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(54) **ULTRASOUND ENDOSCOPE**

ULTRASCHALLENDOSKOP

ECHO-ENDOSCOPE

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Description

Technical Field

[0001] The present invention relates to an ultrasound endoscope including an ultrasound observation section and a connection portion for connecting the ultrasound observation section with a bending portion in a distal end rigid portion, the distal end rigid portion being located on a distal end side with respect to the bending portion in an insertion portion to be inserted into an interior of a body.

Background Art

[0002] There is a well-known ultrasound endoscope which repeatedly transmits ultrasound to an area to be inspected in the interior of the body from an ultrasound transmission/reception section, and receives an echo signal of the ultrasound reflected from the area to be inspected with the ultrasound transmission/reception section, thereby enabling observation of an ultrasound image which is a two-dimensional visible image of the area to be inspected.

[0003] Japanese Patent Application Laid-Open Publication No. 2002-306489 discloses a structure for improving puncturability, in which a part of a distal end is inclined.

[0004] However, there is a desire for an ultrasound endoscope which is excellent not only in puncturability but also in insertability.

JP 7 143985 A discloses an ultrasound probe which is provided with a needle guide passage for a puncture needle and comprises an ultrasound transducer mounted at the distal end of a flexible catheter member, and a needle passage provided axially within the catheter member for launching the puncture needle therethrough. The needle passage is turned toward an exit opened on a lateral side portion of the rigid fore end section at a position on the near side of the ultrasound transducer, the rigid fore end section of the catheter member being provided with a bent portion. The bent portion is turned off the axis of the catheter member through a predetermined angle in a direction away from a needle launching direction of the needle passage at a position on the near side of the exit opening of the needle passage. An object of the present invention is to provide an ultrasound endoscope which is capable of improving insertability.

Disclosure of Invention

Means for Solving the Problem

[0005] To achieve the above-described object, an ultrasound endoscope in an aspect of the present invention includes: a bending portion; a distal end rigid portion which is located on a distal end side with respect to the bending portion; an ultrasound observation section making up the distal end rigid portion; and a connection portion making up the distal end rigid portion, for connecting the ultrasound observation section with the bending portion, wherein the connection portion is inclined with respect to a central axis of the bending portion, an interface between the connection portion and the bending portion is perpendicular to the central axis, and the connection portion has a swept shape which is obtained by making a cross-section of the interface slide in a direction perpendicular to the central axis while keeping the perpendicularity along a straight line intersecting with the central axis.

Brief Description of the Drawings

[0006]

Fig. 1 is a diagram to schematically show the distal end side of an insertion portion of an ultrasound endoscope of a first embodiment;
Fig. 2 is a schematic diagram focusing on a part of the insertion portion of Fig. 1;
Fig. 3 is a schematic diagram focusing on a part of the insertion portion of Fig. 9;
Fig. 4 is a diagram to schematically show the distal end side of an insertion portion of an ultrasound endoscope of a second embodiment;
Fig. 5 is a diagram to show the distal end side of the insertion portion of the ultrasound endoscope of the present embodiment, along with the distal end side of a conventional insertion portion shown in Fig. 7 in which a distal end rigid portion along with a bending portion has a linear shape;
Fig. 6 is a diagram to schematically show the distal end side of the insertion portion of the present embodiment of Fig. 5, along with the distal end side of a conventional insertion portion shown in Fig. 8, and the distal end side of an insertion portion in which a connection portion does not have a swept shape and an ultrasound observation section is bent;
Fig. 7 is a diagram to show the distal end side of an insertion portion of a conventional ultrasound endoscope in which a distal end rigid portion along with a bending portion has a linear shape;
Fig. 8 is a diagram to schematically show the distal end side of the conventional insertion portion of Fig. 7; and
Fig. 9 is a diagram to schematically show an example of an ultrasound endoscope in which a connection portion of an insertion portion does not have a swept shape.

Best Mode for Carrying Out the Invention

[0007] Hereinafter, embodiments of the present invention will be described with reference to the drawings. It is noted that drawings are schematically shown and a relationship between a thickness and a width of each member, a ratio of the thicknesses of respective mem-

bers, and the like may be different from actual ones, and also it is a matter of course that portions having different dimensional relations and ratios from each other between respective drawings may be included.

(First Embodiment)

[0008] Fig. 1 is a diagram to schematically show the distal end side of an insertion portion of an ultrasound endoscope of the present embodiment, and Fig. 2 is a schematic diagram focusing on a part of the insertion portion of Fig. 1.

[0009] As shown in Fig. 1, an ultrasound endoscope 10 is provided with a known bending portion 2 on the distal end side in a direction S with respect to an insertion portion 1 which is to be inserted into the interior of the body, for example, a bronchus, and is also provided with a non-bending distal end rigid portion 5 on the distal end side in the direction S with respect to the bending portion 2. It is noted that since the configuration of the ultrasound endoscope 10 in the rearward in the direction S with respect to the bending portion 2 is well known, description thereof will be omitted.

[0010] A principal part of the distal end rigid portion 5 is configured to include an ultrasound observation section 3 and a connection portion 4. The connection portion 4 connects the ultrasound observation section 3 with the bending portion 2.

[0011] It is noted that although not shown in Fig. 1, the distal end rigid portion 5 may be provided with an observation section and an image pickup section for observing the interior of the body, an illumination section for illuminating the interior of the body, and the like. Further, the distal end rigid portion 5 may be provided with a below-described protrusion opening 4g (see Fig. 5) which is opened thereon and from which a treatment instrument passed through the insertion portion 1 is protruded.

[0012] Further, the connection portion 4 is inclined by an angle $\theta 1$ which is less than 90°, with respect to a central axis J of the bending portion 2 which is parallel with the direction S, as shown in Fig. 1. The angle $\theta 1$ herein refers to an angle on the distal end side in the direction S out of the angles formed between the central axis J of the bending portion 2 and the connection portion 4 as shown in Fig. 1.

