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(54) **ULTRASONIC DIAGNOSTIC DEVICE AND METHOD FOR CONTROLLING ULTRASONIC DIAGNOSTIC DEVICE**

ULTRASCHALLDIAGNOSEVORRICHTUNG UND VERFAHREN ZUR STEUERUNG DER ULTRASCHALLDIAGNOSEVORRICHTUNG

DISPOSITIF DE DIAGNOSTIC ULTRASONIQUE ET PROCÉDÉ DE COMMANDE DE DISPOSITIF DE DIAGNOSTIC ULTRASONIQUE

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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to an ultrasound diagnostic apparatus according to the preamble of claim 1 and a method for controlling the ultrasound diagnostic apparatus, and more particularly, to an ultrasound diagnostic apparatus that does not require an operation of a user in a case in which an examination is interrupted.

2. Description of the Related Art

[0002] In the related art, an ultrasound diagnostic apparatus using an ultrasound image has been put to practical use in the medical field. In general, in this type of ultrasound diagnostic apparatus, an ultrasound probe provided with an array transducer scans the body of a patient with an ultrasound beam and receives ultrasound echoes from the patient and the received signal is electrically processed to generate an ultrasound image.

[0003] For example, a method which continuously examines a plurality of predetermined examination parts, such as an extended focused assessment with sonography for trauma (eFAST) examination, is performed in a case in which the ultrasound diagnostic apparatus is used to diagnose a patient. In a case in which the examination is interrupted during the continuous examination, there is a concern that examination data including, for example, an ultrasound image obtained by the examination will not be appropriately stored. For this reason, JP5242023B discloses an ultrasound image diagnostic apparatus that appropriately store examination data even in a case in which an examination is interrupted.
In accordance with the preamble of claim 1, US 2013/163838 A1 discloses an ultrasound diagnostic apparatus in which the examination situation determination unit determines whether the examination has ended or not. To this end, it is determined whether additional images are included in a selected workflow. In that case, a user may indicate whether he wants to return to the workflow or not.

SUMMARY OF THE INVENTION

[0004] However, the user needs to operate the ultrasound image diagnostic apparatus to perform an interruption process in order to interrupt an examination using the ultrasound image diagnostic apparatus disclosed in JP5242023B and it takes a lot of time and effort to perform the interruption process. In particular, in a case in which a patient different from the patient who is being examined needs to be urgently examined, it is difficult to appropriately perform the interruption process.

[0005] The invention has been made in order to solve the problems of the related art and an object of the invention is to provide an ultrasound diagnostic apparatus and a method for controlling the ultrasound diagnostic apparatus that do not require an operation of a user in a case in which an examination is interrupted.

[0006] According to the invention, there is provided an ultrasound diagnostic apparatus comprising the features of claim 1.

[0007] Preferably, the ultrasound diagnostic apparatus further comprises an apparatus control unit that stores the content of the examination in the memory unit so as to be associated with the patient information, generates examination data including at least one ultrasound image generated from the imaging unit by continuously examining the plurality of examination parts, and stores the generated examination data in the memory unit.

[0008] The ultrasound diagnostic apparatus may further comprise a part determination unit that determines the imaging part of the patient on the basis of the ultrasound image generated by the imaging unit. The examination situation determination unit may determine whether the examination of all of the plurality of examination parts related to the content of the examination associated with the patient information has ended on the basis of a determination result of the part determination unit.

[0009] The tag giving unit may give the examination interruption tag to the examination data in a case in which the examination situation determination unit determines that the examination of all of the plurality of examination parts related to the content of the examination associated with the patient information has not ended and may give the examination end tag to the examination data in a case in which the examination situation determination unit determines that the examination of all of the plurality of examination parts related to the content of the examination associated with the patient information has ended. The apparatus control unit may store the examination data, to which the examination interruption tag has been given by the tag giving unit, as examination interruption data in the memory unit so as to be associated with the patient information in a case in which the examination situation determination unit determines that the examination of all of the plurality of examination parts related to the content of the examination associated with the patient information has not ended and may store the examination data, to which the examination end tag has been given by the tag giving unit, as examination end data in the memory unit so as to be associated with the patient information in a case in which the examination situation determination unit determines that the examination of all of the plurality of examination parts related to the content of the examination associated with the patient information has ended.

[0010] The ultrasound diagnostic apparatus may further comprise an examination resumption determination unit that determines whether the examination interruption data associated with the new patient information has been stored in the memory unit, determines whether to

resume the interrupted continuous examination in a case in which it is determined that the examination interruption data associated with the new patient information has been stored in the memory unit, and determines to start a new continuous examination in a case in which the interrupted continuous examination is not resumed.

[0011] The tag giving unit may give the examination end tag to the examination interruption data associated with the new patient information in a case in which the examination resumption determination unit determines to start the new continuous examination, and the apparatus control unit may store the examination interruption data, to which the examination end tag has been given by the tag giving unit, as the examination end data in the memory unit.

[0012] The examination resumption determination unit may determine to resume the interrupted continuous examination in a case in which an examination interruption period from a time when the tag giving unit gives the examination interruption tag to the new patient information to a time when the new patient information is input to the input unit again is less than a preset threshold value and may determine to start a new continuous examination in a case in which the examination interruption period is equal to or greater than the preset threshold value.

[0013] The apparatus control unit may store the examination data, from which the ultrasound image that is not suitable for diagnosis has been removed, in the memory unit according to a determination result of the examination situation determination unit.

[0014] According to the invention, there is provided a method for controlling an ultrasound diagnostic apparatus. The method comprises: a step of transmitting and receiving an ultrasound beam to and from a patient using an ultrasound probe and converting a received signal output from the ultrasound probe into an image to generate an ultrasound image of an imaging part of the patient; a step of allowing a user to input patient information including information for specifying a patient; a step of storing content of an examination for continuously examining a plurality of examination parts of the patient so as to be associated with the patient information; a step of, in a case in which new patient information is input during the continuous examination, determining whether the examination of all of the plurality of examination parts related to the content of the examination associated with the patient information has ended; and a step of giving an examination interruption tag indicating that an examination has been interrupted to the patient information in a case in which it is determined that the examination of all of the plurality of examination parts related to the content of the examination associated with the patient information has not ended and giving an examination end tag indicating that an examination has ended to the patient information in a case in which it is determined that the examination of all of the plurality of examination parts related to the content of the examination associated with the patient information has ended.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015]

Fig. 1 is a block diagram illustrating the configuration of an ultrasound diagnostic apparatus according to Embodiment 1 of the invention.

Fig. 2 is a block diagram illustrating the internal configuration of a receiving unit.

Fig. 3 is a block diagram illustrating the internal configuration of a B-mode processing unit.

Fig. 4 is a flowchart illustrating the operation of Embodiment 1.

Fig. 5 is a diagram illustrating a dialogue displayed in Embodiment 1.

Fig. 6 is a flowchart illustrating an interruption process according to Embodiment 1.

Fig. 7 is a flowchart illustrating an end process according to Embodiment 1.

Fig. 8 is a diagram illustrating a dialogue displayed in a modification example of Embodiment 1.

Fig. 9 is a block diagram illustrating the configuration of Embodiment 2.

Fig. 10 is a flowchart illustrating an interruption process according to Embodiment 2.

Fig. 11 is a flowchart illustrating an interruption process according to Embodiment 3.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0016] Hereinafter, embodiments of the invention will be described with reference to the accompanying drawings.

Embodiment 1

[0017] Fig. 1 illustrates the configuration of an ultrasound diagnostic apparatus according to Embodiment 1 of the invention. The ultrasound diagnostic apparatus includes an ultrasound probe 1 provided with an array transducer 1A. An image generation unit 3 is connected to the ultrasound probe 1 through a transmitting/receiving unit 2 and a display unit 5 is connected to the image generation unit 3 through a display control unit 4.

[0018] The transmitting/receiving unit 2 includes a transmitting unit 6 and a receiving unit 7 that are connected to the array transducer 1A of the ultrasound probe 1 and a transmission/reception control unit 8 that is connected to the transmitting unit 6 and the receiving unit 7. The image generation unit 3 includes a brightness-mode (B-mode) processing unit 9 that is connected to the receiving unit 7 of the transmitting/receiving unit 2 and a digital scan converter (DSC) 10 that is connected to the B-mode processing unit 9. The display control unit 4 is connected to the DSC 10.

[0019] Apart determination unit 11 and an apparatus control unit 12 are connected to the DSC 10 of the image generation unit 3.

[0020] The apparatus control unit 12 is connected to the transmission/reception control unit 8 of the transmitting/receiving unit 2, the B-mode processing unit 9 of the image generation unit 3, the display control unit 4, and the part determination unit 11. In addition, an examination situation determination unit 13 is connected to the apparatus control unit 12. A tag giving unit 14 is connected to the examination situation determination unit 13 and the apparatus control unit 12. Furthermore, a memory unit 15, an input unit 16, and a storage unit 17 are connected to the apparatus control unit 12.

[0021] The array transducer 1A of the ultrasound probe 1 includes a plurality of ultrasound transducers that are one-dimensionally or two-dimensionally arranged. Each of the ultrasound transducers transmits ultrasonic waves in response to a driving signal supplied from the transmitting unit 6. In addition, each of the ultrasound transducers receives ultrasound echoes from a patient and outputs a received signal. Each ultrasound transducer is, for example, a transducer in which electrodes are formed at both ends of a piezoelectric body made of piezoelectric ceramic typified by lead zirconate titanate (PZT), a polymer piezoelectric element typified by polyvinylidene difluoride (PVDF), or a piezoelectric crystal typified by lead magnesium niobate-lead titanate (PMN-PT).

[0022] In a case in which a pulsed voltage or a continuous-wave voltage is applied to the electrodes of the transducer, the piezoelectric body is expanded and contracted and pulsed or continuous ultrasonic waves are generated from each transducer. The ultrasonic waves are combined to form an ultrasound beam. In addition, each transducer receives propagated ultrasonic waves, is expanded and contracted, and generates an electric signal. The electric signal is output as a received ultrasound signal.

[0023] The transmitting/receiving unit 2 transmits and receives an ultrasound beam and the image generation unit 3 generates a B-mode image signal. Therefore, the transmitting/receiving unit 2 and the image generation unit 3 form an imaging unit. The transmitting unit 6 of the transmitting/receiving unit 2 includes, for example, a plurality of pulse generators, adjusts the amount of delay of each driving signal such that the ultrasonic waves transmitted from a plurality of ultrasound transducers in the array transducer 1A form an ultrasound beam, on the basis of a transmission delay pattern selected according to a control signal from the transmission/reception control unit 8, and supplies the driving signals to the plurality of ultrasound transducers.

[0024] As illustrated in Fig. 2, the receiving unit 7 has a configuration in which an amplification unit 18 and an analogue/digital (A/D) conversion unit 19 are sequentially connected in series. The receiving unit 7 amplifies the received signals transmitted from each ultrasound transducer of the array transducer 1A with the amplification unit 18 and performs A/D conversion for the received signals with the A/D conversion unit 19 to generate digital received data.

[0025] The transmission/reception control unit 8 controls the transmitting unit 6 and the receiving unit 7 on the basis of various control signals transmitted from the apparatus control unit 12 such that the transmission of an ultrasound pulse to the patient and the reception of an ultrasound echo from the patient are repeated at a pulse repetition frequency (PRF) interval.

[0026] The B-mode processing unit 9 of the image generation unit 3 has a configuration in which a beam former 20 and a signal processing unit 21 are sequentially connected in series, as illustrated in Fig. 3. The beam former 20 applies a delay to each received data item output from the receiving unit 7 of the transmitting/receiving unit 2 according to a sound speed or a sound speed distribution set on the basis of a reception delay pattern selected according to a control signal from the apparatus control unit 12 and adds the received data to perform a reception focusing process. A sound ray signal in which the focus of an ultrasound echo subjected to phasing addition is narrowed is generated by the reception focusing process.

[0027] The signal processing unit 21 corrects the attenuation of the sound ray signal generated by the beam former 20 depending on the vibration of the reflection position of ultrasonic waves and then performs an envelope detection process. In addition, the signal processing unit 21 performs various types of necessary image processing including a gradation process to generate a B-mode image signal which is tomographic image information related to the tissues of the patient.

[0028] The DSC 10 of the image generation unit 3 converts the B-mode image signal generated by the signal processing unit 21 into an image signal based on a general television signal scanning system (raster conversion).

[0029] The display control unit 4 displays a B-mode image on the display unit 5 on the basis of the B-mode image signal generated by the image generation unit 3.

[0030] The display unit 5 includes a display device, such as a liquid crystal display (LCD), and displays the B-mode image under the control of the display control unit 4.

[0031] The part determination unit 11 determines an imaging part of the patient on the basis of the B-mode image signal generated by the image generation unit 3.

[0032] Here, data including at least one B-mode image signal obtained by examining an examination part of the patient, the determination result of an imaging part of the patient by the part determination unit 11, and various kinds of information obtained by examination is defined as examination data. In addition, the examination data is configured such that a plurality of ultrasound images can be sequentially displayed and viewed as a motion picture.

