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(54) **ULTRASONIC PROBE, ULTRASONIC MEASUREMENT DEVICE, AND ULTRASONIC IMAGE DEVICE**

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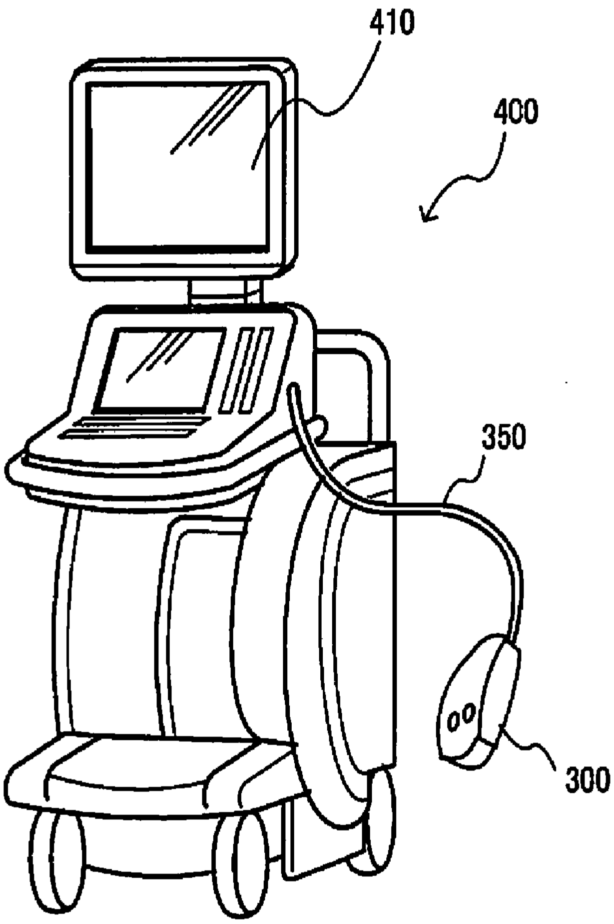
USPC **600/445**; 600/459

(57) **ABSTRACT**

An ultrasonic probe includes an ultrasonic sensor section and a guide section. The ultrasonic sensor section has an ultrasonic transducer device. The guide section is disposed on a sensor surface on which the ultrasonic sensor section is provided. The guide section is configured and arranged such that a resistance force with respect to a target sample when the ultrasonic probe is moved in a first direction while the sensor surface contacts a surface of the target sample as the ultrasonic sensor section faces the target sample is smaller than the resistance force with respect to the target sample when the ultrasonic probe is moved in a second direction intersecting the first direction.



