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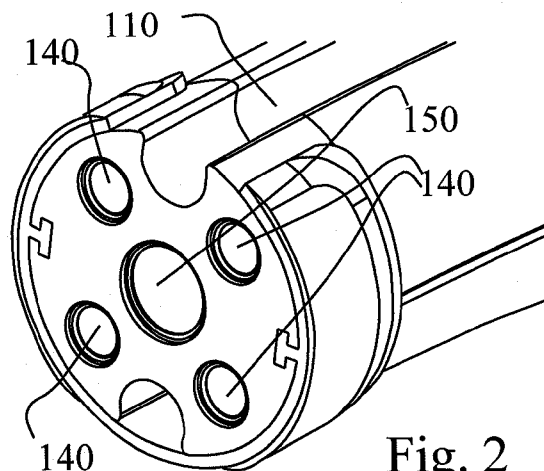
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**Fig. 2**

(57) Abstract: The present invention provide a pre-shaped port, at least partially introduced into a body cavity, comprising a body characterized by a distal end and a proximal end; said body comprising at least one throughgoing channel enabling introduction of at least one surgical tool; said distal end comprises at least one extension; wherein said extension is adapted to provide mechanical support to a distally located organ within said body cavity.



## **A PRE-SHAPED RIGID PORT**

### **FIELD OF THE INVENTION**

This invention relates to devices adapted for use in laryngeal microsurgery. In particular and preferably, it relates to a rigid, semi-rigid, semi-flexible, modular platform for use in such surgery.

### **BACKGROUND OF THE INVENTION**

The surgical method most commonly used today for procedures on the larynx and hypopharynx is Direct Micro-Laryngoscopy (DML). This method enables both direct view of the region upon which the procedure is being performed via a rigid laryngoscope, the use of a binocular microscope and the use of a variety of surgical instruments.

A number of inventions disclosing means for positioning surgical devices for use in laryngeal surgery are known. U.S. Pat. No. 5894840 and European Pat. No. EP1062963 are examples of disclosures of means for fixing an endotracheal tube. These devices ensure that the endotracheal tube will remain in place and the patient's airway will remain open during surgery. A laryngoscope that will allow passage of microsurgical tools and maintain the patient's airway open but that allows the patient to remain in a natural body position and that helps prevent the risk of tissue damage common in typical laryngoscopic procedures, thus remains a long-felt, yet unmet, need.

### **SUMMARY OF THE INVENTION**

It is an object of the invention to disclose to a rigid, semi-rigid, semi-flexible, modular platform for use in surgery, particularly laryngeal microsurgery.

It is another object of the invention to disclose a pre-shaped port, comprising a body characterized by a distal end and a proximal end; said body comprising at least one throughgoing channel enabling introduction of at least one surgical tool; wherein said distal end comprises an extension adapted to provide mechanical support to a distally located organ.

It is another object of the invention to disclose a method for surgery, comprising: (a) obtaining a pre-shaped port, comprising a body characterized by a distal end and a proximal end; said body comprising at least one throughgoing channel enabling introduction of at least one surgical tool; (b) obtaining at least one surgical tool; (c) inserting said port into a body passage of a patient; and (d) inserting said surgical tool into said port; wherein said distal end

of said pre-shaped port comprises an extension adapted to provide mechanical support to a distally located organ.

## **BRIEF DESCRIPTION OF THE DRAWINGS**

The invention is now described with reference to the drawings, wherein

FIG. **1A-B** illustrates (not to scale) the construction of a laryngoscope or port according to an embodiment of the invention;

FIGs. **2-6** illustrate views (not to scale) of the distal end of the laryngoscope or port according to embodiments of the invention;

FIGs. **7-9** illustrate embodiments (not to scale) of handshaking interfaces;

FIG. **10** illustrates an embodiment (not to scale) of an articulating distal tip; and

FIGs. **11A-D** illustrates the engagement interface of the the fixation and stabilization element.

## **DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS**

In the following description, various aspects of the invention will be described. For the purposes of explanation, specific details are set forth in order to provide a thorough understanding of the invention. It will be apparent to one skilled in the art that there are other embodiments of the invention that differ in details without affecting the essential nature thereof. Therefore the invention is not limited by that which is illustrated in the figures and described in the specification, but only as indicated in the accompanying claims, with the proper scope determined only by the broadest interpretation of said claims.

The present invention provides a pre-shaped port, preferably S-shaped, comprising a body characterized by a distal end and a proximal end; said body comprising at least one throughgoing channel enabling introduction of at least one surgical tool; wherein said distal end comprises an extension adapted to provide mechanical support to a distally located organ.

According to one embodiment, the port is a laryngoscope. According to another embodiment, the organ supported is the epiglottis.

According to the core concept of the present invention the port is rigid port, a semi-rigid port, a semi-flexible port and any combination thereof.

The port of the present invention preferably comprises a multi channel rigid trans-oral port with, in some embodiments, a circular cross-section, a pre-shaped multi-channel device to be placed trans-orally, partially in the hypopharynx and partially in the oral cavity in a bent fashion.

The core concept behind the present invention is to provide a rigid, pre-shaped port with a support rim at its distal end and at least one throughgoing channel adapted to allow passage therethrough of at least one tool. Tools are preferably flexible, but can be semiflexible.

In preferred embodiments, a single handle controls both the port and at least one function of the distal end of the tool. In other embodiments, there are separate controls for the port and for the at least one function of the distal end of the tool.

In some embodiments of the present invention, the port also comprises an interface that enables the actuation of **only** allowable tools. Thus, tools that are not "allowed" would not be able to be actuated. Actuation mechanisms can be either passive or active. It is to be emphasized that having an interface to allow tools is an option; in preferred embodiments, all tools with outside diameter no larger than the diameter of a channel are allowed tools.

In some embodiments of the present invention, the articulated tools are activated by means of an interface between the port and the tool, such that only tools which are identified (by means of said interface) would be able to be introduced into the port and be actuated.

It should be emphasized that the following description discloses a port and the area of the larynx; however, similar ports that can be used in different anatomic area (e.g., trans-rectum colon surgery, laparoscopic surgery, intestinal surgery or examination where the point of entry is the anus, uterine surgery or examination where the point of entry is the vagina, bladder surgery or examination via the urethra and prostate surgery or examination via the urethra, and NOTES (Natural Orifice Transluminal Surgery)) are enclosed within the scope of the present invention.

The term laryngoscope refers hereinafter to any port adapted to introduce surgical tools into any body cavity.

The port of the present invention enables the following:

(1) provide exposure of the surgical or treatment area by causing widening of the space directly above the larynx (hypopharynx) to create a "working area", analogous to the inflated abdominal cavity in laparoscopy;

- (2) provide access by allowing passage both alongside the port, for example, of an endotracheal tube, and through the port of optics and of a number of surgical tools; and,
- (3) provide precision, tremor free surgery or treatment by lending support, stability and anchorage to the equipment both within the throughgoing channels and at the port's distal end, thereby allowing stable, precise laryngeal surgery or treatment by ensuring smooth movement of the surgical tools through the channels in the port.

If the port is used as a laryngoscope, the same is disposable and is preferably about 25 cm to about 30 cm in length and about 18 mm to about 35 mm in diameter, although the diameter may vary at different parts of the laryngoscope to be better accommodated to the anatomy of the mouth and throat.

Furthermore, the port, as provided by the present invention, is biocompatible and safe for working in a laser treatment environment.

In use, the proximal end of the port (e.g., laryngoscope) extends through the patient's mouth and outside the teeth and lips to allow easy access for the operator or operators. The distal end is situated either just superior or just inferior to the tip of epiglottis, approximately 2 cm above the vocal cords.

The present invention relates to laryngeal medical procedures, such as treatment or surgery. The general method of carrying out laryngeal medical procedures using the port as provided by the present invention is as follows:

- a. Intubate the patient with a small diameter endotracheal tube (#5.5-6.5) and induce anesthesia.
- b. Insert the port (i.e., the laryngoscope) atraumatically by gliding it along the endotracheal tube until its distal end has passed beyond the base of tongue. An anesthesiologist's laryngoscope (used for intubation) may be employed to aid insertion.
- c. Pass an endoscope through its designated channel in the port and view the surgical field so obtained. The surgeon sees the picture on a monitor.
- d. Fine tune the position of the port using a displayed view of the surgical field.
- e. Once the desired field is obtained, inflate the distal inflation mechanism to expand the field and stabilize the port.

- f. Fasten and fixate the port to the head using the mouth-bite (refers hereinafter as a fixation element) and to the designated head fixation mechanism such that both the head of the patient and the laryngoscope are immobile. The head fixation mechanism can be a head rest, a head support pillow, an external stand, and any combination thereof.
  - g. Optionally, secure to the operating bed a designated stand, which holds the proximal ends of the tools, endoscope, laser and suction.
  - h. Using the current best practice position - behind and above the patient's head – perform the medical procedure using the specially designed articulating tools, or laser.
    - i. Advance a first set of tools through the channels in the port.
    - ii. Perform the medical procedure, changing tools as needed.
      - a. When the laser is used, it will pass through one channel and a small suction channel will be connected to continuous suction so as to clear smoke and vapors.
      - b. One of the channels can be used to insert neuro-pads for hemostasis and also as the port for removal of resected tissue. Optionally, specimens can be put in special bag before removal to avoid spillage and seeding- similar to what is commonly done in laparoscopy.
      - c. For embodiments of the port with distal articulation (disclosed hereinbelow), the surgeon may, during the medical procedure, adjust the view by using the articulation abilities of the distal tip of the port (Up to about 30 degrees to each side). For embodiments without distal articulation, the field of view can be adjusted using the camera's articulation capability.
3. Complete the procedure by:
- a. Deflate the inflation mechanism and remove the stabilization straps for the head and port.
  - b. Remove the port from the oral cavity.

The term "**about**" refers hereinafter to a range of 25% below or above the referred value.

The term "**surgical tool**" refers hereinafter to any tool that can be at least partially inserted through a port. Surgical tools can be broadly divided into two classes, surgical instruments, which are used during surgical procedures, and treatment tools, which are used during treatment of medical conditions. Typical examples of surgical instruments comprise scalpels, forceps, hemostats and clamps. Typical examples of treatment tools comprise syringes, hypodermic needles, applicators and lasers, although lasers can also function as surgical instruments.

Typical examples of surgical procedures include removal of tumors and repair of torn vocal cords. Typical examples of treatment of medical conditions include injection treatments for the vocal cords.

The term "**epiglottis**" refers hereinafter to a flap that is made of elastic cartilage tissue covered with a mucous membrane, attached to the entrance of the larynx.

The term "**allowed tool**" refers hereinafter to any tool which can engage with the port and thus can be actuated when introduced through the same. In some embodiments of the present invention, a tool is an allowed tool if its outer diameter is no larger than the diameter of the port. In other embodiments, the port comprises an identification interface, which identifies whether a surgical tool is an allowed tool. The identification interface can be either passive or active. Once a tool has been identified as "allowed", the same can engage with the port and can be actuated. It should be emphasized that once the tool has been identified as "allowed", the same can either be introduced into the port and/or can be actuated.

The term "**passive interface**" refers hereinafter to any passive means that ensures a proper engagement between the tool and the port (and the identification of the tool as allowed) before the tool can be activated and used. For a passive interface, there is no need for any part (either in the port or the tool) to be active in order to provide the identification and engagement.