[0033] In a case in which a continuous examination for

continuously examining a plurality of predetermined examination parts in a predetermined order is performed, the plurality of examination parts and the examination order are defined as the content of the examination.

[0034] The memory unit 15 stores the content of various types of continuous examinations typified by an eFAST examination that continuously examines the examination parts in the order of, for example, the right abdomen, the left abdomen, the bladder, the heart, the right lung, and the left lung in advance. In addition, the memory unit 15 stores examination data obtained by examining the patient.

[0035] The memory unit 15 can be formed by a recording medium, such as a hard disk, a flexible disk, a magneto-optical disk (MO), a magnetic tape (MT), a random access memory (RAM), a compact disk read only memory (CD-ROM), a digital versatile disk read only memory (DVD-ROM), a secure digital card (SD card), a compact flash card (CF card), or a universal serial bus memory (USB memory). It is preferable that the memory unit 15 is formed by a server so as to store the examination data through a network. In this case, for example, the memory unit 15 can exchange the examination data with remote hospitals.

[0036] The storage unit 17 stores, for example, an operation program and can have the same configuration as the memory unit 15.

[0037] The input unit 16 is used by a user to perform an input operation and may include, for example, a keyboard, a mouse, a trackball, and a touch panel.

[0038] Here, identification symbols including information for specifying the patient, such as the name, sex, blood type, birth date, and phone number of the patient, are defined as patient information (patient specification information). An example of the patient information (patient specification information) is a patient identification (ID) number. The patient information (patient specification information) is input to the input unit 16 by an input operation of the user.

[0039] In a case in which the patient information (patient specification information) is input to the input unit 16, the apparatus control unit 12 associates the patient information (patient specification information) with the content of the examination for continuously examining a plurality of examination parts, such as the eFAST examination, stored in the memory unit 15 in advance. Then, the memory unit 15 stores the content of the examination associated with the patient information (patient specification information).

[0040] In addition, in a case in which new patient information (patient specification information) different from the patient information (patient specification information) of the patient who is currently being examined is input to the input unit 16, the apparatus control unit 12 outputs the new patient information (patient specification information) to the examination situation determination unit 13.

[0041] The apparatus control unit 12 generates examination data and stores the examination data in the memory unit 15.

[0042] In addition, the apparatus control unit 12 controls the transmission/reception control unit 8, the B-mode processing unit 9, the DSC 10, the display control unit 4, the part determination unit 11, the examination situation determination unit 13, and the tag giving unit 14 on the basis of commands input to the input unit 16 by the user.

[0043] In a case in which new patient information (patient specification information) different from the patient information (patient specification information) of the patient who is currently being examined is input to the input unit 16, the examination situation determination unit 13 reads the content of the examination associated with the patient information (patient specification information) from the memory unit 15 and automatically determines whether the examination of all of the examination parts related to the content of the examination associated with the patient information (patient specification information) has ended.

[0044] For example, in a case in which an eFAST examination for examining the right abdomen, the left abdomen, the bladder, the heart, the left lung, and the right lung is performed, the patient information (patient specification information) is associated with the content of the eFAST examination. Then, the examination situation determination unit 13 determines whether the examination of all of the examination parts has ended. Specifically, the examination situation determination unit 13 reads the examination data stored in the memory unit 15. In a case in which the read examination data includes the determination result of the part determination unit 11 indicating that all of the examination parts related to the content of the eFAST examination have been determined to be the imaging parts of the patient, the examination situation determination unit 13 determines that the examination of all of the examination parts related to the content of the eFAST examination has ended.

[0045] In a case in which the examination situation determination unit 13 determines that the examination of all of the plurality of examination parts related to the content of the examination associated with the patient information (patient specification information) has not ended, that is, the current examination has been interrupted, the tag giving unit 14 gives an examination interruption tag indicating that the examination has been interrupted to the patient information (patient specification information). In addition, the tag giving unit 14 gives the examination interruption tag to the examination data stored in the memory unit 15. The apparatus control unit 12 stores the examination data, to which the examination interruption tag has been given, as examination interruption data in the memory unit 15 so as to be associated with the patient information (patient specification information) to which the examination interruption tag has been given.

[0046] In addition, in a case in which the examination situation determination unit 13 determines that the ex-

amination of all of the plurality of examination parts related to the content of the examination associated with the patient information (patient specification information) has ended, that is, the current examination has ended, the tag giving unit 14 gives an examination end tag indicating that the examination has ended to the patient information (patient specification information). In addition, the tag giving unit 14 gives the examination end tag to the examination data stored in the memory unit 15. The apparatus control unit 12 stores the examination data, to which the examination end tag has been given, as examination end data in the memory unit 15 so as to be associated with the patient information (patient specification information) to which the examination end tag has been given.

[0047] The image generation unit 3, the display control unit 4, the transmission/reception control unit 8 of the transmitting/receiving unit 2, the part determination unit 11, the apparatus control unit 12, the examination situation determination unit 13, and the tag giving unit 14 are formed by a central processing unit (CPU) and an operation program that causes the CPU to perform various processes. However, these units may be formed by digital circuits. In addition, some or all of the image generation unit 3, the display control unit 4, the transmission/reception control unit 8 of the transmitting/receiving unit 2, the part determination unit 11, the apparatus control unit 12, the examination situation determination unit 13, and the tag giving unit 14 may be integrated into one CPU.

[0048] Next, the operation of Embodiment 1 will be described with reference to a flowchart illustrated in Fig. 4.

[0049] First, in Step S1, the user operates the input unit 16 to input the patient information (patient specification information) of the patient to be examined to the input unit 16. Here, the memory unit 15 stores the content of various types of continuous examinations typified by the eFAST examination that continuously examines, for example, the right abdomen, the left abdomen, the bladder, the heart, the right lung, and the left lung in this order in advance. In addition, the user operates the input unit 16 to select the type of continuous examination to be performed on the patient corresponding to the input patient information (patient specification information), for example, the eFAST examination. Then, the apparatus control unit 12 associates the content of the eFAST examination with the patient information (patient specification information) input to the input unit 16 and the memory unit 15 stores the content of the eFAST examination associated with the patient information (patient specification information).

[0050] In Step S2, the transmitting/receiving unit 2 performs the transmission and reception of ultrasound beams and scanning, using the plurality of ultrasound transducers in the array transducer 1A of the ultrasound probe 1. Each ultrasound transducer which has received ultrasound echoes from the patient outputs a received signal to the receiving unit 7. The receiving unit 7 performs amplification and A/D conversion for the received signal to generate received data.

[0051] In, Step S3, the received data is input to the image generation unit 3. The B-mode processing unit 9 performs the reception focusing process for the received data and the DSC 10 converts the received data into a signal to generate a B-mode image signal. The B-mode image signal is output from the image generation unit 3 to the display control unit 4 and a B-mode image is displayed on the display unit 5.

[0052] The B-mode image signal output from the DSC 10 of the image generation unit 3 is input to the part determination unit 11. In Step S4, the part determination unit 11 determines an imaging part of the patient. For example, in a case in which the right abdomen that is examined at the beginning of the eFAST examination is examined, a captured image of the right abdomen is included in the B-mode image signal and the part determination unit 11 determines that the imaging part of the patient is the right abdomen.

[0053] A known matching technique can be used to determine the imaging part of the patient on the basis of the B-mode image signal. In addition to the matching technique, for example, machine learning or a general image recognition method may be used to calculate similarity and the imaging part may be determined on the basis of the calculated similarity.

[0054] Here, the apparatus control unit 12 generates examination data including the B-mode image signal of the right abdomen output from the DSC 10 of the image generation unit 3, the determination result of the part determination unit 11 indicating that the imaging part of the patient is the right abdomen, and various kinds of information obtained by the examination. The B-mode image of the right abdomen is associated with the determination result of the part determination unit 11. In a case in which the user diagnoses the patient with the B-mode image, the user can refer to the determination result indicating that the imaging part of the patient is the right abdomen.

[0055] Then, the apparatus control unit 12 stores the examination data in the memory unit 15.

[0056] Then, in Steps S5 and S6, the B-mode image signal of the right abdomen is generated and the B-mode image of the right abdomen is displayed on the display unit 5. In addition, the B-mode image signal is added to the examination data. Then, in Step S7, it is determined whether new patient information (patient specification information) different from the patient information (patient specification information) of the patient who is currently being examined has been input to the input unit 16. In a case in which it is determined that the new patient information (patient specification information) has not been input to the input unit 16, it is determined whether the examination of the examination part that is being examined, that is, the right abdomen has ended in Step S8.

[0057] The user may operate the input unit 16 to determine whether the examination of the part that is being examined has ended. Alternatively, it may be automatically determined that the imaging part of the B-mode im-

age signal has been changed from, for example, the right abdomen to the left abdomen and it may be determined whether the examination of the part that is being examined has ended. Specifically, in general, in a case in which the imaging part is changed, the probe is separated from the surface of the body and emits ultrasonic waves to the air. Therefore, it is possible to determine whether the imaging part has been changed by detecting the aerial emission state (a state in which a reflected signal is not obtained).

[0058] Until it is determined in Step S7 that new patient information (patient specification information) has been input to the input unit 16 or it is determined in Step S8 that the examination of the right abdomen that is being examined has ended, Steps S5 to S8 are repeated and the right abdomen is continuously diagnosed. In this way, various kinds of information including, for example, the B-mode image signal of the right abdomen and the diagnosis results of the user obtained by the examination are accumulated as the examination data.

[0059] In a case in which it is determined in Step S8 that the examination of the right abdomen that is being examined has ended, the examination result is reflected in a dialogue D illustrated in Fig. 5. The dialogue D shows the situation of the continuous examination that is currently being performed and includes a text box T for inputting the patient information (patient specification information) and a plurality of situation display portions L indicating whether the examination of each examination part related to the continuous examination that is currently being performed has ended. In a case in which the corresponding examination parts have not been examined, "unexamined" is displayed in the plurality of situation display portions L. In a case in which the corresponding examination parts have been examined, ultrasound images corresponding to the examination parts are displayed in the plurality of situation display portions L.

[0060] The patient corresponding to the patient information (patient specification information) is specified by the patient information (patient specification information) input to the text box T and the examination situation of the patient are displayed in the dialogue D. As described above, the examination result indicating that the examination of the right abdomen has ended is reflected in the dialogue D in such a way that an ultrasound image of the right abdomen is displayed in the situation display portion L corresponding to the right abdomen.

[0061] In addition, the user can operate the input unit 16 such that the dialogue D and the B-mode image are displayed on the display unit 5. The user can operate the input unit 16 such that only the dialogue D or only the B-mode image is displayed on the display unit 5.

[0062] Then, in Step S9, it is determined whether the examination of all of the examination parts related to the content of the eFAST examination associated with the patient information (patient specification information) input to the input unit 16 has ended.

[0063] In a case in which it is determined in Step S9 that the examination of all of the examination parts related to the content of the eFAST examination associated with the patient information (patient specification information) input to the input unit 16 has not ended, the process returns to Step S2. For example, in a case in which the left abdomen is examined after the examination of the right abdomen ends, it is determined that the examination of all of the examination parts related to the content of the eFAST examination associated with the patient information (patient specification information) has not ended and the process returns to Step S2.

[0064] In Steps S2 and S3, a B-mode image signal of the left abdomen is generated. Then, in Step S4, the part determination unit 11 determines that the left abdomen captured in the B-mode image signal output from the DSC 10 of the image generation unit 3 is the imaging part of the patient. In Steps S5 and S6, a B-mode image signal of the left abdomen is generated. Then, the B-mode image signal of the left abdomen and the determination result indicating that the imaging part of the patient is the left abdomen are added to the examination data.

[0065] In this way, Steps S2 to S9 are repeated and the examination of a plurality of examination parts related to the content of the eFAST examination associated with the patient information (patient specification information) ends sequentially. The ultrasound images corresponding to each examination part are displayed in the plurality of situation display portions L of the dialogue D illustrated in Fig. 5.

[0066] In a case in which the ultrasound images are displayed in all of the situation display portions L, the user determines whether to end the examination in Step S9. Specifically, an icon for performing an end process is displayed in a blank B of the dialogue D. In a case in which the user selects the icon through the input unit 16, the examination is determined to end and the determination result is output from the apparatus control unit 12 to the tag giving unit 14. Then, in Step S11, the end process is performed. The end process is performed through a process in Steps S31 and S32 of the flowchart illustrated in Fig. 7.

[0067] In Step S31, first, the tag giving unit 14 that has received the determination result from the apparatus control unit 12 gives the examination end tag indicating that the examination has ended to the patient information (patient specification information). Then, the tag giving unit 14 gives the examination end tag to the examination data stored in the memory unit 15. Then, in Step S32, the apparatus control unit 12 stores the examination data, to which the examination end tag has been given, as the examination end data in the memory unit 15 so as to be associated with the patient information (patient specification information) to which the examination interruption tag has been given. In this way, the eFAST examination of the patient corresponding to the patient information (patient specification information) input to the input unit 16 ends.

