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(71) Applicant (for all designated States except US): **WILSON-COOK MEDICAL, INC.** [US/US]; 4900 BETHANIA STATION ROAD, P.o. Box 4191, Winston-salem, North Carolina 27105 (US).

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(72) Inventor; and

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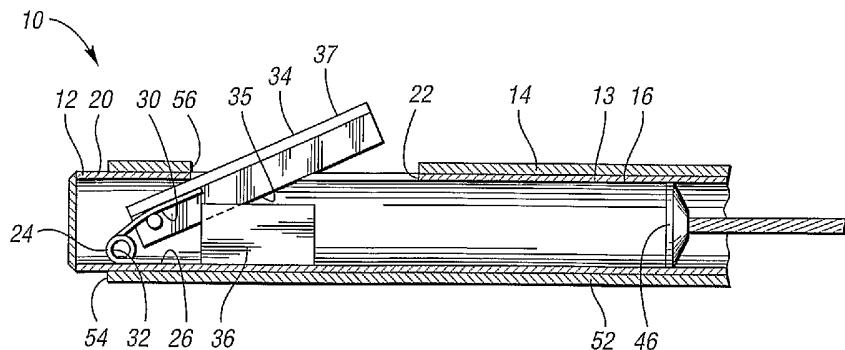
(75) Inventor/Applicant (for US only): **SURTI, Vihar, C.** [US/US]; 632 Timberline Ridge Lane, Winstone Salem, North Carolina 27106 (US).

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(74) Agents: **ALEMDA, Lawrence, G.**, et al.; BRINKS HOFER GILSON & LIONE, P.o. Box 10087, Chicago, Illinois 60610 (US).

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: ENDOSCOPIC CUTTING DEVICE



(57) Abstract: An endoscopic cutting device is disclosed. The device comprises an inner catheter including an inner wall having an opening formed therethrough. The inner wall further has a cutting blade moveably disposed thereon and biasingly extends through the opening. The inner wall has a receiving member disposed thereon and is configured to cooperatively receive the cutting blade. The device further comprises an outer catheter including an outer wall moveably disposed about the inner catheter. The outer wall has an aperture formed therethrough. The aperture is configured to moveably align with the opening of the inner wall for allowing the cutting blade to biasingly extend through the opening and biasingly engage the cutting blade with the receiving member to cut.

WO 2006/083679 A1

## ENDOSCOPIC CUTTING DEVICE

## CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of U.S. Provisional Application no. 60/647,517, filed on January 27, 2005, entitled "ENDOSCOPIC CUTTING DEVICE," the entire contents of which are incorporated herein by reference.

## BACKGROUND OF THE INVENTION

[0002] The present invention relates to endoscopic cutting devices and apparatus for medical procedures involving endoscopic procedures and cutting sutures.

[0003] Endoscopic devices have been commonly used for various procedures, typically in the abdominal area. Endoscopy is the examination and inspection of the interior of body organs, joints or cavities through an endoscope. Endoscopy allows physicians to peer through the body's passageways. An endoscopic procedure may be used to diagnose various conditions by close examination of internal organs and body structures, and may also guide therapy and repair, such as the removal of torn cartilage from the bearing surfaces of a joint. A biopsy, a procedure involving tissue sampling for pathologic testing, may also be performed under endoscopic guidance. For example, endoscopic procedures include the following known procedures: gastroscopy, sigmoidoscopy and colonoscopy, esophago gastro duodenoscopy (EGD), endoscopic retrograde cholangiopancreatography (ERCP), and bronchoscopy.

[0004] Typically, an endoscope uses two fiber optic lines. A "light fiber" emits light into a body cavity and an "image fiber" carries an image of the body cavity back

to a viewing lens. Endoscopes may be used in conjunction with a camera or video recorder to document images of the inside of the joint or chronicle an endoscopic procedure. New endoscopes have digital capabilities for manipulating and enhancing the video images.

**[0005]** An endoscope typically includes at least one separate port to allow for administration of drugs, suction, or irrigation. Such port(s) may also be used to introduce small folding instruments such as forceps, scissors, brushes, snares or baskets for tissue excision, sampling, or other diagnostic and therapeutic work.

**[0006]** For example, endoscopic scissors and forceps may be configured to be used with a particular endoscope for sampling and excision purposes, and for cutting sutures. Although many current endoscopic scissors are adequate, improvements may be made. For instance, current endoscopic scissors typically have a pair of moveable jaws on which blades are disposed. As cuts are made distally from the apex of the jaws, the pressure or cutting effectiveness decreases. As a result, many cuts or dissections are relatively not sharp. When the scissor blades contact sutures (or other items to be cut) adjacent a distal portion of the blades, the results many times involve undesirable shearing.

