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(54) Ultrasonic diagnostic apparatus and ultrasonic image display method

Ultraschall Diagnosevorrichtung und Verfahren zur Anzeige von Ultraschallbildern

Appareil et procédé de diagnostic ultrasonique

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(56) References cited:

EP-A- 0 844 581

US-A1- 2004 066 398

US-A1- 2004 116 812

US-B1- 6 335 979

US-B1- 6 402 693

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Description

[0001] The present invention relates to an ultrasonic diagnostic apparatus and ultrasonic image display method which allow easy and simple reference to arbitrary images (past images) acquired or generated in the past, which are typified by ultrasonic images or other modality images (e.g., CT images and MR images), at the time of ultrasonic image diagnosis, medical treatment under the guidance of ultrasonic images, and the like.

[0002] An ultrasonic diagnostic apparatus is a medical image device which noninvasively obtains a tomogram of soft tissue in a living body from the body surface by an ultrasonic pulse reflection method. This ultrasonic diagnostic apparatus is, for example, smaller in size, more inexpensive, and safer because of no exposure to X-rays than other medical image devices, can perform blood flow imaging, and hence is widely used in a cardiac department, abdominal department, urological department, obstetrics and gynecology, and the like.

[0003] This ultrasonic diagnostic apparatus has a dual display function as an image display function which simultaneously displays a frozen image and a live image. With this dual display function, when, for example, performing a contrast medium examination immediately before paracentesis, a doctor can puncture a target tumor while seeing a perfusion image of the 7 of claim 1 and the ultrasonic image display method of claim 13. tumor displayed on one window and a live image on the other window. In addition, for example, while performing medical treatment with a tumor image (past image) before cauterization being displayed on one window, the doctor can determine a treatment effect while comparing with a live image displayed on the other window.

[0004] The ultrasonic diagnostic apparatus has a patient browser function as another image display function which is used to browse information (including image information) about a predetermined patient. Using this patient browser function makes it possible to access and check desired B-mode images and contrast-enhanced images in the past when, for example, puncturing a hepatic tumor.

[0005] In actual clinical settings, for example, there is a demand to puncture a tumor and determine an effect after medical treatment while comparing a live image with an arbitrary past image typified by a B-mode image, a contrast-enhanced image, or a CT image on a view box, as needed, or to use past images acquired in a plurality of examinations while easily switching the display of images. The conventional ultrasonic diagnostic apparatuses only have the dual display function and the patient browser function in image display but cannot meet the above demand.

[0006] US 2004/116812 A1 relates to a conventional ultrasonic diagnostic apparatus as discussed above. US 2004/066398 A1 is a further example of a known ultrasonic diagnostic apparatus.

[0007] The present invention has been made in con-

sideration of the above situation, and has as its object to provide an ultrasonic diagnostic apparatus and ultrasonic image display method which allow to compare and observe a desired image acquired in the past with a live image or a stored image after acquisition, as needed, during tumor paracentesis or the like.

[0008] This is achieved by the ultrasonic diagnostic apparatus 7. Further advantageous developments are specified in the sub-claims.

[0009] The invention can be more fully understood from the following detailed description when taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a block diagram showing the arrangement of an ultrasonic diagnostic apparatus 1 according to this embodiment;

FIG. 2 is a flowchart showing an example of a processing procedure executed in an image acquisition mode;

FIG. 3 is a view showing an example of a past image registered in an image table;

FIG. 4 is a view showing another example of the past image registered in the image table;

FIG. 5A is a flowchart showing an example of a processing procedure executed in an image comparison mode;

FIG. 5B is a view showing an example of a display form in the image comparison mode;

FIG. 5C is a view showing another example of the display form in the image comparison mode;

FIG. 6 is a view showing a display example in the image comparison mode when a reference image is a past ultrasonic image;

FIG. 7A is a view showing a display example in the image comparison mode when a reference image is a past CT image;

FIG. 7B is a view showing an example of displaying two past images generated in the same procedure side by side; and

FIG. 8 is a view for explaining an example of an application associated with the image acquisition mode and image comparison mode.

[0010] An embodiment of the present invention will be described below with reference to the views of the accompanying drawing. Note that in the following description, the same reference numerals denote constituent elements having almost the same functions and arrangements, and a repetitive description will be made only when required.

[0011] FIG. 1 is a block diagram showing the arrangement of an ultrasonic diagnostic apparatus 1 according to this embodiment. As shown in FIG. 1, the ultrasonic diagnostic apparatus 1 comprises an ultrasonic probe 11, ultrasonic transmission unit 12, ultrasonic reception unit 13, B-mode processing unit 14, color mode processing unit 15, cinema memory 16, control unit (CPU) 17, display control unit 18, reference image list management

unit 19, image recording device 20, operation unit 22, and monitor 23.

[0012] The ultrasonic probe 11 includes a plurality of piezoelectric transducers which generate ultrasonic waves on the basis of driving signals from the transmission unit 12 and convert reflected waves from a subject to be examined into electrical signals, a matching layer provided for the piezoelectric transducers, a backing member which prevents ultrasonic waves from propagating backward from the piezoelectric transducers, and the like. When ultrasonic waves are transmitted from the ultrasonic probe 11 to the subject, various harmonic components are generated due to the nonlinearity of a living tissue along the propagation of the ultrasonic waves. Fundamental waves and harmonic components constituting transmission ultrasonic waves are scattered backward by acoustic impedance boundaries of a tissue in a living body, micro-scattering, and the like, and are received as reflected waves (echoes) by the ultrasonic probe 11.

[0013] The ultrasonic transmission unit 12 includes a delay circuit, a pulser circuit, and the like (not shown). The pulser circuit repetitively generates rate pulses for the formation of transmission ultrasonic waves at a predetermined rate frequency f_r Hz (period: $1/f_r$ sec). The delay circuit gives each rate pulse a delay time necessary to focus an ultrasonic wave into a beam and determine transmission directivity for each channel. The transmission unit 12 applies a driving pulse to each vibrator so as to form an ultrasonic beam toward a predetermined scan line at the timing based on this rate pulse.

[0014] The ultrasonic reception unit 13 includes an amplifier circuit, A/D converter, adder, and the like (not shown). The amplifier circuit amplifies an echo signal received via the probe 11 for each channel. The A/D converter gives the amplified echo signals delay times necessary to determine reception directivities. The adder then performs addition processing for the signals. With this addition, an ultrasonic echo signal corresponding to a predetermined scan line is generated.

[0015] Note that the a T/R switch (not shown) is used to switch connection between the ultrasonic probe 11, ultrasonic transmission unit 12, and ultrasonic reception unit 13 at the time of transmission and reception.

[0016] The B-mode processing unit 14 performs envelope detection processing for the ultrasonic echo signal received from the reception unit 13 to generate a B-mode signal or the like corresponding to the amplitude intensity of the ultrasonic echo.

[0017] The color mode processing unit 15 performs quadrature detection processing, autocorrelation processing, and the like for the echo signal received from the reception unit 13, and obtains a tissue Doppler signal corresponding to the velocity, variance, and power of the tissue which moves in the subject on the basis of the Doppler shift component of the ultrasonic echo signal having undergone delay/addition processing.

[0018] The cinema memory 16 is, for example, a mem-

ory which stores ultrasonic images corresponding to a plurality of frames immediately before freezing. Continuous display (cinema display) of the images stored in the cinema memory 16 makes it possible to display an ultrasonic moving image.

[0019] The control unit 17 functions as an information processing apparatus (computer) and statically or dynamically controls the operation of this ultrasonic diagnostic apparatus.

[0020] The display control unit 18 generates a B-mode ultrasonic image, Doppler image, or the like which represents a dimensional distribution associated with a predetermined slice of a B mode signal. The display control unit 18 performs image processing for a reference image to match its observation angle, magnification, positional relationship, and the like with those of a live image in an image comparison mode (to be described later).

[0021] The reference image list management unit 19 executes processing associated with an image acquisition mode and image reference mode (to be described later) by unarchiving predetermined programs in a memory under the control of the control unit 17.

[0022] The image recording device 20 stores ultrasonic images acquired by the ultrasonic diagnostic apparatus, an image table generated in the image acquisition mode (to be described later), information (storage location information) about the storage locations of past images registered in the image table, and the like. Note that the ultrasonic image data which the operation unit 22 stores can be so-called raw image data before scan conversion.

[0023] The operation unit 22 is connected to the apparatus body and includes a mouse, trackball, mode switch, keyboard, and the like which are used to input, to the apparatus body, various instructions from the operator, an instruction to set a region of interest (ROI), various image quality setting instructions, and the like.

[0024] The monitor 23 displays morphological information and blood flow information in the living body as images on the basis of video signals from the display control unit 18. The monitor 23 displays an image table, a past image registered in the image table, information about the past image, a reference image, a live image, and the like in predetermined forms in the image acquisition mode and image comparison mode (to be described later) under the control of the control unit 17.

(Image Acquisition Mode and Image Reference Mode)

[0025] Operation in the image acquisition mode and image comparison mode which the ultrasonic diagnostic apparatus 1 has will be described next. In this case, the image acquisition mode (Acquisition Mode) is an operation form of registering desired past images, in the image table, which are displayed together with live images during imaging so as to be used as references for paracentesis and treatment effect determination. The image comparison mode (Comparison Mode) is an operation form

of displaying an image (reference image) selected from the past images registered in the image table together with a live image in a predetermined form. Each mode will be described in detail below by taking, as an example, a case in which each mode is used for paracentesis.

(Image Acquisition Mode)

[0026] FIG. 2 is a flowchart showing an example of a processing procedure executed in the image acquisition mode. As shown in FIG. 2, first of all, a past image which is likely to serve as a reference in paracentesis is selected from the past images stored in an image server on a network, an image storage device in another modality, the image recording device 20 which the ultrasonic diagnostic apparatus 1 has, or the like (step S1).

[0027] Note that in this selection of a past image, it is possible to set, as selection targets, not only past images associated with the same patient but also past images of another person obtained by applying medical treatment to the same disease in the same region by using pieces of DICOM header information and the like. Therefore, for example, as shown in FIGS. 3 and 4, it is possible to select past images of another person before and after paracentesis treatment for a predetermined morbid portion.

