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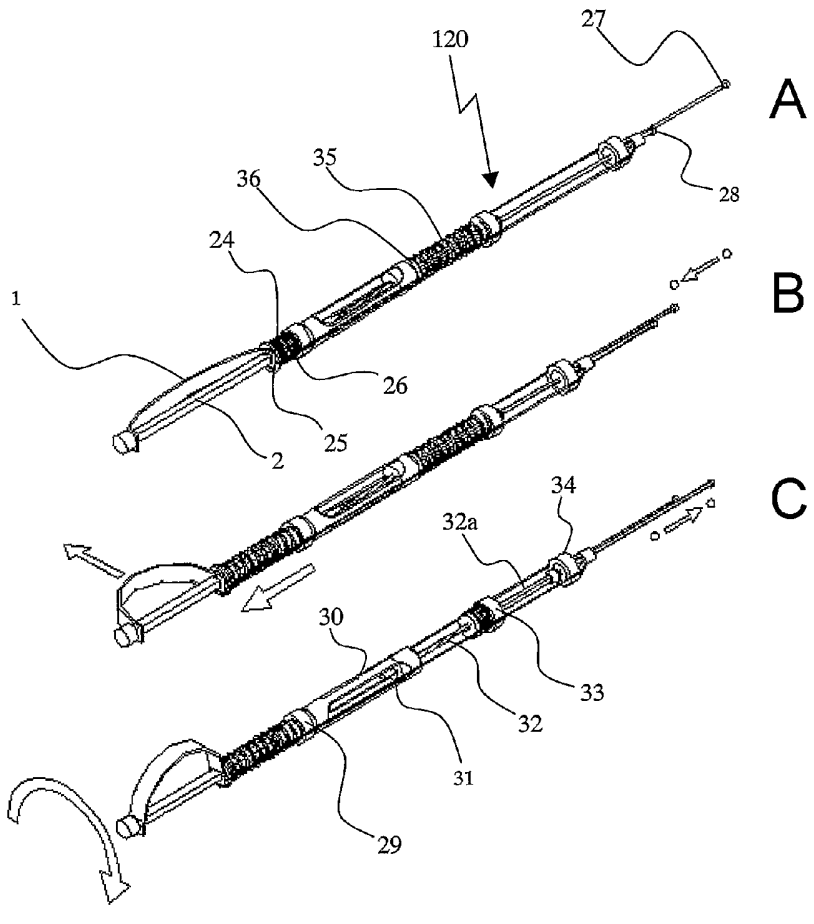
(54) Title: MEDICAL CUTTING TOOL WITH ADJUSTABLE ROTATING BLADE



(57) Abstract: The present invention relates to a cost effective working tool useful for lateral resection of biological tissues by means of a flexible blade with adjustable curve size (1). Said rod-like tool (100) has a distal end, adapted to be inserted into a body cavity, and a proximal end, located adjacent to a user. The longitudinal axis of said maneuverable blade is parallel to the longitudinal axis of the said tool or shifted in respect to the same. The working tool comprising a bending mechanism (27), adapted to adjust the bending of said blade to a predetermined measure and a rotating mechanism (28), adapted to rotate said blade in a lateral bi-directional movement in respect to the resected tissue such that a side-to-side resection is obtained. A novel method of lateral resecting of biological tissues by the same is also presented.

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A WORKING TOOL FOR MEDICAL PURPOSES WITH ROTATING BLADE OF ADJUSTABLE SIZE AND A METHOD THEREOF

FIELD OF THE INVENTION

The present invention generally relates to a working tool useful for medical purposes with a rotating blade of adjustable size. More specifically, the present invention relates to either a mechanical or diathermical reusable and/or disposable working tool adapted for flexible and/or rigid endoscopes. Said tool is used for side-to-side resection and biopsy of biological tissues from within body cavities.

BACKGROUND OF THE INVENTION

Diagnostic and therapeutic endosocopy is commonly used to gain access to body cavities, such as the gastrointestinal tract, the lungs and the urinary tract, for the purposes of observing or removing tissues. Endoscopic resection has gained more and more importance in the treatment of early stage cancers over the past few years. The choice between the different available techniques depends on the site, the macroscopic type of the lesion and the personal experience of the endoscopic surgeon. Endoscopic methods for obtaining tissue samples include the use of snares, forceps, needles, brushes and scissors. While these techniques permit the accomplishment of many diagnostic and/or therapeutic goals, in some instances they may be inadequate.

For example, endoscopic removal of flat lesions may not be possible due to lack of satisfactory tools that permit complete tissue removal and enable accurate pathological assessment. For the purpose of endoscopic mucosal resection (EMR), different techniques have recently been developed, including the "lift and cut" resection, polypectomy after a submucal injection of saline, glucose and the "pure cut and hemoclip" method.

Furthermore, snares are commonly used to remove a polypoid type lesion from within the gastrointestinal tract. A common disadvantage of this technique relates to the need to maneuver the snare about the polyp, which may become a difficult and challenging task at certain locations along the gastrointestinal lumen. Commercially available

rotating snares are still hampered by their jerky-type rotational movement, rendering their use mostly inconvenient for the practicing endoscopic surgeon.

Surgical knifes and diathermia wires with a single maneuver, either a rotating movement or a deflecting movement are known in the art. Hence, US Pat. No 6,540,695 to Burbank *et al.* discloses a biopsy device characterized by a single rotating maneuver. This device has a side-cutting mechanism, which includes both a cutting wire, configured to be rotated about the longitudinal axis of a shaft, thereby isolating a body of target tissue, and a tissue anchoring mechanism. Similarly, US Pat. No 5,415,656 to Tihon *et al.* provides an RF electric current driven apparatus, useful for incision of a stricture within the lumen, essentially including (a) an electrically conducting, deflectable wire,combined with an introducer means for introducing the wire into the body lumen, (b) means for deflecting the proximal portion of the wire outwards relative to the introducer means, the wire being slidable within said conduit, the portion of wire deflected outwards is in the form of a loop defining a monopolar electrosurgical knife.

Such instruments are clumsy to handle and not suitable for the aforementioned delicate medical procedures. It is thus the object of this invention to provide an improved method for the removal of tissues within a body cavity. A cost effective surgical device, and especially a disposable one, adapted for lateral resection of biological tissues in or adjacent to narrow body cavities and lumens by means of a flexible blade or wire with an adjustable curve size thus remains a long felt need.

SUMMARY OF THE INVENTION

It is thus the core of the present invention to provide a novel working tool for lateral resection of biological tissues by means of a flexible blade with adjustable curve size. Said rod-like tool has a distal end, adapted to be inserted into a body cavity, and a proximal end, located adjacent to a user; the longitudinal axis of said maneuverable blade is parallel to the longitudinal axis of the said tool or shifted in respect to the same; said working tool comprising: bending mechanism, adapted to adjust the bending of said blade to a predetermined measure; and rotating mechanism, adapted to rotate said blade in a lateral bi-directional movement in respect to the resected

tissue, such that a side-to-side resection is obtained. Said working tool is especially useful for endoscopic resections.

It is in the scope of the present invention to provide the working tool as defined above and described in any of the appended figures. This working tool is especially adapted for either cold resection; wherein the maneuverable blade is a sharp razor-like member, which is adapted to cut biological tissues mechanically; or for facilitated (hot) resection by diathermia; cryo-therapy, RF or any other vibrational means; or any combination thereof; wherein the said blade is not necessarily a sharp member.

It is also in the scope of the present invention wherein the aforementioned working tool additionally comprises a plurality of maneuvering means located at its proximal portion. These means are adapted to maneuver the flexible blade, which is located at the distal end by bending it and/or rotating it laterally. Preferably yet not solely, these means are selected from at least one control knob, handle, endless cable or any combination thereof.

According to one specific embodiment of the present invention, the said working tool is additionally comprised of at least one handle located at its proximal portion. This handle is adapted to maneuver the flexible blade located at the distal end by both bending and rotating it laterally.

It is according to yet another embodiment of the present invention wherein the working tool, as defined in any of the above, comprises *inter alia* (a) a rectangular rigid or non-rigid rod located at the extreme distal portion of said tool; (b) a flexible blade, whose distal end is rigidly immobilized to said rod and whose proximal end comprises a rectangular hole fitted around said rectangular rod by means of a sliding bore with a polygonal profile, such that said blade can slide along its longitudinal axis solely to a predetermined point; (c) a control box comprising *inter alia* a housing element, and at least one control knob; (d) an endless movement cable connecting the rectangular rod at the distal portion of the tool with the control knob located at its proximal portion; and(e), an outer flexible tube with a circular bore encompassing the proximal portion of said rectangular rod and said movement cable. By pushing or pulling aforesaid control knob along the longitudinal main axis of the tool, said movement cable and said rectangular rod are simultaneously pulled or pushed, curving or flattening the said flexible curve. Moreover, by twisting said

control knob around said longitudinal main axis, said movement cable and said rectangular rod are simultaneously rotated, rotating the said flexible curve on a predetermined course.

The working tool defined above may also be comprised of electrical inlet adapted to provide a blade effective for diathermia, cryo-therapy or RF means. A free and continuous electrical communication is provided in the course of the said electrical inlet to the movement cable, rectangular rod and flexible blade. This cable of the electrical inlet may be rolled over an electrical inlet cable allowing the movement cable to rotate freely. The electrical inlet may further be in communication either with a coal pressure contact and its contact spring or with a plurality of connecting plates.

It is further in the scope of the present invention wherein at least a portion of the movement cable is a spring assembly comprising a clockwise coiled inner spring and counter-clockwise coiled outer spring enveloping said second spring of the inner core and *vice versa*.

It is further in the scope of the present invention wherein the control box comprises *inter alia* (a) at least one rotating knob useful for rotating the blade in any predetermined lateral maneuver; and (b), at least one bending knob adapted to be twisted on the bending knob threads for bending it to obtain a predetermined curve. When the bending knob is twisted backwards, the movement cable or spring assembly and rectangular rode are pulled backwards, so that the flexible blade is forced to bend along its longitudinal axis to form a curved blade.

It is still in the scope of the present invention wherein the control box comprises *inter alia* (a) a bending knob twistable on a bending knob threadfor bending it to obtain a predetermined curve; and further wherein said bending knob is twisted backwards, pulling the movement cable or spring assembly and rectangular rode backwards, so that the flexible blade is forced to bend along its longitudinal axis to form a curved blade; and a handle assembly. This handle assembly is comprised *inter alia* of (a) a handle maneuvered forwards and backwards along the longitudinal axis in a recess in the housing element; (b) a tube pusher with a tube- pushing thread and a protruding pin member adapted to fit a slot in the tool's housing; (c) a twisted rectangle; (d) a cable and screw connector which rigidly connects said twisted rectangle to the movement cable or spring assembly; (e) a sliding bolt; (f) at least one returning spring

adapted to either pull or push said handle after its maneuver; and (g), a palm rest located at the extreme proximal end, adapted to accommodate the thumb or palm of the user. When the handle is maneuvered by the user along the longitudinal axis of the tool, it simultaneously pushes or pulls the sliding bolt, thus rotating the twisted rectangle and transforming a linear movement into a rotational maneuver of the blade, so that a side-to-side resection is provided.

The working tool as defined above is further proved useful when a blade band plate is located at the distal portion of the rod. This plate is maneuvered either by pulling or pushing of a blade bend spring by means of at least one blade bend cable comprising two proximal ends: a blade bending cable end and a blade rotating cable end. The said blade bending cable is maneuvered at its proximal end in a direction parallel to the longitudinal axis of the tool, releasing said spring and thus pushing the plate forward so that the blade is bended in a predetermined manner; and further wherein the blade rotating cable, being located at said tool's proximal portion, is pushed backwardly in a direction parallel to the longitudinal axis. Said cable, *via* bend cables connector and a rectangular rod connected to it, rotates a twisted rectangular rod by means of a twisted rectangular nut and a nut connector rotating assembly, such that said nut connector is in communication at its distal portion with a cap tube, and such that said cable longitudinal movement is translated by means of said blade into a predetermined lateral rotating movement

It is a second object of the present invention to provide a method for lateral resection of biological tissues by means of the working tool as defined in any of the above, comprising a flexible blade with adjustable curve size. This method essentially includes the following steps: (a) inserting the distal end of said tool into a body cavity, and positioning the maneuverable blade in contact with or adjacent to the tissue to be resected; (b) bending said blade to a predetermined measure; (c) rotating said blade in a lateral movement such that a side-to-side resection is obtained; and (d), retracting said blade and withdrawing the tool outside said body cavity.

It is also in the scope of the present invention to provide the aforesaid method adapted for facilitated (hot) lateral resection, comprising the steps of (a) inserting the distal end of said tool into a body cavity, and positioning the maneuverable blade in contact with or adjacent to the tissue to be resected; (b) bending said blade to a predetermined measure; (c) supplying high frequency electrical current to said blade while rotating

said blade in a lateral movement such that a side-to-side resection is obtained; (d) switching off the current when the incision procedure is completed; and, then (e), retracting said blade and withdrawing the tool outside said body cavity.

