

(19)



(11)

EP 2 545 862 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention
of the grant of the patent:
30.09.2015 Bulletin 2015/40

(51) Int Cl.:
A61B 17/32 ^(2006.01) **A61B 17/34** ^(2006.01)
A61B 19/00 ^(2006.01)

(21) Application number: **12186720.4**

(22) Date of filing: **01.10.2004**

(54) **Bladeless optical obturator with a lock for an optical instrument**

Klingeloser, optischer Obturator mit einer Verriegelung für ein optisches Instrument

Obturbateur optique sans lame avec un système de verrouillage d'un instrument optique

(84) Designated Contracting States:
DE FR GB

(30) Priority: **03.10.2003 US 508390 P**

(43) Date of publication of application:
16.01.2013 Bulletin 2013/03

(62) Document number(s) of the earlier application(s) in
accordance with Art. 76 EPC:
04793965.7 / 1 670 349

(73) Proprietor: **Applied Medical Resources
Corporation
Rancho Santa Margarita, CA 92688 (US)**

(72) Inventors:
• **Kahle, Henry
Rancho Santa Margarita, CA California 92688
(US)**
• **Strokosz, Arkadiusz A
Rancho Santa Margarita, CA California 92688
(US)**
• **McGinley, Kimball B
Rancho Santa Margarita, CA California 92688
(US)**

• **Taylor, Scott V
Rancho Santa Margarita, CA California 92688
(US)**
• **Johnson, Gary M
Rancho Santa Margarita, CA California 92688
(US)**
• **Brustad, John R
Rancho Santa Margarita, CA California 92688
(US)**

(74) Representative: **Fitchett, Stuart Paul
Saunders & Dolleymore LLP
9 Rickmansworth Road
Watford
Hertfordshire WD18 0JU (GB)**

(56) References cited:
WO-A1-00/18306 WO-A1-01/01847
WO-A1-01/01871 WO-A1-94/11040
WO-A1-03/026512 WO-A2-02/41795
WO-A2-96/01074 WO-A2-03/096879
DE-U1- 29 503 750 US-A- 4 607 619
US-A- 4 959 067 US-A- 5 562 696
US-A- 5 569 291 US-A- 5 738 628
US-A- 5 817 061 US-A- 5 865 809
US-B1- 6 228 059

Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

EP 2 545 862 B1

Description**BACKGROUND OF THE INVENTION**Field of the Invention

[0001] This invention generally relates to trocar systems including obturators and, more specifically, to blunt tip obturators having hollow shafts for insertion of optical instruments.

Discussion of the Prior Art

[0002] Trocar systems have been of particular advantage in facilitating less invasive surgery across a body wall and within a body cavity. This is particularly true in abdominal surgery where trocars have provided a working channel across the abdominal wall to facilitate the use of instruments within the abdominal cavity.

[0003] The trocar systems of the past typically included a cannula, which provides the working channel, and an obturator which is used to place the cannula across the abdominal wall. The obturator is inserted into the working channel of the cannula and then pushed through the abdominal wall with a penetration force of sufficient magnitude resulting in penetration of the abdominal wall. Once the cannula is in place, the obturator can be removed.

[0004] Obturators have been developed with an attempt to reduce the penetration force of the abdominal wall. For example, sharp blades, sharp edges and piercing points have typically been used to enable the obturator to cut or pierce its way through the abdominal wall. While the sharp blades, sharp edges and piercing points have facilitated a reduced penetration force, they have also caused larger trocar site defects. These trocar site defects may have to be sutured closed resulting in increased operating room costs and procedural time. Moreover, once the abdominal wall has been penetrated, the sharp blades, sharp edges and piercing points of the obturator may still cause damage to the vessels and organs that lie within the peritoneal cavity. For example, the blades on the obturators that serve to cut tissue during insertion may also cut vessels or puncture organs that may result in patient injury or surgical complications.

[0005] In some cases, shields have been provided with the obturators in order to sense penetration of the abdominal wall and immediately shield the sharp blades, edges or piercing points. These shielding systems are typically complex and require some time to deploy and, as such, many have not been effective in protecting the vessels and organs against the sharp blades, edges or piercing points.

[0006] US 5,569,291, WO 03/026512 and WO 96/01074 each disclose surgical instrument that separates tissue during insertion through a body wall and permits an optical instrument to be inserted to permit visualization during insertion. The preamble of appended

claim 1 is based on the disclosure of US 5,569,291,

SUMMARY OF THE INVENTION

[0007] According to the present invention there is provided a surgical access device as defined in appended claim 1.

[0008] The invention is particularly directed to a bladeless trocar obturator to separate or divaricate body tissue during insertion through a body wall. The distal tip of the bladeless obturator is constructed of a transparent material to enable visualization of tissue during the insertion of the obturator through the body wall. The bladeless obturator may be configured to enable the insertion of a conventional laparoscope which typically includes an imaging element and fiber optic light fibers. During use, the bladeless obturator is first inserted into and through a trocar seal and cannula. A conventional laparoscope can then be inserted into the proximal end of the bladeless obturator and advanced to the distal tip of the obturator. An endoscopic video camera may be attached to the proximal end of the laparoscope and the bladeless trocar system is then axially advanced by the surgeon through the body wall, the surgeon can visually observe the tissue as it is being separated via a video monitor that is connected to the endoscopic video camera.

[0009] The obturator of the invention may comprise a bladeless tip disposed at the distal end of the shaft and having a generally tapered configuration with an outer surface, the outer surface extending distally to a blunt point with a pair of side sections having a common shape and being separated by at least one intermediate section, wherein each of the side sections extends from the blunt point radially outwardly with progressive positions proximally along the axis. With this aspect, the tapered configuration facilitates separation or spreading of different layers of the body tissue and provides proper alignment of the tip between the layers. The side sections include a distal portion and a proximal portion, the distal portion of the side sections being twisted radially with respect to the proximal portion of the side sections. The intermediate section includes a distal portion and a proximal portion, the distal portion of the intermediate section being twisted in a first radial direction and the proximal portion of the intermediate section being twisted in a second radial direction opposite the first radial direction.

[0010] The bladeless tip is formed from a transparent material. The bladeless tip can be formed from a plastic material or a glass material. The plastic material can be at least one of polycarbonate, polyphenylsulfone, polyetherimide, acrylic, and polyvinyl chloride. The bladeless obturator can be constructed such that at least one of the shaft and the tip is formed from a reusable or a disposable material. The reusable material can be a metallic material or an autoclavable polymer. The bladeless tip can be generally hollow or substantially solid to receive the distal end of the optical instrument. The bladeless tip can also be solid. The bladeless tip can further comprise

at least one portion that is marked differently from the rest of the tip to serve as an indicator, for example, of depth as the tip is being inserted into the body tissue. The bladeless tip can be shaped and configured to receive the distal end of the optical instrument having an angled or non-angled lens. The bladeless tip can further comprise a ledge to provide proper positioning of the distal end of the optical instrument having an angled or non-angled lens. The bladeless tip can further comprise a bulbous section to accommodate the distal end of the angled lens optical instrument. The bladeless tip can be further coated or formed from a soft elastomeric material. The shaft and the tip can be connected together by adhesive bonding, ultrasonic welding, snap-fitting, with a shrink tube, or by overmolding the tip over the shaft. The bladeless tip can further comprise a cutout section to provide the distal end of the optical instrument with direct vision of the body tissue.

[0011] The bladeless obturator comprises a lock disposed at the proximal end of the shaft to frictionally lock the optical instrument in an axial position in the shaft. The lock prevents the optical instrument from moving axially relative to the shaft but may allow the optical instrument to rotate freely in the shaft. The lock can be constructed from a plastic material including polycarbonate. The lock comprises an elastomeric element that facilitates frictional engagement with the optical instrument in the axial position relative to the shaft.

[0012] The bladeless obturator may further comprises a cap disposed at the proximal end of the shaft. The cap may further comprise a handle.

[0013] These and other features of the invention will become more apparent with a discussion of the various embodiments in reference to the associated drawings.

DESCRIPTION OF THE DRAWINGS

[0014] The accompanying drawings, which are included in and constitute a part of this specification, illustrate the embodiments of the invention and, together with the description, explain the features and principles of the invention. In the drawings:

FIGS. 1A and 1B illustrate side views of a trocar system including a cannula with associated valve housing, and an obturator with a blunt tip extending through the working channel of the cannula to facilitate placement across the abdominal wall;

FIG. 2 is a side elevation view of the blunt tip of the obturator;

FIG. 3 is a side elevation view of the blunt tip taken along line 3-3 of FIG. 2;

FIG. 4 is an end view taken along line 4-4 of FIG. 2;

FIG. 5 is a radial cross-section view taken along line 5-5 of FIG. 2;

FIG. 6 is a radial cross-section view taken along line 6-6 of FIG. 2;

FIG. 7 is a radial cross-section view taken along line

7-7 of FIG. 2;

FIG. 8 is a radial cross-section view taken along line 8-8 of FIG. 2;

FIG. 9 is a radial cross-section view taken along line 9-9 of FIG. 2;

FIG. 10 is a schematic view illustrating each of the FIGS. 4-9 superimposed to facilitate an understanding of the blunt tip and its twisted configuration;

FIG. 11 illustrates a side view of a bladeless obturator having a tip formed as a blunt tapered shape;

FIG. 12 illustrates a side view of a bladeless obturator having a tip formed as a pyramidal shape;

FIG. 13 illustrates a side view of a bladeless obturator having a fully radiused tip;

FIGS. 14 and 15 illustrate a side view and a cross-section view, respectively, of the trocar system of FIGS. 1A and 1B and further illustrating the insertion of a laparoscope;

FIG. 16 illustrates a side view of a bladeless obturator having a bulbous tip;

FIG. 17 illustrates a side view of a bladeless obturator having a tip with a cutout section;

FIG. 18 illustrates a side view of a bladeless obturator having a shaft with a cutout section;

FIG. 19 illustrates a side view of a bladeless obturator and a cover for the cutout section of the shaft of FIG. 18;

FIGS. 20 and 21 illustrate side views of a bladeless obturator having a laparoscope lock;

FIGS. 22 and 23 illustrate side views of a bladeless obturator including a cap with pistol-grip handle;

FIGS. 24 and 25 illustrate the locking mechanism between the bladeless obturator and the trocar seal; and

FIGS. 26 and 27 illustrate the release mechanism between the bladeless obturator and the trocar seal.

