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(54) INSUFFLATING OPTICAL SURGICAL INSTRUMENT

INSUFFLIERENDES OPTISCHES OPERATIONSINSTRUMENT

INSTRUMENT CHIRURGICAL OPTIQUE À INSUFFLATION

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Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] This invention generally relates to surgical instruments and, in particular, to surgical instruments providing visual entry and visual insufflation.

Discussion of the Prior Art

[0002] Laparoscopic surgery of the abdominal area typically requires the introduction of an insufflation gas into the peritoneal cavity of the patient. The insufflation gas is usually pressurized to about 10 mm Hg above atmospheric pressure. This in turn lifts the abdominal wall away from the organs underlying it. Cannulas having seals are then placed at various locations through the abdominal wall to allow the use of a laparoscope and operating instruments. It is well known that establishing access to a non-inflated peritoneal cavity can be a very dangerous part of any laparoscopic procedure. The most common method to achieve insufflation is to pass a sharp needle through the abdominal wall and into the abdominal region, and then inject a gas through the needle and into the region thereby creating an enlarged or ballooned cavity to accommodate a laparoscopic procedure. Unfortunately, insertion of the needle has been required without any visual aid to facilitate location of the sharp needlepoint. In order to reduce the probability of inadvertent penetration of delicate internal organs in this "blind" procedure, the sharp insufflation needle has been provided with a spring-loaded and retractable safety mechanism.

[0003] The safety mechanisms associated with most insufflation needles consist of a blunt or rounded member disposed within the lumen of the needle, and biased by a spring to an extended position beyond the needle tip. This spring must be responsive to the insertion pressure during placement of the needle but must be capable of immediately moving forward when that pressure is relieved. This is a highly mechanical event at best and offers less than optimal arrangement. As pointed out above, a drawback of this procedure is it is performed blindly. A consequence of this blind insertion is the surgeon may inadvertently damage the organs and tissues underlying the abdominal wall such as major blood vessels and the intestinal tract. Once access is gained, it can take several minutes for the gas to insufflate the abdomen and while this is happening the surgeon may be unaware of any complications caused by the insertion of the needle.

[0004] Another commonly used method of gaining initial access to the peritoneal cavity is by using a procedure known as the Hasson technique. This method involves making a mini-laparotomy and using the fingers to bluntly dissect the tissues of the abdominal wall and thereby creating an access similar to an open surgical procedure. This method is generally considered to be safer but not without risks, and results in an access site that is not well suited for the subsequent introduction and use of a laparoscopic cannula. The cannula is typically held in place with an additional device that allows the cannula to be tied down with sutures to prevent it from slipping out of the abdominal wall. This also leaves a large defect and is difficult to perform in large abdominal walls.

[0005] Some surgeons have used trocars designed for use with laparoscopes for the initial entry into the peritoneal cavity. These devices allow the placement of a laparoscope through the internal diameter of the trocar and have a trocar tip that is made of clear plastic to allow the surgeon to visualize the passage of the tip through the abdominal wall. However, in order to allow the subsequent introduction of insufflation gas through the cannula, the trocar and cannula must be inserted all the way through the wall of the abdomen and this in turn can be potentially dangerous as the tip of the trocar may have to advance as much as one inch beyond the distal surface of the abdominal wall and into the underlying anatomical structures. As such, there remains a need in the art for an improved surgical instrument that may provide visual entry and visual insufflation, and that minimizes the risks of damaging organs, tissues and vessels underlying a body wall.

[0006] WO96/01132 discloses a high flow insufflation instrument and method for laparoscopic surgery. The insufflation instrument comprises a sharp-tipped hollow cannula with an open distal end and a hollow obturator located in the hollow cannula. The hollow obturator has a blunt distal tip. The obturator is shiftable relative to the cannula between an advanced position in which the blunt distal tip of the obturator is located distally of the sharp distal tip of the cannula and a retracted position in which the blunt distal tip of the obturator is not located distally of the sharp distal tip of the cannula. A first insufflation flow pasage is defined within the obturator and extends from a proximal portion of the obturator to at least one aperture located in a distal portion.

[0007] A second insufflation flow passage is defined between the obturator and the inside of the hollow cannula and extends from the proximal end of the hollow cannula to the open distal end thereof.

SUMMARY OF THE INVENTION

[0008] According to the present invention there is provided an insufflating surgical instrument as recited in claim 1.

[0009] The insufflating surgical instrument comprises a tip at the distal end of the shaft, the tip having a first, closed position during penetration of the abdominal wall and a second, opened position to expel the fluid under pressure to insufflate the abdominal region after penetration of the abdominal wall. The tip may be a flip-top that automatically opens upon traversing the abdominal

wall or a flapper valve that opens to the second position when gas or fluid is introduced at the source and into the insufflation channel. The insufflating surgical instrument may further comprise a retention member for connecting the shaft and the flip-top. The flip-top may be a two-piece flip-top, the flapper valve may be a reverse flapper valve or a spring-based flapper valve, and the retention member may be one of a spring, a spring wire, an offset hinge or a living hinge. In another aspect, the tip may comprise at least two petals that reposition to the side of the shaft in the second insufflation position.

[0010] 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

[0011] The accompanying drawings explain the features and principles of the invention. In the drawings:

FIG. 1 illustrates a typical laparoscopic abdominal surgery of the prior art;

FIG. 2 illustrates a perspective view of an insufflation needle of the prior art;

FIG. 3 illustrates a perspective view of an insufflating optical trocar;

FIGS. 4(a) and 4(b) illustrate cross-sectional views of an insufflating optical trocar;

FIG. 5 illustrates a perspective view of a septum seal for use with the insufflating optical trocar of Figures 4(a) and 4(b);

FIG. 6(a)-6(d) illustrate cross-sectional views of the septum seal of Figure 5;

FIGS. 7(a) and 7(b) illustrate the insufflating optical trocar and cannula;

FIGS. 8(a)-8(f) illustrate different geometric shapes and patterns of the vent hole;

FIG. 9 illustrates an insufflating needle having a transparent distal tip and insufflating vent;

FIG. 10 illustrates an insufflating scope having a transparent distal tip and insufflating vent;

FIG. 11 illustrates an insufflating scope sleeve having a transparent distal tip and insufflating vent;

FIGS. 12(a)-12(e) illustrate additional tip designs of an insufflating optical surgical instrument;

FIGS. 13(a) and 13(b) illustrate a coiled insufflating optical trocar and a coiled insufflating optical trocar with a coiled tip, respectively;

FIGS. 14(a)-14(c) illustrate flip-top or flip-tip designs of insufflating optical surgical instruments in accordance with the invention; and

FIGS. 15(a)-15(c) illustrate cross-sectional views of insufflating valve vents of insufflating optical surgical instruments in accordance with the invention.

DESCRIPTION OF THE INVENTION

[0012] Referring to FIG. 1, there is shown a typical laparoscopic abdominal surgery where an inflation needle 10 is inserted through a body or abdominal wall 15 and into an abdominal cavity 25. A gas is passed through the needle 10 to create a space within the abdominal cavity 25. This procedure is referred to as insufflation. The needle 10 is referred to as an insufflation needle and the gas supply is referred to as an insufflation gas. The insufflation needle 10 is placed through the body wall 15 blindly. In other words, there is no direct visualization of the procedure from the inside of the body wall 15. As explained earlier, the current procedure may inadvertently damage organs and tissues underlying the body or abdominal wall 15 such as major blood vessels and the intestinal tract. It is not uncommon for there to be internal structures attached to the internal side of the body wall 15. This is especially so in the case of the abdominal cavity 25. Portions of the intestines, colon and bowel may be attached to the abdominal wall 15. These attachments are referred to as adhesions.

[0013] Adhesions represent a potential complication in laparoscopic surgery. This is especially the case as the procedure is initiated using a sharp or pointed instrument such as the insufflation needle 10. The delicate internal structures that may be attached by adhesions may inadvertently be pierced by the introduction of the insufflation needle 10. This can be very serious and may go undetected for some time.

[0014] Referring to FIG. 2, the typical insufflation needle 10 comprises an elongate tubular body 12, a proximal connecting housing 14, a sharp, pointed distal tip 16 and a spring, biased internal blunt core 18 with a blunt end 24 that extends beyond the sharp distal tip 16 under the influence of an extended compression spring 20. A typical placement of the insufflation needle 10 requires a user to push the sharp distal tip 16 into the abdominal wall 15, which pushes the blunt core 18 proximally, then continues to push until the distal end 22 is through the body wall 15. At that point, the blunt end 24 moves forward and thereby protects delicate structures from being inadvertently punctured by the sharp distal tip 16 of the needle 10. The safety of such a device depends to a large extent on the design and integrity of the spring 20 since the sharp distal tip 16 remains within the established internal region or body cavity 25.

[0015] Referring to FIG. 3, there is shown a perspective view of an insufflating optical instrument or trocar 30. The insufflating optical trocar 30 is designed to separate tissue fibers during insertion through the body wall 15. The insufflating optical trocar 30 includes a shaft 34 having a lumen extending substantially along an axis between a proximal end and a distal end, a handle 35 disposed at the proximal end of the shaft 34, and a blunt tip 32 disposed at the distal end of the shaft 34. The shaft 34 of the insufflating optical trocar 30 is sized and configured for disposition within a working channel of a cannula system. With this disposition, the insufflating optical trocar 30 functions to penetrate a body or abdominal wall to provide the cannula with access across the body wall 15 and into the body cavity 25, such as the peritoneal or abdominal cavity.

[0016] The shaft 34 and tip 32 may be integrally formed of a transparent material to enable visualization of tissue during the insertion of the insufflating optical trocar 30 through the body wall 15. The insufflating optical trocar 30 may be configured to enable the insertion of a conventional laparoscope, which typically includes an imaging element and fiber optic light fibers. The tip 32 further includes at least one vent hole 36, and preferably two or more vent holes one on each side of the tip 32, for the insufflation gas to transfer from the inside of the trocar 30 into the body or abdominal cavity 25. The vent hole 36 may be chamfered on the proximal side such that the vent hole does not core tissue as the insufflating optical trocar 30 enters through the body wall 15.

