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(54) **SUPPORT APPARATUS OF ULTRASOUND PROBE, HANDSFREE ULTRASOUND PROBE INCLUDING THE SUPPORT APPARATUS, AND METHOD OF OPERATING THE SUPPORT APPARATUS**

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(57) **ABSTRACT**

A support apparatus of an ultrasound probe, a handsfree ultrasound probe including the support apparatus, and a method of operating the support apparatus. The support apparatus includes: a housing including an accommodation unit capable of accommodating an ultrasound probe and an adhesion unit capable of contacting a target object; and a first control unit for controlling an adhesive force with respect to the target object of the adhesion unit according to whether a user touches at least one of the ultrasound probe and the housing.

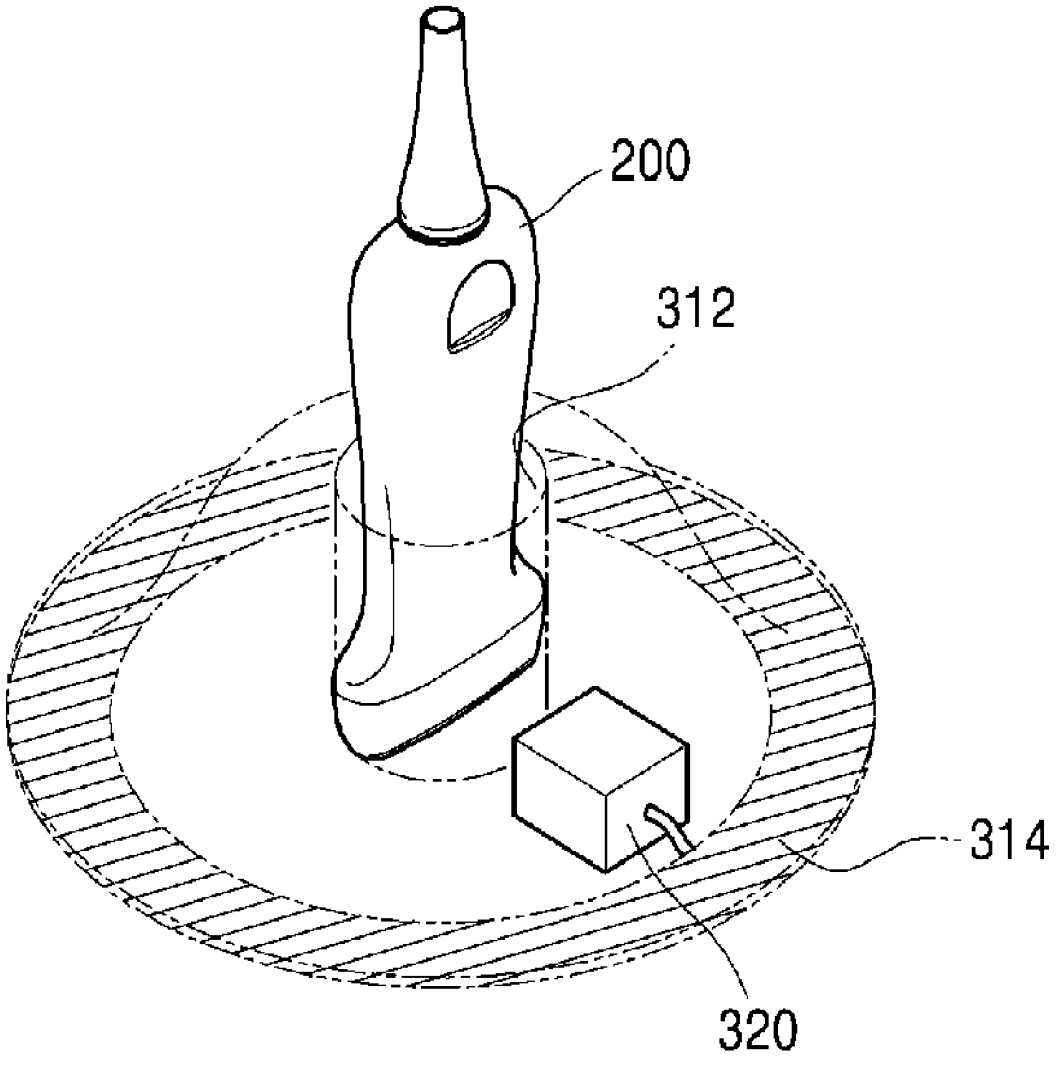


FIG. 1

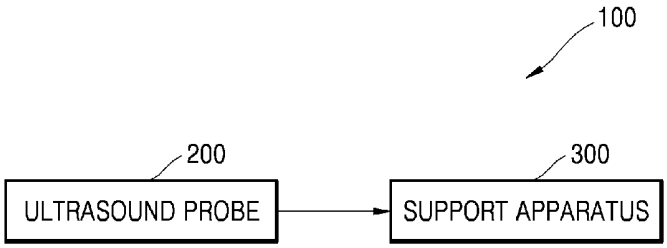

100
200
ULTRASOUND PROBE
300
SUPPORT APPARATUS

FIG. 2

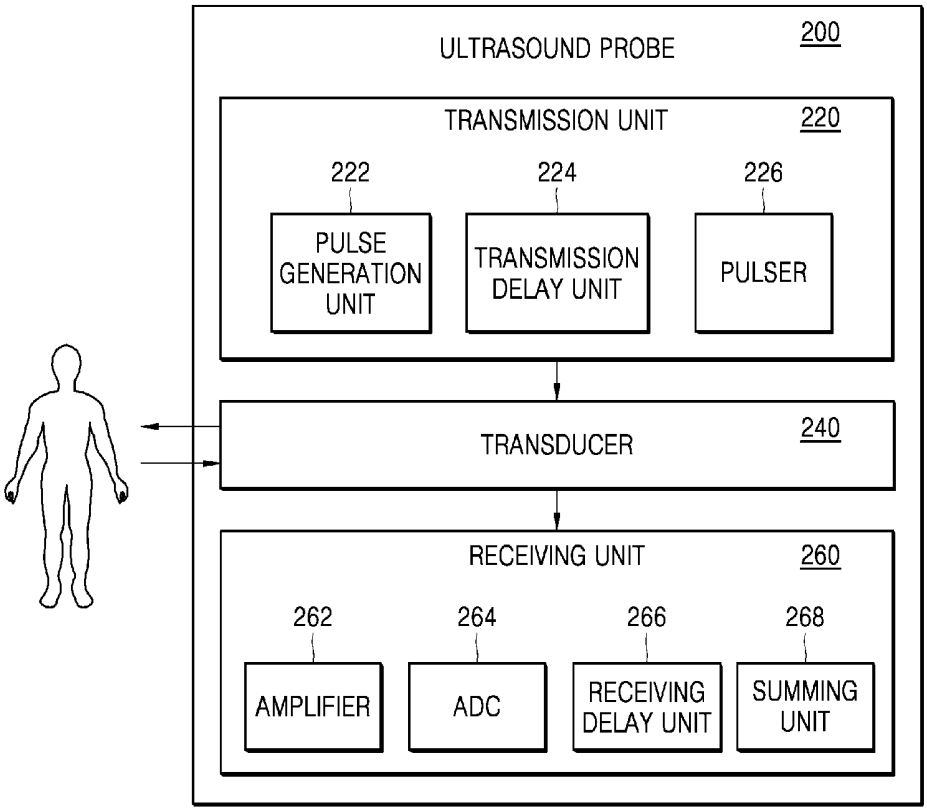

ULTRASOUND PROBE
200
TRANSMISSION UNIT
220
222
PULSE GENERATION UNIT
224
TRANSMISSION DELAY UNIT
226
PULSER
TRANSDUCER
240
RECEIVING UNIT
260
262
AMPLIFIER
264
ADC
266
RECEIVING DELAY UNIT
268
SUMMING UNIT