DESCRIPTION OF THE INVENTION

[0015] A trocar system is illustrated in FIG. 1 and is designated by reference numeral 10. This system includes a cannula 12, defining a working channel 14, and a valve housing 16. The system 10 also includes an obturator 18 having a shaft 21 extending along an axis 23. A handle 25 is disposed at a proximal end of the shaft 21 while a blunt tip 27 is disposed at a distal end of the shaft 21. The shaft 21 of the obturator 18 is sized and configured for disposition within the working channel 14 of the cannula 12. With this disposition, the obturator 18 can be placed across a body wall such as the abdominal wall to provide the cannula 12 with access across the wall and into a body cavity, such as the peritoneal or abdominal cavity. The blunt tip 27 serves to direct the obturator 18 through the abdominal wall and the peritoneum, and can be removed with the obturator 18 once the cannula 12 is operatively disposed with the working channel 14 extending into the abdominal cavity. The diameter of the shaft 21 can range from about 3 mm to

about 20 mm and is designed to fit within a trocar seal and the cannula 12.

[0016] The tip 27 is provided with a blunt tip configuration. The blunt tip 27 takes into account the anatomical configuration of the abdominal wall with an improved structural design and method of insertion. To fully appreciate these aspects, it is helpful to initially discuss the anatomy associated with the abdominal wall. The abdominal wall typically includes a skin layer and a series of muscle layers, in addition to fat and fascia. The muscle layers are each defined by muscle fibers that extend generally parallel to each other in a direction that is different for each of the layers. For example, fibers of a first muscle layer and a second muscle layer may extend in directions that are generally 90 degrees off of each other.

[0017] Having noted the directional nature of the muscle fibers, it can be appreciated that such a structure may be separated or divaricated by an obturator having a blunt tip. The blunt tip may also include a twisted rectangular configuration to facilitate movement between the muscle fibers and layers. That is, the blunt tip is capable of being moved generally parallel to and between the fibers associated with a particular muscle layer.

[0018] As described earlier, the fibers of the muscle layers may be oriented at different angles to each other such that proper alignment of the tip 27 for separation of one layer may not necessarily result in proper alignment for separation of the next layer. For at least this reason, the obturator 18 has a blunt tip 27 to direct the obturator 18 through the different layers and a rectangular configuration that is twisted slightly so that separation of a first layer begins to rotate the distal end of the blunt tip 27 into proper orientation for separation of the next layer.

[0019] The twisted configuration of the blunt tip 27 also causes the blunt tip 27 to function, for example, with the mechanical advantage of a screw thread. With this configuration, an exemplary method of placement requires that the user grip the handle 25 of the obturator 18 and twist it about the axis 23. This twisting motion in combination with the screw configuration of the blunt tip 27 converts radial movement into forward movement along the axis 23. Thus, the user applies both a forwardly directed force as well as a radial force to move the trocar system 10 in a forward direction.

[0020] The twisted configuration of the blunt tip 27 is most apparent in the side elevation views of FIGS. 2 and 3. In this embodiment, the blunt tip 27 comprises generally of eight surfaces: two opposing surfaces 50 and 52, separated by two side surfaces 54 and 56, two end surfaces 58 and 59, a generally tapered surface 60 formed in surfaces 50 and 52 around axis 23 and extending beyond end surfaces 58 and 59, and a blunt surface 62.

[0021] The surfaces 50 and 52, side surfaces 54 and 56, and tapered surface 60 generally define the cross-section of the blunt tip 27 from blunt surface 62 to proximal end 61. This configuration can best be appreciated with reference to the cross-section views of FIGS. 4-9. In FIG. 4, the distal end of the blunt tip 27 is shown with a circle

64 having the smallest circular area and a rectangle 63 having the greatest length-to-width ratio. The rectangle 63 has a twisted, S-shaped configuration at end surfaces 58 and 59.

[0022] As views are taken along progressive proximal cross-sections, it can be seen that the circle 64 becomes larger and the rectangle 63 becomes less twisted, and the width increases relative to the length of the rectangle 63. The spiral nature of the blunt tip 27 is also apparent as the circle 64 and rectangle 63 move counterclockwise around the axis 23. This is perhaps best appreciated in a comparison of the circle 64 and the rectangle 63 in FIG. 6 relative to that in FIG. 5. With progressive proximal positions, the circle 64 begins to expand with increasing circular area and the rectangle 63 begins to widen with a reduction in the ratio of length to width. The long sides of the rectangle 63 also tend to become more arcuate as they approach a more rounded configuration most apparent in FIGS. 8 and 9. That is, the circle 64 and the rounded rectangle 63 become more circular with progressive proximal positions. Furthermore, the circle 64 expands at a lesser rate than the rectangle 63, which eventually absorbs the circle 64 as shown in FIGS. 8 and 9. In these figures, it will also be apparent that the rotation of the rectangle 63 reaches a most counterclockwise position and then begins to move clockwise. This is best illustrated in FIGS. 7-9. This back and forth rotation results from the configuration of the side surfaces 54 and 56, which in general are U-shaped as best illustrated in FIGS. 2 and 3.

[0023] The ratio of the length to width of the rectangle 63 is dependent on the configuration of the side surfaces 54 and 56, which define the short sides of the rectangle 63 as well as the configuration of the surfaces 50 and 52, which define the long sides of the rectangle 63. Again with reference to FIGS. 2 and 3, it can be seen that the side surfaces 54 and 56 are most narrow at the end surfaces 58 and 59. As the side surfaces 54 and 56 extend proximally, they reach a maximum width near the point of the most counterclockwise rotation, shown generally in FIG. 8, and then reduce in width as they approach the proximal end 61. Along this same distal to proximal path, the surfaces 50 and 52 transition from a generally flat configuration at the end surfaces 58 and 59 to a generally rounded configuration at the proximal end 61.

[0024] In the progressive views of FIGS. 5-7, the circle 64 is further designated with a lower case letter a, b or c, respectively; similarly, the rectangle 63 is further designated with a lower case letter a, b, c, d or e, respectively, in FIGS. 5-9. In FIG. 10, the circles 64, 64a-64c and the rectangles 63, 63a-63e are superimposed on the axis 23 to show their relative sizes, shapes and angular orientations.

[0025] With a generally tapered configuration at the distal end and a rectangular configuration at a distal portion of the tip, the tip 27 appears much like a flathead screwdriver having a blunt tip. More particularly, the tip 27 includes a tapered structure extending outward from

the end surfaces 58 and 59 that serves to direct the obturator 18 through the tissue fibers.

[0026] In one aspect, the lengths of the end surfaces 58 and 59 may be aligned parallel with the fibers of each muscle layer. A simple back and forth twisting motion of the blunt tip 27 tends to separate the fibers along natural lines of separation, opening the muscle layer to accept the larger diameter of the cannula 12. Once the first layer is substantially separated, the tapered and twisted configuration of the blunt tip 27 directs and turns the rectangle 63 more into a parallel alignment with fibers in the next layer. Again, the blunt tip 27 and the twisting or dithering motion facilitates an easy separation of the fibers requiring a significantly reduced insertion force.

[0027] A method of separating tissue is provided that can be applied to any object with a blunt tip and generally flat sides. In particular, the device of the invention can be operated by rotating in alternating clockwise and counterclockwise directions while applying a downward force. When rotating in alternating directions, the tissue is moved apart and a larger opening is created for a profile of greater cross-sectional area to follow. This process continues safely as the device enters the peritoneal cavity and moves to its operative position.

[0028] When the cannula 12 is ultimately removed, the size of the opening left in the tissue is minimal. Importantly, this opening is left with a small defect that does not require suturing due to a dilating effect caused by the mere separation of fibers. Since there are no sharp blades, sharp edges or piercing points to cut tissue fibers, the healing process is shortened. It is appreciated that, the tip of the bladeless obturator 18 can be formed as a generally tapered shape 27a with a blunt distal end as illustrated in FIG. 11, as a pyramidal shape 27b with a blunt distal end and blunt edges as illustrated in FIG. 12, and as a fully radiused tip 27c for insertion through flaccid tissue or an existing body orifice such as the urethra as illustrated in FIG. 13.

[0029] The blunt tip 27 can be formed from a translucent or a transparent material. The blunt tip 27 can be formed from a plastic material or a glass material. In one aspect, the shaft 21 and the tip 27 are formed from a transparent polycarbonate material.

[0030] Referring to FIGS. 14 and 15, the bladeless obturator 18 is designed to accommodate the insertion of a conventional laparoscope 30. In particular, the shaft 21 of the bladeless obturator 18 is hollow to allow for the insertion of the laparoscope 30 at an opening 32. The shaft 21 is sized and configured to allow the laparoscope 30 to slide within proximity of the tip 27 thus providing a viewing area through the tip 27. An endoscopic video camera (not shown) is typically connected to the laparoscope 30 and this combination is connected to a video monitor. By enabling the positioning of the conventional laparoscope 30 within the tip 27 of the bladeless obturator 18, it is possible to visually observe body tissue as it is being separated by the trocar system 10. Visualization of body tissue as it is being separated by the trocar sys-

tem 10 allows a surgeon to monitor the advancement of the trocar system 10 and to avoid traumatizing vessels or organs. For example, during a laparoscopic cholecystectomy, a trocar is usually placed through the umbilicus of the patient. The placement of this trocar is typically performed in a blind fashion in that the surgeon cannot see where the tip of the trocar is as it is advanced through the abdominal wall and into the abdominal cavity of the patient. This results in a high degree of risk that the trocar may be inadvertently advanced too far into the abdomen of the patient resulting in trauma to vital organs and/or vessels. By providing a trocar system with visualization properties, this risk is diminished as the surgeon is better able to determine when the trocar has traversed the abdominal wall.

[0031] It is appreciated that the tip 27 may be generally hollow or it may be substantially solid to receive the distal end of the laparoscope 30. In another aspect, the tip 27 may be a solid tip. The tip 27 may further comprise at least one portion that is marked differently from the rest of the tip to serve as an indicator, for example, of depth as the tip 27 is being inserted into the body tissue. The at least one portion may be opaque or marked with a different color from the rest of the tip 27.

[0032] The shaft 21 and the tip 27 of the bladeless obturator 18 can accommodate a laparoscope with a non-angled lens, also known as a 0° laparoscope. The shaft 21 and the tip 27 can also accommodate a laparoscope with an angled lens such as a 30° laparoscope. The tip 27 is designed such that when either a 0° laparoscope or a 30° laparoscope is inserted therein, the lens of the laparoscope extends beyond a distal edge 36 of the cannula 12 thereby providing a clear and unobstructed view through the tip 27. The tip 27 further includes a ledge 39 that properly engages either the 0° laparoscope or the 30° laparoscope.

[0033] It should be noted that conventional trocars with visualization properties typically require a 0° laparoscope for insertion of the trocars and a 30° laparoscope for viewing anatomical structures during the remainder of the laparoscopic procedure. This requires the operating staff to provide two laparoscopes for the laparoscopic procedure, which increases hospital inventory costs and surgical preparation costs relating to cleaning and sterilization of the laparoscopes. In addition, because two laparoscopes are required for the laparoscopic procedure, there is additional operating room time required during the surgical procedure to transfer the endoscopic video camera from the 0° laparoscope to the 30° laparoscope which results in increased operating room costs for the hospital.

