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(54) **ULTRASONIC DIAGNOSTIC DEVICE**

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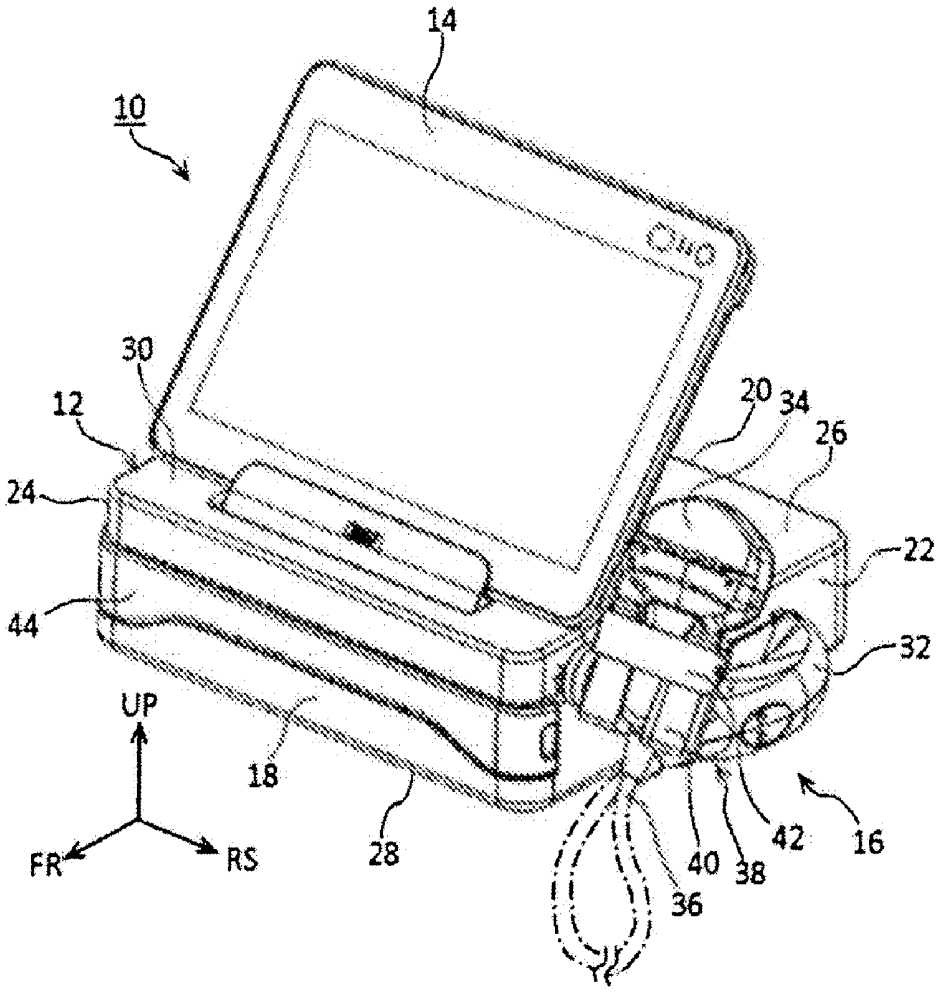
(57) **ABSTRACT**

An ultrasonic diagnostic device (**10**) has a probe holder (**38**) that is mounted on a side surface of a device main body (**12**). The probe holder (**38**) holds a probe head (**34**) of an ultrasonic probe. The probe holder (**38**) can rotate around an axis line that extends in the left-right direction and can be stopped in a desired position. The orientation, with respect to the device main body (**12**), of the probe head that is held by the probe holder (**38**) can be altered.



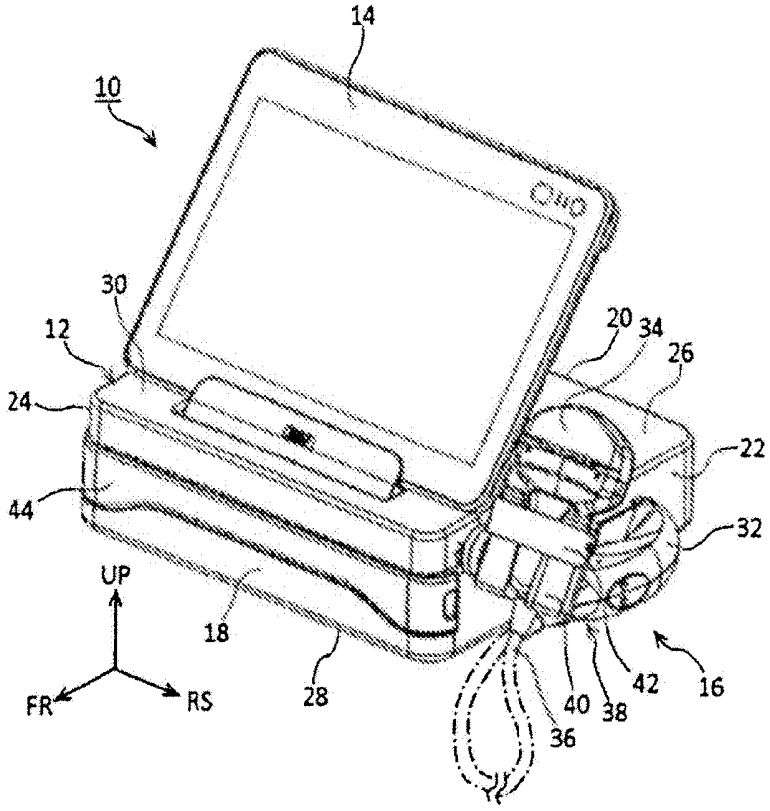

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FIG. 1

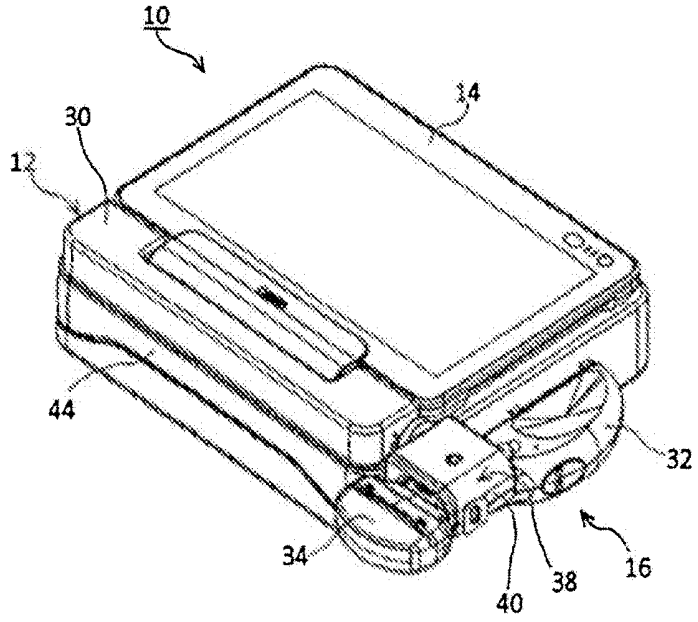
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FIG. 2