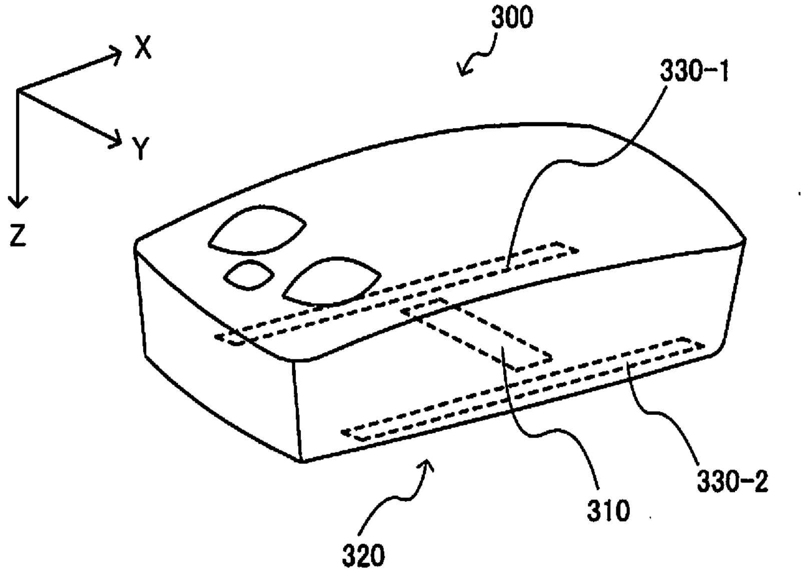


Fig. 1

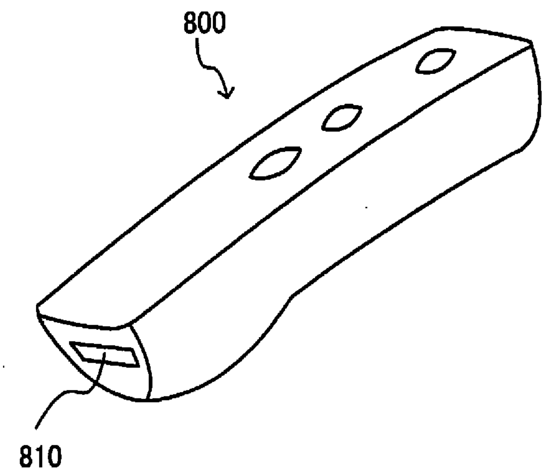


Fig. 2

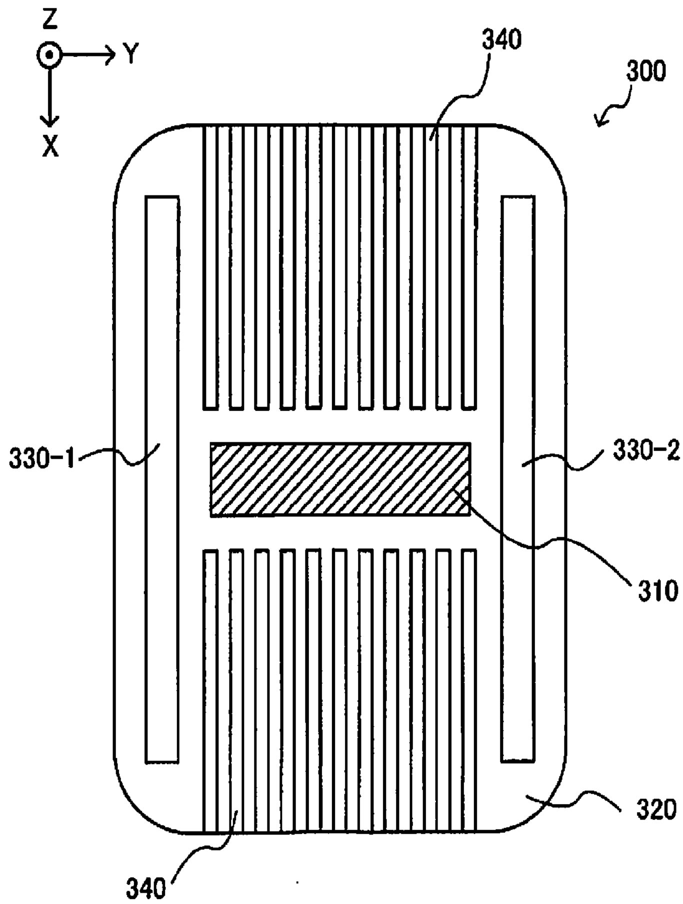


Fig. 3A

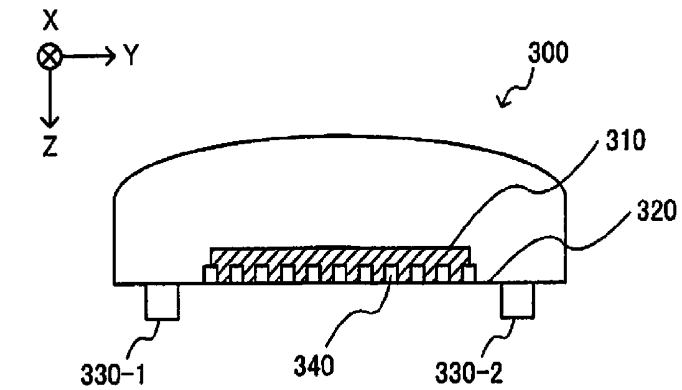


Fig. 3B

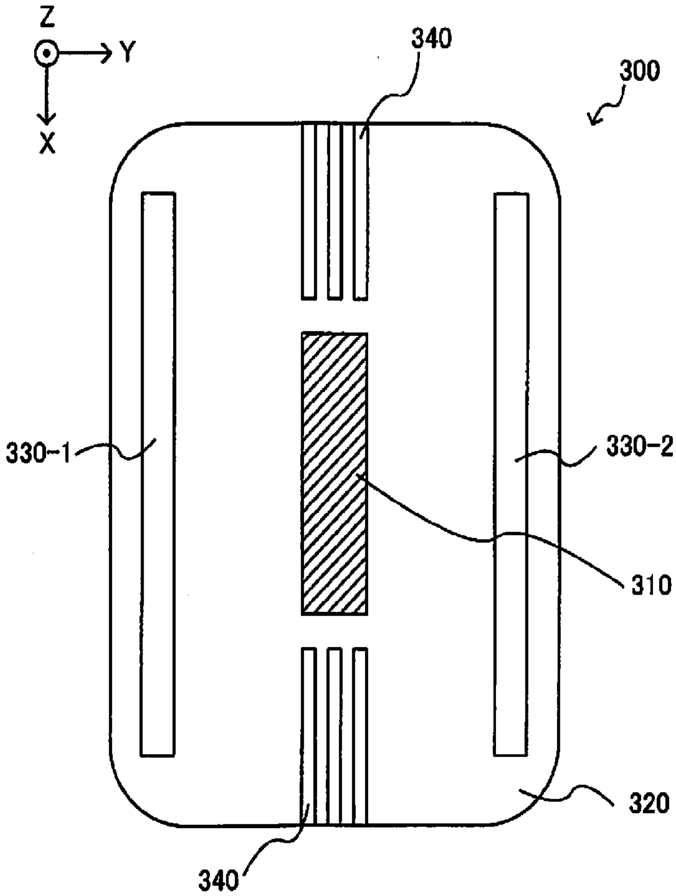


Fig. 4A

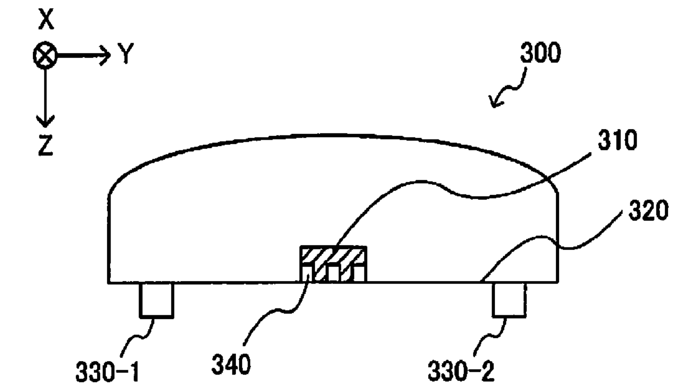


Fig. 4B

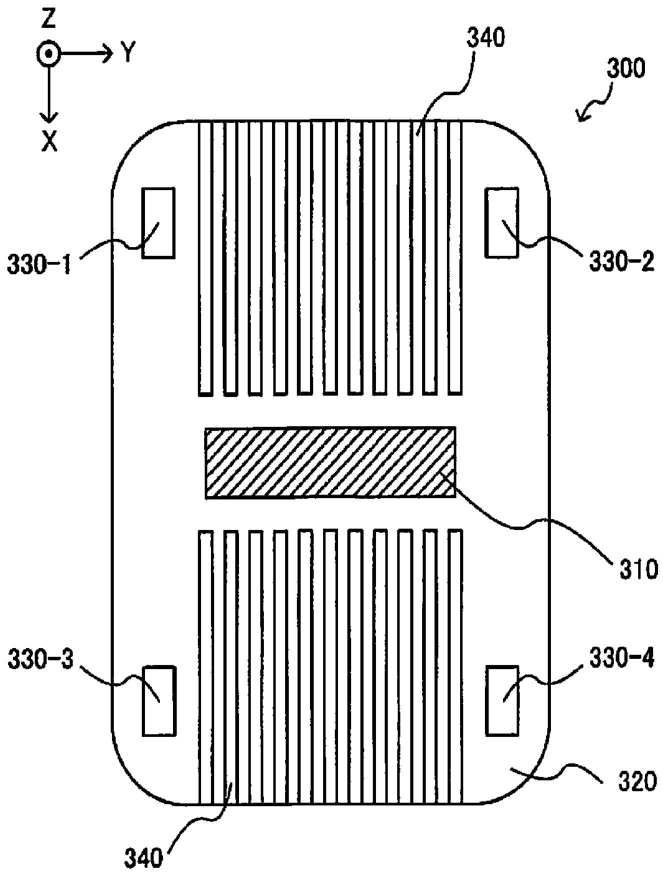

Z
Y
X
340
300
330-1
330-2
310
330-3
330-4
320
340

Fig. 5A

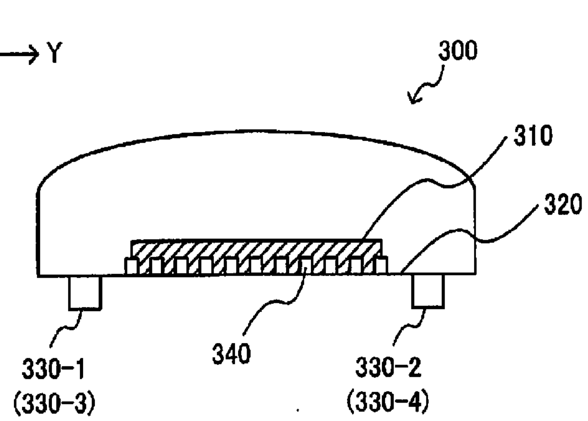

X
Y
Z
300
310
320
330-1
(330-3)
340
330-2
(330-4)

