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CPC **A61B 8/12** (2013.01)
USPC **600/459**(73) Assignee: **OLYMPUS MEDICAL SYSTEMS CORP.**, Tokyo (JP)(21) Appl. No.: **13/848,082**(57) **ABSTRACT**(22) Filed: **Mar. 21, 2013****Related U.S. Application Data**

(63) Continuation of application No. PCT/JP2012/073178, filed on Sep. 11, 2012.

(30) **Foreign Application Priority Data**

Dec. 8, 2011 (JP) 2011-269204

An ultrasound probe includes an ultrasound transmission/reception portion which transmits and receives ultrasound, a proximal-end-side balloon fixing portion arranged on a more proximal end side than the ultrasound transmission/reception portion and having a stepped shape in which a proximal end side is high, and a balloon fixing tool mounting groove arranged on a more distal end side than the proximal-end-side balloon fixing portion and having a width narrower than a width of the proximal-end-side balloon fixing portion.

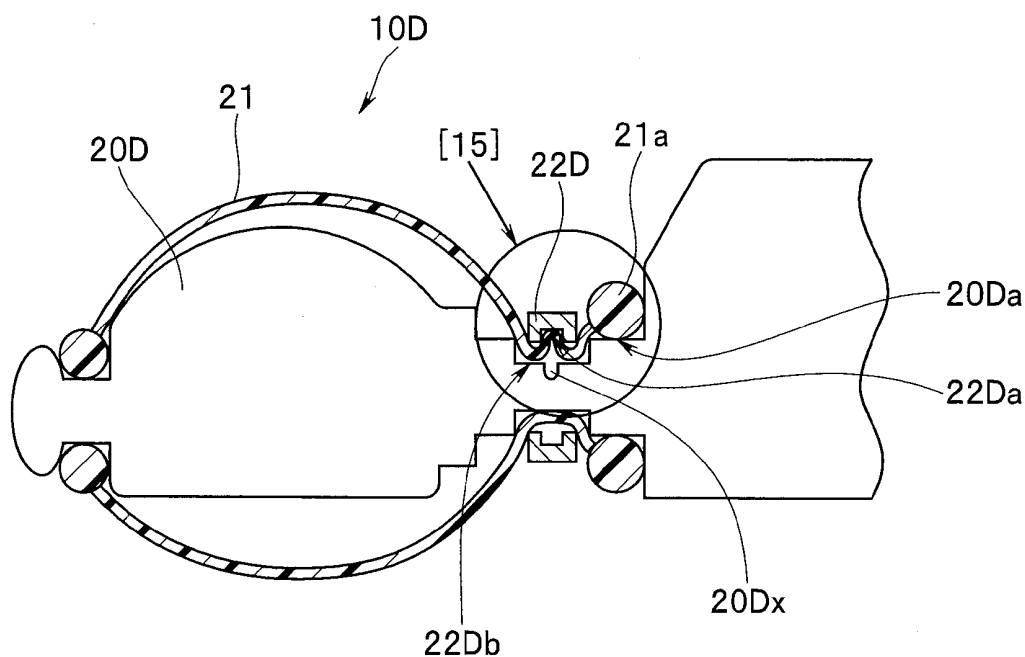


FIG.1

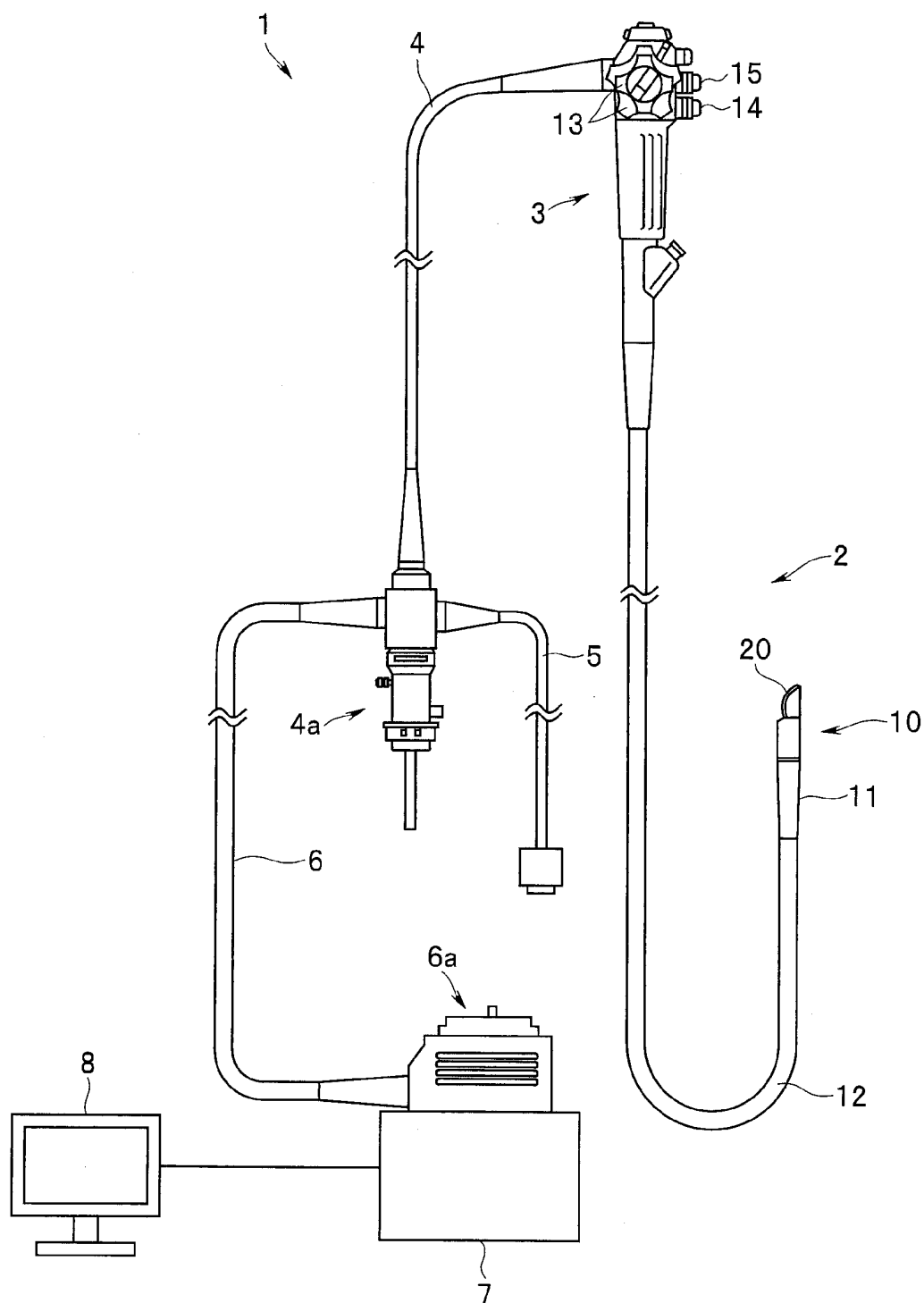


FIG.2

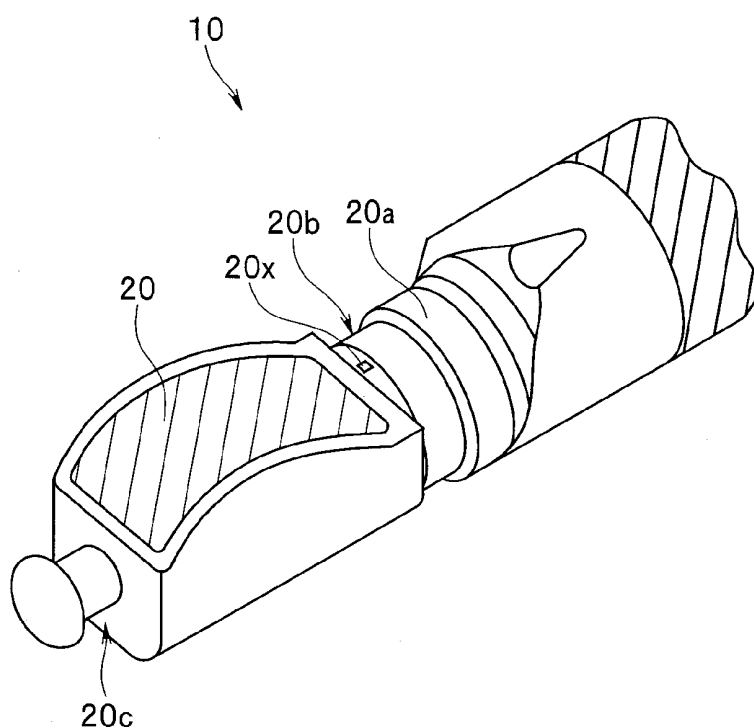