[0017] The shaft 34 includes at least one shaft vent 38 and preferably a plurality of shaft vents 38 along the axis between the proximal end and the distal end. It is appreciated that vent holes 36 and shaft vents 38 may be of any geometric shape including round, oval, square, rectangular, etc., as illustrated in FIGS. 8(a)-8(c) and may be configured in different patterns such as a waffle pattern as illustrated in FIG. 8(f). Furthermore, the tip 32 may be an open tip 180 or a non-coring tip 182 as illustrated in FIGS. 8(d) and 8(e), respectively, to allow the transfer of insufflation gas into the body cavity 25. Advantages of the shaft vents 38 include supporting a plurality of core pins during the injection molding process of the shaft 34 to provide a uniform part thickness, and allowing the insufflation gas to transfer from the inner diameter of the cannula and seal housing into the inner diameter of the insufflating optical trocar 30 and consequently out of the vent holes 36 at tip 32.

[0018] Referring to FIGS. 4(a) and 4(b), there are shown side cross-sectional views of an insufflating optical trocar 40. The insufflating optical trocar 40 includes a shaft 34b having a lumen extending substantially along an axis between a proximal end and a distal end, and a blunt tip 32b disposed at the distal end. The insufflating optical trocar 40 further includes at least one gas channel 42 extending along the length of the shaft 34b to provide rapid gas transfer through the insufflating optical trocar 40 when a scope has been placed within the inner diameter. It is appreciated that there may be more than one gas channel 42 extending along the length of the shaft 34b to provide rapid gas transfer through the trocar 40. It is further appreciated that the gas channel 42 may be formed as a separate channel or as the same channel for inserting the scope, that is, by increasing the inner diameter of the shaft 34b to be bigger than the diameter of the scope. More specifically, even if the scope and gas share the same channel, the gas channel 42 assures that there is sufficient cross-sectional area for the gas to travel along the side of the scope and down to the vent hole(s) 36b even when the scope is in place.

[0019] The tip 32b may further include a marker 46 to be used as a visible reference point. The marker 46, together with an area indicated by reference number 44 as shown in FIG. 4A, depict the down vent of the insufflating optical trocar 40 that transfers the gas from the gas channel 42 of the trocar 40 to the vent holes 36b at tip 32b. For example, as the trocar 40 is being placed through the abdominal wall 15, at some point the tip 32b of the trocar 40 will penetrate the peritoneum. Once the peritoneum can be seen through the tip 32b and once the peritoneum is above the visible marker 46, the insufflation gas can be turned on and insufflation can begin. As such, this marks the point where the vent hole 36b is within the abdominal cavity. Once the insufflation gas has created sufficient space between the abdominal wall and the organ bed, the remainder of the insufflating optical trocar 40 including the cannula system can then be fully inserted to an operative position.

[0020] The insufflating optical trocar 40 may further include a scope stop 48 as illustrated in FIG. 4(b) to keep a scope from being inserted into the taper of the inner diameter of the trocar 40. The scope stop 48 may further include a ledge that further prevent the possibility of the scope from being inserted too far into the trocar and consequently block the distal portion of the gas channel 42.

[0021] Referring to FIG. 5, there is shown a perspective view of a septum seal 50 to be used with the insufflating optical trocar. The septum seal 50 includes a tubular body 52, a septum ring 53 and a plurality of leaflets 54 formed by a slit 56 providing an instrument seal when a scope is inserted into the insufflating optical trocar and a zero seal when the scope is withdrawn from the trocar. In addition, the thickness of the leaflets 54 can be controlled such that a pressure release mechanism can be created and consequently allowing the leaflets 54 to invert and release pressure if the abdominal pressure within the patient undergoes a sudden spike. Referring to FIGS. 6(a)-6(d), there are shown cross-sectional views of the septum seal 50 of FIG. 5. The septum seal 50 further includes a retaining ledge 58, which allows the septum seal 50 to be attached to the cap or handle 35 of the insufflating optical trocar, and also serves as a sealing surface. Reference number 59 illustrates a sealing surface between the septum seal 50 and the cap or handle of the insufflating optical trocar. The septum seal 50 may further comprise a duckbill or double duckbill valve placed dis-

tally of the leaflets 54 to further limit gas or fluid escape.

[0022] During use, the insufflating optical trocar 30 is first inserted into a seal housing 84 and cannula 70 as illustrated in FIG. 7(a). A conventional laparoscope 72 is then inserted into the proximal end of the insufflating optical trocar 30 and advanced to the distal end of the trocar 30. An endoscopic video camera is attached to the proximal end of the laparoscope 72. The trocar 30 is then axially advanced by the surgeon through the body wall 15. As the surgeon advances the cannula 70 and trocar 30 through the body wall 15, the surgeon can visually observe tissue of the body wall 15 as it is being separated via a video monitor, which is connected to the endoscopic video camera. The surgeon can also readily determine when the body wall 15 has been completely traversed by the trocar 30. Once the trocar 30 has traversed the body wall 15, the trocar 30 and laparoscope 72 may be removed which leaves the cannula 70 disposed across the body wall 15 to provide an access channel into the body cavity 25 for the insertion of laparoscopic instrumentation.

[0023] As illustrated in FIG. 7(a), the insufflating optical trocar 30 is designed for use with the seal housing 84 and cannula 70. The tip 32 may be blunt and does not include any sharp edges, piercing points or blades. The tip 32 of the bladeless insufflating optical trocar 30 is transparent and generally hollow. This enables a clear view through the distal tip of the insufflating optical trocar 30 and increases the visibility of tissue as it is being traversed. The obturator shaft 34 with the integral tip 32 may be formed of a transparent material such as polycarbonate. The septum seal 50, which may be formed of a material such as Kraton, silicone and the like, may be snap fitted onto the proximal end of the obturator shaft 34. The seal housing 84 may further include a handle attachment 35 including a cannula seal, which may be formed of a plastic material such as polycarbonate, that operates to attach the trocar 30 to the cannula 70 so as to maintain axial position during insertion. The diameter of the shaft 34 can range from about 2 mm to 50 mm and is designed to fit within the seal housing 84 and cannula 70.

[0024] Referring to FIG. 7(b), the cannula 70 is designed to releasably attach to the seal housing 84 via cannula seal 80a, 80b. As the shaft 34 is inserted into the seal housing 84 and cannula 70, the cannula seal 80a, 80b passively engages the seal housing 84 and serves to axially lock the shaft 34 to the seal housing 84 and cannula 70. To release the shaft 34 from the seal housing 84 and cannula 70, outboard tabs on shaft 34 are depressed inwardly and the shaft 34 is then free to be slidably removed. The shaft 34 includes axial key members 37 (see FIG. 3) at its proximal end which are designed to mate with axial keyways on the seal housing 84. As the shaft 34 is inserted into the seal housing 84 and cannula 70, the shaft 34 is rotated slightly to align key members 37 with the keyways and then advanced until the cannula seal 80a, 80b engages the seal housing 84. The key members 37 serve to rotationally index the shaft 34 to the seal housing 84. In another aspect, cannula 70 may further include distal cannula seal 82 formed at a distal portion of cannula 70 and shaft 34 so as to further limit gas or fluid escape.

[0025] The insufflating optical trocar 30 may include a laparoscope lock 86 having an elastomeric element. The addition of the elastomeric element would enhance the frictional engagement with the laparoscope 72. An example of an elastomeric element would be a silicone O-ring sized with an inside diameter smaller than the outside diameter of the laparoscope 72. The laparoscope lock 86 could either rotate freely to enable the laparoscope 72 to rotate freely relative to the shaft 34 or the laparoscope lock 86 could be rotationally fixed to prevent the laparoscope 72 from rotating relative to the shaft 34.

[0026] A process of placing and using the insufflating optical trocar is now described. First, the skin around the area to be operated on is incised appropriately for the size of the cannula 70. An insufflation gas line 90, which is attached to the seal housing 84, the insufflating optical trocar 30 and the laparoscope 72 are then inserted into the cannula 70. At this point the gas supply is still turned off. The assembled device is then advanced through the body or abdominal wall 15 under direct vision until it is observed that just the tip 32 of the device has penetrated the peritoneal cavity. The device is then held in place and the flow of insufflation gas is begun. The gas will flow through the tip 32 and into the peritoneal cavity until the cavity is sufficiently distended by gas pressure. The surgeon then completes the insertion of the insufflating optical trocar 30 until the cannula 70 is in an appropriate or desired position. The insufflating optical trocar 30 and laparoscope 72 may then be removed. At this point, the surgeon may elect to reinsert just the laparoscope 72 through the seal housing 84 and thereby allow observation of the abdominal cavity and subsequent insertions of additional laparoscopic instrumentation.

[0027] As explained earlier, an indicator line or marker 46 as shown in FIG. 4(a) may be located on tip 32 to be viewed by laparoscope 72 to indicate when the device has advanced far enough into the body cavity to begin insufflation. The coincidence of anatomical features with the indicator line or marker 46 may indicate the correct position to begin insufflation. The indicator line or marker 46 could be circumferential in nature and when the peritoneal layer, as it is being penetrated, forms a coincident circle with respect to the indicator line 46, the surgeon can begin insufflating. Another method is to employ an O-ring seal 86. Additionally, it is preferred that a zero seal be present on the trocar to prevent escape of the gas when the trocar is used to place cannulas without the laparoscope 72. A double duckbill valve 88 would work well too for this application as would a single duckbill, a flapper valve or a slit valve.

[0028] It is appreciated that the above-described concept may be applied to any surgical instruments providing visual entry and visual insufflation, regardless of size or

type of fluid transfer as further described in the following exemplary embodiments. For example, FIG. 9 illustrates an insufflating needle 190 comprising an elongate tubular body 192 having an insufflation channel extending along an axis between a proximal end and a distal end, a transparent distal tip 194 operably attached to the distal end of the tubular body 192, and at least one insufflating vent hole 196 formed at the distal tip 194 or tubular body 192 and being in connection with the insufflation channel. The insufflating needle 190 may further include an insufflation-controlling device 198 such as a stopcock and a sealing mechanism 200 at the proximal end of the tubular body 192. A small diameter scope 202 may be inserted at the proximal end of the tubular body 192 and then advanced to the distal end of the tubular body 192 as the insufflating needle 190 such as an insufflating Veress needle is placed through an abdominal wall.