BRIEF DESCRIPTION OF THE INVENTION

In order to understand the invention and to see how it may be implemented in practice, a plurality of preferred embodiments will now be described, by way of non-limiting example only, with reference to the accompanying drawings, in which

figure 1 schematically presents a generalized presentation of a working tool (100) according to one embodiment of the present invention in its most simplified presentation;

figures 2A, 2B and 2C schematically present the mechanical functional relations between control knob (6B) and flexible blade (1) and rectangular rigid rod (2) and all parts of the aforementioned simplified working tool (100);

figures 3A and 3B schematically present the aforementioned simplified working tool (100) without the outer housing envelope (6A);

figures 4A, 4B and 4C schematically illustrate the distal portion of the aforementioned working tool (100), without presenting the outer flexible tube (4).

figure 5 schematically illustrates another embodiment of the present invention wherein the movement cable (5) is a spring assembly (50) comprising a clockwise coiled inner spring (50B) and counter-clockwise coiled outer spring (50A) enveloping said first spring;

figures 6A and 6B and 6C schematically illustrate the working tool (60) according to yet another embodiment of the present invention with two knobs, and the mechanical functional relations between control knobs (6B and 6C) and flexible blade (1) and rectangular rigid rod (2);

figure 7A, schematically presents the aforementioned working tool (60) without the box housing (6A); figure 7B schematically presents the aforementioned

working tool (60) without the box housing (6A), bend knob (6C), and outer flexible tube (4);

figure 8A, schematically presents the working tool (80) according to yet another embodiment of the present invention with a handle and a knob; figure 8B shows working tool (80) performing a bending maneuver; Fig. 8C illustrates the same, performing a rotating maneuver;

figure 9A, schematically presents the aforementioned working tool (80) without showing the box housing; Fig. 9B schematically presents the aforementioned working tool (80) without showing the handle, the return spring, bend knob and outer flexible tube (4) ;

figure 10A schematically presents a lateral cross section of the whole aforementioned working tool (80); Fig. 10B presents the same without the handle, return spring and bend knob;

figure 11 schematically presents said central rotating and bending mechanism of the working tool (80) connected at its proximal portion to three different optional electrical contact assemblies; this view provides assembled and disassembled view of the same;

figure 12 schematically presents the working tool (120) according to yet another embodiment of the present invention with a blade bending cable end (27) and a blade rotating cable end (28);

figures 13A and 13B schematically present the working tool (120) mode of action;

figures 14A-14C schematically present said cable-based working tool (120), inner construction and mode of action;

figures 15A-15C schematically present a close and detailed view of the mechanisms of said cable-based working tool (120); and,

figures 16A-16E schematically present examples of various blades adapted to the working tool according to various embodiments of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

The following description is provided, alongside all chapters of the present invention, so as to enable any person skilled in the art to make use of said invention and sets forth the best modes contemplated by the inventor of carrying out this invention. Various modifications, however, will remain apparent to those skilled in the art, since the generic principles of the present invention have been defined specifically to provide a working tool for lateral resection of biological tissues by means of a flexible rotatable blade with adjustable curve size and a method of lateral resecting thereof.

The tool is elongated and narrow and has a distal end, which is inserted into a body cavity, and a proximal end, which is adjacent to a user. It is characterized by a maneuverable blade whose longitudinal axis is parallel to the longitudinal axis of the said tool. It is comprised of a bending mechanism adapted to bend said blade to any desired curve within the designated mechanical range, and of a rotating mechanism adapted to rotate said blade in a lateral movement such that a side-to-side resection may be obtained.

Such a working tool according to the present invention refers to either a rigid or flexible tool, disposable or reusable, useful for various endoscopic devices and surgical utilizations, such as for resectoscopes, cystoscopes, laparascopy, endoscopy, colonoscopy, gastroscopy, bronchoscopy and any medical or veterinary means for invasive diagnosis, biopsy and treatment, especially in the field of urology, gynecology, arthroscopy, laparoscopy endogastrology, airway management, and ENT (e.g., for otorhinolaryngology etc).

The tool comprises at least one flexible and deflectable blade, characterized by any thin, narrow and elongated shape whose longitudinal axis is parallel to the longitudinal axis of the tool. This blade is designed to bend or to curve up to a determined measure only along its said longitudinal axis.

Reference is now made now to figure 1, illustrating a schematic and generalized presentation of the aforementioned working tool in its most simplified presentation. Working tool (100) is adapted to be inserted into a body cavity in such a manner that a rotatable flexible blade (1) is located at the extreme distal end inside said cavity and the control box is located outside said cavity, adjunct to the user. The tool is characterized by an elongated tube-like shape with a main longitudinal axis.

The flexible blade (1) is connected to a rectangular rigid rod (2) at its extreme distal end, wherein its proximal end comprises a rectangular hole encircling the rectangular rod (2), thus enabling blade (1) to slide along the longitudinal axis of rod (2) while bending, and simultaneously preventing the blade (1) from rotating angularly around rod (2). Said rectangular rigid rod (2) extends from the extreme distal end of the tool (100) and enters flexible tube (4) through a circular hole in cup (3). Cup (3) is an adaptor located at the distal end of tube (4). Within tube (4) close to its distal end, rectangular rod (2) couples to movement cable (5) by means of connector (10, See Fig. 9B). Tube (4) connects to control box (6A). Within tube (4) and control box (6A) movement cable (5) connects rectangular rigid rod (2) at the distal portion of tool (100) with control knob (6B) at the proximal portion of tool (100). Box (6) comprises *inter alia* housing (6A), at least one electrical inlet (8) adapted to provide blade (1) with effective diathermia means.

It is acknowledged in this respect that flexible blade (1) is immobilized to the rectangular rode (2) at the extreme distal end or at adjacent location, wherein the proximal portion is free to slide along said rod. Nevertheless, in an alternative configuration, blade (1) is immobilized to the rod (2) a the proximal end of the rod, such that the distal portion of the blade is free to slide along the longitudinal axis up to a stopper located at the distal end of the rod. Solely for the sake of simplicity, only the first hereto-defined embodiment will be described.

Reference is made now to figure 2A, illustrating the aforementioned simplified working tool (100), comprising *inter alia* a flexible blade (1), rectangular rigid rod (2) and control knob (6B).

With reference now to figure 2B, a first means for maneuvering blade (1); i.e., bending it, is illustrated. Hence, rectangular rigid rod (2) may be either pulled or pushed along the longitudinal main axis (2BC). By either pulling or pushing rod (2), blade (1) bends or flattens only at its longitudinal axis. The movement cable (5), connects rod (2) to control knob (6b) through tube (4) and the operating control box (6A). When control knob (6b) is distanced from box (6a) in the direction (2BA) and to the distance (2BB), movement cable (5) is pulled accordingly, thus pulling rod (2) into tube (4) through cap (3), and accordingly the distal end of flexible blade (1) is pulled in the direction (2BA) and (2BC). Blade (1) cannot enter cap (3) and thus bends in the direction (2BD) respectively and vice versa. The aforementioned bending

of blade (1) is thus provided by a controllable blade curve having longitudinal and lateral dimensions of 2BC and 2BD, respectively.

Reference is made now to figure 2C, presenting the second means to maneuver blade (1), i.e., rotating it laterally in any predetermined manner so that a side-to-side resection is provided. Hence, when knob (6b) is rotated in the direction and measure (2CA), cable (5) accordingly rotates, simultaneously rotating rod (2) and blade (1) in direction and measure (2CB), wherein curves (2CA) and (2CB) may be either equal or different in angular direction, and the rotation may be either clockwise or counter-clockwise.

Reference is made now to figure 3A, illustrating the aforementioned simplified working tool (100) without the outer housing envelope (6A); comprising *inter alia* flexible blade (1), rectangular rigid rod (2), outer flexible tube (4), movement cable or, alternatively, movement cable assembly (5), control knob (6B), and electrical inlet (8) accommodated in electrical inlet roller (9). Roller (9) is connected to cable (5) and allows a continuous electrical contact through inlet (8) when cable 5 rotates laterally. Figure 3B presents the same, wherein connector (10) connects cable (5) to rod (2) in a rigid manner, thus ensuring their effective coupling and a continuous electrical contact. It is in the scope of the present invention wherein the rotational movement of blade (1) is alternatively provided by a means of a plurality of interconnected conic wheels (not shown).

Reference is made now to figure 4A, illustrating the distal portion of the aforementioned working tool (100), without presenting outer flexible tube (4). Flexible blade (1) is connected to a rectangular rigid rod (2) at its very distal end or at any adjacent location, wherein its proximal end comprises a rectangular hole affixed around rod (2) by means of sliding bore (1A), here with a rectangular shape similar to the size and shape of the rod's cross-section. Thus, the proximal portion of blade (1) is maneuverable along the longitudinal axis of rode (2) to any predetermined measure. Cup (3) is an adaptor located at the distal end of tube (4), designed to restrain rod (2) radially while enabling rod (2) to enter and exit tube (4) in the longitudinal axis of the device. In addition cup (3) is also designed to adapt to and fill the gap between said relatively small, polygonal rod's cross-section and the bigger and rounded inner bore of tube (4, not shown). Connector (10) is further illustrated to present the coupling site of cable (5) and rod (2). Figure 4B shows blade (1) of working tool (100) bending so

that a curved blade is obtained; and Fig. 4C shows the same blade rotating laterally such that a side-to-side rotation is provided.

It is acknowledged in this respect that a compressing spring may potentially envelop rectangular rod (2) adapted to either push or pull said proximal loose portion of the flexible blade (1).

It is further acknowledged that blade (1) may be comprised of any suitable structure, selected in a non-limited manner from a blade-like shape as presented in figure 4A-C, deflectable wire or deflectable wire-like filament of any suitable diameter and shape, a wire or wire-like member characterized by a unitendon or multitendon infrastructure; or loop-like symmetrical shapes, toothed or sharpened members, polygonal shaped constructions, spoon-like structures, roller-like, spring-like members or scythe-like non-symmetrical blades or any combination thereof. Various embodiments are presented in Fig. 16. This blade is made of, yet not restricted to metals (e.g., stainless steel, tungsten, niobium chromated metal alloys etc), shape memory alloys (e.g., nickel titanium based alloys), composite materials, polymers or any mixture thereof.

According to the present invention, blade (2) is adapted for either cold resection, i.e., to cutting of biological tissues mechanically, or hot resection, i.e., cutting of biological tissues, e.g., by means of a blade, adapted to forward and backwards knife movement by any suitable diathermia or other heated or cooled means known in the art; RF or any other commercially available vibrational means and/or any combination thereof. Hence, said blade may be either sharp or blunt, or a combination thereof.

Reference is made now to figure 5, illustrating one embodiment of the present invention wherein movement cable (5) is a spring assembly (50) comprising a clockwise coiled inner spring (50B) and counter-clockwise coiled outer spring (50A) enveloping said second spring of the inner core and *vice versa*. Said spring assembly (50) is forced to rotate in a certain direction (5A), here clockwise. Thus, the outer spring (50A) is coiled to become thinner and the inner spring (50B) is coiled to become thicker so that the two springs clutch each other firmly to minimize flexibility in the clockwise angular direction along the longitudinal main axis. A third spring may be added to envelope both said springs, coiled according to the inner spring, thus minimizing flexibility in both angular directions clockwise and counter- clockwise.

Reference is made now to figure 6A, schematically presenting the working tool (60) according to yet another embodiment of present invention. The distal portion of tool (60) is generally similar to the one defined and described in tool (100) above, and comprises *inter alia* flexible blade (1), rectangular rigid rod (2), cup member (3), outer flexible tube (4), and movement cable (5) or interchangeably spring assembly (50). The control box (6) of tool (60) comprises *inter alia* a housing element(6A) adapted to be handled by the user, an electrical inlet (8), a rotating knob (6B) for rotating blade (1) in any desired lateral maneuver, and bending knob (6C) for bending blade (1) so a curved blade is provided.

Fig. 6B presents the same tool (60) wherein bending knob (6C) is twisted backwards along threads (6D), pulling movement cable (5) and rectangular rode (2) backwards, so flexible blade (1) is forced to bend along its longitudinal axis to form a curved blade. Fig. 6C presents the same tool (60) wherein rotating knob (6B) is rotated, forcing blade (1) to maneuver laterally in a predetermined angular course.

Reference is made now to figure 7A, schematically presenting the aforementioned working tool (60) without the box housing (6A). Said tool comprises a bending knob thread (6D), a bending knob (6C), lock (12) and a rotating knob (6B). Fig. 7B presents the same apparatus without showing the bending knob thread (6D) and its bending knob (6C).

