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(54) ULTRASONIC PROBE DEVICE

ULTRASCHALLSONDENVORRICHTUNG

DISPOSITIF DE SONDE ULTRASONORE

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(56) References cited:
KR-A- 20100 047 393
US-A- 5 820 549
US-A- 5 976 090
US-A- 6 045 508
US-A- 6 059 728
US-A1- 2003 055 337
US-A1- 2012 095 347
US-B2- 6 635 019

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Description

[Technical Field]

[0001] The present invention relates to an ultrasonic probe, and more particularly, an ultrasonic probe device in which probes are modularized and various types of the probes are detachably joined and used to one ultrasonic probe apparatus

[Background Art]

[0002] An ultrasonic wave is an acoustic wave having a frequency above the range of human audibility, and a sound wave having a frequency which is between about 20 kHz and 100 kHz.

[0003] Ultrasonic waves are used for inspecting inner parts of a human body or animal or for measuring, in a non-destructive manner, the thicknesses or inside combinations of solid matters such as a metal or a plastic. In these cases, ultrasonic waves are implemented in the form of a probe (hereinafter, referred to as "an ultrasonic probe") for easy handling by users.

[0004] This ultrasonic probe includes a piezoelectric ceramic to interchangeably convert an electrical signal to an acoustic signal by vibration of a piezoelectric material, an acoustic matching layer configured to decrease an acoustic impedance difference between the piezoelectric ceramic and an object so that ultrasonic waves generated in the piezoelectric ceramic can be fully delivered to the object, and a lens layer to focus ultrasonic waves propagating in a forward direction of the piezoelectric ceramic at a certain position, and a rear-side block to exclude ultrasonic waves propagating in a rearward direction of a piezoelectric layer to prevent image distortion.

[0005] Ultrasonic probes formed as these configurations have been widely used in medical field. An ultrasonic diagnosis apparatus using an ultrasonic probe applies ultrasonic waves to an organism, converts reflected ultrasonic waves to electrical signals, transmits the electrical signals to an image processing unit, and generates an image through the signals received by the image processing unit.

[0006] Through the above-described process, the ultrasonic probes have been advantageously used for detecting a foreign material in an organism, measuring the degree of injury, observing a tumor, and observing a fetus.

[0007] Since ultrasonic waves have various frequency areas, in ultrasonic diagnosis using ultrasonic probes, the range of diagnosis is limited based on the frequency areas.

[0008] Therefore, since an appropriate probe is used for a diagnosis desired by a user, there are inconveniences in that different probes should be used according to intended use.

[0009] US 2012/095347 A1 discloses a multiple aperture ultrasonic probe device. In this multiple aperture ultrasonic probe device, a plurality of ultrasonic probe modules are separated from one another, controlling modules for controlling the plurality of ultrasonic modules are included, and each of the ultrasonic probe modules includes a module encasement and a backing block.

[0010] US 6 635 019 B2 discloses a scanhead as another ultrasonic probe device. In US 6 635 019 B2, a transducer assembly is demountable from the scanhead.

[0011] It is the object of the invention to provide an improved ultrasonic probe device considering a performance and diagnosis frequency range which can be desired by a user.

[0012] The above object is solved by an ultrasonic probe device having the features of claim 1.

[0013] Further developments are stated in the dependent claims.

[0014] In the detachably joined ultrasonic probe device according to the present invention, the ultrasonic probe modules may include a linear array ultrasonic probe module in which ultrasonic waves propagate in a fixed direction or a phased array ultrasonic probe module in which the ultrasonic waves are steered and proceed in propagating according to a propagation direction and a depth.

[0015] In the detachably joined ultrasonic probe device according to the present invention, the control module may be electrically connected to the ultrasonic probe modules to operate at least one of the linear array ultrasonic probe module and the phased array ultrasonic probe module.

[0016] In the detachably joined ultrasonic probe device according to the present invention, the case may accommodate a pair of phased array ultrasonic probe modules, and a linear array ultrasonic probe module disposed between the pair of phased array ultrasonic probe modules. The control module may operate the pair of the phased array ultrasonic probe module, and the linear array ultrasonic probe module to generate three dimensional image data.

[0017] In the detachably joined ultrasonic probe device according to the present invention, each of the ultrasonic probe device modules may include a a piezoelectric ceramic formed on top of the rear-side block, an acoustic matching layer formed on top of the piezoelectric ceramic, an acoustic lens formed on top of the acoustic matching layer, a flexible printed circuit board disposed between the rear-side block and the piezoelectric ceramic, wherein the module case surrounds the rear-side block, the piezoelectric ceramic, the acoustic matching layer, the acoustic lens, and an exterior of the flexible printed circuit board excluding an upper portion of the acoustic lens, wherein the flexible printed circuit board is connected to the control module and the control module controls the ultrasonic probe module.

[0018] In the detachably joined ultrasonic probe device according to the present invention, each of the ultrasonic probe modules may further include a ground plate formed between the acoustic matching layer and the piezoelec-

tric ceramic.

[Advantageous Effects]

[0019] An ultrasonic probe device according to the present invention allows a user to select and use an appropriate ultrasonic probe based on a performance and diagnosis frequency range which a user desires so that the user uses probes of various types in one ultrasonic probe device without needing a plurality of ultrasonic probe devices.

[Description of Drawings]

[0020]

FIG. 1 is a view illustrating a configuration of a plurality of ultrasonic probe modules coupled with a case according to an embodiment of the present invention.

