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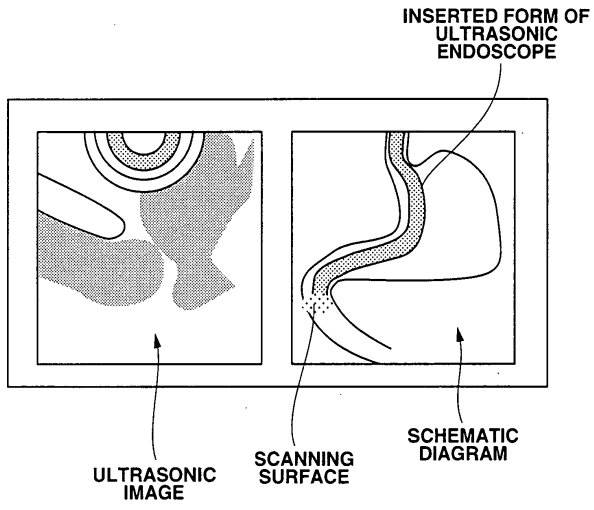
(54) **ULTRASONOGRAPH**

(57) In order to display a part being observed in ultrasonic scanning within a body cavity clearly and a desired section easily, ultrasonic wave is scanned and is obtained in the body cavity. Then, an ultrasonic image creating unit creates an ultrasonic image therefrom. A schematic diagram data creating unit extracts schematic diagram data read from a schematic diagram data storing unit based on the attitude/position signal indicating the attitude of an object and the position for scanning ultrasonic wave in the body cavity, which are obtained from a position/orientation detecting unit. An image synthesizing unit synthesizes the ultrasonic image created by the ultrasonic image creating unit and the schematic diagram data created by the schematic diagram data creating unit. Then, a display displays the ultrasonic image and the schematic diagram corresponding to the position for scanning ultrasonic wave on the same screen.

FIG.3



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Description

Technical Field

[0001] The present invention relates to an ultrasonic diagnosis apparatus for creating an ultrasonic image from ultrasonic signals obtained by transmitting and receiving ultrasonic wave to or from an object.

Background Art

[0002] One of ultrasonic diagnosis apparatus obtains a living body tomogram by irradiating ultrasonic pulses into a living body and receiving waves reflected from the living body tissue. Since the ultrasonic diagnosis apparatus can be used for the diagnosis of the inside of a living body noninvasively, the ultrasonic diagnosis apparatus is widely used for the external obstetric and gynecologic examinations.

[0003] In order to easily identify a contact position of an ultrasonic contact in the ultrasonic diagnosis apparatus, Japanese Unexamined Patent Application Publication No. 60-66735 discloses a diagnosed part displaying method for an ultrasonic diagnosis apparatus for displaying a sample three-dimensionally with the contour and multiple ellipses and displaying the position of an ultrasonic contact.

[0004] Furthermore, Japanese Unexamined Patent Application Publication No. 10-151131 discloses a method for displaying a CT image and an MRI image in accordance with the position being scanned by an ultrasonic contact instead of the display of a sample with an abstract body mark including the contour and multiple ellipses.

[0005] The positional relationship between an ultrasonic probe and a human body can be identified from a simple display of an object with the contour and multiple ellipses as disclosed in Japanese Unexamined Patent Publication Application No. 60-66735. However, the positional relationship between an organ being actually diagnosed and a probe is difficult for operators to understand.

[0006] Furthermore, an ultrasonic diagnosis apparatus connecting to a long and narrow, flexible ultrasonic endoscope to be inserted into an object does not allow operators to visually check the state of the ultrasonic endoscope. Therefore, the part being observed in the object is more difficult to identify, which is a problem, in comparison with an ultrasonic probe used in an external ultrasonic diagnosis apparatus disclosed in Japanese Unexamined Patent Application Publication No. 10-151131. Therefore, moving a tomogram toward a concerned area so as to render a desired section is very difficult in the ultrasonic endoscope, which significantly hinders the spread of ultrasonic endoscopes.

[0007] Also, an oval and spherical ultrasonic sonde easily swallowable from the mouth cavity, for example, of an object is connected to the ultrasonic diagnosis apparatus, the operator cannot visually check the state of the ultrasonic sonde. Therefore, the part being observed of the object is difficult to identify, which is another problem.

[0008] The present invention was made in view of these problems. It is an object of the present invention to provide an ultrasonic diagnosis apparatus which can render the part being observed of an object clearly and a desired tomogram easily by creating an ultrasonic image from ultrasonic signals obtained by using a long and narrow, flexible ultrasonic probe or oval and spherical ultrasonic sonde easily swallowable from the mouth cavity, for example, for generating ultrasonic signals within the object.

Disclosure of Invention

[0009] According to one aspect of the invention, there is provided an ultrasonic diagnosis apparatus including an ultrasonic-wave transmitting/receiving unit for transmitting and receiving ultrasonic wave to or from an object, an ultrasonic-wave scanning position detecting unit for detecting a position of the ultrasonic-wave transmitting/receiving unit for transmitting and receiving ultrasonic wave, an ultrasonic image creating unit for creating an ultrasonic image based on the ultrasonic signals, and a control for obtaining information relating to a part of the object corresponding to position information obtained by the ultrasonic-wave scanning position detecting unit from an anatomical data holding unit having human body anatomical data and displaying the information and the ultrasonic image on the same screen.

[0010] The other characteristics and advantages of the invention will be sufficiently apparent from the descriptions below.

Brief Description of the Drawings

[0011]

Figs. 1 to 3 relate to a first embodiment of the present invention;

Fig. 1 is a construction diagram showing a system configuration of an ultrasonic diagnosis apparatus;

Fig. 2 is a diagram showing a state where a mechanical scan type ultrasonic endoscope is being inserted to the body cavity;

Fig. 3 is a diagram for describing an operation of the ultrasonic diagnosis apparatus in Fig. 1;

Figs. 4 to 9 relate to a second embodiment of the invention;

Fig. 4 is a construction diagram showing a system construction of an ultrasonic diagnosis apparatus;

Fig. 5 is a diagram for describing an operation of the ultrasonic diagnosis apparatus in Fig. 4;

Fig. 6 is a diagram showing an arrangement of an ultrasonic transducer of an electronic radial scan type ultrasonic endoscope and an ultrasonic scan-

ning surface;
Fig. 7 is a diagram showing an arrangement of an ultrasonic transducer of a mechanical scan type ultrasonic endoscope and an ultrasonic scanning surface;
Fig. 8 is a diagram showing an arrangement of an ultrasonic transducer of an electronic convex scan type ultrasonic endoscope and an ultrasonic scanning surface;
Fig. 9 is a diagram for describing an operation of an ultrasonic diagnosis apparatus in the electronic convex scan type ultrasonic endoscope in Fig. 8;
Figs. 10 to 15 relate to a third embodiment of the present invention;
Fig. 10 is a construction diagram showing a construction of an ultrasonic diagnosis apparatus;
Fig. 11 is a diagram for describing an operation of the ultrasonic diagnosis apparatus in Fig. 10;
Fig. 12 is a construction diagram showing a construction of a first variation example of the ultrasonic diagnosis apparatus in Fig. 10;
Fig. 13 is a diagram for describing an operation of the first variation example of the ultrasonic diagnosis apparatus in Fig. 12;
Fig. 14 is a construction diagram showing a construction of a second variation example of the ultrasonic diagnosis apparatus in Fig. 10;
Fig. 15 is a diagram for describing an operation of a second variation example of the ultrasonic diagnosis apparatus in Fig. 14;
Fig. 16 is a construction diagram showing a construction of an ultrasonic diagnosis apparatus according to a fourth embodiment of the invention;
Fig. 17 is a construction diagram showing a construction of an ultrasonic diagnosis apparatus according to a fifth embodiment of the invention; and
Fig. 18 is a construction diagram showing a construction of a capsule type ultrasonic sonde according to a sixth embodiment of the invention.

Best Mode for Carrying Out the Invention

[0012] The present invention will be described in detail with reference to appended drawings.

First Embodiment

[0013] Fig. 1 includes a mechanical scan type ultrasonic endoscope 1, an ultrasonic diagnosis apparatus 2, a display 3, an object 4, a position/orientation detecting unit 5 (as an ultrasonic scan position detecting unit), a send coil 6, a receive coil 7, an attitude detecting unit 8, a scope SW 9, an ultrasonic image creating unit 10, a schematic diagram data creating unit 11, an image synthesizing unit 12, a schematic diagram data storing unit 13, a control 14, a keyboard 15, a shaft 16, and an ultrasonic transducer 17 (as an ultrasonic sending/receiving unit).

[0014] A system construction according to this embodiment will be described which uses the mechanical scan type ultrasonic endoscope 1 to make use of a magnetic field for detecting the position of the mechanical scan type ultrasonic endoscope 1.

[0015] Fig. 1 shows a system construction of an ultrasonic diagnosis apparatus according to this embodiment using a magnetic field for position detection.

[0016] In order to detect a ultrasonic scan position of the mechanical scan type ultrasonic endoscope 1, the send coil 6 for generating a magnetic field is implemented at the inserting end of the mechanical scan type ultrasonic endoscope 1. Signals generated by the magnetic field by the implemented send coil 6 are output from the position/orientation detecting unit 5. The position/orientation detection unit 5 has the receive coil 7 for receiving the magnetic field from the send coil 6 implemented in the mechanical scan type ultrasonic endoscope 1. Furthermore, signals from the attitude detecting unit 8 attached to the object 4 for detecting the attitude of the object 4 are input to the position/orientation detecting unit 5.

[0017] Thus, the position/orientation detecting unit 5 outputs to the ultrasonic diagnosis apparatus 2 signals indicating the attitude of the object 4 and signals indicating the ultrasonic scan position of the mechanical scan type ultrasonic endoscope 1.

[0018] In the ultrasonic diagnosis apparatus 2 according to this embodiment, the ultrasonic transducer 17 at the inserting end is mechanically rotated by the shaft 16 of the mechanical scan type ultrasonic endoscope 1. Thus, ultrasonic signals are scanned circumferentially about the shaft 16. Through this operation, the ultrasonic image creating unit 10 creates an ultrasonic image from the obtained ultrasonic signals.