Reference is made now to figure 8A, schematically presenting the working tool (80) according to yet another embodiment of present invention. The distal portion of tool (80) is generally similar to the one defined and described in tools (60) and (100) above, and comprises *inter alia* flexible blade (1), rectangular rigid rod (2), cup member (3), outer flexible tube (4), and movement cable (5) or interchangeably spring assembly (50); the control box (6) comprises *inter alia* bending knob (6C) and its bending knob thread (not shown), a handle (13) maneuvered forwards and backwards along the longitudinal axis in a recess (not shown). An optional palm rest (14) is located at the extreme proximal end, adapted to accommodate the thumb or palm of the user. Said rest may be designed to any proper configuration, such as a ring member, a designed niche, a nest-like member etc. Bending knob (11) is twisted or rolled by the user to either pull or push tube (4) thus lengthening or shortening the distance between cap (3) and control box (6), movement cable (5) or spring assembly (50), and being rigidly connected along its longitudinal axis between rod (2) and

control box (6) will then either pull or release rod (2), thus adjusting flexible blade (1) to curve to a desired measure.

Figure 8B shows working tool (80) with a bending maneuver. Bending knob (11) is twisted by the user to either pull or push tube (4) thus lengthening or shortening the distance between cap (3) and control box (6), movement cable (5) or spring assembly (50), and being rigidly connected along its longitudinal axis between rod (2) and control box (6) will then either pull or release rod (2), thus adjusting flexible blade (1) to curve to a desired measure; a tension spring (20) (not shown) is added to apply constant tension to movement cable (5) thus ensuring smooth operation. Fig. 8C illustrates the same, with a rotating maneuver. Handle (13) is maneuvered by the user to the proximal end to rotate cable (5) or spring assembly (50) and thus to enable rotational maneuver of the blade so that a side-to-side resection is provided.

Reference is made now to figure 9A, schematically presenting the aforementioned working tool (80) without showing the box housing and the handle. Said tool comprises *inter alia* bending knob (6C), cable (5), twisted rectangle (18), connector (15), sliding bolt (16), at least one returning spring (17) adapted to return handle (13) toward the distal end of tool (80) after its maneuver toward the proximal end of tool (80), an electrical inlet roller (9) and an electrical inlet (8). Reference is made now to Fig. 9B, schematically presenting the aforementioned working tool (80) without showing as in Fig 9A bend knob (11) and return spring (17). Optional tube tension spring (20) is located at the distal portion of movement cable (5), adjacent to connector (10). Tube pusher (19) has a tube pushing thread (19A) and a protruding pin member adapted to fit a slot in the tool's housing (6, not shown), pin member (19) is utilized to disable angular rotation of tube pushing thread (19A). The rotating mechanism comprises *inter alia* the following components: a handle member (13), a sliding bolt (16), and a twisted rectangle (18). By maneuvering the handle (13) along the longitudinal axis of the tool, sliding bolt (16) which is rigidly coupled to handle (13) cannot rotate angularly, and thus is simultaneously pushed or pulled, rotating twisted rectangle. (18). Connector (15) rigidly connects twisted rectangle (18) to the movement cable (5) or spring assembly (50). Tube pusher (19) is maneuvered along said longitudinal axis by means of thread (19A) driven by the knob (11). Tube pusher (19) is rotationally locked to housing (6) by means of slot and pin member assembly.

Reference is made now to figure 10A, schematically presenting a lateral cross section of the whole aforementioned working tool (80). Fig. 10B presents the same, wherein the central rotating and bending mechanism, i.e., rectangular rod (2), tube (4), tube pusher thread (19A), sliding bolt (16), twisted rectangular (18) etc, is projected without the enveloping ingredients. It is acknowledged in this respect that this central rotating and bending mechanism is locked in a longitudinal axis and may only rotate in a predetermined measure, wherein back and forwards movements are restricted by the housing compartment (6).

Reference is made now to figure 11, schematically presenting said central rotating and bending mechanism (110) connected at its proximal portion to three electrical contact assemblies, wherein the upper mechanism comprises a electrical inlet roller (9) adapted to accommodate electrical inlet (8); central mechanism comprising a coal pressure contact (21) and its contact spring (22); and a lower mechanism comprising a plurality of connecting plates (23).

Reference is made now to figure 12, schematically presenting the very distal end of working tool (120) according to yet another embodiment of present invention, comprising two pull/release cables instead of one cable with two functions, rotating and pull/release movements utilized in the previous embodiments, a control box which is not shown for this embodiment. The extreme distal portion of tool (120) is generally similar to the previously defined and described embodiments above, and comprises *inter alia* flexible blade (1) and a rectangular rigid rod (2). At the proximal portion of blade (1) a blade bend plate (25) is located, grasped (e.g., either pulled or released) by means of cables (26), which are located at the two sides of plate (25), and fuse into one blade bend cable (27) following part (34) (not shown here). Blade bend spring (24) is utilized to bend blade (1) when cables (26) are released, or partly released. Said plate (25) is maneuvered by means of a blade bend cable (26) and spring (24). In addition, at the proximal end of the drawing, the ends of cable (27), which is utilized, to bend and flatten blade (1) is shown, as is cable (28), which is utilized to rotate blade (1) around the longitudinal axis of said tool.

Reference is made now to figures 13A-13B, schematically presenting said cable-based working tool (120) mode of action. Releasing the blade band cable end (27) forwards towards the proximal direction (See Fig. 13A) simultaneously results in release of the blade band cable (26), hence causing spring (24) to elongate, thus

forcing blade (1) to bend. Pulling the blade rotate cable end (28) backwards towards the distal direction (See Fig. 13B) similarly results in rotating the blade clockwise, and *vice versa*; when cable (27) is pulled blade (1) will simultaneously flatten, and when cable (28) is released blade (1) will simultaneously rotate counter clockwise.

Reference is made now to figures 14A-14C, schematically presenting said cable-based working tool (120) inner construction and mode of action. As illustrated in Fig. 14A, the bending mechanism is comprised *inter alia* of a blade bending cable (26) maneuvered at its proximal end (27) in a direction parallel to the longitudinal axis, releasing, or partially releasing spring (24) and thus pushing plate (25) forwards so that blade (1) is bended or partially bended, as desired by the user. Also presented in figure 14A is the rotating mechanism, which is comprised *inter alia* of blade rotating cable, terminating at the tool's proximal portion (28), blade rotating spring (35) and rotating spring stopper (36). When said cable (28) is pulled backwards in a direction parallel to the longitudinal axis, said cable passes freely through the center of bend cables connector (34) and connects to rectangular rod (32A) which passes through disk (33) which incorporates a rectangular hole (33a), thus rectangular rod (32a) is unable to rotate angularly around the longitudinal axis of said tool. At its distal end rectangular rod (32a) connects to rectangular twisted rod (32) thus activating its linear movement along the longitudinal axis of the tool and disabling its angular movement. Spring (35) is positioned between disk (33) and spring stopper (36) which is rigidly connected to rectangular rod (32a), when cable (28) is pulled rectangular rod (32a) travels toward the proximal end of said tool, thus further loading preloaded spring (35) and vise versa. Nut (31) incorporates a twisted rectangular hole and is unable to move linearly and thus rotates when twisted rectangular rod (32) is actuated. Nut (31) is rigidly connected to connector (30) thus both are rotated angularly by twisted rectangular rod (32). Rectangular rod (2) is rigidly connected to connector (30) and thus rotates accordingly.

It is further acknowledged that a simple control box may be designed to control the pull release of cables (27) and (28).

A closer view of aforesaid mechanism of bending and rotating is provided in figures 15A-15C. Figure 15A illustrates the distal portion of tool (120) comprising blade (1) on rod (2), wherein blade bend plate (25) is clasped against the distal portion of the blade by means of blade bend spring (24). The proximal end of blade (1) slides along

rode (2) by means of quadrangle bore (1A). Cup tube (29) forces said spring to its illustrated location. By pulling or releasing blade bend cable (26), plate (25) is shifted backwards or forwards, to erect or deflect the blade so that the desired curved shape is obtained. Figure 15B illustrates the central portion of tool (120) comprising cup tube (29), nut connector (30), twisted rectangular rod (32) distal portion and the rectangular rod (32a) extruding from it, nut (31), and blade rotate spring (35). Figure 15C shows the extreme distal portion of the same, underlining the position of the bend cable connector (34).

Lastly, reference is made to figures 16A-16E, presenting in a non-limiting manner various non-wire blades and wire-like blades, namely non-symmetrical saw-like blade, (16A), pointed-edge blade (16B), symmetrical polygonal blade (16C), deflectable filament-type blade (16D) and rotating multiply-filamented blade, here double-wired structure adapted to bend and rotate (16E).

The present invention also provides a novel method for lateral resection of biological tissues by means of a working tool with flexible blade of an adjustable curve size. The core of the aforesaid method consists of the sequential steps of inserting the distal end of said tool into a body cavity, and positioning the maneuverable blade in contact with or adjacent to the tissue to be resected; bending said blade to a predetermined measure; rotating said blade in a lateral movement such that a side-to-side resection is obtained; and then, retracting said blade and withdrawing the tool outside said body cavity.

It is according to one embodiment of the present invention wherein the aforementioned method of lateral resection is based on a working tool with a flexible blade of an adjustable curve size. This tool is elongated and narrow and has a distal end, which is inserted into a body cavity, and a proximal end, which is adjacent to a user; the longitudinal axis of said maneuverable blade is parallel to the longitudinal axis of the said tool. It is further characterized by both a bending mechanism, adapted to bend said blade to a predetermined measure, and a rotating mechanism, adapted to rotate said blade in a lateral movement such that a side-to-side resection is obtained. Such a useful method is provided by the working tools as defined and described in any of the above embodiments of the present invention and in their descriptive figures

It is according to yet another embodiment of the present invention wherein the aforementioned method of lateral resection comprises the steps of inserting the distal end of said tool into a body cavity, and positioning the maneuverable blade in contact with or adjacent to the tissue to be resected; bending said blade to a predetermined measure; supplying high frequency electrical current to said blade while rotating said blade in a lateral movement such that a side-to-side resection is obtained; switching off the current when the incision procedure is completed; and then retracting said blade and withdrawing the tool outside said body cavity. Such a method is especially useful for facilitated (hot) resections as defined above.

This facilitated (hot) method is especially useful when the working tool is adapted for lateral resection of biological tissues by providing a flexible blade with an adjustable curve size; said tool is elongated and narrow and has a distal end, which is inserted into a body cavity, and a proximal end, which is adjacent to a user; the longitudinal axis of said maneuverable blade is parallel to the longitudinal axis of the said tool; wherein said working tool is characterized by both bending mechanism, adapted to bend said blade to a predetermined measure; and rotating mechanism, adapted to rotate said blade in a lateral movement such that a side-to-side resection is obtained. Such a working tool may be selected from any embodiment defined and described in the present invention and in its appended figures.

CLAIMS

1. A working tool for lateral resection of biological tissues by means of a flexible blade with adjustable curve size; said rod-like tool has a distal end, adapted to be inserted into a body cavity, and a proximal end, located adjacent to a user; the longitudinal axis of said maneuverable blade is parallel to the longitudinal axis of the said tool or shifted in respect to the same; said working tool comprising:
   a. bending mechanism, adapted to adjust the bending of said blade to a predetermined measure; and
   b. rotating mechanism, adapted to rotate said blade in a lateral bi-directional movement in respect to the resected tissue such that a side-to-side resection is obtained.

2. The working tool according to claim 1, wherein the shape of the blade is selected from blade, wire-like, snare or loop-like symmetrical, asymmetrical shapes, toothed or sharpened members, polygonal shaped constructions, roller-like, spoon-like structures, spring-like members or scythe-like non-symmetrical blades or any combination thereof.

3. The working tool according to claim 1 useful for cold resection; wherein the maneuverable blade is a sharp razor-like member adapted to cut biological tissues mechanically.

4. The working tool according to claim 3 useful for cold resection; wherein the maneuverable blade is adapted to forward and backwards knife movement, vibrational motion, or a combination thereof.

5. The working tool according to claim 2 wherein the blade is made of metals selected from stainless steel, tungsten, niobium, chromatic alloys or shape memory alloys; polymers; composite materials or any mixture or combination thereof.

6. The working tool according to claim 1 useful for facilitated (hot) resection; additionally comprising means for diathermia; cryo-therapy; RF or any other vibrational means; or any combination thereof.

7. The working tool according to claim 1 additionally comprising maneuvering means located at its proximal portion adapted to maneuver the flexible blade located at the distal end by bending it and/or rotating it laterally; said means are selected from at least one control knob, handle, endless cable or any combination thereof.

8. The working tool according to claim 1 additionally comprising at least one handle located at its proximal portion adapted to maneuver the flexible blade located at the distal end by both bending it and rotating it laterally.