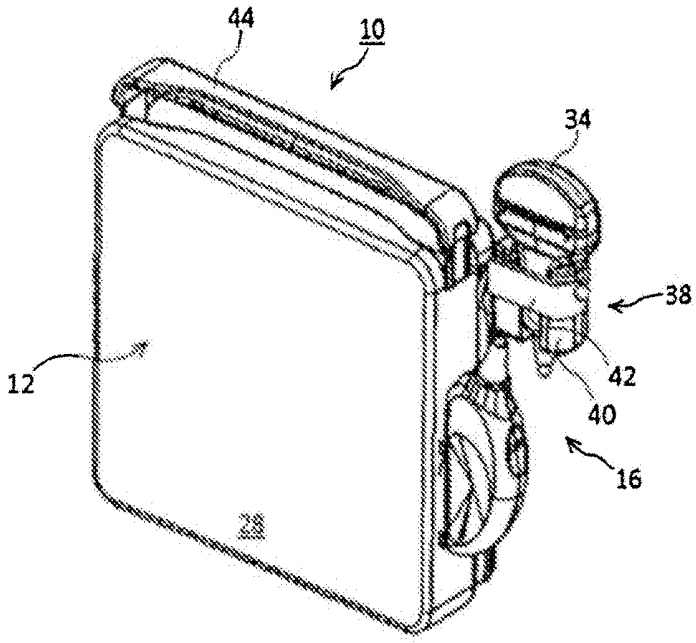


FIG. 3

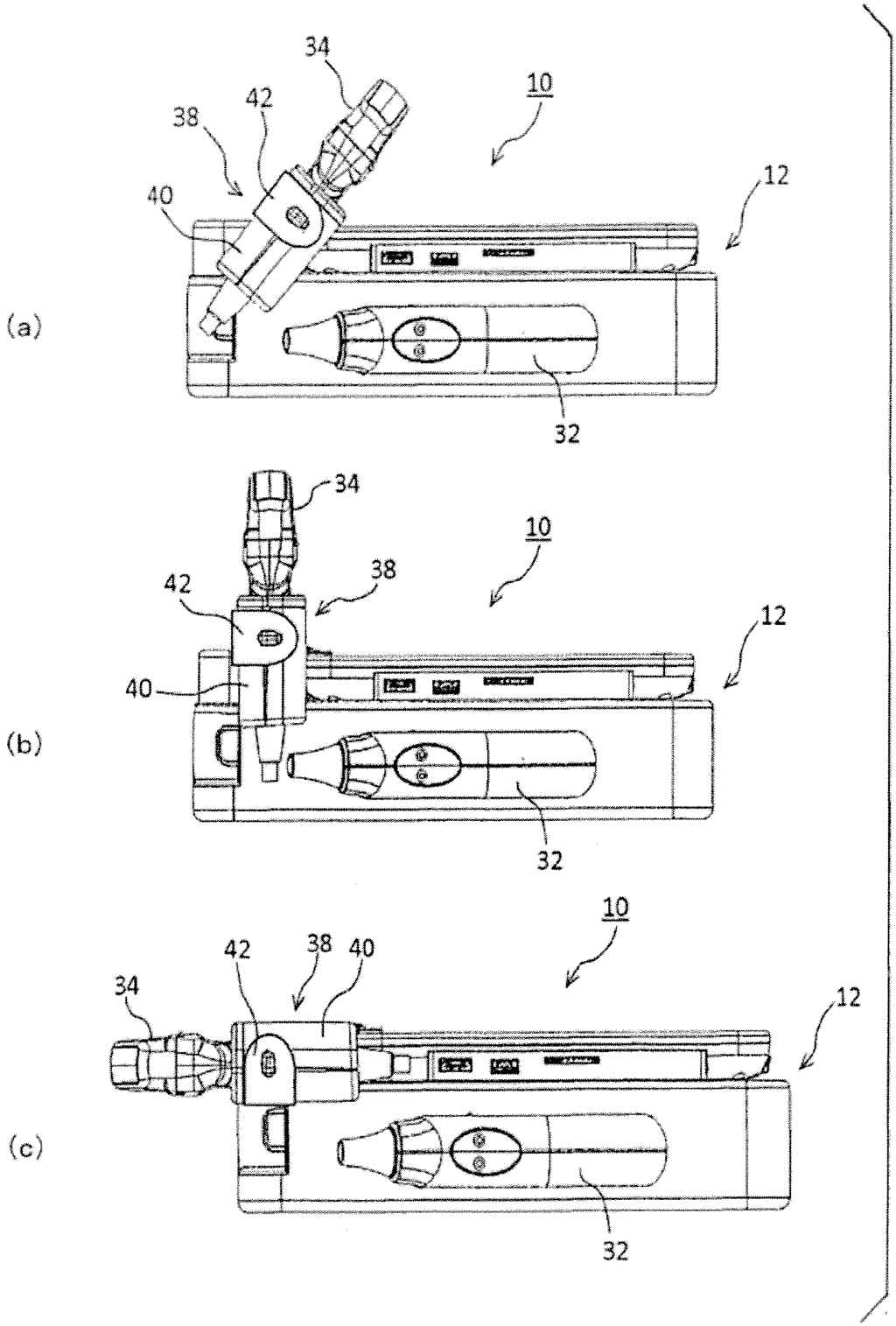
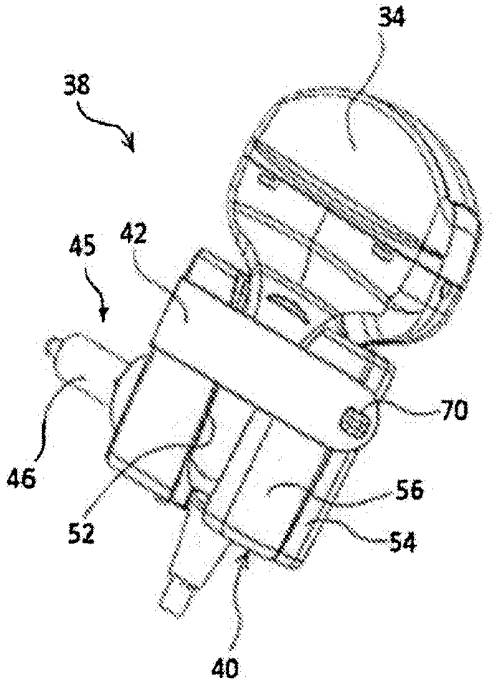


FIG.4



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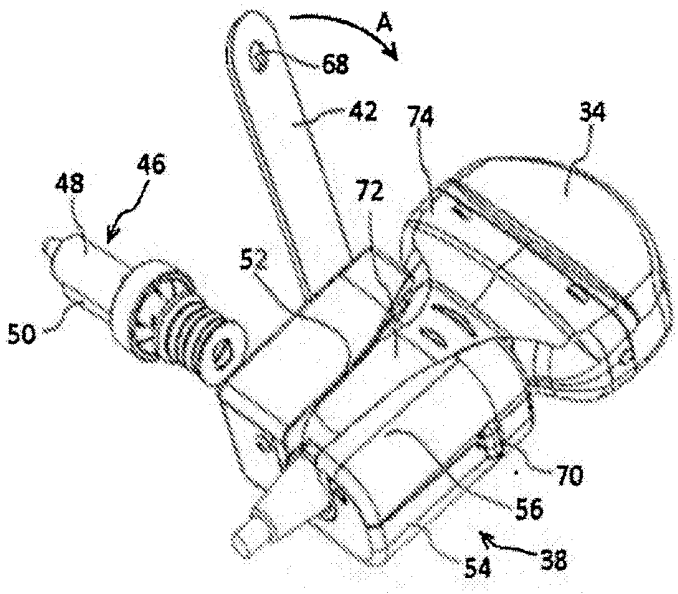