The term "**active interface**" refers hereinafter to any active means that ensures a proper engagement between the tool and the port (and the identification of the tool as allowed) before the tool can be activated and used. For an active interface, a movement of a part within either the port or the tool is required in order to provide the identification and engagement.

The term "**laryngoscope**" refers hereinafter to any laryngoscope (used in laryngeal treatment or surgery) or any port to be used mainly for introduction of surgical tools, including surgical instruments or treatment tools, into a body cavity for performing and facilitating a medical procedure, which can be surgery or a treatment procedure.

Reference is now made to FIG. 1, which illustrates (not to scale) a port of the present invention. FIG. 1A illustrates one embodiment 10 of the invention. In this embodiment, the port (10) is generally S-shaped. It can be made of any suitable biocompatible material. The upper part of the S comprises, at the proximal end of the port, two connectors adapted to be connected to handles (591) to control motion of the tools (592). The control portion (470) of the handles (591), in the embodiment shown, comprises a closing mechanism, adapted to close the tools (592). The port (10) further comprises at least one throughgoing channel; one such channel (151) is adapted to accept a lighting means, as described hereinbelow.

In preferred embodiments, the tools are flexible tools, although they can be semi-flexible.

Preferred embodiments, such as that shown in FIG. 1A, comprise an exterior groove adapted to hold an intubation tube (112) which enables passage of air past the port so that the patient can breathe.

FIG. 1B illustrates, in an out-of-scale manner the connection between the handle (591) and the port (10). In this embodiment, another button has been added, which fits into the application port of the tool. The interface enables insertion of a tool into and out of the port and further enables rotation of the tool, when the same is fitted into the interface.

The diameter of the body is chosen to be appropriate for the size of the patient's oral cavity and throat, while the length is chosen to be appropriate for the patient and the type of medical procedure being performed. In preferred embodiments of the invention, the port is provided in a variety of standard sizes.

In some embodiments, the port comprises a body with cross-sectional shape selected from a group consisting of triangular, trapezoidal, rectangular, rhomboidal, polygonal, oval, elliptical, and any combination thereof.

In some embodiments, the cross-sectional shape of the port is similar throughout the length of the port. In other embodiments, the cross-sectional shape differs in different parts of the port. An illustrative example of an embodiment of a port with different cross-sections in different parts is the embodiment (10) of the port of FIGs. 1A-B, which comprises a generally cylindrical cross-section in the central and distal regions, and generally circular cross-sections in the proximal portion.

In reference to FIG. 2, the body further comprises a plurality of longitudinal channels through the length of its interior. In preferred embodiments of the laryngoscope or port, it comprises a central channel (140) and a plurality of other channels 150. The diameter of the central



channel (**140**) is adapted for accommodation of an endoscopic camera and a light source. The diameters of the other channels (**150**) are adapted to accommodate other microsurgical tools. FIG. **2** also shows the intubation groove (**110**).

In some embodiments, the channels further comprise mating interfaces (described hereinbelow) providing a handshake interface to allow the endoscopic camera and microsurgical tools to slide through the channels, and then to reversibly ensure that the camera and tools are properly engaged within the channels, enabling proper positioning of the tools and maintenance of the tools in their desired locations.

Alternatively, the channels further comprise mating mechanisms providing a handshake interface to allow the endoscopic camera and microsurgical tools to slide through the channels, and then to lock the camera and tools in place, enabling proper positioning of the tools and maintenance of the tools in their desired locations.

According to some embodiments of the present invention, the handshake interface between the port and a surgical tool can be performed in at least one channel. Handshaking can be individual, with each tool handshaking within a channel, or it can be multiple, with handshaking activating a plurality of tools in a plurality of channels.

According other embodiments, the central channel can be coupled to an external light source via coupler **140** and, for example, can enable the passage of optical fibers to the distal end of the same.

FIG. **3A-B** illustrates, in an out-of-scale manner, two views of the distal end of the port (**10**), showing two tools (**592**) and the connection ports (**140**) by which the tools are connected to the port and which enable control of at least one degree of freedom of the tools by the handles (not shown). Said degree of freedom controlled by the port is selected from a group consisting of activation of the tool, rotation of the distal end of the tool, translation of the distal end of the tool and any combination thereof.

The ports also control activation of the tools. In FIG. **3A**, the tools are approximately parallel to each other; in FIG. **3B**, they have been rotated towards each other so that their tips almost touch, and also rotated about their longitudinal axes so that they face downward rather than sideways, as they did in Fig. **3A**.

FIG. **3A-B** also illustrates the groove (**110**) for the intubation tube; and the extension (**1005**) adapted to provide support for the epiglottis. It is emphasized that the term "mechanical support" refers hereinafter to at least partially removing the tissue or organ (e.g., the

epiglottis) from the field of view and supporting it so that it remains out of the field of view. It can also increase the 'working area' available to the physician.

In preferred embodiments, the extension (**1005**) can be fixed in place or articulates or can be linearly moved relative to the distal end of the port, as described hereinbelow.

One of the major difficulties in laryngeal surgery is to overcome the difficulties caused by the epiglottis (e.g., constant saliva\mucous drooling; the required need to "lift" and move the epiglottis from its position). Thus, according to one embodiment of the present invention, a roof-like extension **1005** is provided.

The extension **1005** is an extension to the port body which guides the port through the larynx. Furthermore, the extension **1005** provides mechanical support and lifting of the epiglottis. Yet more, due to its construction and design, it shifts away any saliva/mucous drooling from the field of view of the physician.

Reference is now made to FIGs. **4A-B**, which illustrate an embodiment of the extension (**1005**) at the distal end of the port (**10**) in two different positions. In some embodiments, the extension (**1005**) is rigidly coupled to the rim of the distal end of the port (**10**), encircling at least a portion of the rim. In said embodiment, the extension (**1005**) is an integral part of the port.

In preferred embodiments, the extension (**1005**) articulates with respect to the distal end of the port (**10**). The articulation can comprise (a) sliding in and out relative to the distal end, so that the distance from the end of the extension (**1005**) to the distal tip of the port (**10**) can change; (b) rotation relative to the main longitudinal axis of the port (**10**), so that the extension (**1005**) can rotate around the distal tip. In this manner, the longest portion of an extension (**1005**) can be placed in any desired position with respect to the port (**10**), for non-limiting example, above it (as illustrated in FIGs **4A-B**), to the side of it, or below it; (c) rotation relative to an axis perpendicular to the main longitudinal axis. In this manner, the extension (**1005**) can be folded away from the tools (**592**) or toward them.

In FIGs. **4A-B**, the extension (**1005**) slides with respect to the distal end of the port (**10**). In FIG. **4A**, the extension (**1005**) is in its fully retracted position, so that the distance from the end of the extension (**1005**) to the distal tip of the port (**10**) is a minimum. In FIG. **4B**, the extension (**1005**) has been linearly slid outwards; so that the distance from the end of the extension (**1005**) to the distal tip of the port (**10**) is close to its maximum.

FIGs **4A-B** also show the ends of the throughgoing channels (**140, 150**) and the intubation groove (**110**).

Reference is now made to FIGs. **5A-B**, which illustrate an extension (**1005**) that rotates relative to the distal end of the port (**10**). In FIG. **4A**, the extension (**1005**) is in its most open position, with the extension (**1005**) substantially parallel to the top rim of the port (**10**). In FIG. **4B**, the extension (**1005**) has been bent downwards to approximately its maximum bend, so that the extension (**1005**) substantially covers the face of the distal end of the port (**10**). The hinging mechanism in FIGs. **5A-B** comprises an integral pivot (**1015**) on the extension (**1005**) which fits into a recess on the distal tip of the port (**10**). In this embodiment, the pivot (**1015**) is offset from the main body of the extension (**1005**).

Reference is now made to FIGs. **6A-B**, which illustrate two embodiments of the extension (**1005**) at the distal end of the port (**10**). The embodiment of FIGs. **6A**, like the embodiment of FIGs. **5A-B**, has an extension (**1005**) adapted to rotate about a hinge (**1015**). However, the hinging mechanism of FIG. **6A** comprises a pivot pin (**1015**) passing through the extension (**1005**). In this embodiment, the pivot (**1015**) passes through the main body of the extension (**1005**).

Other hinging mechanisms (**1015**) and pivot locations will be obvious to persons skilled in the art. FIG. **6A** also shows the intubation groove (**110**).

The extension (**1005**) of the embodiment shown in Fig. **6B** entirely encircles the rim of the port (**10**). The ends of the throughgoing channels (**140, 150**) and the intubation groove (**110**) are also shown.

It is within the core concept of the present invention wherein said extension is used not only to support an organ (e.g., the epiglottis) but also to "support" the tool going through the channels.

According to said embodiment, by providing said extension, any unwanted movement of the tool out of the boundaries (provided by said extension) will be prevented.

The present invention can additionally comprise an engagement device to ensure that the microsurgical tool must be properly engaged with the port before it can be activated and used. Activation can be mechanical, electrical, electronic, or any combination thereof. It can be (a) passive, requiring no moving parts within either port or tool; (b) active, wherein movement of a part within either port or tool is required for activation; or, (c) operator-assisted, requiring an action by the operator, above and beyond insertion of the tool into the port.

The concept behind the above, is to provide a handshake interface between a port and a surgical tool, such that only when the surgical tool is identified as an "allowed" tool, can the same engage with the port and be actuated. Thus, tools that are not "allowed" could not engage with the port and could not be (a) actuated; or (b) inserted through said port.

According to the above embodiments, the handshake interface between a port and a surgical tool comprises:

- (a) at least one surgical tool, adapted to be introduced through a port;
- (b) a port having a body, characterized by a distal end and a proximal end interconnected by a main longitudinal axis. The body comprising an identification interface, adapted to identify said surgical tool as an allowed tool; and,
- (c) an actuation interface, adapted to actuate said tool once said tool has been identified as an allowed tool; wherein at least a portion of said tool comprises an identification portion such that said tool is defined as allowed and is actuated only after a handshake match between said identification interface of said port and said identification portion of said tool.

In reference to FIG. 7, an illustration of a tool (690) of the prior art is shown. FIG. 7A shows the entire tool (690), while FIG. 7B shows a close-up of the section of the tool (694), labeled A in FIG 7A and surrounded by a solid line, where the handle joins the body of the tool. As shown in FIG. 7A, the tool has a handle (591) at the proximal end, a functional distal end (592), and a flexible body (693) of substantially constant cross-section. In FIG. 7A, the section of the tool at the junction of the body and the handle (694) is shown in cutaway view, while the exterior of the remainder of the tool is shown.

In reference to FIG. 7B, a cutaway view of the section of the tool at the junction of the body and the handle (694) is shown, on an enlarged scale. In FIG. 7B, the proximal end of the tool body comprises a substantially constant cross-section along its entire length.

Unlike the prior art tool, Fig. 8 provides an example of a passive activation of the tool.

In reference to FIG. 8, an embodiment of the engagement device provides a non-limiting example of a key-in-lock type passive activation interface, where a section of the microsurgical tool comprises a male profile, fitting a female profile in the port.

As will be described hereinafter, once there is a fit and a match between the port and the tool, the identification interface identifies the tool as allowed and thus, the same can be actuated.

In reference to FIG. **8A**, the proximal end of the port is shown, with an embodiment of the channels **140** in which the proximal end of the channels is profiled (**741**). The microsurgical tool can not be inserted into the channel unless the male profile on the microsurgical tool mates with the female profile **741** on the port.