FIG.3

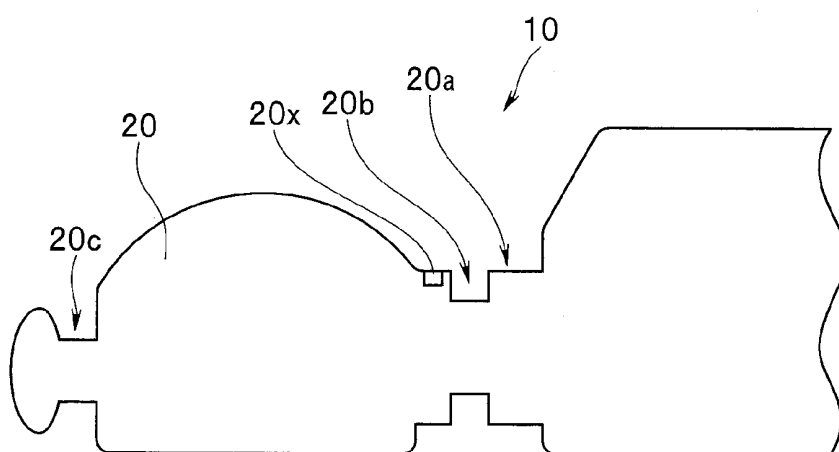


FIG.4

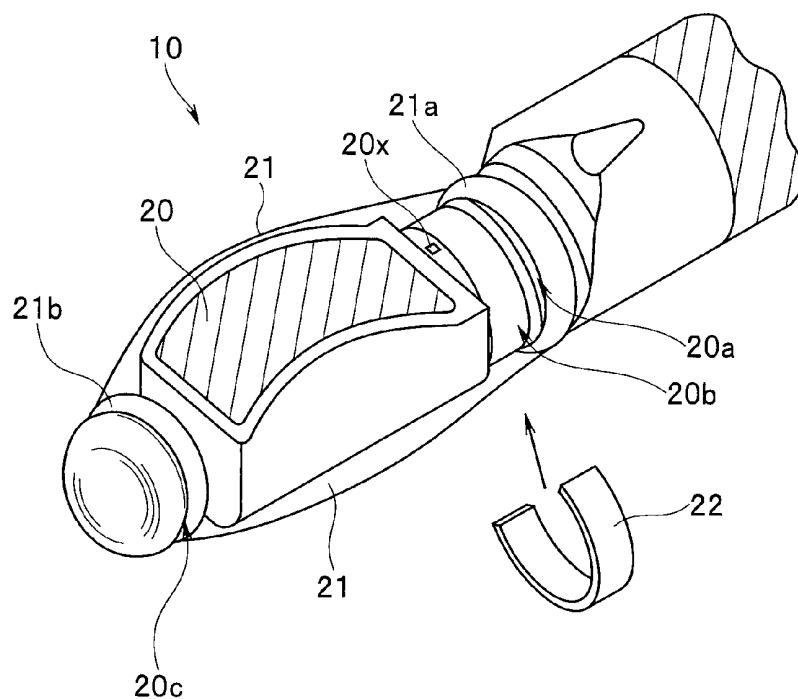


FIG.5

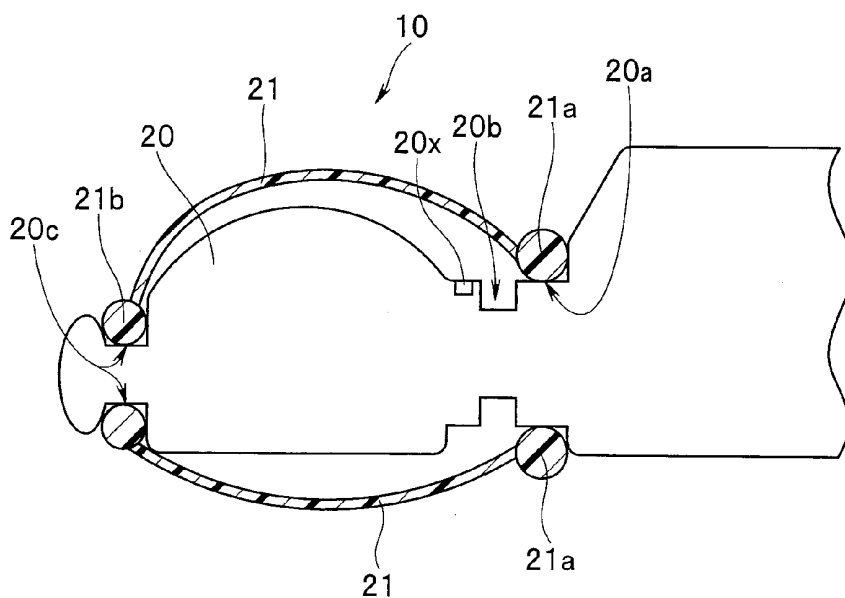


FIG.6

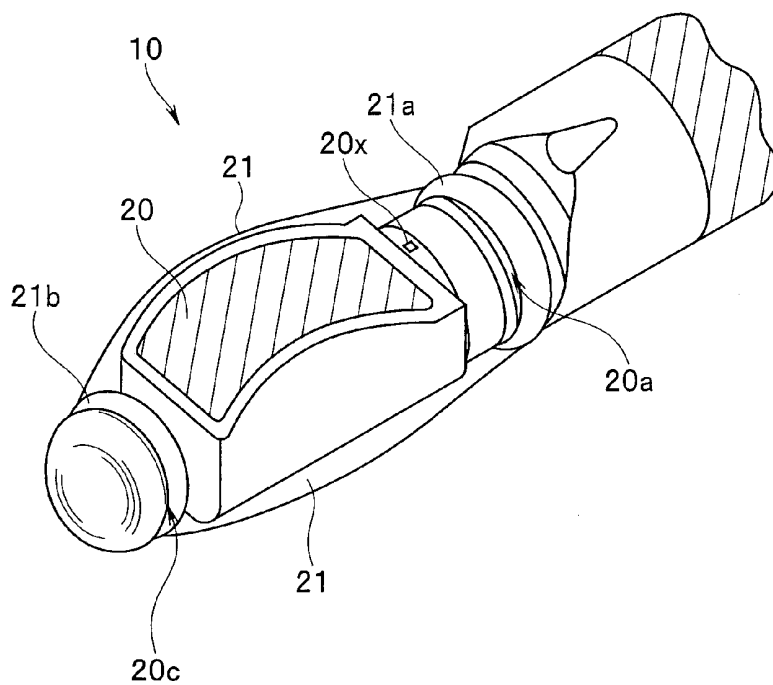


FIG.7

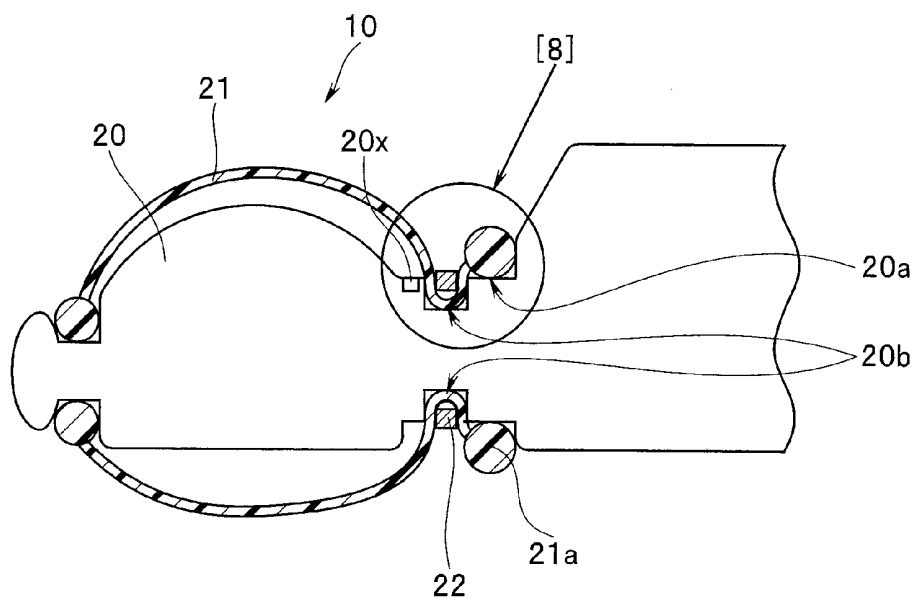


FIG.8

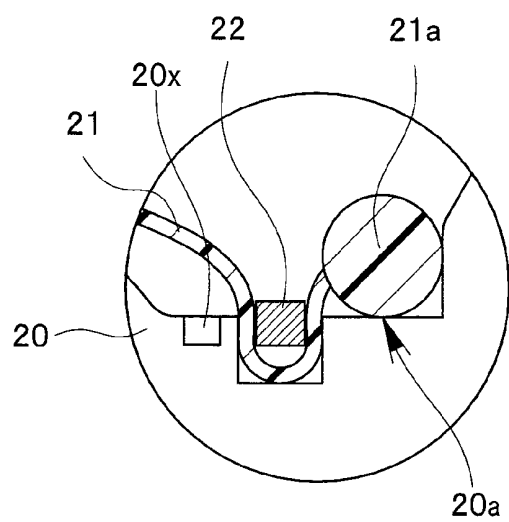


FIG.9

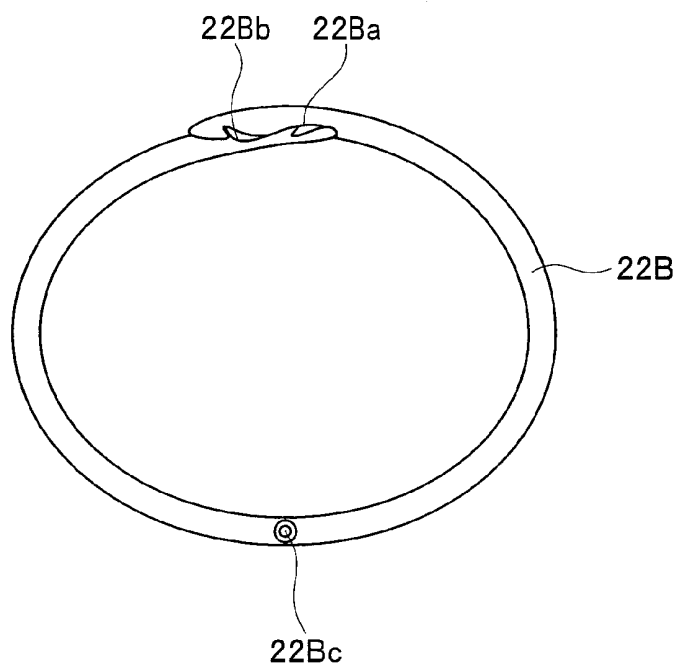


FIG.10

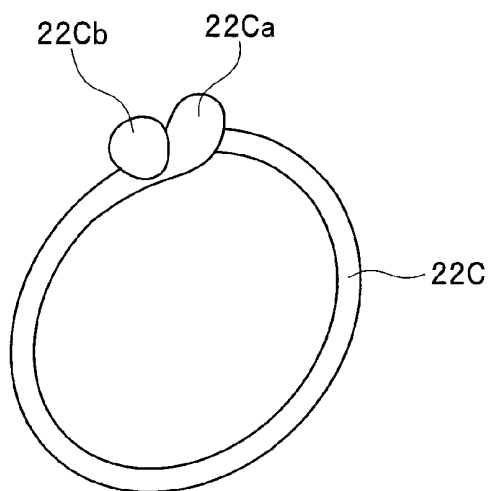


FIG.11

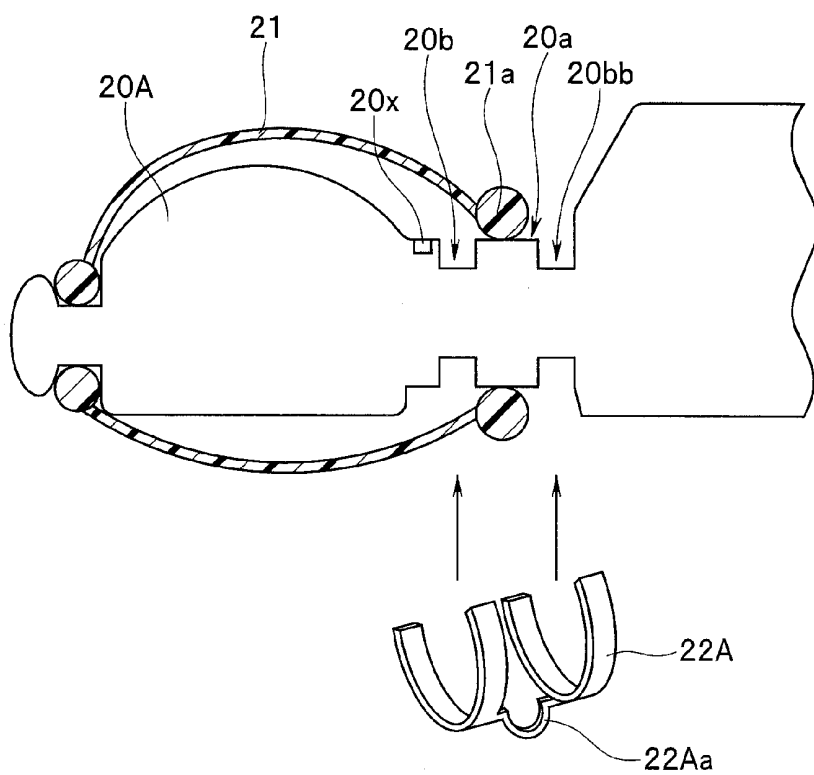


FIG.12

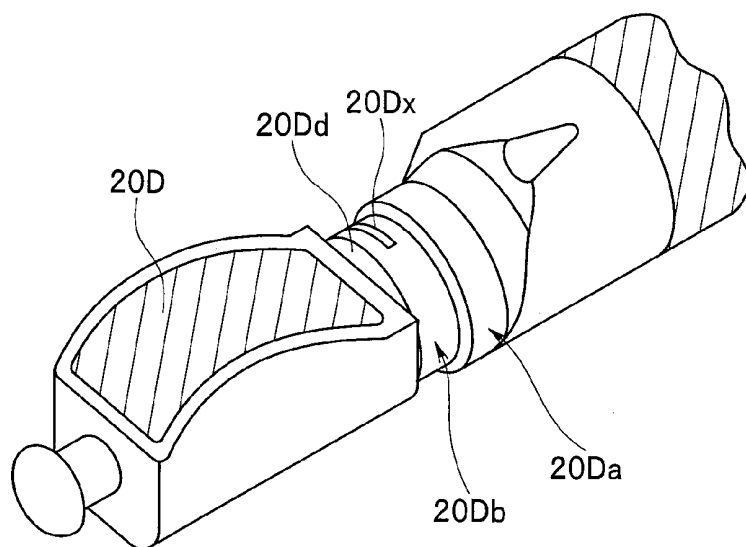
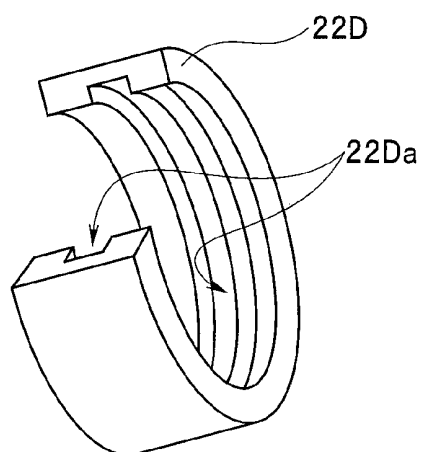


