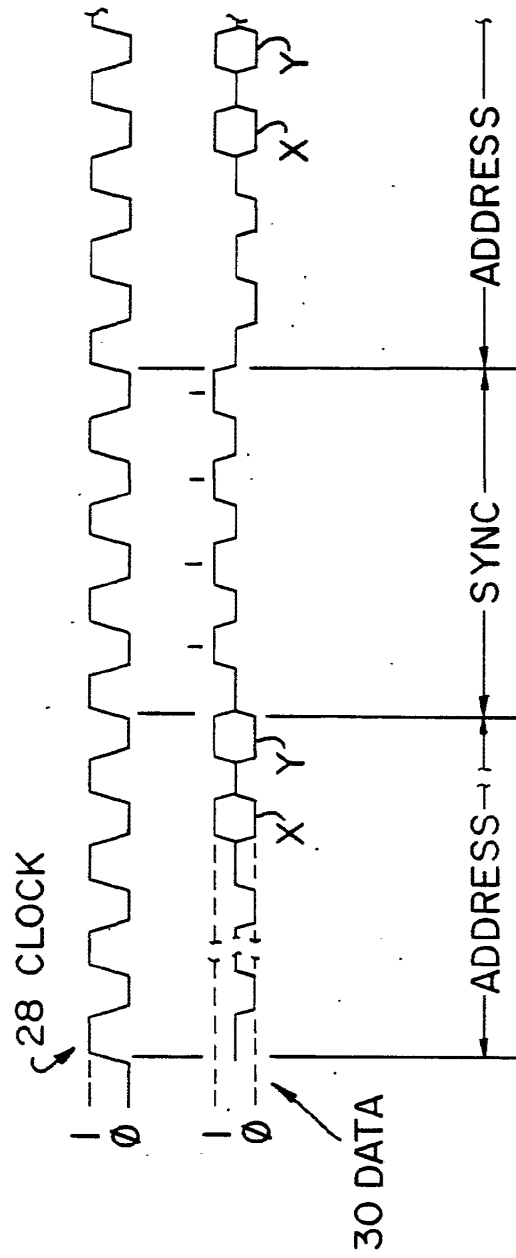
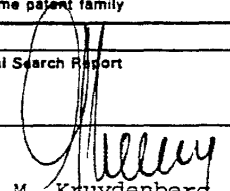


FIG.12

INTERNATIONAL SEARCH REPORT

International Application No. PCT/US 85/00923

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) *		
According to International Patent Classification (IPC) or to both National Classification and IPC		
IPC ⁴ : G 06 K 11/06		
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁷		
Classification System	Classification Symbols	
IPC ⁴	G 06 K 11/06	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁸		
III. DOCUMENTS CONSIDERED TO BE RELEVANT ⁹		
Category ⁹	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
A	US, A, 4198623 (SANDERS ASSOCIATES MISEK et al.) 15 April 1980, see column 2, lines 51-57; column 6, lines 42-46; figures 1,4 --	1,5,9
A	US, A, 4243879 (CARROLL MANUFACTURING CORP. CARROLL et al.) 6 January 1981, see abstract; column 3, lines 20-34,46-51; column 6, lines 53-57; column 7, lines 31-37; figure 1 (cited in the application) --	1,5,9
A	US, A, 3764813 (BELL TELEPHONE LABS, CLEMENT et al.) 9 October 1973, see abstract; column 2, lines 1-5; column 4, lines 40-45; column 5, lines 14-26; figure 2A-1 (cited in the application) --	1,2,5,6,9,10
X,P	Electrical Design News, volume 29, nr. 15, 26 July 1984, (Boston, Massachusetts, US) R. Comerford: "Pointing-device innovations enhance user/machine interfaces", pages 54-66 see page 59, lines 41-44,48-57; figure 3 --	1
<p>* Special categories of cited documents: ¹⁰</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"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)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"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</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"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.</p> <p>"&" document member of the same patent family</p>		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	
21st August 1985	23 SEP. 1985	
International Searching Authority	Signature of Authorized Officer	
EUROPEAN PATENT OFFICE	 G.L.M. Kruidenberg	

Form PCT/ISA/210 (second sheet) (January 1985)

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON

INTERNATIONAL APPLICATION NO. PCT/US 85/00923 (SA 9608)

This Annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 09/09/85

The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US-A- 4198623	15/04/80	None	
US-A- 4243879	06/01/81	US-A- 4201295	06/05/80
US-A- 3764813	09/10/73	None	

For more details about this annex :
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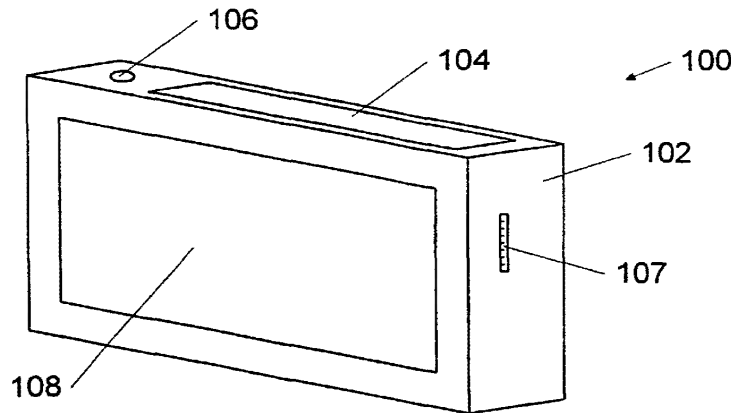
(71) Applicant and
(72) Inventor: **LI, Chuang** [US/US]; 19884 Charters Avenue, Saratoga, CA 95070 (US).

Published:
— With international search report.

(74) Agents: **PISANO, Nicola, A.** et al.; Fish & Neave, 1251 Avenue of the Americas, New York, NY 10020 (US).

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.

(54) Title: METHODS AND APPARATUS FOR CONTROLLING A PORTABLE ELECTRONIC DEVICE USING A TOUCH-PAD



(57) Abstract: Apparatus and methods for controlling a portable electronic device, such as an MP3 player, portable radio, voice recorder, or portable CD player are disclosed. A touchpad (108, 401) is mounted on the housing of the device, and a user enters commands by tracing patterns with his finger on a surface of the touchpad (108, 401). No immediate visual feedback is provided as a command pattern is traced, and the user does not need to view the device to enter commands. A microcontroller (404) within the device matches the pattern traced by the user against a plurality of preset patterns, each of which corresponds to a predefined function or command of the device. If the pattern traced by the user is a reasonably close match to any of the preset patterns, the device performs the predefined function corresponding to the matched pattern. The touchpad (108, 401) replaces the numerous buttons that are typically used to control portable electronic devices, thereby enhancing usability and reducing manufacturing costs.

WO 01/02949 A1

METHODS AND APPARATUS FOR CONTROLLING
A PORTABLE ELECTRONIC DEVICE
USING A TOUCHPAD

Field Of The Invention

5 The present invention relates generally to
methods and apparatus for controlling the operation of
a portable electronic device, such as a portable radio,
cassette player, voice recorder, or MP3 player. More
particularly, the present invention relates to using a
10 touchpad to control a portable electronic device.

Background Of The Invention

As technology advances, portable electronic
devices, such as portable radios, CD-players, voice
recorders, and cassette tape players are becoming
15 smaller, and are integrating an increasing number of
functions. With the recent introduction of portable
MP3 players, and other portable devices that play music
from solid state memory or other digital storage,
portable electronic devices may become still smaller,
20 and even more complex to operate.

As used herein, a portable electronic device
refers to one of a wide variety of small, portable
consumer electronic devices that are primarily designed
to perform specific predefined functions. Most of
25 these devices are small enough to fit within a pocket,

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or be clipped onto a belt, though some, such as portable stereos that include speakers may be considerably larger. Many consumer audio devices such as portable radios, cassette players and recorders, 5 portable CD players, voice recorders, and portable MP3 players are among the types of devices that are considered portable electronic devices for purposes of this application. Other portable entertainment devices, such as portable DVD players, as well as other 10 portable electronic devices having specific predefined functions, such as pagers, remote controls, and cellular telephones may also be within the definition of a portable electronic device.

More complex devices, such as portable 15 computers or personal digital assistants (PDAs), which provide general functionality or are extensively programmable are not within the definition of a portable electronic device, as used herein. Although such general purpose devices may include a capability 20 to play audio from storage or from a CD, or may be programmed to perform other functions similar to those performed by portable electronic devices, these are not typically the predefined functions of the device, and are not the functions for which these general purpose 25 devices were primarily designed. General purpose devices, such as portable computers and PDAs do not compete in the same market as portable electronic devices, do not typically include the same limited-purpose components and predefined functions, and do not 30 face the same cost and usability concerns as portable electronic devices.

Typically, portable electronic devices include numerous buttons, switches, knobs, and displays to permit a user to control the operation of the

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device. All of these components take space on the housing of the device, and thereby limit the ability to reduce the size of the device. Reducing the size of these components may cause usability problems, since
5 pressing tiny buttons and reading miniature displays may be awkward or irritating for many users. These problems are becoming more severe, since an increased number of integrated functions typically requires an increased number of buttons to control all of the
10 functions.

The use of numerous small buttons and switches to control portable electronic devices also results in complex and inconvenient operation. Particularly, it may be difficult to find a desired
15 button among the many buttons on such a device. Finding the correct button may be particularly difficult when attempting to operate the device without looking at it, as would be typical when the device is kept in a pocket, attached to a belt, or used during
20 physical activity, such as jogging. Since these are among the major intended uses of portable electronic devices, this usability problem is a serious concern.

The use of numerous buttons to control these devices also increases the cost and decreases the
25 manufacturing yield of the devices. Typically, assembly of the numerous buttons on a portable electronic device must be completed by hand, resulting in higher manufacturing costs and lower yields. Additionally, each button, switch, or knob is a
30 separate mechanical component which may fail, reducing the manufacturing yield and the reliability of the devices.

Various input and control methods have been successfully used on other types of portable electronic

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equipment. On portable computers, input devices such as trackballs, touchpads, and control sticks have been used to control the movement of a cursor on a screen. Cursor movement may be used to control the operation of a variety of applications running on a portable
5 computer. In personal digital assistants (PDAs), such as the PALMPILOT™, a trademark of Palm Computing, Inc. (a subsidiary of 3Com Corporation), of Santa Clara, California, which have some of the same size concerns
10 as portable electronic devices, pen-based input and control is common. Typically, a stylus or pen is used to draw characters on a touch-sensitive screen to input the characters into the PDA without using a keyboard. Gestures, such as crossing out a word on the screen, or
15 tapping the stylus over a graphical icon on the screen may be used to enter and edit text, or to control the operation of a typical PDA.

On portable computers, immediate visual feedback from the pointing device, typically provided
20 in the form of cursor motion on a screen, is critical to operation of the computer. Without this feedback, the user would have no ability to determine where the cursor is located, and no ability to position the cursor over icons or other controls on the screen,
25 which are used to control the operation of the portable computer.

PDAs, such as the PALMPILOT™, while less reliant on immediate visual feedback than personal computers, still rely on the user being able to view a
30 screen built into the PDA to control the operation of the PDA. Most operations on the PALMPILOT™, for example, are specified by tapping a stylus over an icon or control that appears on the screen. Other gestures are used to enter and edit text -- another activity

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that demands that a user view the screen to see the text that is being entered.

