US010420533B2

(12) **United States Patent**
Kim et al.

(10) **Patent No.: US 10,420,533 B2**
(45) **Date of Patent: Sep. 24, 2019**

(54) **ULTRASOUND DIAGNOSIS APPARATUS AND CONTROL METHOD THEREOF**

(71) Applicant: **Samsung Electronics Co., Ltd.**, Suwon-si, Gyeonggi-do (KR)

(72) Inventors: **Yun-Kyung Kim**, Suwon-si (KR); **Hyun-Jin Kim**, Seoul (KR); **Mi-Young Lee**, Seoul (KR); **Su-yeon Jung**, Yongin-si (KR)

(73) Assignee: **Samsung Electronics Co., Ltd.**, Suwon-si (KR)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 908 days.

(21) Appl. No.: **14/931,105**

(22) Filed: **Nov. 3, 2015**

(65) **Prior Publication Data**

US 2016/0120508 A1 May 5, 2016

Related U.S. Application Data

(60) Provisional application No. 62/074,834, filed on Nov. 4, 2014.

(30) **Foreign Application Priority Data**

May 7, 2015 (KR) 10-2015-0063866

(51) **Int. Cl.**
A61B 8/00 (2006.01)

(52) **U.S. Cl.**
CPC ***A61B 8/469*** (2013.01); ***A61B 8/465*** (2013.01); ***A61B 8/467*** (2013.01); ***A61B 8/54*** (2013.01); *A61B 8/4405* (2013.01)

(58) **Field of Classification Search**
CPC A61B 8/13; A61B 8/4405; A61B 8/4472; A61B 8/4477; A61B 8/465; A61B 8/467; A61B 8/469; A61B 8/54
USPC 600/437
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,468,212	B1 *	10/2002	Scott	A61B 8/00 600/437
7,158,123	B2	1/2007	Myers et al.	
9,877,699	B2 *	1/2018	Chiang	G16H 30/20
2009/0043195	A1 *	2/2009	Poland	A61B 8/00 600/437
2010/0049046	A1 *	2/2010	Peiffer	A61B 8/13 600/443
2010/0062803	A1	3/2010	Yun et al.	
2010/0298701	A1	11/2010	Shin	
2010/0321324	A1 *	12/2010	Fukai	A61B 8/00 345/173

(Continued)

FOREIGN PATENT DOCUMENTS

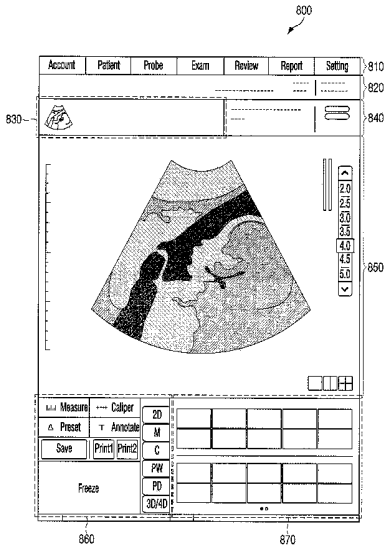
KR	10-2010-0028862	A	3/2010
KR	10-2010-0110893	A	10/2010
KR	10-1167248	B1	7/2012

Primary Examiner — Baisakhi Roy
(74) *Attorney, Agent, or Firm* — Jefferson IP Law, LLP

(57) **ABSTRACT**

An ultrasound diagnosis apparatus for emitting ultrasound waves to an examination object and obtaining an ultrasound image is provided. The apparatus includes a touch display configured to display a screen that includes the ultrasound image, and a controller configured to receive a touch input associated with the ultrasound image, and set a focus or depth of the ultrasound image to be displayed based on a touched position.

20 Claims, 58 Drawing Sheets



(56) **References Cited**

U.S. PATENT DOCUMENTS

2014/0276069 A1* 9/2014 Amble A61B 8/5207
600/447

* cited by examiner

FIG. 1

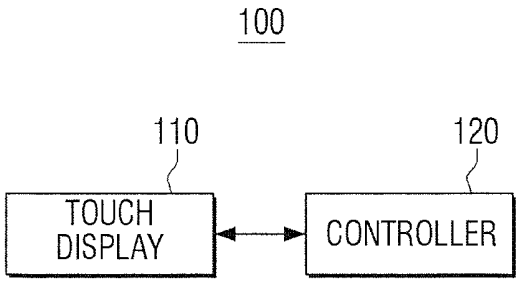


FIG. 2

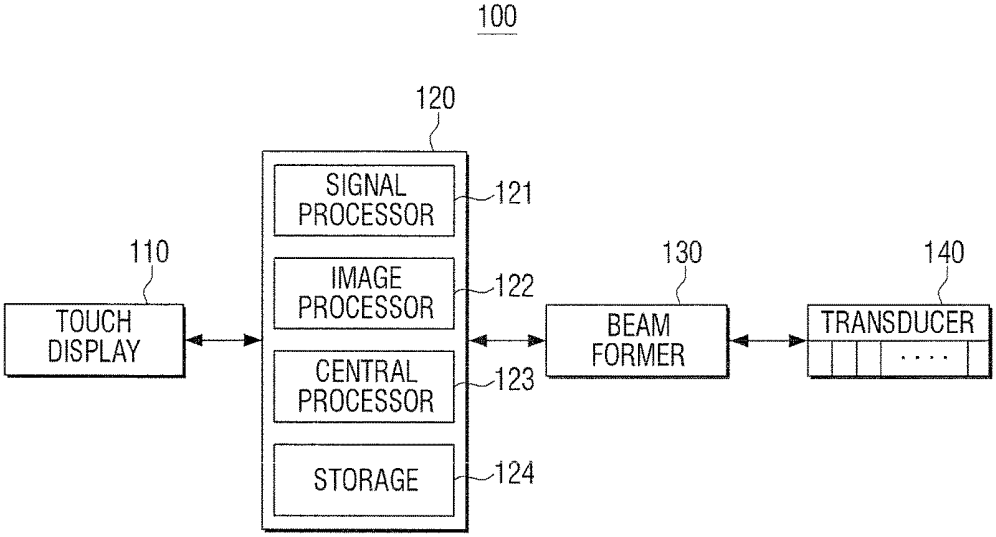

100
120
SIGNAL PROCESSOR
121
IMAGE PROCESSOR
122
CENTRAL PROCESSOR
123
STORAGE
124
110
TOUCH DISPLAY
130
BEAM FORMER
140
TRANSDUCER

FIG. 3

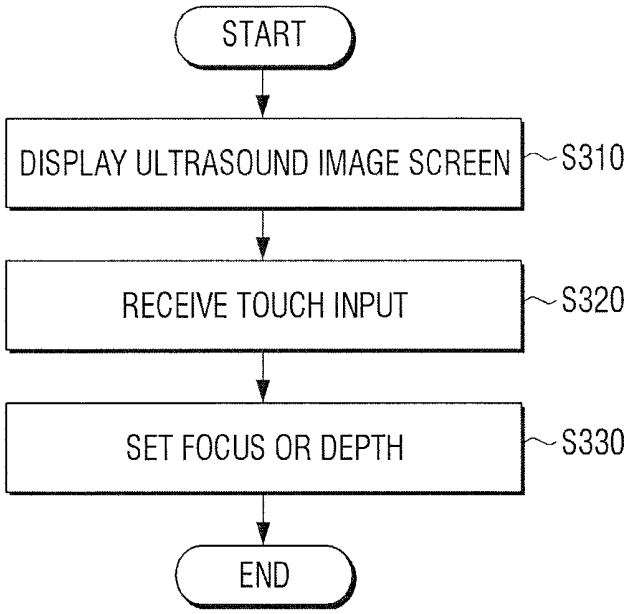

START
DISPLAY ULTRASOUND IMAGE SCREEN
S310
RECEIVE TOUCH INPUT
S320
SET FOCUS OR DEPTH
S330
END

FIG. 4

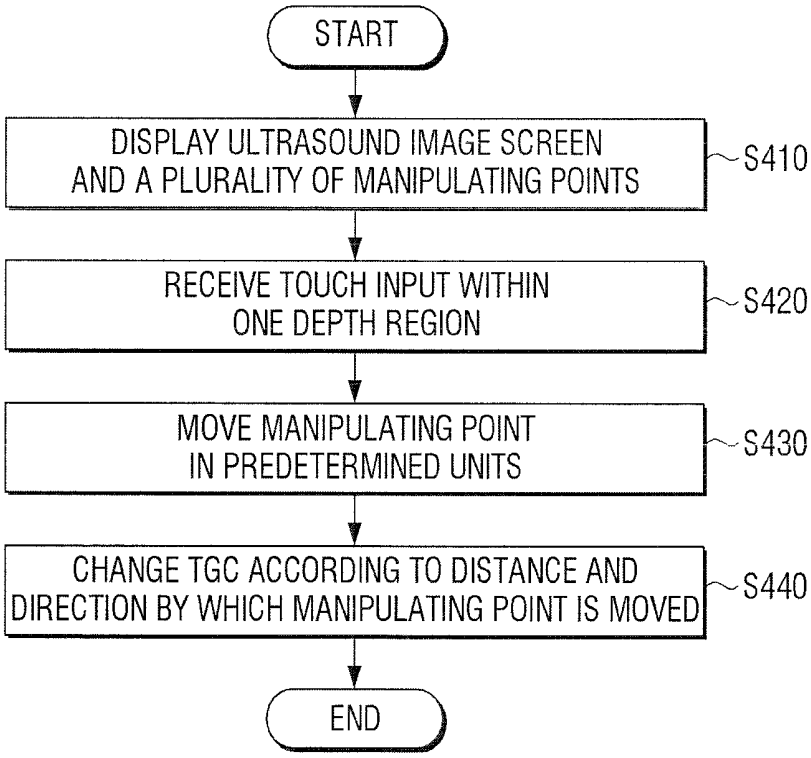

START
DISPLAY ULTRASOUND IMAGE SCREEN AND A PLURALITY OF MANIPULATING POINTS
S410
RECEIVE TOUCH INPUT WITHIN ONE DEPTH REGION
S420
MOVE MANIPULATING POINT IN PREDETERMINED UNITS
S430
CHANGE TGC ACCORDING TO DISTANCE AND DIRECTION BY WHICH MANIPULATING POINT IS MOVED
S440
END

FIG. 5

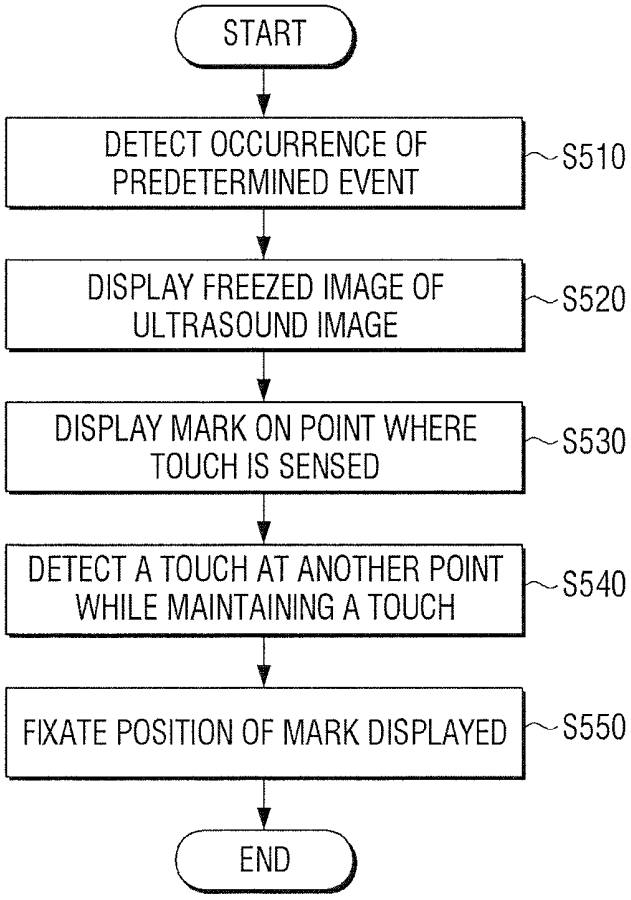

START
DETECT OCCURRENCE OF PREDETERMINED EVENT
S510
DISPLAY FREEZED IMAGE OF ULTRASOUND IMAGE
S520
DISPLAY MARK ON POINT WHERE TOUCH IS SENSED
S530
DETECT A TOUCH AT ANOTHER POINT WHILE MAINTAINING A TOUCH
S540
FIXATE POSITION OF MARK DISPLAYED
S550
END

FIG. 6

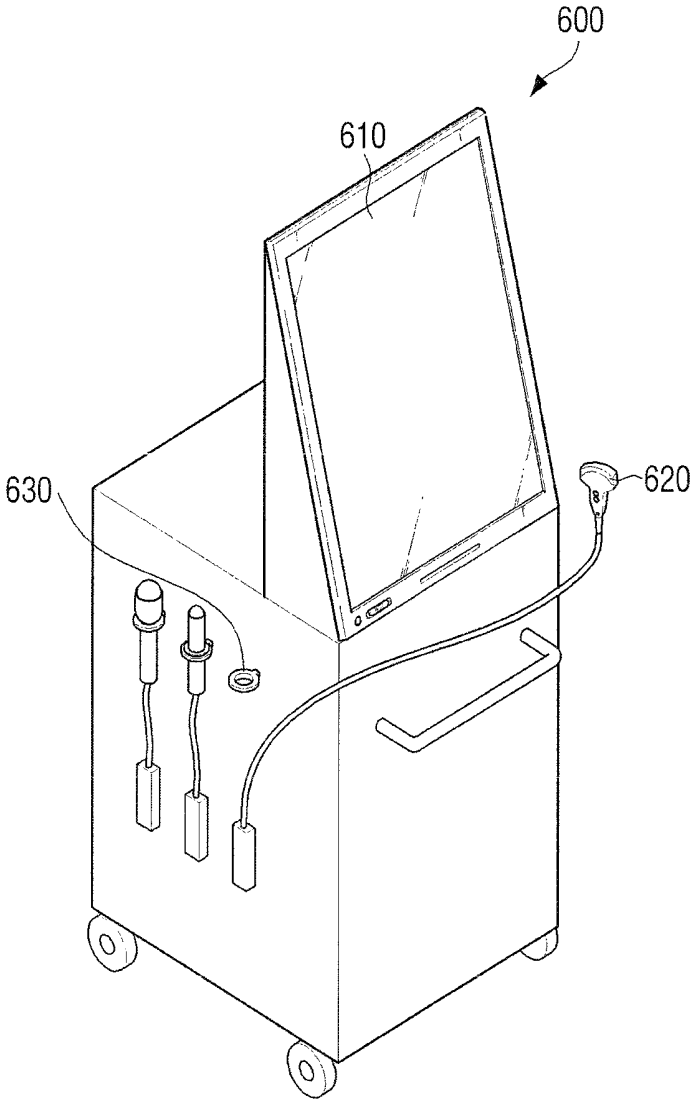


FIG. 7

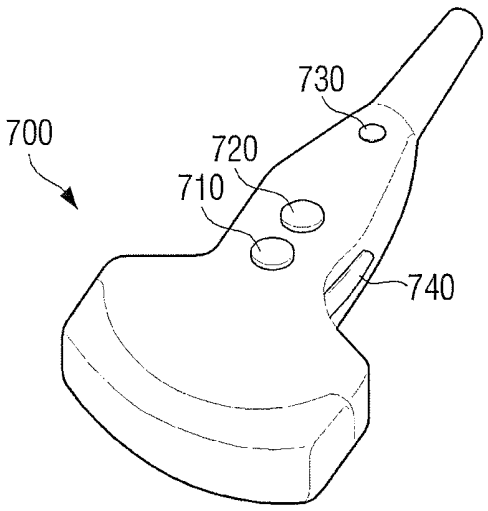


FIG. 8

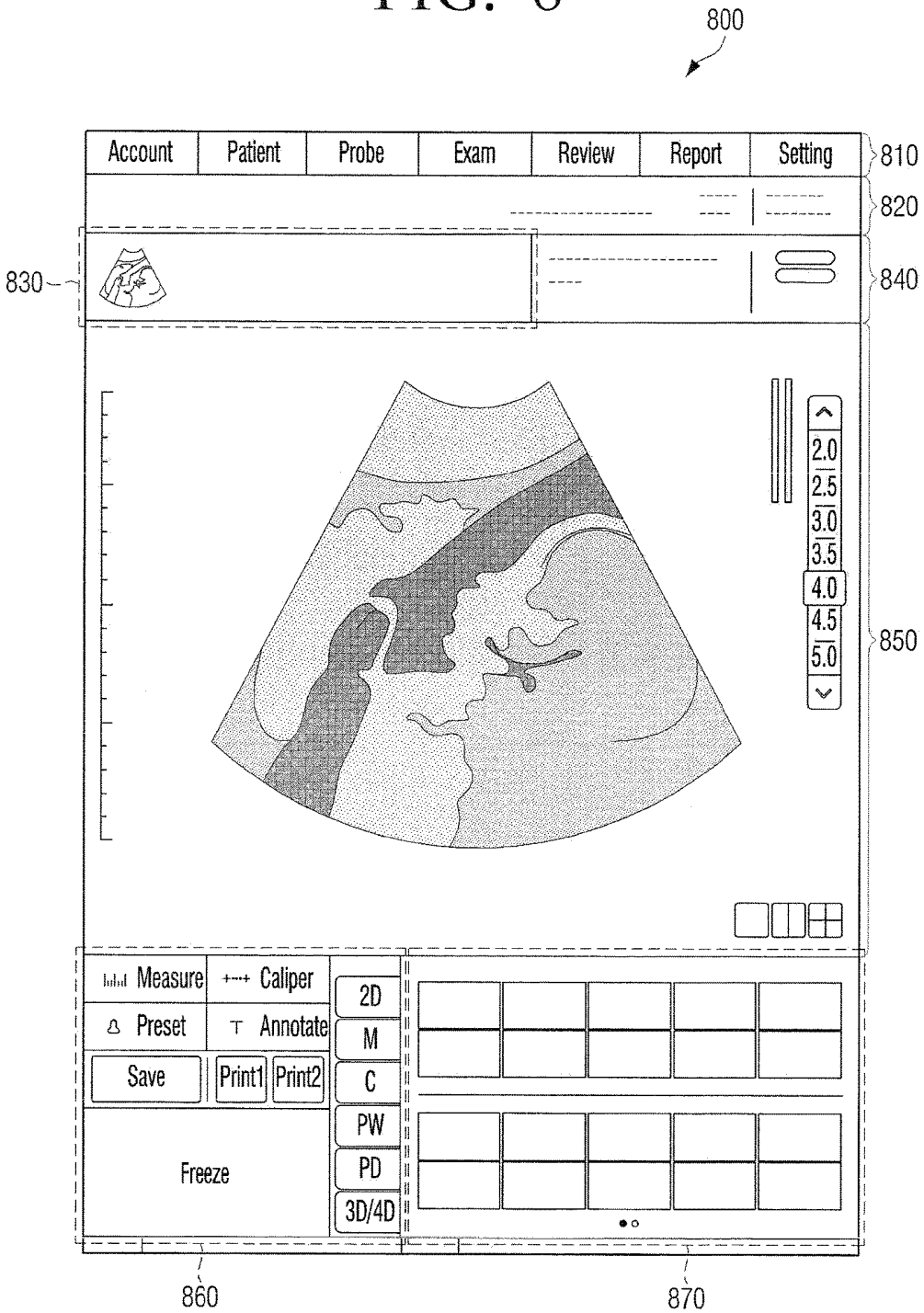

800
Account
Patient
Probe
Exam
Review
Report
Setting
810
820
830
840
2.0
2.5
3.0
3.5
4.0
4.5
5.0
850
Measure
Caliper
Preset
Annotate
Save
Print1
Print2
Freeze
2D
M
C
PW
PD
3D/4D
860
870

FIG. 9

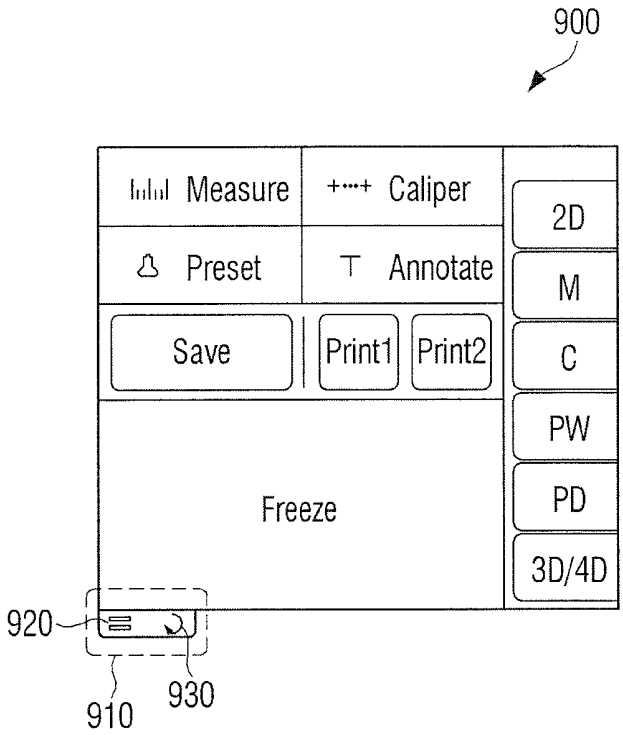

900
Measure
Caliper
Preset
Annotate
Save
Print1
Print2
Freeze
2D
M
C
PW
PD
3D/4D
920
910
930

FIG. 10A

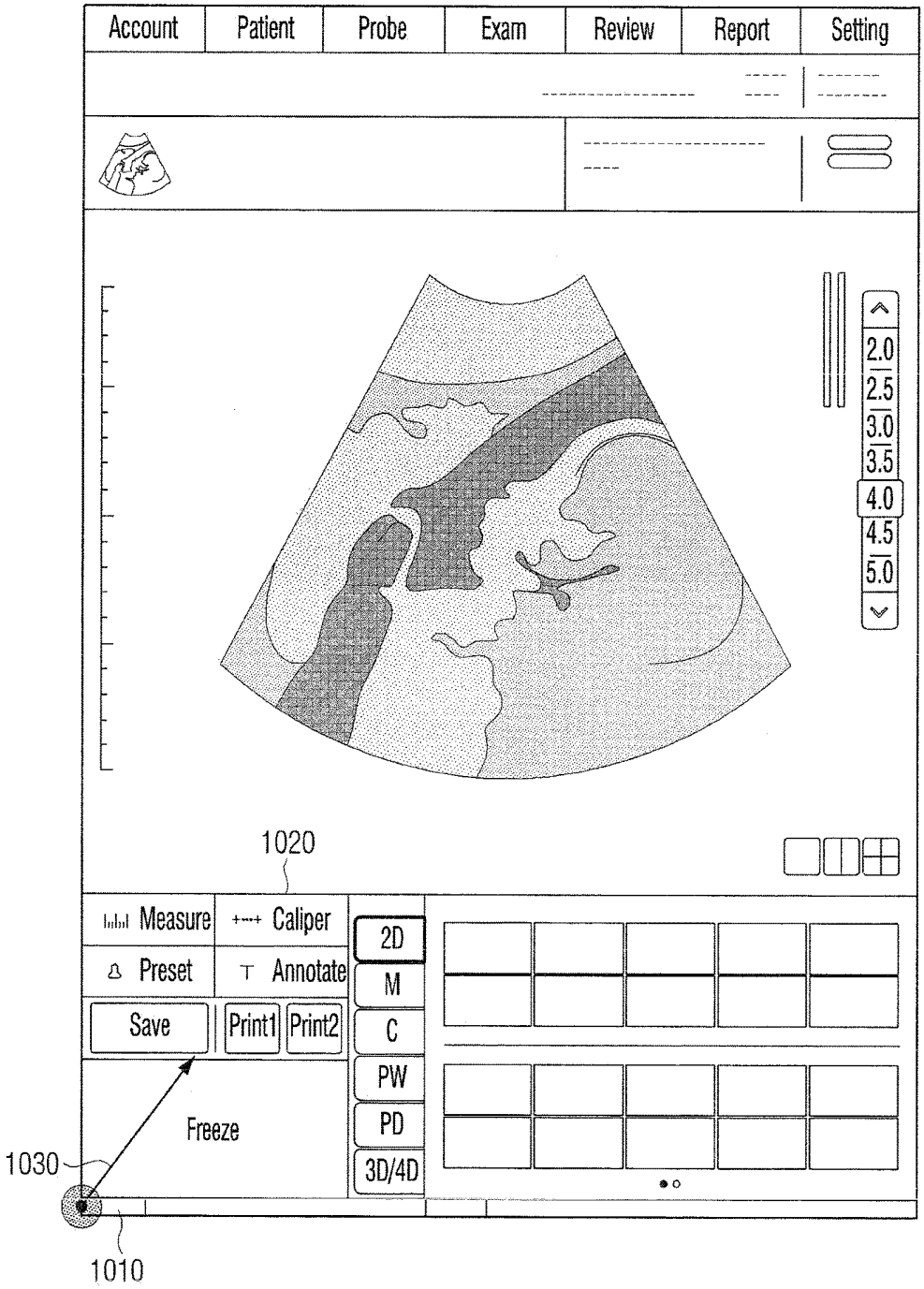

Account
Patient
Probe
Exam
Review
Report
Setting
2.0
2.5
3.0
3.5
4.0
4.5
5.0
1020
Measure
Caliper
Preset
Annotate
Save
Print1
Print2
Freeze
2D
M
C
PW
PD
3D/4D
1030
1010

FIG. 10B

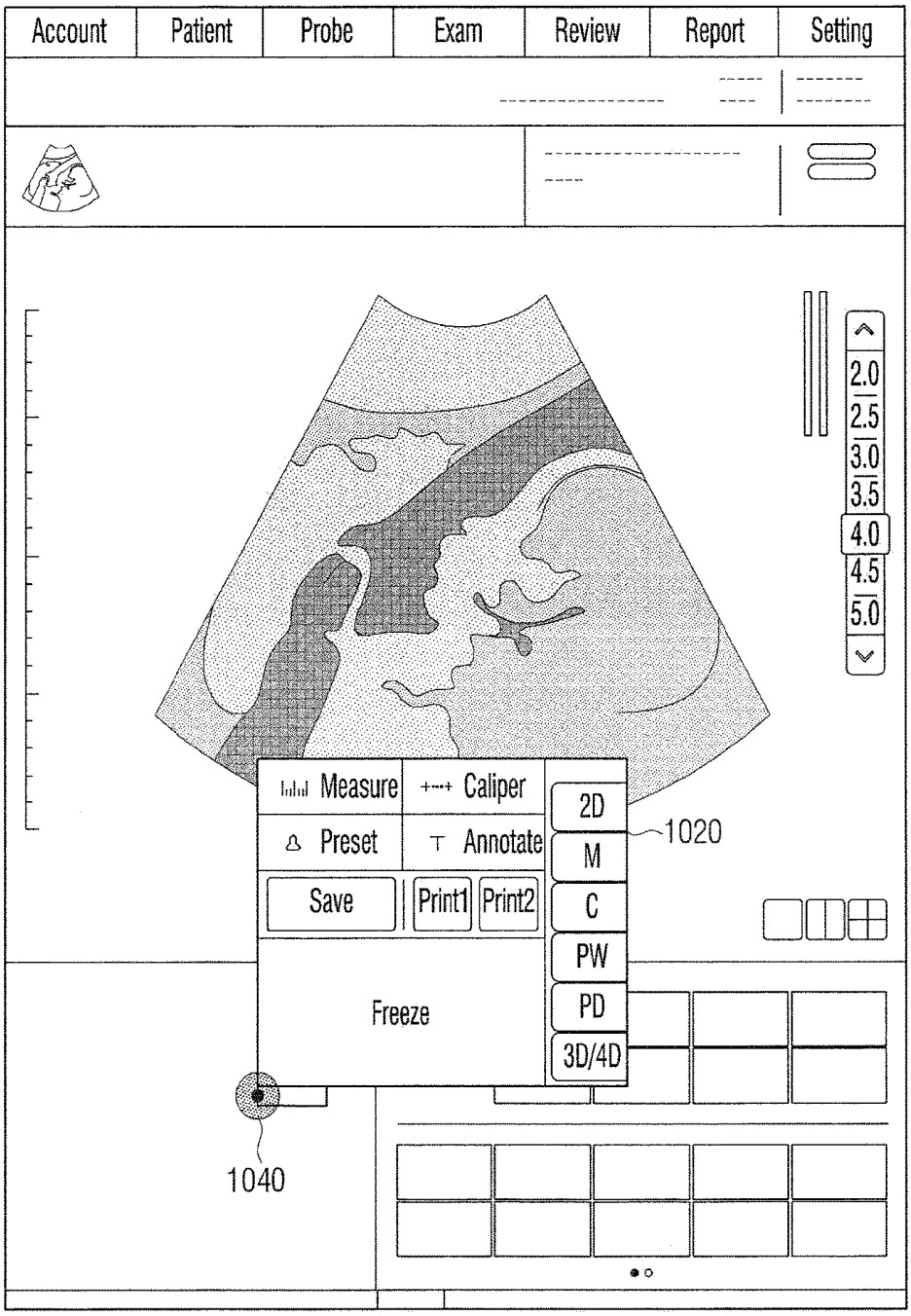

Account
Patient
Probe
Exam
Review
Report
Setting
2.0
2.5
3.0
3.5
4.0
4.5
5.0
Measure
Caliper
Preset
Annotate
Save
Print1
Print2
Freeze
2D
M
C
PW
PD
3D/4D
1020
1040