[0028] In addition, selectable past images are not limited to ultrasonic images. That is, it is possible to select past images acquired by other modalities (e.g., CT images and MR images). Sample images, animation images, and the like can also be used. Furthermore, past images can be two-dimensional images, two-dimensional moving images, three-dimensional images, or three-dimensional moving images.

[0029] The operator then inputs an attribute associated with the selected past image (step S2). The selected past image is classified according to the attribute and registered, and the storage location information of the past image is stored (step S3). In this case, an attribute is a label which the operator can arbitrarily input to classify and manage the past image registered in the image table. Note that it is not essential to input an attribute, and it is possible to omit this operation if there is no need for classification.

[0030] When another past image is to be additionally registered in the image table, the processing in steps S1 to S3 is repeatedly executed. If there is no past image to be added, the image acquisition mode is terminated (step S4).

[0031] Note that the operator can clear the image table with predetermined operation at an arbitrary timing. When the process shifts to a new examination (medical treatment), the image table is automatically reset. When a past image is newly registered in the reset or cleared image table afterward, the processing in steps S1 to S4 is repeatedly executed.

(Image Comparison Mode)

[0032] FIG. 5A is a flowchart showing an example of a processing procedure executed in the image comparison mode. As shown in FIG. 5A, first of all, the image table generated in the image acquisition mode is read out, and registered past images are displayed (step S11). The registered past images can be displayed in any form as long as the operator can grasp the contents of the images. Typical examples of such form include thumbnail display (see FIG. 5B), individual display (see FIG. 5C) in which images are displayed while being manually or automatically switched one by one, list display using text information indicating the storage location information of each image or attributes of each image (e.g., patient information, an examination name, an examination region, an imaging modality, an examination date, examiner, and the like), and the like.

[0033] Upon receiving selection of a desired past image via the operation unit 22 (step S12), the control unit 17 acquires the image from a predetermined location on the basis of the storage location information of the selected past image.

[0034] A reference image having undergone predetermined image processing is displayed on the monitor 23 together with a live image (step S13). FIG. 6 shows a display example in the image comparison mode in a case in which a reference image is a past ultrasonic image. FIG. 7A shows a display example in the image comparison mode in a case in which a reference image is a past CT image. The doctor can perform paracentesis while observing the reference image and the live image which are displayed in the form shown in each of the drawings. FIG. 7B shows an example of displaying the first and second past images generated in the same procedure as that described above side by side. As the second past image, for example, a reference image is registered independently of the first past image. In the example in FIG. 7B, perfusion images in contrast echo imaging before and after medical treatment are respectively displayed as the first and second past images so as to be compared with each other.

[0035] The display control unit 18 then performs predetermined image processing for the acquired past image (step S13). In this case, the predetermined image processing includes the processing of matching an observation angle, magnification, positional relationship, temporal information, and the like between the reference image and the live image and the processing of matching a luminance, dynamic range, and image filter between the reference image and the live image. For example, the display control unit 18 executes positional relationship matching with reference to a plurality of characteristic regions designated in advance. If a reference image is a moving image, for example, the display control unit 18 executes this processing with reference to an image subjectively determined as an equivalent frame by the operator. If, for example, a treatment target is the heart

and a reference image is matched with information about a cardiac time phase, temporal information matching is executed to match the cardiac time phase of the reference image with that of the live image or the second reference image.

[0036] When the sameness of a patient is required between a reference image and a live image, the control unit 17 checks the sameness before step S13 by comparing a patient ID added as the header information of the reference image with the patient ID of the patient currently diagnosed. The control unit 17 can display the patient ID (or information for specifying the patient) added to a reference image together with the reference image, as needed.

[0037] When the displayed reference image is to be changed, the processing from step S11 to step S14 is repeatedly executed (step S15). If the medical treatment using the display reference image is complete and an end instruction is issued, the image comparison mode is terminated (step S16).

(Application)

[0038] An application associated with the image acquisition mode and image comparison mode of the ultrasonic diagnostic apparatus 1 will be described next.

[0039] FIG. 8 is a view for explaining an example of an application associated with the image acquisition mode and image comparison mode. As shown in FIG. 8, the image comparison mode of displaying a past image and a live image is activated. As shown in FIG. 6, when the operator presses an image acquisition button during Comp1 Mode, the current mode shifts to the image acquisition mode. The processing from step S1 to step S4 shown in FIG. 2 is then executed to generate an image table in which image 1 and image 2 are registered. During Comp1 Mode, image 1 or image 2 is selected and displayed as a past image on the left window, and a live image is displayed on the right window. In the steps shown in FIG. 5A, the above display is executed, and the image size and position are also adjusted.

[0040] After medical treatment, the image comparison mode in which the first and second past images are displayed side by side is activated. The processing in steps S11 to S16 is executed for the first and second past images to display the first reference image together with the second past image for the determination of the treatment effect of paracentesis in a predetermined form.

[0041] All the past images registered in the image table in the image comparison mode (Comp1 Mode) are cleared (ALL Clear). In the image acquisition mode, an image table in which image 6 and image 7 are classified as images with the same attribute is generated again. When an examination (medical treatment) is resumed, a reference image is displayed together with a live image for monitoring paracentesis in a predetermined form. This image comparison mode exemplifies a case in which the image acquisition mode is activated during paracentesis,

and images (image 8 to image 10) required to indicate the state of paracentesis are newly registered in the image table. In the above case, all the past images are cleared (All Clear). In some cases, unnecessary images are partly deleted (edited).

[0042] When an examination (medical treatment) is to be performed on a new patient, the image table is automatically reset, and the same processing is repeatedly executed.

[0043] According to the above arrangement, the following effects can be obtained.

[0044] According to this ultrasonic diagnostic apparatus, in the image acquisition mode, a desired past image is registered in the image table. This apparatus displays a past image selected from the past images registered in the table as a reference image together with a live image in a predetermined form. In addition, selecting another image registered in the image table at an arbitrary timing makes it possible to display another past image upon replacing the reference image with it. When, therefore, determining an effect after medical treatment in puncturing a tumor, an operator such a doctor can compare and observe a live image and a desired past image, as needed. This makes it possible to provide effective medical information in a suitable form and contribute to safe paracentesis, reliable treatment effect determination, and the like.

[0045] This ultrasonic diagnostic apparatus also allows to register only desired images in the image table in the image acquisition mode. This saves the doctor from having to see any unnecessary images during image diagnosis without much time to spare. This can therefore reduce the operation load on an operator such as a doctor during image diagnosis.

[0046] It is possible to execute the image acquisition mode and image comparison mode of this ultrasonic diagnostic apparatus at arbitrary timings. Even if it suddenly becomes necessary to execute such a mode during image diagnosis, it is possible to quickly and easily display a past image and a live image in a form that allows comparison. In addition, this ultrasonic diagnostic apparatus allows the image table to be reset at an arbitrary timing. Even if, therefore, a registered reference image is not suitable for comparison with a live image, suitable image diagnosis can be executed by activating the image acquisition mode after resetting or clearing the image table, and then quickly generating a new image table.

[0047] In addition, this ultrasonic diagnostic apparatus displays a reference image and a live image in a form that matches a positional relationship, observation angle, temporal information, magnification, and the like between them. Even if, therefore, magnifications, observation angles, modalities by which a live image and a reference image have been acquired, and the like differ between the live image and the reference image, it is possible to compare and observe them in a suitable form, thereby providing effective medical information.

[0048] The present invention is not limited to the above

embodiment, and constituent elements can be modified and embodied in the execution stage within the spirit and scope of the invention. The following are concrete modifications.

(1) Each function associated with this embodiment can also be implemented by installing programs which execute equivalent processing in a computer such as a workstation and unarchiving them in a memory. In this case, the programs which can cause the computer to execute the corresponding techniques can be distributed by being stored in recording media such as magnetic disks (floppy (registered trademark) disks, hard disks, and the like), optical disks (CD-ROMs, DVDs, and the like), and semiconductor memories.

(2) The above embodiment is configured to store link information indicating the storage location of each image together with an image table. However, the present invention is not limited to this, and an image table can be generated and managed with image data themselves being attached thereto.

(3) The respective functions described in the above embodiment can also be used in combination with the functions of an existing ultrasonic diagnostic apparatus. For example, if past images registered in the image table have been acquired by different modalities, it is possible to perform predetermined conversion processing for each past image on the basis of DICOM header information attached thereto, store the resultant image in the image recording device 20, and browse them by using the patient browser function.

[0049] In addition, various inventions can be formed by proper combinations of a plurality of constituent elements disclosed in the above embodiments. For example, several constituent elements may be omitted from all the constituent elements disclosed in the above embodiments. Furthermore, constituent elements in the different embodiments may be properly combined.

[0050] It is explicitly stated that all features disclosed in the description and/or the claims are intended to be disclosed separately and independently from each other for the purpose of original disclosure as well as for the purpose of restricting the claimed invention independent of the composition of the features in the embodiments and/or the claims. It is explicitly stated that all value ranges or indications of groups of entities disclose every possible intermediate value or intermediate entity for the purpose of original disclosure as well as for the purpose of restricting the claimed invention, in particular as limits of value ranges.

Claims

1. An ultrasonic diagnostic apparatus (1), comprising:

a display unit (18, 23) adapted to display past images acquired from a patient or another patient together with an ultrasonic live image from the patient;

a selection unit (19) capable of selecting past images from among past images acquired by imaging modalities other than an ultrasonic imaging modality such as a CT or MR imaging modality from the same or the other patient and/or in ultrasound examinations of the other patient from an image storage management unit in the ultrasonic diagnostic apparatus (1), an image recording medium connected to the apparatus, and/or an image storage management system connected via a network;

a reference image registration unit (19) adapted to register selected images in an image table for image reference together with information about a storage location of the image;

an acquisition unit adapted to acquire an image registered in the image table on the basis of the information about the storage location and to store the image in an image storage management unit in the ultrasonic diagnostic apparatus (1), wherein

the display unit (18, 23) is adapted to arbitrarily repeatedly display the acquired past image in the image table as a reference image.

2. An apparatus according claim 1, wherein the selection unit is adapted to select past ultrasound images acquired from the same patient.

3. An apparatus (1) according to claim 1 or 2, wherein the display unit (18, 23) is adapted to display the reference image together with the ultrasonic live image or a frozen image of a patient.