**[0007]** Thus, it is desirable to provide an improved cutting device compatible with an endoscope.

#### BRIEF SUMMARY OF THE INVENTION

**[0008]** The present invention generally provides a cutting device that is compatible with an endoscope for endoscopy. The cutting device includes blades that provide effective and relatively sharp dissections along any portion of the blades. The cutting device provides relatively sharp dissections regardless of the

cut location along the blade, thereby avoiding shearing and broad cuts. As a result, shearing is avoided.

**[0009]** One embodiment of the present invention provides an endoscopic cutting device. The device comprises an inner catheter including an inner wall having an opening formed therethrough. The inner wall further has a cutting blade moveably disposed thereon and biasingly extending through the opening. The inner wall has a receiving member disposed thereon and is configured to cooperatively receive the cutting blade. The device further comprises an outer catheter including an outer wall moveably disposed about the inner catheter. The outer wall has an aperture formed therethrough. The aperture is configured to moveably align with the opening of the inner wall for allowing the cutting blade to biasingly extend through the opening and biasingly engage the cutting blade with the receiving member to cut.

**[0010]** In another embodiment, the cutting device comprises an inner catheter including an inner wall having a proximal portion and a closed distal portion. The distal portion has an opening formed therethrough. The inner wall further has a spring loaded cutting blade disposed thereon and biasingly extending through the opening. The inner wall has a receiving member disposed thereon and is configured to cooperatively receive the cutting blade.

**[0011]** The cutting device further comprises an outer catheter including an outer wall having a proximal end and an open distal end. The outer wall is slidably disposed about the inner catheter. The outer wall has an aperture formed therethrough. The aperture of the outer wall is configured to align with the opening

of the inner wall, allowing the cutting blade to biasingly extend therethrough and biasingly engage the receiving member to cut.

**[0012]** In yet another embodiment, the present invention provides an endoscopic cutting apparatus. The apparatus comprises an inner catheter including an inner wall having a proximal portion and a closed distal portion. The distal portion has an opening formed therethrough. The inner wall further has a spring loaded cutting blade disposed thereon and biasingly extending through the opening. The inner wall has a receiving member disposed thereon and is configured to cooperatively receive the cutting blade.

**[0013]** The apparatus further comprises an outer catheter including an outer wall having a proximal end and an open distal end. The outer wall is slidably disposed about the inner catheter. The outer wall has an aperture formed therethrough. The aperture of the outer wall is configured to align with the opening of the inner wall, allowing the cutting blade to biasingly extend therethrough and biasingly engage the receiving member to cut.

**[0014]** Further objects, features, and advantages of the present invention will become apparent from consideration of the following description and the appended claims when taken in connection with the accompanying drawings.

#### BRIEF DESCRIPTION OF THE DRAWINGS

**[0015]** Figure 1 is a partial side view of an endoscopic cutting device in accordance with one embodiment of the present invention;

**[0016]** Figure 2 is another partial side view of the endoscopic cutting device of Figure 1;

[0017] Figure 3 is a cross-sectional view of the endoscopic cutting device of Figure 2 taken along line 3-3;

[0018] Figure 4 is another cross-sectional view of the endoscopic cutting device of Figure 2 taken along line 4-4;

[0019] Figure 5 is a break-away side view of the endoscopic cutting device of Figure 2;

[0020] Figure 6 is an elevated view of an endoscope apparatus implementing the cutting device in accordance with one embodiment of the present invention; and

[0021] Figure 7 is a side view of the endoscope apparatus in Figure 6.

#### DETAILED DESCRIPTION OF THE INVENTION

[0022] The present invention generally comprises a cutting device that provides relatively sharp dissections regardless of the cut location along its blade, thereby minimizing shearing and broad cuts. The embodiments of the present invention comprise inner and outer catheters having open areas formed therethrough and configured to be aligned. The inner catheter includes a receiving member and a cutting blade that biasingly extends through the open area of the inner catheter. The outer catheter is slidably retractable to force the cutting blade inward and engage the receiving member to cut a suture or dissect a vessel or an organ. As a result, the likelihood of shearing is reduced.

