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(54) Tomographic ultrasonic diagnostic apparatus

Tomographisches Ultraschall- Diagnosegerät

Appareil diagnostique à ultrasons par tomographie

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- **PATENT ABSTRACTS OF JAPAN vol. 018, no. 285 (C-1206), 31 May 1994 (1994-05-31) & JP 06 054850 A (TOSHIBA CORP), 1 March 1994 (1994-03-01)**

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Description

[0001] The present invention relates to an ultrasonic diagnostic apparatus for transmitting an ultrasonic wave to a living body and receiving a wave reflected by the living body to produce a tomographic image from the reflected wave.

[0002] An ultrasonic diagnostic apparatus has been conventionally used for medical diagnosis for the purpose of producing organic information of a living body or a patient. This ultrasonic diagnostic apparatus transmits an ultrasonic pulse into an organ of the patient through an ultrasonic probe and receives the reflected wave from a boundary surface between tissues different in acoustic impedance through the ultrasonic probe to convert the reflected wave into an electric signal. Further, the ultrasonic diagnostic apparatus displays an ultrasonic tomographic image on a monitor on the basis of the electric signal.

[0003] In such a ultrasonic diagnostic apparatus, the depth from the organic surface in which an ultrasonic tomographic image can be produced, namely, a limit of visible depth becomes shallower the higher frequency of ultrasonic wave is used for diagnosis because an ultrasonic wave is heavily absorbed by the organ in proportional to the frequency of the ultrasonic wave. However, it is desirable to use a high frequency wave in order to produce an ultrasonic tomographic image of a high resolution.

[0004] In transmission of an ultrasonic wave, it is desirable to increase the frequency of the ultrasonic wave to be transmitted in order to increase the resolution of a target region for diagnosis. However, even if the depth set to be displayed on the monitor, namely, the depth of field of view is set deep, the limit of visible depth is constant because the frequency of the ultrasonic wave to be transmitted is constant.

[0005] Conventionally, the ultrasonic diagnostic apparatus as described in Japanese Patent Public Disclosure No. 6-54850 is well known. The construction of this apparatus is shown in Fig. 5. In Fig. 5, a system controller 112 controls a drive frequency for an ultrasonic probe 115 according to a focus position, a color display area or a Doppler signal detection position. According to this apparatus, the frequency of the ultrasonic wave is changed according to the focus position, the color display area or the Doppler signal detection position.

[0006] However, the conventional apparatus as set forth above has disadvantages that even if the depth of field of view is set deep in order to display the diagnostic target region, the visual depth limit does not change because the transmitting frequency does not change and as a result, it is difficult to produce organic information on the area surrounding the diagnostic target region.

[0007] Further, the conventional apparatus has disadvantages that even if the depth of field of view is set shallow in order to display the diagnostic target region, the resolution of the diagnostic target region does not change because the transmitting frequency does not change and as a result, it is difficult to produce an image of high resolution.

[0008] Further, the conventional apparatus has disadvantages that even if the enlargingly displayed area of field of view is set deep in order to enlargingly display the diagnostic target region, the visible depth limit does not change because the transmitting frequency does not change and as a result, it is difficult to produce organic information on the area surrounding the enlargingly displayed area of field of view.

[0009] Further, the conventional apparatus has disadvantages that even if the enlargingly displayed area of field of view is set shallow in order to enlargingly display the diagnostic target region, the resolution of the enlargingly displayed area of field of view does not change because the transmitting frequency does not change and as a result, it is difficult to produce an image of high resolution.

[0010] Further, the conventional apparatus has disadvantages that even if the field of view is changed, the transmitting frequency cannot be changed without changing the focus position, the color display area or the Doppler signal detection position in the field of view.

[0011] It is an object of the present invention to solve the problem set forth above in the prior art and to provide an improved ultrasonic diagnostic apparatus capable of automatically changing an ultrasonic wave to be transmitted according to the field of view.

[0012] According to the present invention there is provided an ultrasonic diagnostic apparatus comprising:

ultrasonic transmitting/receiving means for transmitting ultrasonic waves to a living body and receiving the reflected waves from the living body, the transmitting/receiving means being arranged, in use, to convert the received waves into an electric signal;
control means for determining a driving frequency of the ultrasonic waves to be transmitted from said ultrasonic transmitting/receiving means;
a transmitting circuit for converting a trigger signal having the driving frequency determined by said control means into a pulse signal for application to the ultrasonic transmitting/receiving means; and
display means for displaying a diagnostic image based on the electric signal from said ultrasonic transmitting/receiving means;
the ultrasonic diagnostic apparatus being characterized by:

an operation panel for, when manipulated by an operator, setting an intended depth of field of view of the displayed diagnostic image resulting from applying said ultrasonic waves from said ultrasonic transmitting/ receiving means to said living body;

wherein said control means determines the driving frequency of the ultrasonic waves to be transmitted from said ultrasonic transmitting/receiving means in accordance with the depth of field of view which has been set by said operator using said operation panel, such that when the depth of the field of view is made shallow, the driving frequency of the ultrasonic waves to be transmitted from said ultrasonic transmitting/receiving means is increased, and when the depth of field of view is made deep, the driving frequency of the ultrasonic waves to be transmitted from said ultrasonic transmitting/receiving means is decreased.

[0013] In this arrangement, the frequency of the ultrasonic waves to be transmitted by the ultrasonic transmitting/ receiving means can be automatically changed according to the depth of field of view.

[0014] Preferably, in the ultrasonic diagnostic apparatus of the present invention, the control means selects an area of field of view on the display means in which the depth of field of view has been set, each area of field of view covering a different range of depths of field of view; and

the control means is arranged to control the driving frequency of the ultrasonic waves to be transmitted by the ultrasonic transmitting/ receiving means according to the selected area of field of view. In this arrangement, the frequency of the ultrasonic waves to be transmitted by the ultrasonic transmitting/ receiving means can be automatically changed according to the selected area of field of view.