FIG. 6

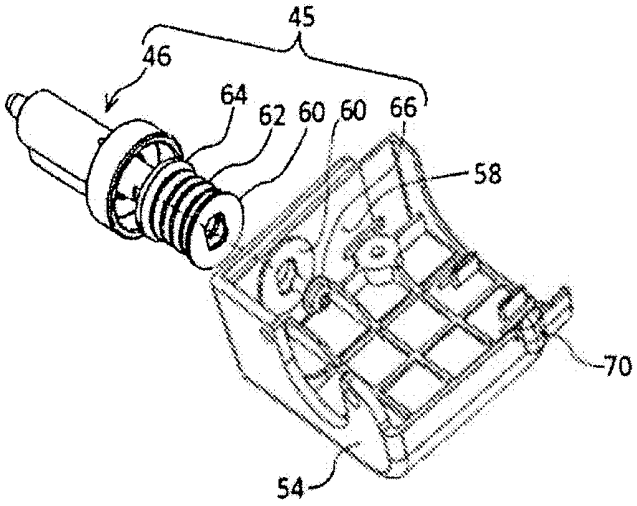

FIG. 7

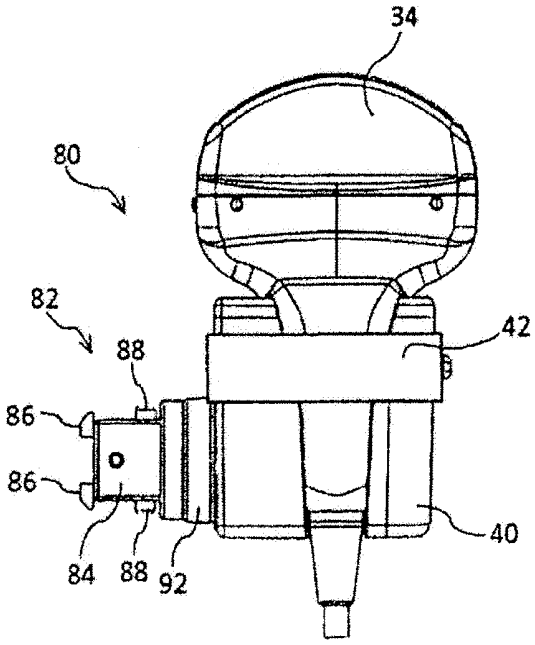

FIG. 8

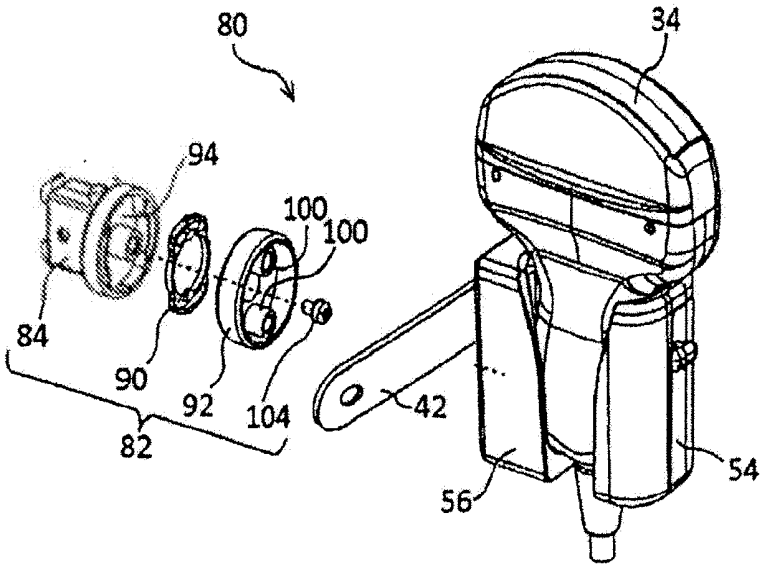

FIG. 9

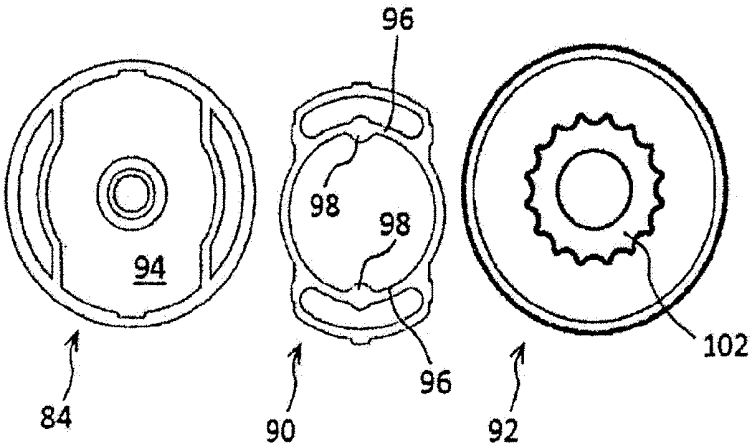

FIG. 10

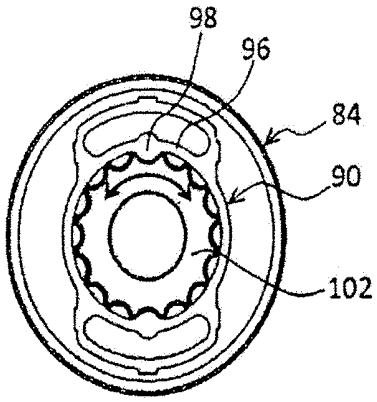

FIG. 11

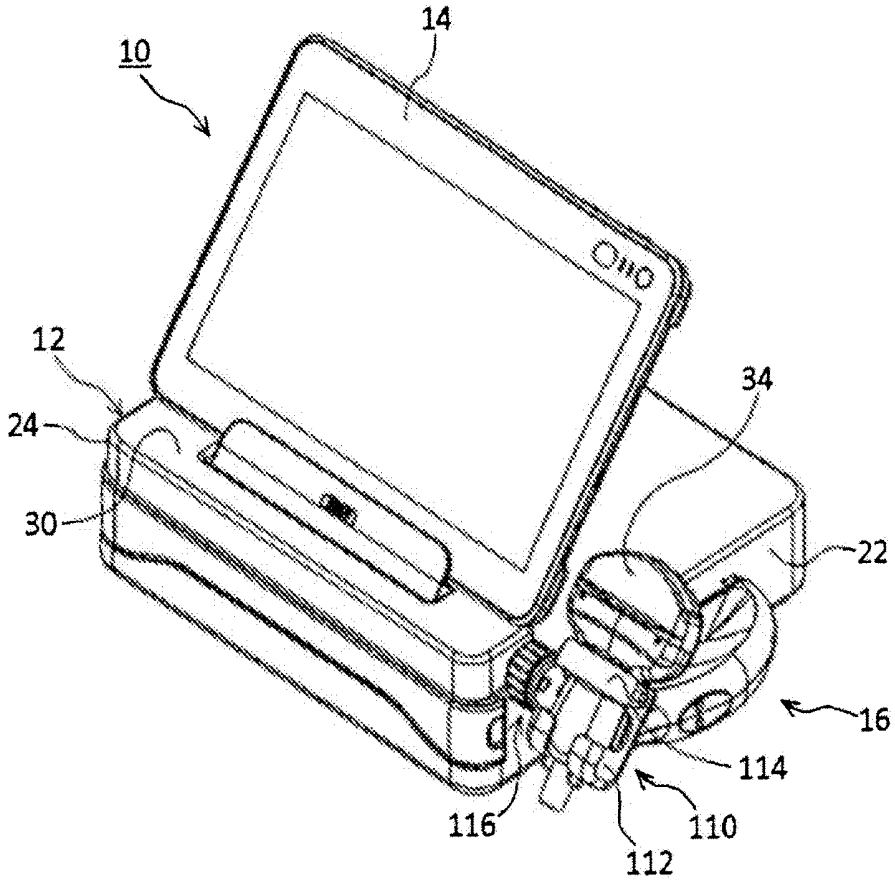

FIG. 12