[0029] In FIG. 10, an insufflating scope 210 comprises an elongate body 212 having an insufflation channel 224 extending along an axis between a proximal end and a distal end, a transparent tip 214 operably attached to the distal end of the elongate body 212 and having at least one insufflating vent hole 216 being in connection with the insufflation channel 224, and a handle 218 formed at the proximal end of the elongate body 212. The insufflating scope 210 may further include an insufflation-controlling device 220 such as a stopcock at the proximal end of the elongate body 212 or on the handle 218. The elongate body 212 includes an optical element 222 that directs light to the tip 214 and at least one insufflation channel 224 to transfer the insufflation gas into the surgical cavity.

[0030] Referring to FIG. 11, there is shown an insufflating scope sleeve 230. The insufflating scope sleeve 230 comprises a flexible sleeve 232 having a proximal end and a distal end, a transparent tip 234 operably attached to the distal end of the flexible sleeve 232 and having at least one insufflating vent hole 236, and a handle 238 attached to the proximal end of the flexible sleeve 232. The insufflating sleeve 230 may further include an insufflation-controlling device 240 such as a stopcock and a sealing mechanism 242 at the proximal end of the insufflating sleeve 230. A scope 244 may be inserted at the proximal end of the insufflating scope sleeve 230 and then advanced to the distal end of the insufflating scope sleeve 230 as the insufflating scope sleeve 230 is placed through an abdominal wall.

[0031] Referring to FIGS. 12(a)-12(e), there are shown additional tip designs 32o-32s to facilitate penetration of a body tissue. FIG. 12(a) illustrates a spoon-shaped or asymmetric tip 320 having at least one vent hole 360; FIG. 12(b) illustrates a generally domed or conical shaped tip 32p having plastic or metal blades 33p along an axis of the shaft and at least one vent hole 36p; FIG. 12(c) illustrates a blunt tip 32q having at least one vent hole 36q; FIG. 12(d) illustrates a generally domed or conical shaped tip 32r having at least one bladed fin 33r and at least one vent hole 36r; and FIG. 12(e) illustrates a generally conical shaped tip 32s having at least one vent hole 36s at the distal tip. It is appreciated that tips 32o, 32p, 32r and 32s have a sharp, pointed or bladed tip and/or edge to facilitate penetration of body tissue. The surface of the tip may have at least one tissue engaging raised pattern on the surface. The surface operates to facilitate insertion of the insufflating surgical instrument or optical trocar with a reduced penetration force and minimize tenting of the body wall. The surface may further facilitate separation of different layers of the body wall and provides proper alignment of the tip between the layers. The tip may have an outer surface extending distally to a blunt point and includes a pair of side sections separated by an intermediate section, and wherein the side sections extend from the blunt point radially outwardly with progressive positions proximally along the axis. The side sections may include a distal portion in proximity to the blunt point and a proximal portion in proximity to the tubular body, and the distal portion of the side sections being twisted radially with respect to the proximal portion of the side sections.

[0032] FIGS. 13(a) and 13(b) illustrate a coiled insufflating optical trocar 250 and a coiled insufflating optical trocar with a coiled tip 260, respectively. The coiled insufflating optical trocar 250 comprises a shaft 34t having a lumen and a hollow coiled tube or gas channel 42t wrapped substantially along the length of the shaft 34t to provide gas transfer into the body cavity. An advantage of this is coiling also helps to keep the trocar from moving about inside a body cavity. The coiled insufflating optical trocar 250 may further include an insufflation-controlling device 240 such as a stopcock at the proximal end of the coiled insufflating optical trocar 250. A scope may be inserted at the proximal end of the coiled insufflating optical trocar 250 and then advanced to the distal end of the trocar 250 as the trocar 250 is placed through an abdominal wall. The coiled insufflating optical trocar with coiled tip 260 as shown in FIG. 13(b) is similar to the coiled insufflating optical trocar 250 but further includes a tip 32u and a hollow coiled tube or gas channel 42u that wraps around the tip 32u and substantially along the length of the shaft 34u.

[0033] Referring to FIGS. 14(a)-14(c), there are shown additional tip designs 32v-32x of an insufflating surgical instrument of the type previously described when in accordance with the invention. For example, the tip 32v as illustrated in FIG. 14(a) comprises a flip-top 272 and a conical body 270 that operates to move from a first, penetrating position to a second, insufflating position when the body wall has been traversed. The tip 32v may further comprise a retention member for connecting the flip-top 272 and the conical body 270. The retention member may be one of a spring, a spring wire, an offset hinge or a "living" hinge. Other flip-top or flip-tip designs as described in U.S. Patent Application, Publication No. 2005/0209619 A1, may also be used with the insufflating concept of the invention. In yet another aspect of the invention, the tip 32w as illustrated in FIG. 14(b) com-

prises a two-piece flip-top 282a, 282b that operates to move from a first, penetrating position to a second, insufflating position when the body wall has been traversed. In particular, the tip 32w may comprise at least two or more parts or petals that reposition to the side of the shaft 34w in the second, insufflating position. FIG. 14(c) illustrates the tip 32x in accordance with another aspect of the invention comprising a two-stage flip-top 290 that operates to move from a penetrating position to an insufflating position and then to an instrument access position. In particular, the two-stage flip-top 290 comprises a distal flip portion 292 and a proximal flip portion 294. In the first stage, the distal flip portion 292 moves from a penetrating position to an open or insufflating position once the body wall has been traversed. Once insufflation has been achieved, the proximal flip portion 294 moves to an open or instrument access position in the second stage. The tip 32x may further comprise retention members for connecting between the distal flip portion 292 and the proximal flip portion 294, and between the proximal flip portion 294 and the shaft 34x.

[0034] FIGS. 15(a)-15(c) illustrate insufflating valve vents of an insufflation surgical instrument also in accordance with the invention. More specifically, FIG. 15(a) illustrates an insufflating valve vent 300 formed at the distal end of the shaft 34. The insufflating valve vent 300 is formed of an elastic material to allow gas such as CO_2 to be introduced from the inside of the shaft 34 to a body cavity. It is appreciated that when there is no gas, the elastic material of the insufflating valve vent 300 causes it to close so as to provide an airtight seal. FIG. 15(b) illustrates an insufflating flapper valve 310 formed at tip 32y of an insufflating optical trocar. The insufflating flapper valve 310 comprises at least one flapper valve vent 312 that operates to open when a gas such as CO_2 is introduced in the shaft 34. It is appreciated that when there is no gas, the flapper valve vent 312 closes to provide a tight seal. Similarly to FIG. 15(b), FIG. 15(c) illustrates an insufflating reverse flapper valve 320 formed at tip 32z of an insufflating optical trocar. The insufflating reverse flapper valve 320 comprises at least one flapper valve vent 322 that remains close or shut by tissue during insertion, and once peritoneum is passed, pressure by a gas such as CO_2 would then open the reverse flapper valve 320 to allow the transfer of the gas into a body cavity. It is appreciated that each of the above flapper valve vents may be spring loaded to operate like a Veress needle.

[0035] It is appreciated that the above described surgical instruments and devices can be used to access not only the peritoneal cavity but can be used for preperitoneal hernia repair, retroperitoneal operations including back and kidney operations, percutaneous kidney operations, thoracic surgery and arthroscopic access. In addition to gas such as carbon dioxide, it is appreciated that other fluids such as air, water and saline can also be introduced into a body cavity with the technique of the invention. It is appreciated that operating scopes may be modified such that a lumen may be used to introduce insufflation fluid. Accordingly, it is understood that many other modifications can be made to the various disclosed embodiments without departing from the scope of the invention as claimed. For these reasons, the above description should not be construed as limiting the invention, but should be interpreted as merely exemplary embodiments.

Claims

1. An insufflating surgical instrument adapted for penetrating an abdominal wall to insufflate an abdominal region of a patient, comprising:

   a cannula (70) comprising a wall forming a first lumen and a first channel extending along an axis between the proximal end and a distal end of the cannula (70) and adapted for connection to a source of fluid under pressure at the proximal end; and
   a trocar (30) insertable into and removable from the lumen of the cannula (70); the trocar (30) comprising:

   - a shaft (34) having a wall forming a second lumen and a second channel extending along an axis between a proximal end and a distal end of the trocar (30); the second channel operably connected to the first channel to allow fluid transfer from the cannula (70) to the trocar (30); and
   - a tip (32) at the distal end of the shaft adapted to penetrate tissue and enclosing the distal end of the shaft; the tip (32) having at least one vent hole (36);

   an insufflation channel comprising the first channel and the second channel;
   characterized by the at least one vent hole having a first, closed position during penetration of the abdominal wall and a second, opened position to expel the fluid under pressure to insufflate the abdominal region after penetration of the abdominal wall.

2. The insufflating surgical instrument of claim 1 wherein the tip (32) comprises a flip-top (272) and a conical body (270) that operates to move from a first, penetrating position to a second, insufflating position.

3. The insufflating surgical instrument of claim 1 wherein the tip (32) is a flip-top (272) that automatically opens upon traversing the abdominal wall.

4. The insufflating surgical instrument of claim 2 further comprising a retention member for connecting the shaft and the flip-top.

5. The insufflating surgical instrument of claim 1 wherein the tip is a flapper valve (310) that opens to the second position when gas or fluid is introduced at the source and into the insufflation channel.

6. The insufflating surgical instrument of claim 5 wherein the flapper valve (310) is a reverse flapper valve (320).

7. The insufflating surgical instrument of claim 5 wherein the flapper valve (310) is a spring-based flapper valve.

8. The insufflating surgical instrument of claim 4 wherein the retention member is one of a spring, a spring wire, an offset hinge or a living hinge.

9. The insufflating surgical instrument of claim 1 wherein the tip (32) is a two-piece flip-top (282).

10. The insufflating surgical instrument of claim 1 wherein the tip (32) comprises at least two petals that reposition to the side of the shaft in the second insufflation position.