FIG. 10C

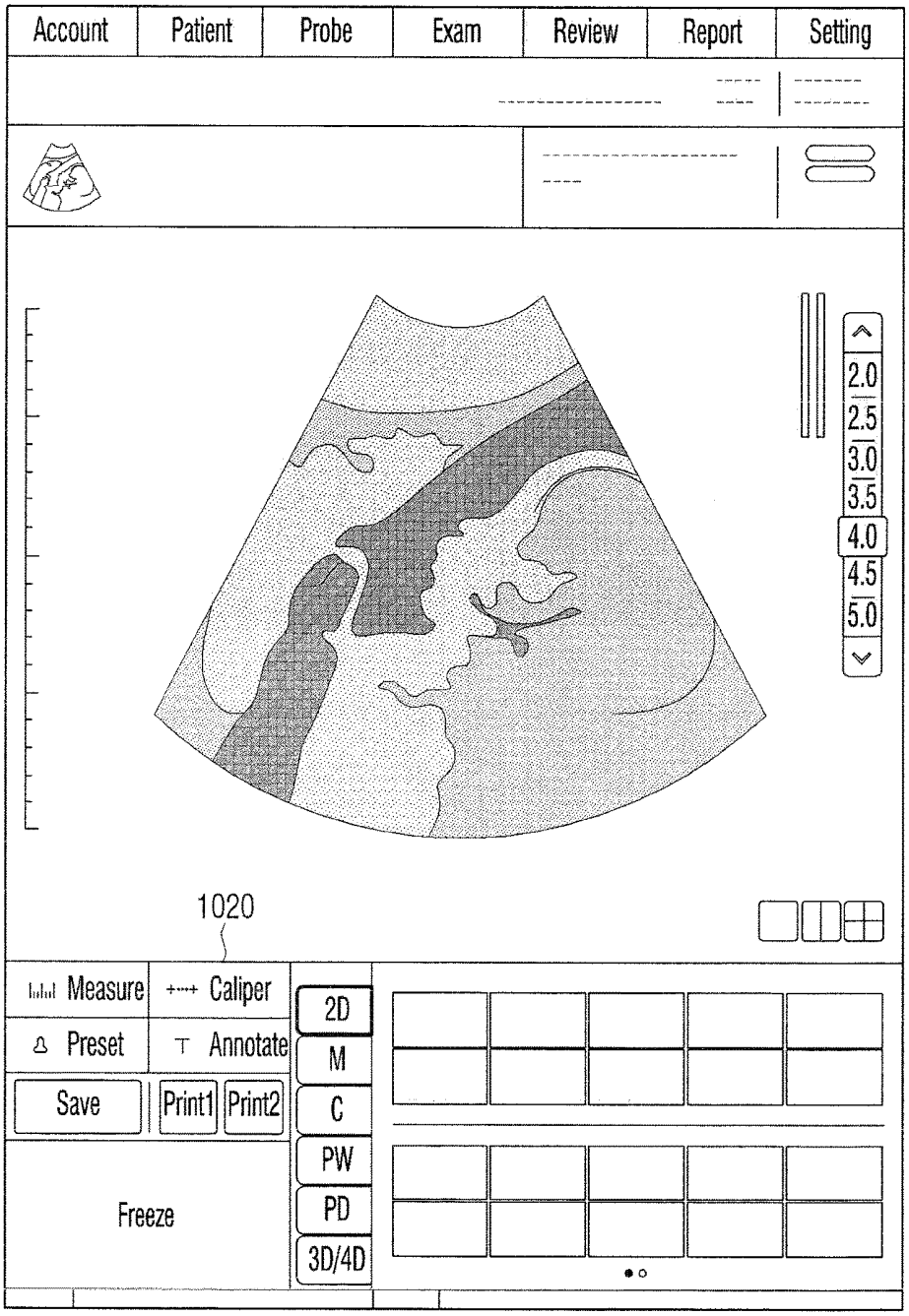

Account
Patient
Probe
Exam
Review
Report
Setting
2.0
2.5
3.0
3.5
4.0
4.5
5.0
1020
Measure
Caliper
Preset
Annotate
Save
Print1
Print2
Freeze
2D
M
C
PW
PD
3D/4D

FIG. 11A

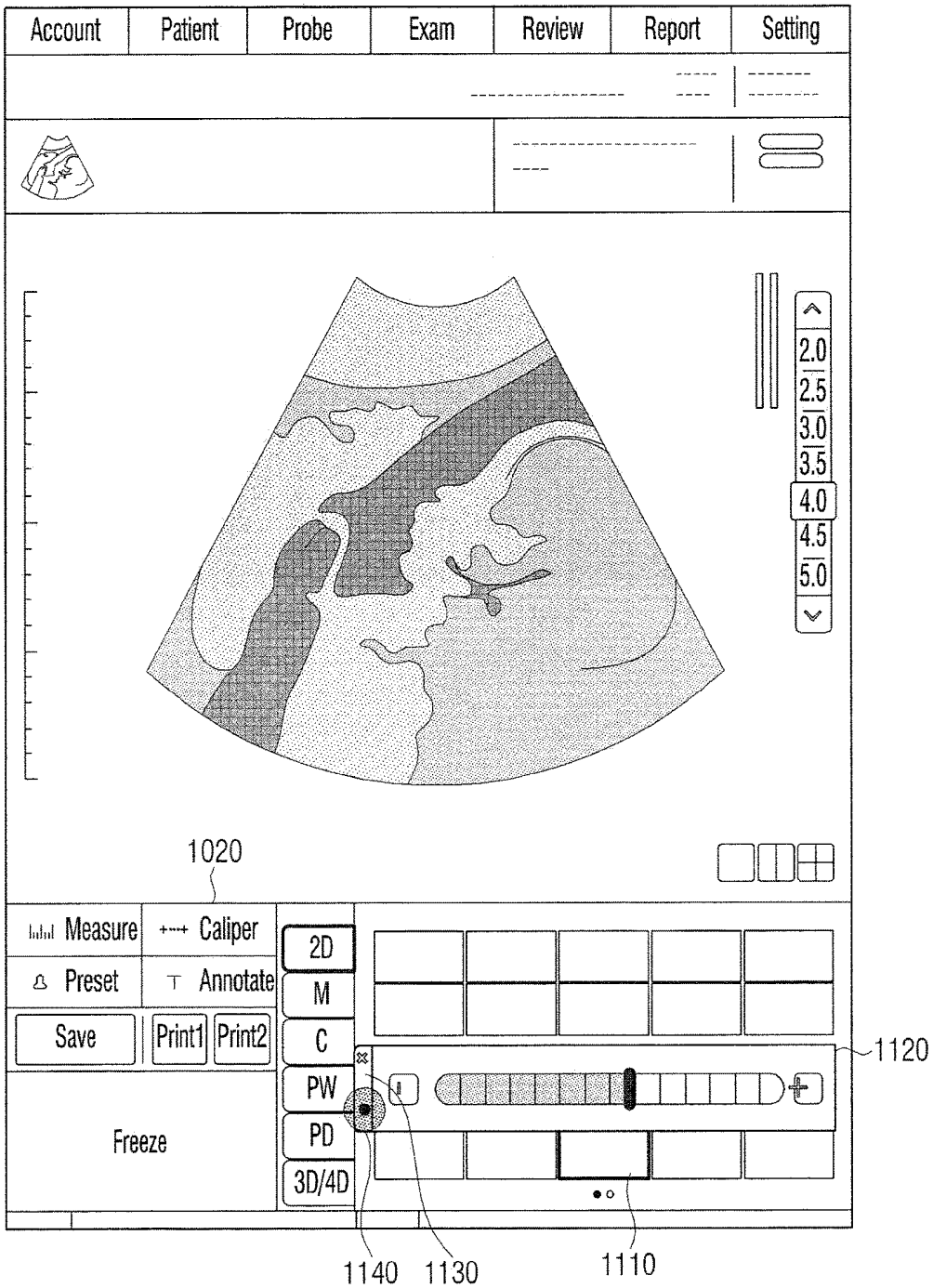

Account
Patient
Probe
Exam
Review
Report
Setting
2.0
2.5
3.0
3.5
4.0
4.5
5.0
1020
Measure
Caliper
Preset
Annotate
Save
Print1
Print2
Freeze
2D
M
C
PW
PD
3D/4D
1120
1140
1130
1110

FIG. 11B

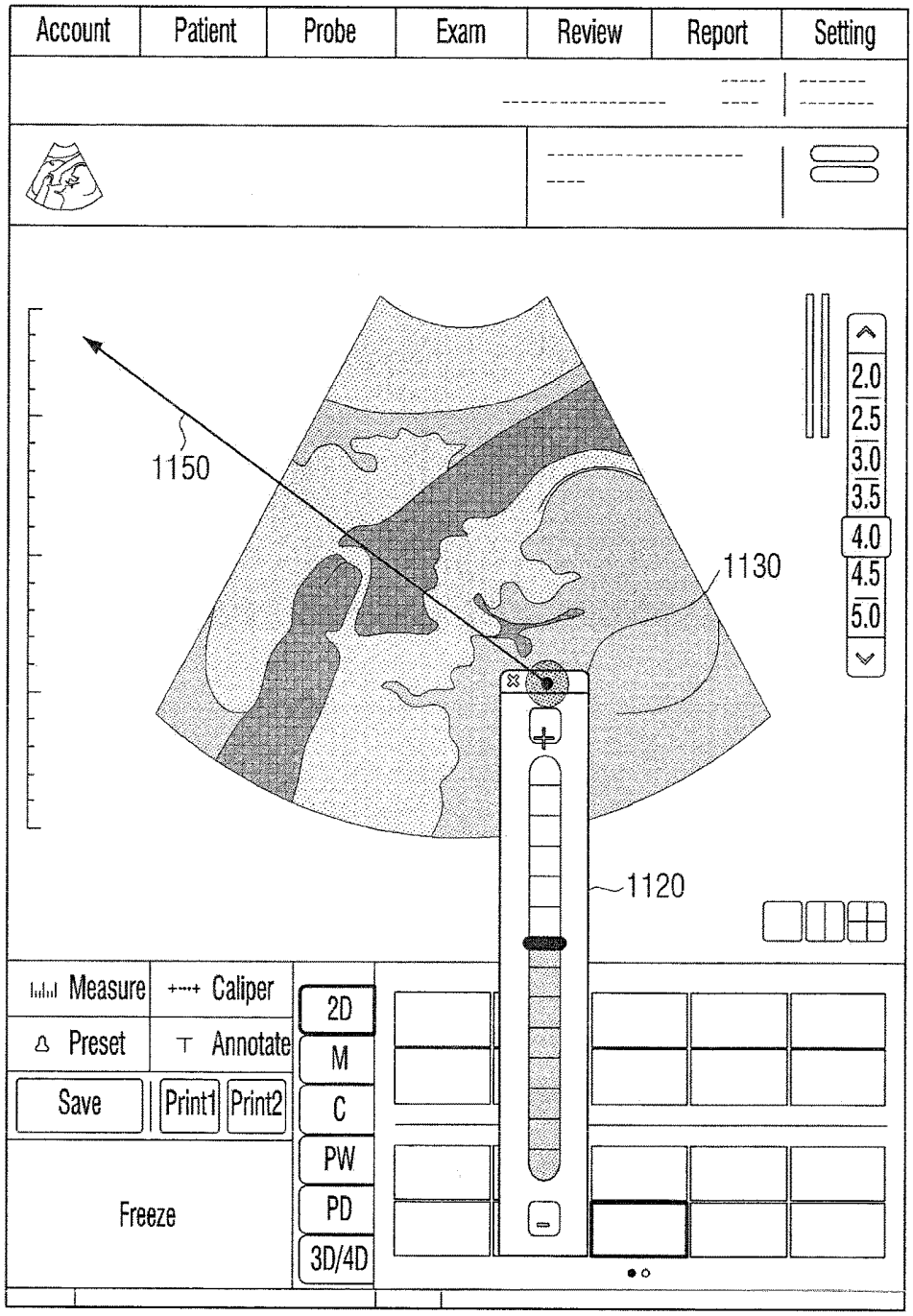

Account
Patient
Probe
Exam
Review
Report
Setting
1150
1130
1120
2.0
2.5
3.0
3.5
4.0
4.5
5.0
Measure
Caliper
Preset
Annotate
Save
Print1
Print2
Freeze
2D
M
C
PW
PD
3D/4D

FIG. 11C

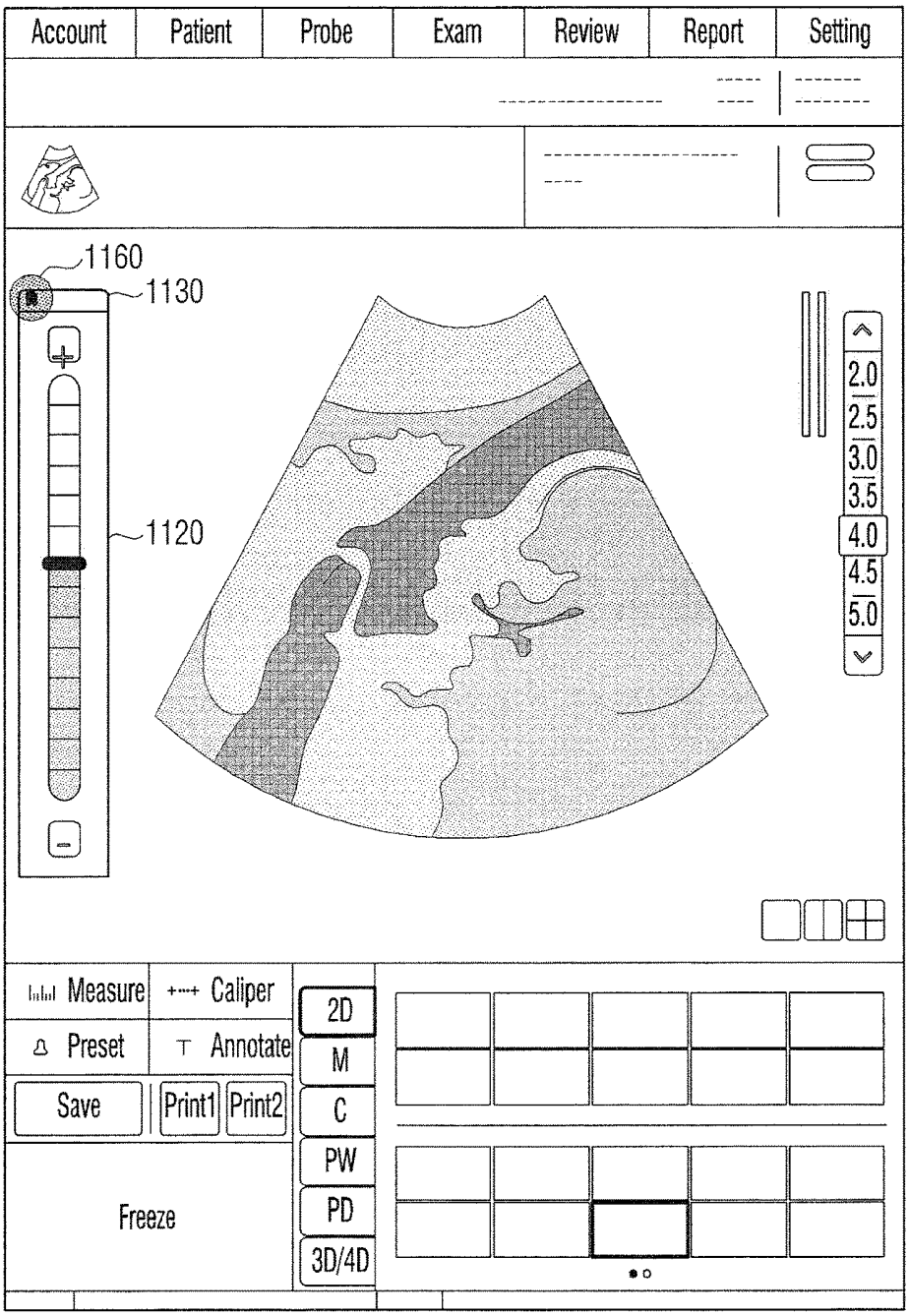

Account
Patient
Probe
Exam
Review
Report
Setting
1160
1130
1120
2.0
2.5
3.0
3.5
4.0
4.5
5.0
Measure
Caliper
Preset
Annotate
Save
Print1
Print2
Freeze
2D
M
C
PW
PD
3D/4D

FIG. 12A

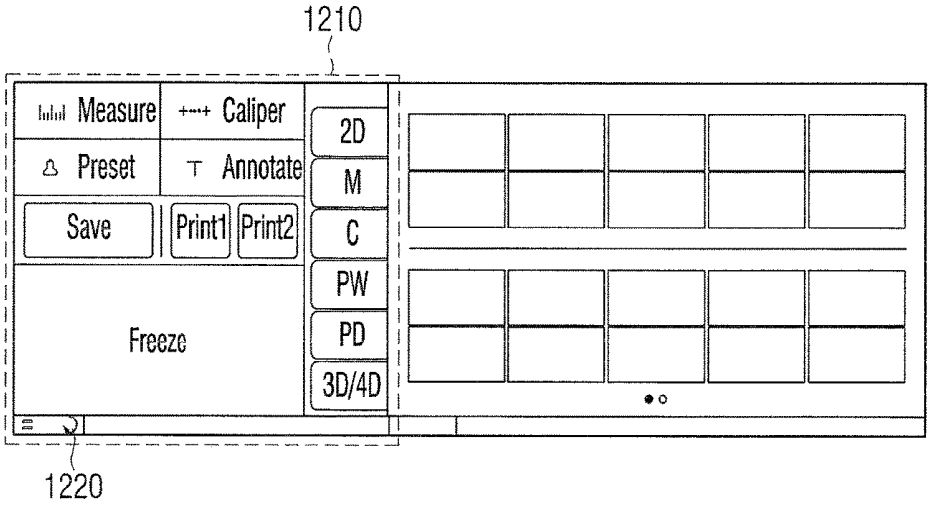

1210
Measure
Caliper
Preset
Annotate
Save
Print1
Print2
Freeze
2D
M
C
PW
PD
3D/4D
1220

FIG. 12B

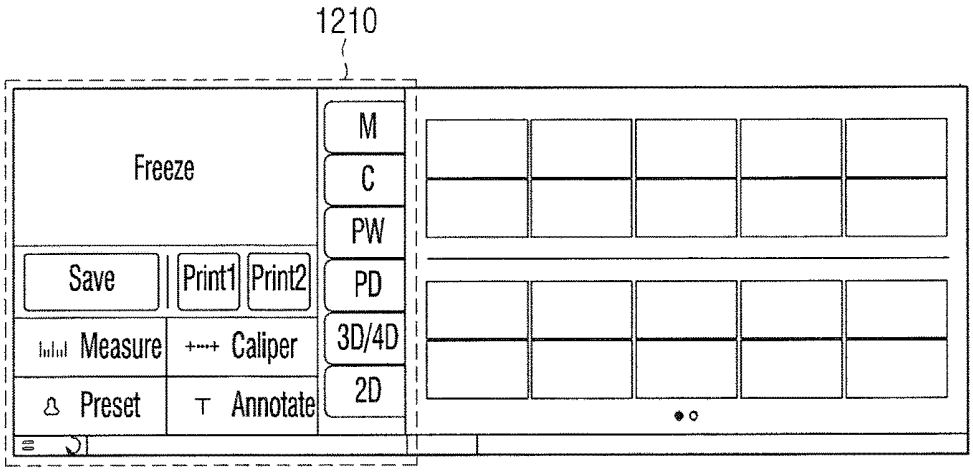

1210
Freeze
Save
Print1
Print2
Measure
Caliper
Preset
Annotate
M
C
PW
PD
3D/4D
2D

FIG. 13A

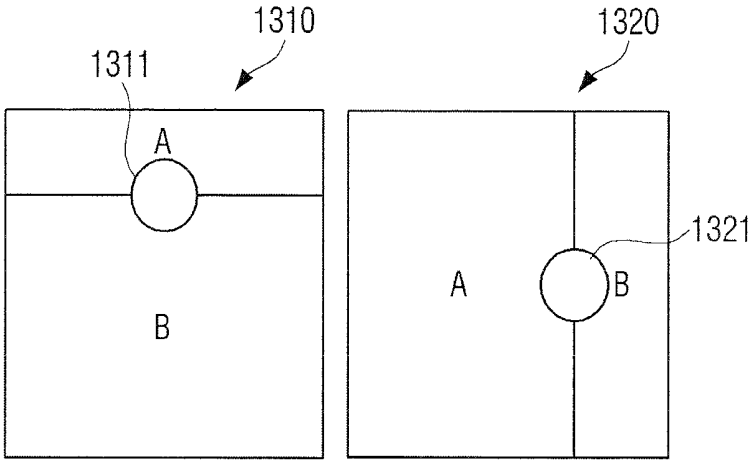


FIG. 13B

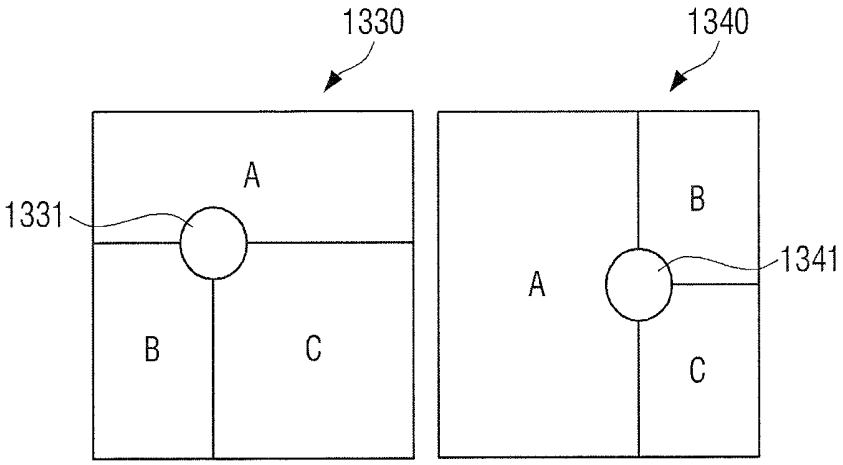


FIG. 13C

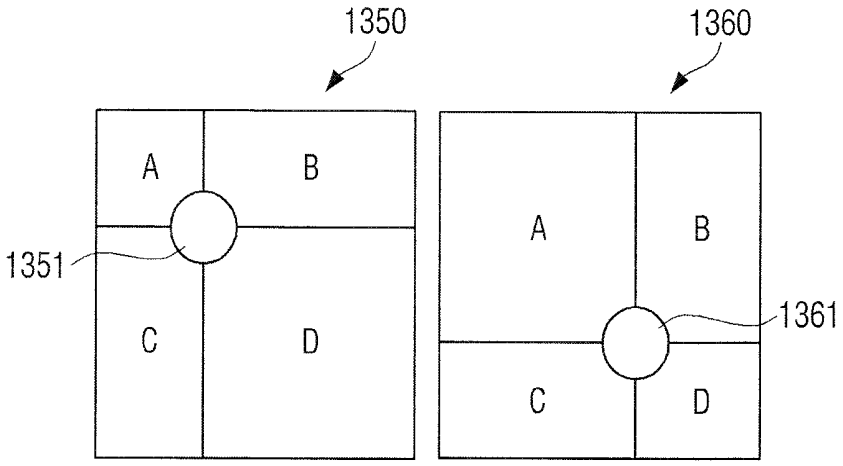


FIG. 14A

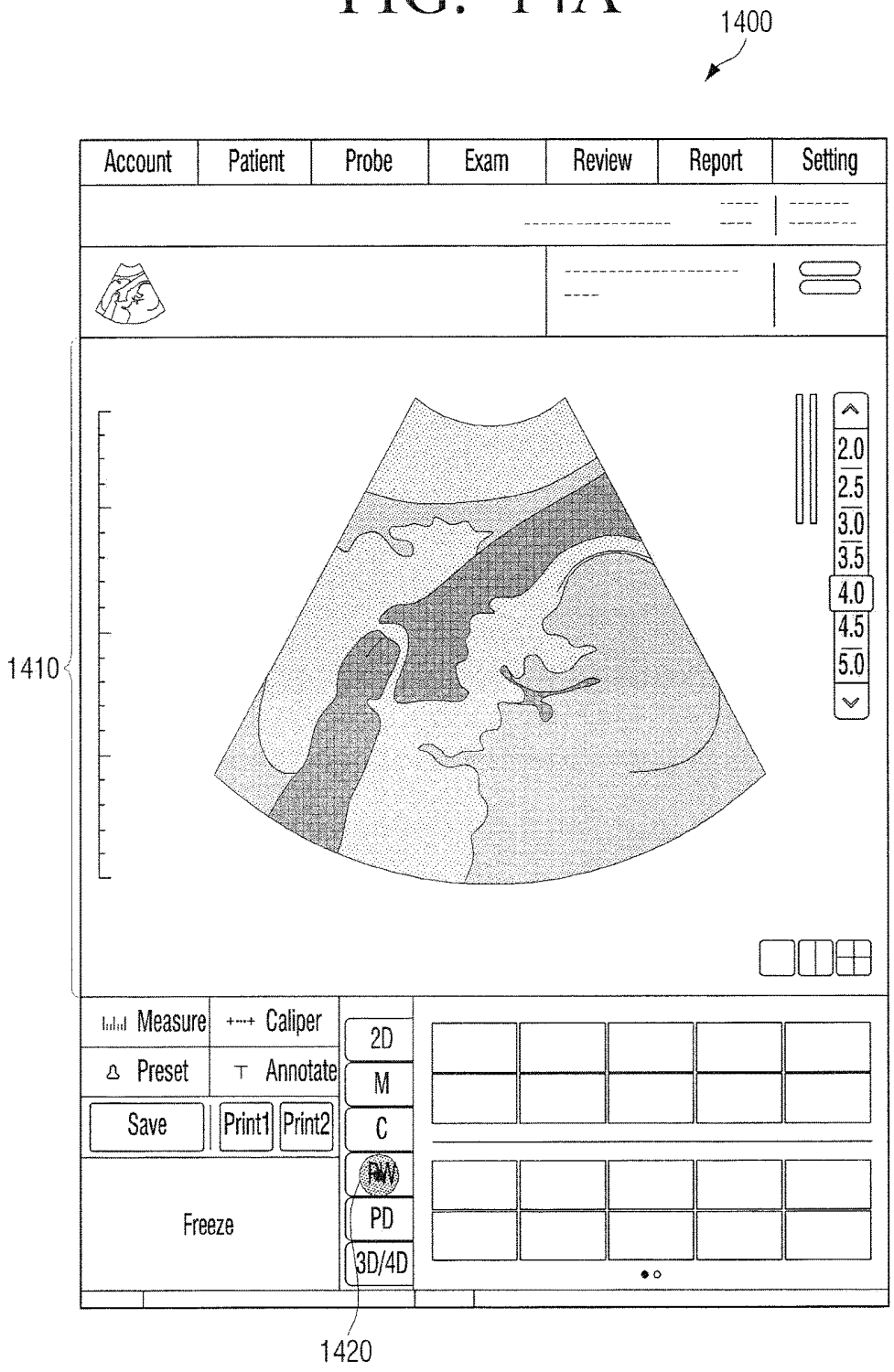

1400
Account
Patient
Probe
Exam
Review
Report
Setting
2.0
2.5
3.0
3.5
4.0
4.5
5.0
1410
Measure
Caliper
Preset
Annotate
Save
Print1
Print2
Freeze
2D
M
C
PW
PD
3D/4D
1420

