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(54) **METHODS AND SYSTEMS FOR CONFIGURING ULTRASOUND SYSTEMS FOR ULTRASOUND EXAMINATIONS**

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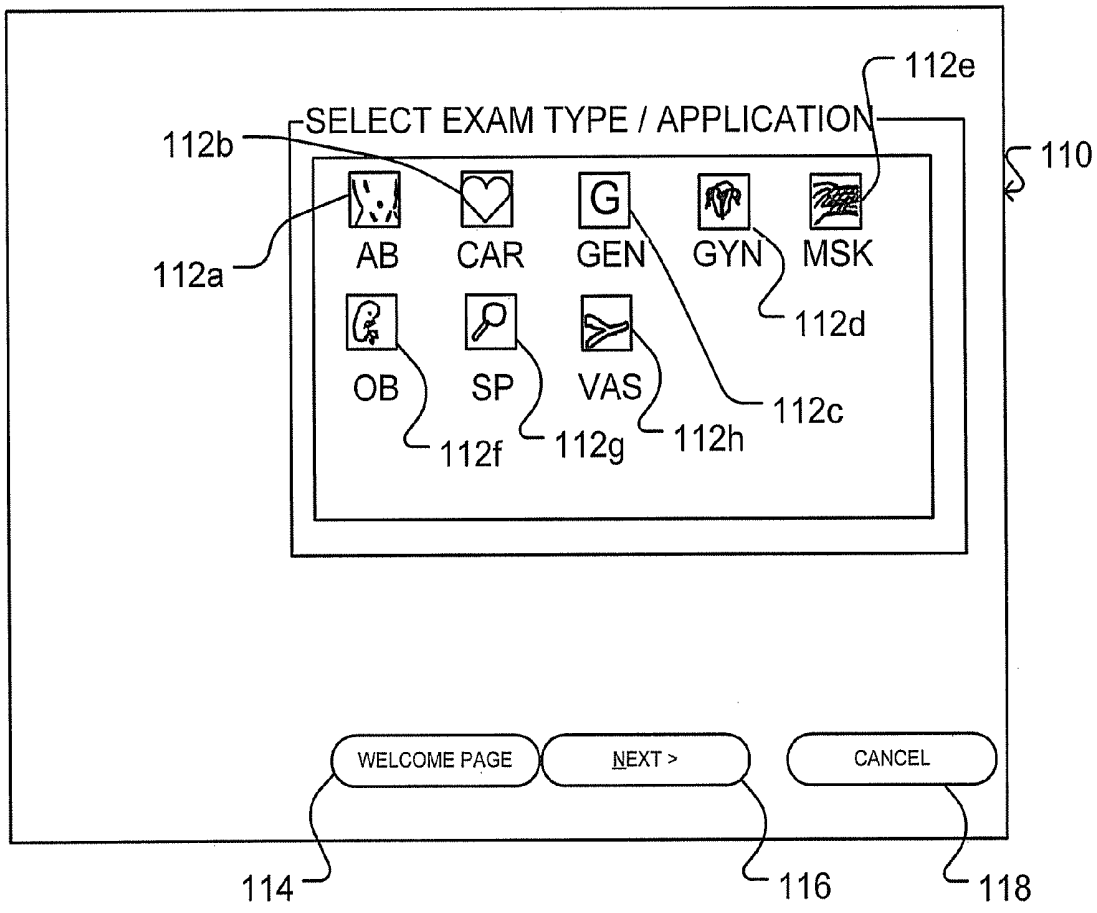
(57) **ABSTRACT**

A method for configuring an ultrasound system for an examination comprises displaying a plurality of examination categories for selection by a user, receiving a user-selected examination category, identifying any probes connected to the ultrasound system, determining which of the connected probes are suitable for the user-selected examination category, for each suitable connected probe, displaying an indication identifying the suitable connected probe for selection by the user, receiving a user-selected probe identification, and, activating a selected probe indicated by the user-selected probe identification for data acquisition.