4. An apparatus (1) according to any one of claims 1 to 3, further comprising an input unit (22) adapted to input an attribute for each of said registered past images, and in which the registration unit (19) is adapted to register the past image in the image table upon classifying the image according to the input attribute.

5. An apparatus (1) according to any of claims 1 to 4, wherein the registration unit (19) is adapted to edit or reset the image table at an arbitrary timing in response to manual operation of an operator.

6. An apparatus (1) according to any of claims 1 to 5, wherein the registration unit (19) is adapted to edit or reset the image table for each examination.

7. An apparatus (1) according to any of claims 1 to 6, further comprising a determination unit (19) adapted

to determine, on the basis of patient information attached to the acquired past image, whether the acquired past image is acquired from the patient, and in which the display unit (23) is adapted to display a determination result obtained by the determination unit (19).

8. An apparatus (1) according to any of claims 1 to 7, wherein the display unit (23) is adapted to generate and display the reference image by performing predetermined image processing for the acquired past image.

9. An apparatus (1) according to claim 8, wherein the display unit (23) is adapted to execute image processing of matching at least one of an observation angle, magnification, and positional relationship between the reference image and the live image.

10. An apparatus (1) according to any of claims 1 to 9, wherein the display unit (23) is adapted to display the reference image and the live image in synchronism with each other so as to match temporal information or spatial information therebetween.

11. An apparatus (1) according to any of claims 1 to 10, wherein the display unit (23) is adapted to display, in selection by the selection unit, at least one of a thumbnail image of a past image registered in the image table, information about the storage location of the past image registered in the image table, and information representing an attribute of the past image registered in the image table.

12. An apparatus (1) according to any of claims 1 to 11, wherein
when another past image is selected from the registered past images by the selection unit at an arbitrary timing, the acquisition unit is adapted to acquire the selected other past image from the storage location on the basis of the information about the storage location, and
the display unit (23) is adapted to display the acquired other past image as the reference image.

13. An ultrasonic image display method, comprising:

displaying past images after being acquired from a patient or another patient together with an ultrasonic live image from the patient;
selecting past images from among past images acquired by imaging modalities other than an ultrasonic imaging modality such as a CT or MR imaging modality from the same or the other patient and/or in ultrasound examinations of the other patient from an image storage management unit in the ultrasonic diagnostic apparatus (1), an image recording medium connected to

the apparatus, and/or an image storage management system connected via a network;
registering the selected past images in an image table for image reference together with information about a storage location of the registered image; and
acquiring an image registered in the image table, from the storage location on the basis of the information about the storage location, and to store the image in an image storage management unit in the ultrasonic diagnostic apparatus (1),

wherein in the displaying step the acquired past images in the image table are arbitrarily repeatedly displayed as a reference image.

14. A method according to claim 13, wherein in the same selection step ultrasound images acquired from the same patient are selected.

15. A method according to claim 13 or 14, which further comprises inputting an attribute for each of said registered past images, and in which in the registration, the past image is registered in the image table upon being classified according to the input attribute.

16. A method according to any one of claims 12 to 15, wherein in the registration, the image table is edited or reset at an arbitrary timing in response to manual operation of an operator.

17. A method according to any of claims 13 to 16, wherein in the registration, the image table is edited or reset for each examination.

18. A method according to any of claims 13 to 17, which further comprises determining, on the basis of patient information attached to the acquired past image, whether the acquired past image is acquired from the patient, and in which in the display, a determination result obtained in the determination is displayed.

19. A method according to any of claims 13 to 18, wherein in the display, the reference image is generated and displayed by performing predetermined image processing for the acquired past image.

20. A method according to claim 19, wherein in the display, image processing of matching at least one of an observation angle, magnification, and positional relationship between the reference image and the live image is executed.

21. A method according to any of claims 13 to 20, wherein in the display, the reference image and the live image are displayed in synchronism with each other

so as to match temporal information or spatial information therebetween.

22. A method according to any of claims 13 to 21, wherein in the display, at least one of a thumbnail image of a past image registered in the image table, information about the storage location of the past image registered in the image table, and information representing an attribute of the past image registered in the image table is displayed.
23. A method according to any of claims 13 to 22, wherein in the acquisition, when another past image is selected from the registered past images at an arbitrary timing, the selected other past image is acquired from the storage location on the basis of the information about the storage location, and in the display, the acquired other past image is displayed as the reference image.

Patentansprüche

1. Ultraschalldiagnosevorrichtung (1) mit einer Anzeigeeinheit (18, 23), die zum Anzeigen von für einen Patienten oder einen anderen Patienten aufgenommenen früheren Bildern zusammen mit einem Ultraschalllivebild des Patienten ausgebildet ist, einer Auswahlinheit (19), die dazu ausgebildet ist, frühere Bilder von früheren Bildern auszuwählen, die durch Bildgebungsmodalitäten mit Ausnahme einer Ultraschallbildgebungsmodalität wie eine CT- oder MR-Bildgebungsmodalität von dem gleichen oder dem anderen Patienten und/oder in Ultraschalluntersuchungen des anderen Patienten von einer Bildspeicherverwaltungseinheit in der Ultraschalldiagnosevorrichtung (1), einem Bildaufnahmemedium, welches mit der Vorrichtung verbunden ist, und/oder einem Bildspeicherverwaltungssystem, welches über ein Netzwerk verbunden ist, auszuwählen, einer Referenzbildregistrierungseinheit (19), die dazu ausgebildet ist, ausgewählte Bilder in einer Bildtabelle zur Bildreferenz zusammen mit Informationen über einen Speicherort des Bildes zu registrieren, einer Erfassungseinheit, die dazu ausgebildet ist, ein in der Bildtabelle registriertes Bild auf der Basis der Information über den Speicherort zu erfassen und das Bild in einer Bildspeicherverwaltungseinheit in der Ultraschalldiagnosevorrichtung (1) zu speichern, wobei die Anzeigeeinheit (18, 23) dazu ausgebildet ist, zufällig wiederholt das erfasste frühere Bild in der Bildtabelle als Referenzbild anzuzeigen.
2. Vorrichtung nach Anspruch 1, wobei die Auswahlinheit dazu ausgebildet ist, vom gleichen Patienten

aufgenommene alte Ultraschallbilder auszuwählen.

3. Vorrichtung (1) nach Anspruch 1 oder 2, wobei die Anzeigeeinheit (18, 23) dazu ausgebildet ist, das Referenzbild zusammen mit dem Ultraschalllivebild oder einem eingefrorenen Bild eines Patienten anzuzeigen.
4. Vorrichtung (1) nach einem der Ansprüche 1 bis 3, ferner mit einer Eingabeeinheit (22), die dazu ausgebildet ist, ein Attribut für jedes der registrierten früheren Bilder einzugeben, und in dem die Registrierungseinheit (19) dazu ausgebildet ist, das frühere Bild in der Bildtabelle nach Klassifizieren des Bildes gemäß des Eingabeattributs zu registrieren.
5. Vorrichtung (1) gemäß einem der Ansprüche 1 bis 4, wobei die Registrierungseinheit (19) dazu ausgebildet ist, die Bildtabelle zu einem zufälligen Zeitpunkt in Erwiderung eines manuellen Betriebs durch einen Bediener zu bearbeiten oder zurückzusetzen.
6. Vorrichtung (1) nach einem der Ansprüche 1 bis 5, wobei die Registrierungseinheit (19) dazu ausgebildet ist, die Bildtabelle für jede Untersuchung zu bearbeiten oder zurückzusetzen.
7. Vorrichtung (1) nach einem der Ansprüche 1 bis 6, ferner mit einer Bestimmungseinheit (19), die dazu ausgebildet ist, auf der Basis von an dem erfassten früheren Bild angehängter Patienteninformation zu bestimmen, ob das erfasste frühere Bild von dem Patienten erfasst ist, und bei dem die Anzeigeeinheit (23) dazu ausgebildet ist, ein von der Bestimmungseinheit (19) erhaltenes Bestimmungsergebnis anzuzeigen.
8. Vorrichtung (1) nach einem der Ansprüche 1 bis 7, wobei die Anzeigeeinheit (23) dazu ausgebildet ist, das Referenzbild durch Durchführen vorbestimmten Bildverarbeitens für das erfasste frühere Bild zu erzeugen und anzuzeigen.
9. Vorrichtung (1) nach Anspruch 8, wobei die Anzeigeeinheit (23) dazu ausgebildet ist, ein Bildverarbeiten des Abstimmens von einem Beobachtungswinkel, einer Vergrößerung und/oder eines Positionsverhältnisses zwischen dem Referenzbild und dem Livebild auszuführen.
10. Vorrichtung (1) nach einem der Ansprüche 1 bis 9, wobei die Anzeigeeinheit (23) dazu ausgebildet ist, das Referenzbild und das Livebild in Synchronisation miteinander anzuzeigen, um zeitliche Information und räumliche Information zwischen diesen abzustimmen.
11. Vorrichtung (1) nach einem der Ansprüche 1 bis 10,

wobei die Anzeigeeinheit (23) dazu ausgebildet ist, nach Auswahl durch die Auswahleinheit ein Thumbnail-Bild eines in der Bildtabelle registrierten früheren Bildes, Information über den Speicherort des in der Bildtabelle registrierten früheren Bildes und/oder Information, welche ein Attribut des in der Bildtabelle registrierten früheren Bildes darstellt, anzuzeigen.

12. Vorrichtung (1) nach einem der Ansprüche 1 bis 11, wobei, wenn ein anderes früheres Bild von den registrierten früheren Bildern durch die Auswahleinheit zu einem zufälligen Zeitpunkt ausgewählt wird, die Erfassungseinheit dazu ausgebildet ist, das ausgewählte andere frühere Bild vom Speicherort auf der Basis der Information über den Speicherort zu erfassen, und die Anzeigeeinheit (23) dazu ausgebildet ist, das erfasste andere frühere Bild als Referenzbild anzuzeigen.

