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(54) **Title**: SURGICAL ENDOSCOPE

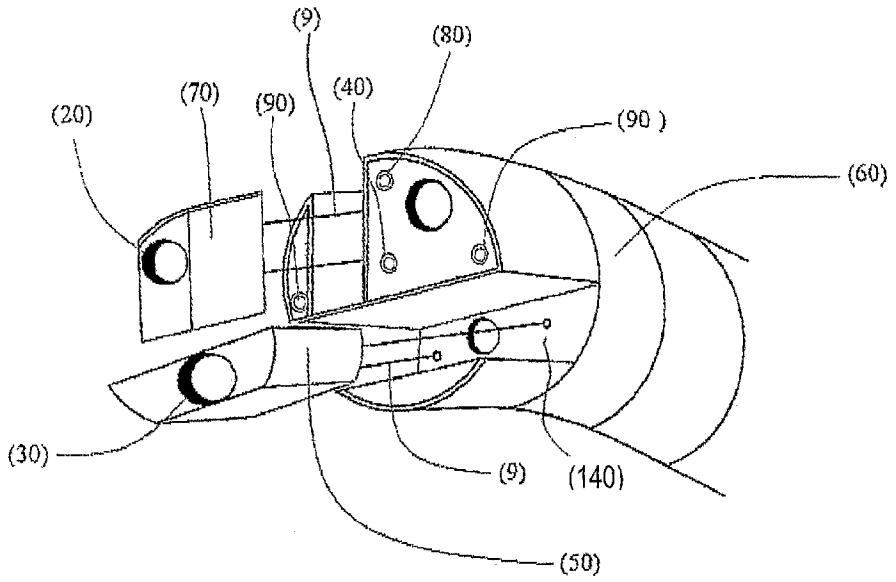

Fig. 9

(57) **Abstract**: The present invention refers to surgical endoscopes, more specifically to surgical endoscopes for the performance of operations held, preferably, through an external orifice to a bodily opening defined by tissue of an internal bodily lumen, such as the case of abdominal and thoracic operations through perforations in digestive organs with lumen, but not limited to this type of operations, being also possible to use them in laparoscopic surgery. The invention was developed for diagnostic and/or therapeutic applications, based on the techniques known as NOTES, that is, Natural Orifice Translumenal Endoscopic Surgery.

WO 2010/003208 A1

Title: **"SURGICAL ENDOSCOPE".**

The present invention refers to a surgical endoscope, more specifically to a surgical endoscope to perform operations, preferably, through the *NOTES* (*N*atural *O*rifice *T*ranslumenal *E*ndoscopic *S*urgery) technique, such as the case of abdominal and thoracic operations through perforations in digestive organs with lumen, but not limited to this kind of operations, being also possible to use them in laparoscopic surgery or any other surgical procedure.

The subject matter of the invention was developed for diagnostic and/or therapeutic applications, based on the techniques known as *NOTES*.

Due to the lack of incisions in the skin and of wall opening, the use of the *NOTES* technique – the goal of the surgical endoscope covered by the invention – offers advantages such as less painful postoperative course, faster recovery, cosmetic advantages, lack of hernias, less abdominal adherences, absence of infections in the incisions, less deep anesthesia, shorter hospital stays and lower costs.

In other words, the subject matter of the invention is a surgical endoscope provided by a flexible endoscope which makes it possible to perform operations through natural orifices of the human body or animals, with advantages in comparison with the state of the art.

Background of the Invention

The surgical operation techniques through the wall of the digestive organs with lumen – such as esophagus, stomach, duodenum, and the small and large intestines – is incipient.

When one says "translumenal", the vagina, the anus and the bladder are included as well. There are doubts whether the navel (belly button) may be considered a natural orifice.

Handling the organs sought during operation – among which, the gallbladder and appendix are the most frequent – is not the hardest task at the moment. The opening and closing of the organs to be perforated, i.e. the esophagus, stomach and intestines has been the major problem to be settled, a fact worsened by the inexistence of appropriate devices and accesso-

ries.

As a new surgical technique, the method has been developed and performed in the large centers, and the development of new devices has been the goal of the companies of specific equipment.

There have not been yet many operations in patients using the *NOTES* method, mainly through the stomach. Some transvaginal operations have been practiced, since this access site is already used in other speciality rather than the digestive one. However, once it is an exclusive route for women. Therefore, it is not considered a universal technique.

A surgical device for endosurgery as the one mentioned herein is already known, for instance, in patent US 5,797,835 (Green), which reveals a system and a method for use in endoscopy and endosurgery, in which a set formed by two endoscopic devices externally interconnected is inserted into a part of the body in two points of entry.

Such device, although projected for the performance of endosurgery, is used for application through external incisions in the patient's body, without characteristics which allow it to be used through translumenal natural orifices.

Patent US 6,569,085 (Kortonbach et al.) discloses a method and a device to provide an endosurgical medical tool all over and in the exterior of an endoscope installed in the body of a patient, enabling the use of tools whose dimensions do not fit into the working channel of an endoscope. This invention eliminates the need of a working channel in a common endoscope, which, according to its author, minimizes the likelihood of contamination.

Many other patent documents related to the state of the art could be mentioned, like US 6,458,074, US 3,915,157, US 2008/0039690 and US 6,352,503. However, very shortly, it is possible to state that the state of the art related to endoscopic devices used in internal surgeries comprises:

- combined devices for hybrid-endoscopic/laparoscopic use;
- devices which have only two working channels;
- devices which work with external accessories or complementary devices;

- endosurgical devices installed externally to the body of an endoscope.

The surgical endoscopes of the state of the art do not have interchangeable distal parts which, in the case of the present invention, are platforms that can be interchanged by specific platforms.

Another drawback of the state of the art lies in the difficulty of disinfecting the endoscopes after they are used, since their accessories cannot be disassembled.

In a simplified manner, it is possible to state that, as laparoscopic surgery has advantageously replaced conventional open surgery, in many procedures, the device proposed herein by the invention, specifically projected for the application of the *NOTES* technique, intends to replace laparoscopic surgery.

Purposes of the Invention

The main goal of the surgical endoscope proposed by the invention is its use in situations in which the stomach is used as an access route to the peritoneal cavity, making it possible to perform these operations by means of a single device, through a single perforation.

As the surgical endoscope of the invention is projected to perform the technique without the help of other equipment, a purpose of the invention is also to provide a surgical device capable of performing the most far-reaching method, which has been called "*full NOTES*."

Another goal of the invention is to offer a device which has three operative channels, representing a great advantage over what is already available at the market (devices with only one or two channels).

Another goal is to enable the use of interchangeable and specific platforms, which move independently at different planes, increasing considerably the possibilities of use of the endoscope.

Another purpose of the invention is to provide a device with more than two working internal channels.

The invention also aims at offering a device whose distal end provides conditions for performing all the necessary operations, through the surgical endoscope itself.

Moreover, the invention aims at providing a device which allows for coupling specific platforms for several functions, interchangeably.

Finally, the invention also intends to provide a surgical endoscope which allows for exchanging specific platforms on its distal end, increasing considerably the possibilities of use.

Description of the Drawings

In order to better understand the proposed invention, it is described below, with references to the attached drawings, in which:

Figure 1 illustrates a prior art endoscope, in which it is possible to view an insertion tube (10), a knob (4), a light guide (2), angling commands (3), an eyepiece (1) and vertebra (60), as already known.