FIG. 3

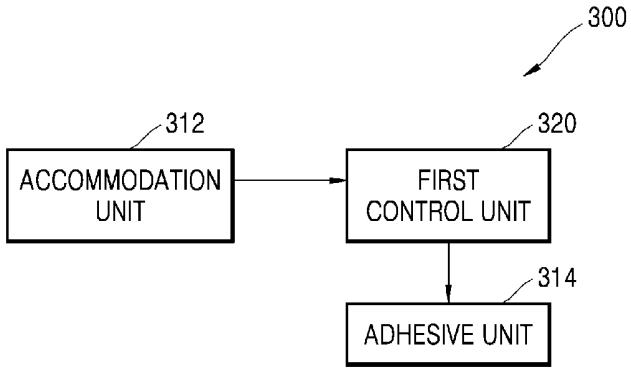

300
312
ACCOMMODATION UNIT
320
FIRST CONTROL UNIT
314
ADHESIVE UNIT

FIG. 4A

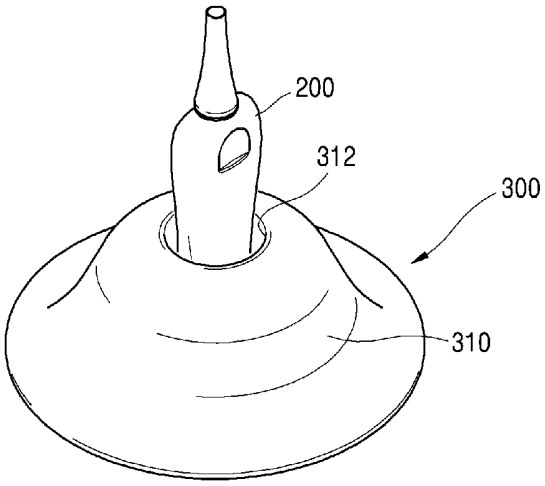


FIG. 4B

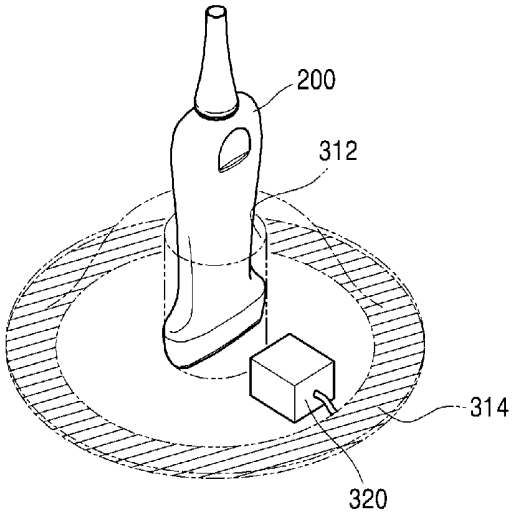


FIG. 5

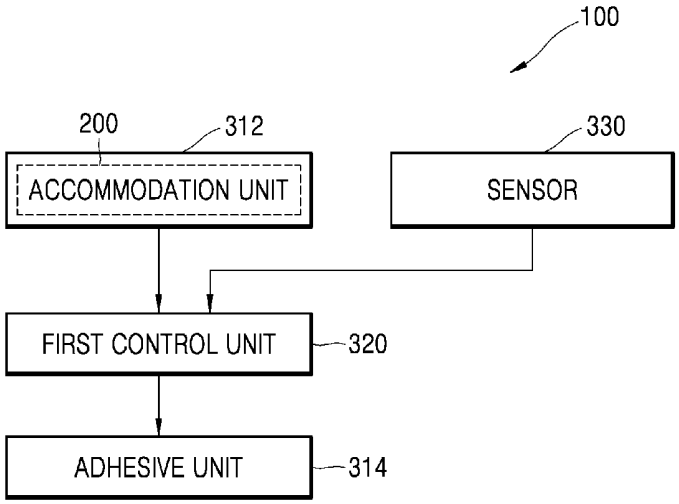

100
200
312
330
ACCOMMODATION UNIT
SENSOR
FIRST CONTROL UNIT
320
ADHESIVE UNIT
314

FIG. 6

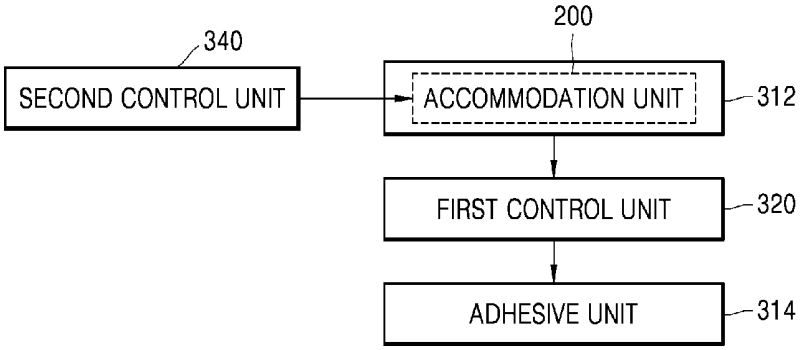

340
200
SECOND CONTROL UNIT
ACCOMMODATION UNIT
312
FIRST CONTROL UNIT
320
ADHESIVE UNIT
314

FIG. 7

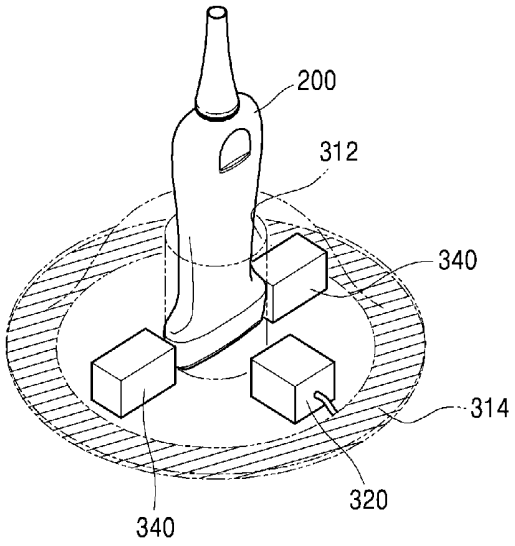


FIG. 8

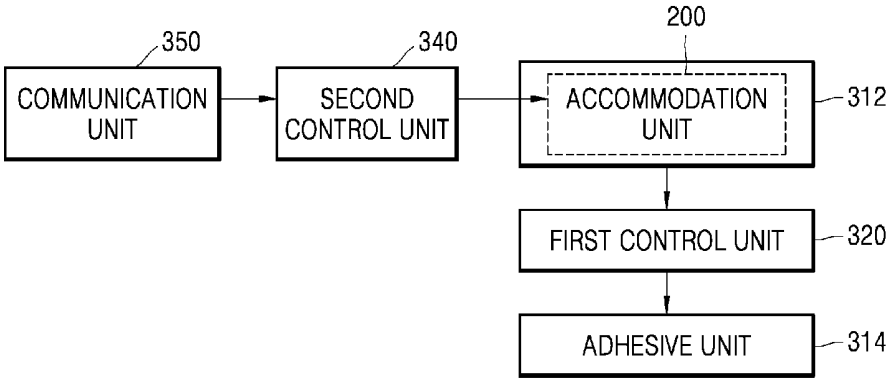

350
340
200
COMMUNICATION UNIT
SECOND CONTROL UNIT
ACCOMMODATION UNIT
312
FIRST CONTROL UNIT
320
ADHESIVE UNIT
314

FIG. 9A

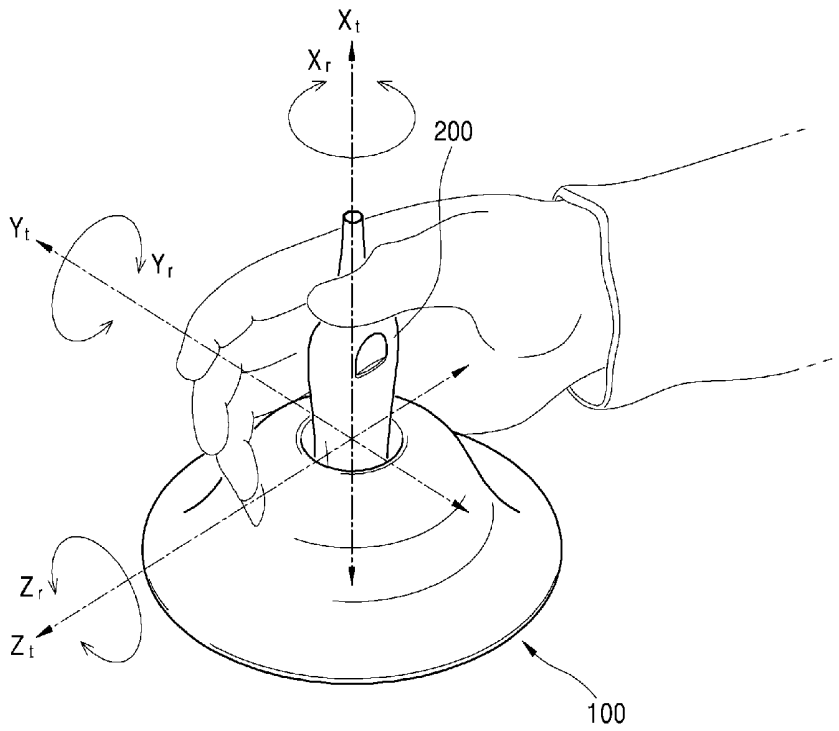

X_t
X_r
200
Y_t
Y_r
Z_r
Z_t
100

FIG. 9B

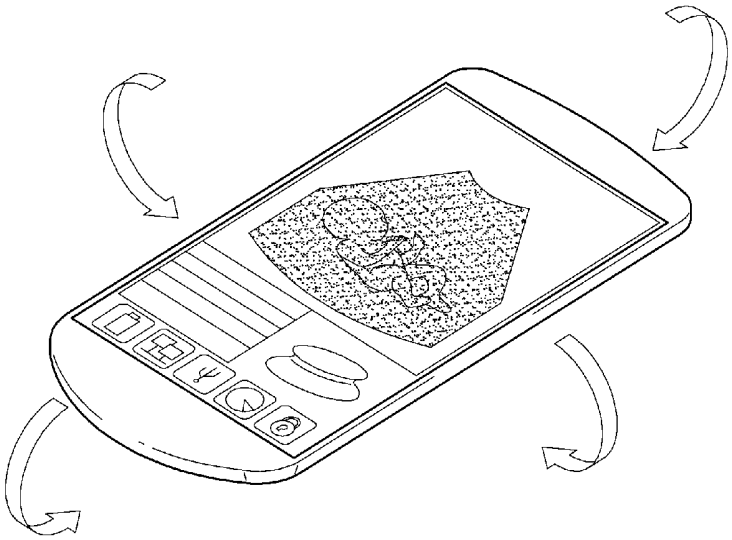


FIG. 9C

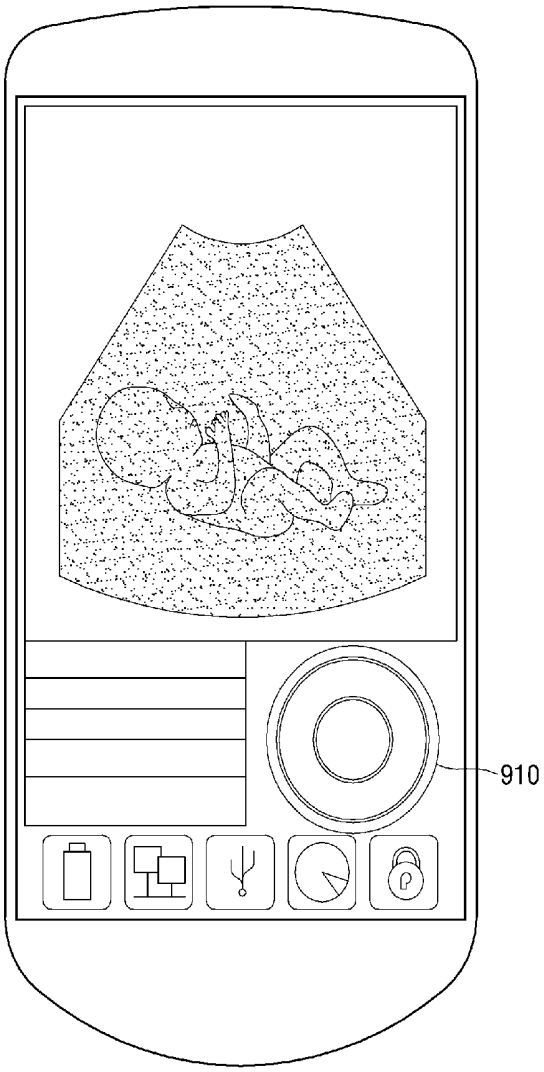


FIG. 10

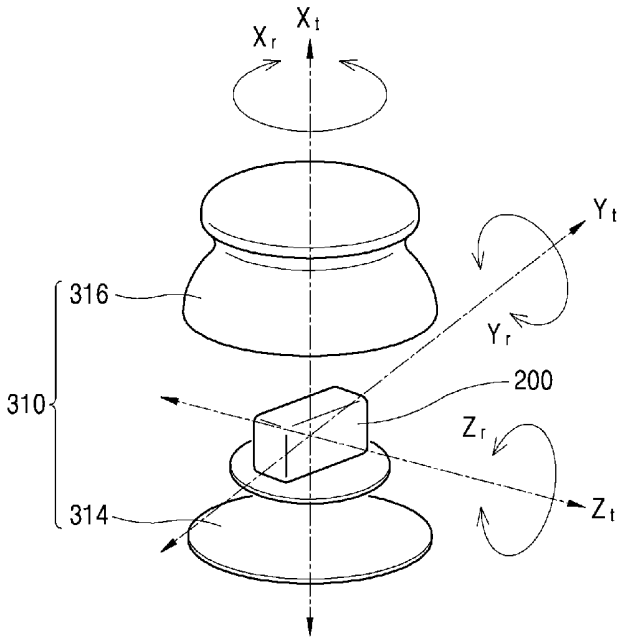