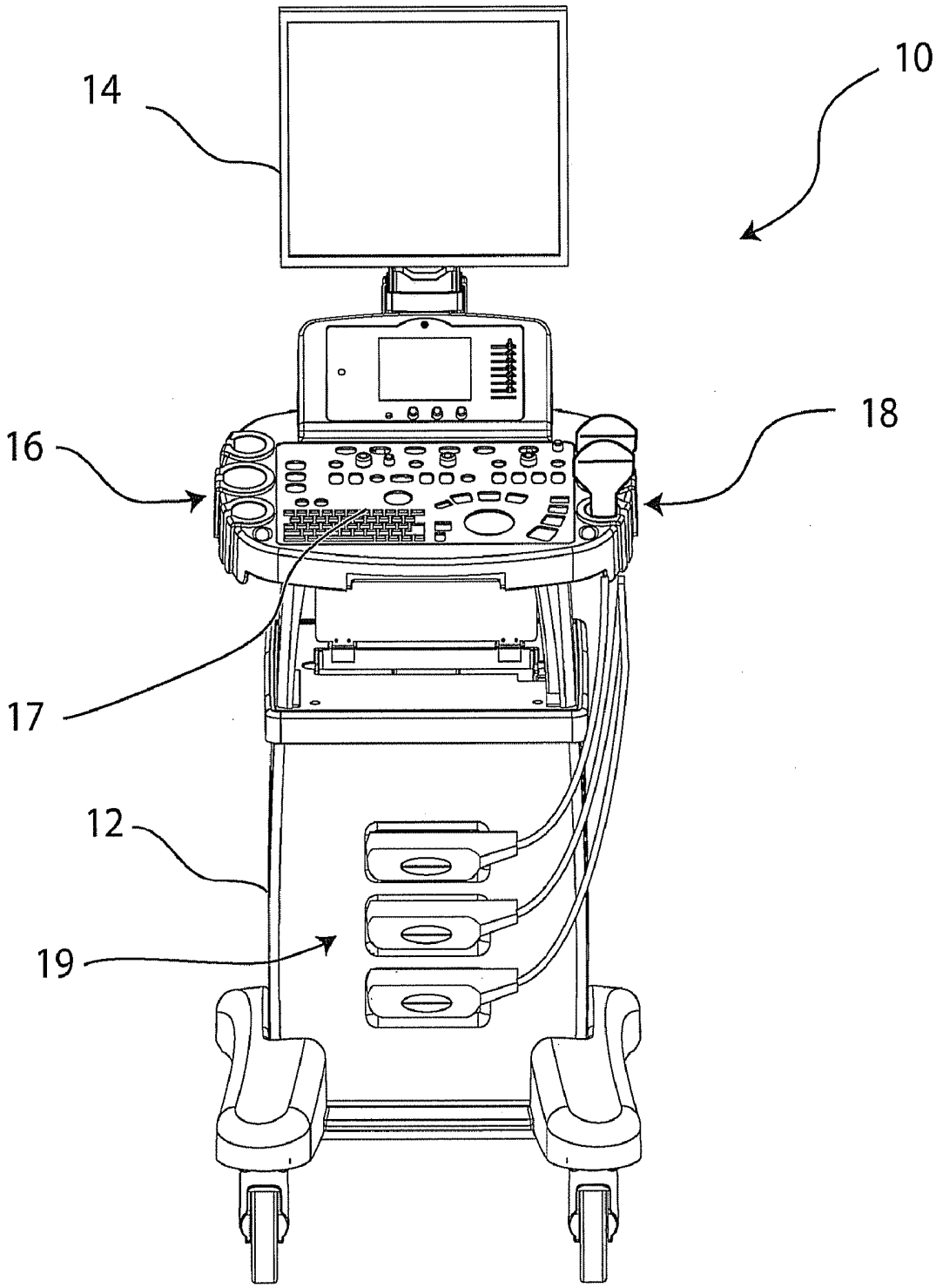



FIGURE 1

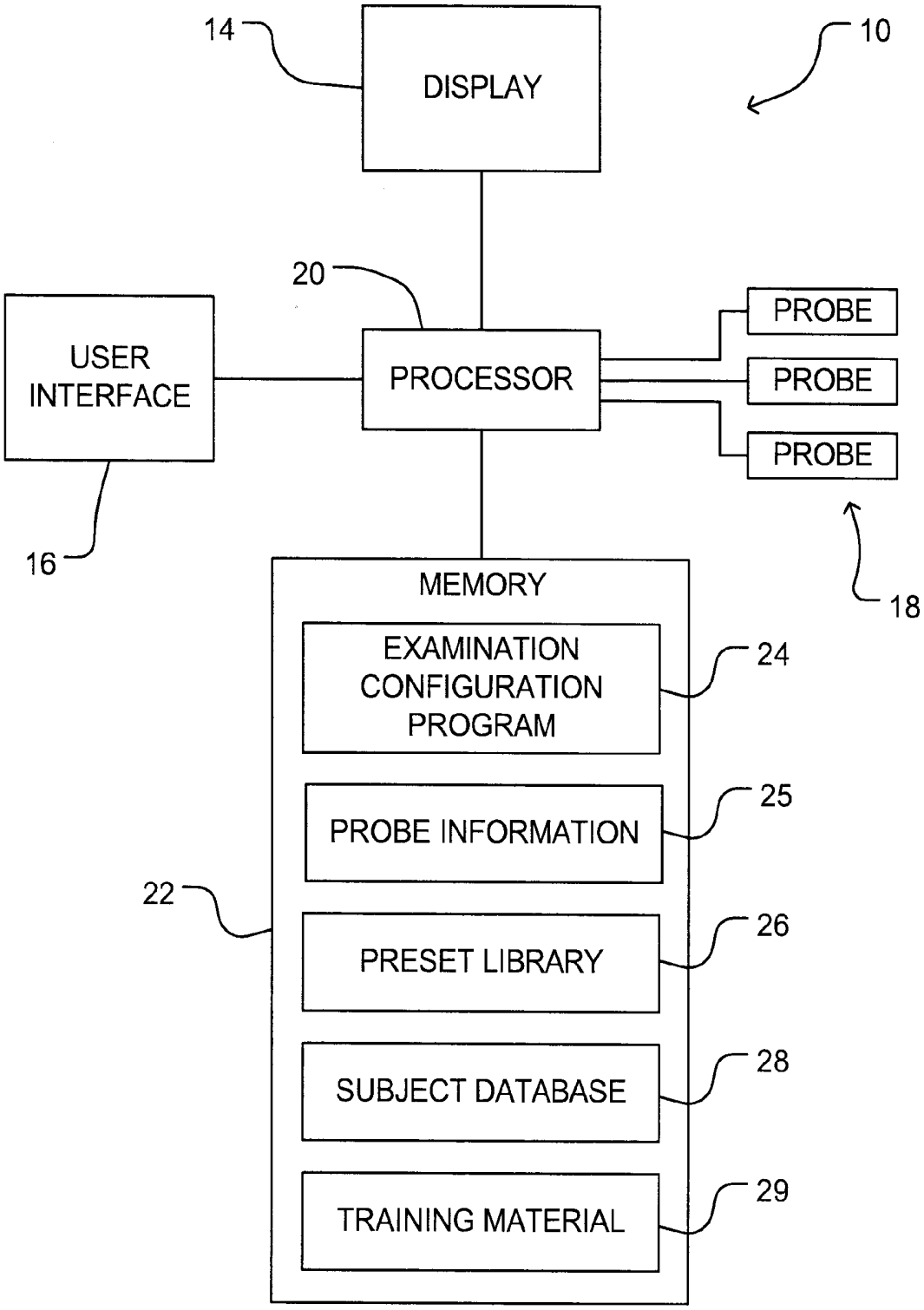

14
DISPLAY
10
20
USER INTERFACE
PROCESSOR
PROBE
PROBE
PROBE
16
18
MEMORY
EXAMINATION CONFIGURATION PROGRAM
24
PROBE INFORMATION
25
22
PRESET LIBRARY
26
SUBJECT DATABASE
28
TRAINING MATERIAL
29