[0068] On the other hand, in a case in which it is de-

termined in Step S7 that new patient information (patient specification information) different from the patient information (patient specification information) of the patient who is currently being examined has been input to the text box T of the dialogue D illustrated in Fig. 5 through the input unit 16, an interruption process is performed in Step S10. The interruption process is performed through a process from Step S21 to Step S24 in a flowchart illustrated in Fig. 6.

[0069] First, in Step S21, it is automatically determined whether the examination of all of the examination parts related to the content of the eFAST examination associated with the patient information (patient specification information) of the patient who is currently being examined has ended. Specifically, the examination situation determination unit 13 reads the examination data stored in the memory unit 15 and determines whether the examination of all of the examination parts related to the content of the eFAST examination associated with the patient information (patient specification information) has ended on the basis of the determination result of the part determination unit 11 included in the read examination data.

[0070] In a case in which it is determined in Step S21 that the examination of all of the examination parts related to the content of the eFAST examination associated with the patient information (patient specification information) has not ended, the process proceeds to Step S22. For example, in a case in which the examination of only the right abdomen has ended, only the determination result indicating that the imaging part of the patient is the right abdomen is included in the read examination data. The examination situation determination unit 13 determines that the examination of all of the examination parts related to the content of the eFAST examination associated with the patient information (patient specification information) of the patient who is currently being examined has not ended, that is, the eFAST examination has been interrupted, on the basis of the determination result, and outputs the determination result to the tag giving unit 14.

[0071] Then, in Step S22, first, the tag giving unit 14 that has received the determination result from the examination situation determination unit 13 gives the examination interruption tag indicating that the examination has been interrupted to the patient information (patient specification information) of the patient who is currently being examined. Then, the tag giving unit 14 gives the examination interruption tag to the examination data stored in the memory unit 15.

[0072] Then, in Step S24, the apparatus control unit 12 stores the examination data, to which the examination interruption tag has been given, as the examination interruption data in the memory unit 15 so as to be associated with the patient information (patient specification information) to which the examination interruption tag has been given.

[0073] On the other hand, in Step S21, in a case in which the examination data read from the memory unit 15 by the examination situation determination unit 13 includes the determination result of the part determination unit 11 indicating that all of the examination parts related to the content of the eFAST examination are the imaging parts of the patient, the examination situation determination unit 13 determines that the examination of all of the examination parts related to the content of the eFAST examination associated with the patient information (patient specification information) of the patient who is currently being examined has ended and outputs the determination result to the tag giving unit 14.

[0074] Then, in Step S23, first, the tag giving unit 14 that has received the determination result from the examination situation determination unit 13 gives the examination end tag to the patient information (patient specification information) of the patient who is currently being examined. Then, the tag giving unit 14 gives the examination end tag to the examination data stored in the memory unit 15.

[0075] Then, in Step S24, the apparatus control unit 12 stores the examination data, to which the examination end tag has been given, as examination end data in the memory unit 15 so as to be associated with the patient information (patient specification information) to which the examination end tag has been given.

[0076] As such, in a case in which new patient information (patient specification information) different from the patient information (patient specification information) of the patient who is currently being examined is input to the input unit 16, it is determined whether the examination has been interrupted and the examination interruption data or the examination end data is automatically stored in the memory unit 15. Therefore, the user does not need to operate the input unit 16 in order to interrupt the examination. In addition, for example, in a case in which a patient different from the patient who is currently being examined is transported and the transported patient needs to be urgently examined, it is possible to appropriately store the examination data of the patient who has been examined so far.

[0077] In a case in which the examination data of the patient who has been examined so far is stored in the memory unit 15 in Step S24, the process returns to Step S2 in the flowchart illustrated in Fig. 4 and a new examination of the patient corresponding to the new patient information (patient specification information) starts.

[0078] For example, in a case in which the eFAST examination is performed on a new patient corresponding to new patient information (patient specification information), Steps S2 to S9 are repeated and the examination of a plurality of examination parts related to the content of the eFAST examination associated with the new patient information (patient specification information) ends sequentially. The ultrasound images corresponding to each examination part are displayed in the plurality of situation display portions L of the dialogue D illustrated in Fig. 5.

[0079] In a case in which the ultrasound images are displayed in all of the situation display portions L, an icon

for performing the end process is displayed in the blank B of the dialogue D in Step S9. In a case in which the user selects the icon through the input unit 16, the end process is performed in Step S11.

[0080] In Step S31 of the flowchart illustrated in Fig. 7, first, the tag giving unit 14 gives the examination end tag to the new patient information (patient specification information). Then, the tag giving unit 14 gives the examination end tag to the examination data stored in the memory unit 15. Then, in Step S32, the apparatus control unit 12 stores the examination data, to which the examination end tag has been given, as the examination end data in the memory unit 15. In this way, the eFAST examination of the patient corresponding to the new patient information (patient specification information) input to the input unit 16 ends.

[0081] As described above, the dialogue D illustrated in Fig. 5 includes the text box T and the plurality of examination situation display portions L. However, as illustrated in Fig. 8, the dialogue D may be configured such that a schema image S illustrating each examination part of the patient is added. The configuration in which the schema image S is added to the dialogue D makes it possible for the user to easily check, for example, the position of each examination part related to the content of the eFAST examination.

[0082] In addition, since the examination data is configured such that a plurality of ultrasound images accumulated by the examination are sequentially displayed and viewed as a motion picture, capacity is likely to increase. In some cases, the examination data includes a B-mode image that is not suitable for diagnosis, such as a B-mode image that is all black due to inappropriate contact between the ultrasound probe 1 and the patient, a B-mode image that is all white, or a B-mode image that includes a large amount of noise. It takes a lot of time and effort for the user to remove the B-mode image that is not suitable for diagnosis with the input unit 16.

[0083] For this reason, the apparatus control unit 12 can be configured so as to automatically remove the B-mode image that is not suitable for diagnosis from the examination data using, for example, the above-mentioned known matching technique. With this configuration, the apparatus control unit 12 automatically removes the B-mode image that is not suitable for diagnosis from the examination data before the tag giving unit 14 gives the examination interruption tag or the examination end tag to the examination data.

[0084] As such, since the apparatus control unit 12 automatically removes the B-mode image that is not suitable for diagnosis from the examination data, it is possible to easily prevent an increase in the capacity of the examination data stored in the memory unit 15.

Embodiment 2

[0085] In Embodiment 1, in a case in which new patient information (patient specification information) different from the patient information (patient specification information) of the patient who is currently being examined is input to the input unit 16, the interruption process is performed and then a new examination of a patient corresponding to the new patient information (patient specification information) starts. However, the invention is not limited thereto. In Embodiment 2, in a case in which the examination of the patient corresponding to the new patient information (patient specification information) was interrupted in the past, it is possible to resume the interrupted examination.

[0086] Fig. 9 illustrates the configuration of an ultrasound diagnostic apparatus according to Embodiment 2. The ultrasound diagnostic apparatus according to Embodiment 2 has the same configuration as the ultrasound diagnostic apparatus according to Embodiment 1 illustrated in Fig. 1 except that it further includes an examination resumption determination unit 31. The examination resumption determination unit 31 is connected to the apparatus control unit 12, the examination situation determination unit 13, and the tag giving unit 14.

[0087] Next, an interruption process according to Embodiment 2 will be described with reference to a flowchart illustrated in Fig. 10.

[0088] In a case in which new patient information (patient specification information) different from the patient information (patient specification information) of the patient who is currently being examined is input to the input unit 16 by an operation of the user, the examination data of the patient who is currently being examined is stored as examination interruption data or examination end data in the memory unit 15 through the process from Step S21 to Step S24.

[0089] Then, in Step S41, it is determined whether the examination interruption data associated with the new patient information (patient specification information) input to the input unit 16 has been stored in the memory unit 15. Specifically, the examination resumption determination unit 31 that has received the determination result of the examination situation determination unit 13 searches for the examination interruption data associated with the new patient information (patient specification information). The examination interruption data associated with the new patient information (patient specification information) stored in the memory unit 15 indicates that the examination of the patient corresponding to the new patient information (patient specification information) was interrupted in the past.

[0090] In addition, the examination interruption tag given to the new patient information (patient specification information) indicates that the examination of the patient corresponding to the new patient information (patient specification information) was interrupted in the past. In a case in which the examination interruption tag has not been given to the new patient information (patient specification information), it is considered that the examination of the patient corresponding to the new patient information (patient specification information) has not been

interrupted and the examination interruption data has not been stored in the memory unit 15. In this case, the examination resumption determination unit 31 does not search for the examination interruption data associated with the new patient information (patient specification information) and determines that the examination interruption data associated with the new patient information (patient specification information) has not been stored in the memory unit 15.

[0091] In a case in which it is determined in Step S41 that the examination interruption tag has not been given to the new patient information (patient specification information) or the examination interruption data associated with the new patient information (patient specification information) has not been stored in the memory unit 15, the examination resumption determination unit 31 outputs the determination result to the apparatus control unit 12. Then, in Step S45, a new examination of the patient corresponding to the new patient information (patient specification information) starts.

[0092] On the other hand, in a case in which it is determined in Step S41 that the examination interruption data associated with the new patient information (patient specification information) has been stored in the memory unit 15, the examination resumption determination unit 31 outputs the determination result to the apparatus control unit 12. Then, in Step S42, it is determined whether to resume the interrupted examination. Specifically, the apparatus control unit 12 controls the display control unit 4 on the basis of the determination result of the examination resumption determination unit 31 such that a dialogue for allowing the user to determine whether to resume the interrupted examination is displayed on the display unit 5.

[0093] In a case in which the user determines to resume the examination in Step S42, the interrupted examination of the patient corresponding to the new patient information (patient specification information) is resumed in Step S43. In this case, since the content of the interrupted examination has already been associated with the new patient information (patient specification information), the examination is resumed for the content of the examination associated with the new patient information (patient specification information). For example, in a case in which the eFAST examination has been interrupted, the apparatus control unit 12 reflects the situation of the interrupted examination in the dialogue D illustrated in Fig. 5 on the basis of the examination interruption data. Therefore, the user can resume the examination with reference to the dialogue D in which the situation of the interrupted examination has been reflected.

[0094] In addition, in a case in which the user resumes the interrupted examination, the user may use all of the examination interruption data associated with the new patient information (patient specification information) or may use a portion of the examination interruption data. That is, a portion of the examination data obtained by the resumed examination can be replaced with a portion of the examination interruption data.

[0095] In a case in which the user determines not to resume the examination in Step S42, the examination resumption determination unit 31 outputs the determination result to the tag giving unit 14. Then, in Step S44, the tag giving unit 14 that has received the determination result of the examination resumption determination unit 31 gives the examination end tag to the examination interruption data associated with the new patient information (patient specification information). Then, the apparatus control unit 12 stores the examination interruption data, to which the examination end tag has been given, as the examination end data in the memory unit 15. Therefore, in a case in which the patient corresponding to the new patient information (patient specification information) is separately examined, the examination resumption determination unit 31 is prevented from determining that the examination interruption data associated with the new patient information (patient specification information) has been stored in the memory unit 15.

[0096] Then, in Step S45, a new examination of the patient corresponding to the new patient information (patient specification information) starts.

[0097] As such, in a case in which the examination interruption data associated with the new patient information (patient specification information) has been stored in the memory unit 15, it is possible to resume the interrupted examination with the examination interruption data.

[0098] In a case in which it is determined in Step S41 that the examination interruption data associated with the new patient information (patient specification information) has been stored in the memory unit 15, in Step S42, the user may start an examination, without determining whether to resume the examination, and may determine whether the examination has been resumed on the basis of examination data acquired by the resumed examination.

[0099] For example, in a case in which the B-mode image signals of the right abdomen and the left abdomen are included in the examination interruption data stored due to the interruption of the eFAST examination, if a B-mode image signal of the bladder is generated in the examination that has started, it is considered that the bladder to be examined after the left abdomen in the eFAST examination is examined. In a case in which the B-mode image of the bladder is generated in the examination that has started, it can be determined that the examination has been resumed.

[0100] In contrast, in a case in which a B-mode image signal of the right abdomen is generated in the examination that has started, it is considered that the right abdomen which has been examined is reexamined. In a case in which the B-mode image signal of the right abdomen is generated in the examination that has started, it can be determined that a new examination has started.

[0101] In this embodiment, the interruption process is performed in a case in which new patient information

(patient specification information) different from the patient information (patient specification information) of the patient who is currently being examined is input to the input unit 16. However, the invention is not limited thereto. For example, the user may operate the input unit 16 to interrupt the examination of the patient who is currently being examined, without inputting new patient information (patient specification information), and may examine a patient different the patient. In this case, since no patient information (patient specification information) is input to the input unit 16, it is difficult to determine whether examination interruption data associated with the patient information (patient specification information) has been stored in the memory unit 15. Therefore, a new examination of the patient is regarded as having started. In a case in which patient information (patient specification information) is issued in parallel to the examination of the patient, the user knows that the patient information (patient specification information) has been present from information such as the name of the patient. In addition, in a case in which the examination interruption data associated with the patient information (patient specification information) has been stored in the memory unit 15, the user can read the examination interruption data and can determine whether to resume the examination.

[0102] With this configuration, it is possible to omit the input of the patient information (patient specification information) and to rapidly start an examination. In addition, in a case in which the examination interruption data has been stored in the memory unit 15, it is possible to resume the examination with the examination interruption data and thus to rapidly end the examination.