9. A flexible working tool as defined in claim 1 or in any of its dependent claims.

10. A disposable working tool as defined in claim 1 or in any of its dependent claims.

11. A working tool for endoscopic resection as defined in claim 1 or in any of its dependent claims.

12. The working tool as defined in claim 1 or in any of its dependent claims comprising *inter alia*
    a. a rigid rod located at the extreme distal portion of said tool;
    b. a flexible blade, whose distal end is rigidly immobilized to said rod and further whose proximal end comprises a hole affixed around said rod by means of sliding bore with a polygonal profile, such that said blade can slide along its longitudinal axis solely to a predetermined measure;
    c. a control box comprising *inter alia* a housing element, and at least one control knob;
    d. an endless movement cable connecting rod at the distal portion of the tool with the control knob located at its proximal portion;

e. an outer flexible tube with a circular bore encompassing the proximal portion of said rod and the said movement cable;

wherein by either pushing or pulling the said control knob along the longitudinal main axis of the tool, said movement cable and said rod are simultaneously pulled or pushed, curving or flattening the said flexible curve, and further wherein by twisting said control knob around said longitudinal main axis, said movement cable and said rod are simultaneously rotated, rotating the said flexible curve along a predetermined course.

13. The working tool according to claim 12 additionally comprising an electrical inlet adapted to provide the blade with effective diathermia, cryo-therapy or RF means; wherein a free and continuous electrical communication is provided by the said electrical inlet, to the movement cable, rectangular rod and flexible blade.

14. The working tool according to claim 13, wherein the movement cable of the electrical inlet is rolled over an electrical inlet cable allowing the movement cable to rotate freely.

15. The working tool according to claim 13, wherein the electrical inlet is in communication with a coal pressure contact and its contact spring.

16. The working tool according to claim 13, wherein the electrical inlet is in communication with a plurality of connecting plates.

17. The working tool according to claim 12, wherein at least a portion of the movement cable is a spring assembly comprising a clockwise coiled inner spring and counter-clockwise coiled outer spring enveloping said second spring of the inner core and *vice versa*.

18. The working tool as defined in claim 12 or in any of its dependent claims wherein the control box comprises *inter alia* a rotating knob for rotating the blade in any predetermined lateral maneuver, and bending knob twistable on a bending knob thread for bending it to obtain a predetermined curve; and

further wherein said bending knob is twisted backwards, pulling movement cable or spring assembly and rod backwards, so that flexible blade is forced to bend along its longitudinal axis to form a curved blade.

19. The working tool as defined in claim 12 or in any of its dependent claims wherein the control box comprises *inter alia*

    a. a bending knob twistable on a bending knob thread for bending it to obtain a predetermined curve; and further wherein said bending knob is twisted backwards, pulling movement cable or spring assembly and rod backwards, so that flexible blade is forced to bend along its longitudinal axis to form a curved blade;

    b. a handle assembly comprising

        i. a handle maneuvered forwards and backwards along the longitudinal axis in a recess at the housing;

        ii. a tube pusher with a tube pushing thread and a protruding pin member adapted to fit a slot in the tool's housing;

        iii. a twisted rectangle;

        iv. a cable and screw connector rigidly connecting said twisted rectangular to the movement cable or spring assembly;

        v. a sliding bolt;

        vi. at least one return spring adapted to either pull or push said handle after its maneuver

        vii. a palm rest located at the extreme proximal end, adapted to accommodate the thumb or palm of the user;

    when the handle is maneuvered by the user along the longitudinal axis of the tool, it simultaneously pushes or pulls the sliding bolt, thus rotating twisted rectangle and transforms a linear movement into a rotational maneuver of the blade so that a side-to-side resection is provided.

20. The working tool as defined in claim 12 or in any of its dependent claims wherein a blade band plate is located at the distal portion of rod; said plate is grasped either by pulling or pushing by means of a blade bend spring; said plate is maneuvered by means of at least one blade bend cable with at least

two proximal ends: a blade bending cable end and a blade rotating cable end; wherein said blade bending cable is maneuvered at its proximal end in a direction parallel to the longitudinal axis, releasing said spring and thus pushing plate forwards so that blade is bended in a predetermined manner; and further wherein blade rotating cable, terminating at said tool's proximal portion is pushed backwards in a direction parallel to the longitudinal axis, said cable, *via* bend cables connector and a rectangular rod connected to it, rotates a twisted rectangular rod by means of a twisted rectangular, nut and nut connector rotating assembly, such that said nut connector is in communication at its distal portion with a cap tube so that said cable longitudinal movement is translated to said blade in a predetermined lateral rotation.

21. The working tool as described in any of figures 1 to 16.

22. A method for lateral resection of biological tissues by means of a working tool with a flexible blade of an adjustable curve size, operated by:
    a. inserting the distal end of said tool into a body cavity, and positioning the maneuverable blade in contact with or adjacent to the tissue to be resected;
    b. bending said blade to a predetermined measure;
    c. rotating said blade in a lateral movement such that a side-to-side resection is obtained; and,
    d. retracting said blade and withdrawing the tool outside said body cavity.

23. The method according to claim 22, comprising a working tool adapted for lateral resection of biological tissues by means of a flexible blade of an adjustable curve size; said tool is elongated and narrow and has a distal end, which is inserted into a body cavity, and a proximal end, which is adjacent to a user; the longitudinal axis of said maneuverable blade is parallel to the longitudinal axis of the said tool; wherein said working tool is characterized by both bending mechanism, adapted to bend said blade to a predetermined measure; and rotating mechanism, adapted to rotate said blade in a lateral movement such that a side-to-side resection is obtained.

24. A method for lateral resection of biological tissues by means of a working tool with a flexible blade of an adjustable curve size comprising the steps of inserting the distal end of said tool into a body cavity, and positioning the maneuverable blade in contact with or adjacent to the tissue to be resected, bending said blade to a predetermined measure; rotating said blade in a lateral movement such that a side-to-side resection, rotation or other lateral maneuver is obtained; and retracting said blade and withdrawing the tool outside said body cavity, wherein said working tool is defined in claim 1 or in any of its dependent claims.

25. The method according to claim 22, comprising the steps of:
    e. inserting the distal end of said tool into a body cavity, and positioning the maneuverable blade in contact with or adjacent to the tissue to be resected;
    f. bending said blade to a predetermined measure;
    g. supplying high frequency electrical current to said blade while rotating said blade in a lateral movement such that a side-to-side resection is obtained;
    h. switching off the current when the incision procedure is completed; and,
    i. retracting said blade and withdrawing the tool outside said body cavity.

26. The method for lateral resection of biological tissues according to claim 24, wherein the working tool is adapted for lateral resection of biological tissues by means of a flexible blade with an adjustable curve size; said tool is elongated and narrow and has a distal end, which is inserted into a body cavity, and a proximal end, which is adjacent to a user; the longitudinal axis of said maneuverable blade is parallel to the longitudinal axis of the said tool; wherein said working tool is characterized by both bending mechanism, adapted to bend said blade to a predetermined measure; and rotating mechanism, adapted to rotate said blade in a lateral movement such that a side-to-side resection is obtained.

27. The method according to claim 24, comprising the steps of inserting the distal end of said tool into a body cavity, and positioning the maneuverable blade in contact with or adjacent to the tissue to be resected; bending said blade to a

predetermined measure; supplying high frequency electrical current to said blade while rotating said blade in a lateral movement such that a side-to-side resection is obtained; switching off the current when the incision procedure is completed; and retracting said blade and withdrawing the tool outside said body cavity; wherein said working tool is defined in claim 1 or in any of its dependent claims.