13. Ultraschallbildanzeigeverfahren mit den Schritten:

Anzeigen früherer Bilder, nachdem diese von einem Patienten oder einem anderen Patienten erfasst wurden, zusammen mit einem Ultraschalllivebild des Patienten,

Auswählen früherer Bilder aus früheren Bildern, die durch Bildgebungsmodalitäten mit Ausnahme einer Ultraschallbildgebungsmodalität wie eine CT- oder MR-Bildgebungsmodalität von dem gleichen oder dem anderen Patienten und/oder in Ultraschalluntersuchungen des anderen Patienten von einer Bildspeicherverwaltungseinheit in der Ultraschalldiagnosevorrichtung (1), einem Bildaufnahmemedium, welches mit der Vorrichtung verbunden ist, und/oder einem Bildspeicherverwaltungssystem, welches über ein Netzwerk verbunden ist, erzeugt wurden,

Registrieren der ausgewählten früheren Bilder in einer Bildtabelle zur Bildreferenz zusammen mit Information über einen Speicherort des registrierten Bildes, und

Erfassen eines in der Bildtabelle registrierten Bildes von dem Speicherort auf der Basis der Information über den Speicherort und Speichern des Bildes in einer Bildspeicherverwaltungseinheit in der Ultraschalldiagnosevorrichtung (1),

wobei in dem Anzeigeschritt die erfassten früheren Bilder in der Bildtabelle zufällig wiederholt als ein Referenzbild angezeigt werden.

14. Verfahren nach Anspruch 13, wobei in dem gleichen Auswahlsschritt Ultraschallbilder, die von dem gleichen Patienten erfasst wurden, ausgewählt werden.

15. Verfahren nach Anspruch 13 oder 14, wobei dieses ferner aufweist ein Eingeben eines Attributs für jedes der registrierten früheren Bilder, und in welchem bei der Registrierung das frühere Bild in der Bildtabelle nach dem Klassifizieren gemäß dem Eingabeattribut registriert wird.

16. Verfahren nach einem der Ansprüche 12 bis 15, wobei bei der Registrierung die Bildtabelle zu einem zufälligen Zeitpunkt in Erwiderung auf einen manuellen Betrieb durch einen Bediener bearbeitet oder zurückgesetzt wird.

17. Verfahren nach einem der Ansprüche 13 bis 16, wobei bei der Registrierung die Bildtabelle für jede Untersuchung bearbeitet oder zurückgesetzt wird.

18. Verfahren nach einem der Ansprüche 13 bis 17, wobei dieses ferner aufweist ein Bestimmen auf Grundlage von Patienteninformation, die an dem erfassten früheren Bild angehängt ist, ob das erfasste frühere Bild von dem Patienten erfasst wurde, und bei dem beim Anzeigen ein Bestimmungsergebnis, welches bei der Bestimmung erhalten wurde, angezeigt wird.

19. Verfahren nach einem der Ansprüche 13 bis 18, wobei bei der Darstellung das Referenzbild durch Durchführen vorbestimmten Bildverarbeiten für das erfasste frühere Bild erzeugt und dargestellt wird.

20. Verfahren nach Anspruch 19, wobei bei der Darstellung Bildverarbeiten des Abstimmens eines Beobachtungswinkels, einer Vergrößerung und/oder eines Positionsverhältnisses zwischen dem Referenzbild und dem Livebild ausgeführt wird.

21. Verfahren nach einem der Ansprüche 13 bis 20, wobei beim Darstellen das Referenzbild und das Livebild in Synchronisation miteinander dargestellt werden, um zeitliche Information und räumliche Information zwischen diesen abzustimmen.

22. Verfahren nach einem der Ansprüche 13 bis 21, wobei bei der Darstellung ein Thumbnail-Bild eines in der Bildtabelle registrierten früheren Bildes, Information über den Speicherort des in der Bildtabelle registrierten früheren Bildes und/oder Information, die ein Attribut des in der Bildtabelle registrierten früheren Bildes darstellt, angezeigt wird.

23. Verfahren nach einem der Ansprüche 13 bis 22, wobei beim Erfassen, wenn ein anderes früheres Bild aus den registrierten früheren Bildern zu einem zufälligen Zeitpunkt ausgewählt wird, das ausgewählte andere frühere Bild von dem Speicherort auf der Grundlage der Information über den Speicherort erfasst wird und bei der Darstellung das erfasste andere frühere Bild als das Referenzbild angezeigt

wird.

Revendications

1. Appareil de diagnostic ultrasonique (1), comprenant :

une unité d'affichage (18, 23) adaptée pour afficher des images antérieures acquises d'un patient ou d'un autre patient ainsi qu'une image en temps réel ultrasonique du patient ;
une unité de sélection (19) capable de sélectionner des images antérieures parmi des images antérieures acquises par des modalités d'imagerie autres qu'une modalité d'imagerie ultrasonique telle qu'une modalité d'imagerie tomodensitométrie ou par RM du même patient ou de l'autre patient et/ou dans des examens ultrasoniques de l'autre patient à partir d'une unité de gestion de stockage d'images de l'appareil diagnostique ultrasonique (1), d'un support d'enregistrement d'images connecté à l'appareil, et/ou d'un système de gestion de stockage d'images connecté via un réseau ;
une unité d'enregistrement d'image de référence (19) adaptée pour enregistrer des images sélectionnées dans une table d'images aux fins de référence d'images avec des informations concernant un emplacement de stockage de l'image ;
une unité d'acquisition adaptée pour acquérir une image enregistrée dans la table d'images sur la base des informations concernant l'emplacement de stockage et pour stocker l'image dans une unité de gestion de stockage d'images dans l'appareil de diagnostic ultrasonique (1), dans lequel

l'unité d'affichage (13, 23) est adaptée pour afficher arbitrairement de façon répétée l'image antérieure acquise dans la table d'images en tant qu'image de référence.

2. Appareil selon la revendication 1, dans lequel l'unité de sélection est adaptée pour sélectionner des images ultrasoniques antérieures acquises du même patient.
3. Appareil (1) selon la revendication 1 ou 2, dans lequel l'unité d'affichage (18, 23) est adaptée pour afficher l'image de référence avec l'image en temps réel ultrasonique ou une image figée d'un patient.
4. Appareil (1) selon l'une quelconque des revendications 1 à 3, comprenant en outre une unité d'entrée (22) adaptée pour entrer un attribut pour chacune desdites images antérieures enregistrées, et dans

lequel l'unité d'enregistrement (19) est adaptée pour enregistrer l'image antérieure dans la table d'images lors de la classification de l'image selon l'attribut d'entrée.

5. Appareil (1) selon l'une quelconque des revendications 1 à 4, dans lequel l'unité d'enregistrement (19) est adaptée pour éditer ou réinitialiser la table d'images à un moment arbitraire en réponse à une opération manuelle d'un opérateur.
6. Appareil (1) selon l'une quelconque des revendications 1 à 5, dans lequel l'unité d'enregistrement (19) est adaptée pour éditer ou réinitialiser la table d'images pour chaque examen.
7. Appareil (1) selon l'une quelconque des revendications 1 à 6, comprenant en outre une unité de détermination (19) adaptée pour déterminer, sur la base d'informations de patient jointes à l'image antérieure acquise, si l'image antérieure acquise est acquise du patient, et dans lequel l'unité d'affichage (23) est adaptée pour afficher un résultat de détermination obtenu par l'unité de détermination (19).
8. Appareil (1) selon l'une quelconque des revendications 1 à 7, dans lequel l'unité d'affichage (23) est adaptée pour générer et afficher l'image de référence en effectuant un traitement de l'image prédéterminé pour l'image antérieure acquise.
9. Appareil (1) selon la revendication 8, dans lequel l'unité d'affichage (23) est adaptée pour exécuter le traitement d'image consistant à faire correspondre au moins un angle d'observation, un grossissement et une relation positionnelle entre l'image de référence et l'image en temps réel.
10. Appareil (1) selon l'une quelconque des revendications 1 à 9, dans lequel l'unité d'affichage (23) est adaptée pour afficher l'image de référence et l'image en temps réel en synchronisme l'une avec l'autre de sorte à faire correspondre les informations temporelles ou les informations spatiales entre elles.
11. Appareil (1) selon l'une quelconque des revendications 1 à 10, dans lequel l'unité d'affichage (23) est adaptée pour afficher, dans la sélection par l'unité de sélection, au moins une image miniature d'une image antérieure enregistrée dans la table d'images, des informations concernant l'emplacement de stockage de l'image antérieure enregistrée dans la table d'images, et des informations représentant un attribut de l'image antérieure enregistrée dans la table d'images.
12. Appareil (1) selon l'une quelconque des revendications 1 à 11, dans lequel lorsqu'une autre image an-

térieure est sélectionnée parmi des images antérieures enregistrées par l'unité de sélection à un moment arbitraire, l'unité d'acquisition est adaptée pour acquérir l'autre image antérieure sélectionnée dans l'emplacement de stockage sur la base des informations concernant l'emplacement de stockage, et l'unité d'affichage (23) est adaptée pour afficher l'autre image antérieure acquise en tant qu'image de référence.

- 13.** Procédé d'affichage d'image ultrasonique, comprenant :

l'affichage d'images antérieures une fois qu'elles ont été acquises d'un patient ou d'un autre patient en conjugaison avec une image en temps réel ultrasonique du patient ;
la sélection d'images antérieures parmi des images antérieures acquises par des modalités d'imagerie autres qu'une modalité d'imagerie ultrasonique telle qu'une modalité d'imagerie tomomodensitométrie ou par RM du même patient ou de l'autre patient et/ou dans des examens ultrasoniques de l'autre patient à partir d'une unité de gestion de stockage d'images de l'appareil diagnostique ultrasonique (1), d'un support d'enregistrement d'images connecté à l'appareil, et/ou d'un système de gestion de stockage d'images connecté via un réseau ;
l'enregistrement des images antérieures sélectionnées dans une table d'images aux fins de référence d'images avec des informations concernant un emplacement de stockage de l'image enregistrée ; et
l'acquisition d'une image enregistrée dans la table d'images, depuis l'emplacement de stockage sur la base des informations concernant l'emplacement de stockage, et pour stocker l'image dans une unité de gestion d'images dans l'appareil de diagnostic ultrasonique (1),

dans lequel dans l'étape d'affichage, les images antérieures acquises dans la table d'images sont affichées arbitrairement de manière répétée en tant qu'image de référence.