Embodiment 3

[0103] In Embodiment 2, in a case in which the examination resumption determination unit 31 determines that examination interruption data associated with new patient information (patient specification information) has been stored in the memory unit 15, the user determines to resume the interrupted examination. However, in Embodiment 3, the examination resumption determination unit 31 automatically determines whether to resume the examination.

[0104] An interruption process according to Embodiment 3 will be described with reference to a flowchart illustrated in Fig. 11.

[0105] In a case in which new patient information (patient specification information) different from the patient information (patient specification information) of the patient who is currently being examined is input to the input unit 16 by an operation of the user, the examination data of the patient who is currently being examined is stored in the memory unit 15 through the process from Step S21 to Step S24. Then, in Step S41, the examination resumption determination unit 31 that has received the determination result of the examination situation determination unit 13 determines whether the examination interruption data associated with the new patient information (patient specification information) input to the input unit 16 has been stored in the memory unit 15.

[0106] In a case in which it is determined in Step S41 that the examination interruption data associated with the new patient information (patient specification information) has been stored in the memory unit 15, the examination resumption determination unit 31 calculates an examination interruption period in Step S51.

[0107] Here, the examination interruption period is a period from the time when the tag giving unit 14 gives the examination interruption tag to the patient information (patient specification information) to the time when the patient information (patient specification information) is input to the input unit 16 again, that is, a period for which the examination of the patient corresponding to the patient information (patient specification information) is interrupted.

[0108] Then, in Step S52, it is determined whether the examination interruption period calculated by the examination resumption determination unit 31 is less than a preset threshold value. The threshold value of the examination interruption period can be set to, for example, 30 days. However, the threshold value may be appropriately changed.

[0109] In a case in which it is determined in Step S52 that the examination interruption period is less than the threshold value, the interrupted examination of the patient corresponding to the new patient information (patient specification information) is resumed in Step S43. In this case, the apparatus control unit 12 reflects the situation of the interrupted examination in the dialogue D on the basis of the examination interruption data. Therefore, after inputting new patient information (patient specification information) to the input unit 16, the user can resume the examination with reference to the dialogue D in which the situation of the interrupted examination has been reflected, without operating the input unit 16 at all.

[0110] On the other hand, in a case in which it is determined in Step S52 that the examination interruption period is equal to or greater than the threshold value, the examination resumption determination unit 31 outputs the determination result indicating that the interrupted examination is not resumed to the tag giving unit 14. The reason is as follows. In a case in which the examination interruption period is equal to or greater than the preset threshold value, the examination interruption data stored in the memory unit 15 is too old. It is considered that the use of the examination interruption data at the time of the resumption of the interrupted examination is inappropriate.

[0111] Then, in Step S44, the tag giving unit 14 gives the examination end tag to the examination interruption data associated with the new patient information (patient specification information). Then, the apparatus control unit 12 stores the examination interruption data, to which the examination end tag has been given, as the exami-

nation end data in the memory unit 15. In Step S45, a new examination of the patient corresponding to the new patient information (patient specification information) starts.

[0112] As such, in a case in which the examination interruption data associated with new patient information (patient specification information) has been stored in the memory unit 15, the examination interruption period is calculated and is compared with the preset threshold value. Therefore, it is possible to automatically determine whether to resume the interrupted examination.

[0113] In the resumed examination, for example, in a case in which the examination interruption data includes a B-mode image signal of the right abdomen, a dialogue may be displayed on the display unit 5 such that the user determines whether to overwrite a B-mode image signal obtained by newly examining the right abdomen on the B-mode image signal in the examination interruption data. In this case, the user can determine whether to resume the examination using all of the read examination interruption data, using some of the read examination interruption data, or without using the read examination interruption data.

Explanation of References

[0114]

1: ultrasound probe
1A: array transducer
2: transmitting/receiving unit
3: image generation unit
4: display control unit
5: display unit
6: transmitting unit
7: receiving unit
8: transmitting/receiving unit
9: B-mode processing unit
10: DSC
11: part determination unit
12: apparatus control unit
13: examination situation determination unit
14: tag giving unit
15: memory unit
16: input unit
17: storage unit
18: amplification unit
19: A/D conversion unit
20: beam former
21: signal processing unit
31: examination resumption determination unit
D: dialogue
T: text box
L: situation display portion
B: blank
S: schema image

Claims

1. An ultrasound diagnostic apparatus comprising:

an ultrasound probe (1);
an imaging unit (3) adapted to transmit and to receive an ultrasound beam to and from a patient using the ultrasound probe (1) and to convert a received signal output from the ultrasound probe into an image to generate an ultrasound image of an imaging part of the patient;
an input unit (16) adapted to be used by a user to input patient information including information for specifying a patient;
a memory unit (15) adapted to store content of an examination for continuously examining a plurality of examination parts of the patient associated with the patient information; and
an examination situation determination unit (13).
characterized in that the examination situation determining unit (13) is adapted to in a case in which new patient information is input to the input unit during the continuous examination, determine whether the examination of all of the plurality of examination parts related to the content of the examination associated with the patient information has ended; and
a tag giving unit, that is adapted to give an examination interruption tag indicating that an examination has been interrupted to the patient information in a case in which the examination situation determination unit determines that the examination of all of the plurality of examination parts related to the content of the examination associated with the patient information has not ended and to give an examination end tag indicating that an examination has ended to the patient information in a case in which the examination situation determination unit determines that the examination of all of the plurality of examination parts related to the content of the examination associated with the patient information has ended.

2. The ultrasound diagnostic apparatus according to claim 1, further comprising:
an apparatus control unit (12) adapted to store the content of the examination in the memory unit so as to be associated with the patient information, to generate examination data including at least one ultrasound image generated from the imaging unit by continuously examining the plurality of examination parts, and to store the generated examination data in the memory unit.

3. The ultrasound diagnostic apparatus according to claim 2, further comprising:

a part determination unit (11) adapted to determine the imaging part of the patient on the basis of the ultrasound image generated by the imaging unit,

wherein the examination situation determination unit (13) is adapted to determine whether the examination of all of the plurality of examination parts related to the content of the examination associated with the patient information has ended on the basis of a determination result of the part determination unit.

4. The ultrasound diagnostic apparatus according to claim 2 or 3,

wherein the tag giving unit is adapted to give the examination interruption tag to the examination data in a case in which the examination situation determination unit determines that the examination of all of the plurality of examination parts related to the content of the examination associated with the patient information has not ended and to give the examination end tag to the examination data in a case in which the examination situation determination unit determines that the examination of all of the plurality of examination parts related to the content of the examination associated with the patient information has ended, and

the apparatus control unit (12) is adapted to store the examination data, to which the examination interruption tag has been given by the tag giving unit, as examination interruption data in the memory unit so as to be associated with the patient information in a case in which the examination situation determination unit determines that the examination of all of the plurality of examination parts related to the content of the examination associated with the patient information has not ended and to store the examination data, to which the examination end tag has been given by the tag giving unit, as examination end data in the memory unit so as to be associated with the patient information in a case in which the examination situation determination unit determines that the examination of all of the plurality of examination parts related to the content of the examination associated with the patient information has ended.

5. The ultrasound diagnostic apparatus according to claim 4, further comprising:

an examination resumption determination unit (31) adapted to determine whether the examination interruption data associated with the new patient information has been stored in the memory unit, to determine whether to resume the interrupted continuous examination in a case in which it is determined that the examination interruption data associated with the new patient information has been stored in the memory unit, and to determine to start a new continuous examination in a case in which the interrupted continuous examination is not resumed.

6. The ultrasound diagnostic apparatus according to claim 5,

wherein the tag giving unit (14) is adapted to give the examination end tag to the examination interruption data associated with the new patient information in a case in which the examination resumption determination unit determines to start the new continuous examination, and

the apparatus control unit (12) is adapted to store the examination interruption data, to which the examination end tag has been given by the tag giving unit, as the examination end data in the memory unit.

7. The ultrasound diagnostic apparatus according to claim 5 or 6,

wherein the examination resumption determination unit (31) is adapted to determine to resume the interrupted continuous examination in a case in which an examination interruption period from a time when the tag giving unit gives the examination interruption tag to the new patient information to a time when the new patient information is input to the input unit again is less than a preset threshold value and to determine to start a new continuous examination in a case in which the examination interruption period is equal to or greater than the preset threshold value.

8. The ultrasound diagnostic apparatus according to any one of claims 4 to 7,

wherein the apparatus control unit (12) is adapted to store the examination data, from which the ultrasound image that is not suitable for diagnosis has been removed, in the memory unit (15) according to a determination result of the examination situation determination unit (13).

9. A method for controlling an ultrasound diagnostic apparatus, the method comprising:

a step of transmitting and receiving an ultrasound beam to and from a patient using an ultrasound probe (1) and converting a received signal output from the ultrasound probe into an image to generate an ultrasound image of an imaging part of the patient;

a step of allowing a user to input patient information including information for specifying a patient;

a step of storing content of an examination for continuously examining a plurality of examina-

tion parts of the patient so as to be associated with the patient information;
a step of, in a case in which new patient information is input during the continuous examination, determining whether the examination of all of the plurality of examination parts related to the content of the examination associated with the patient information has ended; and
a step of giving an examination interruption tag indicating that an examination has been interrupted to the patient information in a case in which it is determined that the examination of all of the plurality of examination parts related to the content of the examination associated with the patient information has not ended and giving an examination end tag indicating that an examination has ended to the patient information in a case in which it is determined that the examination of all of the plurality of examination parts related to the content of the examination associated with the patient information has ended.

Patentansprüche

1. Ultraschalldiagnosevorrichtung, umfassend:

eine Ultraschallsonde (1);
eine Bildgebungseinheit (3), ausgebildet zum Senden und zum Empfangen eines Ultraschallstrahls zu bzw. von einem Patienten unter Verwendung der Ultraschallsonde (1), und zum Umwandeln eines empfangenen Signals, das von der Ultraschallsonde ausgegeben wurde, in ein Bild, um ein Ultraschallbild eines Bildgebungsteils des Patienten zu erzeugen;
eine Eingabeeinheit (16), ausgebildet zur Verwendung durch einen Benutzer zwecks Eingabe von Patienteninformation, welche Information zum Spezifizieren eines Patienten enthält;
eine Speichereinheit (15), ausgebildet zum Speichern des Inhalts einer Untersuchung zur kontinuierlichen Untersuchung mehrerer Untersuchungsteile des Patienten in Verbindung mit der Patienteninformation; und
eine Untersuchungssituations-Bestimmungseinheit (13),
dadurch gekennzeichnet, dass die Untersuchungssituations-Bestimmungseinheit (13) ausgebildet ist, um für den Fall, dass neue Patienteninformation in die Eingabeeinheit während der kontinuierlichen Untersuchung eingegeben wird, zu bestimmen, ob die Untersuchung sämtlicher der mehreren Untersuchungsteile bezüglich des Inhalts der mit der Patienteninformation zusammenhängenden Untersuchung abgeschlossen ist; und
eine Etikettiereinheit, ausgebildet, um der Patienteninformation dann ein Untersuchungsunterbrechungsetikett, das eine Untersuchungs-Unterbrechung angibt, hinzuzufügen, wenn die Untersuchungssituations-Bestimmungseinheit bestimmt, dass die Untersuchung sämtlicher der mehreren Untersuchungsteile bezüglich des Inhalts des zu der Patienteninformation gehörigen Untersuchung nicht abgeschlossen ist, und um ein Untersuchungsendeetikett, welches ein Untersuchungs-Ende angibt, der Patienteninformation dann hinzuzufügen, wenn die Untersuchungssituations-Bestimmungseinheit bestimmt, dass die Untersuchung sämtlicher der mehreren Untersuchungsteile bezüglich des Inhalts der zu der Patienteninformation gehörigen Untersuchung abgeschlossen ist.

2. Vorrichtung nach Anspruch 1, weiterhin umfassend:
eine Vorrichtungssteuereinheit (12), ausgebildet zum Speichern des Inhalts der Untersuchung in der Speichereinheit in Zuordnung zu der Patienteninformation, um Untersuchungsdaten einschließlich mindestens eines Ultraschallbilds zu erzeugen, welches von der Bildgebungseinheit erzeugt wird, durch kontinuierliches Untersuchen der mehreren Untersuchungsteile, und zum Speichern der erzeugten Untersuchungsdaten in der Speichereinheit.

3. Vorrichtung nach Anspruch 2, weiterhin umfassend:

eine Teilbestimmungseinheit (11), ausgebildet zum Bestimmen des Bildgebungsteils des Patienten auf der Grundlage des von der Bildgebungseinheit erzeugten Ultraschallbilds,
wobei die Untersuchungssituations-Bestimmungseinheit (13) ausgebildet ist zum Bestimmen, ob die Untersuchung sämtlicher der mehreren Untersuchungsteile bezüglich des Inhalts der zu der Patienteninformation gehörigen Untersuchung abgeschlossen ist, auf der Grundlage eines Bestimmungsergebnisses der Teiluntersuchungseinheit.