FIG. 14B

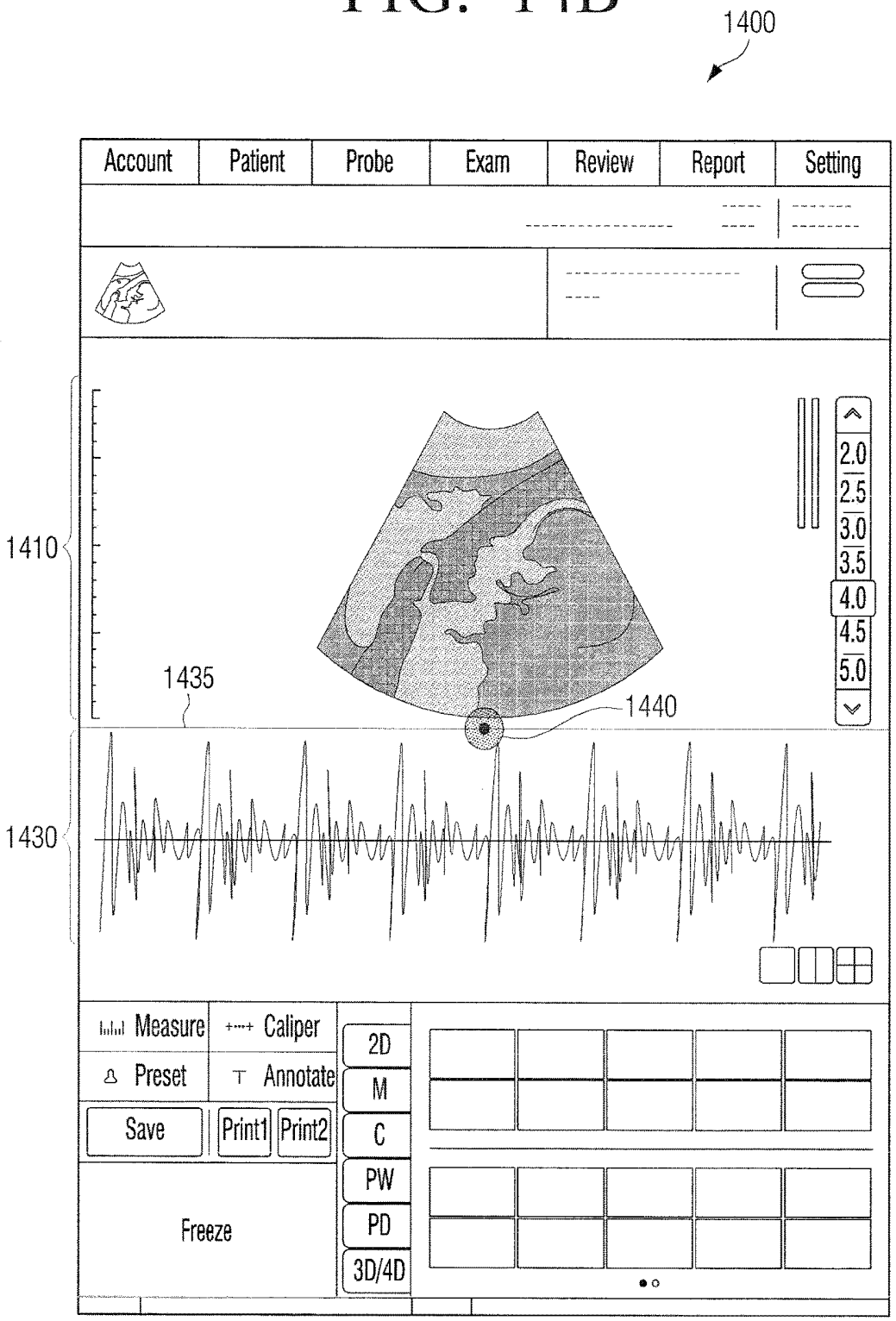

1400
Account
Patient
Probe
Exam
Review
Report
Setting
1410
1435
1440
1430
2.0
2.5
3.0
3.5
4.0
4.5
5.0
Measure
Caliper
Preset
Annotate
Save
Print1
Print2
Freeze
2D
M
C
PW
PD
3D/4D

FIG. 14C

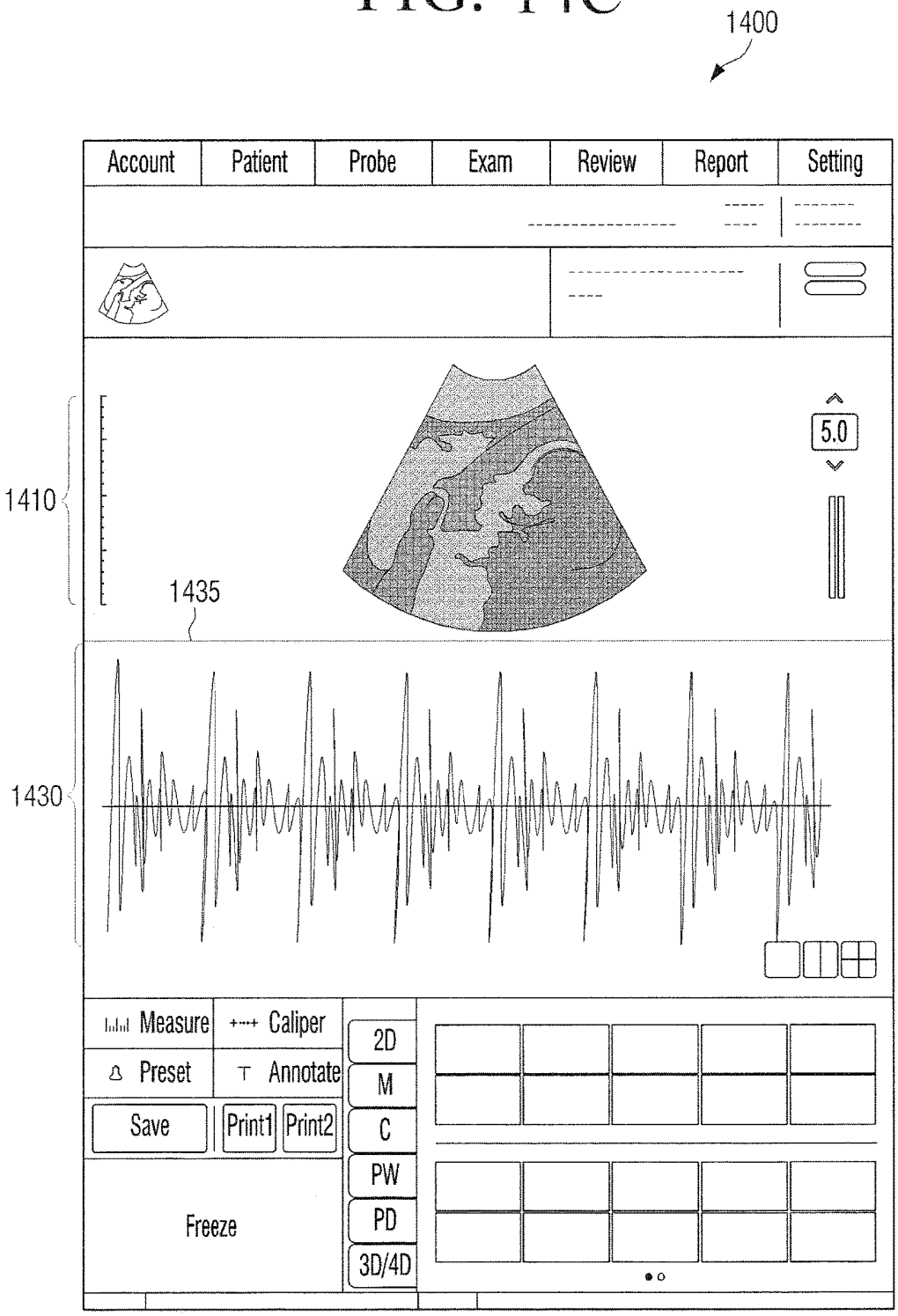

1400
Account
Patient
Probe
Exam
Review
Report
Setting
5.0
1410
1435
1430
Measure
Caliper
Preset
Annotate
Save
Print1
Print2
Freeze
2D
M
C
PW
PD
3D/4D

FIG. 15A

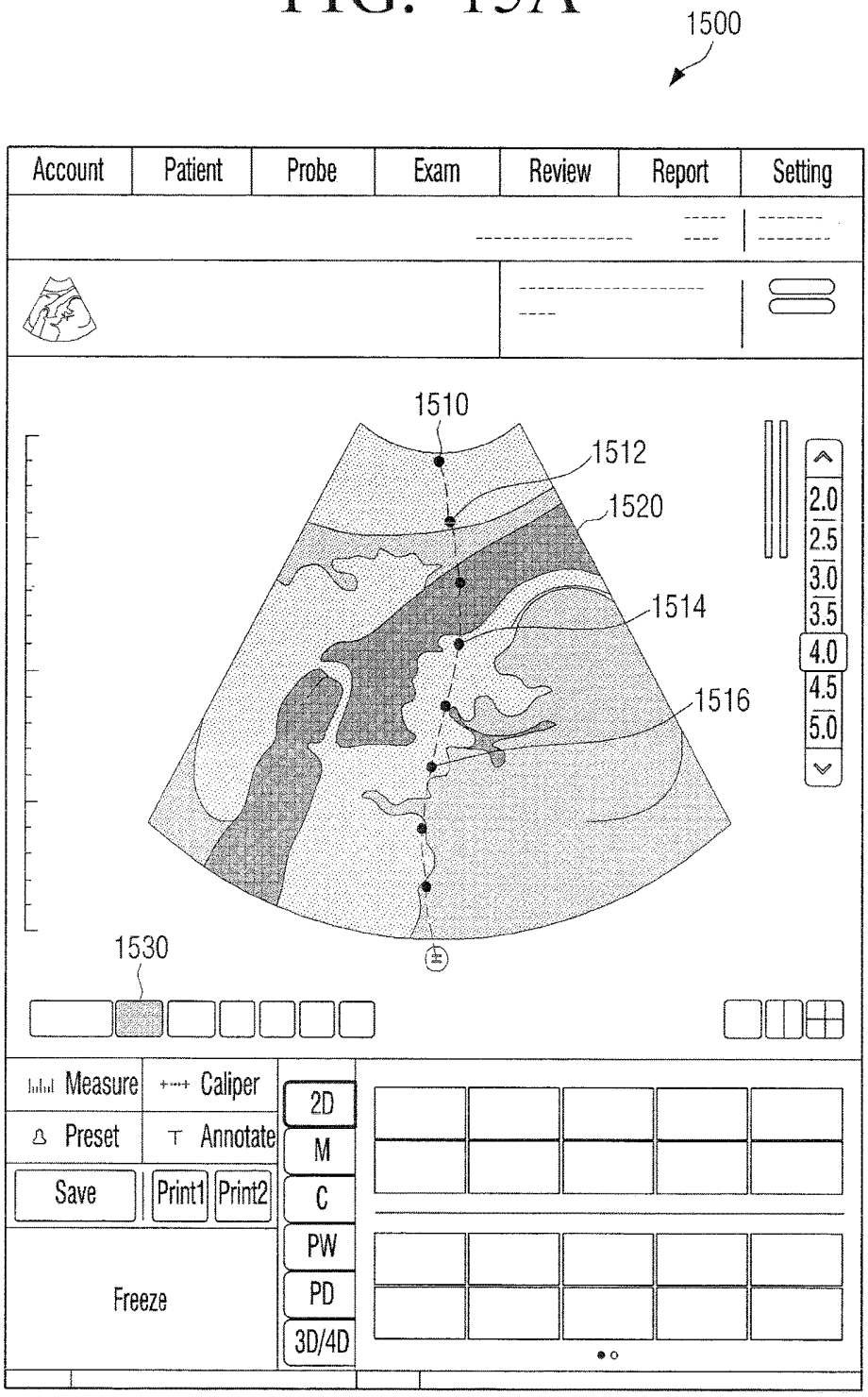

1500
Account
Patient
Probe
Exam
Review
Report
Setting
1510
1512
1520
1514
1516
2.0
2.5
3.0
3.5
4.0
4.5
5.0
1530
Measure
Caliper
Preset
Annotate
Save
Print1
Print2
Freeze
2D
M
C
PW
PD
3D/4D

FIG. 15B

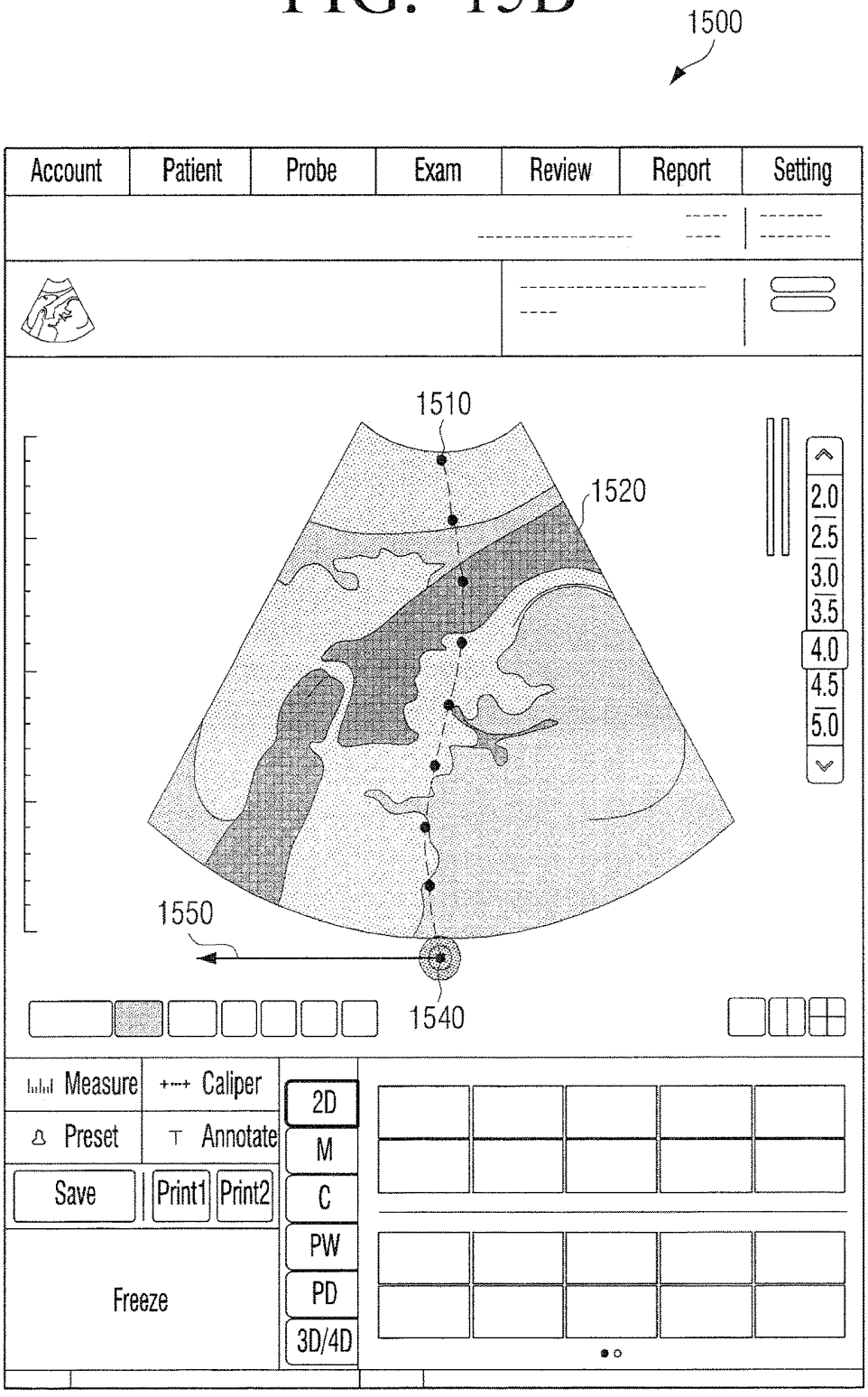

1500
Account
Patient
Probe
Exam
Review
Report
Setting
1510
1520
2.0
2.5
3.0
3.5
4.0
4.5
5.0
1550
1540
Measure
Caliper
Preset
Annotate
Save
Print1
Print2
Freeze
2D
M
C
PW
PD
3D/4D

FIG. 15C

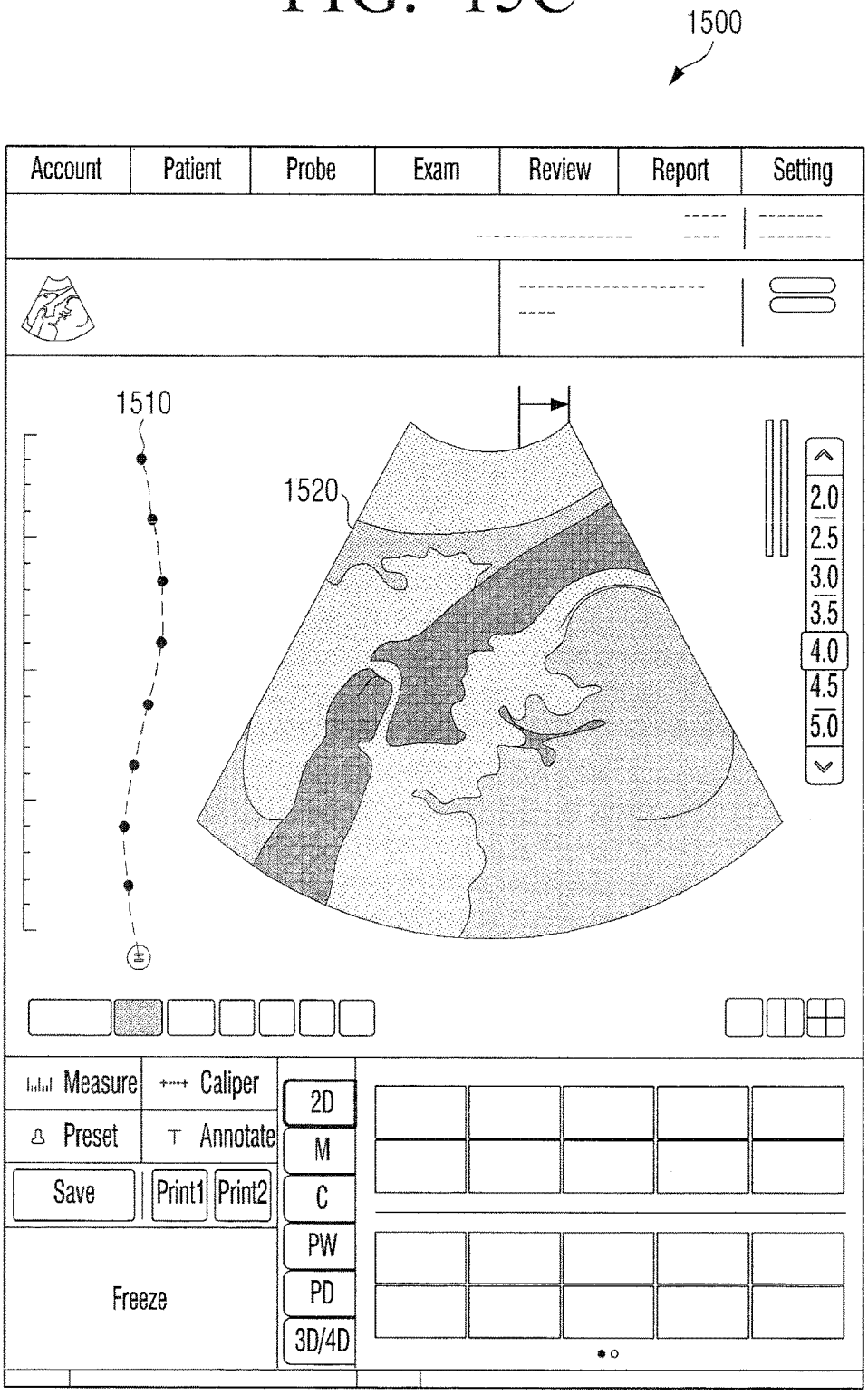

1500
Account
Patient
Probe
Exam
Review
Report
Setting
1510
1520
2.0
2.5
3.0
3.5
4.0
4.5
5.0
Measure
Caliper
Preset
Annotate
Save
Print1
Print2
Freeze
2D
M
C
PW
PD
3D/4D

FIG. 16

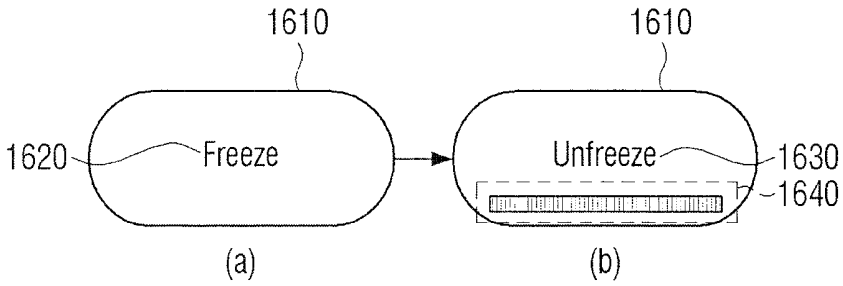


FIG. 17

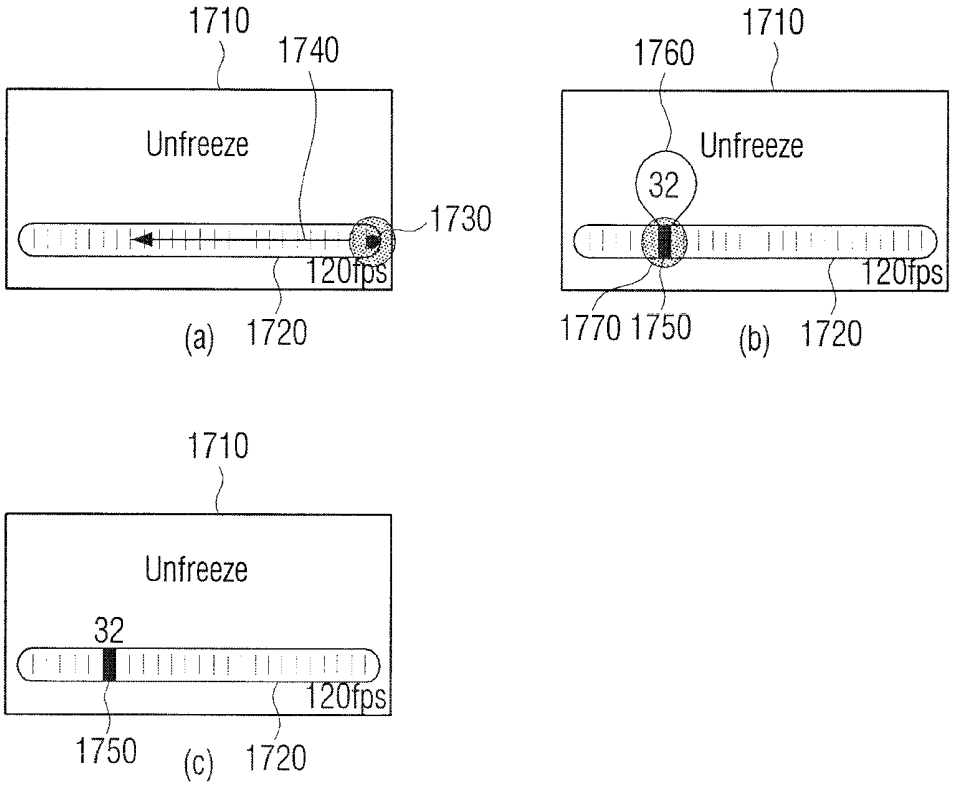

1710
1740
Unfreeze
1730
120fps
(a)
1720
1710
1760
Unfreeze
32
120fps
1770
1750
(b)
1720
1710
Unfreeze
32
120fps
1750
(c)
1720

FIG. 18

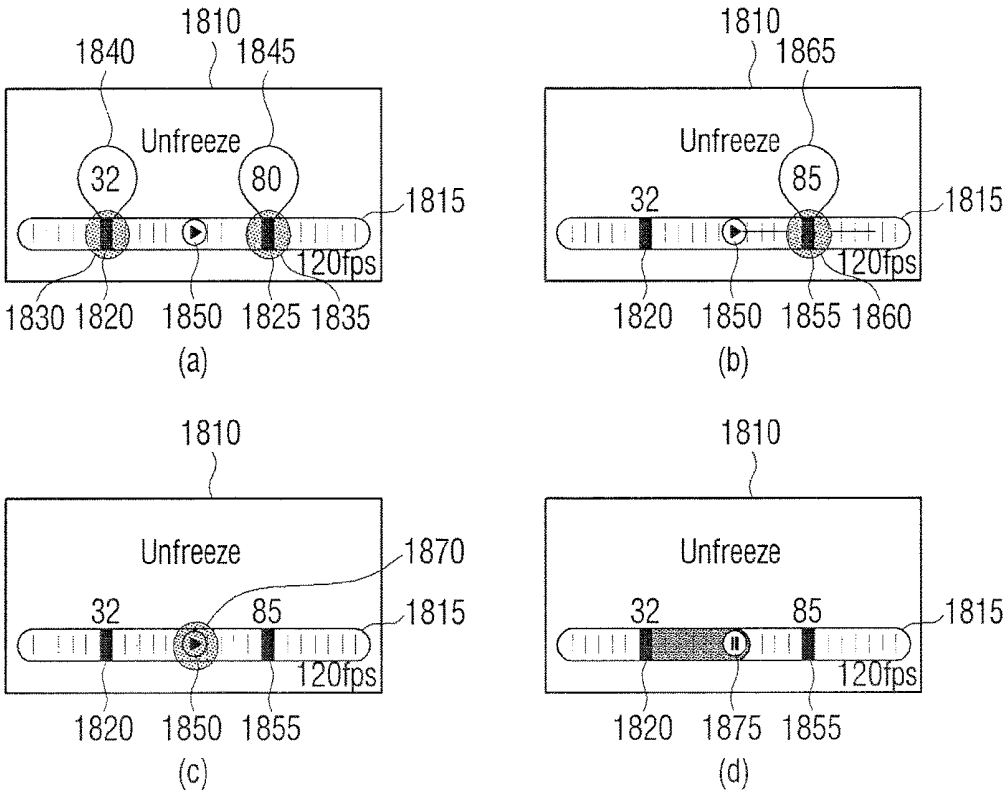

1810
1840
1845
Unfreeze
32
80
1815
120fps
1830 1820 1850 1825 1835
(a)
1810
1865
Unfreeze
85
32
1815
120fps
1820 1850 1855 1860
(b)
1810
Unfreeze
1870
32
85
1815
120fps
1820 1850 1855
(c)
1810
Unfreeze
32
85
1815
120fps
1820 1875 1855
(d)