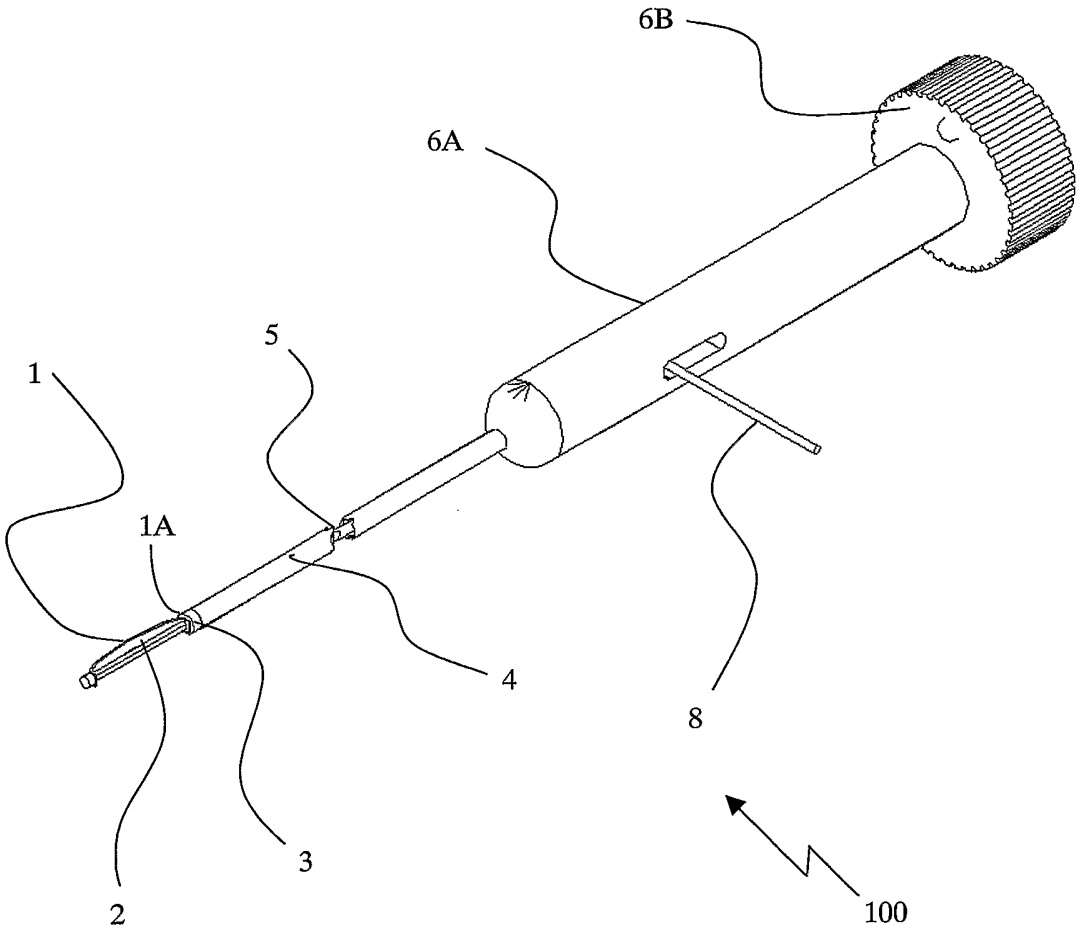


FIG. 1

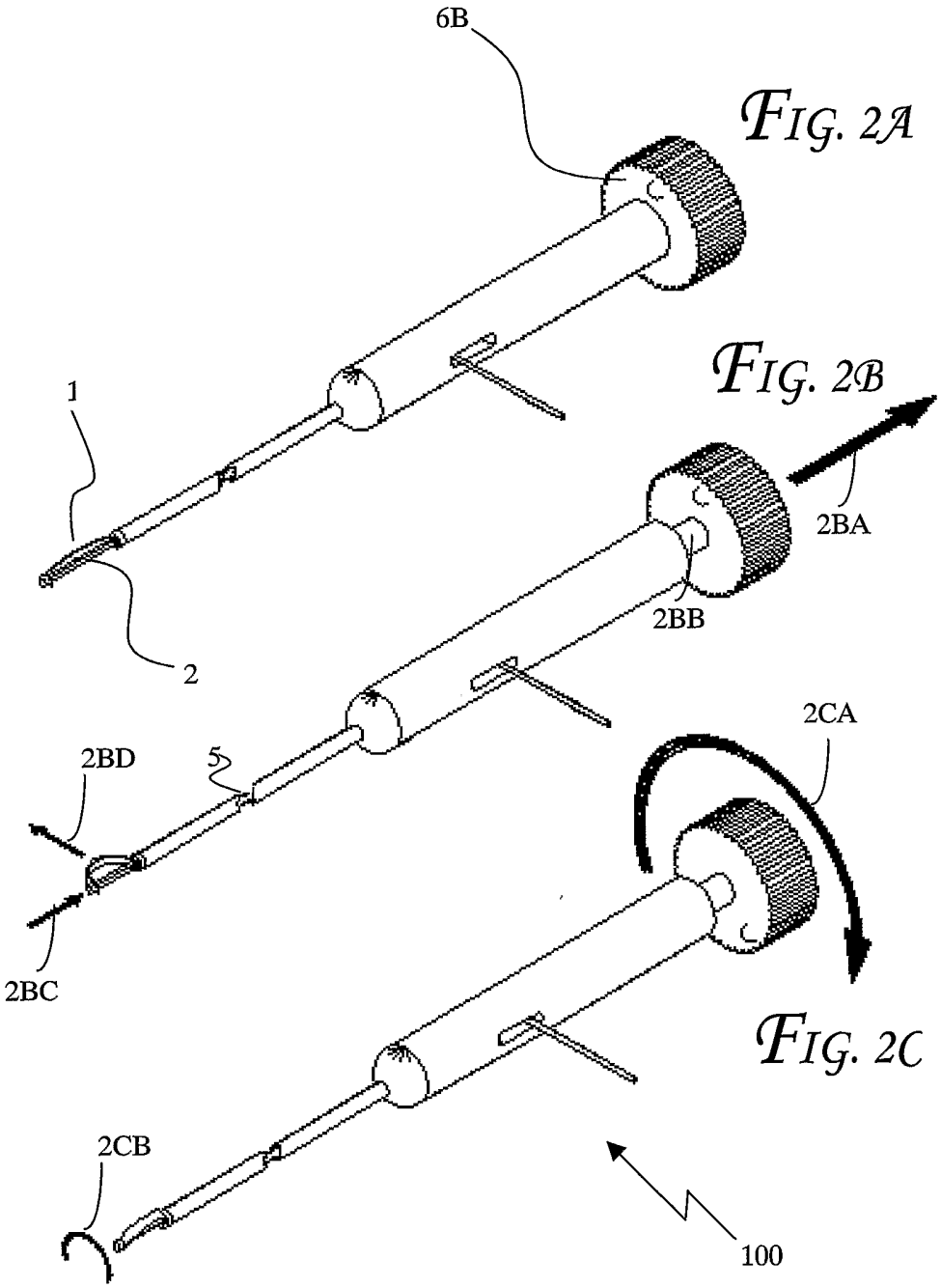


FIG. 2A

FIG. 2B

FIG. 2C

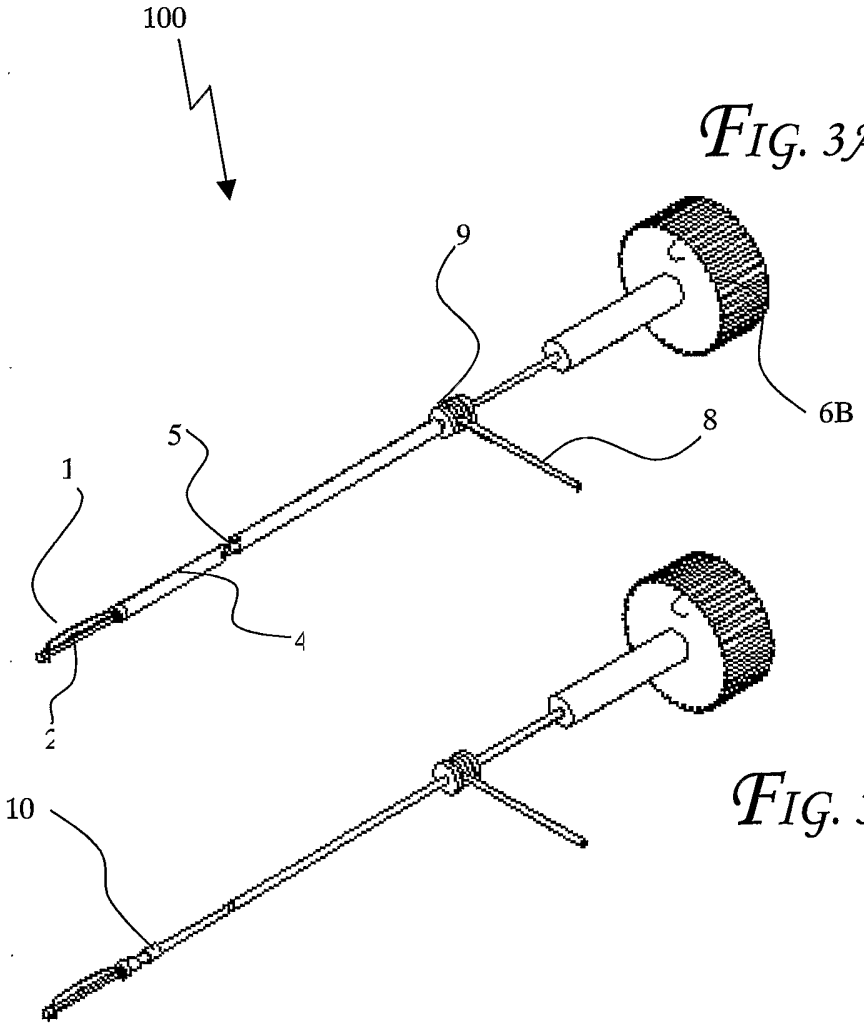


FIG. 3A

FIG. 3B

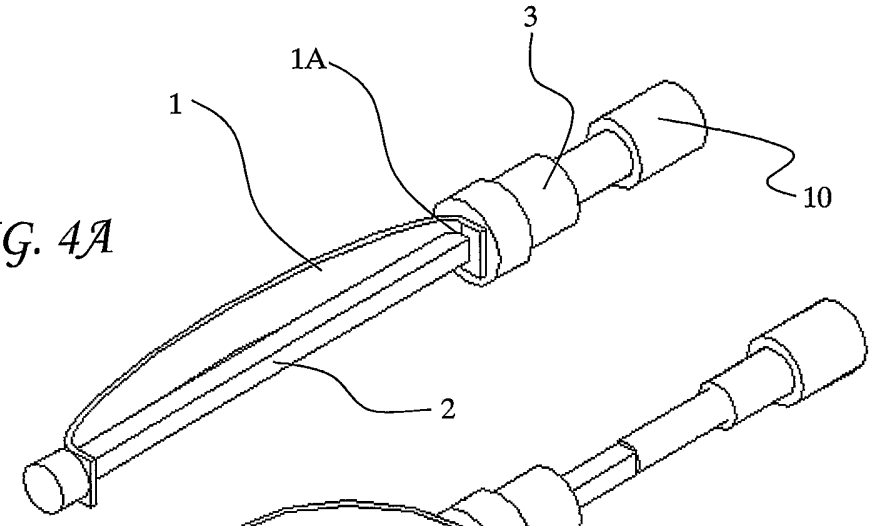


FIG. 4A

FIG. 4B

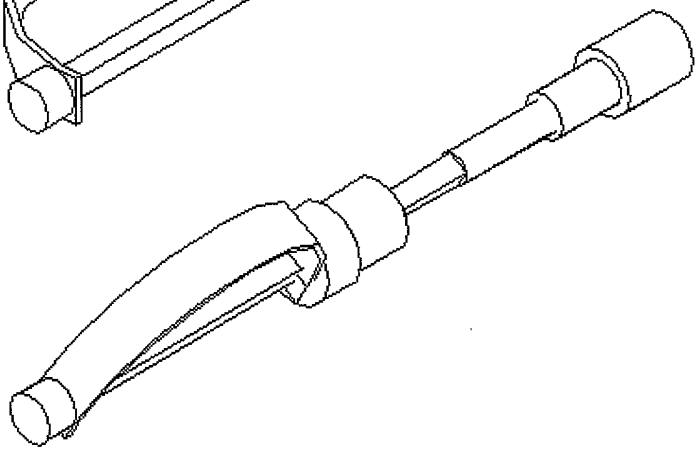