4. Vorrichtung nach Anspruch 2 oder 3,

bei der die Etikettiereinheit ausgebildet ist zum Anfügen des Untersuchungsunterbrechungsetiketts an die Untersuchungsdaten für den Fall, dass die Untersuchungssituations-Bestimmungseinheit bestimmt, dass die Untersuchung sämtlicher der mehreren Untersuchungsteile bezüglich des Inhalts der Untersuchung in Verbindung mit der Patienteninformation nicht abgeschlossen ist, und den Untersuchungsdaten ein Untersuchungsendeetikett hinzuzufügen, falls die Untersuchungssituations-Bestimmungseinheit bestimmt, dass die Untersuchung sämtlicher der mehreren Untersuchungsteile in

Verbindung mit dem Inhalt der zu der Patienteninformation gehörigen Untersuchung abgeschlossen ist, und
die Vorrichtungssteuereinheit (12) dazu ausgebildet ist, die Untersuchungsdaten, denen das Untersuchungsunterbrechungsetikett von der Etikettiereinheit hinzugefügt wurde, zu speichern als Untersuchungsunterbrechungsdaten innerhalb der Speichereinheit, um der Patienteninformation zugeordnet zu werden, falls die Untersuchungssituations-Bestimmungseinheit bestimmt, dass die Untersuchung sämtlicher der mehreren Untersuchungsteile in Verbindung mit dem Inhalt der zu der Patienteninformation gehörigen Untersuchung nicht abgeschlossen ist, und die Untersuchungsdaten, denen das Untersuchungsendeetikett durch die Etikettiereinheit hinzugefügt wurde, als Untersuchungsendedaten in der Speichereinheit in Zuordnung zu der Patienteninformation dann zu speichern, wenn die Untersuchungssituations-Bestimmungseinheit bestimmt, dass die Untersuchung sämtlicher der mehreren Untersuchungsteile in Verbindung mit dem Inhalt der zu der Patienteninformation gehörigen Untersuchung abgeschlossen ist.

5. Vorrichtung nach Anspruch 4, weiterhin umfassend:
eine Untersuchungswiederaufnahme-Bestimmungseinheit (31), ausgebildet zum Bestimmen, ob die zu der neuen Patienteninformation gehörige Untersuchungsunterbrechungsdaten in der Speichereinheit gespeichert wurden, um festzustellen, ob die unterbrochene kontinuierliche Untersuchung dann wieder aufzunehmen ist, wenn festgestellt wird, dass die zu der neuen Patienteninformation gehörigen Untersuchungsunterbrechungsdaten in der Speichereinheit gespeichert wurden, und um zu bestimmen, dass eine neue kontinuierliche Untersuchung begonnen wird, falls die unterbrochene kontinuierliche Untersuchung nicht wieder aufgenommen wird.

6. Vorrichtung nach Anspruch 5,

bei der die Etikettiereinheit (14) dazu ausgebildet ist, das Untersuchungsendeetikett zu den Untersuchungsunterbrechungsdaten in Verbindung mit der neuen Patienteninformation dann hinzuzufügen, wenn die Untersuchungswiederaufnahme-Bestimmungseinheit bestimmt, die neue kontinuierliche Untersuchung zu beginnen, und
die Vorrichtungssteuereinheit (12) dazu ausgebildet ist, die Untersuchungsunterbrechungsdaten, denen das Untersuchungsendeetikett von der Etikettiereinheit hinzugefügt wurde, als die Untersuchungsendedaten in der Speichereinheit zu speichern.

7. Vorrichtung nach Anspruch 5 oder 6,
bei der die Untersuchungswiederaufnahme-Bestimmungseinheit (31) dazu ausgebildet ist, die unterbrochene kontinuierliche Untersuchung dann wieder aufzunehmen, wenn eine Untersuchungsunterbrechungszeitspanne von einem Zeitpunkt, zu dem die Etikettiereinheit das Untersuchungsunterbrechungsetikett der neuen Patienteninformation hinzugefügt hat, bis zu einer Zeit, zu der die neue Patienteninformation in die Eingabeeinheit erneut eingegeben wird, kürzer ist als ein voreingestellter Schwellenwert, und zum Bestimmen, eine neue kontinuierliche Untersuchung dann zu starten, wenn die Untersuchungsunterbrechungszeitspanne gleich oder größer als der voreingestellte Schwellenwert ist.

8. Vorrichtung nach einem der Ansprüche 4 bis 7,
bei der die Vorrichtungssteuereinheit (12) dazu ausgebildet ist, die Untersuchungsdaten, aus denen das für eine Diagnose ungeeignete Ultraschallbild entfernt wurde, in der Speichereinheit (15) nach Maßgabe eines Bestimmungsergebnisses der Untersuchungssituations-Bestimmungseinheit (13) zu speichern.

9. Verfahren zum Steuern einer Ultraschalldiagnosevorrichtung, umfassend:

einen Schritt des Sendens und des Empfangens eines Ultraschallstrahls zu bzw. von einem Patienten unter Verwendung einer Ultraschallsonde (1) und des Umwandelns eines empfangenen Signals, das von der Ultrschallsonde ausgegeben wird, in ein Bild, um ein Ultraschallbild eines Bildgebungsteils des Patienten zu erzeugen;
einen Schritt, der es einem Benutzer ermöglicht, Patienteninformation einschließlich Information zum Spezifizieren eines Patienten einzugeben;
einen Schritt des Speicherns des Inhalts einer Untersuchung für eine kontinuierliche Untersuchung mehrerer Untersuchungsteile des Patienten in Verbindung mit der Patienteninformation;
einen Schritt, bei dem für den Fall, dass während der kontinuierlichen Untersuchung neue Patienteninformation eingegeben wird, bestimmt wird, ob die Untersuchung sämtlicher der mehreren Untersuchungsteile bezüglich des Inhalts der zu der Patienteninformation gehörigen Untersuchung abgeschlossen ist; und
einen Schritt des Hinzufügens eines Untersuchungsunterbrechungsetiketts, welches angibt, dass eine Untersuchung unterbrochen wurde, zu der Patienteninformation dann, wenn festgestellt wird, dass die Untersuchung sämtlicher der mehreren Untersuchungsteile bezüglich

des Inhalts der zu der Patienteninformation gehörigen Untersuchung nicht abgeschlossen ist, und des Hinzufügens eines Untersuchungsendeetiketts, das angibt, dass eine Untersuchung abgeschlossen ist, zu der Patienteninformation, falls bestimmt wird, dass die Untersuchung sämtlicher der mehreren Untersuchungsteile bezüglich des Inhalts der zu de Patienteninformation gehörigen Untersuchung abgeschlossen ist.

Revendications

1. Appareil de diagnostic à ultrasons, comprenant :

une sonde à ultrasons (1) ;
une unité d'imagerie (3), apte à transmettre et recevoir un faisceau ultrasonore en direction et en provenance d'un patient à l'aide de la sonde à ultrasons (1), et à convertir un signal reçu produit à partir de la sonde à ultrasons en une image afin de générer une image ultrasonore d'une partie d'imagerie du patient ;
une unité d'entrée (16), apte à être utilisée par un utilisateur pour entrer des informations de patient incluant des informations pour spécifier un patient ;
une unité de mémoire (15), apte à stocker un contenu d'un examen pour examiner en continu une pluralité de parties d'examen du patient, associé aux informations de patient, et
une unité de détermination de situation d'examen (13),
caractérisé en ce que, dans un cas où de nouvelles informations de patient sont entrées dans l'unité d'entrée durant l'examen continu, l'unité de détermination de situation d'examen (13) est apte à déterminer si oui ou non l'examen de la totalité de la pluralité de parties d'examen liées au contenu de l'examen associé aux informations de patient est terminé, et
une unité d'attribution d'étiquette, laquelle est apte à attribuer une étiquette d'interruption d'examen, indiquant qu'un examen a été interrompu, aux informations de patient dans un cas où l'unité de détermination de situation d'examen détermine que l'examen de la totalité de la pluralité de parties d'examen liées au contenu de l'examen associé aux informations de patient n'est pas terminé, et à attribuer une étiquette de fin d'examen, indiquant qu'un examen est terminé, aux informations de patient dans un cas où l'unité de détermination de situation d'examen détermine que l'examen de la totalité de la pluralité de parties d'examen liées au contenu de l'examen associé aux informations de patient est terminé.

2. Appareil de diagnostic à ultrasons selon la revendication 1, comprenant en outre :
une unité de commande d'appareil (12), apte à stocker le contenu de l'examen dans l'unité de mémoire de manière à ce qu'il soit associé aux informations de patient, afin de générer des données d'examen incluant au moins une image ultrasonore générée à partir de l'unité d'imagerie en examinant en continu la pluralité de parties d'examen, et à stocker les données d'examen générées dans l'unité de mémoire.

3. Appareil de diagnostic à ultrasons selon la revendication 2, comprenant en outre :

une unité de détermination de partie (11), apte à déterminer la partie d'imagerie du patient sur la base de l'image ultrasonore générée par l'unité d'imagerie, et
dans lequel l'unité de détermination de situation d'examen (13) est apte à déterminer si oui ou non l'examen de la totalité de la pluralité de parties d'examen liées au contenu de l'examen associé aux informations de patient est terminé sur la base d'un résultat de détermination de l'unité de détermination de partie.

4. Appareil de diagnostic à ultrasons selon la revendication 2 ou 3,
dans lequel l'unité d'attribution d'étiquette est apte à attribuer l'étiquette d'interruption d'examen aux données d'examen dans un cas où l'unité de détermination de situation d'examen détermine que l'examen de la totalité de la pluralité de parties d'examen liées au contenu de l'examen associé aux informations de patient n'est pas terminé, et à attribuer une étiquette de fin d'examen aux données d'examen dans un cas où l'unité de détermination de situation d'examen détermine que l'examen de la totalité de la pluralité de parties d'examen liées au contenu de l'examen associé aux informations de patient est terminé, et
l'unité de commande d'appareil (12) est apte à stocker les données d'examen, auxquelles l'étiquette d'interruption d'examen a été attribuée par l'unité d'attribution d'étiquette, comme données d'interruption d'examen dans l'unité de mémoire de manière à ce qu'elles soient associées aux informations de patient dans un cas où l'unité de détermination de situation d'examen détermine que l'examen de la totalité de la pluralité de parties d'examen liées au contenu de l'examen associé aux informations de patient n'est pas terminé, et à stocker les données d'examen, auxquelles l'étiquette de fin d'examen a été attribuée par l'unité d'attribution d'étiquette, comme données de fin d'examen dans l'unité de mémoire de manière à ce qu'elles soient associées aux informations de patient dans un cas où l'unité de détermination de situation d'examen détermine que

l'examen de la totalité de la pluralité de parties d'examen liées au contenu de l'examen associé aux informations de patient est terminé.

5. Appareil de diagnostic à ultrasons selon la revendication 4, comprenant en outre :
l'unité de détermination de reprise d'examen (31) apte à déterminer si oui ou non les données d'interruption d'examen associées aux nouvelles informations de patient ont été stockées dans l'unité de mémoire, afin de déterminer la reprise ou non de l'examen continu interrompu dans un cas où il est déterminé que les données d'interruption d'examen associées aux nouvelles informations de patient ont été stockées dans l'unité de mémoire, et à déterminer de démarrer un nouvel examen continu dans un cas où l'examen continu interrompu n'est pas repris.

6. Appareil de diagnostic à ultrasons selon la revendication 5,
dans lequel l'unité d'attribution d'étiquette (14) est apte à attribuer l'étiquette de fin d'examen aux données d'interruption d'examen associées aux nouvelles informations de patient dans un cas où l'unité de détermination de reprise d'examen détermine de démarrer le nouvel examen continu, et
l'unité de commande d'appareil (12) est apte à stocker les données d'interruption d'examen, auxquelles l'étiquette de fin d'examen a été attribuée par l'unité d'attribution d'étiquette, comme données de fin d'examen dans l'unité de mémoire.

