



US 20170322724A1

(19) **United States**

(12) **Patent Application Publication**
NIELSEN et al.

(10) **Pub. No.: US 2017/0322724 A1**

(43) **Pub. Date: Nov. 9, 2017**

(54) **ULTRASOUND IMAGING SYSTEM TOUCH PANEL CLUSTER CONTROL INTERACTION**

A61B 8/00 (2006.01)

A61B 8/00 (2006.01)

G06F 3/0484 (2013.01)

G06F 3/0482 (2013.01)

(71) Applicant: **B-K Medical Aps, Herlev (DK)**

(72) Inventors: **Torben Svanberg NIELSEN**,
Copenhagen (DK); **John ANTOL**,
Nahant, MA (US); **Kaj DUNKIN**,
Stenlille (DK); **Jesper Helleso**
HANSEN, Kobenhavn NV (DK)

(52) **U.S. Cl.**

CPC *G06F 3/04886* (2013.01); *G06F 3/04845*

(2013.01); *G06F 3/0482* (2013.01); *A61B*

8/4405 (2013.01); *A61B 8/465* (2013.01);

A61B 8/467 (2013.01)

(73) Assignee: **B-K Medical Aps, Herlev (DK)**

(21) Appl. No.: **15/529,564**

(22) PCT Filed: **Nov. 26, 2014**

(86) PCT No.: **PCT/IB2014/066365**

§ 371 (c)(1),

(2) Date: **May 25, 2017**

Publication Classification

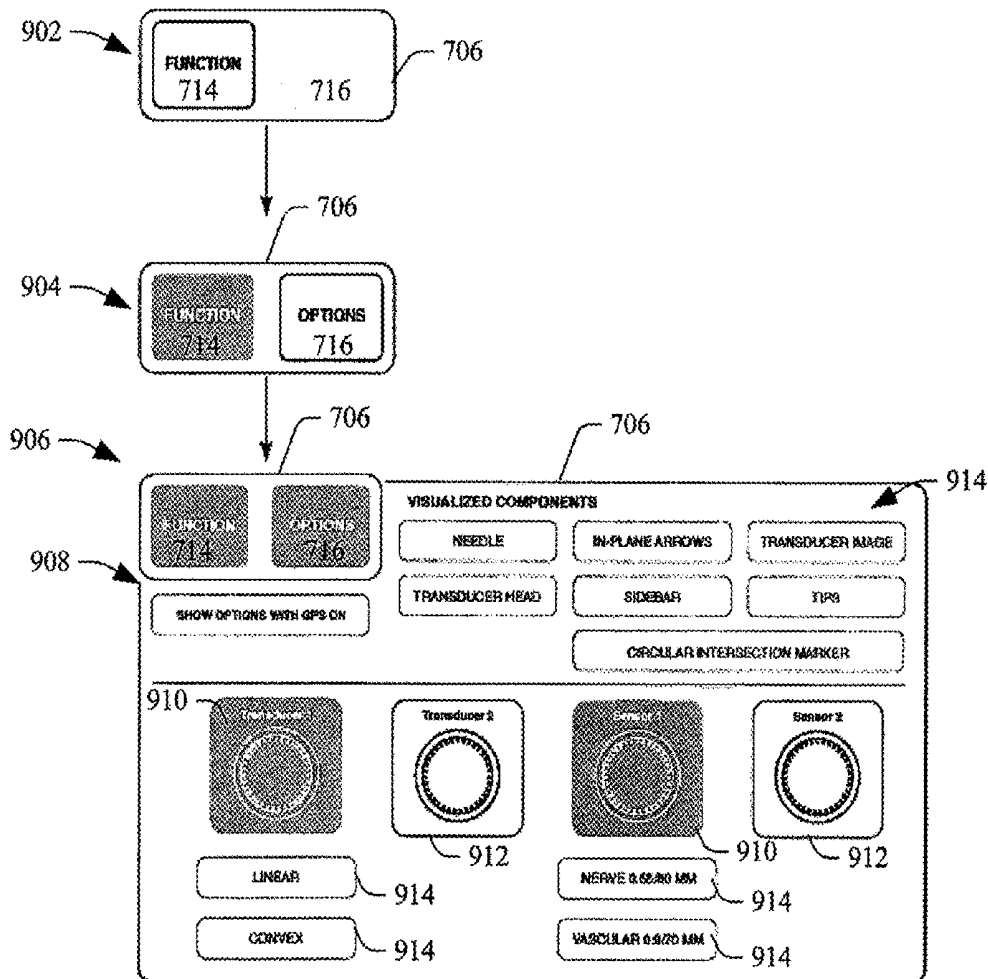
(51) **Int. Cl.**

G06F 3/0488 (2013.01)

A61B 8/00 (2006.01)

(57) **ABSTRACT**

A method includes receiving a signal from a first touch screen control in response to invocation of the first touch screen control. The first touch screen control is a control from a first cluster of touch screen controls of a plurality of different clusters of touch screen controls of an ultrasound imaging system touch screen user interface. The method further includes identifying a type of the first touch screen control based on the signal. The method further includes obtaining a control configuration for the touch screen controls based on the type of control. The method further includes constructing a control layout for the touch screen user interface based on the configuration. The method further includes visually rendering the control layout via the touch screen user interface.