FIG.13



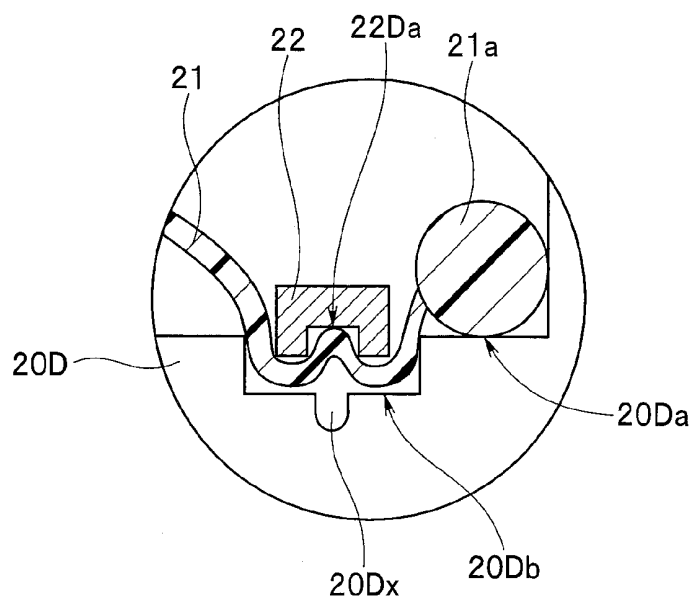


FIG.16

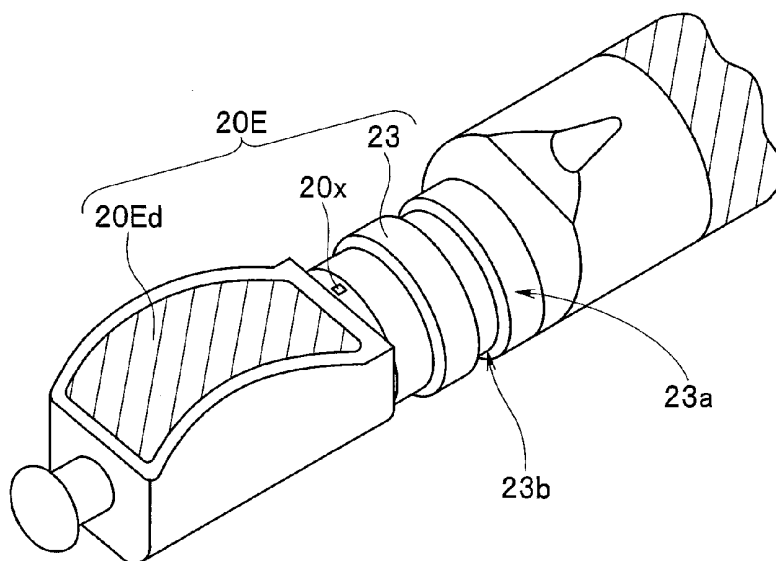


FIG.17

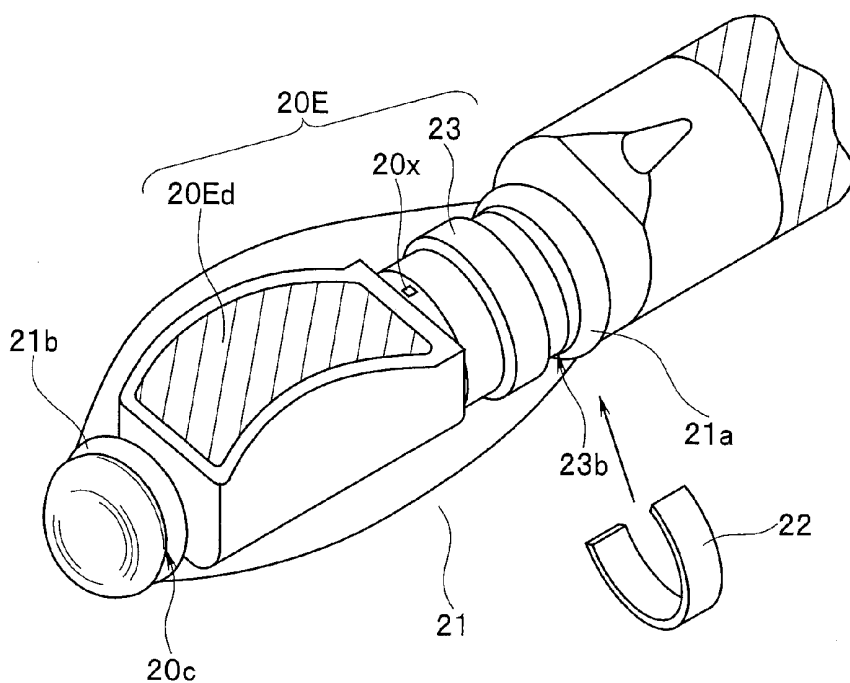
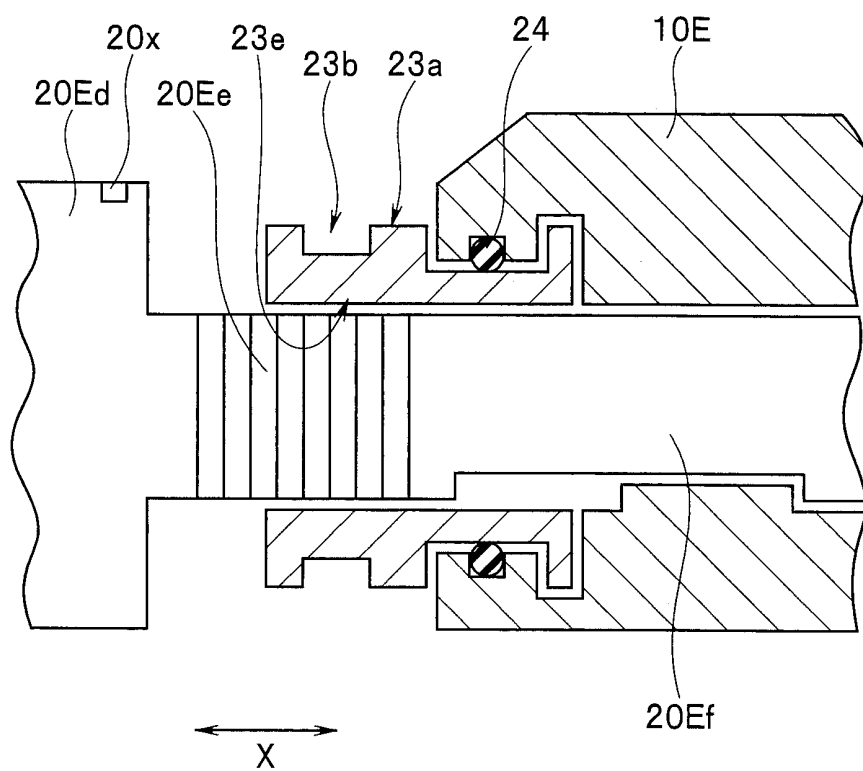


FIG.18



ULTRASOUND PROBE

CROSS REFERENCE TO RELATED APPLICATION

[0001] This application is a continuation application of PCT/JP2012/073178 filed on Sep. 11, 2012 and claims benefit of Japanese Application No. 2011-269204 filed in Japan on Dec. 8, 2011, the entire contents of which are incorporated herein by this reference.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present invention relates to a structure of a balloon fixing portion for mounting and fixing an ultrasound balloon which covers an ultrasound transmission/reception portion of an ultrasound probe.

[0004] 2. Description of the Related Art

[0005] Conventionally, an ultrasound endoscope system has been widely spread, which is configured to insert an ultrasound probe, which includes an insertion section that incorporates at a distal end thereof an ultrasound transmission/reception portion including an ultrasound transducer, into a body, and to generate an ultrasound image by transmitting ultrasound toward a living tissue from the ultrasound transmission/reception portion and receiving the ultrasound reflected from the living tissue.

[0006] When ultrasound diagnosis is performed by using such a kind of ultrasound endoscope system, a medium that effectively transmits ultrasound is allowed to intervene between the ultrasound transmission/reception portion of the ultrasound probe and a living tissue, in order to acquire an excellent ultrasound image. An ultrasound endoscope system has been commercialized, which is configured such that an ultrasound balloon made of an elastic material is mounted to a distal end section of an insertion section of an ultrasound probe and an ultrasound transmitting medium (liquid or the like) is filled in the balloon.

[0007] As disclosed in Japanese Patent Application Laid-Open Publication Nos. 2010-005098 and 2010-017485, for example, a conventional ultrasound probe generally includes a balloon formed by including opening portions made of thick ring-shape portions at both ends of a cylindrical elastic member, and a distal end section of an insertion section which corresponds to the balloon, that is, groove portions for fixing the balloon, which are respectively formed on a proximal end side and a distal end side across an ultrasound transmission/reception portion.