[0034] The bladeless obturator of for use with the present invention may provide a clear unobstructed view of body tissue through either a 0° or a 30° laparoscope, therefore obviating the need for a hospital to carry the additional inventory required to provide two laparoscopes for each laparoscopic surgical procedure, and obviating the need for a hospital to clean and sterilize a

second laparoscope for each laparoscopic surgical procedure, and obviating the need to transfer the endoscopic video equipment from one laparoscope to the other laparoscope during each laparoscopic surgical procedure. Referring to FIG. 16, the shaft 21 may include a tip with a bulbous section 27d to better accommodate the distal end of the angled lens laparoscope. By adding the bulbous section 27d, the distal end of the angled lens laparoscope would be closer to the tip of the obturator thereby improving visualization.

[0035] The bladeless obturator can include integral fiber optic light fiber elements and an integral imaging element within the shaft and the tip of the obturator. The bladeless obturator with integral imaging means can be formed of reusable or disposable materials.

[0036] The bladeless obturator 18 can be constructed as a single component or as multiple components such as the shaft 21 and the tip 27. If the obturator 18 is constructed as a single component, then it can be formed from either disposable or reusable materials. If the obturator 18 is constructed as two or more components, then each component can be formed from either disposable or reusable materials as desired for a particular configuration. In one aspect, the obturator 18 is constructed from a single reusable material such as metal (e.g., stainless steel) or an autoclavable polymer to facilitate re-sterilization. In another aspect, the obturator 18 is formed from a transparent steam sterilizable reusable plastic material such as polyphenylsulfone or polyetherimide. The blunt tip 27 can also be coated or otherwise constructed from a soft elastomeric material. In such a case, the material can be a solid elastomer or composite elastomer/polymer.

[0037] It is further appreciated that the shaft 21 can be formed so as to be partially or fully flexible. With this configuration, the obturator 18 can be inserted through a passageway containing one or more curves of virtually any shape. A partially or fully flexed obturator 18 can then be used with a flexible cannula 12 allowing greater access to an associated body cavity.

[0038] The obturator 18 can include a separately molded tip 27 and a molded or extruded shaft 21 with the two components, as explained above, comprising of the same material or different materials. The tip 27 can then be attached to the shaft 21 by adhesive bonding, ultrasonic welding, snap-fitting, or with a shrink tube. The tip 27 can also be overmolded over the shaft 21 to mechanically lock the two components together. The tip 27 can be formed from a transparent material such as polycarbonate to enable visualization while the shaft 21 can be formed from either an opaque material or a transparent material. The shaft 21 can also be formed from a metal material.

[0039] In another aspect, the obturator 18 can include a disposable tip that is releasably attached to a reusable shaft 21. In this aspect, a new tip 27 can be used for each procedure to provide optimal visualization through the tip 27 of the obturator 18 during each procedure.

[0040] Referring to FIG. 17, there is shown a shaft 21e including a cutout section 100e in the tip portion 27e that enables direct visualization of the body tissue as the tip 27e separates tissue fibers. By providing an obturator with cutout sections, the reflection of light from the laparoscope is minimized and the visibility of the tissue through the laparoscope is improved as compared to a design where visualization occurs through a plastic or glass window. It is appreciated that the shaft 21e can include a single or a plurality of cutouts 100e in the tip 27e or along the shaft of the obturator.

[0041] Referring to FIG. 18, there is shown a shaft 21f having a cutout portion 100f along the axial axis of the shaft 21 f. The shaft 21f has a cross-section of about $\frac{1}{2}$ -circle to about $\frac{3}{4}$ -circle and the cutout portion 100f has a cross-section of about $\frac{1}{2}$ -circle to about $\frac{1}{4}$ -circle. An advantage of this is the wall of the shaft 21f can be a little thicker as a result of the cutout section, which makes injection molding of the shaft easier.

[0042] Referring to FIG. 19, there is shown a cover 102f that can be attached over the cutout portion 100f of the $\frac{1}{2}$ -circle shaft 21f as shown in FIG. 18. In particular, a polycarbonate cover also with a $\frac{1}{2}$ -circle shaped cross-section can be attached to the shaft to form a tubular cross-section. An advantage of molding the tubular shaft 21f in two pieces is increased manufacturability of the shaft 21 f. The cover 102f can be attached to the shaft 21f with an adhesive bond, an ultrasonic weld, a snap-fit, or with a shrink tube.

[0043] The obturator can be formed from two clam-shell components each including one-half of the shaft and tip configuration along the axial axis of the obturator. The two components can then be affixed together using an adhesive bond, an ultrasonic weld, an outer shrink tube, or a snap fit.

[0044] Referring to FIGS. 20 and 21, a feature in accordance with the present invention of the bladeless obturator 18 is it is designed to frictionally lock the laparoscope 30 in place using a laparoscope lock 40, which can be formed within the handle 25. The laparoscope lock 40 prevents the laparoscope 30 from moving axially relative to the shaft 21 of the obturator 18 during handling within the sterile field and during insertion through a body wall but may enable the laparoscope 30 to rotate freely relative to the shaft 21. This rotation of the lock 40 enables the trocar system 10 to be twisted during insertion into and through the abdominal wall while maintaining the laparoscope 30 in a fixed rotational position that provides for a stable viewing image on the video monitor.

[0045] The conventional obturators with visualization properties include means for locking the laparoscope in place but these obturators lock the laparoscope both axially and rotationally. A drawback of the conventional devices is the viewing image on the video monitor is unstable if the trocar is twisted during insertion. More specifically, with prior art obturator laparoscope locks, if the trocar is twisted back and forth in a clockwise and counter-clockwise fashion, the laparoscope also moves clock-

wise and counter-clockwise with the trocar resulting in an oscillating and disorienting viewing image on the video monitor. The laparoscope lock 40 of the present invention improves visualization and enables a more precise placement of the trocar within the body tissue and across the body wall as compared to obturators of the prior art while preventing inadvertent axial movement of the laparoscope during handling and use.

[0046] In one aspect of the invention as illustrated in FIGS. 20 and 21, the bladeless obturator 18 further comprises a cap 42 that can be snap-fitted onto the proximal end of the obturator shaft 21, after which the laparoscope lock 40 can be snap-fitted onto the end of the cap 42. Both the cap 42 and the lock 40 can be formed of a plastic material such as polycarbonate. The obturator cap 42 can be provided with and without a pistol-grip handle. The handled version of the bladeless obturator provides a pistol-grip to ease insertion of the trocar system as illustrated in FIGS. 22 and 23. The pistol-grip handle is designed to nest into the handle on the trocar seal to prevent excessive flexure of the handle during insertion of the trocar as illustrated in FIG. 23. More particularly, the handled bladeless obturator includes three components comprising of an obturator shaft 21b, an obturator cap 42b having a pistol-grip handle 26b, and a laparoscope lock 40b, all of which can be injection molded out of polycarbonate. The pistol-grip handle 26b can be formed with two components frictionally fitted together with, for example, interference pins. The interference pins can be fitted into holes in the handle 26b to affect a frictional lock between the two components.

[0047] Referring to FIG. 24, the bladeless obturator 18 is designed to releasably attach to a trocar seal 17 via two cantilever snap-fits 70a, 70b. As the obturator 18 is inserted into the trocar seal 17 and cannula 12, the snap-fits 70a, 70b passively engage the trocar seal 17 and serve to axially lock the obturator 18 to the trocar seal 17 and cannula 12 (FIGS. 24 and 25). To release the obturator 18 from the trocar seal 17 and cannula 12, outboard tabs 72a, 72b on the obturator cap 42 are depressed inwardly and the obturator 18 is then free to be slidably removed as illustrated in FIGS. 26 and 27. Referring back to FIGS. 20 and 21, the bladeless obturator 18 includes axial key members 74 at its proximal end which are designed to mate with axial keyways on the trocar seal 17. As the bladeless obturator 18 is inserted into the trocar seal 17 and cannula 12, the obturator 18 is rotated slightly to align the axial key members 74 with the axial keyways and then advanced until the snap-fits 70a, 70b engage the trocar seal 17. The axial key members 74 serve to rotationally lock the obturator 18 to the trocar seal 17.

[0048] Referring back to FIGS. 20 and 21, the obturator shaft 21 of the bladeless obturator 18 can be configured with a barb 76 at its proximal end. The barb 76 is vertically slotted to enable the shaft 21 to flex during assembly. The obturator shaft 21 may also include a plurality of keys (not shown) near its proximal end. The obturator cap 42 is configured to axially slide over the barb 76 on the ob-

turator shaft 21 to affect a one-way snap-fit lock between the two components. This snap-fit prevents the removal of the obturator cap 42 from the obturator shaft 21. The obturator cap 42 may further include keyways (not shown) that engage the keys on the obturator shaft 21 to rotationally index the components together. The obturator cap 42 may further include a second barb (not shown) at its proximal end. The laparoscope lock 40 may include a plurality of tabs (not shown) that are designed to spread and axially slide over the second barb on the obturator cap 42 to affect a one-way snap-fit lock between the obturator cap 42 and the laparoscope lock 40. This snap-fit prevents the axial removal of the laparoscope lock 40 from the obturator cap 42. The laparoscope lock 40 is free to rotate relative to the obturator cap 42.

[0049] In accordance with the present invention the lock for the optical instrument may include an elastomeric element. The addition of the elastomeric element can enhance the frictional engagement with the laparoscope. An example of such an elastomeric element is a silicone O-ring sized with an inside diameter smaller than the outside diameter of the laparoscope. The laparoscope lock can either rotate freely to enable the laparoscope to rotate freely relative to the shaft or the laparoscope lock can be rotationally fixed to prevent the laparoscope from rotating relative to the shaft.

[0050] The obturator 18 can also be used as an insufflation needle having a passageway and valve to administer carbon dioxide or other insufflation gas to the peritoneal cavity. The obturator 18 can also be used with an insufflation needle cannula in which case removal of the obturator 18 upon entry would allow for rapid insufflation of the peritoneal cavity.

[0051] The bladeless obturator can be formed with a 2-3 mm outer diameter and with a small thru-hole at its distal end. The bladeless obturator can be used in conjunction with a miniaturized laparoscope to provide initial access into a hollow body cavity. Once access is obtained, the laparoscope can be removed from the bladeless obturator and an insufflation gas such as carbon dioxide can be dispensed through the obturator into the hollow body cavity. The bladeless obturator can also include holes in the tip portion to enhance the flow of insufflation gases through the obturator. More particularly, the bladeless obturator can be formed with a 2-3 mm outer diameter and used in conjunction with a miniaturized laparoscope to provide initial access into a hollow body cavity. After access is obtained, the bladeless obturator can be removed from the trocar cannula and an insufflation gas such as carbon dioxide can be dispensed through the cannula and into the hollow body cavity.