[0013] To be specific, the connection portion 4 is positioned along a straight line Q that intersects with the central axis J at an angle $\theta 1$ as shown in Fig. 1. An interface Z between the connection portion 4 and the bending portion 2 is perpendicular to the central axis J, and is configured to have a swept shape which is obtained by making the cross section of the interface Z slide in a direction perpendicular to the central axis J while keeping its perpendicularity along the straight line Q.

[0014] To be more specific, as shown in Fig. 2, the connection portion 4 is formed into a shape in which when taking a b2-b2 cross-section in a direction E at whatever position along the straight line Q, the cross-sectional shape corresponds to the shape of a b1-b1 cross-section of the direction E in the interface Z.

[0015] In other words, the connection portion 4 is formed into a shape in which the shape of a b3-b3 cross-section of the connection portion 4 in a direction F which is perpendicular to the straight line Q does not correspond to the b1-b1 cross-section in the direction E of the interface Z.

[0016] It is noted that in the present embodiment, the ultrasound observation section 3 is also positioned along the straight line Q which intersects with the central axis J at the angle of $\theta 1$, as shown in Fig. 1.

[0017] Here, Fig. 9 is a diagram to schematically show an example of an ultrasound endoscope in which a connection portion of an insertion portion does not have a swept shape, and Fig. 3 is a schematic diagram focusing on a part of the insertion portion of Fig. 9.

[0018] As shown in Figs. 3 and 9, in an endoscope 200 in which a connection portion 204 does not have a swept shape, the connection portion 204 is formed into a shape in which the shape of a b1-b1 cross-section of a direction E in the interface Z corresponds to a b3-b3 cross-section of the connection portion 4 in a direction F as shown in Fig. 3, in an insertion portion 201 having a distal end rigid portion 205, which includes an ultrasound observation section 203 and the connection portion 204, and a bending portion 202.

[0019] In other words, the connection portion 204 is formed into a shape in which the shape of a b2-b2 cross-section of the connection portion 204 in the direction E does not correspond to the shape of the b1-b1 cross-section of the direction E in the interface Z at whatever position along the straight line Q of the connection portion 204.

[0020] That is, the connection portion 4 in the present embodiment is formed into a shape in which a straight area along the direction S surrounded by a chain line Y in Fig. 3, which is present in the connection portion 204 not having a swept shape shown in Fig. 3, is formed into a shape which is not present in a proximal end of the connection portion 4.

[0021] It is noted that while the entire connection portion 4 may have a shape obtained by making the interface Z slide along the straight line Q so as to be perpendicular to the central axis J, it may also have a shape in which a part thereof is cut off according to purposes. Moreover, configuration may also be such that a portion which is made to slide so as to be perpendicular to the central axis J and a portion which is made to slide at a certain angle other than perpendicularity with respect to the central axis J may coexist.

[0022] In this way, since in the present embodiment, the connection portion 4 has a swept shape, the insertability of the insertion portion 1 is excellent. It is noted that the reason why the insertability of the insertion portion 1 is made excellent by the arrangement that the connection portion 4 has a swept shape will be described later.

(Second Embodiment)

[0023] Fig. 4 schematically shows the distal end side of an insertion portion of an endoscope showing the present embodiment.

[0024] As shown in Fig. 4, in the present embodiment as well, the connection portion 4 has a swept shape as in the first embodiment described above.

[0025] As a result of this, as in the first embodiment, the present embodiment has a configuration in which the insertability of the insertion portion 1 is excellent. It is noted that the reason why the insertability of the insertion portion 1 is made excellent by the arrangement that the connection portion 4 has a swept shape will be described later.

[0026] Further, the present embodiment is configured such that the ultrasound observation section 3 is bent (inclined) from the distal end of the connection portion 4 with respect to the connection portion 4 in the direction of an axis J' which is parallel with the central axis J of the bending portion 2.

[0027] As a result of this, the present embodiment has a configuration in which the insertability of the insertion portion 1 is improved than in the first embodiment. It is noted that the reason why the insertability of the insertion portion 1 is improved by the arrangement that the ultrasound observation section 3 is bent will be described later.

(Third Embodiment)

[0028] Fig. 5 is a diagram to show the distal end side of an insertion portion of an ultrasound endoscope of the present embodiment, along with the distal end side of a conventional insertion portion shown in Fig. 7 in which a distal end rigid portion as well as a bending portion has a linear shape. Fig. 6 is a diagram to schematically show the distal end side of the insertion portion of the present embodiment of Fig. 5, along with the distal end side of a conventional insertion portion shown in Fig. 8, and the distal end side of an insertion portion in which a connection portion does not have a swept shape and an ultrasound observation section is bent.

[0029] As shown in Fig. 6, the ultrasound observation section 3 may also be inclined at an angle $\theta 2$ with respect to the direction of an axis J' which is parallel with the central axis J of the bending portion 2. As a result of this, the insertability of the insertion portion 1 will be further improved. It is noted that the reason why the insertability of the insertion portion 1 is improved by the arrangement that the ultrasound observation section 3 is bent at the angle $\theta 2$ will be described later as well.

[0030] Further, hereinafter, owing to the arrangement that the connection portion 4 is inclined from the central axis J at an inclination angle $\theta 1$ as shown in Fig. 5, although this is a common structure in the first to third embodiments, it becomes possible to bring a central axis H of a protrusion opening 4g provided in the area of a chain line D closer to being parallel with the central axis J. That is, it is possible to decrease the inclination angle of the central axis H with respect to the central axis J.

[0031] As a result of this, since a treatment instrument can be protruded from the protrusion opening 4g without being extremely bent along the central axis J, the insertability of the treatment instrument is improved. Further, it is also possible to suppress to a minimum the flexion of a known image guide or a light guide at the connection portion 4, which is inserted into the vicinity of the protrusion opening 4g in the insertion portion 1.

[0032] The ultrasound observation section 3 has a known convex type and includes an ultrasound transmission/reception section 3s, which transmits ultrasound C to an area to be inspected in the interior of the body and receives an echo single of the ultrasound C reflected from the area to be inspected, in a housing 3h which includes an acoustic lens 3n, as shown in Fig. 5. What is described so far is the common structure in the first to third embodiments.