[0008] In order to mount the balloon to the distal end section of the insertion section, an operation for attaching the balloon is performed such that the ring-shape portions of the balloon are attached to balloon fixing grooves so as to fit the ring-shape portions therein by using a balloon mounting jig, for example.

[0009] After the balloon is thus mounted at a predetermined site of the distal end section of the ultrasound probe, an inspection is performed by filling an ultrasound transmitting medium in the balloon. For example, adjustment and the like are performed so as to prevent the balloon from inflating unevenly in one direction. In addition, air bubbles sometimes enter into the balloon at this time. The air bubbles entered into the balloon are removed by an operation for pushing out the air bubbles to the outside from the ring-shape portions located at the both ends of the balloon.

SUMMARY OF THE INVENTION

[0010] An ultrasound probe according to one aspect of the present invention includes: an ultrasound transmission/reception portion which transmits and receives ultrasound; a proximal-end-side balloon fixing portion disposed on a more proximal end side than the ultrasound transmission/reception portion and having a stepped shape in which a proximal end side is high; and a balloon fixing tool mounting groove arranged on a more distal end side than the proximal-end-side balloon fixing portion and having a width narrower than a width of the proximal-end-side balloon fixing portion.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] FIG. 1 is a schematic configuration diagram showing a whole of an ultrasound endoscope system including an ultrasound probe according to a first embodiment of the present invention.

[0012] FIG. 2 is a schematic perspective view showing, in an enlarged manner, a schematic configuration of a part near a distal end section of the ultrasound probe in the ultrasound endoscope system in FIG. 1.

[0013] FIG. 3 is a schematic projection view of FIG. 2.

[0014] FIG. 4 is a schematic perspective view showing a state where a balloon is mounted to the distal end section of the ultrasound probe in FIG. 2.

[0015] FIG. 5 is a schematic projection cross-sectional view of FIG. 4.

[0016] FIG. 6 is a schematic perspective view showing a state where a balloon fixing tool is mounted to the distal end section (in the balloon mounted state) of the ultrasound probe in FIG. 4.

[0017] FIG. 7 is a schematic projection cross-sectional view of FIG. 6.

[0018] FIG. 8 is an enlarged cross-sectional view of a site shown by the reference numeral [8] in FIG. 7.

[0019] FIG. 9 is a schematic perspective view showing a modified example of the balloon fixing tool in the ultrasound probe according to the first embodiment of the present invention.

[0020] FIG. 10 is a schematic perspective view showing another modified example of the balloon fixing tool in the ultrasound probe according to the first embodiment of the present invention.

[0021] FIG. 11 is a schematic view showing a schematic configuration of a part near a distal end section of an ultrasound probe according to a second embodiment of the present invention.

[0022] FIG. 12 is a schematic perspective view showing a schematic configuration of a part near a distal end section of an ultrasound probe according to a third embodiment of the present invention.

[0023] FIG. 13 is a main-part enlarged perspective view showing the balloon fixing tool in the ultrasound probe in FIG. 12 in an enlarged manner by taking out only the balloon fixing tool.

[0024] FIG. 14 is a schematic projection cross-sectional view showing a state where the balloon and the balloon fixing tool are mounted to the distal end section of the ultrasound probe in FIG. 12.

[0025] FIG. 15 is an enlarged cross-sectional view of a site shown by the reference numeral [15] in FIG. 14.

[0026] FIG. 16 is a schematic view showing a schematic configuration of a part near a distal end section of an ultrasound probe according to a fourth embodiment of the present invention.

[0027] FIG. 17 is a schematic perspective view showing a state where the balloon is mounted to the distal end section of the ultrasound probe in FIG. 16.

[0028] FIG. 18 is a cross-sectional view showing a schematic configuration of a part near a balloon mounting and fixing portion at the distal end section of the ultrasound probe in FIG. 16.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0029] Hereinafter, the present invention will be described with embodiments shown in the drawings. Note that, in the drawings used for the explanation below, there is a case where scale sizes are different for each of the constituent elements such that the respective constituent elements have sizes recognizable in the drawings. Therefore, in the present invention, the number, the shapes, the ratio of the sizes of the constituent elements, and the relative positional relationship among the respective constituent elements shown in the drawings are not limited to those in the configurations shown in the drawings.

First Embodiment

[0030] FIGS. 1 to 8 describe the first embodiment of the present invention. Note that, in the schematic projection view in FIG. 3, only the visible outline at the time that the vicinity of a distal end section of an ultrasound probe is projected is shown, and illustration of an internal configuration is omitted in order to avoid complication of the drawing. Further, FIG. 5 shows a cross section of a balloon in the mounted state, in addition to the schematic projection view of FIG. 3. Furthermore, FIG. 7 shows the state in FIG. 5, that is, the state where a balloon fixing tool is mounted to a predetermined site near the distal end section of the ultrasound probe to which the balloon is mounted, and shows the balloon and the balloon fixing tool in the cross sections thereof.

[0031] First, the whole configuration of the ultrasound endoscope system including the ultrasound probe according to the first embodiment of the present invention will be described below with reference to FIG. 1.

[0032] The ultrasound endoscope system including the ultrasound probe according to the present embodiment is configured by mainly including an ultrasound endoscope 1, an ultrasound observation control apparatus 7, a display device, and the like.

[0033] The ultrasound endoscope 1 is configured mainly by an insertion section 2 configured to be able to be introduced into a body of a subject, a control section 3 provided in a linked manner on the proximal end side of the insertion section 2, and a universal cord 4 extended from a side portion of the control section 3.

[0034] The insertion section 2 is configured by including: a distal end section 10 disposed at the distal end of the insertion section; a bending section 11 which is formed to be bendable and provided in a linked manner on the proximal end side of the distal end section 10; and a flexible tube portion 12 which has flexibility and which is provided in a linked manner on the proximal end side of the bending section 11 and connected to the distal end side of the control section 3. Note that the

ultrasound endoscope 1 may be configured as what is called a rigid endoscope in which the insertion section 2 is made of a rigid member.

[0035] An ultrasound probe 20, which includes an ultrasound transmission/reception portion configured to transmit and receive ultrasound and a case member configured to hold the ultrasound transmission/reception portion, and the like, is provided at the distal end section 10 of the insertion section 2.

[0036] The control section 3 is provided with an angle operation knob 13 for operating bending of the bending section 11. Further, the control section 3 is provided with valves 14, 15 for controlling a feeding operation and sucking operation of fluid from an opening portion provided at the distal end section 10.

[0037] An endoscope connector 4a configured to be connected to a light source device, not shown, is provided at the proximal end portion of the universal cord 4. A video cable 5, an ultrasound cable 6, and the like are extended from the endoscope connector 4a. The ultrasound cable 6 is detachably connected to the ultrasound observation control apparatus 7 through an ultrasound connector 6a. The ultrasound observation control apparatus 7 is a control apparatus which controls transmission and reception operations of ultrasound by the ultrasound transmission/reception portion 20, generates an ultrasound image, and outputs the generated ultrasound image to an image display device 8. The ultrasound observation control apparatus 7 is also called as an ultrasound observation apparatus.

[0038] As shown in FIGS. 2 and 3, the distal end section 10 is provided with the ultrasound probe 20. The case member that holds the ultrasound probe 20 is configured such that an ultrasound balloon 21 can be mounted and fitted thereto, as shown in FIGS. 3 and 4.

[0039] The ultrasound balloon 21 is disposed at the case member of the ultrasound probe 20 so as to cover the ultrasound transmission/reception portion with an elastic member. When the ultrasound balloon 21 is in a mounted state with respect to the ultrasound probe 20, an ultrasound transmission medium is filled inside the ultrasound balloon 21.

[0040] To this end, the ultrasound balloon 21 is formed by including, at both ends of the cylindrical-shaped elastic member, thick ring-shape portions, that is, opening portions composed of a proximal end ring-shape portion 21a and a distal end ring-shape portion 21b, for example.