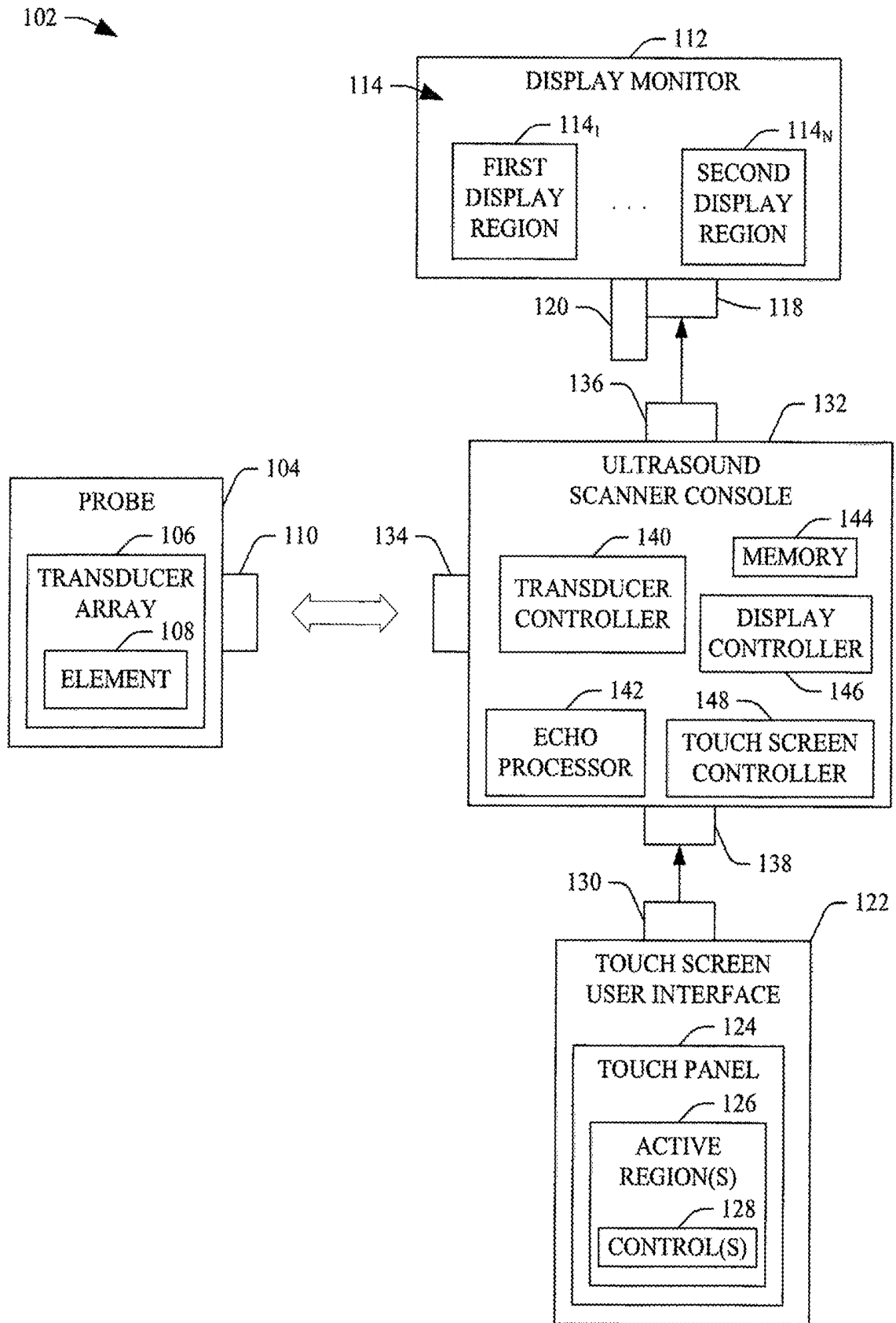


FIGURE 1

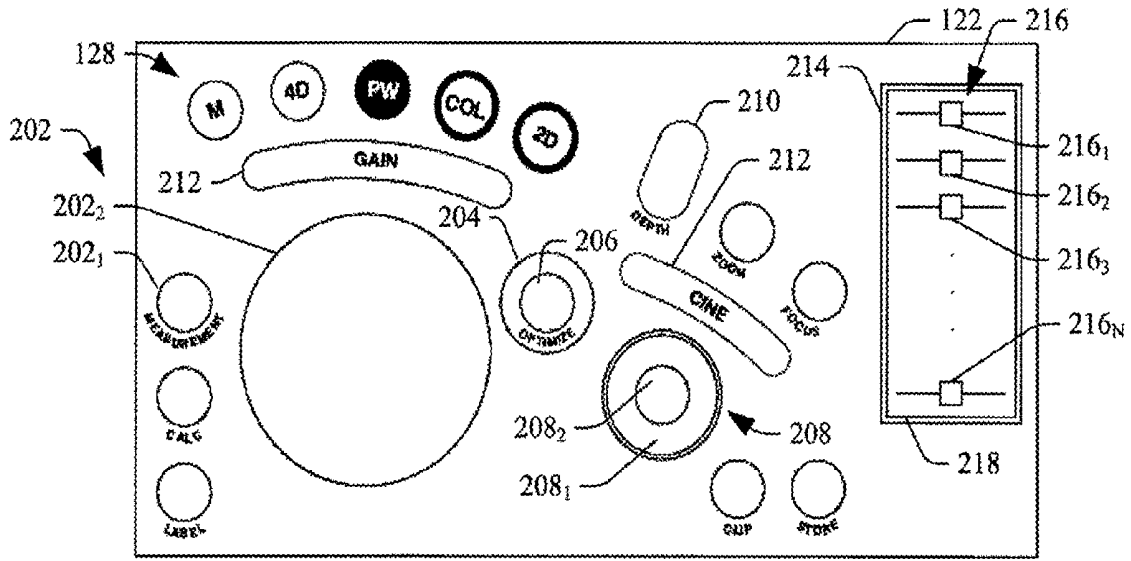


FIGURE 2

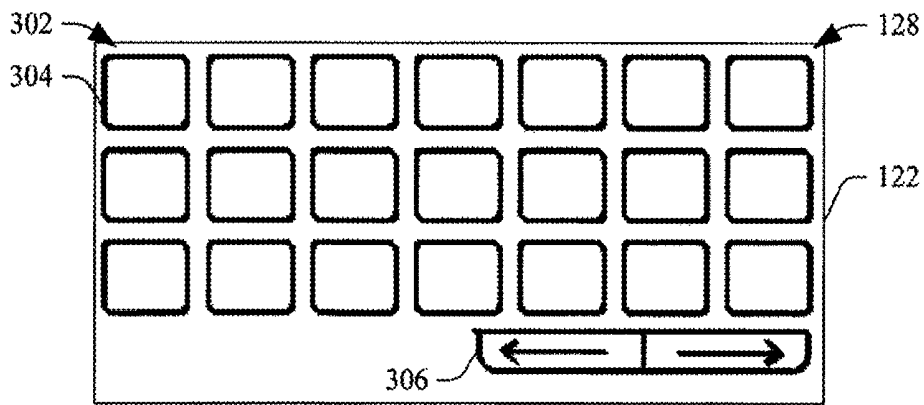


FIGURE 3

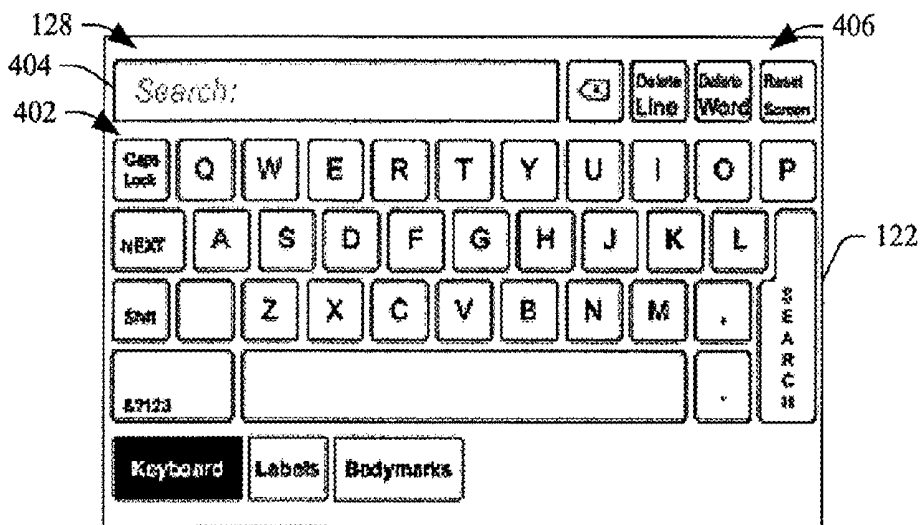


FIGURE 4

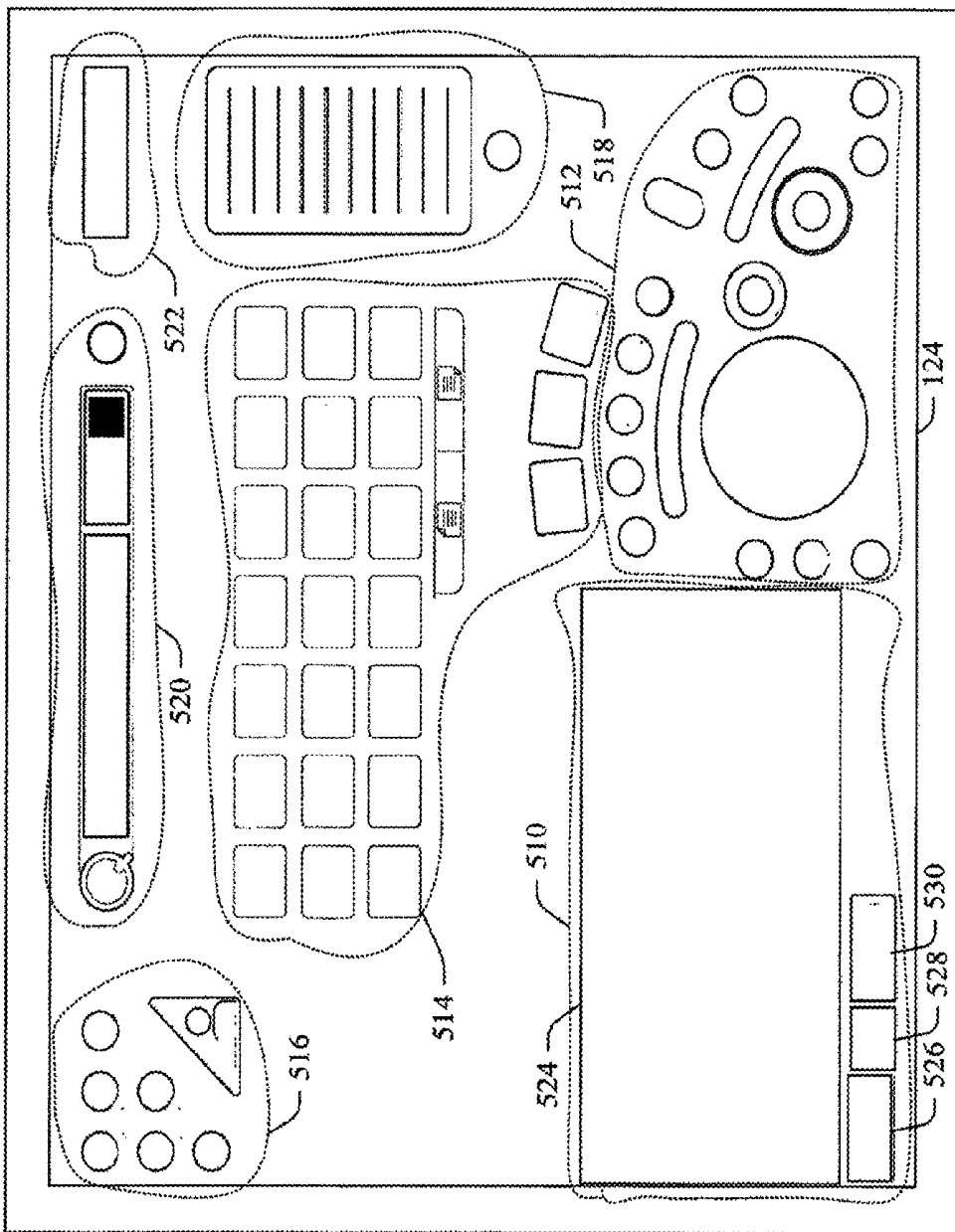


FIGURE 5

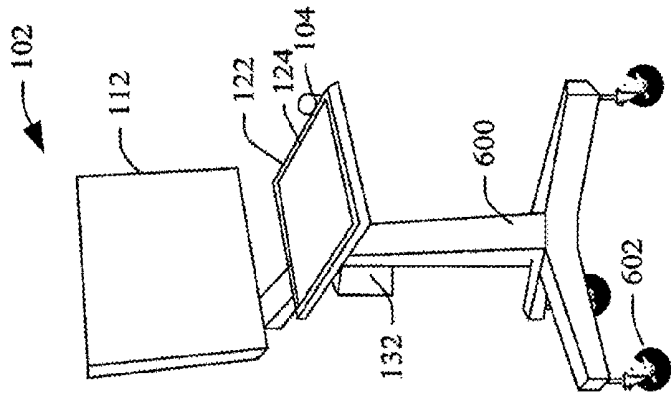


FIGURE 6

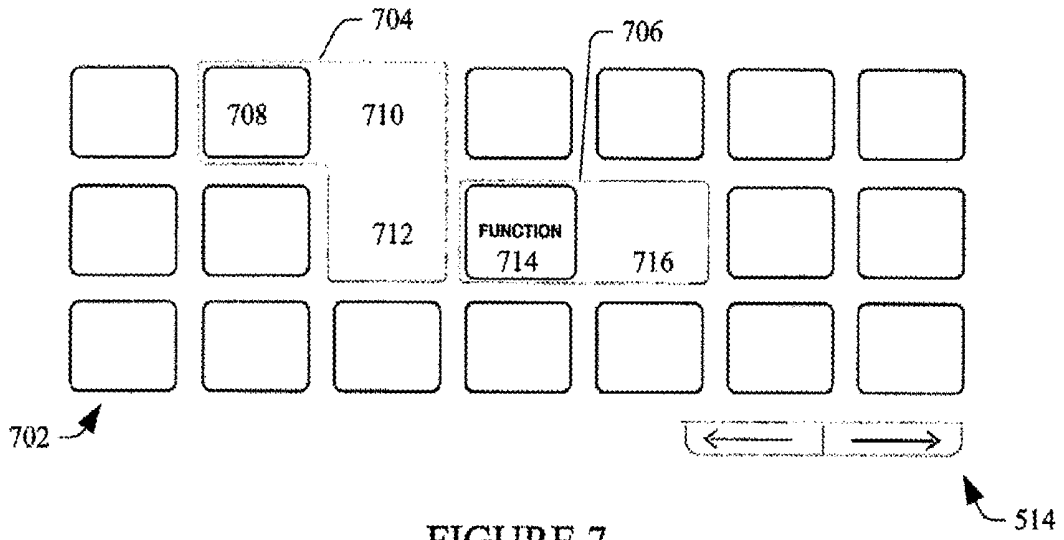


FIGURE 7