[0033] Further, in the present embodiment, the acoustic lens 3n is positioned in the housing 3h such that the transmission direction of ultrasound C corresponds to the direction to the central axis J side.

[0034] Further, the ultrasound observation section 3 is positioned in a back face 3m side, which is an opposite direction side of a position at which the ultrasound C transmitted from the ultrasound transmission/reception section 3s intersects with the central axis J, that is, the opposite direction side of the transmission direction of ultrasound C, in the housing 3h with respect to the central axis J as shown in Fig. 5. In other words, a part of the ultrasound observation section 3 will not intersect with the central axis J. Moreover, the inclination angle $\theta 1$ of the connection portion 4 described above is set to be an angle at which a part of the ultrasound observation section 3 will not intersect with the central axis J.

[0035] Further, in the present embodiment, as described above, the ultrasound observation section 3 is positioned along a straight line W which intersects with a central axis J', which is parallel with the central axis J, at an angle $\theta 2$ which is less than 90° and is also less than the inclination angle $\theta 1$ of the connection portion 4.

[0036] That is, the ultrasound observation section 3 is inclined with respect to the central axis J at an angle $\theta 2$ and having a swept shape. To be more specific, the inclination angle $\theta 2$ of the ultrasound observation section 3 corresponds to the inclination angle of the back face 3m of the housing 3h. Moreover, the inclination angle $\theta 2$ of the ultrasound observation section 3 is set to be an angle at which a part of the ultrasound observation section 3 will not intersect with the central axis J.

[0037] Thus, in the ultrasound endoscope 10 of the present embodiment, the connection portion 4 has a swept shape and the ultrasound observation section 3 has a swept shape as well. As a result of this, when supposing that the length of the ultrasound observation section be t1, and the length of the connection portion 4 be

t2 as shown in Fig. 6, the length of the distal end rigid portion 5 in the direction S is shorter by an amount of m3 than the length of the distal end rigid portion 105 of the insertion portion 101 in the ultrasound endoscope 100, in which the distal end rigid portion 105 including a conventional ultrasound observation section 103 and a connection portion 104, and a bending portion 102 are provided in a linear fashion along the central axis J as shown in Figs. 7 and 9.

[0038] Further, as shown in Fig. 6, the length of the distal end rigid portion 5 becomes shorter by an amount of m2 than that of the distal end rigid portion 505 in the ultrasound endoscope 500, in which the insertion portion 501 includes a distal end rigid portion 505 having a connection portion 504 which does not have a swept shape and an ultrasound observation section 503 which is bent without having a swept shape at an angle $\theta 2$, which is less than $\theta 1$ and less than 90°, from the distal end of the connection portion 504. It is noted that the connection portion 504 has a similar configuration to that of the connection portion 204 of the ultrasound endoscope 200.

[0039] Further, if a passing diameter r3 when the insertion portion 1 is made to proceed in a direction A while deforming a bronchus in the present embodiment is compared with a passing diameter r2 of an ultrasound endoscope 500 in which the connection portion 504 and the ultrasound observation section 503 do not have a swept shape, the result will be r3 < r2.

[0040] That is, the passing diameter will be smaller in the case where not only the connection portion 4 but also the ultrasound observation section 3 has a swept shape and is being bent, as in the present embodiment.

[0041] It is noted that the arrangement that the ultrasound observation section 3 is only being bent at an angle $\theta 2$, which is less than $\theta 1$ and is less than 90°, without having a swept shape will contribute to shortening of the distal end rigid portion 5 and reduction of the passing diameter.

[0042] That is, the arrangement that the connection portion 4 only has a swept shape will contribute to shortening of the distal end rigid portion 5 and the reduction of the passing diameter. This is also true with the first and second embodiments described above.

[0043] Therefore, as shown in the first to third embodiments described above, the arrangement that the connection portion 4 has a swept shape will allow not only the length of the distal end rigid portion 5 to be shortened, but also the passing diameter r3 to be reduced, thus improving the insertability of the insertion portion 1.

[0044] Furthermore, the arrangement that the ultrasound observation section 3 is being bent to be parallel with the central axis J, or so as to have an angle $\theta 2$, or has a swept shape will further improve the insertability of the insertion portion 1.

[0045] This is because if the diameter of the insertion portion 1 to be inserted into, for example, a bronchus, that is, the passing diameter for the bronchus has become larger, or the length of the distal end rigid portion 5 in the direction S has become longer, when inserting the insertion portion 1 at a branching portion of superior and middle lobes selectively to either side of the branching portion, it is difficult to insert it into both sides or either one side, thus degrading the selectivity, and it is difficult to insert the insertion portion into a deeper part after inserting into either of superior lobe or middle lobe. Namely, that is because the insertability of the insertion portion is degraded.

[0046] Therefore, as the result of realizing reduction of the passing diameter of the insertion portion 1 and shortening of the distal end rigid portion 5 in the direction S, the insertability of the insertion portion 1 is improved.

[0047] It is noted that although the ultrasound endoscope 10 has been shown taking an example of the configuration which is inserted into a bronchus, it can be, as a matter of course, applied to an ultrasound endoscope which is to be inserted into other sites.

The present application is filed claiming the priority of Japanese Patent Application No. 2010-255277 filed in Japan on November 15, 2010.

Claims

1. An ultrasound endoscope (10; 100; 200) comprising:

a bending portion (2; 102; 202);
a distal end rigid portion (5; 105; 205) positioned on a distal end side with respect to the bending portion (2; 102; 202);
an ultrasound observation section (3; 103; 203) making up the distal end rigid portion (5; 105; 205); and
a connection portion (4; 104; 204) making up the distal end rigid portion (5; 105; 205), for connecting the ultrasound observation section (3; 103; 203) with the bending portion (2; 102; 202), wherein
the connection portion (4; 104; 204) is inclined with respect to a central axis (J) of the bending portion (2; 102; 202), and
an end face, which is on a side of the connection portion (4; 104; 204), of an interface (Z) between the connection portion (4; 104; 204) and the bending portion (2; 102; 202) is perpendicular to the central axis (J) of the bending portion (2; 102; 202), **characterized in that**
the connection portion (4; 104; 204) has a swept shape which is obtained by making the end face slide along a line (Q) intersecting with the central axis (J) of the bending portion (2; 102; 202) while keeping the perpendicularity with respect to the central axis (J) of the bending portion (2; 102; 202).