[0015] Preferably, the ultrasonic diagnostic apparatus is further arranged to include a rewritable retention table for storing driving frequency values corresponding to various depths of field of view, the control means determining the driving frequency by looking up in the rewritable retention table the depth of field of view set by the operation panel and obtaining the corresponding driving frequency,

wherein the operator is able to rewrite a depth of field of view value in the rewritable retention table to more accurately reflect the actual depth of field of view of the diagnostic image being displayed on the display means. In the arrangement, a user can change easily such a setting that the driving frequency of the ultrasonic waves to be transmitted by the ultrasonic transmitting/ receiving means can be automatically changed according to the field of view.

[0016] Particular embodiments will now be described with reference to the accompanying drawings; in which:

Fig. 1 shows a construction view of the first embodiment of the present invention.
Fig. 2 show a view for illustrating the operation of the present invention.
Fig. 3 shows a flowchart for illustrating the operation of the present invention.
Fig. 4 shows a construction view of the second embodiment of the present invention.
Fig. 5 shows a construction view of prior art.

[0017] The embodiments of the present invention will be described hereinafter using the drawings. Fig. 1 shows the first embodiment of the present invention. An operation panel 11 is adapted to allow a user to set different diagnostic conditions. For example, the user can make selection of diagnostic modes, etc., and settings of the depth of field of view, the enlargingly displayed area of field of view and the like. The information set through the operation panel 11 is supplied to a system controller 12.

[0018] The system controller 12 is adapted to control the whole system, particularly, to determine the frequency of the ultrasonic wave to be transmitted from an ultrasonic probe 14 according to the field of view set through the operation panel 11. The system controller 12 determines to transmit an ultrasonic wave of low frequency when the depth of field of view is set to deep level and to transmit an ultrasonic wave of high frequency when the depth of field of view is set to shallow level. The ultrasonic probe used in this embodiment has a wide frequency range or ultrasonic elements of two or more different types, for example, the ultrasonic probe is designed so that it can transmit and receive ultrasonic waves of 5.0-7.5 MHz.

[0019] One example of the method for determining the ultrasonic wave frequency set forth above will be described with reference to Figs. 2 and 3. Fig. 2 shows the case of mechanical sector. In the present embodiment, the ultrasonic waves of three different frequencies of 5.0, 6.0 and 7.5 MHz are transmitted. In Fig. 2, reference numeral 20 designates the maximum field of view when the ultrasonic wave of 5.0 MHz is transmitted. Arc 21 shows the maximum depth of field of view when the ultrasonic wave 5.0 MHz is transmitted. Arcs 22, 23 and 24 show the limit of visible depth when the frequency of the ultrasonic wave is 5.0, 6.0 and 7.5 MHz respectively. Reference numerals 31, 32, 33 and 34 designate respectively the areas surrounded by these arcs 21, 22, 23 and 24. It is determined that the ultrasonic wave of 5.0 MHz is transmitted when the depth of field of view is set to the areas 31 and 32, the ultrasonic wave of 6.0 MHz is transmitted when the depth of field of view is set to the area 33, the ultrasonic wave of 7.5 MHz is transmitted when the depth of field of view is set to the area 34.

[0020] In conventional case. the limit of visible depth is the arc 23 in Fig. 2 when the ultrasonic wave of 6.0 MHz is

transmitted. In the present invention, the drive frequency for the ultrasonic probe 14 is determined as set forth above, whereby the ultrasonic wave of 5.0 MHz is transmitted when the depth of field of view is set in the area 32, and as a result, the limit of visible depth becomes the arc 22. Consequently, the field of view is extended by the portion of the area 32 over the conventional apparatus. The information concerning the tissue surrounding the diagnostic target region can be obtained as an image to improve the accuracy of the diagnosis. If the depth of field of view is set to the shallow level, the ultrasonic wave of high frequency is transmitted. As a result, the resolution is improved over the conventional apparatus. The case of mechanical sector probe has been described hereinbefore and alternatively, an array probe and the like can be used. There is no limitation on the type of ultrasonic probe.

[0021] A transmitting circuit 13 generates a master signal therein and converts a trigger signal of the frequency determined by the system controller 12 into a pulse signal of high voltage on the basis of the frequency of the master signal and then the pulse signal is applied to the ultrasonic probe 14. The ultrasonic probe 14 transmits an ultrasonic wave into the living body or the organ of the patient in response to the pulse signal and receive a wave reflected from the organ of the patient and converts the reflected wave to an electric signal. This electric signal is input to a receiving circuit 15 in a back stage. The receiving circuit 15 applys the predetermined amplification and detection, etc. to the electric signal and supplies the signal to an image processing unit 16. The image processing unit 16 applies the predetermined processing to the signal from the receiving circuit 15 and displays the signal on a display unit 17 as a diagnostic image. The operation of the ultrasonic diagnostic apparatus set forth above will be described hereinafter.

[0022] A case where B mode is selected through the operation panel 11 will be described. When the depth of field of view is set through the operation panel 14, the information concerning the set depth of field of view is supplied to the system controller 12. The system controller 12 determines the driving frequency for the ultrasonic probe 14 in response to the depth of field of view. For example, the frequency is determined to be set to 5.0 MHz if the set depth of field of view is in the area 32 in Fig. 2. The information concerning the frequency is supplied to the transmitting circuit 13. The transmitting circuit 13 converts the trigger signal of the frequency determined by the system controller 12 into the pulse signal of high voltage and then, the pulse signal is applied to the ultrasonic probe 14. The ultrasonic wave transmitted from the ultrasonic probe 14 in response to the pulse signal is reflected by the different tissues of the patient body and received by the ultrasonic probe 14 and then, converted into an electric signal. This electric signal is input to the receiving circuit 15 in the back stage. The receiving circuit 15 applies amplification and detection, etc. to the electric signal and supplies the electric signal to the image processing unit 16. The image processing unit 16 implements processing such as scan transform or brightness transform to the electric signal and supplies the processed electric signal to the display unit 17 as image data. The display unit 17 displays the image data as an ultrasonic diagnostic image.