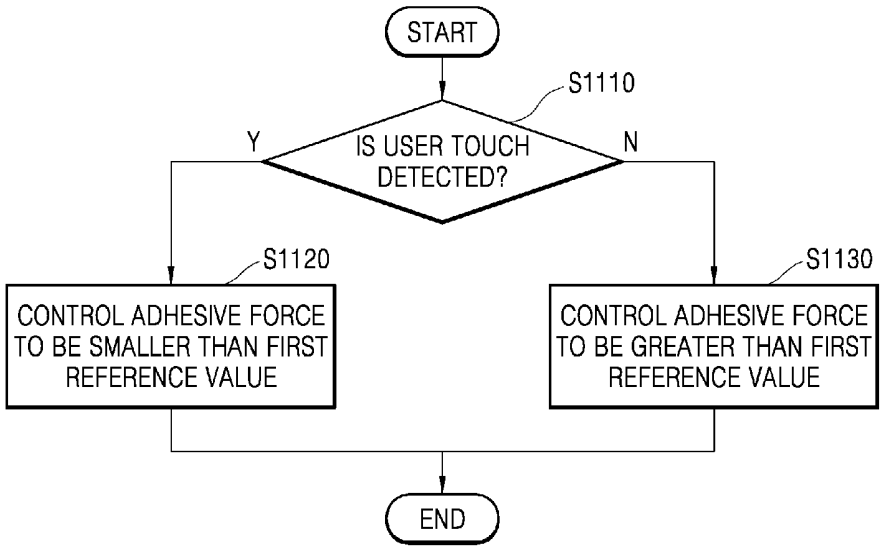

X_r
X_t
Y_t
Y_r
316
310
200
Z_r
Z_t
314

FIG. 11


START
S1110
IS USER TOUCH DETECTED?
Y
N
S1120
CONTROL ADHESIVE FORCE TO BE SMALLER THAN FIRST REFERENCE VALUE
S1130
CONTROL ADHESIVE FORCE TO BE GREATER THAN FIRST REFERENCE VALUE
END

SUPPORT APPARATUS OF ULTRASOUND PROBE, HANDSFREE ULTRASOUND PROBE INCLUDING THE SUPPORT APPARATUS, AND METHOD OF OPERATING THE SUPPORT APPARATUS

RELATED APPLICATIONS

[0001] This application claims the benefit of Korean Patent Application No. 10-2013-0134355, filed on Nov. 6, 2013, in the Korean Intellectual Property Office, the disclosure of which is incorporated herein in its entirety by reference.

BACKGROUND

[0002] 1. Field

[0003] One or more embodiments of the present invention relate to a support apparatus of an ultrasound probe, a handsfree ultrasound probe including the support apparatus, and a method of operating the support apparatus.

[0004] 2. Description of the Related Art

[0005] An ultrasound apparatus, a magnetic resonance imaging (MRI) apparatus, a computed tomography (CT) apparatus, an X-ray apparatus, etc. may be used as medical devices for obtaining a medical image of a body. By reason of a resolution of the medical image or a size of the medical device, these apparatuses may photograph a part of the body or an overall part of the body. The overall part of the body may be photographed at a time or the part of the body may be photographed in several times and then photographed images may be combined into one image to obtain a combined image of the whole part of the body.

[0006] An ultrasound diagnosis apparatus includes an ultrasound probe that transmits and receives ultrasound, a signal processing apparatus that performs signal processing on the received ultrasound, and a display apparatus that displays an ultrasound image.