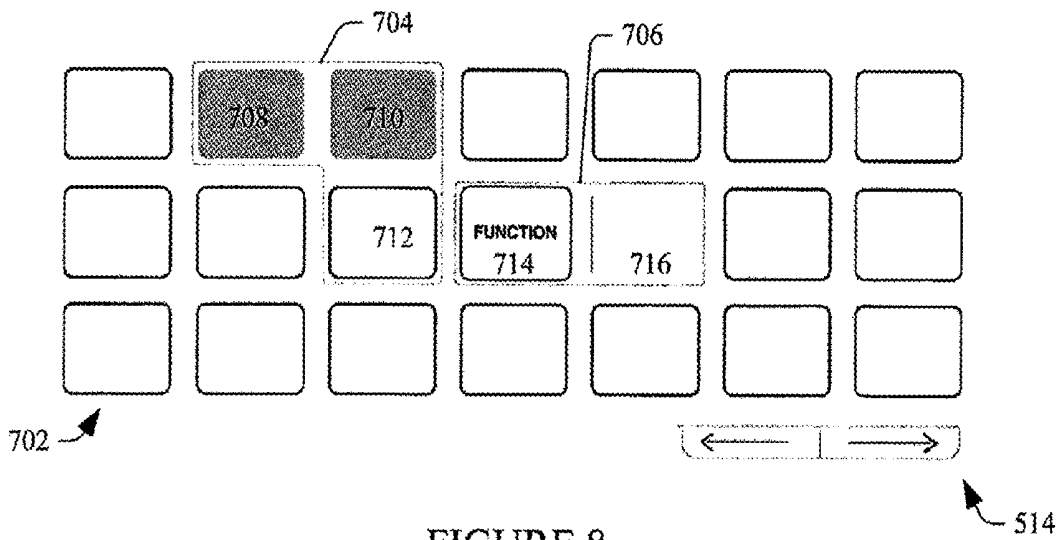


FIGURE 8

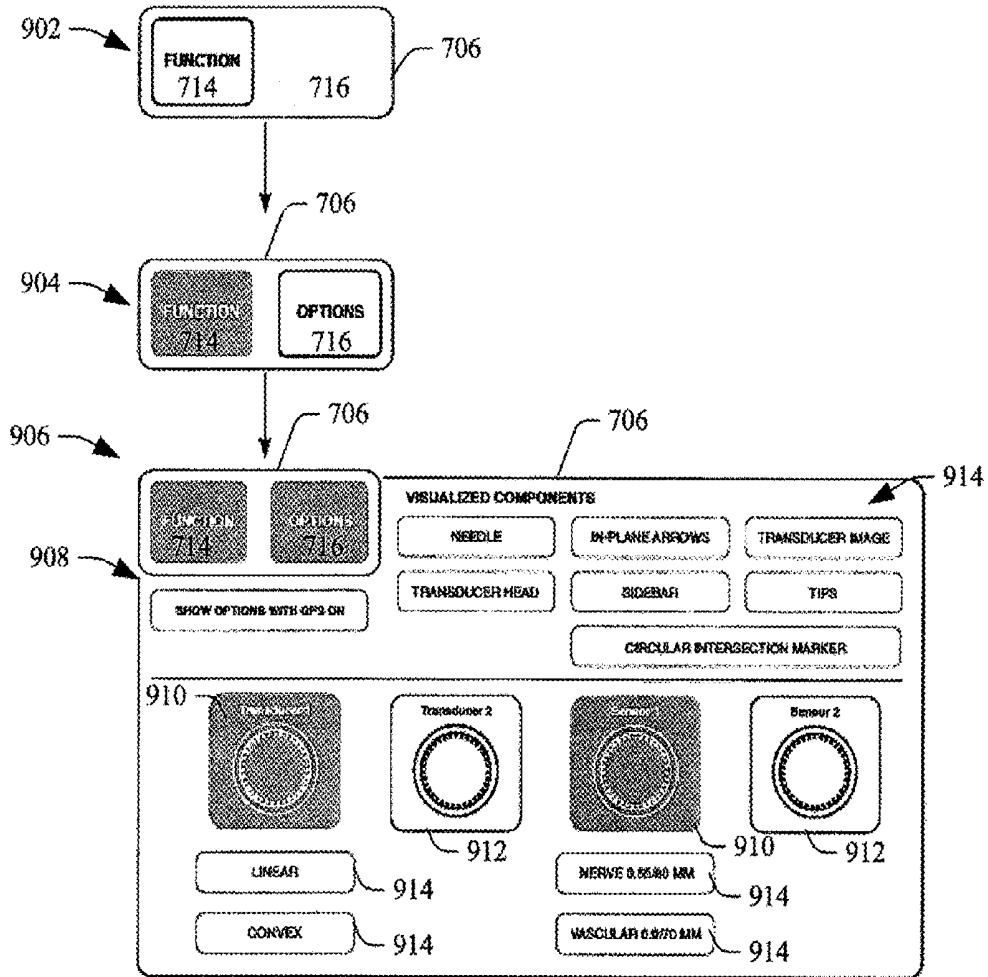


FIGURE 9

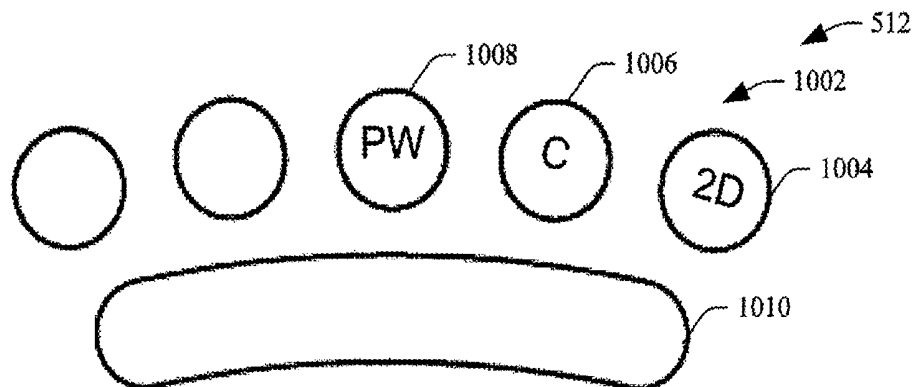
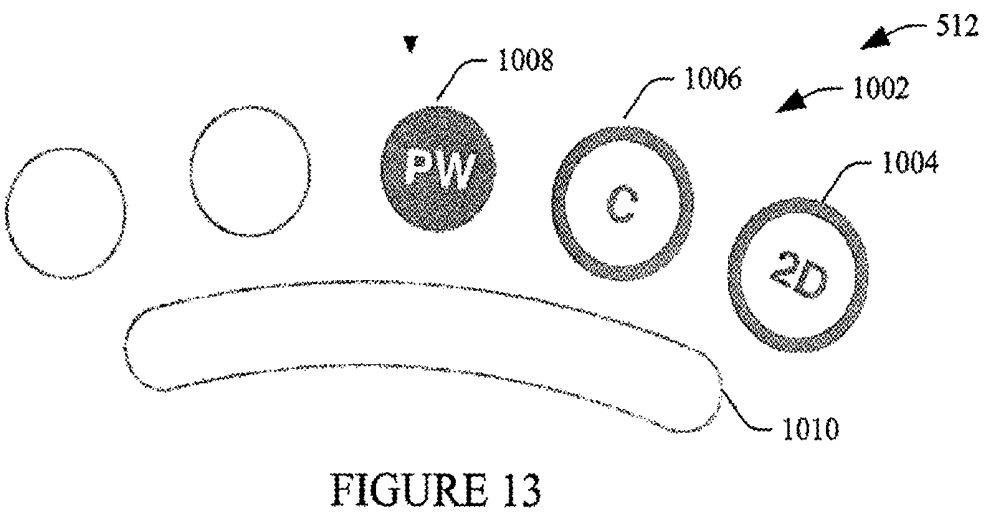
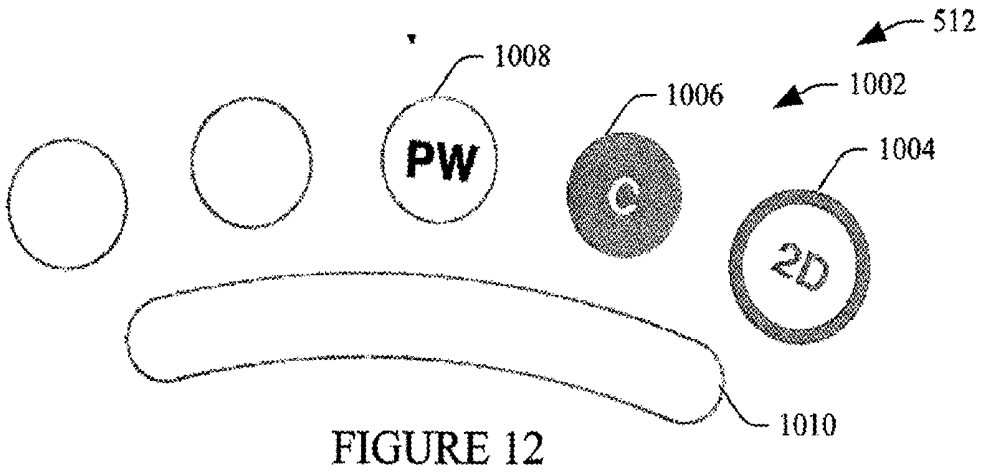
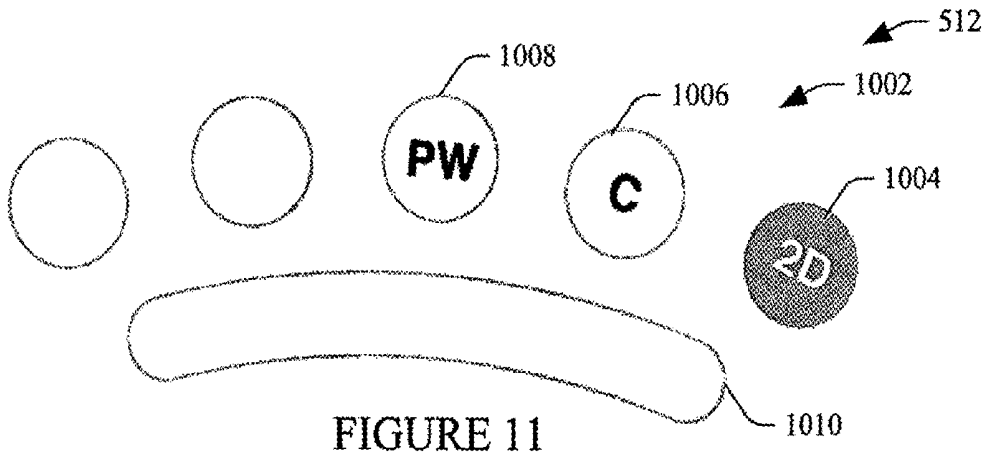
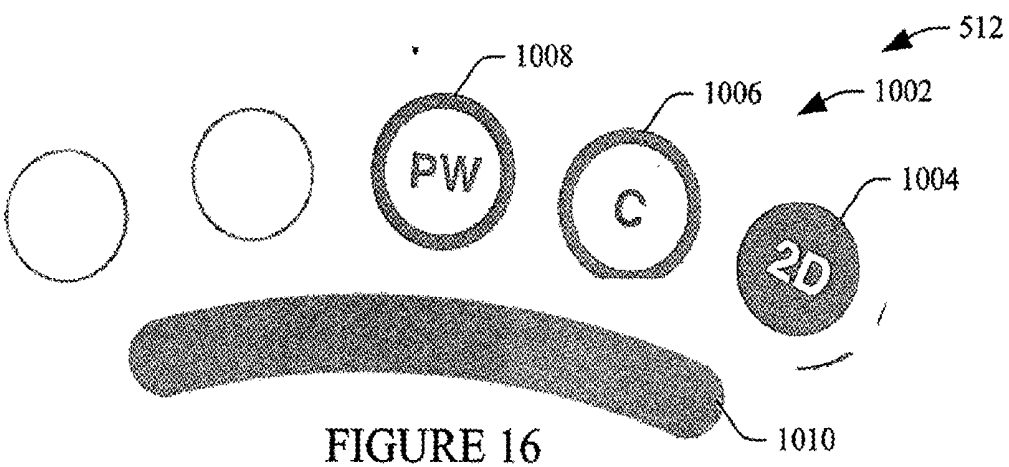
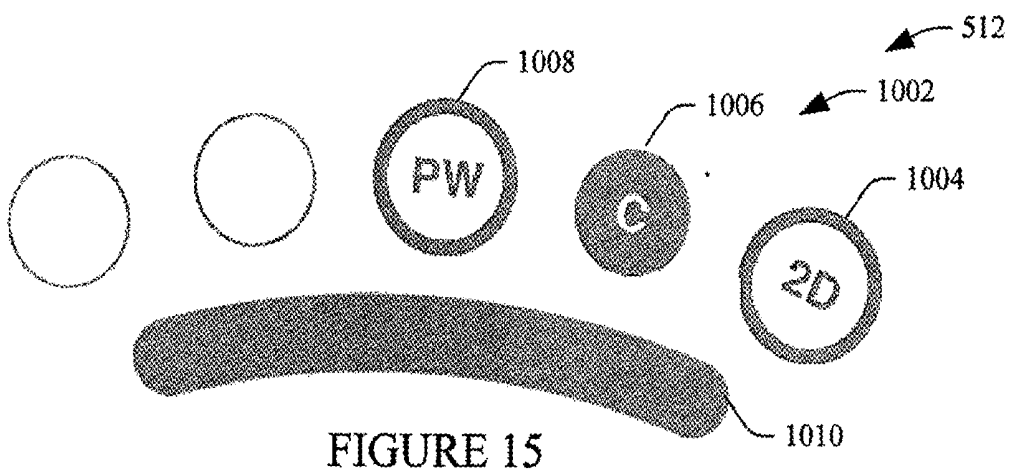
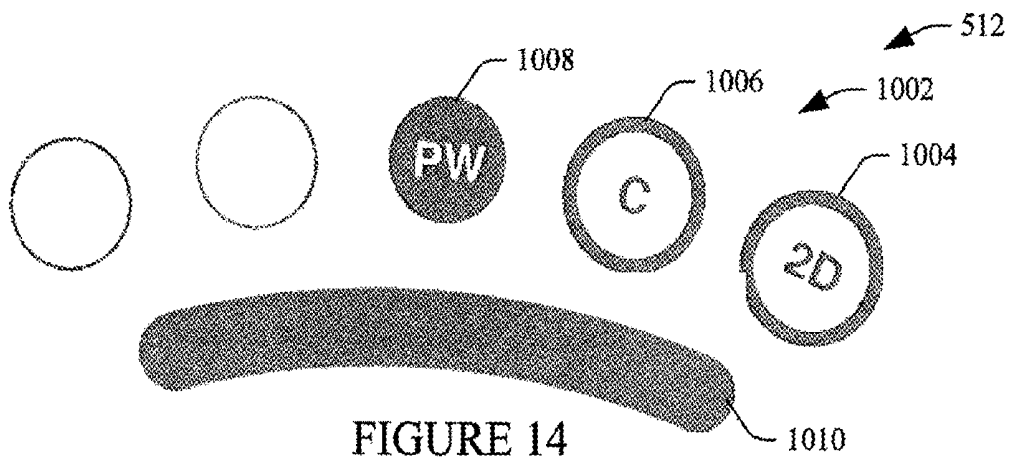