[0041] In accordance with the configuration, as shown in FIGS. 2 to 5, the ultrasound probe 20 is provided with a distal-end-side balloon fixing portion 20c to which the distal end ring-shape portion 21b of the ultrasound balloon 21 is fitted, a proximal-end-side balloon fixing portion 20a to which the proximal end ring-shape portion 21a is placed and fixed, and a balloon fixing tool mounting groove 20b into which a balloon fixing tool 22 (see FIG. 4) to be described later is fitted. In this case, the distal-end-side balloon fixing portion 20c is a circumferential groove formed on the distal-most side of the ultrasound balloon 21. In addition, the proximal-end-side balloon fixing portion 20a is formed at a site on a more proximal end side than the ultrasound transmission/reception portion. The proximal-end-side balloon fixing portion 20a is formed such that the cross-sectional shape thereof has a stepped shape in which the proximal end side is made higher, as shown in FIG. 3.

[0042] The balloon fixing tool mounting groove 20b is a circumferential groove formed at a predetermined site of the case member of the ultrasound probe, that is, a site between

the ultrasound transmission/reception portion and the proximal-end-side balloon fixing portion **20a**. The balloon fixing tool mounting groove **20b** is formed in a groove shape into which the balloon fixing tool **22** for fixing the ultrasound balloon **21** by pressing a part of the ultrasound balloon can be fitted, as described above. Note that the balloon fixing tool mounting groove **20b** is formed to have a width narrower than the width of the proximal-end-side balloon fixing portion **20a** or the proximal end ring-shape portion **21a**. That is, the proximal-end-side balloon fixing portion **20a** has a width wide enough to place thereon the proximal end ring-shape portion **21a**. On the other hand, the balloon fixing tool mounting groove **20b** is set to have a narrow width to the extent that the proximal end ring-shape portion **21a** does not fall into the groove.

[0043] The balloon fixing tool **22** is formed in a circular ring shape with a part thereof being cut out (what is called, C-ring shape), for example, and has elasticity in the circumferential direction. The balloon fixing tool **22** is detachably disposed in the balloon fixing tool mounting groove **20b** by holding a part of the ultrasound balloon **21**, as described above, that is, holding the outer circumference between the both ring-shape portions **21a** and **21b**, which is closer to the proximal end ring-shape portion **21a**. Note that the balloon fixing tool **22** is formed such that the cross section thereof has a shape which is at least more than a semicircle. In addition, in accordance with the cross-sectional shape, the site of the case member where the balloon fixing tool **22** is mounted, that is, the site where the balloon fixing tool mounting groove **20b** is disposed, is formed such that the cross section thereof is substantially a cylindrical shape. Therefore, when the balloon fixing tool **22** is in a state fitted into the balloon fixing tool mounting groove **20b**, the balloon fixing tool **22** is disposed so as to wind around the site where the balloon fixing tool mounting groove **20b** is formed, by elastic force of the balloon fixing tool itself, and configured so as not to easily fall off.

[0044] Further, since a plurality of types of ultrasound probes having different outer diameters or different lengths exist, it is common that a dedicated balloon is prepared for each of the types. However, conventionally, only a type name has been printed on a packaging bag of a balloon. Accordingly, there has been a possibility to mistake a balloon corresponding to an ultrasound probe for another balloon during operation. Therefore, the balloon fixing tool **22** may be provided with an identification portion that is configured to enable identification of the ultrasound probe **20** to which a balloon is fixed. The identification portion is configured as a color code, etc., which can be identified by a color, for example.

[0045] An ultrasound transmitting medium inlet **20x**, which opens in the same direction as a transmission/reception surface (a shaded area in the site indicated by the reference numeral **20** in FIG. 2), is formed on the case member of the ultrasound probe **20** at a site which is more proximal end side than the ultrasound transmission/reception portion and which is closer to the distal end than the balloon fixing tool mounting groove **20b**, in other words, at a site between the ultrasound transmission/reception portion and the balloon fixing tool mounting groove **20b**. The ultrasound transmitting medium inlet **20x** is connected with an ultrasound transmitting medium inlet tube (not shown) inserted and disposed inside the insertion section **2**, the control section **3**, and the universal cord **4**.

[0046] When using the ultrasound probe **20** thus configured according to the present embodiment, the user mounts the ultrasound balloon **21** to the ultrasound probe in advance. Working at that time will be described below.

[0047] First, the ultrasound probe **20** is, from the distal end thereof, passed through the opening of the proximal end ring-shape portion **21a** of the ultrasound balloon **21**, and the proximal end ring-shape portion **21a** is placed at the proximal-end-side balloon fixing portion **20a**. At the same time, the distal end ring-shape portion **21b** is fitted to the distal-end-side balloon fixing portion **20c**. As a result, the ultrasound balloon **21** is mounted to the case member of the ultrasound probe **20** so as to cover the ultrasound transmission/reception portion of the ultrasound probe **20**. The state at this time is shown in FIG. 4 and FIG. 5.

[0048] In this state, operation for discharging the ultrasound transmitting medium by the control by the ultrasound observation control apparatus **7**, for example. According to this operation, the ultrasound transmitting medium passes through the ultrasound transmitting medium inlet tube to be discharged from the ultrasound transmitting medium inlet **20x** and injected into the ultrasound balloon **21**. The injection operation is stopped when a predetermined amount of ultrasound transmitting medium is filled in the ultrasound balloon **21**. At this stage, it is checked whether or not air bubbles and the like are mixed in the ultrasound transmitting medium filled in the ultrasound balloon **21**, whether or not the ultrasound transmitting medium leaks from the ultrasound balloon **21**, and whether or not there is a rip on the balloon. When leaking of the ultrasound transmitting medium, a rip on the balloon, or the like is found, the ultrasound balloon **21** is replaced, for example. In addition, when mixture of air bubbles or the like is found, the air bubbles or the like are removed by pinching or turning up the proximal end ring-shape portion **21a** placed at the proximal-end-side balloon fixing portion **20a**. Furthermore, it is checked whether or not the ultrasound balloon **21** is inflated unevenly, and if the ultrasound balloon is unevenly inflated, adjustment is performed. When such adjustment operations and the like are finished, the balloon fixing tool **22** is fitted into the balloon fixing tool mounting groove **20b**. The balloon fixing tool **22** has elasticity in the circumferential direction. Therefore, if the worker puts the balloon fixing tool **22** into the balloon fixing tool mounting groove **20b** while applying a force in a direction in which the cut-out portion is opened, and after that, if the worker releases the force, the balloon fixing tool **22** is disposed in a fitted manner so as to grip the balloon fixing tool groove **20b** by elasticity of the balloon fixing tool itself. At this time, the balloon fixing tool **22** is fitted into the balloon fixing tool mounting groove **20b** by holding a part of the ultrasound balloon **21** (the outer circumference which is between the ring-shape portions **21a**, **21b** and which is closer to the proximal end ring-shape portion **21a**). According to such a configuration, the ultrasound balloon **21** is surely fixed to the case member of the ultrasound probe **20** so as to cover the ultrasound transmission/reception portion of the ultrasound probe **20**. The state at this time is shown in FIGS. 6 and 7.

[0049] Note that, when it is thus confirmed that the ultrasound probe **20** has been surely mounted in a proper state, operation for withdrawing the ultrasound transmitting medium is performed by the control by the ultrasound observation control apparatus **7**. In this state, the ultrasound probe **20** is in an enabled state.

[0050] When the ultrasound probe 20 is actually used, the insertion operation of the ultrasound probe 20 is performed in the state where the ultrasound balloon 21 is deflated. When the ultrasound probe 20 reaches in the vicinity of a desired observation target in a body, the ultrasound balloon 21 is brought into an inflated state by injecting the ultrasound transmitting medium, to perform ultrasound observation.

[0051] As described above, according to the first embodiment, in the case where the ultrasound balloon 21 is mounted to the ultrasound probe 20 prior to use of the ultrasound probe 20, when mixture of air bubbles or the like in the ultrasound balloon 21 is found and removal operation of the air bubbles or the like is performed, it is possible to rapidly and effectively perform the operation for removing the air bubbles, or the like, since the proximal end ring-shape portion 21a is placed on the proximal-end-side balloon fixing portion 20a formed in a stepped shape and the operation for pinching or turning up the proximal end ring-shape portion 21a can be performed extremely easily compared with a conventional structure (structure in which the proximal end ring-shape portion is fitted into a groove).

[0052] Then, after such operations, the balloon fixing tool 22 is firmly fitted into the balloon fixing tool mounting groove 20b, which enables the ultrasound balloon 21 to be surely mounted and fixed. Further, even in this state, the proximal end ring-shape portion 21a is in a state placed on the proximal-end-side balloon fixing portion 20a formed in a stepped shape. Therefore, when maintenance such as exchanging of the ultrasound balloon 21 is performed, for example, it is easy to pinch or turn up the proximal end ring-shape portion 21a, thereby capable of easily detaching even the balloon fixing tool 22 which is securely fitted into the balloon fixing tool mounting groove 20b.