[0023] The advantage of the apparatus set forth above is that if the depth of field of view is set according to the position of diagnostic target region, an ultrasonic wave which frequency corresponds to the depth of field of view is transmitted, and therefore, information concerning the area surrounding the diagnostic target region is obtained, and if the depth of field of view is set shallow, an image of high resolution can be obtained.

[0024] Further, the advantage of the apparatus is that an ultrasonic wave which frequency corresponds to the depth of field of view is transmitted and therefore, if the depth of field of view is set deep, the limit of visible depth becomes deep whereby it becomes easy to see the diagnostic image, and as a result, the accuracy of diagnosis is improved.

[0025] Further, the advantage of the apparatus is that an ultrasonic wave which frequency corresponds to the position of enlargingly displayed area of field of view is transmitted, and therefore, if the enlargingly displayed area of field of view is set shallow, an image of high resolution can be obtained.

[0026] Further, the advantage of the apparatus is that an ultrasonic wave which frequency corresponds to the position of the enlargingly displayed area of field of view is transmitted and therefore, if the enlargingly displayed area of field of view is set deep, the limit of visible depth becomes deep, whereby it becomes easy to see the enlargingly displayed diagnostic image, and as a result, the accuracy of diagnosis is improved.

[0027] According to the embodiment as described hereinbefore, ultrasonic waves of three different frequencies are transmitted. However, it is intended to include two or more different frequencies. Further, it is not intended to limit the present invention to the embodiment described hereinbefore. Many modifications are possible within the scope of the present invention defined in the appended claims.

[0028] The second embodiment of the present invention will be now described using Fig. 4. As shown in Fig. 4, the second embodiment of the present invention is different from the first embodiment as set forth above in further including a rewritable table 18. The content of the table displayed on the TV moniter is easily rewritable by the user through the operation panel 11. The system controller 12 checks the rewritable table 18 on the basis of the information concerning the field of view set through the operation panel 11 and controls the transmitting circuit 13 to change the frequency of the ultrasonic wave to be transmitted.

[0029] Control of the frequency of the ultrasonic wave to be transmitted with respect to the depth of field of view will be hereinafter described by way of example.

Table 1 shows one example of the contents of the rewritable table 18. Table 1

Depth Of Field Of View	Frequency Of Ultrasonic Wave To Be Transmitted
from 20 mm or more to less than 50 mm	7.5MHz
from 50 mm or more to less than 120 mm	6.0MHz
120 mm or more	5.0MHz

[0030] The value of the depth of field of view shown in Table 1 is displayed on the display unit 17 whereby the user can easily rewrite the value of the depth of field of view through the operation panel 11.

[0031] The degree of absorption of ultrasonic wave into the patient body varies with type of the patient body. The degree of absorption of ultrasonic wave into the patient body varies with different target organs in the diagnostic field such as abdominal area, obstetric area, etc. Since the degree of absorption of ultrasonic wave into patient body changes, the limit of visible depth also changes even if the transmitting frequency is constant.

[0032] According to this construction, the user can easily change the setting wherein the frequency of the ultrasonic wave to be transmitted from the ultrasonic transmitting/receiving means according to the field of view is automatically changed, and therefore, it is easy to compensate in response to the change of limit of visible depth.

[0033] It is possible to rewrite the value of transmitting frequency and keep storing the combination of the values. In the Table, three different ranges are set, but it is possible to set the ranges more finely. Control of the frequency of the ultrasonic wave to be transmitted is made not only in response to the depth of field of view but also in other setting such as in response to the position of the enlargingly displayed area of field of view, etc.

[0034] As described in detail above, the advantage of the present invention is that if the depth of field of view is set according to the position of diagnostic target region, an ultrasonic wave which frequency corresponds to the depth of field of view is transmitted, and therefore, information concerning the area surrounding the diagnostic target region is obtained, and if the depth of field of view is set shallow, an image of high resolution can be obtained.

[0035] Further, the advantage of the present invention is that an ultrasonic wave which frequency corresponds to the depth of field of view is transmitted and therefore, if the depth of field of view is set deep, the limit of visible depth becomes deep whereby it becomes easy to see the diagnostic image, and as a result, the accuracy of diagnosis is improved.

[0036] Further, the advantage of the present invention is that an ultrasonic wave which frequency corresponds to the position of enlargingly displayed area of field of view is transmitted, and therefore, if enlargingly displayed area of field of view is set shallow, an image of high resolution can be obtained.

[0037] Further, the advantage of the present invention is that an ultrasonic wave which frequency corresponds to the position of the enlargingly displayed area of field of view is transmitted and therefore, if the enlargingly displayed area of field of view is set deep, the limit of visible depth becomes deep, whereby it becomes easy to see the enlargingly displayed diagnostic image, and as a result, the accuracy of diagnosis is improved.

[0038] According to the present invention, the user can easily change the setting wherein the frequency of the ultrasonic wave to be transmitted from the ultrasonic transmitting/receiving means according to the field of view is automatically changed, and therefore, it is easy to compensate in response to the change of limit of visible depth.

Claims

1. An ultrasonic diagnostic apparatus comprising:

ultrasonic transmitting/receiving means (14) for transmitting ultrasonic waves to a living body and receiving the reflected waves from the living body, the transmitting/receiving means being arranged, in use, to convert the received waves into an electric signal;
control means (12) for determining a driving frequency of the ultrasonic waves to be transmitted from said ultrasonic transmitting/receiving means;
a transmitting circuit (13) for converting a trigger signal having the driving frequency determined by said control means into a pulse signal for application to the ultrasonic transmitting/receiving means; and
display means (17) for displaying a diagnostic image based on the electric signal from said ultrasonic transmitting/receiving means;
the ultrasonic diagnostic apparatus being **characterized by**:

an operation panel (11) for, when manipulated by an operator, setting an intended depth of field of view of the displayed diagnostic image resulting from applying said ultrasonic waves from said ultrasonic transmitting/receiving means to said living body;

wherein said control means determines the driving frequency of the ultrasonic waves to be transmitted from said ultrasonic transmitting/receiving means in accordance with the depth of field of view which has been set by said operator using said operation panel, such that when the depth of field of view is made shallow, the driving frequency of the ultrasonic waves to be transmitted from said ultrasonic transmitting/receiving means is increased, and when the depth of field of view is made deep, the driving frequency of the ultrasonic waves to be transmitted from said ultrasonic transmitting/receiving means is decreased.