FIGURE 2

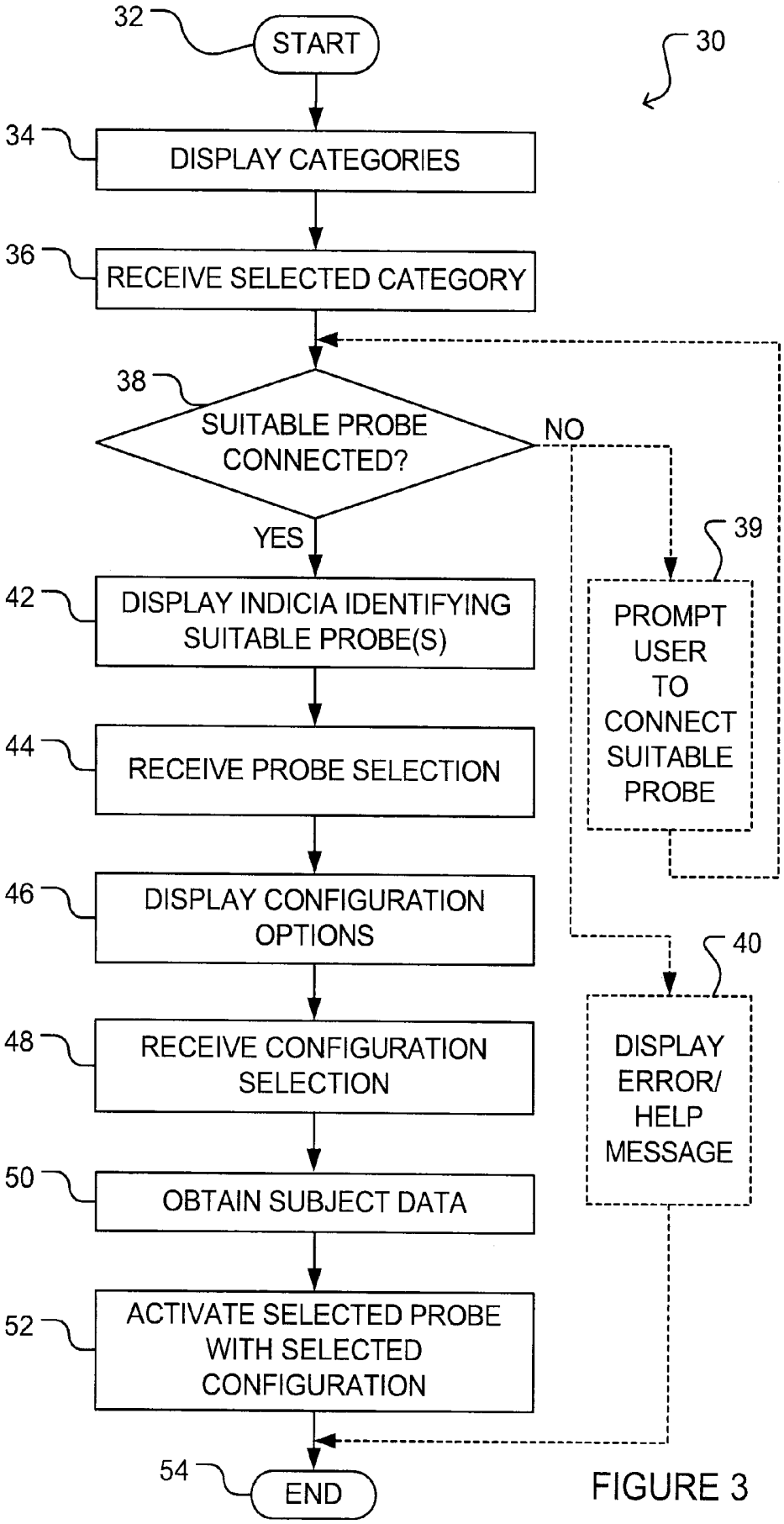

32
START
30
34
DISPLAY CATEGORIES
36
RECEIVE SELECTED CATEGORY
38
SUITABLE PROBE CONNECTED?
NO
YES
39
PROMPT USER TO CONNECT SUITABLE PROBE
42
DISPLAY INDICIA IDENTIFYING SUITABLE PROBE(S)
44
RECEIVE PROBE SELECTION
46
DISPLAY CONFIGURATION OPTIONS
40
DISPLAY ERROR/ HELP MESSAGE
48
RECEIVE CONFIGURATION SELECTION
50
OBTAIN SUBJECT DATA
52
ACTIVATE SELECTED PROBE WITH SELECTED CONFIGURATION
54
END