11. The insufflating surgical instrument of claim 1 wherein the tip (32) is a flip-tip.

12. The insufflating surgical instrument of claim 1 wherein the tip (32) is a two-stage flip-top (290) that operates to move from a penetrating position to an insufflating position and then to an instrument access position.

13. The insufflating surgical instrument of claim 1 wherein the tip is a flip-top (290) comprising a distal flip portion (292) and a proximal flip portion (294).

Patentansprüche

1. Ein chirurgisches Insufflationsinstrument, das zum Penetrieren einer Bauchwand angepasst ist, um eine Bauchregion eines Patienten aufzublasen, das Folgendes beinhaltet:

   eine Kanüle (70) die eine Wand beinhaltet, die ein erstes Lumen und einen ersten Kanal bildet, die sich entlang einer Achse zwischen dem proximalen Ende und einem distalen Ende der Kanüle (70) erstrecken und zum Anschluss an eine Fluidquelle unter Druck an dem proximalen Ende angepasst sind; und
   einen Trokar (30), der in das Lumen der Kanüle (70) eingeführt werden und aus ihm entfernt werden kann; wobei der Trokar (30) Folgendes beinhaltet:

   einen Schaft (34) mit einer Wand, die ein zweites Lumen und einen zweiten Kanal bildet, die sich entlang einer Achse zwischen einem proximalen Ende und einem distalen Ende des Trokars (30) erstrecken; wobei der zweite Kanal betriebsfähig mit dem ersten Kanal verbunden ist, um den Fluidtransfer von der Kanüle (70) zu dem Trokar (30) zu erlauben; und
   eine Spitze (32) an dem distalen Ende des Schafts, der zum Penetrieren von Gewebe angepasst ist und das distale Ende des Schafts umschließt; wobei die Spitze (32) mindestens ein Entlüftungsloch (36) aufweist;
   einen Insufflationskanal, der den ersten Kanal und den zweiten Kanal beinhaltet;
   dadurch gekennzeichnet, dass das mindestens eine Entlüftungsloch eine erste, geschlossene Position während der Penetration der Bauchwand und eine zweite, geöffnete Position zum Ausstoßen des Fluids unter Druck aufweist, um die Bauchregion nach der Penetration der Bauchwand aufzublasen.

2. Chirurgisches Insufflationsinstrument gemäß Anspruch 1, wobei die Spitze (32) einen Klappdeckel (272) und einen verjüngten Hauptteil (270) beinhaltet, der betriebsfähig ist, um sich von einer ersten, penetrierenden Position zu einer zweiten, aufblasenden Position zu bewegen.

3. Chirurgisches Insufflationsinstrument gemäß Anspruch 1, wobei die Spitze (32) ein Klappdeckel (272) ist, der sich beim Überqueren der Bauchwand automatisch öffnet.

4. Chirurgisches Insufflationsinstrument gemäß Anspruch 2, das ferner ein Halteelement zum Verbinden des Schafts und des Klappdeckels beinhaltet.

5. Chirurgisches Insufflationsinstrument gemäß Anspruch 1, wobei die Spitze ein Klappenventil (310) ist, das sich zu der zweiten Position öffnet, wenn Gas oder Fluid an der Quelle und in den Insufflationskanal eingeführt wird.

6. Chirurgisches Insufflationsinstrument gemäß Anspruch 5, wobei das Klappenventil (310) ein Umsteuer-Klappenventil (320) ist.

7. Chirurgisches Insufflationsinstrument gemäß Anspruch 5, wobei das Klappenventil (310) ein Klappenventil auf Federgrundlage ist.

8. Chirurgisches Insufflationsinstrument gemäß Anspruch 4, wobei das Halteelement eines von einer

Feder, einem Federdraht, einem versetzten Scharnier oder einem Filmscharnier ist.

9. Chirurgisches Insufflationsinstrument gemäß Anspruch 1, wobei die Spitze (32) ein zweiteiliger Klappdeckel (282) ist.

10. Chirurgisches Insufflationsinstrument gemäß Anspruch 1, wobei die Spitze (32) mindestens zwei äußere Blätter beinhaltet, die sich in der zweiten Insufflationsposition zur Seite des Schafts repositionieren.

11. Chirurgisches Insufflationsinstrument gemäß Anspruch 1, wobei die Spitze (32) eine Klappspitze ist.

12. Chirurgisches Insufflationsinstrument gemäß Anspruch 1, wobei die Spitze (32) ein Zweiphasen-Klappdeckel (290) ist, der betriebsfähig ist, um sich von einer penetrierenden Position zu einer aufblasenden Position und dann zu einer Instrumentzugangsposition zu bewegen.

13. Chirurgisches Insufflationsinstrument gemäß Anspruch 1, wobei die Spitze ein Klappdeckel (290) ist, der einen distalen Klappteil (292) und einen proximalen Klappteil (294) beinhaltet.

Revendications

1. Instrument chirurgical d'insufflation conçu pour pénétrer une paroi abdominale afin d'insuffler une région abdominale d'un patient, comprenant :

une canule (70) comprenant une paroi formant une première lumière et un premier canal qui se prolongent le long d'un axe entre l'extrémité proximale et une extrémité distale de la canule (70) et qui est conçue pour être raccordée à une source d'un fluide sous pression au niveau de l'extrémité proximale ; et
un trocart (30) pouvant être inséré dans et retiré de la lumière de la canule (70), le trocart (30) comprenant :

une tige (34) dotée d'une paroi formant une deuxième lumière et un deuxième canal qui se prolongent le long d'un axe entre une extrémité proximale et une extrémité distale du trocart (30) ; le deuxième canal étant raccordé d'une manière opérationnelle au premier canal pour permettre un transfert de fluide à partir de la canule (70) jusqu'au trocart (30) ;
une pointe (32) à l'extrémité distale de la tige qui est conçue pour pénétrer un tissu et qui renferme l'extrémité distale de la tige ; la pointe (32) présentant au moins un orifice de ventilation (36) ;
un canal d'insufflation comprenant le premier canal et le deuxième canal ; **caractérisé en ce que** le au moins un orifice de ventilation présente une première position fermée pendant la pénétration de la paroi abdominale et une deuxième position ouverte permettant d'expulser le fluide sous pression pour insuffler la région abdominale après pénétration de la paroi abdominale.

2. Instrument chirurgical d'insufflation de la revendication 1, où la pointe (32) comprend un clapet rabattable (272) et un corps conique (270) qui fonctionne pour passer d'une première position de pénétration à une deuxième position d'insufflation.

3. Instrument chirurgical d'insufflation de la revendication 1, où la pointe (32) est un clapet rabattable (272) qui s'ouvre automatiquement lorsque la paroi abdominale est traversée.

4. Instrument chirurgical d'insufflation de la revendication 2 comprenant en outre un élément de rétention qui raccorde la tige au clapet rabattable.

5. Instrument chirurgical d'insufflation de la revendication 1, où la pointe est une valve à clapet (310) qui s'ouvre dans la deuxième position quand un gaz ou un fluide est introduit au niveau de la source et dans le canal d'insufflation.

6. Instrument chirurgical d'insufflation de la revendication 5, où la valve à clapet (310) est une valve d'inversion à clapet (320).

7. Instrument chirurgical d'insufflation de la revendication 5, où la valve à clapet (310) est une valve à clapet à ressort.

8. Instrument chirurgical d'insufflation de la revendication 4, où l'élément de rétention est un des suivants : ressort, fil d'acier à ressort, charnière excentrée ou charnière dynamique.

9. Instrument chirurgical d'insufflation de la revendication 1, où la pointe (32) est un clapet à deux parties (282).

10. Instrument chirurgical d'insufflation de la revendication 1, où la pointe (32) comprend au moins deux pattes qui sont repositionnées sur le côté de la tige dans la deuxième position d'insufflation.

11. Instrument chirurgical d'insufflation de la revendication 1, où la pointe (32) est une pointe à bascule.

12. Instrument chirurgical d'insufflation de la revendication 1, où la pointe (32) est un clapet rabattable en deux étapes (290) qui fonctionne pour passer d'une position de pénétration à une position d'insufflation et ensuite à une position d'accès d'un instrument.

13. Instrument chirurgical d'insufflation de la revendication 1, où la pointe est un clapet rabattable (290) comprenant une partie basculante distale (292) et une partie basculante proximale (294).