Figure 2 illustrates a detail of the distal end (12) of a prior art endoscope, with an operative channel with conventional caliber (20), objective (40), air/water channel (80), light channel (90) and vertebra (60).

Figure 3 illustrates the surgical endoscope covered by the invention, in which it is possible to see the eyepiece (1), the light guide (2), the angling commands (3), the knob (4), the working channels (5), the operation section (6), the rocker arm support (7), the rocker arm (8), the cables (9), the insertion tube (10), and the lever (11).

Figure 4 illustrates a detail of the knob (4), working channels (5), operation section (6) and insertion tube (10).

Figure 5 illustrates the distal end of the surgical endoscope (12) covered by the invention, in which it is possible to view: the vertebra (60), the operative channel with conventional caliber (20), the special operative channel (30), the objective (40), the movable horizontal platform (50), the movable vertical platform (70), air/water channel (80) and light channel by LEDS or optical fibers (90).

Figure 6 illustrates the distal end (12) with the movable horizontal platform (50) with lateral movement of angular displacement in relation with the vertebra's axis (60), according to arrow A.

Figure 7 illustrates the distal end (12) with the movable vertical platform, with vertical movement of angular displacement in relation with the

vertebra (60), as shown by arrow B.

Figure 8 illustrates the distal end (12) with the movable horizontal platform (50) and the vertical platform (70), both performing their movements according to arrows A an B, respectively.

Figure 9 illustrates the distal end (12), in a situation in which the movable horizontal (50) and vertical (70) platforms are far from it, but connected by their respective cables (9).

Figure 10 illustrates the way by which the cables (9) are fixed on the movable horizontal platform (50).

Figure 11 illustrates the movable horizontal platform (50) far from the distal end (12) and disconnected from the cables (9), to allow the replacement thereof by another specific platform.

Figure 12 illustrates the endoscope of the present invention in an specific embodiment in which the distal end (12) comprises two vertebras (60), enabling it to perform double curvatures in all directions.

Description of the Invention

The surgical endoscope covered by the present invention is new and inventive in the light of the prior art since it has three or more channels for performing surgery operations or the like. Two of the channels have movement capability and are able to be independently commanded (one of them being able to perform lateral movements up to 120 degrees and the other being able to perform vertical movements up to 90 degrees of amplitude). It is also important to note that one of the two channels which allows for movements has an increased diameter (3.8mm, instead of 2.8mm).

The proposed device is a surgical endoscope which allows for coupling, interchangeably, specific platforms with diverse surgical functions, such as suture, dissection, apprehension and cut, in a backward manner (from back to front), among others. This capability is not achieved with the endoscopes of the state of the art.

In essence, the endoscope of the present invention comprises a hollow tubular body having a first end (also known as proximal end) and a second end (also known as distal end). The proximal end is the one from

which the endoscope is operated and the distal end is the one which is inserted into the patient's translumenal natural orifice.

The proximal end comprises a plurality of devices to allow the operation of the endoscope by the surgeon, as follows:

- At least one eyepiece 1, to enable the operator to see inside the body's cavity;
- At least a light guide 2, to provide light inside the body's cavity (preferably LEDS, or an optical fiber);
- One or more angling commands 3, to enable the operator to perform the lateral movements (preferably up to 120 degrees of amplitude) and vertical movements (preferably up to 90 degrees of amplitude).
- At least one knob 4, to permit the secure manipulation of the equipment.
- One ore more working channels 5, operation section 6, rocker arm supports 7, rocker arms 8, cables 9, to allow the remote operation of medical or surgery accessories, and
- One insertion tube 10, and the lever 11.

Alternatively, the rocker arm supports 7, rocker arms 8 and be replaced by rotary controls, or by any other device, with identical results.

The distal end 12 of the endoscope object of the present invention has a plurality of new and inventive features, as described below:

- One insertion tube 10, and the lever 11, to enable the insertions of the distal end into the body's cavity and to make possible the operation of the endoscope;
- A vertebra 60, which is the articulated element that enables the correct positioning of the distal end inside patient's body cavity;
- Two operative channels with conventional caliber 20, enabling the positioning of a medical or a surgery device and its operation remotely by the manipulation of the rocker arms 8 and cables 9 from the proximal end of the endoscope;
- An special operative channel 30;
- An objective 40, to enable images from the interior of body's ca-

vity;

- An movable horizontal platform 50;
- An movable vertical platform 70,
- An air/water channel 80; and
- At least one light channel 90 (preferably LEDS, or optical fiber).

Contrarily to endoscopes of the prior art, the distal end 12 of the surgical endoscope, object of the present invention, enables the interchange of components, enabling the use of specific platforms (medical or surgical devices).

Although externally it may seem similar to the gastrointestinal endoscopes currently at the market, the surgical endoscope covered by the invention has essential differences, which allow for adjusting and adapting it to the diagnostic and therapeutic handling of a certain organ or system.

In order to eliminate the need of placing parallel devices, the surgical endoscope proposed has three operative channels (20, 30), the mentioned two operative channels 20 with conventional diameter of 2.8mm and the special operative channel 30 with a larger diameter of 3.8mm.

The special operative channel 30 with larger diameter allows for moving an accessory placed inside it, enables lateral movement, produced by an movable horizontal platform 50 placed in the distal end 12, guided by the already mentioned rocker arm 8, which is also a movable part coupled to the surgical endoscope by cables (9) and a support (7), together with the knob (4).

Specifically, the distal end 12 defined at least one cavity or hole 140 inside which the medical or surgery device (or any other inserted accessory) can be replaced by another one with specific purposes, as may be the case of a stone grinder or a suture device (see figure 11).

When the endoscope is not in use, the accessory (medical or surgery device, stone grinder, suture device, etc.) keeps positioned inside the cavity 140, but can be positioned outside the cavity when the endoscope is being operated (i.e., when, inside the stomach, the suture device is used to make a suture.

Another advantageous characteristic of the present endoscope is

that the accessory positioned at the cavity 140 can be replaced before it is positioned inside patient's hole. Before or during the endoscopic procedure, the surgeon/operator can replace the already positioned device or change the device by just removing the former one from the cavity 140 and, subsequently, positioning the desired new device into the cavity. This procedure can be performed without the need of use of the channel itself, that is to say, it is not necessary to remove and insert the device through the channel 20,30. In other words, the change of devices can be made externally, directly at the distal end 12.

It is also important to note that, whatever is the device replaced, it keeps inside the cavity 140 when the endoscope is guided through the patient's body' orifice.

One of the two channels with conventional diameter 20 has vertical movement, of a bit less than 90 degrees, triggered by a specific device. The other channel 20 has no movements.

The Special operative channel 30 has a horizontal movement, also triggered by a specific device, of around 120 degrees. The horizontal movement is performed by a horizontal platform 50 with functional accessories, inserted into the channel 30.

The surgical endoscope covered by the invention has a total diameter which is larger than that of conventional ones with larger calibers (such as the colonoscopies), at the approximate rate of 1mm.

The endoscope comprises a hollow tubular and flexible insertion tube 10 having two extremities. The distal end 12 is positioned adjacent to a first extremity, and the proximal end is adjacent to its other extremity, placed together with the knob 4 and the other already mentioned commands.