FIG. 2 is a view illustrating an ultrasonic probe device according to the embodiment of the present invention.

FIG. 3 is a block diagram for describing the ultrasonic probe device according to the embodiment of the present invention.

FIG. 4 is a view illustrating an ultrasonic probe module excluding a module case according to the embodiment of the present invention.

FIG. 5 is a view illustrating an ultrasonic probe module except a module case according to a second embodiment of the present invention.

[Modes of the Invention]

[0021] In the following description, only the parts necessary to understand an exemplary embodiment of the present invention will be described, the omission of descriptions of other parts is not intended to obscure the spirit of the present invention.

[0022] It should be understood that the terms used in the specification and claims set forth below are not to be construed as limited to typical or dictionary meanings, but were simply interpreted by the inventor as terms appropriately defining and explaining the invention properly on the basis of the principle that can be interpreted based on the meanings and concepts corresponding to technical aspects of the present invention. Therefore, the configurations shown in the embodiments and drawings set forth herein are merely preferable embodiments of the present invention, because they are representative of all of the technical features of the present invention, and not intended to limit the scope of the present application. In the present application it should be understood that equivalents and modifications may be made thereto.

[0023] Hereinafter, an ultrasonic probe device according to the present invention will be described in detail with reference to the accompanying drawings.

[0024] An ultrasonic probe is implemented in a probe shape to easily handle ultrasonic waves for inspecting inner parts of a human body or animal or for measuring, in a non-destructive manner, the thickness or inside combinations of solid matters such as a metal or a plastic.

[0025] In an ultrasonic probe, ultrasonic waves may be generated with a piezoelectric ceramic in a configuration of the ultrasonic probe, a rear-side block may absorb the ultrasonic waves which propagate toward the rear-side block, the ultrasonic waves which propagate toward an acoustic matching layer may be transferred to an object to be examined through the acoustic matching layer and an acoustic lens. This description will be described below.

[0026] FIG. 1 is a view illustrating a configuration of a plurality of ultrasonic probe modules coupled with a case according to one embodiment of the present invention. FIG. 2 is a view illustrating the ultrasonic probe device according to one embodiment of the present invention. FIG. 3 is a block diagram for describing the ultrasonic probe device according to one embodiment of the present invention.

[0027] Referring to FIGS. 1 to 3, an ultrasonic probe device 100 according to the embodiment of the present invention includes a plurality of ultrasonic probe modules 10, a case 20 and a control module 30.

[0028] The ultrasonic probe modules 10 are modular ultrasonic probes which can be detachably coupled through open portion 22 of the case 20. That is, the ultrasonic probe modules 10 are formed for the ultrasonic probe to be accommodated and used in receiving portions formed inside the case 20 through the open portion 22 of the case 20.

[0029] The ultrasonic probe device 100 according to one embodiment of the present invention includes the plurality of ultrasonic probe modules 10. The plurality of ultrasonic probe modules 10 is arranged in a perpendicular direction with respect to a direction in which ultrasonic waves are generated and are coupled to be accommodated in the receiving portions through the open portion 22 of the case 20. The ultrasonic probe module 10 accommodated in the case 20 may be a linear array ultrasonic probe module 40 or a phased array ultrasonic probe module 50, descriptions which relate to the above modules will be described below.

[0030] The case 20 has open portion 22 formed in one side thereof, accommodates the plurality of ultrasonic probe modules 10 through the open portion 22, and includes an outer housing 24 and a separation housing 26.

[0031] The outer housing 24 encloses the exterior of the plurality of ultrasonic probe modules 10 accommodated in the open portion 22. That is, the outer housing 24 protects the plurality of ultrasonic probe modules 10 from external shocks by enclosing the exterior of the plurality of ultrasonic probe modules 10 accommodated inside the case 20.

[0032] The separation housing 26 is disposed between the plurality of ultrasonic probe modules 10 to separate

each of the ultrasonic probe modules 10. That is, the separation housing 26 serves a partition role to divide the inside of the case 20 into a plurality of open portions 22, separates each of the ultrasonic probe modules 10 so that the ultrasonic probe modules 10 do not come in contact with each other and are not affected by vibrations of each other.

[0033] Materials of the case 20 may be plastic materials such as polyethylene (PE), polypropylene (PP), or polyethylene terephthalate (PET), but an aspect of the present invention is not limited thereto, and a material having a lightweight, an excellent durability, and non-conductivity may be used.

[0034] A control module 30 is installed inside the case 20 to control the plurality of ultrasonic probe modules 10. That is, the control module 30 may be electrically connected to the plurality of ultrasonic probe modules 10 which are coupled with the open portion 22 of the case 20 to operate or halt each of the ultrasonic probe modules 10.

[0035] The ultrasonic probe device 100 according to one embodiment of the present invention may accommodate in the case 20 a pair of the phased array ultrasonic probe modules 50, and the linear array ultrasonic probe module 40 disposed between the pair of the phased array ultrasonic probe modules 50. The control module 30 is electrically connected to the pair of the phased array ultrasonic probe modules 50 and the linear array ultrasonic probe module 40 and controls each operation thereof. For example, when a user desire to use only the linear array ultrasonic probe module 40, the control module 30 halts the pair of phased array ultrasonic probe modules 50 and operates only the linear array ultrasonic probe module 40 to generate ultrasonic waves.