While this type of visual interface may be desirable for personal computers and PDAs, most portable electronic devices lack the type of display device that would permit such highly visual methods to be used. Additionally, users of most portable electronic devices are interested in operating the device with a minimal amount of difficulty. Ideally, a user should be able to operate the device quickly, easily, and without having to view a display while operating the device. Since methods of using touch-sensitive devices on personal computers and PDAs provide immediate visual feedback as an important part of their user interface, or require interaction with visual elements on a screen, they typically demand that a user view a display on the device while the device is being operated. This renders these methods unsuitable for use on a wide variety of portable electronic devices. Additionally, use of a stylus or pen to enter commands is unacceptable for most portable electronic devices, since attempting to use a pen while jogging or engaging in other physical activity would be nearly impossible for most users.

In view of the above, it would be desirable to provide a portable electronic device that is easy and convenient to use, even without looking at the device.

It also would be desirable to provide a portable electronic device with a reduced number of buttons disposed on its housing, thereby permitting the space on the device to be used for other purposes, such as providing a larger display, or reducing the size of the device.

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It would further be desirable to provide a portable electronic device with reduced manufacturing costs, and higher yields.

Summary Of The Invention

5 It is an object of the present invention to provide a portable electronic device that is easy and convenient to use, even without looking at the device.

 It is also an object of the present invention to provide a portable electronic device with a reduced
10 number of buttons disposed on its housing, thereby permitting the space on the device to be used for other purposes, such as providing a larger display, or reducing the size of the device.

 It is a further object of the present
15 invention to provide a portable electronic device with reduced manufacturing costs, and higher yields.

 These and other objects of the present invention are achieved by providing apparatus and methods for using a touchpad to control a portable
20 electronic device, such as a portable radio, CD player, cassette tape player, voice recorder, pager, portable DVD player, or MP3 player. Instead of using a plurality of buttons disposed on the housing of the device for control, the present invention teaches use
25 of a single touchpad, on which the user traces patterns to control the device. The device does not need to provide immediate visual feedback, and the patterns are simple enough that they may be entered without requiring that the user view the portable electronic
30 device while entering the commands.

 The portable electronic device of the present invention comprises a touchpad disposed on the housing of the device. A microcontroller within the device

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receives electrical signals from the touchpad, representing x-y coordinates of the location at which a user's finger contacts the touchpad. Alternatively, the touchpad may send signals indicative of the motion
5 of a user's finger across the surface of the touchpad. The microcontroller compares the data received from the touchpad with a plurality of patterns stored in a memory coupled to the microcontroller.

Each of the stored patterns represents a
10 command or function of the portable electronic device. If the microcontroller determines that the data received from the touchpad matches one of the patterns, the microcontroller causes the device to perform the command or function associated with the matched
15 pattern.

In a preferred embodiment of the portable electronic device of the present invention, a pattern representing a function does not need to be matched precisely. A "close" match, in which the pattern is
20 scaled, translated, or rotated within preset bounds will be sufficient to indicate a match. Additionally, some variation in timing or speed at which a pattern is traced may be tolerated in the matching process.

The present invention also discloses a method
25 for controlling a portable electronic device by receiving data from a touchpad, and comparing the data with a plurality of predefined patterns, each of which represents a function of the portable electronic device. If a matching pattern is found, the function
30 represented by the matching pattern is performed.

Brief Description Of The Drawings

The above and other objects and advantages of the present invention will be apparent upon

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consideration of the following detailed description, taken in conjunction with the accompanying drawings, in which like reference characters refer to like parts throughout, and in which:

5 FIG. 1 shows a portable electronic device built in accordance with the principles of the present invention;

 FIGS. 2A-2K show illustrative commands that may be entered through a touchpad to control a portable
10 electronic device;

 FIGS. 3A-3D show a range of variation in entering a command on a touchpad;

 FIG. 4 shows an alternative embodiment of a portable electronic device built in accordance with the
15 principles of the present invention;

 FIG. 5 is a block diagram of the electronics of a portable electronic device built in accordance with the principles of the present invention; and

 FIG. 6 is a flowchart of a method in
20 accordance with the present invention for receiving, matching, and performing a command.

Detailed Description Of The Invention

 Referring to FIG. 1, a view of a portable electronic device constructed in accordance with the
25 principles of the present invention is shown. The embodiment shown in FIG. 1 is a portable MP3 music player, that plays music formatted according to the MPEG audio layer 3 standard. It will be evident to one skilled in the art that the features of the present
30 invention could be readily adapted for use in a portable CD player, cassette player/recorder, voice recorder, pager, portable DVD player, remote control, or other portable electronic device. Additionally, it

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will be understood that use of the MPEG audio layer 3 (MP3) standard in the music player of FIG. 1 is for illustration, and that the features of the present invention could be used on a digital music player that
5 plays music encoded in any other digital music format.

Music player 100 comprises housing 102, liquid crystal display 104, headphone jack 106, data port 107, and touchpad 108. Additionally, the housing may have a feature that permits the user to determine
10 the orientation of the device, preferably without looking at the device. For music player 100, the placement of liquid crystal display 104, headphone jack 106, or data port 107 may permit the user to determine the orientation. Other features, such as a distinctive
15 housing shape (not shown), or a belt clip (not shown) may also permit the user to determine the orientation of the device. Alternatively, electronic means may be used to specify the orientation of the device. For example, the user may tap on the top edge of touchpad
20 108 when the device is started to specify the orientation of the device.

The user controls operation of music player 100 by tracing simple patterns with his finger on the surface of touchpad 108. For example, by moving his
25 finger across touchpad 108 from left to right, the user instructs music player 100 to advance to the next song. By tapping twice on the surface of touchpad 108, the user instructs music player 100 to pause. It should be noted that unlike touchpads used for moving a cursor on
30 a computer screen, no immediate visual feedback needs to be given to the user while he or she enters a command. Only once a command is completed is there a feedback in the form of executing the command, such as

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playing the music or stopping the music, indicating that the command was recognized.

Advantageously, since music player 100 is not controlled using a plurality of buttons, it should be relatively easy for a user to control music player 100, even without looking at music player 100 or receiving any other visual feedback. To enter commands, the user need only locate and use touchpad 108 -- the only control on the face of housing 102. Additionally, since music player 100 does not need a plurality of buttons and other controls, housing 102 can be made as small as the size of touchpad 108 and the functions of music player 100 permit (e.g. a cassette player could not be made smaller than the size of a cassette tape). Since touchpads are a mass-produced, inexpensive component, use of touchpad 108 also may reduce the overall cost of manufacturing music player 100, as compared to a music player that uses buttons to control operation. A preferred embodiment of the present invention uses a resistive touchpad, since resistive touchpads are currently less expensive than capacitive touchpads.

It will be understood by one skilled in the art that various changes may be made to the arrangement and composition of controls on housing 102 without departing from the invention. For example, housing 102 may include an optional belt clip (not shown), contacts (not shown) for a battery charger or data download device, and an opening (not shown) in which a battery or additional memory may be added. Additionally, depending on the functions performed by music player 100, it may be desirable to add function switches or buttons (not show), for selecting a function, for turning music player 100 off, for disabling touchpad

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108, or for performing other functions that are not selected using touchpad 108.

Referring now to FIGS 2A-K, illustrative patterns that may be traced on the surface of touchpad 5 108 to control the operation of music player 100 are shown. FIG. 2A shows a pattern representing the "play" command. By sweeping his or her finger rapidly across the surface of touchpad 108 in a motion such as shown by arrow 110, with a left-to-right downward diagonal 10 motion followed by a right-to-left downward diagonal motion, the user instructs music player 100 to start playing a song, or to resume playing after the player has been paused.

FIG. 2B shows a "stop" command. A right-to- 15 left downward diagonal sweep followed by a left-to-right downward diagonal sweep, as traced by arrow 112, may be used to command music player 100 to stop playing a song.

FIGS. 2C and 2D show, respectively, commands 20 for advancing to the next song, or skipping to the previous song. By moving a finger across touchpad 108 in a left-to-right direction, as shown by arrow 114 of FIG. 2C, the user commands music player 100 to advance to the next song. By moving a finger across touchpad 25 108 in a right-to-left motion, as shown by arrow 116 of FIG. 2D, the user commands music player 100 to back up to the previous song.

An upward motion, as shown by arrow 118 of FIG. 2E increases the volume. A downward motion, as 30 shown by arrow 120 of FIG. 2F may be used to decrease the volume.

Circular motions may also be used to indicate commands. A clockwise circular motion, such as is shown by arrow 122 of FIG. 2G commands the player to

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repeat the current song or "repeat range", while a counterclockwise circular motion, as indicated by arrow 124 of FIG. 2H may be used to set the repeat range.

Tapping a finger against the surface of touchpad 108 may also be used to form commands. A tap is indicated as a dot in the figures, and although the dots are shown at specific locations on touchpad 108, tapping at most locations on touchpad 108 is equally effective. FIG. 2I shows a pause command, consisting of two taps on touchpad 108, indicated by dots 126 and 127.

Holding a finger on the surface of touchpad 108 may be used to specify commands or functions. This action is shown in the figures as a short vertical line. A left-to-right motion followed by holding the finger on touchpad 108, as shown by arrow 128 and line 129 of FIG. 2J, may be used to put the player in a "fast-forward" mode. The player keeps running in fast forward mode while the user holds his finger on touchpad 108. A right-to-left motion followed by holding the finger on touchpad 108, as shown by arrow 130 and line 131 of FIG 2K, may be used to put the player into a "fast-reverse" mode. The player will remain in fast reverse mode until the user's finger is lifted from touchpad 108.

Advantageously, all of these commands are relatively simple and intuitive. It should be easy for most users to learn these commands, and easy to use the commands without having to look at touchpad 108 while entering the commands.

It should also be noted that there may be a timing or speed factor in commands entered into touchpad 108. In a preferred embodiment, for example, commands (with the exception of the fast forward and

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fast reverse commands) must occur within a predetermined period of time. Thus, once a command is started, it must be completed within the predetermined period. The predetermined time period is typically
5 between 50 and 1500 milliseconds, though other values are possible. This permits compound commands to be distinguished from commands consisting of the individual elements of the compound command.

Although the commands described above are
10 specific to a random-access music player, such as an MP3 player (or other memory-based music player) or CD player, it will be understood that similar commands may be used to control the operation of other portable electronic devices. For example, a "play" command on a
15 cassette player could be the same as the "play" command shown above in FIG. 2A. On a portable radio, the circular motions shown in FIGS. 2G and 2H may be used to scan forward and backward, searching for stations, while the left-to-right and right-to-left motions shown
20 in FIGS. 2C and 2D may be used to go to the next or previous station in a list of pre-set stations.

It will be understood by one skilled in the art that the commands shown with reference to FIGS. 2A-2K are for illustration. Other combinations of
25 motions, tapping, and holding a finger on the surface of touchpad 108 could be used to perform the commands and functions discussed with reference to FIGS. 2A-2K without departing from the present invention.

Additional commands combining the motions
30 shown above, or using other motions may be used to represent additional functions. For example, a downward motion followed by a tap may be used as a "mute" command. A repeated rapid back and forth motion in a generally left-to-right and right-to-left

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direction, or a motion in the form of an "X" or cross may be used by an MP3 player to remove the current song from memory. On a device combining the functions of an MP3 player with the functions of a portable radio, a
5 clockwise circular motion followed by a tap may be used to switch between an MP3 mode and a radio mode. Nearly any number of functions may be represented by relatively simple patterns or combinations of simple patterns that may be traced using a finger or other
10 pointing device on a touchpad.