[0052] It will be understood that many modifications can be made to the disclosed embodiments without departing from the scope of the invention as defined by the claims. For example, various sizes of the surgical device are contemplated as well as various types of constructions and materials. It will also be apparent that many modifications can be made to the configuration of parts

as well as their interaction. For these reasons, the above description should not be construed as limiting the invention, but should be interpreted as merely exemplary of preferred embodiments.

Claims

1. A surgical access device comprising:

a tissue separating obturator (18) comprising:

an elongate shaft portion (21) extending along a longitudinal axis (23) and defining a first lumen between an open proximal end and a distal end; and

a transparent distal tip portion (27) with an inner surface and an outer surface adapted for penetrating tissue; the distal tip portion (27) disposed at the distal end of the shaft portion (21); at least part of the tip portion (27) having a generally tapered configuration; and

wherein the first lumen is sized and configured to receive an optical instrument having a distal end adapted to receive an image and the tip portion (27) being adapted to permit passage of an image;

a lock (40) disposed at the proximal end of the shaft portion (21);

the access device further including an optical instrument having an outside diameter; **characterized in that** the lock (40) has an inside diameter that is smaller than the outside diameter of the optical instrument in an unlocked state and is adapted to frictionally engage against an outside diameter of the optical instrument inserted into the first lumen to frictionally lock the optical instrument in an axial position in the shaft portion (21).

2. The surgical access device of claim 1 wherein the lock (40) is configured to rotate freely to allow the optical instrument to rotate freely inside and relative to the elongate shaft portion (21).

3. The surgical access device of claim 1 further including a cannula (12) comprising an elongate shaft (21) extending along a longitudinal axis (23) and defining a second lumen (14) between an open proximal end and an open distal end; the cannula (12) being configured to receive the obturator (18) inside the second lumen (14) and to connect to the obturator (18) such that the obturator (18) does not move axially or rotationally relative to the cannula (12).

4. The surgical access device of claim 1 wherein the

lock (40) is an O-ring.

5. The surgical access device of claim 1 further including at least one hole in the distal tip portion (27).

6. The surgical access device of claim 1 wherein the at least one hole in the distal tip portion (27) is configured for delivering insufflation gases through the obturator (18) and out the at least one hole.

7. The surgical access device of claim 1 wherein the transparent distal tip portion (27) has a hollow chamber with the first lumen extending into the hollow chamber.

8. The surgical access device of claim 7 wherein the optical instrument is a laparoscope and the distal end of the laparoscope when inserted extends into the hollow chamber of the tip portion (27).

9. The surgical access device of claim 1 wherein the lock is an elastomeric element.

Patentansprüche

1. Ein chirurgisches Zugangsgerät, das Folgendes beinhaltet:

einen gewebetrennenden Obturator (18), der Folgendes beinhaltet:

einen länglichen Schaftabschnitt (21), der sich entlang einer Längsachse (23) erstreckt und ein erstes Lumen zwischen einem offenen proximalen Ende und einem distalen Ende definiert; und

einen transparenten distalen Spitzenabschnitt (27) mit einer Innenfläche und einer Außenfläche, der zum Durchdringen von Gewebe angepasst ist; wobei der distale Spitzenabschnitt (27) am distalen Ende des Schaftabschnitts (21) angeordnet ist; wobei mindestens ein Teil des Spitzenabschnitts (27) eine im Allgemeinen konisch zulaufende Konfiguration aufweist; und

wobei das erste Lumen dazu dimensioniert und konfiguriert ist, ein optisches Instrument zu empfangen, das ein distales Ende aufweist, das dazu angepasst ist, ein Bild zu empfangen, und wobei der Spitzenabschnitt (27) dazu angepasst ist, den Durchtritt eines Bilds zu gestatten;

eine Arretierung (40), die an dem proximalen Ende des Schaftabschnitts (21) angeordnet ist;

wobei das Zugangsgerät ferner ein optisches Instrument beinhaltet, das einen Au-

- ßendurchmesser aufweist;
dadurch gekennzeichnet, dass die Arretierung (40) einen Innendurchmesser aufweist, der in einem nicht arretierten Zustand kleiner als der Außendurchmesser des optischen Instruments ist und zum Reibschluss gegen einen Außendurchmesser des optischen Instruments, das in das erste Lumen eingeführt wird, angepasst ist, um das optische Instrument durch Reibung in einer axialen Position in dem Schaftabschnitt (21) zu arretieren.
2. Das chirurgische Zugangsgerät gemäß Anspruch 1, wobei die Arretierung (40) dazu konfiguriert ist, frei zu rotieren, um es dem optischen Instrument zu gestatten, frei im Innern und relativ zu dem länglichen Schaftabschnitt (21) zu rotieren.
 3. Das chirurgische Zugangsgerät gemäß Anspruch 1, das ferner eine Kanüle (12) einschließt, die einen länglichen Schaft (21) beinhaltet, der sich entlang einer Längsachse (23) erstreckt und ein zweites Lumen (14) zwischen einem offenen proximalen Ende und einem offenen distalen Ende definiert; wobei die Kanüle (12) dazu konfiguriert ist, den Obturator (18) innerhalb des zweiten Lumens (14) zu empfangen und sich so mit dem Obturator (18) zu verbinden, dass der Obturator (18) sich nicht axial oder rotational im Verhältnis zu der Kanüle (12) bewegt.
 4. Das chirurgische Zugangsgerät gemäß Anspruch 1, wobei die Arretierung (40) ein O-Ring ist.
 5. Das chirurgische Zugangsgerät gemäß Anspruch 1, das ferner mindestens ein Loch in dem distalen Spitzenabschnitt (27) beinhaltet.
 6. Das chirurgische Zugangsgerät gemäß Anspruch 1, wobei das mindestens ein Loch in dem distalen Spitzenabschnitt (27) dazu konfiguriert ist, Insufflationsgase durch den Obturator (18) und aus dem mindestens einen Loch heraus zu leiten.
 7. Das chirurgische Zugangsgerät gemäß Anspruch 1, wobei der transparente distale Spitzenabschnitt (27) eine hohle Kammer aufweist, wobei das erste Lumen sich in die hohle Kammer hinein erstreckt.
 8. Das chirurgische Zugangsgerät gemäß Anspruch 7, wobei das optische Instrument ein Laparoskop ist und das distale Ende des Laparoscops, wenn es eingeführt ist, sich in die hohle Kammer des Spitzenabschnitts (27) hinein erstreckt.
 9. Das chirurgische Zugangsgerät gemäß Anspruch 1, wobei die Arretierung ein elastomeres Element ist.

Revendications

1. Appareil d'accès chirurgical, comprenant :

5 un obturateur séparateur de tissu (18) comprenant :

10 un partie d'arbre allongé (21) s'étendant le long d'un axe longitudinal (23) et définissant une première lumière entre une extrémité proximale ouverte et une extrémité distale; et

un partie de pointe distale transparente (27) ayant une surface interne et une surface externe adaptées pour pénétrer un tissu; la partie de pointe distale (27) étant disposée à l'extrémité distale de la partie d'arbre (21); au moins une partie de la partie de pointe (27) ayant une configuration généralement conique; et

25 dans lequel la première lumière est dimensionnée et configurée pour recevoir un instrument optique ayant une extrémité distale adaptée pour recevoir une image et la partie de pointe (27) étant adaptée pour permettre le passage d'une image;

un dispositif de verrouillage (40) disposé à l'extrémité proximale de la partie d'arbre (21);

30 l'appareil d'accès comprenant en outre un instrument optique ayant un diamètre extérieur;

caractérisé en ce que le dispositif de verrouillage (40) a un diamètre intérieur qui est plus petit que le diamètre extérieur de l'instrument optique dans un état non verrouillé et est adapté pour s'engager par frottement contre un diamètre extérieur de l'instrument optique introduit dans la première lumière afin de verrouiller par frottement l'instrument optique dans une position axiale dans la partie d'arbre (21).

2. Appareil d'accès chirurgical selon la revendication 1, dans lequel le dispositif de verrouillage (40) est configuré pour tourner librement afin de permettre à l'instrument optique de tourner librement à l'intérieur et par rapport à la partie d'arbre allongé (21).

3. Appareil d'accès chirurgical selon la revendication 1, comprenant en outre une canule (12) comprenant un arbre allongé (21) s'étendant le long d'un axe longitudinal (23) et définissant une deuxième lumière (14) entre une extrémité proximale ouverte et une extrémité distale ouverte; la canule (12) étant configurée pour recevoir l'obturateur (18) à l'intérieur de la deuxième lumière (14) et pour se raccorder à l'obturateur (18) de telle sorte que l'obturateur (18) ne

se déplace pas dans le plan axial ou rotatif par rapport à la canule (12).

4. Appareil d'accès chirurgical selon la revendication 1, dans lequel le dispositif de verrouillage (40) est un joint torique. 5
5. Appareil d'accès chirurgical selon la revendication 1, comprenant en outre au moins un trou dans la partie de pointe distale (27). 10
6. Appareil d'accès chirurgical selon la revendication 1, dans lequel le au moins un trou dans la partie de pointe distale (27) est configuré pour fournir des gaz d'insufflation à travers l'obturateur (18) et hors du au moins un trou. 15
7. Appareil d'accès chirurgical selon la revendication 1, dans lequel la partie de pointe distale transparente (27) a une chambre creuse avec la première lumière s'étendant dans la chambre creuse. 20
8. Appareil d'accès chirurgical selon la revendication 7, dans lequel l'instrument optique est un laparoscope et l'extrémité distale du laparoscope lorsqu'il est introduit, s'étend dans la chambre creuse de la partie de pointe (27). 25
9. Appareil d'accès chirurgical selon la revendication 1, dans lequel le dispositif de verrouillage est un élément en élastomère. 30