[0007] The ultrasound probe that a user who is a doctor is holding by his/her hand contacts a target object such as a patient body, transmits ultrasound to the target object, and receives an echo signal of the ultrasound. However, although a user needs to fix the ultrasound probe to the target object when more closely diagnosing a specific part of the target object, it is difficult to fix the ultrasound probe more than a predetermined period of time due to a weight of the ultrasound probe.

SUMMARY

[0008] One or more embodiments of the present invention include a support apparatus of an ultrasound probe that a user may not hold by his/her hand during a diagnosis, a handsfree ultrasound probe including the support apparatus, and a method of operating the support apparatus.

[0009] One or more embodiments of the present invention include a support apparatus of an ultrasound probe capable of remotely controlling a movement of the ultrasound probe, a handsfree ultrasound probe including the support apparatus, and a method of operating the support apparatus.

[0010] Additional aspects will be set forth in part in the description which follows and, in part, will be apparent from the description, or may be learned by practice of the presented embodiments.

[0011] According to one or more embodiments of the present invention, a support apparatus of an ultrasound acoustic probe, the support apparatus including: a housing including an accommodation unit capable of accommodating an ultrasound probe and an adhesion unit capable of contacting a target object; and a first control unit for controlling an adhesive force with respect to the target object of the adhesion unit according to whether a user touches at least one of the ultrasound probe and the housing.

[0012] The adhesive force when a user touch is detected may be smaller than that when the user touch is not detected.

[0013] The first control unit may control the adhesive force to be smaller than a first reference value if a user touch is detected, and control the adhesive force to be greater than the first reference value if the user touch is not detected.

[0014] The first control unit may be capable of adjusting an intensity of the adhesive force at steps.

[0015] The first control unit may control the adhesive force by using an amount of air between the adhesion unit and the target object.

[0016] The first control unit may include a vacuum pump that adjusts the amount of air.

[0017] The support apparatus may further include: a second control unit for controlling a movement of the ultrasound probe according to whether the user touches at least one of the ultrasound probe and the housing.

[0018] The second control unit may include an actuator that is capable of moving such that the actuator contacts the ultrasound probe or is spaced apart from the ultrasound probe.

[0019] The actuator may be spaced apart from the ultrasound probe such that the ultrasound probe moves if the user touch is detected, and fix the ultrasound probe if the user touch is not detected.

[0020] The actuator may move the ultrasound probe in correspondence to a user command used to move the ultrasound probe if the user touch is not detected, and the user command is input.

[0021] The actuator may move at a trace of a protocol that is previously stored in correspondence to the user command.

[0022] The user command may be remotely input.

[0023] The first control unit may receive whether the user touches at least one of the ultrasound probe and the housing from a sensor disposed in at least one of the ultrasound probe and the housing.

[0024] The sensor may include at least one of a touch sensor, a temperature sensor, a button sensor, a light sensor, and a pressure sensor.

[0025] The ultrasound probe may be detached from the accommodation unit.

[0026] According to one or more embodiments of the present invention, a handsfree ultrasound probe including: an ultrasound probe for irradiating ultrasound to a target object and receiving an echo signal of the ultrasound; an accommodation unit for accommodating the ultrasound probe; and an adhesion unit for contacting the target object.

[0027] The handsfree ultrasound probe may further include: a first control unit for controlling an adhesive force with respect to the target object of the adhesion unit according to whether a user touches the handsfree ultrasound probe.

[0028] The first control unit may control the adhesive force when a user touch is not detected to be greater smaller than that when the user touch is detected.

[0029] According to one or more embodiments of the present invention, a method of operating a handsfree ultrasound probe, the method including: detecting whether a user touches the handsfree ultrasound probe; and controlling an adhesive force of the handsfree ultrasound probe with respect

to a target object to be smaller than a first reference value if it is detected that the user touches the handsfree ultrasound probe.

[0030] The method may further include: controlling the adhesive force of the handsfree ultrasound probe with respect to the target object to be greater than the first reference value if it is not detected that the user touches the handsfree ultrasound probe.

BRIEF DESCRIPTION OF THE DRAWINGS

[0031] These and/or other aspects will become apparent and more readily appreciated from the following description of the embodiments, taken in conjunction with the accompanying drawings in which:

[0032] FIG. **1** is a schematic block diagram of a handsfree ultrasound probe according to an embodiment of the present invention;

[0033] FIG. **2** is a block diagram of an ultrasound probe shown in FIG. **1**;

[0034] FIG. **3** is a block diagram of a support apparatus shown in FIG. **1**;

[0035] FIG. **4**A illustrates an external appearance of the support apparatus shown in FIG. **1**;

[0036] FIG. **4**B illustrates an internal appearance of the support apparatus shown in FIG. **1**;

[0037] FIG. **5** is a schematic block diagram of a handsfree ultrasound probe according to another embodiment of the present invention;

[0038] FIG. **6** is a block diagram of a support apparatus of an ultrasound probe according to another embodiment of the present invention;

[0039] FIG. **7** illustrates an internal appearance of the support apparatus shown in FIG. **6**;

[0040] FIG. **8** is a block diagram of a support apparatus of an ultrasound probe according to another embodiment of the present invention;

[0041] FIGS. **9**A through **9**C illustrate examples of a user command used to move a handsfree ultrasound probe according to embodiments of the present invention;

[0042] FIG. **10** illustrates an external appearance of a handsfree ultrasound probe according to another embodiment of the present invention; and

[0043] FIG. **11** is a flowchart of a method of operating a handsfree ultrasound probe according to an embodiment of the present invention.

DETAILED DESCRIPTION

[0044] Reference will now be made in detail to embodiments, examples of which are illustrated in the accompanying drawings, wherein like reference numerals refer to the like elements throughout, and redundant explanations are omitted. In this regard, the present embodiments may have different forms and should not be construed as being limited to the descriptions set forth herein. Accordingly, the embodiments are merely described below, by referring to the figures, to explain aspects of the present description. Expressions such as "at least one of," when preceding a list of elements, modify the entire list of elements and do not modify the individual elements of the list.

[0045] Throughout the specification, a term 'target object' may include a person, animal, or a part of a person or animal. For example, the target object may include organs such as the liver, the heart, the womb, the brain, the breast, the abdominal region, etc., or a blood vessel. Throughout the specification, a "user" may be a medical expert including a doctor, a nurse, a medical laboratory technologist, a medical image expert, a technician repairing medical equipments, or the like.