FIGURE 10





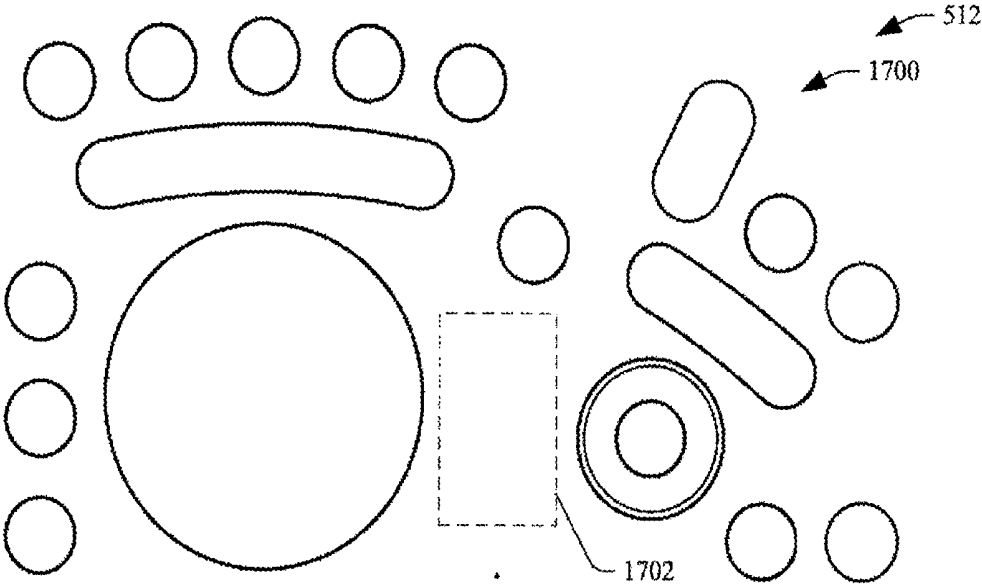


FIGURE 17

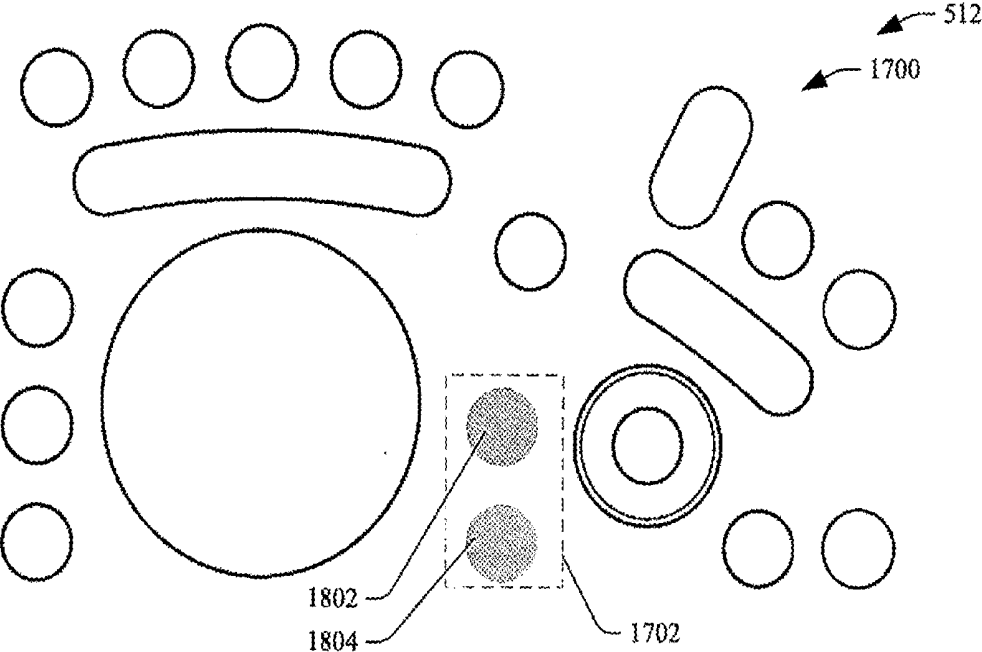


FIGURE 18

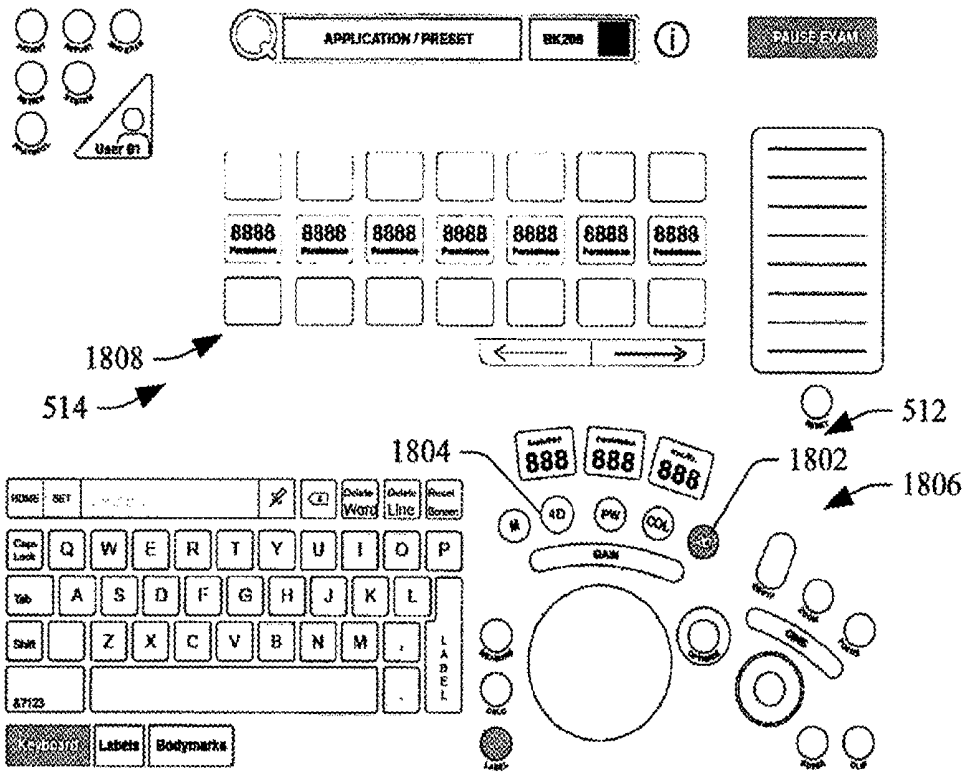


FIGURE 19

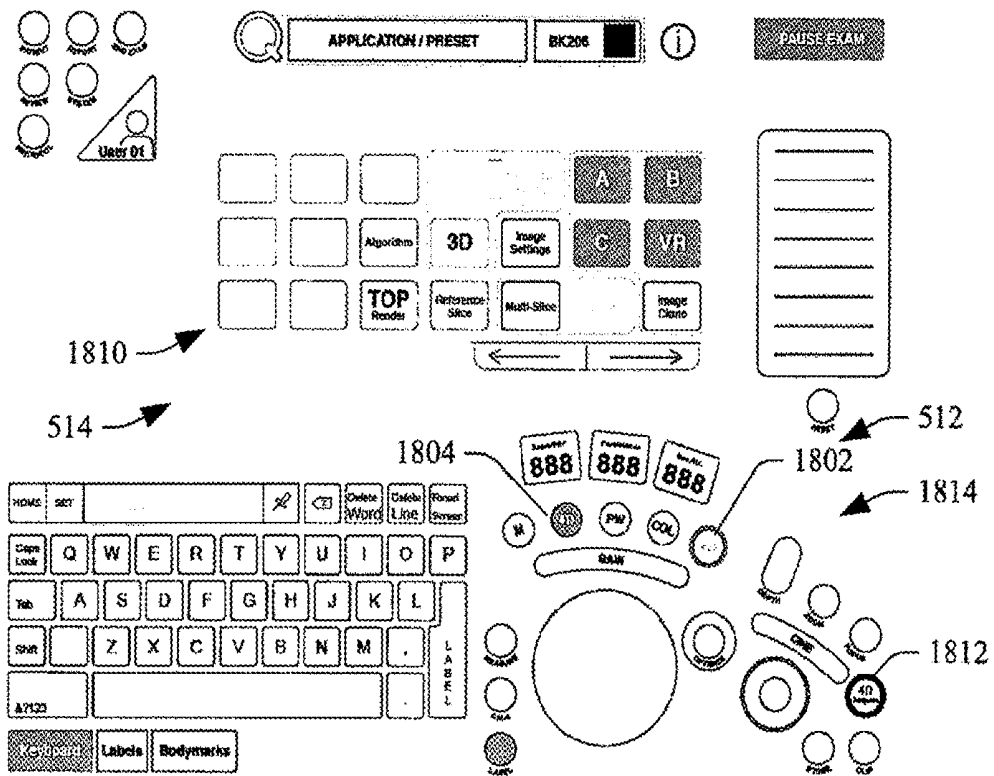


FIGURE 20

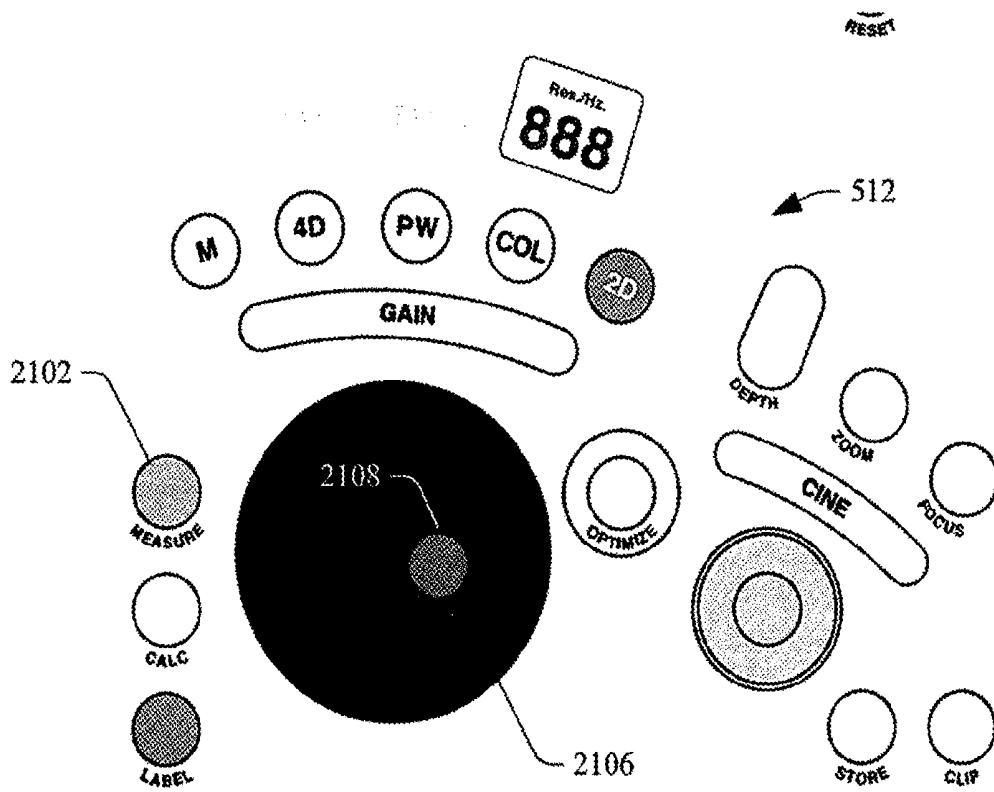


FIGURE 21

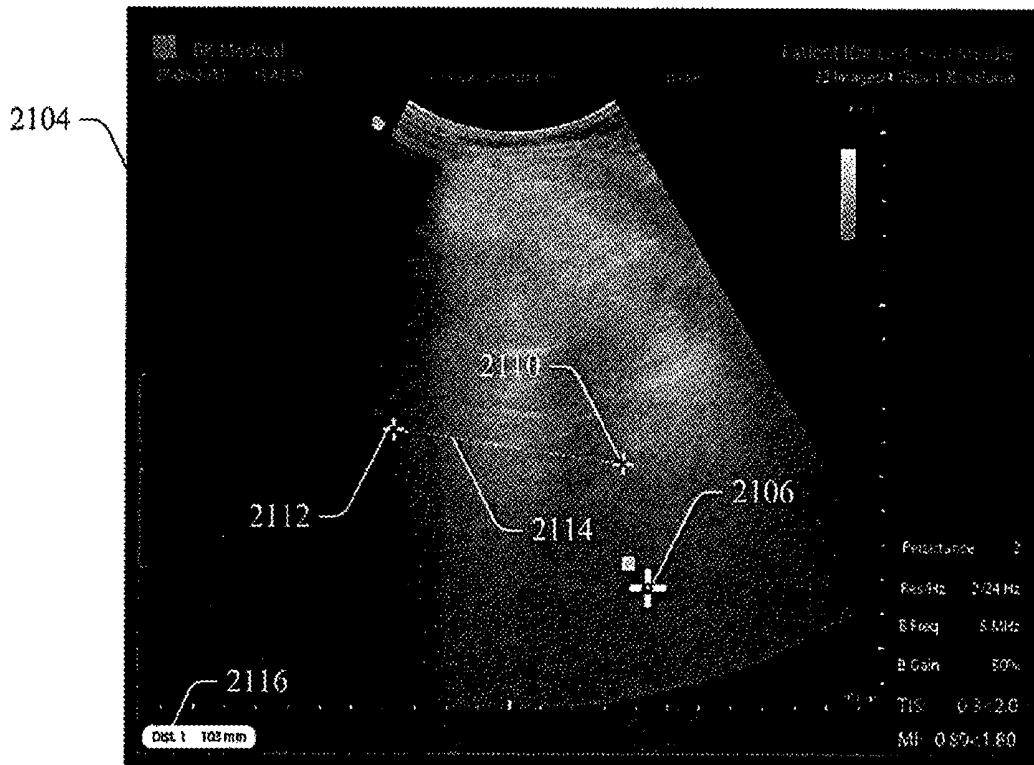


FIGURE 22

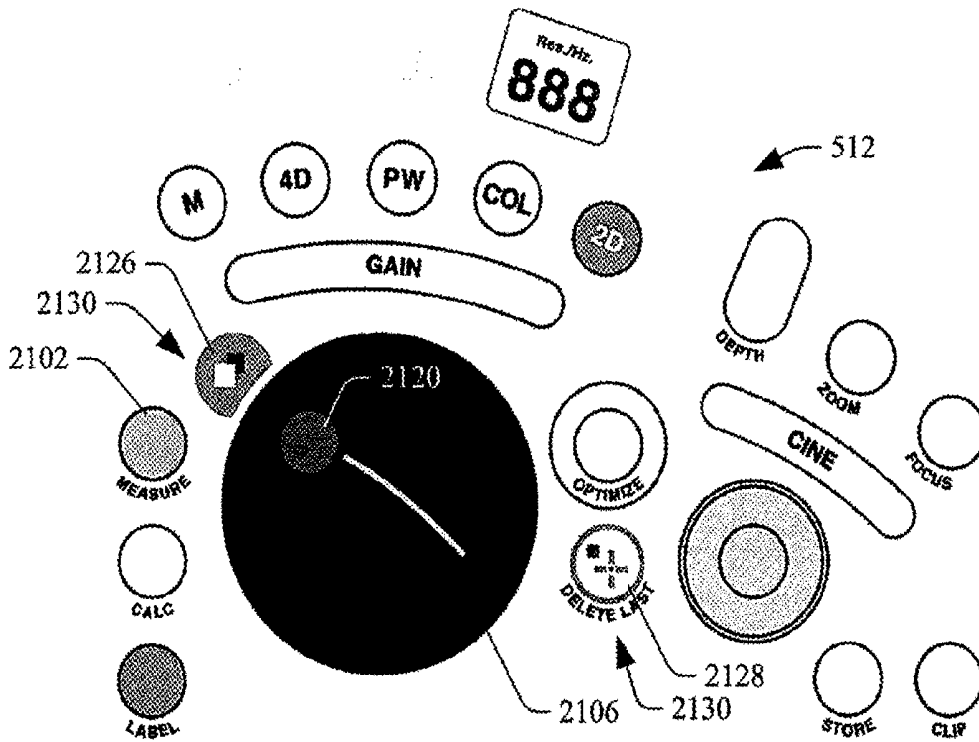


FIGURE 23

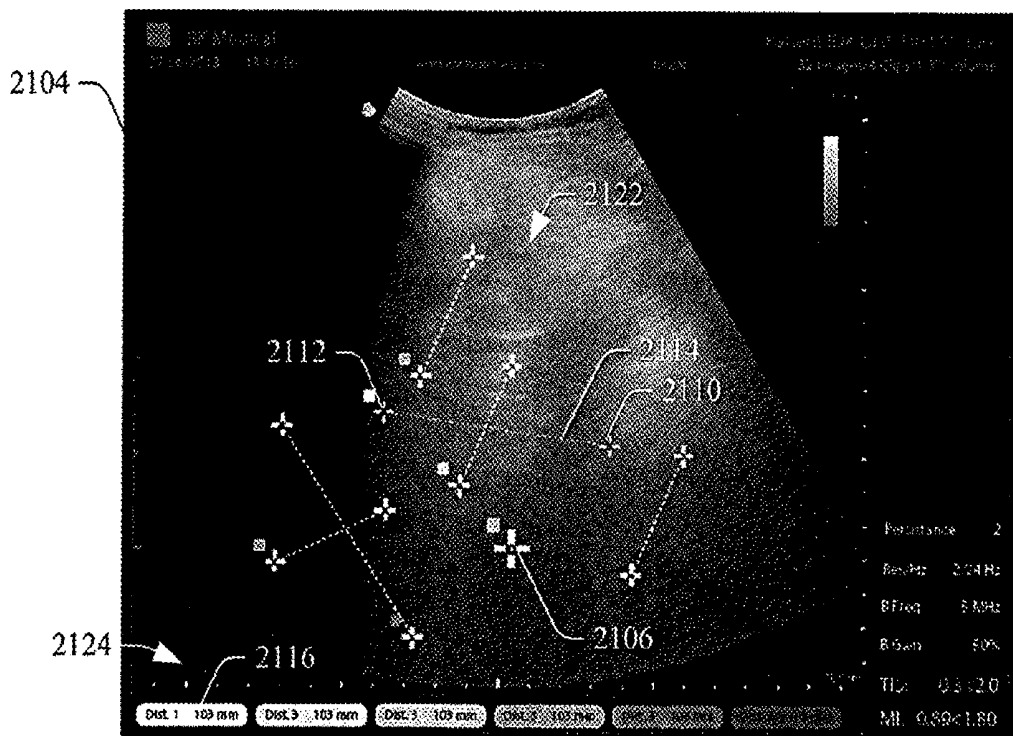


FIGURE 24

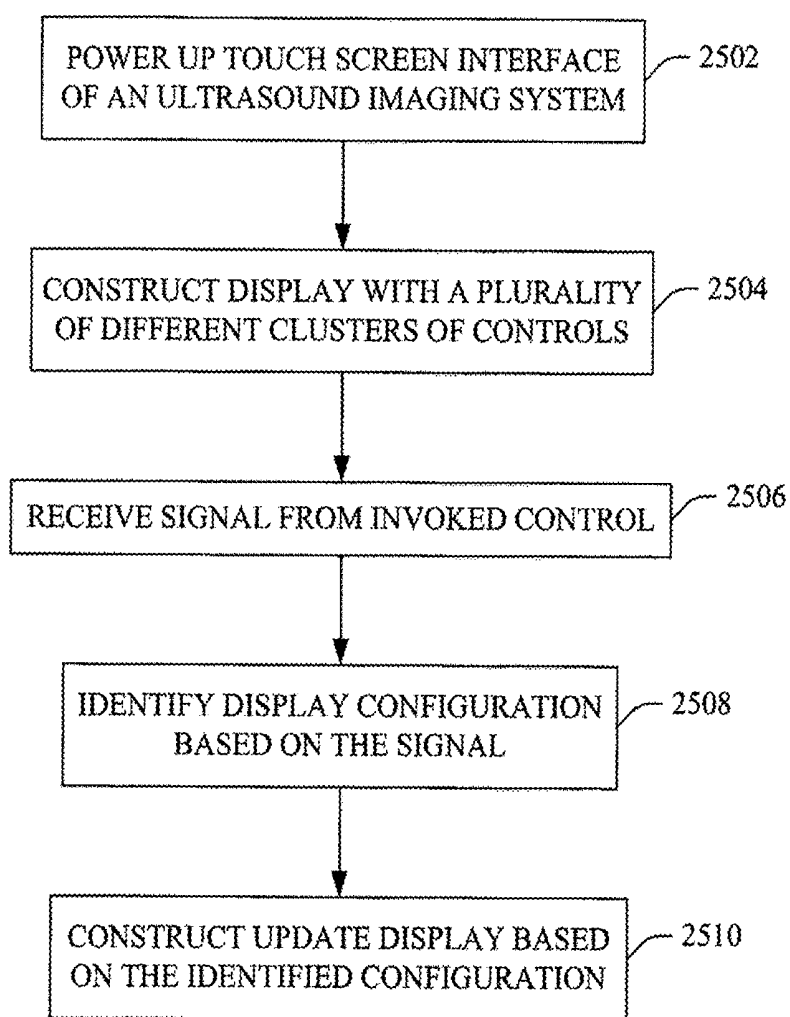


FIGURE 25

ULTRASOUND IMAGING SYSTEM TOUCH PANEL CLUSTER CONTROL INTERACTION

TECHNICAL FIELD

[0001] The following generally relates to ultrasound imaging and more particular to an interaction of controls of multiple different clusters of controls of a touch panel of an ultrasound imaging system.

BACKGROUND

[0002] An ultrasound imaging system has included an ultrasound probe with a transducer, a console with an integrated or external display monitor, and a user interface. The transducer transmits an ultrasound signal into a field of view and receives echoes produced in response to the signal interacting with structure therein. The echoes are conveyed to the console and are processed, producing images of the scanned structure, which may be visually presented through the display monitor.

[0003] The display monitor may include a cathode ray tube (CRT), a liquid crystal display (LCD), a light emitting diode (LED) display, and/or other type of display. The display monitor has been a “dumb” monitor with no processor or processing capabilities and that is simply an output device that displays images and other information (e.g., transducer frequency, gain, etc.). The user interface has included a keyboard or keypad with mechanical depressible buttons and/or a flat touch screen area (e.g., LCD, CRT, etc.).

[0004] The display monitor has been placed in an upright vertical position so that the clinician can look at images and/or the other information displayed via the display monitor. The user interface has been placed in a generally horizontal position, approximately perpendicular to the upright vertical position. This arrangement is similar to that of a desktop computer monitor and corresponding keyboard. The user controls features such as gain, zoom, pans, etc. with the controls of the user interface.

[0005] Unfortunately, with such a user interface/display monitor arrangement, where the user interface includes a touch screen with a flat surface, it may not be readily easy for the user to locate and/or operate touch sensitive controls of the user interface while observing an image and/or patient. Rather, the user may have to look away from the image and/or patient and down at the user interface to find and/or operate the control, adding complexity and inefficiency to the procedure.

SUMMARY

[0006] Aspects of the application address the above matters, and others.

[0007] In one aspect, a method includes receiving a signal from a first touch screen control in response to invocation of the first touch screen control. The first touch screen control is a control from a first cluster of touch screen controls of a plurality of different clusters of touch screen controls of an ultrasound imaging system touch screen user interface. The method further includes identifying a type of the first touch screen control based on the signal. The method further includes obtaining a control configuration for the touch screen controls based on the type of control. The method further includes constructing a control layout for the touch

screen user interface based on the configuration. The method further includes visually rendering the control layout via the touch screen user interface.

[0008] In another aspect, an ultrasound imaging system includes a touch screen user interface of the ultrasound imaging system. The touch screen user interface includes a touch panel. The touch screen user interface further includes a touch screen controller of the ultrasound imaging system configured to display a plurality of different clusters of controls in one of a plurality of different configurations depending on a presently active control of the controls.