[0036] As described above, the ultrasonic probe module 10 according to the embodiment of the present invention may be a linear array ultrasonic probe module 40 or a phased array ultrasonic probe module 50. In connection with the above, the description made with reference to FIG. 4 is as follows.

[0037] FIG. 4 is a view illustrating the ultrasonic probe module excluding a module case according to the embodiment of the present invention.

[0038] Referring to FIG. 4, the ultrasonic probe module 10 according to one embodiment of the present invention includes a rear-side block 12, a piezoelectric ceramic 14, an acoustic matching layer 16, an acoustic lens 18, a flexible circuit board 13, and the module case.

[0039] The rear-side block 12 serves to absorb ultrasonic waves among ultrasonic waves which is generated in the piezoelectric ceramic 14 and is propagating toward the rear-side block 12. An acoustic characteristic of the ultrasonic probe module 10 may be controlled through the rear-side block 12.

[0040] The piezoelectric ceramic 14 is formed on top of the rear-side block 10, converts an electrical signal into an acoustic signal to transmit it to air, and changes an ultrasonic wave reflected and returned in air back into an electrical signal again to deliver it to the device.

[0041] A ceramic material such as lead-zirconate titanate (PZT) or a single crystal material such as lead magnesium niobate-lead titanate (PMN_PT) may be used as a material of the piezoelectric ceramic 14.

[0042] The acoustic matching layer 16 may be formed on top of the piezoelectric ceramic 14, that is, on an electrode of a transceiver surface of the piezoelectric ceramic 14, to increase a reflection rate and efficiency of an ultrasonic wave. Further, the acoustic matching layer 16 may be formed to have one or more layer so as to increase the reflection rate and efficiency of an ultrasonic wave.

[0043] The acoustic lens 18 is formed on top of the acoustic matching layer 16, focuses and applies an ultrasonic wave transmitted to the object to be examined so as to increase a resolution of an ultrasonic image.

[0044] As a material of the acoustic lens 18, for example, a silicone similar to living tissue may be used.

[0045] The flexible circuit board 13 is formed between the rear-side block 12 and the piezoelectric ceramic 14 and is electrically connected to the piezoelectric ceramic 30 and the rear-side block 10. That is, interconnection patterns formed in the flexible circuit board 13 are electrically connected to electrodes formed in a rear surface of the piezoelectric ceramic 14, for example, signal electrodes, ground electrodes, and the rear-side block 12.

[0046] Furthermore, since the flexible circuit board 13 is electrically connected to the control module 30, the control module 30 may control the ultrasonic probe module 10.

[0047] The flexible circuit board 13 is electrically connected to the electrodes of the piezoelectric ceramic 14, and grounded to the rear-side block 10, and a tape circuit board of a polyimide material in which interconnection patterns are formed in the front surface may be used. Further, according to need, a tape circuit board which has both sides in which interconnection patterns are formed may be used as the flexible circuit board 13.

[0048] Since the module case encloses the exterior of the rear-side block 12, the piezoelectric ceramic 14, the acoustic matching layer 16, the acoustic lens 18 and the flexible circuit board 13 excluding the top of the acoustic lens 18, the module case protects the ultrasonic probe module 10 excluding the top of the acoustic lens 18 from external shocks.

[0049] As described above, the ultrasonic probe module 10 according to one embodiment of the present invention may be one of a linear array ultrasonic probe module 40 and a phased array ultrasonic probe module 50.

[0050] The linear array ultrasonic probe module 40 may include the piezoelectric ceramic 14 in which the ultrasonic waves propagate in a fixed direction. Here, the piezoelectric ceramic 14 is divided into a plurality of piezoelectric devices. The linear array ultrasonic probe module 40 may be used on superficial organs such as the breast, the thyroid gland, the musculoskeletal system

and the like.

[0051] The phased array ultrasonic probe module 50 may steerably generate ultrasonic waves according to a propagation direction and a depth. That is, the piezoelectric ceramic 14 of the phased array ultrasonic probe module 50 may include a plurality of piezoelectric devices and each of the piezoelectric devices may generate and propagate acoustic pulses which have phase differences. In other words, the phased array ultrasonic probe module 50 may generate ultrasonic waves having phase differences by arranging every piezoelectric device in phase and steering a propagation direction of the ultrasonic waves to obtain an image. An organ such as the heart between the ribs may be tested through scanning using the phased array ultrasonic probe 90 .

[0052] As described above, the ultrasonic probe device 100 according to the embodiment of the present invention may accommodate the pair of phased array ultrasonic probe modules 50 in the case 20 and the linear array ultrasonic probe module 40 between the pair of phased array ultrasonic probe modules 50. The control module 30 may be electrically connected to and control the pair of the phased array ultrasonic probe modules 50 and the linear array ultrasonic probe module 40, respectively.

[0053] When the control module 30 operates the linear array ultrasonic probe module 40 to generate ultrasonic waves, the ultrasonic waves may be used to diagnose superficial organs such as the breast, the thyroid gland, the musculoskeletal system and the like.

[0054] When the control module 30 operates both or one of the pair of the phased array ultrasonic probe modules 50 to generate ultrasonic waves, the ultrasonic waves may be used to diagnose an organ such as the heart and/or the like through scanning. When both of the pair of phased array ultrasonic probe modules 50 are operated, ultrasonic waves may be generated to have a lower frequency than one of the pair thereof.