2. The ultrasound endoscope according to claim 1, wherein

the ultrasound observation section (3; 103; 203) is inclinedly positioned with respect to the connection portion (4; 104; 204) from the distal end of the connection portion (4; 104; 204).

3. The ultrasound endoscope according to claim 2, wherein
the ultrasound observation section (3; 103; 203) is positioned in parallel with the central axis (J) of the bending portion (2; 102; 202).

4. The ultrasound endoscope according to claim 2, wherein
the ultrasound observation section (3; 103; 203) is inclined with respect to the central axis (J) of the bending portion (2; 102; 202), and
the connection portion (4; 104; 204) has a larger inclination angle ($\theta 1$) with respect to the central axis (J) than an inclination angle ($\theta 2$) of the ultrasound observation section (3; 103; 203).

5. The ultrasound endoscope according to claim 4, wherein
the ultrasound observation section (3; 103) is of a convex type, and comprises a housing (3h) and an ultrasound transmission/reception section (3s) contained in the housing (3h), and wherein
a transmission direction of ultrasound (C) of the ultrasound transmission/reception section (3s) is on a side of the central axis (J), and
the inclination angle ($\theta 2$) of the ultrasound observation section (3; 103) is equal to an inclination angle of a back face (3m) on an opposite side with respect to the transmission direction of the ultrasound (C) in the housing (3h).

6. The ultrasound endoscope according to claim 5, wherein
the ultrasound (C) transmitted from the ultrasound observation section (3; 103; 203) intersects with the central axis.

Patentansprüche

1. Ultraschallendoskop (10, 100, 200) umfassend:

einen Biegeabschnitt (2; 102; 202);
einen steifen distalen Endabschnitt (5; 105; 205), der in Bezug auf den Biegeabschnitt (2; 102; 202) an einer distalen Endseite angeordnet ist;
einen Ultraschallbeobachtungsbereich (3; 103; 203), der den steifen distalen Endabschnitt (5; 105; 205) bildet; und
einen Verbindungsabschnitt (4; 104; 204), der den steifen distalen Endabschnitt (5; 105; 205) bildet, zur Verbindung des Ultraschallbeobachtungsbereichs (3; 103; 203) mit dem Biegeabschnitt (2; 102; 202), wobei
der Verbindungsabschnitt (4; 104; 204) bezüglich einer Zentralachse (J) des Biegeabschnitts (2; 102; 202) geneigt ist und
eine Endfläche einer Grenzfläche (Z) zwischen dem Verbindungsabschnitt (4; 104; 204) und dem Biegeabschnitt (2; 102; 202), welche auf einer Seite des Verbindungsabschnitts (4; 104; 204) liegt, senkrecht zu der Zentralachse (J) des Biegeabschnitts (2; 102; 202) ist, **dadurch gekennzeichnet, dass**
der Verbindungsabschnitt (4; 104; 204) eine gebogene Form hat, die dadurch erhalten wird, dass die Endfläche entlang einer Linie (Q) gleitet, die die Zentralachse (J) des Biegeabschnitts (2; 102; 202) schneidet, während die Rechtwinkligkeit bezüglich der Zentralachse (J) des Biegeabschnitts (2; 102; 202) beibehalten wird.

2. Ultraschallendoskop gemäß Anspruch 1, wobei
der Ultraschallbeobachtungsbereich (3; 103; 203) bezüglich des Verbindungsabschnitts (4; 104; 204) geneigt von dem distalen Ende des Verbindungsabschnitts (4; 104; 204) angeordnet ist.

3. Ultraschallendoskop gemäß Anspruch 2, wobei
der Ultraschallbeobachtungsbereich (3; 103; 203) parallel zu der Zentralachse (J) des Biegeabschnitts (2; 102; 202) angeordnet ist.

4. Ultraschallendoskop gemäß Anspruch 2, wobei
der Ultraschallbeobachtungsbereich (3; 103; 203) bezüglich der Zentralachse (J) des Biegeabschnitts (2; 102; 202) geneigt ist und
der Verbindungsabschnitt (4; 104; 204) einen Neigungswinkel ($\theta 1$) bezüglich der Zentralachse (J) aufweist, der größer ist als ein Neigungswinkel ($\theta 2$) des Ultraschallbeobachtungsbereichs (3; 103; 203).

5. Ultraschallendoskop gemäß Anspruch 4, wobei
der Ultraschallbeobachtungsbereich (3; 103; 203) von einem konvexen Typ ist und ein Gehäuse (3h) und einen Ultraschall-Übertragungs-/Empfangsbereich (3s) umfasst, der in dem Gehäuse (3h) enthalten ist, und wobei
eine Übertragungsrichtung des Ultraschalls (C) des Ultraschall-Übertragungs-/ Empfangsbereichs (3s) auf einer Seite der der Zentralachse (J) liegt, und
der Neigungswinkel ($\theta 2$) des Ultraschallbeobachtungsbereichs (3; 103; 203) gleich einem Neigungswinkel einer Rückseite (3m) ist, die an der gegenüberliegenden Seite bezüglich der Übertragungsrichtung des Ultraschalls (C) in dem Gehäuse (3h) liegt.

6. Ultraschallendoskop gemäß Anspruch 5, wobei
der Ultraschall (C), der von dem Ultraschallbeobachtungsbereich (3; 103; 203) übertragen wird, die Zen-

tralachse schneidet.