FIG. 19A

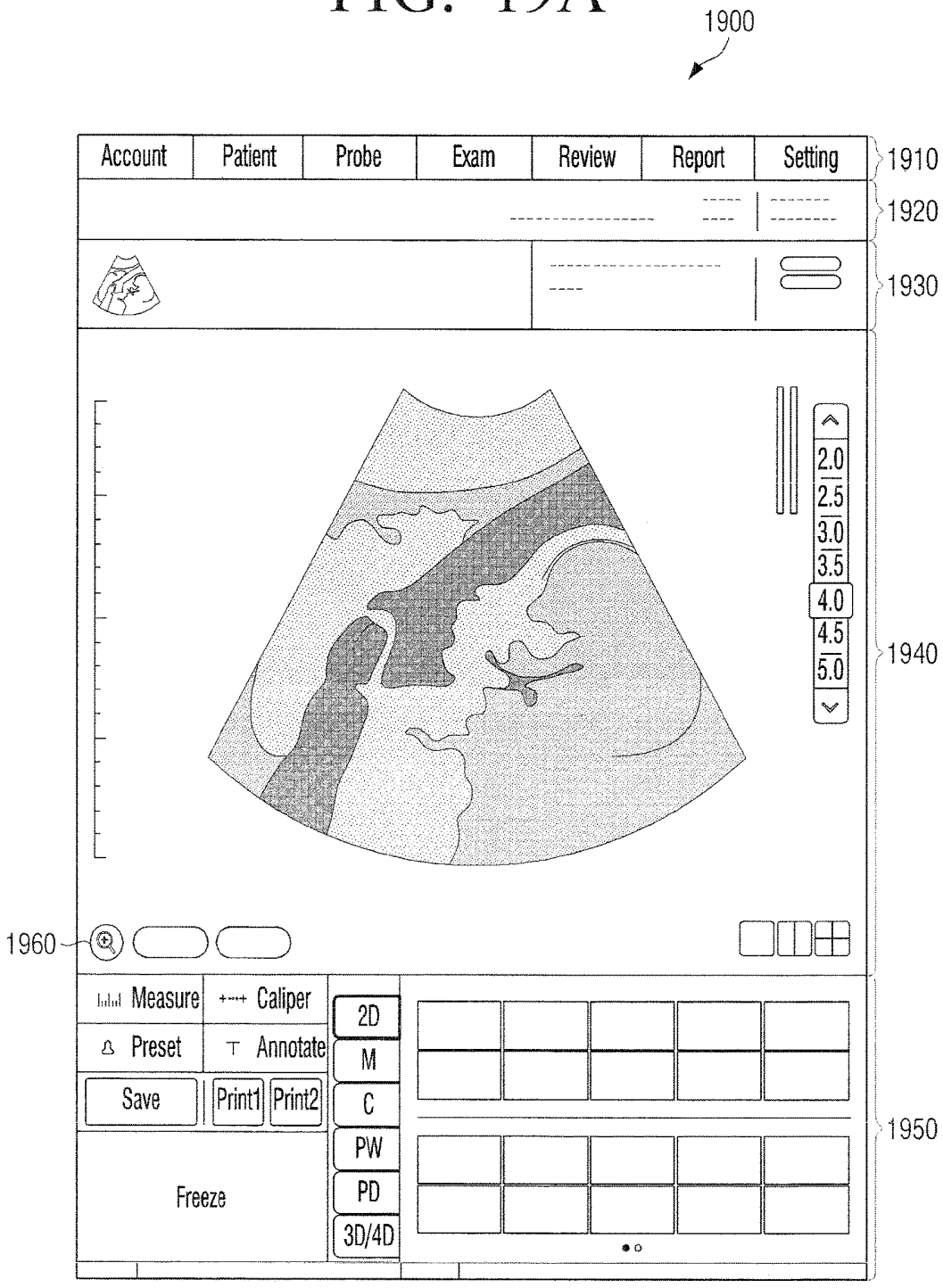

1900
Account
Patient
Probe
Exam
Review
Report
Setting
1910
1920
1930
2.0
2.5
3.0
3.5
4.0
4.5
5.0
1940
1960
Measure
Caliper
Preset
Annotate
Save
Print1
Print2
Freeze
2D
M
C
PW
PD
3D/4D
1950

FIG. 19B

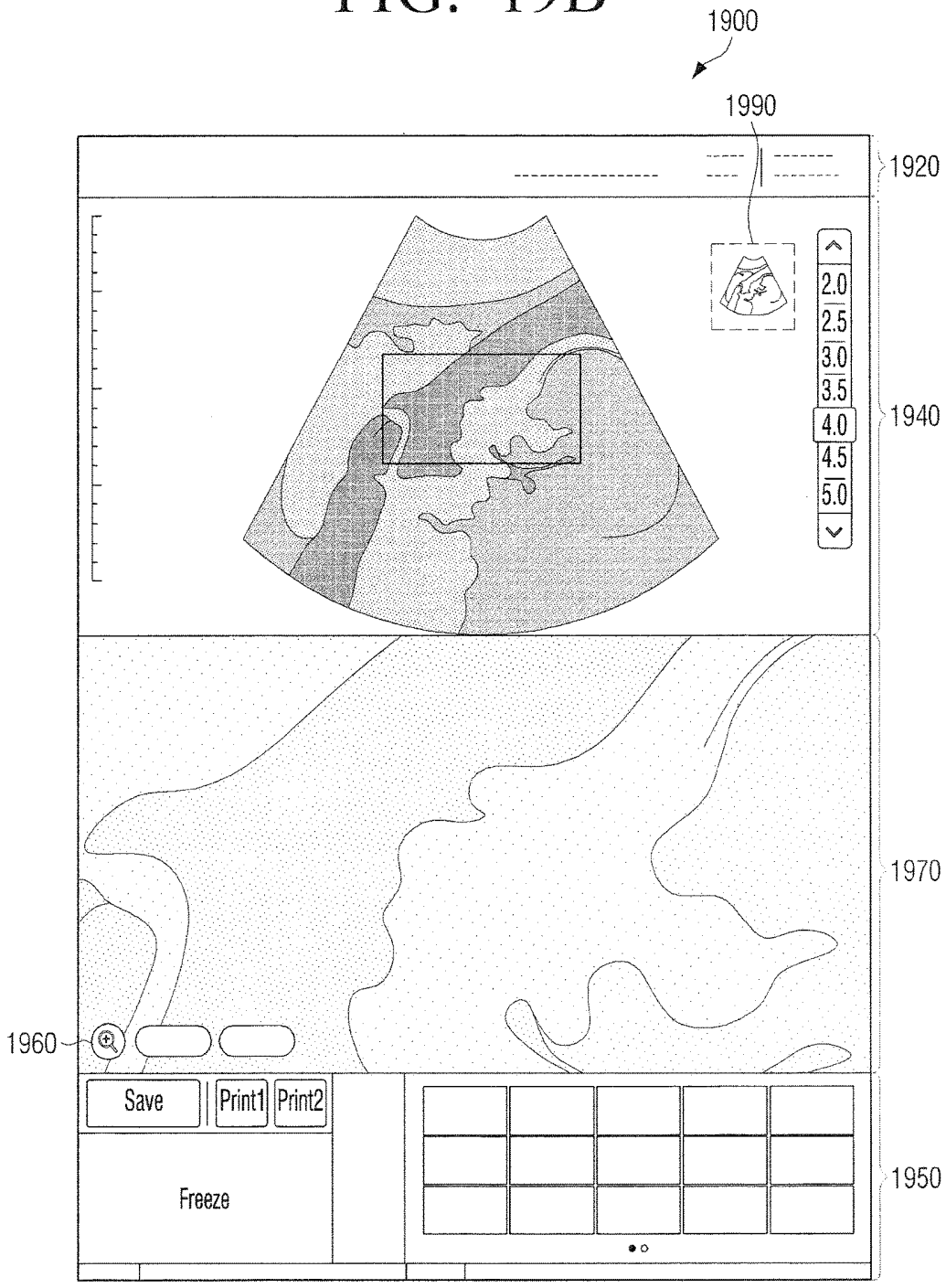

1900
1990
1920
2.0
2.5
3.0
3.5
4.0
4.5
5.0
1940
1970
1960
Save
Print1
Print2
Freeze
1950

FIG. 20A

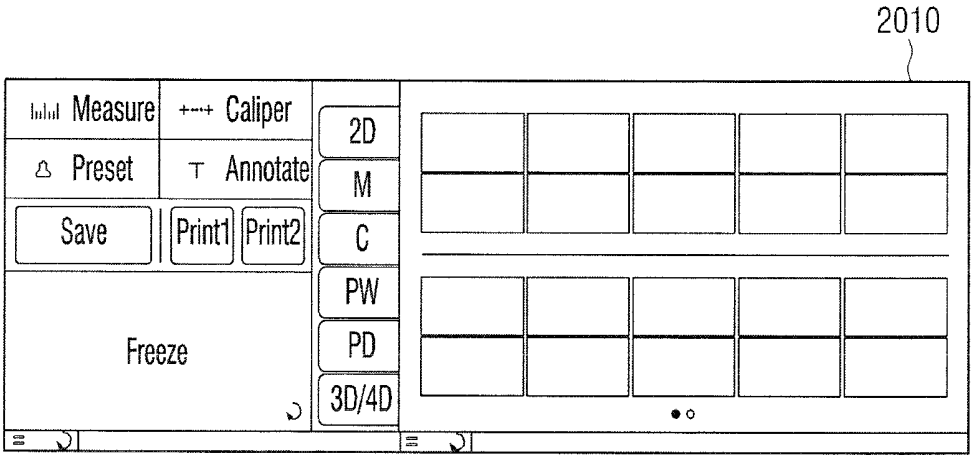

2010
Measure
Caliper
Preset
Annotate
Save
Print1
Print2
Freeze
2D
M
C
PW
PD
3D/4D

FIG. 20B

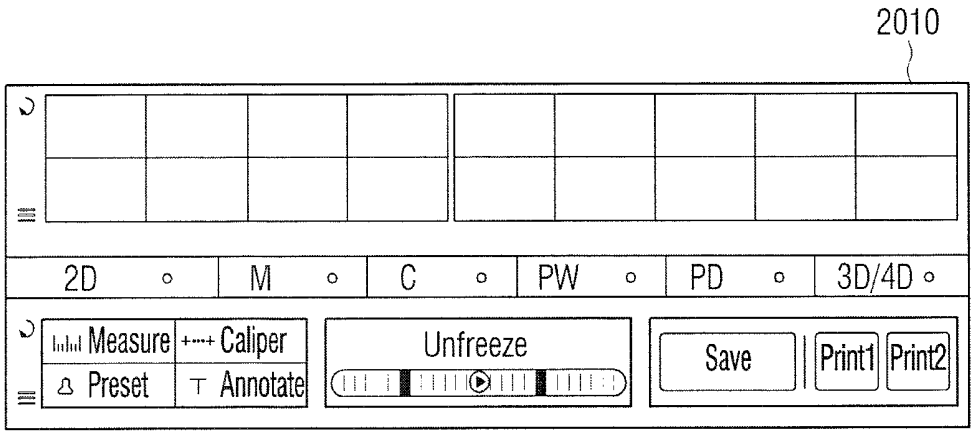

2010
2D
M
C
PW
PD
3D/4D
Measure
Caliper
Preset
Annotate
Unfreeze
Save
Print1
Print2

FIG. 21A

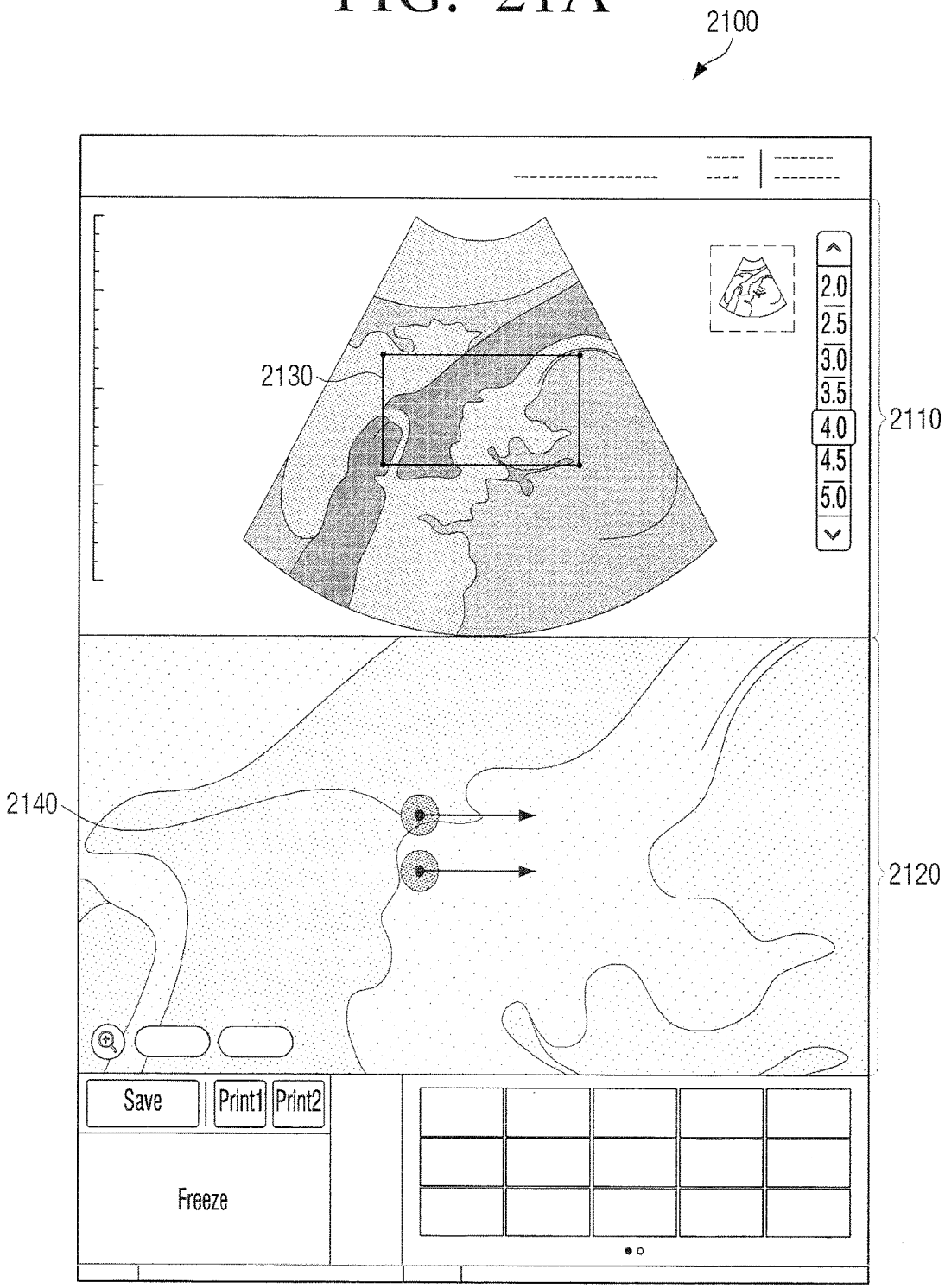

2100
2130
2.0
2.5
3.0
3.5
4.0
4.5
5.0
2110
2120
2140
Save
Print1
Print2
Freeze

FIG. 21B

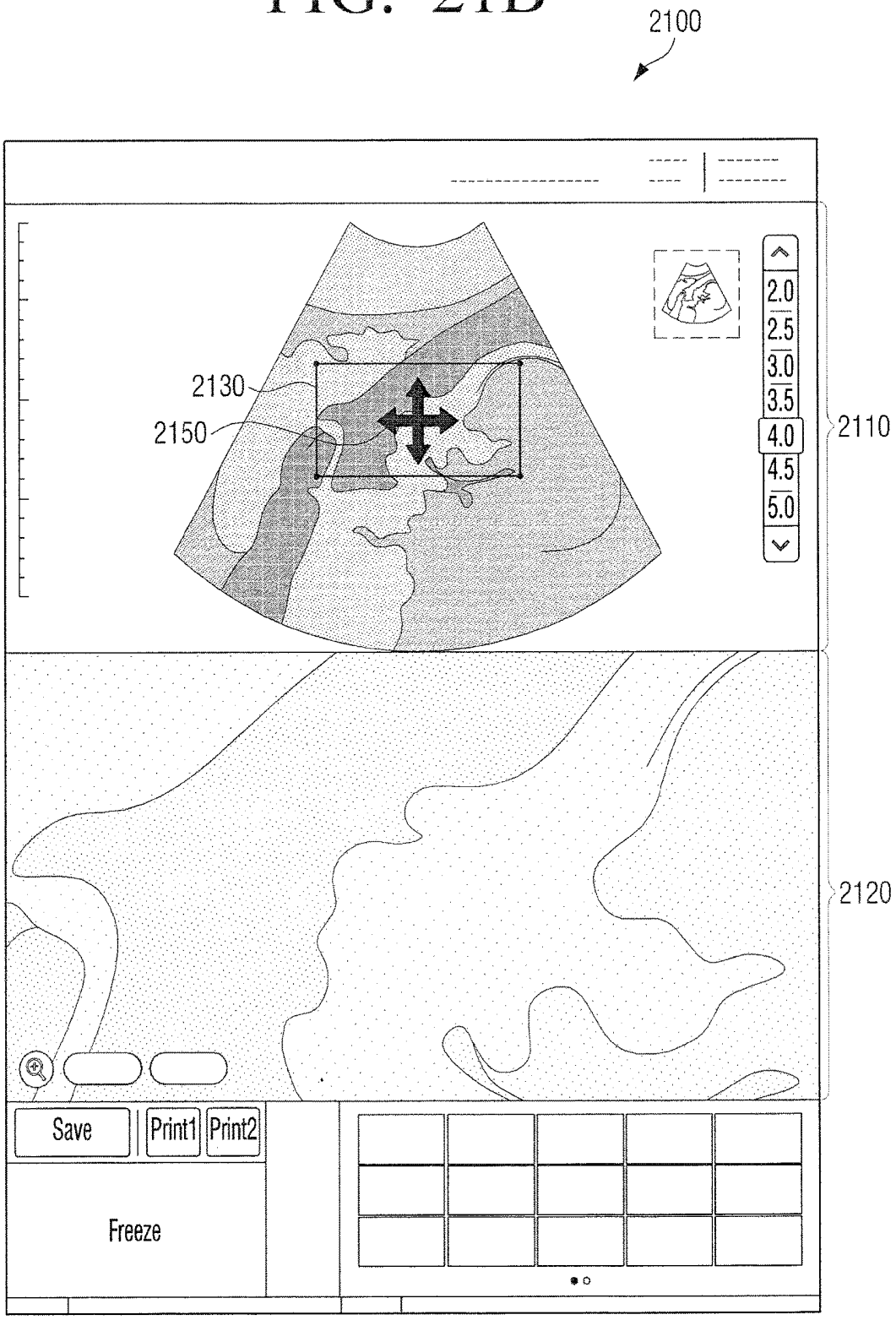

2100
2130
2150
2.0
2.5
3.0
3.5
4.0
4.5
5.0
2110
2120
Save
Print1
Print2
Freeze

FIG. 21C

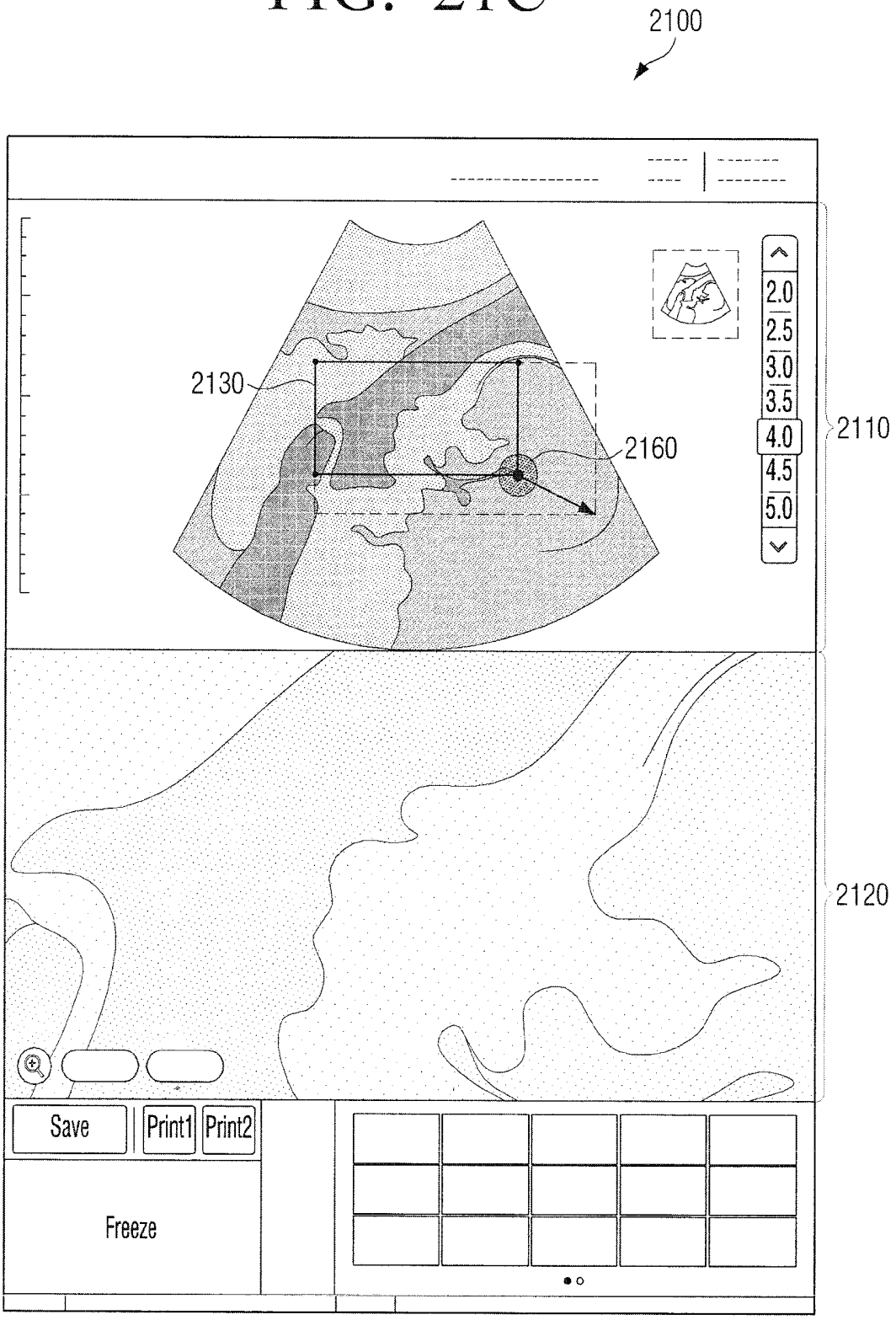

2100
2130
2160
2.0
2.5
3.0
3.5
4.0
4.5
5.0
2110
2120
Save
Print1
Print2
Freeze

FIG. 21D

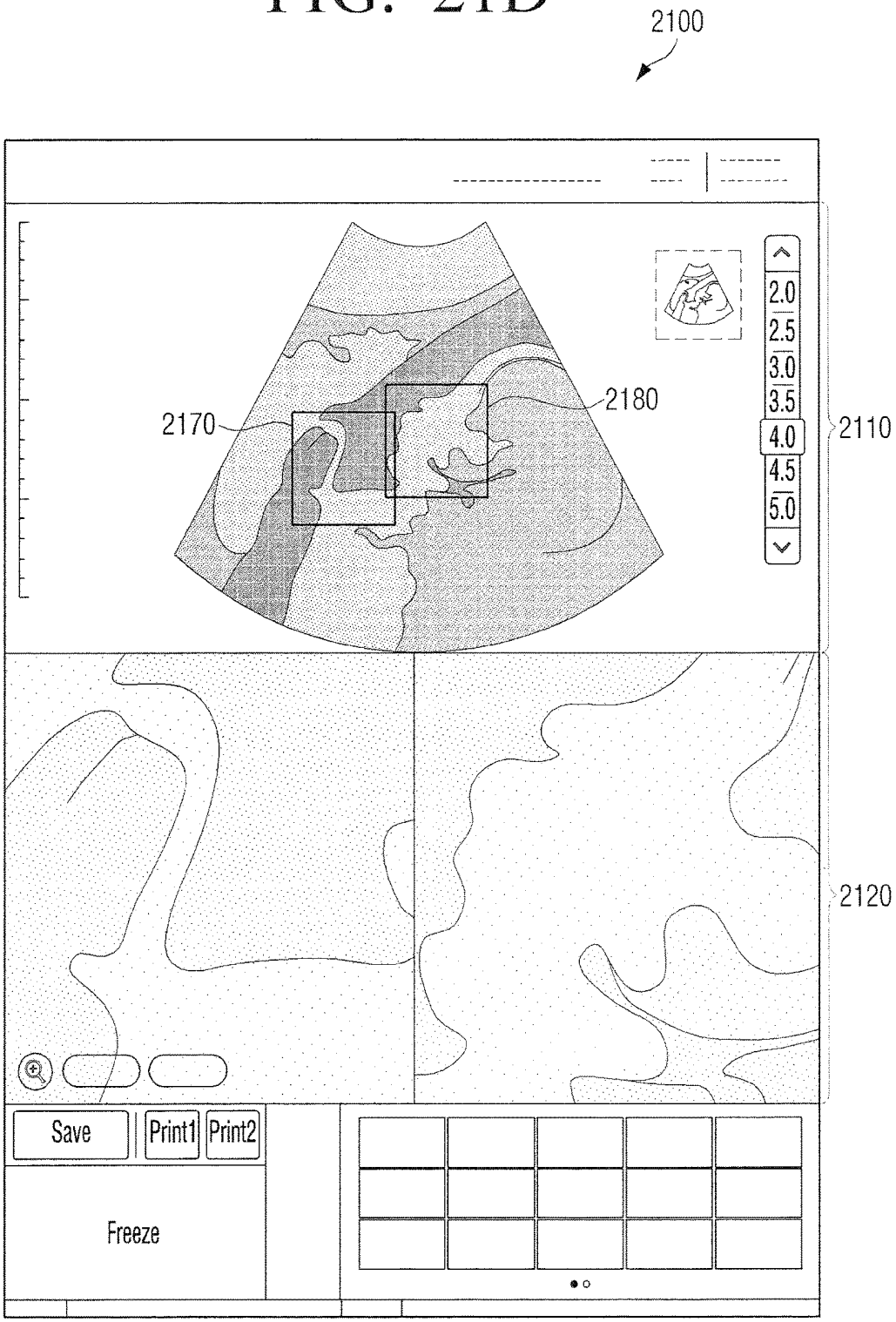

2100
2170
2180
2.0
2.5
3.0
3.5
4.0
4.5
5.0
2110
2120
Save
Print1
Print2
Freeze

FIG. 22

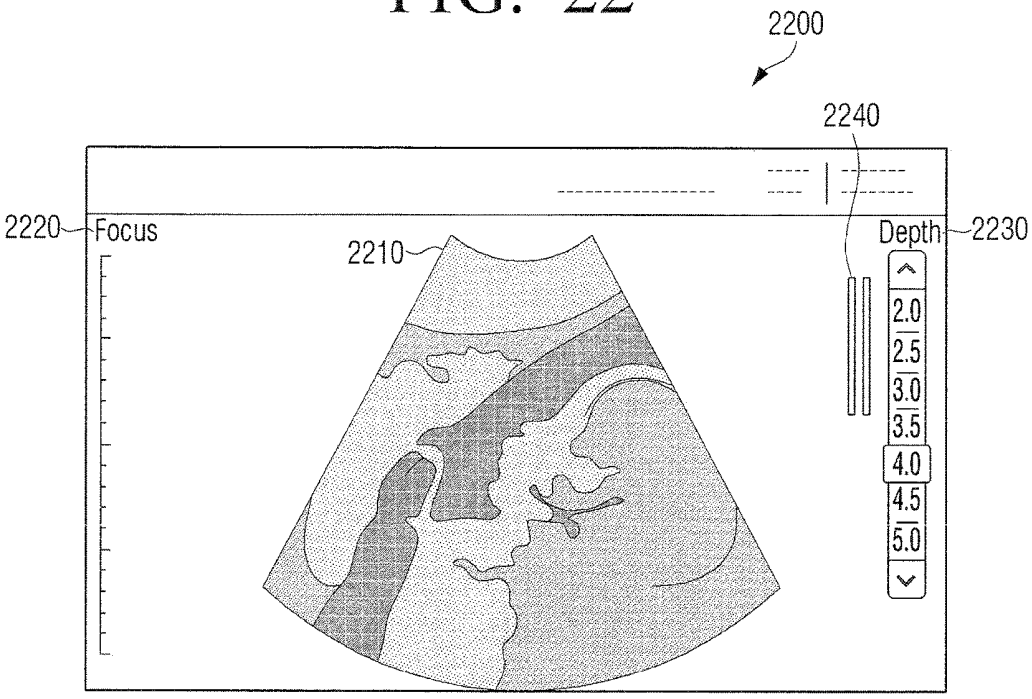


FIG. 23

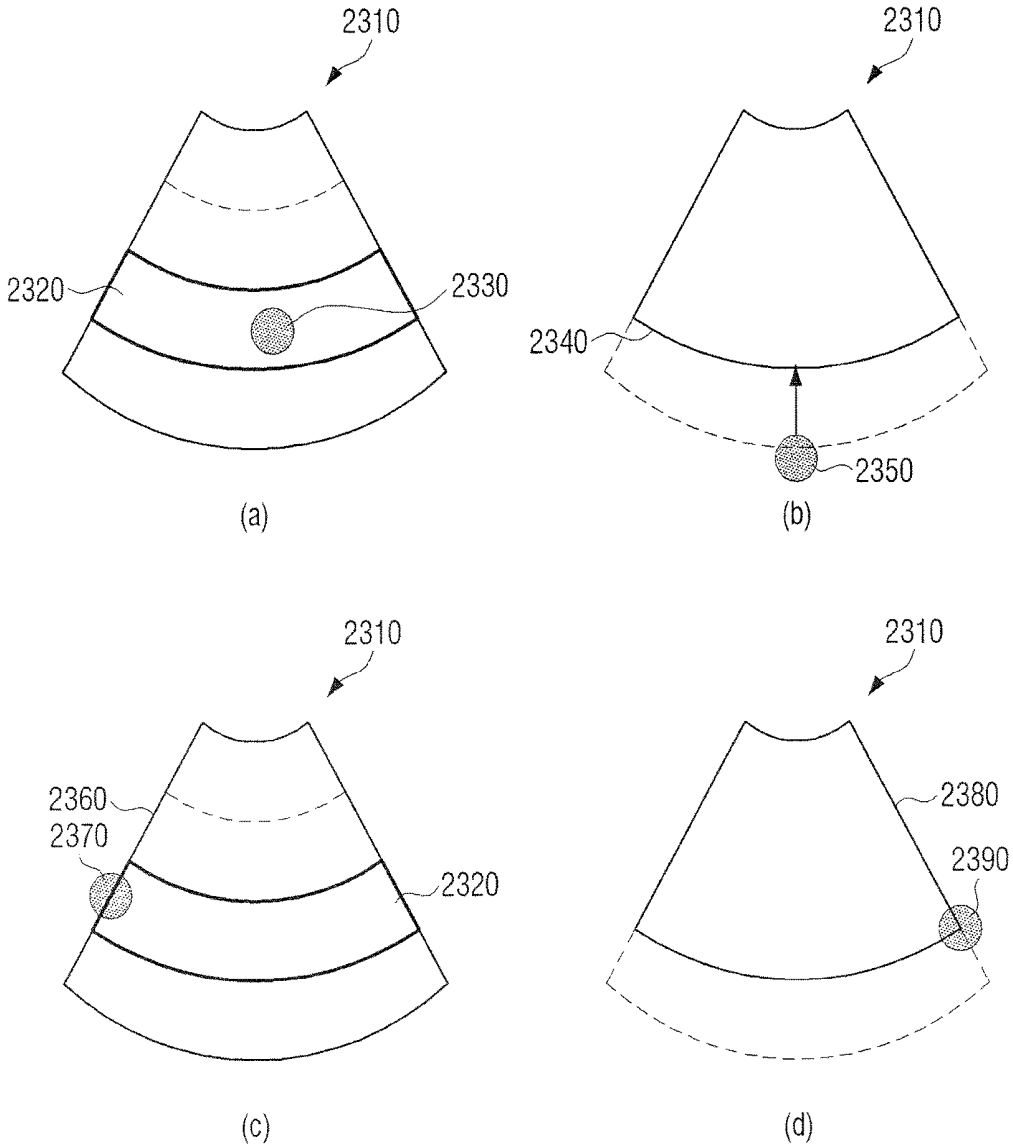

2310
2320
2330
(a)
2310
2340
2350
(b)
2310
2360
2370
2320
(c)
2310
2380
2390
(d)