FIGURE 3

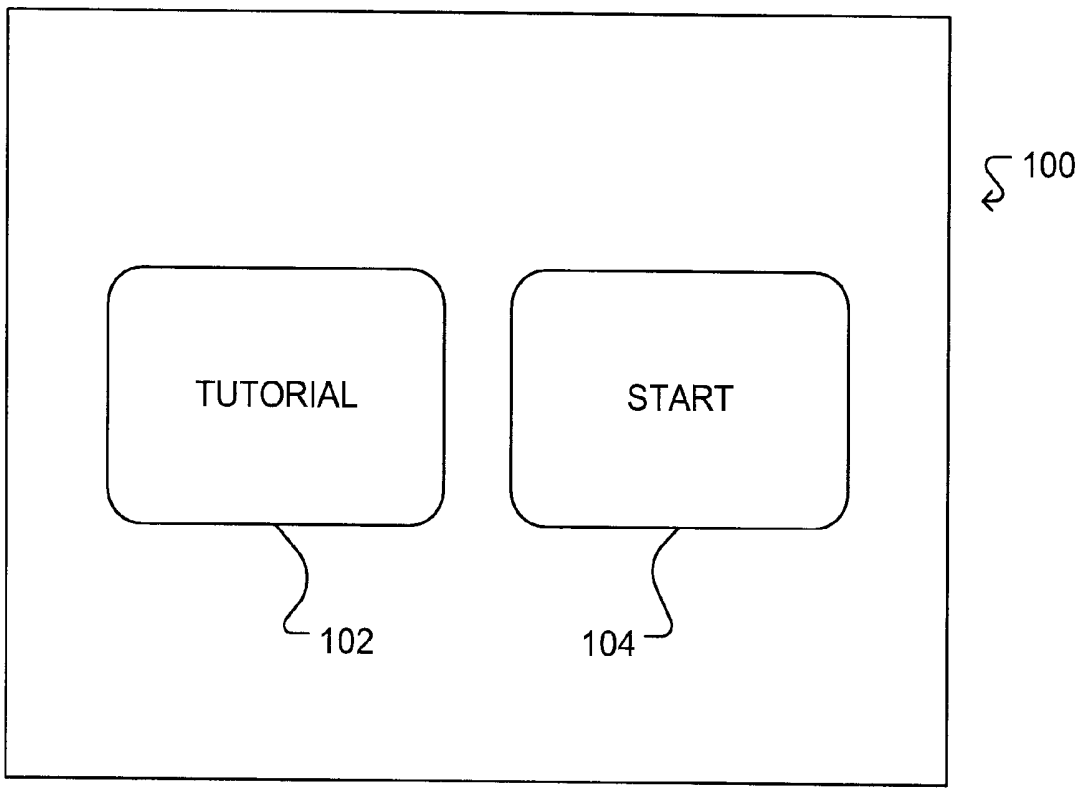



FIGURE 4A

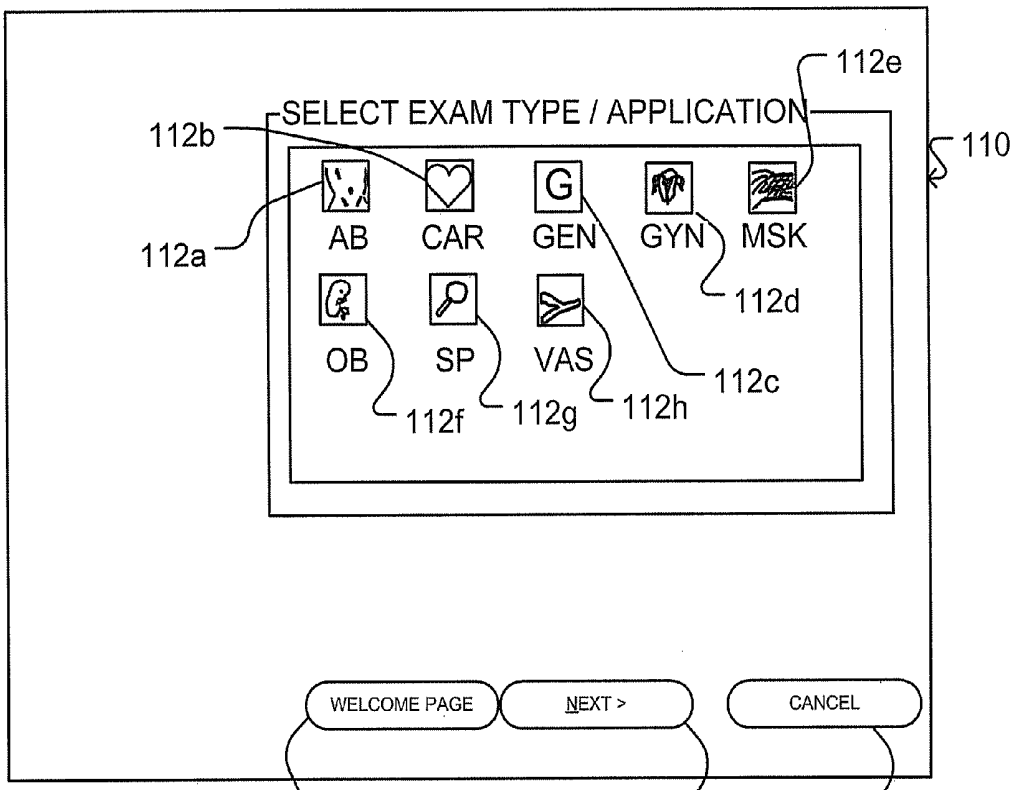



FIGURE 4B

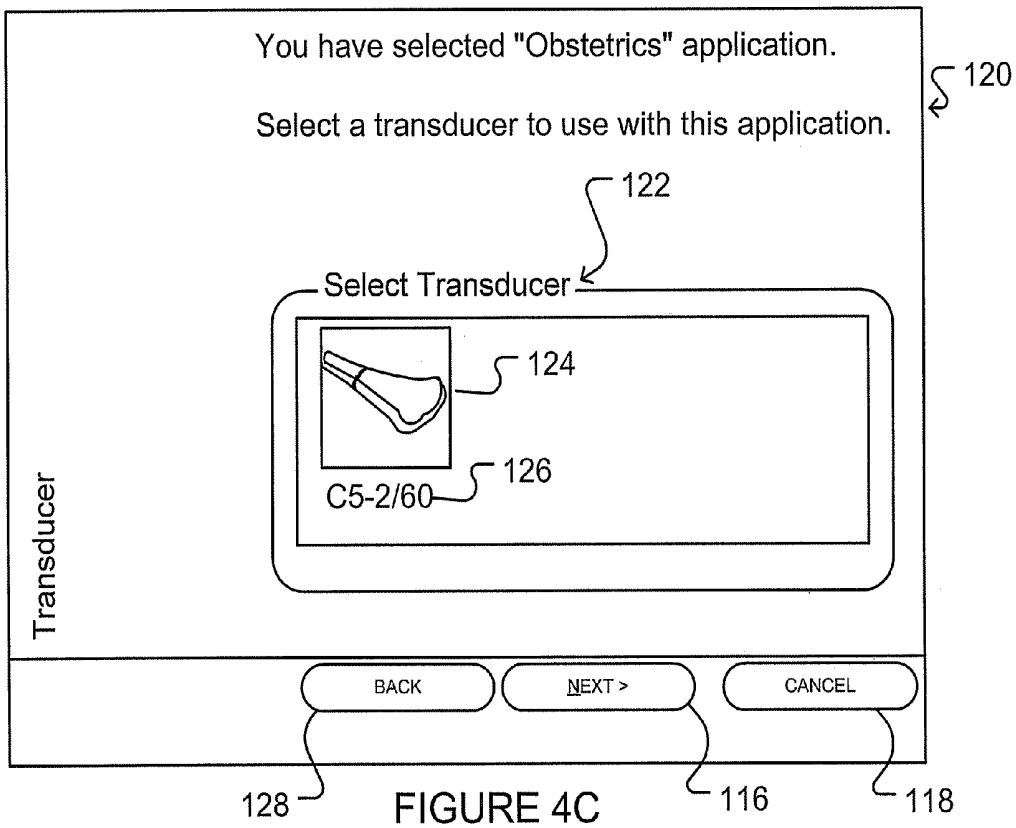



FIGURE 4C

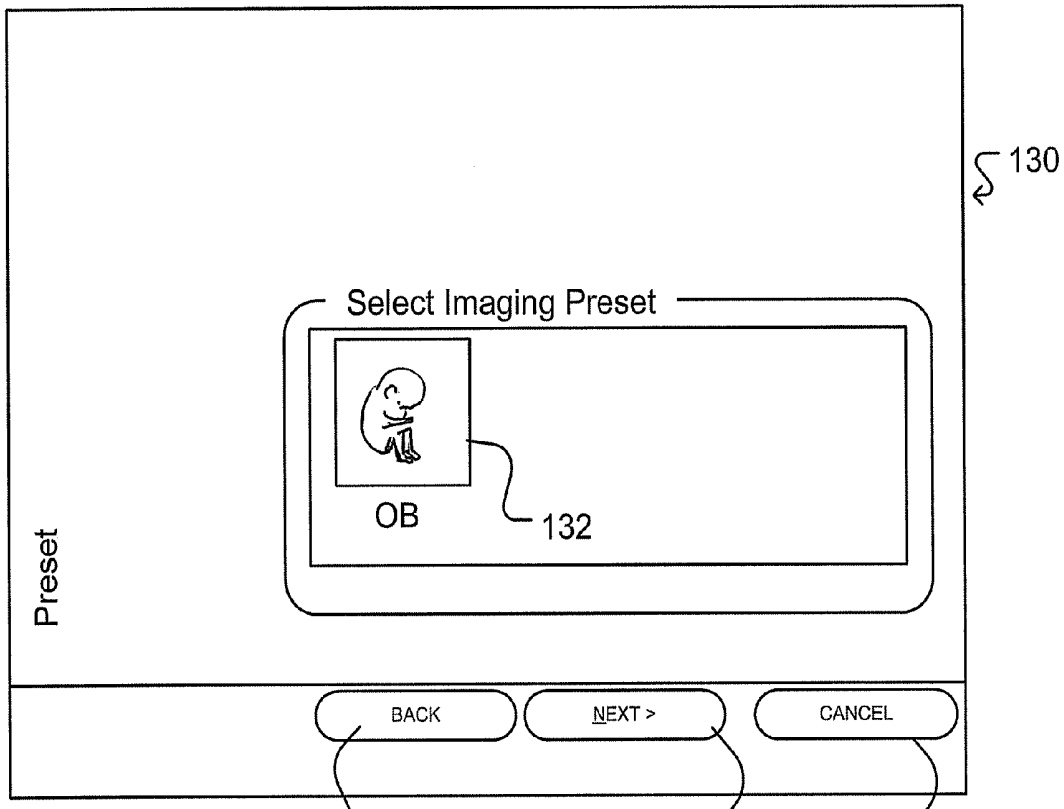



FIGURE 4D

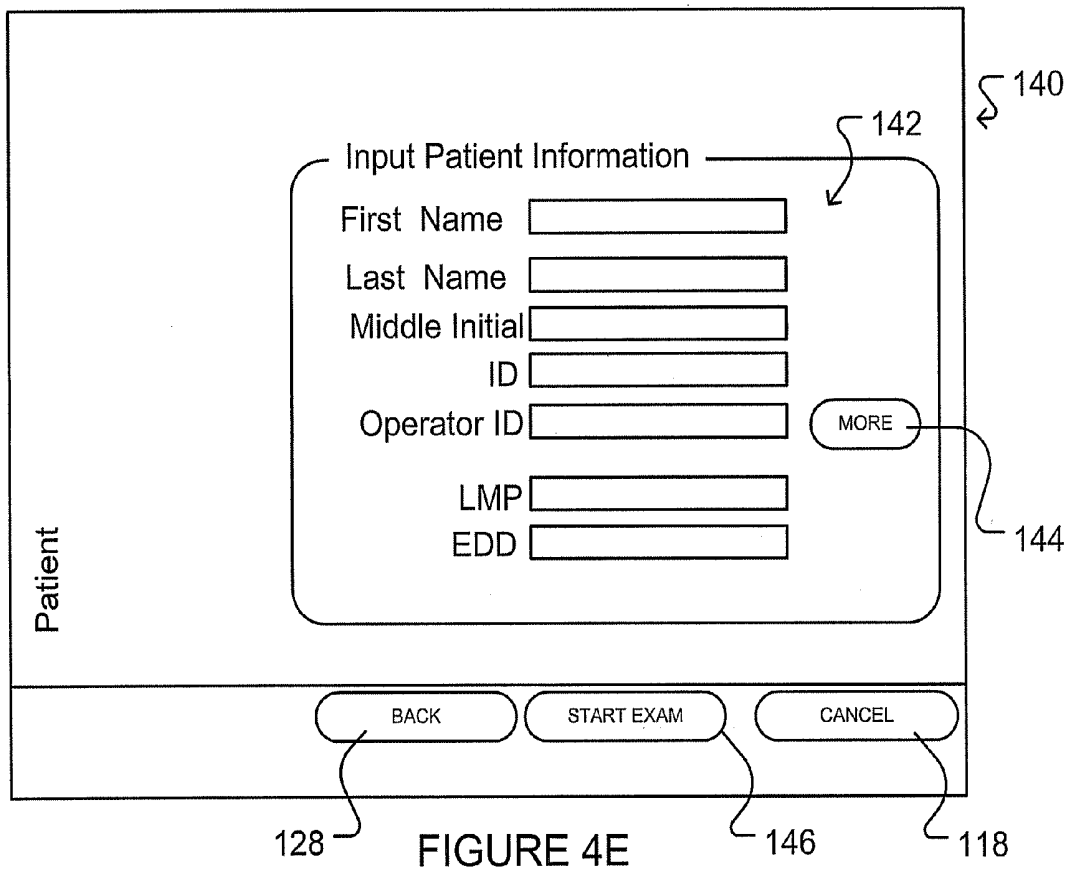



FIGURE 4E

# METHODS AND SYSTEMS FOR CONFIGURING ULTRASOUND SYSTEMS FOR ULTRASOUND EXAMINATIONS

## REFERENCE TO RELATED APPLICATION

[0001] This application claims the benefit under 35 U.S.C. §119 of U.S. application No. 60/744,192 filed 3 Apr. 2006 which is hereby incorporated herein by reference.

## TECHNICAL FIELD

[0002] The invention relates to ultrasound examinations. Certain embodiments of the invention provide methods and systems which assist a user in setting up an ultrasound system for an examination.

## BACKGROUND

[0003] Ultrasound systems are used to explore internal areas of a subject's body. Ultrasound examinations are non-destructive and versatile and can provide high quality images. Images produced from ultrasound examinations may be useful in diagnosing a wide variety of conditions.

[0004] A typical ultrasound system has a transducer, an electronic controller, and a user interface. The transducer typically has several piezoelectric transducer elements coupled to a frame. The transducer may have elements arranged in any of several different geometries, depending upon the medical application for which the transducer will be used. The electronic controller drives the transducer and collects and processes data from the transducer to generate, store, display and manipulate images. The user interface may include various input/output devices which allow a user to control the operation of the ultrasound system.