Additionally, some commands entered into the portable electronic device of the present invention could be dependent on the position on the touchpad at which the command is entered. For example, on a multi-
15 function device, such as a music player combining the functions of an MP3 player, a voice recorder, and a radio, sweeping a finger or other pointing device across a top edge of touchpad 108 may cause the player to switch to the next function, while sweeping across a
20 bottom edge of touchpad 108 causes the player to switch to the previous function. Tapping on the touchpad at the corners of the touchpad could also be used to enter commands or specify functions. Preferably, these position-dependent commands should only use positions
25 on the touchpad such as the edges or corners, that may be located without requiring the user to view the device during operation.

As shown in FIGS. 3A-3D, the entry of commands into touchpad 108 does not need to be precise.
30 Any of the left-to-right motions shown in FIGS. 3A-3C will be recognized as the same command, while the motion shown in FIG. 3D will be recognized as a downward motion, rather than a left-to-right motion. In FIGS. 3A-3D, touchpad 108 is shown divided into

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eight segments to illustrate the range of motions that may be recognized as the same command.

FIG. 3A shows a perfectly formed left-to right motion (arrow 132) through the center of touchpad 108. As shown in FIG. 3B, a similar motion (arrow 134), translated to a different position on the touchpad, and adjusted slightly in scale will still be recognized. FIG. 3C shows that another similar motion (arrow 136), that is translated from the center of the pad, and rotated slightly will also be recognized. When the motion is rotated so that it is more downward than left-to-right, as shown by arrow 138 in FIG. 3D, the system will recognize the motion as a downward motion.

All of the commands recognized by music player 100 may be translated, rotated, scaled, and adjusted in timing and speed of tracing the pattern, within preset bounds, and still be recognized. This makes use of music player 100 more convenient, and permits users to quickly enter commands without looking at touchpad 108, or being too concerned with precision in moving a finger across touchpad 108.

Referring now to FIG. 4, an alternative embodiment of a portable electronic device built in accordance with the principles of the present invention is shown. As above, a portable MP3 device is shown in the figure, though it will be understood that the features of this embodiment could be adapted, mutatis mutandis, to other portable electronic devices, such as radios, voice recorders, cassette players, portable DVD players, pagers, remote controls, or CD players.

Music player 200 comprises housing 202, touchscreen 204, headphone jack 206, and data port 207. Touchscreen 204 combines the functions of a display and

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a touchpad, permitting the user to enter commands in the manner described hereinabove, while providing a relatively large display. Advantageously, music player 200 has a large display, without increasing the size of housing 202 to accommodate both a display and controls.

Unlike the touchscreen used on a typical PDA, touchscreen 204 does not need to provide any immediate visual feedback (e.g. movement of a cursor or displaying the path traced by the user) while the user is entering a command, and the user's interaction with touchscreen 204 does not depend on the position of icons or controls displayed on touchscreen 204.

Specifically, the same commands that were used on music player 100 of FIG. 1 may be used on music player 200.

The user does not need to view touchscreen 204 to operate music player 200. Thus, the touch-sensitive functionality of touchscreen 204 is effectively decoupled from the display aspects of touchscreen 204.

As discussed above, housing 202 may include an optional belt clip (not shown), contacts (not shown) for a battery charger or data download device, an opening (not shown) in which a battery or additional memory may be inserted, an on-off or function switch (not shown), additional buttons (not shown), or other additional features without departing from the present invention.

FIG. 5 shows a block diagram of the electronics of a portable electronic device built in accordance with the principles of the present invention. Portable electronic device 400 comprises touchpad 401, which continuously translates a point touched by a user's finger into an x-y coordinate, which is electrically transmitted across bus 402 to microcontroller 404. Alternatively, touchpad 401 may

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send data about the motion of the user's finger across the touchpad to microcontroller 404. Microcontroller 404 is coupled to memory 406, which may be internal to microcontroller 404, and is programmed to receive data
5 from touchpad 401 and compare the received data with a plurality of patterns stored in memory 406.

In a preferred embodiment, touchpad 401 interrupts microcontroller 404 when the user's finger comes into contact with touchpad 401, after which
10 microcontroller 404 polls touchpad 401 to receive x-y coordinate or motion information. Microcontroller 404 collects these data over a predetermined period of time, typically ranging between 50 and 1500 milliseconds. Microcontroller 404 compares the data
15 with a plurality of preset patterns stored in memory 406, to determine if one of the preset patterns matches the data.

The match does not need to be precise, and, as described hereinabove, translation, rotation,
20 scaling, and timing differences between the preset patterns and the data will be tolerated within preset bounds. In a preferred embodiment, this is achieved by basing the matching on a scaled difference between adjacent data points in the coordinate data, rather
25 than on the coordinate data itself. This scaled difference represents the direction and speed of motion of the user's finger across touchpad 401, rather than exact x-y coordinates, making it easier to match patterns in spite of scaling, rotation, translation,
30 and timing differences. For touchpads that send motion information, rather than x-y coordinates, the motion data may be used directly in the pattern matching.

The pattern matching is performed using any one of a large number of pattern matching algorithms.

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Depending on the algorithm used, portable electronic device 400 may not need to store the coordinate or motion information sent to microcontroller 404 by touchpad 401. Matching may be performed as the data is
5 sent, using, for example, a finite state machine-based matching algorithm. In this case, it is not necessary to store the coordinate or motion information. In a preferred embodiment, matching is performed using a
10 previously known octant and quadrant-based matching algorithm, such as is described in the article "Your Own Handwriting Recognition Engine," by Ron Avitzur, in Dr. Dobb's Journal, April, 1992, at pages 32-37, and 103. This type of algorithm matches patterns based on
15 octant and quadrant information, so only octant and quadrant information on the coordinate data needs to be kept.

Each of the preset patterns corresponds to a function or command of portable electronic device 400. If a sufficiently close match between a preset pattern
20 and the coordinate data collected over the predetermined time period is detected, microcontroller 404 will generate signals to cause portable electronic device 400 to carry out the function or command corresponding to the matched pattern. If
25 microcontroller 404 is the main processor for portable electronic device 400, then microcontroller 404 may execute the command or function directly. Alternatively, if portable electronic device 400 includes another processor or microcontroller that
30 performs control functions, microcontroller 404 may send the other processor a signal indicating which function or command should be performed. It is also possible for microcontroller 404 to directly handle a subset of the functions or commands, while sending

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signals for other functions or commands to another processor.

For example, if portable electronic device 400 is an MP3 player, microcontroller 404 may be responsible for decoding and playing MP3 music stored in memory 406 or other memory (not shown) connected to microcontroller 404, as well as matching and handling commands from touchpad 401. Advantageously, by using a single microcontroller to decode and handle commands and to play music, the component count and manufacturing costs of portable electronic device 400 are kept relatively low. Alternatively, if portable electronic device 400 is a cassette player, it may be necessary for microcontroller 404 to send commands on to other electronic or electromechanical components within portable electronic device 400.

It will be understood that there are many variations on the apparatus and methods described with reference to FIG. 5. For instance, instead of being interrupt-driven, microcontroller 404 may continually poll touchpad 400 to determine when the user starts entering a command, or may wait for coordinate data to arrive across bus 402. Additionally, microcontroller 404 may wait until coordinate data have been collected for the entire predetermined time period before starting the matching process, or the matching may begin as soon as there is sufficient coordinate data to begin the matching process.

FIG. 6 shows a flowchart of the method performed by microcontroller 404. At step 501, the system waits for the user to begin entering a command on a touchpad. Once the user's finger contacts the touchpad, a plurality of data points corresponding to the position of a user's finger on a touchpad are

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collected at step 502. Alternatively, the data points may correspond to the motion of the user's finger across the touchpad. In a preferred embodiment, these data are collected over a predetermined period of time.

5 At step 503, the collected data are matched against a plurality of preset patterns, each of the patterns corresponding to a command or function of a portable electronic device. If any of the patterns are deemed to be matched (step 504), the command or function is

10 performed by the portable electronic device (step 505). Otherwise, the system returns to step 501, and waits for the next command.

It will be understood that microcontroller 404 does not need to be idle between the steps shown in

15 FIG. 6. Microcontroller 404 could, for example, play music, decode MP3 format compressed music, or perform other normal functions of a portable electronic device between performing the steps described in FIG. 7.

Although preferred illustrative embodiments

20 of the present invention are described above, it will be evident to one skilled in the art that various changes and modifications may be made without departing from the invention. For example, although the apparatus and methods of the present invention are

25 described as using a touchpad or touchscreen, almost any touch-sensitive device capable of providing information on locations or motions of a user's finger on a surface of the touch-sensitive device may be used in accordance with the apparatus and methods of the

30 present invention. Additionally, although the described embodiments apply the apparatus and methods of the present invention to a portable MP3 player, it will be understood that the use of patterns or gestures traced on a touchpad to control the functions of a

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portable electronic device may be used with minimal
adaptation on a wide variety of portable electronic
devices. Further, although the application refers to
MP3 players, there are many similar music compression
5 formats currently known or being developed that could
be played on a portable audio music player in addition
to, or instead of music in the MP3 format. It is
intended in the appended claims to cover all such
changes and modifications that fall within the true
10 spirit and scope of the invention.

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What Is Claimed Is:

1. A portable electronic device comprising:
a housing; and
a touch-sensitive surface mounted on the housing, the portable electronic device controlled by a user tracing a command pattern on the touch-sensitive surface with a finger, the command pattern matching one of a plurality of preset patterns, each of the plurality of preset patterns corresponding to a predefined function of the portable electronic device, the command pattern being traced without requiring the user to view the portable electronic device.

2. The portable electronic device of claim 1, wherein the command pattern matches one of the plurality of preset patterns imprecisely, within preset bounds.

3. The portable electronic device of claim 2, wherein the preset bounds permit a range of variation in the translation, rotation, scale, timing, and speed of tracing the command pattern.

4. The portable electronic device of claim 1, wherein the touch-sensitive surface comprises a touchpad.

5. The portable electronic device of claim 1, wherein the portable electronic device further comprises a display.

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6. The portable electronic device of claim 1, wherein the portable electronic device is a portable entertainment device.

7. The portable electronic device of claim 6, wherein the portable electronic device is a music player.

8. The portable electronic device of claim 7, wherein the portable electronic device plays music stored in MP3 format.

9. The portable electronic device of claim 1, wherein the portable electronic device includes predefined functions of one or more devices selected from a group consisting of an MP3 player, a cassette player, a cassette recorder, a CD player, a radio, a voice recorder, a DVD player, a pager, a remote control, and a digital music player.

10. The portable electronic device of claim 1, wherein the command pattern is composed of one or more motions of the finger on the touch-sensitive surface, the one or more motions selected from a group of motions consisting of a left-to-right motion, a right-to-left motion, an upward motion, a downward motion, a clockwise circular motion, a counterclockwise circular motion, a diagonal motion, a tapping motion, and holding the pointing device against the touch-sensitive surface.

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11. The portable electronic device of claim 10, wherein the command pattern depends on a position at which the command pattern is traced or tapped on the touch-sensitive surface.

12. A portable electronic device comprising:
a microcontroller;
a memory coupled to the microcontroller, the memory storing a plurality of preset patterns, each one of the plurality of preset patterns corresponding to a predefined function of the portable electronic device;
and
a touch-sensitive device coupled to the microcontroller, the touch-sensitive device provides data indicative of the position or motion of a user's finger on a surface of the touch-sensitive device to the microcontroller,
wherein the microcontroller is programmed to:
collect the data without requiring a user to view the portable electronic device;
match the data against the plurality of preset patterns to determine a matched pattern if any one of the plurality of preset patterns sufficiently matches the data; and
cause the portable electronic device to perform the predefined function that corresponds to the matched pattern.