The microsurgical tool is inserted until its profiled section has passed fully through the profiled section of the port. Once the microsurgical tool has passed fully through the profiled section of the port and its distal end is therefore in the proper position to be used, the microsurgical tool is activated and is free to turn and 360 degrees freely rotate. The tool can not be removed from the port unless the profiles are again matched, prevented unwanted retraction of the tool from the port.

According to some embodiments, activation is possible if there is at least a **partial** tight fit match between the cross section of at least a portion of a channel in the port and a cross-section of at least a portion of the body of the tool. In this embodiment, activation is possible if part of the perimeter of the cross-section on the tool matches part of the perimeter of the cross-section on the port and, for the remainder of the perimeter, the radius of the tool is less than that of the corresponding radius of the channel. If there is no such match or if the tool perimeter is larger than the corresponding channel perimeter, the distal end of the tool can not reach a proper position to be used and the tool is not activatable.

According to other embodiments, activation is only possible if there is a **full** tight fit match between the cross section of at least a portion of a channel in the port and a cross-section of at least a portion of the body of the tool. In this embodiment, activation is possible if the shape of the perimeter of the cross-section on the tool matches the shape of the perimeter of the cross-section on the port channel for substantially all of both perimeters. If there is no such match, the distal end of the tool can not reach a proper position to be used and the tool is not activatable.

In reference to FIG. **8B**, the port (**10**) is shown with an inactivated microsurgical tool (**590**) in position in one of the channels **140**. The male profiled section of the microsurgical tool is at least partly within the profiled section of channel **140**.

In reference to FIG. **8C**, the area within circle A is shown in close-up. In this embodiment, the proximal end of the port and the profiled section of tool **590** are shown. The male profile (**742**), of the tool, comprises two cogs capable of mating with the female profile (**741**) in the proximal face of the channel (**140**) of the port.

In FIG. 8C, the tool is inactivated; the tool cogs of the male profile (742) are engaged with the cogs (741) in the proximal face of the channel (140), thereby preventing rotation of the tool (590).

In reference to FIG. 8D, the port (10) is shown in partial cutaway view with an activated microsurgical tool (590) in one of the channels 140. The proximal portion of the port is shown in cutaway view, so that the interior of the proximal part of the channel can be seen. The male profiled section of the microsurgical tool is wholly within one of the channels 140.

In reference to FIG. 8E, the proximal end of the tool (circle A in FIG 8D) is shown in close up with an activated microsurgical tool (590) in one of the channels 140. The male profiled section (742) is wholly within the channel 140 and is not in contact with cogs (741) in the proximal face of the channel (140), permitting 360 degrees rotation of the tool within the port (10).

It should be pointed out that the profiled section of the channel (140) can be at the proximal end of the port, at the distal end of the port, all along the channel, in a portion of the body of the port, in the articulated section of the port, just proximal to the articulated section, or any combination thereof.

The profiled section of the tool (590) can be at the proximal end of the tool, at the distal end of the tool, all along the tool, in the body (693) of the tool, or any combination thereof.

It should be pointed out that according to the passive embodiment, illustrated in the above disclosed Figures), the identification interface of the port is the profiled channels, such that only tool having a match fit (or at least partial fit) with said profiled channels of said port, will be defined as "allowed" tool and would be able to be introduced through said port and actuated in the same.

In reference to FIG. 9, a port and tool are shown in an embodiment of an active interface. According to this embodiment, the tool comprises a movable sleeve/collar (841) and a latching mechanism.

The distal end of the handle (591) and a portion of the tool body immediately distal to the handle are shown in cutaway view. In this embodiment, a latching mechanism is lifted in order to activate the tool 590. The latching mechanism (842) comprises an at least partly flexible body portion attached at one end to the tool and a hook portion (843) attached to the free end of the body portion. In some embodiments, the latching mechanism additionally comprises an extension (in this embodiment a distal tip 844) to facilitate moving the hook

(843) to the activated state. In the inactivated state, the hook of the latching mechanism physically prevents functioning of the functional distal end of the tool. In the present embodiment, as shown hereinbelow, in the inactivated state, the hook (843) rests in a depression in the tool control transmission mechanism, thereby preventing the tool control transmission mechanism from moving and thus preventing the function distal end of the tool from functioning.

In reference to FIG. 9A, the port (10) is shown with an inactivated microsurgical tool (590) in one of the channels 140. The proximal portion of the port is shown in cutaway view, so that the interior of the proximal part of the channels 140 can be seen.

In reference to FIG. 9B, a close-up of area A (rectangle, FIG 8A) is shown, illustrating a close-up of the proximal end of the port (10) with an inactivated microsurgical tool (590) in one of the channels 140.

In this embodiment, in the inactivated state, a hook (843) approximately at the distal end of the latching mechanism (842) penetrates the tool wall (846) and rests snugly in a depression (845) in the tool control transmission mechanism, preventing movement of the tool control transmission mechanism relative to the tool wall, thus preventing the functional distal end of the tool from functioning and thereby preventing use of the tool.

Insertion of the tool fully into the port pushes the sleeve against the latching mechanism (842), lifting the hook (843) free of the depression and the hole, thereby activating the tool.

In reference to FIG. 9C, the tool 590 is shown alone. The distal end of the handle (591) and a portion of the tool body (693) immediately distal to the handle are shown in cutaway view.

In reference to FIG. 9D, a close-up of area A (rectangle, FIG 9C) is shown, illustrating a close-up of the distal end of the handle (591) and the proximal end of the tool body (693) with the microsurgical tool (590) in an inactivated state. The hook (843) approximately at the distal end of the latching mechanism (842) penetrates the tool wall (846) and rests snugly in a depression (845) in the tool control transmission mechanism, preventing rotation of the functional distal end of the tool relative to the tool wall and thereby preventing use of the tool.

In reference to FIG. 9E, the port (10) is shown with an activated microsurgical tool (590) in one of the channels 140. The proximal portion of the port is shown in cutaway view, so that the interior of the proximal part of the channels 140 can be seen.

In reference to FIG. 9F, a close-up of area A (rectangle, FIG 9E) is shown, illustrating a close-up of the distal end of the handle (591) and the proximal end of the tool body (693) with the microsurgical tool (590) in an activated state. The hook (843) approximately at the distal end of the latching mechanism (842) is held clear of the tool wall (846) and the depression (845) in the tool control transmission mechanism by the sleeve (841), thereby permitting rotation of the functional distal end of the tool relative to the tool wall. The extended distal tip (844) of the latching mechanism is adapted to allow smooth ingress of the sleeve (846) into the space between the latching mechanism (842) and the tool wall (846), facilitating raising the hook (843) to the activated position.

In reference to FIG. 9G, the tool 590 is shown alone. The distal end of the handle (591) and a portion of the tool body (693) immediately distal to the handle are shown in cutaway view.

In reference to FIG. 9H, a close-up of area A (rectangle, FIG 9G) is shown, illustrating a close-up of the distal end of the handle (591) and the proximal end of the tool body (693) with the microsurgical tool (590) in an activated state. The hook (843) approximately at the distal end of the latching mechanism (842) is held clear of the tool wall (846) and the depression (845) in the tool control transmission mechanism by the sleeve (841), thereby permitting rotation of the functional distal end of the tool relative to the tool wall. The extended distal tip (844) of the latching mechanism is adapted to allow smooth ingress of the sleeve (846) into the space between the latching mechanism (842) and the tool wall (846), facilitating raising the hook (843) to the activated state.

The hook (843) approximately at the distal end of the latching mechanism (842) can be positioned at the proximal end of the tool, at the distal end of the tool, or any combination thereof.

It should be pointed out that the profiled section of the channel (140) can be at the proximal end of the port, at the distal end of the port, all along the channel, in a portion of the body of the port, in the articulated section of the port, just proximal to the articulated section, or any combination thereof.

The profiled section of the tool can be at the proximal end of the tool, at the distal end of the tool, all along the tool, in the body of the tool, or any combination thereof.

It should be pointed out that according to the passive embodiment, the identification interface of the port is the profiled channels, such that only tool having a match fit (or at least partial



fit) with said profiled channels of said port, will be defined as "allowed" tool and would be able to be introduced through said port and actuated in the same.

The following provides non limiting examples of active interfaces:

- (a) a hook-and-latch mechanism, where the introduction of the tool into the mechanism lifts the latch and the tool is activated when the latch engages with the hook;
- (b) a conductive region either on the tool or on the port, such that the introduction of the tool into the port completes an electrical circuit;
- (c) a detector positioned either in the tool or the port, such that the introduction of the tool into the port reflects an electromagnetic radiation into said detector;
- (d) an RFID tag positioned on the outer surface of the tool; and a tag reader positioned in the port; such that when the tool is introduced into the port the RF reader identifies the RFID tag. It should be pointed out that the RFID tag can be positioned on the port and the tag reader can be positioned on the tool.
- (e) a bar code positioned on the outer surface of the tool; and a bar code reader positioned in the port; such that when the tool is introduced into the port the RF reader identifies the RFID tag. It should be pointed out that the bar code can be positioned on the port and the bar code reader can be positioned on the tool.
- (f) a chip positioned on the outer surface of the tool; and a chip reader positioned in the port; such that when the tool is introduced into the port the RF reader identifies the RFID tag. It should be pointed out that the chip can be positioned on the port and the chip reader can be positioned on the tool.
- (g) an optical/light emitting means positioned on the outer surface of the tool (the optical emitting means is adapted to emit light); and a detector for detecting a beam of light positioned in the port; such that when the tool is introduced into the port, the detector identifies a beam of light emitted from said optical emitting means. It should be pointed out that the optical emitting means can be positioned on the port and the detector can be positioned on the tool.

In operator-activated embodiments, an additional step is needed after insertion of the tool through the port in order to activate the tool. This additional step can comprise the operator lifting or closing a latch, pressing a button, moving a lever, moving a switch, uttering a predetermined voice command, entering a predetermined command via touch screen, entering a predetermined command via keyboard illuminating a portion of the tool, and any combination thereof.

In reference to FIG. 10, an articulating section (980) is shown at the distal tip of a port (10).

In reference to FIG 10A, the articulating section (980) comprises a portion of the port (10) approximately distal to the body, but proximal to the distal face (107). The articulating section (980) is of the same material as the remainder of the body of the port, but has a smaller diameter (981), thereby facilitating bending of the articulating section.

The distal face of the port (107) is in communication with the aiming control (470) on the handle of the port (10) so that the angle of the distal face with respect to the main longitudinal axis of the port (10) can be altered by the surgeon at will.

In further reference to FIG. 10A, the angle of articulation of the articulating section is 0; the main longitudinal axis of the articulating section is parallel to the main longitudinal axis of the port body and the distal face of the port is perpendicular to the main longitudinal axis of the port body.

In other embodiments, the distal face of the port is at an angle different from perpendicular to the main longitudinal axis of the articulating section. Change of the orientation of the distal face, however, is the same for all embodiments, as long as the angle of the distal face is fixed relative to the main longitudinal axis of the articulating section.

In reference to FIG 10B, a close up of area A (circle, FIG. 10A), the distal portion of the port is shown, comprising the articulating section 980. The smaller diameter section (981) is surrounded by a cover (982) of a very soft material which does not interfere with the bending of the articulating section (981). The outer diameter of the cover is substantially the same as the outer diameter of the body of the port, thereby providing a smooth surface for the entire endoscope body and preventing sharp corners that have the potential to damage the patient, as well as crevices that can harbor bacteria.

In reference to FIG. 10C, the articulating section (980) has been bent counter-clockwise by 30 degrees and the distal face (107) is at an angle of 60 degrees to the main longitudinal axis of the port. The cover (982) for the narrow diameter section (981) is shown.