As already mentioned, light is preferably produced by means of LEDS 90, discarding the traditional optical fiber beams for conducting light, with uses space otherwise available for the channels, for example.

An objective 40 with sensor for capturing images obtains the images and sends them to a processor through appropriate wiring.

The channels' horizontal and vertical movement capability, as

well as the possibility of replacement of medical devices externally and directly at the distal end 12 are extremely important features of the present endoscope, being new and having inventive step in relation to the endoscopes from the state of the art, which merely have movements towards only one direction, with the possibility of reversion, that is, at a vertical plane (which suggests the idea of holding a segment of an organ and handle it without moving the device).

The surgical endoscope has all the desirable features verified in gastrointestinal endoscopes, such as excellent vision, the presence of an insufflation channel and working channel, flexibility.

In a preferred embodiment, the vertebra 60 has one point of articulation, enabling "U" movements and backward movement in all directions, when the device takes on the shape of "J" in four directions and positions (up, down, right, left and combinations thereof). As a general rule, said movements are achieved by means of the movement of the shortening of a cable fixed to a movable end at the proximal end, together with the corresponding movement of elongating another cable, by means of a manual control.

However, the mere four movements can eventually be insufficient in some surgical procedures and hence, alternatively, an endoscope having two vertebras 60, is also enclosed in the scope of protections of the present set of claims. The use of two vertebras enables the endoscope to perform double curvatures in all directions, what can eventually be an advantage in some surgical procedures. Therefore, the endoscope distal segment acquires a "S" shape. In this case, additional controls can be provided to enable the performance of the correct movements, otherwise this is not an advantageous feature.

Preferably, the second vertebra 60 contains, at least, six additional cables for fixation and control, allowing conjugated movements in different directions.

The specific construction with two vertebras 60, as well the construction of the additional controls may vary considerably without excluding the endoscope of the scope of protection of the present claims. This feature, ho-

wever, is merely optional.

As a result, unlike the conventional endoscopes, which generally have one command for the movements of the tip and opening for the working channel, the surgical endoscope proposed by the invention was projected to allow for opening additional channels and commands for the movements. Said additional channels can be positioned laterally or proximally, or at any other desired position.

With respect to the knob 4, it is an essential item of the surgical endoscope and is comprised by a metal block, projected especially to receive the new existing commands.

Therefore, the surgical endoscope proposed by the invention herein is defined by the following set of claims.

CLAIMS

1. **SURGICAL ENDOSCOPE** to perform surgical operations preferably by opening in translumenal organs, having at least three operative channels (20, 30), characterized in that the distal end (12) of at least one of them, movable platforms (50, 70) with functional accessories are installed, from distal to proximal direction, interchangeably.

2. **SURGICAL ENDOSCOPE** to perform surgical operations preferably by perforation in translumenal organs, according to claim 1, characterized in that at least one special operative channel (30) has a diameter which is larger than the others (20).

3. **SURGICAL ENDOSCOPE** to perform surgical operations preferably by perforation in translumenal organs, according to claim 2, characterized in that the special operative channel (30) debouches at a horizontal movable platform (50) which allows for performing back-and-forth movements, as well as angular movements at the horizontal plane.

4. **SURGICAL ENDOSCOPE** to perform surgical operations preferably by perforation in translumenal organs, according to claim 2, characterized in that said special operative channel (30) has a diameter ranging from 1.2mm to 3.8mm.

5. **SURGICAL ENDOSCOPE** to perform surgical operations preferably by perforation in translumenal organs, according to claim 3, characterized in that the movements of said movable horizontal platform (50) are commanded by a rocker arm (8).

6. **SURGICAL ENDOSCOPE** to perform surgical operations preferably by perforation in translumenal organs, according to claim 5, characterized in that said movable horizontal platform (50) can be interchanged by horizontal platforms with specific functions such as section, suture, apprehension, dissection, hemostasis and lithotripsy.

7. **SURGICAL ENDOSCOPE** to perform surgical operations preferably by perforation in translumenal organs, according to claim 2, characterized in that one of the operative channels with smaller diameter (20) debouches at a movable vertical platform (70) which allows for performing angular move-

ments at the vertical plane.

8. **SURGICAL ENDOSCOPE** to perform surgical operations preferably by perforation in translumenal organs, according to claim 7, characterized in that the movement of said movable vertical platform (70) is commanded by a lever (11).

9. **SURGICAL ENDOSCOPE** to perform surgical operations preferably by perforation in translumenal organs, according to claim 8, characterized in that said movable vertical platform (70) can be interchanged by vertical platforms with specific functions for sectioning, suturing, apprehending, dissecting, performing hemostasis and lithotripsy.

10. **SURGICAL ENDOSCOPE** to perform surgical operations preferably by perforation in translumenal organs, according to claim 9, characterized in that said movable horizontal and vertical platforms (50, 70) can be detached from the commanding cables (9) at the distal end (12) and are removed by the proximal end, facilitating the disinfection of the entire set.

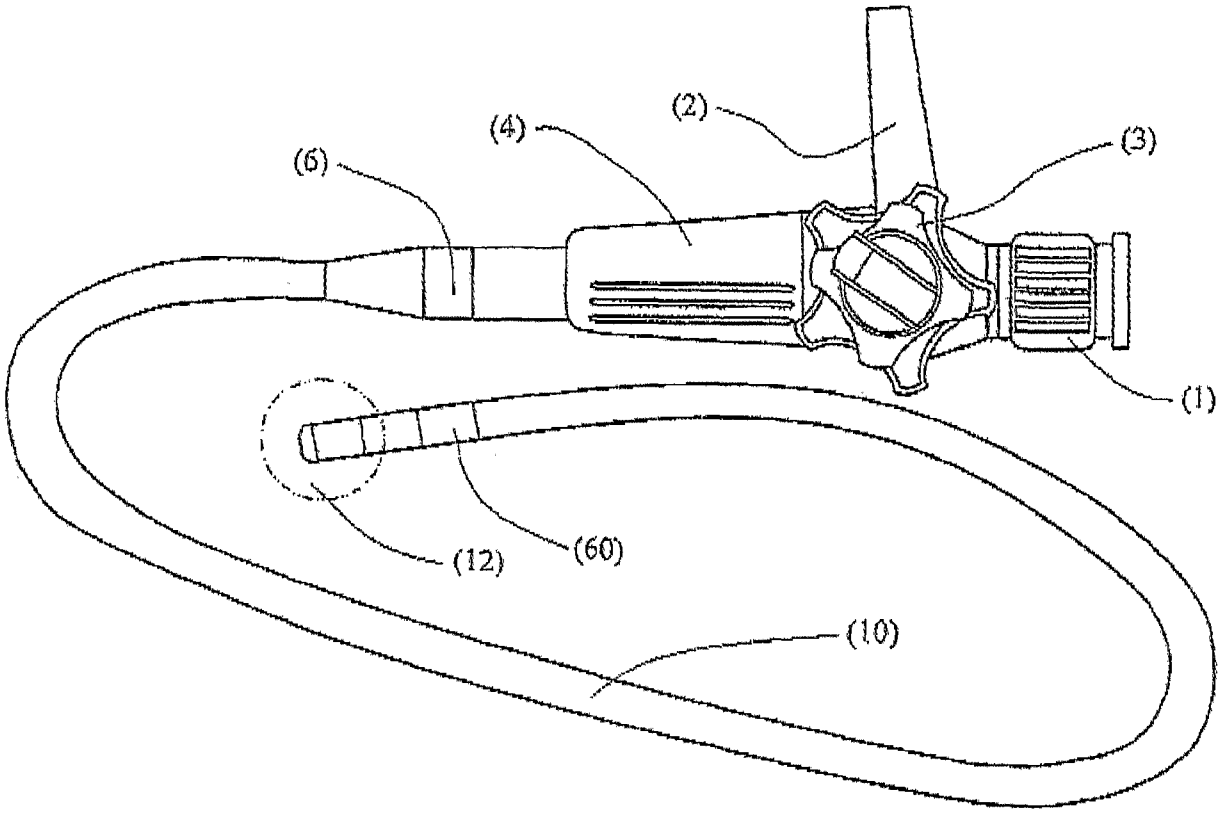

Fig. 1 (prior art)