FIG. 4C

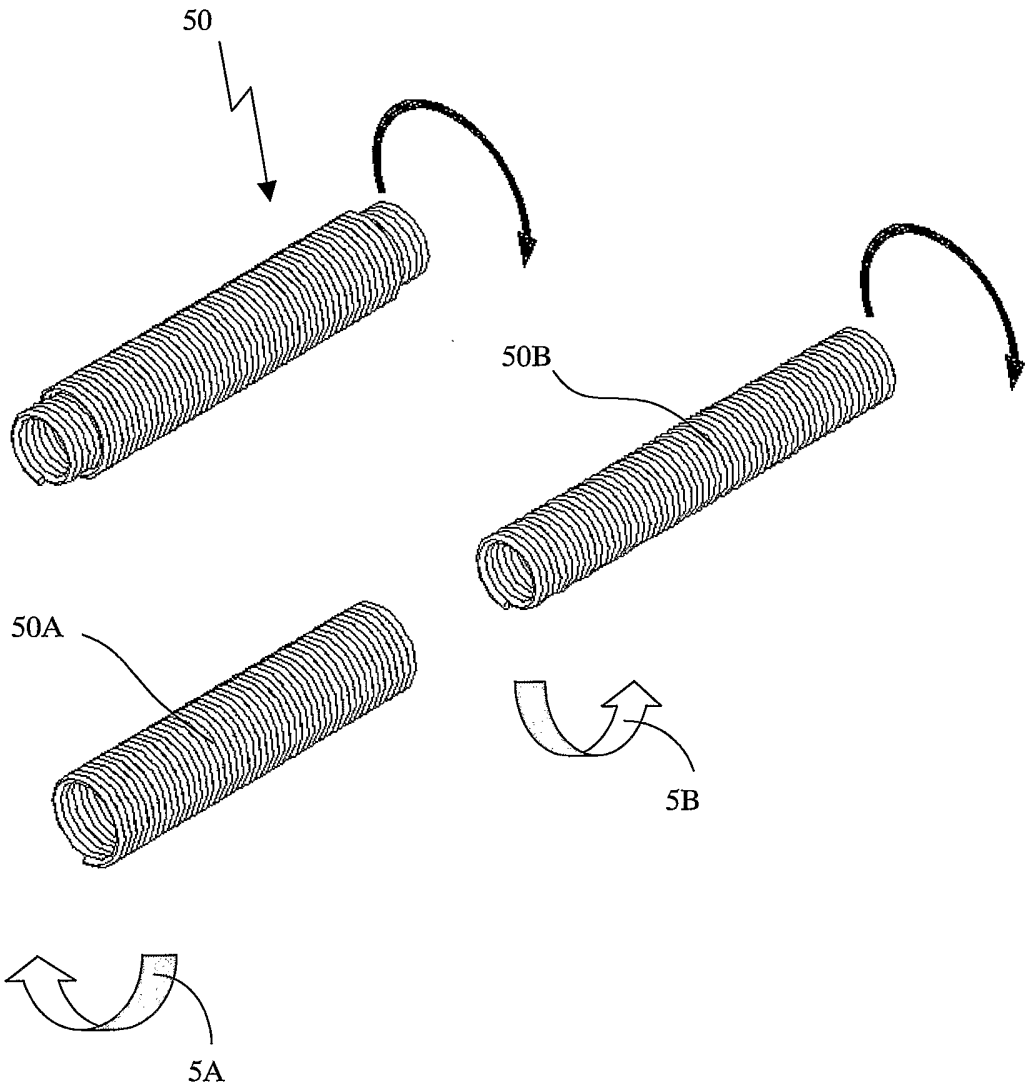


FIG. 5

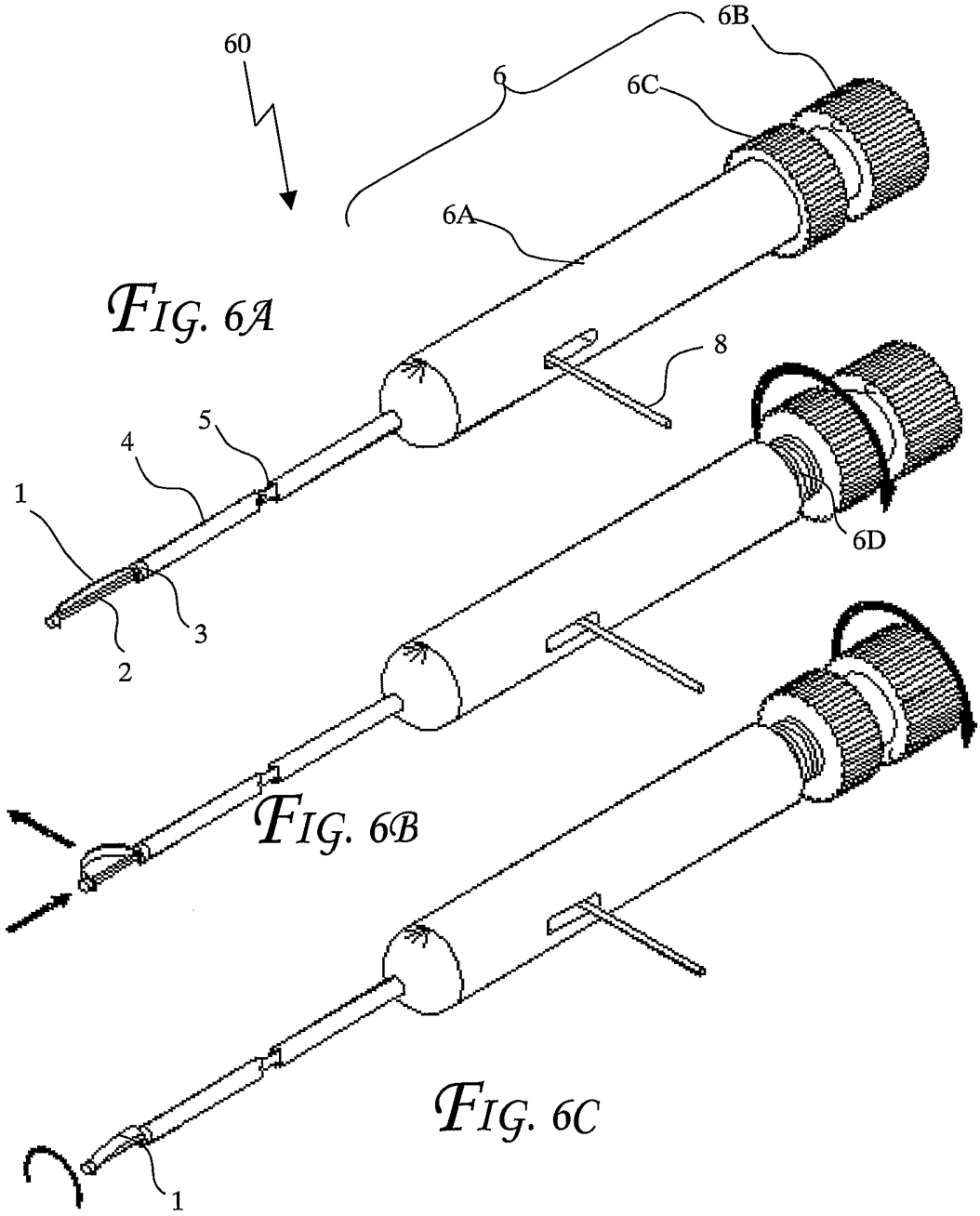


FIG. 6A

FIG. 6B

FIG. 6C

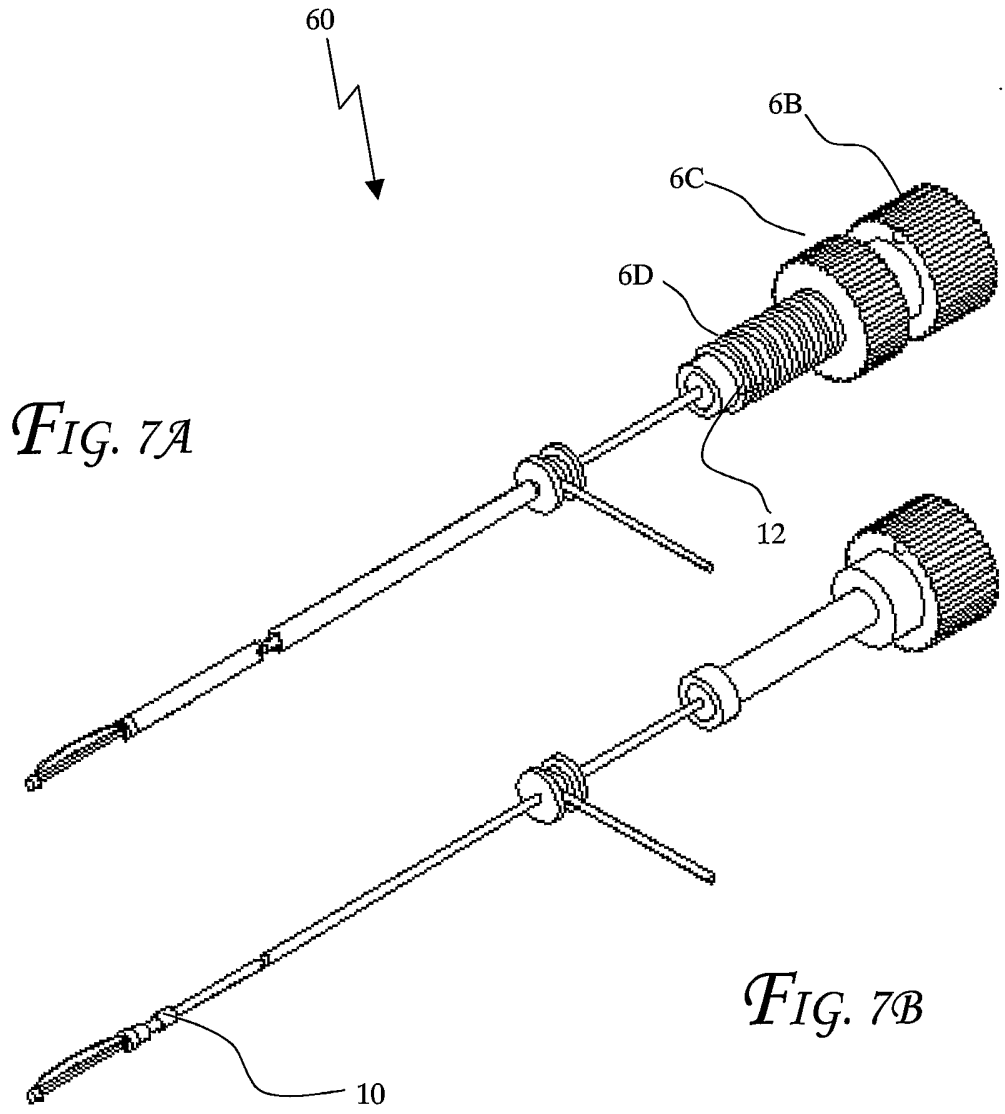


FIG. 7A

FIG. 7B

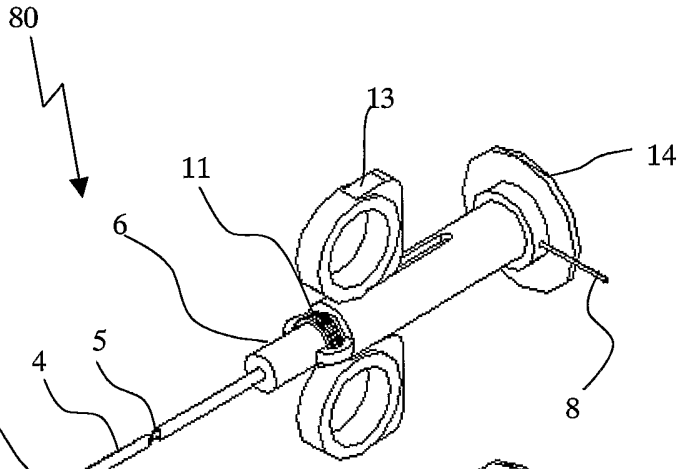


FIG. 8A

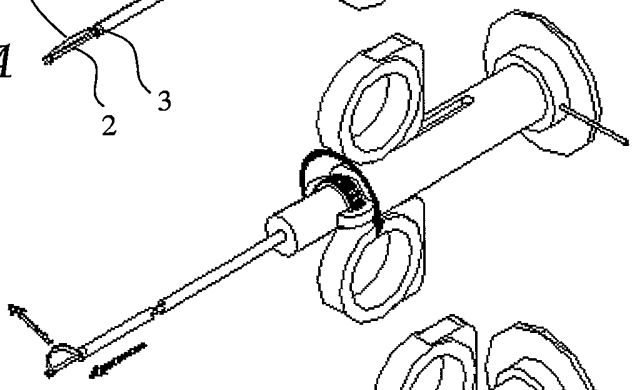