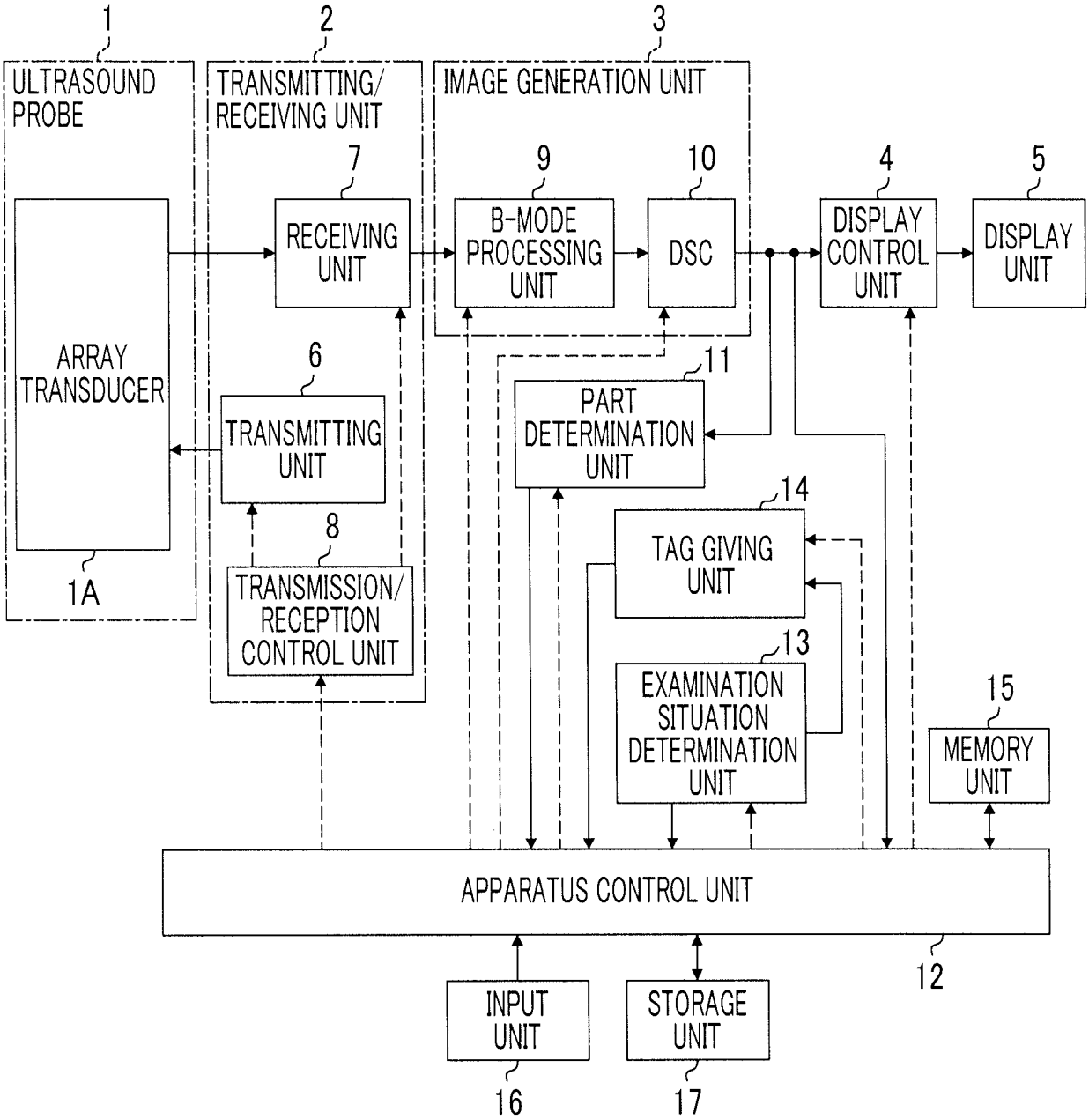
7. Appareil de diagnostic à ultrasons selon la revendication 5 ou 6,
dans lequel l'unité de détermination de reprise d'examen (31) est apte à déterminer la reprise de l'examen continu interrompu dans un cas où une période d'interruption d'examen allant d'un temps où l'unité d'attribution d'étiquette attribue l'étiquette d'interruption d'examen aux nouvelles informations de patient jusqu'à un temps où les nouvelles informations de patient sont à nouveau entrées dans l'unité d'entrée est inférieure à une valeur seuil préréglée, et à déterminer de démarrer un nouvel examen continu dans un cas où la période d'interruption d'examen est supérieure ou égale à la valeur seuil préréglée.

8. Appareil de diagnostic à ultrasons selon l'une quelconque des revendications 4 à 7,
dans lequel l'unité de commande d'appareil (12) est apte à stocker les données d'examen, à partir desquelles l'image ultrasonore ne convenant pas à un diagnostic a été éliminée, dans l'unité de mémoire (15) conformément à un résultat de détermination de l'unité de détermination de situation d'examen (13).

9. Procédé destiné à commander un appareil de diagnostic à ultrasons, le procédé comprenant les étapes suivantes :

une étape pour transmettre et recevoir un faisceau ultrasonore en direction et en provenance d'un patient à l'aide de la sonde à ultrasons (1), et convertir un signal reçu produit à partir de la sonde à ultrasons en une image afin de générer une image ultrasonore d'une partie d'imagerie du patient ;
une étape pour permettre à un utilisateur d'entrer des informations de patient incluant des informations pour spécifier un patient ;
une étape pour stocker un contenu d'un examen pour examiner en continu une pluralité de parties d'examen du patient de manière à ce qu'elles soient associées aux informations de patient ;
une étape pour, dans un cas où de nouvelles informations de patient sont entrées durant l'examen continu, déterminer si oui ou non l'examen de la totalité de la pluralité de parties d'examen liées au contenu de l'examen associé aux informations de patient est terminé, et
une étape pour attribuer une étiquette d'interruption d'examen, indiquant qu'un examen a été interrompu, aux informations de patient dans un cas où il est déterminé que l'examen de la totalité de la pluralité de parties d'examen liées au contenu de l'examen associé aux informations de patient n'est pas terminé, et à attribuer une étiquette de fin d'examen, indiquant qu'un examen est terminé, aux informations de patient dans un cas où il est déterminé que l'examen de la totalité de la pluralité de parties d'examen liées au contenu de l'examen associé aux informations de patient est terminé.

FIG. 1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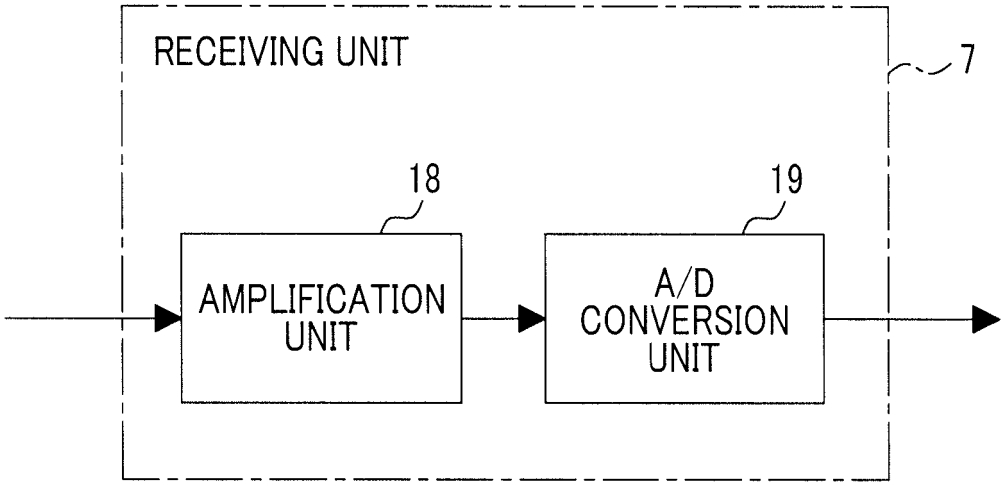
3
ULTRASOUND PROBE
TRANSMITTING/ RECEIVING UNIT
IMAGE GENERATION UNIT
7
9
10
4
5
RECEIVING UNIT
B-MODE PROCESSING UNIT
DSC
DISPLAY CONTROL UNIT
DISPLAY UNIT
ARRAY TRANSDUCER
6
11
TRANSMITTING UNIT
PART DETERMINATION UNIT
14
TAG GIVING UNIT
8
13
TRANSMISSION/ RECEPTION CONTROL UNIT
EXAMINATION SITUATION DETERMINATION UNIT
15
MEMORY UNIT
1A
APPARATUS CONTROL UNIT
12
INPUT UNIT
STORAGE UNIT
16
17

FIG. 2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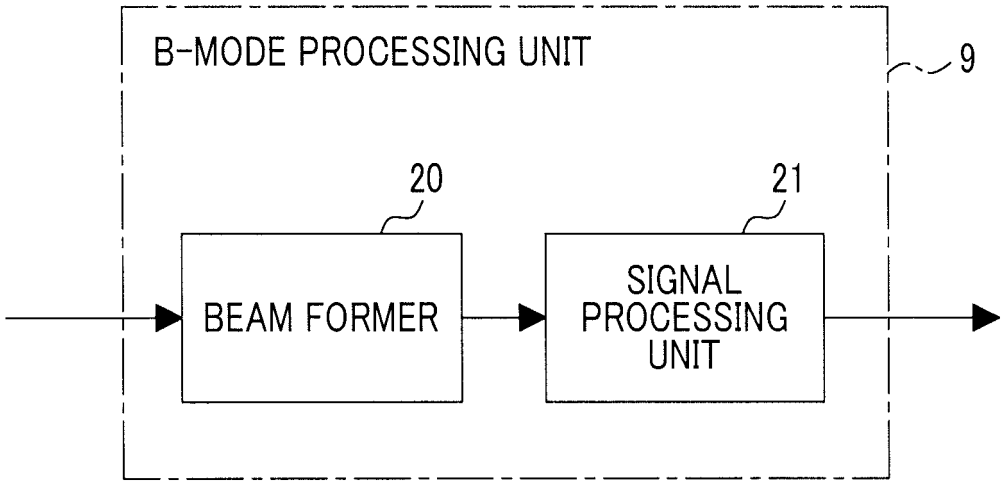
A/D CONVERSION UNIT

FIG. 3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20
21
BEAM FORMER
SIGNAL PROCESSING UNIT

FIG. 4

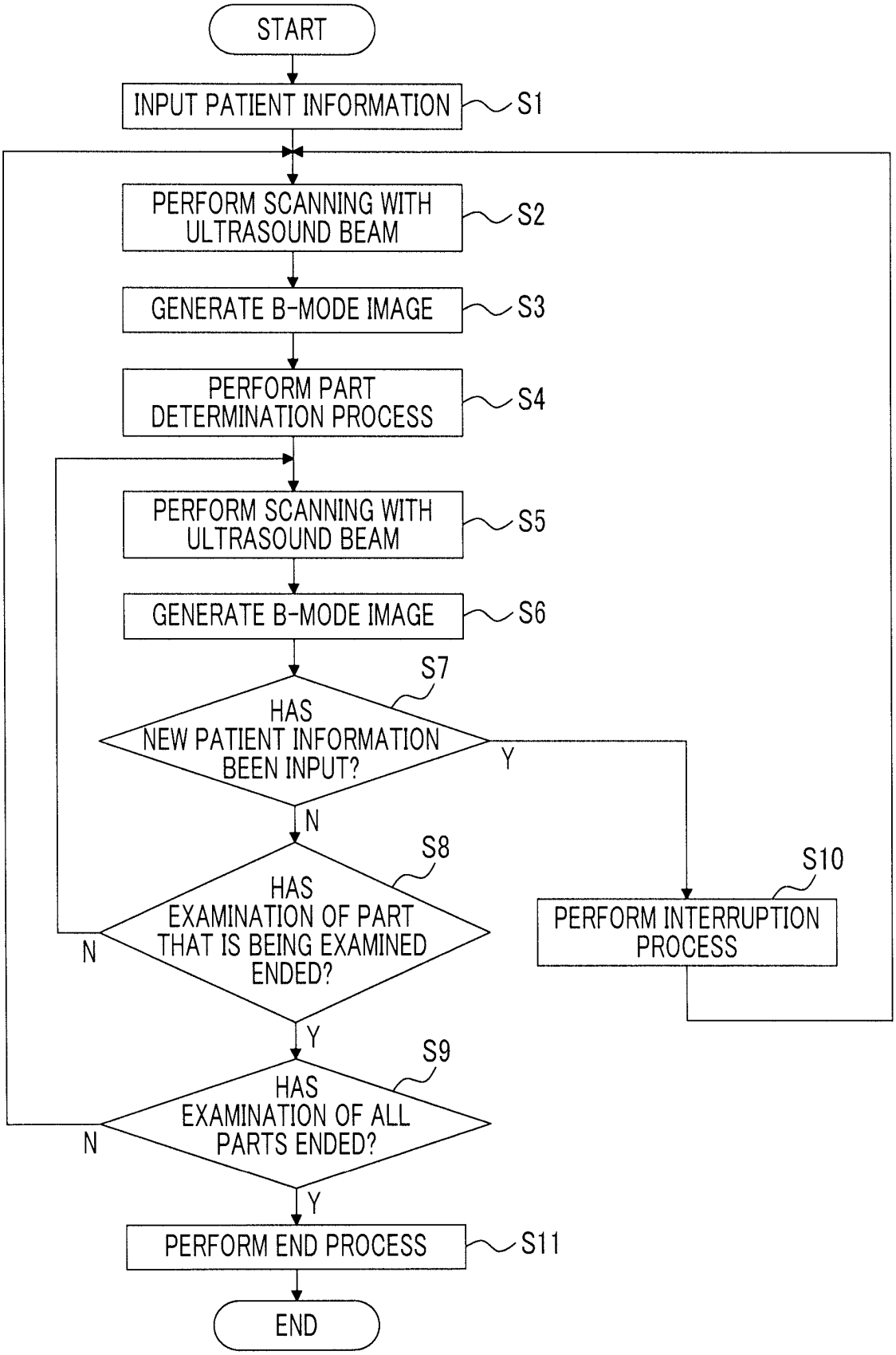

START
INPUT PATIENT INFORMATION
S1
PERFORM SCANNING WITH ULTRASOUND BEAM
S2
GENERATE B-MODE IMAGE
S3
PERFORM PART DETERMINATION PROCESS
S4
PERFORM SCANNING WITH ULTRASOUND BEAM
S5
GENERATE B-MODE IMAGE
S6
S7
HAS NEW PATIENT INFORMATION BEEN INPUT?
Y
N
S8
HAS EXAMINATION OF PART THAT IS BEING EXAMINED ENDED?
N
Y
S10
PERFORM INTERRUPTION PROCESS
S9
HAS EXAMINATION OF ALL PARTS ENDED?
N
Y
PERFORM END PROCESS
S11
END