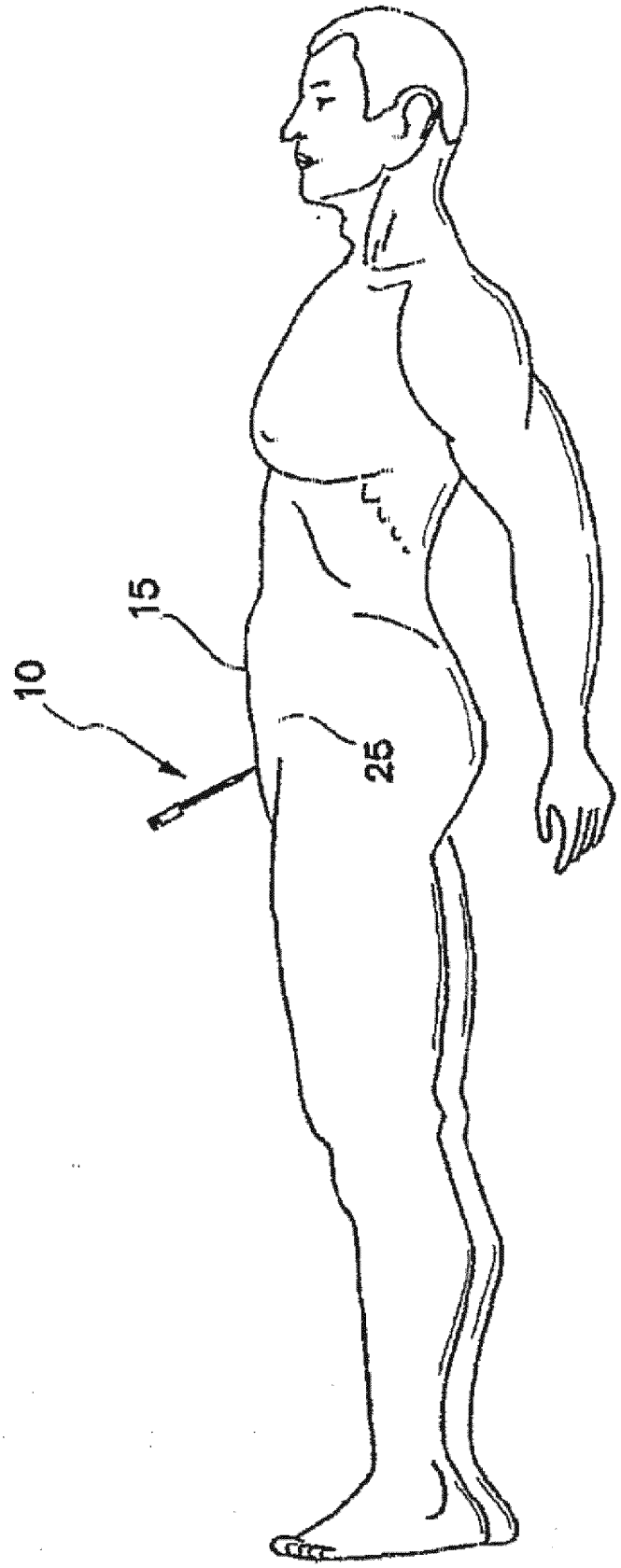


FIG. 1
PRIOR ART

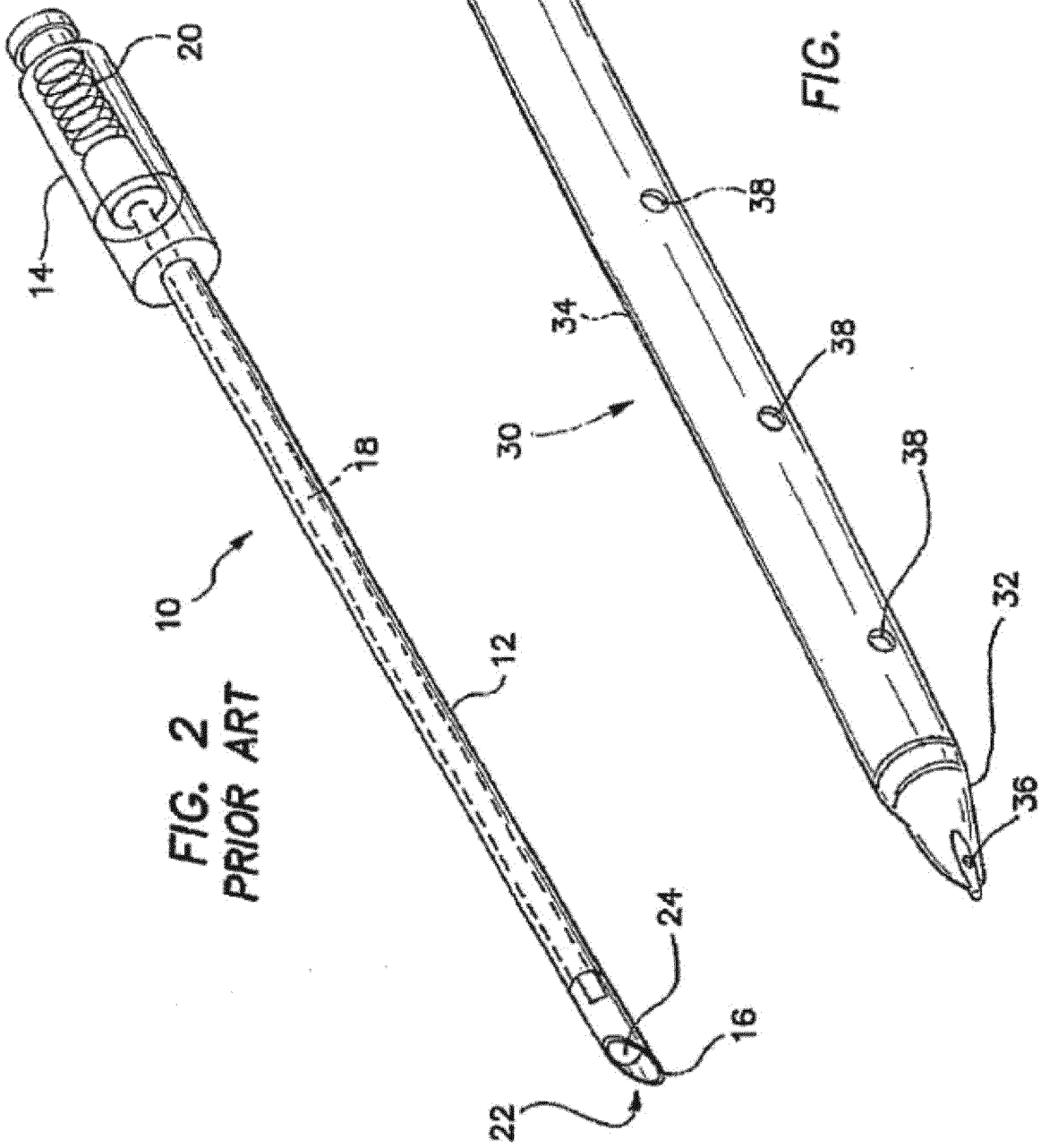


FIG. 2
PRIOR ART

FIG. 3

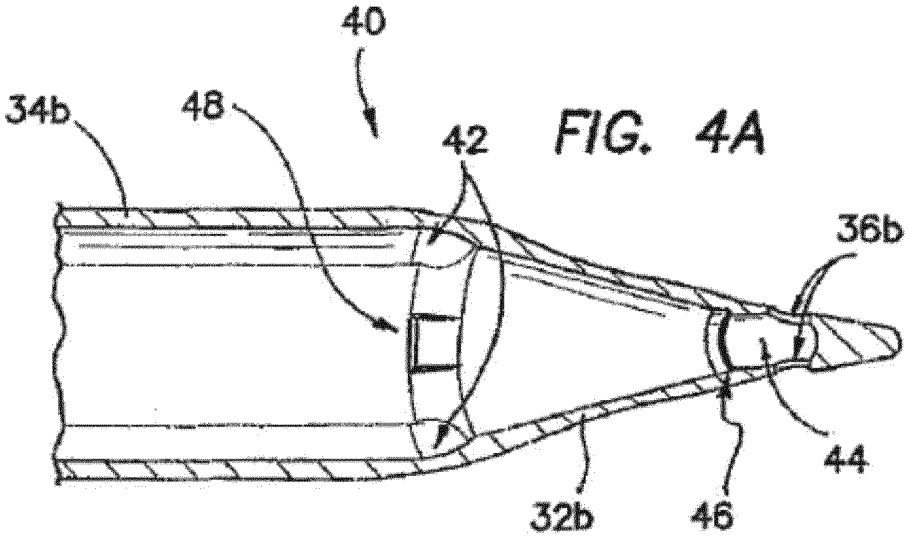


FIG. 4A

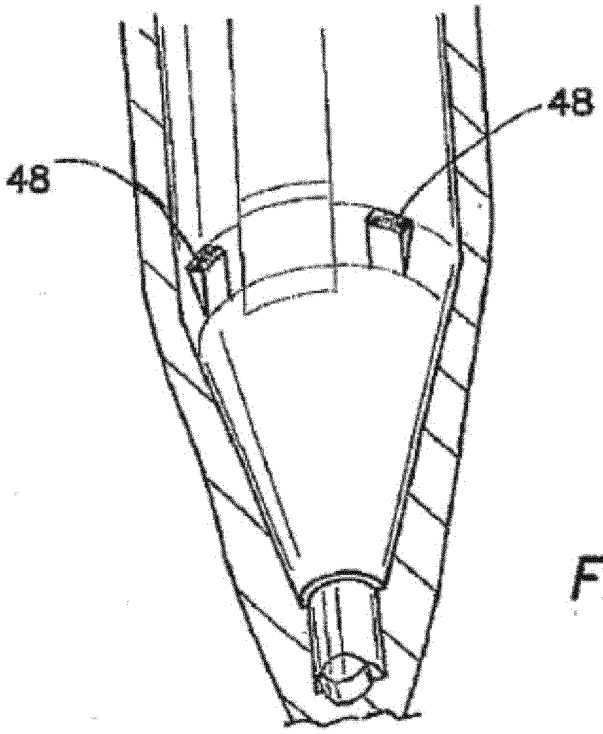


FIG. 4B

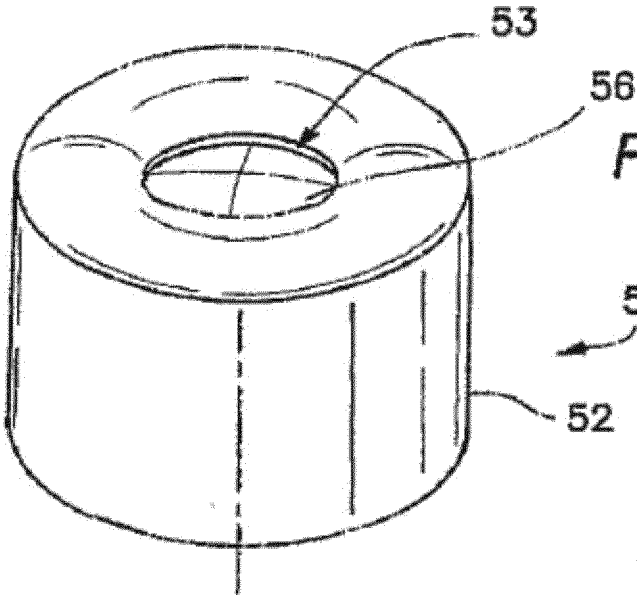


FIG. 5

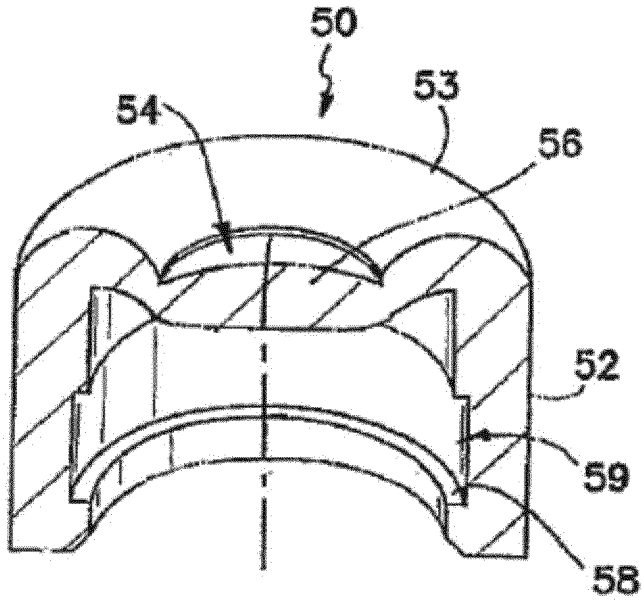


FIG. 6A

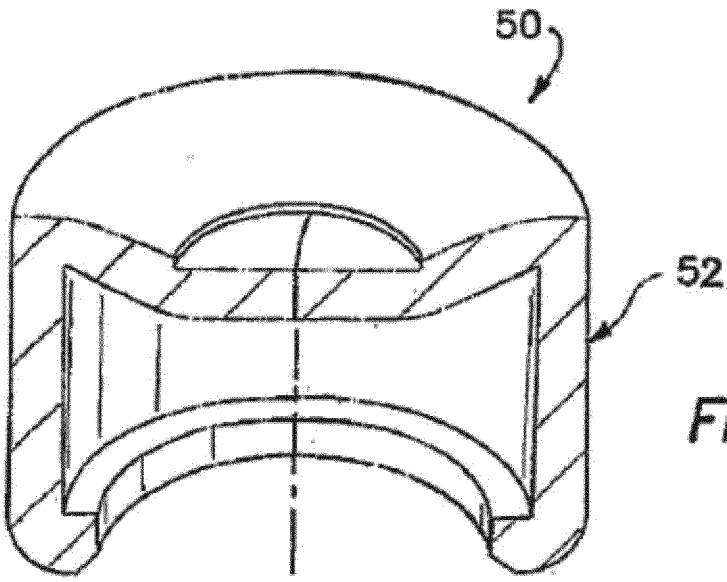


FIG. 6B

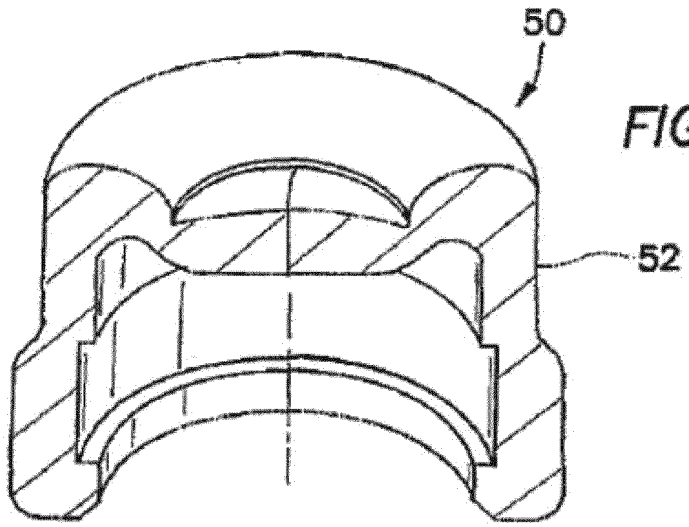


FIG. 6C