FIG. 24

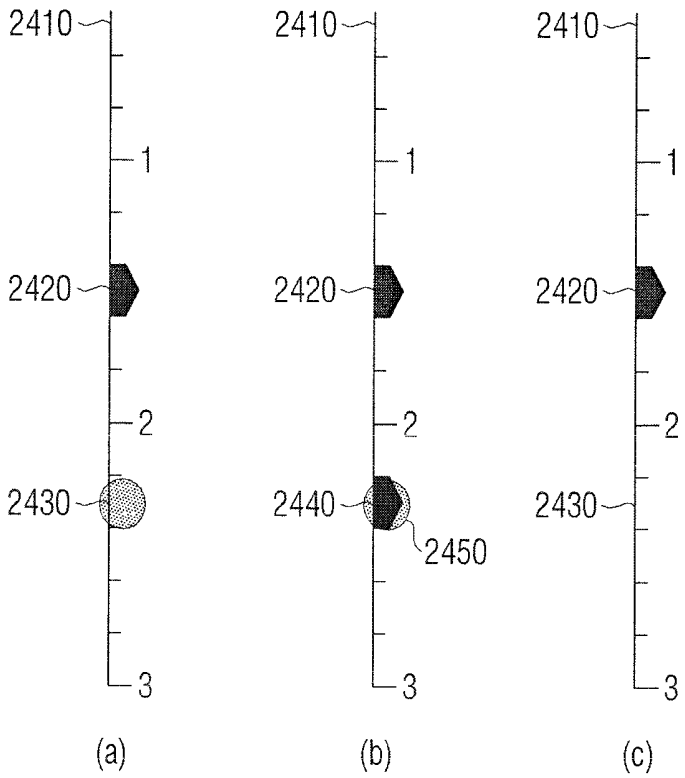

2410
1
2420
2
2430
3
(a)
2410
1
2420
2
2440
2450
3
(b)
2410
1
2420
2
2430
3
(c)

FIG. 25

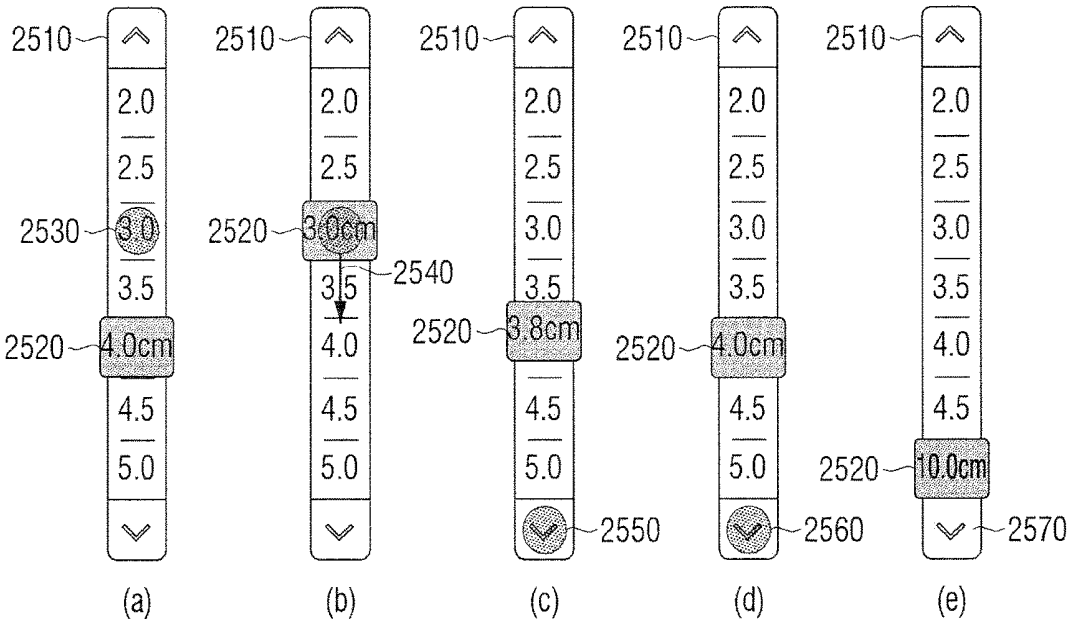

2510
2.0
2.5
2530
3.0
3.5
2520
4.0cm
4.5
5.0
(a)
2510
2.0
2.5
2520
3.0cm
2540
3.5
4.0
4.5
5.0
(b)
2510
2.0
2.5
3.0
3.5
2520
3.8cm
4.5
5.0
2550
(c)
2510
2.0
2.5
3.0
3.5
2520
4.0cm
4.5
5.0
2560
(d)
2510
2.0
2.5
3.0
3.5
4.0
4.5
2520
10.0cm
2570
(e)

FIG. 26

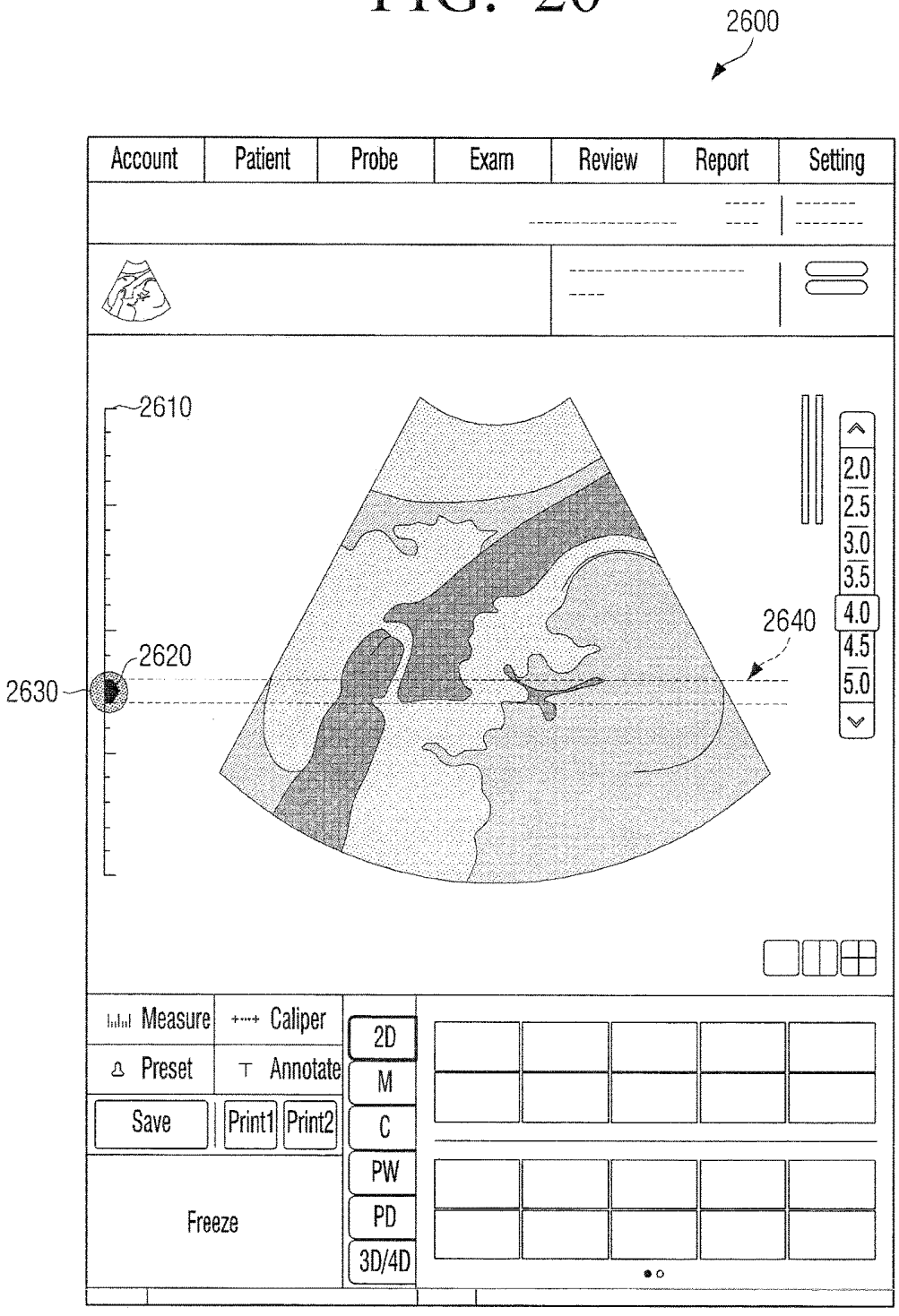

2600
Account
Patient
Probe
Exam
Review
Report
Setting
2610
2620
2630
2640
2.0
2.5
3.0
3.5
4.0
4.5
5.0
Measure
Caliper
Preset
Annotate
Save
Print1
Print2
Freeze
2D
M
C
PW
PD
3D/4D

FIG. 27A

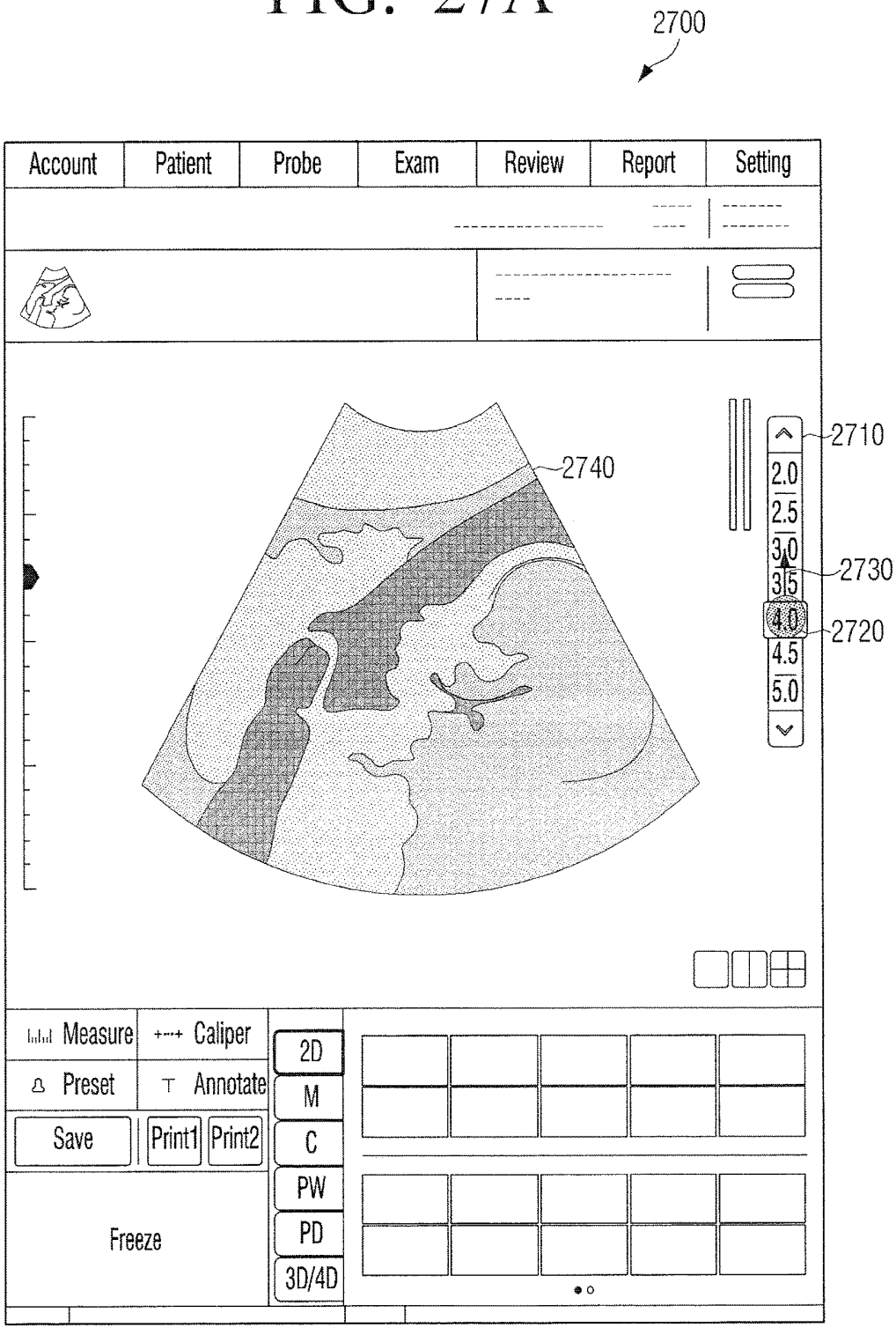

2700
Account
Patient
Probe
Exam
Review
Report
Setting
2740
2710
2.0
2.5
3.0
3.5
4.0
4.5
5.0
2730
2720
Measure
Caliper
Preset
Annotate
Save
Print1
Print2
Freeze
2D
M
C
PW
PD
3D/4D

FIG. 27B

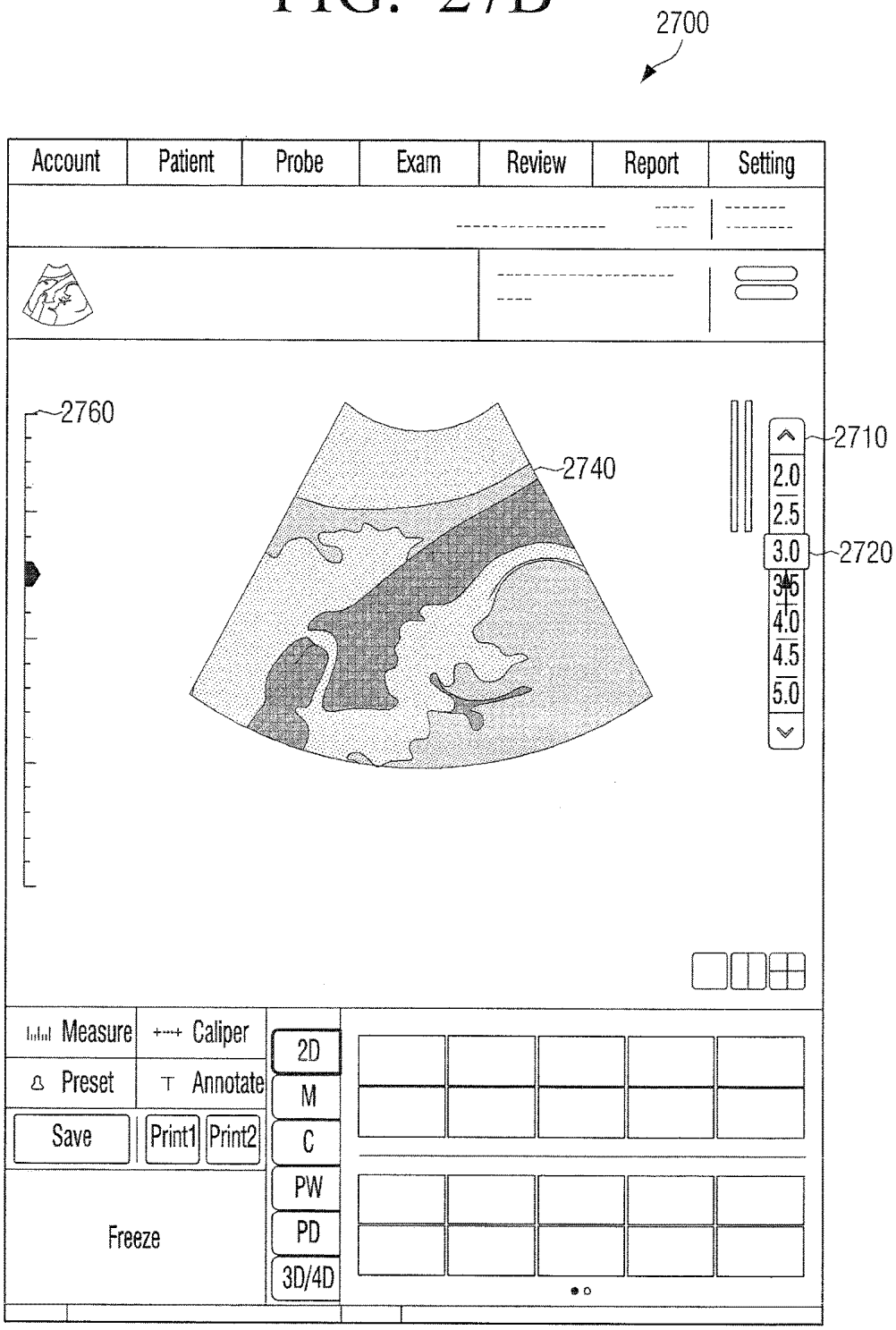

2700
Account
Patient
Probe
Exam
Review
Report
Setting
2760
2740
2710
2.0
2.5
3.0
2720
3.5
4.0
4.5
5.0
Measure
Caliper
Preset
Annotate
Save
Print1
Print2
Freeze
2D
M
C
PW
PD
3D/4D

FIG. 27C

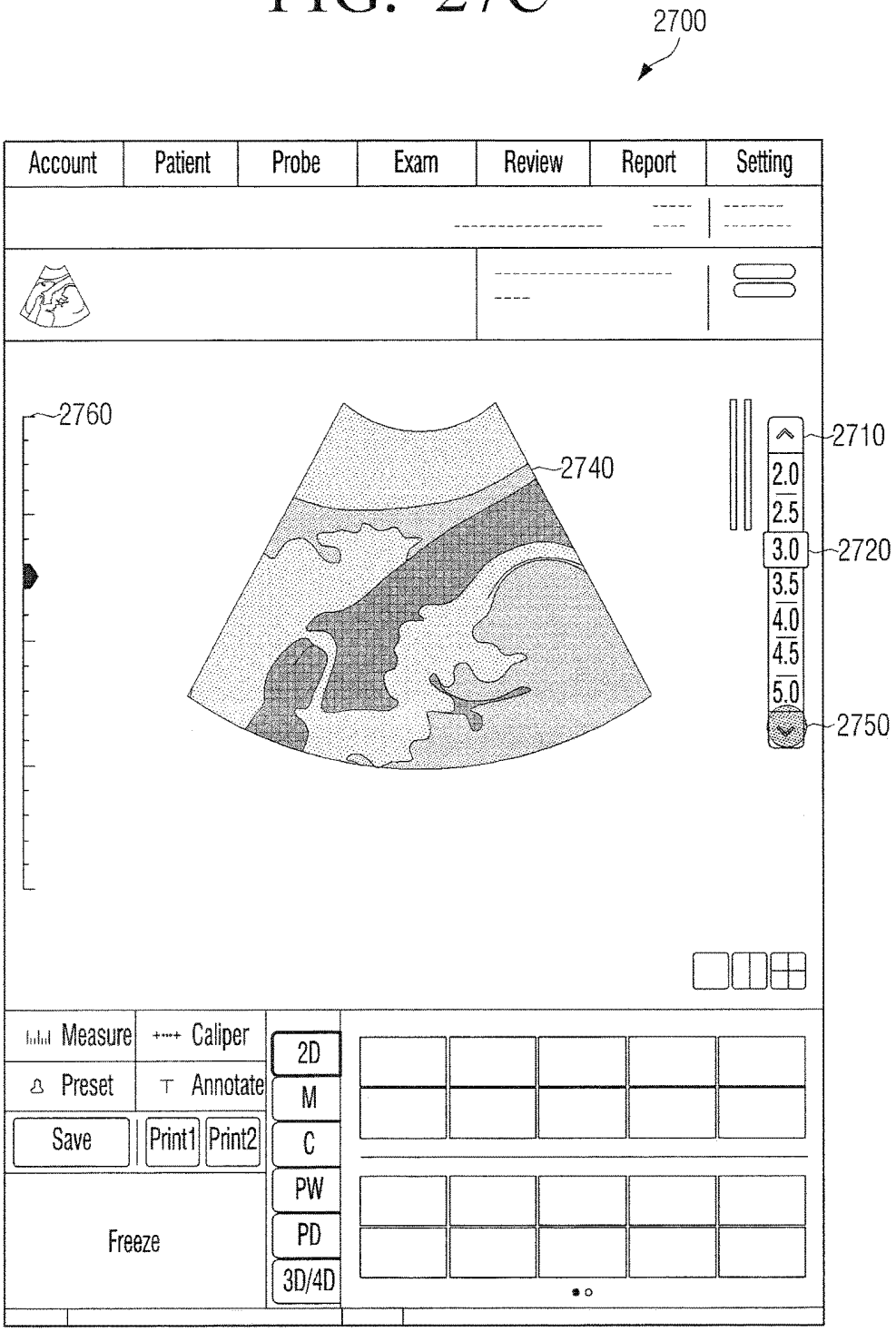

2700
Account
Patient
Probe
Exam
Review
Report
Setting
2760
2740
2710
2.0
2.5
3.0
2720
3.5
4.0
4.5
5.0
2750
Measure
Caliper
Preset
Annotate
Save
Print1
Print2
Freeze
2D
M
C
PW
PD
3D/4D

FIG. 27D

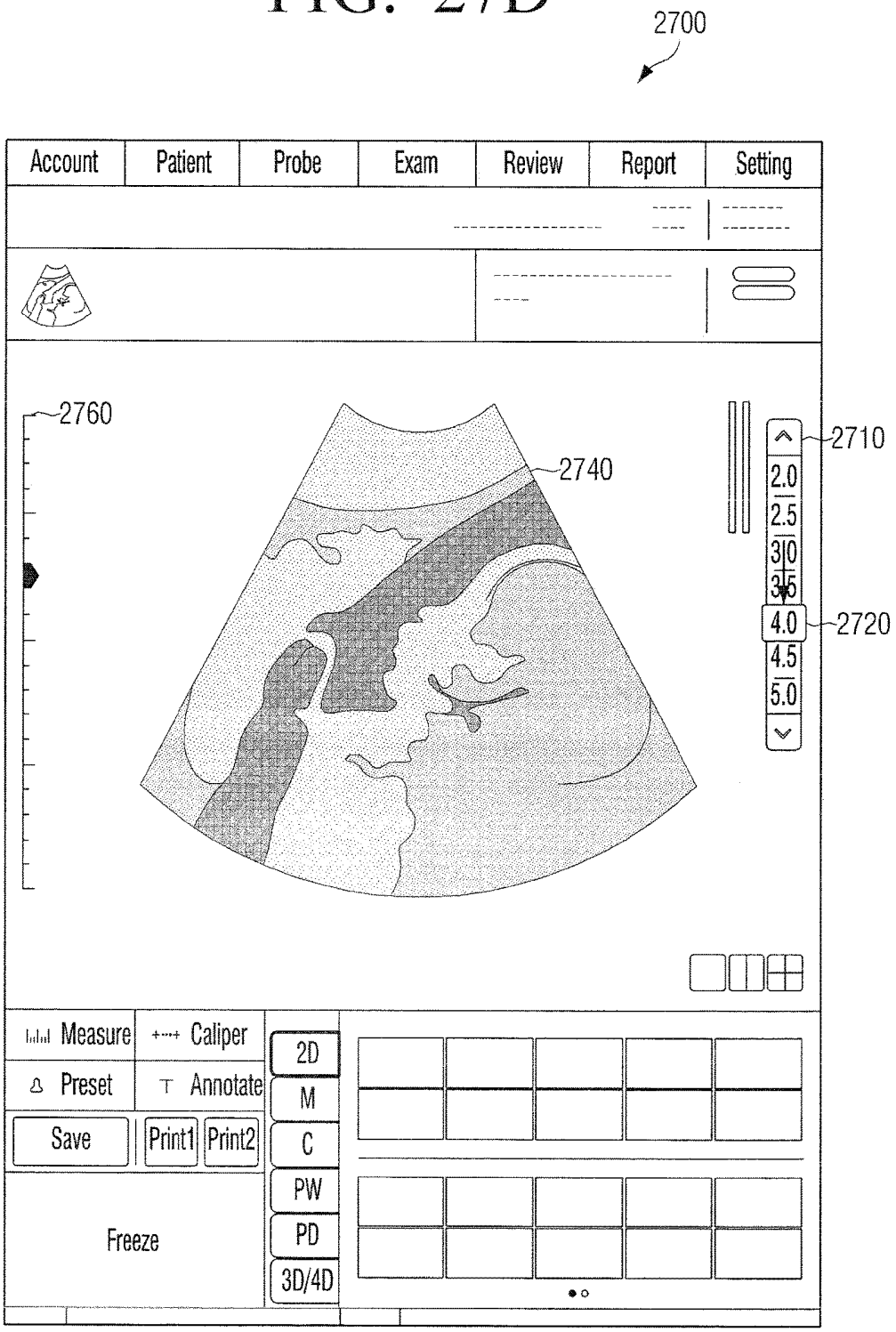

2700
Account
Patient
Probe
Exam
Review
Report
Setting
2760
2740
2710
2.0
2.5
3.0
3.5
4.0
4.5
5.0
2720
Measure
Caliper
Preset
Annotate
Save
Print1
Print2
Freeze
2D
M
C
PW
PD
3D/4D