[0019] On the other hand, the schematic diagram data creating unit 11 extracts schematic diagram data to be read from the schematic diagram data storing unit 13 from attitude position signals indicating the attitude of the object 4 obtained from the position/orientation detecting unit 5 and the position for scanning ultrasonic wave in the mechanical scan type ultrasonic endoscope 1. In order to detect the position of the mechanical scan type ultrasonic endoscope 1, a reference position for starting the detection must be specified.

[0020] The reference position may be specified by turning on the keyboard 15 or the scope SW 9 when the inserting end of the mechanical scan type ultrasonic endoscope 1 reaches the position to be the reference position.

[0021] Fig. 2 shows a simplified construction of the mechanical scan type ultrasonic endoscope 1 and a state where the mechanical scan type ultrasonic endoscope 1 is being inserted to the body cavity. As shown in Fig. 2, the mechanical scan type ultrasonic endoscope 1 is fastened at some positions in the body cavity. Under this condition, the ultrasonic transducer 17 at the inserting end is rotated about the shaft 16 so that the

shaft 16 is twisted in the mechanical scan type ultrasonic endoscope 1 for scanning ultrasonic wave. As a result, the ultrasonic image may be displaced upward.

[0022] A position sensor 28 for detecting the position is provided at the inserting end of the mechanical scan type ultrasonic endoscope 1. Thus, even in the above-described case, the vertical relationship of the screen for scanning ultrasonic wave and schematic diagram data described later can be made in register precisely.

[0023] Referring back to Fig. 1, the image synthesizing unit 12 synthesizes the ultrasonic image created by the ultrasonic image creating potion 10 and the schematic diagram data created by the schematic diagram data creating unit 11. Then, the display 3 displays on the same screen the ultrasonic image and the schematic diagram corresponding to the position for scanning ultrasonic wave.

[0024] Fig. 3 shows a screen display example. Fig. 3 shows an example displaying the ultrasonic image on the left and the schematic diagram on the right. Like the schematic diagram shown in Fig. 3, the scanning surface of the mechanical scan type ultrasonic endoscope 1 and the inserting form may be displayed together. Alternatively, only the scanning surface or only the schematic diagram without the scanning surface may be displayed.

[0025] The schematic diagram on the right of Fig. 3 may be a schema image, a CT image of an object, an MRI image or a human body real optical image obtained from a frozen dead body.

[0026] In Fig. 3, the ultrasonic image and the schematic diagram of the scanning position are displayed in alignment. However, the schematic diagram may be displayed over the ultrasonic image.

[0027] According to this embodiment, a schematic diagram is displayed together with an ultrasonic image such that the part of an object to be observed can be easily identified. Furthermore, a desired tomography plane can be easily extracted.

Second Embodiment

[0028] A second embodiment is substantially the same as the first embodiment, and only the differences will be described below. The same reference numerals are given to the same components here, and the description will be omitted.

[0029] The first embodiment applies a mechanical scan type ultrasonic endoscope but may alternatively apply an ultrasonic endoscope for electrically switching ultrasonic transducers for scanning. The second embodiment will be described below.

[0030] Fig. 4 shows a system construction of an ultrasonic diagnosis apparatus according to the second embodiment. Fig. 4 includes an ultrasonic diagnosis apparatus 2, a display 3, an object 4, a position/orientation detecting unit 5, a send coil 6, a receive coil 7, an attitude detecting unit 8, a scope SW 9, an ultrasonic image creating unit 10, a schematic diagram data creating unit 11, an image synthesizing unit 12, a schematic diagram data storing unit 13, a control 14, a keyboard 15, ultrasonic transducers 18, and an electronic radial scan type ultrasonic endoscope 19.

[0031] Like the first embodiment, a system construction according to this embodiment uses a magnetic field for position detection.

[0032] The ultrasonic diagnosis apparatus 2 according to this embodiment uses the electronic radial scan type ultrasonic endoscope 19 having an array of the ultrasonic transducers 18 including multiple ultrasonic transducers around an inserting axis and includes the send coil 6, which is a position sensor, at the inserting end.

[0033] The electronic scan type ultrasonic endoscope 19 electrically switches ultrasonic transducers for transmitting and receiving ultrasonic signals and scans ultrasonic wave on the circumference of the inserting axis. Therefore, like the mechanical scan type ultrasonic endoscope 1 according to the first embodiment, the upward displacement of an ultrasonic image due to the twist of the shaft 16 does not occur. By providing a position sensor at the inserting end, the ultrasonic scan position can be accurately identified. The electronic radial scan type ultrasonic endoscope 19 does not have to have the ultrasonic transducers 18 on the entire circumference of the inserting axis but may be partially lacking, such as in a fan shape of 270 degrees.

[0034] Like the first embodiment, the ultrasonic image creating unit 10 creates an ultrasonic image from ultrasonic signals obtained by scanning the ultrasonic transducers 18. Furthermore, the schematic diagram data creating unit 11 detects the attitude of the object 4 obtained from the position/orientation detecting unit 5 and the position for scanning ultrasonic wave of the electronic radial scan type ultrasonic endoscope 19. The schematic diagram data creating unit 11 reads from the schematic diagram data storing unit 13 schematic diagram data corresponding to the position for scanning ultrasonic wave by the electronic radial scan type ultrasonic endoscope 19. Then, the ultrasonic image obtained by the ultrasonic image creating unit 10 and the schematic diagram are displayed on the same screen.

[0035] Fig. 5 shows a screen display example. Fig. 5 shows an ultrasonic image by the electronic radial scan type ultrasonic endoscope 19 on the left and a schematic diagram corresponding to the ultrasonic scan position on the right. Like the schematic diagram displayed by the ultrasonic diagnosis apparatus using the mechanical scan type ultrasonic endoscope in Fig. 3, the schematic diagram in Fig. 5 may include the scanning surface and inserting form of the electronic radial scan type ultrasonic endoscope 19. Alternatively, only the scanning plane or the schematic diagram may be included.

[0036] Like the first embodiment, according to this embodiment, an ultrasonic image and a schematic diagram are displayed together. Thus, the part being ob-

served of an object can be easily identified, and a desired tomography plane can be easily extracted.

[0037] The second embodiment adopts an electronic radial scan type ultrasonic endoscope. Alternatively, the second embodiment may adopt an electronic convex scan type ultrasonic endoscope, which includes an array of ultrasonic transducers and electrically switches transducers.

[0038] Fig. 6 shows an electronic radial scan type ultrasonic endoscope. Fig. 7 shows a mechanical scan type ultrasonic endoscope. Fig. 8 shows an electronic convex scan type ultrasonic endoscope. Figs. 6 to 8 show differences between the arrangements and ultrasonic scanning surfaces of the ultrasonic transducers of the ultrasonic endoscopes.

[0039] As shown in Fig. 6, the electronic radial scan type ultrasonic endoscope has an array of ultrasonic transducers on the circumference of the inserting axis and ultrasonically scans on the circumference of the inserting axis.

[0040] As shown in Fig. 7, the mechanical scan type ultrasonic endoscope mechanically rotates ultrasonic transducers and ultrasonically scans on the circumference of the inserting axis.

[0041] As shown in Fig. 8, the electronic convex scan type ultrasonic endoscope has a fan-shaped array of ultrasonic transducers at the end of the inserting axis and ultrasonically scans the surface parallel to the inserting axis.

[0042] The electronic convex scan type ultrasonic endoscope scans in the direction different from the scanning direction of the mechanical scan type ultrasonic endoscope and the electronic radial scan type ultrasonic endoscope. However, the electronic convex scan type ultrasonic endoscope may be also applied to the ultrasonic diagnosis apparatus so as to achieve easily-understandable diagnosis.

[0043] Fig. 9 shows a display example of an electronic convex scan type ultrasonic endoscope. Fig. 9 shows an ultrasonic image on the left and a schematic diagram corresponding to the ultrasonic scanning position on the right. The scanning surface shown in the schematic diagram on the right is represented differently from the first and second embodiments.

[0044] As shown in Fig. 9, the schematic diagram on the right may include the ultrasonic scanning surface and inserting form of the ultrasonic endoscope. Alternatively, only the ultrasonic scanning surface or the schematic diagram may be included.

Third Embodiment

[0045] A third embodiment is substantially the same as the first embodiment. Therefore, only differences will be described. The same reference numerals are given to the same components, and the description will be omitted here.

[0046] Since the ultrasonic diagnosis apparatus 2 according to the first and second embodiments has the construction shown in Fig. 10, the name of a part can be displayed over an ultrasonic image in accordance with the ultrasonic scanning. The construction will be described hereinafter.

[0047] Fig. 10 shows an ultrasonic diagnosis apparatus 2 according to the third embodiment. The ultrasonic diagnosis apparatus 2 includes an ultrasonic image creating unit 10, a name-of-part superposing unit 20, a name-of-part extracting unit 25, and a display 3. The name-of-part extracting unit 25 according to the third embodiment includes a schematic diagram area extracting unit 21, a reference schematic diagram storing unit 22, a name-of-part storing unit 23 and a name-of-part/area correspondence unit 24.

[0048] The ultrasonic image creating unit 10 creates ultrasonic image data from ultrasonic signals obtained by transmitting and receiving ultrasonic wave within an object.

[0049] On the other hand, the schematic diagram area extracting unit 21 detects an area of the scanning position of the ultrasonic endoscope from reference schematic diagram data of the reference schematic diagram storing unit 22 based on the signals of the position and direction for detecting the position of the ultrasonic endoscope and the attitude of the object, which have been input to the name-of-part extracting unit 25. Then, the schematic diagram area extracting unit 21 outputs ultrasonic scan area data.

[0050] The name-of-part/area correspondence unit 24 reads from the name-of-part storing part 23 name-of-part data corresponding to the output ultrasonic scan area data. The name-of-part superposing part 20 displays on the screen of the display 3 the read name-of-part data over the ultrasonic image.