[0005] In today's practices, a user of ultrasound systems may be required to work on a variety of different systems, all with different layouts. In addition to this, use of ultrasound imaging is expanding into new applications in fields where the users may not be experienced with ultrasound systems.

[0006] There is a need for methods and systems which facilitate the setup of an ultrasound system for an examination.

## SUMMARY

[0007] The following embodiments and aspects thereof are described and illustrated in conjunction with systems, tools and methods which are meant to be exemplary and illustrative, not limiting in scope. In various embodiments, one or more of the above-described problems have been reduced or eliminated, while other embodiments are directed to other improvements.

[0008] One aspect of the invention provides a method for configuring an ultrasound system for an examination. The method comprises displaying a plurality of examination categories for selection by a user, receiving a user-selected examination category, identifying any probes connected to the ultrasound system, determining which of the connected probes are suitable for the user-selected examination category, for each suitable connected probe, displaying an indication identifying the suitable connected probe for selection by the user, receiving a user-selected probe identification, and, activating a selected probe indicated by the user-selected probe identification for data acquisition.

[0009] Another aspect of the invention provides an ultrasound system comprising a processor, a user interface coupled to the processor, a display coupled to the processor and a memory coupled to the processor. The processor has at least one probe connection associated therewith to which a probe may be connected. The memory has computer-readable instructions stored thereon which, when executed by the processor, cause the processor to execute an examination configuration method. The examination configuration method comprises displaying a plurality of examination categories for selection by a user, receiving a user-selected examination category, identifying any probes connected to the ultrasound system, determining which of the connected probes are suitable for the user-selected examination category, for each suitable connected probe, displaying an indication identifying the suitable connected probe for selection by the user, receiving a user-selected probe identification, and, activating a selected probe indicated by the user-selected probe identification for data acquisition.

[0010] In addition to the exemplary aspects and embodiments described above, further aspects and embodiments will become apparent by reference to the drawings and by study of the following detailed descriptions.

## BRIEF DESCRIPTION OF DRAWINGS

[0011] Exemplary embodiments are illustrated in referenced figures of the drawings. It is intended that the embodiments and figures disclosed herein are to be considered illustrative rather than restrictive.

[0012] In drawings which illustrate non-limiting embodiments of the invention:

[0013] FIG. **1** shows an ultrasound system according to one embodiment of the invention.

[0014] FIG. **2** schematically depicts elements of the ultrasound system of FIG. **1**.

[0015] FIG. **3** is a flowchart illustrating a method according to one embodiment of the invention.

[0016] FIGS. **4**A-E are screen shots from a display of an ultrasound system according to one embodiment of the invention.

## DESCRIPTION

[0017] Throughout the following description specific details are set forth in order to provide a more thorough understanding to persons skilled in the art. However, well known elements may not have been shown or described in detail to avoid unnecessarily obscuring the disclosure. Accordingly, the description and drawings are to be regarded in an illustrative, rather than a restrictive, sense.

[0018] The invention provides methods and systems for setting up an ultrasound system for an examination. Certain embodiments guide a user through the process of setting up the ultrasound system. In a system according to one embodiment of the invention, the system presents the user with a choice as to the type of examination to be performed. The system then determines which, if any, of the probes that are connected to the ultrasound system are suitable for perform-

ing the type of examination specified by the user. The system then presents the user with a choice as to which of the suitable connected probes are to be used, and then once the user selects a probe, activates the selected probe for data acquisition.

[0019] FIG. **1** shows an ultrasound system **10** according to one embodiment of the invention. FIG. **2** schematically depicts various elements of ultrasound system **10**. Ultrasound system **10** comprises a housing **12** which houses a processor **20** and a memory **22** (see FIG. **2**). Processor **20** is coupled to a display **14** and a user interface **16**, which may be mounted atop housing **12**. A user of ultrasound system **10** may interact with processor **20** by means of user interface **16**. User interface **16** may comprise a quick start button **17** which a user may press to start a method for configuring an ultrasound system for an examination according to one embodiment of the invention.

[0020] A plurality of probes **18** are detachably coupled to processor **20** by means of a plurality of probe connections **19** associated with processor **20**. Processor **20** is configured to send signals to probes **18** which in turn cause transducers in probes **18** to emit ultrasonic pulses. The ultrasonic pulses from the transducers in probes **18** are directed towards an area of interest in a subject's body. Reflected and/or scattered ultrasonic vibrations (which are sometimes referred to as "echoes") are received by the transducers in probes **18**. The transducers in probes **18** convert the received echoes into electrical signals which are provided to processor **20**. Processor **20** receives the electrical signals and converts the electrical signals into image data. The image data may be provided to display **14** in real time, and/or may be stored in memory **22** or provided to an external system (not shown). The operation of processor **20** may be controlled by software stored in memory **22**.

[0021] Memory **22** has an examination configuration program **24** stored therein. Examination configuration program **24** comprises instructions which, when executed by processor **20**, implement a method for configuring ultrasound system **10** for an ultrasound examination according to one embodiment of the invention. Memory **22** may also have probe information **25** stored therein. Probe information **25** may comprise, for example, a plurality of probe identifications, and a suitability indication for each of a plurality of examination categories for each of the plurality of probe identifications.

[0022] A preset library **26** and a subject database **28** may also be stored in memory **22** to facilitate configuration of an ultrasound system for an examination, as described further below. Preset library **26** may comprise a plurality of sets of operational parameters for probes **18**. Subject database **28** may comprise information identifying a plurality of examination subjects. Alternatively, processor **20** may be in communication with an external database (not shown) wherein sets of operational parameters and subject data are stored. Memory **22** may also have additional software (not shown) stored therein for controlling conventional setup and operation ultrasound system **10**.

[0023] Memory **22** may also have training material **29** stored therein. Training material **29** may comprise, for example, information relating to the use of each probe identified by the plurality of probe identifications for each of the plurality of examination categories. Training material **29** may comprise videos, pictures, text, or other material.

[0024] FIG. **3** illustrates a method **30** of configuring an ultrasound system such as ultrasound system **10** for an ultrasound examination according to one embodiment of the invention. Method **30** begins at block **32** in response to input from a user of an ultrasound system. The input which causes method **30** to begin may comprise, for example, pressing a dedicated button on a keyboard which forms part of the user interface of the system to be setup for the examination. The user could also start method **30** by performing any other suitable action, such as selecting an icon on a display with a pointing device, pressing an area of a touch sensitive display, speaking a start command word recognizable to voice recognition software, etc.