- 14.** Procédé selon la revendication 13, dans lequel dans la même étape de sélection, les images ultrasoniques acquises du même patient sont sélectionnées.
- 15.** Procédé selon la revendication 13 ou 14, qui comprend en outre l'entrée d'un attribut pour chacune desdites images antérieures enregistrées, et dans lequel dans l'enregistrement, l'image antérieure est enregistrée dans la table d'images après avoir été classifiée selon l'attribut d'entrée.
- 16.** Procédé selon l'une quelconque des revendications

12 à 15, dans lequel dans l'enregistrement, la table d'images est éditée ou réinitialisée à un moment arbitraire en réponse à une opération manuelle d'un opérateur.

- 17.** Procédé selon l'une quelconque des revendications 13 à 16, dans lequel dans l'enregistrement, la table d'images est éditée ou réinitialisée pour chaque examen.
- 18.** Procédé selon l'une quelconque des revendications 13 à 17, qui comprend en outre le fait de déterminer, sur la base d'informations de patient jointes à l'image antérieure acquise, si l'image antérieure acquise est acquise du patient, et dans lequel dans l'affichage, un résultat de détermination obtenu dans la détermination est affiché.
- 19.** Procédé selon l'une quelconque des revendications 13 à 18, dans lequel dans l'affichage, l'image de référence est générée et affichée en effectuant un traitement d'image prédéterminé pour l'image antérieure acquise.
- 20.** Procédé selon la revendication 19, dans lequel dans l'affichage, le traitement d'image de la correspondance d'au moins l'un d'un angle d'observation, d'un grossissement et d'une relation positionnelle entre l'image de référence et l'image en temps réel est exécuté.
- 21.** Procédé selon l'une quelconque des revendications 13 à 20, dans lequel dans l'affichage, l'image de référence et l'image en temps réel sont affichées en synchronisme l'une avec l'autre de sorte à faire correspondre les informations temporelles ou les informations spatiales entre elles.
- 22.** Procédé selon l'une quelconque des revendications 13 à 21, dans lequel dans l'affichage, au moins l'un d'une image miniature d'une image antérieure enregistrée dans la table d'images, d'informations concernant l'emplacement de stockage de l'image antérieure enregistrée dans la table d'images, et d'informations représentant un attribut de l'image antérieure enregistrée dans la table d'images est affiché.
- 23.** Procédé selon l'une quelconque des revendications 13 à 22, dans lequel dans l'acquisition, lorsqu'une autre image antérieure est sélectionnée parmi les images antérieures enregistrées à un moment arbitraire, l'autre image antérieure sélectionnée est acquise de l'emplacement de stockage sur la base des informations concernant l'emplacement de stockage, et dans l'affichage, l'autre image antérieure acquise est affichée en tant qu'image de référence.