35

40

45

50

55

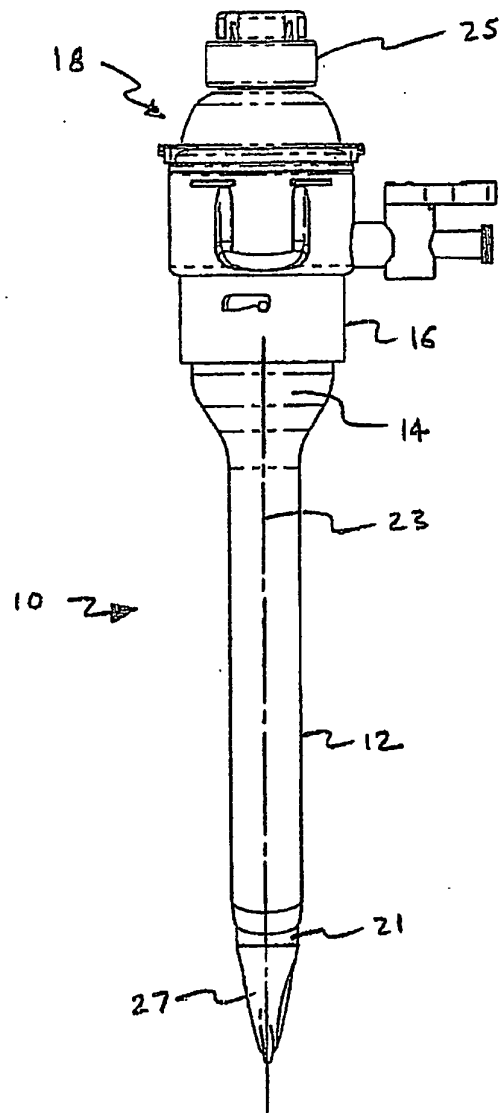


FIG. 1A

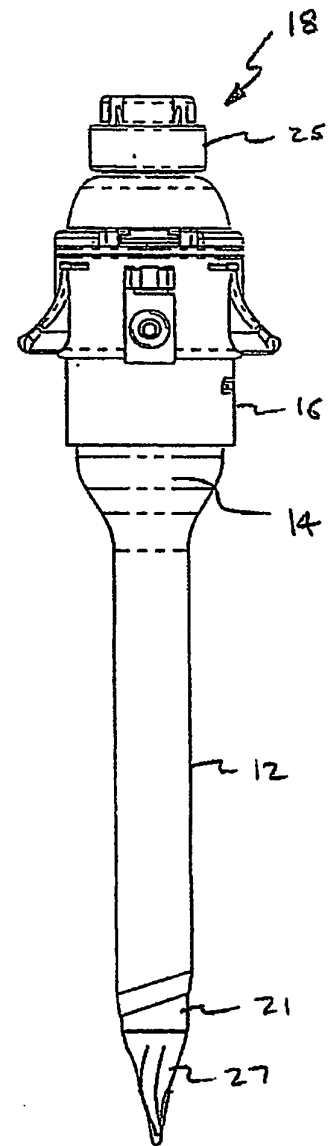


FIG. 1B

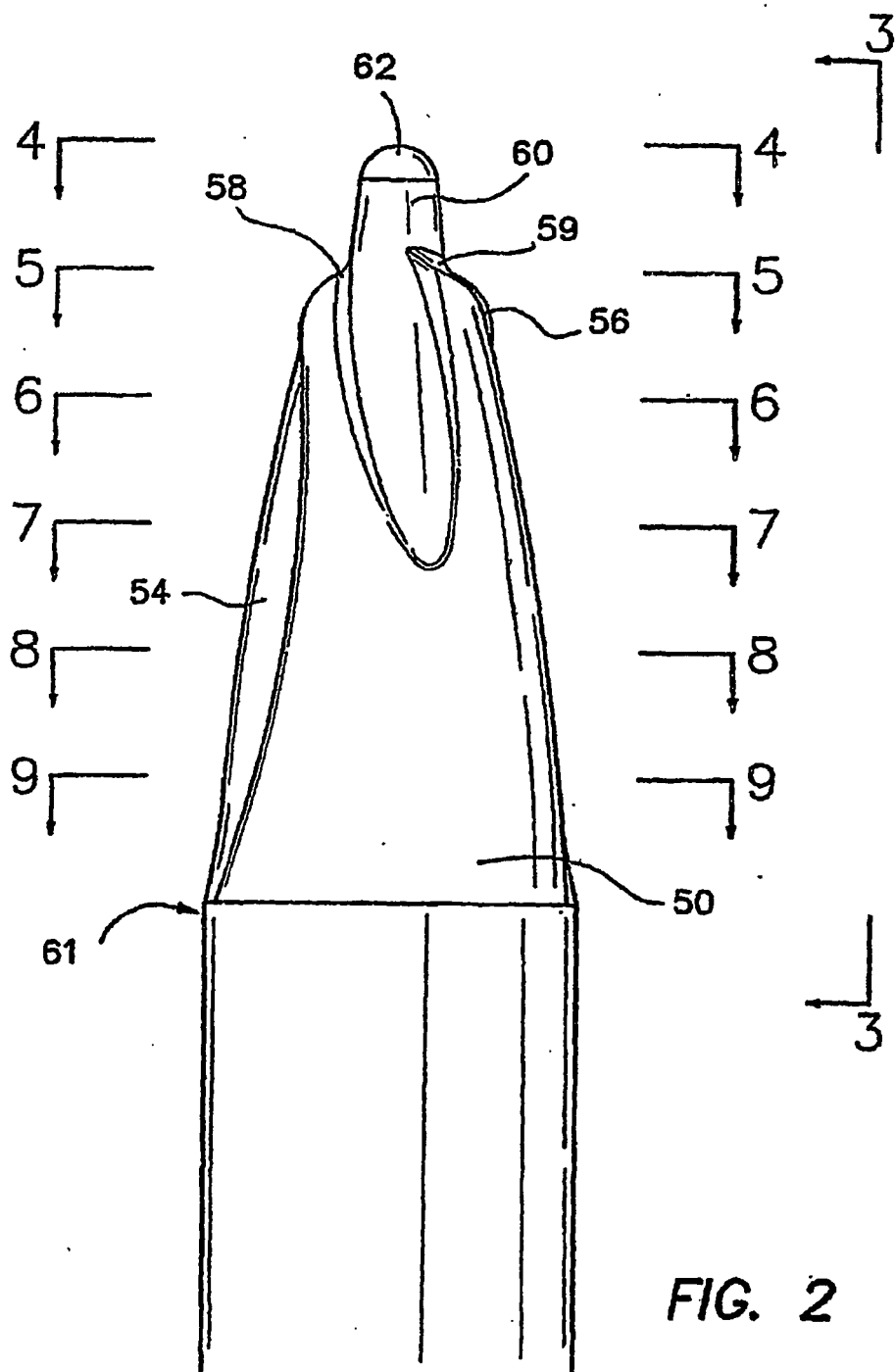


FIG. 2

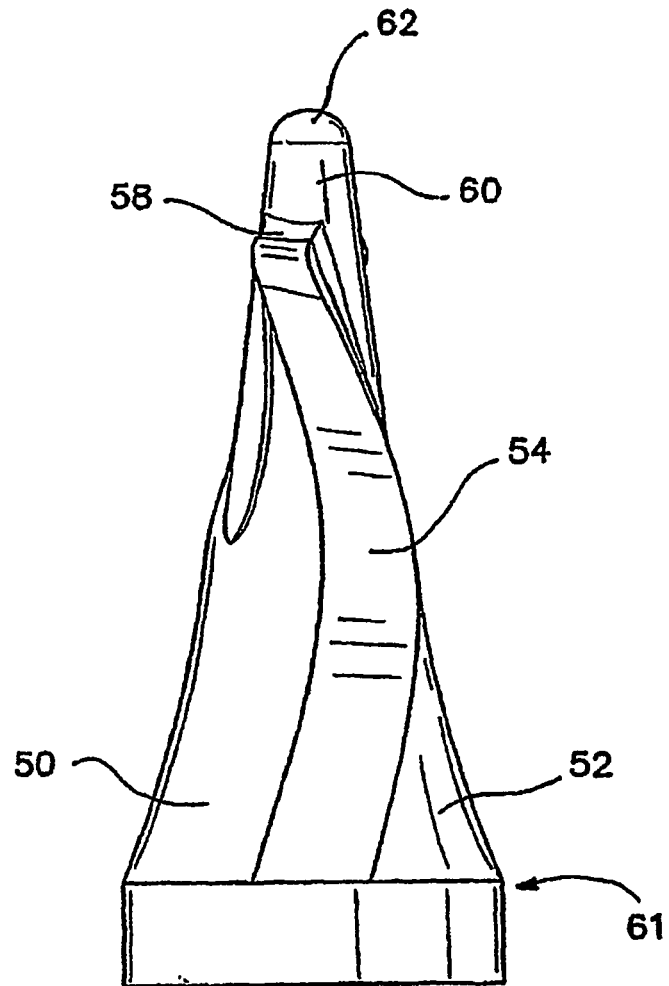
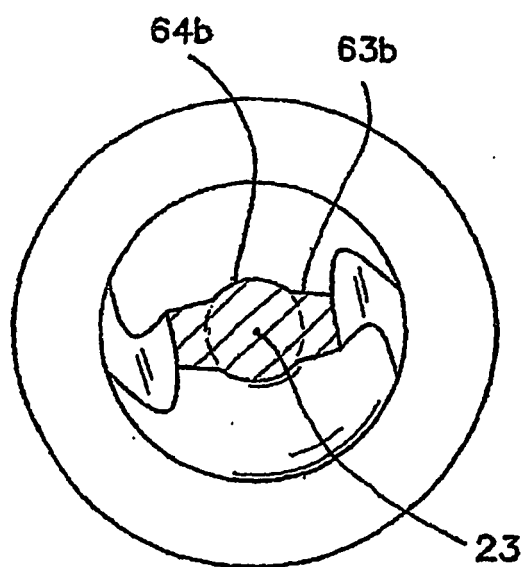
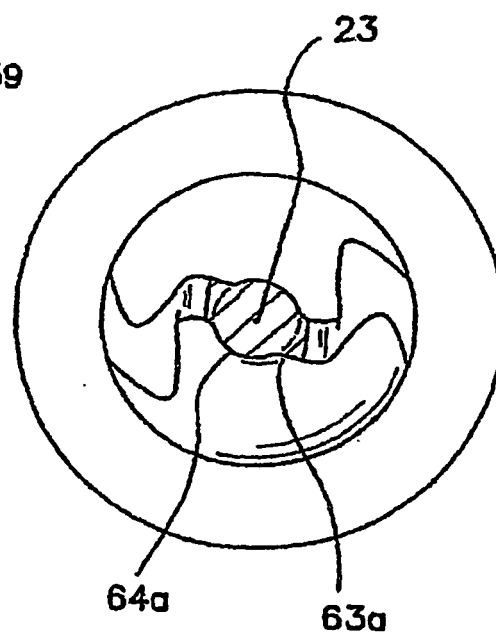
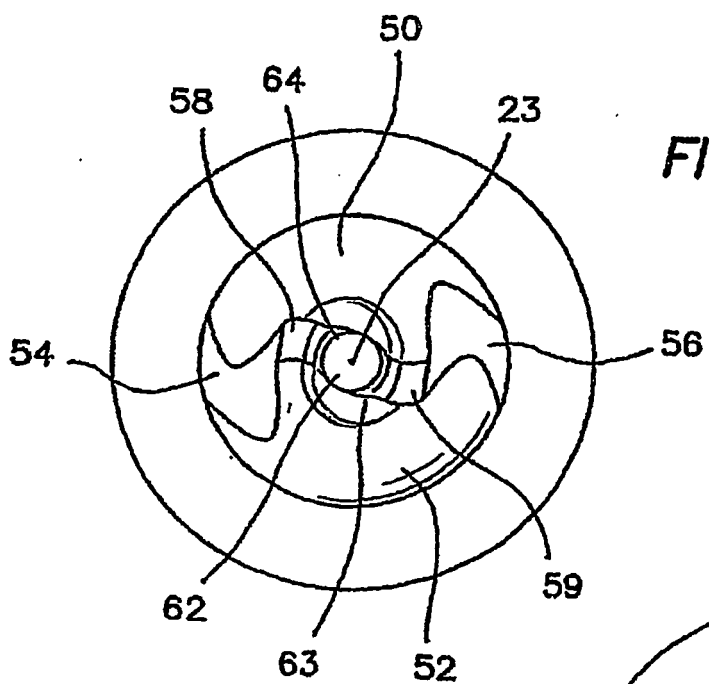