[0051] Fig. 11 shows a screen display example. As shown in Fig. 11, according to this embodiment, in addition to the advantages of the first and second embodiments, a name of a part is superposed on an ultrasonic image. Therefore, the correspondence of the ultrasonic image to an organ becomes clearer, which allows the operator to provide more easily understandable diagnoses.

[0052] Furthermore, because of the construction of the name-of-part extracting unit 25 as shown in Fig. 12, the part can be colored. The constructions and operations of variation examples of the name-of-part extracting unit 25 will be described below.

[0053] Fig. 12 shows an ultrasonic diagnosis apparatus 2 according to a first variation example of the third embodiment. The ultrasonic diagnosis apparatus 2 includes an ultrasonic image creating unit 10, a name-of-part superposing unit 20, a name-of-part extracting unit 25 and a display 3. The name-of-part extracting unit 25 of the first variation example includes a schematic diagram area extracting unit 21, a reference schematic diagram storing unit 22, a part area reading unit 26, and a part area storing unit 27.

[0054] According to the first variation example of the third embodiment, the ultrasonic image creating unit 10 creates ultrasonic image data from ultrasonic signals obtained by transmitting and receiving ultrasonic wave.

[0055] On the other hand, like the operation in Fig. 8, the schematic diagram area extracting unit 21 detects an area being scanned by the ultrasonic endoscope from the reference schematic diagram data of the reference schematic diagram storing unit 22 based on the position and direction signals for detecting the position of the ultrasonic endoscope and the attitude of an object, which have been input to the name-of-part extracting unit 25. Then, the ultrasonic scan area data is output.

[0056] The part area reading unit 26 reads part area data to be colored in accordance with the ultrasonic scan area data from the part area storing unit 27 based on the ultrasonic scan area data output from the schematic diagram area extracting unit 21. The name-of-part superposing unit 20 superposes and displays the read part area colored data on the ultrasonic image.

[0057] Fig. 13 shows a screen display example. As shown in Fig. 13, a part on an ultrasonic image is colored. Therefore, according to the first variation example of the third embodiment, the correspondence of the ultrasonic image to the organ becomes clearer, which allows an operator to provide more easily understandable diagnoses. Furthermore, an operator can provide more easily understandable diagnoses by coloring parts in different colors.

[0058] By displaying a part name over the ultrasonic image and the schematic image together, more easily understandable diagnoses can be achived. An ultrasonic diagnosis apparatus implementing the construction will be described below.

[0059] Fig. 14 shows an ultrasonic diagnosis apparatus 2 according to a second variation example of the third embodiment. The ultrasonic diagnosis apparatus 2 includes an ultrasonic image creating unit 10, a schematic diagram data creating unit 11, a schematic diagram data storing unit 13, an image creating unit 12, a name-of-part superposing unit 20, a name-of-part extracting unit 25 and a display 3.

[0060] According to the second variation example of the third embodiment, the ultrasonic image creating unit 10 creates ultrasonic image data from ultrasonic signals obtained by transmitting and receiving ultrasonic wave.

[0061] Signals of the position and direction for scanning ultrasonic wave of the ultrasonic endoscope are input to the name-of-part extracting unit 25, and the name of the part is therefore output. Then, the name-of-part superposing unit 20 superposes the name of the part on the ultrasonic image.

[0062] On the other hand, the schematic diagram data creating unit 11 reads schematic diagram data corresponding to the ultrasonic-wave scanning position from the schematic diagram data storing unit 13 based on the input signals of the position and direction for scanning ultrasonic wave of the ultrasonic endoscope. The image synthesizing unit 12 synthesizes the read schematic diagram data and the name-of-part superposed ultrasonic image output from the name-of-part superposing unit 20. Then, the display 3 displays the image on the same screen.

[0063] Fig. 15 shows an image display example. An ultrasonic image having a name of a part over an ultrasonic image is displayed on the left while the schematic diagram is displayed on the right. In the schematic diagram on the right as shown in Fig. 15, the ultrasonic-wave scanning surface and the inserting form of the ultrasonic endoscope may be displayed. Alternatively, only the ultrasonic-wave scanning surface or the schematic diagram may be displayed. Fourth Embodiment

[0064] A fourth embodiment is substantially the same as the first embodiment. Therefore, only the differences will be described. Here, the same reference numerals are given to the same components, and the description will be omitted.

[0065] As shown in Fig. 16, the schematic data storing unit 13 according to the fourth embodiment includes schematic diagram data storage devices for types of images including schema images, CT images and real optical human body images obtained from frozen dead bodies. The schematic diagram data storing unit 13 to be referred by the schematic data reading unit 11 may be switched by a switcher 29.

[0066] Thus, an operator can read a desired schematic diagram for easily understandable diagnoses.

Fifth Embodiment

[0067] A fifth embodiment is substantially the same as the first embodiment. Therefore, only the differences will be described. The same reference numerals are given to the same components, and the description will be omitted here.

[0068] In order to provide a schematic diagram data storing unit, a large amount of capacity is required, which costs a lot. Therefore, as shown in Fig. 17, according to the fifth embodiment, only the minimum schematic diagram data to be used for diagnoses is stored in a minimum schematic diagram data storing unit 30 while the other schematic diagram data is stored in an external backing storage 32. When schematic diagram data to be used for a diagnosis does not exist in the minimum schematic diagram data storing unit 30, the external backing storage 32 is connected to the ultrasonic diagnosis apparatus 2. The schematic diagram data in the minimum schematic diagram data storing unit 30 is updated through a data update control 31.

Sixth Embodiment

[0069] All of the above-described embodiments use a long and narrow, flexible ultrasonic endoscope but the invention may be applied to a case where an egg-shaped capsule type ultrasonic sonde containing a po-

sition detecting function as disclosed in Japanese Unexamined Patent Application Publication No. 2000-23980.

[0070] Fig. 18 shows an egg-shaped capsule type ultrasonic sonde 33. The capsule type ultrasonic sonde 33 includes a cover member 34, an array transducer 36, a send antenna 37, a battery 38, a magnetic source 39, a transmitter 40, a coil 41, a sending/receiving circuit 42 and a duct 43.

[0071] The capsule type ultrasonic sonde 33 transmits and receives ultrasonic wave by driving the array transducer from the sending/receiving circuit 42 by using energy of the battery 38, switches transducers for transmitting and receiving and scans the ultrasonic wave.

[0072] Thus, ultrasonic wave is received, is amplified in the sending/receiving circuit 42 and is sent from the send antenna 37 to an external ultrasonic synthesizing operation apparatus (not shown). Then, an ultrasonic image is created.

[0073] At the same time, by using the energy of the battery 38, a positional signal is sent from the transmitter 40 through the coil 41 and is received by the receive coil 7 as shown in Fig. 1. Thus, the position/orientation detecting unit 6 detects the position of the capsule type ultrasonic sonde 33.

[0074] The subsequent steps for displaying the scanning position over a schematic diagram and for coloring and displaying the name of a part and the part area over an ultrasonic image are performed in accordance with the position of the capsule type ultrasonic sonde 33 like the constructions shown in Figs. 1, 4, 10 and 12.

[0075] Apparently, according to the present invention, different embodiments can be variously constructed based on the present invention without departing from the spirit and scope of the present invention. The present invention is only limited by the appended claims and is not limited by the specific embodiments.

Industrial Applicability

[0076] As described above, an ultrasonic diagnosis apparatus according to the present invention is effective for observing concerned parts within a body cavity through ultrasonic tomograms.

Claims

1. An ultrasonic diagnosis apparatus, comprising:

an ultrasonic-wave transmitting/receiving unit for transmitting and receiving ultrasonic wave to or from an object;
an ultrasonic-wave scanning position detecting unit for detecting a position of the ultrasonic-wave transmitting/receiving unit for transmitting and receiving ultrasonic wave;
an ultrasonic image creating unit for creating an ultrasonic image based on the ultrasonic signals; and
a control for obtaining information relating to a part of the object corresponding to position information obtained by the ultrasonic-wave scanning position detecting unit from an anatomical data holding unit having human body anatomical data and displaying the information and the ultrasonic image on the same screen.

2. An ultrasonic diagnosis apparatus according to Claim 1, wherein the information relating to a part of the object is anatomical image information of the part of the object, and the anatomical data of the human body is schematic diagram data of the human body.

3. An ultrasonic diagnosis apparatus according to Claim 1, wherein the information relating to a part of the object is a name of the part of the object, and the anatomical data of the human body is a name of the part of the human body.

4. An ultrasonic diagnosis apparatus according to Claim 1, wherein the anatomical data of the human body is data on a part area of the human body;

wherein the control associates the part of the object with data on a part area of the human body, colors the part corresponding to the part of the ultrasonic image and causes a display to display the colored part.

5. An ultrasonic diagnosis apparatus according to Claim 1, further comprising:

a schematic diagram data storing unit, which is the anatomical data holding unit provided in the ultrasonic diagnosis apparatus, for storing schematic diagram data of a human body; and
a schematic diagram creating unit for reading data from the schematic diagram data storing unit and for creating a schematic diagram corresponding to the position detected by the ultrasonic-wave scanning position detecting unit.

6. An ultrasonic diagnosis apparatus according to Claim 5,

wherein the human body schematic diagram data is a human body schema image, a CT image of an object, an MRI image of an object or a human body real optical image obtained from a frozen dead body.

7. An ultrasonic diagnosis apparatus according to Claim 5, further comprising:

a position-marked schematic diagram creating

unit for creating a position-marked schematic diagram indicating an ultrasonic-wave scanning position by showing schematic diagram data read in accordance with the ultrasonic-wave scanning position over schematic diagram data created by the schematic diagram creating unit.

8. An ultrasonic diagnosis apparatus according to Claim 6,

wherein the schematic diagram data storing unit further includes:

a schematic diagram data switching unit for storing different kinds of multiple pieces of schematic diagram data among human body schema images, object CT images, object MRI images and human body real optical images obtained from frozen dead bodies and for switching the multiple schematic diagram data storing units,

wherein the control further controls the switching by the schematic diagram data switching unit.