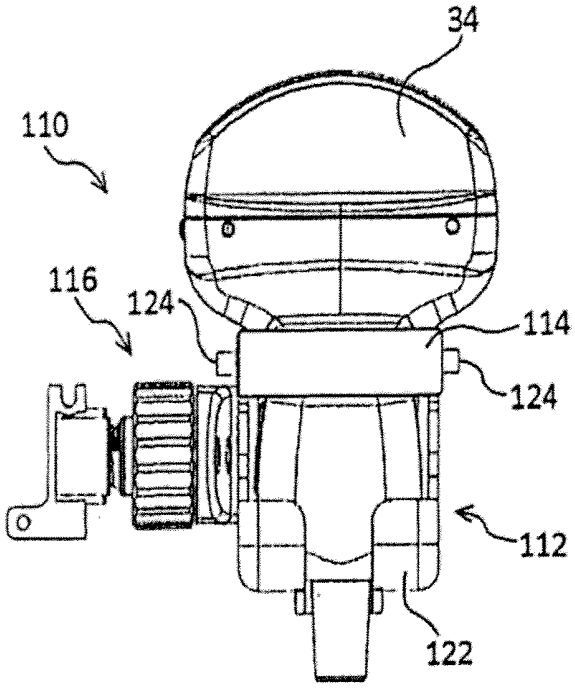

FIG. 13

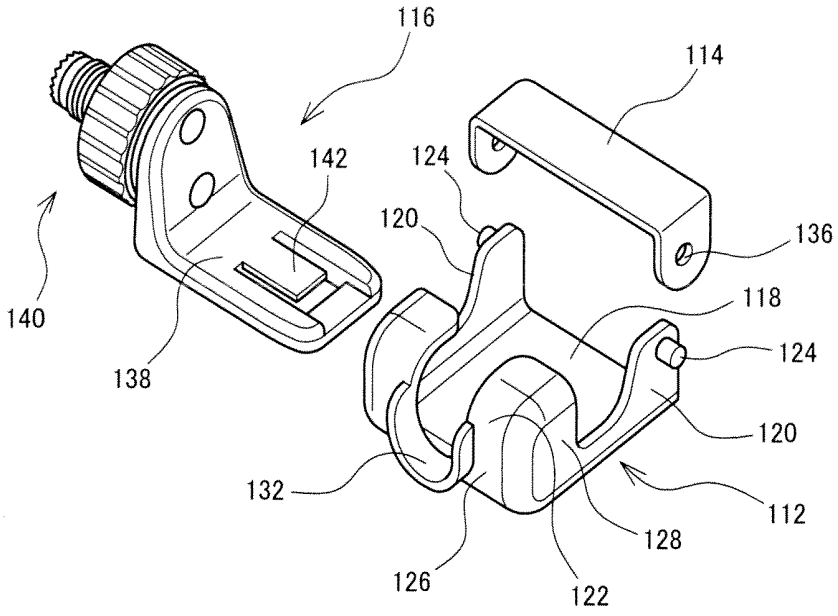

FIG. 14

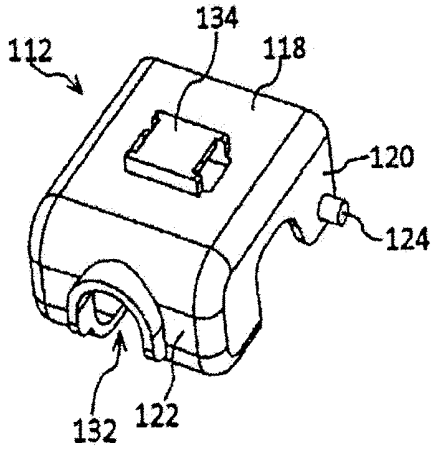
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FIG. 15

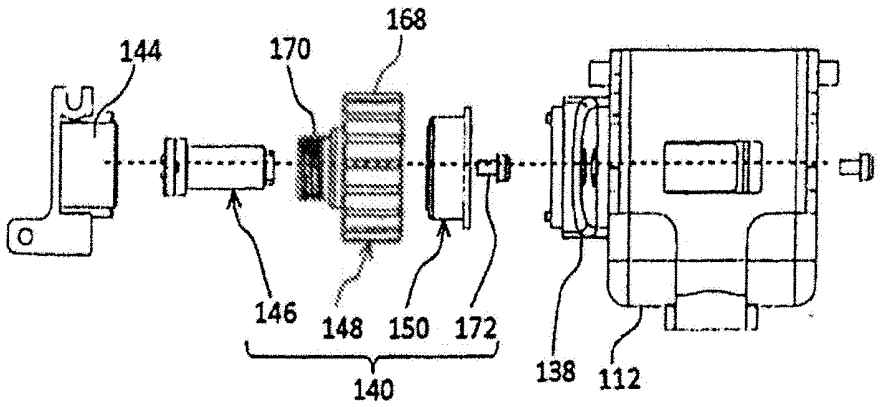
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FIG. 16