[0055] When the control module 30 simultaneously operates the pair of phased array ultrasonic probe modules 50 and the linear array ultrasonic probe module 40 to generate ultrasonic waves, the detachably joined ultrasonic probe device 100 according to the embodiment of the present invention may arrange each of the piezoelectric ceramics 14 in the form of a matrix array and generate a three dimensional image data.

[0056] As described above, the ultrasonic probe device 100 according to one embodiment of the present invention may detachably couple the ultrasonic probe module 10 with the case 20 and use the ultrasonic probe module 10 having an appropriate diagnosis range and performance which a user desires.

[0057] As shown in FIG. 5, an ultrasonic probe module 10 according to a second embodiment of the present invention may further include a ground plate 15.

[0058] Here, FIG. 5 is a view illustrating an ultrasonic probe module excluding a module case according to the second embodiment of the present invention.

[0059] Referring to FIG. 5, since an ultrasonic probe module 60 according to the second embodiment of the present invention may have the same configuration comparatively as the ultrasonic probe module 10 in FIG. 4 except that a ground plate 15 is further provided, the following description will be focused on a structure in which the ground plate 15 is formed.

[0060] The ground plate 15 is formed between an acoustic matching layer 16 and a piezoelectric ceramic 14, and both end portions thereof are in contact with interconnection patterns of a flexible circuit board 13. That is, the ground plate 15 is in contact with the ground patterns of interconnection patterns in the flexible circuit board 13.

[0061] Since the ground plate 15 is included, the ultrasonic probe module 60 according to the second embodiment of the present invention may improve an acoustic characteristic.

[0062] On the other hand, the embodiments of the invention disclosed in the specification and drawings are merely presented as specific example for clarity and are not intended to limit the scope of the invention. It will be apparent to those of ordinary skill in the art that other modifications based on the technical concept of the present invention, in addition to the embodiments disclosed herein, can be carried out.

Claims

1. An ultrasonic probe device (100) comprising:

a plurality of ultrasonic probe modules (10) perpendicularly arranged with respect to the direction of ultrasonic wave generation;

a case (20) configured to accommodate the plurality of ultrasonic probe modules (10) through an open portion (22) formed in one side thereof and detachably couple the ultrasonic probe modules (10), the case (20) including an outer housing (24) configured to enclose an exterior of the plurality of ultrasonic probe modules (10) and a separation housing (26) provided between the plurality of ultrasonic probe modules (10) such that the separation housing (26) is a partition to divide the inside of the case (20) into a plurality of open portions and separate the plurality of ultrasonic probe modules (10) from each other such that the plurality of ultrasonic probe modules (10) are prevented from coming in contact with each other and affecting each other by vibration thereof; and

a control module (30) installed in the case (20) and to control the plurality of ultrasonic probe modules (10),

wherein each of the ultrasonic probe modules (10) includes a module case, each of the module cases includes a rear-side block (12), and each

of the ultrasonic probe modules (10) is accommodated in the open portion (22).

2. The device (100) of claim 1, wherein the plurality of ultrasonic probe modules (10) include a linear array ultrasonic probe module (40) in which an ultrasonic wave proceed in a fixed direction or a phased array ultrasonic probe module (50) in which an ultrasonic wave is steered and proceeds in proportion to a proceeding direction and depth of the ultrasonic wave.

3. The device (100) of claim 2, wherein the control module (30) is electrically connected to the ultrasonic probe modules (10) to operate at least one of the linear array ultrasonic probe module (40) and the phase arrayed ultrasonic probe module.

4. The device (100) of claim 3, wherein the case accommodates a pair of phased array ultrasonic probe modules (50), and a linear array ultrasonic probe module (40) disposed between the pair of the phased array ultrasonic probe modules (50) and wherein the control module operates the pair of the phased array ultrasonic probe modules (50), and the linear array ultrasonic probe module (40) to generate data of a three dimensional image data.

5. The device (100) of claim 1, wherein each of the ultrasonic probe modules (10) further includes:

a piezoelectric ceramic (14) disposed on an upper portion of the rear-side block (12);
an acoustic matching layer (16) disposed on an upper portion of the piezoelectric ceramic (14);
an acoustic lens (18) disposed on an upper portion of the acoustic matching layer (16); and
a flexible circuit board (13) disposed between the rear-side block (12) and the piezoelectric ceramic (14),
wherein the module case surrounds the rear-side block (12), the piezoelectric ceramic (14), the acoustic matching layer (16), the acoustic lens (18), an exterior of the flexible circuit board (13) except an upper portion of the acoustic lens (18),
wherein the flexible circuit board (13) is connected to the control module 30 for controlling the ultrasonic probe module (10).

6. The device (100) of claim 5, wherein each of the ultrasonic probe modules (10) further includes a ground plate (15) formed between the acoustic matching layer (16) and the piezoelectric ceramic (14).