13. The portable electronic device of claim 12, wherein the microcontroller is programmed to collect the data over a predetermined period of time.

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14. The portable electronic device of claim 12, wherein the microcontroller is programmed to perform one or more of the predefined functions of the portable electronic device.

15. The portable electronic device of claim 12, wherein the microcontroller is programmed to permit variation, within preset bounds, in translation, rotation, scale, timing, and speed of tracing of a pattern when the data is matched against the plurality of preset patterns.

16. The portable electronic device of claim 12, wherein the touch-sensitive device comprises a touchpad.

17. The portable electronic device of claim 12, wherein the portable electronic device comprises a display.

18. The portable electronic device of claim 12, wherein the portable electronic device is a portable entertainment device.

19. The portable electronic device of claim 18, wherein the portable electronic device is a music player.

20. The portable electronic device of claim 19, wherein the portable electronic device plays music stored in MP3 format.

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21. The portable electronic device of claim 12, wherein the portable electronic device includes predefined functions of one or more devices selected from a group consisting of an MP3 player, a cassette player, a cassette recorder, a CD player, a radio, a voice recorder, a DVD player, a pager, a remote control, and a digital music player.

22. A method of controlling a portable electronic device using a touch-sensitive device, the method comprising:

contacting a surface of the touch-sensitive device;

collecting data corresponding to a pattern traced across the surface of the touch-sensitive device without requiring a user to view the portable electronic device;

matching the data against a plurality of preset patterns, each one of the preset patterns corresponding to a predefined function of the portable electronic device;

determining whether a sufficiently close match was found; and

performing the predefined function corresponding to a matched one of the plurality of preset patterns if a sufficiently close match was found.

23. The method of claim 22, wherein collecting the data is performed over a predetermined period of time.

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24. The method of claim 22, wherein matching the data against the plurality of preset patterns permits variation, within preset bounds, in translation, rotation, scale, timing, and speed of tracing of a pattern.