FIG. 28A

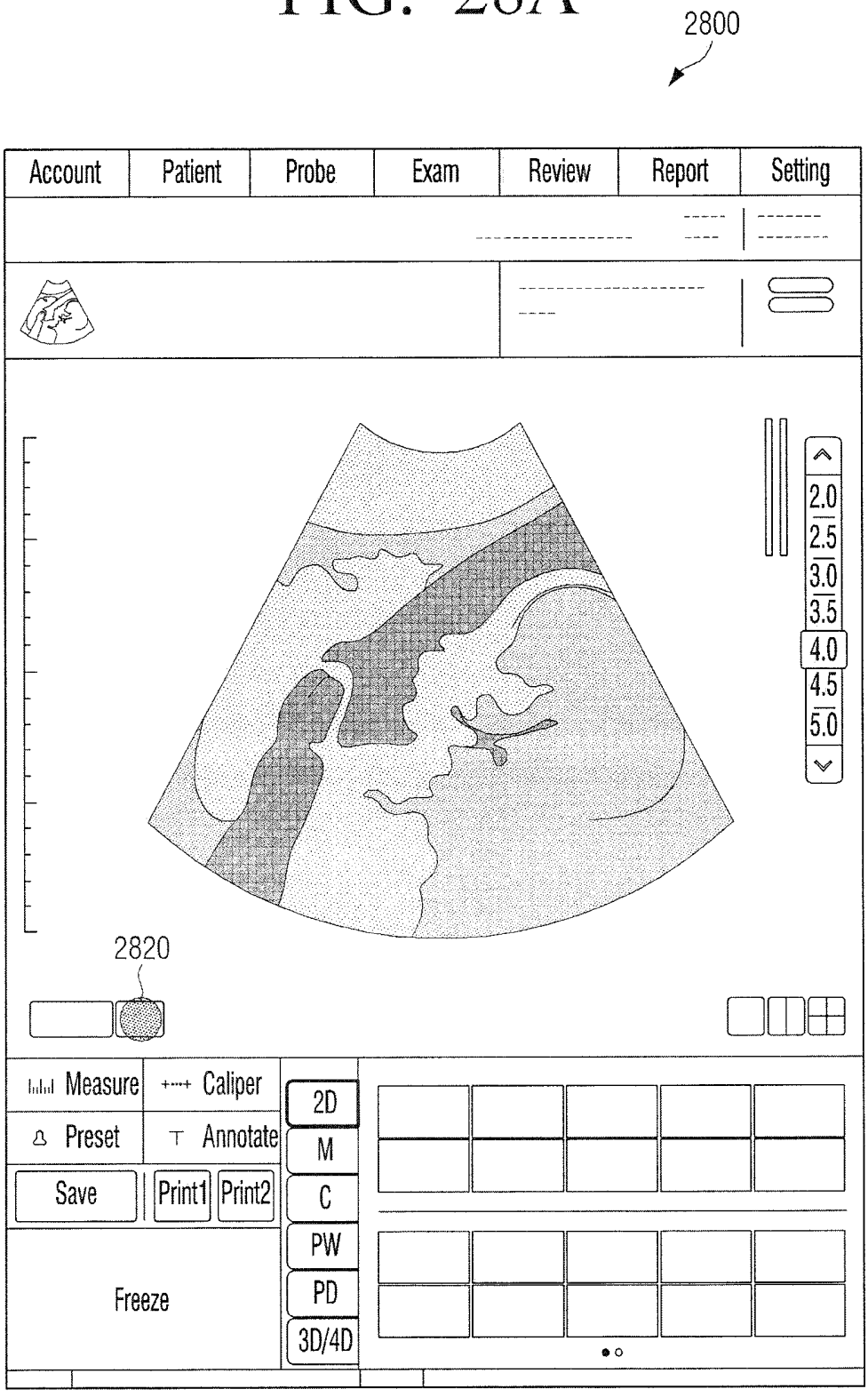

2800
Account
Patient
Probe
Exam
Review
Report
Setting
2.0
2.5
3.0
3.5
4.0
4.5
5.0
2820
Measure
Caliper
Preset
Annotate
Save
Print1
Print2
Freeze
2D
M
C
PW
PD
3D/4D

FIG. 28B

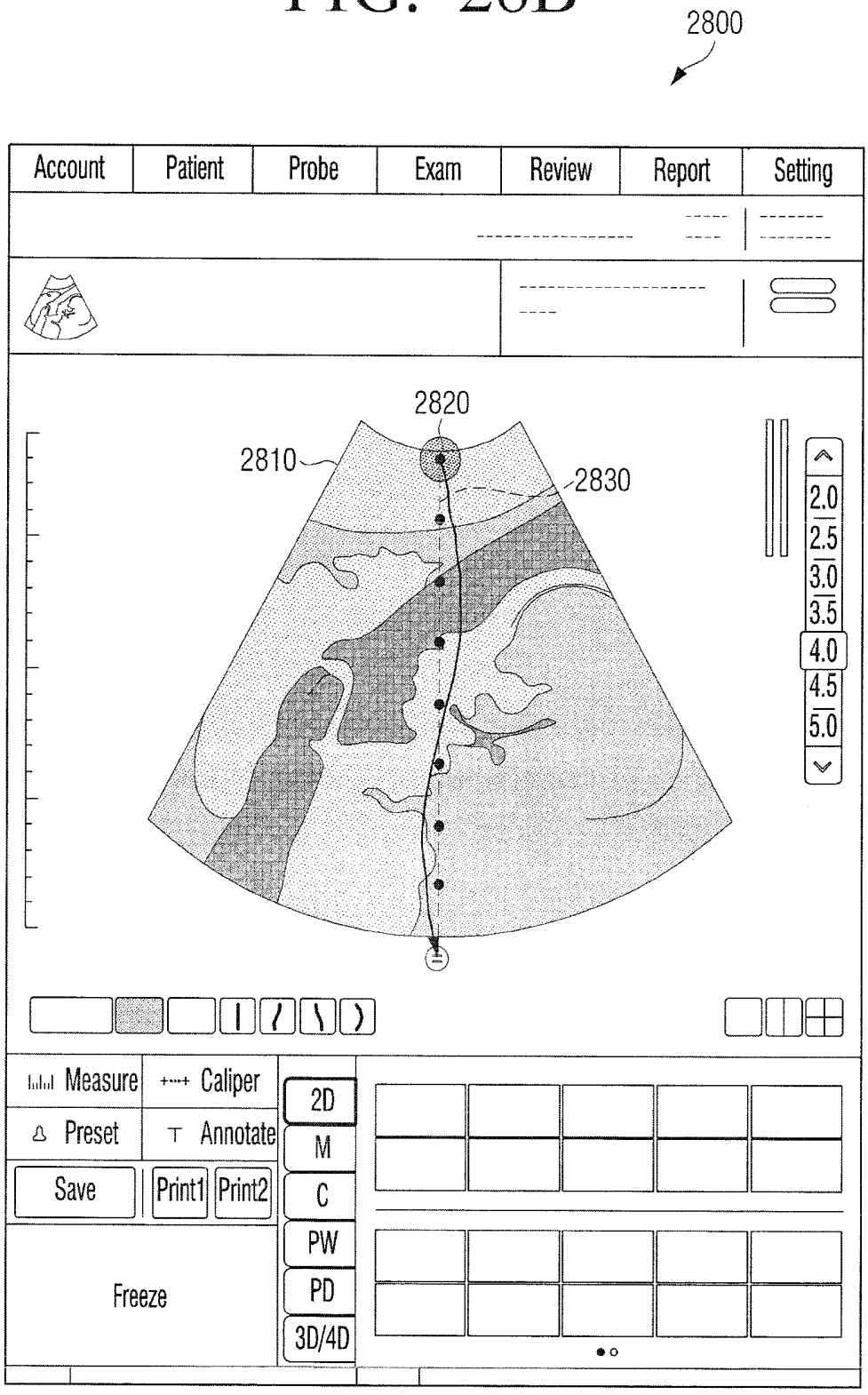

2800
Account
Patient
Probe
Exam
Review
Report
Setting
2820
2810
2830
2.0
2.5
3.0
3.5
4.0
4.5
5.0
Measure
Caliper
Preset
Annotate
Save
Print1
Print2
Freeze
2D
M
C
PW
PD
3D/4D

FIG. 28C

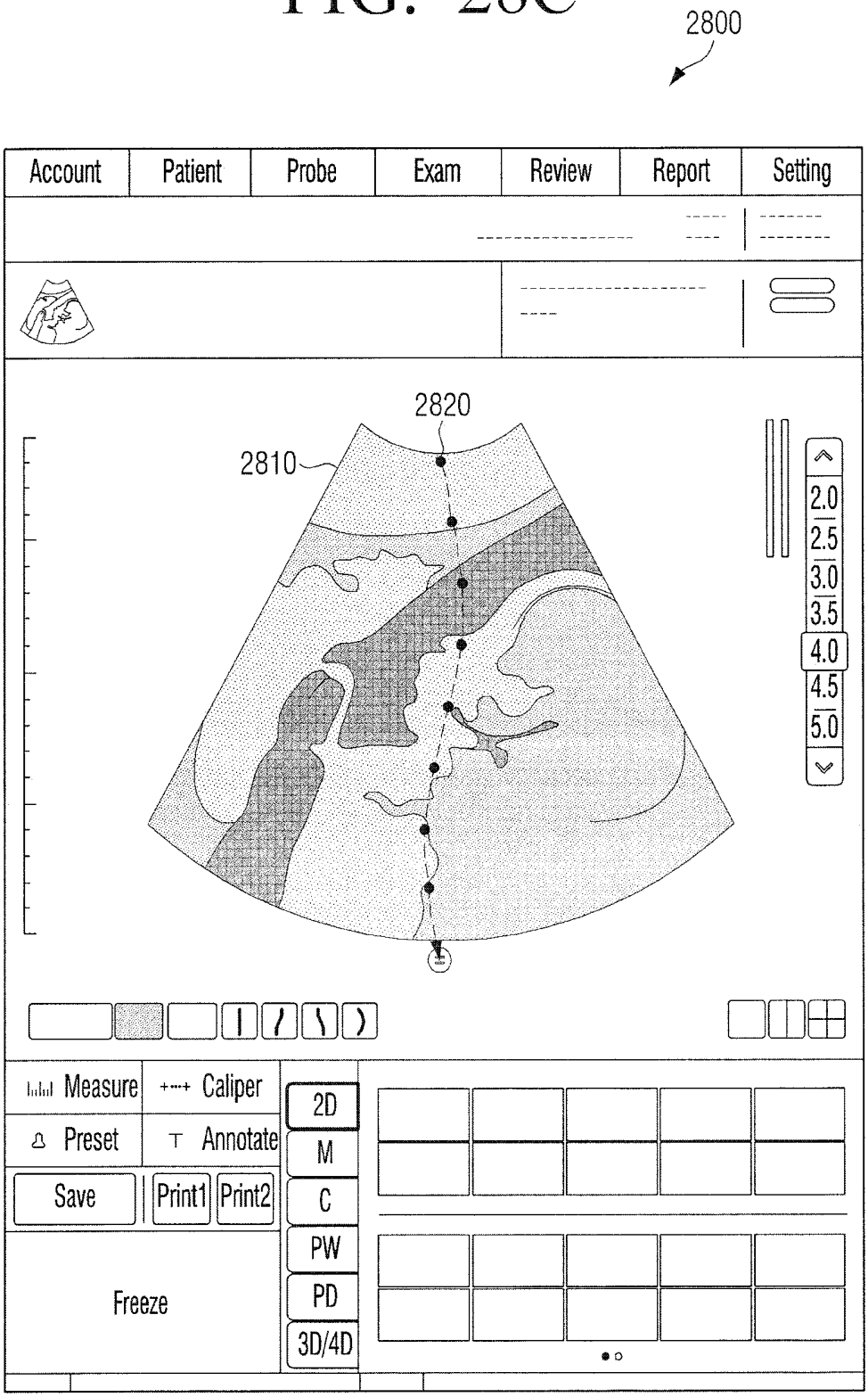

2800
Account
Patient
Probe
Exam
Review
Report
Setting
2820
2810
2.0
2.5
3.0
3.5
4.0
4.5
5.0
Measure
Caliper
Preset
Annotate
Save
Print1
Print2
Freeze
2D
M
C
PW
PD
3D/4D

FIG. 29A

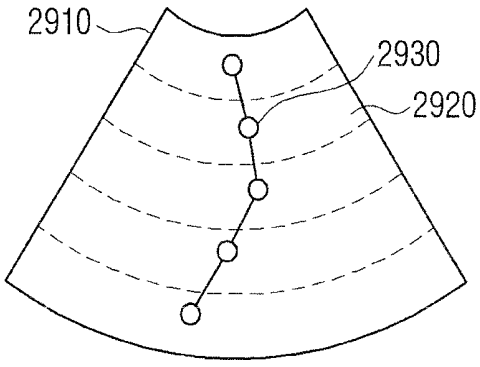


FIG. 29B

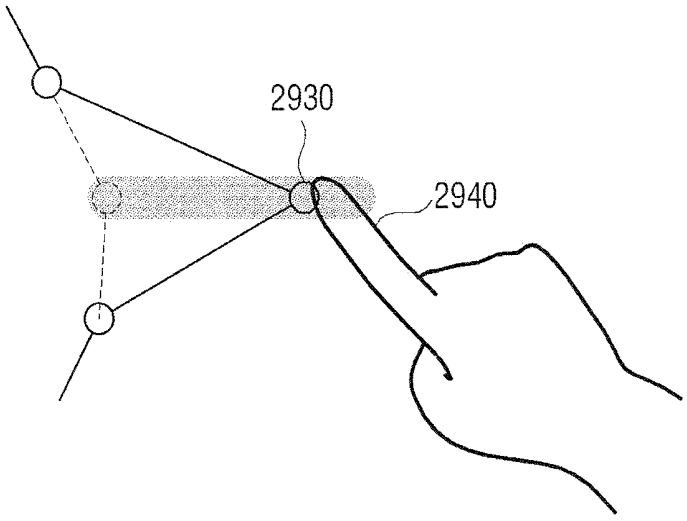


FIG. 29C

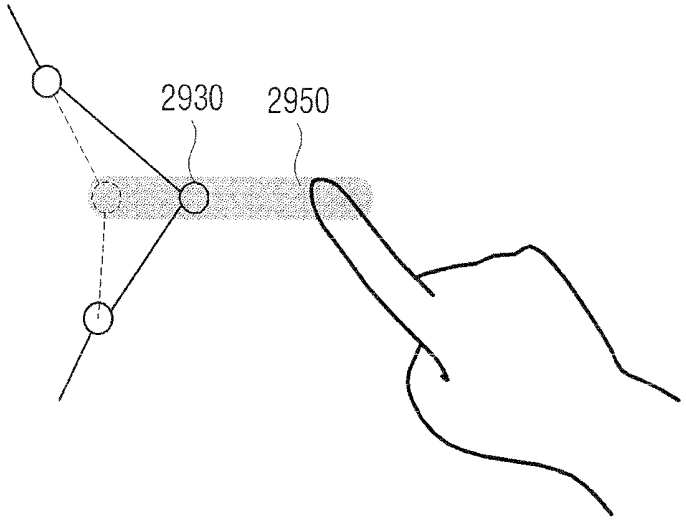


FIG. 29D

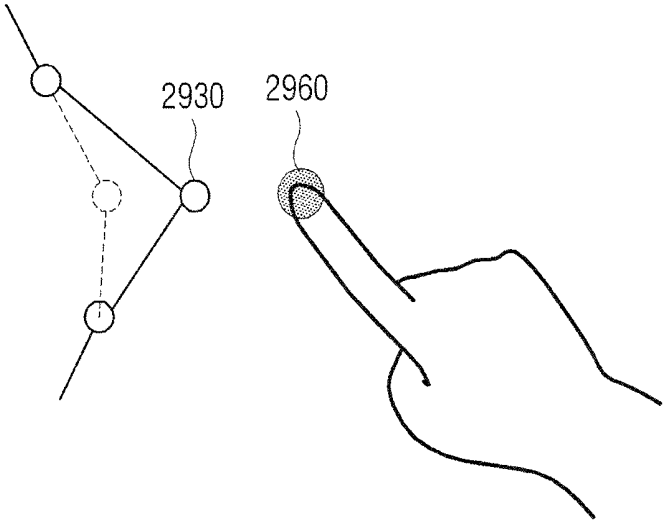


FIG. 30

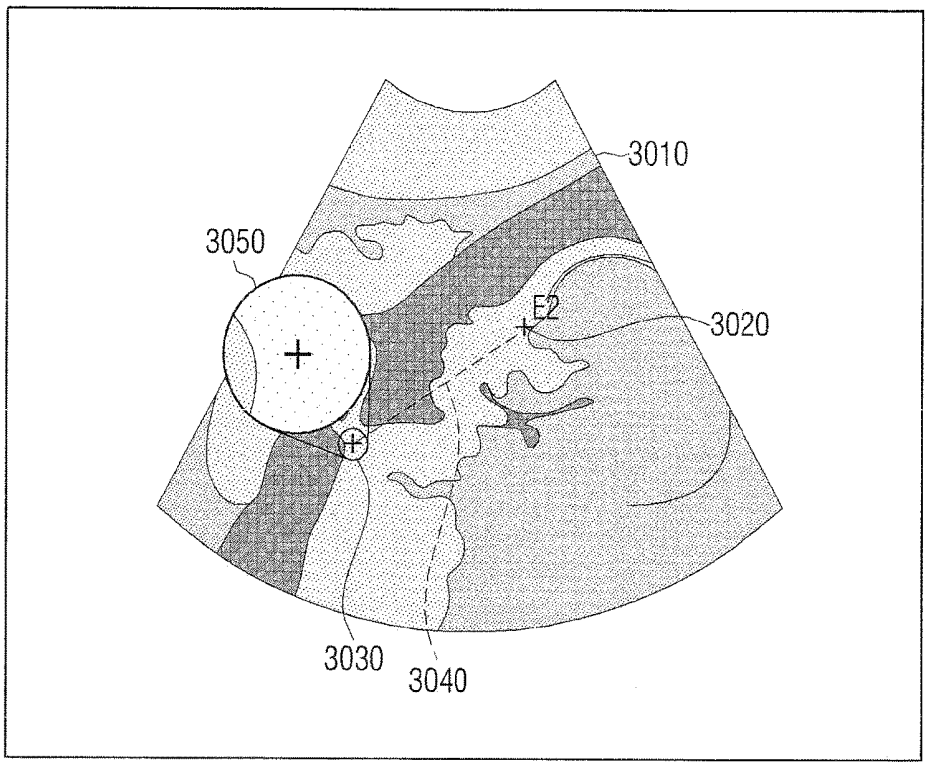


FIG. 31A

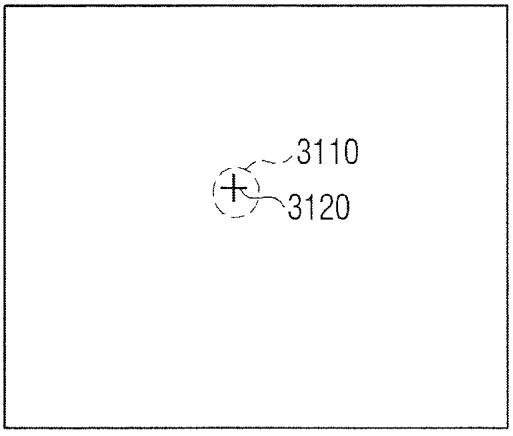


FIG. 31B

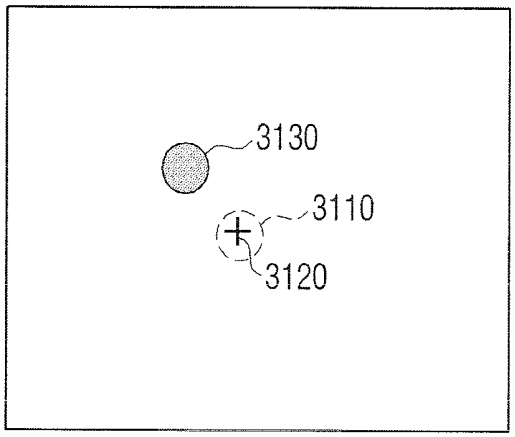


FIG. 32A

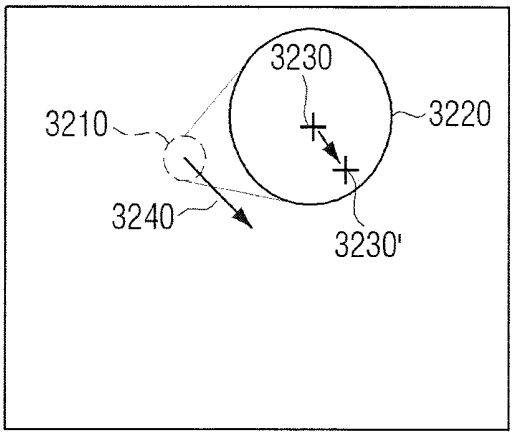
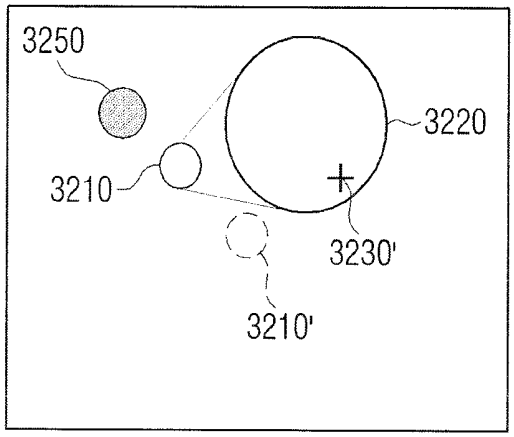


FIG. 32B



ULTRASOUND DIAGNOSIS APPARATUS AND CONTROL METHOD THEREOF

CROSS-REFERENCE TO RELATED APPLICATION(S)

This application claims the benefit under 35 U.S.C. § 119(e) of a U.S. provisional application filed on Nov. 4, 2014, in the U.S. Patent and Trademark Office and assigned Ser. No. 62/074,834, and under 35 U.S.C. § 119(a) of a Korean patent application filed on May 7, 2015 in the Korean Intellectual Property Office and assigned serial number 10-2015-0063866, the entire disclosure of which is hereby incorporated by reference.

TECHNICAL FIELD

The present disclosure relates to methods and apparatuses consistent with the various embodiments of an ultrasound diagnosis apparatus and a control method thereof. More particularly, the present disclosure relates to an ultrasound diagnosis apparatus that provides a new interface to photograph or manipulate an ultrasound image and a control method thereof.

BACKGROUND

An ultrasound diagnosis apparatus is a main diagnosis apparatus capable of observing a lesion inside a patient in medical fields.

An ultrasound diagnosis apparatus is an apparatus configured to emit high frequency sound waves in inaudible ranges from outside to inside a patient's body and to receive sound waves being reflected from the body so as to generate images. Modern high performance ultrasound diagnosis apparatuses have advanced to display not only 2-dimensional tomographic images of inside a subject body but also to generate and display 3-dimensional images thereof.

An ultrasound diagnosis apparatus is equipped with a display for displaying ultrasound images and a control panel having multiple input buttons or dial buttons and the like to control the functions of the ultrasound diagnosis apparatus according to the related art.

In order to use the ultrasound diagnosis apparatus, a user must be well aware of the locations and manipulating methods associated with the buttons in the control panel. Not only that, a user has to overcome the difficulty to carefully control the analog type buttons while watching the display according to the related art.

The above information is presented as background information only to assist with an understanding of the present disclosure. No determination has been made, and no assertion is made, as to whether any of the above might be applicable as prior art with regard to the present disclosure.

SUMMARY

Aspects of the present disclosure are to address at least the above-mentioned problems and/or disadvantages and to provide at least the advantages described below. Accordingly, an aspect of the present disclosure is to provide an ultrasound diagnosis apparatus equipped with a new type of interface for photographing and manipulating ultrasound images and a control method thereof.

In accordance with an aspect of the present disclosure, an ultrasound diagnosis apparatus for emitting ultrasound waves to an examination object and obtaining an ultrasound image is provided. The apparatus includes a touch display configured to display a screen that includes the ultrasound image, and a controller configured to receive a touch input associated with the ultrasound image and set a focus or depth of the ultrasound image to be displayed based on a touched position.

The controller is further configured to set a focus region at a depth corresponding to the touched position to be in focus so as to change a resolution of the ultrasound image when the touch input associated with the ultrasound image is received.

The controller is further configured to: in response to receiving the touch input at a first corner from among two corner regions parallel to a depth direction of the ultrasound image, set the focus of the ultrasound image corresponding to the touched position on the first corner, and in response to receiving the touch input at a second corner, set the depth of the ultrasound image to be displayed corresponding to the touched position on the second corner to be displayed.

The controller is further configured to, in response to receiving the touch input of dragging a corner region at an end of a depth direction of the ultrasound image displayed, set the depth of the ultrasound image to be displayed according to a position associated with a location in which the first or second corner region is dragged.

The controller is further configured to display a manipulating point on each of a plurality of depth regions that configure the ultrasound image and in response to receiving the touch input within a depth region associated with one of the plurality of manipulating points, move the one manipulating point in predetermined units, and change a total gain compensation (TGC) according to a distance and direction by which the manipulating point is moved.

The controller is further configured to, in response to receiving the touch input of dragging within the depth region, move the manipulating point within the depth region where the drag is detected in smaller units than the distance by which the touched point is moved by the drag.

The controller is further configured to, in response to receiving the touch input of tapping within the depth region, move the manipulating point within the depth region where the tapping is detected in the predetermined units based on a number of times the touch input of tapping is received.

The controller, in response to a predetermined event occurring, is further configured to display a still image of the ultrasound image, display a mark on the point where a touch is detected in the still ultrasound image, and in response to detecting a touch in another point with the touch of the still ultrasound image being retained, fixate the position of the displayed mark.

The controller is further configured to display an expanded image of a periphery associated with the point where the touch is detected in the still ultrasound image, display a mark on the expanded image, where the mark corresponds to the point where the touch is detected in the still ultrasound image, and in response to the touch on the still ultrasound image being dragged, move the mark within the expanded image.

The controller is further configured to move the mark within the expanded region in smaller units than the distance by which the touched point is moved by the drag.

In accordance with an aspect of the present disclosure, a method of controlling an ultrasound diagnosis apparatus for emitting ultrasound waves to an examination object and obtaining an ultrasound image is provided. The method includes displaying a screen that includes the ultrasound image, receiving a touch input associated with the ultra-

sound image, and setting a focus or depth of the ultrasound image to be displayed based on a touched position.

The setting of the focus, in response to receiving the touch input associated with the ultrasound image, may set a focus region at a depth corresponding to the touched position to be in focus so as to change a resolution of the ultrasound image.

The setting of the focus, in response to receiving a touch input at a first corner from among two corner regions parallel to a depth direction of the ultrasound image, may set the focus of the ultrasound image corresponding to the touched position on the one corner, and in response to receiving the touch input at a second corner, set the depth of the ultrasound image to be displayed corresponding to the touched position on the second corner to be displayed.

The setting of the focus, in response to receiving the touch input of dragging a corner region at an end of a depth direction of the ultrasound image displayed, may set the depth of the ultrasound image to be displayed according to a position to which the corner region is dragged.

The setting of the focus may further comprises displaying a manipulating point on each of a plurality of depth regions associated with the ultrasound image, and the method may further includes in response to receiving the touch input within a depth region associated with to one of the plurality of manipulating points, moving the one manipulating point in predetermined units, and changing a TGC based on a distance and direction by which the manipulating point is moved.

The moving of the one manipulating point, in response to receiving the touch input of dragging within the depth region, may move the manipulating point within the depth region where the drag is detected in smaller units than the distance by which the touched point is moved by the drag.

The moving of the manipulating point, in response to receiving a touch input of tapping within the depth region, may move the manipulating point within the depth region where the tapping is detected in the predetermined units according to a number of times the touch input of tapping is received.

The method may further include in response to a predetermined event occurring, displaying a still image of the ultrasound image, displaying a mark on a first point where a touch is detected in the still ultrasound image, and in response to detecting a touch at a second point with the touch associated with the first point being retained, fixating the position of the displayed mark.

The method may further include displaying an expanded image of a periphery of the point where the touch input is detected in the still ultrasound image, displaying a mark on the expanded image, where the mark associated with the point where the touch input is detected in the still ultrasound image, and in response to the touch on the still ultrasound image being dragged, moving the mark within the expanded image.

The moving of the mark within the expanded image includes may move the mark within the expanded region in smaller units than the distance by which the touched point is moved by the drag.

According to the aforementioned various embodiments of the present disclosure, a user may manipulate the ultrasound diagnosis apparatus more easily and intuitively.