[0025] A welcome page may be displayed to the user at block **32**. FIG. **4**A shows an example screen shot **100** from a screen of a display such as display **14** wherein a welcome page is displayed, the welcome page including a TUTORIAL button **102** and a START button **104**. The user may view informational material about the ultrasound system by pressing TUTORIAL button **102**. For example, when the user presses TUTORIAL button **102**, the ultrasound system may enter into a tutorial mode wherein the user may cause informational material about each control of the user interface to be displayed by touching that control. In tutorial mode, the system may also provide the user with the option to view a video, flash presentation, or other material which provides general application about the ultrasound system and how it may be used. Alternatively, in some embodiments a video, flash presentation, or other material which provides general application about the ultrasound system and how it may be used may automatically be displayed to the user. The user may proceed to configure the ultrasound system by pressing START button **104**, and proceeding to block **34**. Alternatively, method may proceed directly to block **34** without displaying a welcome page.

[0026] At block **34**, one or more categories are displayed to the user. FIG. **4**B shows an example screen shot **110** from a screen of a display such as display **14** wherein eight categories **112***a-h* are displayed. In the illustrated example, categories **112***a-h* respectively comprise Abdominal (AB), Cardiological (CAR), General (GEN), Gynecological (GYN), Musculo-skeletal (MSK), Obstetrics (OB), Small Parts (SP) and Vascular (VAS) examination categories.

[0027] At block **34**, the user may also be presented with the option to refer to training material such as tutorials and the like. For example, the user could press a WELCOME PAGE button **114** to cause the screen to display the welcome page.

[0028] Method **30** proceeds to block **36** when a selected category is received from the user. In the illustrated example, the user selects a category and proceeds to block **36** by highlighting category **112***f* and pressing a NEXT button **116**. The user may also terminate method **30** at any time by pressing a CANCEL button **118**.

[0029] At block **38** the processor determines whether any suitable probes for the selected category are connected to the ultrasound system. The processor may obtain information about the types of any probes connected to the ultrasound system, for example, by querying the probes themselves or by consulting a data structure stored in memory which is updated to reflect disconnections and reconnections of probes to the ultrasound system. The processor may obtain

information about the types of probes which would be suitable for the selected category by consulting a data structure stored in memory which indicates probes suitable for each of a plurality of examination categories.

[0030] If no suitable probes are connected to the ultrasound system (block **38** NO output), method may optionally proceed to either block **39** or block **40**. At block **39** the user is prompted to connect a suitable probe and method **30** returns to block **38**. At block **40** a suitable help and/or error message is displayed, and method **30** proceeds to block **54** and ends.

[0031] If at least one suitable probe is connected to the ultrasound system (block **38** YES output), method proceeds to block **42**. At block **42** indicia identifying the suitable connected probe(s) are displayed to the user. FIG. **4**C shows an example screen shot **120** wherein indicia **122** are displayed, identifying a single suitable connected probe. If there were one or more other suitable connected probes, additional indicia would be displayed for each such probe. Indicia **122** may comprise, for example, a probe icon **124** and a probe name **126**. Probe icon **124** may include, for example, a picture of the associated probe. It is to be understood that indicia **122** could alternatively comprise other features.

[0032] Method **30** proceeds to block **44** when input identifying a selected probe is received from the user. The user may select a probe and proceed to block **44**, for example, by highlighting an indicia which identifies a desired probe and pressing NEXT button **116**. The user may also cause method to return to block **34** to select a different examination category by pressing BACK button **128**.

[0033] At block **46** one or more configurations are displayed to the user for selection. Each configuration may comprise a set of operational parameters for the selected probe and the selected category. The sets of operational parameters may be stored in a data structure accessible by the processor, such as, for example, preset library **26** of FIG. **2**. FIG. **4**D shows an example screen shot **130** wherein a single configuration **132** is displayed.

[0034] Method **30** proceeds to block **48** when a configuration selection is received from the user. The user may select a configuration and proceed to block **48**, for example, by highlighting a configuration and pressing NEXT button **116**. The user may also cause method to return to block **42** to select a different probe by pressing BACK button **128**.

[0035] At block **50** information about the subject of the examination is obtained. Information about the subject may be obtained, for example, by presenting the user with a plurality of data entry fields. FIG. **4**E shows an example screen shot **140** wherein a plurality of data entry fields **142** are displayed to the user. In the illustrated example, data entry fields **142** provide spaces for the user to enter the subject's name and, if applicable, identification (ID). Spaces may also be provided for the user's own identification (Operator ID).

[0036] The user may also enter application-dependent information such as Last Menstruation Period (LMP) and Estimated Delivery Date (EDD). A MORE button **144** may also be provided to allow the user to enter additional information about the subject, the user, and/or the examination to be performed. MORE button **144** may also optionally allow the user to load data about the subject, the user, the examination to be performed and/or information saved from a past examination from a memory of the ultrasound system or from an external data storage medium.

[0037] Method **30** proceeds to block **52** when the user presses a START EXAM button **146**. In some embodiments, START EXAM button **146** may be unavailable or inoperative until the user has provided at least a minimum threshold of subject information (i.e., the name of the subject or the subject's ID). In other embodiments, start exam button **146** may be operative even if the user has not entered any information about the subject.

[0038] In some embodiments, the user may be presented with the option to view training material before starting the examination. The training material may comprise, for example, videos, pictures, or other information related to the selections made by the user. For example, after a user selects the abdominal category and a suitable connected probe for that category, the user may view a video showing the selected probe being used for an Abdominal ultrasound examination. In some embodiments, the user may select a beginner mode wherein training material is automatically displayed after the user has selected the category, the probe, the operational parameters and/or after the user has entered the subject data. In other embodiments, the user may be presented with an option to view training material after making each selection and after entering subject data.

[0039] At block **52** the processor activates the selected probe using the set of operational parameters specified by the selected configuration. Method **30** then proceeds to block **54** and ends. The user may then conduct the ultrasound examination to acquire ultrasound imaging data from the subject. The acquired imaging data may be associated with the subject if the user provided subject information at block **50**. Method **30** thus allows relatively inexperienced users to conduct an ultrasound examination to acquire imaging data and associate the acquired data with the subject. Method **30** could be used with any types of ultrasound system and probes, and the user need not be familiar with the ultrasound system or the probes in order to conduct the ultrasound examination.