[0046] FIG. **1** is a schematic block diagram of a handsfree ultrasound probe **100** according to an embodiment of the present invention. FIG. **2** is a block diagram of an ultrasound probe **200** shown in FIG. **1**. FIG. **3** is a block diagram of a support apparatus **300** shown in FIG. **1**. FIG. **4**A illustrates an external appearance of the support apparatus **300** shown in FIG. **1**. FIG. **4**B illustrates an internal appearance of the support apparatus **300** shown in FIG. **1**.

[0047] Referring to FIG. **1**, the handsfree ultrasound probe **100** includes the ultrasound probe **200** that photographs a target objet by using ultrasound to generate an ultrasound image and the support apparatus **300** that supports the ultrasound probe **200** to contact the target object.

[0048] The ultrasound probe **200** transmits ultrasound to the target object and receives an echo signal of the ultrasound from the target object. The ultrasound probe **200** may include a transmission unit **220**, a transducer **240**, and a receiving unit **260** as shown in FIG. **2**.

[0049] The transmission unit **220** provides the transducer **240** with a driving signal. The transmission unit **220** may include a pulse generation unit **222**, a transmission delay unit **224**, and a pulser **226**.

[0050] The pulse generation unit **222** generates rate pulses for forming transmission ultrasound according to a predetermined pulse repetition frequency (PRF). The transmission delay unit **224** applies delay time to the rate pulses generated by the pulse generation unit **222** to determine a transmission directionality. The rate pulses to which the delay time is applied respectively correspond to a plurality of unit devices included in the transducer **240**. The pulser **226** applies the driving signal (or a driving pulse) to the transducer **240** at timing corresponding to each of the rate pulses to which the delay time is applied. The unit devices may be in a one-dimensional array or a two-dimensional array.

[0051] The transducer **240** sends the ultrasound to the target object according to the driving signal provided by the transmission unit **220** and receives the echo signal of the ultrasound reflected from the target object. The transducer **240** may include a plurality of unit devices that convert an electrical signal into acoustic energy (or vice versa). The unit devices may be in a one-dimensional array or a two-dimensional array.

[0052] The transducer **240** may be implemented as a piezoelectric micromachined ultrasonic (pMUT) that inter-converts the ultrasound and the electrical signal by using a change in pressure while vibrating, a capacitive MUT (cMUT) that inter-converts the ultrasound and the electrical signal by using a change in capacitance, a magnetic MUT (mMUT) that inter-converts the ultrasound and the electrical signal by using a change in a magnetic field, an optical ultrasound detector that inter-converts the ultrasound and the electrical signal by using a change in an optical characteristic, etc.

[0053] The receiving unit **260** may generate ultrasound data by processing signals received from the transducer **240**, and include an amplifier **262**, an analogue digital converter (ADC) **264**, a receiving delay unit **266**, and a summing unit **268**.

[0054] The amplifier **262** amplifies the signals received from the transducer **240**. The ADC **264** AD-converts the amplified signals. The receiving delay unit **266** applies a

delay time used to determine a reception directionality to the digitally converted signals. The summing unit **268** generates the ultrasound data by summing signals processed by the receiving delay unit **266**. A reflective component may be emphasized from a direction determined by the reception directionality according to the summing performed by the summing unit **268**.

[0055] Although the ultrasound probe **200** necessarily includes the transducer **240**, some elements of the transmission unit **220** and the receiving unit **260** may be included in another apparatus. For example, the ultrasound probe **200** may not include the summing unit **268** of the receiving unit **260**.

[0056] The support apparatus **300** may include a housing **310** that forms an external appearance thereof and a first control unit **320** that controls an adhesive force with respect to a target object of the housing **310** according to whether the user touches at least one of the ultrasound probe **200** and the housing **310**.

[0057] The housing **310** may include an accommodation unit **312** that is capable of accommodating the ultrasound probe **200** and an adhesion unit **314** that is capable of being adhered to the target object. The ultrasound probe **200** may be detachable from the accommodation unit **312**. The accommodation unit **312** may be formed as a hole that passes through the housing **310** so that the ultrasound probe **200** may contact the target object but is not limited thereto. The accommodation unit **312** may be a groove formed inside the housing **310** or may be a space between a coverer **316** and the adhesion unit **314** of the housing **310**.

[0058] The adhesion unit **314** may be a floor surface of the housing **310** to contact the target object. When the accommodation unit **312** is formed as the hole or the groove, the adhesion unit **314** may be disposed to surround the accommodation unit **312**. When the accommodation unit **312** is a space inside the housing **310**, the adhesion unit **314** may be the whole floor surface of the housing **310**. The adhesion unit **314** may be formed of an elastic material. A shape of the adhesion unit **314** may be slightly changed according to an adhesive force with respect to the target object.

[0059] The first control unit **320** controls the adhesive force with respect to the target object of the adhesion unit **314** according to whether the user touches at least one of the ultrasound probe **200** and the housing **310**. For example, if it is detected that the user touches at least one of the ultrasound probe **200** and the housing **310**, the first control unit **320** controls the adhesive force to be smaller than a first reference value, and, if it is not detected that the user touches at least one of the ultrasound probe **200** and the housing **310**, the first control unit **320** controls the adhesive force to be greater than the first reference value. That is, the adhesive force with respect to the target object when a user touch is detected is smaller than that when the user touch is not detected. When the user touches the ultrasound probe **200** or the housing **310**, since the adhesive force with respect to the target object is weak, the handsfree ultrasound probe **100** may freely move. When the user does not touch the ultrasound probe **200** or the housing **310**, since the adhesive force with respect to the target object is strong, the handsfree ultrasound probe **100** may contact the target object.

[0060] The first control unit **30** may control an intensity of the adhesive force by using an amount of air between the adhesion unit **314** and the target object. For example, the first control unit **320** may include a vacuum pump capable of adjusting the amount of air. That is, the first control unit **320** may control the adhesive force to be stronger by reducing the amount of air between the adhesion unit **314** and the target object and may control the adhesive force to be weaker by increasing the amount of air between the adhesion unit **314** and the target object. The first control unit **320** may be disposed inside the housing **310** but is not limited thereto. The first control unit **320** may be disposed on the cover **316**.