Patentansprüche

1. Ultraschall-Sondenvorrichtung (100), umfassend:

mehrere Ultraschall-Sondenmodule (10), die in Bezug auf die Richtung einer Ultraschallwellenerzeugung senkrecht angeordnet sind;
eine Hülle (20), die eingerichtet ist, um die mehreren Ultraschall-Sondenmodule (10) durch einen offenen Abschnitt (22), der in einer Seite davon gebildet ist, aufzunehmen und die Ultraschall-Sondenmodule (10) abnehmbar zu koppeln, wobei die Hülle (20) ein äußeres Gehäuse (24), das eingerichtet ist, um ein Äußeres der mehreren Ultraschall-Sondenmodule (10) zu umschließen, und ein Trennungsgehäuse (26) aufweist, das zwischen den mehreren Ultraschall-Sondenmodulen (10) derart vorgesehen ist, dass das Trennungsgehäuse (26) eine Unterteilung ist, um das Innere der Hülle (20) in mehrere offene Abschnitte aufzuteilen und die mehreren Ultraschall-Sondenmodule (10) voneinander derart zu trennen, dass verhindert wird, dass die mehreren Ultraschall-Sondenmodule (10) miteinander in Kontakt kommen und sich gegenseitig durch ihre Schwingung beeinflussen; und
ein Steuermodul (30), das in der Hülle (20) installiert ist und zum Steuern der mehreren Ultraschall-Sondenmodule (10) ausgelegt ist,
wobei jedes der Ultraschall-Sondenmodule (10) eine Modulhülle aufweist, wobei jede Modulhülle einen rückseitigen Block (12) aufweist und jedes der Ultraschall-Sondenmodule (10) in dem offenen Abschnitt (22) aufgenommen ist.

2. Vorrichtung (100) nach Anspruch 1, wobei die mehreren Ultraschall-Sondenmodule (10) ein Linear-Array-Ultraschall-Sondenmodul (40), in dem eine Ultraschallwelle in einer festen Richtung verläuft, oder ein Phased-Array-Ultraschall-Sondenmodul (50), in dem eine Ultraschallwelle gelenkt wird und in einer Proportion zu einer Verlaufsrichtung und einer Tiefe der Ultraschallwelle verläuft, aufweisen.

3. Vorrichtung (100) nach Anspruch 2, wobei das Steuermodul (30) mit den Ultraschall-Sondenmodulen (10) elektrisch verbunden ist, um mindestens eines von dem Linear-Array-Ultraschall-Sondenmodul (40) und dem Phased-Array-Ultraschall-Sondenmodul zu betreiben.

4. Vorrichtung (100) nach Anspruch 3, wobei die Hülle ein Paar Phased-Array-Ultraschall-Sondenmodule (50) und ein Linear-Array-Ultraschall-Sondenmodul (40) aufnimmt, das zwischen dem Paar Phased-Array-Ultraschall-Sondenmodule (50) angeordnet ist, und wobei das Steuermodul das Paar Phased-Ar-

ray-Ultraschall-Sondenmodule (50) und das Linear-Array-Ultraschall-Sondenmodul (40) betreibt, um Daten von dreidimensionalen Bilddaten zu erzeugen.

5. Vorrichtung (100) nach Anspruch 1, wobei jedes der Ultraschall-Sondenmodule (10) ferner aufweist:

eine piezoelektrische Keramik (14), die auf einem oberen Abschnitt des rückseitigen Blocks (12) angeordnet ist;
eine akustische Anpassungsschicht (16), die auf einem oberen Abschnitt der piezoelektrischen Keramik (14) angeordnet ist;
eine akustische Linse (18), die auf einem oberen Abschnitt der akustischen Anpassungsschicht (16) angeordnet ist; und
eine flexible Leiterplatte (13), die zwischen dem rückseitigen Block (12) und der piezoelektrischen Keramik (14) angeordnet ist,
wobei die Modulhülle den rückseitigen Block (12), die piezoelektrische Keramik (14), die akustische Anpassungsschicht (16), die akustische Linse (18), ein Äußeres der flexiblen Leiterplatte (13), ausgenommen einem oberen Abschnitt der akustischen Linse (18), umgibt,
wobei die flexible Leiterplatte (13) mit dem Steuermodul (30) zum Steuern des Ultraschall-Sondenmoduls (10) verbunden ist.

6. Vorrichtung (100) nach Anspruch 5, wobei jedes der Ultraschall-Sondenmodule (10) ferner eine Erdungsplatte (15) aufweist, die zwischen der akustischen Anpassungsschicht (16) und der piezoelektrischen Keramik (14) gebildet ist.

Revendications

1. Dispositif de sonde ultrasonore (100) comprenant :

une pluralité de modules de sonde ultrasonore (10) agencés perpendiculairement par rapport à la direction de génération d'onde ultrasonore ;
un boîtier (20) configuré pour loger la pluralité de modules de sonde ultrasonore (10) à travers une portion ouverte (22) formée dans un côté de celui-ci et coupler de manière détachable les modules de sonde ultrasonore (10), le boîtier (20) comportant un logement externe (24) configuré pour renfermer un extérieur de la pluralité de modules de sonde ultrasonore (10) et un logement de séparation (26) prévu entre la pluralité de modules de sonde ultrasonore (10) de sorte que le logement de séparation (26) soit une cloison pour diviser l'intérieur du boîtier (20) en une pluralité de portions ouvertes et séparer la pluralité de modules de sonde ultrasonore (10) les uns des autres de sorte que la pluralité de modules de sonde ultrasonore (10) ne puissent pas entrer en contact les uns avec les autres et se toucher les uns les autres par leur vibration ; et
un module de commande (30) installé dans le boîtier (20) et pour commander la pluralité de modules de sonde ultrasonore (10),
dans lequel chacun des modules de sonde ultrasonore (10) comporte un boîtier de module, chacun des boîtiers de module comporte un bloc de côté arrière (12), et chacun des modules de sonde ultrasonore (10) est logé dans la portion ouverte (22).

