

(19)



(11)

EP 2 851 020 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention of the grant of the patent:
20.01.2016 Bulletin 2016/03

(51) Int Cl.:
A61B 17/34^(2006.01)

(21) Application number: **14190029.0**

(22) Date of filing: **26.01.2009**

(54) **Insufflating access system**

Insufflierendes Zugangssystem

Système d'accès d'insufflation

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO SE SI SK TR

- **Johnson, Gary M**
Rancho Santa Margarita, CA California 92688 (US)
- **Brustad, John R**
Rancho Santa Margarita, CA California 92688 (US)

(30) Priority: **25.01.2008 US 23539 P**

(43) Date of publication of application:
25.03.2015 Bulletin 2015/13

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

(62) Document number(s) of the earlier application(s) in accordance with Art. 76 EPC:
09703532.3 / 2 231 233

(73) Proprietor: **APPLIED MEDICAL RESOURCES CORPORATION**
Rancho Santa Margarita, CA 92688 (US)

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(72) Inventors:
 • **Albrecht, Jeremy J**
Rancho Santa Margarita, CA California 92688 (US)

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Description

BACKGROUND

Technical Field

[0001] This application is directed to an insufflating access system.

Description of the Related Art

[0002] In laparoscopic procedures in which a patient's abdomen is insufflated or inflated with gas, placing a device through which the abdomen is insufflated, also referred to as a first entry device, is often problematic. Because the peritoneum directly contacts the organ bed, a device puncturing the peritoneum can also damage the underlying organ bed. Placing subsequent devices is less dangerous because the insufflating the abdomen lifts the peritoneum above a gas-fill space or cavity above the organ bed, thereby reducing the risk of inadvertent damage thereto.

[0003] Several techniques are used to achieve pneumoperitoneum in laparoscopic surgery. A first technique uses a Veress needle, which is a sharp needle placed blindly through the abdominal wall into the abdominal cavity. An insufflation gas, for example, CO₂, is then pumped through the hollow Veress needle and into the abdominal cavity, thereby insufflating the peritoneal cavity. The Veress needle technique, also known as a controlled stab, is capable of damaging organs such as the intestinal tract. The technique provides little or no feedback to the surgeon that any damage to an anatomic structure has occurred.

[0004] A second technique is known as the Hassan technique in which a surgeon performs a mini-laparotomy through the abdominal layers into the abdominal cavity, through which a trocar is inserted and the abdomen insufflated. The Hassan technique is a cut-down technique that results in larger abdominal defects and increased patient scarring. The technique is also difficult to perform on obese patients with very thick abdominal walls.

[0005] In a third technique, the surgeon places a trocar optically, visualizing the abdominal layers as the trocar is placed through the abdominal wall through a laparoscope disposed within the obturator of the trocar. The tip of the obturator can penetrate about 2 cm (about 0.75") into the organ bed of the abdominal cavity when placing the cannula and establishing pneumoperitoneum.

[0006] In a fourth technique, the abdominal layers are visualized while the trocar is advanced through the abdominal wall. As soon as the tip of the obturator punctures the peritoneum, gas is pumped through the trocar system into the abdominal cavity through vent holes disposed at the tip of the obturator. The fourth technique uses a vacuum release, which causes the organs to fall away from the abdominal wall, thereby creating a space in the abdominal cavity for the obturator tip. Accordingly, the ab-

dominal cavity can be inflated with minimal penetration into the space. As soon as the tip of the obturator punctures the peritoneum, gas enters the abdominal cavity through the vent holes in the tip of the obturator, thereby reducing the negative pressure caused by the surgeon's lifting of the abdominal wall, and in turn, creating a space above the organ bed into which the trocar system is fully inserted into the cavity. A seal is disposed within the obturator that provides a gas tight seal both with and without the laparoscope in place. The vent holes at the tip of the obturator allow moisture and tissue to enter the obturator, however, which obscure the field of view within the obturator tip. Gas flowing directly past the laparoscope within the obturator can cool the laparoscope, thereby fogging of the lens thereof.

[0007] European Patent Application EP 1733707 A1, US Patent Application US2005/007851 A1 and International Patent Application WO 03/020140 A1 disclose known access systems of the type to which the present invention relates.

[0008] EP1733707 is considered the closest prior art.

SUMMARY OF THE INVENTION

[0009] The present invention provides an access system in accordance with Claim 1. This may permit insufflation of a body cavity prior to the insertion of a cannula into the body cavity. The access system has a closed configuration, in which a distal end of the access system is fluidly isolated from the fluid flow channel, and an open configuration, in which the distal end of the access system is fluidly connected to the fluid flow channel, thereby permitting fluid flow, for example, an insufflation gas into a body cavity.

[0010] In some embodiments, the trocar seal assembly further comprises a zero seal.

[0011] In some embodiments, the distal end of the cannula comprises an angled tip.

[0012] In some embodiments, the fluid port is disposed on the trocar seal assembly.

[0013] In some embodiments, the fluid flow seal is integrated with a cannula tip disposed at the distal end of the cannula. In some embodiments, the fluid flow seal is disposed proximal of the distal end of the cannula. In some embodiments, the fluid flow seal is substantially perpendicular to the longitudinal axis of the axis channel. In some embodiments, the fluid flow seal is not perpendicular to the longitudinal axis of the axis channel.

[0014] In some embodiments, the obturator further comprises an instrument well open at a proximal end of the obturator, extending longitudinally through the body of the obturator, terminating at the tip of the obturator, and dimensioned to receive a laparoscope therein, wherein at least a portion of the tip of the obturator is transparent. Some embodiments further comprise a laparoscope.

[0015] In some embodiments, the fluid flow channel comprises a space defined by the lumen of the cannula

and the body of the obturator. In some embodiments, the fluid flow channel comprises an instrument well disposed in the body of the obturator. In all embodiments, the fluid flow channel comprises a slot disposed in the body of the obturator.

[0016] In some embodiments, in the closed position, the obturator is displaced proximally in the access channel compared with the open position. In some embodiments, in the closed position, the obturator is rotated in the access channel compared with the open position.

[0017] Some embodiments further comprise means for visually monitoring the position of the penetrating tip through a laparoscope.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018]

FIG. **1A** is a perspective view of an insufflating access system. FIG. **1B** is a perspective cutaway view of a trocar of the insufflating access system illustrated in FIG. **1A**. FIG. **1C** is a side cutaway view of the trocar illustrated in FIG. **1B**. FIG. **1D** is a side cutaway view of the insufflating access system illustrated in FIG. **1A** in the closed configuration. FIG. **1E** is a side cross-sectional view of the insufflating access system illustrated in FIG. **1A** in a closed configuration. FIG. **1F** is a cross-sectional view of the insufflating access system illustrated in FIG. **1A** in an open configuration.

FIG. **2A** is a perspective view of an embodiment of an insufflating access system according to the invention.

FIG. **2B** is a perspective view of an embodiment of an obturator from the insufflating access system illustrated in FIG. **2A**. FIG. **2C** is a side cutaway view of an embodiment of the insufflating access system illustrated in FIG. **2A** in a closed configuration. FIG. **2D** is a side cutaway view of the embodiment of the insufflating access system illustrated in FIG. **2C** in an open configuration.

Figures 3-5 show views of alternative insufflating access systems that do not form part of the invention.

DETAILED DESCRIPTION OF CERTAIN EMBODIMENTS

[0019] FIG. **1A** is a perspective view an insufflating access system **100** comprising a trocar **110** and an obturator **160** slidably insertable into the trocar **110**. The insufflating access system **100** also comprises a fluid flow channel, which is discussed in greater detail below. The trocar **110** and obturator **160** comprise suitable biologically compatible materials.

[0020] FIG. **1B** is a perspective cutaway view and FIG. **1C** is a partial side cross section of the trocar **110**. The trocar **110** comprises a proximal end **112** and a distal end **114**. A trocar seal assembly **120** is disposed at the

proximal end **112** of the trocar, and an elongate cannula **130** extends from the trocar seal assembly **120** and is disposed at the distal end **114** of the trocar. An access channel **116** extends through the trocar seal assembly **120** and the cannula **130**, from the proximal end **112** to the distal end **114** of the trocar. The access channel **116** defines a longitudinal axis. In some embodiments, the trocar seal assembly **120** and the cannula **130** are integrated, while in other embodiments, the trocar seal assembly **120** and the cannula **130** are separate components, and in some embodiments, releasably coupled.