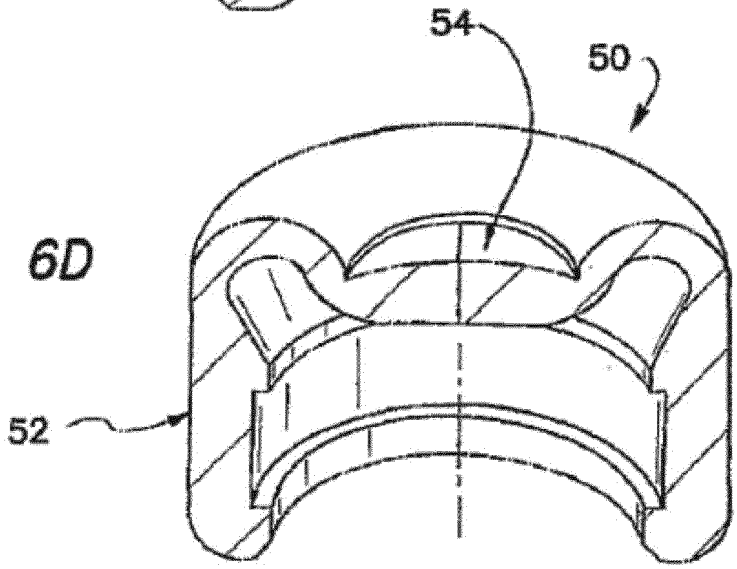


FIG. 6D

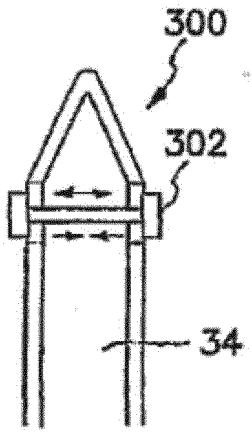


FIG. 15A

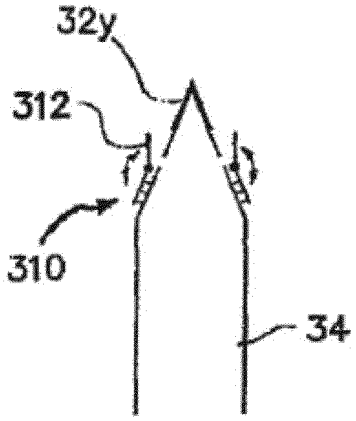


FIG. 15B

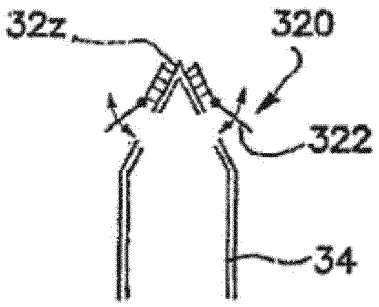


FIG. 15C

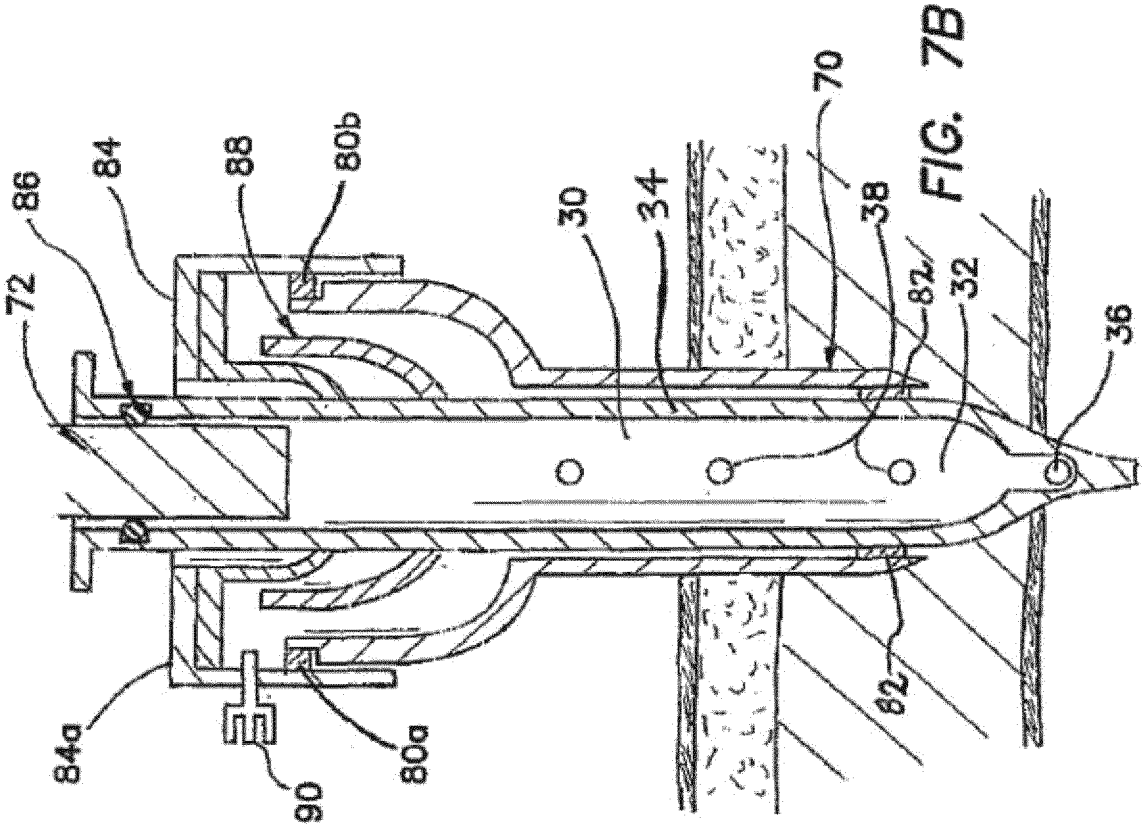

72
86
84
88
80b
30
34
70
38
82
32
36
84a
90
80a
82

FIG. 7B

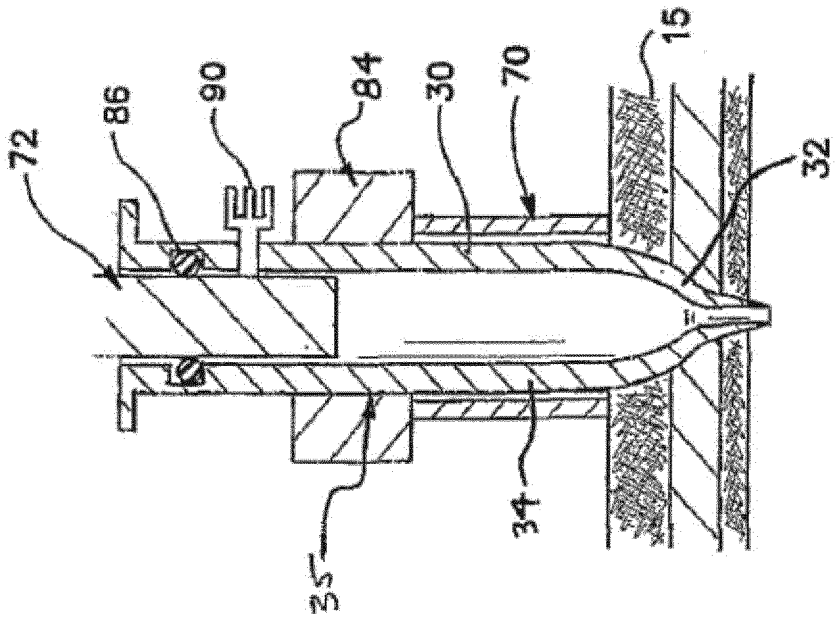

72
86
90
84
30
70
15
32
35
34

FIG. 7A

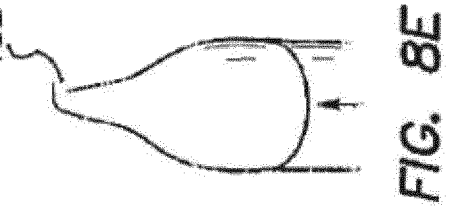


FIG. 8E

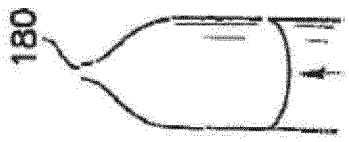