Revendications

1. Endoscope (10 ; 100 ; 200) à ultrasons comprenant :

   une partie (2 ; 102 ; 202) de cintrage ;
   une partie (5 ; 105 ; 205) rigide d'extrémité distale positionnée sur un côté d'extrémité distale par rapport à la partie (2 ; 102 ; 202) de cintrage ;
   une section (3 ; 103 ; 203) d'observation par ultrasons constituant la partie (5 ; 105 ; 205) rigide d'extrémité distale ; et
   une partie (4 ; 104 ; 204) de connexion constituant la partie (5 ; 105 ; 205) rigide d'extrémité distale, pour connecter la section (3 ; 103 ; 203) d'observation par ultrasons avec la partie (2 ; 102 ; 202) de cintrage, dans lequel
   la partie (4 ; 104 ; 204) de connexion est inclinée par rapport à un axe central (J) de la partie (2 ; 102 ; 202) de cintrage, et
   une face d'extrémité qui se situe sur un côté de la partie (4 ; 104 ; 204) de connexion, d'une interface (Z) entre la partie (4 ; 104 ; 204) de connexion et la partie (2 ; 102 ; 202) de cintrage est perpendiculaire à l'axe central (J) de la partie (2 ; 102 ; 202) de cintrage, **caractérisé en ce que**
   la partie (4 ; 104 ; 204) de connexion présente une forme balayée qui est obtenue en amenant la face d'extrémité à glisser le long d'une ligne (Q) croisant l'axe central (J) de la partie (2 ; 102 ; 202) de cintrage tout en maintenant la perpendicularité par rapport à l'axe central (J) de la partie (2 ; 102 ; 202) de cintrage.

2. Endoscope à ultrasons selon la revendication 1, dans lequel
   la section (3 ; 103 ; 203) d'observation par ultrasons est positionnée de manière inclinée par rapport à la partie (4 ; 104 ; 204) de connexion à partir de l'extrémité distale de la partie (4 ; 104 ; 204) de connexion.

3. Endoscope à ultrasons selon la revendication 2, dans lequel
   la section (3 ; 103 ; 203) d'observation par ultrasons est positionnée en parallèle par rapport à l'axe central (J) de la partie (2 ; 102 ; 202) de cintrage.

4. Endoscope à ultrasons selon la revendication 2, dans lequel
   la section (3 ; 103 ; 203) d'observation par ultrasons est inclinée par rapport à l'axe central (J) de la partie (2 ; 102 ; 202) de cintrage, et
   la partie (4 ; 104 ; 204) de connexion présente un angle ($\theta 1$) d'inclinaison plus grand par rapport à l'axe central (J) qu'un angle ($\theta 2$) d'inclinaison de la section (3 ; 103 ; 203) d'observation par ultrasons.

5. Endoscope à ultrasons selon la revendication 4, dans lequel
   la section (3 ; 103) d'observation par ultrasons est d'un type convexe et comprend un logement (3h) et une section (3s) de transmission/réception d'ultrasons contenue dans le logement (3h), et dans lequel une direction de transmission des ultrasons (C) de la section (3s) de transmission/réception d'ultrasons se situe sur un côté de l'axe central (J), et
   l'angle ($\theta 2$) d'inclinaison de la section (3 ; 103) d'observation par ultrasons est égal à un angle d'inclinaison d'une face arrière (3m) sur un côté opposé par rapport à la direction de transmission des ultrasons (C) dans le logement (3h).

6. Endoscope ultrasons selon la revendication 5, dans lequel
   les ultrasons (C) transmis depuis la section (3 ; 103 ; 203) d'observation par ultrasons croisent l'axe central.