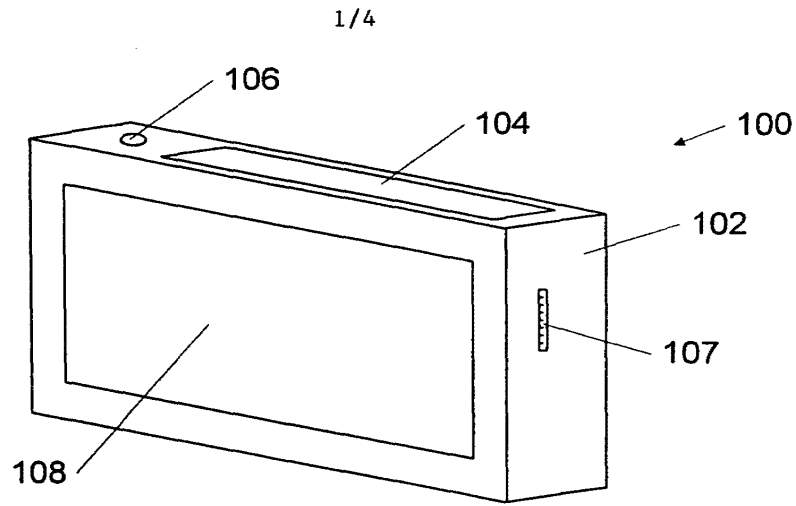


FIG. 1

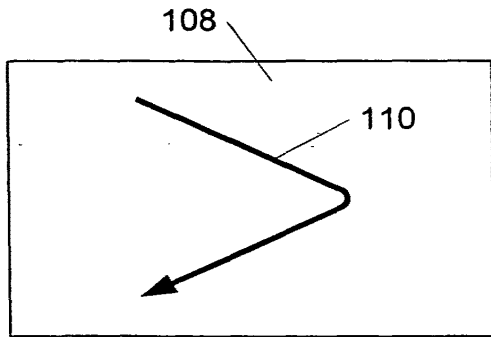


FIG. 2A

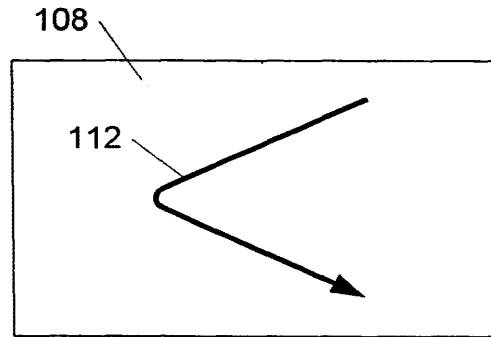


FIG. 2B

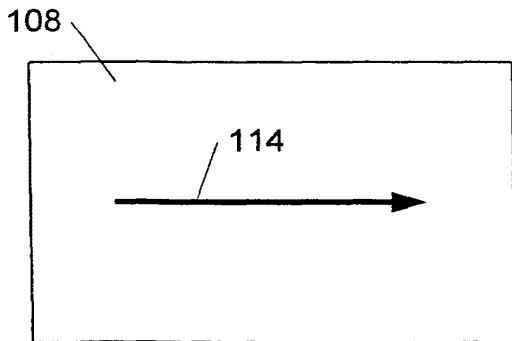


FIG. 2C

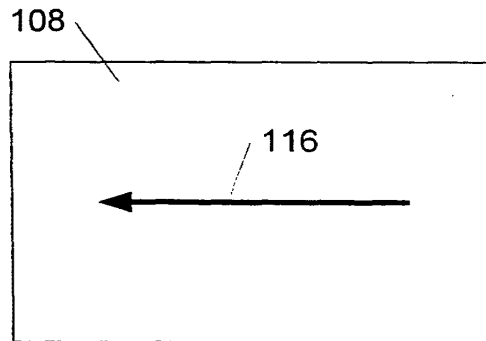


FIG. 2D

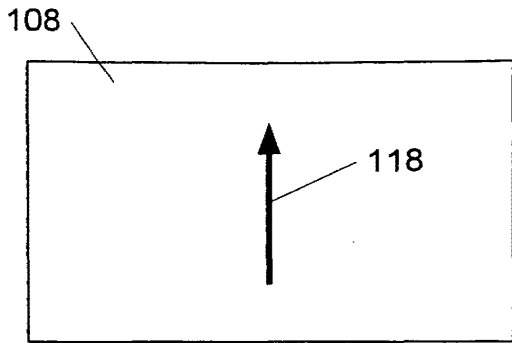


FIG. 2E

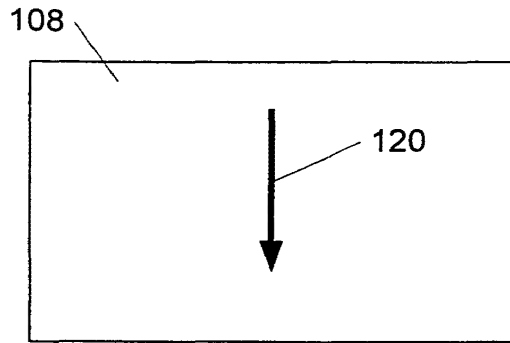


FIG. 2F

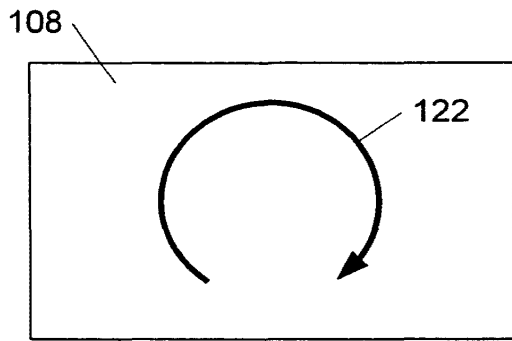


FIG. 2G

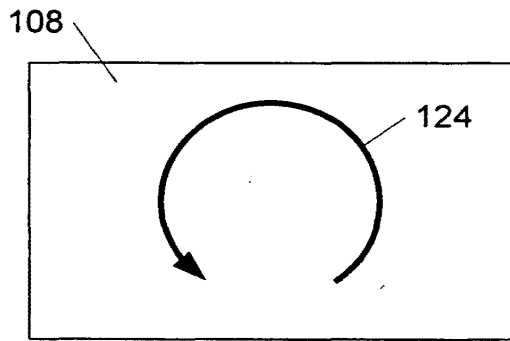


FIG. 2H

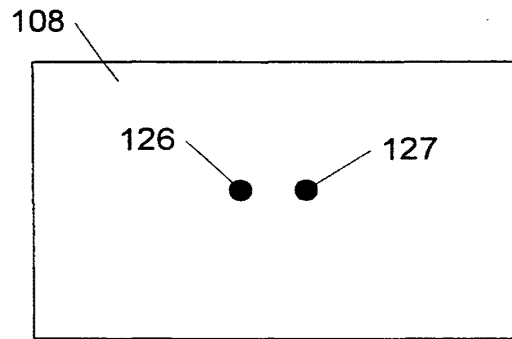


FIG. 2I

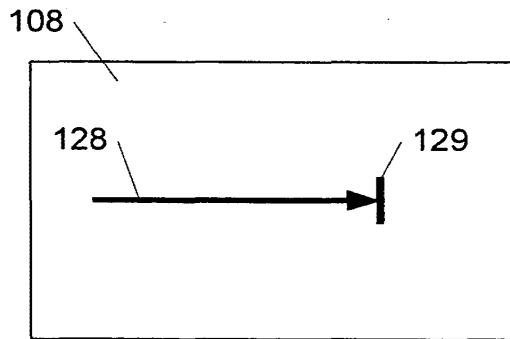


FIG. 2J

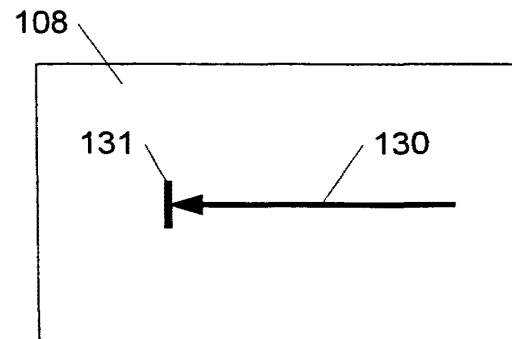


FIG. 2K

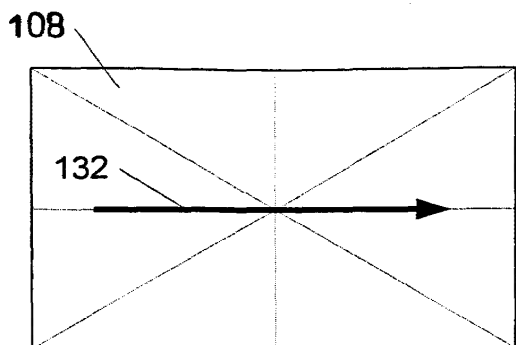


FIG. 3A

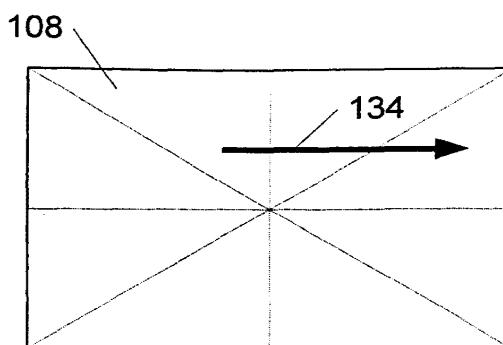


FIG. 3B

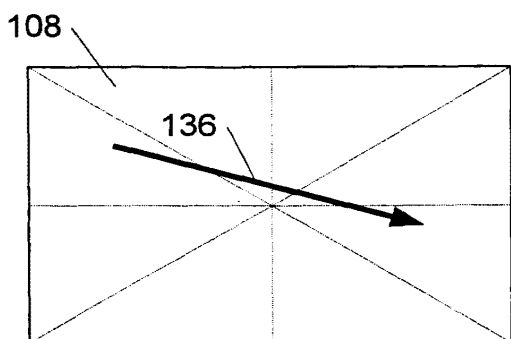


FIG. 3C

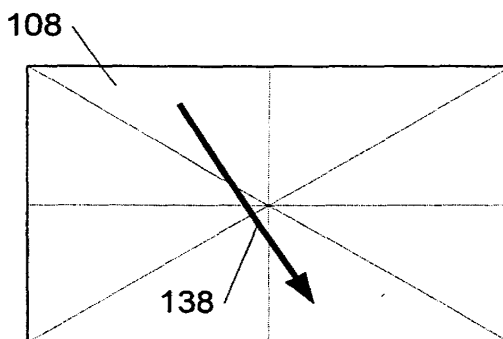


FIG. 3D

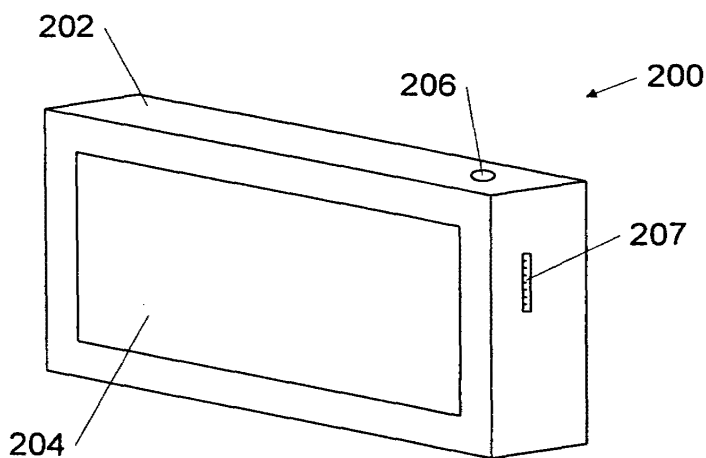


FIG. 4

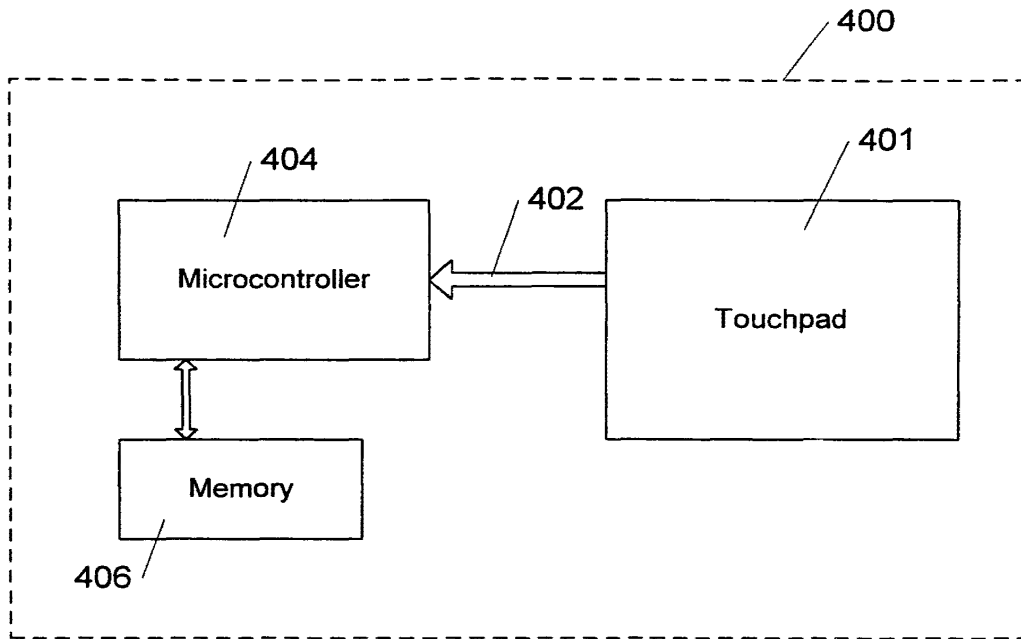


FIG. 5

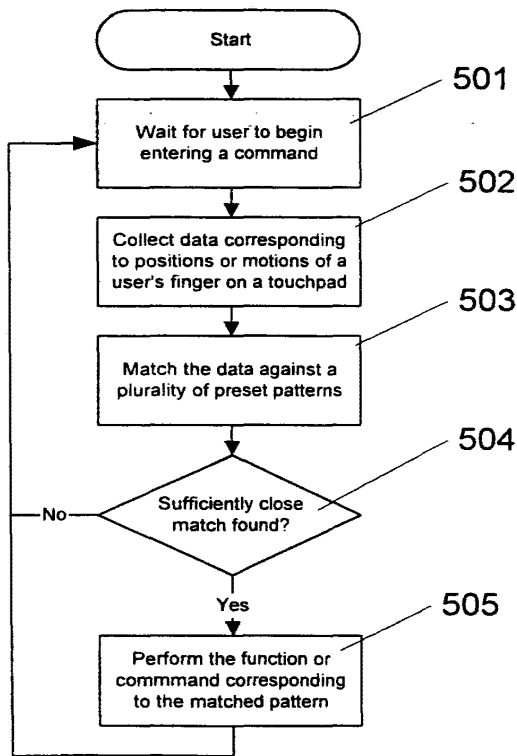


FIG. 6

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 00/40318

A. CLASSIFICATION OF SUBJECT MATTER IPC 7 G06F3/033		
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		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practical, search terms used) EPO-Internal, WPI Data, IBM-TDB, INSPEC		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 2 327 558 A (MOTOROLA INC) 27 January 1999 (1999-01-27) page 15, line 4 -page 18, line 13 page 19, line 11 - line 16; figure 7	1-7, 9-19, 21-24
X	US 5 564 005 A (WEBER KARON A ET AL) 8 October 1996 (1996-10-08) column 28, line 12 -column 29, line 11	1-7, 9-19, 21-24
X	DE 195 10 657 A (SAMSUNG ELECTRONICS CO LTD) 1 February 1996 (1996-02-01) column 5, line 14 - line 50; figures -/--	1-4,9, 10, 12-16, 21-24
<input checked="" type="checkbox"/> Further documents are listed in the continuation of box C. <input checked="" type="checkbox"/> Patent family members are listed in annex.		
* Special categories of cited documents : *A* document defining the general state of the art which is not considered to be of particular relevance *E* earlier document but published on or after the international filing date *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) *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 relevance; 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 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. *&* document member of the same patent family		
Date of the actual completion of the international search 9 October 2000		Date of mailing of the international search report 18/10/2000
Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016		Authorized officer Durand, J

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 00/40318

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 197 29 086 A (SCHOEPF STEFAN ;WEIHRETER SVEN (DE)) 14 January 1999 (1999-01-14) the whole document ---	1, 4, 5, 9-14, 16, 17, 21-23
A	EP 0 330 767 A (PIONEER ELECTRONIC CORP) 6 September 1989 (1989-09-06) column 3, line 39 - line 54 column 9, line 40 -column 10, line 31; figure 9 ---	1-7, 9-19, 21-24
A	"CELLULAR PHONE WITH INTEGRATED MP3 PLAYER" RESEARCH DISCLOSURE, GB, INDUSTRIAL OPPORTUNITIES LTD. HAVANT, no. 418, February 1999 (1999-02), page 184 XP000893213 ISSN: 0374-4353 the whole document ---	8, 9, 20, 21
A	"ORGANIZER SPIELT MP3-MUSIK" CT MAGAZIN FUER COMPUTER TECHNIK, DE, VERLAG HEINZ HEISE GMBH., HANNOVER, no. 12, 7 June 1999 (1999-06-07), page 56 XP000824456 ISSN: 0724-8679 the whole document -----	8, 9, 20, 21

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Form PCT/ISA/210 (continuation of second sheet) (July 1992)

page 2 of 2

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/US 00/40318

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DE 19510657 A	01-02-1996	KR 170326 B JP 8065539 A US 5545857 A	30-03-1999 08-03-1996 13-08-1996
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(19) World Intellectual Property Organization
International Bureau



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28 November 2002 (28.11.2002)

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(10) International Publication Number
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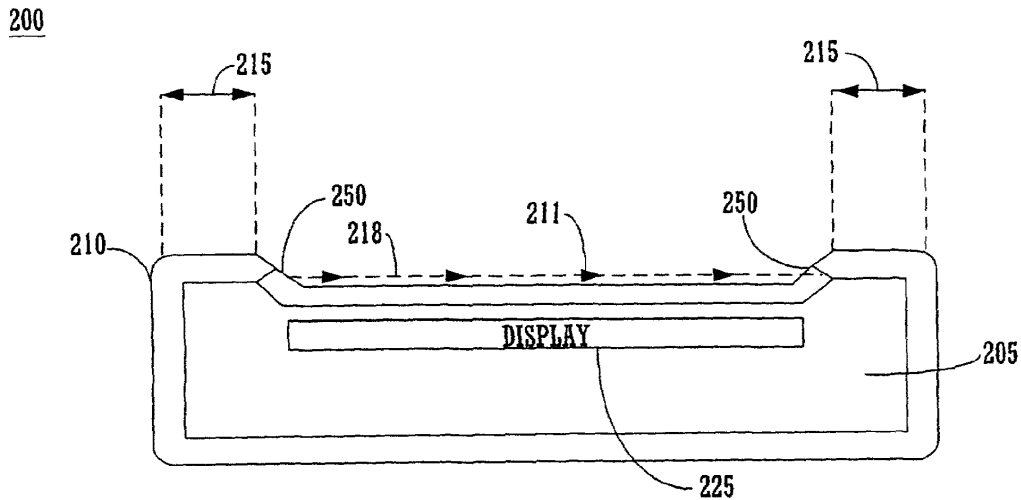
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- (25) Filing Language: English
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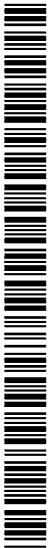
Published:
 — with international search report
 — before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

[Continued on next page]

(54) Title: TOUCH DISPLAY ASSEMBLY



(57) **Abstract:** An integrated enclosure/touch screen assembly (200). A touch screen assembly consisting of a display mechanism and optical sensor mechanism are enclosed within a single piece cover. The optical sensor mechanism consists of lens structure (250) an an optical sensor coupled to the lens structure. The single piece cover includes a transparent top surface (211) and the lens structure is embedded within the transparent top surface. The transparent top surface of the single piece cover provides an enclosure that is both dust free and waterproof. The lens structure of the single piece cover functions by columnating light across the transparent surface. The optical touch sensor is coupled to the lens structure to register contact with the transparent surface via the lens structure by detecting disturbances in the columnated light. In one embodiment, the single piece cover is constructed by embedding the lens structure directly into the transparent surface.



WO 02/095668 A1



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.

TOUCH DISPLAY ASSEMBLY

TECHNICAL FIELD

The present disclosure relates to a system for implementing a touch screen display for a personal information device ("PID"). In particular, the present invention relates to a system and method for implementing a reliable touch screen display system having increased light transmissiveness resistant to environmental contamination. The present disclosure discusses a high transparency integrated enclosure touch screen assembly for a portable hand held device.