Other aspects, advantages, and salient features of the disclosure will become apparent to those skilled in the art from the following detailed description, which, taken in conjunction with the annexed drawings, discloses various embodiments of the present disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other aspects, features, and advantages of certain embodiments of the present disclosure will be more apparent from the following description taken in conjunction with the accompanying drawings, in which:

FIGS. **1** and **2** are block diagrams illustrating a configuration of an ultrasound diagnosis apparatus according to an embodiment of the present disclosure;

FIG. **3** is a flowchart illustrating a control method of an ultrasound diagnosis apparatus according to an embodiment of the present disclosure;

FIG. **4** is a flowchart illustrating a control method of an ultrasound diagnosis apparatus according to an embodiment of the present disclosure;

FIG. **5** is a flowchart illustrating a control method of an ultrasound diagnosis apparatus according to an embodiment of the present disclosure;

FIG. **6** is a view illustrating an appearance and automatic execution function of an ultrasound diagnosis apparatus according to an embodiment of the present disclosure;

FIG. **7** is a view illustrating a structure of a probe according to an embodiment of the present disclosure;

FIG. **8** is a view illustrating a layout of a screen of a full touch display according to an embodiment of the present disclosure;

FIG. **9** is a view illustrating a sixth region included in the screen of FIG. **8** according to an embodiment of the present disclosure;

FIGS. **10**A to **10**C are views illustrating a manipulation of changing a state where the sixth region of FIG. **9** is being displayed on the screen of FIG. **8** according to an embodiment of the present disclosure;

FIGS. **11**A to **11**C are views illustrating a manipulation of changing a state where a popup menu is being displayed on the screen of FIG. **8** according to an embodiment of the present disclosure;

FIGS. **12**A and **12**B are views illustrating a manipulation of changing an arrangement of a plurality of buttons within the sixth region of FIG. **9** according to an embodiment of the present disclosure;

FIGS. **13**A to **13**C are views illustrating a manipulation of adjusting a size of each region of a screen divided into a plurality of regions according to an embodiment of the present disclosure;

FIGS. **14**A to **14**C are views illustrating where the manipulation of FIG. **13**A has been applied according to an embodiment of the present disclosure;

FIGS. **15**A to **15**C are views illustrating a manipulation of changing a position of a total gain compensation (TGC) line according to an embodiment of the present disclosure;

FIG. **16** illustrates an embodiment where a cine bar displayed on a still image display button according to an embodiment of the present disclosure;

FIG. **17** is a view illustrating an embodiment of manipulating the cine bar of FIG. **16** according to an embodiment of the present disclosure;

FIG. **18** is a view illustrating an embodiment of manipulating the cine bar of FIG. **16** according to an embodiment of the present disclosure;

FIGS. **19**A and **19**B are views illustrating an embodiment where a layout of a screen is automatically changed by execution of a certain function according to an embodiment of the present disclosure;

FIGS. **20**A and **20**B are views illustrating an embodiment where a layout of a screen is automatically changed by execution of a certain function according to an embodiment of the present disclosure;

FIGS. **21**A to **21**D are views illustrating four types of manipulations of changing a displaying state when a close-up view function is executed according to an embodiment of the present disclosure;

FIG. **22** is a view illustrating a configuration of an image display region according to an embodiment of the present disclosure;

FIG. **23** is a view illustrating a manipulation of setting a focus or depth of an ultrasound image according to an embodiment of the present disclosure;

FIG. **24** is a view illustrating a manipulation of setting a focus of an ultrasound image according to an embodiment of the present disclosure;

FIG. **25** is a view illustrating a manipulation of setting a depth of an ultrasound image according to an embodiment of the present disclosure;

FIG. **26** is a view illustrating an example of a screen where the manipulation of FIG. **24** has been applied according to an embodiment of the present disclosure;

FIGS. **27**A to **27**D are views illustrating an example of a screen where the manipulation of FIG. **25** has been applied according to an embodiment of the present disclosure;

FIGS. **28**A to **28**C are views illustrating a manipulation of setting a TGC according to an embodiment of the present disclosure;

FIGS. **29**A to **29**D are views illustrating a manipulation of changing a TGC setting according to an embodiment of the present disclosure;

FIG. **30** is a view illustrating a measuring function according to an embodiment of the present disclosure;

FIGS. **31**A and **31**B are views illustrating a manipulation of displaying a mark on an ultrasound image according to an embodiment of the present disclosure; and

FIGS. **32**A and **32**B are views illustrating a manipulation of displaying a mark on an ultrasound image according to an embodiment of the present disclosure.

Throughout the drawings, like reference numerals will be understood to refer to like parts, components, and structures.

DETAILED DESCRIPTION

The following description with reference to the accompanying drawings is provided to assist in a comprehensive understanding of various embodiments of the present disclosure as defined by the claims and their equivalents. It includes various specific details to assist in that understanding but these are to be regarded as merely exemplary. Accordingly, those of ordinary skill in the art will recognize that various changes and modifications of the various embodiments described herein can be made without departing from the scope and spirit of the present disclosure. In addition, descriptions of well-known functions and constructions may be omitted for clarity and conciseness.

The terms and words used in the following description and claims are not limited to the bibliographical meanings, but, are merely used by the inventor to enable a clear and consistent understanding of the present disclosure. Accordingly, it should be apparent to those skilled in the art that the following description of various embodiments of the present disclosure is provided for illustration purpose only and not for the purpose of limiting the present disclosure as defined by the appended claims and their equivalents.

It is to be understood that the singular forms "a," "an," and "the" include plural referents unless the context clearly dictates otherwise. Thus, for example, reference to "a component surface" includes reference to one or more of such surfaces.

In the following description, like drawing reference numerals are used for the like elements, even in different drawings. The matters defined in the description, such as detailed construction and elements, are provided to assist in a comprehensive understanding of various embodiments of the present disclosure. However, various embodiments of the present disclosure can be practiced without those specifically defined matters. Also, well-known functions or constructions are not described in detail since they would obscure the application with unnecessary detail.

Terms such as 'first' and 'second' may be used to describe various components, but they should not limit the various components. Those terms are only used for the purpose of differentiating a component from other components. For example, a first component may be referred to as a second component, and a second component may be referred to as a first component and so forth without departing from the spirit and scope of the present disclosure. In addition, 'and/or' may include any one of or a combination of the components mentioned.

In addition, a singular form may include a plural from as long as it is not specifically mentioned in a sentence. In addition, "include/comprise" or "including/comprising" used in the specification represents that one or more components, operations, and elements exist or are added.

In the embodiments of the present disclosure, a 'module' or 'unit' performs at least one function or operation, and may be realized as hardware or software, or a combination thereof. In addition, a plurality of 'modules' or a plurality of 'units' may be integrated into at least one module and be realized as at least one processor (not illustrated) except for when they need to be realized as a certain hardware.

FIGS. **1** and **2** are block diagrams illustrating a configuration of an ultrasound diagnosis apparatus according to an embodiment of the present disclosure.

Referring to FIG. **1**, the ultrasound diagnosis apparatus **100** includes a touch display **110** and controller **120**.

The touch display **110** detects a touch and displays an image on a screen. More specifically, the touch display **110** may output a rendered image data visually, and at the same time detect a contact (touch) of a user's body part or touch input apparatus on the screen.

The touch display **110** displays a user interface screen and detects a touch on the interface screen thereby providing the user with the intuitiveness of directly manipulating and/or interacting with the interface through the screen.

The touch display **110** may display not only an ultrasound image and the interface screen but also various types of screens such as a booting screen, an alarm screen, and the like.

The touch display **110** may include a touch unit for sensing a touch input and a display unit for displaying an interface and/or an image on a screen. In an exemplary embodiment, the touch unit and display unit may be coupled to each other (e.g., deposited on top of each other) or integrated with each other as a single device. The touch unit may include a touch sensor for sensing a touch input and a proximity sensor for sensing an approaching of a user's touch. The display unit may use a cathode ray tube (CRT) or various types of flat panel displays (FPD) such as a liquid crystal display (LCD) panel and the like.

The controller **120** is configured to control each component of the ultrasound diagnosis apparatus **100**. More specifically, the controller **120** may control each component of the ultrasound diagnosis apparatus **100** in order to perform a diagnosing function using ultrasound of the ultrasound diagnosis apparatus **100**.

The controller **120** may process image data to be displayed on the touch display **110** graphically and provide the processed image data to the touch display **110**. In addition, the controller **120** may receive a touch input detected at the touch display **110**.

The controller **120** may display various interface screens on the touch display **110**. Specific examples and explanation thereon will be explained later on with reference to the drawings.

The controller **120** includes at least one processor, a read-only memory (ROM) for storing a control program that controls the ultrasound diagnosis apparatus **100** and a random access memory (RAM) used to store a signal or data input from outside the ultrasound diagnosis apparatus **100** or used as a memory area for applications or operations to be performed in the ultrasound diagnosis apparatus **100**. The processor may include at least one of a single core processor, a dual core processor, a triple core processor and a quad core processor. In an exemplary embodiment, at least one processor, ROM, and RAM are mutually connected through an internal bus. More detailed explanation on the configuration of the ultrasound diagnosis apparatus **100** will be made hereinafter with reference to FIG. **2**.

Referring to FIG. **2**, the ultrasound diagnosis apparatus **100** includes a touch display **110**, a controller **120**, a beam former **130**, and a probe **140**. The controller **120** includes a signal processor **121**, an image processor **122**, a central processor **123**, and storage **124**.

The touch display **110** has the same configuration and operation methods as the touch display **110** of FIG. **1** and thus repeated explanation will not be made.

The probe **140** includes a plurality of transducers. In an exemplary embodiment, each transducer transmits ultrasound waves to the examination object and then receives ultrasound waves reflected back from the examination subject.

The beam former **130** performs a transmission-focusing of the ultrasound wave being transmitted from each transducer to the examination object and performs a reception-focusing of the reflected waves emitted from the examination object to each transducer by applying a time-delay to the reflected waves.

The signal processor **121** receives a signal of a reflected wave that has been reception-focused at the beam former **130** and adjusts a gain of the signal. More specifically, the signal processor **121** sets a total gain compensation (TGC) or sensitivity time compensation (STC) of the signal by the reflected wave received.

In an exemplary embodiment, the TGC refers to controlling a gain of a reflected wave according to a depth of an organ to which ultrasound was emitted in order to alleviate the phenomenon in which the farther the organ is distanced from the body surface, the more blurry the image of the organ is since the deeper the ultrasound is emitted into the examination object, less intense the reflected ultrasound is.

The image processor **122** generates ultrasound image data. More specifically, the image processor **122** may generate ultrasound image data that may display the reflected wave signal output from the signal processor **121** on the touch display **110** as a 2-dimensional or 3-dimensional image.

The central processor **123** controls each component of the ultrasound diagnosis apparatus **100**. More specifically, the central processor **123** may relay a signal being transmitted inside the controller **120** or a signal being input and output between the controller **120** and other components. In addition, the central processor **123** may perform computation operations for executing a program such as an operating system and application and the like on the ultrasound diagnosis apparatus **100** and operations of transmitting a suitable signal to each component at a command received from the user.

The storage **124** is configured to store data. More specifically, the storage **124** may store various programs and image data generated when photographing an ultrasound image.

Hereinafter, control operations and functions of the controller **120** of the ultrasound diagnosis apparatus **100** of FIGS. **1** and **2** will be explained with reference to FIGS. **3** to **5**.

FIG. **3** is a flowchart illustrating a control method of an ultrasound diagnosis apparatus according to an embodiment of the present disclosure.

Referring to FIG. **3**, a screen that includes an ultrasound image is displayed on the touch display **110** at operation **5310**. More specifically, a screen for providing the ultrasound image obtained after emitting ultrasound waves to an examination subject may be displayed on the touch display **110** together with an interface.

Then, a touch input corresponding to a touch detected in the touch display **110** is received in the controller **120** at operation **5320**.

In addition, the controller **120** sets a focus parameter associated with the ultrasound image or a depth of the ultrasound image being displayed based on the touched position at operation **5330**.

In an exemplary embodiment, the controller **120** may set the focus parameter or the depth by determining in which part of the ultrasound image displayed on the screen of the touch display **110** the user's manipulation of touching the ultrasound image has been detected. More detailed explanation thereof will be made later on with reference to FIGS. **22** to **27**.

FIG. **4** is a flowchart illustrating a control method of an ultrasound diagnosis apparatus according to an embodiment of the present disclosure.

Referring to FIG. **4**, on the touch display **110**, a plurality of manipulating points for controlling or manipulating an ultrasound image and TCG are displayed on each of the plurality of depth regions that form the ultrasound image at operation **5410**. More specifically, the controller **120** may set the divided depth regions per each predetermined depth on the ultrasound image. In addition, the controller **120** may provide manipulating points for adjusting a gain of a wave reflected from the plurality of divided depth regions at each depth region.

Then, the controller **120** receives a touch input of a touch made within a depth region where one of the manipulating points displayed on the touch display **110** belongs to at operation **5420**. More specifically, the touch display **110** detects a user's touch in one of the plurality of depth regions and the controller **120** may receive a signal indicative of the touch input of the detected touch.

In addition, the controller **120** moves the manipulating point associated with the touched depth region in predetermined units at operation **5430**. More specifically, the controller **120** may move the manipulating point associated with the depth region where the touch input was detected in

predetermined units. In an exemplary embodiment, the controller **120** may vary the direction in which to move the manipulating point depending on whether the touched position is at a left or right side of the manipulation point. In addition, the controller **120** may move the manipulating point in predetermined units and directions based on the depth and position where the touch was detected. More detailed explanation will be made later on with reference to FIGS. **28** and **29**.

The controller **120** changes the TGC according to the distance and direction by which the manipulating point was moved at operation **5440**. For example, the controller **120** may set a gain of the reflected wave corresponding to the depth region where the manipulating point is located according to the distance and direction by which the manipulating point was moved with respect to a central axis which is used as a reference.

FIG. **5** is a flowchart illustrating a control method of an ultrasound diagnosis apparatus according to an embodiment of the present disclosure.

Referring to FIG. **5**, the controller **120** receives a signal that a predetermined event has been detected at operation **5510**. For example, the controller **120** may receive a signal that represents that an event of touching a FREEZE button on the touch display **110** has occurred.

The touch display **110** displays a still image of the ultrasound image at operation S**520**. More specifically, the controller **120** may control the touch display **110** such that a still image of the ultrasound image is displayed. The still image may be an ultrasound image photographed when the event occurred.

The touch display **110** displays a mark on a point where the touch was detected at operation S**530**. More specifically, when a touch input is received, the controller **120** may control the touch display **110** such that a mark is displayed on the point where the touch was detected. In an exemplary embodiment, a mark refers to an object for marking a point where a lesion such as cancer is observed on a still ultrasound image in order to measure the size of the lesion.

The touch display **110** may detect another touch input from a different point while maintaining a former touch input at operation S**540**. More specifically, when a mark is positioned at a point to display the mark through an initial touch in the touch display **110**, when a second touch is made at another point with the initial touch maintained, the touch display **110** may sense the user's multi touch manipulation.

The controller **120** may fix the mark displayed at operation S**550**. More specifically, when a second touch input is received, the controller **120** may fix the position of the mark displayed while maintaining the first touch. More detailed explanation thereof will be made later on with reference to FIGS. **30** and **31**.

Such a control method of an ultrasound diagnosis apparatus according to various embodiments of the present disclosure may provide a more intuitive, detailed, simple, and convenient interface environment. The control method of FIGS. **3** to **5** may be embodied in an ultrasound diagnosis apparatus having the configuration of FIG. **1** or FIG. **2**. Otherwise, the control method of FIGS. **3** to **5** may be executed in one or a plurality of apparatuses each embodied with only some of the functions or only one configuration.

In addition, such a control method of an ultrasound diagnosis apparatus as aforementioned may be embodied as a program executable in at least one computer for executing the control method. In addition, such an executable program may be stored in a non-transitory computer readable record medium.

Therefore, each of the blocks of the present disclosure may be embodied as a computer recordable code on a computer readable record medium. The computer readable record medium may be a device that may store data that may be read by a computer system.

For example, the computer readable record medium may be a ROM, RAM, CD-ROM, magnetic tape, floppy disc, optical disc, optical data storing device, or an image display such as a television that includes the storing device. In addition, the computer readable code may be embodied as a computer data signal of a reflected wave.

Probe Interaction

FIG. **6** is a view illustrating an appearance and automatic execution function of an ultrasound diagnosis apparatus according to an embodiment of the present disclosure.

Referring to FIG. **6**, the ultrasound diagnosis apparatus **600** is a cart type apparatus equipped with a handle and wheels so that apparatus **600** may be moved around.

A touch display **610** is provided at an upper part of the ultrasound diagnosis apparatus **600** such that that the display **610** may sense or detect a touch on any part of a screen when an image or an interface is displayed on the display.

The main body of the ultrasound diagnosis apparatus **600** may include various storage spaces, a plurality of probes **620**, and a holder **630** to hang the probe. In an exemplary embodiment, the main body of the ultrasound diagnosis apparatus **600** may be further equipped with various components for communication with an external device such as various communication ports, a speaker, a gel warmer, a record medium drive, and the like.

The ultrasound diagnosis apparatus **600** may detect when the probe **620** is separated from the holder **630**. More specifically, the ultrasound diagnosis apparatus **600** may generate a signal that the probe **620** has been separated from the holder **630** based on a sensor provided in the holder **630**. In addition, the signal indicating that the probe **620** has been separated from the holder **630** may vary according to the type of the probe **620**. Therefore, the ultrasound diagnosis apparatus **600** may also identify which probe **620** will be used by a user.

In an exemplary embodiment, the ultrasound diagnosis apparatus **600** executes an application corresponding to the identified probe **620**. More specifically, when a probe for a certain use is separated, the ultrasound diagnosis apparatus **600** may automatically execute the diagnosis application suitable to the use of the separated probe.

FIG. **7** is a view illustrating a structure of a probe according to an embodiment of the present disclosure.

Referring to FIG. **7**, a probe **700** includes a plurality of input means. More specifically, the probe **700** may be equipped with a plurality of buttons **710**, **720**, **730**, **740** formed on a part of the probe **700** to be grasped by the user. For example, as illustrated in FIG. **7**, the probe **700** may be equipped with a SAVE button **710**, a FREEZE button **720**, and a LOCK button **730** formed within an operation range manipulable by an index finger of a hand that grasps the probe **700**, and a DEPTH button **740** formed within an operation range manipulable by a thumb of the hand that grasps the probe **700**. In an exemplary embodiment, the SAVE button **710** may provide a function of capturing an ultrasound image, the FREEZE button **720** may provide a function of freezing or resuming photography, the LOCK button **730** may provide a function of disregarding inputting of other buttons provided in the probe **700**, and the DEPTH button **740** may provide a function of adjusting the depth of an ultrasound image. One of ordinary skill in the art would recognize that a method of input utilizing physical force

and/or a method of detecting a contact by a body part or motion of a body part may be applied to the input methods of the aforementioned buttons. It is also a matter of course that some of the aforementioned plurality of buttons may be omitted or a button for providing a function related to another probe may be added to the probe.

Touch Interaction for Changing Layout

FIG. **8** is a view illustrating a layout on a screen of a full touch display according to an embodiment of the present disclosure.

Referring to FIG. **8**, a screen **800** is displayed on a touch display where the screen **800** is divided into a plurality of regions.

A first region **810** at an uppermost end includes a menu bar from which an option regarding an account, a patent, a probe, a diagnosis, a review, a report, and a configuration setting may be selected.

A second region **820** includes a title associated with the ultrasound imaging that includes a patient name, a hospital name, an application being executed, a photograph frame rate, information associated with the probe used in the diagnosis, sound output information, date/time information, and the like.

A third region **830** includes a thumbnail of a captured ultrasound image.

A fourth region **840** includes information on whether an ultrasound image is a 2-dimensional ultrasound image or a 3-dimensional ultrasound image, depth of the image, and focus of the image.

A fifth region **850** displays an ultrasound image being photographed or photographed together with several image setting interfaces.

A sixth region **860** provides a quick menu that includes options that are frequently used when diagnosing to help the user easily select imaging or diagnosis options.

A seventh region **870** provides a sub menu that includes various selectable options provided from the application related to the mode being executed.

FIG. **9** is a view illustrating in detail the sixth region included in the screen of FIG. **8** according to an embodiment of the present disclosure.

Referring to FIG. **9**, the sixth region **900** includes a Measure button for calculating a length, angle, and size area, a Caliper button providing a ruler function of connecting two points on an ultrasound image, a Preset button for deleting a text or indicator and the like displayed on an ultrasound image, an Annotate button for inputting a letter in any position on an ultrasound image, a Save button for capturing an ultrasound image during photographing, a Print 1 button, a Print 2 button, a Freeze button, and a plurality of Mode buttons 2D, M, C, PW, PD, 3D/4D for converting or adding an ultrasound image photographing mode.

In an exemplary embodiment, at a lowermost end of the sixth region **600**, a handle **910** is provided that includes a move button **920** for the sixth region **600** and a conversion button **930** for changing an arrangement of the buttons within the sixth region **600**. Referring to FIG. **10**, explanation on manipulating the handle **910** will be made.

FIGS. **10**A to **10**C are views illustrating a manipulation of changing a state of the sixth region of FIG. **9** displayed on the screen of FIG. **8** according to an embodiment of the present disclosure.

Referring to FIG. **10**A, the screen includes a plurality of regions arranged in a basic layout.

At the lower end of the sixth region **1020** where the quick menu is provided, a handle **1010** is provided.

The user may input a touch and drag **1030** manipulation of a move button of the handle **1010** through the touch display.

Referring to FIG. **10**B, a state where the sixth region **1020** has been moved from a lower left end of the screen to the center of the screen by a drag manipulation input by the user is illustrated. In an exemplary embodiment, the sixth region **1020** may be displayed semi-transparently while it is being moved by the user's drag.

The user may input a double tap **1040** manipulation by tapping the position change button in the handle **1010**.

Referring to FIG. **10**C, a state where the sixth region **1020** has moved to the position of the initial basic layout after a double tap **1040** manipulation has been input and detected is illustrated.

FIGS. **11**A to **11**C are views illustrating a manipulation of changing a state where a popup menu is displayed on the screen of FIG. **8** according to an embodiment of the present disclosure.

Referring to FIG. **11**A, together with the plurality of regions arranged in the basic layout, a popup window **1120** is displayed on the screen.

In an embodiment of the present disclosure, the popup window **1120** is displayed when one option **1110** of the plurality of options of the sub menu is selected. The popup window **1120** provides an interface where the user may set a certain range.

A handle **1130** is displayed together at one side of the popup window **1120**.

The user touches a rotation button **1140** on the handle **1130** of the popup window **1120**.

Referring to FIG. **11**B, a state where the popup window **1120** has been rotated by 90 degrees by the user's manipulation of touching the conversion button is illustrated.

The user may input a manipulation of touching and dragging **1150** a move button of the handle **1130**.

Referring to FIG. **11**C, a state where the popup window **1120** has been moved to where the user had input the drag manipulation is illustrated.

In an exemplary embodiment, the popup window **1120** is not displayed if the user touches a close button **1160** of the handle **1130** or if there is no user manipulation for more than a predetermined period of time.

FIGS. **12**A to **12**B are views illustrating a manipulation of changing an arrangement of the plurality of buttons in the sixth region of FIG. **9** according to an embodiment of the present disclosure.

Referring to FIG. **12**A, a state where the buttons inside the sixth region **1210** are arranged in the basic layout is illustrated.

The user may touch a conversion button **1220** on the handle at a lower end of the sixth region **1210**.

Referring to FIG. **12**B, a state where the buttons inside the sixth region **1210** have been arranged in another layout based on the user's manipulation of touching the conversion button **1220** is illustrated.

In an exemplary embodiment, there may be two or more layouts in which the buttons may be arranged. In addition, every time the user touches the conversion button **1220**, the layout of the buttons will change to every one of the plurality of layouts in serial order.

FIGS. **13**A to **13**C are views illustrating a manipulation of adjusting a size of each region of the screen divided into a plurality of regions according to an embodiment of the present disclosure.

Referring to FIG. **13**A, screens **1310**, **1320** illustrate where a region is divided into two portions A, B. The screen

1310 on the left is divided into two by a horizontal boundary line, while the screen 1320 on the right is divided into two by a vertical boundary line. By touching and dragging a boundary indicator 1311, 1321 associated with the two divided regions, one of the divided regions may be expanded as the other one is reduced.

Referring to FIG. 13B, screens 1330, 1340 illustrate where a region is divided into three portions A, B, C. The screen 1330 on the left is divided into two by a horizontal boundary line and then one of the two regions is divided again by a vertical boundary line. The screen 1340 on the right is divided into two by a vertical boundary line and then one of the two regions is divided again by a horizontal boundary line.

In an exemplary embodiment, the three divided regions may be expanded or reduced by a manipulation associated with touching and dragging an intersection indicator 1331, 1341 where the two boundary lines dividing the screen in a horizontal direction and a vertical direction meet.

Referring to FIG. 13C, screens 1350, 1360 illustrate where a region is divided into four portions A, B, C, D. The four divided regions may be expanded or reduced by a user's manipulation of touching and dragging an intersection indicator 1351, 1361 where two boundary lines crossing the screen in a horizontal direction and a vertical direction meet.

FIGS. 14A to 14C are views illustrating the application of the manipulation described in FIG. 13A according to an embodiment of the present disclosure.

Referring to FIG. 14A, an ultrasound image is being displayed on screen 1400 in an image region 1410 where a 2D/C mode has been activated.

In an exemplary embodiment, the user may touch a PW mode button 1420 to activate a 2D/C/PW complex mode.

Referring to FIG. 14B, the PW mode has been executed and screen 1400 is divided into an image region 1410 and pulsed wave image region 1430 based on an input associated with the activation of the 2D/C.PW complex mode. In addition, a boundary line 1435 is displayed in the boundary of the image region 1410 and the PW image region 1430.

Referring to FIG. 14B, in an exemplary embodiment, the user may input a manipulation 1440 by touching the boundary line displayed and providing an input associated with dragging the boundary line in an upward direction thereby increasing the area of the PW image region 1430 and decreasing the area of the image region 1410.

Referring to FIG. 14C, as the image region 1410 displayed on screen 1400 is reduced by the user's dragging manipulation, the interfaces arranged on the left and right of the ultrasound image are also reduced. In addition, the graph of the expanded PW image region 1430 is expanded as well.

It is noted that one of ordinary skill in the art would recognize that the boundary line 1435 may also be manipulated such that an input associated with dragging the boundary line in a downward direction thereby decreasing the area of the PW image region 1430 and increasing the area of the image region 1410.

FIGS. 15A to 15C are views illustrating a manipulation of changing a position of a TGC line according to an embodiment of the present disclosure.

Referring to FIG. 15A, a screen 1500 illustrates where a touch input is detected associated with a TGC button 1530 thereby activating the TGC setting. On an image region of the screen 1500, a TGC line 1510 is displayed overlapping the ultrasound image 1520.

On the TGC line 1510, there are a plurality of manipulation points 1512, 1514, and 1516 corresponding to each of the divided depth regions according to depth of the ultrasound image.

Referring to FIG. 15B, a manipulation 1550 of touching and dragging a move button 1540 displayed on one end of the TGC line 1510 in order to change the position of the TGC line 1510 being displayed on the screen 1500 over the ultrasound image 1520 is illustrated.

Referring to FIG. 15C, the result of the user's dragging manipulation 1550 provided in FIG. 15B, the TGC line 1510 has been moved outside the ultrasound image 1520 such that the TGC line 1510 no longer overlaps the ultrasound image 1520 displayed on the screen 1500. In addition, the ultrasound image 1520 has been moved to the direction opposite to the direction that the TGC line 1510 had been moved so as not to overlap the TGC line 1510. In an exemplary embodiment, as illustrated in FIGS. 15B and 15C, the detected user manipulation 1550 is indicative of dragging the TGC line 1510 to the left of the screen 1500 and thus the ultrasound image 1520 moved to the right of the screen 1500. However, one of ordinary skill in the art would recognize that the TGS line 1510 may be manipulated in right direction causing the ultrasound image 1520 to move in a left direction.

FIG. 16 illustrates a cine bar displayed on a Freeze display button according to an embodiment of the present disclosure.

Referring to FIG. 16, a still image display button (e.g., a Freeze button) 1610 capable of pausing an ultrasound image being photographed in real time is illustrated. The Freeze button 1510 may be displayed on a display of the ultrasound apparatus. For example, the Freeze button 1610 includes a text indicator (e.g., "Freeze 1620" or "Unfreeze 1630") and is displayed indicating a current state based on whether the ultrasound image has been paused. In an exemplary embodiment, text indicator of Freeze 1620 is displayed within the Freeze button 1610 during an image generating state (a) and text indicator of Unfreeze 1630 is displayed on the Freeze button 1610 during a paused state (b) to release the pause state and resume photographing to generate an ultrasound image. A cine bar 1640 is displayed on a lower end within the Freeze button 1610 during the paused state (b). The cine bar 1640 is a timeline that provides an interface for searching frames of the ultrasound image from the starting point of photographing the image to the pause point. A method of manipulating the cine bar 1640 will be explained in detail later on with reference to FIGS. 17 and 18.

The Freeze button 1610 displays the text indicators "Freeze" and "Unfreeze" alternately based on a user's touch input.