[0053] In addition, in the conventional structure, the ultrasound balloon 21 has been fixed by pushing the proximal end ring-shape portion 21a of the ultrasound balloon 21 into the groove portion. However, such an operation process is not required in the structure according to the present embodiment. Therefore, it is possible to simplify the mounting operation of the ultrasound balloon 21.

[0054] The balloon fixing tool 22 is provided with a color code associated with the corresponding ultrasound probe 21 so as to be easily identifiable, which makes it possible to surely and unfailingly mount the ultrasound balloon 21 and the balloon fixing tool 22 which are appropriate for the type of the ultrasound balloon 21 to which the ultrasound balloon and the balloon fixing tool are mounted.

[0055] The above-described first embodiment exemplifies, as a configuration of the balloon fixing tool 22, the one having elasticity in the circumferential direction and the shape, what is called C-ring shape, formed by cutting out a part of a circular ring shape. The configuration of the balloon fixing tool is not limited to the above, and other various configurations can be considered.

[0056] For example, FIGS. 9 and 10 show modified examples of the balloon fixing tool. Each of the balloon fixing tools 22B, 22C shown in FIGS. 9 and 10 is formed by cutting off a part of a member, the whole shape of which is a circular ring shape, and includes an engagement mechanism at the cut-off sites. Note that the cross-sectional shapes of the balloon fixing tools 22B, 22C in this case are substantially circular shapes, for example.

[0057] The balloon fixing tool 22B in FIG. 9 is configured such that one ends of two semicircular members formed by

dividing a circular ring-shaped member into two are rotatably connected to each other and the other ends, that is, two opposed end portions of the cut-off sites are provided with engaging pawls 22Ba, 22Bb, respectively.

[0058] When the engaging pawls 22Ba, 22Bb are engaged with each other, the whole shape becomes a circular ring shape. In addition, when the engaged state between the engaging pawls 22Ba and 22Bb is released, the two semicircular members rotate at a connecting portion 22Bc such that the opposed two end portions of the cut-off sites are separated from each other. Therefore, the cut-off sites can be separated from each other only by rotating the two semicircular members with the connecting portion 22Bc as a rotational center, which enables the fitting operation of the balloon fixing tool into the balloon fixing tool mounting groove 20b to be performed easily.

[0059] Further, the balloon fixing tool 22C in FIG. 10 is formed by cutting off a part of a circular ring-shaped member and forming convex portions 22Ca, 22Cb respectively at two opposed end portions at the cut-off sites. The balloon fixing tool 22C is formed so as to have elasticity in the circumferential direction.

[0060] The balloon fixing tool, the whole shape of which is circular ring shape, is formed by engaging the convex portions 22Ca and 22Cb with each other. In addition, the balloon fixing tool can be fitted into the balloon fixing tool mounting groove 20b by pressing the cut-off sites apart against the elasticity in the circumferential direction in the state where the engagement between the convex portions 22Ca and 22Cb is released.

[0061] As a result, also when these balloon fixing tools 22B and 22C are used, the same effects as those in the above-described first embodiment can be obtained.

[0062] Note that, as the balloon fixing tool 22 in the above-described first embodiment, the one having a substantially rectangular cross-section is exemplified as shown in the drawings (see FIGS. 4 and 7). In addition, though not clearly shown, the above-described two modified examples (FIGS. 9, 10) exemplify the balloon fixing tool supposing that the tool has a substantially circular cross section. However, the cross-sectional shape of the balloon fixing tool according to the present invention is not limited to the above-described examples. That is, the balloon fixing tools, cross sections of which are various shapes such as a substantially circular shape, an elliptic shape, or a polygonal shape, can be also used.

Second Embodiment

[0063] FIG. 11 is a schematic view showing a schematic configuration of a part near a distal end section of an ultrasound probe according to a second embodiment of the present invention. Note that, also in FIG. 11, only the visible outline at the time that the vicinity of the distal end section of the ultrasound probe is projected is shown, illustration of an internal configuration is omitted, and only the mounted balloon is shown in the cross section thereof, in order to avoid complication of the drawing. Further, the balloon fixing tool to be mounted to the ultrasound probe is shown in perspective view.

[0064] The present embodiment has substantially the same configurations as those in the first embodiment. However, an ultrasound probe 20A according to the present embodiment is different from the one in the first embodiment in that the two

balloon fixing tool mounting grooves **20b**, **20bb** are provided and a balloon fixing tool **22A** having a shape corresponding to the grooves is used.

[0065] As described above, the two balloon fixing tool mounting grooves **20b**, **20bb** are provided on the proximal end side of the ultrasound probe **20A** according to the present embodiment, and the proximal-end-side balloon fixing portion **20a** is formed between the two balloon fixing tool mounting grooves **20b** and **20bb**. The groove widths of the two balloon fixing tool mounting grooves **20b**, **20bb** are set so as to be narrower than the thickness (diameter) of the proximal end ring-shape portion **21a** of the ultrasound balloon **21**.

[0066] On the other hand, the balloon fixing tool **22A** is formed such that members having what is called C-ring shape which is substantially the same shape as that of the balloon fixing tool **22** in the first embodiment are connected to each other at a connecting portion **22Aa**. Furthermore, the connecting portion **22Aa** includes a convex-shaped portion formed outwardly such that the connection portion **22Aa** does not interfere with the proximal end ring-shape portion **21a** of the ultrasound balloon **21** when the balloon fixing tool **22A** is attached to a predetermined position of the ultrasound probe **20A**, that is, in the state where the two C-ring shaped portions are fitted into the two balloon fixing tool mounting grooves **20b**, **20bb**. Other configurations and workings are the same as those in the above-described first embodiment.

[0067] As described above, according to the second embodiment, the same effects as those in the first embodiment can be obtained. In addition, in the present embodiment, the balloon fixing tool **22A** is configured to have the two C-ring shaped portions, thereby enabling attachment and detachment of the balloon fixing tool **22A** to be performed more easily.

Third Embodiment

[0068] FIGS. **12** to **15** illustrate a third embodiment of the present invention. Note that, in the schematic projection view in FIG. **14**, only the visible outline at the time that the vicinity of the distal end section of the ultrasound probe is projected is shown, illustration of an internal configuration is omitted, and only the balloon in the mounted state is shown in the cross section thereof, in order to avoid complication of the drawing.

[0069] The present embodiment has substantially the same configurations as those in the first embodiment. However, an ultrasound probe **20D** according to the present embodiment is different from the one in the first embodiment in that an ultrasound transmitting medium inlet **20Dx** is provided in a balloon fixing tool mounting groove **20Db** and a balloon fixing tool **22D** having a shape corresponding to the groove is used.

[0070] As shown in FIG. **12**, the ultrasound transmitting medium inlet **20Dx** is provided in the balloon fixing tool mounting groove **20Db** of the ultrasound probe **20D** according to the present embodiment. In addition, a proximal-end-side balloon fixing portion **20Da** is formed at the site closer to the proximal end than the balloon fixing tool mounting groove **20Db**. The proximal-end-side balloon fixing portion **20Da** is formed such that the cross-sectional shape thereof is a stepped shape in which the proximal end side is made higher, similarly in the first embodiment.

[0071] On the other hand, as shown in FIG. **13**, the balloon fixing tool **22D** is formed such that the whole shape is what is called C-ring shape formed by cutting out a part of a circular ring shape, for example, and has elasticity in the circumfer-

ential direction, similarly in the first embodiment. In addition, the balloon fixing tool **22D** according to the present embodiment includes, at the substantially center portion on the inner circumferential surface side thereof, a circumferential groove **22Da** formed along the circumferential direction. The circumferential groove **22Da** is formed at a position opposed to the ultrasound transmitting medium inlet **20Dx** of the balloon fixing tool mounting groove **20Db** when the balloon fixing tool **22D** is fitted into the balloon fixing tool mounting groove **20Db** of the ultrasound probe **20D** (the state shown in FIG. **14**). Furthermore, the circumferential groove **22Da** of the balloon fixing tool **22D** is formed so as to open toward the distal end side of the ultrasound probe **20D**, for example, to allow the ultrasound transmitting medium discharged from the ultrasound transmitting medium inlet **20Dx** to be guided toward the ultrasound transmission/reception portion when the injection operation of the ultrasound transmitting medium is performed. Other configurations are substantially the same as those in the first embodiment.