2. An ultrasonic diagnostic apparatus according to claim 1, wherein said control means (12) determines the driving frequency of the ultrasonic waves to be transmitted from said ultrasonic transmitting/receiving means (14) according to a maximum depth of field of view.

3. An ultrasonic diagnostic apparatus according to claim 1 or 2, wherein the control means selects an area (31, 32, 33, 34) of field of view on the display means (17) in which the depth of field of view has been set, each area of field of view covering a different range of depths of field of view; and
wherein said control means (12) controls the driving frequency of the ultrasonic waves to be transmitted by said ultrasonic transmitting/receiving means (14) according to the selected area of field of view.

4. An ultrasonic diagnostic apparatus according to any preceding claim, the apparatus further comprising a rewritable retention table (18) for storing driving frequency values corresponding to various depths of field of view, the control means determining the driving frequency by looking up in the rewritable retention table the depth of field of view set by the operation panel (11) and obtaining the corresponding driving frequency,
wherein the operator is able to rewrite a depth of field of view value in the rewritable retention table,to more accurately reflect the actual depth of field of view of the diagnostic image being displayed on the display means (17).

5. An ultrasonic diagnostic apparatus according to any preceding claim, wherein said ultrasonic transmitting/receiving means has an ultrasonic probe (14) for transmitting ultrasonic waves of a plurality of different frequencies,
wherein said control means (12) includes a system controller for determining the frequency of the ultrasonic waves to be transmitted from said ultrasonic probe according to the depth of field of view set by the operator through the operation panel (11), and wherein said display means includes a display unit (17).

Patentansprüche

1. Ultraschall-Diagnosevorrichtung, umfassend:

ein Ultraschall-Sende-/Empfangsmittel (14) zum Senden von Ultraschallwellen zu einem lebenden Körper und Empfangen der reflektierten Wellen von dem lebenden Körper, wobei das Sende-/Empfangsmittel im Gebrauch angeordnet ist, um die empfangenen Wellen in ein elektrisches Signal umzuwandeln,
ein Steuermittel (12) zum Bestimmen einer Ansteuerfrequenz der von dem genannten Ultraschall-Sende-/Empfangsmittel zu sendenden Ultraschallwellen,
eine Sendeschaltung (13) zum Umwandeln eines Auslösersignals, das die von dem genannten Steuermittel bestimmte Ansteuerfrequenz hat, in ein Pulssignal zum Anlegen an das Ultraschall-Sende-/Empfangsmittel und ein Anzeigemittel (17) zum Anzeigen eines Diagnosebilds auf der Basis des elektrischen Signals von dem genannten Ultraschall- Sende- / Empfangsmittel,
wobei die Ultraschall-Diagnosevorrichtung **gekennzeichnet ist durch**:

ein Bedienfeld (11) zum Einstellen einer beabsichtigten Bildfeldtiefe des angezeigten Diagnosebilds, das sich aus dem Anlegen der genannten Ultraschallwellen von dem genannten Ultraschall-Sende-/Empfangsmittel an den genannten lebenden Körper ergibt, wenn es von einer Bedienkraft bedient wird,
wobei das genannte Steuermittel die Ansteuerfrequenz der von dem genannten Ultraschall-Sende-/Empfangsmittel zu sendenden Ultraschallwellen gemäß der Bildfeldtiefe bestimmt, die von der genannten Bedienkraft mithilfe des genannten Bedienfelds eingestellt wurde, so dass, wenn die Bildfeldtiefe flach gemacht wird, die Ansteuerfrequenz der von dem genannten Ultraschall-Sende-/Empfangsmittel zu sendenden Ultraschallwellen erhöht wird, und wenn die Bildfeldtiefe tief gemacht wird, die Ansteuerfrequenz der von dem genannten Ultraschall-Sende-/Empfangsmittel zu sendenden Ultraschallwellen verringert wird.

2. Ultraschall-Diagnosevorrichtung nach Anspruch 1, wobei das genannte Steuermittel (12) die Ansteuerfrequenz der von dem genannten Ultraschall-Sende-/Empfangsmittel (14) zu sendenden Ultraschallwellen gemäß einer maxi-

malen Bildfeldtiefe bestimmt.

3. Ultraschall-Diagnosevorrichtung nach Anspruch 1 oder 2, wobei das Steuermittel eine Fläche (31, 32, 33, 34) des Bildfelds auf dem Anzeigemittel (17) auswählt, in der die Bildfeldtiefe eingestellt wurde, wobei jede Fläche des Bildfelds einen anderen Bildfeldtiefenbereich abdeckt, und
wobei das genannte Steuermittel (12) die Ansteuerfrequenz der von dem genannten Ultraschall-Sende-/Empfangsmittel (14) zu sendenden Ultraschallwellen gemäß der ausgewählten Bildfeldfläche regelt.

4. Ultraschall-Diagnosevorrichtung nach einem der vorhergehenden Ansprüche, wobei die Vorrichtung ferner eine wiederbeschreibbare Speicherungstabelle (18) zum Speichern von Ansteuerfrequenzwerten, die verschiedenen Bildfeldtiefen entsprechen, aufweist, wobei das Steuermittel die Ansteuerfrequenz bestimmt, indem es in der wiederbeschreibbaren Speicherungstabelle die von dem Bedienfeld (11) eingestellte Bildfeldtiefe sucht und die entsprechende Ansteuerfrequenz erhält,
wobei die Bedienkraft einen Bildfeldtiefenwert in der wiederbeschreibbaren Speicherungstabelle überschreiben kann, um die tatsächliche Bildfeldtiefe des auf dem Anzeigemittel (17) angezeigten Diagnosebilds genauer zu reflektieren.