In reference to FIG. 10D, a close up of area A (circle, FIG. 10C), the distal portion of the port, is shown, comprising the articulating section 980. The articulating section (980) has been bent counter-clockwise by 30 degrees and the distal face (107) is at an angle of 60 degrees to the main longitudinal axis of the port. The cover (982) for the narrow diameter section (981) is shown.

The handle (460) comprises an aiming control (470) adapted to control the angle of the distal articulation section (480) relative to the body (102) of the device. The aiming control (470) can comprise a dial, a knob, a lever, a wheel, electronic mean, joystick, a sound detector adapted enable response to predetermined sounds, a light detector adapted to enable response to predetermined light patterns, any combination thereof, or any other means of controlling movement known in the art.

In a preferred embodiment, there is provided a communication mechanism for transmitting changes in the angle of the distal face from the control on the handle to the distal face of the port. This is at least one, and preferably four, strong cables running through the port from the control to the distal face. Moving the proximal end of the cables will move the distal end thereof, thereby rotating the distal face of the port. For non-limiting example, in an embodiment with four cables, one pair moves the distal face left-right, while the other pair moves it up-down.

In other embodiments, inflatable cuffs, electric motors or piezoelectric actuators are used to effect changes in the angle of the distal face of the port. For the embodiments with electric motors or piezoelectric actuators, the communication mechanism is either wired or wireless.

In some embodiments, the port further comprises at least one stabilization zone, for example, one near the proximal end (120, Fig. 1A; 1001, Fig. 11) of the port and one near the distal end (1005, Fig. 11) of the port.

In some embodiments the distal stabilization zone comprises a distal inflatable zone located near the distal end of the laryngoscope or port. In some embodiments, the proximal stabilization zone comprises a second inflatable zone, a proximal inflatable zone. The balloon-like inflatable zones are made of a suitable biocompatible flexible material that expands on being filled with fluid. In a preferred embodiment, said fluid is air. In other embodiments, the fluid is an inert gas such as, but not limited to, nitrogen or argon. In yet other embodiments, it is oxygen. In yet other embodiments, a mixture of gases is used. In yet other embodiments, the gas mixture includes medically active materials, such as, but not limited to, anesthetics, analgesics or antibiotics. In further embodiments, the fluid is a liquid such as, but not limited to, water or saline solution. In some embodiments where the inflatable zone is filled with a liquid, the liquid includes medically active materials such as, but not limited to, anesthetics, analgesics or antibiotics. The fluid may also contain inert materials such as, but not limited to, stabilizers, anti-caking or anti-sticking agents, or preservatives.

In preferred embodiments of the invention, the inflatable zones are attached (e.g. by gluing) to a ring-like member, made of a relatively stiff biocompatible plastic, that is adapted to fit into the groove in which the inflatable zone sits. In most preferred embodiments, a pair of tabs are attached to the inner surface of the ring-like member, which are adapted to fit into slots, thus fixing the inflatable zone in place.

According to another embodiment of the present invention, the inflatable zones are an integral part of the laryngoscope or port.

In the uninflated state, the outer diameter of the inflatable zones is no greater than the largest diameter of the body, so that the port can be inserted into the patient via the patient's oral cavity. In the inflated state, the outer diameter of the inflatable zones is sufficient to contact the inner surface of the patient's throat and/or hypopharynx. Each inflatable zone is in fluid connection with an inflation inlet located at the proximal end of the port. The inflation inlet is designed to allow introduction of air or other gas to inflate the inflatable zones and removal of air to deflate them. The inflation inlet is designed either to make a sealable connection with the gas source or to comprise a separate sealing means (e.g. by a valve). Any means for inflating the inflatable zones known in the art may be used instead.

The exact positioning of the inflatable zones along the length of the body is not vital to the operation of the port.

According to another embodiment of the present invention, either one of the distal/proximal inflatable zones has the ability to slide along the longitudinal axis of the port. Such an embodiment will allow exact positioning of the inflatable zones (namely, the balloons) by the surgeon.

In preferred embodiments, the proximal stabilization zone comprises a fixation and stabilization element adapted to fit over the patient's mouth, within the patient's mouth, over the lower part of the patient's face or any combination thereof.

According to another embodiment, the proximal stabilization zone is the fixation and stabilization element adapted to fit over the patient's mouth, within the patient's mouth, over the lower part of the patient's face or any combination thereof.

The main functions of the fixation and stabilization mechanism are the following:

- (a) to stabilize and fixate the port in relation to the patient so that the port, once in place, will not move during microsurgery. It fixates its position and orientation. Such fixation

is highly important as, during the procedure, tools are introduced through the port, which eventually results in friction between the tool and the port that can lead to an unwanted movement of the port.

- (b) to stabilize and fixate the port to the patient's bed so as to prevent unwanted movements of either the head or the port.

According to another embodiment of the present invention, the fixation and stabilization element is designed as a bite guard, adapted to both stabilize and fixate the port, but also to protect the teeth, tissues in the oral cavity, the tongue, the gingiva and any combination thereof.

Thus, the fixation and stabilization element stabilizes the port in relation to the patient and the patient's bed so that the port, once in place, will not move (left or right, up or down) during microsurgery.

In preferred embodiments, the fixation and stabilization element is made from flexible material and is of a shape and size that will fit to the human mouth and teeth.

According to one embodiment, it comprises a collar, adapted to fit around the port body and between the patient's upper and lower teeth. The collar is adapted to prevent the patient from biting the port, which could damage the patient's teeth or the port.

According to one embodiment, the fixation and stabilization element comprises a tongue catcher, adapted to catch and hold the tongue during the microsurgery.

Reference is now made to FIGs. **11A-D** providing four different views of the fixation and stabilization element **1001** and the tongue catcher **1002**. It should be emphasized that the main core concept behind the fixation and stabilization element **1001** is to fixate the port in place so as to prevent any unwanted movement of said port relative to the patient and the patient's bed.

FIGs. **11A-D** further illustrate an embodiment of a distal stabilization zone (**1005**). In this embodiment, the distal stabilization zone comprises 3 inflatable elements, shown in the inflated state. The distal stabilization zone provides support, stability and anchorage to the port at its distal end.

In preferred embodiments, the distal stabilization zone (**1005**) is adapted such that the surgeon is able to "fine tune" the position of the port in the body orifice (e.g. the throat). For example, in the embodiment of FIGs. **11A-D**, the surgeon can fine tune the position by

selectively increasing or decreasing the amount of inflation of at least one of the inflatable zones. By, for non-limiting example, by increasing inflation of the inflatable zone **(1005)** uppermost in FIGs. **11A-D**, the distal end of the port **(10)** is moved downward.

According to one embodiment, the the fixation and stabilization element **1001** is able to slide along the port so that the distance between the distal and proximal stabilizations mechanisms is such that the body and distal end of the port rests stably and comfortably within the patient's mouth and throat, with the patient's head in a natural position.

In preferred embodiments, the fixation and stabilization element **1001** has at least one engagement mechanism **1003** characterized by two states, a locked state where the fixation and stabilization element **1001** is held in a fixed position relative to the port and a released state where the fixation and stabilization element **1001** is free to slide along the body of the port.

The engagement mechanism **1003** can comprise, but is not limited to, a radial clamping mechanism, a side screw pressable into the body of the port, a spring wheich, when released, presses into the body of the port, a tightenable O-ring or any combination thereof.

In Figs **11A-D**, a radial clamping or side screw embodiment of the engagement mechanism **(1003)** is shown.

According to another embodiment of the present invention, the fixation and stabilization element **1001** additionally comprises at least one groove **1004** (FIG. **11D**) through which straps can be threaded. Said straps can be later attached to either the patient's head or bed, so as to fixate the position and orientation of the port to the patient's bed.

In preferred embodiments, the port further comprises an external fixation mechanism. This external fixation mechanism can comprise an airway control pillow, connection means to connect the airway control pillow to the port and, in preferred embodiments, a support bar or frame.

The airway control pillow rests at least partly under the patient's head, supporting the patient's head such that the patient's airway is in the "sniffing position". The pillow places the head in this position by supporting the head and neck in a reaised position such that the head is 7-8 cm above the bed the patient is lying on and the neck is about 11 cm from the same.

The fixation mechanism further comprises connection means adapted to connect the pillow to the port and possibly to a frame or bars attached to or resting on the bed, thereby ensuring that the laryngoscope can not move relative to the patient's head.

The airway control pillow is connected to the patient and, in some embodiments, to the bar or frame, by any connection means well known in the art. Non-limiting examples of such connections means are flexible straps held in place by tying; by flexible straps held in place by loops at at least one end, said loops encircling at least one of a portion of the patient's head, the laryngoscope, or the frame or bar; by Velcro straps; and by adhesive tape.

The handle is at least partly removable from the port. The removable portion of the handle is connected to the port by screws, pins, levers, latches, bayonet fittings, friction fittings or by any other means of releasably retaining demountable fittings known in the art.

In preferred embodiments, the port will comprise a built-in illumination device (not shown), which can be a light source (lamp or LED) attached to the distal end of the port or can be optical fibers traversing the port and carrying light from a source outside the port to the distal end of the same and thereby illuminating the field of view.

In preferred embodiments, the port has a plurality of channels, these channels can be:

1. A channel to accommodate a standard endoscopic camera (which has its own light source). The endoscopic camera is preferably a digital, distal chip endoscope that delivers high definition video images. The diameter of endoscopes is typically 3-4mm so that the diameter of the channel should be at least 7 mm to prevent friction with the endoscope. Optionally, this channel will be designed such that it can accommodate endoscopes of different diameters. Preferably, this channel will not comprise any engagement interface so that any standard endoscopic camera can be used.
2. A preferably small diameter channel to provide ongoing suction, used to evacuate smoke or gas while using a laser or performing diathermy. The proximal outlet of this channel is preferably designed to attach to a standard suction tube.
3. Preferably at least two channels to accommodate the flexible, rotatable and articulating surgical tools. Since the surgeon has only two hands, two working channels normally suffice. The tools will comprise at least: triangular forceps, alligator forceps, scissors, a flexible, articulating laser hand-piece and a flexible, articulating suction handpiece in addition to or in place of the suction side-channel. The surgical tool can be selected

from a group consisting of scissors, forceps, injection needle, dissector, laser, suction, and fiber optics or any other required surgical instrument.

4. A large diameter channel for removal of tissue specimens such as, but not limited to, vocal cord polyps or tumors. This channel could also be used for passage of absorbent pads for hemostasis. In some embodiments, this channel has a substantially larger diameter than the other channels. In other embodiments, the channel is enlargeable by removing part of its internal circumference.
5. Optionally, at least one channel comprising optical fibers or an LED to provide additional light to the surgical field to prevent blocking or shadowing caused by the surgical tools.

In some embodiments, the port additionally comprises a plurality of inflatable gliding balloons mounted on a grooved rail attached to the outer circumference of the port and adapted to allow additional adaptation of the port to the patient's anatomy and to secure anchorage in the pharynx. The balloons will be positioned by the surgeon according to the patient's anatomy to provide a broad surgical field, stable anchoring and positioning of the distal end of the port by selectively inflating the balloons.

In some embodiments, the device is provided in a plurality of standard sizes, including, but not limited to, a men's diameter, a women's diameter, a children's diameter and different lengths.