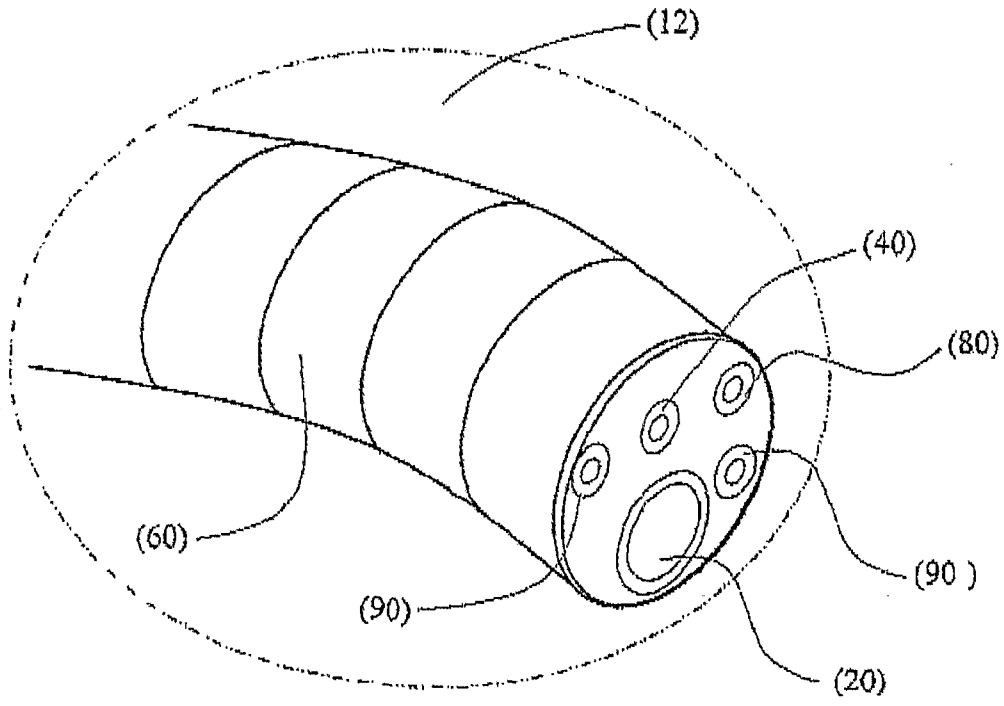

Fig. 2 (prior art)