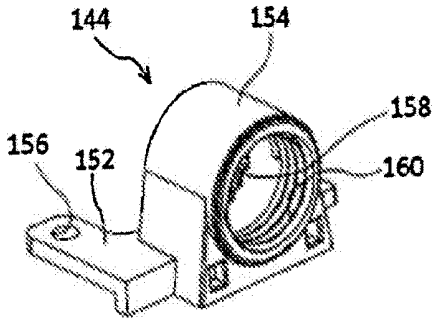

FIG. 17

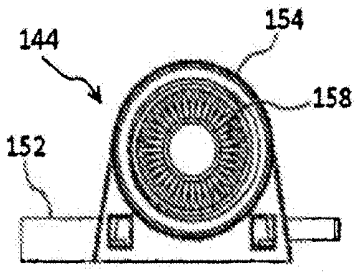

FIG. 18

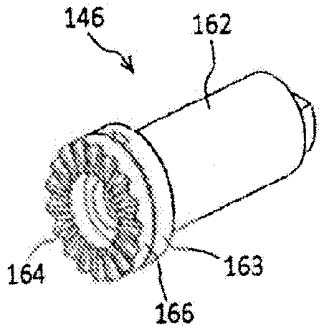

FIG. 19

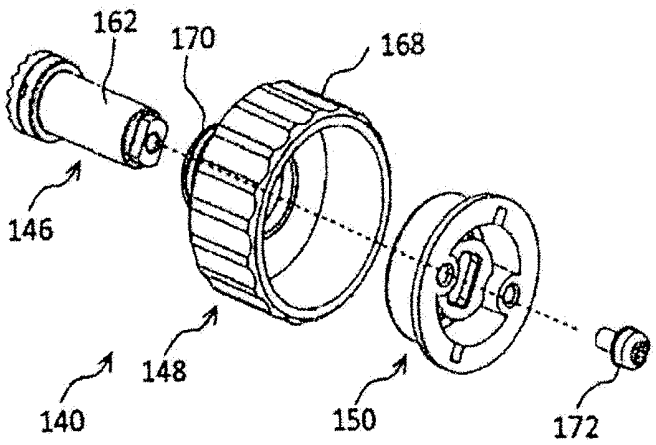

FIG. 20

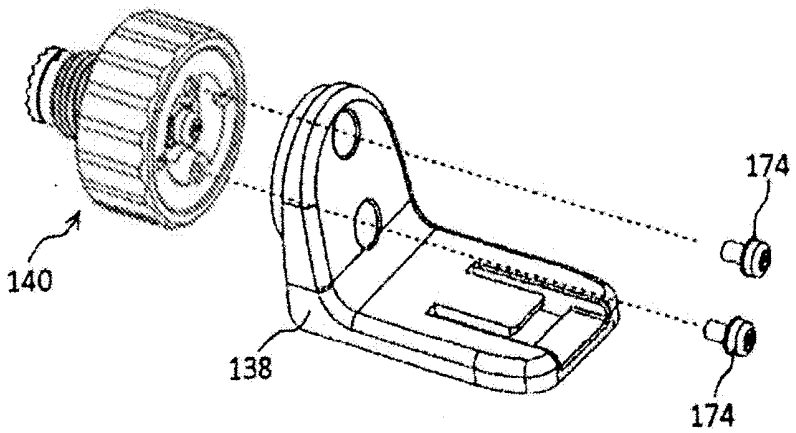

FIG. 21

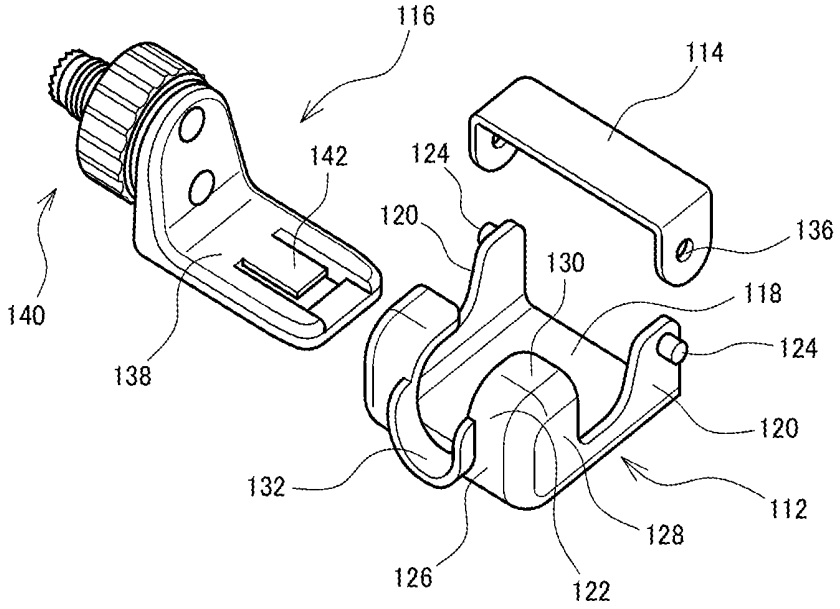
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FIG. 14

ULTRASONIC DIAGNOSTIC DEVICE

TECHNICAL FIELD

[0001] The present invention relates to an ultrasonic diagnostic device, and more particularly to a structure for holding a probe head of an ultrasonic probe.

BACKGROUND

[0002] Ultrasonic diagnostic devices transmit ultrasound waves through a body surface of an examinee into the body, receive ultrasound waves reflected within the body, and, using signals based on the received ultrasound waves, obtain tomographic images or images concerning blood flows. Ultrasound waves are transmitted and received to and from the examinee by an ultrasonic probe. An ultrasonic diagnostic device includes a main body having main elements forming the device, an ultrasonic probe that transmits and receives ultrasound waves to and from an examinee and is detachable with respect to the main body, an operation panel including switches, keys, and other components for operating the device, and a display device designed for displaying an image based on the ultrasound waves.

[0003] The ultrasonic probe includes a probe connector to be connected to the main body of an ultrasonic diagnostic device, a probe head which is brought into contact with the body surface of an examinee, and a probe cable coupling the probe connector and the probe head. The probe head includes ultrasonic transducers for transmitting and receiving ultrasound waves. The ultrasonic probe includes a probe head having a shape corresponding to a target portion, which is replaceable in accordance with the target portion.

[0004] To perform ultrasonic diagnosis, an operator obtains an ultrasound image while holding the probe head with one hand to bring the probe head into contact with a surface of an examinee and move the probe head on the surface, and operating the operation panel with the other hand. When not in use, the ultrasonic probe is held with the probe head hanging on a probe holder mounted on the ultrasonic diagnostic device. Patent Document 1 listed below discloses a foldable probe holder.

CITATION LIST

Patent Literature

[0005] Patent Document 1: JP 2010-188126 A

SUMMARY

Technical Problem

[0006] The orientation of a probe head held by a conventional probe holder is fixed with respect to a main body of a device.

[0007] An object of the invention is to provide a probe holder that holds a probe head such that the orientation of the probe head with respect to a device main body can be varied.

Solution to Problem

[0008] An ultrasonic diagnostic device according to an embodiment of the invention includes an ultrasonic diagnostic device main body, and a probe holder that holds a probe head of an ultrasonic probe, which is mounted on a side surface of the ultrasonic diagnostic device main body and is rotatable about an axis extending in a lateral direction. The probe holder configured to be rotatable with respect to the ultrasonic diagnostic device main body allows variation in the orientation of the probe head with respect to the ultrasonic diagnostic device main body.

[0009] The probe holder may be retained at a desired rotation position. The probe holder may be configured to be mountable on either a left or right side surface.

[0010] The ultrasonic diagnostic device can be portable.

Advantageous Effects of Invention

[0011] The configuration of the probe holder which is rotatable with respect to the ultrasonic diagnostic device main body enables the probe head held by the probe holder to be placed in a desired orientation. The probe head can be placed in a desired orientation even when the position of the ultrasonic diagnostic device main body is changed.

BRIEF DESCRIPTION OF DRAWINGS

[0012] FIG. **1** illustrates the outer appearance of an ultrasonic diagnostic device **10**, with a display device **14** being raised.

[0013] FIG. **2** illustrates the outer appearance of the ultrasonic diagnostic device **10**, with a display device **14** being laid down.

[0014] FIG. **3** illustrates the outer appearance of the ultrasonic diagnostic device **10**, with a device main body **12** being raised.

[0015] FIG. **4** is a right side view of an ultrasonic diagnostic device **10**, showing rotation of a probe holder **38**.

[0016] FIG. **5** illustrates the probe holder **38** holding a probe head **34** with a belt **42** being fastened.

[0017] FIG. **6** is an exploded view of the probe holder **38**, illustrating the probe holder **38** holding the probe head **34** without the belt **42** being fastened.

[0018] FIG. **7** is an exploded view of a part of the probe holder **38**.

[0019] FIG. **8** illustrates another probe holder **80**.

[0020] FIG. **9** is an exploded perspective view of the probe holder **80**.

[0021] FIG. **10** illustrates a bracket **84**, a ratchet **90**, and a gear **92** individually.

[0022] FIG. **11** illustrates the bracket **84**, the ratchet **90**, and the gear **92** in an assembly.

[0023] FIG. **12** is a perspective view of an ultrasonic diagnostic device including another probe holder **110**.

[0024] FIG. **13** illustrates the probe holder **110**.

[0025] FIG. **14** illustrates a holder supporting portion **116** and a receiving portion **112** of the probe holder **110** separately.

[0026] FIG. **15** illustrates a back surface of a receiving section **112**.

[0027] FIG. **16** is an exploded view of the probe holder **110**.

[0028] FIG. **17** is a detailed view of a shaft holder **144**.

[0029] FIG. **18** is a detailed view of the shaft holder **144**.

[0030] FIG. **19** is a detailed view of a shaft **146**.

[0031] FIG. **20** is an exploded view of a positioning portion **140**.

[0032] FIG. **21** illustrates a support arm **138** and the positioning portion **140** separately.

DESCRIPTION OF EMBODIMENTS

[0033] Embodiments of the invention will be described hereinafter with reference to the drawings. FIGS. **1** to **3** are perspective views illustrating the outer appearance of an ultrasonic diagnostic device **10**. The ultrasonic diagnostic device **10** includes a device main body **12** which is substantially a rectangular parallelepiped, a display device **14** which is rotatable with respect to the device main body **12**, and an ultrasonic probe **16** which is detachable with respect to the device main body **12**. FIG. **1** illustrates a normal state of use of the ultrasonic diagnostic device **10**, and the ultrasonic diagnostic device **10** is placed on a desk or a stand, with the display device **14** facing an operator. A surface of the device main body **12** facing the operator; that is, a surface facing in the direction indicated by an arrow FR, is referred to as a main body front surface **18**, and a surface opposite the main body front surface **18** is referred to as a main body back surface **20**. A surface facing in the direction of an arrow RS is referred to as a main body right side surface **22**, and a surface opposite the main body right side surface **22** is referred to as a main body left side surface **24**. A surface facing in the direction of an arrow UP is referred to as a main body top surface **26**, and a surface opposite the main body top surface **26** is referred to as a main body bottom surface **28**. The device main body **12**, in its normal state of use, has a flat rectangular parallelepiped shape having a shorter length in the vertical direction. The main body top surface **26** and the main body bottom surface **28** are the largest surfaces of the rectangular parallelepiped. The dimension in the lateral direction is greater than the dimension in the depth direction, and the main body front surface **18** and the main body back surface **20** are the second largest surfaces. The main body top surface **26** is stepped and a portion with a higher level (hereinafter referred to as a mount portion **30**) extends along the entire length of an edge on the front surface side.