[0021] In the illustrated device, the trocar seal assembly **120** comprises a first seal **122** and a second seal **124** disposed on the access channel **116** within a trocar seal housing **126**. The first seal **122** is an instrument seal, which forms a substantially fluid tight seal with an instrument extending therethrough, thereby preventing fluid from escaping from the proximal end **112** of the trocar. In some embodiments, the first seal **122** comprises a septum seal. The second seal **124** is a zero seal, which forms a fluid tight seal with no instrument extending therethrough, preventing fluid from escaping from the proximal end **112** of the trocar. In some embodiments, the second seal **124** comprises a duckbill valve, a double duckbill valve, and/or a flap valve. The second seal **124** is optional in some embodiments. For example, in some variants, the first seal **122** provides both an instrument seal and a zero seal, for example, a valve comprising a gel material. Other variants do not comprise a zero seal. In some variants, the first seal **122** and the second seal **124** comprise an elastomer, for example rubber, synthetic rubber, silicone, ethylene propylene diene monomer (EPDM), ethylene-propylene copolymer (EP rubber), polyisoprene, polybutadiene, polyurethane, styrene-butadiene, ethylene vinyl acetate (EVA), polychloroprene (Neoprene®), perfluorelastomer (Kalrez®), and the like.

[0022] The cannula **130** comprises a proximal end, at which the trocar seal assembly **120** is disposed, and a distal end terminating in a tip **132**. In the illustrated variant, the tip **132** of the cannula is angled with a beveled edge. The angled tip **132** facilitates insertion through tissue. In some embodiments, the tip **132** is not angled. The cannula **130** comprises a hollow tube open at the proximal and the distal ends. The hollow tube defines a lumen **134**, through which the access channel **116** extends. One or more optional vents **136** perforate the cannula **130** at or near the distal end thereof. In the illustrated variant, the cannula **130** has a generally circular cross section, although those skilled in the art will understand that other variants have other suitable cross sections, for example, oval, elliptical, diamond, square, polygonal, and the like.

[0023] A fluid flow seal **140** is disposed within the lumen of the cannula **130**, on an inner wall of the hollow tube. The fluid flow seal **140** is positioned, dimensioned, and configured for sealing contacting the body **162** of the obturator, as discussed in greater detail below. In the illustrated variant, the fluid flow seal **140** is disposed near the

tip **132** or distal end of the cannula. The fluid flow seal **140** is substantially normal or perpendicular to the longitudinal axis of the trocar **110**, and consequently, is generally circular in the illustrated embodiment. In other variants, the fluid flow seal **140** is disposed at another location. For example, in some variants, the fluid flow seal **140** is disposed at or integrated with the tip **132** of the cannula, or spaced adjacent to or just slightly inward from the tip **132** at the distal-most end. In some of these variants in which the tip **132** is not perpendicular to the longitudinal axis of the trocar **110**, the fluid flow seal **140** also subtends a non-normal angle with the longitudinal axis, and consequently, is elliptical or oval rather than circular. In some variants, the fluid flow seal **140** and the tip **132** subtend about the same angle with the longitudinal axis, while in other variants, the fluid flow seal **140** and the tip **132** subtend different angles with the longitudinal axis. Some variants of the fluid flow seal **140** comprise a plurality of sub-seals, which are disposed at about the same location in some variants, and disposed in a plurality of locations in other variants. The fluid flow seal **140** comprises a suitable elastomer for example, at least one of rubber, synthetic rubber, silicone, ethylene propylene diene monomer (EPDM), ethylene-propylene copolymer (EP rubber), polyisoprene, polybutadiene, polyurethane, styrene-butadiene, ethylene vinyl acetate (EVA), polychloroprene (Neoprene®), perfluorelastomer (Kalrez®), and the like.

[0024] A fluid port **150** is disposed on the housing **126** of the trocar seal assembly, fluidly connected with the access channel **116** distal of the first **122** and second **124** seals. The fluid port **150** comprises a stopcock in the illustrated variants, and terminates in a fitting that permits coupling to a fluid and/or suction source, for example, a Luer fitting. In other variants, the fluid port **150** has another location, for example, on the cannula **130** or the obturator **160**. Variants of the fluid port **150** are useful for introducing and/or venting an insufflation gas, for example, carbon dioxide, therethrough. Other fluids are introduced and/or vented in other variants.

[0025] The trocar **110** is typically manufactured in a range of sizes to accommodate instruments of different diameters, for example, up to about 5 mm, up to about 8 mm, up to about 11 mm, up to about 12 mm, or up to about 15 mm. Variants of the trocar **110** have working cannula lengths of about 55 mm, about 75 mm, about 100 mm, or about 150 mm.

[0026] As best seen in FIG. **1D**, which is a side cutaway view of the insufflating access system **100**, the obturator **160** comprises an elongate body **162** comprising a proximal end terminating in a handle **164** and a distal end terminating in a tissue penetrating tip **166**. A diameter of the tip **166** converges from a proximal end to a distal end thereof. The body **162** and tip **166** of obturator is slidably insertable into and removable from the access channel **116** through the proximal end of the trocar **110**. In a fully inserted configuration, the tip **166** of the obturator extends out of the distal end or tip **132** of the cannula **130**.

The first seal **122** of the trocar seal assembly forms an instrument seal with the body **162** of the cannula, thereby substantially preventing fluid leaking from the proximal end of the access channel **116**. In the illustrated variant, the body **162** comprises a hollow, instrument well **168**, which is open at the handle **162** at the proximal end of the obturator, and which extends to the tip **166** of the obturator. The instrument well **168** is dimensioned to receive a laparoscope through the proximal opening thereof. When fully inserted, an end of the laparoscope extends through the body **162** of the obturator into or proximal to the tip **166**. In the illustrated variant, the tip **166** comprises at least a transparent or windowed portion through which the laparoscope images tissue proximal to the tip **166**, for example, for monitoring the position of the tip **166** during the insertion of the access system **100** into a body cavity. Some variants of the tip **166** comprise markers or another type of visually enhancing or facilitating features, which assist in viewing the tissue and body cavity, and thus, traversal of the tip **166** through the body. In some variants, the laparoscope is fully inserted in the instrument well **168**, thereby preventing or reducing fogging thereof. Accordingly, some variants comprise at least one of a distal laparoscope seal, membrane, or lock in that provides at least one of holding the laparoscope in a fully or nearly fully inserted position, preventing or reducing fogging, and preventing or reducing other types of interference of the viewing area of the laparoscope.

[0027] FIG. **1E** is a side cross section of the insufflating access system **100** in a closed configuration and FIG. **1F** is a side cross section of the insufflating access system **100** in an open configuration. The lumen **134** of the cannula and the body **162** of the obturator together define a fluid flow channel **180** therebetween, which extends longitudinally in the access channel **116**. A proximal end **182** of the fluid flow channel is fluidly connected to the fluid port **150**. A distal end **184** of the fluid flow channel extends to the distal end of the access system **100**, which in the illustrated variant, comprises the tip **132** of the cannula. In the illustrated variant, the lumen **134** of the cannula and the body **162** of the obturator are both generally circular and define a fluid flow channel **180** with a generally annular cross section. In other variants, cross-sectional shapes of the lumen **134** of the cannula and the body **162** of the obturator are different from each other, and the cross section of the fluid flow channel **180** has another shape.

[0028] A size of a space or gap between the tip **166** of the obturator and the tip **132** of the cannula is selected to prevent or reduce coring of tissue as the access system is advanced. In some variants, the gap between the tip **166** of the obturator and the tip **132** of the cannula provides sufficient gas flow for insufflation, which is discussed in greater detail below. In some variants, a gap between the body **162** of the obturator and the lumen **134** of the cannula is not uniform longitudinally, for example, wider at the proximal end **112** and narrower at the distal end **116**.

[0029] In the closed configuration illustrated in FIG. 1E, the tip 166 of the obturator extends from the tip 132 of the cannula in a configuration suitable for inserting the access system 100 through a body wall and into a body cavity. The position of the obturator 160 in this configuration is referred to as a closed position. In the closed configuration, the fluid flow seal 140 sealing contacts the body 162 of the obturator, thereby cooperating therewith to prevent fluid flow through the fluid flow channel 180, from the fluid port 150, and out through the tip 132 of the cannula. Accordingly, the fluid port 150 is not fluidly connected with the distal end of the fluid flow channel 184.