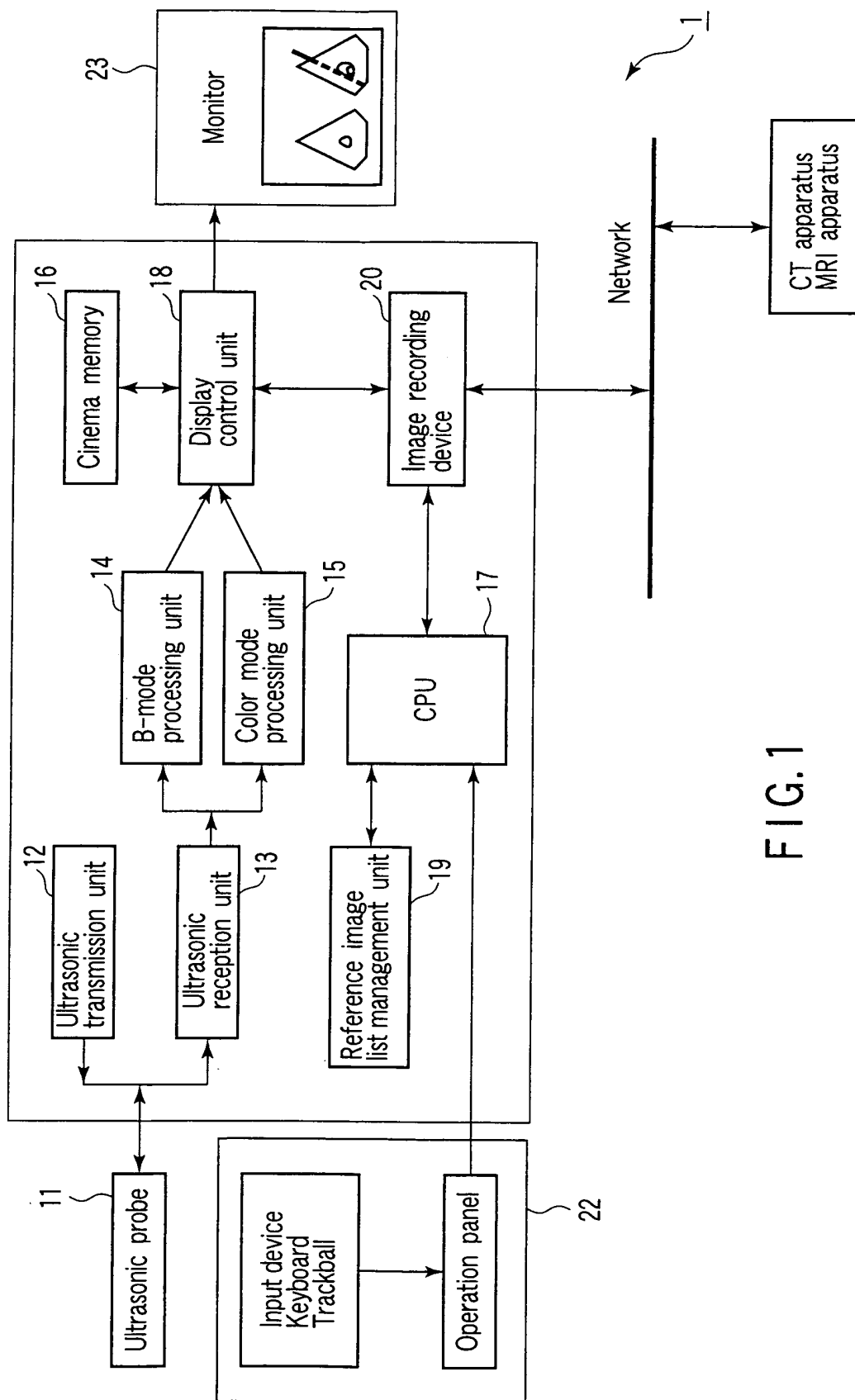


FIG. 1

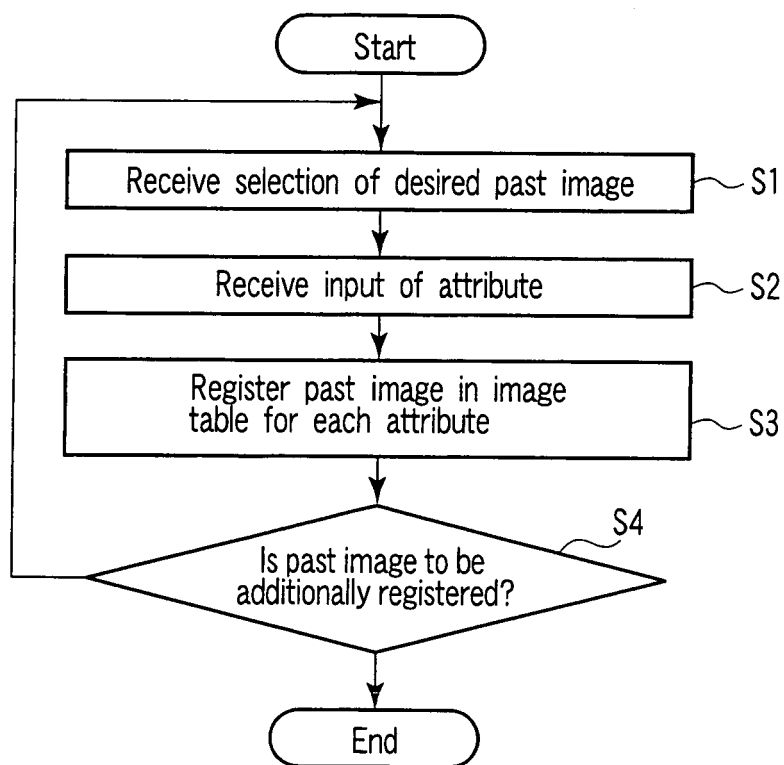


FIG. 2

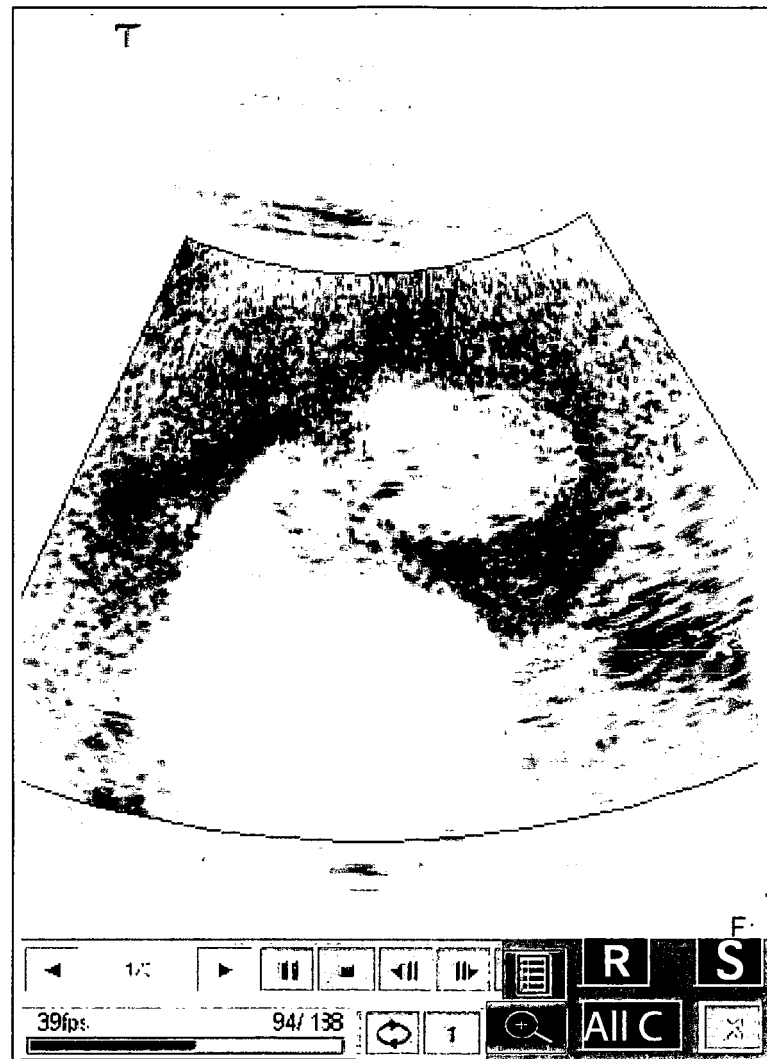


FIG.3

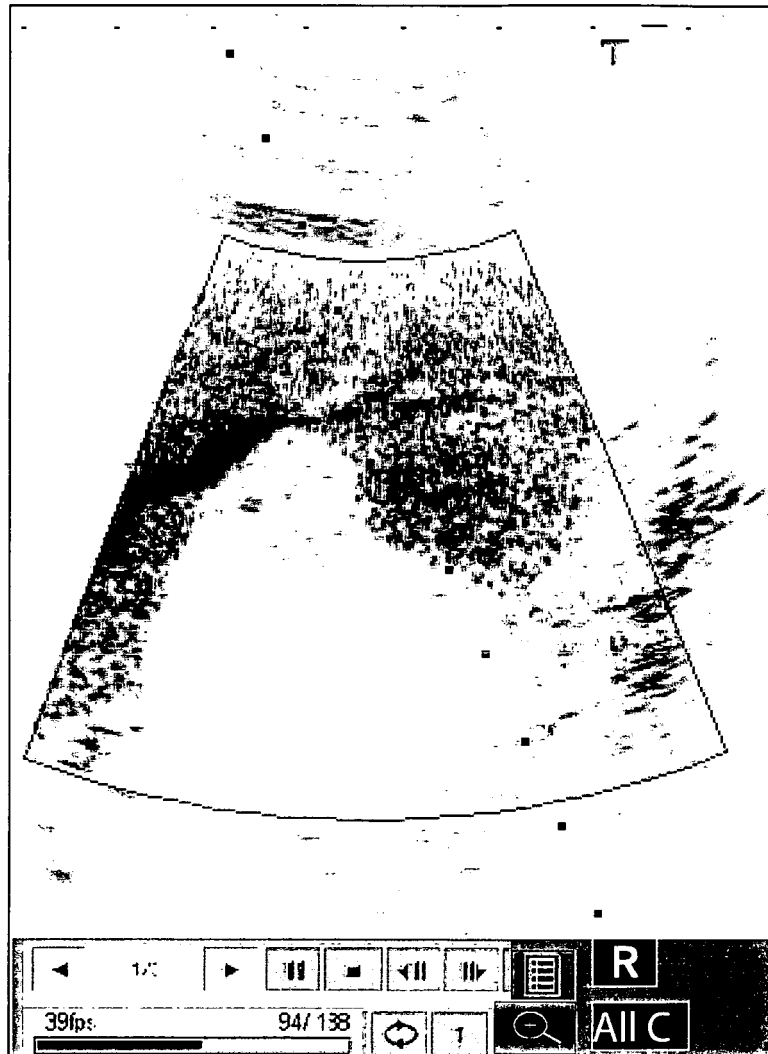


FIG. 4