In some embodiments, the tools are 35-40 cm long, with an articulating section 1.5 to 3 cm long. The tools are no more than 3 mm in diameter. In some embodiments, the maximum articulation is 30 degrees. In other embodiments, it is 90 degrees. The tools can rotate around their main longitudinal axis through a full 360 degrees.

According to one embodiment, at least one channel within the port is adapted to deliver at least one medicament.

In light of the above, the advantages of the port of the present invention include:

1. The surgeon is able to position the camera and light source at any designated distance and any desired angle from the surgical field.
2. The endotracheal tube can be placed precisely at a desired position in relation to the port.
3. There is an invagination on one or more sides of the port to allow passage of endotracheal tubes.



4. Optionally, at least one channel comprising an engagement mechanism with gradable friction levels to allow comfortable sliding of the tools (and possibly endoscope) through the channels and also give better control and stability of movement.
5. The port is adapted to be firmly and safely fixed to the patient's head to fix its position and stabilize it.
6. Optionally, a locking mechanism providing safety with regards to the tool. In such embodiments, when the tools are locked (in-actuated), their functional distal ends can not move relative to the tool, thereby preventing damage to the tissues from unintentional movement of the functional distal end.
7. Safety with regards to the tools. Limitation of tool movements – reduces unwanted movement of the functional distal end due to tremor or vibration of the physician's hands.
8. Safety with regards to the tools. Limitation of movement of the port – unwanted movement of the port due to tremor or vibration of the physician's hands is prevented.

The port as described hereinabove has been adapted for use as a laryngoscope. In other embodiments, it can be adapted for use as a trochar or port system in other areas. Examples include, but are not limited to, laparoscopic surgery, intestinal surgery or examination where the point of entry is the anus, uterine surgery or examination where the point of entry is the vagina, bladder surgery or examination via the urethra and prostate surgery or examination via the urethra, and NOTES (Natural Orifice Transluminal Surgery).

In the foregoing description, embodiments of the invention, including preferred embodiments, have been presented for the purpose of illustration and description. They are not intended to be exhaustive or to limit the invention to the precise form disclosed. Obvious modifications or variations are possible in light of the above teachings. The embodiments were chosen and described to provide the best illustration of the principals of the invention and its practical application, and to enable one of ordinary skill in the art to utilize the invention in various embodiments and with various modifications as are suited to the particular use contemplated. All such modifications and variations are within the scope of the invention as determined by the appended claims when interpreted in accordance with the breadth they are fairly, legally, and equitably entitled.

**CLAIMS**

We claim:

1. A pre-shaped port, at least partially introduced into a body cavity, comprising a body characterized by a distal end and a proximal end; said body comprising at least one throughgoing channel enabling introduction of at least one surgical tool;  
said distal end comprises at least one extension;  
wherein said extension is adapted to provide mechanical support to a distally located organ within said body cavity.
2. The pre-shaped port of claim 1, wherein said port is laryngoscope and said body cavity is the oral cavity and the hypopharynx of a patient.
3. The pre-shaped port of claim 2, wherein said organ is the epiglottis.
4. The pre-shaped port of claim 3, wherein at least one of said channels accommodates at least one endoscopic camera such that a field of view is defined for said port; further wherein said mechanical support is used to maintain said organ at least partially out of said port's field of view.
5. The pre-shaped port of claim 1, wherein the shape of said port is a S-shaped.
6. The pre-shaped port of claim 2, wherein said port is selected from a group consisting of: a rigid port, a semi-rigid port, a semi-flexible port and any combination thereof.
7. The pre-shaped port of claim 2, wherein said surgical tool is at least one of an articulated and flexible tool.
8. The pre-shaped port of claim 2, wherein said extension is either an integral part of the laryngoscope or an extension thereof.
9. The pre-shaped port of claim 2, wherein said extension is located at least partially on the outer perimeter of said distal end of said port.
10. The pre-shaped port of claim 2, additionally comprising a mechanism adapted to move said extension in at least one direction selected from a group consisting of reciprocally linearly move longitudinally with respect to said distal end of said port, rotate about main longitudinal axis of said distal end of said port, rotate about at least one axis perpendicular to said main longitudinal axis and any combination thereof.
11. The pre-shaped port of claim 2, wherein said extension is fixedly coupled to said distal end of said port.
12. The pre-shaped port of claim 2, wherein said port comprises a mechanism adapted to control at least one degree of freedom of said tool, said degree of freedom selected from

a group consisting of activation of the tool, articulation of distal end of said tool; rotation of the distal end of the tool, translation of the distal end of the tool, and any combination thereof.

13. The port of claim 2, wherein said at least one channel is adapted to deliver at least one medicament.
14. The port of claim 2, wherein at least a portion of said channels is characterized by a predetermined cross section such that only surgical tools characterized by substantially the same cross section can be introduced through said channels.
15. The port of claim 1, wherein said body is characterized by a substantially either constant or varying cross section area along said main longitudinal axis, said variation selected from a group consisting of varying in diameter, varying in shape, and any combination thereof.
16. The port of claim 2 or 15, wherein cross-sectional shape of at least one of said body and said thoroughgoing channel comprises at least one selected from a group consisting of substantially circular, substantially lenticular, substantially oval, substantially elliptical, substantially crescent moon-shaped, substantially half moon-shaped, and substantially polygonal with  $n$  sides, where  $n$  is greater than 2.
17. The port of claim 2, wherein said diameter is greatest at said proximal end and smallest at said distal end of said body.
18. The port of claim 2, additionally comprising at least one inflatable zone; said inflatable zone maintains said laryngoscope in a desired position, said inflatable zone in a location selected from said proximal end, said distal end, said body and any combination thereof.
19. The port of claim 2, additionally comprising at least one inflatable zone adapted for inflation and deflation, wherein said inflatable zone is adapted to inflate to a predetermined outer circumference at least large enough to contact the inner walls of the hypopharynx of a patient.
20. The port of claim 2, wherein said body comprises at least one longitudinal groove in outer circumference of said body, said longitudinal groove adapted to accommodate an intubation tube.
21. The port of claims 19, wherein at least one said inflatable zone comprises at least one balloon, said balloon adapted to inflate so as to encircle part of said circumference.
22. The port of claim 19, wherein at least one said inflatable zone is integral with said port.

23. The port of claim **19**, additionally comprising at least one inflation inlet located at an end of said body, said inflation inlet connectable to an external source of fluid; said end selected from said proximal end, said distal end and any combination thereof.
24. The port of claim **23**, additionally comprising at least one fluid connection channel providing a fluid connection between at least one said inflatable zone and at least one said inflation inlet.
25. The port of claim **23**, wherein said external source of fluid is pressurized.
26. The port of claim **23**, wherein said fluid is selected from a group consisting of air, nitrogen, argon, water, saline solution, anesthetic, analgesic, antibiotic, preservative, anti-caking agent, anti-sticking agent, and any combination thereof.
27. The port of claim **2**, wherein said cross-section of said longitudinal channels differs in at least one of shape and size in different portions of said body.
28. The port of claim **2**, wherein said port is modular, said modules being selected from a group consisting of proximal portion modules, distal portion modules, body portion modules and any combination thereof.
29. The port of claim **2**, wherein said modules differ in at least one of a group consisting of size and shape.
30. The port of claim **2**, adapted to be inserted trans-orally and to be placed, while in use, partially within the upper hypopharynx and partially within the oral cavity, wherein said port is further adapted to sit in place in a bent fashion.
31. The port of claim **2**, wherein location of said throughgoing channel is selected from a group consisting of a central channel, n side channels; n is an integer greater than or equal to 1, and any combination thereof.
32. The port of claim **31**, wherein said central channel is adapted to accommodate at least one selected from a group consisting of endoscopic camera and a light source; at least one optical fiber so as to transmit light to the distal part of said port; at least one surgical tool selected from a group consisting of scissors, forceps, injection needle, dissector, laser, suction means, and fiber optics, and any other required surgical instrument.
33. The port of claim **2**, wherein said port additionally comprises at least one gliding balloon mounted on a grooved rail attached to said port's outer circumference and

adapted to allow additional adaptation of said port to the patient's anatomy and to secure anchorage in the pharynx.

34. The port of claim 2, further comprising a fixation and stabilization element adapted to fit in at least one position selected from: over the patient's mouth, within the patient's mouth, over the lower part of the patient's face or any combination thereof; and further adapted to fixate and stabilize the port in relation to the patient, said fixation and stabilization element preventing movement of said port relative to said patient.
35. The port of claim 34, wherein said fixation and stabilization element additionally comprises at least one engagement mechanism characterized by two states, a locked state in which said fixation and stabilization element is held in a fixed position relative to said laryngoscope; and, a released state in which said fixation and stabilization element is free to slide along the body of said laryngoscope.
36. The port of claim 34, wherein said fixation and stabilization element additionally comprises a tongue catcher adapted to catch and hold the tongue.
37. The port of claim 34, wherein said fixation and stabilization element additionally comprises at least one groove throughout which straps can be threaded; said straps are adapted to fixate the position and orientation said laryngoscope to the patient's bed.
38. The port of claim 2, additionally comprising an aiming control adapted to enable said surgeon to alter the angle of said distal end of said port relative to said main longitudinal axis of the same.
39. The port of claim 38, wherein said aiming control comprises at least one of a group consisting of: dials, knobs, levers, wheels, electronic mean, joystick, sound detectors, and light detectors.
40. The port of claim 2, additionally comprising a handshake interface between said port and said surgical tool, wherein at least a portion of said tool comprises an identification section such that said tool is defined as allowed and can be either introduced into said port or actuated within the same only after a hand shake match between said identification mechanism of said port and said identification portion of said tool.
41. The port of claim 40 wherein said handshake interface is integrated within at least one of said channels.
42. The port of claim 40, wherein (a) at least one said channel of said port is characterized such that a portion of the outer perimeter cross section of at least a portion of said at least one channel has a predefined shape; (b) at least a portion of the outer perimeter

cross section of said identification section of said tool has a predefined shape; such that a tight fit match between said cross sections of said identification section of said tool and said channels defines said tool as an allowed tool.

43. The port of claim 40, wherein said identification section of said tool comprises a movable collar reversibly encircling said identification section; said tool is characterized by at least two configuration; an active configuration, in which said collar is removed from said portion; and an inactive configuration in which said collar encircles said portion; wherein the outer perimeter of said channel is smaller than the diameter of said collar; such that the removal of said collar defines said tool as an allowed tool.
44. The port of claim 40, wherein (a) at least a portion of the outer perimeter cross section of at least a portion of said at least one channel has a female profile; (b) at least a portion of the outer perimeter cross sections of said identification section of said tool has a male profile; such that matting between said female profile and said male profile defines said tool as an allowed tool.
45. The port of claim 40, wherein (a) a portion of the outer perimeter cross section of at least a portion of said at least one channel has a predefined shape; (b) at least a portion of the outer perimeter cross section of said identification section of said tool has a predefined shape; such that a tight fit match between said cross sections of said identification section of said tool and said channel defines said tool as an allowed tool.
46. The port of claim 40, wherein (a) said identification mechanism of said port comprises at least one bar code reader; (b) at least a portion of the outer perimeter of said identification section of said tool comprises bar code; such that said tool is defined as an allowed tool if said bar code reader identifies said bar code.
47. The port of claim 40, wherein (a) said identification mechanism of said port comprises at least one bar code; (b) at least a portion of the outer perimeter of said identification section of said tool comprises bar code reader; such that said tool is defined as an allowed tool if said bar code reader identifies said bar code.
48. The port of claims 46 or 47, wherein said bar code is an RFID tag; and said bar code reader is an RFID tag reader.
49. The port of claim 40, wherein (a) said identification mechanism of said port comprises at least one detector for detecting a beam of light; (b) at least a portion of the outer perimeter of said identification section of said tool comprises light emitting means; such

that said tool is defined as an allowed tool if said detector identifies said beam of light emitted from said light emitting means.