FIG. 3



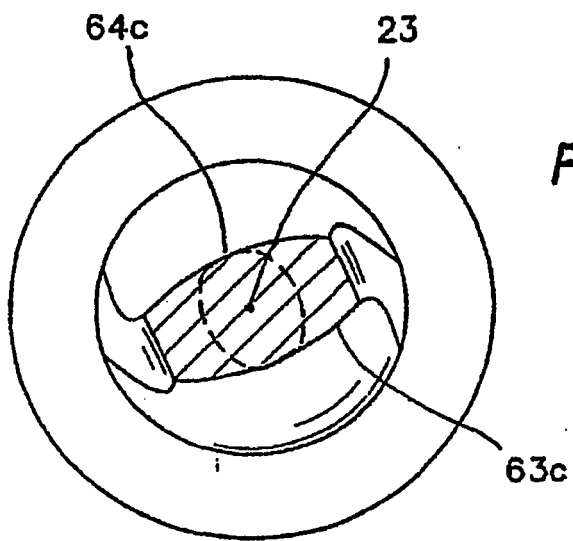


FIG. 7

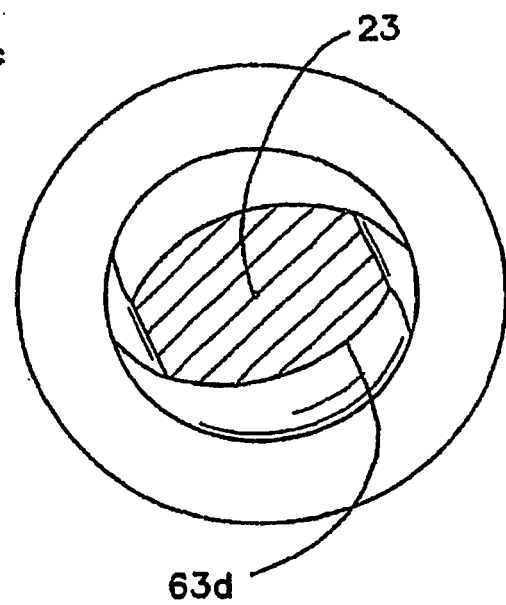


FIG. 8

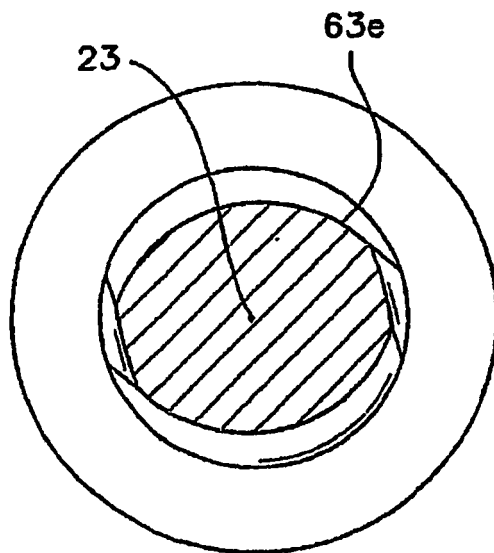


FIG. 9

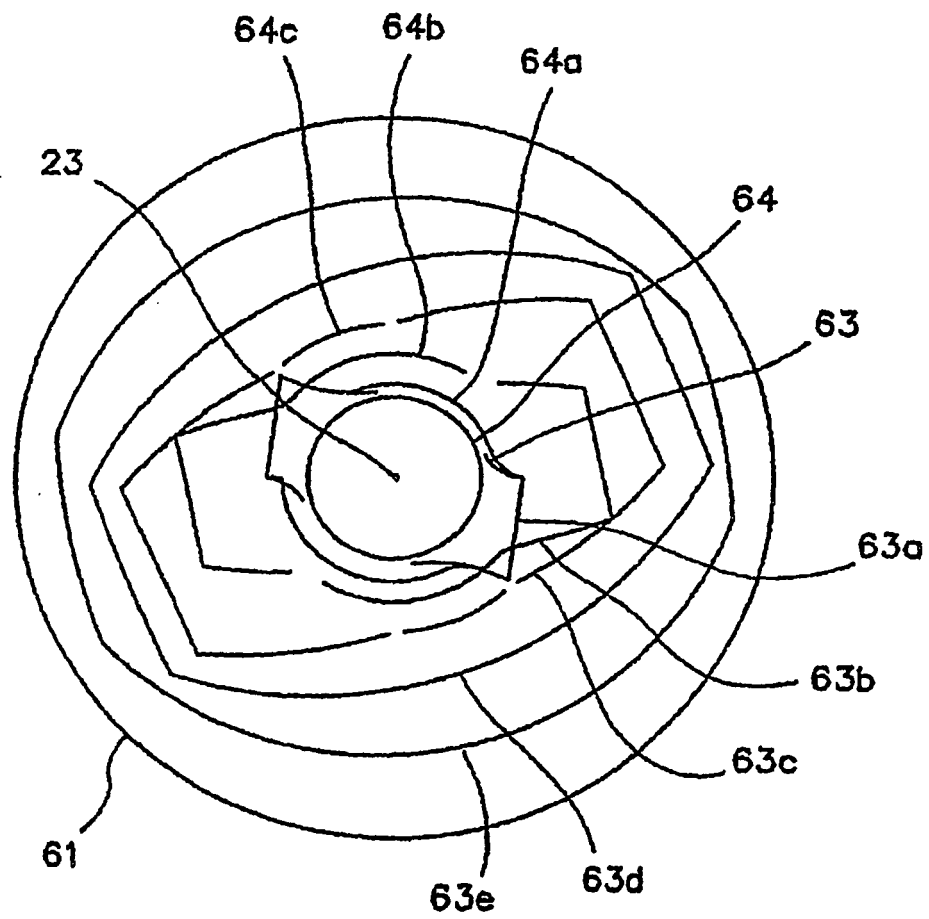


FIG. 10

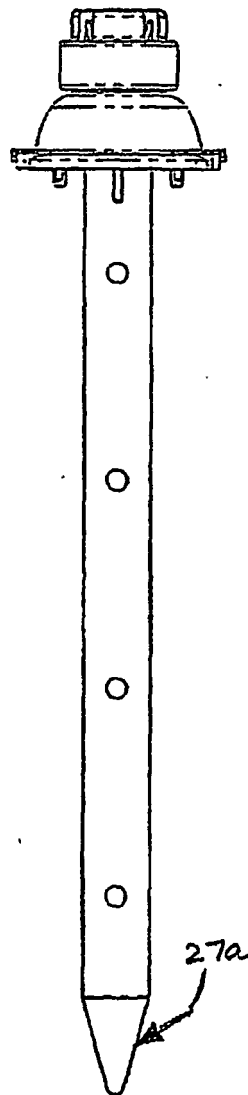


FIG. 11

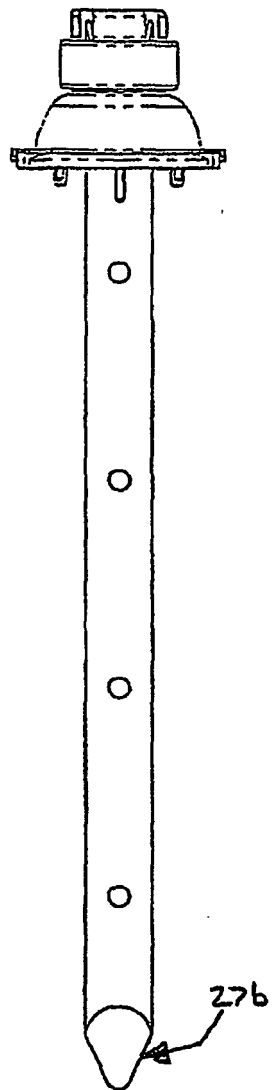


FIG. 12

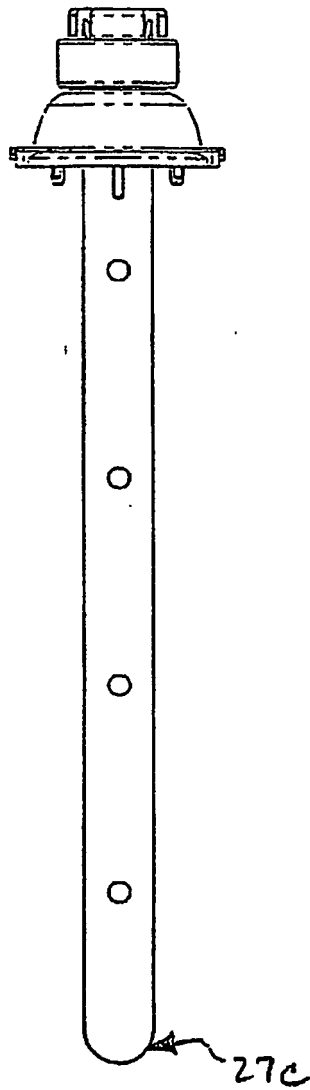


FIG. 13

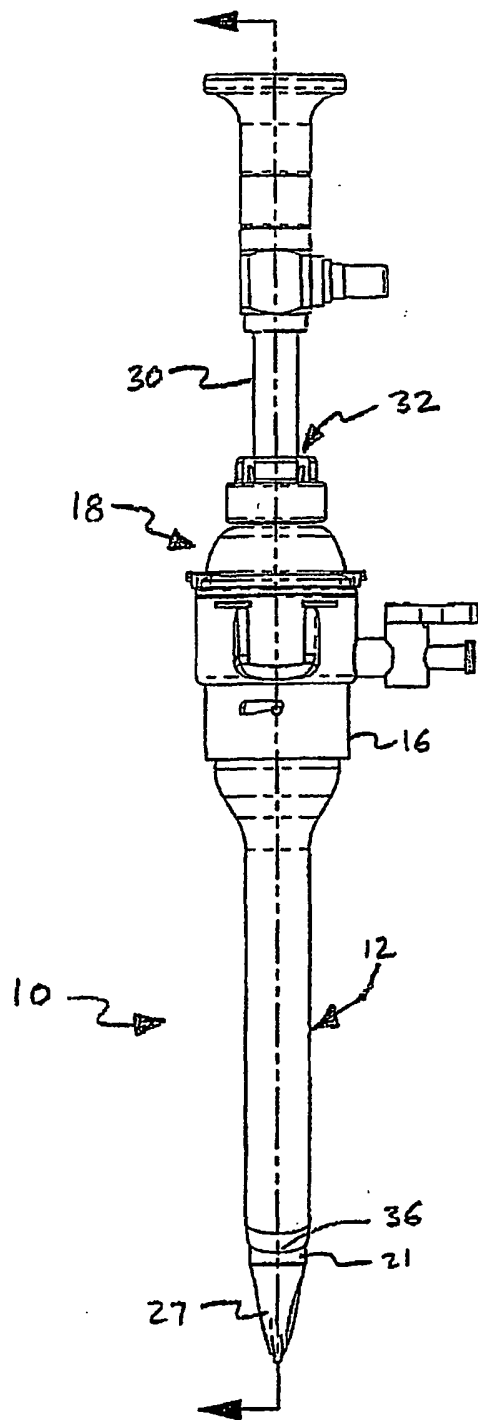


FIG. 14

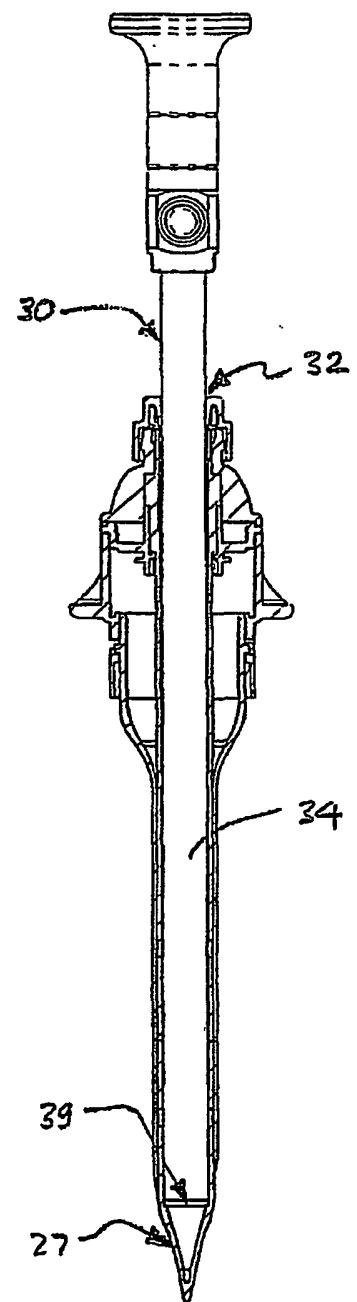


FIG. 15

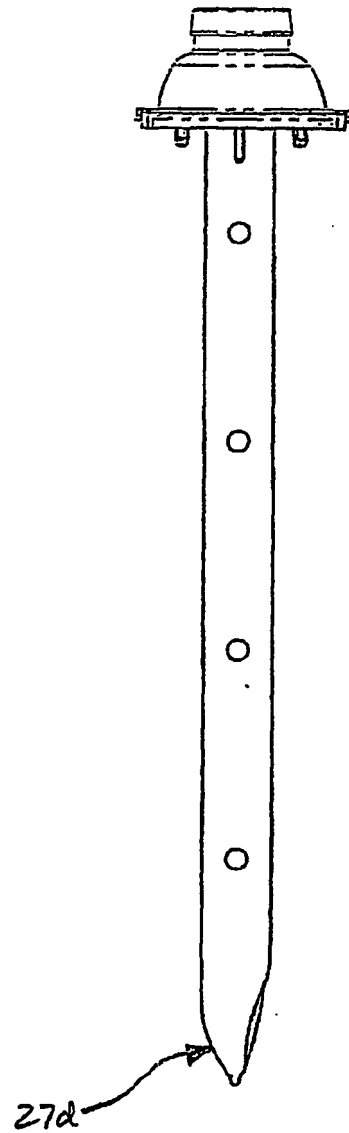


FIG. 16

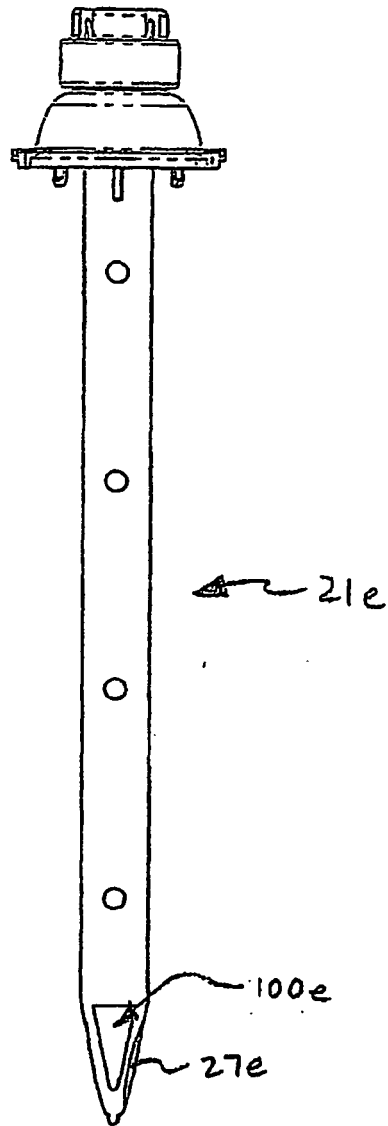


FIG. 17

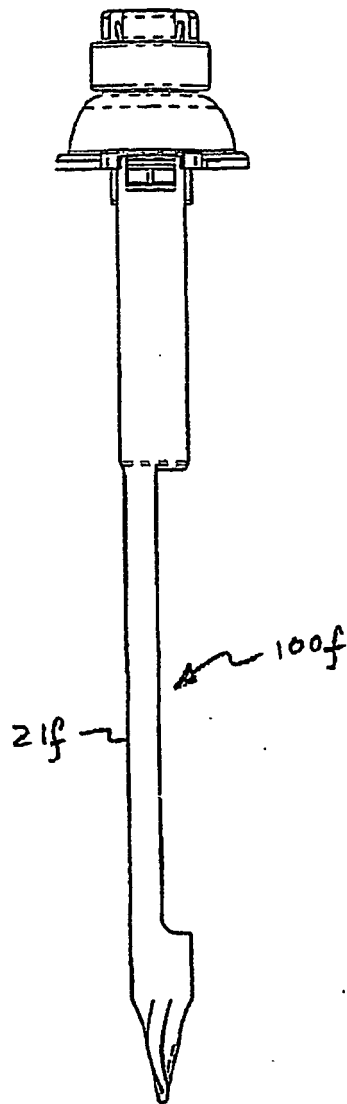


FIG. 18

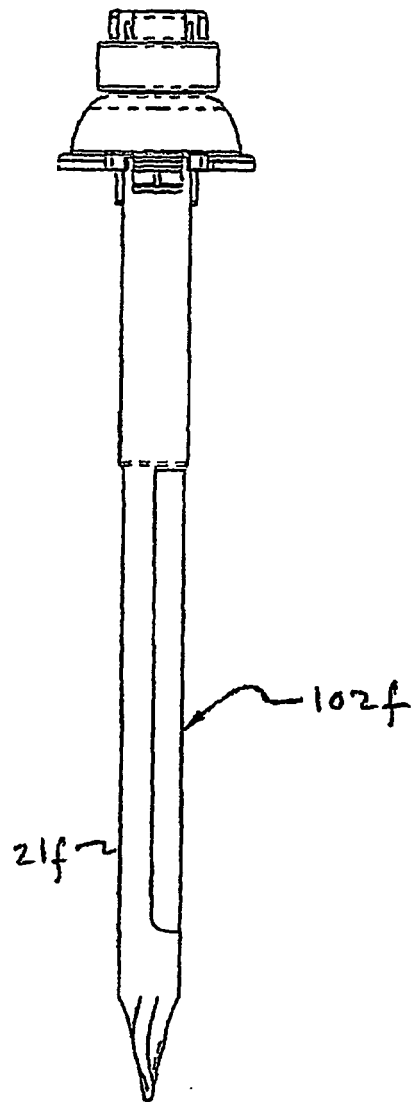


FIG. 19

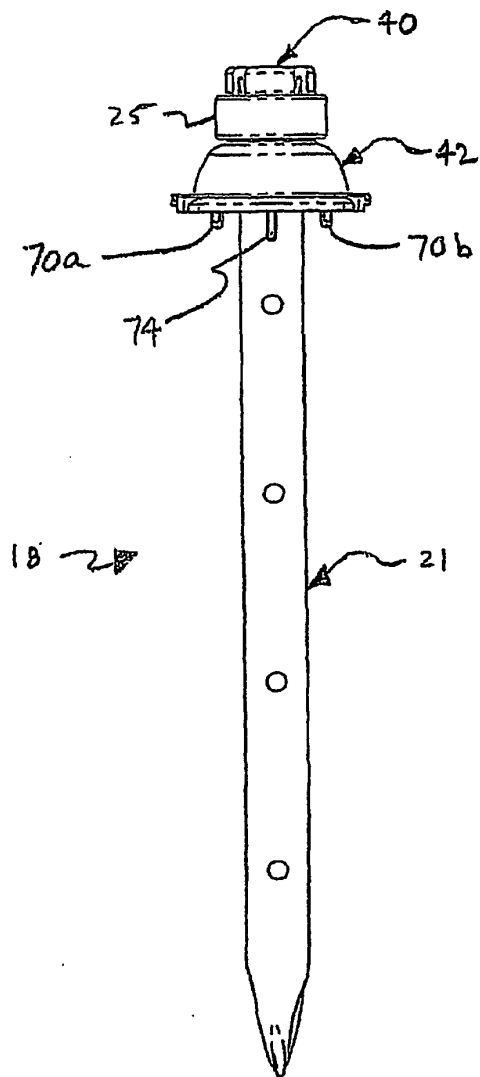


FIG. 20

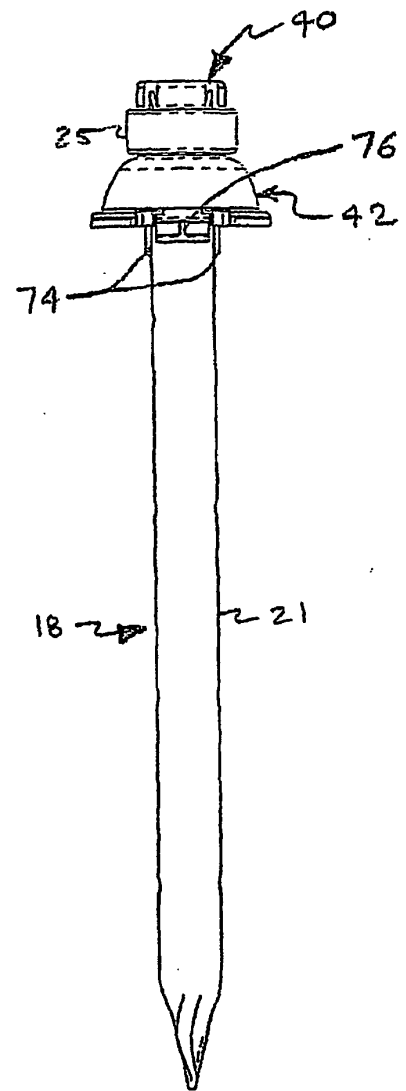


FIG. 21