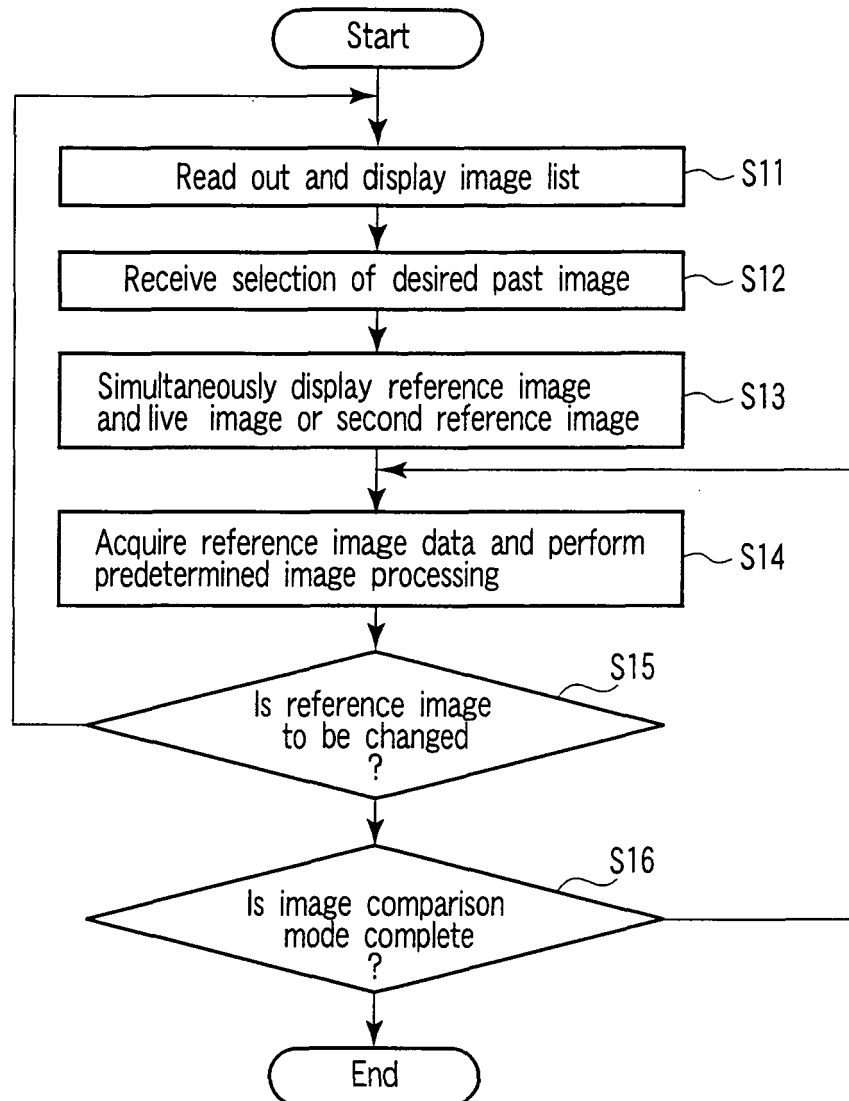
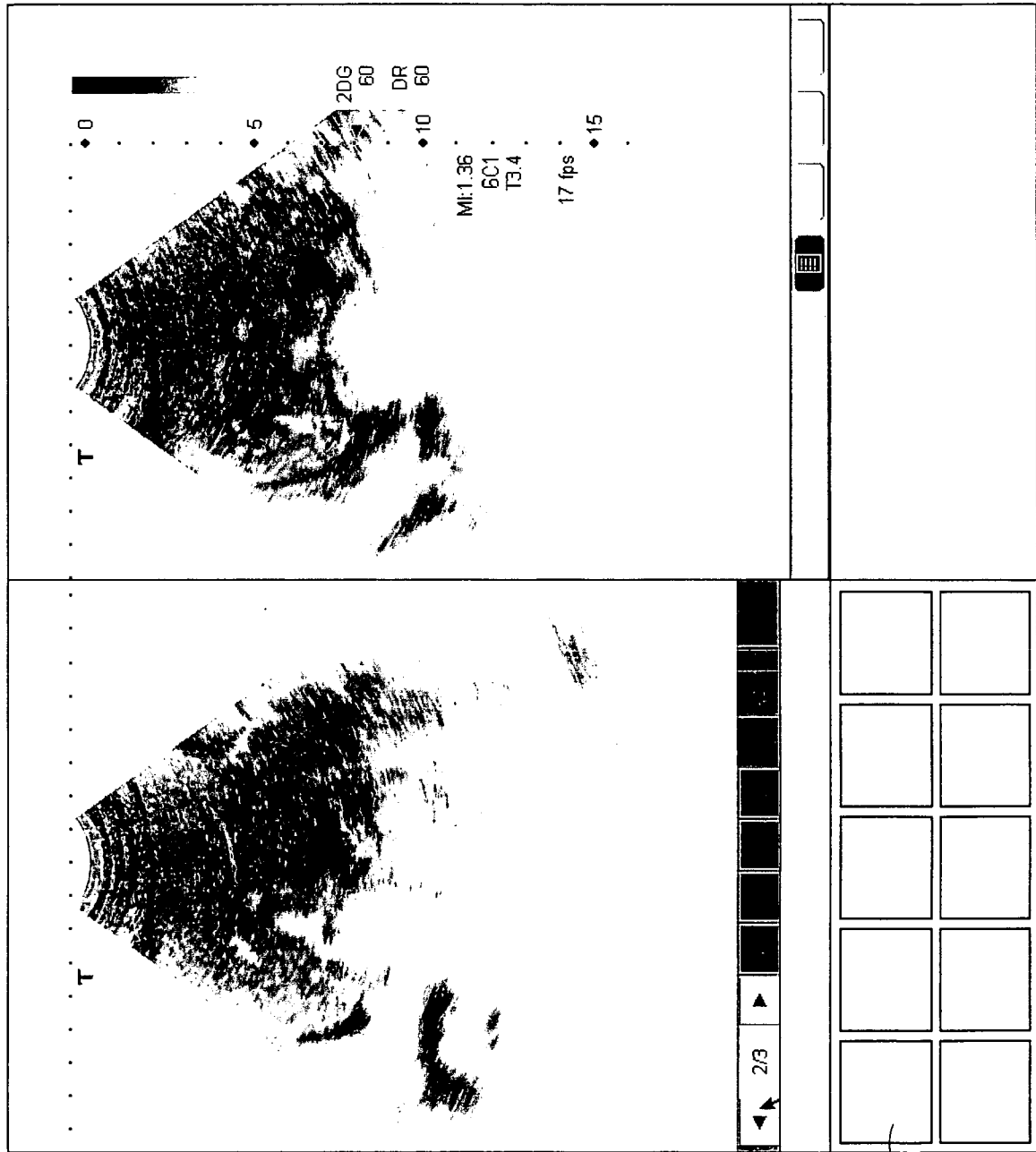
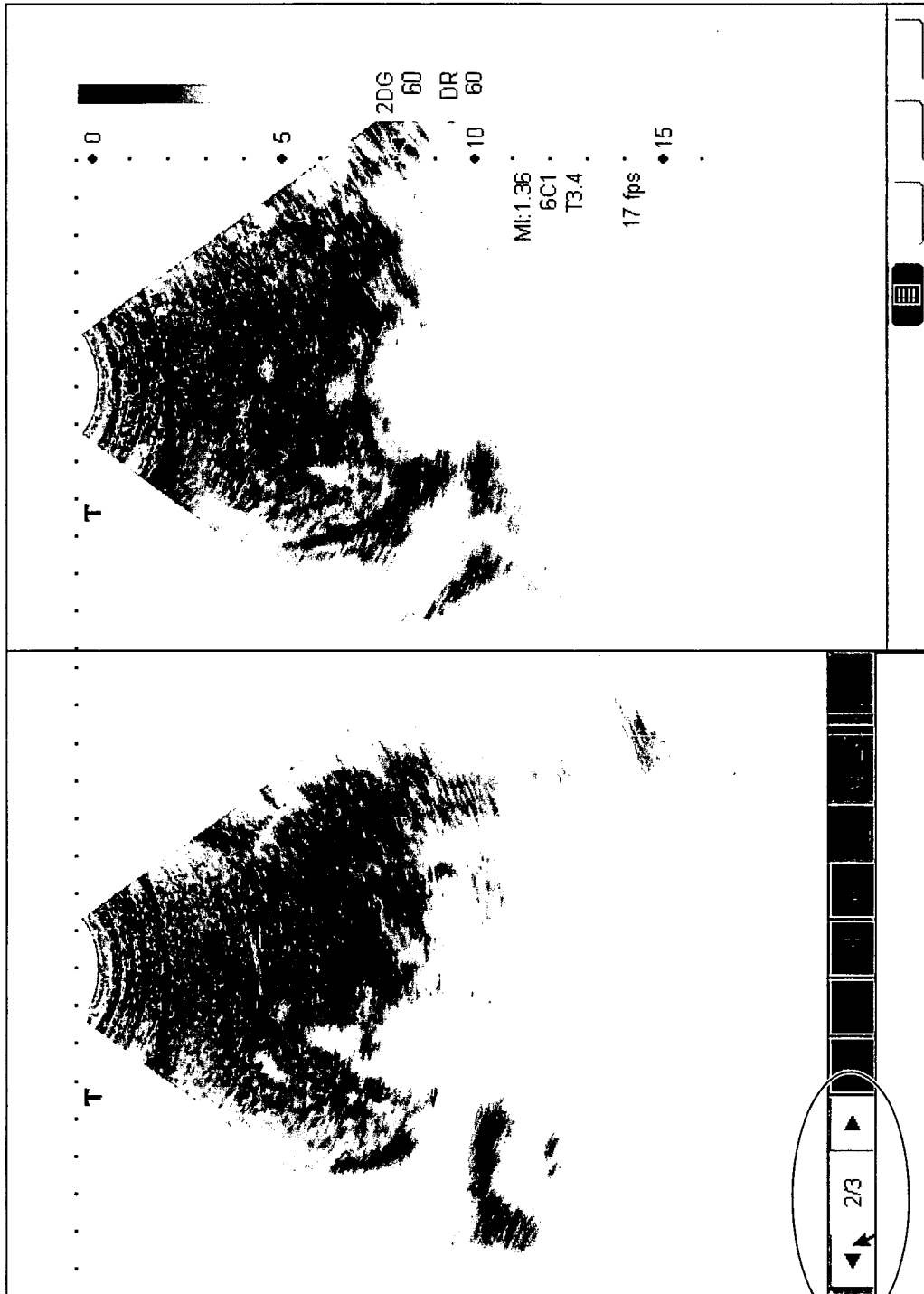
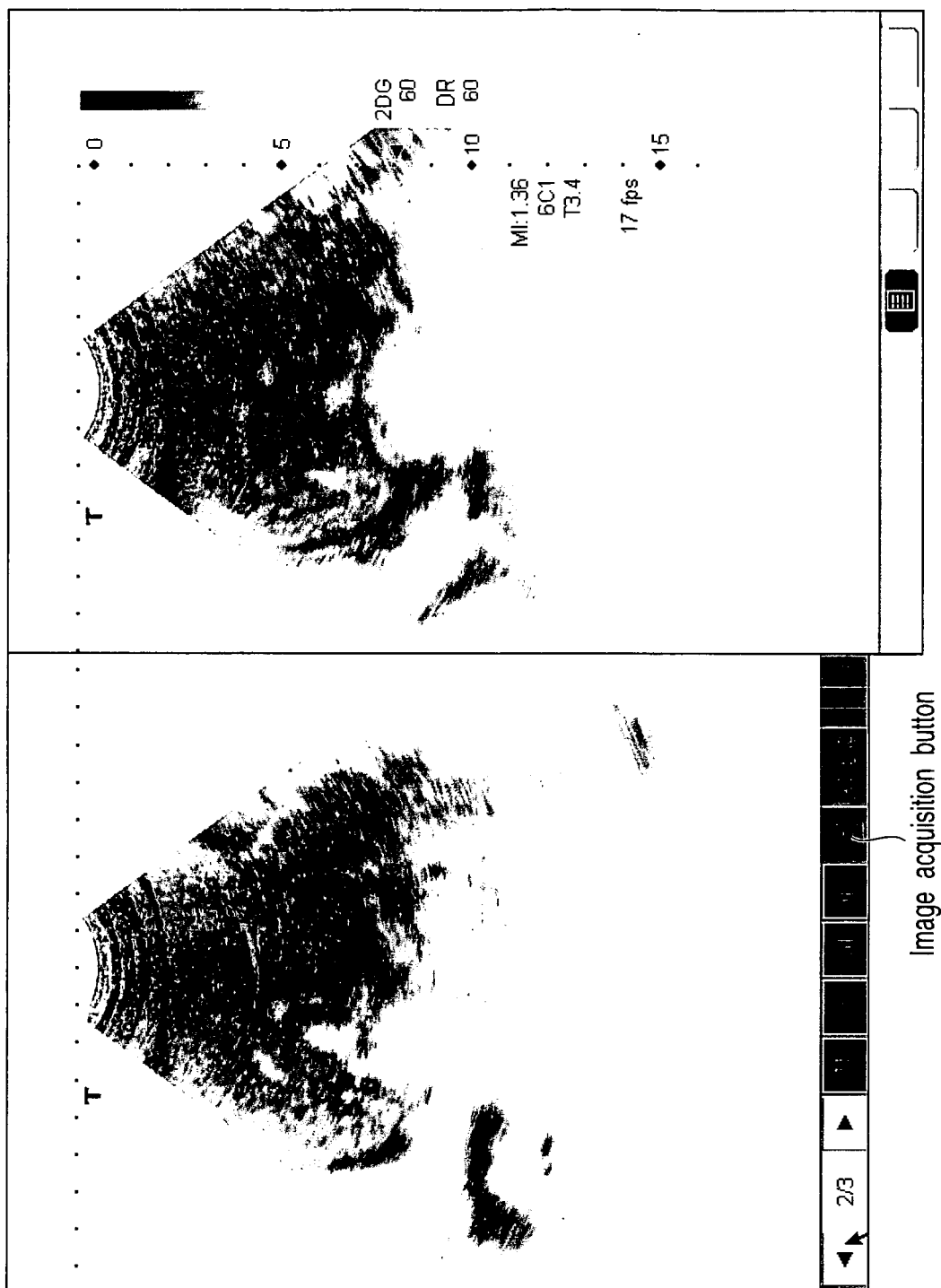
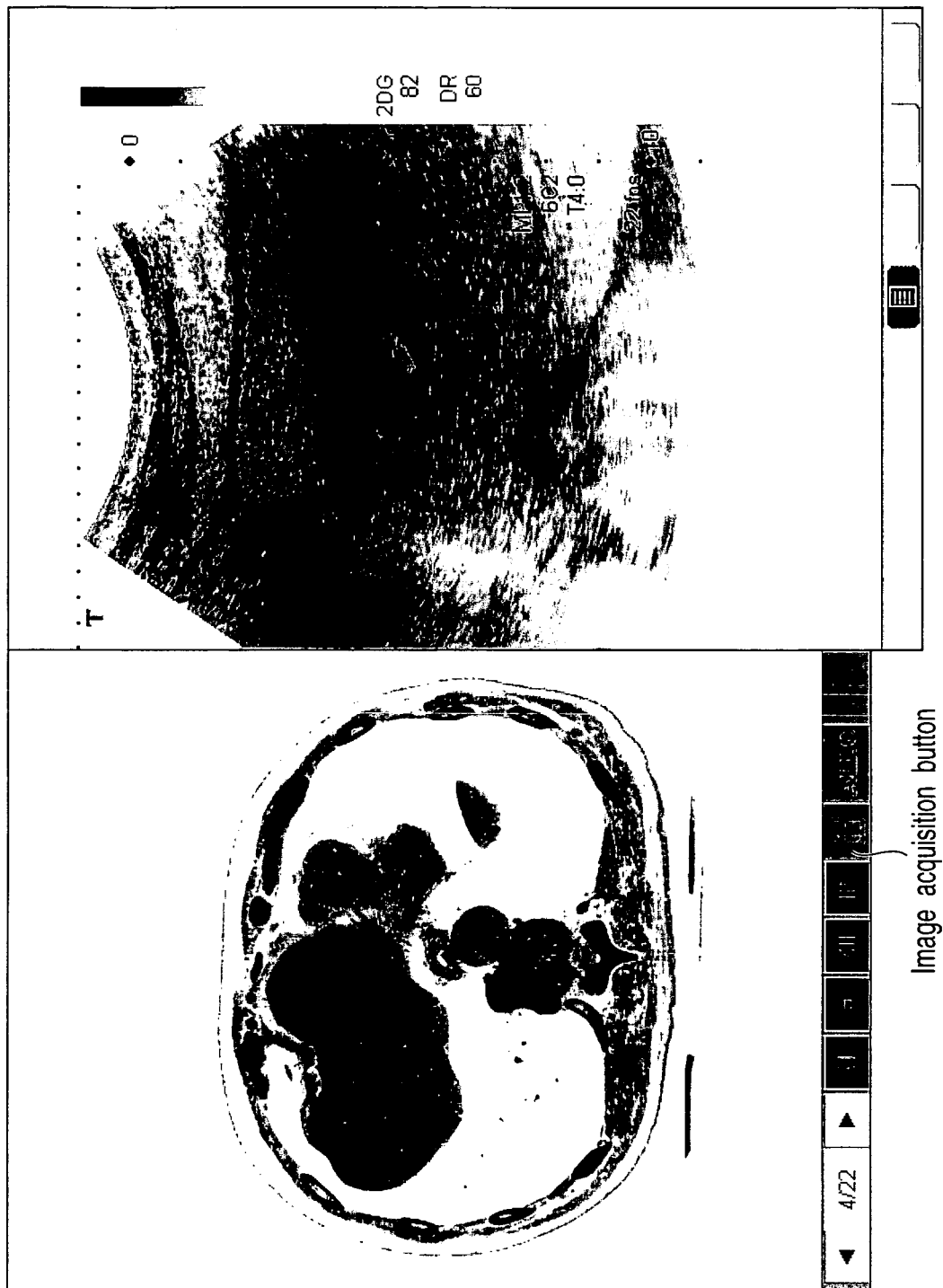