[0030] In the open configuration illustrated in FIG. 1F, the obturator 160 is partially withdrawn from access channel 116, that is translated proximally along the longitudinal axis compared with the configuration illustrated in FIG. 1E. The position of the obturator 160 in this configuration is referred to as an open position. In the illustrated variant, the body 162 of the obturator is proximal of the fluid flow seal 140, and consequently, does not make contact and form a seal therewith. Accordingly, in the open configuration, the distal end 184 of the fluid flow channel is fluidly connected with the fluid port 150. In some variants, the fluid flow seal 140 contacts a portion of the body 162 of the obturator in the open configuration, but does not sealing contact therewith. For example, in some variants, at least one of the fluid flow seal 140, and a transition between the body 162 and tip 166 of obturator are not normal or perpendicular to the longitudinal axis. In some of these variants, in some positions of the obturator 160 in the access channel, the body 162 of the obturator contacts only a portion of the fluid flow seal 140 rather than the entire sealing surface thereof, and consequently, does not form a seal therewith.

[0031] Some variants of the access system 100 comprise an indicator of the configuration thereof. For example, some variants comprise indicia on the obturator 160 and/or the trocar 110 that indicate the position of the obturator 160 in the open and/or closed position. Some variants comprise an audio and/or visual indicator of fluid flow through the fluid flow channel 180 and/or fluid port 150, for example, a spinning disk, a spinning ball, a lamp, a whistle, and/or an alarm.

[0032] Some variants comprise one or more mechanical features that indicate the state of and/or lock the access system 100 into at least one of the open configuration and the closed configuration, for example, detents, latches, stops, and the like.

[0033] FIG. 2A is a perspective view of an embodiment of an insufflating access system 200 generally similar to the embodiment illustrated in FIGS. 1A-1F, comprising a trocar 210, an obturator 260 inserted in the trocar 210, and a laparoscope 290 inserted into the obturator 260. FIG. 2B is a perspective view of an embodiment of the obturator 260, which is similar to the embodiment of the obturator 160 described above, and comprises an elongate body 262, a handle 264 disposed at the proximal end, a tip 266 disposed at the distal end, and an instru-

ment well 268 extending longitudinally from an opening in the handle 264 at the proximal end of the obturator to the tip 266 at the distal end thereof.

[0034] The obturator 260 according to the present invention further comprises a slot 272 that extends longitudinally on the body 262 thereof. As will be apparent from the description below, the slot 272 incorporates the instrument well 268 into the fluid flow channel 280 in the illustrated embodiment. Because the fluid flow channel 280 comprising the instrument well 268 has a larger cross-sectional area compared with the fluid flow channel 180 of the variants illustrated in FIGS. 1A-1F, embodiments of the access system 200 exhibit increased fluid flow. A proximal end of the slot 272 is positioned such that the slot 272 does not interfere with the instrument seal between the body 262 and the trocar seal assembly 220 when the obturator 260 is in the open position or the closed position. A distal end of the slot 272 is positioned such that fluid does not flow from the slot 272 in the closed configuration, that is, the distal end of the slot 272 is fluidly isolated from the distal end of the access system 200. The open configuration permits fluid flow from the distal end of the slot 272, that is, the distal end of the slot 272 is fluidly connected to the distal end of the access system 200. In the illustrated embodiment, the slot 272 perforates the body 262 of the obturator into the instrument well 268. Accordingly, the illustrated embodiment comprises a seal between the proximal end of the obturator 260 and the laparoscope 290, thereby preventing or reducing fluid flow therefrom. The seal is disposed on at least one of the laparoscope 290 and the obturator 260. In some embodiments, the slot 272 does not perforate the body 262 of the obturator, for example, comprising one or more longitudinal grooves disposed on an outer surface of the body 262. The seal between the proximal end of the obturator 260 and the laparoscope 190 is optional in these embodiments. Some embodiments of the fluid flow channel 280 comprise one or more longitudinal grooves disposed on an inner wall of the cannula 230.

[0035] FIG. 2C is a side cutaway view of an embodiment of the insufflating access system illustrated in FIG. 2A in a closed configuration. In the closed position, the obturator 260 is inserted into the access channel of the trocar 210 with the tip 266 extending from the tip 232 of the cannula in a tissue penetrating position. The proximal end of the slot 272 is disposed below the instrument seal of the seal assembly 220, in fluid communication with the fluid port 250. The distal end of the slot 272 is disposed proximal to the fluid channel seal 240, which seals with the body 262 of the obturator, thereby fluidly isolating the slot 272 from the tip 232 of the cannula and the distal end of the access system 200.

[0036] FIG. 2D is a side cutaway view of the embodiment of the insufflating access system illustrated in FIG. 2C in an open configuration in which the obturator 260 is advanced distally in the access channel, for example, using the handle 264, thereby advancing the distal end of the slot 272 past the fluid channel seal 240, and thereby

releasing the seal between the body **262** of the obturator and the fluid channel seal **240**. In the illustrated embodiment, the slot **272** has about the same length as the cannula **230**, extending from about the position of the fluid inlet to past a proximal portion of the angled tip **232** of the cannula, with which the slot **272** is aligned. Accordingly, alignment of the distal end of the slot **272** with the proximal portion of the angled tip **232** exposes the distal end of the slot **272**, thereby providing a fluid flow channel **280** that permits insufflation gas to exit directly out the slot **272** and into the body cavity. In some embodiments, the obturator **260** and trocar **210** are keyed or otherwise configured to prevent rotation therebetween, thereby locking the slot **272** in the exposed condition when the access system **200** is in the open configuration. Those skilled in the art will understand that some embodiments in which the slot **272** is rotated relative to the configuration illustrated in FIG. **2D** such that the distal end of the slot **272** and the proximal portion of the angled tip **232** are not aligned, also permit fluid flow therethrough, but at reduced flow rates.

[0037] In other embodiments, the access system **200** has an open configuration, as illustrated in FIG. **2A**, with a fluid flow seal **240** disposed in the cannula **230** at or near the angled tip **232** thereof. As discussed above, in some of these embodiments, the fluid flow seal **240** subtends the same or a similar angle as the tip **232**. Rotating the obturator **260** positions the entirety of the slot **272** within the cannula **230**, proximal of the fluid flow seal **240**, thereby converts the open configuration to the closed configuration in which the distal end of the slot **272** is fluidly isolated from the distal end of the access system **200**, and preventing fluid flow therefrom. In some of these embodiments, rotation of the handle **264** of the obturator is restricted such that the device **200** is in the open configuration at a first limit of the rotation and in a closed configuration at a second limit thereof.

[0038] FIG. **3A** is a perspective view of another variant of an insufflating access system **300** in an open configuration. FIG. **3B** is a side cross section of the insufflating access system **300** illustrated in FIG. **3A** in a closed configuration. The variant of the access system **300** illustrated in FIGS. **3A** and **3B** is similar to the embodiments described above. Like the embodiment illustrated in FIGS. **2A-2D**, a gas flow channel in the illustrated embodiment incorporates an instrument well, thereby increasing the cross sectional area thereof. The access system **300** comprises a trocar **310** and an obturator **360**.

[0039] As best seen in FIG. **3B**, the obturator **360** comprises at least one proximal opening **372** and at least one distal opening **374**, both of which perforate the body **362** of the obturator into the instrument well **368**. In the illustrated variant, the at least one proximal opening **372** and the at least one distal opening **374** are both generally circular or oval, but in other variants, independently have other suitable shapes.

[0040] A fluid flow seal **340** is disposed at or integrated with the cannula tip **332** in the illustrated variant, as de-

scribed above. Some variants of the trocar **310** further comprise a second fluid flow seal, either in addition to or instead of the fluid flow seal **340**. Some variants of the second fluid flow seal comprise a tubular member, disposed in the seal assembly **120**, through which the obturator **160** extends, wherein the tubular member comprises at least one opening that is aligned with the at least one proximal opening **372** when the obturator is in an open position, thereby permitting fluid flow therethrough. The at least one opening in the tubular member is not aligned with the at least one proximal opening **372** when the obturator is in a closed position, thereby preventing fluid flow therethrough.