BACKGROUND ART

Personal Information Devices include the class of computers, personal digital assistants and electronic organizers that tend both to be physically smaller than conventional computers and to have more limited hardware and data processing capabilities. PIDs include, for example, products sold by Palm, Inc. of Santa Clara, California, under such trademark as Pilot, and Pilot 1000, Pilot 5000, PalmPilot, PalmPilot Personal, PalmPilot Professional, Palm, and Palm III, Palm V, Palm VII, as well as other products sold under such trade names as WorkPad, Franklin Quest, and Franklin Convey.

PIDs are generally discussed, for example, in U. S. Patent Nos. 5,125,0398; 5,727,202; 5,832,489; 5,884,323; 5,889,888; 5,900,875; 6,000,000; 6,006,274; and 6,034,686, which are incorporated herein by reference. PIDs typically include a
5 screen and data processor, allowing the PID user to operate a substantial variety of applications relating to, for example: electronic mail, a calendar, appointments, contact data (such as address and telephone numbers), notebook records, a calendar, expense reports, to do lists or games. PIDs also often include
10 substantial electronic memory for storing such applications as well as data entered by the user. Due to their substantial variety of applications and uses, personal information devices are becoming increasingly widely used.

One important characteristic of personal information devices is the easy manner in which software applications and information are made available to the
15 user. Many PIDs are equipped with touch screen displays. The touch screen displays are used to implement various user input and output schemes. Since PIDs and other similar palmtop computer systems are very small, keyboards are generally not efficient input devices. For example, PIDs with keyboards have
20 keyboards that are so small that a user cannot touch-type. Furthermore, to use a keyboard a user must either place the PID system down onto a flat surface so the user can type with both hands or hold the PID system with two hands and type with thumbs only.

Thus, instead of using a keyboard, many PIDs employ a stylus and a touch
25 screen or digitizer pad as an input system. The stylus and touchscreen combination works well for PIDs since the arrangement allows a user to hold the

PID system in one hand while writing with the stylus onto the touchscreen with the other hand.

5 There is a problem, however, in that the mechanism for implementing the touch screen functionality tends to interfere with the transmission of light to an underlying display. Typical prior art touch screen displays employ a touch sensor mechanism overlaid on top of a display screen. The touch sensor mechanism detects user touches of its area, and translates such touches into appropriate inputs, such as, for example, icon manipulations, text entry, menu selections, and
10 the like. The touch sensor mechanism is designed to be transparent to allow viewing of the underlying display screen. Unfortunately, prior art touch sensor mechanisms are not perfectly transparent. Prior art touch sensor mechanisms often allow only 60 percent or less of the impinging light to pass through to the underlying display screen. This leads to very dim displays. To overcome this
15 characteristic, some manufacturers employ back lighting or front lighting of the display to compensate for the light attenuation of the touchscreen mechanism. This leads to excessive power consumption, decreased battery life, and overly large touch screen displays.

20 There exists an additional problem in that by combining a separate touchscreen mechanism and display screen to implement a touchscreen display, a seam necessarily exists between the mechanism and the screen. Although this seam can be sealed, it is still vulnerable to the entry of environment contaminants, such as dust, various liquids, etc. To improve the environmental
25 seal, many manufacturers employ a beveled edge around the outsides of the touchscreen display, enclosing both the touchscreen mechanism and the display. Although the beveled edge improves the seal, environmental contaminants (e.g.,

dust, etc.) can still make their way around the edge and into the touchscreen display.

Thus, what is required is a solution that eliminates exposed seams of a PID.

5 What is required is a solution which improves the transmission of light through the touchscreen mechanism, thereby improving the visibility of the display. The required solution should be inherently impervious to the entry of particulate contaminants and the like. The present invention provides a novel solution to the above requirements.

10

SUMMARY

The present invention provides an integrated enclosure/touch screen assembly solution that eliminates exposed seams of a display of a hand-held electronic device. The present invention provides a solution which improves the transmission of light through the touchscreen mechanism, thereby improving the visibility of the display. The present invention is inherently impervious to the entry of particulate contaminants and the like.

In one embodiment, the present invention is implemented as an integrated enclosure/touch screen assembly for a PID. A touch screen assembly consisting of a display mechanism and optical sensor mechanism are enclosed within a single piece cover. The optical sensor mechanism consists of lens structure and optical sensor couple to the lens structure. The single piece cover includes a transparent top surface and the lens structure is embedded within the transparent top surface. The transparent top surface of the single piece cover is free of any steps or indentations which provides an enclosure that is both dust free and waterproof.

A soft thermoplastic material can be used for the single piece cover to allow activation of the optical sensor mechanism by means of mechanical contact applied to the transparent surface of the single piece cover. In one embodiment, the single piece cover is constructed by embedding the lens structure directly into the transparent surface. This process forms the flat outer surface for the single piece cover and also may be used to provide various shapes for the outer edges of the cover. The single piece cover eliminates exposed seams of the touch screen assembly. Additionally, the transparent surface is disposed directly above the display without any intervening layers, thereby improving the transmission of

light to the display.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention is illustrated by way of example and not by way of limitation in the Figures of the accompanying drawings, in which like reference numerals refer to similar elements, and in which:

5

Figure 1 is a cross-sectional view of an enclosure/touch screen assembly having multiple layers and having exposed edge seals protected by a beveled edge as utilized in prior art.

10

Figure 2 shows a cross-sectional view of an embodiment in accordance with one embodiment of the present invention that does not have the exposed seals or the beveled edges as utilized in the prior art.

15

Figure 3 shows a close up cross-sectional view of embodiment 200 in accordance with one embodiment of the present invention.

20

Figure 4 shows a top-down view of the embodiment from Figure 2 and Figure 3 showing the transparent area, the optical lens structure, a light source, and an optical sensor according to an embodiment of the present invention.

25

Figure 5 shows a schematic top-down view of an optical sensor assembly, showing the lens structure in conjunction with the wave guides that couple the lens structure to the optical sensor, in accordance with one embodiment of the present invention.

5

8

DETAILED DESCRIPTION OF THE INVENTION

In the following detailed description of the present invention, numerous specific details are set forth in order to provide a thorough understanding of the present invention. However, it will be obvious to one skilled in the art that the present invention may be practiced without these specific details. In other instances well known methods, procedures, components, and circuits have not been described in detail as not to obscure aspects of the present invention unnecessarily.

10 The present invention is directed towards an integrated enclosure/touch screen assembly solution that eliminates exposed seams of a display of a hand-held electronic device. The present invention provides a solution which improves the transmission of light through the touchscreen mechanism, thereby improving the visibility of the display. The present invention is inherently impervious to the entry of particulate contaminants and the like. The present invention and its benefits are further described below.

Figure 1 is a cross-sectional view of an enclosure/touch screen assembly 100 utilized in prior art. The entire assembly is held in place by the supporting structure 105. The outermost protective film, or hard coat, 110 provides mechanical protection for the digitizer film 120. In addition, the outermost protective film is coupled to the support mechanism in order to provide a moisture and dust seal. The digitizing element 130 is located below and close to the digitizer film. An externally applied pressure that deflects the protective film will also deflect the digitizer film.

Any applied pressure great enough to cause the digitizer film to contact the digitizing element will then activate the digitizer mechanism. The display element 140 is located below the digitizer mechanism. User information is displayed on the upper surface of the display element. Together, the protective film, the digitizer
5 film and the digitizing element must have an opacity small enough to allow viewing of the information displayed on the display element. The entire touch screen assembly is located within the support structure such that the surface of the outermost protective film is below the upper edge of the support structure. There is therefore a step-down corner 150 from the upper edge of the support structure
10 to the surface of the outermost protective film and the resulting assembly exhibits a bezel like appearance. These step-down corners are dust and moisture collectors, are difficult to clean and frequently do not seal properly. Bevel edges 160 are provided to help seal the step down corners. However, even bevel edges 160 do not provide adequate protection.

15

Other types of touch screen assemblies employ integrated single piece covers, for example, soft thermoplastic polycarbonate material covers, to provide environmental seals against dust and moisture. Although such single piece covers are more effective at sealing out environmental contaminants, the many layers of
20 material of the touch screen assembly (e.g., a protective single piece cover, digitizer film, digitizer element, etc.) tend to significantly decrease the amount of light that reaches the underlying display. Additional disclosure of integrated single piece covers can be found in, INTEGRATED ENCLOSURE/TOUCH SCREEN ASSEMBLY, U.S. Patent Application No. 09/774,990, by Slothower et al., filed
25 01/30/2001.

Figure 2 shows a cross-sectional view of an embodiment 200 in accordance with one embodiment of the present invention, showing an integrated enclosure/touch screen assembly incorporating an optical lens structure for use with an optical sensor. In this embodiment, the single cover piece 210
5 incorporates an optical lens structure 250. In this embodiment, optical lens structure 250 columnates light transmitted parallel to surface of cover piece 210, as opposed to detecting pressure that deflects the surface, as in the embodiments described above. The light transmitted parallel to the surface of cover piece 210 is depicted as light beam 218 (e.g., dotted line 218). Contact with surface 210
10 interferes with light 218 transmitted between the optical lenses of lens structure 250, thereby allowing the accurate determination of the coordinates (e.g., x-y) of the contact (e.g., touch with a stylus or a finger).

A display 225 is disposed directly beneath cover piece 210. Cover piece 210
15 includes a transparent area 211 directly above the display. The transparent area 211, since it does not have to register contact, is optimized for its transparency. For example, transparent area 211 can be configured to transmit greater than 95 percent of the light impinging upon its surface to the underlying display 225. There are no intervening layers between area 211 and display 225. Accordingly,
20 display 225 will have a much higher apparent brightness to a user since there are no intervening layers to further attenuate impinging light. A support structure 205 provides support for the cover piece 210 and display 225. An area 215 along the periphery of the transparent area 211 can be provided with in-mold decoration, for example, to distinguish the particular model of device 200, or the
25 like.

Figure 3 shows a close up cross-sectional view of embodiment 200 in accordance with one embodiment of the present invention, a user's finger 216 or a stylus 217 in the process of actuating the touch screen. showing an integrated enclosure/touch screen assembly incorporating an optical lens structure for use with an optical sensor. As described above, optical lens structure 250 columnates light transmitted parallel to surface of cover piece 210. Light is transmitted parallel to the surface of cover piece 210 (e.g., dotted line 218). Contact with surface 210 interferes with light 218 transmitted between the optical lenses of lens structure 250, thereby allowing the accurate determination of the coordinates (e.g., x-y) of the contact with the finger 216 or the stylus 216.

Figure 4 shows a top-down view of the embodiment 200 showing the transparent area 211, the optical lens structure 250, a light source 260, and an optical sensor 261. Light source 260 provides light to optical lenses of optical structure 250, which transmit light parallel to the surface of transparent area 211 to corresponding optical lenses on an opposite side of transparent area 211. Contact is detected when an object, such as, for example, a finger or a stylus, interferes with the light transmitted among the lenses of optical lens structure 250. Interferences with the light are detected by the coupled optical sensor 261. In this embodiment, a photodetector is used to implement optical sensor 261.

Figure 5 shows a schematic top-down view of an optical sensor assembly in accordance with one embodiment of the present invention. Optical lens structure 250 columnates light across the upper surface of cover piece 210 parallel to surface of cover piece 210, depicted as the horizontal and vertical dotted lines across transparent area 211 over the display. Contact with the surface of transparent area 211 creates a shadow and is thus detected by optical

sensor/light detector 261. In this embodiment, the "grid" arrangement provided by optical lens structure 250 allows the accurate determination of the coordinates (e.g., x-y) of the contact (e.g., touch with a stylus or a finger). In this embodiment, optical lens structure 250 is embedded directly within cover piece 210, along the periphery of transparent area 211, thereby eliminating any seams through which contaminants might enter the assembly.