[0040] While a number of exemplary aspects and embodiments have been discussed above, those of skill in the art will recognize certain modifications, permutations, additions and sub-combinations thereof.

What is claimed is:

**1**. A method for configuring an ultrasound system for an examination, the method comprising:

displaying a plurality of examination categories for selection by a user;

receiving a user-selected examination category;

identifying any probes connected to the ultrasound system;

determining which of the connected probes are suitable for the user-selected examination category;

for each suitable connected probe, displaying an indication identifying the suitable connected probe for selection by the user;

receiving a user-selected probe identification; and,

activating a selected probe indicated by the user-selected probe identification for data acquisition.

**2**. A method according to claim 1 comprising, after the step of receiving a user-selected probe selection:

displaying indicia identifying one or more sets of operational parameters for the selected probe for selection by the user; and,

receiving a user-selected set of operational parameters, wherein activating the selected probe comprises applying the user-selected set of operational parameters to the selected probe.

**3**. A method according to claim 2 wherein the one or more sets of operational parameters comprise one or more preset sets of operational parameter.

**4**. A method according to claim 2 wherein the one or more sets of operational parameters comprise one or more user-programmable sets of operational parameters.

**5**. A method according to claim 1 wherein displaying an indication identifying each suitable connected probe comprises displaying a picture of each suitable connected probe.

**6**. A method according to claim 1 comprising, before the step of activating the selected probe:

obtaining information identifying a subject of the examination.

**7**. A method according to claim 6 comprising associating data acquired by the activated probe with the identified subject.

**8**. A method according to claim 6 wherein obtaining information identifying the subject comprises requiring the user to provide a minimum threshold of information about the subject.

**9**. A method according to claim 1 comprising, before displaying the plurality of examination categories:

displaying tutorial material to the user, the tutorial material comprising information about how to operate the ultrasound machine.

**10**. A method according to claim 1 wherein the method beings in response to the pressing of a dedicated button of a user interface.

**11**. A method according to claim 1 comprising, before activating the selected probe:

displaying training material to the user, the training material comprising information related to the user-selected examination category and/or the selected probe.

**12**. An ultrasound system comprising:

a processor, the processor having at least one probe connection associated therewith to which a probe may be connected;

a user interface coupled to the processor;

a display coupled to the processor;

a memory coupled to the processor, the memory having computer-readable instructions stored thereon which, when executed by the processor, cause the processor to execute an examination configuration method, the examination configuration method comprising:

displaying a plurality of examination categories for selection by a user;

receiving a user-selected examination category;

identifying any probes connected to the ultrasound system;

determining which of the connected probes are suitable for the user-selected examination category;

for each suitable connected probe, displaying an indication identifying the suitable connected probe for selection by the user;

receiving a user-selected probe identification; and,

activating a selected probe indicated by the user-selected probe identification for data acquisition.

**13**. An ultrasound system according to claim 12 wherein the memory has a preset library stored therein, the preset library comprising a plurality of sets of operational parameters.

**14**. An ultrasound system according to claim 12 wherein the memory has a subject database stored therein, the subject database comprising information identifying a plurality of examination subjects.

**15**. An ultrasound system according to claim 12 wherein the user interface comprises a dedicated button thereon which causes the processor to execute the examination initiation method when pressed by a user.

**16**. An ultrasound system according to claim 12 wherein the memory has probe information stored therein.

**17**. An ultrasound system according to claim 16 wherein the probe information comprises a plurality of probe identifications, and a suitability indication for each of a plurality of examination categories for each of the plurality of probe identifications.

**18**. An ultrasound system according to claim 17 wherein the memory has training material stored therein, the training material comprising information relating to the use of each probe identified by the plurality of probe identifications for each of the plurality of examination categories.

* * * * *

| | | | |
|---|---|---|---|
| 专利名称(译) | 用于配置超声检查的超声系统的方法和系统 | | |
| 公开(公告)号 | US20070232907A1 | 公开(公告)日 | 2007-10-04 |
| 申请号 | US11/616814 | 申请日 | 2006-12-27 |
| [标]申请(专利权)人(译) | PELISSIER LAURENT<br>THOMPSON ROBERT乙 | | |
| 申请(专利权)人(译) | PELISSIER LAURENT<br>THOMPSON ROBERT乙 | | |
| 当前申请(专利权)人(译) | ULTRASONIX医疗法人 | | |
| [标]发明人 | PELISSIER LAURENT<br>THOMPSON ROBERT B | | |
| 发明人 | PELISSIER, LAURENT<br>THOMPSON, ROBERT B. | | |
| IPC分类号 | A61B8/00 | | |
| CPC分类号 | A61B8/00 A61B8/4405 A61B8/467 A61B8/465 A61B8/4438 A61B8/4477 A61B8/461 | | |
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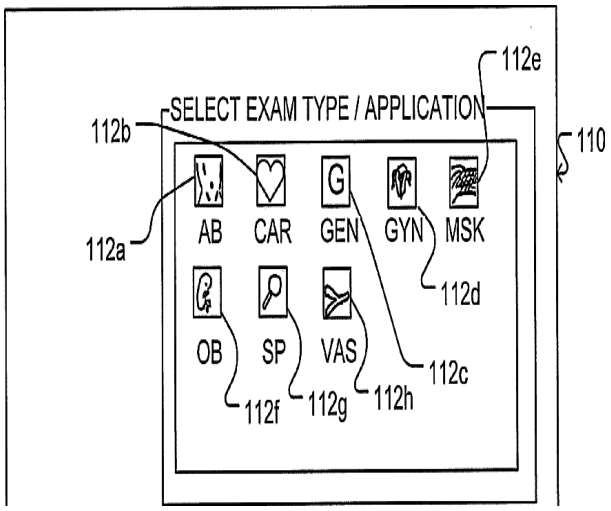
| 外部链接 | Espacenet USPTO | | |


摘要(译)

用于配置用于检查的超声系统的方法包括显示多个检查类别以供用户选择，接收用户选择的检查类别，识别连接到超声系统的任何探针，确定哪个连接的探针适合于用户选择的检查类别，针对每个合适的连接探针，显示标识用于用户选择的合适连接探针的指示，接收用户选择的探针标识，以及激活由用户选择的探针标识指示的所选探针用于数据收购。