[0041] In the illustrated variant, the access system **300** is converted from the open configuration illustrated in FIG. **3A** to the closed configuration illustrated in FIG. **3B** by rotating the obturator **360**, for example, using the handle **362**. In the illustrated variant, the obturator **360** is rotated about 180° between the views illustrated in FIGS. **3A** and **3B**, although those skilled in the art will understand that other rotational angles are used in other variants. The particular rotational angle depends on factors including the size and shape of the distal opening **374**, the location of the distal opening **374**, the location of the fluid flow seal **340**, the angle of the fluid flow seal **340**. In the illustrated variant, fluid flows from the fluid port **350**, into the proximal opening **372**, into the instrument well **368**, and out of the distal opening **374**. In the illustrated variant, the distal opening **374** is exposed in the open configuration. In the closed configuration, the distal opening **374** is positioned proximal of the fluid flow seal **340**, which forms a seal with a portion of the body **362** of the obturator distal of the distal opening **374**, thereby preventing fluid flow therefrom.

[0042] FIG. **3C** is a see-through view of another variant of an insufflating access system **300** in an open configuration. In the illustrated variant, the trocar **310** is similar to the variant illustrated in FIGS. **1A-1F** in which the fluid flow seal **340** is disposed in the lumen **334** of the cannula proximal to the tip **332**. In the illustrated variant, the access system **300** is converted from the illustrated open configuration to a closed configuration by withdrawing the obturator longitudinally toward the proximal end, thereby positioning the distal opening **374** proximal of the fluid flow seal **340**. The fluid flow seal **340** seals with a portion of the body **362** of the obturator distal of the distal opening **374**, thereby preventing fluid flow therefrom.

[0043] FIG. **4A** is a side cross section of another variant of an insufflating access system **400** in a closed configuration. FIG. **4B** is a side cross section of the insufflating access system **400** illustrated in FIG. **4A** in an open configuration. The insufflating access system **400** is generally similar to the insufflating access systems described above, and comprises a trocar **410** and an obturator **460**. In the illustrated variant, the trocar **410** is generally similar to the variant illustrated in FIGS. **1A-1F** and described above. The trocar **410** comprises a fluid flow seal **440**

disposed in the lumen **434** of a cannula **430** thereof, proximal of the tip **432** of the cannula. In the illustrated variant, the fluid flow seal **440** is generally perpendicular to a longitudinal axis of the trocar **310**.

[0044] As best seen in FIG. **4C**, which is a perspective view of a variant of an obturator **460**, the obturator **460** comprises a plurality of openings **472** disposed longitudinally and circumferentially on the body **462** of the obturator, which extend into the instrument well **468**. The illustrated variant comprises a plurality of proximal openings **472a**, a plurality of distal openings **472b**, and a plurality of optional intermediate openings **472c**.

[0045] In converting the access system **400** from the closed configuration illustrated in FIG. **4** to the open configuration illustrated in FIG. **4B**, the obturator **460** is translated proximally along the longitudinal axis. In the closed configuration illustrated in FIG. **4A**, the fluid flow seal **440** seals with a portion of the body **462** of the obturator distal of the distal openings **472b**, thereby preventing fluid flow out of the tip **432** of the cannula at the distal end of access system **400**. In the open configuration illustrated in FIG. **4B**, because the body **462** of the obturator is proximal of the fluid flow seal **440**, the body **462** and fluid flow seal **440** do not cooperate in forming a seal in the fluid flow channel **480**. Accordingly, fluid flow is possible from the fluid port **450** into and through the fluid flow channel **480**. In the illustrated variant, the fluid flow channel **480** comprises both the instrument well **468** and a space between the lumen **434** of the cannula and the body **462** of the obturator. As best seen in FIG. **4B**, in the illustrated variant, the proximal openings **472a** are disposed proximal to the cannula **430** within the trocar seal assembly **420**, thereby increasing a cross sectional area around the proximal openings **472a** and increasing fluid flow there-through. Fluid continues flowing longitudinally towards the distal end of the access system **400** through both the instrument well **468** and the space between the lumen **434** of the cannula and the body **462** of the obturator. At the distal end of the obturator **460**, fluid exits the instrument well **468** through the distal openings **472c** and continues distally in the space between the lumen **434** of the cannula and the body **462** of the obturator. The fluid exits the access system **400** through the tip **432**.

[0046] Although embodiments of the insufflating access system are applicable to any endoscopic application using insufflation, a prototypical application is in laparoscopic procedures. Consequently, for purposes of illustration only, the following describes a method for inserting an endoscopic port or trocar of an insufflating access system, and establishing pneumoperitoneum in laparoscopic surgery with reference to the variant illustrated in FIGS. **1A-1F**. Those skilled in the art will understand that the method is also applicable to embodiments of the access system disclosed herein.

[0047] The obturator **160** is inserted into the trocar **110** and positioned in the closed configuration illustrated in FIG. **1E**. A laparoscope is inserted into the instrument well **168** of the obturator and the laparoscope coupled

with an imaging system, for example, a camera and a video monitor. The fluid port **150** is fluidly coupled to a source of pressurized insufflation gas.

[0048] The user positions the tissue penetrating tip **166** in an incision made at a desired location on the patient's abdomen **500** and advances the insufflating access system **100** through the abdominal wall **502** as illustrated schematically in FIG. **5A**. The user monitors the position of the tip **166** through the laparoscope and imaging system. When the user observes the tip **166** penetrating the peritoneum **504**, as illustrated in FIG. **5B**, the user converts the access system **100** to the open configuration. In the illustrated example, the user urges the obturator **160** proximally, for example, pulling on the handle **162** to convert the access system **100** to the open configuration illustrated in FIG. **1F**. As discussed above, in some embodiments, the obturator **160** and/or trocar **110** comprise one or more marks or indicia that indicate the position of the obturator **160** in the open position. With the access system **100** in the open configuration, insufflation gas flows from the source of insufflation gas, into the fluid port **150**, into the proximal end **182** of the fluid flow channel, longitudinally through the fluid flow channel **180**, past the fluid flow seal **140**, past the partially withdrawn tip **166** of the obturator, and out the tip **132** of the cannula. Some gas may also flow out of the vents **136**, particularly if the tip **132** of the cannula is fully or partially blocked. The gas flows through the opening in the peritoneum into the abdominal cavity, thereby insufflating the abdominal cavity **506** and establishing pneumoperitoneum as illustrated in FIG. **5C**.

[0049] Accordingly, embodiments of the access system and associated methods provide an accurate and simple method for gaining access to the abdominal cavity for laparoscopic surgery. In other embodiments, the insufflating access system provides access to the abdominal cavity through another surface adjacent to the peritoneal lining of the abdominal cavity, for example, the cul-de-sac of the vagina, any point along the gastrointestinal tract from the diaphragm to the anus, or one of the great vessels such as the abdominal aorta or vena cava. Embodiments of the access system and associated methods provide access to other internal structures, for example, the kidney, the stomach, and/or the third ventricle of the brain, or any hollow organ for which accurate and shallow entry and the subsequent flow of gas or liquid is desired.

[0050] Disposing a fluid flow seal **140** between the obturator **160** and the distal end **114** of the cannula permits the device **100** to be fluidly coupled with a source of CO₂ while the device **100** is advanced through the abdominal wall **502**. As soon as the peritoneum **504** is punctured by the tip **166** of the obturator, the surgeon stops forward movement of the device **100** and dislocates the fluid flow seal **140** between the obturator **160** and the cannula **130**, thereby allowing the gas to flow through the gas flow channel **180** and out of the device **100**. The gas, following a path of least resistance, flows between the tip **166** and

the abdominal wall **502**, through the opening made in the peritoneum **504**, and finally into the abdominal cavity **504**. Consequently, pneumoperitoneum is established with reduced penetration into the organ bed because the tip **166** of the obturator does not extend as far beyond the peritoneum as in embodiments in which the tip comprises vent holes through which gas insufflates the abdominal cavity. Variants of the device **100** also do not comprise at least one of: seals within the obturator and gas channels around the laparoscope. Some embodiments eliminate or reduce the possibility of fluid and/or tissue entering the visual field within the obturator tip **166**. In some methods, the peritoneum **504** is punctured and the abdominal cavity **504** insufflated without further penetration of the tip **166** beyond the peritoneum **504** and into the abdominal cavity **506** or organ bed.