- 50.** The port of claim **40**, wherein (a) said identification mechanism of said port comprises light emitting means; (b) at least a portion of the outer perimeter of said identification section of said tool comprises at least one detector for detecting a beam of light; such that said tool is defined as an allowed tool if said detector identifies said beam of light emitted from said light emitting means.
- 51.** The port of claim **40**, wherein said body is characterized by substantially either a constant or a varying cross sectional area along said main longitudinal axis, said variation selected from a group consisting of varying in diameter, varying in shape, and any combination thereof.
- 52.** The port of claim **40**, wherein at least one of said channels is adapted to accomplish a member selected from a group consisting of: accommodate an optical fiber adapted to transmit light to the distal part of said laryngoscope, provide suction to said distal end of said body, enable the removal of tissue specimens, accommodate at least one surgical tool selected from a group consisting of scissors, forceps, injection needle, dissector, laser, suction, and fiber optics and any other required surgical instrument.
- 53.** A method for surgery, comprising:
- a.** obtaining a pre-shaped port, comprising a body characterized by a distal end and a proximal end; said body comprising at least one throughgoing channel enabling introduction of at least one surgical tool;
  - b.** obtaining at least one surgical tool;
  - c.** at least partially introducing said port into a body cavity of a patient; and
  - d.** inserting said surgical tool into said port;
- wherein said distal end of said pre-shaped port comprises an extension adapted to provide mechanical support to a distally located organ, located within said cavity.
- 54.** The method of claim 53, additionally comprising steps of (a) selecting said port to be a laryngoscope; (b) inserting said laryngoscope trans-orally into the oral cavity and hypopharynx of a patient.
- 55.** The method of claim 54, additionally comprising steps of selecting said organ to be the epiglottis.
- 56.** The method of claim 55, wherein at least one of said channels accommodates at least one endoscopic camera such that a field of view is defined for said port; further wherein

said mechanical support is used to maintain said organ at least partially out of said port's field of view.

57. The method of claim 54, additionally comprising steps of said port is S-shaped.
58. The method of claim 54, additionally comprising steps of selecting said port from a group consisting of: a rigid port, a semi-rigid port, a semi-flexible port and any combination thereof.
59. The method of claim 54, additionally comprising steps of providing said surgical tool as at least one of an articulated and flexible tool.
60. The method of claim 54, additionally comprising steps of providing said extension as either an integral part of the laryngoscope or an extension thereof.
61. The method of claim 54, additionally comprising steps of locating said extension at least partially on the outer perimeter of the distal end of said port.
62. The method of claim 54, additionally comprising steps of moving said extension in at least one direction selected from a group consisting of reciprocally linearly move longitudinally with respect to said distal end of said port, rotate about main longitudinal axis of said distal end of said port, rotate about at least one axis perpendicular to said main longitudinal axis and any combination thereof.
63. The method of claim 54, additionally comprising steps of fixedly coupling said extension to said port.
64. The method of claim 54, additionally comprising steps of comprising said port of a mechanism adapted to control at least one degree of freedom of said tool, said degree of freedom selected from a group consisting of activation of the tool, rotation of the distal end of the tool, translation of the distal end of the tool, and any combination thereof.
65. The method of claim 54, additionally comprising steps of delivering at least one medicament via said at least one channel.
66. The method of claim 54, additionally comprising steps of characterizing at least a portion of said channels by a predetermined cross section such that only surgical tools characterized by substantially the same cross section can be introduced through said channels.
67. The method of claim 54, additionally comprising steps of characterizing said body by a substantially either constant or varying cross section area along said main longitudinal axis, said variation selected from a group consisting of varying in diameter, varying in shape, and any combination thereof.



68. The method of claim 54, additionally comprising steps of comprising cross-sectional shape of at least one of said body and said thoroughgoing channel by at least one selected from a group consisting of substantially circular, substantially lenticular, substantially oval, substantially elliptical, substantially crescent moon-shaped, substantially half moon-shaped, and substantially polygonal with  $n$  sides, where  $n$  is greater than 2.
69. The method of claim 54, additionally comprising steps of providing said port wherein said diameter is greatest at said proximal end and smallest at said distal end of said body.
70. The method of claim 54, additionally comprising steps of maintaining said laryngoscope in a desired position by means of at least one inflatable zone; said inflatable zone in a location selected from said proximal end, said distal end, said body and any combination thereof.
71. The method of claim 54, additionally comprising steps of inflating and deflating said inflatable zone; disposing said inflatable zone about the outer circumference of said body near said end of said body, wherein the outer diameter of said inflatable zone is no larger than that of said body when said inflatable zone is in its deflated state, and further inflating said inflatable zone to a predetermined outer circumference at least large enough to contact the inner walls of the hypopharynx of a patient.
72. The method of claim 54, additionally comprising steps of accommodating an intubation tube in a longitudinal groove in outer circumference of said body.
73. The method of claim 54, additionally comprising steps of inflating at least one said inflatable zone using at least one balloon, said balloon encircling at least part of said circumference.
74. The method of claim 54, additionally comprising steps of providing at least one said inflatable zone integral with said body of said port.
75. The method of claim 54, additionally comprising steps of locating at least one inflation inlet located at an end of said body, connecting said inflation inlet to an external source of fluid; wherein said end is selected from said proximal end, said distal end and any combination thereof.

76. The method of claim 54, additionally comprising steps of providing a fluid connection between at least one said inflatable zone and at least one said inflation inlet by means of at least one fluid connection channel.
77. The method of claim 54, additionally comprising steps of pressurizing said external source of fluid.
78. The method of claim 54, additionally comprising steps of selecting said fluid from a group consisting of air, nitrogen, argon, water, saline solution, anesthetic, analgesic, antibiotic, preservative, anti-caking agent, anti-sticking agent, and any combination thereof.
79. The method of claim 54, additionally comprising steps of providing said cross-section of said longitudinal channels differing in at least one of shape and size in different portions of said body.
80. The method of claim 54, additionally comprising steps of providing said port to be modular, and selecting said modules from a group consisting of proximal portion modules, distal portion modules, body portion modules and any combination thereof.
81. The method of claim 54, additionally comprising steps of providing said modules differing in at least one of a group consisting of size and shape.
82. The method of claim 54, additionally comprising steps of inserting said port trans-orally and placing the same, while in use, partially within the upper hypopharynx and partially within the oral cavity, said port sitting in place in a bent fashion.
83. The method of claim 54, additionally comprising steps of locating said throughgoing channel in a location selected from a group consisting of a central channel, n side channels; n is an integer greater than or equal to 1, and any combination thereof.
84. The method of claim 54, additionally comprising steps of accommodating in said central channel at least one selected from a group consisting of endoscopic camera and a light source; at least one optical fiber so as to transmit light to the distal part of said port; at least one surgical tool selected from a group consisting of scissors, forceps, injection needle, dissector, laser, suction means, and fiber optics, and any other required surgical instrument.
85. The method of claim 54, additionally comprising steps of providing at least one gliding balloon mounted on a grooved rail attached to said port's outer circumference, said

balloon allowing additional adaptation of said port to the patient's anatomy and securing anchorage in the pharynx.

86. The method of claim 54, additionally comprising steps of providing a fixation and stabilization element adapted to fit in at least one position selected from: over the patient's mouth, within the patient's mouth, over the lower part of the patient's face or any combination thereof; and further adapted to fixate and stabilize the port in relation to the patient, said fixation and stabilization element preventing movement of said port relative to said patient.
87. The method of claim 54, additionally comprising steps of comprising said fixation and stabilization element of at least one engagement mechanism characterized by two states, a locked state in which said fixation and stabilization element is held in a fixed position relative to said laryngoscope; and, a released state in which said fixation and stabilization element is free to slide along the body of said laryngoscope.
88. The method of claim 54, additionally comprising steps of comprising said fixation and stabilization element of a tongue catcher adapted to catch and hold the tongue.
89. The method of claim 54, additionally comprising steps of comprising said fixation and stabilization element of at least one groove throughout which straps can be threaded; said straps are adapted to fixate the position and orientation said laryngoscope to the patient's bed.
90. The method of claim 54, additionally comprising steps of enabling said surgeon to alter the angle of said distal end of said port relative to said main longitudinal axis of the same by means of an aiming control.
91. The method of claim 54, additionally comprising steps of comprising said aiming control of at least one of a group consisting of: dials, knobs, levers, wheels, electronic mean, joystick, sound detectors, and light detectors.
92. The method of claim 54, additionally comprising steps of providing a handshake interface between said port and said surgical tool, said handshake interface comprising an identification section such that said tool is defined as allowed and can be either introduced into said port or actuated within the same only after a hand shake match between an identification mechanism of said port and an identification portion of said tool
93. The method of claim 54, additionally comprising steps of integrating said handshake interface within at least one of said channels.

- 94.** The method of claim **54**, additionally comprising steps of (a) characterizing at least one channel of said port such that a portion of the outer perimeter cross section of at least a portion of said at least one channel has a predefined shape; (b) at least a portion of the outer perimeter cross section of said identification section of said tool has a predefined shape; such that a tight fit match between said cross sections of said identification section of said tool and said channels defines said tool as an allowed tool.
- 95.** The method of claim **54**, additionally comprising steps of providing aid identification section of said tool comprising a movable collar reversibly encircling said identification section; characterizing said tool by at least two configuration; an active configuration, in which said collar is removed from said portion; and an inactive configuration in which said collar encircles said portion; wherein the outer perimeter of said channel is smaller than the diameter of said collar; such that the removal of said collar defines said tool as an allowed tool.
- 96.** The method of claim **54**, additionally comprising steps of providing (a) at least a portion of the outer perimeter cross section of at least a portion of said at least one channel with a female profile; (b) providing at least a portion of the outer perimeter cross section of said identification section of said tool with a male profile; and, if matting occurs between said female profile and said male profile, defining said tool as an allowed tool.
- 97.** The method of claim **54**, additionally comprising steps of providing (a) said identification mechanism of laryngoscope with at least one bar code reader; (b) at least a portion of the outer perimeter of said identification section of said tool comprises bar code; such that said tool is defined as an allowed tool if said bar code reader identifies said bar code.
- 98.** The method of claim **54**, additionally comprising steps of providing (a) said identification mechanism of laryngoscope with at least one bar code; (b) at least a portion of the outer perimeter of said identification section of said tool comprises bar code reader; such that said tool is defined as an allowed tool if said bar code reader identifies said bar code.
- 99.** The method of claims **97-98**, wherein said bar code is an RFID tag; and said bar code reader is an RFID tag reader.
- 100.** The method of claim **54**, wherein (a) said identification mechanism of said laryngoscope comprises at least one detector for detecting a beam of light; (b) at least a portion of the outer perimeter of said identification section of said tool comprises light

emitting means; such that said tool is defined as an allowed tool if said detector identifies said beam of light emitted from said light emitting means.