[0009] In another aspect, a touch screen user interface includes a touch panel with an active region configured to visually display different clusters of touch sensitive controls, each cluster controlling different ultrasound imaging operations of the ultrasound imaging system. A control of the active region generates a control single for an ultrasound imaging operation in response to invocation of the control. The touch screen user interface further includes a touch screen controller of the ultrasound imaging system configured to display the different clusters of touch sensitive controls on the active region in one of a plurality of different configurations in response to a signal from a currently employed control.

[0010] Those skilled in the art will recognize still other aspects of the present application upon reading and understanding the attached description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] The application is illustrated by way of example and not limitation in the figures of the accompanying drawings, in which like references indicate similar elements and in which:

[0012] FIG. 1 schematically illustrates an example ultrasound imaging system with a touch screen user interface;

[0013] FIG. 2 illustrates an example of a cluster of controls for the touch screen user interface;

[0014] FIG. 3 illustrates another example of a cluster of controls for the touch screen user interface;

[0015] FIG. 4 illustrates another example of a cluster of controls for the touch screen user interface;

[0016] FIG. 5 illustrates an example of the touch screen user interface with multiple clusters of controls;

[0017] FIG. 6 illustrates an example ultrasound imaging system with the touch screen user interface of FIG. 5;

[0018] FIGS. 7 and 8 illustrate interaction of controls within a grouping of a cluster;

[0019] FIG. 9 illustrates interaction of controls which display additional controls for the grouping of FIGS. 7 and 8;

[0020] FIG. 10 illustrates a subset of controls within a cluster;

[0021] FIG. 11 illustrate single control mode in connection with FIG. 10;

[0022] FIG. 12 illustrates duplex control mode in connection with FIG. 10;

[0023] FIG. 13 illustrates triplex control mode in connection with FIG. 10;

[0024] FIGS. 14-16 illustrate a common control shared across the controls in triplex mode;

[0025] FIGS. 17 and 18 illustrate interaction which displays additional soft controls;

[0026] FIGS. 19 and 20 illustrate interaction between controls of a same cluster and between different clusters;

[0027] FIGS. 21-24 illustrate interaction within a cluster in connection with measurement controls; and

[0028] FIG. 25 illustrates example method in accordance with the description herein.

DETAILED DESCRIPTION

[0029] FIG. 1 schematically illustrates an ultrasound (US) imaging system 102.

[0030] The ultrasound imaging system 102 includes a probe 104 with a one-dimensional (1D) or two-dimensional (2D) transducer array 106 with at least one transducer element 108. Suitable array configurations include, but are not limited to, linear, curved (e.g., concave, convex, etc.), circular, etc., full populated or sparse, etc. The probe 104 further includes a console interface 110, which may include a connector (e.g., an electro-mechanical device for joining electrical circuits) and/or wireless transceiver.

[0031] The ultrasound imaging system 102 further includes a display monitor 112. The display monitor 112 can be a cathode ray tube (CRT), a liquid crystal display (LCD), a light emitting diode (LED), and/or other display monitor. The display monitor 112 includes a display area 114 with a multiple sub-display regions 114₁, . . . , 114_N, where N is a positive integer. The display monitor 112 further includes a console interface 110, which may include a connector (e.g., an electro-mechanical device for joining electrical circuits) and/or wireless receiver.

[0032] The display monitor 112 can be affixed to a support 120 (as shown in FIG. 1) such as a stand, a bracket, etc. that rests on or is affixed to a surface (e.g., a desk, a table, etc.) and holds the display monitor 112 in a generally upright vertical viewing position. In another instance, the support 120 can be a wall bracket that mounts to a wall, a ceiling, etc., thereby indirectly mounting the display monitor 112 thereto. Other supports are also contemplated herein. The support 120 may be configured to rotate, tilt, translate, and/or otherwise move, which selectively allows for spatially orienting the region 114.