[0051] While certain embodiments have been particularly shown and described with reference to exemplary embodiments thereof, it will be understood by those of ordinary skill in the art that various changes in form and details may be made therein without departing from the scope of the present invention as defined by the following claims.

Claims

1. An insufflating surgical access system (100) comprising:

a trocar (110) comprising:

a proximal end (112) and a distal end (114);
 a trocar seal assembly (120) disposed at the proximal end of the trocar (110), the trocar seal assembly (120) comprising an instrument seal (122);
 an elongate cannula (130) disposed at the distal end (114) of the trocar, the cannula (130) comprising a tubular wall defining a lumen (134), an open proximal end, and an open distal end;
 an access channel (116) defining a longitudinal axis, extending through the trocar seal assembly (120) and the lumen (134) of the cannula (130), from the proximal end (112) of the trocar to the distal end (114) of the trocar;
 a fluid port (150) disposed at the proximal end (112) of the trocar; and
 a fluid flow seal (140) disposed in the access channel (116);

an obturator (160) comprising:

an elongate body (162) comprising a proximal end and a distal end;
 a tissue penetrating tip (166) disposed at

the distal end; and

a handle (164) disposed at the proximal end,

wherein the obturator (160) is slidably insertable into a proximal end of the access channel (116), and the tip (166) of the obturator (160) extends out of the distal, open end of the cannula (130) when fully inserted therethrough; and

a fluid flow channel (180) fluidly connected to the fluid port (150) of the trocar, and extending to a distal end of the insufflating access system (100),

wherein the obturator (160) in the access channel (116) has a closed position, in which the body (162) of the obturator (160) sealingly contacts the fluid flow seal (140), thereby preventing fluid flow through the fluid flow channel (180), and

an open position, in which the body (162) of the obturator (160) does not sealingly contact the fluid flow seal (140), thereby allowing fluid flow through the fluid flow channel (180),

characterized in that the fluid flow channel (180) comprises a slot (272) disposed in the body (162) of the obturator (160).

2. The access system (100) of claim 1 wherein the slot (272) extends longitudinally on the body (162) and wherein the distal end of the slot (272) is fluidly isolated from the distal end of the access system in the closed position.

3. The access system (100) of claim 2 further including an instrument well (268) and the slot (272) perforates the body (262) of the obturator into the instrument well (268).

4. The access system (100) of claim 2 wherein the slot (262) comprises one or more longitudinal grooves disposed on an outer surface of the body (262) and does not perforate the body (262) of the obturator (260).

5. The access system (100) of claim 1 wherein the slot (272) includes a proximal end and a distal end and in the closed position, the proximal end of the slot (272) is disposed below the instrument seal (122) and the distal end of the slot (272) is disposed proximal to the fluid flow seal (140) which seals the body (162, 262) of the obturator (160), wherein in the open position the obturator (260) is advanced distally in the access channel (116) advancing the distal end of the slot (172, 272) past the fluid flow seal (140, 240).

6. The access system (100) of claim 5 wherein the elon-

gate cannula (130) has an angled tip (232) with a proximal portion and wherein in the open position, the distal end of the slot (272) is aligned with the proximal portion of the angled tip (232) exposing the distal end of the slot (272).

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7. The access system (100) of claim 1 wherein the cannula has an angled tip and a fluid flow seal near the angled tip, the fluid flow seal subtending the same or a similar angle to the tip and wherein the obturator (260) is rotated between the open position and the closed position. 10
8. The access system (100) of claim 7 wherein rotating the obturator (260) positions the slot (272) within the cannula (230) proximal of the fluid flow seal (240) to convert from an open position to a closed position. 15
9. The access system (100) of claim 1 wherein the fluid flow seal (140) is integrated with a cannula tip (132) disposed at the distal end of the cannula (130). 20
10. The access system (100) of claim 1 wherein the fluid flow seal (140) is disposed proximal of the distal end of the cannula (130). 25
11. The access system (100) of claim 1 wherein the obturator (160) further comprises an instrument well (168) open at a proximal end of the obturator (160), extending longitudinally through the body (162) of the obturator (160), terminating at the tip (166) of the obturator (160), and dimensioned to receive a laparoscope therein, wherein at least a portion of the tip (166) of the obturator (160) is transparent. 30
12. The access system (100) of claim 1 wherein the fluid flow channel (180) comprises an instrument well (168) disposed in the body (162) of the obturator (160). 35
13. The access system (100) of claim 1 wherein in the closed position, the obturator (160) is displaced proximally in the access channel (116) compared with the open position. 40
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Patentansprüche

1. Ein chirurgisches Insufflationszugangssystem (100), das Folgendes beinhaltet: 50
- einen Trokar (110), der Folgendes beinhaltet:
- ein proximales Ende (112) und ein distales Ende (114); 55
- eine Trokardichtungsbaugruppe (120), die am proximalen Ende des Trokars (110) angeordnet ist, wobei die Trokardichtungs-

baugruppe (120) eine Instrumentendichtung (122) beinhaltet;

eine längliche Kanüle (130), die am distalen Ende (114) des Trokars angeordnet ist, wobei die Kanüle (130) eine röhrenförmige Wand, die ein Lumen (134) definiert, ein offenes proximales Ende, und ein offenes distales Ende beinhaltet;

einen Zugangskanal (116), der eine Längsachse definiert, die sich durch die Trokardichtungsbaugruppe (120) und das Lumen (134) der Kanüle (130), von dem proximalen Ende (112) des Trokars bis zu dem distalen Ende (114) des Trokars, erstreckt;

eine Fluidöffnung (150), die an dem proximalen Ende (112) des Trokars angeordnet ist; und

eine Fluidflussdichtung (140), die in dem Zugangskanal (116) angeordnet ist;

einen Obturator (160), der Folgendes beinhaltet:

einen länglichen Hauptteil (162), der ein proximales Ende und ein distales Ende beinhaltet;

eine gewebedurchdringende Spitze (166), die an dem distalen Ende angeordnet ist; und

einen Handgriff (164), der an dem proximalen Ende angeordnet ist,

wobei der Obturator (160) gleitfähig in ein proximales Ende des Zugangskanals (116) einführbar ist und die Spitze (166) des Obturators (160) sich aus dem distalen, offenen Ende der Kanüle (130) erstreckt, wenn er vollständig durch sie eingeführt ist; und

einen Fluidflusskanal (180), der in fluider Verbindung mit der Fluidöffnung (150) des Trokars steht und sich bis zu einem distalen Ende des Insufflationszugangssystems (100) erstreckt,

wobei der Obturator (160) in dem Zugangskanal (116) Folgendes aufweist: eine geschlossene Position, in der der Hauptteil (162) des Obturators (160) in dichtendem Kontakt mit der Fluidflussdichtung (140) steht, wodurch der Fluidfluss durch den Fluidflusskanal (180) verhindert wird, und eine offene Position, in der der Hauptteil (162) des Obturators (160) nicht in dichtendem Kontakt mit der Fluidflussdichtung (140) steht, wodurch der Fluidfluss durch den Fluidflusskanal (180) gestattet wird,

dadurch gekennzeichnet, dass der Fluidflusskanal (180) einen Schlitz (272) beinhaltet, der in dem Hauptteil (162) des Obturators (160) angeordnet ist.