5. Ultraschall-Diagnosevorrichtung nach einem der vorhergehenden Ansprüche, wobei das genannte Ultraschall-Sende/Empfangsmittel eine Ultraschallsonde (14) zum Senden von Ultraschallwellen mit einer Vielzahl verschiedener Frequenzen hat,
wobei das genannte Steuermittel (12) einen Systemcontroller zum Bestimmen der Frequenz der von der genannten Ultraschallsonde zu sendenden Ultraschallwellen gemäß der von der Bedienkraft durch das Bedienfeld (11) eingestellten Bildfeldtiefe beinhaltet und wobei das genannte Anzeigemittel eine Anzeigeeinheit (17) beinhaltet.

Revendications

1. Appareil diagnostique à ultrasons comprenant :

   un moyen de transmission/réception des ultrasons (14) pour transmettre des ultrasons à un organisme vivant et pour recevoir les ondes réfléchies de l'organisme vivant, le moyen de transmission/réception étant disposé, en cours d'utilisation, de manière à convertir les ondes reçues en un signal électrique ;
   un moyen de contrôle (12) pour déterminer une fréquence pilote des ultrasons à transmettre à partir dudit moyen de transmission/réception des ultrasons ;
   un circuit de transmission (13) pour convertir un signal de déclenchement ayant la fréquence pilote déterminée par ledit moyen de contrôle en un signal à impulsions pour l'application au moyen de transmission/réception des ultrasons ; et
   un moyen d'affichage (17) pour afficher une image diagnostique ayant pour base le signal électrique provenant dudit moyen de transmission/réception des ultrasons ;
   l'appareil diagnostique à ultrasons **se caractérisant en ce que** :

      un panneau opérationnel (11) pour, lorsque manipulé par un opérateur, régler une profondeur du champ de vision visée de l'image diagnostique affichée résultant de l'application desdits ultrasons provenant dudit moyen de transmission/réception des ultrasons et se dirigeant vers ledit organisme vivant ;
      dans lequel ledit moyen de contrôle détermine la fréquence pilote des ultrasons à transmettre à partir dudit moyen de transmission/réception des ultrasons conformément à la profondeur du champ de vision qui a été réglée par ledit opérateur en utilisant ledit panneau opérationnel, d'une manière telle que, lorsque la profondeur du champ de vision est rendue peu profonde, la fréquence pilote des ultrasons à transmettre à partir dudit moyen de transmission/réception des ultrasons soit augmentée, et que, lorsque la profondeur du champ de vision est rendue profonde, la fréquence pilote des ondes ultrasoniques à transmettre à partir dudit moyen de transmission/réception des ultrasons soit diminuée.

2. Appareil diagnostique à ultrasons selon la revendication 1, dans lequel ledit moyen de contrôle (12) détermine la fréquence pilote des ultrasons à transmettre à partir dudit moyen de transmission/réception des ultrasons (14) conformément à une profondeur maximale du champ de vision.

3. Appareil diagnostique à ultrasons selon la revendication 1 ou 2, dans lequel le moyen de contrôle sélectionne une zone (31, 32, 33, 34) du champ de vision sur le moyen d'affichage (17) dans lequel la profondeur du champ de

vision a été réglée, chaque zone du champ de vision couvrant une gamme différente de profondeurs du champ de vision ; et
dans lequel ledit moyen de contrôle (12) contrôle la fréquence pilote des ultrasons à transmettre par ledit moyen de transmission/réception des ultrasons (14) conformément à la zone sélectionnée du champ de vision.

4. Appareil diagnostique à ultrasons selon l'une quelconque des revendications précédentes, l'appareil comprenant, en outre, un tableau de rétention réinscriptible (18) pour mémoriser les valeurs de la fréquence pilote correspondant aux diverses profondeurs du champ de vision, le moyen de contrôle déterminant la fréquence pilote en recherchant dans le tableau de rétention réinscriptible la profondeur du champ de vision réglée par le panneau opérationnel (11) et en obtenant la fréquence pilote correspondante,
dans lequel l'opérateur est capable de réinscrire une profondeur du champ de vision dans le tableau de rétention afin de refléter plus précisément la profondeur réelle du champ de vision de l'image diagnostique étant affichée sur le moyen d'affichage (17).

5. Appareil diagnostique à ultrasons selon l'une quelconque des revendications précédentes, dans lequel ledit moyen de transmission/réception des ultrasons possède une sonde ultrasonique (14) pour transmettre les ultrasons d'une pluralité de diverses fréquences,
dans lequel ledit moyen de contrôle (12) inclut un contrôleur de système pour déterminer la fréquence des ultrasons à transmettre à partir de ladite sonde ultrasonique conformément à la profondeur du champ de vision réglée par l'opérateur grâce au panneau opérationnel (11), et dans lequel ledit moyen d'affichage inclut une unité d'affichage (17).