[0033] The ultrasound imaging system 102 further includes a touch screen user interface 122. The touch screen user interface 122 includes a touch panel 124. At least a sub-portion of the touch panel 124 includes one or more active regions 126 with one or more touch sensitive control (s) 128 such as a time-gain control (TGC), a mode (e.g., 2D, 3D, 4D, etc.) selector control, a CINE control, a measurement control, a zoom control, a depth control, a focus control, etc. The touch panel 124 may include a resistive, a capacitive, an acoustic, an infrared, an optical, a piezoelectric, and/or other region. Furthermore, the touch panel 124 may include an LCD, thin film transistor (TFT) LCD, organic light-emitting diode (OLED), and/or other display.

[0034] The one or more controls 128, in one instance, are kept in a normally de-activate state, but are activatable. A de-activated control 128, when actuated by a gesture (e.g., a press, a swipe, a touch, etc.) on the control 128 with one or more fingers, a stylus, a glove, etc., transitions to an active state. An activate control 128, when operated, generates an electrical signal corresponding to the operation of the control 128. Generally, when a control 128 is active, one or more other non-active controls transition to a non-activatable state. In a variation, one or more controls can be kept in a normally active state. In this variation, the normally active control may transition to a de-active state in response

to activation of another control, a gesture over the control, an input signal including a control signal that de-activates the control, etc.

[0035] As an example of activation and operation, a gain control is activated by touching the control and then the gain is increased or decreased (i.e., operated) through the control through a predetermined gesture. For example, circling clockwise, sliding over in direction, etc. the gain control with a suitable object increases gain, and circling counter-clockwise, sliding in another direction, etc. over the gain control with the suitable object decreases gain. A reset control may be provided to quickly return on or more of the touch controls 128 to the initial or starting conditions. An active control can be configured to automatically transition back to a de-active state, e.g., in response to lapse of a pre-determined length of time of inactivity, activation of another control 128, on demand, etc.

[0036] Briefly turning to FIGS. 2, 3 and 4, non-limiting examples of the touch screen user interface 122 are illustrated.

[0037] In FIG. 2, the controls 128 include circular shaped controls 202 including one control 202₁ with one diameter and another control 202₂ with a different larger diameter, a ring shape control 204 with a non-active area 206 in the hole of the ring, concentric controls 208 including one control 208₁ surrounded by another control 208₁, a rectangular control 210 with rounded edges, and curved rectangular controls 212 with rounded edges. A control 214 includes a plurality of touch activated slides 216₁, 216₂, 216₃, . . . , 216_N, collectively referred to herein as virtual slides 216, which reside in a recess 218 in the touch panel 124. Again, the controls 128 can be activated and used by pressing, tapping, swiping, etc.

[0038] Turning to FIG. 3, the controls 128 include a two-dimensional (2D) array 302 of rectangular controls 304 and other controls 306. In FIG. 4, the controls 128 include controls 402 of a computer keyboard as well as other controls 128, such as a search box 404, and custom configure controls 406. Another example touch screen user interface 122 includes a combination of FIGS. 2, 3 and/or 4, optionally with alternative and/or additional controls. Still other controls can also include physical mechanical controls such as a trackball, a track pad, etc. Other examples of touch screen controls are described in application Ser. No. 13/748, 653, filed on Jan. 24, 2013, entitled "Ultrasound Imaging System," and assigned to B-K Medical Aps, which is incorporated herein by reference in its entirety.