101. The method of claim 54, wherein (a) said identification mechanism of said laryngoscope comprises light emitting means; (b) at least a portion of the outer perimeter of said identification section of said tool comprises at least one detector for detecting a beam of light; such that said tool is defined as an allowed tool if said detector identifies said beam of light emitted from said light emitting means.
102. The method of claim 54, wherein said body is characterized by a substantially either constant or varying cross sectional area along said main longitudinal axis, said variation selected from a group consisting of varying in diameter, varying in shape, and any combination thereof.
103. The method of claim 54, wherein said central channel is adapted to: accommodate at least one selected from a group consisting of an endoscopic camera and a light source; accommodate at least one optical fiber so as to transmit light to the distal part of said laryngoscope; provide suction to said distal end of said body; enable the removal of tissue specimens and any combination thereof.
104. The method of claim 54, wherein at least one of said plurality of longitudinal channels is adapted to accommodate at least one surgical tool selected from a group consisting of scissors, forceps, injection needle, dissector, laser, suction, and fiber optics or any other required surgical instrument.
105. The method of claim 53, additionally comprising step of providing said laryngoscope additionally with at least one roof-like extension adapted to provide mechanical support to the epiglottis.
106. The port of claim 2, wherein the diameter is greater in at least one of said proximal end and said distal end of said body than in at least some portion of central region of said body.
107. The port of claim 2, wherein cross-section of said channels differs in size in different portions of said body.
108. The port of claim 2, wherein said body comprises two end portions having smooth surfaces and an intermediate portion made of flexible material, said intermediate portion formed integrally with said end portions, the wall of said intermediate portion comprising a series of spaced corrugations having radial outer crests separated by

intervening valleys, the greatest diameter of said radial outer crests being no greater than the largest diameter of said end portions.

- 109.** The port of claim **108**, wherein said intermediate portion is formed in an accordion shape.
- 110.** The port of claim **1**, wherein each of said plurality of channels further comprises a locking mechanism with gradable friction levels.
- 111.** The port of claim **2**, additionally comprising a locking mechanism adapted to fixate the orientation and angle of said body.
- 112.** The port of claims **110-111**, wherein said locking mechanism is an integral part of said port.
- 113.** The port of claims **110-111**, wherein said locking mechanism is coupled to said port by means selected from a group consisting of mechanical means glue, vacuum, clips, magnetic means, electrical means and any combination thereof.
- 114.** The port of claims **110-111**, additionally comprising a locking mechanism adapted to fixate at least one selected from a group consisting of (a) at least one of said channels; (b) said proximal end; (c) said distal end; (d) said entire port; and any combination thereof.
- 115.** The port of claims **1-53**, wherein said inflatable zones is enabled to be translated along the longitudinal axis of said laryngoscope.
- 116.** The port of claim **115**, wherein said at least one translatable inflatable zone rides in grooves in said body of said laryngoscope.
- 117.** The port of claim **116**, wherein said grooves are disposed on said body of said laryngoscope in at least one manner selected from a group consisting of longitudinally and spirally.