FIG.1

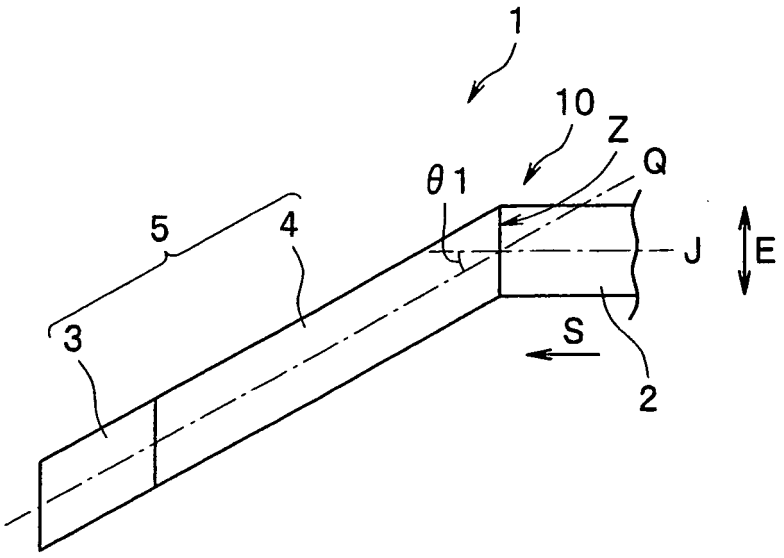


FIG.2

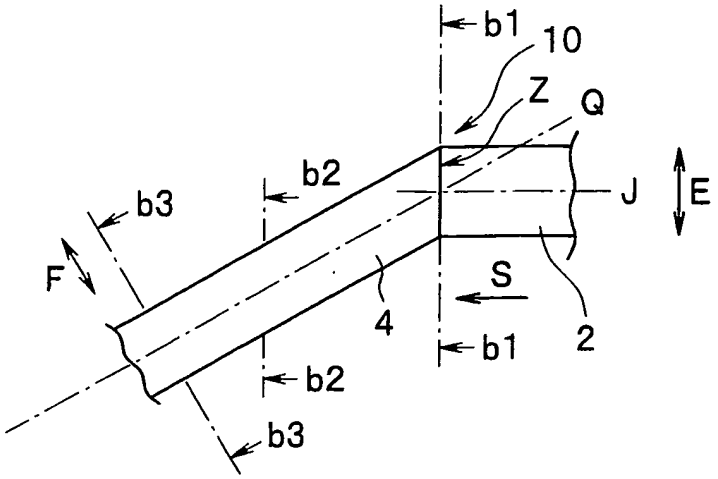


FIG.3

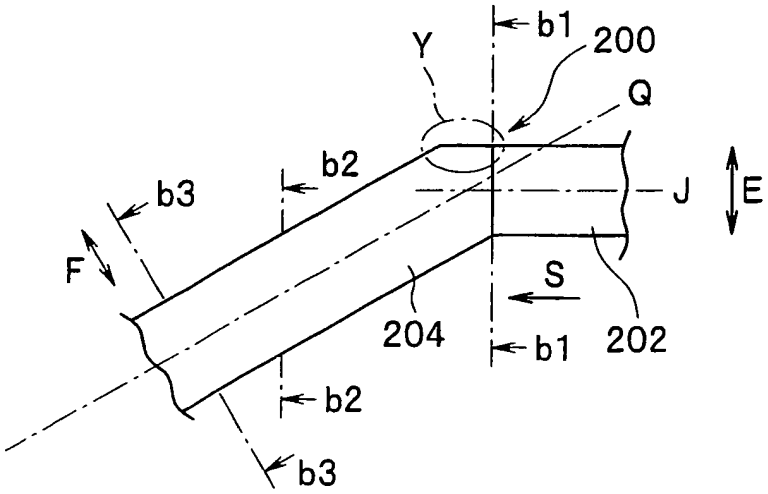


FIG.4

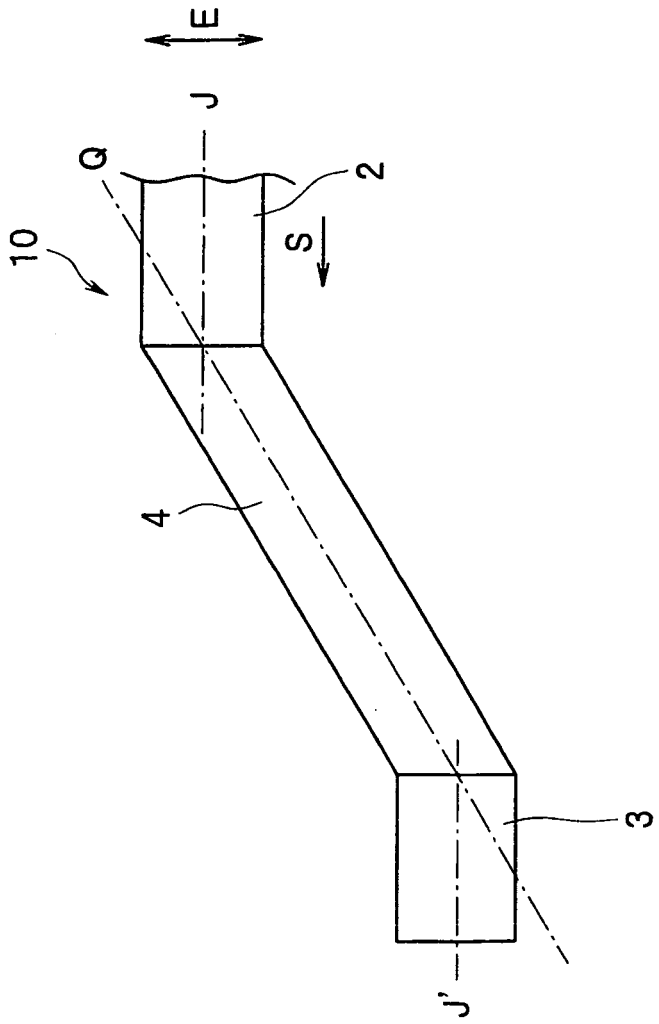


FIG.5

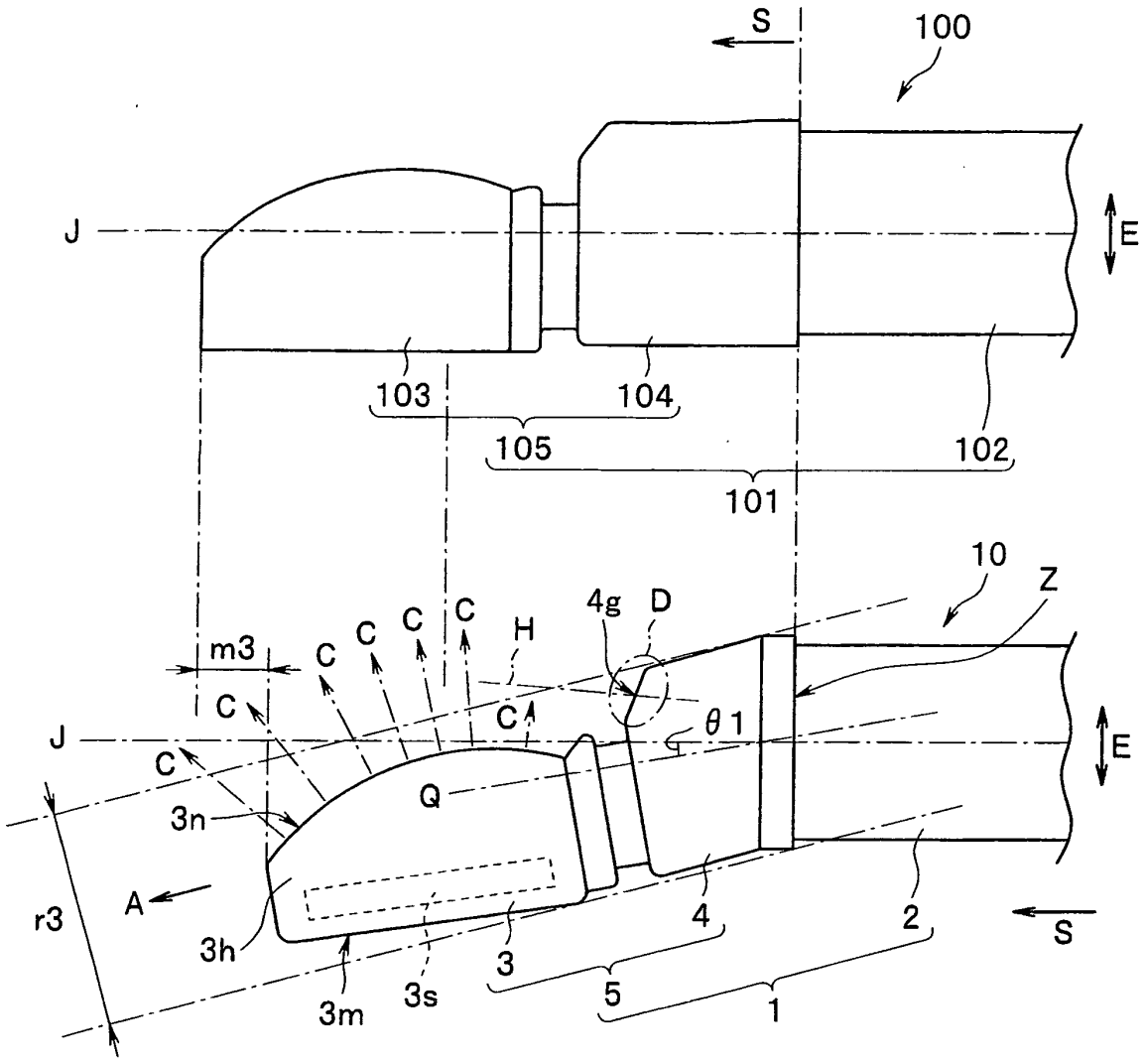
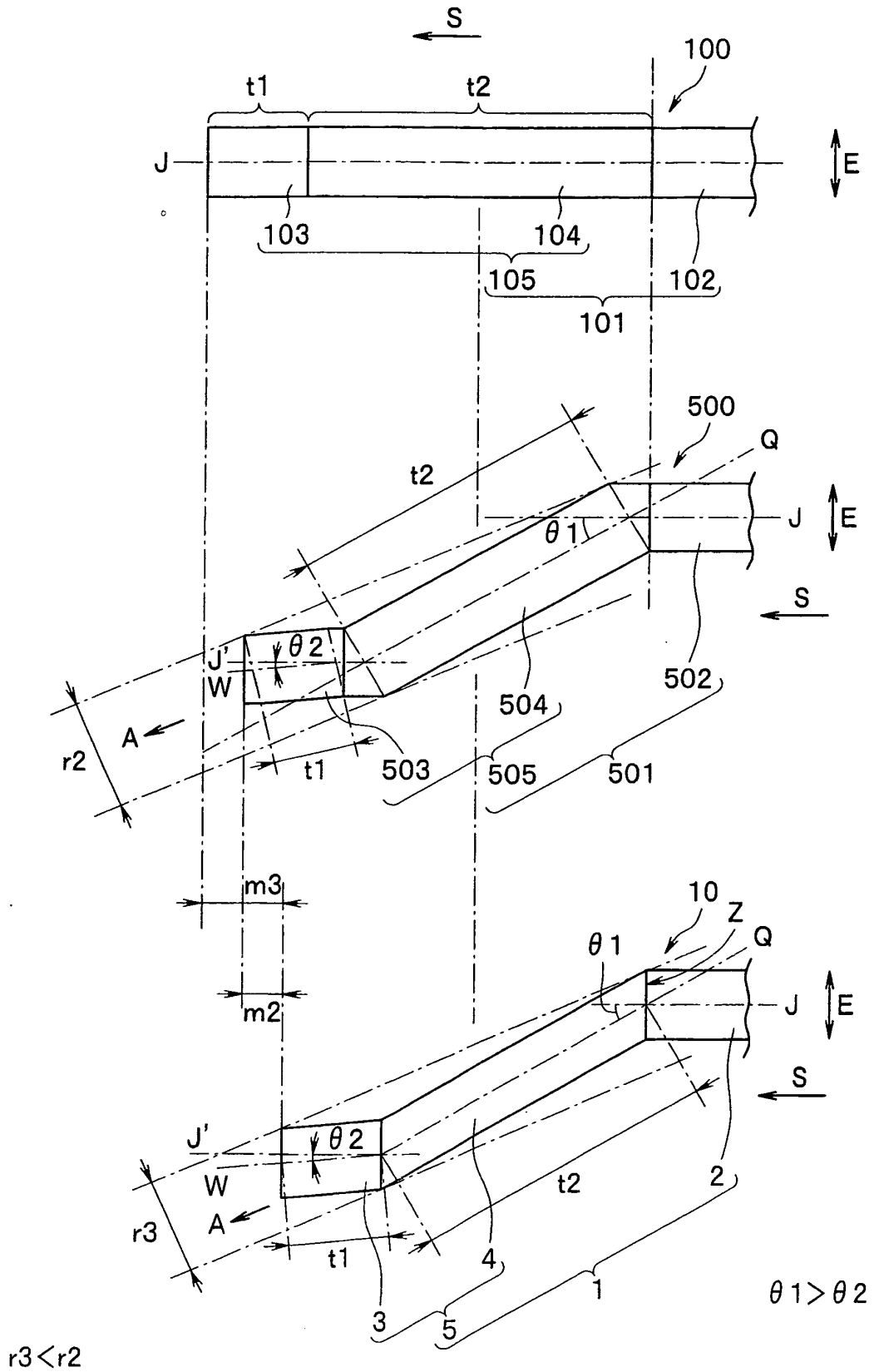

S
100
J
E
103
104
105
102
101
10
Z
4g
D
m3
C
H
θ1
Q
3n
A
r3
3h
3m
3s
3
4
5
2
1

FIG.6


S
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t1
t2
J
E
103
104
105
102
101
500
Q
t2
θ1
J
E
S
J'
θ2
W
A
r2
t1
503
504
505
502
501
m3
m2
10
Z
θ1
Q
J
E
S
J'
θ2
W
A
r3
t1
t2
2
4
3
5
1
θ1>θ2
r3<r2