[0034] The device main body **12** accommodates a transmitting and receiving circuit for driving ultrasonic transducers included in the ultrasonic probe **16**, a signal processing circuit for processing received ultrasound signals, a control circuit for controlling the transmitting and receiving circuit and the signal processing circuit, a power source circuit for supplying a power source to each circuit, and an interface for transmitting and receiving information to and from external devices, for example.

[0035] The display device **14** is disposed on the main body top surface **26**. The display device **14**, when positioned along the main body top surface **26** (see FIG. **2**), occupies the lower level portion of the main body top surface **26** to thereby form, with the device main body **12**, a substantially rectangular parallelepiped as a whole. The display device **14** has a thickness which is substantially the same as the height of the step or the height of the mount portion **30**. The display device **14** is a touch panel display and also functions as an operation panel. The display device **14** is rotatably supported on the mount portion **30**, and can be used at the position along the main body top surface **26** as illustrated in FIG. **2** or can be rotated and raised for use as illustrated in FIG. **1**.

[0036] The ultrasonic probe **16** includes a probe connector **32**, a probe head **34**, and a probe cable **36**. The probe connector **32** is attached to and detached from a connector receiver (not shown) in the device main body **12**. The connector receiver is formed on the main body right side surface **22** in the ultrasonic diagnostic device **10**. The connector receiver may be formed on the main body left side surface **24** or on the main body back surface **20**, and may be formed on two of these three surfaces or on all the three surfaces. The probe head **34** includes ultrasonic transducers formed of a plurality of elements, and is brought into contact with a body surface of an examinee for transmitting and receiving ultrasound waves. The probe cable **36** connects the probe connector **32** and the probe head **34**. The probe cable **36** contains lines for connecting the elements of the ultrasonic transducers in the probe head **34** with the ultrasound transmitting and receiving circuit within the device main body **12**. The probe cable **36** is not shown in the drawings other than FIG. **1**.

[0037] The probe head **34** is held by a probe holder **38** rotatably mounted on the device main body **12**. In the ultrasonic diagnostic device **10**, the probe holder **38** is mounted on the main body right side surface **22**, and more preferably on the right end of the mount portion **30** such that the probe holder **38** can rotate about an axis extending in the lateral direction. The probe holder **38** may be detachable from the device main body **12**. The probe holder **38** may be mounted on the main body left side surface **24** or may be mounted on both side surfaces **22** and **24**. The probe holder **38** may also be mounted on the surface where the probe connector **32** is mounted. A single probe holder **38** may be configured to be mountable on either the right or left side surface **22** or **24**.

[0038] The probe holder **38** includes a housing **40** that houses a portion of the probe head **34**, particularly a grip portion, and a belt **42** that binds, together with the housing **40**, the portion of the probe head **34** which is housed, from the outer periphery. The belt **42** is made of a pliable or flexible material. The belt **42** enables reliable holding of the probe head **34**. The probe holder **38** will be described in detail below.

[0039] FIG. **3** illustrates the ultrasonic diagnostic device **10** in a raised state in which the main body back surface **20** faces downward and the main body front surface **18** faces upward. The probe holder **38** is rotated such that the probe head **34** faces upward; that is, a surface of the probe head **34** that transmits and receives ultrasound waves faces upward. The probe head **34**, which is thus held while facing upward, is prevented from being removed from the probe holder **38**. The probe head **34** can be held further reliably by fastening the belt **42**. A carrying handle **44** is stored in the main body front surface **18** of the device main body **12**. In a normal state, as illustrated in FIGS. **1** and **2**, a surface of the carrying handle **44** is flush with and forms a portion of the main body front surface **18**. As illustrated in FIG. **3**, the carrying handle **44** can be pulled out of the device main body **12** by a predetermined amount and gripped in this state, so that the ultrasonic diagnostic device **10** can be carried. A device which can be transported by a hand as described above is referred to as a portable ultrasonic diagnostic device. During transportation, it is possible to prevent the probe head **34** from dropping off, by holding the probe head **34** facing upward or binding the probe head **34** with the belt **42** to securely hold the probe head **34**.

[0040] FIG. **4** is a right side view of the ultrasonic diagnostic device **10** placed flat; that is, placed with the main body bottom surface **28** facing downward, and shows how the probe holder **38** rotates. Specifically, the probe holder **38** is tilted backward in (a) in FIG. **4**, stands vertically in (b), and faces front in (c). The probe holder **38** of the ultrasonic

diagnostic device **10** is rotatable within a range of states (a) to (c). The range of rotation of the probe holder can be increased or decreased.

[0041] FIGS. **5**, **6**, and **7** illustrate the probe holder **38** in detail. The probe holder **38** includes the housing **40** and the belt **42** as described above, and also includes a holder support **45**. The holder support **45** is mounted onto the device main body **12** to support the housing **40**. The holder support **45** includes a bracket **46** configured to be inserted into a bracket receiver (not shown) formed in the device main body **12**. The bracket **46** includes a shaft **48** having a circular cross section, and a key **50** projecting from the shaft **48** in the radial direction. When the bracket **46** is inserted into the device main body **12**, the key **50** prevents the bracket **46** from rotating. Further, the bracket **46** is held within the bracket receiver by friction.

[0042] The housing **40** has a receiving groove **52** on a front surface thereof (i.e., a surface facing the operator in use). The receiving groove **52** extends in an in-plane direction orthogonal to the rotation axis of the probe holder **38**. The receiving groove **52** is open at the respective ends of the housing **40**, so that the probe head **34** is placed within the receiving groove **52** with its axis aligned in the extending direction of the receiving groove **52**. The receiving groove **52** has a narrow width on the front surface and has a wider width toward the back. This narrow portion prevents the probe head **34** which is contained from projecting beyond the front surface. The probe head **34** can be placed within the probe holder **38** by passing the thin portion of the probe head **34** (e.g., a portion to be held by the operator) or the probe cable **36** through the opening on the front surface side of the receiving groove **52**. The housing **40** includes a hard base **54** illustrated in FIG. **7** and a soft or flexible holding portion **56** attached to the base **54**. The holding portion **56**, with flexibility thereof, deforms to conform to the shape of the probe head **34** and holds the probe head **34** from the circumference thereof. The receiving groove **52** is formed in the holding portion **56**.

[0043] The bracket **46** and the housing **40**, particularly the base **54**, are coupled together in a relatively rotatable manner by a friction coupling structure. To form a friction coupling structure, the holder support **45** includes two friction plates **60**, a disc spring **62**, a washer **64**, and a screw **66**. The two friction plates **60** are disposed to sandwich a side plate **58** of the base **54**, and a plurality of disc springs **62** and a single washer **64** are further stacked toward the bracket **46**, all of which are then fastened to the bracket **46** as a single unit, via the screw **66** passing therethrough from the direction of the base **54**. The friction plates **60** are fixed to the bracket **46**, and the friction plates **60** and the base **54** rotate relative to each other. Friction generated between the friction plates **60** and the base **54** makes the probe holder **38** at rest.

[0044] The belt **42** is made of a pliable or flexible material similar to that of the holding portion **56**, and is integrally molded with the holding portion **56**. The belt **42** has a base end located on the side of the housing **40** where the bracket **46** is coupled. The belt **42** also has a tip portion having an engaging hole **68**. Engagement of the engaging hole **68** with an engaging projection **70** formed integrally with the base **54** fixes a free end of the belt **42**.