FIG. 1

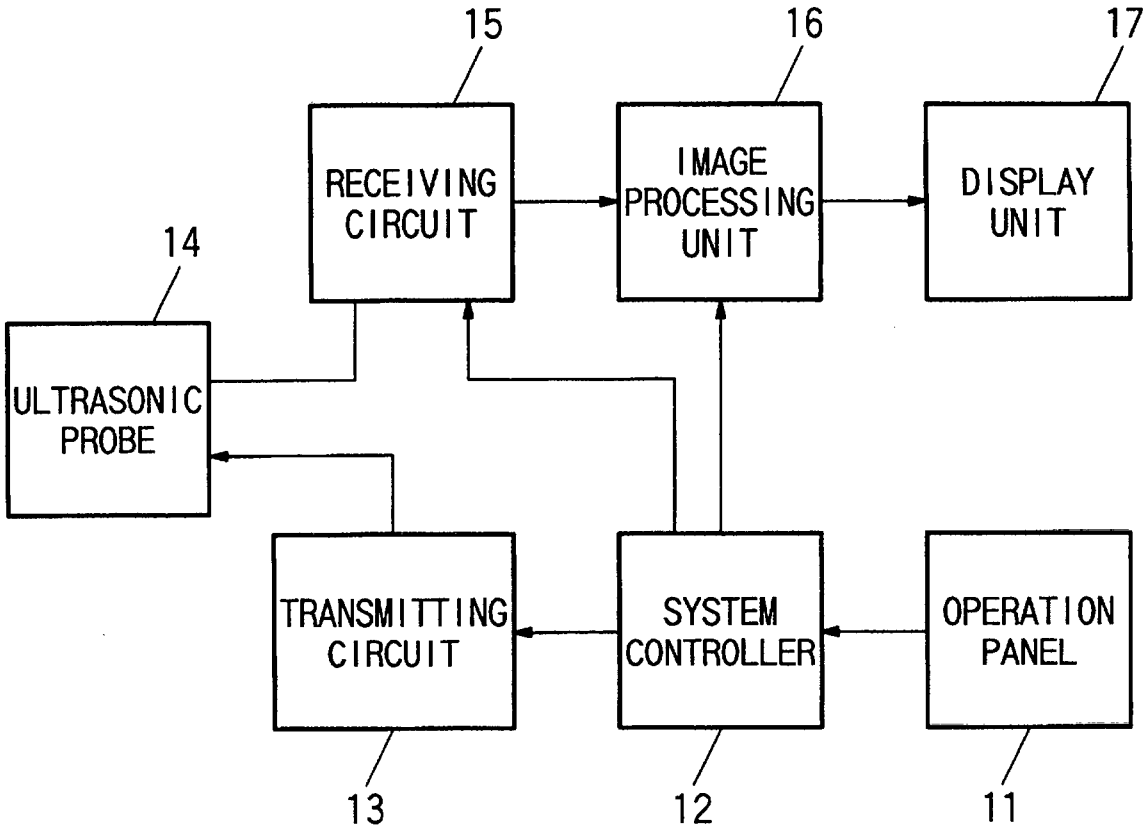

15
16
17
RECEIVING CIRCUIT
IMAGE PROCESSING UNIT
DISPLAY UNIT
14
ULTRASONIC PROBE
TRANSMITTING CIRCUIT
SYSTEM CONTROLLER
OPERATION PANEL
13
12
11