FIG.7

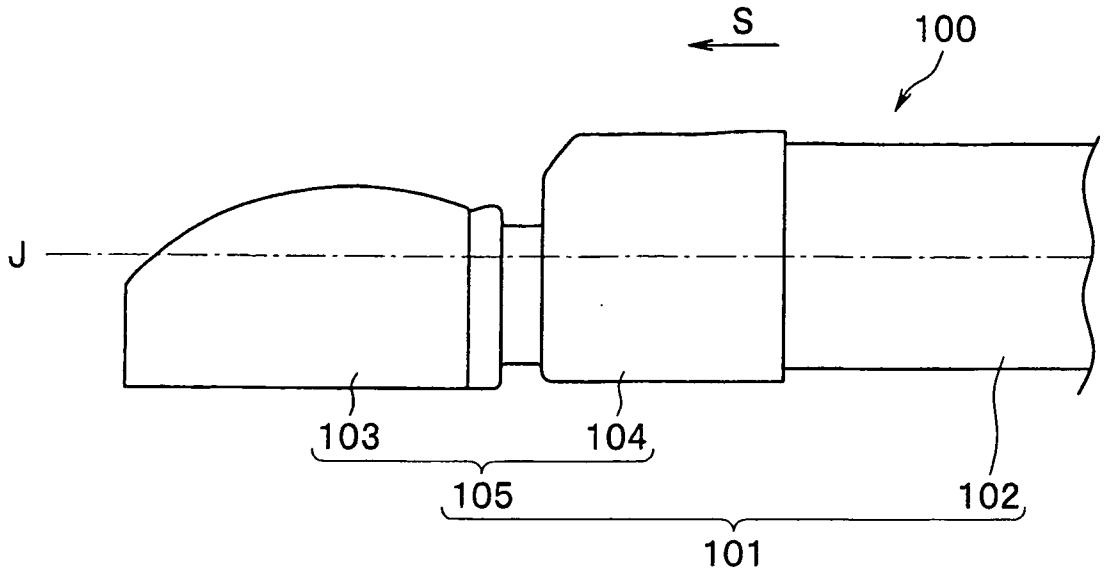


FIG.8

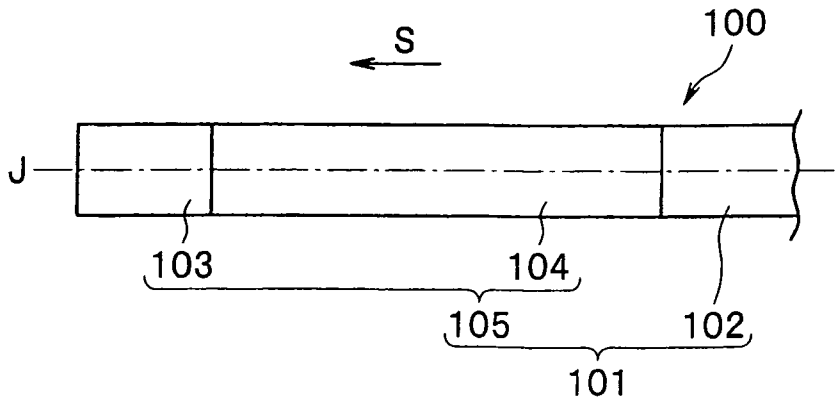
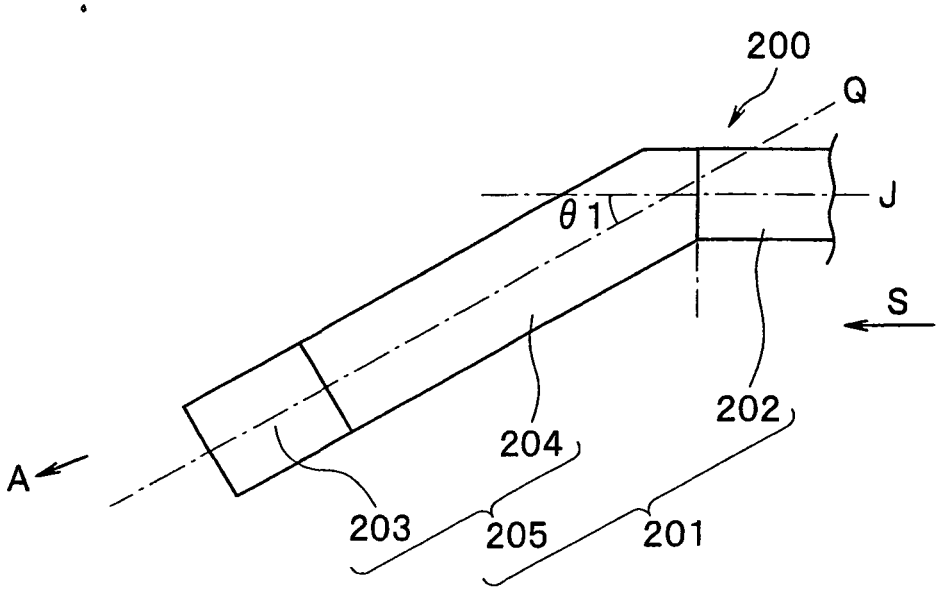


FIG.9



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2002306489 A **[0003]**
- JP 7143985 A **[0004]**
- JP 2010255277 A **[0047]**

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摘要(译)

超声波内窥镜包括：弯曲部分2;远端刚性部分5，其相对于弯曲部分2位于远端侧;超声观察部分3构成远端刚性部分5;构成远端刚性部分的连接部分4，用于连接超声波观察部分3和弯曲部分2，其中连接部分4相对于弯曲部分的中心轴线J倾斜，界面Z之间的界面Z连接部分4和弯曲部分2垂直于中心轴线J，连接部分4具有扫掠形状，该扫掠形状是通过使界面Z的横截面在垂直于中心轴线J的方向上滑动而获得的，同时保持沿着与中心轴J相交的直线Q的垂直度。

FIG.1