Fig. 5B

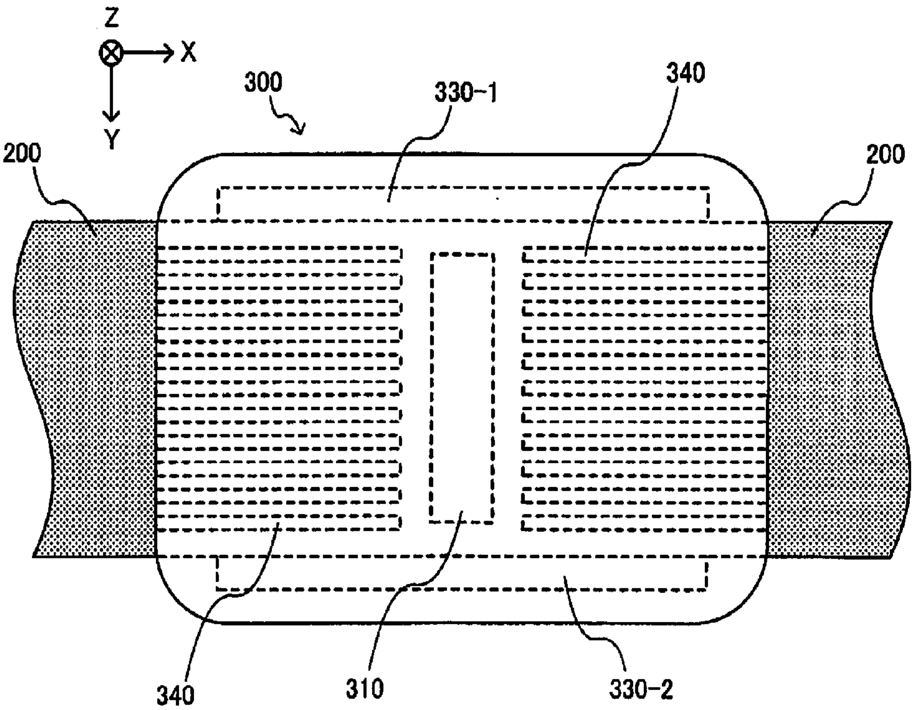

Z
X
Y
300
330-1
340
200
200
340
310
330-2

Fig. 6A

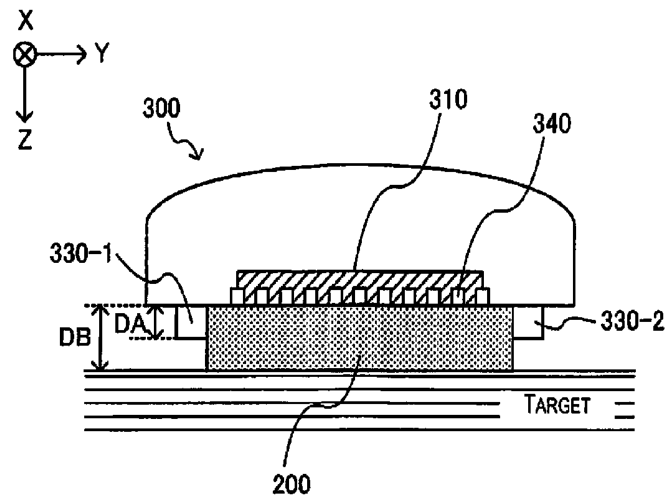

X
Y
Z
300
310
340
330-1
DA
DB
330-2
TARGET
200

Fig. 6B

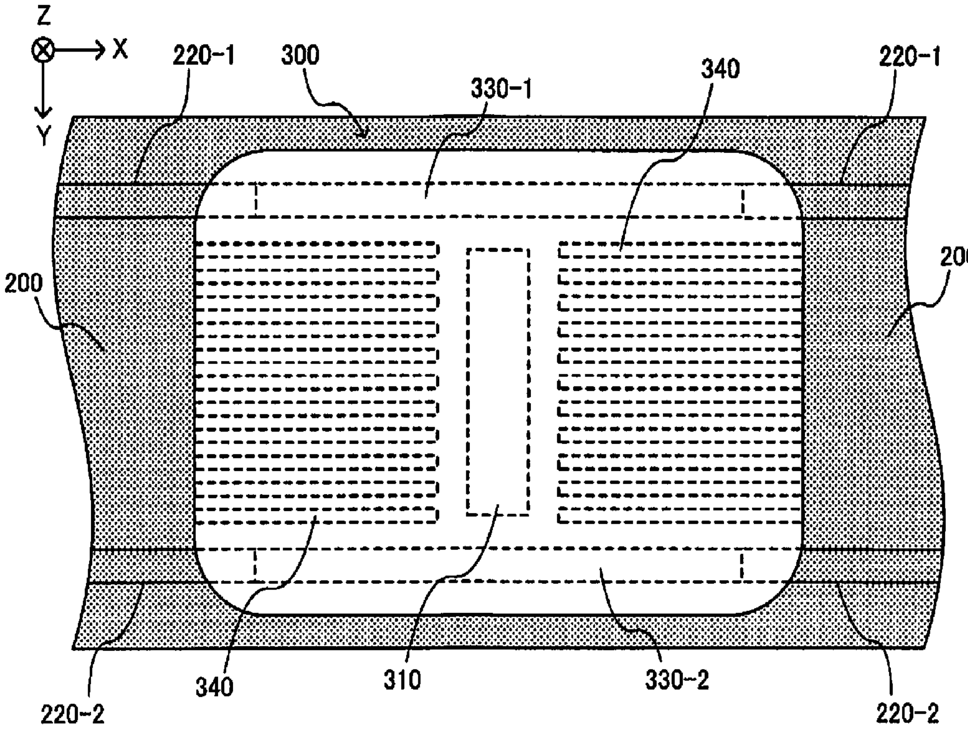

Z
X
Y
220-1
300
330-1
340
220-1
200
200
340
310
330-2
220-2
220-2

Fig. 7A

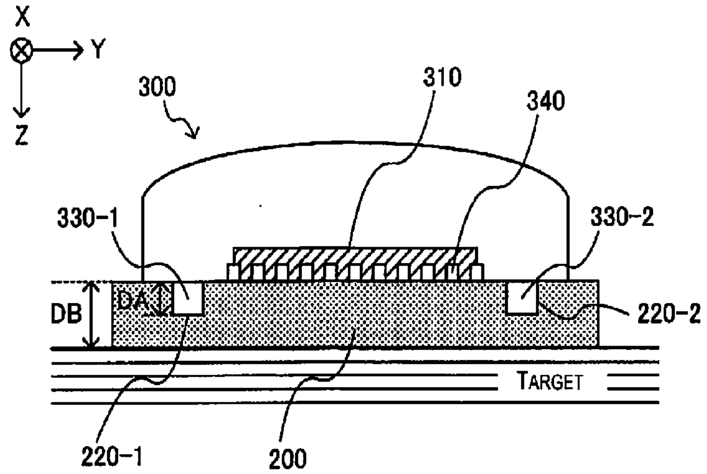

X
Y
Z
300
310
340
330-1
330-2
DB
DA
220-2
TARGET
220-1
200

Fig. 7B

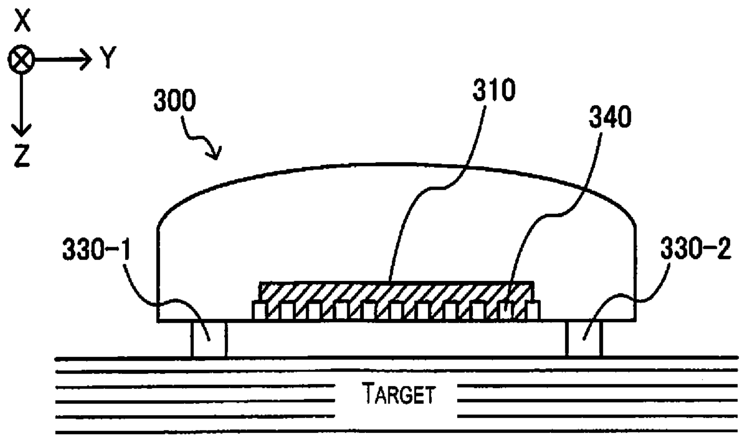

X
Y
Z
300
310
340
330-1
330-2
TARGET

Fig. 8

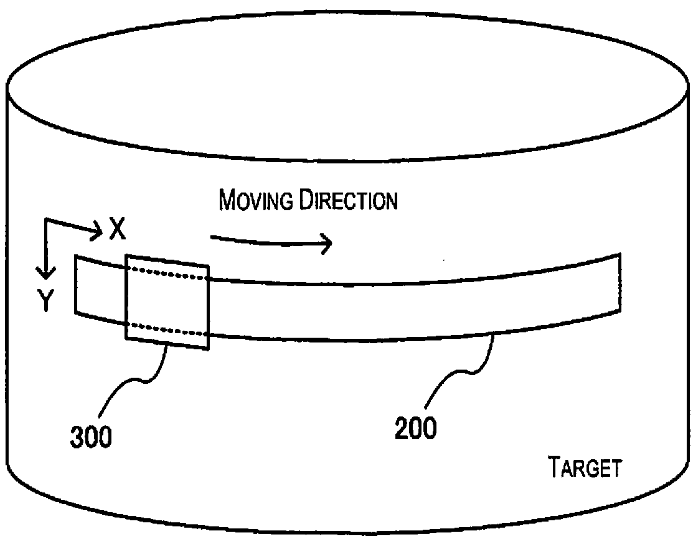

MOVING DIRECTION
X
Y
300
200
TARGET

Fig. 9

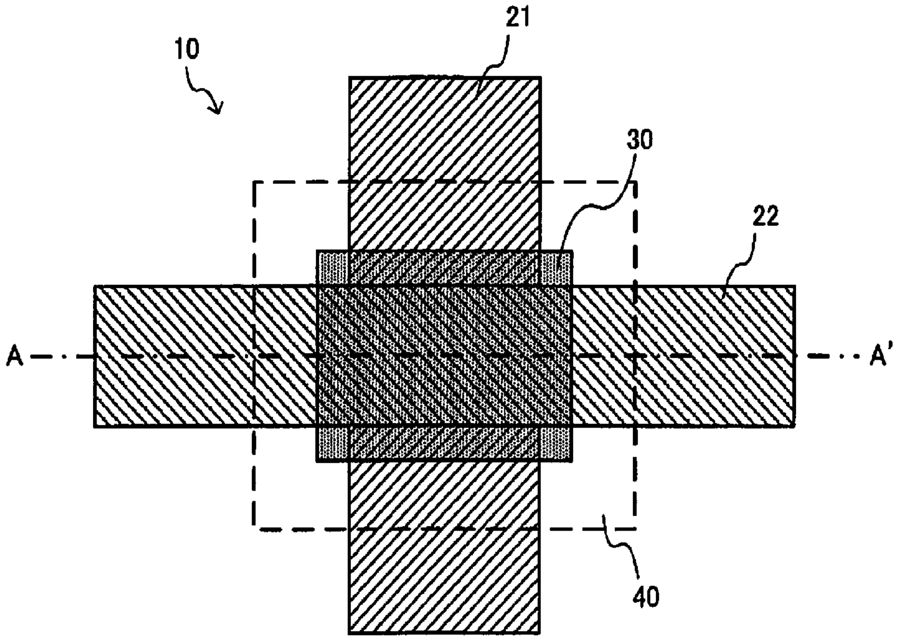


Fig. 10A

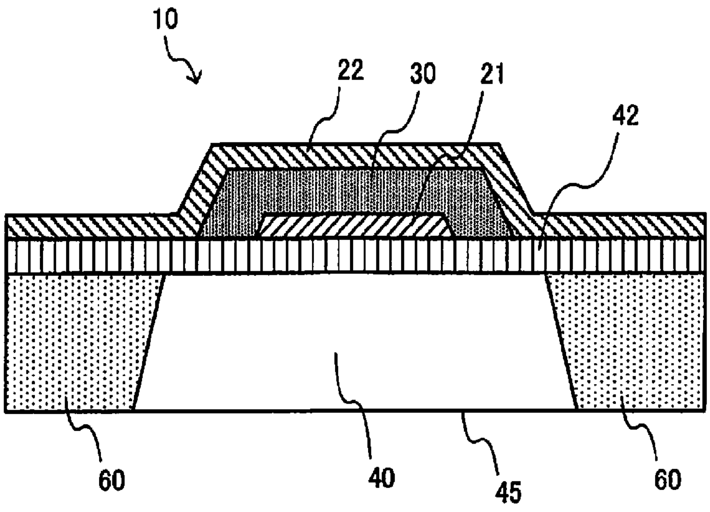


Fig. 10B

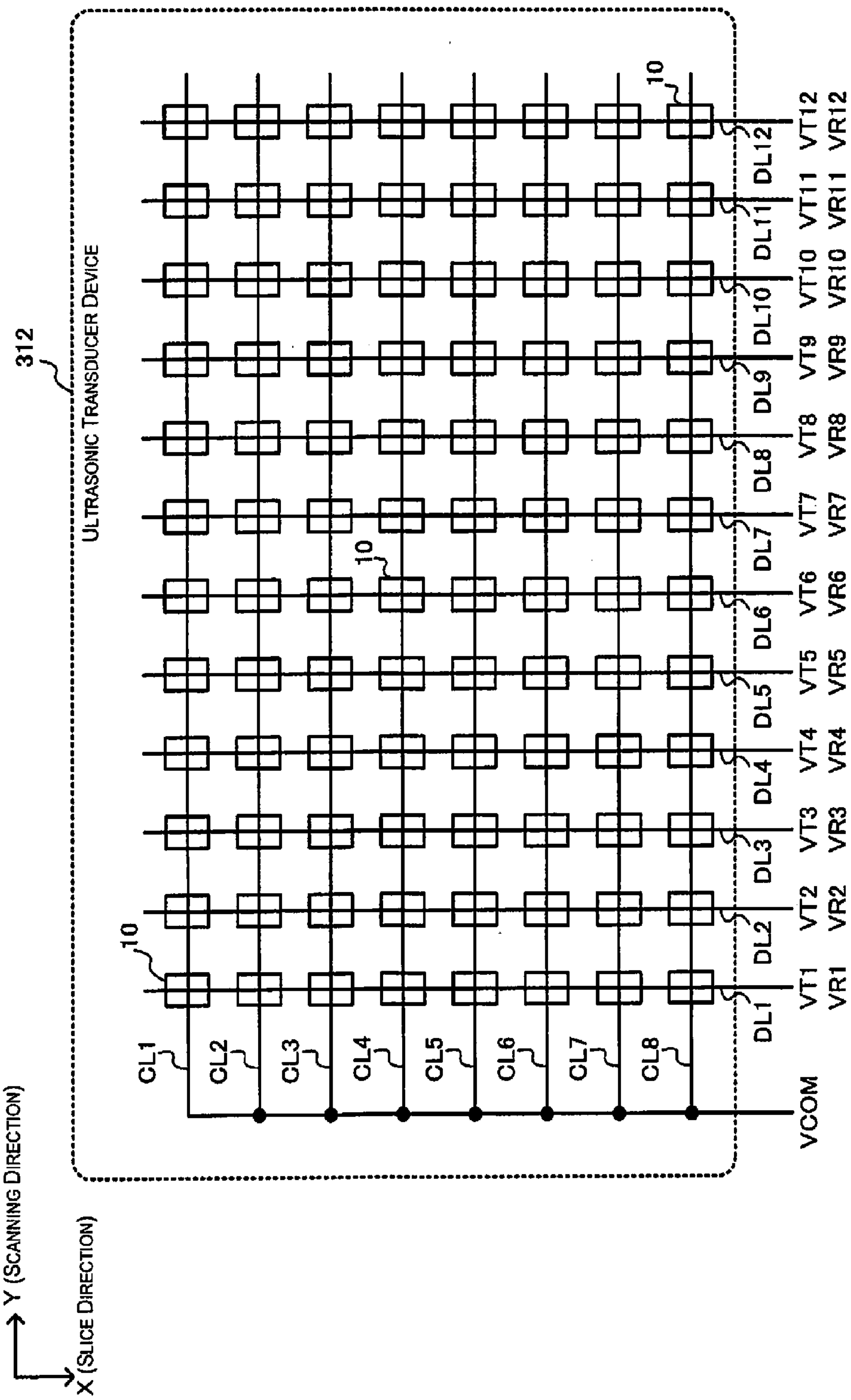

312
ULTRASONIC TRANSDUCER DEVICE
10
CL1
CL2
CL3
CL4
CL5
CL6
CL7
CL8
VCOM
DL1
DL2
DL3
DL4
DL5
DL6
DL7
DL8
DL9
DL10
DL11
DL12
VT1 VR1
VT2 VR2
VT3 VR3
VT4 VR4
VT5 VR5
VT6 VR6
VT7 VR7
VT8 VR8
VT9 VR9
VT10 VR10
VT11 VR11
VT12 VR12
Y (SCANNING DIRECTION)
X (SLICE DIRECTION)