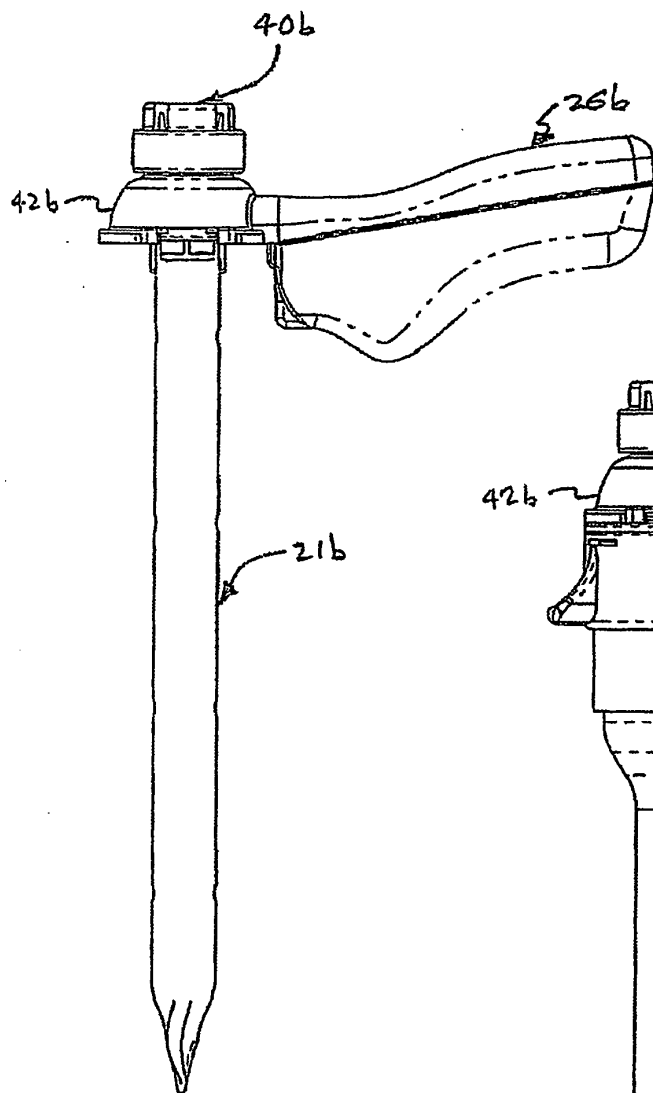


FIG. 22

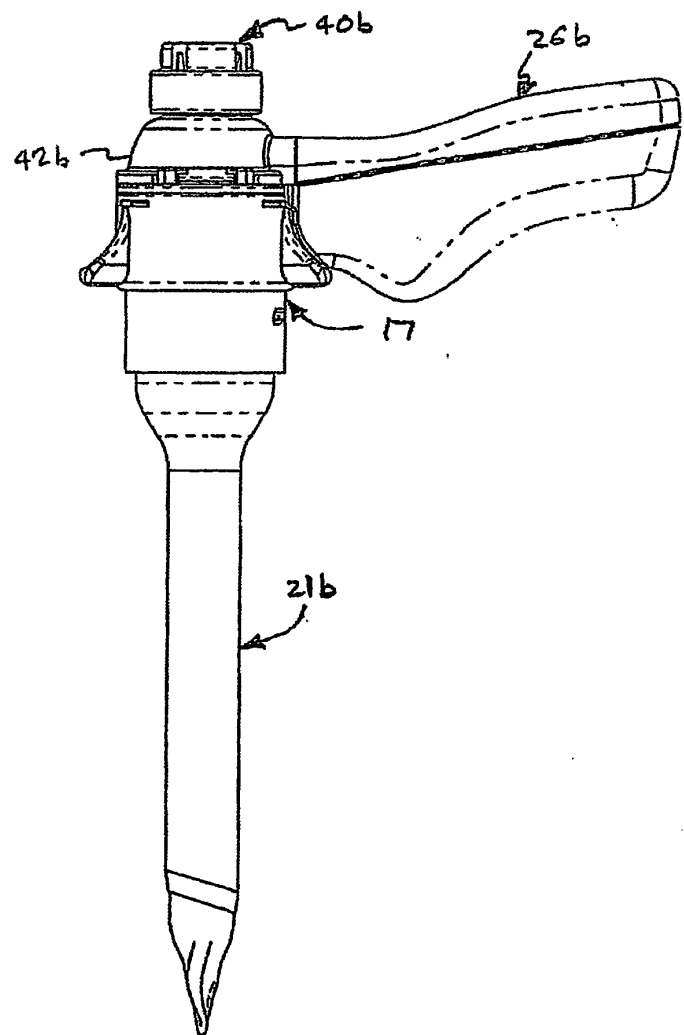


FIG. 23

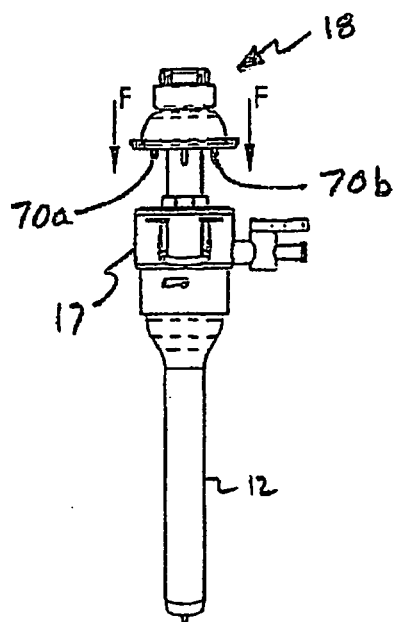


FIG. 24

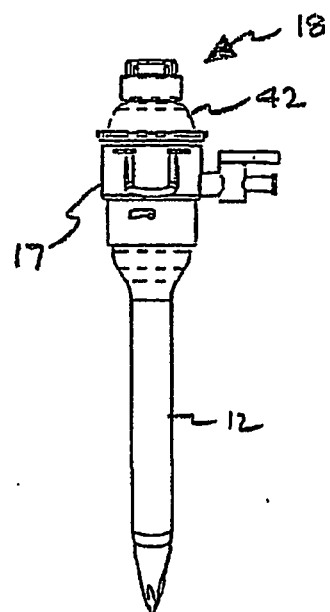


FIG. 25

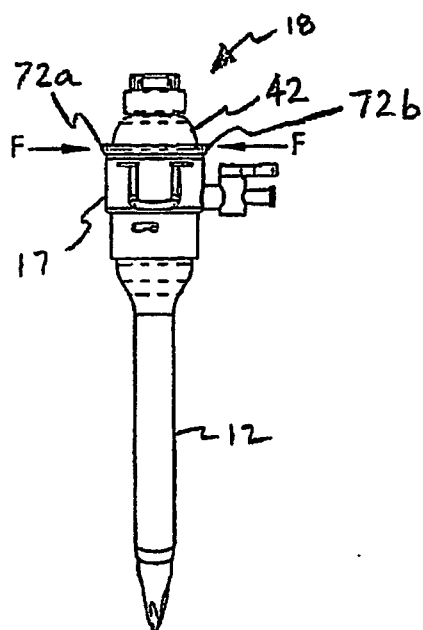


FIG. 26

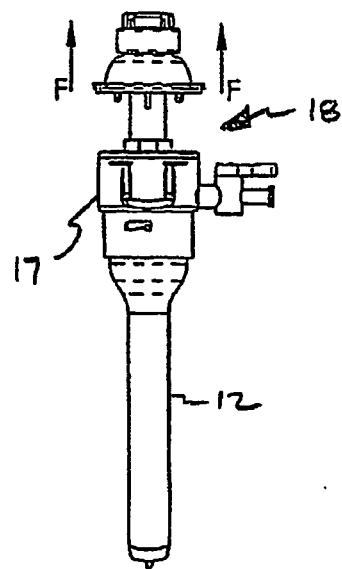


FIG. 27

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US 5569291 A [0006]
- WO 03026512 A [0006]
- WO 9601074 A [0006]

专利名称(译)	无叶光学闭孔器，带有用于光学仪器的锁		
公开(公告)号	EP2545862B1	公开(公告)日	2015-09-30
申请号	EP2012186720	申请日	2004-10-01
[标]申请(专利权)人(译)	应用医疗资源		
申请(专利权)人(译)	应用医疗资源CORPORATION		
当前申请(专利权)人(译)	应用医疗资源CORPORATION		
[标]发明人	KAHLE HENRY STROKOSZ ARKADIUSZ A MCGINLEY KIMBALL B TAYLOR SCOTT V JOHNSON GARY M BRUSTAD JOHN R		
发明人	KAHLE, HENRY STROKOSZ, ARKADIUSZ A MCGINLEY, KIMBALL B TAYLOR, SCOTT V JOHNSON, GARY M BRUSTAD, JOHN R		