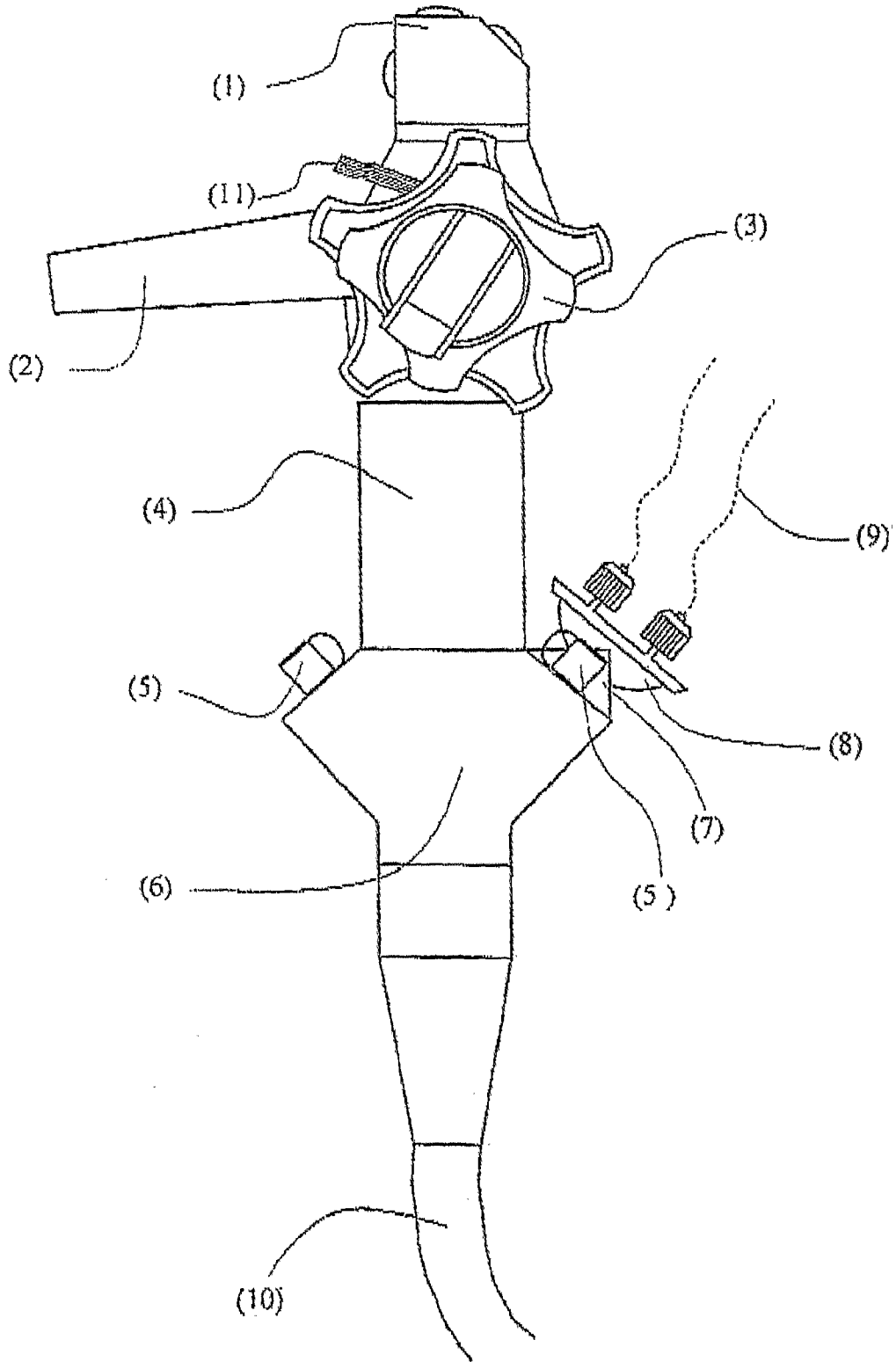

Fig. 3

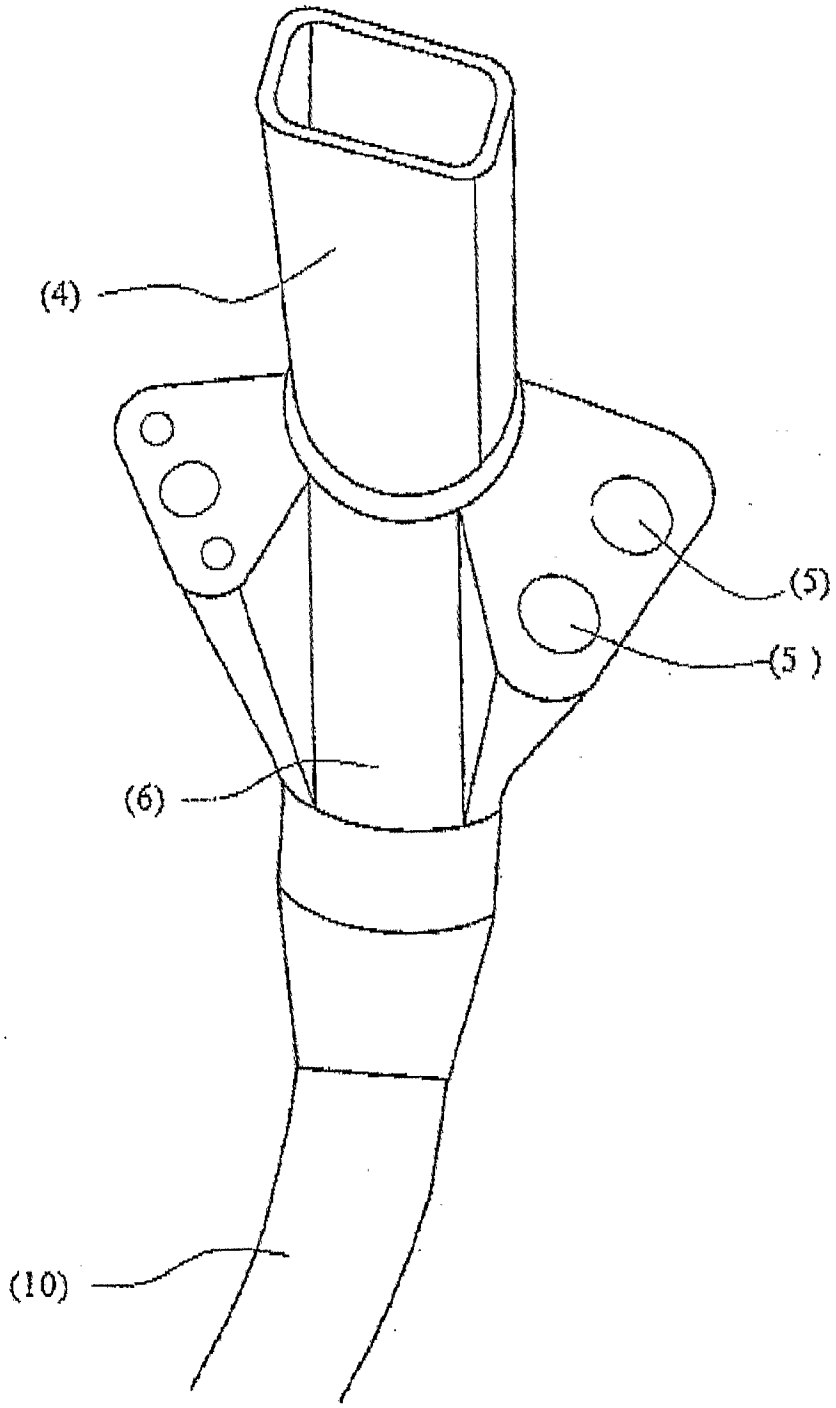

Fig. 4

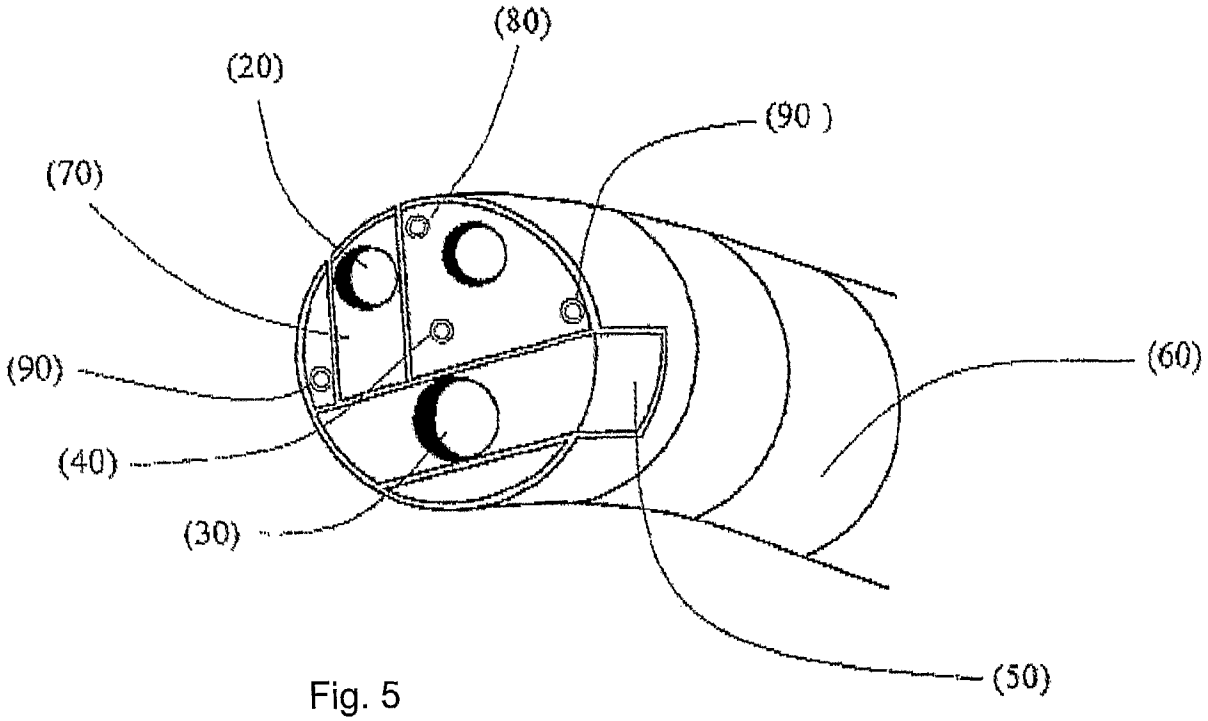

Fig. 5

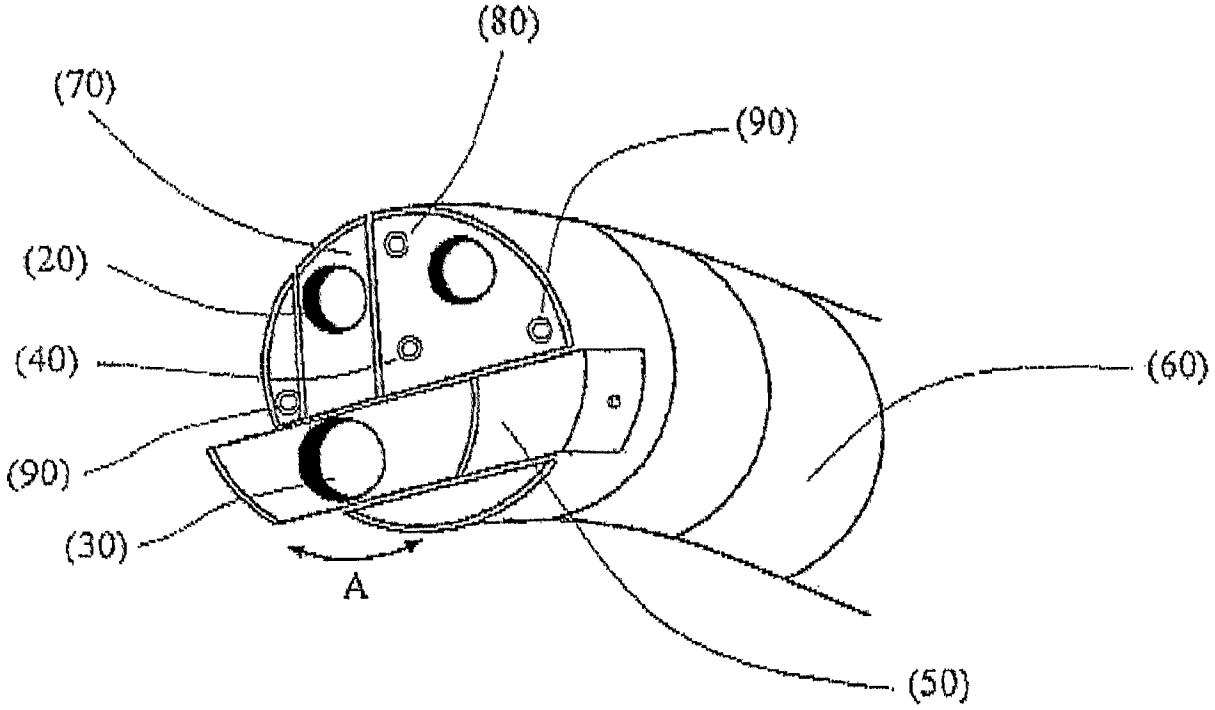

Fig. 6

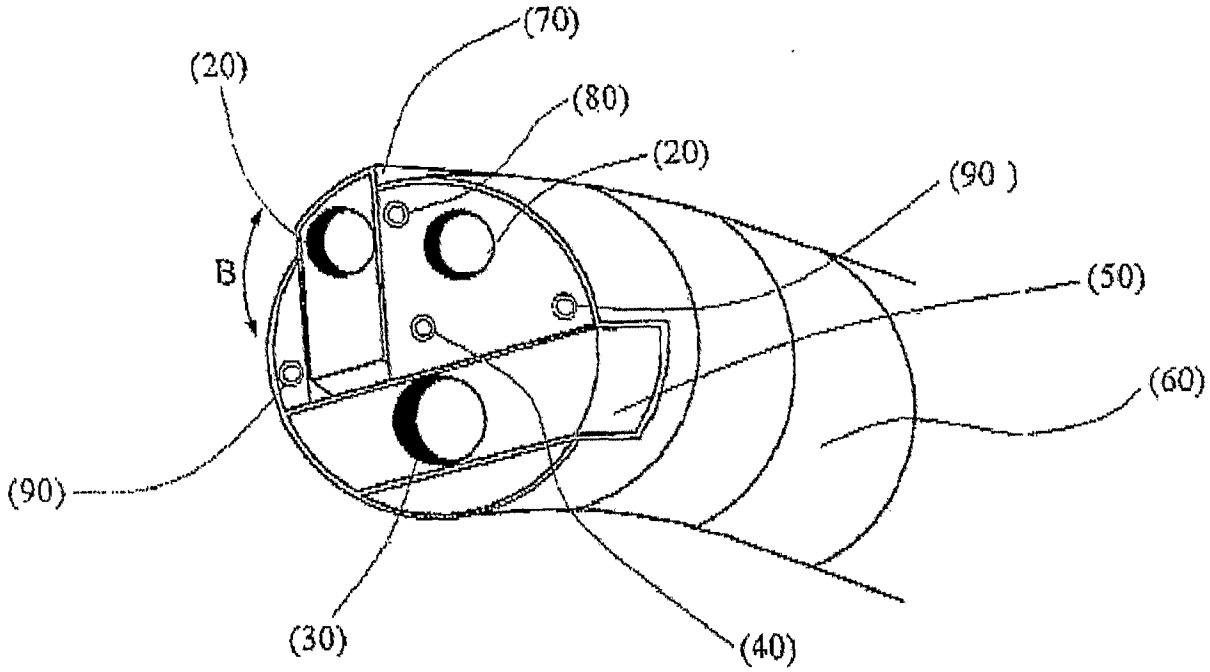

Fig. 7

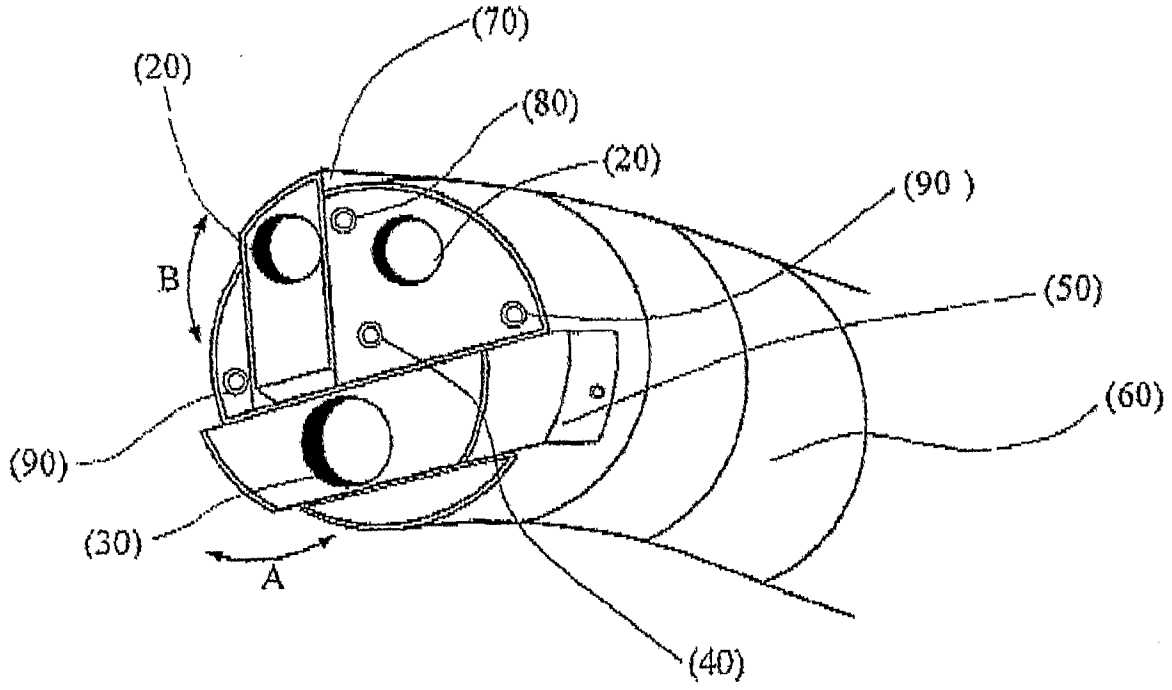

Fig. 8

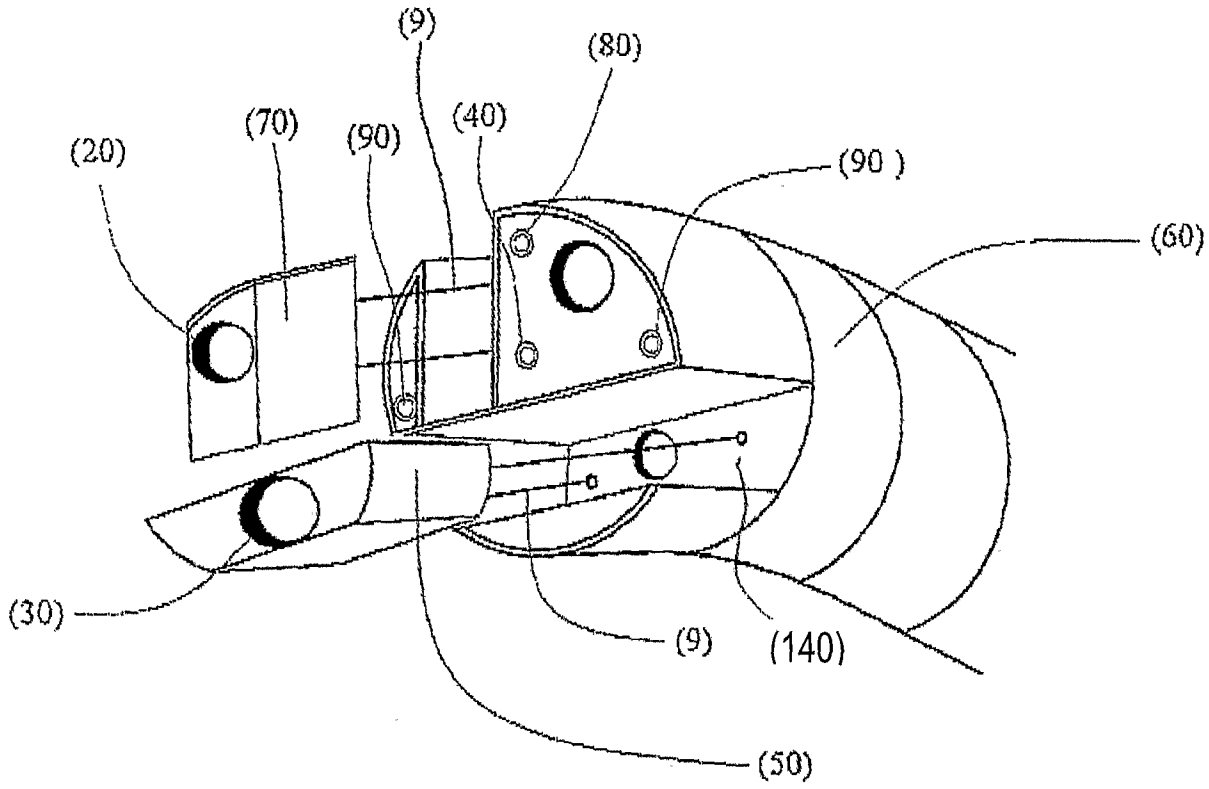

Fig. 9

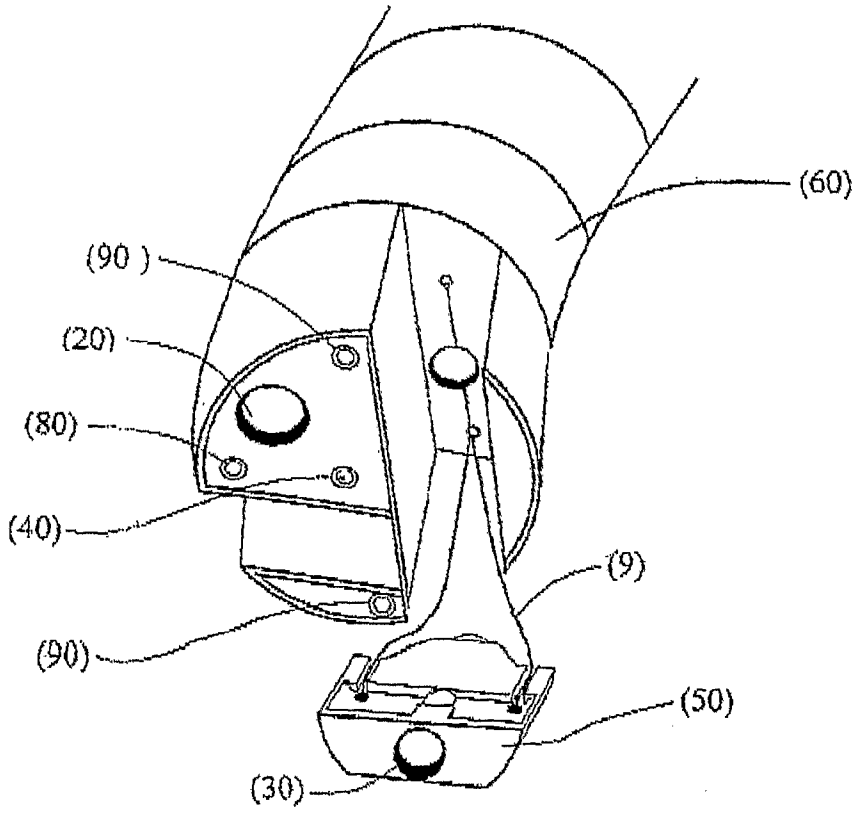

Fig. 10

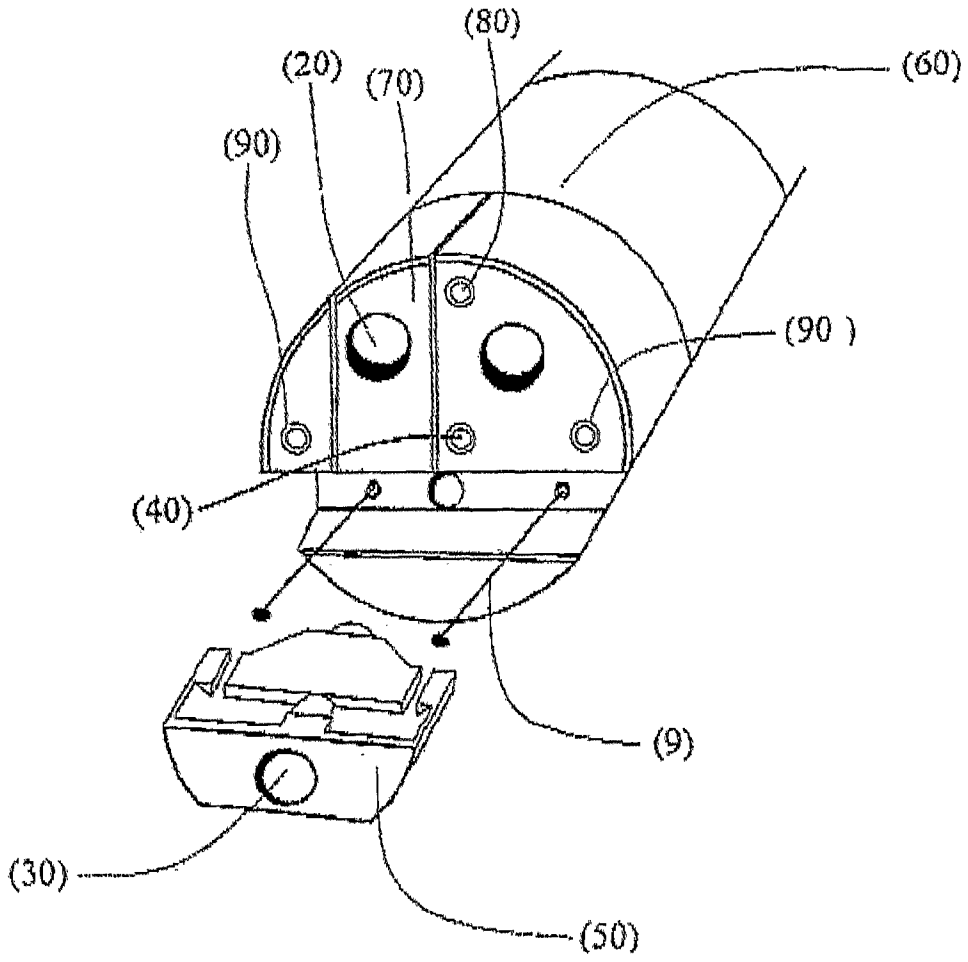

Fig. 11

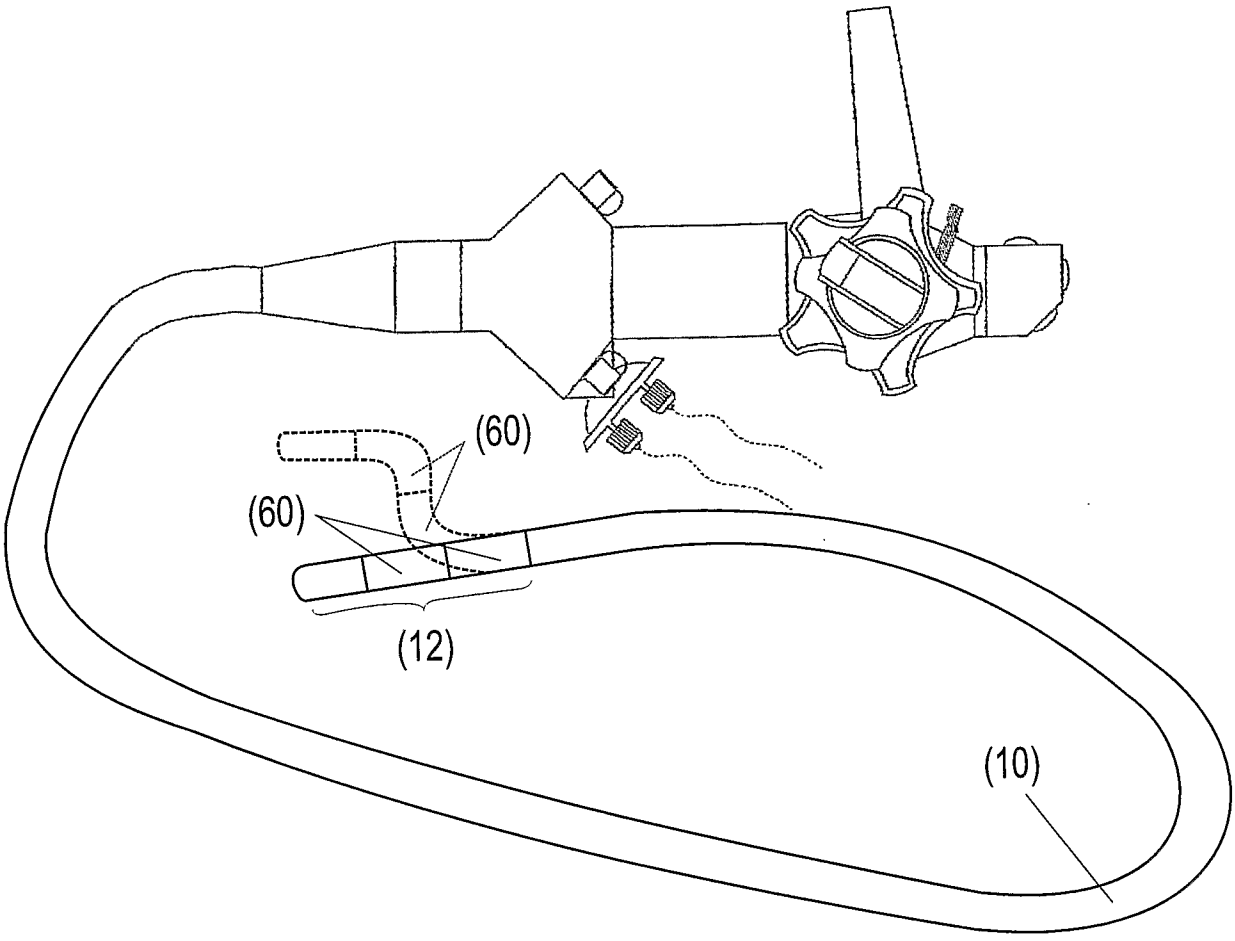