FIG. 8B

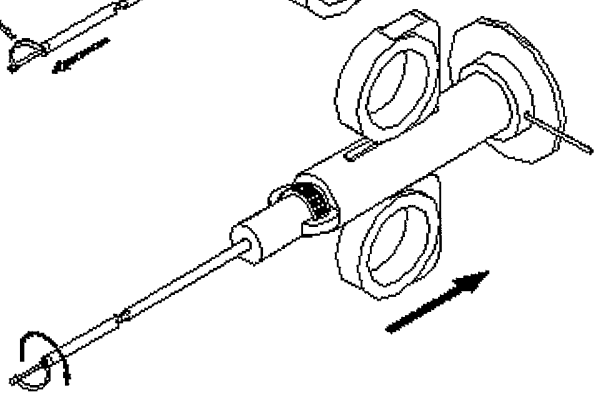


FIG. 8C

FIG. 9A

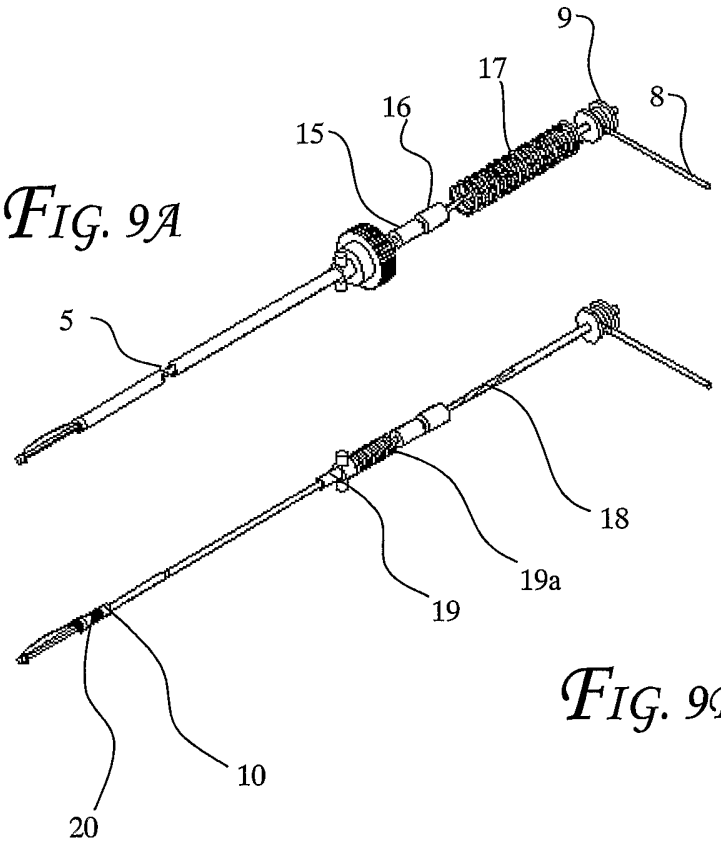


FIG. 9B

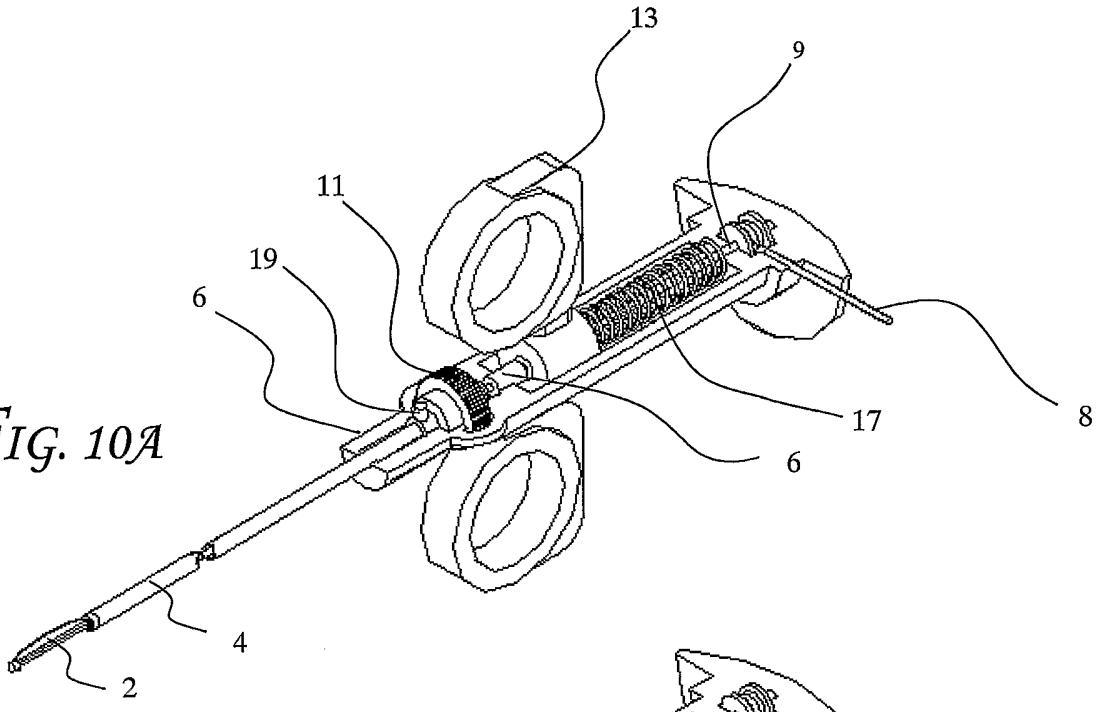


FIG. 10A

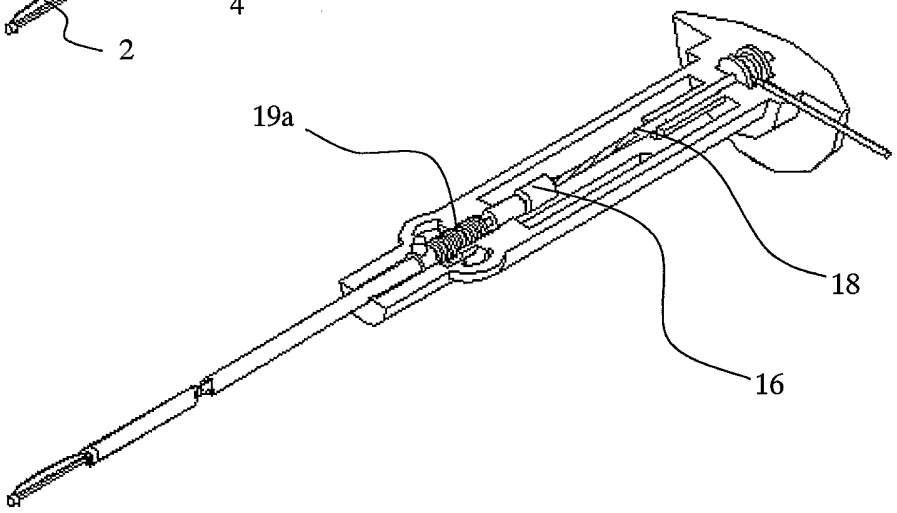
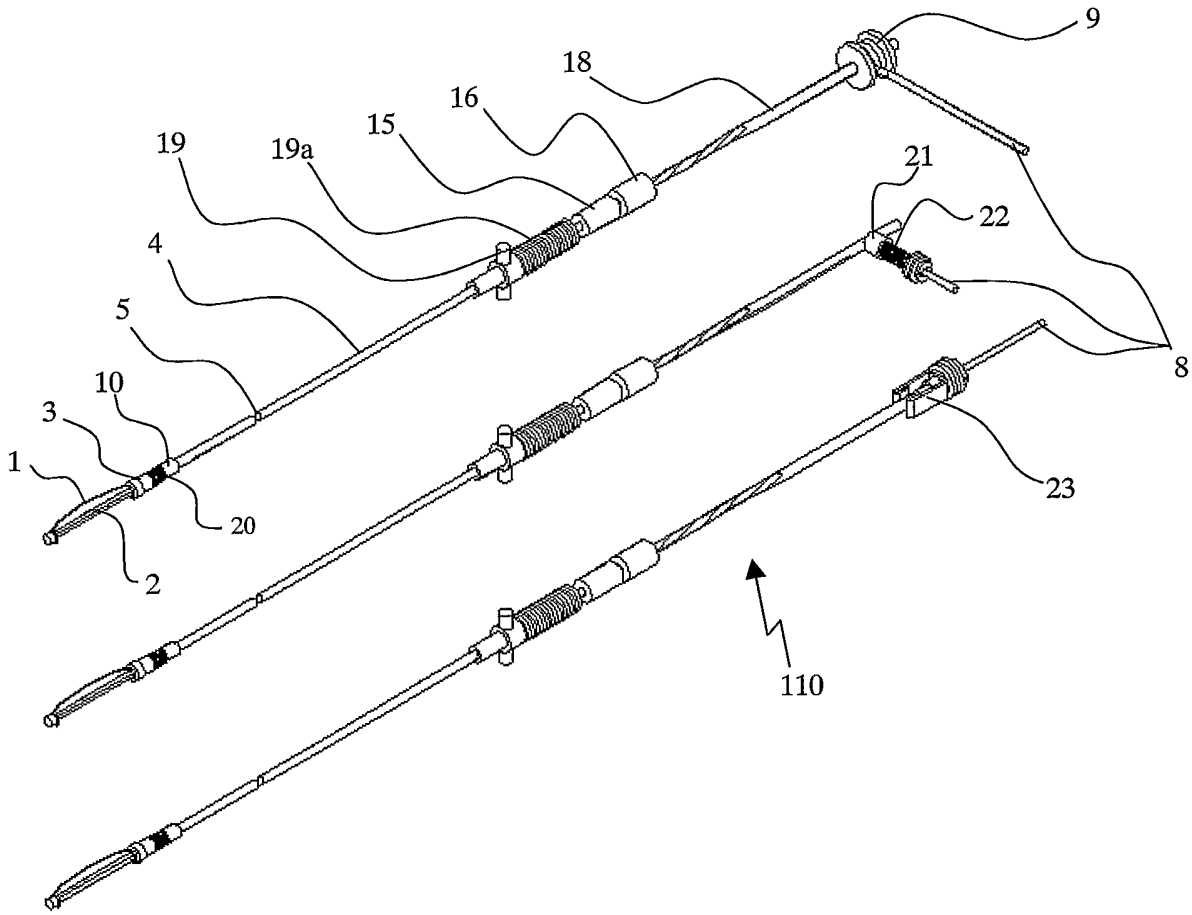