[0023] Figure 1 illustrates an endoscopic cutting device 10 in accordance with one embodiment of the present invention. The cutting device 10 is compatible with an endoscope for endoscopy and cutting sutures. For example, the cutting device 10 may be implemented for the following procedures: cutting sutures with an endoscope, gastroscopy, sigmoidoscopy and colonoscopy, esophago gastro

duodenoscopy (EGD), endoscopic retrograde cholangiopancreatography (ERCP), and bronchoscopy. The cutting device 10 provides relatively sharp dissections regardless of the cut location along the blade, thereby avoiding shearing and broad cuts.

**[0024]** As shown in Figures 2 and 3, the cutting device 10 comprises an inner catheter 12 having an inner wall 13 and an outer catheter 14 slidably disposed about the inner catheter 12. Preferably, inner wall 13 has a proximal portion 16 and a closed distal portion 20. The inner catheter 12 may be made of any suitable material such as Nitinol or polymeric materials, e.g., low density polyethylene, polypropylene, polytetrafluoroethylene (PTFE) or mixtures thereof. In this embodiment, the distal portion has a distal opening 22 longitudinally formed therethrough.

**[0025]** Preferably, the inner wall 13 further includes a spring mechanism 24 having first and second arms 26, 30 connected to each other at an apex or a cutting axis 32. The cutting axis 32 is preferably defined by the spring mechanism 24. As shown, the first and second arms 26, 30 are spring-loaded to biasingly extend away from each other relative the apex 32. In this embodiment, the first arm 26 is attached to the inner wall 13 and the second arm 30 biasingly extends proximally from the first arm 26 through the opening 22. Thus, the first arm 26 remains stationary on the inner wall 13 while the second arm 30 is biasingly pivotable relative to the first arm 26. It is to be noted that the spring mechanism 24 may be positioned such that the second arm 30 extends distally relative to the cutting device 10.

**[0026]** As shown, the inner wall 13 further includes a cutting blade 34 attached to the second arm 30 of the spring mechanism 24 adjacent the distal opening 22. In this embodiment, the cutting blade 34 comprises a cutting edge 35

for cutting and a back or non-cutting edge 37 opposite the cutting edge 35. Thus, the cutting blade 34, being spring-loaded by the spring mechanism 24, biasingly extends proximally through the distal opening 22 of the inner wall 13. Moreover, the cutting blade 34 is pivotably moveable about the cutting axis 32 to cut sutures on the cutting edge 35. The cutting blade 34 may be made of any suitable material such as metal or high density polymer.

**[0027]** Figures 3 and 4 depict the inner wall 13 further including a receiving assembly 36 disposed thereon. In this embodiment, the receiving assembly 36 is disposed on the first arm 26 and is attached to the inner wall 13. As shown, the receiving assembly 36 is configured to cooperatively receive the cutting blade 34 for cutting. The receiving assembly 36 facilitates cutting as the cutting edge 35 of the cutting blade 34 is pivotally moved toward the first arm 30. In this embodiment, the receiving assembly 36 has a base 40 for receiving the cutting edge 35 of the cutting blade 34. As shown, the base 40 is attached on the first arm 26 and extends across a portion of inner catheter 12 to facilitate stability of the spring mechanism 24. The receiving assembly may be made of any suitable material such as metal or high density polymer.

**[0028]** As shown, the receiving assembly 36 further includes a receiving blade 42 extending from the base 40 and is configured to cooperate with the cutting blade 34 for cutting and dissecting. As described in greater detail below, the cutting blade 34 is pivotally moved inwardly to engage with the receiving assembly 36. Cutting and dissecting are achieved by engaging the cutting edge of the cutting blade 34 with the receiving blade 42 to cut suture, vessel, or any other desirable item to be

endoscopically cut. The cutting blade 34 is cooperatively received by the base 40 in notch 44.

**[0029]** In this embodiment a drive wire 46 is disposed on the distal portion 20 of the inner wall 13 to position and manipulate the inner wall 13 within the body of a patient. However, other suitable mechanisms may be implemented without falling beyond the scope or spirit of the present invention.

**[0030]** As shown, the cutting device 10 further comprises the outer catheter 14 including an outer wall 50 having a proximal end 52 and an open distal end 54. The outer catheter 14 may be made of any suitable material such as Nitinol or polymeric materials, e.g., low density polyethylene, polypropylene, polytetrafluoroethylene (PTFE) or mixtures thereof. The outer catheter 14 is slidably disposed about the inner catheter 12. The distal end 54 is open to allow clearance for facilitating longitudinal movement of the outer catheter 14 about the inner catheter 12. The outer wall 50 includes an aperture 56 formed therethrough adjacent the distal end 54. The outer wall 50 is configured to slidably move relative to the inner catheter 12 and align the aperture 56 with the distal opening 22 of the inner wall 13.