[0072] According to such a configuration, in the state where the ultrasound balloon **21** is mounted and fixed by fitting the balloon fixing tool **22D** into the balloon fixing tool mounting groove **20Db** while sandwiching the ultrasound balloon **21** therebetween, if the injection operation of the ultrasound transmitting medium is performed, the ultrasound transmitting medium causes the sandwiched site of the ultrasound balloon **21** to inflate in the circumferential groove **22Da** of the balloon fixing tool **22D**, and the ultrasound transmitting medium is smoothly injected into the ultrasound balloon **21**. Other workings are substantially the same as that in the first embodiment.

[0073] As described above, according to the third embodiment, the same effects as those in the first embodiment can be obtained. In addition, in the present embodiment, the ultrasound transmitting medium inlet **20Dx** is provided in the balloon fixing tool mounting groove **20Db** and the circumferential groove **22Da** is formed on the inner circumferential surface of the balloon fixing tool **22D** so as to correspond to the ultrasound transmitting medium inlet. According to such a configuration, when the injection operation of the ultrasound transmitting medium is performed, the ultrasound transmitting medium can be surely injected into the ultrasound balloon **21** and the injection can be effectively performed while preventing the ultrasound balloon **21** from unevenly inflating. Note that, also when discharge operation of the ultrasound transmitting medium is performed, similarly, the balloon can be deflated evenly.

Fourth Embodiment

[0074] FIGS. **16** to **18** illustrate a fourth embodiment of the present invention. The present embodiment has substantially the same configurations as those in the first embodiment. However, an ultrasound probe **20E** according to the present embodiment is different from the one in the first embodiment in that a balloon mounting site adjusting mechanism is provided.

[0075] That is, the ultrasound probe **20E** according to the present embodiment includes a main body unit **20Ed** including an ultrasound transmission/reception portion and a case member, a balloon mounting site adjusting mechanism **23** including a proximal-end-side balloon fixing portion **23a** and a balloon fixing tool mounting groove **23b**, and the like.

[0076] The main body unit **20Ed**, though detailed illustration thereof is omitted, includes the ultrasound transmission/

reception portion and the case member. As shown in FIG. 18, a pipe 20Ef, which incorporates various signal lines and tubes (not shown), which pass from the distal end opening of the insertion section 2 through inner portions of the insertion section 2, the control section 3, and to the inner portion the universal cord 4, is extended from the proximal end side of the case member. In addition, a screw portion 20Ee is formed on the outer circumference of the pipe 20Ef at a site which is closer to the distal end.

[0077] The balloon mounting site adjusting mechanism 23 includes, on the outer circumferential surface thereof, the proximal-end-side balloon fixing portion 23a and the balloon fixing tool mounting groove 23b, and is a substantially cylindrical member formed as a body separated from the main body unit 20Ed. In addition, as shown in FIG. 18, a female screw portion 23e which screws with a screw portion 20Ee of the pipe 20Ef is formed on the inner circumferential surface of the balloon mounting site adjusting mechanism 23. The balloon mounting site adjusting mechanism 23 is rotatably disposed with respect to the distal-most site of the distal end section 10E. Furthermore, a sealing member 24 is interposed between the balloon mounting site adjusting mechanism 23 and the distal-most site of the distal end section 10E, for example, thereby achieving watertightness. According to such a configuration, when the balloon mounting site adjusting mechanism 23 is rotated around the long axis of the insertion section 2 (distal end section 10E), the main body unit 20Ed and the pipe 20Ef advance or retreat in the direction along the long axis (direction along the arrow X shown in FIG. 18) of the insertion section 2 (distal end section 10E). In this configuration, the arrangement relationship between the proximal-end-side balloon fixing portion 23a and the balloon fixing tool mounting groove 23b is as follows. That is, the balloon fixing tool mounting groove 23b is disposed at a position closer to the distal end than the proximal-end-side balloon fixing portion 23a.

[0078] In addition, the balloon mounting site adjusting mechanism 23 including the balloon fixing tool mounting groove 23b is a pressing portion which is advanceable and retractable on the more distal end side than the proximal-end-side balloon fixing portion 23a, and which presses and fixes the outer circumference of the end portion of the ultrasound balloon 21, which is in the vicinity of the proximal end ring-shape portion 21a and closer to the distal end, using the balloon fixing tool 22. Other configurations are substantially the same as those in the first embodiment.

[0079] Also in the ultrasound probe 20E thus configured, the mounting operation of the ultrasound balloon 21 can be performed in substantially the same procedure as that described in the first embodiment.

[0080] As described above, according to the fourth embodiment, the same effects as those in the first embodiment can be obtained. Furthermore, the ultrasound probe 20E according to the present embodiment includes the balloon mounting site adjusting mechanism 23. Accordingly, when the mounting operation of the balloon is performed, the balloon mounting site adjusting mechanism 23 having the balloon mounting site on the ultrasound transmission/reception portion side is moved, thereby providing a room in the vicinity of the balloon mounting site in the insertion axis direction. Therefore, it is possible to improve the workability of the operations such as the balloon mounting operation and the air bubbles removing operation.

[0081] After the balloon mounting operation, the balloon mounting site adjusting mechanism 23 is moved to the proximal end side, thereby capable of applying tension to the mounted balloon 21. Therefore, it is possible to equalize the tensional force applied to the ultrasound balloon 21, thereby preventing the balloon from unevenly inflating when the ultrasound transmitting medium is injected.

[0082] Note that, when the balloon mounting site adjusting mechanism 23 is moved in the state where the balloon is mounted, the balloon mounting site adjusting mechanism 23 only moves inside the ultrasound balloon 21. Therefore, it is possible to prevent outside filth from entering into the ultrasound balloon 21.

[0083] The present invention is not limited to the above-described embodiments, and it is needless to say that various modifications and applications can be performed without departing from the gist of the invention. Furthermore, the above-described embodiments include inventions at various stages, and by appropriately combining a plurality of constituent features disclosed in the embodiments, inventions at various stages can also be extracted. For example, even if some constituent features are deleted from all the constituent features shown in the above-described present embodiments, if the problem to be solved by the invention can be solved and the effects of the invention can be obtained, the configuration in which some constituent features are deleted can be extracted as an invention.

[0084] The present invention can be applied not only to endoscope control apparatuses in the medical fields but also in endoscope control apparatuses in the industrial fields.

What is claimed is:

1. An ultrasound probe comprising:

an ultrasound transmission/reception portion which transmits and receives ultrasound;

a proximal-end-side balloon fixing portion disposed on a more proximal end side than the ultrasound transmission/reception portion and having a stepped shape in which a proximal end side is high; and

a balloon fixing tool mounting groove arranged on a more distal end side than the proximal-end-side balloon fixing portion and having a width narrower than a width of the proximal-end-side balloon fixing portion.

2. The ultrasound probe according to claim 1, further comprising:

a balloon fixing tool formed so as to be attachable to and detachable from an outer circumference on a proximal end side of an ultrasound balloon, the balloon fixing tool being configured to fix the ultrasound balloon by pressing a part of the ultrasound balloon arranged so as to cover the ultrasound transmission/reception portion.

3. The ultrasound probe according to claim 2, wherein the balloon fixing tool is formed in a shape formed by cutting out a part of a circular ring shape.

4. The ultrasound probe according to claim 2, wherein the balloon fixing tool includes an identification portion configured to be able to identify the ultrasound probe to which the ultrasound balloon is fixed.

5. The ultrasound probe according to claim 2, further comprising a pressing portion which is disposed on a more distal end side than the proximal-end-side balloon fixing portion, configured to be advanceable and retractable on the more distal end side than the proximal-end-side balloon fixing portion.

tion, and fixes the ultrasound balloon by pressing a part of the outer circumference on a proximal end side of the ultrasound balloon.

* * * * *

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摘要(译)

超声波探头包括：超声波发送/接收部分，其发送和接收超声波；近端侧球囊固定部分，布置在比超声波发送/接收部分更近端侧并且具有阶梯形状，其中近端侧球囊固定工具安装槽设置在比近端侧球囊固定部分更远端侧并且具有比近端侧球囊固定部分的宽度窄的宽度。