FIG. 2

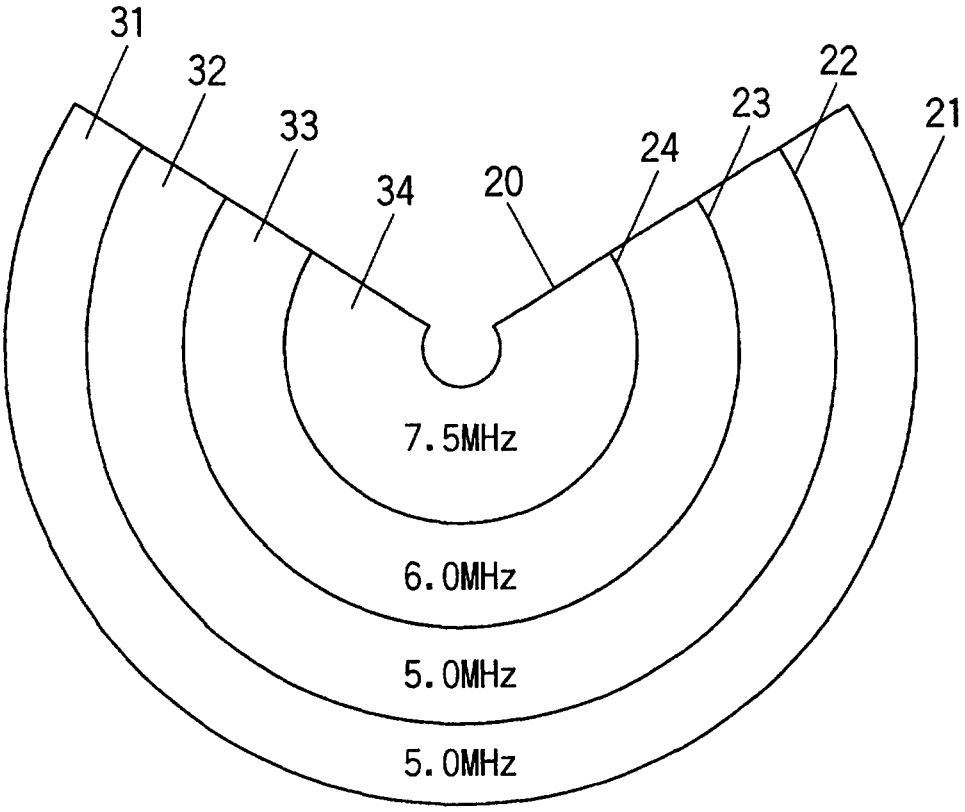


FIG. 3

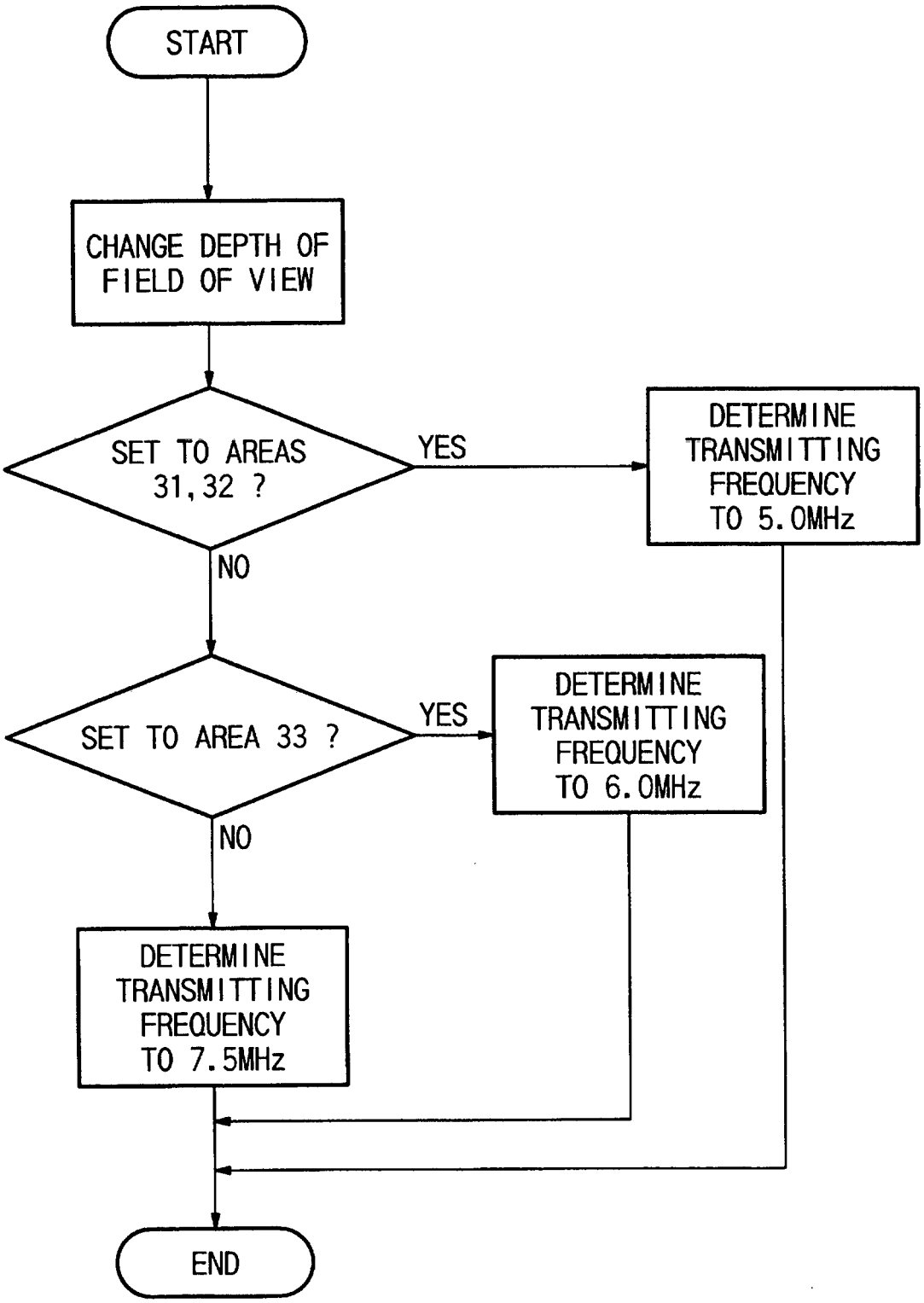

START
CHANGE DEPTH OF FIELD OF VIEW
SET TO AREAS 31, 32 ?
YES
DETERMINE TRANSMITTING FREQUENCY TO 5.0MHz
NO
SET TO AREA 33 ?
YES
DETERMINE TRANSMITTING FREQUENCY TO 6.0MHz
NO
DETERMINE TRANSMITTING FREQUENCY TO 7.5MHz
END