**[0031]** In this embodiment, retraction of the outer catheter 14 allows engagement between the outer catheter 14 with the back edge 37 of the cutting blade 34, thereby moving the cutting blade 34 downwardly to biasingly engage with the receiving blade 42 for closing the blade and for cutting. The cutting blade 34 is received at the base 40 of the receiving assembly 36. Thus, the force of the outer catheter 14 on the cutting blade 34 is placed directly on an item for cutting, such as a suture. As the outer catheter 14 rides along the cutting blade 34 and forces the

cutting blade inwardly, the cutting blade engages the receiving assembly 36 and the item is cut or dissected.

**[0032]** Figure 5 illustrates controller 60 cooperable with the drive wire 46 and the inner and outer catheters 12, 14. In this embodiment, the controller 60 includes a spool 62 connected to the drive wire 46 for movement of the inner catheter 12 relative to the outer catheter 14. The controller 60 further includes a handle 64 proximally connected to the outer catheter 14 and configured to facilitate movement thereof for cutting and dissection.

**[0033]** Figures 6 and 7 depict an endoscope apparatus 70 having the cutting device 10 in accordance with one embodiment of the present invention. The apparatus 70 may be used for cutting sutures and various other endoscopic procedures including gastroscopy, sigmoidoscopy and colonoscopy, esophago gastro duodenoscopy (EGD), endoscopic retrograde cholangiopancreatography (ERCP), and bronchoscopy. By way of the endoscope apparatus 70, the cutting device 10 provides relatively sharp dissections regardless of the cut location along the blade 34, thereby minimizing shearing and broad cuts.

**[0034]** As shown, the apparatus 70 comprises an endoscopic assembly 72 for endoscopy. The endoscopic assembly 72 includes an insertion tube 74 having a plurality of channel ports 75 through which endoscopic units may be disposed. In one embodiment, the endoscopic units disposed in one of the ports may include one embodiment of the cutting device mentioned above, an endoscopic camera lens 80, a suction source 82, and a water/air flush 84. Other suitable units may be used as desired.

**[0035]** As shown, the endoscopic assembly 72 further includes a control system 86 that is in mechanical and fluid communication with the insertion tube 74. The control system 86 is configured to control the insertion tube 74 and endoscopic parts disposed therein. As shown, the control system 86 includes first and second control knobs 87, 88. The control knobs 87, 88 are configured to be in mechanical communication with the insertion tube 74. The control knobs 87, 88 allow the physician to control and guide, by known means, the insertion tube 74 through vessels and cavities of a patient. The control system 86 further includes valve switches (e.g., suction valve 90, air/water valve 91, camera valve 92), each of which are in communication to one of the channel ports 75 of the insertion tube 74. For example, the suction valve switch 90, when activated, allows a vacuum from a suction source through a suction channel port 82 for suctioning unwanted plaque and debris from the patient.

**[0036]** As shown in Figures 6 and 7, the endoscopic apparatus 70 includes the endoscopic cutting device 10 described above. In this embodiment, the endoscopic cutting device 10 is inserted through the biopsy/scissors channel port 76 of the endoscopic assembly 72. The device 10 is then fed through the respective biopsy channel port 76 of the endoscopic assembly 72. The cutting device 10 is preferably fed therethrough until the distal end 54 of the outer catheter 14 is adjacent nozzle 78 of the insertion tube 74.

**[0037]** As mentioned above, the endoscopic cutting device 10 comprises the inner catheter 12 having the cutting base 40 disposed thereon, the outer catheter 14 disposed about the inner catheter 12, and the drive wire 46 attached within the inner catheter 12.

**[0038]** In one example, the distal end of the insertion tube 74 is inserted, rectally or orally, to a predetermined endoscopic location within a patient. Insertion of the insertion tube 74 may be rectally or orally depending on the endoscopic procedure. At the location, a physician may activate and control the endoscopic units as desired, such as to cut sutures previously surgically placed in a patient. The endoscope in combination with the cutting device of the present invention allows the physician to make sharp dissections and cuts as desired.

**[0039]** While the present invention has been described in terms of preferred embodiments, it will be understood, of course, that the invention is not limited thereto since modifications may be made to those skilled in the art, particularly in light of the foregoing teachings.