Fig. 11

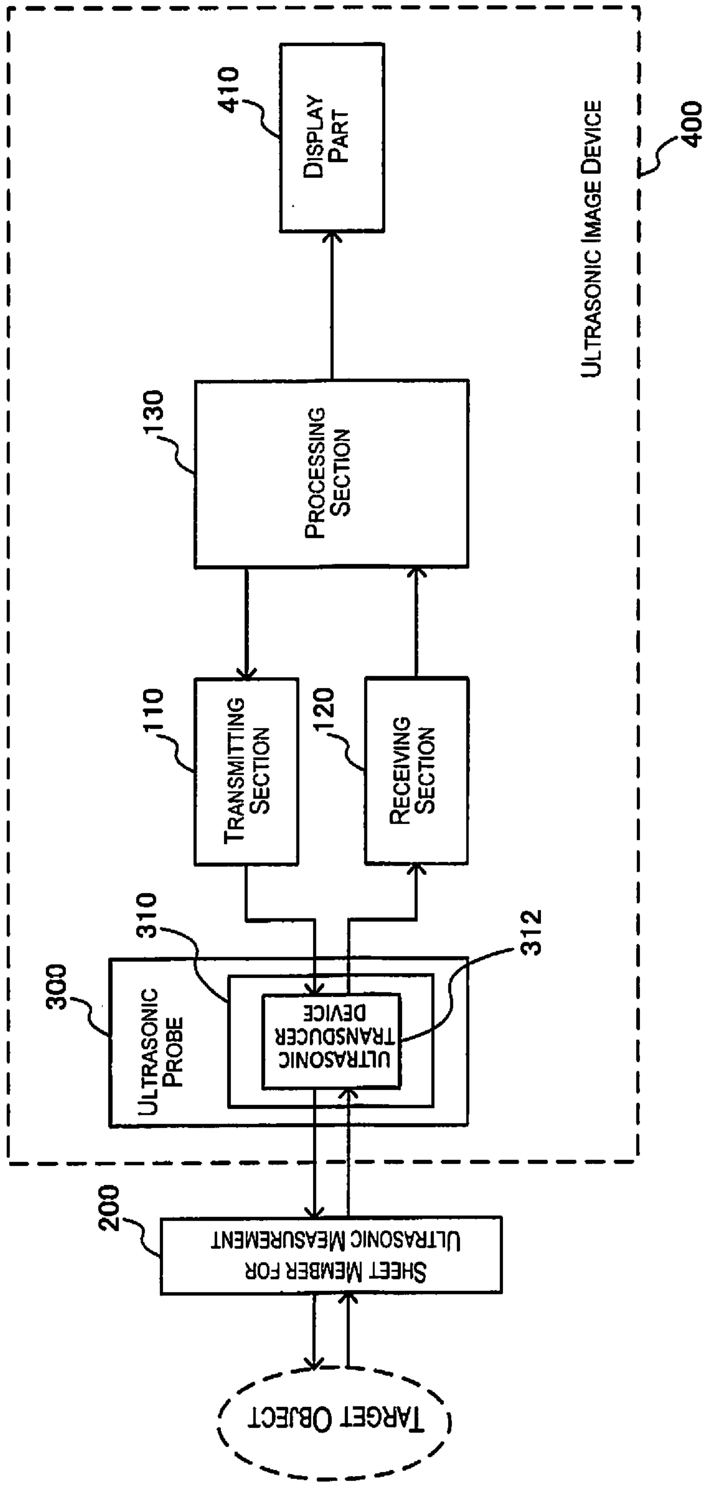

410
DISPLAY PART
400
ULTRASONIC IMAGE DEVICE
130
PROCESSING SECTION
110
TRANSMITTING SECTION
120
RECEIVING SECTION
310
312
300
ULTRASONIC PROBE
ULTRASONIC TRANSDUCER DEVICE
200
SHEET MEMBER FOR ULTRASONIC MEASUREMENT
TARGET OBJECT

Fig. 12

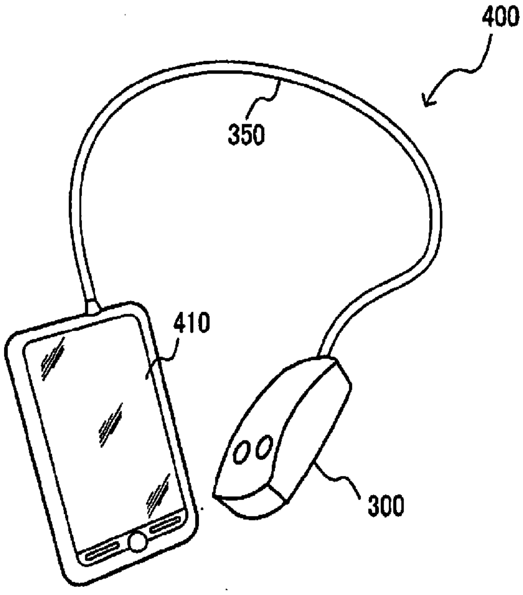


Fig. 13A

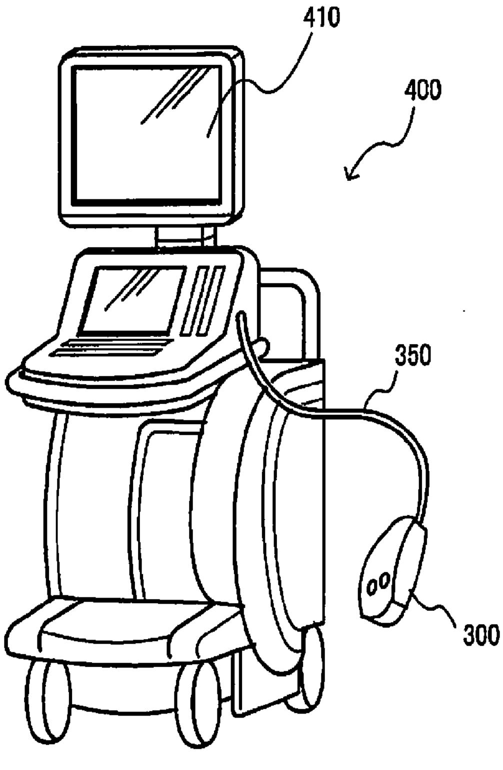


Fig. 13B

ULTRASONIC PROBE, ULTRASONIC MEASUREMENT DEVICE, AND ULTRASONIC IMAGE DEVICE

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to Japanese Patent Application No. 2013-071574 filed on Mar. 29, 2013. The entire disclosure of Japanese Patent Application No. 2013-071574 is hereby incorporated herein by reference.

BACKGROUND

[0002] 1. Technical Field

[0003] The present invention relates to an ultrasonic probe, an ultrasonic measurement device, and ultrasonic image device, etc.

[0004] 2. Related Art

[0005] A method for obtaining a panoramic image by using an ultrasonic image device (ultrasonic diagnostic apparatus) is well known. For obtaining this panoramic image, it is necessary to perform an ultrasonic measurement while a technician moves an ultrasonic probe along a desired track by freehand. However, it is difficult to precisely move the probe along an intended track while giving a constant pressure to a body surface by consistently holding the probe in a vertical position with respect to the body surface so that there is a problem that it is difficult to obtain a precise panoramic image.

[0006] For this problem, for example, in Japanese Laid-open Patent Application No. 2007-21172, a method for guiding a movement of an ultrasonic probe by a guide rail is described. However, in this method, there are problems that it is difficult to provide a precise measurement for shapes or body types of various parts to be measured, and the device becomes complicated.

SUMMARY

[0007] According to some aspects of the present invention, an ultrasonic probe, an ultrasonic measurement device, and an ultrasonic image device, etc. that enables to move the ultrasonic probe along a desired track can be provided.

[0008] An ultrasonic probe according to one aspect includes an ultrasonic sensor section and a guide section. The ultrasonic sensor section has an ultrasonic transducer device. The guide section is disposed on a sensor surface on which the ultrasonic sensor section is provided. The guide section is configured and arranged such that a resistance force with respect to a target sample when the ultrasonic probe is moved in a first direction while the sensor surface contacts a surface of the target sample as the ultrasonic sensor section faces the target sample is smaller than the resistance force with respect to the target sample when the ultrasonic probe is moved in a second direction intersecting the first direction.

[0009] According to one aspect of the present invention, by the guide section provided on the sensor surface of the ultrasonic probe, the movement of the ultrasonic probe in the first direction becomes easier than the movement of the second direction so that the user can precisely move the ultrasonic probe in the first direction. As a result, with the simple configuration, it is possible to easily obtain a plurality of ultrasonic images while precisely moving the ultrasonic probe along a desired track.

[0010] Also, in one aspect of the present invention, the sensor surface preferably has an elongated shape in a plan view, and a longitudinal direction of the sensor surface is preferably defined as the first direction.

[0011] Because of this, the guide section can guide the movement of the ultrasonic probe in the longitudinal direction of the sensor surface.

[0012] Further, in one aspect of the present invention, the guide section preferably has a first guide section and a second guide section with a longitudinal direction of the sensor surface is defined as the first direction, and the ultrasonic sensor section is preferably disposed between the first guide section and the second guide section.

[0013] Because of this, the first and second guide sections can guide the movement of the ultrasonic probe in the longitudinal direction of the sensor surface so that the user can precisely move the ultrasonic probe in the longitudinal direction of the sensor surface.

[0014] Further, in one aspect of the present invention, the sensor surface preferably has a rectangular shape in a plan view, and the guide section preferably has a first guide section, a second guide section, a third guide section, and a fourth guide section disposed at four corner sections of the sensor surface in the plan view.

[0015] Because of this, the first to fourth guide sections can guide the movement of the ultrasonic probe in the first direction so that the user can precisely move the ultrasonic probe in the first direction.

[0016] Further, in one aspect of the present invention, the guide section is preferably configured and arranged to engage with a part of a sheet member for ultrasonic measurement fixed on the target sample to guide a movement in the first direction of the sensor surface of the ultrasonic probe.

[0017] Because of this, when the ultrasonic measurement is performed in the case of fixing the sheet member for ultrasonic measurement to the target sample, the guide section can guide the movement of the ultrasonic probe in the first direction of the sensor surface so that the user can precisely move the ultrasonic probe in the longitudinal direction of the sheet member for ultrasonic measurement, for example. Further, the sheet member for ultrasonic measurement can be fixed corresponding to shapes or body types of various parts to be measured so that it can be precisely moved corresponding to a shape of various parts to be measured or a body type.

[0018] Further, in one aspect of the present invention, a height of the guide section from the sensor surface is preferably less than or equal to a thickness of the sheet member for ultrasonic measurement.

[0019] Because of this, the ultrasonic measurement can be precisely performed because the sensor surface of the ultrasonic probe can contact to the surface of the sheet member for ultrasonic measurement.

[0020] Further, in one aspect of the present invention, the resistance force is preferably generated by a friction between the guide section and the target sample.

[0021] Because of this, even when the sheet member for ultrasonic measurement is not used, the movement of the ultrasonic probe in the first direction with respect to the target sample can be easier than the movement in the second direction so that the user can precisely move the ultrasonic probe in the first direction.

[0022] Further, in one aspect of the present invention, the sensor surface preferably has an elongated shape, and includes a groove portion extending in a longitudinal direction of the sensor surface.

[0023] Because of this, a gel applied to the surface of the target sample or the sheet member for ultrasonic measurement can be efficiently collected to an emission surface of the ultrasonic sensor section through the groove portion so that entering air between the ultrasonic sensor section and the target sample or the sheet member for ultrasonic measurement can be prevented.

[0024] Further, in one aspect of the present invention, the ultrasonic sensor section is preferably disposed on the sensor surface so that a scanning direction of the ultrasonic transducer device is oriented parallel to a longitudinal direction of the sensor surface, and the guide section is preferably configured and arranged to guide a movement of the ultrasonic probe in the longitudinal direction of the sensor surface.

[0025] Because of this, the guide section can guide the movement of the ultrasonic probe in the scanning direction.

[0026] An ultrasonic measurement device according to another aspect includes the ultrasonic probe as described above, a transmitting section configured to perform a process of transmitting ultrasonic waves, a receiving section configured to perform a process of receiving ultrasonic echoes, and a processing section configured to perform a process of controlling ultrasonic measurement. The processing section is configured to generate an ultrasonic panoramic image based on a reception signal from the receiving section.

[0027] According to another aspect of the present invention, it is possible to easily obtain an ultrasonic panoramic image while precisely moving the ultrasonic probe along a track with a simple configuration.