Thus, the present disclosure is directed towards an integrated enclosure/touch screen assembly solution that eliminates exposed seams of a display of a hand-held electronic device. The present disclosure provides a solution which improves the transmission of light through the touchscreen mechanism, thereby improving the visibility of the display. The present disclosure is inherently impervious to the entry of particulate contaminants and the like.

The present disclosure discusses an integrated enclosure/touch screen assembly. A touch screen assembly consisting of a display mechanism and optical sensor mechanism are enclosed within a single piece cover. The optical sensor mechanism consists of lens structure and optical sensor couple to the lens structure. The single piece cover includes a transparent top surface and the lens structure is embedded within the transparent top surface. The transparent top surface of the single piece cover provides an enclosure that is both dust free and waterproof. The lens structure of the single piece cover functions by columnating light across the transparent surface. The optical touch sensor is coupled to the lens structure to register contact with the transparent surface via the lens structure by detecting disturbances in the columnated light. In one embodiment, the single

piece cover is constructed by embedding the lens structure directly into the transparent surface. This process forms the single piece cover and also may be used to provide various shapes for the outer edges of the cover. The single piece cover eliminates exposed seams of the touch screen assembly. Additionally, the transparent surface is disposed directly above the display without any intervening layers, thereby improving the transmission of light to the display.

The foregoing descriptions of specific embodiments of the present invention have been presented for purposes of illustration and description. They are not intended to be exhaustive or to limit the invention to the precise forms disclosed, and obviously many modifications and variations are possible in light of the above teaching. The embodiments were chosen and described in order best to explain the principles of the invention and its practical application, thereby to enable others skilled in the art best to utilize the invention and various embodiments with various modifications as are suited to the particular use contemplated. It is intended that the scope of the invention be defined by the claims appended hereto and their equivalents.

CLAIMS

What is claimed is:

1. A display assembly comprising:
a display mechanism;
an optical sensor;
a lens structure coupled to the optical sensor; and
a cover, the cover including the lens structure, the optical sensor registering contact.

2. The assembly of Claim 1, wherein the assembly is an integrated enclosure/touch screen assembly further comprising a supporting structure for supporting the display mechanism, the optical sensor, the lens structure, and the cover, wherein the lens structure and the cover form a single mechanical structure and wherein the optical sensor can be activated by touching the external surface of the cover to disturb light received by the lens structure, the cover being a bezel-less and single piece enclosure.

3. The assembly of Claim 1, being a touch screen display for a personal information device, the optical sensor being an optical touch sensor, the cover, being a single-piece cover containing the optical touch sensor, the single piece cover having a transparent surface for viewing the display disposed beneath the transparent surface, the single piece cover including the lens structure for columnating light across the transparent surface, the optical touch sensor coupled to the lens structure to register contact with the transparent surface via the lens structure while the single piece cover prevents contaminants from entering the personal information

device.

4. The assembly of Claim 1, wherein the assembly is a display assembly for a portable electronic device, the cover being a bezel-less transparent surface wherein the lens structure is coupled to the transparent surface to form a single mechanical structure and wherein contact with the transparent surface is detected by the optical sensor detecting a shadow from the contact via the lens structure.

5. The assembly of Claim 3, wherein the lens structure included within the single piece cover is coupled to the optical touch sensor to provide columnated light for detecting and registering contact with the transparent surface.

6. The assembly of Claim 5, wherein a plurality of waveguides are coupled to the lens structure and embedded within the single piece cover.

7. The assembly of Claim 3, wherein the optical touch sensor detects and registers contact from a finger or a stylus on the transparent surface.

8. The assembly of Claim 3, wherein the single piece cover comprises a mylar polycarbonate material.

9. The assembly of Claim 3, wherein the single piece cover is bezel-less.

10. The assembly of Claim 3, wherein the transparent surface transmits more than 90

percent of light impinging upon the transparent surface to the display.

11. The integrated enclosure/touch screen assembly according of Claim 2, wherein the single piece cover enclosure includes a transparent surface and the display mechanism is disposed beneath the transparent surface.

12. The integrated enclosure/touch screen assembly according of Claim 2, wherein finger contact or stylus contact on the transparent surface of the single piece cover enclosure may be used to activate the optical sensor via the lens structure.

13. The integrated enclosure/touch screen assembly according of Claim 2, wherein the optical lens structure is disposed along a periphery of the transparent surface of the single piece cover enclosure.

14. The assembly of Claim 2, 3 or 4, wherein the cover includes in mold decoration along a periphery of the single piece cover.

15. The assembly of Claim 4, wherein the display mechanism is a flat panel display.

16. The assembly of Claim 4, wherein a wave guide structure couples the lens structure to the optical sensor.

17. The assembly of Claim 4, wherein the transparent surface is a single layer transparent surface configured to transmit more than 90 percent of light impinging upon the transparent surface to the display screen.

18. The assembly of Claim 4, wherein the lens structure is embedded within the transparent surface of the display assembly.

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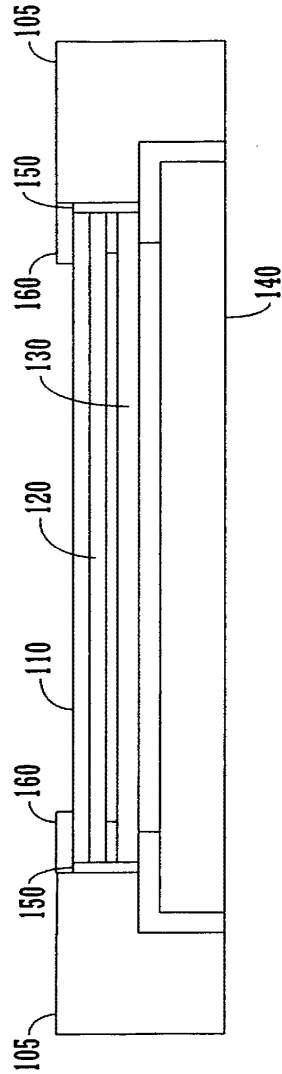


FIGURE 1

100

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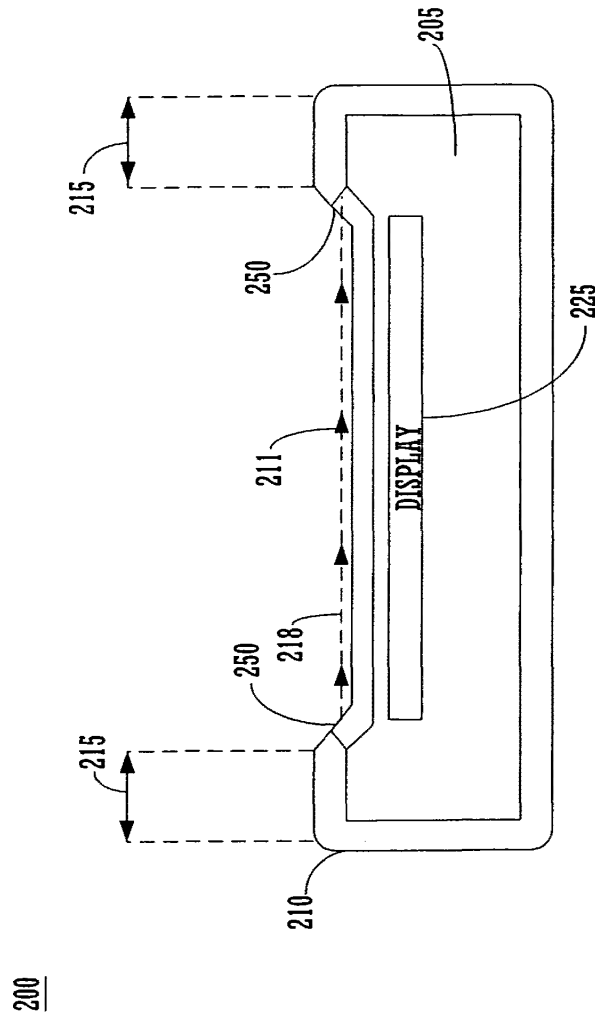


FIGURE 2

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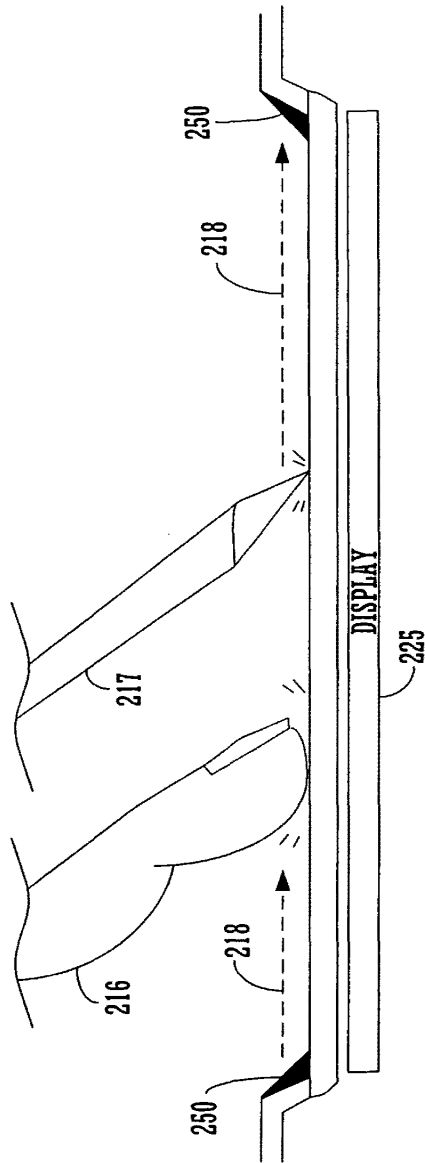