## CLAIMS

1. An endoscopic cutting device, the device comprising:
  - an inner catheter including an inner wall having an opening formed therethrough, the inner wall further having a cutting blade moveably disposed thereon and biasingly extending through the opening, the inner wall having a receiving member disposed thereon and being configured to cooperatively receive the cutting blade; and
  - an outer catheter including an outer wall moveably disposed about the inner catheter, the outer wall having an aperture formed therethrough, the aperture of the outer wall being configured to moveably align with the opening of the inner wall for allowing the cutting blade to biasingly extend through the opening and biasingly engage the cutting blade with the receiving member to cut.
2. The cutting device of claim 1 wherein the inner wall has a proximal portion and a distal portion, the opening being formed through the distal portion.
3. The cutting device of claim 2 wherein the distal portion has a closed distal end.
4. The cutting device of claim 1 further comprising a drive wire disposed on the distal portion of the inner wall for positioning the inner wall within the body of the patient.
5. The cutting device of claim 1 wherein the cutting blade is spring loaded to biasingly extend from the inner wall.
6. The cutting device of claim 1 wherein the outer wall has a proximal end and a distal end, the distal end being open to slidably move about the inner wall.
7. The cutting device of claim 1 wherein the outer wall is slidably disposed about the inner wall.

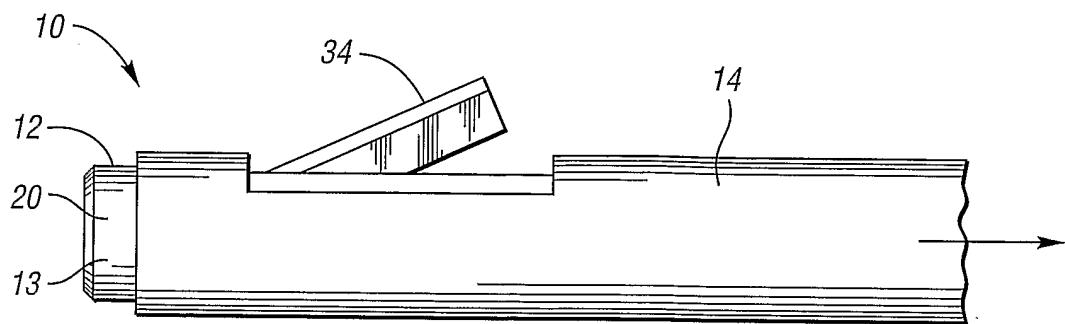
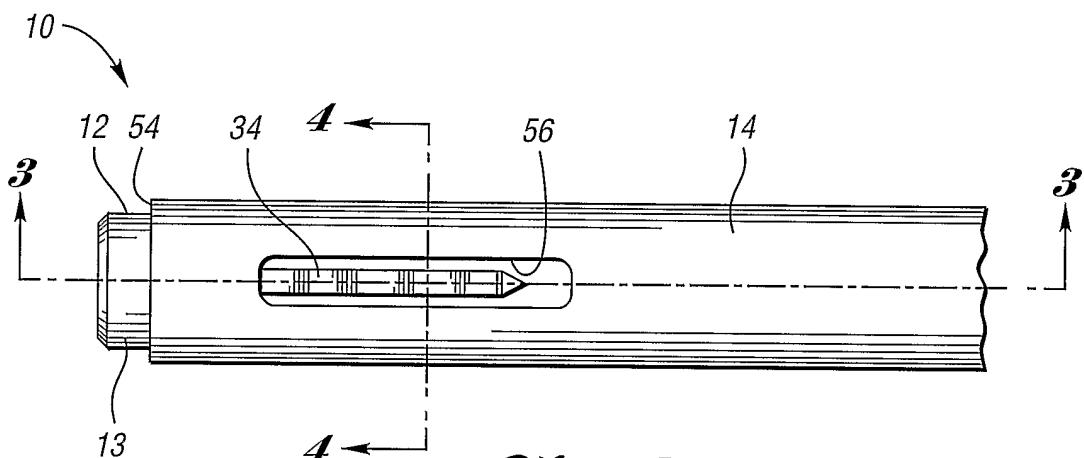
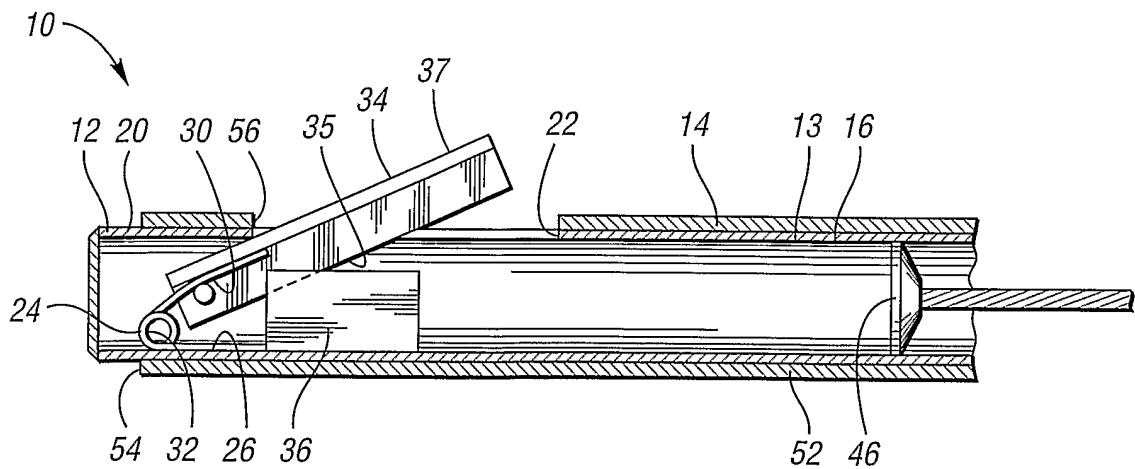
8. The cutting device of claim 1 wherein the receiving member is a receiving assembly having a base for receiving the cutting blade, the receiving assembly further having a receiving blade extending from the base and being configured to cooperate with the cutting blade for cutting.