FIG. 5

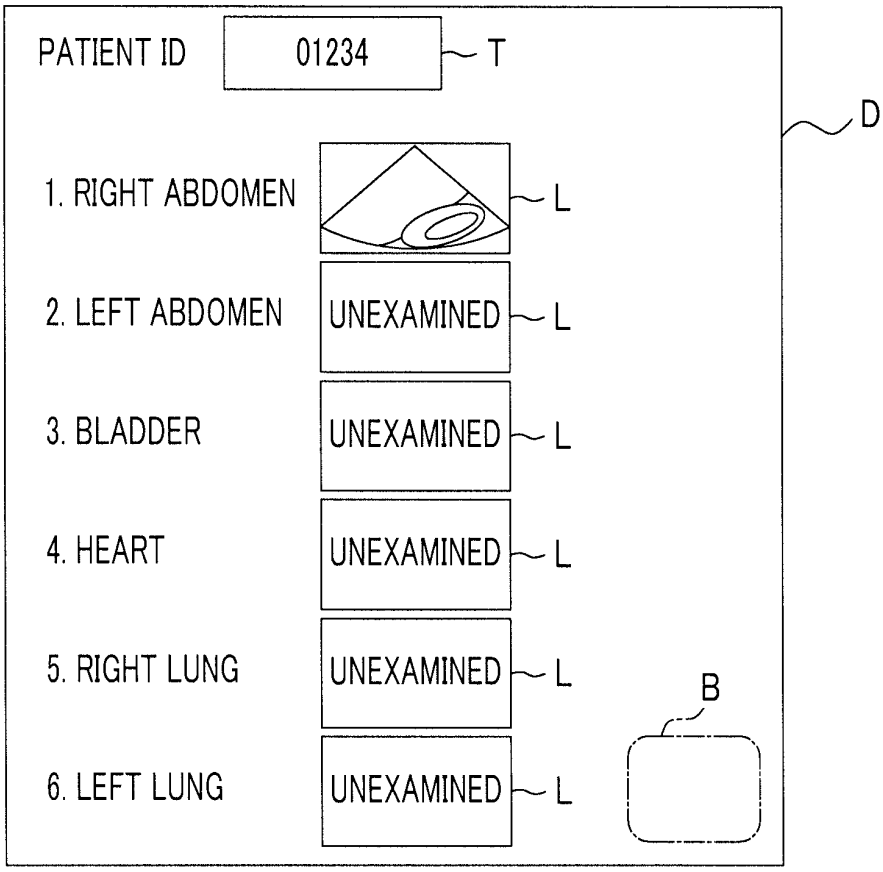

PATIENT ID
01234
T
D
1. RIGHT ABDOMEN
L
2. LEFT ABDOMEN
UNEXAMINED
L
3. BLADDER
UNEXAMINED
L
4. HEART
UNEXAMINED
L
5. RIGHT LUNG
UNEXAMINED
L
B
6. LEFT LUNG
UNEXAMINED
L

FIG. 6

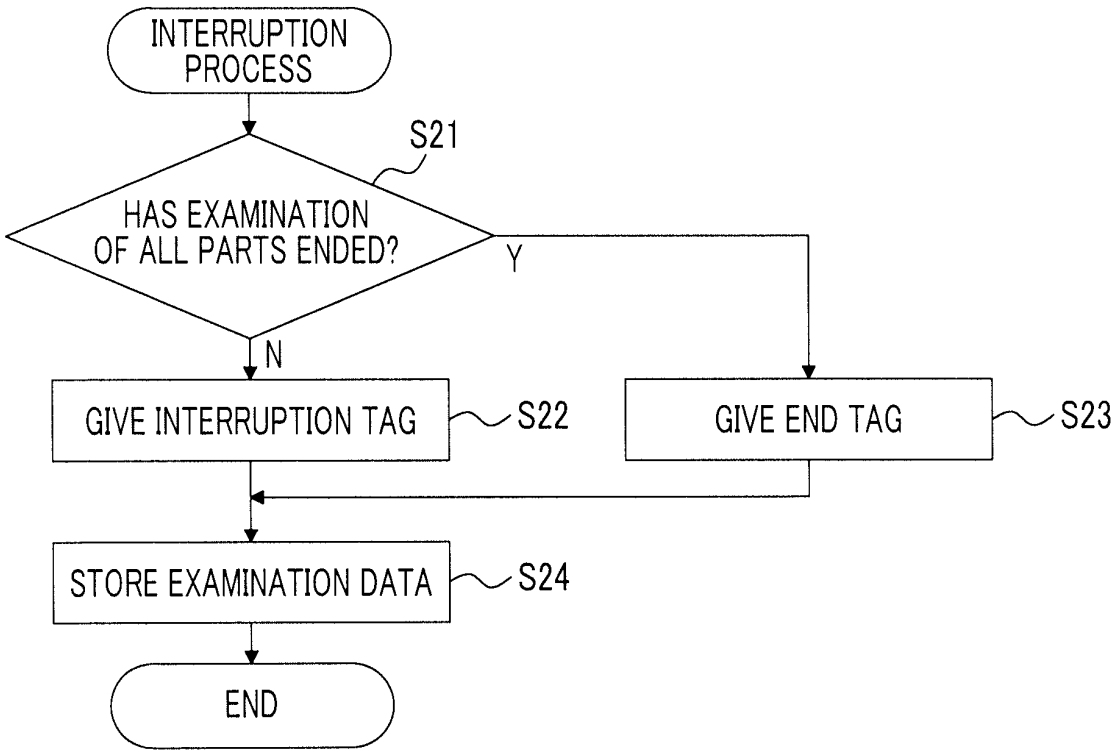

INTERRUPTION PROCESS
S21
HAS EXAMINATION OF ALL PARTS ENDED?
Y
N
GIVE INTERRUPTION TAG
S22
GIVE END TAG
S23
STORE EXAMINATION DATA
S24
END

FIG. 7

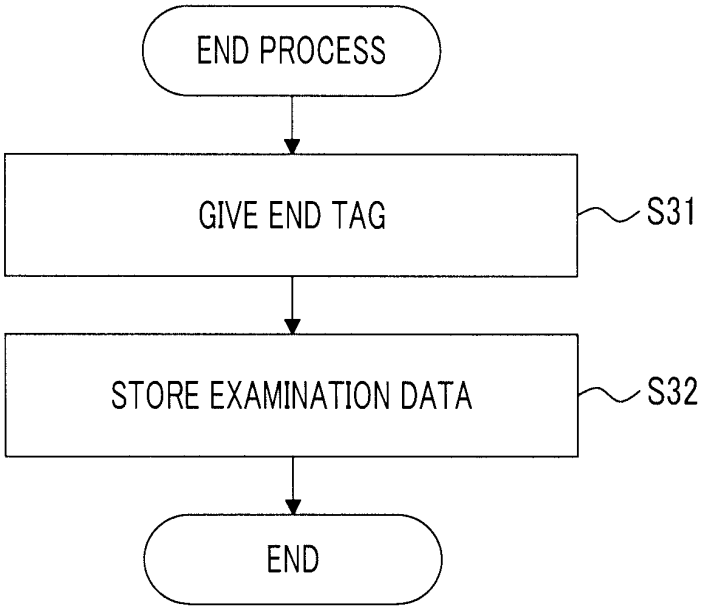

END PROCESS
GIVE END TAG
S31
STORE EXAMINATION DATA
S32
END

FIG. 8

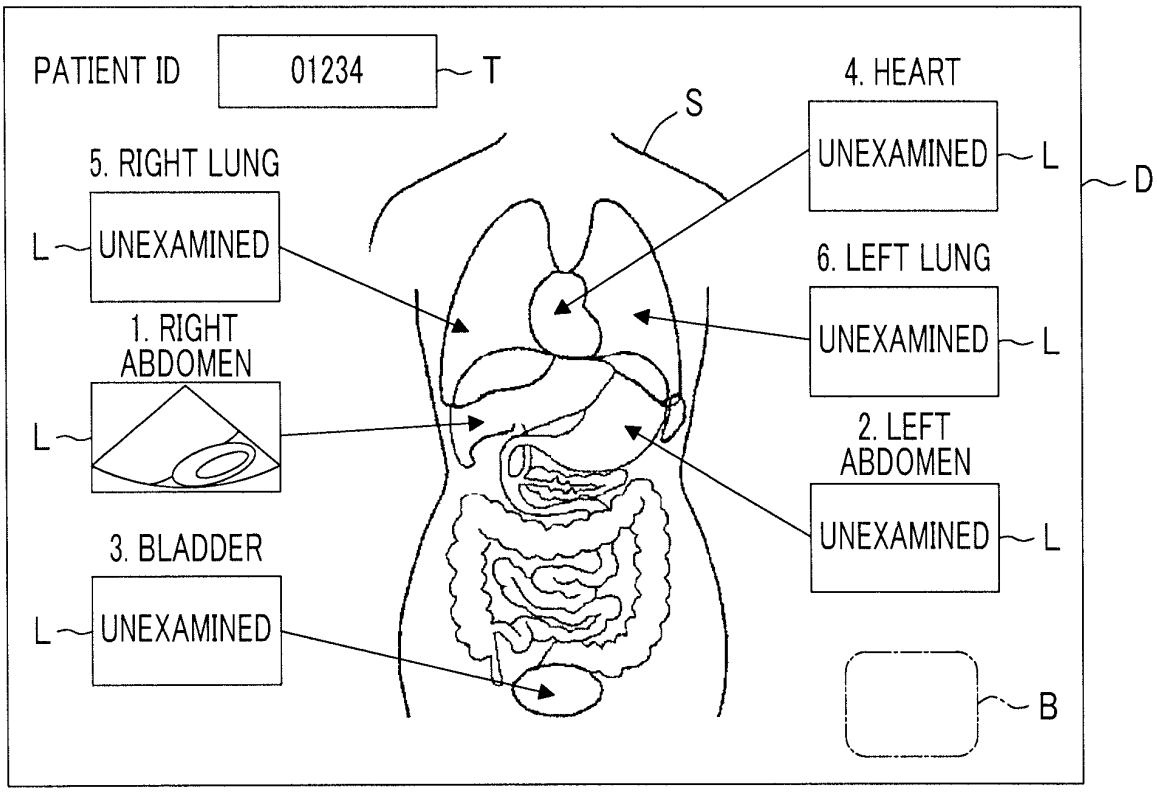

PATIENT ID
01234
T
S
4. HEART
UNEXAMINED
L
D
5. RIGHT LUNG
L
UNEXAMINED
6. LEFT LUNG
UNEXAMINED
L
1. RIGHT ABDOMEN
L
2. LEFT ABDOMEN
UNEXAMINED
L
3. BLADDER
L
UNEXAMINED
B