2. Das Zugangssystem (100) gemäß Anspruch 1, wobei der Schlitz (272) sich längs auf dem Hauptteil (162) erstreckt und wobei das distale Ende des Schlitzes (272) in der geschlossenen Position in fluidler Isolierung von dem distalen Ende des Zugangssystems steht. 5
3. Das Zugangssystem (100) gemäß Anspruch 2, das ferner einen Instrumentenschacht (268) umfasst, und wobei der Schlitz (272) den Hauptteil (262) des Obturators in den Instrumentenschacht (268) hinein perforiert. 10
4. Das Zugangssystem (100) gemäß Anspruch 2, wobei der Schlitz (262) eine oder mehrere Längsrillen beinhaltet, die auf einer Außenfläche des Hauptteils (262) angeordnet sind, und den Hauptteil (262) des Obturators (260) nicht perforiert. 15
5. Das Zugangssystem (100) gemäß Anspruch 1, wobei der Schlitz (272) ein proximales Ende und ein distales Ende umfasst, das proximale Ende des Schlitzes (272) in der geschlossenen Position unterhalb der Instrumentendichtung (122) angeordnet ist und das distale Ende des Schlitzes (272) proximal von der Fluidflussdichtung (140) angeordnet ist, die den Hauptteil (162, 262) des Obturators (160) abdichtet, wobei der Obturator (260) in der offenen Position nach distal in den Zugangskanal (116) vorgeschoben wird, wobei das distale Ende des Schlitzes (172, 272) an der Fluidflussdichtung (140, 240) vorbei vorgeschoben wird. 20 25 30
6. Das Zugangssystem (100) gemäß Anspruch 5, wobei die längliche Kanüle (130) eine angewinkelte Spitze (232) mit einem proximalen Anteil aufweist und wobei das distale Ende des Schlitzes (272) in der offenen Position mit dem proximalen Anteil der angewinkelten Spitze (232) ausgerichtet ist, wodurch das distale Ende des Schlitzes (272) freigelegt wird. 35 40
7. Das Zugangssystem (100) gemäß Anspruch 1, wobei die Kanüle eine angewinkelte Spitze und eine Fluidflussdichtung in der Nähe der angewinkelten Spitze aufweist, wobei die Fluidflussdichtung den gleichen oder einen ähnlichen Winkel zu der Spitze begrenzt und wobei der Obturator (260) zwischen der offenen Position und der geschlossenen Position gedreht wird. 45 50
8. Das Zugangssystem (100) gemäß Anspruch 7, wobei das Drehen des Obturators (260) den Schlitz (272) innerhalb der Kanüle (230) proximal von der Fluidflussdichtung (240) positioniert, um von einer offenen Position in eine geschlossene Position umzuwandeln. 55
9. Das Zugangssystem (100) gemäß Anspruch 1, wobei die Fluidflussdichtung (140) mit einer Kanülenspitze (132) integriert ist, die an dem distalen Ende der Kanüle (130) angeordnet ist.
10. Das Zugangssystem (100) gemäß Anspruch 1, wobei die Fluidflussdichtung (140) proximal von dem distalen Ende der Kanüle (130) angeordnet ist.
11. Das Zugangssystem (100) gemäß Anspruch 1, wobei der Obturator (160) ferner einen Instrumentenschacht (168) beinhaltet, der an einem proximalen Ende des Obturators (160) offen ist, sich längs durch den Hauptteil (162) des Obturators (160) erstreckt, an der Spitze (166) des Obturators (160) endet und zum Aufnehmen eines Laparoscops darin dimensioniert ist, wobei mindestens ein Anteil der Spitze (166) des Obturators (160) transparent ist.
12. Das Zugangssystem (100) gemäß Anspruch 1, wobei der Fluidflusskanal (180) einen Instrumentenschacht (168) beinhaltet, der in dem Hauptteil (162) des Obturators (160) angeordnet ist.
13. Das Zugangssystem (100) gemäß Anspruch 1, wobei der Obturator (160) in der geschlossenen Position im Vergleich mit der offenen Position nach proximal in den Zugangskanal (116) verschoben ist.

Revendications

1. Système d'accès chirurgical d'insufflation (100) comprenant :

un trocart (110) comprenant :

une extrémité proximale (112) et une extrémité distale (114) ;

un assemblage d'étanchéité de trocart (120) disposé à l'extrémité proximale du trocart (110), l'assemblage d'étanchéité de trocart (120) comprenant un joint d'étanchéité d'instrument (122) ;

une canule allongée (130) disposée à l'extrémité distale (114) du trocart, la canule (130) comprenant une paroi tubulaire définissant une lumière (134), une extrémité proximale ouverte et une extrémité distale fermée ;

un canal d'accès (116) définissant un axe longitudinal, s'étendant à travers l'assemblage d'étanchéité de trocart (120) et la lumière (134) de la canule (130), de l'extrémité proximale (112) du trocart à l'extrémité distale (114) du trocart ;

une ouverture de fluide (150) disposée à l'extrémité proximale (112) du trocart ; et

- un joint d'étanchéité d'écoulement de fluide (140) disposé dans le canal d'accès (116) ;
- un obturateur (160) comprenant :
- un corps allongé (162) comprenant une extrémité proximale et une extrémité distale; un embout qui pénètre dans un tissu (166) disposé à l'extrémité distale ; et une poignée (164) disposée à l'extrémité proximale,
- dans lequel l'obturateur (160) est insérable de manière coulissante dans une extrémité proximale du canal d'accès (116) et l'embout (166) de l'obturateur (160) s'étend en dehors de l'extrémité distale ouverte de la canule (130) quand il est inséré complètement à travers celle-ci ; et
- un canal d'écoulement de fluide (180) en connexion fluïdique avec l'ouverture de fluide (150) du trocart et s'étendant jusqu'à une extrémité distale du système d'accès d'insufflation (100),
- dans lequel l'obturateur (160) dans le canal d'accès (116) a une position fermée, dans laquelle le corps (162) de l'obturateur (160) entre en contact de manière étanche avec le joint d'étanchéité d'écoulement de fluide (140), empêchant ainsi l'écoulement du fluide à travers le canal d'écoulement de fluide (180) et
- une position ouverte, dans laquelle le corps (162) de l'obturateur (160) n'entre pas en contact de manière étanche avec le joint d'étanchéité d'écoulement de fluide (140), permettant ainsi l'écoulement du fluide à travers le canal d'écoulement de fluide (180),
- caractérisé en ce que** le canal d'écoulement de fluide (180) comprend une entaille (272) disposée dans le corps (162) de l'obturateur (160).
2. Système d'accès (100) selon la revendication 1, dans lequel l'entaille (272) s'étend longitudinalement sur le corps (162) et dans lequel l'extrémité distale de l'entaille (272) est isolée vis-à-vis des fluides de l'extrémité distale du système d'accès en position fermée.
 3. Système d'accès (100) selon la revendication 2 comprenant en outre un puits d'instrument (268) et l'entaille (272) perce le corps (262) de l'obturateur dans le puits d'instrument (268).
 4. Système d'accès (100) selon la revendication 2, dans lequel l'entaille (262) comprend une ou plusieurs rainures longitudinales disposées sur une surface externe du corps (262) et ne perce pas le corps (262) de l'obturateur (260).
 5. Système d'accès (100) selon la revendication 1, dans lequel l'entaille (272) comprend une extrémité proximale et une extrémité distale et en position fermée, l'extrémité proximale de l'entaille (272) est disposée au-dessous du joint d'étanchéité d'instrument (122) et l'extrémité distale de l'entaille (272) est disposée à proximité du joint d'étanchéité d'écoulement de fluide (140) qui ferme de manière étanche le corps (162, 262) de l'obturateur (160), dans lequel en position ouverte l'obturateur (260) est avancé de manière distale dans le canal d'accès (116) faisant passer l'extrémité distale de l'entaille (172, 271) devant le joint d'étanchéité d'écoulement de fluide (140, 240).
 6. Système d'accès (100) selon la revendication 5, dans lequel la canule allongée (130) a un embout en biais (232) avec une partie proximale et dans lequel en position ouverte, l'extrémité distale de l'entaille (272) est alignée avec la partie proximale de l'embout en biais (232) exposant l'extrémité distale de l'entaille (272).
 7. Système d'accès (100) selon la revendication 1, dans lequel la canule a un embout en biais et un joint d'étanchéité d'écoulement de fluide près de l'embout en biais, le joint d'étanchéité d'écoulement de fluide sous-tendant le même angle ou un angle similaire par rapport à l'embout et dans lequel l'obturateur (260) est amené à pivoter entre la position ouverte et la position fermée.
 8. Système d'accès (100) selon la revendication 7, dans lequel la rotation de l'obturateur (260) positionne l'entaille (272) à l'intérieur de la canule (230) à proximité du joint d'étanchéité d'écoulement de fluide (240) pour convertir d'une position ouverte à une position fermée.
 9. Système d'accès (100) selon la revendication 1, dans lequel le joint d'étanchéité d'écoulement de fluide (140) fait partie intégrante avec un embout de canule (132) disposé à l'extrémité distale de la canule (130).
 10. Système d'accès (100) selon la revendication 1, dans lequel le joint d'étanchéité d'écoulement de fluide (140) est disposé à proximité de l'extrémité distale de la canule (130).
 11. Système d'accès (100) selon la revendication 1, dans lequel l'obturateur (160) comprend en outre un puits d'instrument (168) ouvert à une extrémité proximale de l'obturateur (160), s'étendant longitudinalement à travers le corps (162) de l'obturateur (160),

se terminant à l'embout (166) de l'obturateur (160) et dimensionné pour recevoir un laparoscope dans celui-ci, dans lequel au moins une partie de l'embout (166) de l'obturateur (160) est transparent.