9. An ultrasonic diagnosis apparatus according to Claim 1,

wherein an ultrasonic image is created from ultrasonic signals obtained by transmitting and receiving ultrasonic wave to or from the inside of the object by using a round-shaped ultrasonic sonde easily swallowable from the mouth cavity of the object.

10. An ultrasonic diagnosis apparatus according to Claim 1,

wherein an ultrasonic image is created from ultrasonic signals obtained by transmitting and receiving ultrasonic wave to or from the inside of the object by using a long and narrow, flexible ultrasonic probe to be inserted to the object;

wherein the ultrasonic probe is:

an electronic radial scan type ultrasonic endoscope having an array of ultrasonic transducers around an inserting axis;
an electronic convex scan type ultrasonic endoscope having ultrasonic transducers in a fan shape at one end of the inserting axis; or
a mechanical scan type ultrasonic endoscope in which an ultrasonic transducer piece rotates about the inserting axis.

11. An ultrasonic diagnosis apparatus, comprising:

ultrasonic-wave transmitting/receiving means for transmitting and receiving ultrasonic wave to or from an object;
ultrasonic-wave scanning position detecting means for detecting the position of the ultrasonic-wave transmitting/receiving means for transmitting and receiving ultrasonic wave;
ultrasonic image creating means for creating an ultrasonic image based on the ultrasonic signals; and
control means for obtaining information relating to a part of the object in accordance with the position information obtained by the ultrasonic-wave scanning position detecting means from an anatomical data holding unit having human body anatomical data and displaying the information and the ultrasonic image on the same screen.

12. A method for displaying an ultrasonic diagnosis image, the method comprising:

an ultrasonic-wave transmitting/receiving step for transmitting and receiving ultrasonic wave to or from an object by using an ultrasonic-wave transmitting/receiving unit;
an ultrasonic-wave scanning position detecting step for detecting the position of the ultrasonic-wave transmitting/receiving unit for transmitting and receiving ultrasonic wave;
an ultrasonic image creating step for creating an ultrasonic image based on the ultrasonic signals; and
a control step for obtaining information relating to a part of the object in accordance with the position information obtained by the ultrasonic-wave scanning position detecting step from an anatomical data holding unit having human body anatomical data and displaying the information and the ultrasonic image on the same screen.

13. A method for displaying an ultrasonic diagnosis image according to Claim 12, wherein the information relating to a part of the object is anatomical image information of the part of the object, and the anatomical data of the human body is schematic diagram data of the human body.

14. A method for displaying an ultrasonic diagnosis image according to Claim 12, wherein information relating to a part of the object is a name of the part of the object, and the anatomical data of the human body is a name of the part of the human body.

15. A method for displaying an ultrasonic diagnosis image according to Claim 12, wherein the anatomical data of the human body is data on a part area of the human body;

wherein the control step associates the part

of the object with data on a part area of the human body, colors the part corresponding to the part on the ultrasonic image and causes a display to display the colored part.

16. A method for displaying an ultrasonic diagnosis image according to Claim 12, further comprising:

a schematic diagram data storing step, which is an anatomical data holding step, for storing schematic diagram data of a human body to the schematic diagram data storing unit provided in the ultrasonic diagnosis apparatus; and
a schematic diagram creating step for reading data from the schematic diagram data storing unit and for creating a schematic diagram corresponding to the position detected by the ultrasonic-wave scanning position detecting unit.

FIG.1

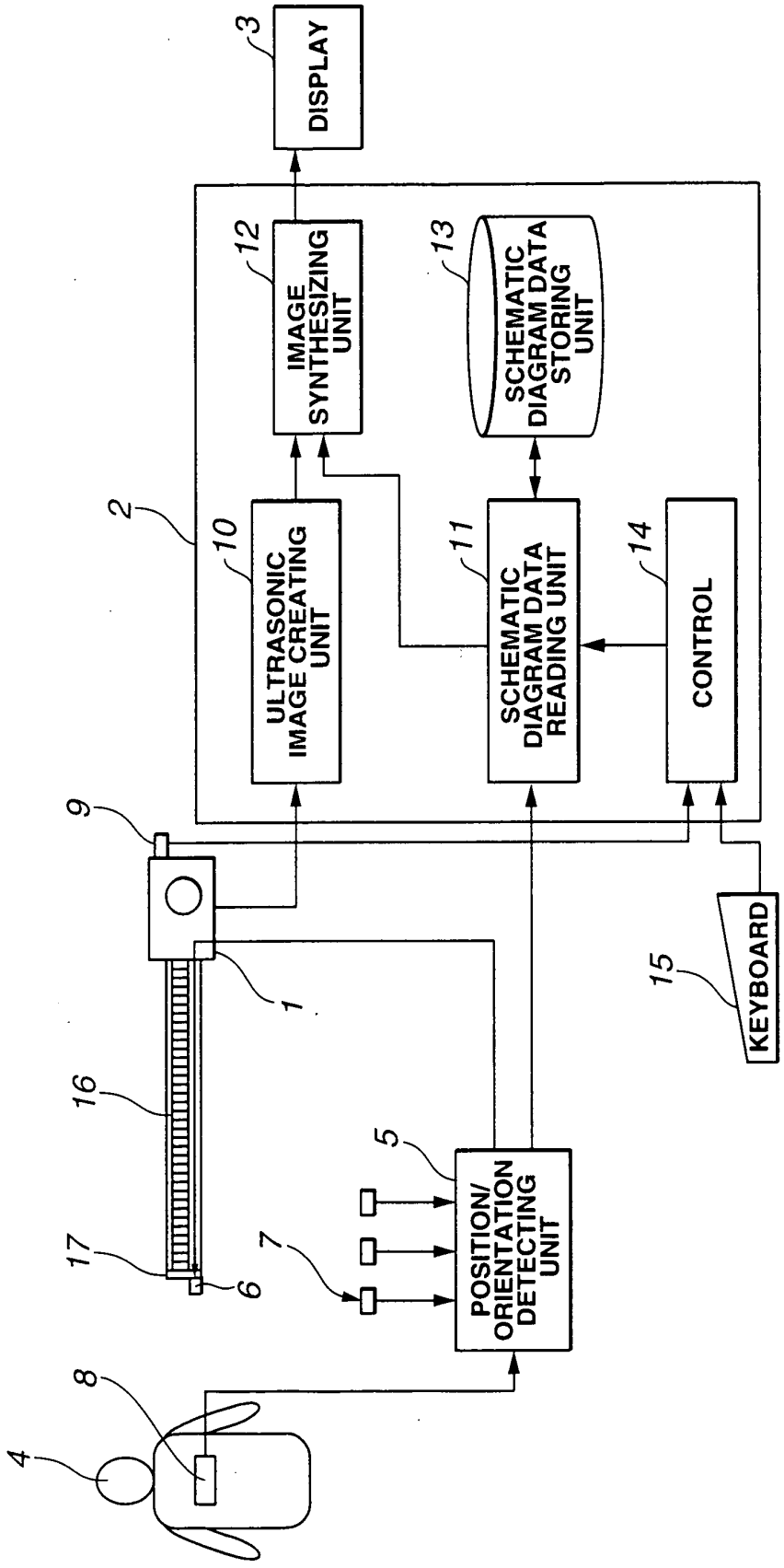

3
DISPLAY
12
IMAGE SYNTHESIZING UNIT
13
SCHEMATIC DIAGRAM DATA STORING UNIT
2
10
ULTRASONIC IMAGE CREATING UNIT
11
SCHEMATIC DIAGRAM DATA READING UNIT
14
CONTROL
9
1
15
KEYBOARD
16
17
6
7
5
POSITION/ ORIENTATION DETECTING UNIT
8
4