Fig. 12

INTERNATIONAL SEARCH REPORT

International application No
PCT/BR2009/000203

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61B1/018

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

B. FIELDS SEARCHED

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.
X Y	WO 2008/070556 A (BOSTON SCIENT SCIMED INC [US]) 12 June 2008 (2008-06-12) paragraphs [0136], [0140], [0210] - [0214]; figures 1,2A,32,A,32,B,33A,33B,35	1-5,7,8, 10 6,9
Y	US 6 059 719 A (YAMAMOTO TETSUYA [JP] ET AL) 9 May 2000 (2000-05-09) abstract; figures 1,2,12,22,33 column 2, line 1 - line 30 column 6, line 1 - line 65 column 9, line 13 - line 60 column 11, line 35 - line 43 column 13, line 55 - column 14, line 3	6,9

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
21 September 2009	08/10/2009

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INTERNATIONAL SEARCH REPORT

International application No
PCT/BR2009/000203

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A	US 5 460 168 A (MASUBUCHI RYOUJI [JP] ET AL) 24 October 1995 (1995-10-24) cited in the application abstract; figures 1,2 the whole document	1-10
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专利名称(译)	手术内窥镜		
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外部链接	Espacenet		

摘要(译)

本发明涉及手术内窥镜，更具体地涉及用于执行操作的手术内窥镜，优选地，通过外部孔口到由内部体腔的组织限定的身体开口，例如通过穿孔的腹部和胸部操作的情况。在具有管腔的消化器官中，但不限于这种类型的手术，也可以在腹腔镜手术中使用它们。基于已知为NOTES的技术，即自然孔口经腔内窥镜手术，开发了本发明用于诊断和/或治疗应用。