[0039] Returning to FIG. 1, the touch screen user interface 122 may also include visual indicators (e.g., lights, etc.), audible indicators (e.g., speakers, etc.), tactile indicators (e.g., vibration, etc.), other controls (e.g., physical mechanical buttons, physical mechanical slides, physical mechanical rotary knobs, etc.), an image display region, etc. The touch screen user interface 122 further includes a console interface 130, which may include a connector (e.g., an electro-mechanical device for joining electrical circuits) and/or wireless transceiver.

[0040] The ultrasound imaging system 102 further includes an ultrasound scanner console 132. The console 132 includes a probe interface 134, a display monitor interface 136, and a touch screen user interface 138, which, respectively are complementary to the console interfaces 110, 118 and 130. For example, the probe interface 134 is complementary to the console interface 110 in that the probe

interface **134** and the console interface **110** physically engage and provide an electrical pathway between the probe **104** and the ultrasound scanner console **132**. For instance, the console interface **110** may include a female connector and the probe interface **134** may include a male connector, wherein the connectors physically engage and physically connect electrodes.

[0041] The ultrasound scanner console **132** further includes a transducer controller **140**. The transducer controller **140** controls excitation of the at least one transducer element **108**. The transducer controller **140** also controls detection of echoes with the at least one transducer element **108**. In a variation, the excitation and detection can be through separate components such as transmit and receive circuitry. The console **132** further includes an echo processor **142** (e.g., microprocessor, central processing unit, etc.) that processes detected echoes. Such processing may include generating an image, estimating flow velocity, and/or processing. The ultrasound scanner console **132** further includes a physical memory device (memory) **144**, which can be used to store ultrasound data.

[0042] A controller **146** controls the information visually presented in at least one of the display regions **114** of the display monitor **112**. By way of example, in one non-limiting instance, the display controller **146** renders an ultrasound image in at least one of the display regions **114**. In another example, the display controller **146** renders a graphical representation of one of the controls **128** in at least one of the display regions **114**. As described in greater detail below, for the latter, the display controller **146** identifies activation and/or operation of a touch control **128** and renders the graphical representation in the at least one of the display regions **114**, where the graphical representation may include alpha-numeric information and/or graphics, shows a current value and/or any changes thereto, shows movement of the actual control, etc.

[0043] Generally, the graphical representation provides a virtual control of a touch control **128**, on the display monitor **112**, that mirrors or mimics the touch control **128** of the touch screen user interface **122** and operation of the touch control **128** through the touch screen user interface **122**. The graphical representation shows in the display monitor **112**, for example, where the user's finger (or other object) is located on the touch screen user interface **122** with respect to the control **128**, thereby allowing the user to adjust a control **128** without looking at the control **128** on the touch screen user interface **122**. In one instance, this provides a more intuitive adaptation of the touch controls, and may reduce complexity and inefficiency, relative to a configuration in which the display controller **146** does not render virtual controls on a display region of the display monitor **112**.

[0044] The ultrasound scanner console **132** further includes a touch screen controller **148**. The touch screen controller **148** controls display of the controls **128** in the active region **126** and an interaction between the controls. In one instance, this includes obtaining a control cluster configuration for the touch screen user interface **122** from the memory **144** and/or other memory, constructing a display with clusters of controls for the touch screen user interface based on the control cluster configuration, and visually rendering the constructed display on the touch panel **124** of the touch screen user interface **122**. The rendered controls **128** operate as discussed herein, for example, in connection

with at least the description of FIGS. **2**, **3** and **4**, and/or otherwise. For example, certain controls are rendered active while other controls are rendered inactive, depending on a current mode of operation, a current step in a sequence of steps, etc.

[0045] As discussed in connection with FIGS. **2-4**, another example touch screen user interface **122** includes a combination of FIGS. **2**, **3** and/or **4**, optionally with alternative and/or additional controls. In such instances, different groupings of controls can be considered different clusters of controls, for example, a cluster of controls corresponding to FIG. **2**, a different cluster of controls corresponding to FIG. **3**, another different cluster of controls corresponding to FIG. **4**, and/or one or more other different clusters corresponding to one or more other controls. The spatial arrangement of the different clusters with respect to each other and/or within the touch panel **124** can be based on a default configuration, an orientation (e.g., portrait or landscape) of the touch panel **124**, a size (e.g., 19" or 15") of the touch panel **124**, an active mode of operation, an active control, an expected location of the user of the touch panel **124**, etc.

[0046] FIG. **5** illustrates a non-limiting example of the touch panel **124**. In FIG. **5**, the illustrated touch panel **124** includes an annotation cluster **510**, a primary cluster **512**, a contextual cluster **514**, a pre/post cluster **516**, a TGC cluster **518**, an application cluster **520**, and an exam cluster **522**. Other and/or different clusters of controls are contemplated herein. Other examples of suitable cluster configurations are described in international application serial number PCT/IB2014/066363, filed on Nov. 26, 2014, and entitled "ULTRASOUND IMAGING SYSTEM TOUCH PANEL WITH MULTIPLE DIFFERENT CLUSTERS OF CONTROLS, which is incorporated herein by reference in its entirety.

[0047] Gestures that can be used with one or more of the controls described herein include, but are not limited to, a tap, multiple successive taps, a drag, a flick, a hold down, a direct touch, a press, a slide, a rotation, etc. Interaction (e.g., by a user) with a control of a cluster **510-522** may result in an interaction between controls of a same cluster and/or a control(s) of one cluster and a control(s) of one or more other clusters. Examples of such interaction include, but are not limited to, a visibility of a control, an operation controlled by a control, a status of a control (e.g., active in focus, active, activatable, inactive, etc.), a location of a control, etc.

[0048] FIG. **6** shows the touch screen user interface **122** in connection with an example portable ultrasound device. In FIG. **6**, the display monitor **112**, the touch screen user interface **122**, the touch panel **124**, and the ultrasound scanner console **132** are integrated and part of a mobile cart **600**, which include movers **602** such as wheels, casters, etc. In another configuration, the ultrasound imaging system **102** rests on a table, desk, etc., and does not include movers and is not integrated into a cart, is also contemplated herein.

[0049] FIGS. **7-24** illustrate non-limiting examples of an interaction between controls of one or more of the clusters **510-522**.

[0050] Initially referring to FIGS. **7** and **8**, an example of an interaction within the contextual cluster **514** is illustrated. In FIG. **7**, the contextual cluster **514** includes a plurality of controls **702**, including multiple groupings of two or more of the controls **702**, for example, at least a first grouping **704** and another or a second different grouping **706**. Each control **702** can exist in a plurality of states, including an active

(active in focus state if more than one active state), an activatable state, and an inactive state. In one instance, active (or active in focus) state represents a currently invoked control, an activatable state represents a control that can be actuated or invoked to transition to the active state, and an inactive state represents a state in which the control cannot be currently activated, but can become activatable under certain conditions.

[0051] The grouping 704 includes controls 708, 710 and 712. In FIG. 7, the control 708 is in the activatable state, and the controls 710 and 712 both are in the inactive state. In this example, the controls 710 and 712 control sub-functions that are not activatable until the control 708 is active. Transitioning the control 708 to the active state, for example, through a gesture as described herein, automatically transitions the control 710 to the active state and the control 712 to the activatable state. FIG. 8 shows the controls 708 and 710 in the active state and the control 712 in the activatable state. The grouping 706 includes controls 714 and 716. In FIG. 7, the control 714 is in the activatable state and the control 716 is in the inactive state. The control 716 controls a sub-function and is active only when the control 714 is in the active state. Controls 702 outside of the groupings 704 and 706 are in the activatable state.

[0052] FIG. 9 shows a further example of the grouping 706 of FIGS. 7 and 8. At 902, the controls 714 and 716 are as shown in FIGS. 7 and 8. At 904, the control 714 invoked to transition into the active status, and the control 716, in coordination therewith, automatically transitions to the activatable state. At 906, the control 716 invoked to transition into the active state. In this example, invoking the control 716 results in the touch screen controller 148 constructing and visually displaying a set of extended controls 908. The set of controls 908 is shown with controls 910 in the active state, controls 912 in the activatable state, and controls 914 in the inactive state. Invoking the control 714 to transition to the activatable state at 902 automatically transitions the control 716 to the inactive state like at 902. Changing the state of one or both of the controls 714 and 716 may also transition at least one other control 702 of FIGS. 7 and 8 to another state.

[0053] FIGS. 10, 11, 12, 13, 14, 15 and 16 illustrate example interaction within a sub-portion 1002 of the primary cluster 512. Initially referring to FIG. 10, at least a sub-set of controls 1004, 1006 and 1008 are configured to operate in single, duplex or triplex mode. The control 1004 controls a “2D” mode operation, a control 1006 controls a “color” mode operation, and a control 1008 controls a “pulse wave” mode operation. In other example, the controls 1004, 1006 and 1008 can control other operations. The controls 1004, 1006 and 1008 are spatially grouped together and can be invoked for simultaneous operation of their respective modes. In single mode, only one of the controls 1004, 1006 and 1008 is active. In duplex mode, two of the controls 1004, 1006 and 1008 are active. In triplex mode, all three of the controls 1004, 1006 and 1008 are active. A control 1010 controls a gain for the in focus mode.

[0054] With duplex and triplex modes, the active control of the multiple active controls that is currently being used is the active in focus control. In FIG. 11, the control 1004 is the active control. The controls 1006 and 1008 are activatable. In FIG. 12, the controls 1004 and 1006 are both active with the control 1006 being the active in focus control. The control 1008 is activatable. In FIG. 13, the controls 1004,

1006 and 1008 are all active with the control 1008 being the active in focus control. FIG. 14 is similar to FIG. 13 except that the common control 1010 is active for control 1008. In FIG. 15, the controls 1004, 1006 and 1008 are all active with the control 1006 being the active in focus control and common control 1010 is active for control 1006. In FIG. 16, the controls 1004, 1006 and 1008 are all active with the control 1004 being the active in focus control and common control 1010 is active for control 1004. The common control 1010, in this example, represents a control shared across the controls 1004-1008 to control a gain and/or other parameter for each of the controls 1004, 1006 and 1008.

[0055] FIGS. 17 and 18 illustrate another example interaction within the primary cluster 512. In FIG. 17, the primary cluster 512 includes controls 1700 and a region 1702 in which the touch screen controller 148 can render nothing or a visible soft control. In one instance, the default configuration is no soft control. As shown in FIG. 18, the touch screen controller 148 renders one or more soft controls 1802 and 1804 in the region 1702 in response to invocation of a control of the controls 1700. The soft controls 1802 and 1804 provide extended functionality for the cluster. In other embodiments, the region 1702 could be located elsewhere on the touch panel 124. Furthermore, the touch panel 124 may include more than one region 1702. All of the controls 1700 may not include extended functionality. In such instance, nothing or other information can be rendered in the region 1702.