2. Dispositif (100) selon la revendication 1, dans lequel la pluralité de modules de sonde ultrasonore (10) comportent un module de sonde ultrasonore à réseau linéaire (40) dans lequel une onde ultrasonore évolue dans une direction fixe ou un module de sonde ultrasonore à réseau à commande de phase (50) dans lequel une onde ultrasonore est dirigée et évolue en proportion à une direction et une profondeur d'évolution de l'onde ultrasonore.

3. Dispositif (100) selon la revendication 2, dans lequel le module de commande (30) est connecté électriquement aux modules de sonde ultrasonore (10) pour faire fonctionner au moins l'un du module de sonde ultrasonore à réseau linéaire (40) et du module de sonde ultrasonore à réseau à commande de phase.

4. Dispositif (100) selon la revendication 3, dans lequel le boîtier loge une paire de modules de sonde ultrasonore à réseau à commande de phase (50), et un module de sonde ultrasonore à réseau linéaire (40) disposé entre la paire de modules de sonde ultrasonore à réseau à commande de phase (50) et dans lequel le module de commande fait fonctionner la paire de modules de sonde ultrasonore à réseau à commande de phase (50), et le module de sonde ultrasonore à réseau linéaire (40) pour générer des données de données d'image tridimensionnelle.

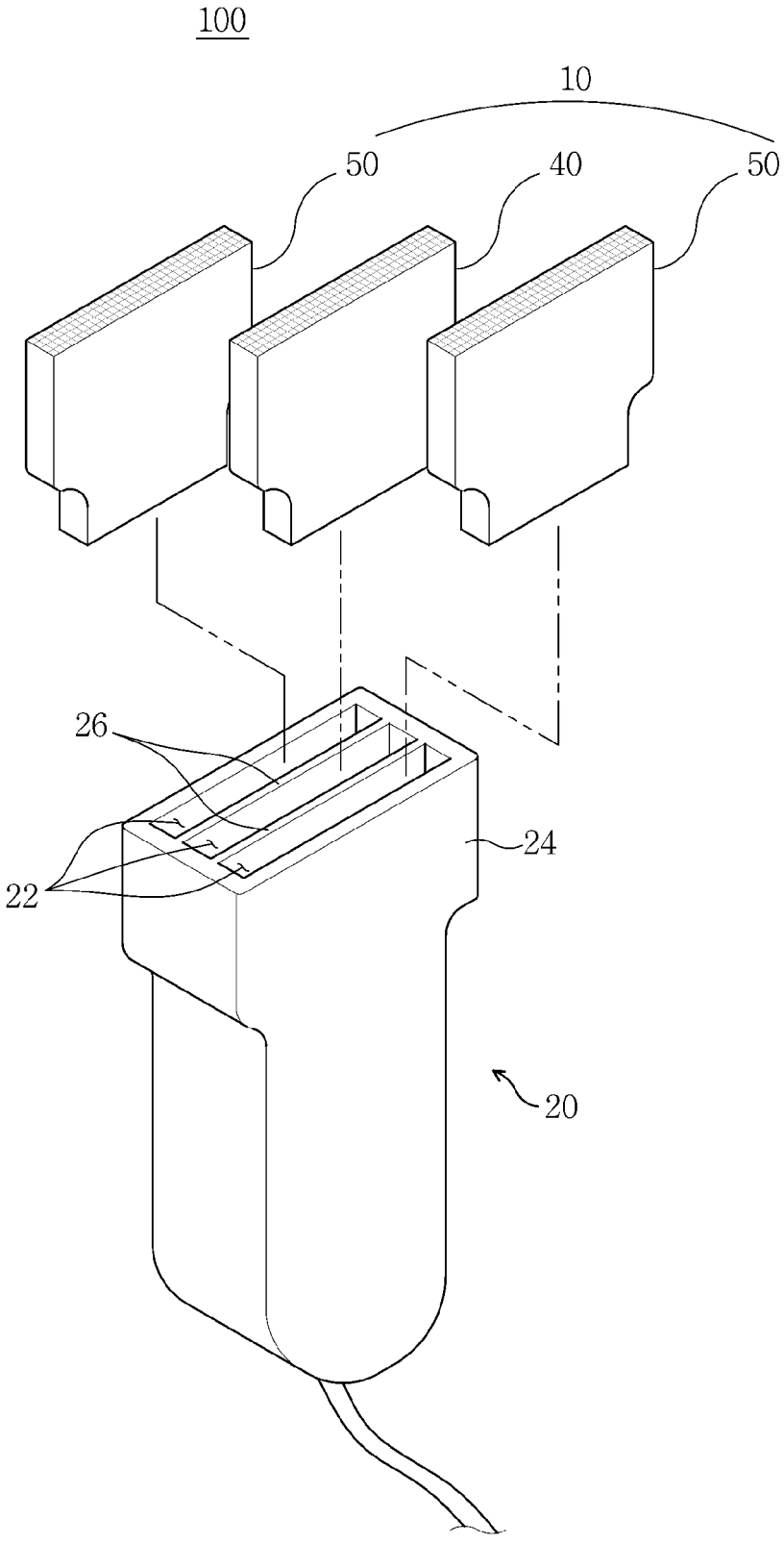
5. Dispositif (100) selon la revendication 1, dans lequel chacun des modules de sonde ultrasonore (10) comporte en outre :

une céramique piézoélectrique (14) disposée sur une portion supérieure du bloc de côté arrière (12) ;
une couche d'adaptation acoustique (16) disposée sur une portion supérieure de la céramique piézoélectrique (14) ;
une lentille acoustique (18) disposée sur une portion supérieure de la couche d'adaptation acoustique (16) ; et

une carte de circuit imprimé flexible (13) disposée entre le bloc de côté arrière (12) et la céramique piézoélectrique (14),
dans lequel le boîtier de module entoure le bloc de côté arrière (12), la céramique piézoélectrique (14), la couche d'adaptation acoustique (16), la lentille acoustique (18), un extérieur de la carte de circuit imprimé flexible (13) à l'exception d'une portion supérieure de la lentille acoustique (18),
dans lequel la carte de circuit imprimé flexible (13) est connectée au module de commande (30) pour commander le module de sonde ultrasonore (10).