[0028] Another aspect of the present invention relates to an ultrasonic image device including the ultrasonic measurement device described above, and a display section configured to display image data.

BRIEF DESCRIPTION OF THE DRAWINGS

[0029] Referring now to the attached drawings which form a part of this original disclosure:

[0030] FIG. **1** is a basic configuration example of an ultrasonic probe.

[0031] FIG. **2** is a comparative example of an ultrasonic probe.

[0032] FIG. **3**A and FIG. **3**B are the first configuration example of the ultrasonic probe.

[0033] FIG. **4**A and FIG. **4**B are a modification example of the first configuration example of the ultrasonic probe.

[0034] FIG. **5**A and FIG. **5**B are the second configuration example of an ultrasonic probe.

[0035] FIG. **6**A and FIG. **6**B are the first example of the ultrasonic measurement performed by the ultrasonic probe.

[0036] FIG. **7**A and FIG. **7**B are the second example of the ultrasonic measurement performed by the ultrasonic probe.

[0037] FIG. **8** is the third example of the ultrasonic measurement performed by the ultrasonic probe.

[0038] FIG. **9** is a diagram describing a movement of the ultrasonic probe.

[0039] FIG. **10**A and FIG. **10**B are a basic configuration of an ultrasonic transducer element.

[0040] FIG. **11** is a configuration example of the ultrasonic transducer device.

[0041] FIG. **12** is a basic configuration example of an ultrasonic measurement device and an ultrasonic image device.

[0042] FIG. **13**A and FIG. **13**B are a concrete example of the ultrasonic image device.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS

[0043] Hereinafter, preferred embodiments of the present invention will be described. The present embodiments described below shall not be construed as unreasonably limiting the subject matter of the present invention described in the scope of claims, and all the elements described in the present embodiment are not necessarily essential to the solving means of the present invention.

1. Ultrasonic Probe

[0044] FIG. **1** is a basic configuration example of an ultrasonic probe **300** of the present embodiment. The ultrasonic probe **300** of the present invention is provided with an ultrasonic sensor section **310**, guide section **330** (**330-1**, **330-2**). By the way, the ultrasonic probe **300** of the present embodiment is not limited to the configuration of FIG. **1** so that it is possible to provide various modified embodiments such that a part of the constituent elements may be omitted, it may be replaced to another constituent element, another constituent element may be added, etc.

[0045] As shown in FIG. **1**, a surface toward the target sample side at the time of measurement by the ultrasonic probe **300** is defined as a sensor surface **320**, and a longitudinal direction of the sensor surface **320** is defined as X direction (, first direction), and a direction intersecting the X direction is defined as Y direction (, second direction), and a direction intersecting the X direction and the Y direction and toward the target sample at the time of measurement is defined as Z direction.

[0046] The sensor surface **320** is one of the surfaces forming the external surface of the case of the ultrasonic probe **300**, and is directed toward the target sample side at the time of ultrasonic measurement. The sensor surface **320** may be a flat surface or a curved surface. For example, the sensor surface **320** is an elongated shape or a rectangular shape in a plan view viewed from the Z direction. The definition of the longitudinal direction of the sensor surface **320** is that for example, the sensor surface **320** is directed along the longitudinal direction when the sensor surface **320** is an elongated shape in the plan view, and the sensor surface **320** is directed along the long side when the sensor surface **320** is a rectangular shape in the plan view. The sensor surface **320** may be, for example, an elliptical shape or a similar shape thereto in the plan view, or a rectangle, which is a shape cutting out the four corners, or a similar shape thereto in the plan view.

[0047] The ultrasonic sensor section **310** is provided with an ultrasonic transducer device (not shown) which sends an ultrasonic wave to the target sample (target object) and receives an ultrasonic echo. The ultrasonic sensor section **310** is provided on the sensor surface **320** and is formed along the direction (Y direction) that the scanning direction of the ultrasonic transducer device intersects the longitudinal direction of the sensor surface **320**. Alternatively, the ultrasonic sensor section **310** is provided on the sensor surface **320** and is formed along a longitudinal direction (X direction) of the sensor surface **320** that is the scanning direction of the ultrasonic transducer device. For example, as shown in FIG. **1**, the ultrasonic sensor section **310** is arranged between the first guide section **330-1** and the second guide section **330-2**. The ultrasonic transducer device will be described in detail later.

[0048] The guide section **330** is provided on the sensor surface **320**, and it is a member projecting to the target sample side (Z direction side) from the sensor surface **320**. In the condition that the ultrasonic sensor section **310** is positioned toward the target sample, the guide section **330** provides that a resistance force with respect to the target sample when the sensor surface **320** is contacted to the surface of the target sample and is moved in the X direction is smaller than a resistance force with respect to the target sample in a case of moving in the Y direction. As a result, the movement of the ultrasonic probe **300** in the X direction becomes easier than the movement in the Y direction. The guide section **330** guides the movement of the longitudinal direction of the sensor surface **320**. The guide section **330** has a configuration that the longitudinal direction of the sensor surface **320** is defined as the X direction.

[0049] For example, as shown in FIG. **1**, the guide section **330** has the first guide section **330-1** and the second guide section **330-2** which are provided so as to define the longitudinal direction as the X direction. The first guide section **330-1** is provided in the −Y direction side with respect to the central axis, which passes through the center of the sensor surface **320** and is parallel to the X direction. The second guide section **330-2** is provided in the +Y direction side with respect to the central axis, which passes through the center of the sensor surface **320** and is parallel to the X direction.

[0050] As described later, when the ultrasonic measurement is performed with a sheet member for ultrasonic measurement, the guide section **330** is engaged to a part of the sheet member for ultrasonic measurement fixed on the target sample so as to guide the movement of the ultrasonic probe **300** in the longitudinal direction (X direction) of the sensor surface **320**. Alternatively, when the ultrasonic measurement is performed without using the sheet member for ultrasonic measurement, by the friction with the target sample, the guide section **330** provides a condition that the movement of the ultrasonic probe **300** in the X direction with respect to the target sample becomes easier than the movement in the Y direction.

[0051] FIG. **2** shows an ultrasonic probe **800** as a comparative example. The ultrasonic probe **800** of the comparative example as shown in FIG. **2** is different from the ultrasonic probe **300** of the present invention so that an ultrasonic sensor section **810** is provided in the end portion of the longitudinal direction of the ultrasonic probe **800**. In this type of the ultrasonic probe, it is difficult to stably and vertically hold the probe with respect to the target surface.

[0052] On the other hand, as shown in FIG. **1**, a shape of the ultrasonic probe **300** of the present embodiment is a mouse-shape so that the ultrasonic sensor section can be provided in a position of the center of gravity of the probe or close to the position of the center of gravity of the probe. In this configuration, it facilitates the measurement by stably holding the probe to the target surface.

[0053] FIG. **3**A and FIG. **3**B shows the first configuration example of the ultrasonic probe **300** of the present embodiment. The ultrasonic probe **300** of the first configuration example is provided with the ultrasonic sensor section **310**, the first and second guide sections **330-1**, **330-2**, and the groove portion **340**. By the way, the ultrasonic probe **300** of the present embodiment is not limited to the configuration of FIG. **3**A and FIG. **3**B, so that it is possible to provide various modified embodiments such that a part of the constituent elements may be omitted, it may be replaced to another constituent element, another constituent element may be added, etc. For example, the groove portion **340** may be omitted.

[0054] FIG. **3**A is a diagram viewed from the Z direction side, that is, the sensor surface **320** side that is the surface toward the target sample side at the time of measurement, and FIG. **3**B is a schematic diagram viewed from the −X direction side. By the way, the X, Y, Z directions correspond to the definition shown in FIG. **1**.

[0055] The sensor surface **320** of the ultrasonic probe **300** shown in FIG. **3**A has a shape similar to a rectangular shape in a plan view that is viewed from the Z direction side. Specifically, it has a shape that the four corners of the rectangular shape are modified to a rounded shape.

[0056] The ultrasonic sensor section **310** has already been described in FIG. **1** so that the detailed description will be omitted here. By the way, the ultrasonic emission surface of the ultrasonic sensor section **310** is not necessary to be provided in the same surface as the sensor surface **320**, and a part of the ultrasonic sensor section **310** (e.g., acoustic lens, etc.) may be extended in the Z direction from the sensor surface **320**. Alternatively, on the other hand, the ultrasonic emission surface of the ultrasonic sensor section **310** may be reduced in the Z direction from the sensor surface **320**.

[0057] The first and second guide sections **330-1**, **330-2** are provided so as to form the longitudinal direction along the X direction, and guide the movement in the longitudinal direction of the sensor surface **320** of the ultrasonic probe **300**. The first guide section **330-1** is provided in the −Y direction side with respect to the central axis which is parallel to the X direction on the sensor surface **320**, and the second guide section **330-2** is provided in the +Y direction side with respect to the central axis which is parallel to the X direction on the sensor surface **320**.

[0058] For example, as shown in FIG. **3**A and FIG. **3**B, the first and second guide sections **330-1**, **330-2** have a length in the X direction and have a width in the Y direction. It is a member projecting in the Z direction (target sample side) and it has a shape similar to a rectangular in a cross-section along the Y direction. By the way, the first and second guide sections **330-1**, **330-2** do not have to be the same shape. For example, the length of the first guide section **330-1** may be longer than the length of the second guide section **330-2**, and the width of the first guide section **330-1** may be wider than the width of the second guide section **330-2**. Alternatively, the cross-sectional shape of the first guide section **330-1** and the second guide section **330-2** may be different. For example, the thickness of the first guide section **330-1** in the X direction may be thicker than the thickness of the second guide section **330-2** in the Z direction.

[0059] The groove portion **340** has a length in the X direction, a width in the Y direction, and a depth in the −Z direction. The groove portion is an opening on the sensor surface **320**. On the sensor surface **320**, it is provided that the longitudinal direction is formed in the X direction (, the first direction), that is, the longitudinal direction of the groove portion **340** is provided so as to be formed in the longitudinal direction of the sensor surface **320**. The groove portion **340** has a concave shape in the cross-section along the Y direction. For example, as shown in FIG. **3**A and FIG. **3**B, a plurality of groove portions **340** may be respectively provided in a region of +X direction side and a region of −X direction side with respect to the ultrasonic sensor section **310** on the sensor surface **320**. The number of the groove portion **340** is not limited to the number in the drawings. Each of the plurality of groove portions **340** may be the same shape, or for example, the length, width, depth, etc. of each groove portion may be different, respectively. Further, the respective groove portions may not have to be parallel each other.

[0060] By providing the groove portion **340**, when the ultrasonic measurement is performed while moving the ultrasonic probe **300** in the X direction, a gel applied to the target surface or the sheet member for ultrasonic measurement can be efficiently collected to the emission surface of the ultrasonic sensor section **310** through the groove portion **340**. Because of this, entering air between the ultrasonic sensor section **310** and the target sample or the sheet member for ultrasonic measurement can be prevented.