IPC分类号	A61B17/32 A61B17/34 A61B19/00 A61B A61B17/00		
CPC分类号	A61B17/3417 A61B17/3462 A61B17/3474 A61B17/3478 A61B17/3496 A61B90/361 A61B90/92 A61B2017/0046 A61B2017/00477 A61B2017/00907 A61B2017/320044 A61B2017/3456 A61B2017/ /346 A61B2017/3464 A61B2017/347 A61B2090/3937 A61B1/3132 A61B17/3415 A61B17/3421 A61B17/ /3423 A61B17/3468 A61B2017/3425 A61B2017/3445		
优先权	60/508390 2003-10-03 US		
其他公开文献	EP2545862A2 EP2545862A3		
外部链接	Espacenet		

摘要(译)

本发明涉及一种无刀片套管针闭塞器，用于在穿过体壁插入期间分离或分离身体组织。在一个方面，本发明的填塞器包括沿近端和远端之间的轴线延伸的轴；无刀尖端设置在轴的远端并且具有带有外表面的大致锥形结构，外表面向远侧延伸到钝点，其中一对侧部具有共同的形状并被至少一个中间件分开该部分，其中每个侧部从钝点径向向外延伸，沿着轴向近侧具有渐进位置，并且轴的尺寸和构造适于接收具有远端的光学仪器以接收身体组织的图像。在这方面，锥形构造有利于身体组织的不同层的分离，并提供层之间的尖端的适当对准。侧部包括远端部分和近端部分，侧部的远端部分相对于侧部的近端部分径向扭转。中间区段包括远侧部分和近侧部分，中间区段的远侧部分沿第一径向方向扭转，并且中间区段的近侧部分沿与第一径向方向相反的第二径向方向扭转。