9. The cutting device of claim 8 wherein the inner wall further includes: a spring mechanism having first and second arms, the first arm being attached to the inner wall and the second arm biasingly extending from the first arm and through the opening, the second arm biasingly moveable relative to the first arm, the receiving assembly being disposed on the first arm and attached to the inner wall, the cutting blade being disposed on the second arm and being moveable for cutting.

10. The cutting device of claim 9 wherein the second arm is biasingly pivotable about a cutting axis of the cutting blade, the cutting axis being defined by the spring.

11. The cutting device of claim 1 wherein the cutting blade comprises a cutting edge for cutting and a back edge opposite the cutting edge.

12. The cutting device of claim 11 wherein the outer catheter engages the back edge of the cutting blade to move the cutting blade downwardly to biasingly engage with the receiving blade for closing the blade and cutting.

*Fig. 1**Fig. 2**Fig. 3*

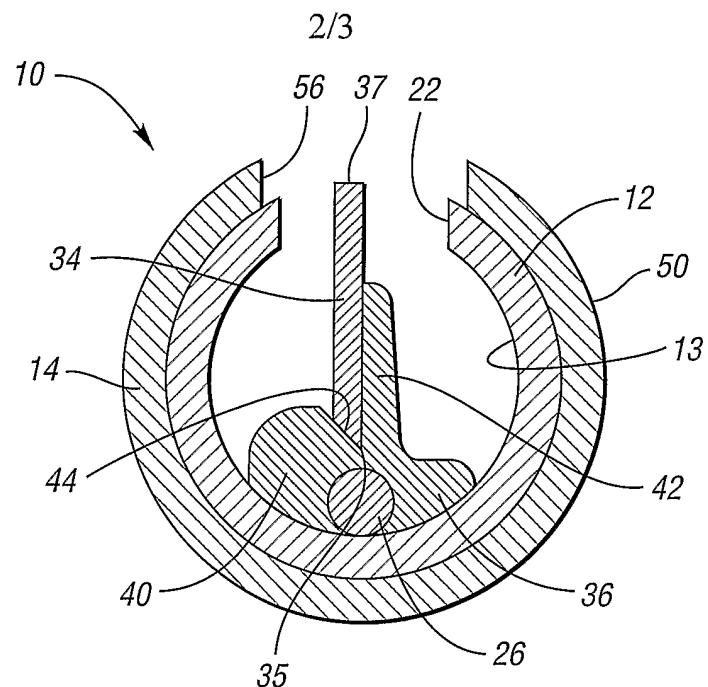


Fig. 4

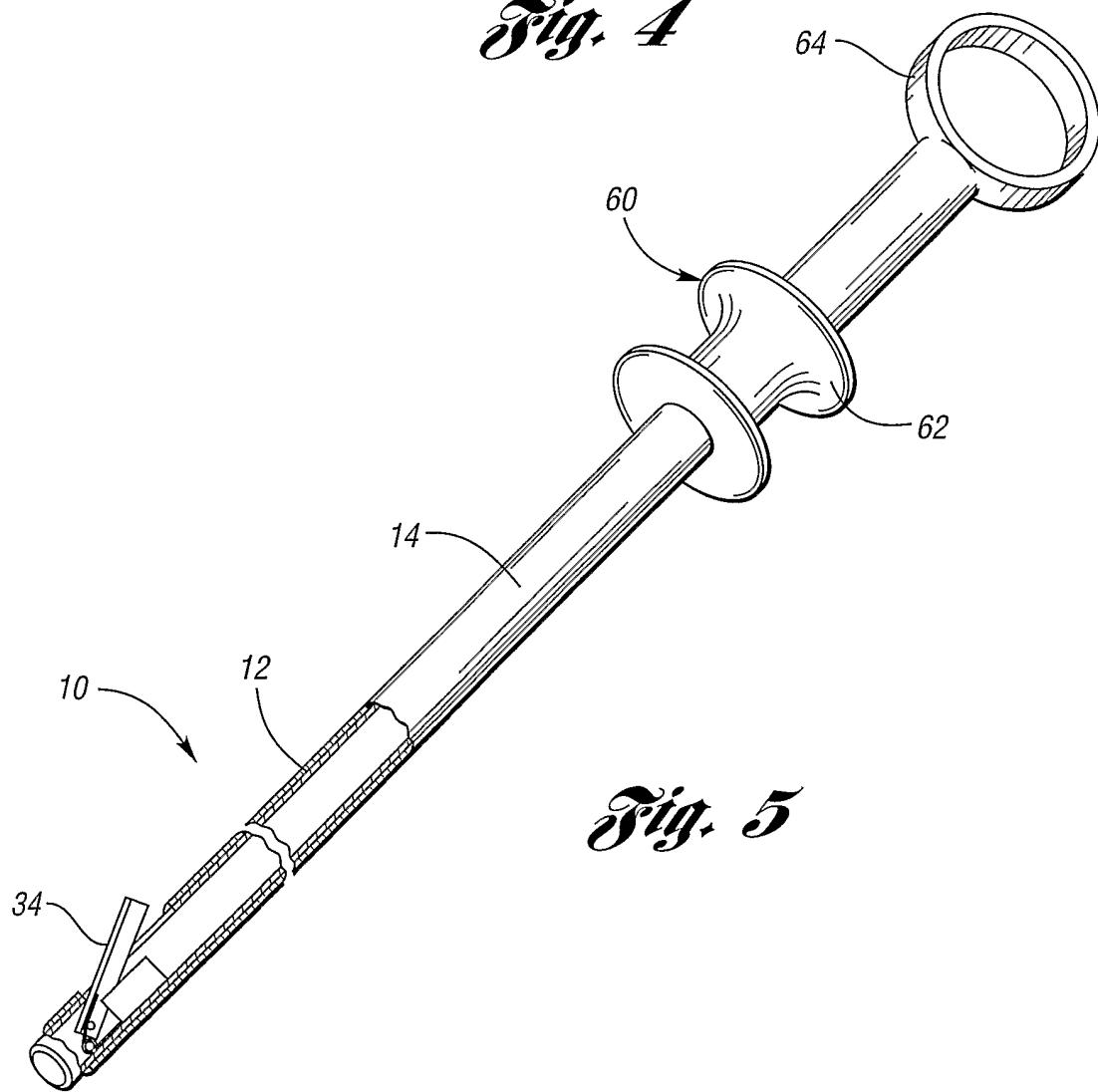
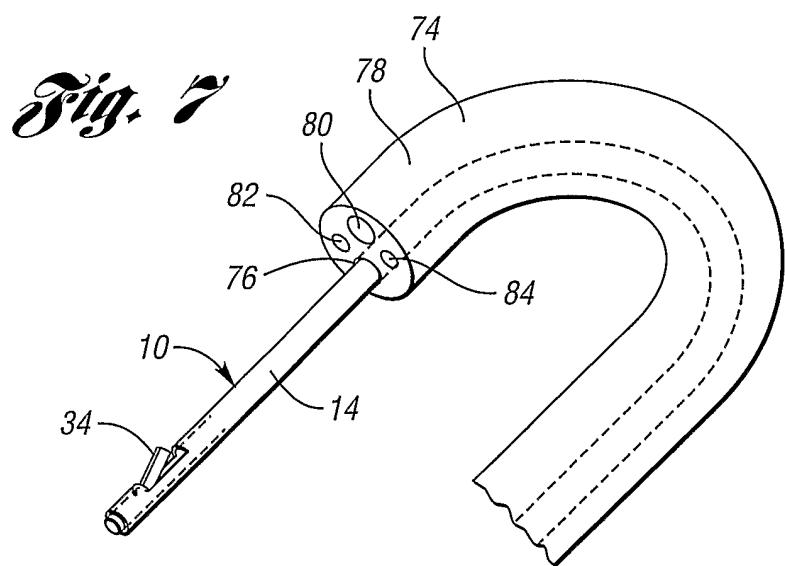
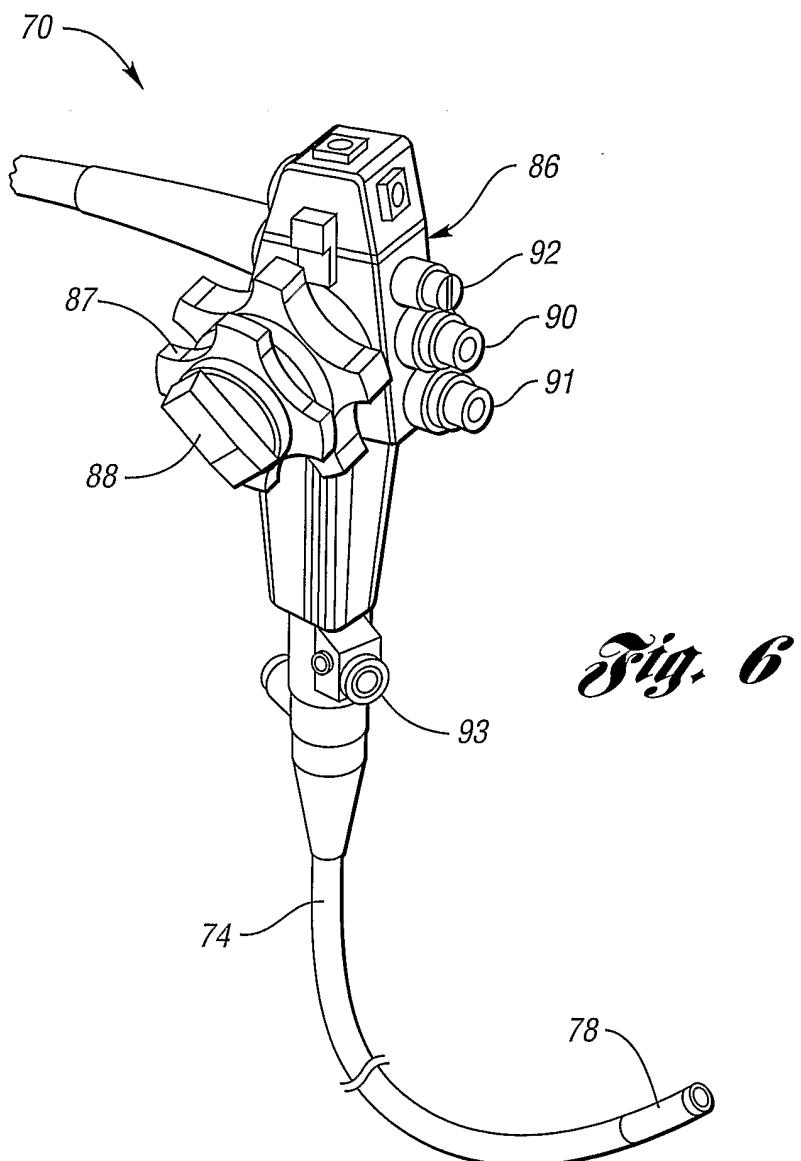


Fig. 5

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# INTERNATIONAL SEARCH REPORT

International application No

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**A. CLASSIFICATION OF SUBJECT MATTER**  
INV. A61B17/04 A61B17/32

According to International Patent Classification (IPC) or to both national classification and IPC

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Minimum documentation searched (classification system followed by classification symbols)  
A61B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P, X	WO 2005/034767 A (NMT MEDICAL, INC; OPOLSKI, STEVEN; FORDE, SEAN) 21 April 2005 (2005-04-21) the whole document -----	1-12
A	WO 98/11825 A (CORAL MEDICAL, INC) 26 March 1998 (1998-03-26) abstract; figures 8,9 -----	1
A	WO 2004/112616 A (ORTHEON MEDICAL LLC; SCHUMACHER, BRIAN, S; GOLDIN, MARK, A) 29 December 2004 (2004-12-29) abstract; figure 15 -----	1

Further documents are listed in the continuation of Box C.

See patent family annex.

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Date of the actual completion of the international search

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Name and mailing address of the ISA/  
European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

Hansen, S

**INTERNATIONAL SEARCH REPORT**

## Information on patent family members

International application No

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