FIG. 8D

FIG. 8C

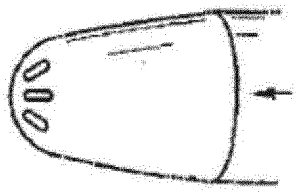


FIG. 8B

FIG. 8A

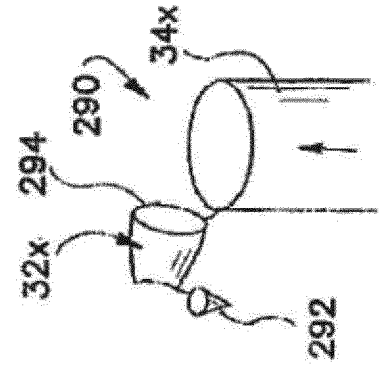


FIG. 14C

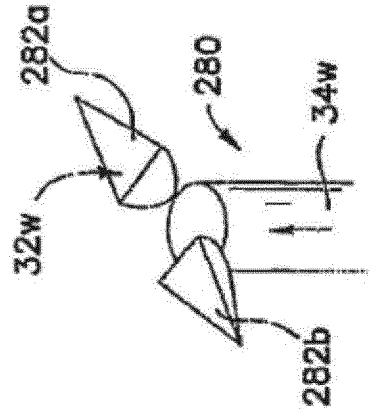


FIG. 14B

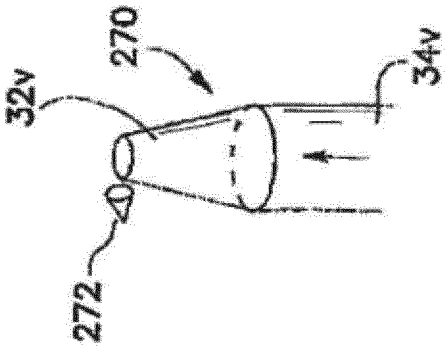


FIG. 14A

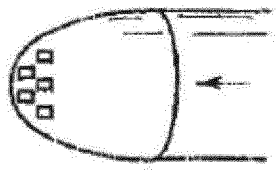


FIG. 8F

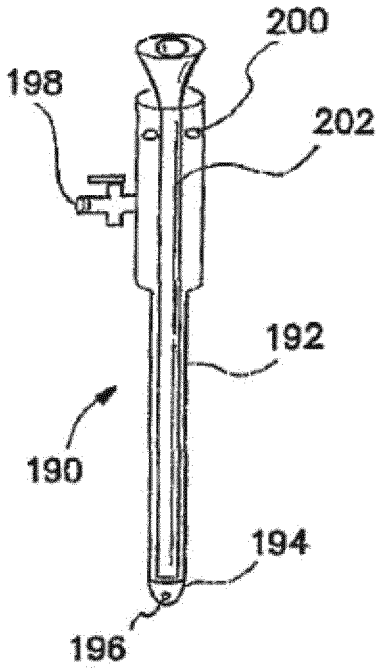


FIG. 9

FIG. 10

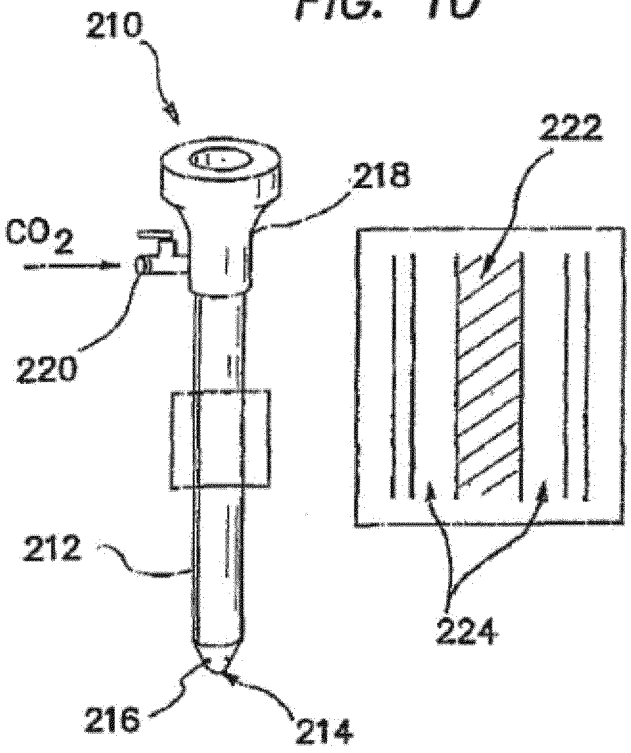
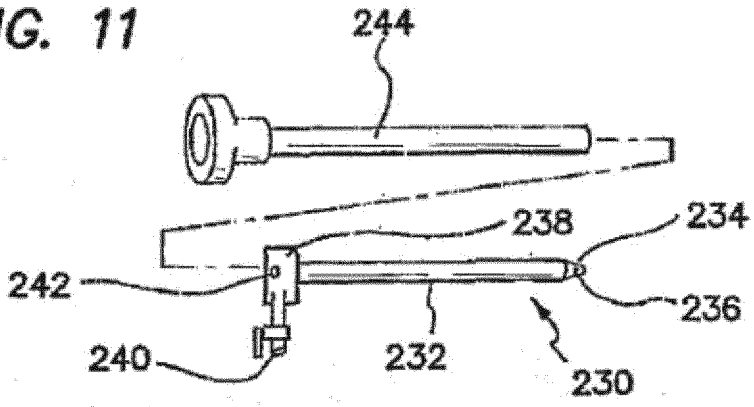