[0045] The probe head **34** illustrated in each drawing is a convex type with a tip portion **74** that stores ultrasonic transducers having a broader width than that of a grip **72** to be held by the operator. The probe holder **38** uses this difference in width to hold the probe head **34**. When the grip **72** is stored within the probe holder **38** with the tip end of the probe head **34** facing upward, a step formed between the tip portion **74** and the grip **72** engages with edges of the probe holder **38** to thereby hold the probe head **34**. If the operator wishes to temporarily release the probe head **34** from his/her hand during diagnosis, for example, the operator brings the probe head **34** into engagement with the probe holder **38**. When the probe head **34** is not to be used for a long time, or when the ultrasonic diagnostic device **10** is being carried, the belt **42** is bent in the direction of an arrow A in FIG. **6** for fastening, to thereby hold the probe head **34** more reliably. By fastening the belt **42**, the holding portion **56** deforms to adhere to the probe head **34** more closely for binding the probe head **34**. When not in use, the belt **42** may be bent around the back surface of the housing **40** (the surface of the base **54**) and fixed to the engaging projection **70**.

[0046] The rotation axis of the probe holder **38** and the center axis of the probe head **34** held by the probe holder **38** are positioned to intersect each other, particularly to be orthogonal to each other. This structure enables the probe head **34** to be held facing upward, whether the device body **12** is placed flat as illustrated in FIG. **1** or is raised as illustrated in FIG. **3**. As described above, the probe head **34** is held with its step hanging on the probe holder **38**, and is in a stable state when held facing upward. The probe holder **38**, which is rotatable, can hold the probe head **34** facing upward even when the device body **12** changes its position.

[0047] The probe head may have various shapes, but generally includes the grip portion having substantially the same shape, particularly substantially the same diameter. Various types of probe head can be therefore held with a single housing **40**. The holding portion **56** of the probe holder **38** which contacts the probe head is pliable, and deforms, because of pliability thereof, to conform to different shapes of the probe head. When the movement of the ultrasonic diagnostic device **10** is large, such as when it is being carried, fastening of the belt **42** enables reliable holding of the probe head having various shapes. The belt **42** may contact the probe head **34** or contact the holding portion **56** only. The belt **42** can be shrinkable so as to bind the probe head more firmly.

[0048] FIG. **8** to FIG. **11** illustrate another example probe holder. Components similar to those of the probe holder **38** described above are denoted with similar numerals and their descriptions will not be repeated. A probe holder **80** illustrated in FIG. **8** to FIG. **11** includes a holder support **82** having a structure which is different from that of the holder support **45** of the probe holder **38**. The housing **40** and the belt **42** are similar to those described above.

[0049] The holder support **82** is mounted onto the device body **12** to hold the housing **40**. The holder support **82** includes a bracket **84** to be inserted in a bracket receiver (not shown) formed in the device body **12**. The bracket **84** has a rectangular cross section which is orthogonal to the rotation axis of the probe holder **80**. The bracket receiver formed in the device body **12** also has a rectangular cross section. The rectangular cross sections of the bracket **84** and the bracket receiver prohibit rotation of the bracket **84**. The bracket **84** includes, at its tip, a pair of claws **86**, and the bracket receiver in the device body **12** includes therein claw receivers for receiving the claws **86**. The pair of claws **86** are urged in opposite directions away from each other, and this urging

force causes the claws **86** to engage the claw receivers, to thereby prevent removal of the bracket **84** from the device body **12**. The claws **86** are disengaged by depressing disengaging buttons **88** formed on sides of the bracket **84**. Depression of the disengaging buttons **88** causes the pair of claws **86** to move toward each other against the urging force to be disengaged from the claw receivers.

[0050] FIG. **9** is an exploded view of the holder support **82**. The holder support **82** includes, in addition to the bracket **84**, a ratchet **90** and a gear **92**. FIG. **10** illustrates shapes of portions of the bracket **84**, the ratchet **90**, and the gear **92**, which are related to each other, and FIG. **11** illustrates these components in an assembled state. The bracket **84** includes a ratchet container **94** for receiving and storing the ratchet **90**. The ratchet **90**, when stored in the ratchet container **94**, is prevented from rotation with respect to the bracket **84**. The ratchet **90** includes a pair of flexible beams **96**, each having an engaging projection **98** at substantially the center thereof. The gear **92** includes two screw receivers **100** (see FIG. **9**), and is fixed to the base **54** of the housing with screws. Therefore, the gear **92** is integral with the housing **40**. The gear **92** includes a gear portion **102** having teeth. With this gear portion **102** being inserted into the ratchet **90**, the gear **92** is coupled with the bracket **84** with a screw **104**. At this state, the bracket **84** and the gear **92** are rotatable relative to each other. The engaging projections **98** of the ratchet **90** engage with a circumference of the gear portion **102**. Rotation of the housing **40** causes the gear **92** to rotate together, with the gear portion **102** rotating, with respect to the ratchet **90**. When the flexible beams **96** are bent, the engaging projections **98** climb over the teeth of the gear portion **102**. Upon engagement of the engaging projects **98** with a valley portion formed between teeth of the gear portion **102**, the position of the housing **40** is retained.

[0051] FIG. **12** to FIG. **21** illustrate a further example probe holder. Components other than the probe holder are similar to those in the above examples, and are therefore designated with the same numerals and their descriptions will not be repeated.

[0052] FIG. **12** illustrates the ultrasonic diagnostic device **10** with a probe holder **110** attached thereto. The probe holder **110**, similar to the probe holders **38** and **80**, is attached to the main body right side surface **22**, particularly to the front edge of the main body, and is rotatable about the axis extending in the lateral direction. The probe holder **110** can be removed and attached to the main body left side surface **24**.

[0053] FIG. **13** illustrates the probe holder **110** holding the probe head **34**. The probe holder **110** includes a housing **112** for storing the probe head **34**, a belt **114** for binding, in combination with the housing **112**, the stored probe head **34** from the circumference thereof, and a holder support **116** for holding the housing **112** such that the housing **112** is rotatable with respect to the device body **12**.

[0054] FIG. **14** illustrates the housing **112**, the belt **114**, and the holder support **116** in an exploded view. FIG. **15** illustrates a backside of the housing **112**. The housing **112** is made of a hard material such as plastic. The housing **112** includes a back plate **118**, a pair of side plates **120** extending from the opposite side edges of the back plate **118** toward the front (the operator side), and a holding bottom portion **122** for receiving and holding a proximal end of the probe head **34**. Each side plate **120** includes an engaging projection **124** projecting outward. The holding bottom portion **122** includes a bottom surface **126** for supporting the probe head **34** from below, side surfaces **128** for supporting left and right sides of the probe head **34**, and a front surface **130** opposite the back plate **118** for supporting the probe head **34** from the front. The holding bottom portion **122** includes a valley **132** at the center, and the valley **132** divides each of the front surface **130** and most of the bottom surface **126** into two parts. As illustrated in FIG. **15**, the back plate **118** includes, on the back surface, a claw receiver **134** that receives a coupling claw **142** of the support which will be described below.

[0055] The belt **114**, which is pliable or flexible, includes engaging holes **136** at opposite ends. The probe head **34** is bound by laying the belt **114** over to fit the engaging holes **136** to the two engaging projections **124** formed on the housing **112**.

[0056] The holder support **116** includes a support arm **138** for supporting the housing **112**, and a positioning portion **140** for fixing the support arm **138** to the device body **12** and determining the rotation position of the support arm **138**. The support arm **138** has a substantially L shape, with one side of the L shape being coupled with the positioning portion **140** and the other side including the coupling claw **142** for coupling with the housing **112**. The coupling claw **142** is to be inserted into the claw receiver **134** formed on the back surface of the housing **112** to couple the holder support **116** with the housing **112**. The claw receiver **134** can receive the coupling claw **142** from either the right or left direction in FIG. **14**, so that the probe holder **110** can be mounted on either the right side or the left side of the device body **12**.

[0057] FIG. **16** is an exploded view of the probe holder **110**, particularly the holder support **116**. A shaft holder **144** is included in the device body **12**, particularly on each of the right and left ends of the mount portion **30** of device body **12**. The positioning portion **140** includes a shaft **146**, a knob **148**, and a fixture **150**.