FIG.2

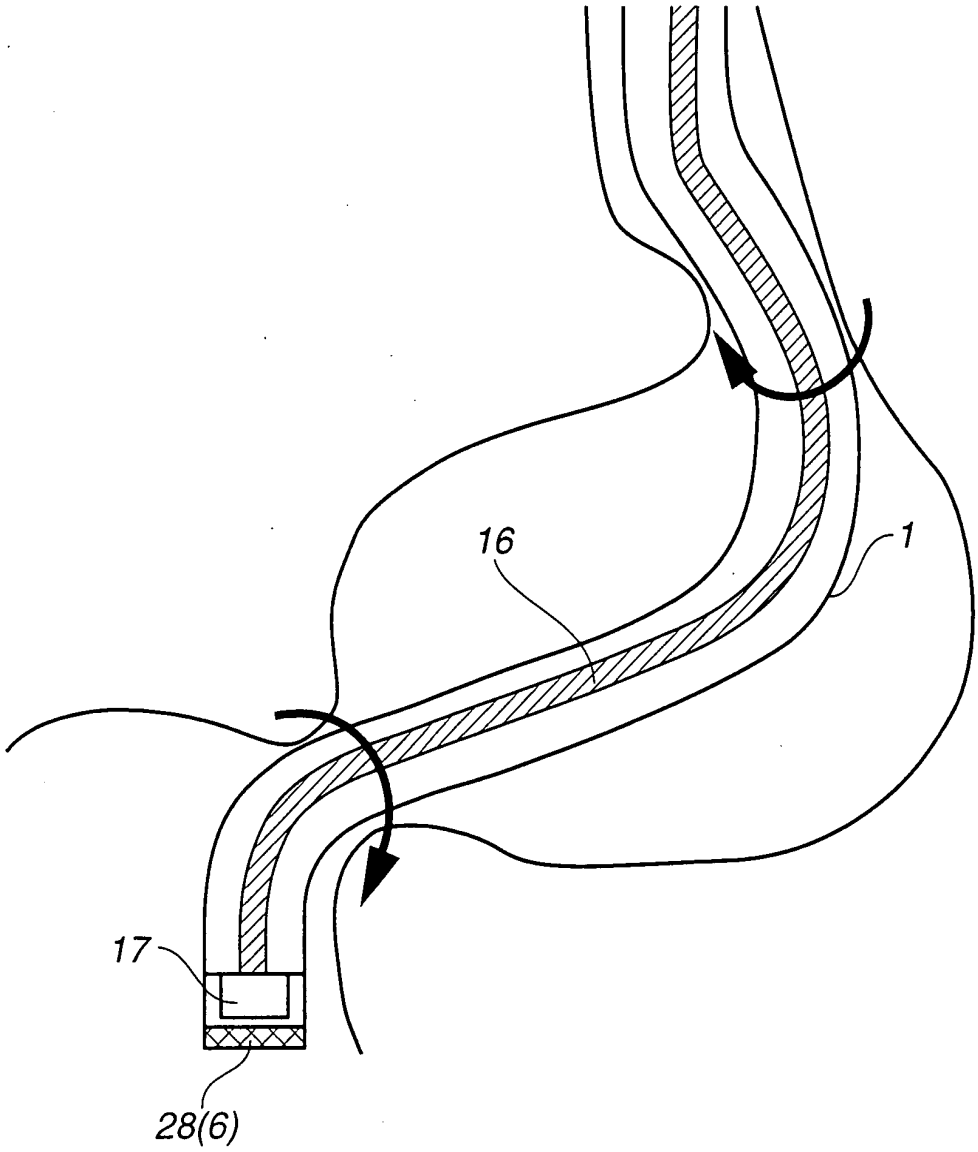


FIG.3

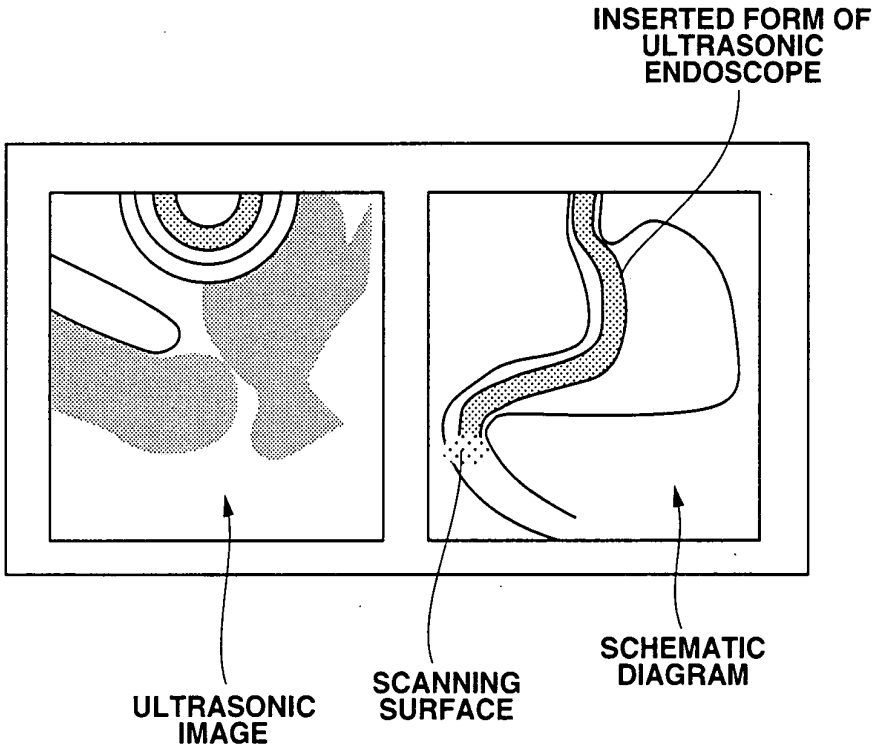

INSERTED FORM OF ULTRASONIC ENDOSCOPE
ULTRASONIC IMAGE
SCANNING SURFACE
SCHEMATIC DIAGRAM

FIG.4

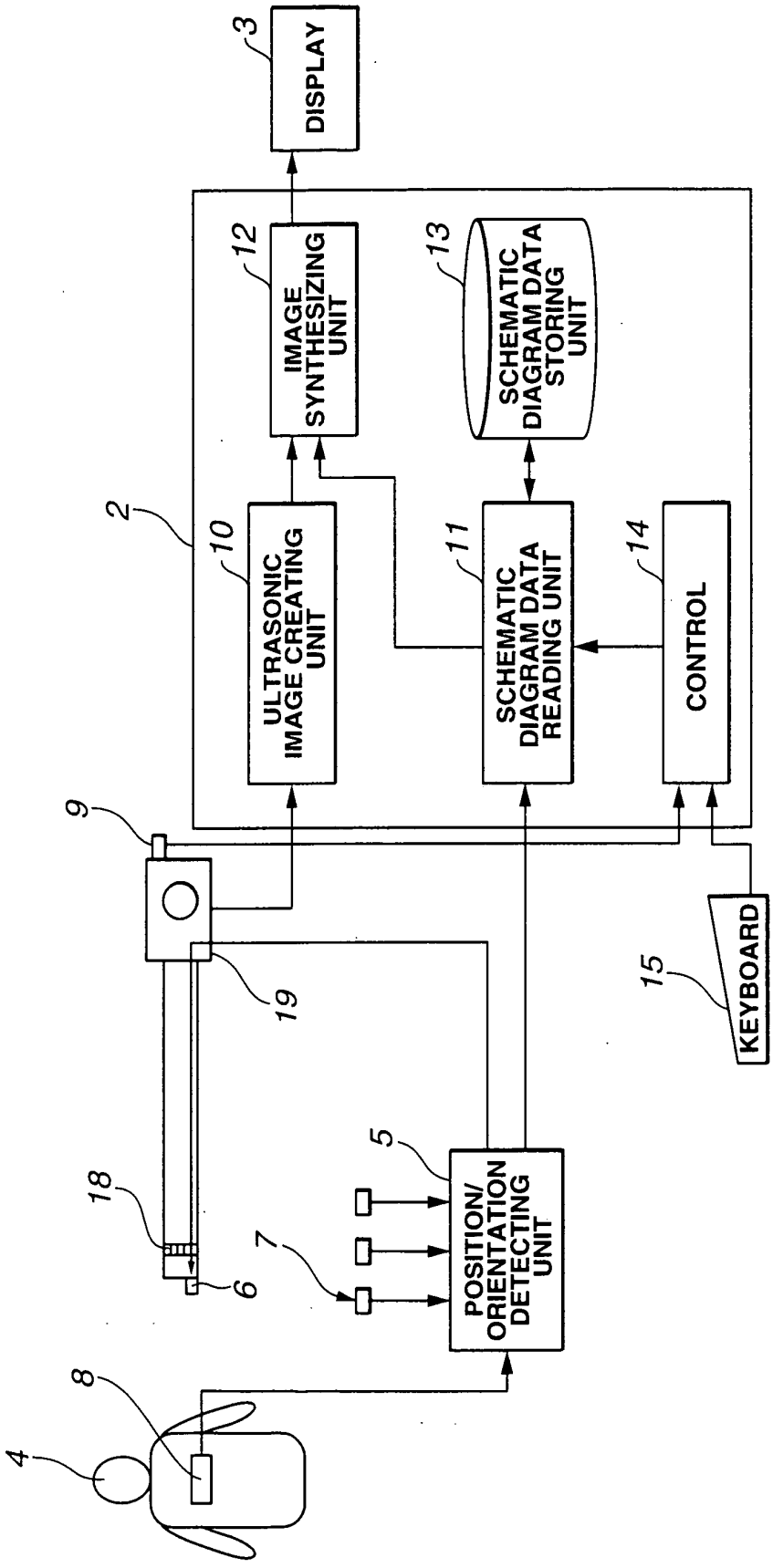

3
DISPLAY
12
IMAGE SYNTHESIZING UNIT
13
SCHEMATIC DIAGRAM DATA STORING UNIT
2
10
ULTRASONIC IMAGE CREATING UNIT
11
SCHEMATIC DIAGRAM DATA READING UNIT
14
CONTROL
9
19
15
KEYBOARD
5
POSITION/ ORIENTATION DETECTING UNIT
18
7
6
8
4