FIG. 11



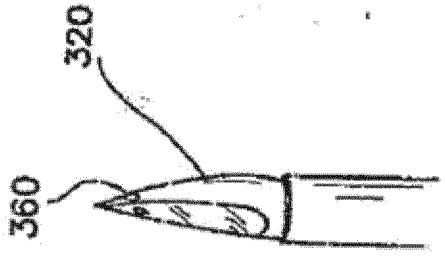


FIG. 12A

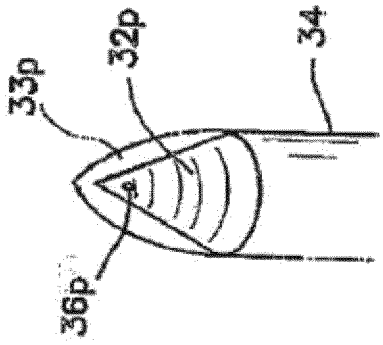


FIG. 12B

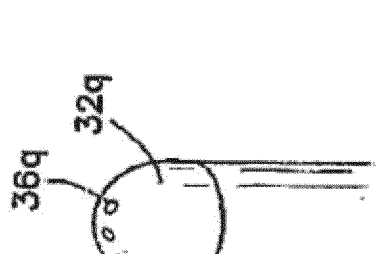


FIG. 12C

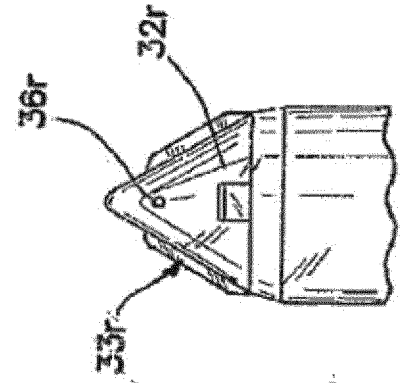


FIG. 12D

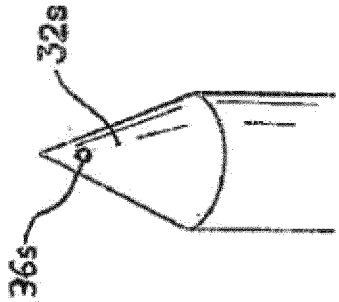


FIG. 12E

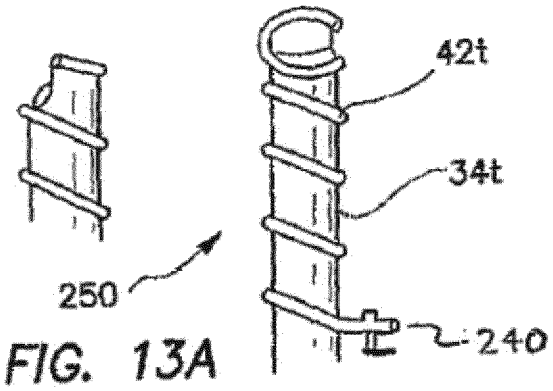


FIG. 13A

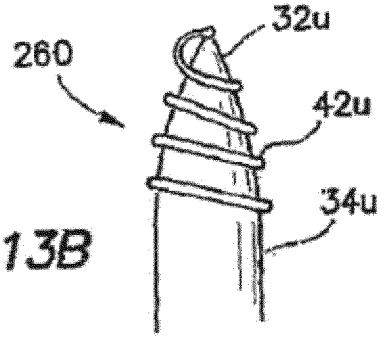


FIG. 13B

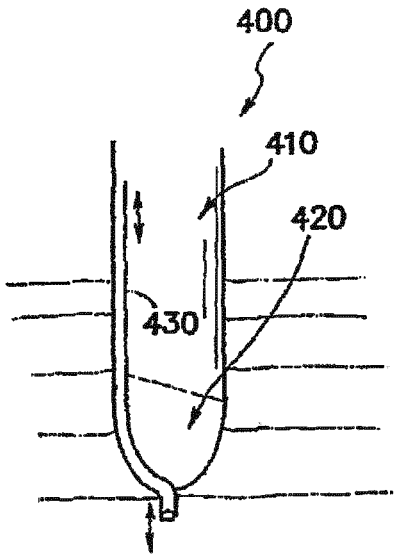


FIG. 16

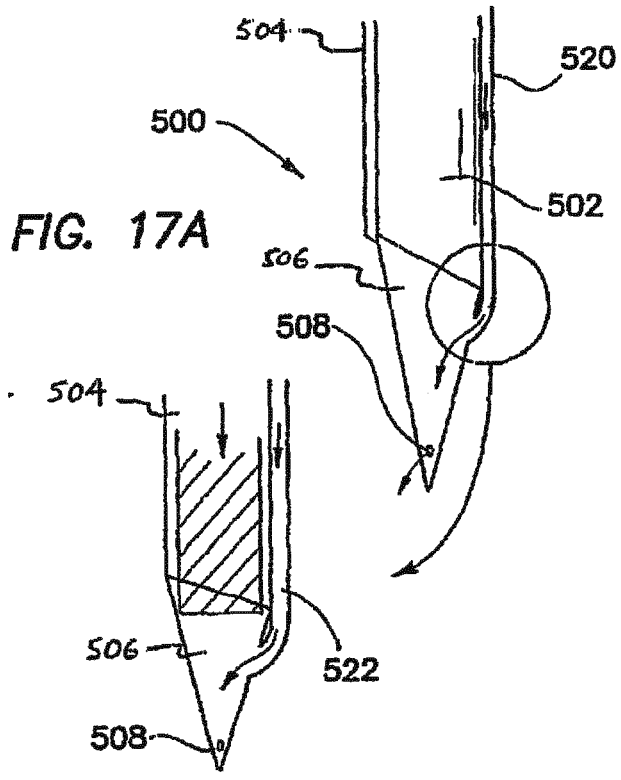
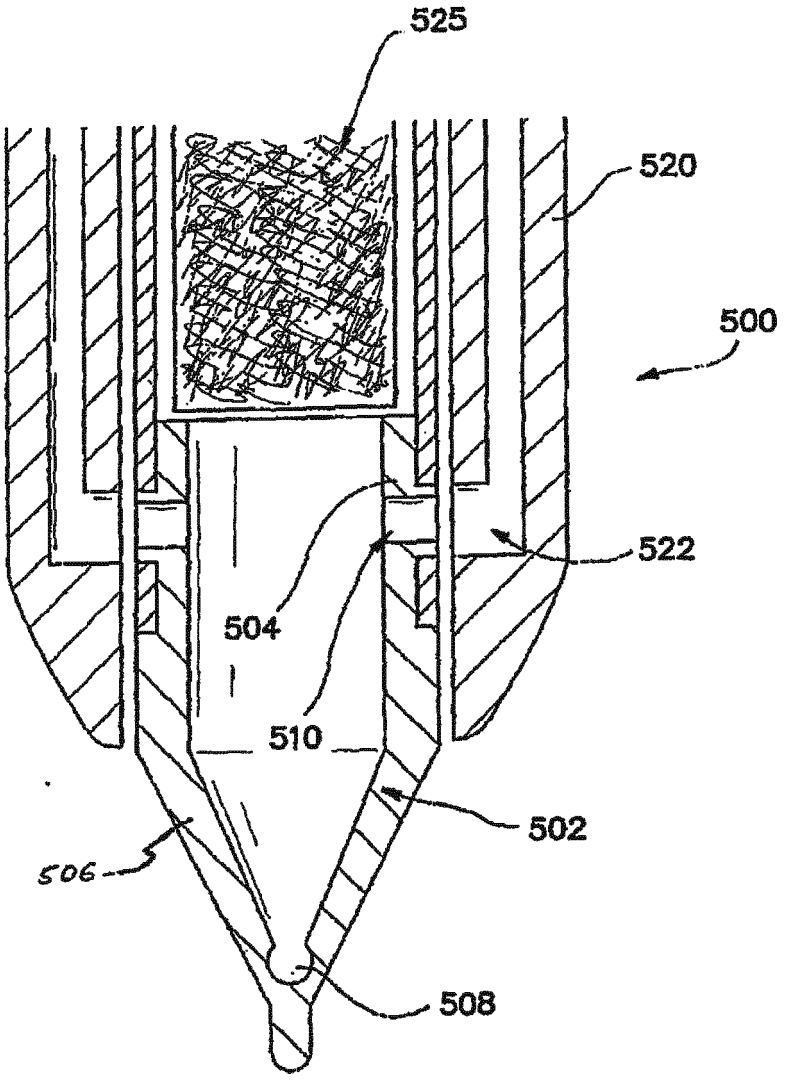


FIG. 17A

FIG. 17B



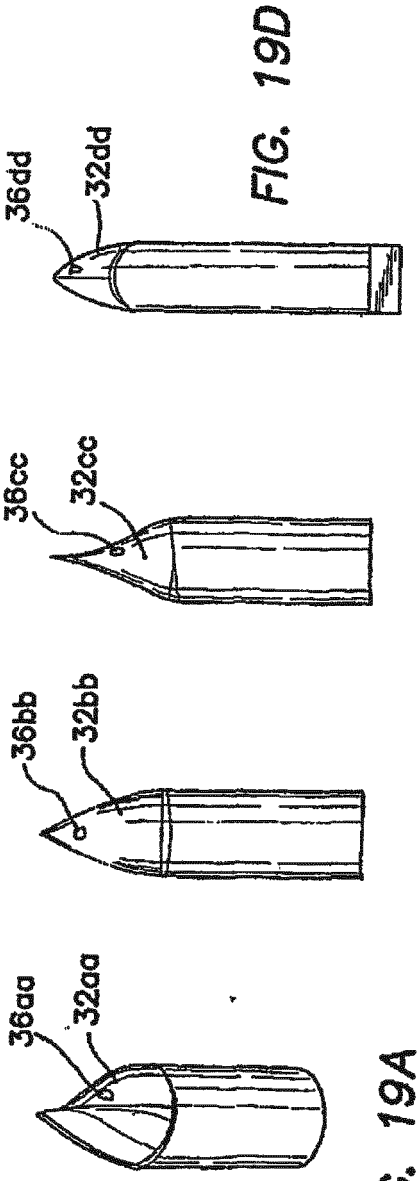


FIG. 19A

FIG. 19B

FIG. 19C

FIG. 19D

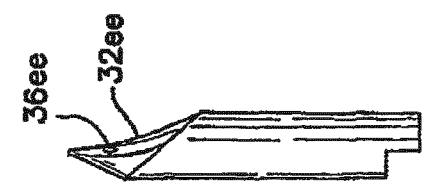


FIG. 19E

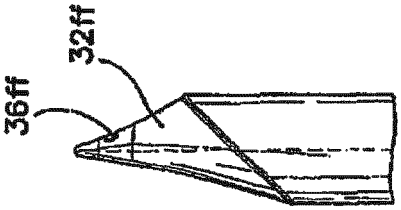


FIG. 19F

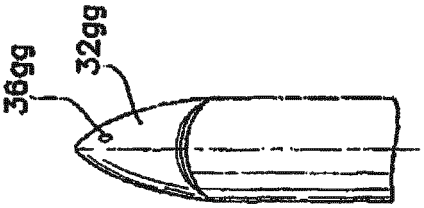


FIG. 19G

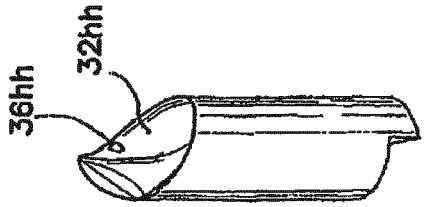


FIG. 19H

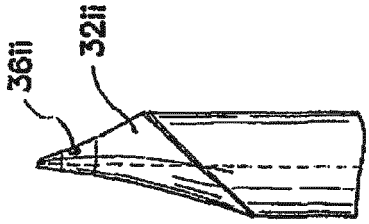


FIG. 19I

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO 9601132 A **[0006]**
- US 20050209619 A1 **[0033]**

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摘要(译)

一种腹腔镜吹气手术器械，其适于穿过腹壁移动以吹入患者的腹部区域，包括：- 套管（520），其具有形成沿着近端和远端之间的轴线延伸的第一腔的壁，以及至少第一吹入通道（522）形成在壁中并适于连接到近端压力下的流体源;- 具有轴（504）的套管针（502），所述轴（504）具有沿着轴线在近端和远端之间延伸的第二腔，所述套管针在所述轴的远端具有尖端（506）;- 在套管针的尖端处形成至少一个通气孔（508）;- 在所述轴或所述套管针的尖端中形成的第二吹入通道（510），其适于与所述第一吹入通道对准，以在压力下将流体从所述第一吹入通道传递到所述套管针并且在压力下将所述流体排出通过所述第一吹入通道。通气孔吹气腹部。