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- 12.** Système d'accès (100) selon la revendication 1, dans lequel le canal d'écoulement de fluide (180) comprend un puits d'instrument (168) disposé dans le corps (162) de l'obturateur (160).

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- 13.** Système d'accès (100) selon la revendication 1, dans lequel en position fermée, l'obturateur (160) est déplacé de manière proximale dans le canal d'accès (116) par rapport à la position ouverte.

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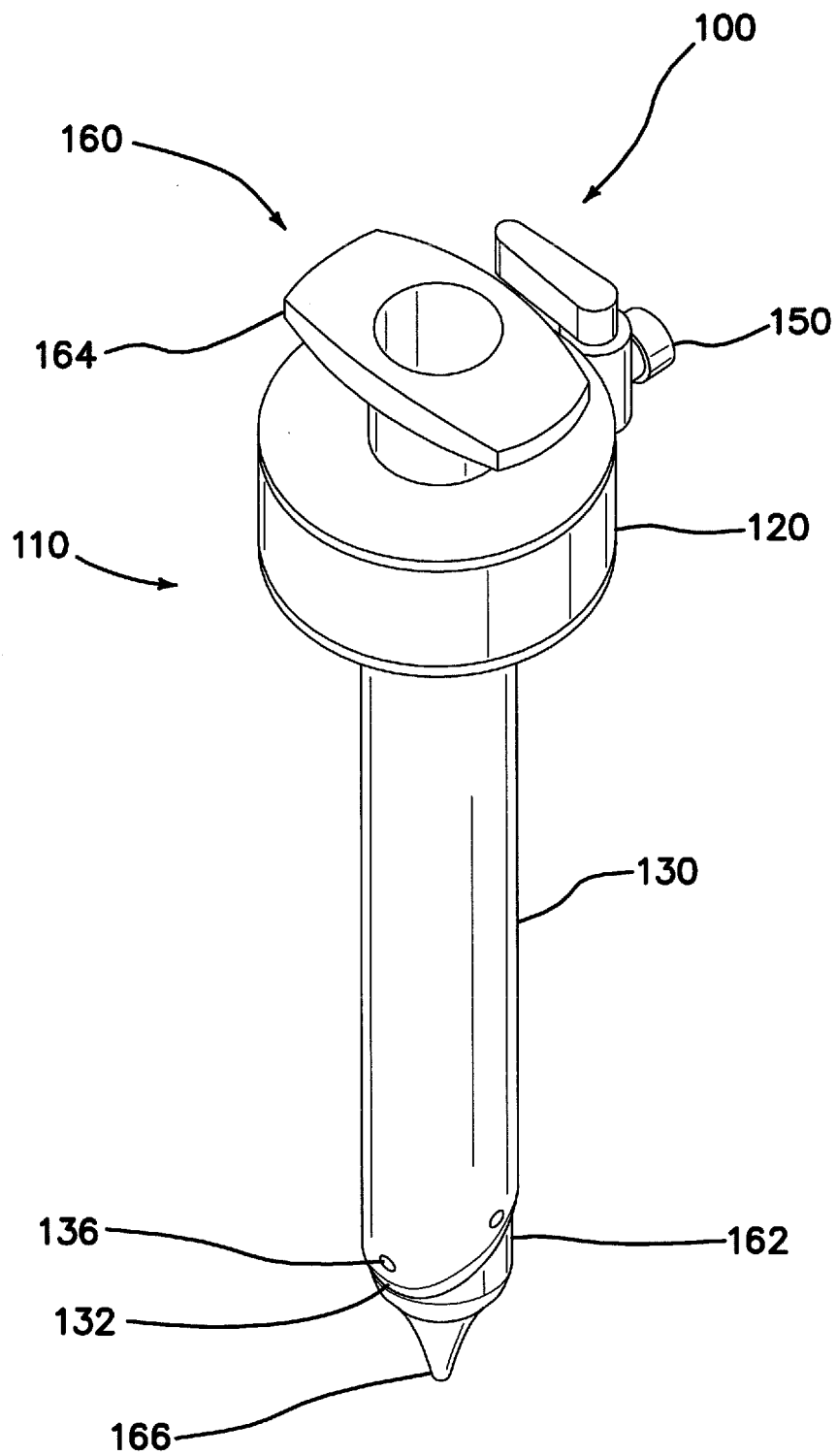
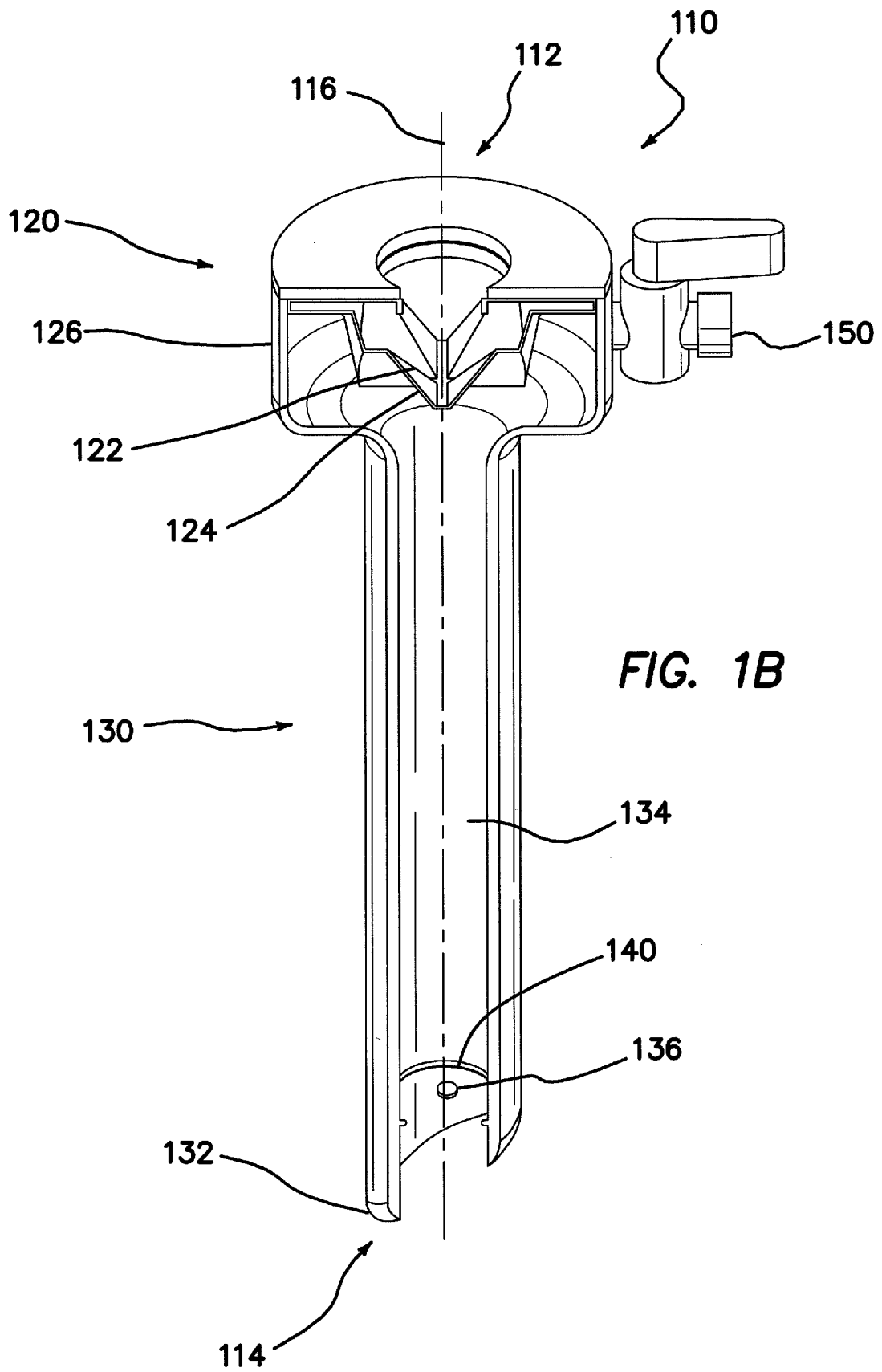
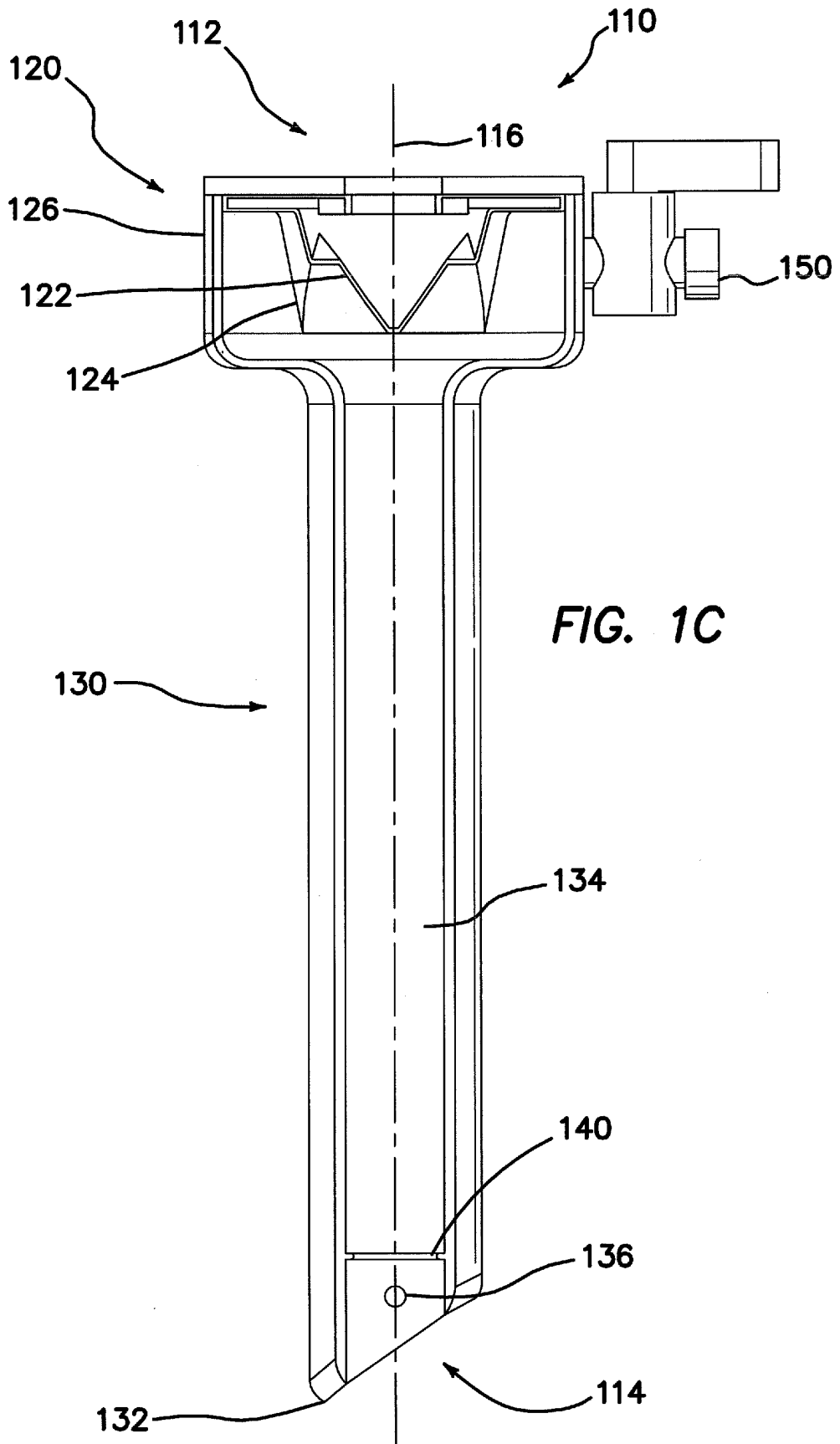