FIG.5

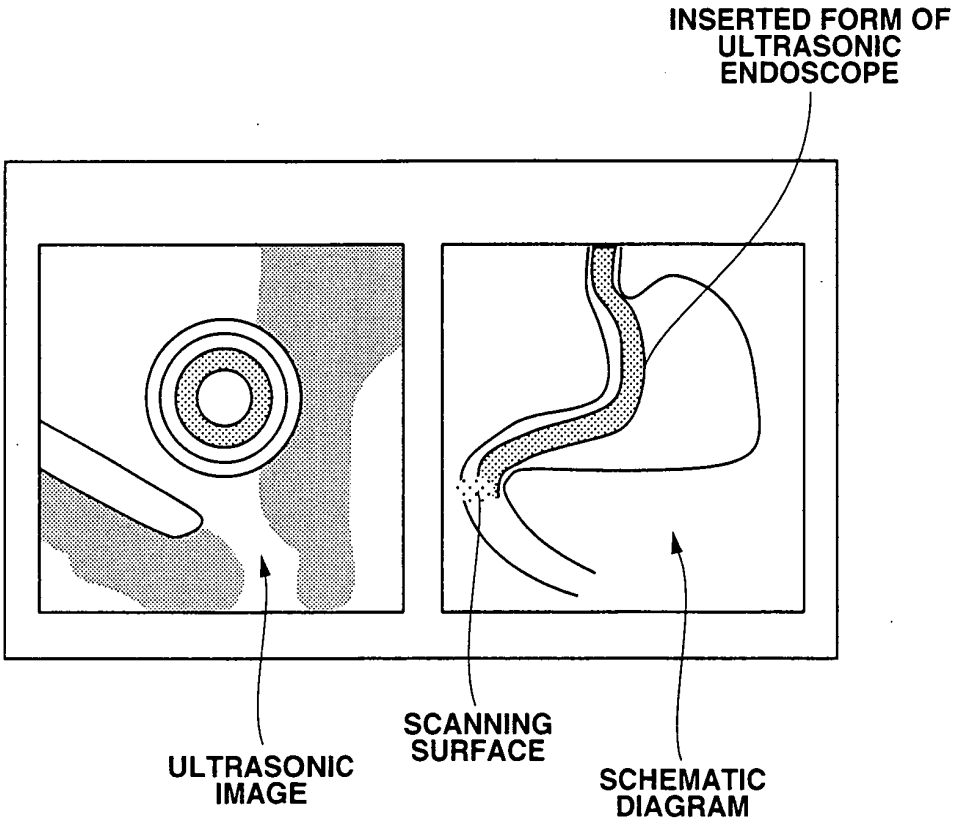

INSERTED FORM OF ULTRASONIC ENDOSCOPE
ULTRASONIC IMAGE
SCANNING SURFACE
SCHEMATIC DIAGRAM

FIG.6

FIG.7

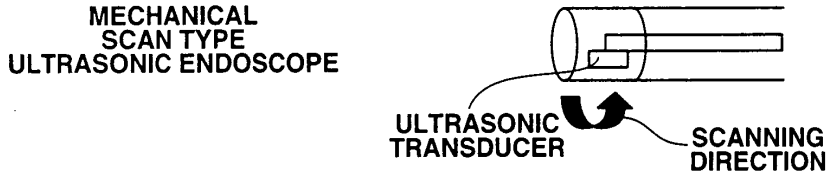


FIG.8

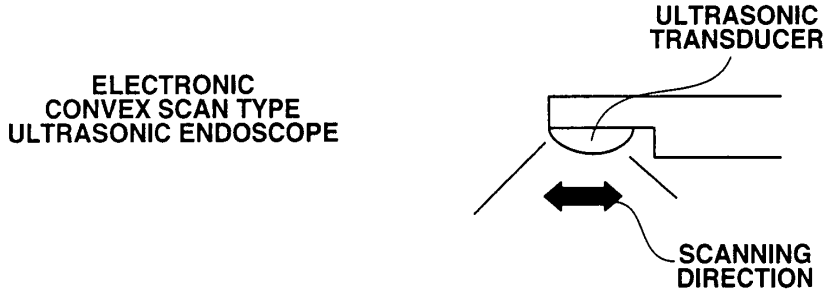


FIG.9

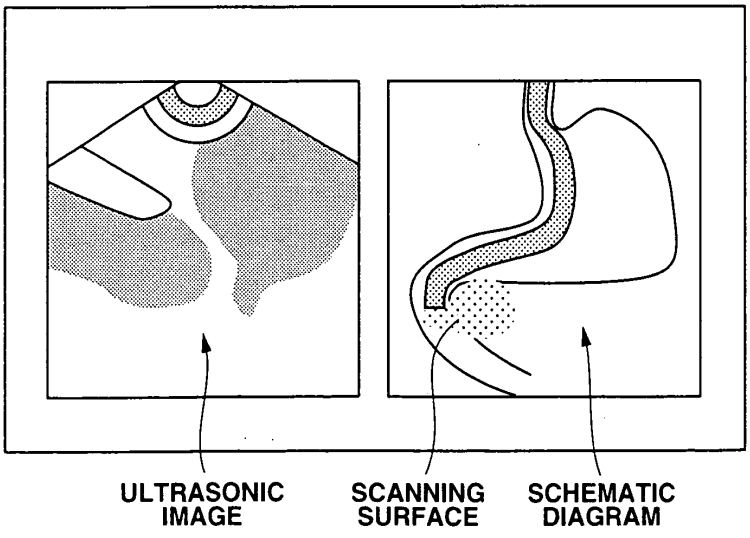


FIG.10

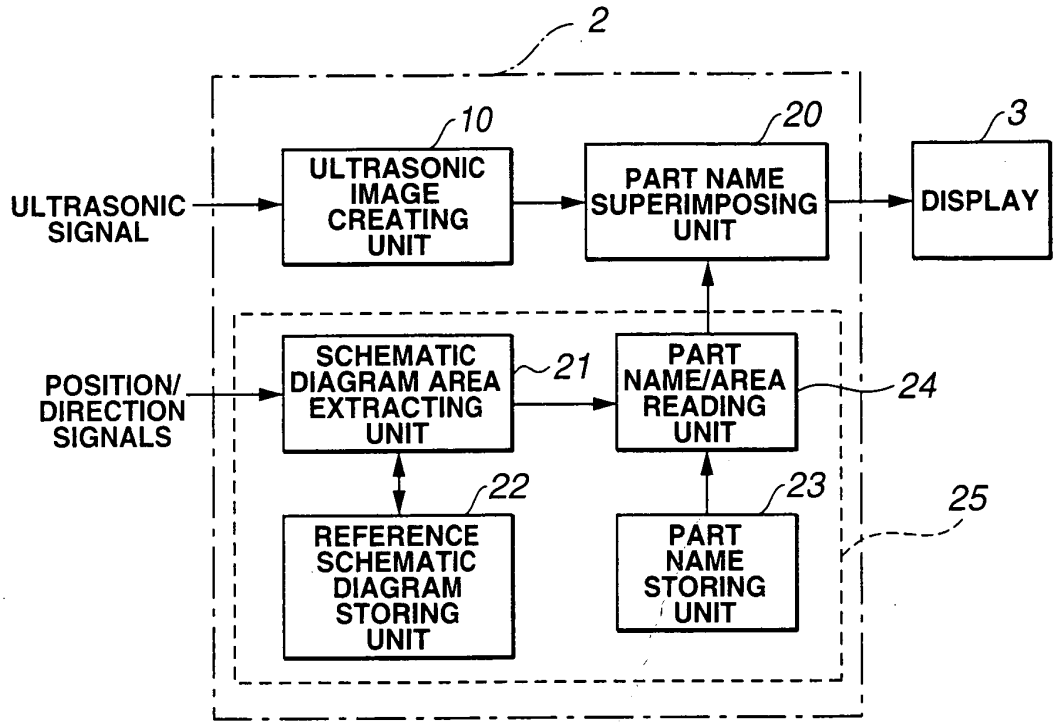

2
10
20
3
ULTRASONIC SIGNAL
ULTRASONIC IMAGE CREATING UNIT
PART NAME SUPERIMPOSING UNIT
DISPLAY
SCHEMATIC DIAGRAM AREA EXTRACTING UNIT
21
PART NAME/AREA READING UNIT
24
POSITION/ DIRECTION SIGNALS
22
23
25
REFERENCE SCHEMATIC DIAGRAM STORING UNIT
PART NAME STORING UNIT

FIG.11

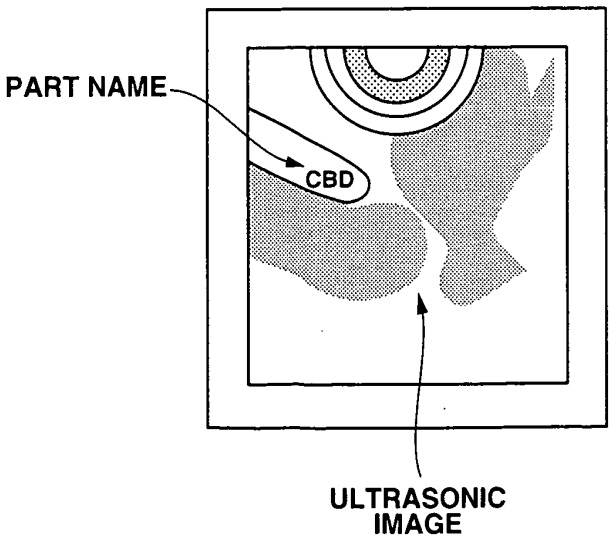

PART NAME
CBD
ULTRASONIC IMAGE

FIG.12

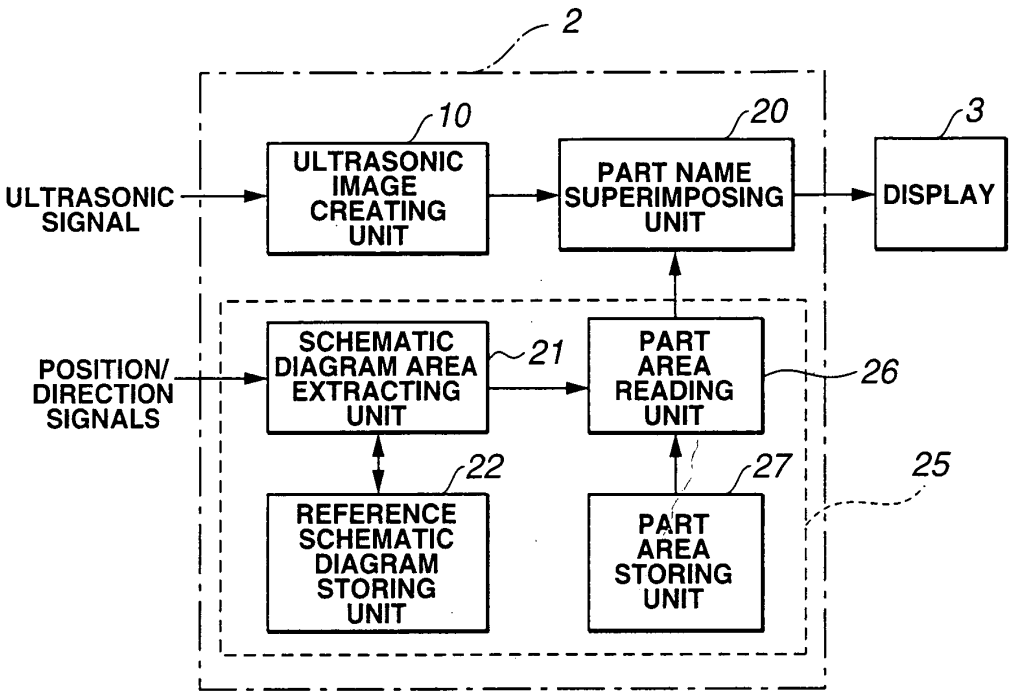

2
10
20
3
ULTRASONIC SIGNAL
ULTRASONIC IMAGE CREATING UNIT
PART NAME SUPERIMPOSING UNIT
DISPLAY
POSITION/ DIRECTION SIGNALS
SCHEMATIC DIAGRAM AREA EXTRACTING UNIT
21
PART AREA READING UNIT
26
22
27
25
REFERENCE SCHEMATIC DIAGRAM STORING UNIT
PART AREA STORING UNIT