6. Dispositif (100) selon la revendication 5, dans lequel chacun des modules de sonde ultrasonore (10) comporte en outre une plaque de base (15) formée entre la couche d'adaptation acoustique (16) et la céramique piézoélectrique (14).

【FIG1】



【FIG 2】

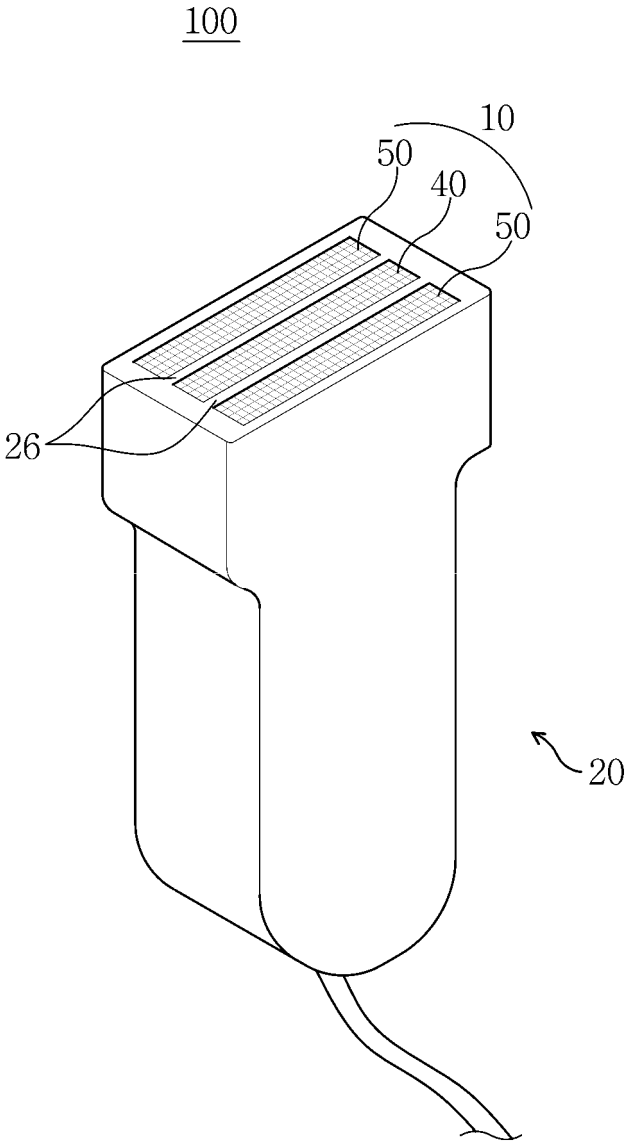


FIG3.

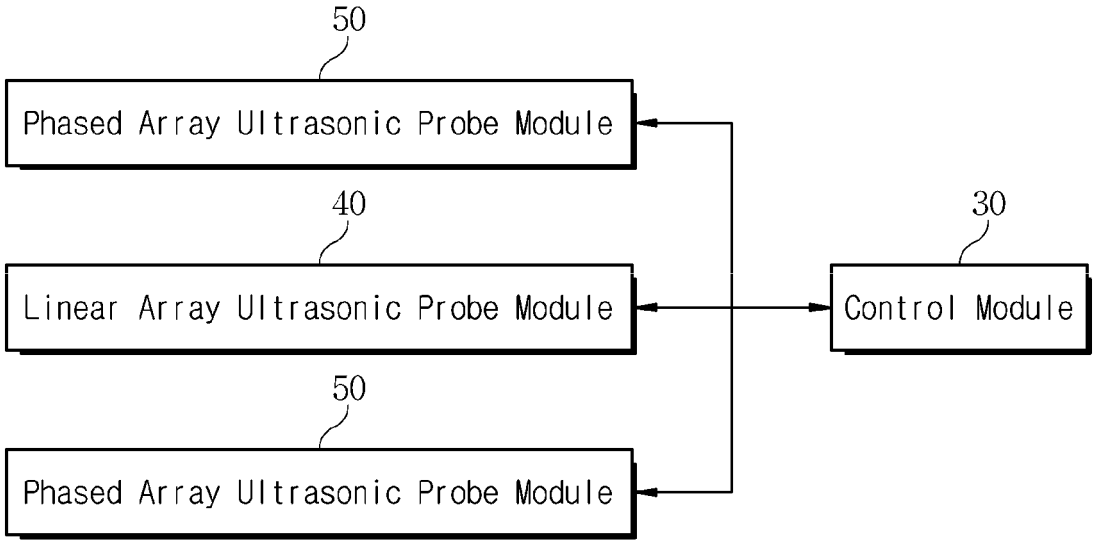

50
Phased Array Ultrasonic Probe Module
40
Linear Array Ultrasonic Probe Module
50
Phased Array Ultrasonic Probe Module
30
Control Module

FIG4.