FIGURE 3

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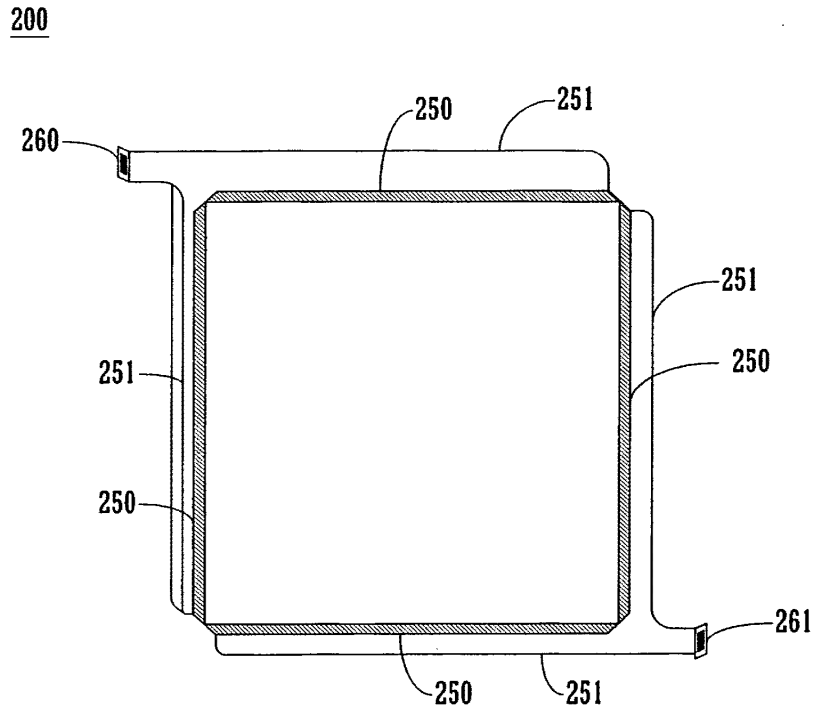
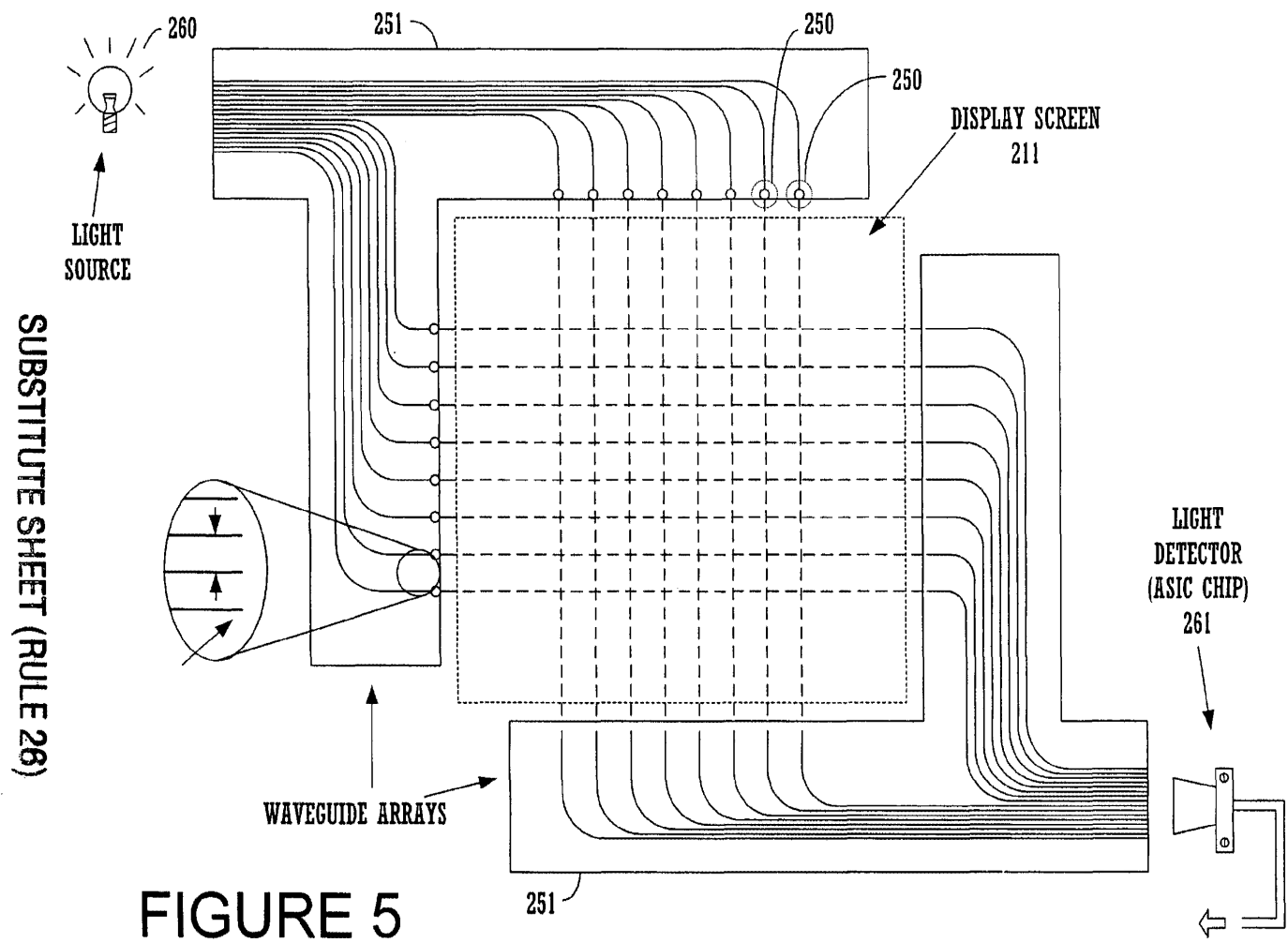


FIGURE 4

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FIGURE 5

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WO 02/095668

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INTERNATIONAL SEARCH REPORT

PCT/US 02/15538

A. CLASSIFICATION OF SUBJECT MATTER
 IPC 7 G06K11/08

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

B. FIELDS SEARCHED
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 IPC 7 G06K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)
 EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 181 842 B1 (GRAHAM DAVID S ET AL) 30 January 2001 (2001-01-30) column 4, line 60 -column 11, line 37; figures 1A,3 ---	1
A	EP 0 668 569 A (SPACELABS MEDICAL INC) 23 August 1995 (1995-08-23) abstract ---	1
A	US 5 785 439 A (BOWEN JAMES H) 28 July 1998 (1998-07-28) column 4, line 33 -column 5, line 9; figure 1 -----	1

Further documents are listed in the continuation of box C. Patent family members are listed in annex.

° Special categories of cited documents :

A document defining the general state of the art which is not considered to be of particular relevance	*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
E earlier document but published on or after the international filing date	*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
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)	*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.
O document referring to an oral disclosure, use, exhibition or other means	* & * document member of the same patent family
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 6 September 2002	Date of mailing of the international search report 24/09/2002
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Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Authorized officer Schmidt, R
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INTERNATIONAL SEARCH REPORT

Information on patent family members

PCT/US 02/15538

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6181842	B1	30-01-2001	NONE
EP 0668569	A	23-08-1995	US 5515083 A 07-05-1996 CA 2142774 A1 18-08-1995 EP 0668569 A2 23-08-1995
US 5785439	A	28-07-1998	US 5707160 A 13-01-1998 US 5605406 A 25-02-1997 US 5577848 A 26-11-1996 US 5378069 A 03-01-1995

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TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ,
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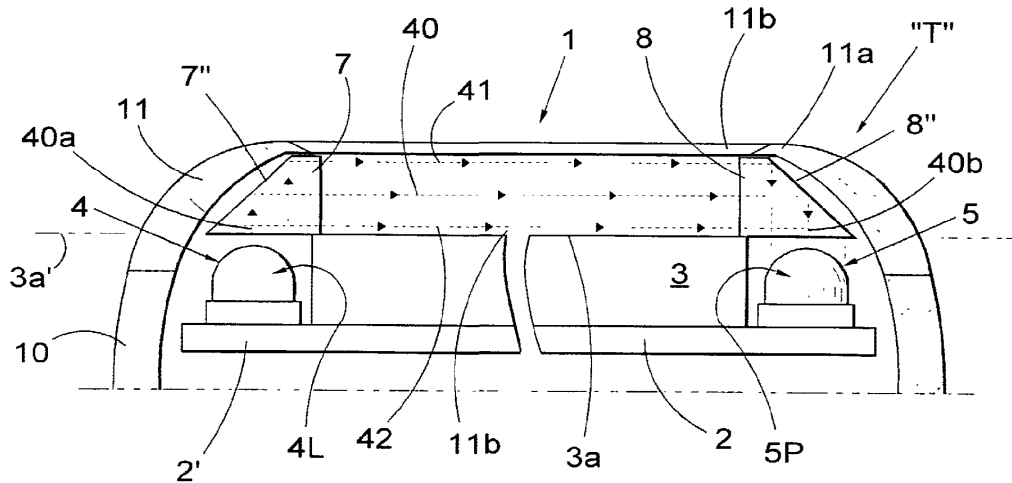
— of inventorship (Rule 4.17(iv)) for US only

Published:

— with international search report
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[Continued on next page]

(54) Title: ON A SUBSTRATE FORMED OR RESTING DISPLAY ARRANGEMENT



(57) Abstract: A touch screen arrangement (1) fitted to a mobile telephone apparatus (T) and built-on or resting on a substrate (2). The touch screen includes a display unit (3) and a number of light pulse emitting units (4L) and a number of light pulse receiving units (5P), said units being edge-related to said display unit (3). The light pulse emitting units (4L) and the light pulse receiving units (5P) are orientated adjacent said display unit (3), with the directions of said emitted and received light pulses (40a, 40b) being at right angles, or at least generally at right angles, to a planar surface (3a) on the display unit (3). The touch screen also includes four light pulse deflecting devices (7, 8, 7', 8') positioned close to the display surface (3).



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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.

ON A SUBSTRATE FORMED OR RESTING DISPLAY ARRANGEMENT.

Field of invention

5 The present invention relates generally to a display arrangement, that is formed onto or is supported by a substrate, and more particularly to a mobile-telephone-adapted touch screen arrangement, which is constructed with and around a display unit, whose external dimensions conform with those applicable to mobile telephone apparatus or cell phones.

10 The touch screen arrangement is hereinafter abbreviated to "touch screen".

Description of the background art

Mobile telephone displays normally consist of an LCD unit and an associated keypad, where depression of a key activates one or more telephone functions.

15 It can be mentioned with regard to known technology, that the use of a touch screen has been proposed with regard to hand-carried computer terminals, with the intention of reducing the dimensions of a display surface, wherein selected functions can be activated through the medium of visible digits or other symbols, by exerting pressure on a surface section corresponding to the surface section of the symbol concerned, with the aid of a pointer.

20 Touch screens, or touch sheets, of this kind have been produced in the form of two mutually parallel plastic sheets, where an mechanical actuation of an uppermost sheet within a chosen surface section creates conditions for a resistance measurement perpendicular to said surface section, wherein the geographical position of said surface section on the touch screen can be established by a calculating circuit, with the aid of the resistance values established, and therewith generate a significant signal for a function related to a touched symbol.

30 In this case, there is used a hand-held and hand-manoeuvred elongate pointer having a tip, comparable to that of a pencil or pen, which requires physical actuation on and pressure against the chosen surface section of the display unit.

Also known to the art are touch screens that have relatively large external dimensions, where the dimensions chosen and a chosen screen thickness are of small account and constitute no limitation to the chosen application.

For example, it is known in respect of this use application to allow the touch screen to be comprised of a display unit in the form of an LCD unit, with edge-orientated and mutually opposite light-emitting units and light receiving units.

5 More particularly, in the case of this application the light-emitting units and the light receiving units are orientated in two rows and two columns over the upper surface of the display unit, with the transmitting and receiving directions of the light rays orientated and directed immediately above the upper surface of the display unit, with said units directly opposite each other.

10 Light emitting circuits and light receiving circuits are also mutually coordinated and connected to a calculating or computing unit in this case, so as to evaluate and calculate a position representative of the geographical position on the upper surface of the display unit, where mutually intersecting light rays are shadowed by an object serving as a pointer, depending on the position of one or more coordinate-orientated light receiving units, having associated circuits which
15 are intended to indicate the presence of light.

It is known in the case of this latter application to use the tip of an index finger as a pointer, and no physical actuation of or pressure against said display surface section is required in this particular technique, even though such is usual.

20 The contents of the patent publications listed below also belong to the earlier standpoint of techniques with regard to the use of a touch screen, in which light emitting and light receiving units and the tip of an index finger or the like function to activate signals corresponding to a chosen symbol presented on a surface section of the display surface.

25 **US-A-4,847,606**

This publication illustrates and describes a control system (10), which in addition to a display panel (22) comprised of liquid crystals also includes a light source (20) and a light detector (36).

30 More specifically, the publication is concerned with allowing light from the light source to be directed through at least part of the liquid crystal display panel and onto the light detector.

The system (10) includes a casing (12), which is formed to be fitted to the instrument panel of a car, said panel including a sunken surface part (14) and being produced from a transparent material.