[0061] FIG. **4**A and FIG. **4**B shows a modification example of the first configuration example of the ultrasonic probe **300** of the present embodiment. In the modification example of the first configuration example, the ultrasonic sensor section **310** is provided on the sensor surface **320** so that the scanning direction of the ultrasonic transducer device is parallel to the longitudinal direction of the sensor surface **320**. The first and second guide sections **330-1**, **330-2** guide the movement in the longitudinal direction of the sensor surface **320** of the ultrasonic probe **300**. That is, it can guide the movement of the ultrasonic probe **300** in the scanning direction.

[0062] According to the modification example of the first configuration example of the ultrasonic probe **300** of the present embodiment, the ultrasonic measurement is performed while moving the ultrasonic probe **300** in the scanning direction along a desired track so that a plurality of ultrasonic images along the desired track can be easily obtained. As a result, for example, it is possible to obtain an ultrasonic panoramic image along the desired track.

[0063] FIG. **5**A and FIG. **5**B shows the second configuration example of the ultrasonic probe **300** of the present embodiment. The ultrasonic probe **300** of the second configuration example is provided with the ultrasonic sensor section **310**, the first to fourth guide sections **330-1** to **330-4**, and the groove portion **340**. By the way, the ultrasonic probe **300** of the present embodiment is not limited to the configuration of FIG. **5**A and FIG. **5**B so that it is possible to provide various modified embodiments such that a part of the constituent elements may be omitted, it may be replaced to another constituent element, another constituent element may be added, etc. For example, the groove portion **340** may be omitted.

[0064] FIG. **5**A is a diagram viewed from the Z direction side, that is, the sensor surface **320** side that is the surface toward the target sample side at the time of measurement. FIG. **5**B is a schematic diagram viewed from the −X direction side. By the way, the respective directions of X, Y, Z correspond to the definition shown in FIG. **1**.

[0065] The ultrasonic sensor section **310** has already been described in FIG. **1**, FIG. **3**A, and FIG. **3**B so that the detailed description will be omitted here.

[0066] The first to fourth guide sections **330-1** to **330-4** are provided in the first to fourth corner parts of the sensor surface **320**, and guide the movement in the longitudinal direction (X direction) of the sensor surface **320** of the ultrasonic probe **300**.

[0067] In the sensor surface **320**, the range of X in the X-condition in the region where the ultrasonic sensor section **310** is provided is defined as $xa \le x \le xb$ and when the range of Y in the Y-condition is defined as $ya \le y \le yb$ the first corner part is the region that is $x < xa$ and $y < ya$ in the sensor surface **320**. Also, the second corner part is the region that is $x < xa$ and $y > yb$ in the sensor surface **320**. The third corner part is the region that is $x > xb$ and $y < ya$ in the sensor surface **320**. The fourth corner part is the region that is $x > xb$ and $y > yb$ in the sensor surface **320**.

[0068] For example, as shown in FIG. **5**A and FIG. **5**B, the first to fourth guide sections **330-1** to **330-4** have a length in the X direction and a width in the Y direction, and it is a member projecting to the Z direction (target sample side) from the sensor surface **320** so that the cross-section along the Y direction is a rectangular shape or similar to the shape. By the way, the shape of the first to fourth guide sections **330-1** to **330-4** is not limited to the shape in the drawing so that it may be, for example, a cylindrical shape or an elliptic shape. Also, the first to fourth guide sections **330-1** to **33-4** may be different shape, respectively. Further, the first to fourth guide sections **330-1** to **330-4** may not have to be symmetrically arranged each other with respect to the central axis, which passes through the center of the sensor surface **320** and is parallel to the X direction, or the central axis, which passes through the center of the sensor surface **320** and is parallel to the Y direction.

[0069] The groove portion **340** has already been described in FIG. **3**A and FIG. **3**B so that the detailed description will be omitted here.

[0070] FIG. **6**A and FIG. **6**B shows the first example of the ultrasonic measurement performed by the ultrasonic probe **300** of the present embodiment. Here, it is shown in the case that the ultrasonic probe **300** of the first configuration example and the sheet member for ultrasonic measurement **200** are used. FIG. **6**A is a diagram viewed from −Z direction side, that is, it is viewed from the opposite side of the sensor surface **320**. FIG. **6**B is a schematic diagram viewed from −X direction side.

[0071] The sheet member for ultrasonic measurement **200** is configured by an ultrasonic transmissive medium that transmits an ultrasonic wave, and it is fixed on the surface of the target sample at the time of the ultrasonic measurement. The ultrasonic probe **300** emits an ultrasonic wave to the target sample (target object) through the sheet member for ultrasonic measurement **200**.

[0072] The sheet member for ultrasonic measurement **200** is a sheet which transmits an ultrasonic wave, and is provided between the ultrasonic probe **300** and the target sample to secure an acoustic matching (acoustic impedance matching) between the ultrasonic sensor section **310** and the target sample at the time of ultrasonic measurement.

[0073] The first and second guide sections **330-1**, **330-2** are engaged with a part of the sheet member for ultrasonic measurement fixed on the target sample, and guide the movement in the longitudinal direction (X direction) of the sensor surface **320** of the ultrasonic probe **300**. Specifically, the first guide section **330-1** is engaged with the end portion of −Y direction side of the sheet member for ultrasonic measurement **200**, and the second guide section **330-2** is engaged with the end portion of +Y direction side of the sheet member for ultrasonic measurement **200** so that it is possible to guide the movement in the longitudinal direction (X direction) of the sensor surface **320** of the ultrasonic probe **300**. That is, the surface (edge face) of the end portion of −Y direction side of the sheet member for ultrasonic measurement **200** and the surface of the first guide section **330-1**, which is opposed to the edge face, are contacted, and the surface of the end portion of +Y direction side of the sheet member for ultrasonic measurement **200** and the surface of the second guide section **330-2**, which is opposed to the surface of the end portion, are contacted so that the movement of the ultrasonic probe **300** in the Y direction, which is a direction perpendicular to the surface, can be limited.

[0074] A part of the sheet member for ultrasonic measurement **200** is a portion of the sheet member for ultrasonic measurement **20**, and it is a portion that guides the movement in the longitudinal direction (X direction) of the sensor surface **320** of the ultrasonic probe **300** by engaging with the guide section **330**, or a portion that limits the movement of the Y direction of the ultrasonic probe **300**. For example, it is a portion contacting and fitting with the projecting portion of the guide section **330**, a portion guiding the movement in the longitudinal direction (X direction) of the sensor surface **320** of the ultrasonic probe **300** by fitting, or a portion limiting the movement in the Y direction of the ultrasonic probe **300**. Specifically, it may be the end portion shown in FIG. **6**A and FIG. **6**B, or it may be the groove portion shown in FIG. **7**A and FIG. **7**B.

[0075] The height DA from the sensor surface **320** of the first and second guide sections **330-1**, **330-2** is less than or equal to the thickness DB of the sheet member for ultrasonic measurement **200**. By the way, the height DA of the first and second guide sections **330-1**, **330-2** may be different.

[0076] FIG. **6**A and FIG. **6**B shows when the first configuration example (FIG. 3A, FIG. 3B) of the ultrasonic probe **300** is used as an example, but it is also the same manner when the modified example of the first configuration example (FIG. 4A, FIG. 4B) is used. Also, it is the same manner when the second configuration example (FIG. 5A, FIG. 5B) is used. That is, the first and third guide sections **330-1**, **33-3** are engaged with the end portion of the −Y direction side of the sheet member for ultrasonic measurement **200**, and the second and fourth guide sections **330-2**, **330-4** are engaged with the end portion of the +Y direction side of the sheet member for ultrasonic measurement **200** so that it is possible to guide the movement in the longitudinal direction (X direction) of the sensor surface **320** of the ultrasonic probe **300**.

[0077] The end portion of the sheet member for ultrasonic measurement **200** is a portion including the surface of +Y direction side and its vicinity or a portion including the surface of −Y direction side and its vicinity among the six surfaces that forms the outer surface of the sheet member for ultrasonic measurement **200**.

[0078] FIG. **7**A and FIG. **7**B shows the second example of the ultrasonic measurement performed by the ultrasonic probe **300** of the present embodiment. Here, it is shown in the case that the ultrasonic probe **300** of the first configuration example and the sheet member for ultrasonic measurement **200** are used. FIG. **7**A is a diagram viewed from −Z direction side, that is, it is viewed from the opposite side of the sensor surface **320**. FIG. **7**B is a schematic diagram viewed from −X direction side.

[0079] The sheet member for ultrasonic measurement **200** shown in FIG. **7**A and FIG. **7**B includes the first and second groove portions **220-1**, **220-2** provided along the longitudinal direction (X direction) of the sheet member for ultrasonic measurement **200**. The first and second groove portions **220-1**, **220-2** are the groove portion guiding the movement of the ultrasonic probe **300**.

[0080] The first and second groove portions **220-1**, **220-2** are provided in the ultrasonic probe **200** side of the surface of the sheet member for ultrasonic measurement **200**, and have a length in the X direction, a width in the Y direction, and a depth in the Z direction, and is the groove portion that opens in the ultrasonic probe **300** side of the surface of the sheet member for ultrasonic measurement **200**. The first and second groove portions **220-1**, **220-2** have a concave shape in the cross-section along the Y direction. The first groove portion **220-1** is provided in the −Y direction side with respect to the central axis along the longitudinal direction (X direction) of the sheet member for ultrasonic measurement **200**, and the second groove portion **220-2** is provided in the +Y direction side with respect to the central axis along the longitudinal direction (X direction) of the sheet member for ultrasonic measurement **200**.

[0081] The first and second guide sections **330-1**, **330-2** are engaged with a part of the sheet member for ultrasonic measurement fixed on the target sample, and guide the movement in the longitudinal direction (X direction) of the sensor surface **320** of the ultrasonic probe **300**. Specifically, the first guide section **330-1** is fitted (engaged) with the first groove portion **220-1** of the sheet member for ultrasonic measurement **200** and the second guide section **330-2** is fitted with the second groove portion **220-2** of the sheet member for ultrasonic measurement **200** so that it is possible to guide the movement in the longitudinal direction (X direction) of the sensor surface **320** of the ultrasonic probe **300**. Alternatively, it is possible to limit the movement of the ultrasonic probe **300** in the Y direction with respect to the target sample. That is, the surface of the first guide section **330-1** and the surface of the first groove portion **220-1**, which is opposed to the surface of the first guide section, are contacted, and the surface of the second guide section **330-2** and the surface of the second groove portion **220-2**, which is opposed to the surface of the second guide section, are contacted so that it is possible to guide the movement in the longitudinal direction (X direction) of the sensor surface **320** of the ultrasonic probe **300**.