[0061] In addition, the first control unit **320** may adjust the intensity of the adhesive force at plural steps. For example, if the user touch is not detected, the first control unit **320** controls the adhesive force to be greater than the first reference value, and, if the user touch is detected, when an angle movement of the ultrasound probe **200** is detected, the first control unit **320** controls the adhesive force to be smaller than the first reference value and to be greater than a second reference value. When the user touch is detected, if a rectilinear movement (for example, a movement in a normal line direction or a tangent line direction with respect to the target object) of the ultrasound probe **200** is detected, the first control unit **320** controls the adhesive force to be smaller than the second reference value. The first control unit **320** may include elements in addition to the vacuum pump. For example, the first control unit **320** may be a motor that applies a pressure to contact the adhesion unit **314** to the target object or that separates the adhesion unit **314** from the target object.

[0062] Since the adhesive force with respect to the target object differs according to whether there is the user touch as described above, the user does not need to place the handsfree ultrasound probe **100** in a specific portion of the target object and hold the handsfree ultrasound probe **100**. Thus, a pain in an arm that is like to occur by operating the ultrasound probe **200** may be reduced. The user may operate another function of an ultrasound diagnosis apparatus without using his/her hand to fix the ultrasound probe **200**, thereby conveniently operating the ultrasound diagnosis apparatus. Furthermore, the handsfree ultrasound probe **100** may photograph an image with respect to a specific region of the target object for a predetermined period of time without shaking, and thus the user may accurately diagnose the specific region.

[0063] FIG. **5** is a schematic block diagram of the handsfree ultrasound probe **100** according to another embodiment of the present invention. Referring to FIG. **5**, the handsfree ultrasound probe **100** may further include a sensor **330** that detects a user touch with respect to at least one of the ultrasound probe **200** and the housing **310** of the support apparatus **300**. The sensor **330** may be at least one of a touch sensor, a temperature sensor, a button sensor, a light sensor, and a pressure sensor. The sensor **330** may be disposed in the ultrasound probe **200** or in the housing **310** of the support apparatus **300**. If the sensor **330** is disposed in the ultrasound probe **200**, the sensor **330** may be electrically connected to the first control unit **320** when the ultrasound probe **200** is accommodated in the accommodation unit **312** of the support apparatus **300**. Thus, a detection result of the sensor **330** may be applied to the first control unit **320**.

[0064] FIG. **6** is a block diagram of the support apparatus **300** of the ultrasound probe **200** according to another embodiment of the present invention. FIG. **7** illustrates an internal appearance of the support apparatus **300** shown in FIG. **6**. Compared to the support apparatus **300** shown in FIG. **3**, the support apparatus **300** shown in FIG. **6** may further include a second control unit **340** that controls a movement of the ultrasound probe **200** according to whether a user touch is

detected. The second control unit **340** may include an actuator that is capable of moving such that the actuator may contact the ultrasound probe **200** or may be spaced apart from the ultrasound probe **200**. The actuator may be spaced apart from the ultrasound probe **200** such that the ultrasound probe **200** may move if the user touch is detected. The actuator may contact and fix the ultrasound probe **200** if the user touch is not detected.

[0065] The second control unit **340** may control a movement of the ultrasound probe **200** according to a protocol that is previous stored. FIG. **8** is a block diagram of the support apparatus **300** of the ultrasound probe **200** according to another embodiment of the present invention. Compared to the support apparatus **300** shown in FIG. **7**, the support apparatus **300** shown in FIG. **8** may further include a communication unit **350** that is capable of communicating with an external device. The external device may be a portable terminal as an apparatus capable of inputting a user command. If the ultrasound probe **200** is installed in the accommodation unit **312**, the first control unit **320** controls an adhesive force of the adhesion unit **314** to be smaller than a first reference value, and the second control unit **340** fixes the ultrasound probe **200**. If a user touch is not detected, the first control unit **320** controls the adhesive force of the adhesion unit **314** to be greater than the first reference value. In addition, if the user touch is not detected, and a user command used to move the ultrasound probe **200** is input through the communication unit **350**, the second control unit **340** may move the ultrasound probe **200** according to the user command. The user command may be remotely input. That is, the user command may be input via wireless communication. The second control unit **340** may move the ultrasound probe **200** at one or more degrees of freedom.

[0066] Furthermore, if the user command is a movement command according to a protocol that is previous stored. For example, a movement trace of the ultrasound probe **200** may be previously stored according to a type (liver, abdomen, etc.) of a target object that is to be photographed. If a user command used to select the type of the target object is input, the second control unit **340** may move the ultrasound probe **200** to a movement trace corresponding to a selected type of the target object. The communication unit **350** is disposed in the support apparatus **300** in FIG. **7** but is not limited thereto. The communication unit **350** may be disposed in the ultrasound probe **200**, and, when the ultrasound probe **200** is accommodated in the accommodation unit **312**, may be electrically connected to the second control unit **340**.

[0067] FIGS. **9**A through **9**C illustrate examples of a user command used to move the handsfree ultrasound probe **100** according to embodiments of the present invention.

[0068] Referring to FIG. **9**A, after contacting the handsfree ultrasound probe **100** to a target object, a user may move the ultrasound probe **200** at one or more degrees of freedom while holding the ultrasound probe **200**.

[0069] Alternatively, the user ends touching the handsfree ultrasound probe **100** while contacting the handsfree ultrasound probe **100** to the target object. Referring to FIG. **9**B, a user control apparatus, for example, a portable terminal, may be used to control a movement of the ultrasound probe **200**. Since a gyro sensor, an acceleration sensor, etc, are embedded in the portable terminal, if the user moves the portable terminal at one or more degrees of freedom, a movement of the portable terminal is transmitted to the handsfree ultrasound probe **100**, and the ultrasound probe **200** may move in correspondence to the movement of the portable terminal.

[0070] Alternatively, referring to FIG. **9**C, an icon **910** used to control a movement of the ultrasound probe **200** may be disposed in the user control apparatus. The user may control the movement of the ultrasound probe **200** by using the icon **910**.

[0071] FIG. **10** illustrates an external appearance of the handsfree ultrasound probe **100** according to another embodiment of the present invention. Referring to FIG. **10**, the housing **310** of the support apparatus **300** may be configured as the adhesion unit **314** and the cover **316**, and the ultrasound probe **200** may be disposed in an inner space between the adhesion unit **314** and the cover **316**. The ultrasound probe **200** may further include a wireless communication unit (not shown) that is capable of communicating with an external device (for example, a signal processing apparatus). Thus, the wireless communication unit may communicate data according to the digital imaging and communication in medicine (DICOM) standard.