FIG. 4

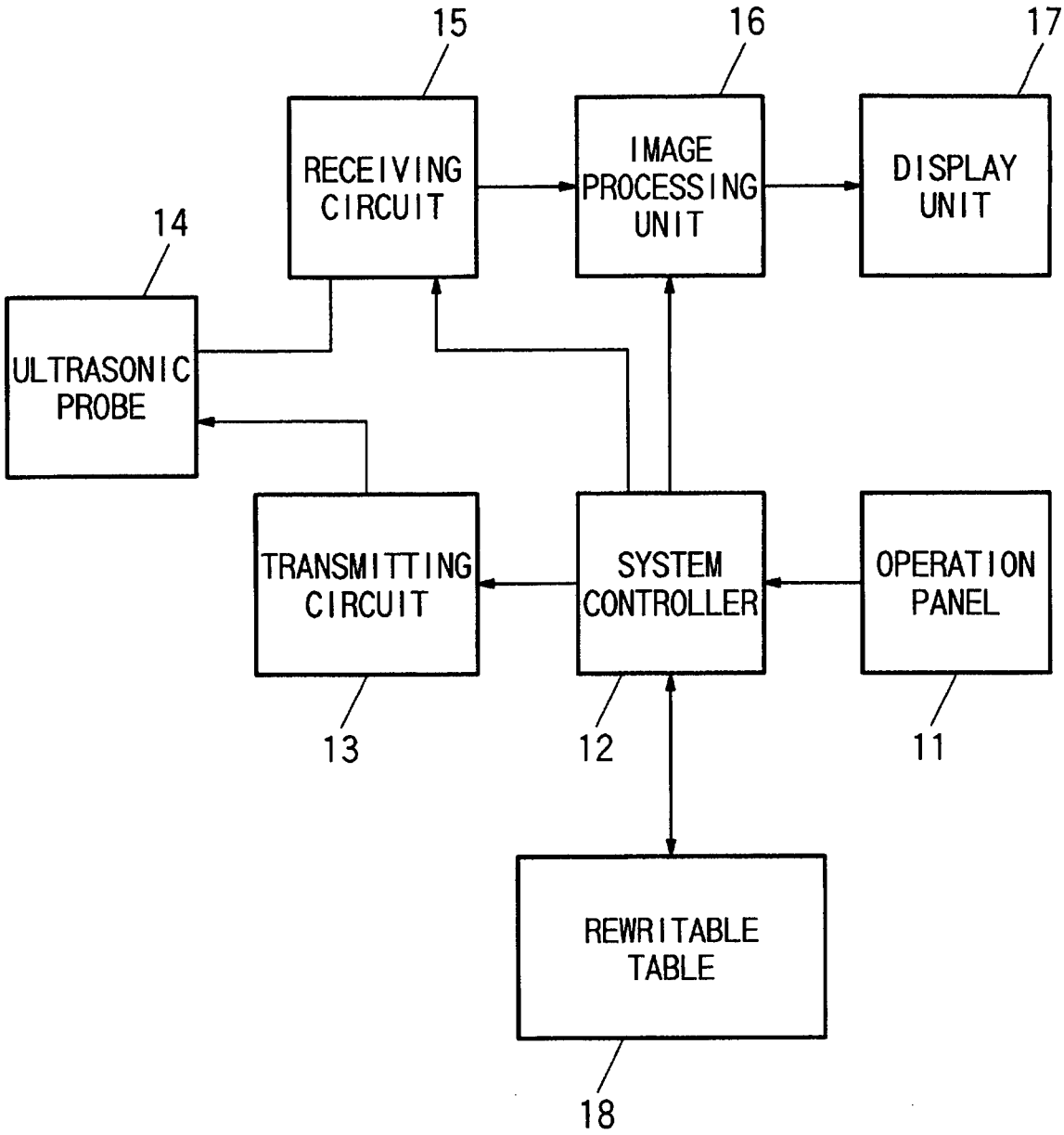
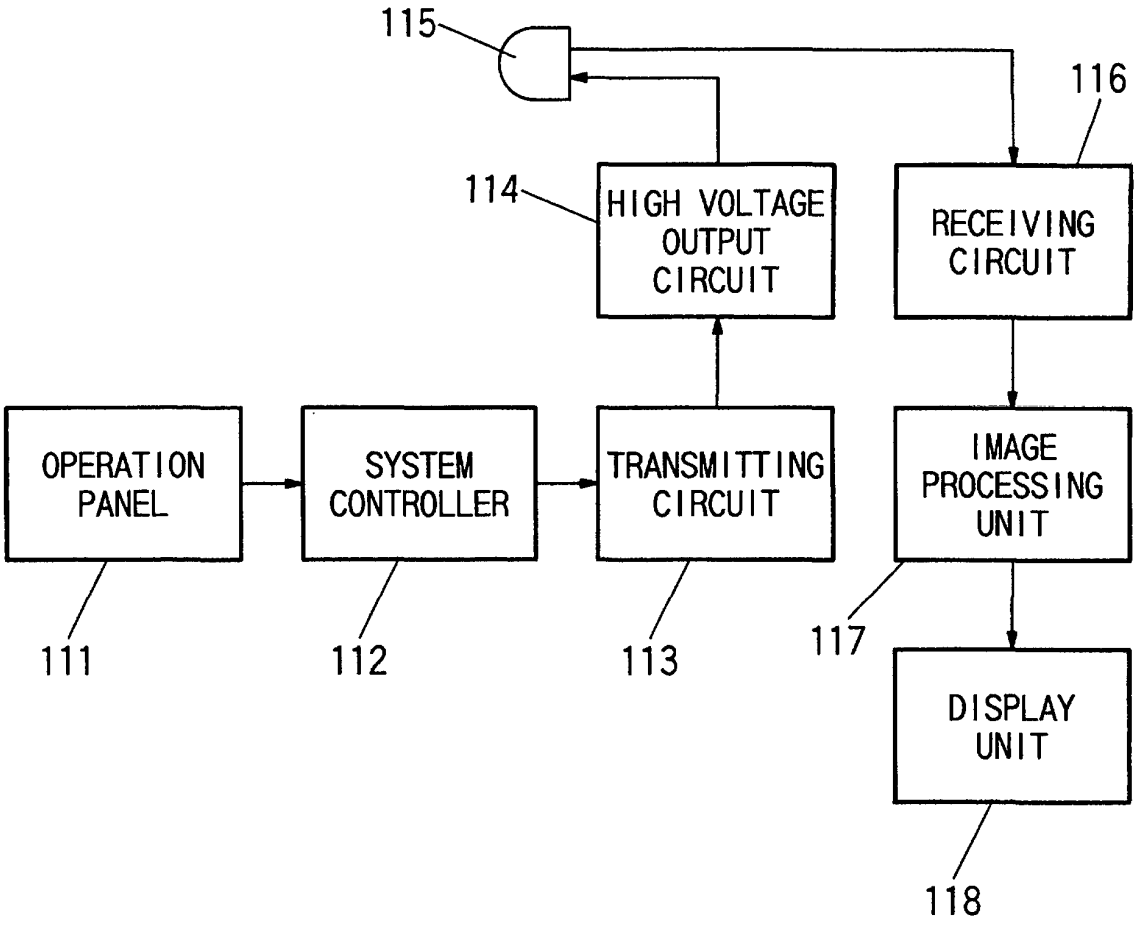

15
16
17
RECEIVING CIRCUIT
IMAGE PROCESSING UNIT
DISPLAY UNIT
14
ULTRASONIC PROBE
TRANSMITTING CIRCUIT
SYSTEM CONTROLLER
OPERATION PANEL
13
12
11
REWRITABLE TABLE
18

FIG. 5


115
116
114
HIGH VOLTAGE OUTPUT CIRCUIT
RECEIVING CIRCUIT
OPERATION PANEL
SYSTEM CONTROLLER
TRANSMITTING CIRCUIT
IMAGE PROCESSING UNIT
111
112
113
117
DISPLAY UNIT
118

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 6054850 A **[0005]**

专利名称(译)	断层超声诊断设备		
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当前申请(专利权)人(译)	柯尼卡美能达，INC.		
[标]发明人	NAKAMURA MITSUYUKI KOSAKA NOBORU		
发明人	NAKAMURA, MITSUYUKI KOSAKA, NOBORU		
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代理机构(译)	哈利，STEPHEN		
优先权	2000087851 2000-03-28 JP		
其他公开文献	EP1138262A3 EP1138262A2		
外部链接	Espacenet		

摘要(译)

本发明的超声波诊断装置包括：操作面板11，通过该操作面板设定不同的诊断条件;系统控制器12，用于根据视场控制要发送的超声波的频率;发送电路13，用于发送超声波波形，用于接收来自超声波探头14的反射波以将反射波转换成电信号的接收电路15，用于对来自接收电路15的信号进行预定处理的图像处理单元16和用于接收电路15的显示单元17基于来自图像处理设备16的电信号显示断层图像。

FIG. 1