[0082] The height DA from the sensor surface **320** of the first and second guide sections **330-1**, **330-2** is less than or equal to the thickness DB of the sheet member for ultrasonic measurement **200**. By the way, the height DA of the first and second guide sections **330-1**, **330-2** may be different, respectively. The height DA of the first and second guide sections **330-1**, **330-2** is the length from the sensor surface **320** to the projected edge in the Z direction.

[0083] FIG. **7**A and FIG. **7**B shows the case of the first configuration example (FIG. 3A and FIG. 3B) of the ultrasonic probe **300** as an example, but the case of the modified example (FIG. 4A and FIG. 4B) of the first configuration example is in the same manner. Also, the case of the second configuration example (FIG. **5**A and FIG. **5**B) is in the same manner. That is, the first and third guide sections **330-1**, **330-3** are engaged with the first groove portion **220-1** of the sheet member for ultrasonic measurement **200**, and the second and fourth guide sections **330-2**, **330-4** are engaged with the second groove portion **220-2** of the sheet member for ultrasonic measurement **200** so that it is possible to guide the movement in the longitudinal direction (X direction) of the sensor surface **320** of the ultrasonic probe **300**.

[0084] FIG. **8** shows the third example of the ultrasonic measurement performed by the ultrasonic probe **300** of the present invention. Here, it is shown in the case that the sheet member for ultrasonic measurement **200** is not used. FIG. **8** is a schematic diagram viewed from the −X direction side.

[0085] By the friction with the target sample, the first and second guide sections **330-1**, **330-2** provide a condition that the resistance force with respect to the target sample when the ultrasonic sensor section **310** is moved in the X direction by contacting the sensor surface **320** to the surface of the target sample becomes smaller than the resistance force with respect to the target sample in the case of moving in the Y direction. As a result, by the friction with the target sample, the first and second guide sections **330-1**, **330-2** provide a condition that the movement of the ultrasonic probe **300** in the X direction with respect to the target sample can be easier than the movement in the Y direction. In the case of the second configuration example of the ultrasonic probe **300**, in the same manner, the first to fourth guide sections **330-1** to **330-4** provide a condition that the movement of the ultrasonic probe **300** in the X direction with respect to the target sample can be easier than the movement in the Y direction by the friction with the target sample.

[0086] By the way, when the sheet member for ultrasonic measurement **200** is not used, by applying the gel on the surface of the target sample, entering air between the target sample and the ultrasonic sensor section **310** can be prevented. As described above, by providing the groove portion **340** on the sensor surface **320** of the ultrasonic probe **300**, the gel applied on the surface of the target sample can be efficiently collected to the emission surface of the ultrasonic sensor section **310** through the groove portion **340**.

[0087] FIG. **9** is an explanatory diagram showing the movement of the ultrasonic probe **300** guided by the sheet member for ultrasonic measurement **200**. The longitudinal direction of the sheet member for ultrasonic measurement **200** is defined as the X direction.

[0088] As described above, the guide section **330** provided in the ultrasonic probe **300** is engaged with a part of the sheet member for ultrasonic measurement **200** fixed on the target sample so as to guide the movement in the longitudinal direction (X direction) of the sensor surface **320** of the ultrasonic probe **300**.

[0089] As shown in FIG. **9**, the user fixes the sheet member for ultrasonic measurement **200** on a measurement target region (region of interest) of the target sample and the ultrasonic probe **300** is set on the region. At this time, the scanning direction or the slice direction is set so as to be parallel to the X direction. The movement of the ultrasonic probe **300** in the Y direction is limited, but the movement in the X direction is not limited. That is, the ultrasonic probe **300** can be freely moved in the longitudinal direction of the sheet member for ultrasonic measurement **200**. As a result, the ultrasonic probe **300** can be securely moved along the track defined by the sheet member for ultrasonic measurement **200**. Also, the sheet member for ultrasonic measurement **200** can be fixed corresponding to a shape of the target sample, and the like, so that the ultrasonic probe **300** can be precisely moved corresponding to a shape of various parts to be measured or a body type of the target sample.

[0090] Because of this, the ultrasonic measurement can be performed while moving the ultrasonic probe **300** along the predetermined track so that it is possible to easily obtain a plurality of ultrasonic images along the predetermined track on, for example, the measurement target region. Further, it is possible to obtain an ultrasonic panoramic image or a three-dimensional ultrasonic image based on the plurality of ultrasonic images along the predetermined track.

[0091] As described above, according to the ultrasonic probe **300** of the present embodiment, by the guide section **330** provided on the sensor surface **320**, it can guide the movement in the longitudinal direction of the sensor surface **320** of the ultrasonic probe **300**. In addition, by using the sheet member for ultrasonic measurement, it can guide the movement of the ultrasonic probe in the longitudinal direction of the sheet member for ultrasonic measurement. As a result, obtaining a plurality of ultrasonic images while the user moves the ultrasonic probe in the longitudinal direction of the sheet member for ultrasonic measurement, that is, precisely moving along the predetermined track can be easily performed with a simple configuration. Moreover, it is possible to obtain an ultrasonic panoramic image or a three-dimensional ultrasonic image based on the plurality of ultrasonic images obtained such way.

2. Ultrasonic Transducer Device

[0092] The ultrasonic sensor section **310** of the ultrasonic probe **300** of the present embodiment has an ultrasonic transducer device **312**. FIG. **10**A and FIG. **10**B show a basic configuration example of an ultrasonic transducer element **10**(thin film piezoelectric ultrasonic transducer element). The ultrasonic transducer element **10** of the present embodiment is provided with a vibrating membrane **42** and a piezoelectric element part. The piezoelectric element part is provided with a first electrode layer **21**, a piezoelectric element **30**, and a second electrode layer **22**. By the way, the ultrasonic transducer element **10** of the present embodiment is not limited to the configuration of FIG. **10**A and FIG. **10**B so that it is possible to provide various modified embodiments such that a part of the constituent elements may be omitted, it may be replaced to another constituent element, another constituent element may be added, etc.

[0093] FIG. **10**A is a diagram showing a plane view of the ultrasonic transducer element **10** formed on a substrate **60** (silicon substrate) which is viewed from a direction perpendicular to the substrate in the element formation surface side. FIG. **10**B is a diagram showing a cross-sectional view along A-A' of FIG. **10**A.

[0094] The first electrode layer **21** (lower electrode) is formed by, for example, a metallic thin film on the upper layer of the vibrating membrane **42**. The first electrode layer **21** is extended outward of the element formation region as shown in FIG. **10**A, and it may be a wire connected to the adjacent ultrasonic transducer element **10**.

[0095] The piezoelectric layer **30** is formed by, for example, a lead zirconate titanate (PZT) thin film, and it is provided to cover at least a part of the first electrode layer **21**. By the way, the material of the piezoelectric layer **30** is not limited to PZT so that for example, lead titanate ($PbTiO_3$), lead zirconate ($PbZrO_3$), lead lanthanum titanate ($(Pb, La)TiO_3$) may be used.

[0096] The second electrode layer **22** (upper electrode) is formed by, for example, a metal thin film, and it is provided to cover at least a part of the piezoelectric layer **30**. The second electrode layer **22** is extended to the outside of the element formation area as shown in FIG. **10**A, and it may be a wire connected to the adjacent ultrasonic transducer element **10**.

[0097] The vibrating membrane **42** (membrane) is provided to cover the opening **45** by two layers structure, for example, SiO_2 thin film and ZrO_2 thin film. The vibrating membrane **42** supports the piezoelectric layer **30**, and the first and second electrode layers **21**, **22**, and it vibrates in accordance with the expansion and contraction of the piezoelectric layer **30** so as to generate the ultrasonic wave.

[0098] The opening **45** is arranged in the substrate **60**. A cavity region **40** of the opening **45** is formed by etching such as Reactive Ion Etching (RIE), etc. from the back surface (the surface where an element is not formed) side of the substrate **60**. A resonance frequency of the ultrasonic wave is determined by the size of the vibrating membrane **42** which enables to be vibrated by forming the cavity region **40**, and the ultrasonic wave is radiated to the piezoelectric layer **30** side (forward direction from the back surface on a page in FIG. **10**A).

[0099] The lower electrode of the ultrasonic transducer element **10** is formed by the first electrode layer **21**, and the upper electrode is formed by the second electrode layer **22**. Specifically, a portion that is covered by the piezoelectric film **30** within the first electrode layer **21** forms a lower electrode, and a portion that covers the piezoelectric film **30** within the second electrode layer **22** forms an upper electrode. That is, the piezoelectric film **30** is provided between the lower electrode and the upper electrode.

[0100] The piezoelectric film **30** stretches in-plane direction by applying a voltage between the lower electrode and the upper electrode, that is, the first electrode layer **21** and the second electrode layer **22**. The ultrasonic transducer element **10** uses a monomorph (unimorph) structure in which a thin piezoelectric element part and the vibrating membrane are bonded together, and when the piezoelectric element part stretches in-plane, the dimension of the bonded vibrating membrane **42** is unchanged so as to occur warping. Accordingly, by applying alternating voltage to the piezoelectric film **30**, the vibrating membrane **42** vibrates in a film thickness direction so that the ultrasonic wave is radiated by the vibration of the vibrating membrane **42**. The voltage applied to the piezoelectric film **30** is, for example, 10V to 30V, and the frequency is, for example, 1 MHz to 10 MHz.

[0101] The driving voltage of the ultrasonic transducer element of bulk is approximately 100V from a peak to a peak, and on the other hand, in the thin film piezoelectric ultrasonic transducer element shown in FIG. **10**A and FIG. **10**B, the driving voltage can be approximately 10 to 30V from a peak to a peak.

[0102] The ultrasonic transducer element **10** operates as a reception element receiving an ultrasonic echo where the radiated ultrasonic wave is returned by the reflection at the target object. The vibrating membrane **42** is vibrated by the ultrasonic echo and the pressure is applied to the piezoelectric film **30** by this vibration so that the voltage is generated between the lower electrode and the upper electrode. This voltage can be taken out as a reception signal.

[0103] FIG. **11** shows a configuration example of the ultrasonic transducer device **312** provided in the ultrasonic probe **300** of the present embodiment. The ultrasonic transducer device **312** of the present configuration example includes a plurality of ultrasonic transducer elements **10** arranged in an array pattern, the 1st to n-th driving electrode wires DL1 to DLn (n is an integer of more than or equal to 2), and the 1st to m-th (m is an integer of more than or equal to 2) common electrode wires CL1 to CLm. FIG. **11** shows the case of m=8, n=12, but it may be more than the values. By the way, the ultrasonic transducer device **312** of the present embodiment is not limited to the configuration of FIG. **11** so that it is possible to provide various modified embodiments such that a part of the constituent elements may be omitted, it may be replaced another constituent element, another constituent element may be added, etc.