FIG.13

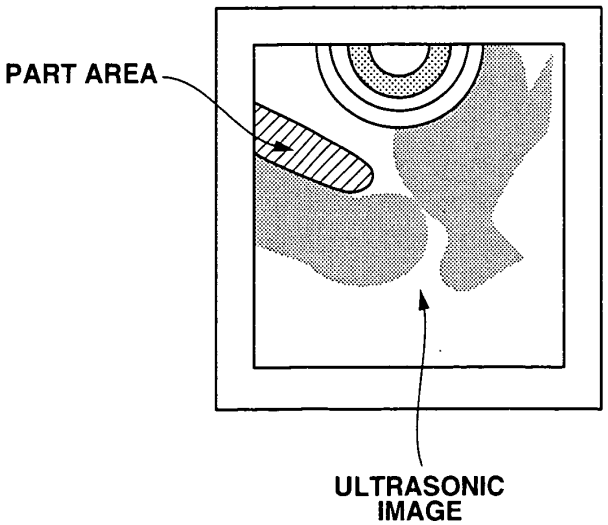

PART AREA
ULTRASONIC IMAGE

FIG.14

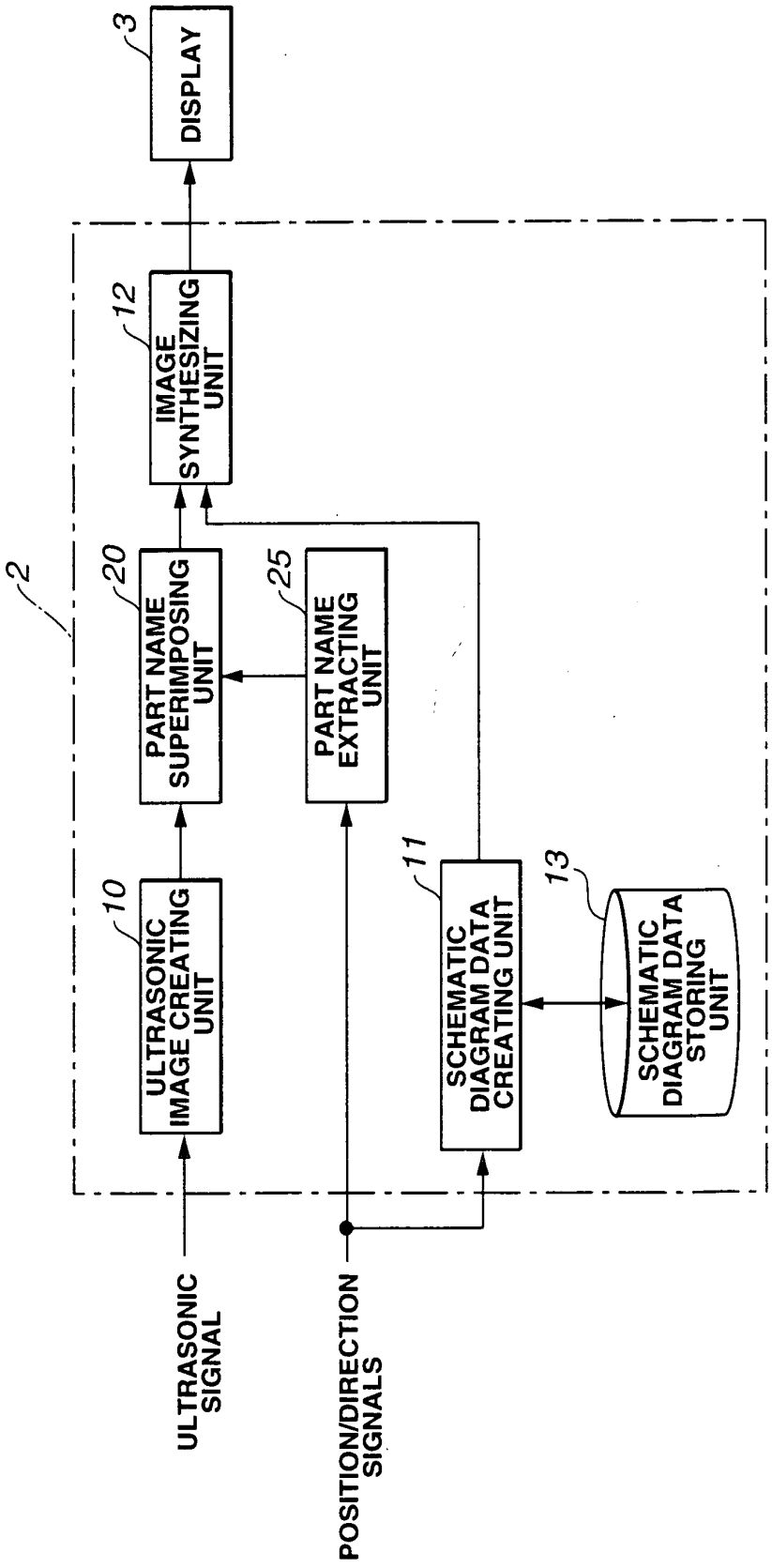

3
DISPLAY
12
IMAGE SYNTHESIZING UNIT
2
20
PART NAME SUPERIMPOSING UNIT
25
PART NAME EXTRACTING UNIT
10
ULTRASONIC IMAGE CREATING UNIT
11
SCHEMATIC DIAGRAM DATA CREATING UNIT
13
SCHEMATIC DIAGRAM DATA STORING UNIT
ULTRASONIC SIGNAL
POSITION/DIRECTION SIGNALS

FIG.15

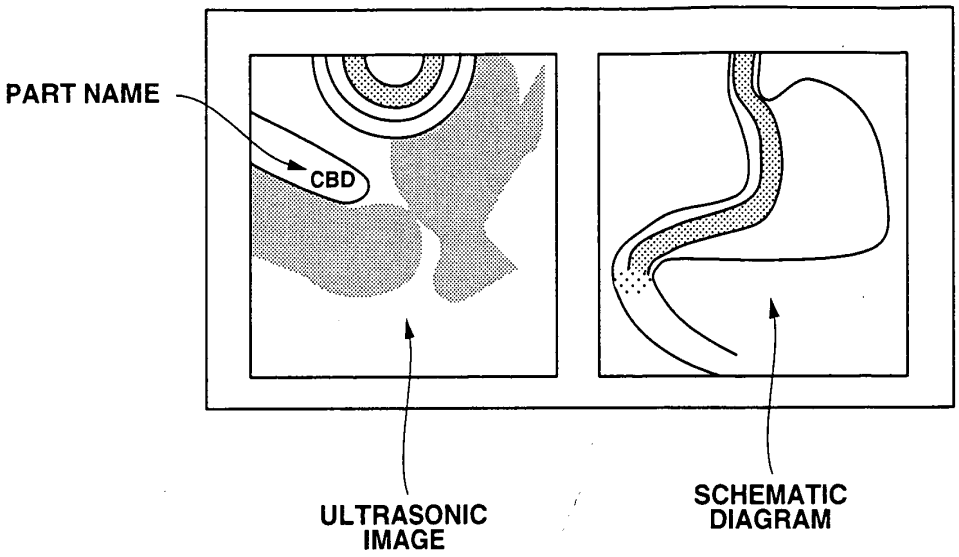

PART NAME
CBD
ULTRASONIC IMAGE
SCHEMATIC DIAGRAM

FIG.16

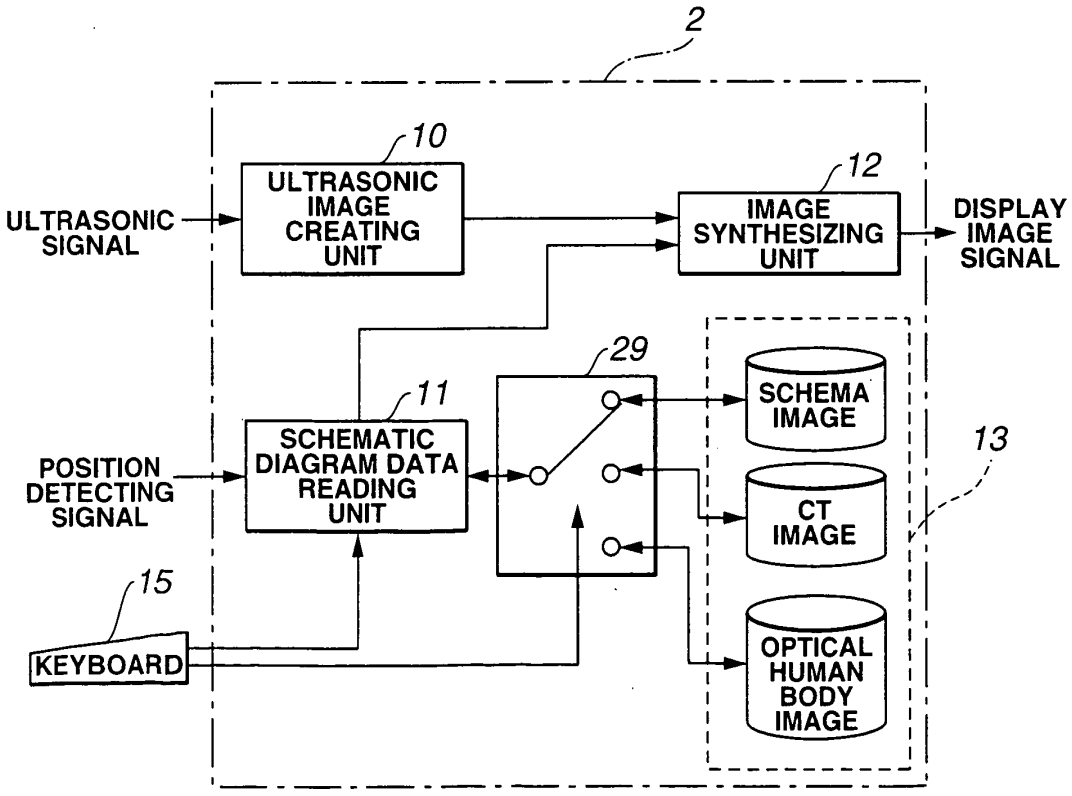

2
10
ULTRASONIC IMAGE CREATING UNIT
12
IMAGE SYNTHESIZING UNIT
ULTRASONIC SIGNAL
DISPLAY IMAGE SIGNAL
29
11
SCHEMATIC DIAGRAM DATA READING UNIT
SCHEMA IMAGE
CT IMAGE
OPTICAL HUMAN BODY IMAGE
13
POSITION DETECTING SIGNAL
15
KEYBOARD