[0056] FIGS. 19 and 20 illustrate example interaction within the primary cluster 512 and between the primary cluster 512 and the context cluster 514. In FIG. 19, a control 1802 is the active control. In this example, the control 1802 controls an operation of the 2D mode. A control 1804 is activatable. The primary cluster 512 includes a first set of controls 1806, and the context cluster 514 includes a second set of controls 1808. FIG. 20 shows that when the control 1804 is invoked to be active in focus, at least a sub-set of the controls in the context cluster 514 changes to the context of the mode operated by the control 1804, for example, 4D controls. The context cluster 514 now includes a different set of controls 1810. This represents an example of interaction between the primary cluster 512 and the context cluster 514. Additionally, the touch screen controller 148 renders a soft control 1812 on the touch panel 124 in the primary cluster 512. The primary cluster 512 now includes a different set of controls 1814. This represents an example of interaction within the primary cluster 512.

[0057] FIGS. 21-24 illustrate an example of the primary cluster 512 in connection with taking measurements and interaction within the primary cluster 512. In FIG. 21, a control 2102 which is configured to control measurement functions is active. FIG. 22 shows an image 2104. The image 2104 can be displayed by the display monitor 112 and/or the touch screen user interface 122. With reference to FIGS. 21 and 22, a control 2106 (such as a trackball control) controls a spatial location of cursor 2106 that is superimposed over the image. A gesture such as a finger tap or press on the control 2106 (shown by 2108) places a mark 2110 on the image 2104. The mark 2110 represents one of two marks identifying end points for a length measurement. FIG. 22 also shows a second mark 2112 with a line 2114 between the two marks 2110 and 2112 indicating which two marks are the end points for a measurement, which is displayed in measurement display 2116.

[0058] FIG. 23 shows a second gesture such as a finger tap or press on the control 2106 (shown by 2120), which places the second mark 2112 on the image 2104. The gesture can be made after swiping across the control 2106 or removing physical contact and the establishing physical contact at 2120. In the illustrated example, a plurality of pairs of marks 2122 is illustrated along visual presentation of the corresponding measurements 2124. In response to adding at least one mark, the touch screen controller 148 renders a soft control 2128 in a region 2130, which is similar to the region 1702 of FIGS. 17 and 18 in that the touch screen controller 148 can render different visible soft controls in the region 2130, for example, based on the active mode of operation or no visible soft control. In this example, the touch screen controller 148 renders a soft control 2128 which, if invoked, deletes the last measurement mark.

[0059] With further reference to FIGS. 22 and 23, in response to adding at least two marks, the touch screen controller 148 renders a soft control 2126 in another region 2130 on the touch panel 124 in the primary cluster 512. In the illustrated example, the soft control 2126 is adjacent to the control 2106. However, other locations are contemplated herein. In the illustrated example, the soft control 2126 is configured to toggle through the measurement marks to control which of the measurement marks is editable at any given time. In operation, the user performs a gesture (e.g., a tap) on the soft control 2126. With each tap, the measurement mark which is editable changes to another measurement mark. The sequence may be determined on a temporal basis, such as the time a measurement mark was created relative to other measurement marks and/or otherwise. An editable measurement mark can be moved. The measurement mark can be saved and/or stored along with the image 2104.

[0060] FIG. 25 illustrates example method in accordance with one or more of the embodiments described herein.

[0061] It is to be appreciated that the ordering of the below acts is for explanatory purposes and not limiting. As such, other orderings are also contemplated herein. In addition, one or more of the acts may be omitted and/or one or more other acts may be included.

[0062] At 2502, a touch screen interface of an ultrasound imaging system is turned on.

[0063] At 2504, a display, including a plurality of different clusters of controls, is constructed on a touch panel of the touch screen interface.

[0064] At 2506, a signal is received from the control in response to invocation of the control.

[0065] At 2508, a display configuration is identified based on the signal.

[0066] At 2510, an update display is constructed based on the identified configuration.

[0067] In the updated display, at least one of another control of the cluster is automatically changed or a control of another cluster is automatically changed. As described herein, this may include changing a state of another control of the cluster, changing a set of controls of the cluster or the other cluster, displaying an additional set of soft controls, etc.

[0068] At least a portion of the methods discussed herein may be implemented by way of computer readable instructions, encoded or embedded on computer readable storage medium (which excludes transitory medium), which, when executed by a computer processor(s), causes the processor

(s) to carry out the described acts. Additionally or alternatively, at least one of the computer readable instructions is carried by a signal, carrier wave or other transitory medium.

[0069] The application has been described with reference to various embodiments. Modifications and alterations will occur to others upon reading the application. It is intended that the invention be construed as including all such modifications and alterations, including insofar as they come within the scope of the appended claims and the equivalents thereof.

1. A method, comprising:

receiving a signal from a first touch screen control in response to invocation of the first touch screen control, wherein the first touch screen control is a control from a first cluster of touch screen controls of a plurality of different clusters of touch screen controls of an ultrasound imaging system touch screen user interface; identifying a type of the first touch screen control based on the signal; obtaining a control configuration for the touch screen controls based on the type of control; constructing a control layout for the touch screen user interface based on the configuration; and visually rendering the control layout via the touch screen user interface.

2. The method of claim 1, wherein a control is configured to be in one of an active state, an activatable state, or an inactive state.

3. The method of claim 1, wherein visually rendering the control layout includes transitioning a second touch screen control of the first cluster to a different state from a state of the second control prior to invocation of the first touch screen control.

4. The method of claim 3, further comprising: automatically transitioning the second touch screen control of the first cluster from the inactive state to the activatable state only in response to the first touch screen control of the first cluster transitioning to the active state.

5. The method of claim 2, further comprising: automatically transitioning the second touch screen control of the first cluster to the inactive state in response to the first touch screen control transitioning to the inactive state.

6. The method of claim 3, further comprising:

receiving a second signal from the second touch screen control; and visually rendering the second touch screen control in a same state as the first touch screen control.

7. The method of claim 6, further comprising:

visually rendering an extended set of controls for the first cluster in response to the second signal.

8. The method of claim 3, wherein the first and second controls are part of a same sub-grouping of related controls of the first cluster of touch screen controls and the second touch screen control controls a sub-function of the functions controlled by the controls of the first cluster of controls.

9. The method of claim 1, further comprising:

receiving a third signal from a third touch screen control of the first cluster in response to invocation of the third touch screen control; and

rendering the first and third touch screen controls in a same state, wherein the first and third touchscreen controls are independent controls and the state is the active state.

10. The method of claim 9, further comprising: visually rendering a single control of the first cluster configured to control a same function for the first and third touch screen controls.

11. The method of claim 9, further comprising: receiving a fourth signal from a fourth touch screen control of the first cluster in response to invocation of the third touch screen control; and rendering the first, third and fourth touch screen control in a same state, wherein the first, third and fourth touch-screen controls are independent controls and the state is the active state.

12. The method of claim 11, further comprising: visually rendering a single control of the first cluster configured to control a same function for the first, third and fourth touch screen controls.

13. The method of claim 1, wherein visually rendering the control layout includes transitioning a second touch screen control of a second different cluster to a different state from a state of the second control prior to invocation of the first touch screen control.

14. The method of claim 1, wherein the visually rendering of the control layout includes changing a type of another control of the first cluster of touch screen controls.

15. The method of claim 1, wherein the visually rendering of the control layout includes changing a type of a control of a different cluster of touch screen controls.

16. The method of claim 1, further comprising: visually rendering a soft control on the touch screen user interface in response to invocation of the first touch screen control from the first cluster.

17. The method of claim 16, where the soft control includes additional controls for the type of control.

18. The method of claim 17, wherein the additional control is configured to control an editing operation of a measurement landmark on an ultrasound image displayed via a display of the ultrasound imaging system.

19. The method of claim 18, wherein the editing operation moves a location of a saved measurement landmark to a different location on the image in response to a user input.

20. An ultrasound imaging system, comprising:

a touch screen user interface of the ultrasound imaging system, the touch screen user interface including a touch panel; and

a touch screen controller of the ultrasound imaging system configured to display a plurality of different clusters of controls in one of a plurality of different configurations depending on a presently active control of the controls.

21. The system of claim 20, wherein in response to actuation of a first control of a first cluster, the touch screen controller transitions a state of a second touch screen control of the first cluster to a different state from that which it was in before the actuation.

22. The system of claim 21, wherein a new state of the second touch screen control of the first cluster is a same state as the first touch screen control.

23. The system of claim 21, wherein a new state of the second touch screen control of the first cluster is a different state as the first touch screen control.

24. The system of claim 21, wherein the touch screen controller displays an additional set of controls in response to actuation of another control.

25. The system of claim 21, wherein the first and second touch screen controls are part of a same sub-group of related controls of the first cluster.

26. The system of claim 21, wherein the touch screen controller configures a sub-set of controls of the first cluster for simultaneous activation.

27. The system of claim 26, wherein the touch screen controller configures a common control to perform a same function for each control of the sub-set of controls.

28. The system of claim 20, wherein the touch screen controller changes a type of control of a different cluster in response to actuation of a control of the first cluster.

29. The system of claim 20, wherein the touch screen controller displays an additional soft control response to actuation of a control of the first cluster, wherein the soft control extends a set of functions provided by the first cluster.

30. The system of claim 29, wherein the additional soft control controls an editing operation for moving a location of a previously placed measurement landmark to a different location on an image.

31. A touch screen user interface, comprising:

a touch panel with an active region configured to visually display different clusters of touch sensitive controls, each cluster controlling different ultrasound imaging operations of the ultrasound imaging system, wherein a control of the active region generates a control single for an ultrasound imaging operation in response to invocation of the control; and

a touch screen controller of the ultrasound imaging system configured to display the different clusters of touch sensitive controls on the active region in one of a plurality of different configurations in response to a signal from a currently employed control.

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专利名称(译)	超声成像系统触摸面板集群控制交互		
公开(公告)号	US20170322724A1	公开(公告)日	2017-11-09
申请号	US15/529564	申请日	2014-11-26
[标]申请(专利权)人(译)	B-K医疗公司		
申请(专利权)人(译)	B-k医疗APS		
当前申请(专利权)人(译)	B-k医疗APS		
[标]发明人	NIELSEN TORBEN SVANBERG ANTOL JOHN DUNKIN KAJ HANSEN JESPER HELLESO		
发明人	NIELSEN, TORBEN SVANBERG ANTOL, JOHN DUNKIN, KAJ HANSEN, JESPER HELLESO		
IPC分类号	G06F3/0488 A61B8/00 G06F3/0484 G06F3/0482		
CPC分类号	G06F3/04886 G06F3/04845 A61B8/4405 A61B8/465 A61B8/467 G06F3/0482		
外部链接	Espacenet USPTO		

摘要(译)

一种方法包括响应于第一触摸屏控制的调用从第一触摸屏控制接收信号。第一触摸屏控制是来自超声成像系统触摸屏用户界面的多个不同群集的触摸屏控件的第一群触摸屏控件的控制。该方法还包括基于该信号识别第一触摸屏控件的类型。该方法还包括基于控制类型获得用于触摸屏控件的控制配置。该方法还包括基于配置构建用于触摸屏用户界面的控制布局。该方法还包括通过触摸屏用户界面在视觉上呈现控制布局。