1/7

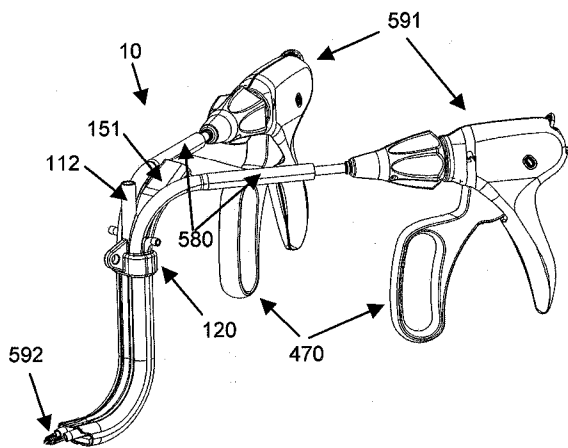


Fig.1A

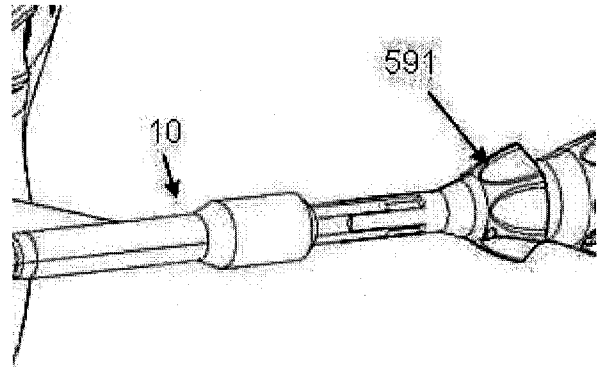


Fig. 1 B

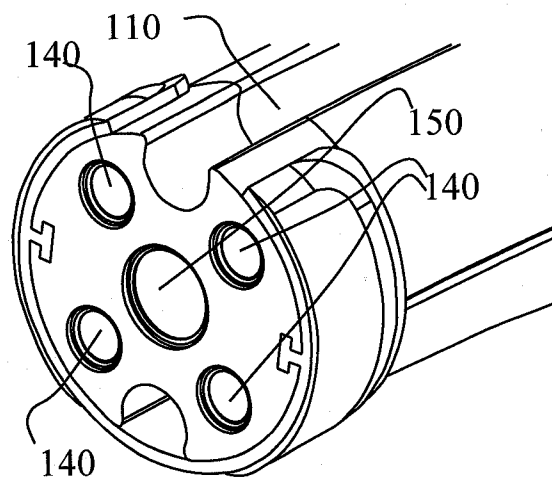


Fig. 2

2/7

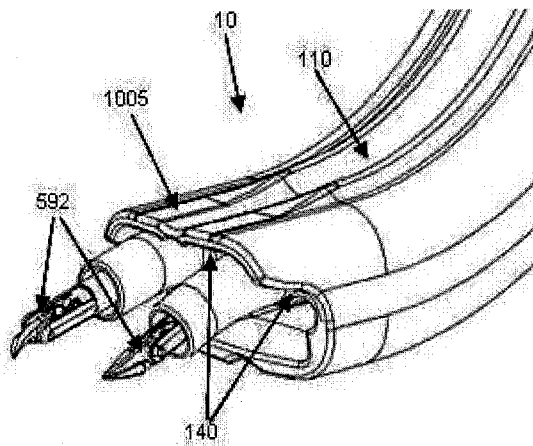


Fig. 3A

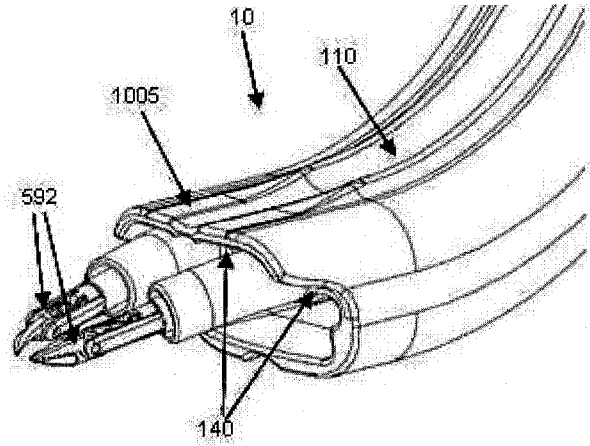


Fig. 3B

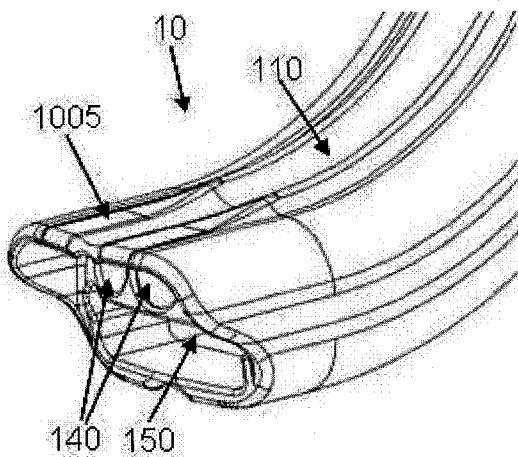


Fig. 4 A

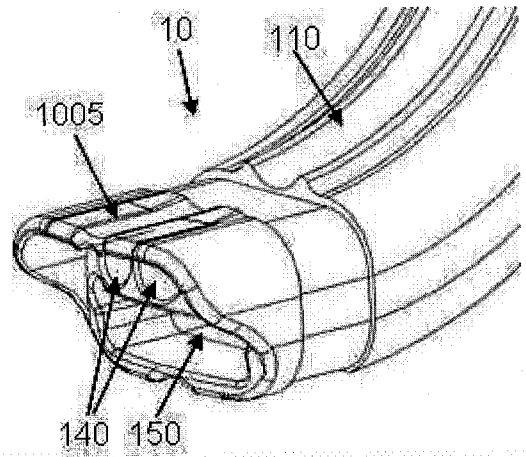


Fig. 4 B

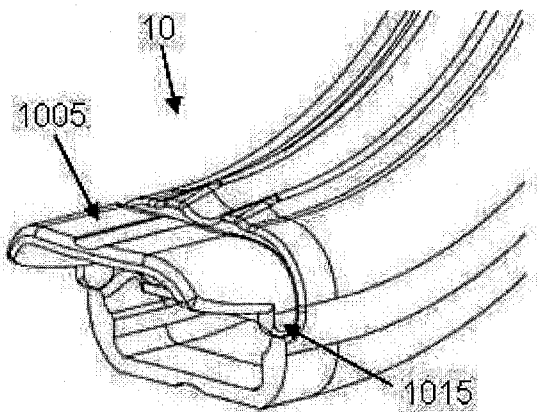


Fig. 5 A

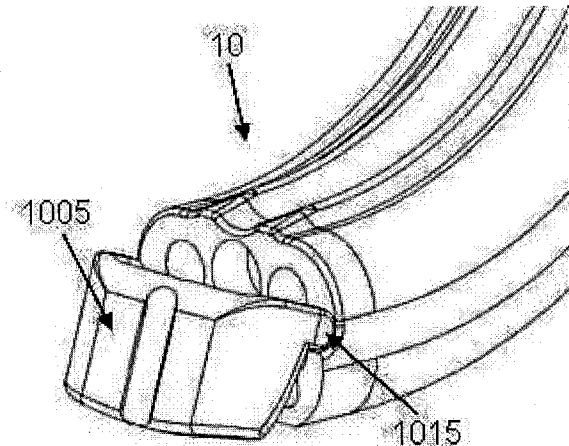


Fig. 5 B



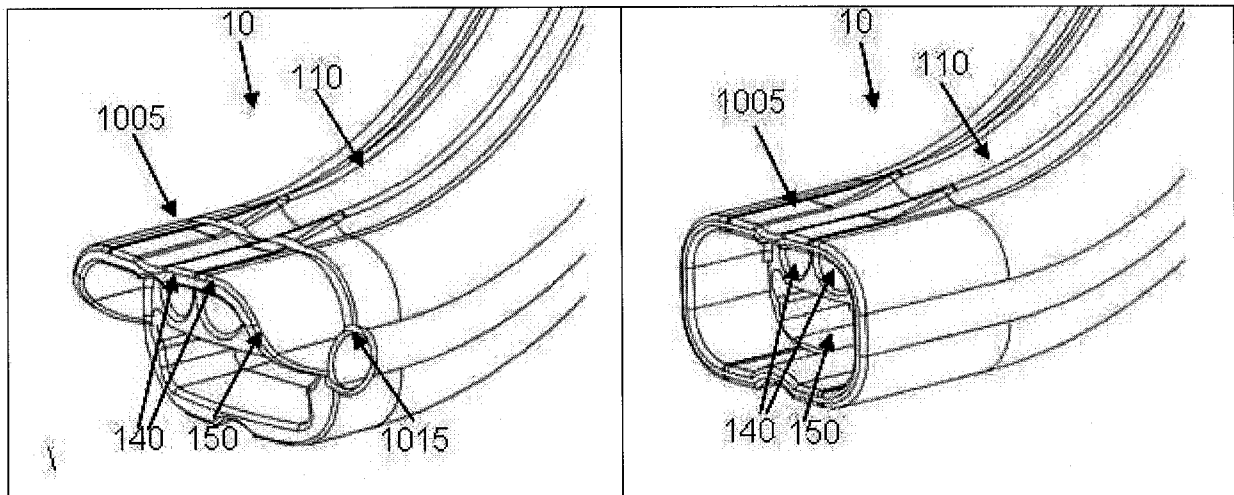


Fig. 6 A

Fig. 6 B

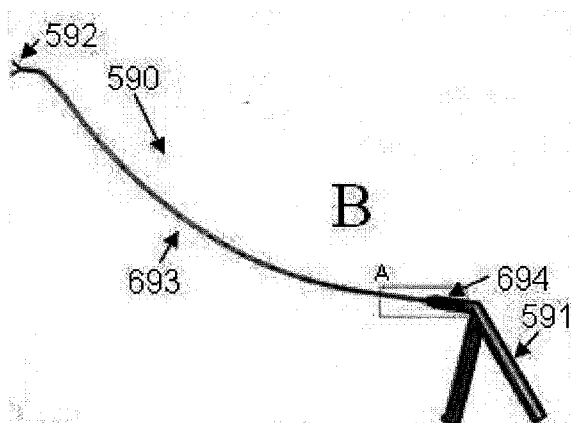


Fig. 7A

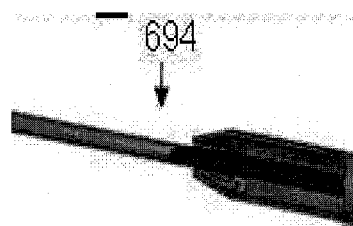


Fig. 7B

4/7

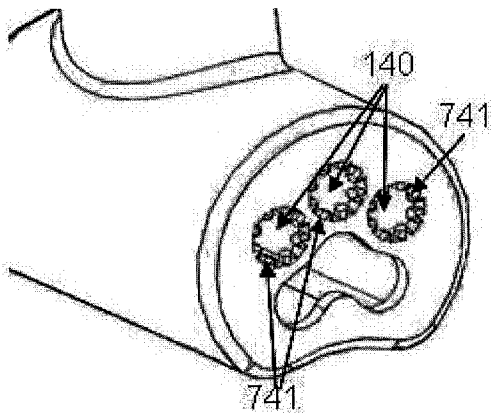


Fig. 8A

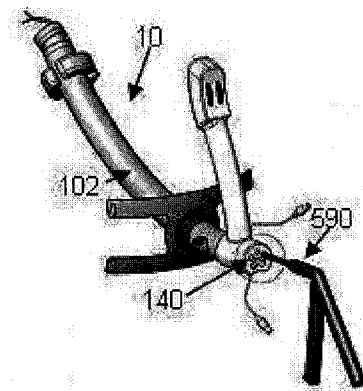


Fig. 8B

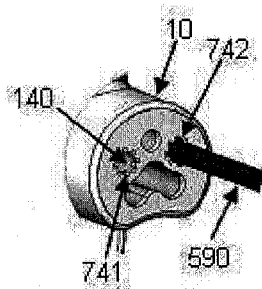


Fig. 8C

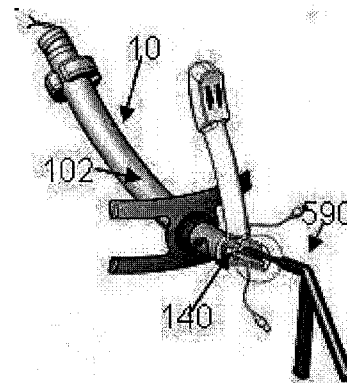


Fig. 8D

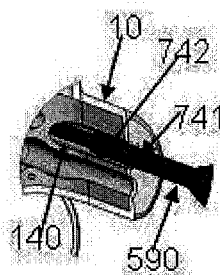


Fig. 8E

5/7

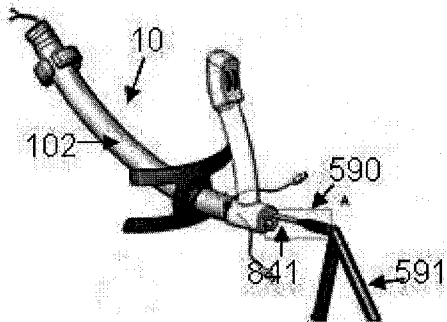


Fig. 9A

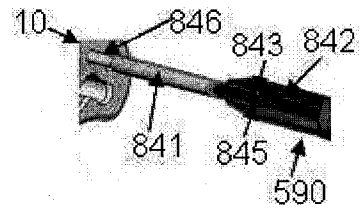


Fig. 9B

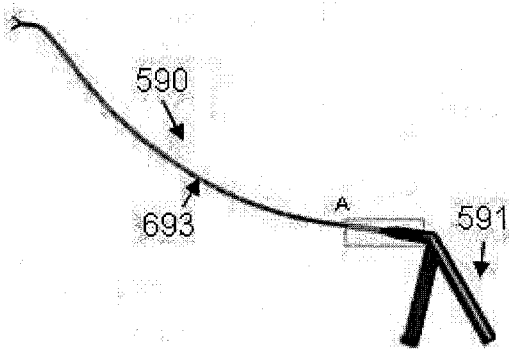


Fig. 9C

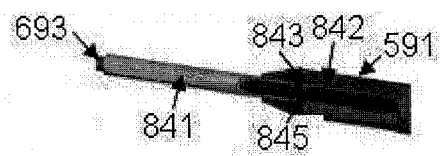


Fig. 9D

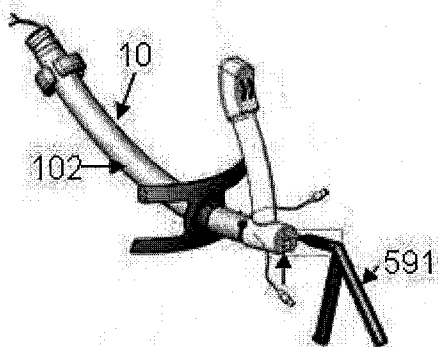


Fig. 9E

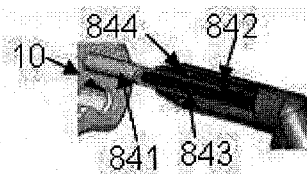


Fig. 9F

6/7

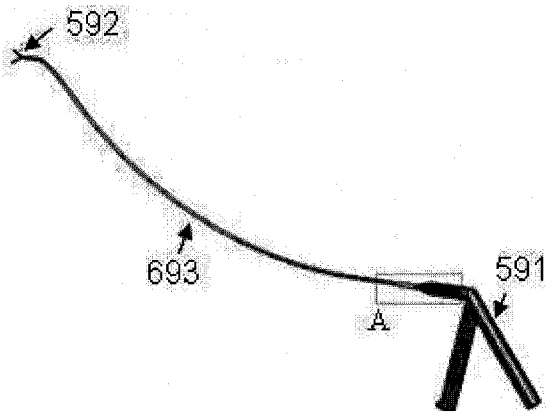


Fig. 9G

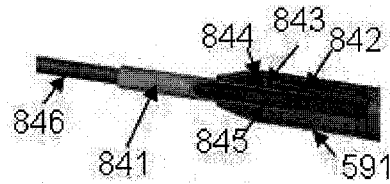


Fig. 9H

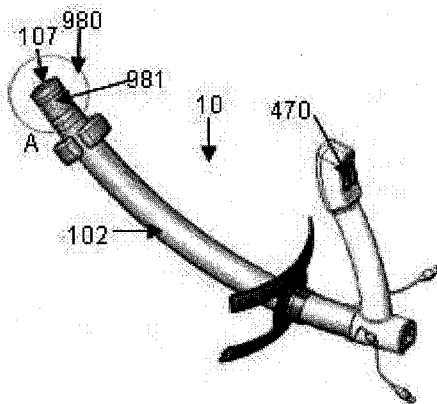


Fig. 10A

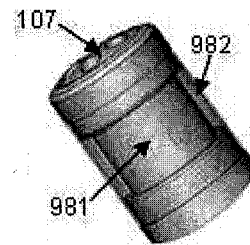


Fig. 10B

7/7

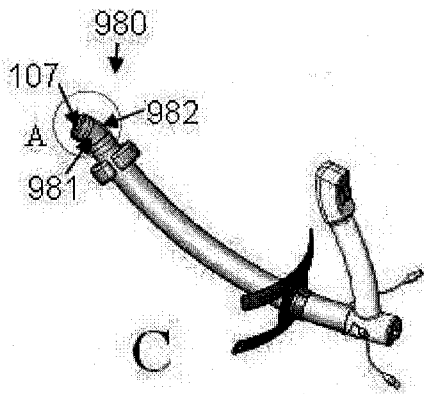


Fig. 10C

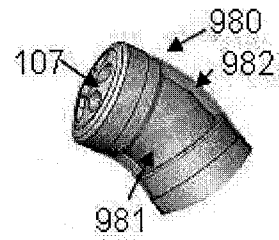


Fig. 10D

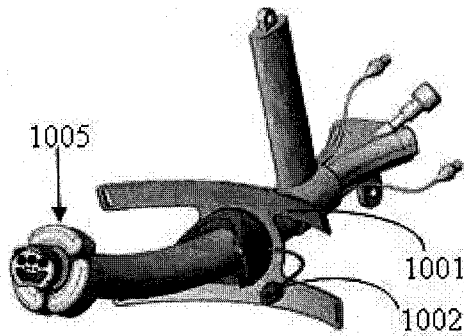


Fig. 11A

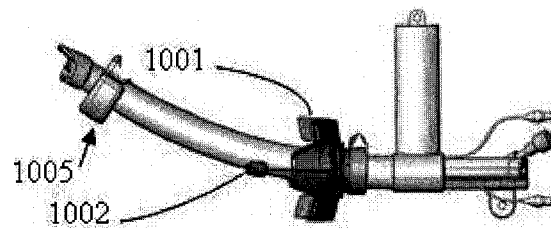


Fig. 11B

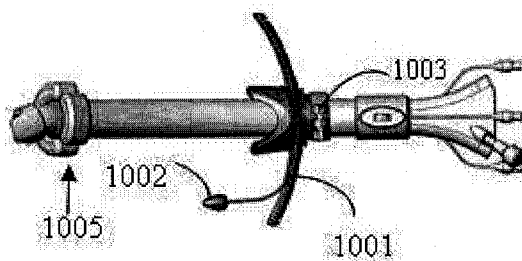


Fig. 11C

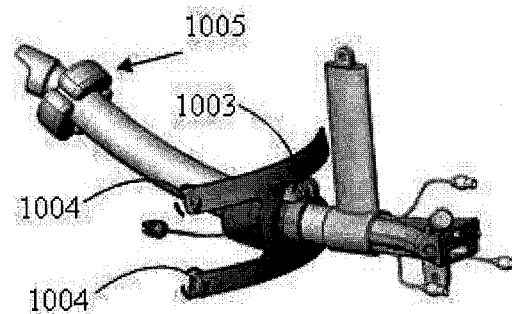


Fig. 11D