FIG.17

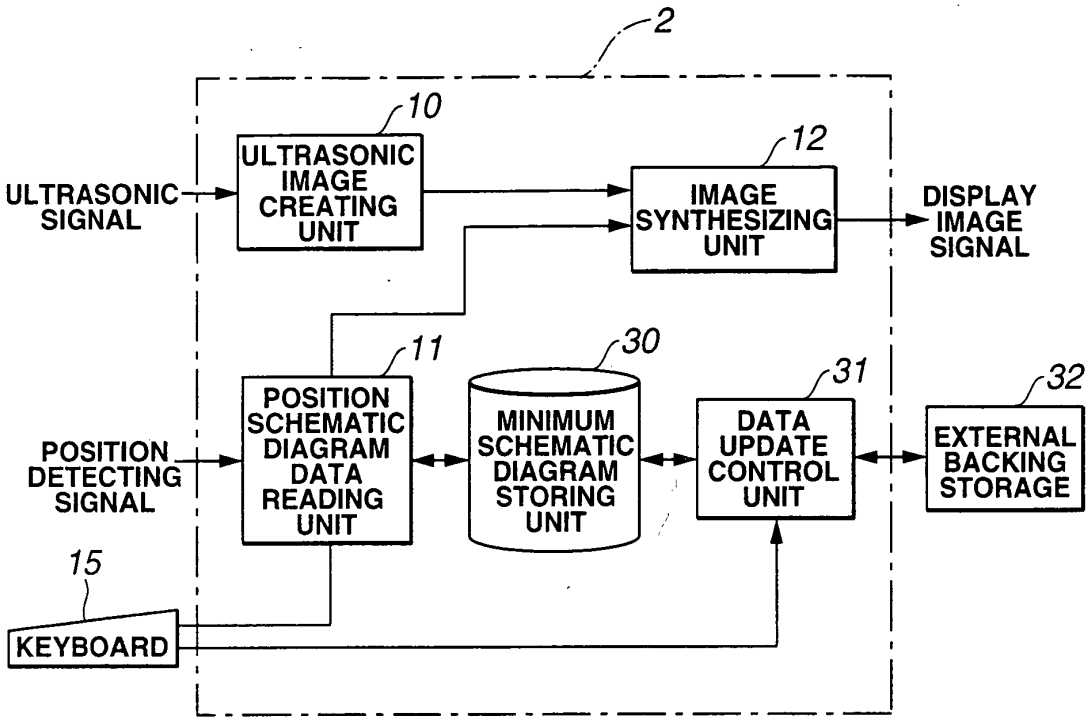
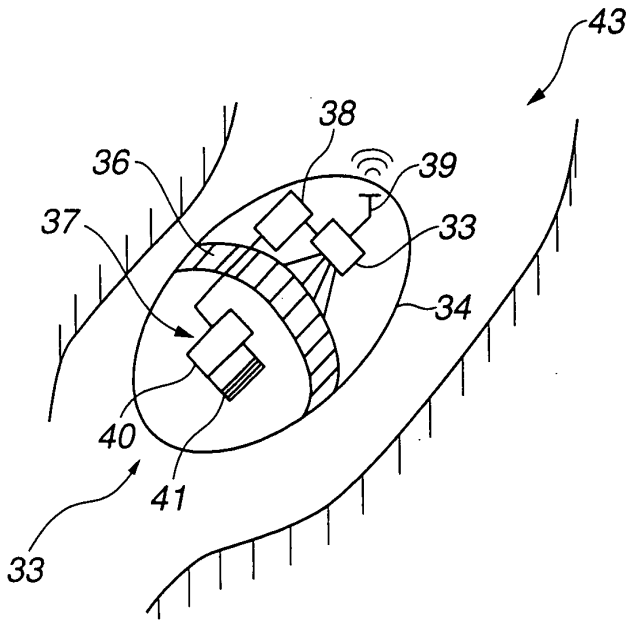

2
10
ULTRASONIC IMAGE CREATING UNIT
12
IMAGE SYNTHESIZING UNIT
ULTRASONIC SIGNAL
DISPLAY IMAGE SIGNAL
11
30
31
32
POSITION SCHEMATIC DIAGRAM DATA READING UNIT
MINIMUM SCHEMATIC DIAGRAM STORING UNIT
DATA UPDATE CONTROL UNIT
EXTERNAL BACKING STORAGE
POSITION DETECTING SIGNAL
15
KEYBOARD

FIG.18


43
38
36
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37
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34
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41
33

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP03/11694

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl[7] A61B8/12

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int.Cl[7] A61B8/00-8/15

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Toroku Jitsuyo Shinan Koho 1994-2003
Kokai Jitsuyo Shinan Koho 1971-2003 Jitsuyo Shinan Toroku Koho 1996-2003

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2002-263101 A (Aloka Co., Ltd.), 17 September, 2002 (17.09.02), Full text; all drawings (Family: none)	1,2,5,6,7,11
A	JP 2001-17433 A (Toshiba Corp.), 23 January, 2001 (23.01.01), Full text; all drawings (Family: none)	1,2,5,6,7,11
A	JP 2000-23980 A (Olympus Optical Co., Ltd.), 25 January, 2000 (25.01.00), Full text; all drawings (Family: none)	1,2,5,6,7,11

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
10 December, 2003 (10.12.03)	24 December, 2003 (24.12.03)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (July 1998)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP03/11694

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2000-23979 A (Olympus Optical Co., Ltd.), 25 January, 2000 (25.01.00), Full text; all drawings (Family: none)	1,2,5,6,7,11
A	JP 11-123187 A (Olympus Optical Co., Ltd.), 11 May, 1999 (11.05.99), Full text; all drawings (Family: none)	1,2,5,6,7,11
A	JP 11-47133 A (Nippon Telegraph And Telephone Corp.), 23 February, 1999 (23.02.99), Full text; all drawings (Family: none)	1,2,5,6,7,11
A	JP 8-257028 A (GE Yokogawa Medical Systems, Ltd.), 08 October, 1996 (08.10.96), Full text; all drawings (Family: none)	1,2,5,6,7,11
A	JP 7-184906 A (Olympus Optical Co., Ltd.), 25 July, 1995 (25.07.95), Full text; all drawings (Family: none)	1,2,5,6,7,11

Form PCT/ISA/210 (continuation of second sheet) (July 1998)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP03/11694

Box I Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. [X] Claims Nos.: 12-16

because they relate to subject matter not required to be searched by this Authority, namely:

The inventions of claims 12-16 relate to a diagnostic method practiced on a human body. Therefore the subject matter is not required to be searched by the International Searching Authority under PCT Article 17(2)(a)(i) and Rule 39.1(iv).

2. [ ] Claims Nos.:

because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. [ ] Claims Nos.:

because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

The technical feature common to claims 1-11 is the one of claim 1.

However, the international search has revealed that this technical feature is not novel since it is disclosed in JP 2002-263101 A (Aloka Co., Ltd.), 17 September, 2002 (17.09.02).

Therefore, the technical feature of claim 1 cannot be considered as a special technical feature within the meaning of PCT Rule 13.2, second sentence.

Consequently, it appears that claims 1, 2, 5, 6, 7, 11, claim 3, claim 4, claim 8, claim 9, and claim 10 do not comply with the requirement of unity of invention.

1. [ ] As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. [ ] As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. [ ] As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. [X] No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.: 1, 2, 5, 6, 7, 11

Remark on Protest

[ ] The additional search fees were accompanied by the applicant's protest.

[ ] No protest accompanied the payment of additional search fees.

Form PCT/ISA/210 (continuation of first sheet (1)) (July 1998)

专利名称(译)	超声波诊断装置		
公开(公告)号	EP1543776A1	公开(公告)日	2005-06-22
申请号	EP2003798404	申请日	2003-09-12
[标]申请(专利权)人(译)	奥林巴斯株式会社		
申请(专利权)人(译)	OLYMPUS CORPORATION		
当前申请(专利权)人(译)	OLYMPUS CORPORATION		
[标]发明人	OKUNO YOSHIYUKI		
发明人	OKUNO, YOSHIYUKI		
IPC分类号	A61B8/12		
CPC分类号	A61B8/0841 A61B8/12 A61B8/4254 A61B8/4461 A61B8/4472 A61B8/4488 A61B8/463 A61B8/5238		
优先权	2002283803 2002-09-27 JP		
其他公开文献	EP1543776A4 EP1543776B1		
外部链接	Espacenet		

摘要(译)

为了清楚地显示在体腔内的超声波扫描中观察到的部分和容易的期望部分，在体腔中扫描并获得超声波。然后，超声图像创建单元从其创建超声图像。示意图数据创建单元基于表示物体的姿态和用于扫描体腔中的超声波的位置的姿态/位置信号，从示意图数据存储单元提取示意图数据，其从位置/获得方向检测单元。图像合成单元合成由超声图像创建单元创建的超声图像和由示意图数据创建单元创建的示意图数据。然后，显示器在同一屏幕上显示超声波图像和与用于扫描超声波的位置相对应的示意图。

FIG.3