[0058] FIG. **17** and FIG. **18** illustrate the shaft holder **144** in detail. The shaft holder **144** includes a fixing plate **152** for fixing the shaft holder to a structure within the device body **12**, and a cylinder portion **154** for receiving the shaft **146** and the knob **148**. The fixing plate **152** includes a through hole **156**. A screw or a bolt is inserted in the through hole **156** and is fastened, to fix the shaft holder **144** to the device body **12**. The cylinder portion **154** has a plurality of radial grooves **158** on the bottom, and the bottom is therefore uneven. The cylinder portion **154** has an internal thread **160** formed on its inner circumference.

[0059] FIG. **19** illustrates the shaft **146** in detail. The shaft **146** includes a frame portion **162** and an uneven disk **166** to be coupled with an end of the frame portion **162** and having on its end surface a plurality of radial projections **164** extending radially. The frame portion **162** has a flange **163** at one end, and the uneven disk **166** is coupled with this flange **163**.

[0060] Referring back to FIG. **16**, the knob **148** will be described. The knob **148** is formed of two cylinders having different diameters coupled to each other. A cylinder with a larger diameter has an uneven outer circumference to form a knob portion **168**, and a cylinder with a smaller diameter has an outer circumference which is threaded to provide a male screw, thereby forming a screw portion **170**.

[0061] FIG. **20** is an exploded perspective view of the positioning portion **140**. The frame portion **162** of the shaft **146** is inserted in the screw portion **170** of the knob **148** and

is coupled to the fixture **150** by a screw **172**. This couples the shaft **146** and the fixture **150** integrally. The knob **148**, which is disposed between the flange **163** of the frame portion **162** and the fixture **150**, is prevented from moving axially but is allowed to rotate on the frame portion **162**. FIG. **21** illustrates the positioning portion **140** in an assembled state. As illustrated in FIG. **21**, the support arm **138** is fixed to the positioning portion **140** by fastening screws **174** in the screw receiver portions of the fixture **150**. Consequently, the shaft **146**, the fixture **150**, and the support arm **138** are integrally connected, with respect to which the knob **148** is rotatable.

[0062] To mount the holder support **116**, the screw portion **170** of the knob **148** is screwed into and coupled to the female screw **160** of the shaft holder **144**. As described above, because the knob **148** is rotatable with respect to the support arm **138**, for example, it is possible to tighten the knob **148** with the rotation position of the support arm **138** being maintained. As the knob **148** is further tightened, an end surface of the screw portion **170** presses the flange **163** of the shaft **146**, thereby pressing the fixing plate **152** against the bottom surface of the cylinder portion **154** of the shaft holder. This allows the radial projections **164** formed in the fixing plate **152** and the radial grooves **158** formed in the bottom surface of the cylinder portion **154** to engage with each other to fix the rotation position of the shaft **146**. Consequently, the rotation position of the support arm **138** is also fixed, which in turn fixes the orientation of the housing **112** coupled to the support arm **138**. To alter the orientation of the housing **112**, the knob **148** is slightly loosened to thereby allow the radiation grooves **158** and the radiation projections **164** to be disengaged from each other, and then, with the housing **112** being rotated in a desired orientation, the knob **148** is tightened again.

[0063] To move the probe holder **110** to the opposite side of the device body **12**, the knob **148** is turned to allow the holder support **116** to be removed from the device body **12**, and then the housing **112** is removed from the holder support **116**. Then, the holder support **140** is screwed in the shaft holder **144** on the opposite side, to which the housing **112** is mounted once again. At this time, the coupling claw **142** of the support arm **138** is inserted into the claw receiver **134** of the housing **112** from the opposite side.

[0064] To allow the probe head **34** to be temporarily held in the probe holder **110**, the probe holder **110** is fixed in a backwardly tilted position. The proximal end of the probe head **34** (where the probe cable **36** is connected) is placed within the holding bottom portion **122** such that the probe head **34** rests against the back plate **118**. The probe cable **36** extends through the valley **132** of the holding bottom portion. The belt **114** may be used to hold the probe head more reliably.

[0065] While the housing **112** of the probe holder **110** is made of a hard material, a portion of the housing contacting the probe head **34** can be made of a pliable or flexible material as in the case of the probe holder **38** or **80**.

[0066] The probe head **34** can be held by the probe holder **38**, **80**, or **110** further reliably by binding the probe head **34** with the belt **42**. The probe head **34** can be held reliably when a motion of the ultrasonic diagnostic device is increased such as while being carried, for example. Further, the probe holder **38**, **80**, or **110**, which is rotatable with respect to the device body **12**, can hold the probe head **34** such that the probe head **34** can be operated easily. Even when the position of the device body **12** changes, the upward orientation of the probe head **34** can be maintained.

REFERENCE SIGNS LIST

[0067] **10** ultrasonic diagnostic device, **12** device body, **14** display device, **16** ultrasonic probe, **18** main body front surface, **20** main body back surface, **22** main body right side surface, **24** main body left side surface, **26** main body top surface, **28** main body bottom surface, **30** mount portion, **32** probe connector, **34** probe head, **36** probe cable, **38** probe holder, **40** housing, **42** belt, **45** holder support, **46** bracket, **52** receiving groove, **54** base portion, **56** holding portion, **58** side surface plate, **60** friction plate, **64** washer, **68** engaging hole, **70** engaging projection, **72** grip, **74** tip portion, **80** probe holder, **82** holder support, **84** bracket, **90** ratchet, **92** gear, **94** ratchet container, **96** flexible beam, **98** engaging projection, **102** gear portion, **110** probe holder, **112** housing, **114** belt, **116** holder support, **118** back plate, **120** side plate, **122** holding bottom portion, **124** engaging projection, **126** bottom surface, **128** side surface, **130** front surface, **132** valley, **134** claw receiver, **136** engaging hole, **138** support arm, **140** positioning portion, **142** coupling claw, **144** shaft holder, **146** shaft, **150** fixture, **154** cylinder portion, **158** radial groove, **162** frame portion, **163** flange, **164** radial projection, **166** uneven disk, **168** knob, **170** screw portion

1. An ultrasonic diagnostic device, comprising:
an ultrasonic diagnostic device main body; and
a probe holder configured to hold a probe head of an ultrasonic probe, the probe holder being configured to be mounted on a side surface of the ultrasonic diagnostic device main body and being rotatable about an axis extending laterally.

2. The ultrasonic diagnostic device according to claim **1**, wherein
the probe holder can be retained at a desired rotation position.

3. The ultrasonic diagnostic device according to claim **1**, wherein
the probe holder is mountable on either a left side surface or a right side surface.

4. The ultrasonic diagnostic device according to claim **1**, wherein
the ultrasonic diagnostic device is portable.

* * * * *

专利名称(译)	超声诊断设备		
公开(公告)号	US20180021015A1	公开(公告)日	2018-01-25
申请号	US15/549594	申请日	2016-01-12
[标]申请(专利权)人(译)	株式会社日立制作所		
申请(专利权)人(译)	HITACHI，LTD.		
当前申请(专利权)人(译)	HITACHI，LTD.		
[标]发明人	NARUSE NAOYUKI ICHIMURA MASARU SATO AKINORI		
发明人	NARUSE, NAOYUKI ICHIMURA, MASARU SATO, AKINORI		
IPC分类号	A61B8/00		
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优先权	2015023522 2015-02-09 JP		
外部链接	Espacenet USPTO		

摘要(译)

超声诊断设备（ 10 ）有一个探头支架（ 38 ），安装在设备主体的侧面（ 12 ）。探针支架（ 38 ）保持超声波探头的探头（ 34 ）。探头支架（ 38 ）可围绕沿左右方向延伸的轴线旋转，并可停在所需位置。可以改变由探针支架保持的探针头（ 38 ）相对于装置主体（ 12 ）的取向。