FIG. 17 illustrates the manipulation of the cine bar of FIG. 16 according to an embodiment of the present disclosure.

Referring to FIG. 17, a first state (a) is associated with a still ultrasound image being displayed. In an exemplary embodiment, the cine bar is displayed on a lower section of the Freeze button 1710.

In order to view the ultrasound image of a desired frame, the user may input a manipulation 1740 of touching a right end 1730 of the cine bar 1720 and dragging the touch input to the left.

In a second state (b), after an input is detected associated with a user's dragging manipulation associated with the cine bar 1720 within the Freeze button 1710, an indicator 1750 is displayed indicating a position of the frame currently being displayed. While the manipulation touch 1770 of dragging continues to a second position 1750, a frame

number indicator **1760** is displayed on an upper part of the second position **1750**. In an exemplary embodiment, referring to FIG. **17**, a number "**32**" may be displayed in a region associated with the second position **1750** of the manipulation input to represent the frame number of the ultrasound image.

When there is no touch detected to be associated with the cine bar **1720**, the frame number indicator is modified. For example, as illustrated in FIG. **17**, the frame number "**32**" is displayed in a small size on an upper part of the indicator **1750** to indicate the frame of the ultrasound image currently being displayed.

FIG. **18** illustrates the manipulation of the cine bar of FIG. **16** according to an embodiment of the present disclosure.

Referring to FIG. **18**, as illustrated at state (a), the cine bar **1815** is displayed at a lower end of the freeze button **1810**. In addition, the cine bar **1815** receives an input of touches **1830**, **1835** at two points. The touches **1830**, **1835** at the two points may be touched one at a time sequentially, or at the same time. Two indicators **1820**, **1825** may be displayed on the cine bar **1815** corresponding to the two touched points **1830**, **1835**. In addition, at an upper part of each of the touched indicator **1820**, **1825**, frame indicators **1840** and **1845** (e.g., "**32**" and "**88**") representing the order of the frames corresponding to the positions being touched are displayed in large sizes. In addition, between the two indicators **1820**, **1825**, a reproduce button **1850** is further displayed.

As illustrated in state (b), after a touch input is received associated with one **1855** of the two indicators **1820**, **1855** displayed and a manipulation **1860** of the one indicator **1855** is detected along the cine bar **1815**, the indicator **1855** associated with an initial touch may be moved to the second manipulation point **1850** corresponding to a different frame. In an exemplary embodiment, the indicator **1855** associated with the ultrasound image of frame **80** illustrated in state (a) was moved to a second location **1860** indicating the ultrasound image of frame **85** illustrated in state (b).

After confirming a section of ultrasound image to reproduce, the user may input a manipulation **1870** associated with touching a reproduce button **1850** displayed between the two indicators **1820**, **1855** on the cine bar **1815** illustrated in state (c).

Referring to FIG. **18**, the reproduce button **1850** illustrated in state (c) is modified to a freeze button **1875** illustrated in state (d) when a touch input manipulation is detected associated with the reproduce button **1850**. In an exemplary embodiment, the ultrasound image is reproduced from the frame where the left indicator **1820** is located to the frame where the right indicator **1855** is located at a speed of 120 frames per second (fps). While the ultrasound image is being reproduced, a color of the position corresponding to the reproduced frame may be changed on the cine bar **1815** and displayed in order to indicate the degree of reproduction.

The freeze button **1875** and reproduce button **1850** may be toggled and displayed every time a user's touch input is detected.

FIGS. **19**A and **19**B are views illustrating an embodiment of the present disclosure where a layout of a screen is automatically changed by execution of a certain function.

Referring to FIG. **19**A, the screen **1900** may be divided into five regions **1910**, **1920**, **1930**, **1940**, **1950** divided vertically. In addition, on the image region **1940** where the ultrasound image is displayed, an expansion button **1960** for executing an expanding function is displayed.

The user may touch the expansion button **1960** to expand or zoom a portion of the ultrasound image.

Referring to FIG. **19**B, a region **1970** where an expanded image associated with the interaction with the expansion button **1960** is further displayed on the screen **1900**. In an exemplary embodiment, regions **1910**, **1930** that contain options and information illustrated in FIG. **19**A may be unnecessary in the expanded view are not displayed in FIG. **19**B. In addition, the region **1950** in the lowermost part of the screen **1900** is displayed in a reduced size. Accordingly, a space for displaying the expanded image is obtained.

FIGS. **20**A and **20**B illustrates where a layout of a screen is automatically changed by execution of a certain function according to an embodiment of the present disclosure.

Referring to FIG. **20**A, a view illustrating a region **2010** where a quick menu and sub menu of the basic layout is displayed. In an exemplary embodiment, the user may touch a certain button of the sub menu and execute an application within screen **1900** illustrated in FIGS. **19**A and **19**B.

Referring to FIG. **20**B, a state where an arrangement of the objects in the quick menu and sub menu of region **2010** are changed thereby modifying the arrangement of the quick menu horizontally at a lowermost part is illustrated.

Touch Interaction for Moving Expanded Region

FIGS. **21**A to **21**D are views illustrating four manipulations associated with changing a state of display when executing a function of expanding an image.

Referring to FIG. **21**A, on the screen **2100** where the expanding function has been activated, an image region **2110** is displayed at an upper portion, and an expanded region **2120** is displayed on a lower portion. In an exemplary embodiment, a view of the entirety of the photographed ultrasound image and a guide box **2130** for indicating a region to be expanded are displayed within the image region **2110**.

Touch inputs **2140** associated with a manipulation of panning two points touched while viewing an expanded image may be received with the expanded region **2120** where the manipulation indicate that a part of the image region **2110** is to be expanded and viewed within the expanded region **2120**. In an exemplary embodiment, the ultrasound image associated with the image region **2110** may be moved under the fixed guide box **2130** such that the touch input **2140** corresponds to the movement of the expanded image.

Referring to FIG. **21**B, the user may input a touch input manipulation associated with touching and panning within the guide box **2130** in the image region **2110** in order move the part of the image to be expanded and viewed within the expanded region **2120**. More specifically, when the user inputs a panning touch **2150**, the guide box **2130** may be moved over the ultrasound image thereby moving the portion of the ultrasound image to be expanded and viewed within the expanded region **2120**.

Referring to FIG. **21**C, a size of the guide box **2130** may be modified by a manipulation **2160** of touching and dragging one of four vertices of the guide box **2130** thereby expanding the size of the image displayed in the expanded region **2120** at a predetermined rate.

Referring to FIG. **21**D, a plurality of guide boxes **2170**, **2180** are displayed on the image region **2110** and an expanded region **2120** where the expanded image corresponding to each guide box **2170**, **2180** is divided is displayed within the expanded region **2120** of screen **2100**.

Touch Interaction for Setting Focusing and Depth

FIG. **22** is a view illustrating a configuration of an image region according to an embodiment of the present disclosure.

Referring to FIG. **22**, the image region **2200** includes an ultrasound image **2210**, a focus adjuster **2220**, a depth adjuster **2230**, and a gamma/brightness adjuster **2240**.

A region where the ultrasound image **2210** is displayed may be divided into a plurality of depth regions according to depth. In other words, regions of bands corresponding to a same depth of an examination object may be classified into one depth region.

The focus adjuster **2220** displays a depth of a current image that is in focus. More specifically, the focus adjuster **2220** may display a depth in which to focus ultrasound waves being emitted may be configured. A plurality of focuses may be set for different depths where the different focus values affect a resolution of an image corresponding to a depth that is in focus.

The depth adjuster **2230** displays a depth of an ultrasound image currently being displayed. More specifically, the depth adjuster **2230** may display a depth of an ultrasound image to be displayed based on a reflected wave received.

The gamma/brightness adjuster **2240** provides an interface for setting at least one of a gamma, a brightness, and a contrast associated with an image to be output so that the user may identify the image better.

FIG. **23** illustrates a manipulation of setting associated with a focus or a depth of an ultrasound image according to an embodiment of the present disclosure.

Referring to FIG. **23**, state (a) illustrates a manipulation **2330** of a user touching inside an ultrasound image **2310**. A depth **2320** corresponding to a position touched by the user may be made to be in focus.

State (b) illustrates a manipulation **2350** of a user dragging an end corner of depth direction of an ultrasound image **2310**. A depth of the ultrasound image **2310** being displayed may be set to the dragged position.

State (c) illustrates a manipulation **2370** of the user touching one corner **2360** of among both corner regions **2320** parallel to the depth direction of the ultrasound image **2310**. A focus may be set on a depth **2320** corresponding to the touched position.

State (d) illustrates a manipulation **2390** of the user touching the other corner **2380** of among the both corner regions parallel to the depth direction of the ultrasound image **2310**. A depth of the ultrasound image **2310** to be displayed may be set to the depth corresponding to the touched position.

FIG. **24** illustrates a manipulation of setting a focus of an ultrasound image according to another embodiment of the present disclosure.

Referring to FIG. **24**, state (a) illustrates an indicator **2420** that indicates a depth that has been set to be in focus automatically when executing the focus adjuster **2410** for the first time. In addition, the user inputs a touch manipulation **2430** associated with tapping a position corresponding to a depth to be made to be in focus in the focus adjuster **2410**.

State (b) illustrates an additional indicator **2440** is displayed on a point where the touch input of the focus adjuster **2410** has been detected. A depth corresponding to the position where the user's touch has been detected may be set to be in focus. In addition, the user inputs a touch manipulation **2450** associated with tapping the displayed indicator **2440**.

State (c) illustrates a state where the indicator **2440** of the tab manipulation of the focus adjuster **2410** is not displayed at position **2430**. In this case, the focus setting corresponding to the disappeared indicator **2440** is deleted.

FIG. **25** illustrates a manipulation of setting a depth of an ultrasound image according to another embodiment of the present disclosure.

Referring to FIG. **25**, at state (a), the depth adjuster **2510** together with an indicator **2520** may be manipulated to indicate a depth of a current ultrasound image. A number indicating the depth is displayed inside the indicator **2520**. In an exemplary embodiment, the user inputs a touch manipulation **2530** associated with tapping the number of a desired depth.

State (b) illustrates a state where the indicator **2520** has moved to a position where a touch of the depth adjuster **2510** was detected and a number indicating a depth is highlighted and displayed inside the indicator **2520**. A depth of the ultrasound image to be displayed is set to a depth corresponding to a position where the user's tap manipulation has been detected. In an exemplary embodiment, the user inputs a manipulation **2540** of touching and dragging the indicator **2520**.

State (c) illustrates a state where the indicator **2520** moves continuously according to the user's dragging manipulation and the number displayed inside the indicator **2520** is changed to a decimal number. By changing the number inside the indicator **2520** to a decimal number, fine control the depth of the ultrasound image to be displayed may be achieved. The user may input a touch manipulation **2550** of tapping one of up/down buttons arranged at both sides of the depth adjuster **2510**.

State (d) illustrates a state where the indicator **2520** has moved to a position corresponding to a depth of predetermined units associated with the user's manipulation of touching the down button to increase the depth of the ultrasound image to be displayed. In an exemplary embodiment, as illustrated in state (d) of FIG. **25**, the minimum unit of depth that may be changed by the up/down button is 0.5 cm. The user may repeatedly input the touch manipulation **2560** of tapping the down button in order to set the depth to the maximum depth.

State (e) illustrates a state where the indicator **2520** has reached the maximum depth. In an exemplary embodiment, the color of the down button **2570** may be shaded darker in order to visually indicate that the maximum depth has been reached thereby deactivating the down button **2570**.

FIG. **26** is a view illustrating an example of a screen where the manipulation of FIG. **24** has been applied.

Referring to FIG. **26**, in the focus adjuster **2610**, the user may perform a manipulation **2630** by touching a position corresponding to a depth of the ultrasound image desired to be in focus on screen **2600**. By the user's touch manipulation, an additional indicator **2620** may be displayed in the focus adjuster **2610** together with a guideline **2640** consisting of two traverse lines starting from the indicator **2620**.

The guideline **2640** is displayed to overlap the ultrasound image thereby enabling the user to visually identify which part of the ultrasound image the depth to be made to be in focus by the user's touch corresponds to.

FIGS. **27**A to **27**D are views illustrating an example of a screen where the manipulation of FIG. **25** has been applied.

Referring to FIG. **27**A, the user may input a manipulation **2730** of touching the indicator **2720** displayed on the depth adjuster **2710** at screen **2700** and dragging it upwards to modify the depth of focus associated with the ultrasound image **2740**.

Referring to FIG. **27**B, a depth of the ultrasound image **2740** to be displayed changes according to a position in which the indicator **2720** has been dragged within the depth adjuster **2710**. For example, the ultrasound image **2740** is

displayed to reflect any changed depth. In an exemplary embodiment, the unit of gradations of the focus adjuster **2760** may also be changed to correspond to the changed depth.

Referring to FIG. **27**C, the user may input a manipulation **2750** associated with tapping the down button of the depth adjuster **2710** may cause the position of the indicator **2720** to be modified.

Referring to FIG. **27**D, the depth may be changed based on the number of times a manipulation **2750** of tapping the down button is detected may be reflected in predetermined units where the indicator **2720** indicates the resulting depth. In addition, the ultrasound image **2740** is modified to reflect the changed depth.

Touch Interaction for Setting TGC

FIGS. **28**A, **28**B, and **28**C illustrate a manipulation of setting a TGC according to an embodiment of the present disclosure.

Referring to FIG. **28**A, the user may touch a TGC button **2820** of a screen **2800** for setting a TGC.

Referring to FIG. **28**B, a TGC line **2820** is displayed over the ultrasound image **2810**. The TGC line **2820** may be associated with a default configuration or may be a line previously defined by a user. The TGC line **2820** includes a segment **2830** in order to visualize a plurality of manipulating points for adjusting a gain of a reflected wave being received in each of the plurality of depth regions divided from an ultrasound image. In an exemplary embodiment, a size of a gain corresponding to a depth region where a manipulating point belongs is determined based on how much the manipulating point is distanced from a central axis, that is, a criteria.

The user may perform a manipulation of sweeping according to a position at each depth region corresponding to a desired gain from a top end of the ultrasound image to a depth direction.

Referring to FIG. **28**C, a state where a TGC line **2820** is displayed to indicate the manipulating points of each depth region that have moved to points where a user's touch has been detected such that the user may set the TGC by only one touch manipulation is illustrated.

FIGS. **29**A to **29**D are views illustrating a manipulation of changing a TGC setting according to an embodiment of the present disclosure.

Referring to FIG. **29**A, an ultrasound image **2910** has been divided into five depth regions **2920**. In addition, five manipulating points **2930** are arranged, where one manipulating point is associated with each depth region **2920** and a TGC line connected the manipulating points **2930** are displayed.

Referring to FIG. **29**B, the user may set the TGC by directly touching and dragging **2940** one or more of the manipulating points **2930**.

Referring to FIG. **29**C, the user may move the manipulating points **2930** in predetermined units by the manipulation **2950** of touching and dragging the manipulating point within the depth region **2920** associated with the manipulating point **2930**. In an exemplary embodiment, the user may move the manipulating points **2930** in smaller units than the movement distances of the touched points by the dragging through the manipulation **2950** of touching and dragging the periphery of the manipulating points **2930**.

Referring to FIG. **29**D, the user may move the manipulating points **2930** in predetermined units through a manipulation **2960** of tapping the periphery of the manipulating points **2930** in the depth region **2920** associated with the manipulating point **2930**. For example, a direction of movement of the manipulating points may be determined by whether a position of the tapping is left or right of the manipulating points.

The aforementioned TGC setting method is capable of fine controlling a gain with only touch manipulations.

Touch Interaction for Marking

FIG. **30** is a view illustrating a measuring function according to an embodiment of the present disclosure.

Referring to FIG. **30**, an ultrasound image **3010** is displayed on an image region, and over the ultrasound image **3010**, two points **3020**, **3030** are displayed by execution of a caliper function. In addition, a segment **3040** is displayed connecting the two points. In an exemplary embodiment, an expanded image **3050** of the periphery of the point **3030** is displayed on the image region thereby enabling the user to identify the exact position of the marker displayed.

FIGS. **31**A to **31**B illustrate a manipulation of displaying a mark on an ultrasound image according to an embodiment of the present disclosure.

Referring to FIG. **31**A, a mark **3120** is displayed on a point **3110** where a touch has been detected in a still ultrasound image. In an exemplary embodiment, the point **3110** where the touch has been detected may be more than one point or a spatial area. In an exemplary embodiment, the position where the mark **3120** is displayed may be the very center of the point **3110** where the touch has been detected.

The user may change the position where the mark is to be displayed by moving the touched point **3110** on the touch display **110**. As the user releases the initial touch without further manipulation and if no further touch is detected, the mark **3120** will not be further displayed either.

Referring to FIG. **31**B, when a touch **3130** is detected at another point while the initial touch **3110** on a still ultrasound image is maintained, the position of the mark **3120** displayed is fixed. More specifically, when a second touch **3130** is detected after the initial touch **3110**, it is possible to display the mark **3120** displayed by the initial touch **3110** fixatedly on the screen regardless of the movement or release of the touch **3110**.

The aforementioned touch interaction of displaying a mark is capable of displaying a mark precisely without occurrences of dislocating the mark by faltering in releasing the touch.

FIGS. **32**A and **32**B are views illustrating a manipulation of displaying a mark on an ultrasound image according to another embodiment of the present disclosure.

Referring to FIG. **32**A, a touch **3210** for displaying a mark on a still ultrasound image is detected. Then, an expanded image **3220** of the periphery of the point where the touch **3210** has been detected is displayed fixatedly.

A mark **3230** is displayed on the expanded image **3220**. More specifically, on the expanded image **3220**, the mark **3230** may be displayed on a position in the expanded image corresponding to a position in a general image where the mark is to be displayed by the touch **3210**.

The user may perform a manipulation **3240** by dragging the point where the initial touch has been made. In addition, when the touch is dragged, the mark **3230** is moved within the expanded image to marker **3230'**. In an exemplary embodiment, a direction of movement of the mark **3230** may correspond to the direction of the detected dragging manipulation, but the distance of movement of the mark **3230** may be smaller than the distance of movement of the touched point made by the dragging manipulation. In addition, the range in which the mark **3230** may be moved by the dragging manipulation may be restricted to within the expanded image.

Referring to FIG. **32**B, when the dragged touch point **3210'** is retained, a marker **3230'** is displayed on the expanded region **3220**. In addition, when a touch **3250** is detected from another point, the marker **3230'** is displayed fixatedly. More specifically, the user may confirm a point to display a mark **3230** within the expanded region **3230** through a dragging manipulation **3240** of a first touch **321**, and then when a mark **3230'** is moved, a second touch **3250** is performed, thereby fixating the displaying of the mark **3230'**.

The aforementioned touch interaction of displaying a mark is capable of adjusting a position to display the mark precisely with only touch manipulations.

Meanwhile, even if it is explained in the present specification that all the components of the embodiments of the present disclosure are combined to one another or operate in combinations to one another, there is no limitation thereto. That is, as long as it is within the purpose of the present disclosure, one or more of the components may be selectively combined. In addition, one or more of the components may be selectively combined and embodied as a computer program having a program module that performs one or more functions combined in one or more hardware. Codes and code segments that configure such a computer program may be easily conceived by one skilled in the related art. Such a computer program may be stored in a non-transitory computer readable medium, and then be read and executed by the computer, thereby providing the embodiments of the present disclosure.

In an exemplary embodiment, a non-transitory computer readable medium refers to a computer readable medium that is configured to store data semi-permanently unlike a medium that stores data for a short period of time such as a register, cache, and memory and the like. More specifically, the aforementioned programs may be stored in and provided through a non-transitory computer readable medium such as a CD, DVD, hard disk, blue ray disk, USB, memory card, and ROM and the like.

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

What is claimed is:

1. An ultrasound diagnosis apparatus for emitting ultrasound waves to an examination object and obtaining an ultrasound image, the apparatus comprising:

a touch display; and

a controller configured to:

control the touch display to display the ultrasound image, and

in response to receiving a touch input to the ultrasound image displayed on the touch display, set a focus or a depth of the ultrasound image based on a touched position of the touch input,

wherein the ultrasound image comprises a plurality of depth areas that are obtained by focusing focal points on a plurality of depths of the ultrasound image, and

wherein the controller is further configured to:

control display of a plurality of manipulating points corresponding to the plurality of depth areas, and

based on a second touch input for selecting a manipulating point from among the plurality of manipulating points, change a total gain compensation (TGC) of a depth area, from among the plurality of depth areas, corresponding to the selected manipulating point.

2. The apparatus according to claim **1**, wherein the controller is further configured to set a focus region at a depth corresponding to the touched position to be in focus so as to change a resolution of the ultrasound image, when the touch input associated with the ultrasound image is received.

3. The apparatus according to claim **1**, wherein the controller is further configured to:

in response to the receiving of the touch input at a first corner from among two corner regions parallel to a depth direction of the ultrasound image, set the focus of the ultrasound image corresponding to the touched position at the first corner, and

in response to the receiving of the touch input at a second corner, set the depth of the ultrasound image corresponding to the touched position at the second corner.

4. The apparatus according to claim **1**, wherein the controller is further configured to, in response to the receiving of the touch input of dragging a corner region at an end of a depth direction of the ultrasound image which is displayed, set the depth of the ultrasound according to a position associated with a location in which a first corner region or a second corner region is dragged.

5. The apparatus according to claim **1**, wherein the controller is further configured to:

control display of the plurality of manipulating points on each of the plurality of depth areas that configure the ultrasound image, and

in response to the receiving of the second touch input within the depth area corresponding to the selected manipulating point, move one of the plurality of manipulating points according to predetermined units, and change the TGC according to a distance and a direction by which the one of the plurality of manipulating points is moved.

6. The apparatus according to claim **5**, wherein the controller is further configured to, in response to the receiving of the touch input of dragging within the depth area, move the one of the plurality of manipulating points within the depth area where the touch input of dragging is detected according to smaller units than the distance by which the one of the plurality of manipulating points is moved by the touch input of dragging.

7. The apparatus according to claim **5**, wherein the controller is further configured to, in response to the receiving of the touch input of tapping within the depth area, move the one of the plurality of manipulating points within the depth area where the tapping is detected according to the predetermined units based on a number of times the touch input of tapping is received.

8. The apparatus according to claim **1**, wherein the controller, in response to a predetermined event occurring, is further configured to:

control the touch display to display a still image of the ultrasound image,

control the touch display to display a mark on a point where a touch is detected in the still image of the ultrasound image, and

in response to detecting a touch in another point with the touch of the still image of the ultrasound image being retained, fixate a position of the displayed mark.

9. The apparatus according to claim **8**, wherein the controller is further configured to:

control the touch display to display an expanded image of a periphery associated with the point where the touch is detected in the still image of the ultrasound image,

control the touch display to display a mark on the expanded image, wherein the displayed mark on the expanded image corresponds to the point where the touch is detected in the still image of the ultrasound image, and

in response to the touch on the still image of the ultrasound image being dragged, move the mark within the expanded image.

10. The apparatus according to claim **9**, wherein the controller is further configured to move the mark within the expanded image according to smaller units than a distance which the touch on the still image of the ultrasound image is moved by being dragged.

11. A method of controlling an ultrasound diagnosis apparatus for emitting ultrasound waves to an examination object and obtaining an ultrasound image, the method comprising:

displaying a screen that includes the ultrasound image;

receiving a touch input associated with the ultrasound image; and

in response to receiving the touch input, setting a focus or a depth of the ultrasound image based on a touched position of the touch input,

wherein the ultrasound image comprises a plurality of depth areas that are obtained by focusing focal points on a plurality of depths of the ultrasound image, and

wherein the method further comprises:

displaying a plurality of manipulating points corresponding to the plurality of depth areas, and

based on a second touch input for selecting a manipulating point from among the plurality of manipulating points, changing a total gain compensation (TGC) of a depth area, from among the plurality of depth areas, corresponding to the selected manipulating point.

12. The method according to claim **11**, wherein the setting of the focus, in response to the receiving of the touch input associated with the ultrasound image, sets a focus region at a depth corresponding to the touched position to be in focus so as to change a resolution of the ultrasound image.

13. The method according to claim **11**,

wherein the setting of the focus, in response to the receiving of the touch input at a first corner from among two corner regions parallel to a depth direction of the ultrasound image, sets the focus of the ultrasound image corresponding to the touched position at the first corner, and

wherein the setting of the focus, in response to the receiving of the touch input at a second corner, sets the depth of the ultrasound image corresponding to the touched position at the second corner.

14. The method according to claim **11**, wherein the setting of the focus, in response to the receiving of the touch input of dragging a corner region at an end of a depth direction of the ultrasound image which is displayed, sets the depth of the ultrasound image according to a position in which the corner region is dragged.

15. The method according to claim **11**,

wherein the setting of the focus further comprises displaying the plurality of manipulating points on each of the plurality of depth areas associated with the ultrasound image, and

wherein the method further comprises:

in response to the receiving of the second touch input within the depth area corresponding to the selected manipulating point, moving the one of the plurality of manipulating points according to predetermined units, and

changing the TGC based on a distance and a direction by which the one of the plurality of manipulating points is moved.

16. The method according to claim **15**, wherein the moving of the one of the plurality of manipulating points, in response to the receiving of the touch input of dragging within the depth areas, moves the one of the plurality of manipulating points within the depth areas where the dragging is detected according to smaller units than the distance by which the one of the plurality of manipulating points is moved by the touch input of dragging.

17. The method according to claim **15**, wherein the moving of the one of the plurality of manipulating points, in response to receiving a touch input of tapping within the depth areas, moves the one of the plurality of manipulating points within the depth areas where the tapping is detected according to the predetermined units according to a number of times the touch input of tapping is received.

18. The method according to claim **11**, further comprising:

in response to a predetermined event occurring, displaying a still image of the ultrasound image;

displaying a mark on a first point where a touch is detected in the still image of the ultrasound image; and

in response to detecting a touch at a second point with the touch associated with the first point being retained, fixating a position of the displayed mark.

19. The method according to claim **11**, further comprising:

displaying an expanded image of a periphery of a point where the touch input is detected in the still image of the ultrasound image;

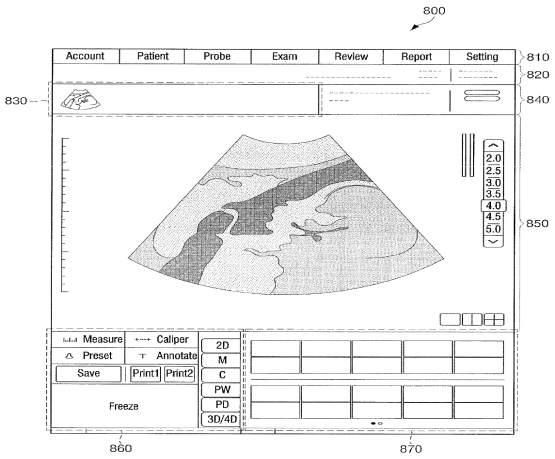
displaying a mark on the expanded image, wherein the mark is associated with the point where the touch input is detected in the still image of the ultrasound image; and

in response to the touch input being detected on the still image of the ultrasound image being dragged, moving the displayed mark within the expanded image.

20. The method according to claim **19**, wherein the moving of the mark within the expanded image includes moving the mark within the expanded image according to smaller units than a distance by which the touch input on the still image of the ultrasound image is moved by being dragged.

* * * * *

专利名称(译)	超声波诊断装置及其控制方法		
公开(公告)号	US10420533	公开(公告)日	2019-09-24
申请号	US14/931105	申请日	2015-11-03
[标]申请(专利权)人(译)	三星电子株式会社		
申请(专利权)人(译)	SAMSUNG ELECTRONICS CO.，LTD.		
当前申请(专利权)人(译)	SAMSUNG ELECTRONICS CO.，LTD.		
[标]发明人	KIM YUN KYUNG KIM HYUN JIN LEE MI YOUNG JUNG SU YEON		
发明人	KIM, YUN-KYUNG KIM, HYUN-JIN LEE, MI-YOUNG JUNG, SU-YEON		
IPC分类号	A61B8/00		
CPC分类号	A61B8/465 A61B8/469 A61B8/467 A61B8/54 A61B8/4405		
优先权	1020150063866 2015-05-07 KR 62/074834 2014-11-04 US		
其他公开文献	US20160120508A1		
外部链接	Espacenet		

摘要(译)

提供了一种用于将超声波发射到检查对象并获得超声图像的超声诊断设备。该设备包括：触摸显示器，配置为显示包括超声图像的屏幕；以及控制器，配置为接收与超声图像相关联的触摸输入，并基于触摸位置设置要显示的超声图像的焦点或深度。 。