FIG. 9

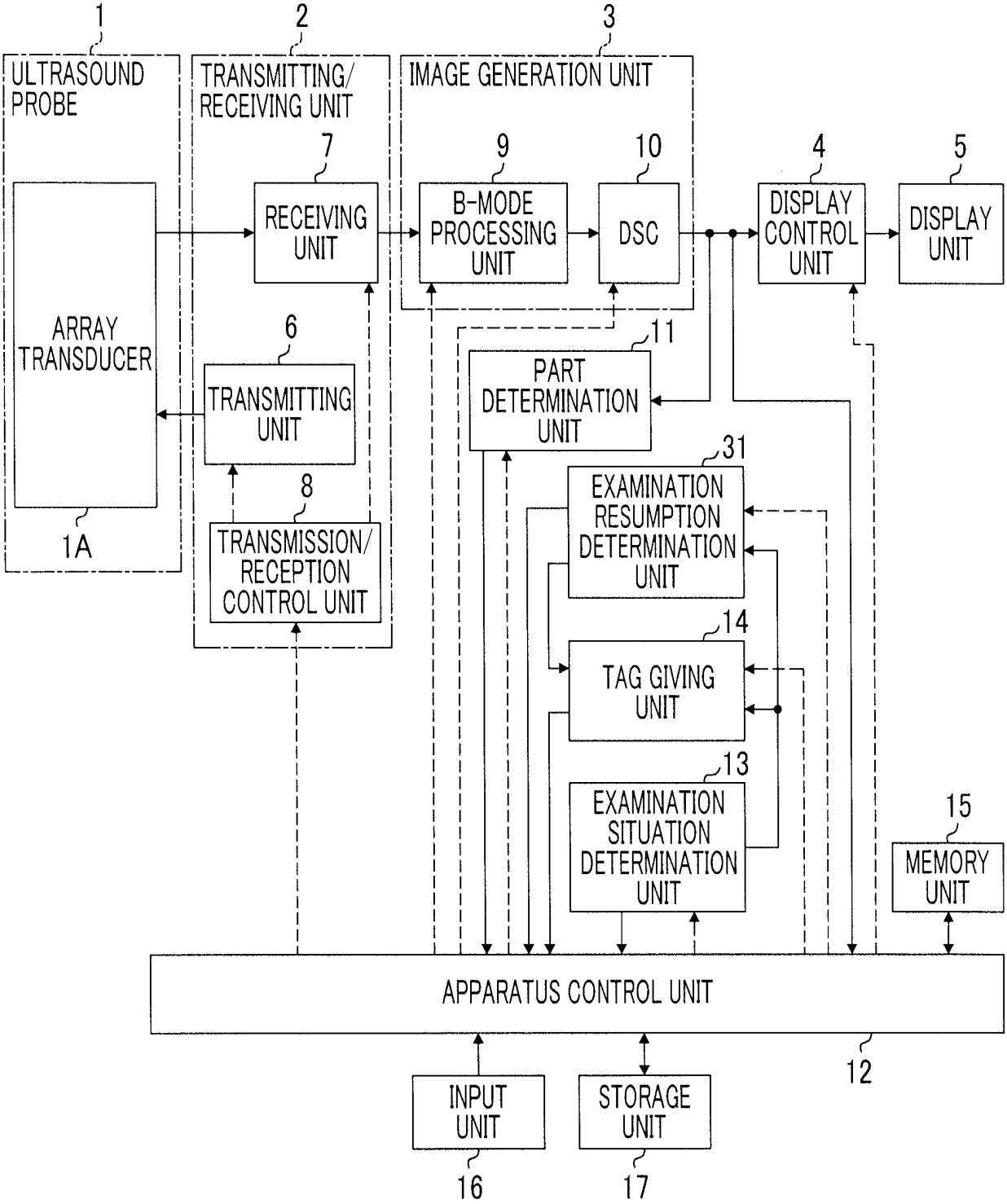

1
2
3
ULTRASOUND PROBE
TRANSMITTING/ RECEIVING UNIT
IMAGE GENERATION UNIT
7
9
10
4
5
RECEIVING UNIT
B-MODE PROCESSING UNIT
DSC
DISPLAY CONTROL UNIT
DISPLAY UNIT
ARRAY TRANSDUCER
6
11
TRANSMITTING UNIT
PART DETERMINATION UNIT
31
8
EXAMINATION RESUMPTION DETERMINATION UNIT
1A
TRANSMISSION/ RECEPTION CONTROL UNIT
14
TAG GIVING UNIT
13
15
EXAMINATION SITUATION DETERMINATION UNIT
MEMORY UNIT
APPARATUS CONTROL UNIT
12
INPUT UNIT
STORAGE UNIT
16
17

FIG. 10

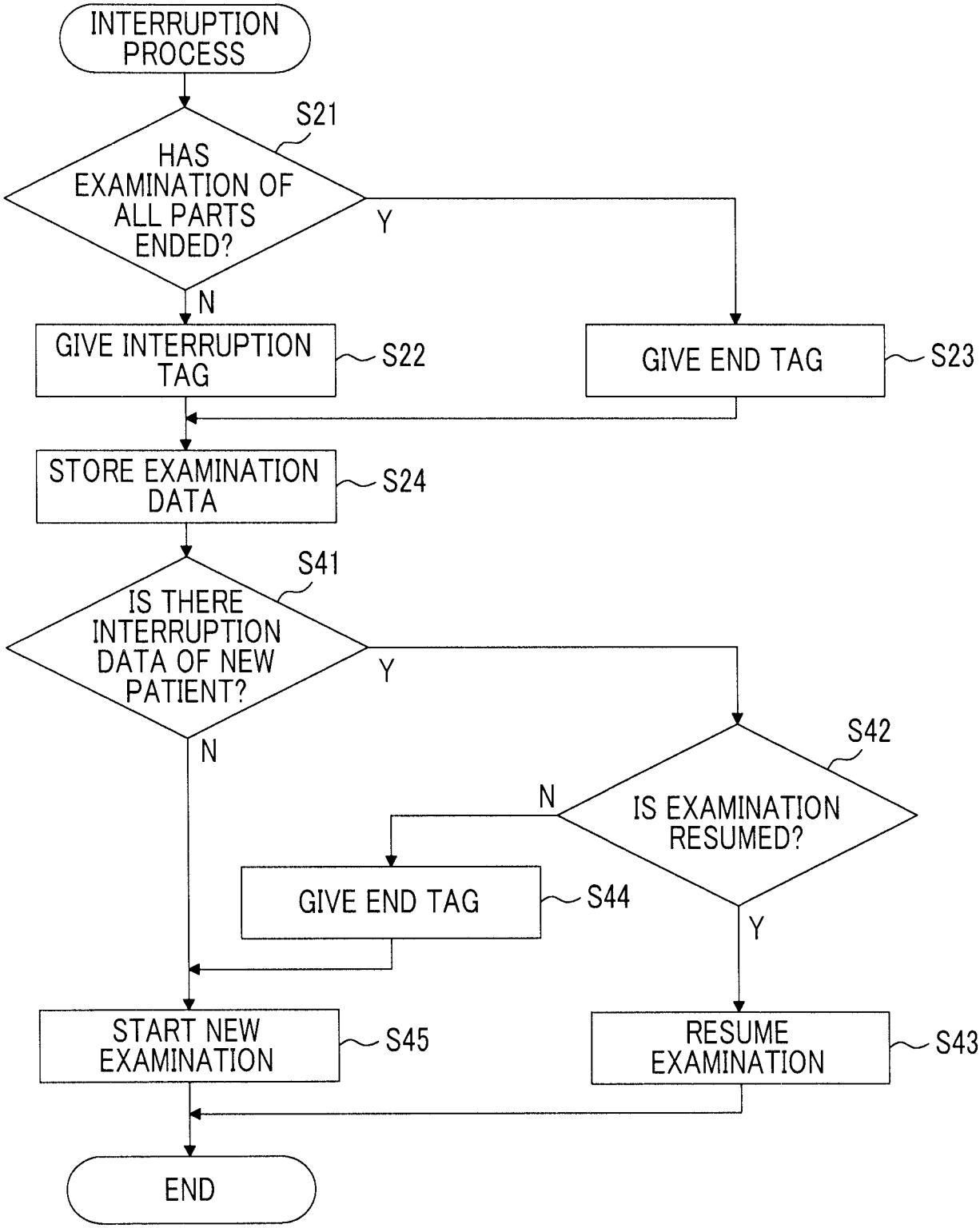
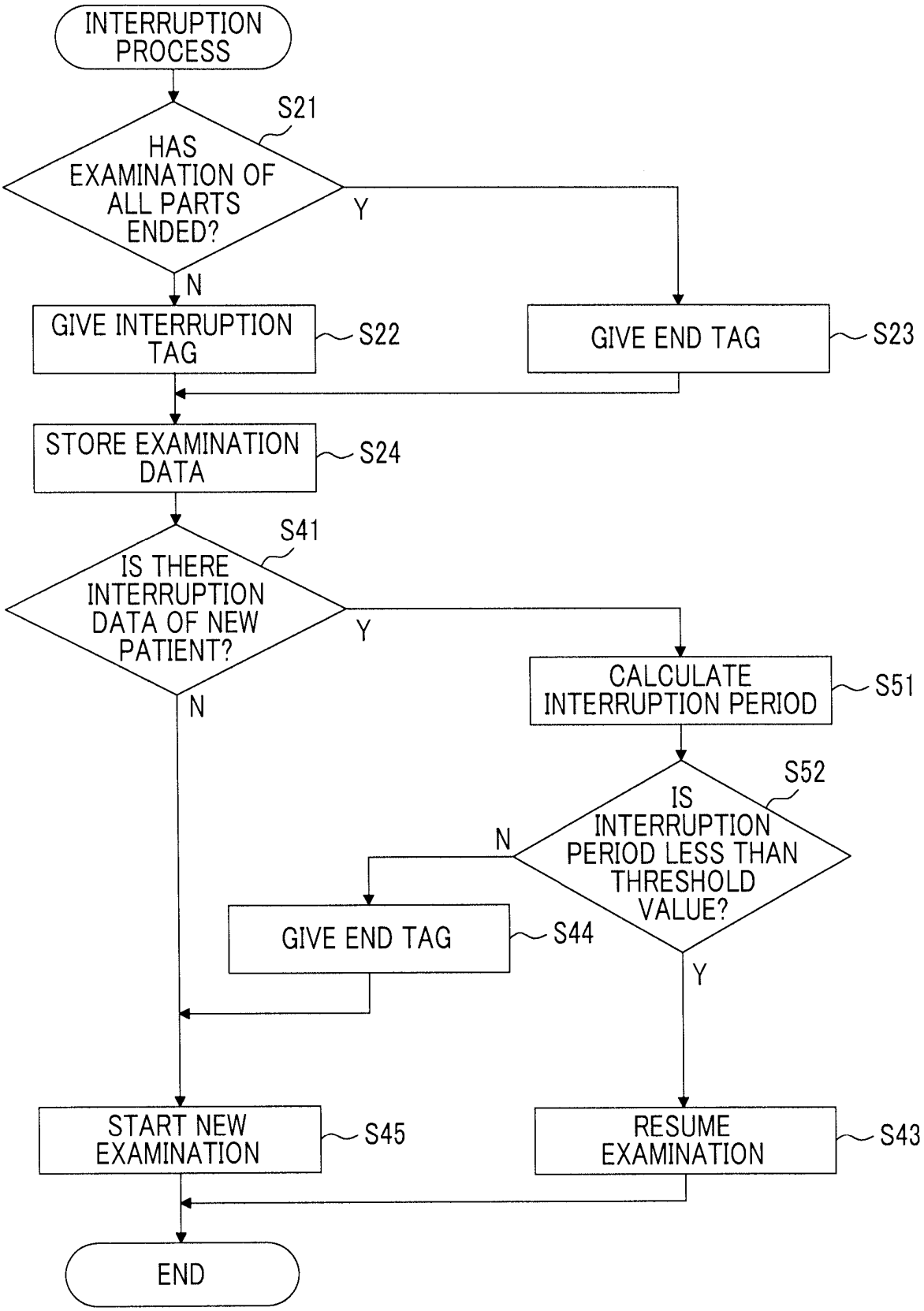

INTERRUPTION PROCESS
S21
HAS EXAMINATION OF ALL PARTS ENDED?
Y
N
GIVE INTERRUPTION TAG
S22
GIVE END TAG
S23
STORE EXAMINATION DATA
S24
S41
IS THERE INTERRUPTION DATA OF NEW PATIENT?
Y
N
S42
IS EXAMINATION RESUMED?
N
Y
GIVE END TAG
S44
START NEW EXAMINATION
S45
RESUME EXAMINATION
S43
END

FIG. 11


INTERRUPTION PROCESS
S21
HAS EXAMINATION OF ALL PARTS ENDED?
Y
N
GIVE INTERRUPTION TAG
S22
GIVE END TAG
S23
STORE EXAMINATION DATA
S24
S41
IS THERE INTERRUPTION DATA OF NEW PATIENT?
Y
N
CALCULATE INTERRUPTION PERIOD
S51
S52
IS INTERRUPTION PERIOD LESS THAN THRESHOLD VALUE?
N
Y
GIVE END TAG
S44
START NEW EXAMINATION
S45
RESUME EXAMINATION
S43
END

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 5242023 B **[0003] [0004]**
- US 2013163838 A1 **[0003]**

专利名称(译)	超声诊断装置及控制超声诊断装置的方法		
公开(公告)号	EP3437566B1	公开(公告)日	2020-01-08
申请号	EP2017774652	申请日	2017-03-23
[标]申请(专利权)人(译)	富士胶片株式会社		
申请(专利权)人(译)	富士胶片株式会社		
当前申请(专利权)人(译)	富士胶片株式会社		
[标]发明人	ENDO MAIKO		
发明人	ENDO, MAIKO		
IPC分类号	A61B8/14 A61B8/00 G01S7/52		
CPC分类号	A61B8/469 A61B8/14 G01S7/52098 A61B8/463 A61B8/468 A61B8/5292 A61B8/54		
优先权	2016074400 2016-04-01 JP		
其他公开文献	EP3437566A1 EP3437566A4		
外部链接	Espacenet		

摘要(译)

一种超声波诊断设备，包括：成像单元，其将从超声波探头输出的接收信号转换成图像以生成超声波图像；以及 用户用来输入患者信息的输入单元； 存储单元，其存储用于连续检查多个检查部位的检查内容，以与患者信息相关联。 检查状况确定单元，在连续检查期间将新的患者信息输入到输入单元的情况下，确定是否对与患者信息相关联的检查内容相关的多个检查部分中的所有检查进行检查 结束了; 标记赋予单元，在判定为多个检查部的全部的检查没有结束的情况下，对患者信息赋予检查中断标签，并在该情况下，对患者信息赋予检查结束标签 其中确定所有多个检查部分的检查已经结束。

FIG. 1