FIG. 10B



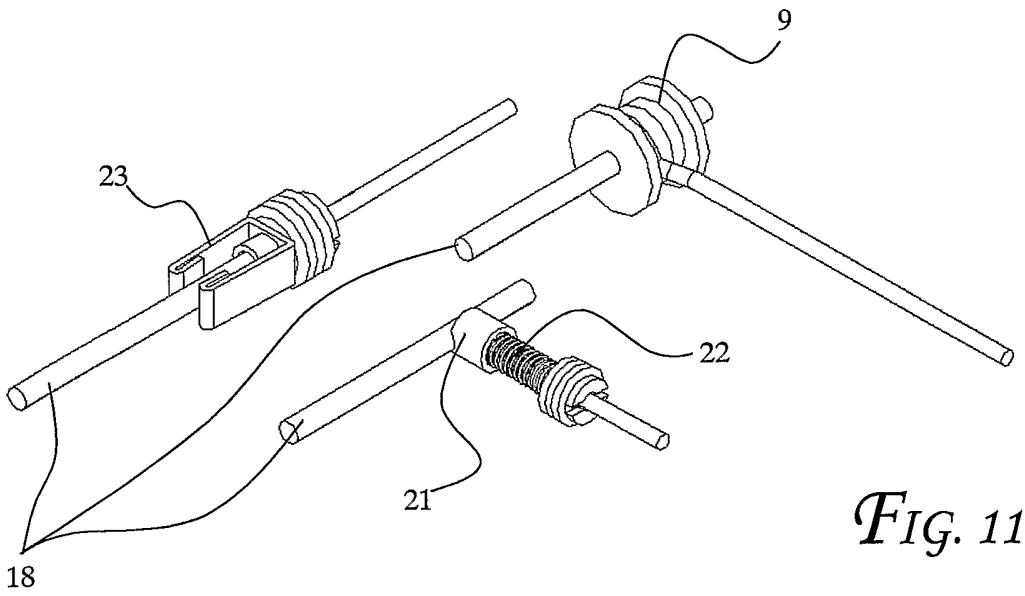


FIG. 11

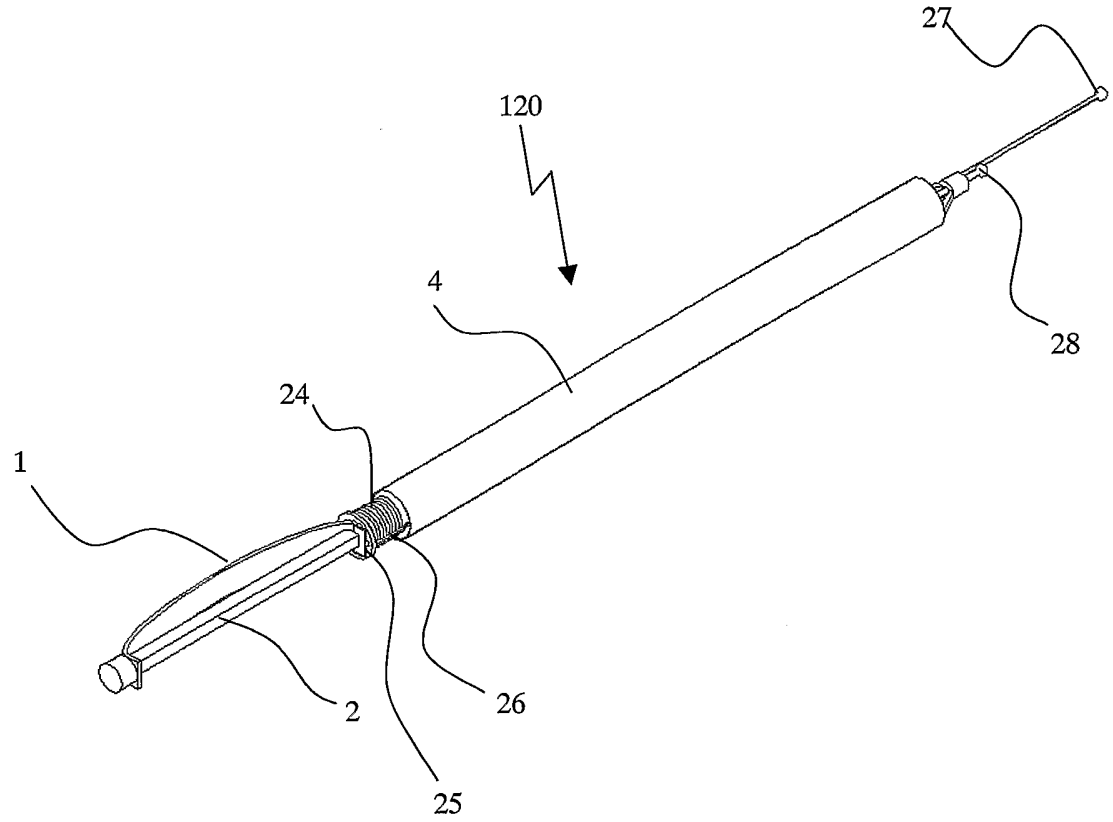


FIG. 12

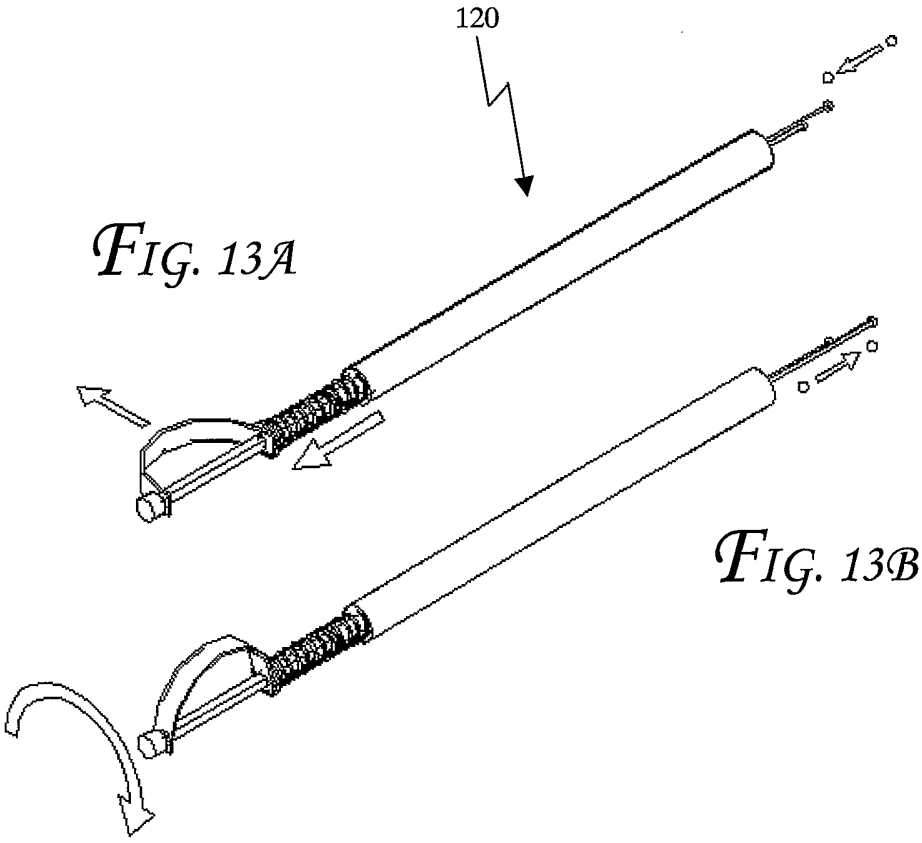


FIG. 13A

FIG. 13B

FIG. 14A

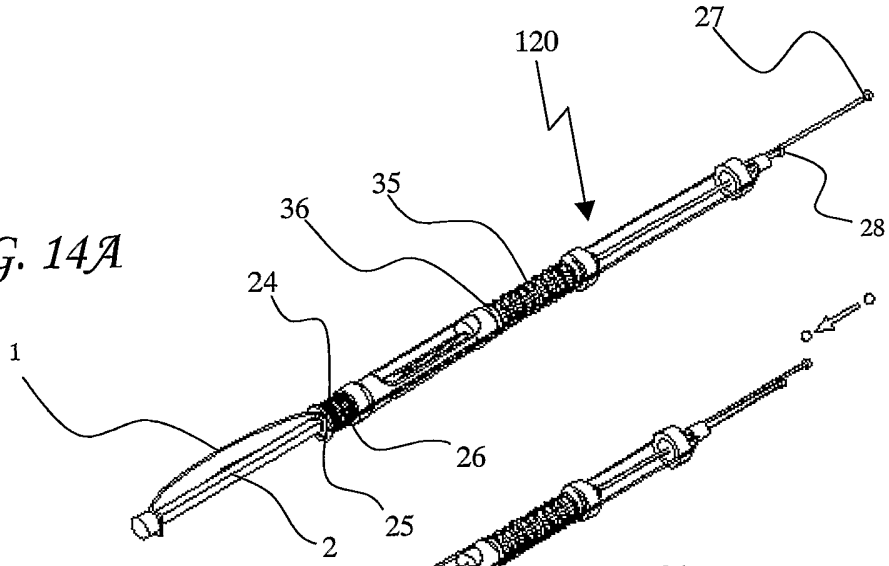


FIG. 14B

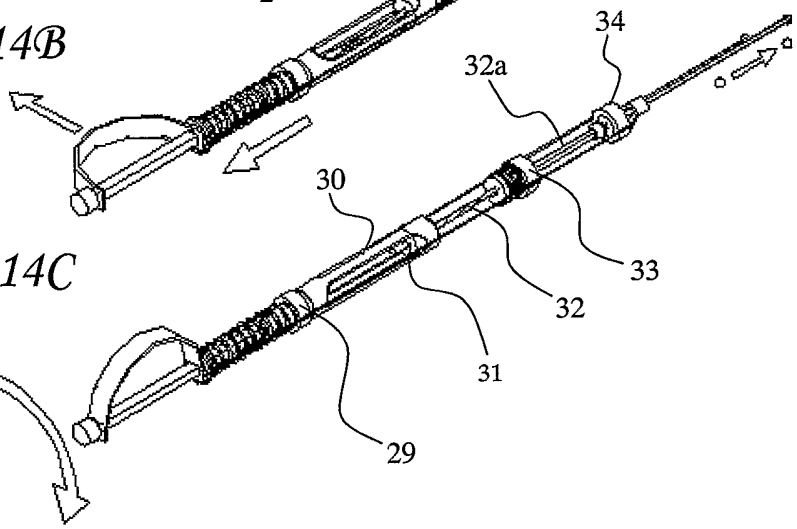


FIG. 14C

FIG. 15A

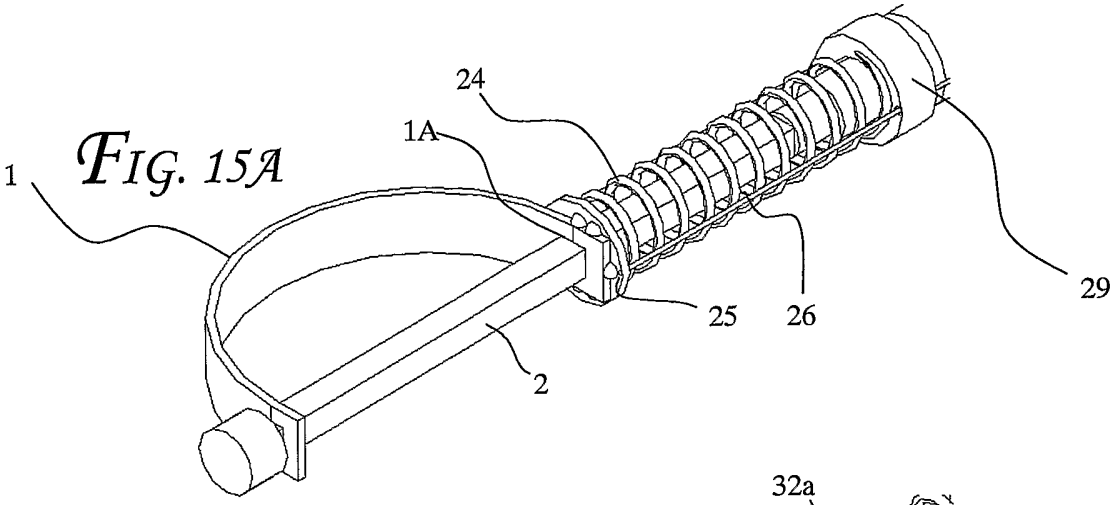


FIG. 15B

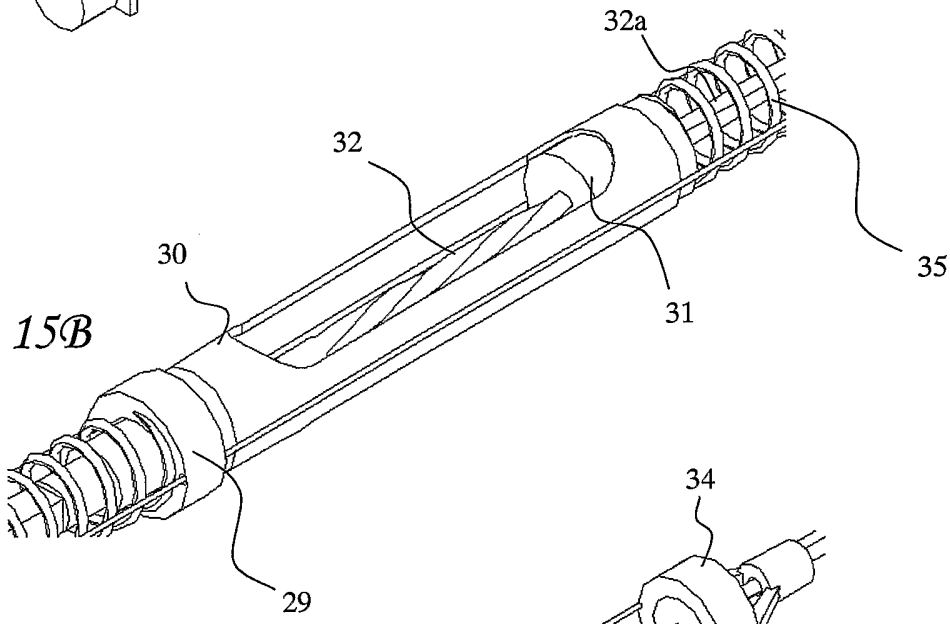
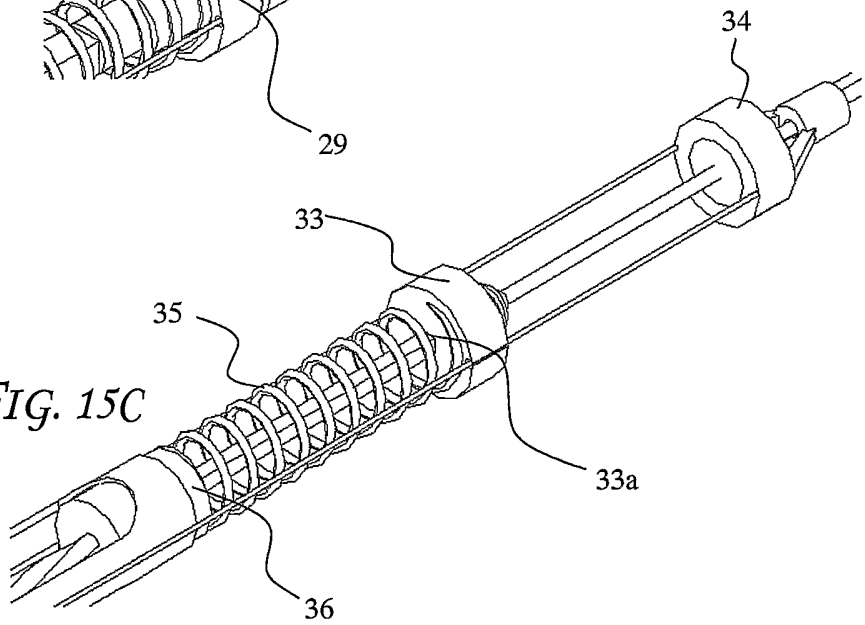


FIG. 15C



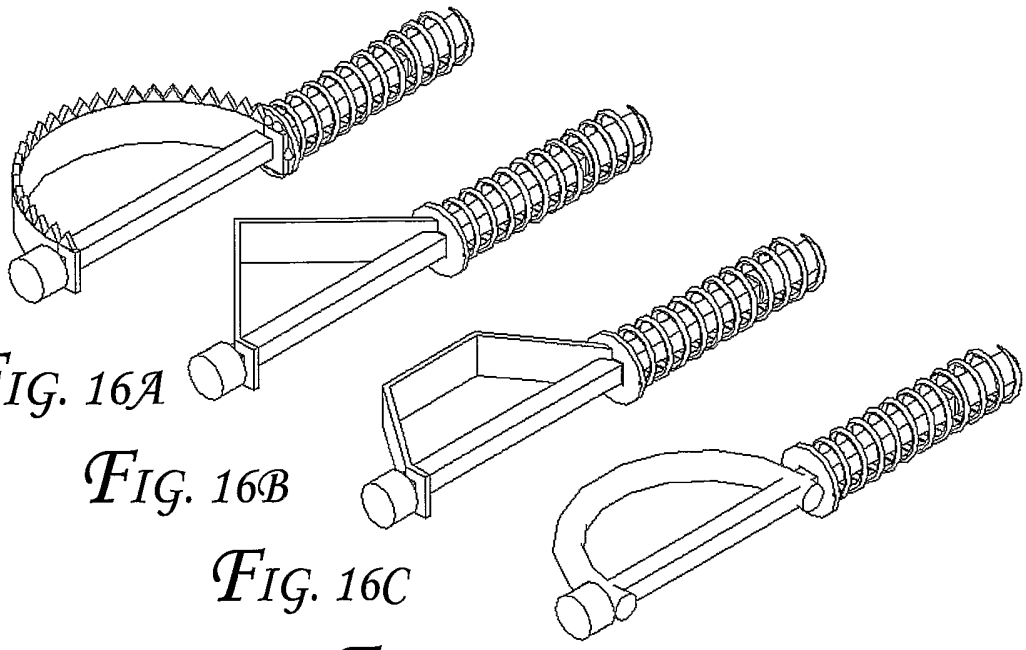


FIG. 16A

FIG. 16B

FIG. 16C

FIG. 16D

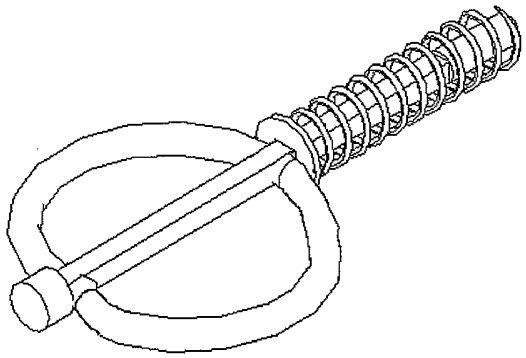


FIG. 16E

INTERNATIONAL SEARCH REPORT

International Application No
PCT/IL2005/000226

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A61B17/32

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A61B

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

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

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2002/077648 A1 (LEE ROBERTA ET AL) 20 June 2002 (2002-06-20) paragraphs '0029!, '0078!, '0083!; figures 1,2,19,20,23	1-20
X	US 5 224 488 A (NEUFFER ET AL) 6 July 1993 (1993-07-06) abstract; figures 1,3,5	1-20
X	US 5 794 626 A (KIETURAKIS ET AL) 18 August 1998 (1998-08-18) abstract; figures 3,11,12	1-20
X	US 5 941 869 A (PATTERSON ET AL) 24 August 1999 (1999-08-24) abstract; figure 13	1-20

-/--

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

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
15 June 2005	23/06/2005

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

INTERNATIONAL SEARCH REPORT

International Application No
PCT/IL2005/000226

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 415 656 A (TIHON ET AL) 16 May 1995 (1995-05-16) the whole document	1-20
A,P	US 2004/122457 A1 (WEBER JAN) 24 June 2004 (2004-06-24) the whole document	1-20

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Continuation of Box II.1

Claims Nos.: 21-27

Claims 22-27 relate to methods for treatment of the human or animal body by surgery (Rule 39.1(iv) PCT) due to the step of resection of biological tissues.

Continuation of Box II.2

Claims Nos.: 21

The subject-matter of independent Claim 21 is solely defined by reference to the drawings. According to Rule 6.2(a) PCT, claims should not contain such references except where absolutely necessary, which is not the case here.

The applicant's attention is drawn to the fact that claims relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure. If the application proceeds into the regional phase before the EPO, the applicant is reminded that a search may be carried out during examination before the EPO (see EPO Guideline C-VI, 8.5), should the problems which led to the Article 17(2) declaration be overcome.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IL2005/000226

Box II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. [X] Claims Nos.: 21-27
because they relate to subject matter not required to be searched by this Authority, namely:

Claims 22-27 relate to methods for treatment of the human or animal body by surgery (Rule 39.1(iv) PCT) due to the step of resection of biological tissues.

2. [X] Claims Nos.: 21
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

see FURTHER INFORMATION sheet PCT/ISA/210

3. [ ] Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. [ ] As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. [ ] As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. [ ] As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4. [ ] No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

[ ] The additional search fees were accompanied by the applicant's protest.

[ ] No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International Application No
PCT/IL2005/000226

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