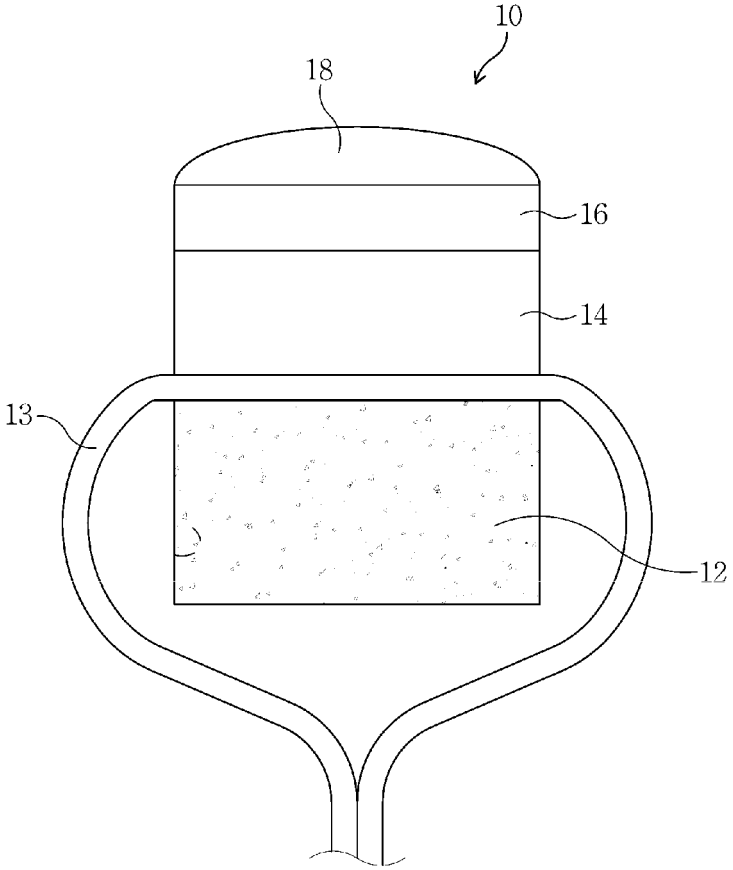
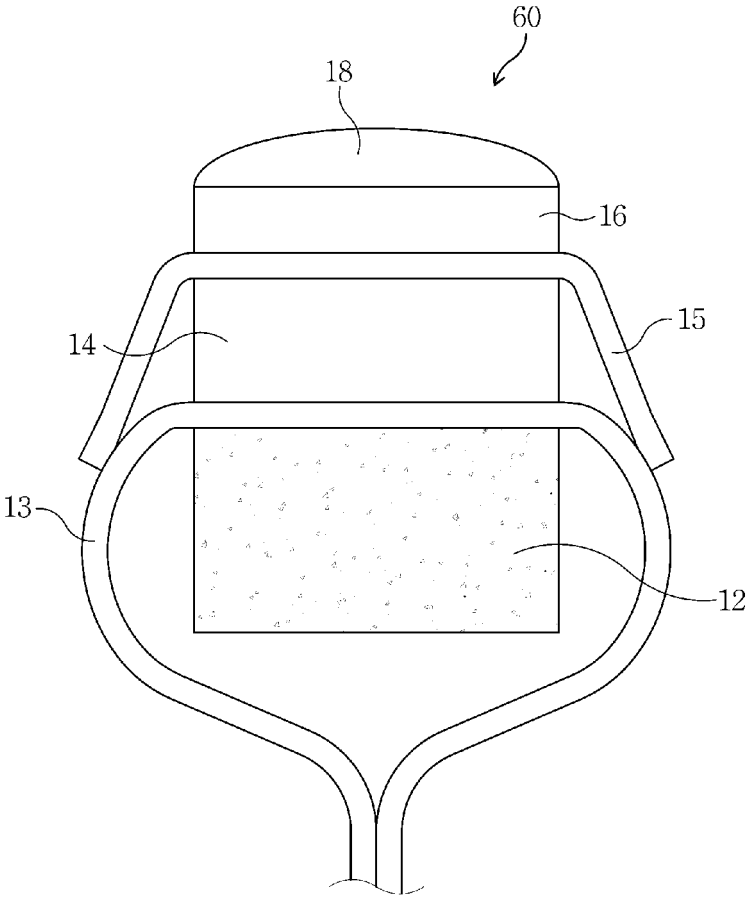

10
18
16
14
13
12

FIG5.



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 2012095347 A1 **[0009]**
- US 6635019 B2 **[0010]**

专利名称(译)	超声波探头装置		
公开(公告)号	EP2995943B1	公开(公告)日	2020-05-13
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摘要(译)

超声波探头装置技术领域本发明涉及一种超声波探头装置，该超声波探头装置包括模块化超声波探头和与模块化超声波探头可拆卸地接合的壳体，该壳体使用户能够根据期望的性能和诊断频率区域选择合适的超声波探头。 根据本发明的装置包括：在产生超声波的方向上水平排列的多个超声波探头模块； 壳体包括：外壳，该外壳具有一个用于容纳和封装多个超声探头模块的敞开侧；以及分离外壳，该分离外壳设置在多个超声探头模块之间，用于将超声模块彼此分离，从而可分离地与外壳连接。 超声波模块； 控制模块，其安装在壳体中，用于控制多个超声波探头模块。