FIG. 5A









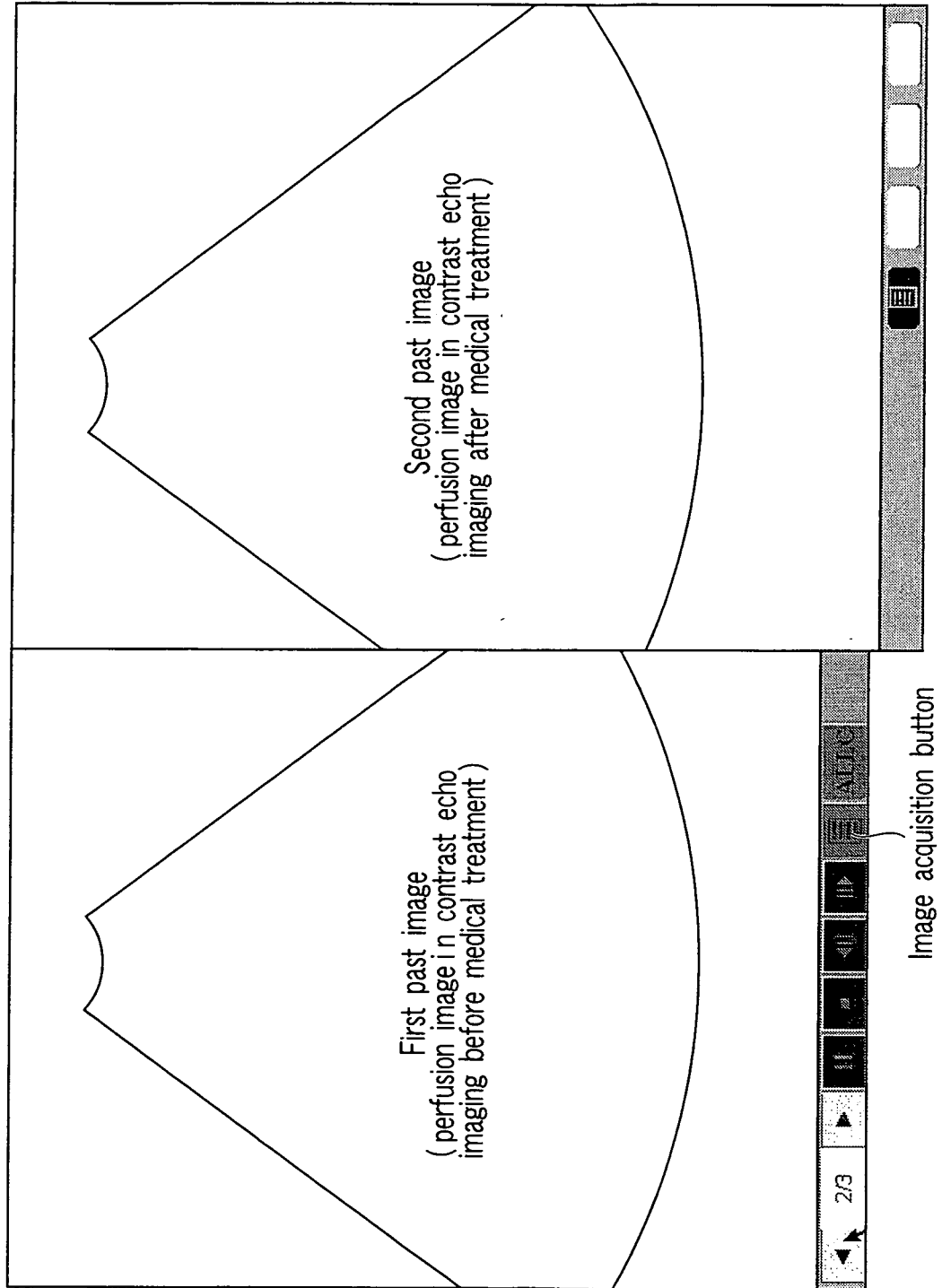
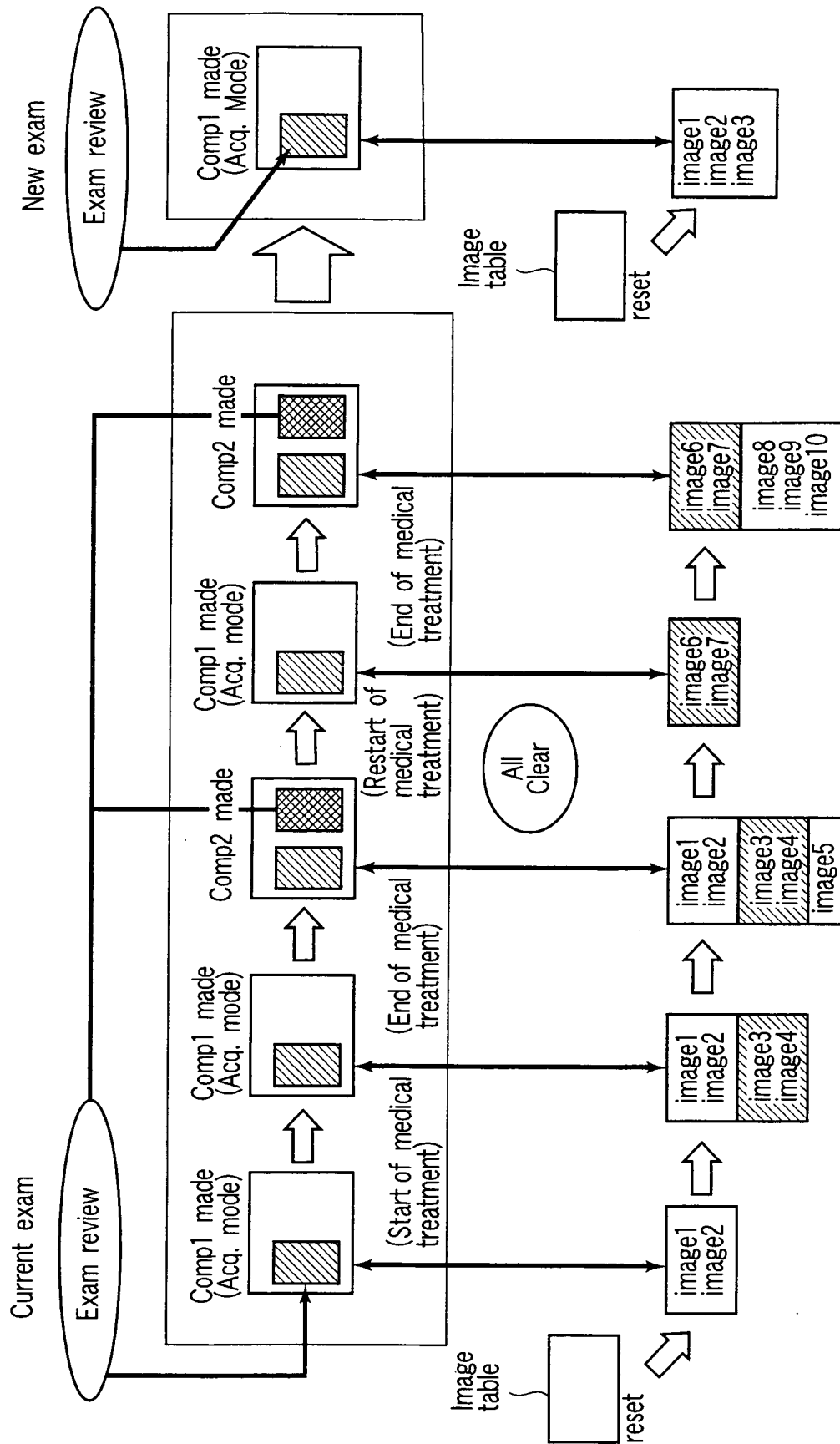


FIG. 7B



F/G.8

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 2004116812 A1 [0006]
- US 2004066398 A1 [0006]

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摘要(译)

在图像获取模式中，期望的过去图像被登记在图像表中。从表中登记的过去图像中选择的过去图像与预定形式的实况图像一起显示为参考图像。在任意时刻选择在图像表中登记的另一图像将在替换参考图像时显示另一过去图像。

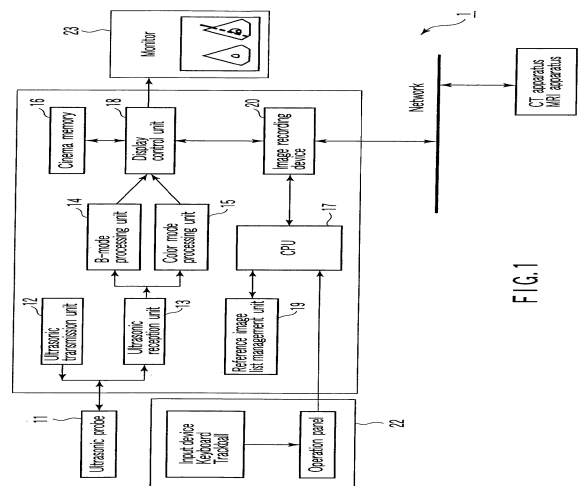


FIG. 1