[0072] FIG. **11** is a flowchart of a method of operating the handsfree ultrasound probe **100** according to an embodiment of the present invention. Referring to FIG. **11**, the sensor **330** detects whether a user touches the handsfree ultrasound probe **100** (operation S**1110**). The sensor **330** may be disposed in the ultrasound probe **200** or in the support apparatus **300**. The sensor **330** may be a touch sensor that is capable of detecting a user touch but is not limited thereto. The sensor **330** may be one of a temperature sensor, a button sensor, a light sensor, and a pressure sensor.

[0073] If a user touch is detected (operation S**1110**—Y), the first control unit **320** may control an adhesive force of the handsfree ultrasound probe **100** with respect to a target object to be smaller than a first reference value (operation S**1120**). Thus, the user may separate the handsfree ultrasound probe **100** from the target object.

[0074] If the user touch is not detected (operation S**1110**—N), the first control unit **320** may control the adhesive force of the handsfree ultrasound probe **100** with respect to the target object to be greater than the first reference value (operation S**1130**). Thus, the user may fix the handsfree ultrasound probe **100** to the target object without touching the handsfree ultrasound probe **100** so that the handsfree ultrasound probe **100** may continuously irradiate ultrasound to a specific region of the target object. Alternatively, the user may remotely move the ultrasound probe **200** and photograph an ultrasound image while contacting the ultrasound probe **200** to the target object. For example, if the user touch is not detected, and a user command used to move the ultrasound probe **200** is input, the second control unit **340** may move the ultrasound probe **200** in correspondence to the user command.

[0075] As described above, according to the one or more of the above embodiments of the present invention, a user may not hold an ultrasound probe during a diagnosis, thereby increasing a user convenience.

[0076] The ultrasound probe moves according to a protocol that is previous stored, thereby more accurately photographing an ultrasound image.

[0077] It should be understood that the exemplary embodiments described therein should be considered in a descriptive sense only and not for purposes of limitation. Descriptions of features or aspects within each embodiment should typically be considered as available for other similar features or aspects in other embodiments.

[0078] While one or more embodiments of the present invention have been described with reference to the figures, it will be understood by those of ordinary skill in the art that various changes in form and details may be made therein without departing from the spirit and scope of the present invention as defined by the following claims.

What is claimed is:

1. A support apparatus of an ultrasound acoustic probe, the support apparatus comprising:

a housing comprising an accommodation unit capable of accommodating an ultrasound probe and an adhesion unit capable of contacting a target object; and

a first control unit for controlling an adhesive force with respect to the target object of the adhesion unit according to whether a user touches at least one of the ultrasound probe and the housing.

2. The support apparatus of claim **1**, wherein the adhesive force when a user touch is detected is smaller than that when the user touch is not detected.

3. The support apparatus of claim **1**, wherein the first control unit controls the adhesive force to be smaller than a first reference value if a user touch is detected, and controls the adhesive force to be greater than the first reference value if the user touch is not detected.

4. The support apparatus of claim **1**, wherein the first control unit is capable of adjusting an intensity of the adhesive force at steps.

5. The support apparatus of claim **1**, wherein the first control unit controls the adhesive force by using an amount of air between the adhesion unit and the target object.

6. The support apparatus of claim **5**, wherein the first control unit comprises a vacuum pump that adjusts the amount of air.

7. The support apparatus of claim **1**, further comprising: a second control unit for controlling a movement of the ultrasound probe according to whether the user touches at least one of the ultrasound probe and the housing.

8. The support apparatus of claim **7**, wherein the second control unit comprises an actuator that is capable of moving such that the actuator contacts the ultrasound probe or is spaced apart from the ultrasound probe.

9. The support apparatus of claim **8**, wherein the actuator is spaced apart from the ultrasound probe such that the ultrasound probe moves if the user touch is detected, and fixes the ultrasound probe if the user touch is not detected.

10. The support apparatus of claim **8**, wherein the actuator moves the ultrasound probe in correspondence to a user command used to move the ultrasound probe if the user touch is not detected, and the user command is input.

11. The support apparatus of claim **10**, wherein the actuator moves at a trace of a protocol that is previously stored in correspondence to the user command.

12. The support apparatus of claim **10**, wherein the user command is remotely input.

13. The support apparatus of claim **1**, wherein the first control unit receives whether the user touches at least one of the ultrasound probe and the housing from a sensor disposed in at least one of the ultrasound probe and the housing.

14. The support apparatus of claim **13**, wherein the sensor comprises at least one of a touch sensor, a temperature sensor, a button sensor, a light sensor, and a pressure sensor.

15. The support apparatus of claim **1**, wherein the ultrasound probe is detached from the accommodation unit.

16. A handsfree ultrasound probe comprising:

an ultrasound probe for irradiating ultrasound to a target object and receiving an echo signal of the ultrasound;

an accommodation unit for accommodating the ultrasound probe; and

an adhesion unit for contacting the target object.

17. The handsfree ultrasound probe of claim **16**, further comprising: a first control unit for controlling an adhesive force with respect to the target object of the adhesion unit according to whether a user touches the handsfree ultrasound probe.

18. The handsfree ultrasound probe of claim **17**, wherein the first control unit controls the adhesive force when a user touch is not detected to be greater smaller than that when the user touch is detected.

19. A method of operating a handsfree ultrasound probe, the method comprising:

detecting whether a user touches the handsfree ultrasound probe; and

controlling an adhesive force of the handsfree ultrasound probe with respect to a target object to be smaller than a first reference value if it is detected that the user touches the handsfree ultrasound probe.

20. The method of claim **19**, further comprising: controlling the adhesive force of the handsfree ultrasound probe with respect to the target object to be greater than the first reference value if it is not detected that the user touches the handsfree ultrasound probe.

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专利名称(译)	超声波探头的支撑装置，包括支撑装置的免提超声波探头，以及操作支撑装置的方法		
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摘要(译)

一种超声波探头的支撑装置，包括该支撑装置的免提超声波探头，以及操作该支撑装置的方法。支撑装置包括：壳体，包括能够容纳超声探头的容纳单元和能够接触目标物体的粘附单元;第一控制单元，用于根据用户是否接触超声波探头和壳体中的至少一个来控制相对于粘附单元的目标物体的粘合力。