[0104] The plurality of ultrasonic transducer elements **10** are arranged in a matrix pattern of m rows and n columns. For example, as shown in FIG. **11**, 8 rows in the X direction and 12 columns in the Y direction, which intersects the X direction, are arranged. The ultrasonic transducer element **10** may be the configuration, for example, as shown in FIG. **10**A and FIG. **10**B.

[0105] The 1^{st} to 12^{th} driving electrode wires DL1 to DL12 (, n-th) are arranged in the X direction. The j-th driving electrode wire DLj (j is an integer of $1 \le j \le 12$) among the 1^{st} to 12^{th} driving electrode wires DL1 to DL12 is connected to the first electrode provided in each ultrasonic transducer element **10** arranged in the j-th column.

[0106] In a transmission period that an ultrasonic wave is radiated, the 1^{st} to 12^{th} transmission signals VT1 to VT12 outputted from a transmitting section **110**, which will be described later, are supplied to each ultrasonic transducer element **10** through the driving electrode wires DL1 to DL12. Also, in a reception period that an ultrasonic echo is received, the reception signals VR1 to VR12 from the ultrasonic transducer element **10** are outputted to a reception section **120**, which will be described later, through the driving electrode wires DL1 to DL12.

[0107] The 1^{st} to 8^{th} common electrode wires CL1 to CL8 (, m-th) are wired in the Y direction. The second electrode provided in the ultrasonic transducer element **10** is connected to any of the 1^{st} to m-th common electrode wires CL1 to CLm. Specifically, for example, as shown in FIG. **11**, the i-th common electrode wire CLi (i is an integer of $1 \le i \le 8$) of the 1^{st} to 8^{th} common electrode wires CL1 to CL8 is connected to the second electrode in each ultrasonic transducer element **10** arranged in the i-th column.

[0108] In the 1^{st} to 8^{th} common electrode wires CL1 to CL8, a common voltage VCOM is supplied. This common voltage may be a fixed DC voltage, and it does not have to be OV, that is, ground potential (grounding potential).

[0109] For example, for the 1st row and the 1st column of the ultrasonic transducer element **10**, the first electrode is connected to the driving electrode wire D1, and the second electrode is connected to the 1^{st} common electrode wire CL1. Also, for example, for the 4^{th} row and the 6th column of the ultrasonic transducer element **10**, the first electrode is connected to the 6^{th} driving electrode wire DL6, and the second electrode is connected to the 4^{th} common electrode wire CL4.

[0110] By the way, the arrangement of the ultrasonic transducer elements **10** is not limited to the matrix arrangement of m-rows and n-columns as shown in FIG. **11**. For example, m ultrasonic transducer elements **10** are arranged in the odd number of columns, and m−1 ultrasonic transducer elements **10** are arranged in the even number of columns. That is, it may be a zigzag pattern.

[0111] The element included in the ultrasonic transducer device **312** is not limited to the aforementioned thin film piezoelectric ultrasonic transducer element, and for example, it may be a bulk piezoelectric ultrasonic transducer element or an ultrasonic transducer element (CMUT: Capacitive Micro-machined Ultrasonic Transducer).

3. Ultrasonic Measurement Device and Ultrasonic Image Device

[0112] FIG. **12** shows a basic configuration example of an ultrasonic measurement device **100** and the ultrasonic image device **400** of the present embodiment. The ultrasonic measurement device **100** is provided with the ultrasonic probe **300**, the transmitting section **110**, the reception section **120**, and the processing section **130**. The ultrasonic image device **400** is provided with the ultrasonic measurement device **100** and the display section **410**. By the way, the ultrasonic measurement device **100** and the ultrasonic image device **400** of the present embodiment are not limited to the configuration of FIG. **12** so that it is possible to provide various modified embodiments such that a part of the constituent elements may be omitted, it may be replaced to another constituent element, another constituent element may be added, etc.

[0113] The ultrasonic probe **300** has already been described so that the detailed description will be omitted. By the way, the ultrasonic probe **300** may perform the ultrasonic measurement through the sheet member for ultrasonic measurement **200** as shown in FIG. **12**, and alternatively, it may perform the ultrasonic measurement without the sheet member for ultrasonic measurement **200**.

[0114] The transmitting section **110** performs a transmission process of an ultrasonic wave. Specifically, the transmitting section **110** outputs a transmission signal (driving signal) to the ultrasonic probe **300**, and the ultrasonic transducer device **312** provided in the ultrasonic probe **300** converts the transmission signal, which is an electronic signal, to the ultrasonic wave so that the ultrasonic wave is emitted to the target object. At least a part of the transmitting section **110** may be provided in the ultrasonic probe **300**.

[0115] The reception section **120** performs a reception processing of the ultrasonic echo. Specifically, the ultrasonic transducer device **312** provided in the ultrasonic probe **300** converts the ultrasonic echo, which comes from the target object, to the electronic signal. And, the reception section **120** performs the reception processing such as amplification of the reception signal (analog signal), which is the electronic signal from the ultrasonic transducer device **312**, detection, A/D conversion, position adjustment, etc., and outputs the reception signal (digital data), which is a signal after the reception processing, to the processing section **130**. At least a part of the reception section **120** may be provided in the ultrasonic probe **300**.

[0116] The processing section **130** performs an image data generation processing based on the control processing of the ultrasonic measurement or the reception signal from the reception section **120**. The generated image data is outputted to the display section **410**.

[0117] The display section **410** is a display device such as, for example, a liquid crystal display, organic electroluminescence display, etc., and displays the image data for display from the processing section **130**.

[0118] FIG. **13**A and FIG. **13**B shows a concrete configuration example of the ultrasonic image device **400** of the present embodiment. FIG. **13**A shows a portable type of the ultrasonic image device **400**, and FIG. **13**B shows a stationary type of the ultrasonic image device **400**.

[0119] The ultrasonic prove **300** is connected to the ultrasonic image device main body by the cable **350**. The display section **410** displays the image data for display.

[0120] By the way, the present embodiments were described above in detail, but it will be apparent to those skilled in the art that various modifications can be made in a scope not substantially deviating from the subject matter and the effect of the present invention. Therefore, such changes and modifications are included in the scope of the invention. For example, the terms used in the specification or the drawings at least once together with a different term having a broader or similar meaning can be replaced with the different term in any portion of the specification or the drawings. Also, the configuration and the operation of the ultrasonic probe, the ultrasonic measurement device, and the ultrasonic measurement device and the ultrasonic image device are also not limited to the description in the present embodiments so that various modifications can be possible.

GENERAL INTERPRETATION OF TERMS

[0121] In understanding the scope of the present invention, the term "comprising" and its derivatives, as used herein, are intended to be open ended terms that specify the presence of the stated features, elements, components, groups, integers, and/or steps, but do not exclude the presence of other unstated features, elements, components, groups, integers and/or steps. The foregoing also applies to words having similar meanings such as the terms, "including", "having" and their derivatives. Also, the terms "part," "section," "portion," "member" or "element" when used in the singular can have the dual meaning of a single part or a plurality of parts. Finally, terms of degree such as "substantially", "about" and "approximately" as used herein mean a reasonable amount of deviation of the modified term such that the end result is not significantly changed. For example, these terms can be construed as including a deviation of at least ±5% of the modified term if this deviation would not negate the meaning of the word it modifies.

[0122] While only selected embodiments have been chosen to illustrate the present invention, it will be apparent to those skilled in the art from this disclosure that various changes and modifications can be made herein without departing from the scope of the invention as defined in the appended claims. Furthermore, the foregoing descriptions of the embodiments according to the present invention are provided for illustration only, and not for the purpose of limiting the invention as defined by the appended claims and their equivalents.

What is claimed is:

1. An ultrasonic probe comprising:

an ultrasonic sensor section having an ultrasonic transducer device; and

a guide section disposed on a sensor surface on which the ultrasonic sensor section is provided, the guide section being configured and arranged such that a resistance force with respect to a target sample when the ultrasonic probe is moved in a first direction while the sensor surface contacts a surface of the target sample as the ultrasonic sensor section faces the target sample is smaller than the resistance force with respect to the target sample when the ultrasonic probe is moved in a second direction intersecting the first direction.

2. The ultrasonic probe according to claim **1**, wherein

the sensor surface has an elongated shape in a plan view, and

a longitudinal direction of the sensor surface is defined as the first direction.

3. The ultrasonic probe according to claim **1**, wherein

the guide section has a first guide section and a second guide section with a longitudinal direction of the sensor surface is defined as the first direction, and

the ultrasonic sensor section is disposed between the first guide section and the second guide section.

4. The ultrasonic probe according to claim **1**, wherein

the sensor surface has a rectangular shape in a plan view, and

the guide section has a first guide section, a second guide section, a third guide section, and a fourth guide section disposed at four corner sections of the sensor surface in the plan view.

5. The ultrasonic probe according to claim **1**, wherein

the guide section is configured and arranged to engage with a part of a sheet member for ultrasonic measurement fixed on the target sample to guide a movement in the first direction of the sensor surface of the ultrasonic probe.

6. The ultrasonic probe according to claim **5**, wherein

a height of the guide section from the sensor surface is less than or equal to a thickness of the sheet member for ultrasonic measurement.

7. The ultrasonic probe according to claim **1**, wherein

the resistance force is generated by a friction between the guide section and the target sample.

8. The ultrasonic probe according to claim **1**, wherein

the sensor surface has an elongated shape, and includes a groove portion extending in a longitudinal direction of the sensor surface.

9. The ultrasonic probe according to claim **1**, wherein

the ultrasonic sensor section is disposed on the sensor surface so that a scanning direction of the ultrasonic transducer device is oriented parallel to a longitudinal direction of the sensor surface, and

the guide section is configured and arranged to guide a movement of the ultrasonic probe in the longitudinal direction of the sensor surface.

10. An ultrasonic measurement device comprising:

the ultrasonic probe according to claim **1**;

a transmitting section configured to perform a process of transmitting ultrasonic waves;

a receiving section configured to perform a process of receiving ultrasonic echoes; and

a processing section configured to perform a process of controlling ultrasonic measurement,

wherein the processing section is configured to generate an ultrasonic panoramic image based on a reception signal from the receiving section.

11. An ultrasonic image device comprising:

the ultrasonic measurement device according to claim **10**; and

a display section configured to display image data.

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专利名称(译)	超声波探头，超声波测量装置和超声波图像装置		
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摘要(译)

超声波探头包括超声波传感器部分和引导部分。超声波传感器部分具有超声波换能器装置。引导部分设置在传感器表面上，超声波传感器部分设置在传感器表面上。引导部分被配置和布置成使得当超声波传感器部分面向目标样本时当超声波探头沿第一方向移动而传感器表面接触目标样本的表面时相对于目标样本的阻力较小当超声波探头沿与第一方向交叉的第二方向移动时，相对于目标样本的阻力大于相对于目标样本的阻力。