FIG. 1A





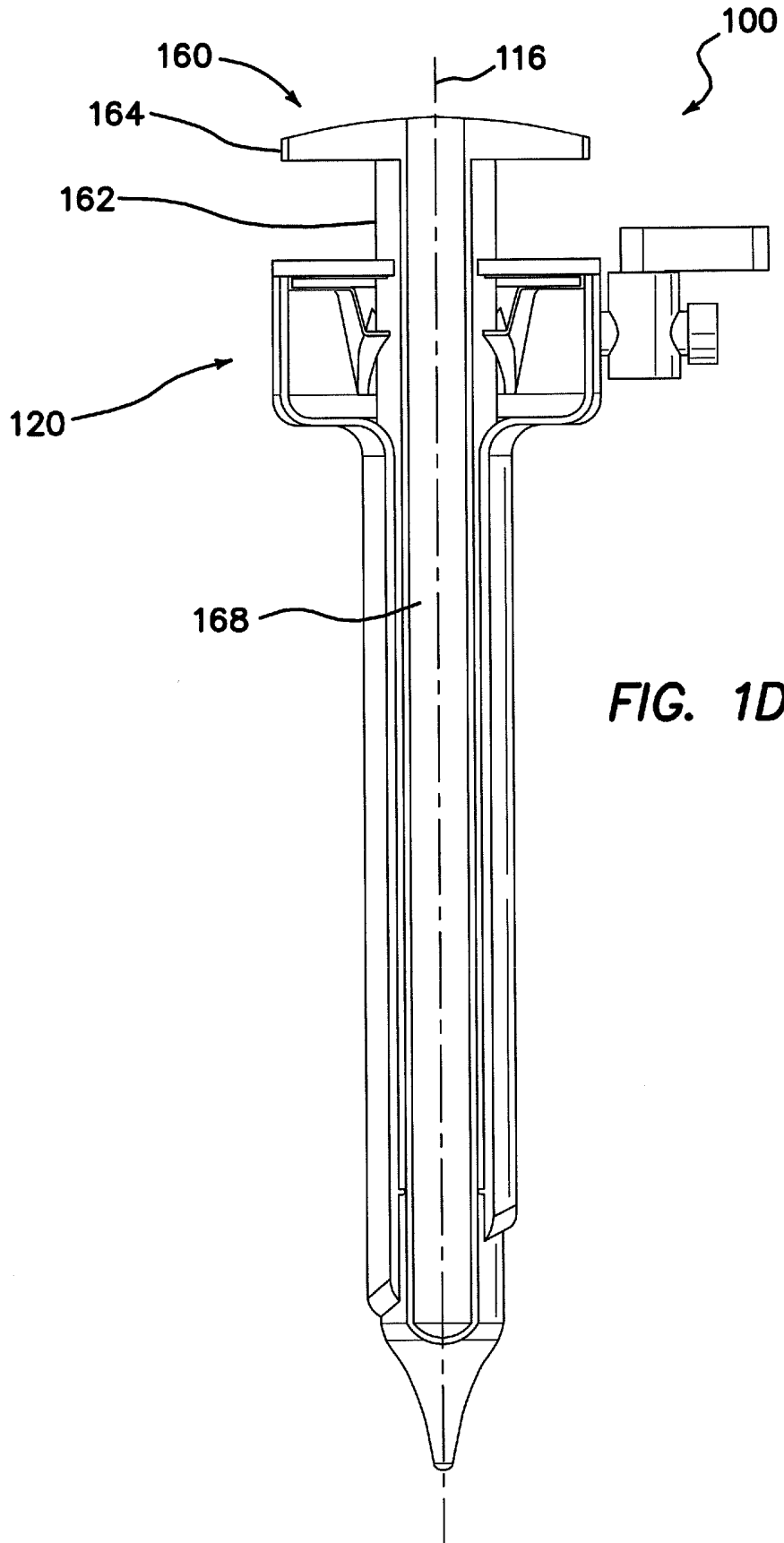
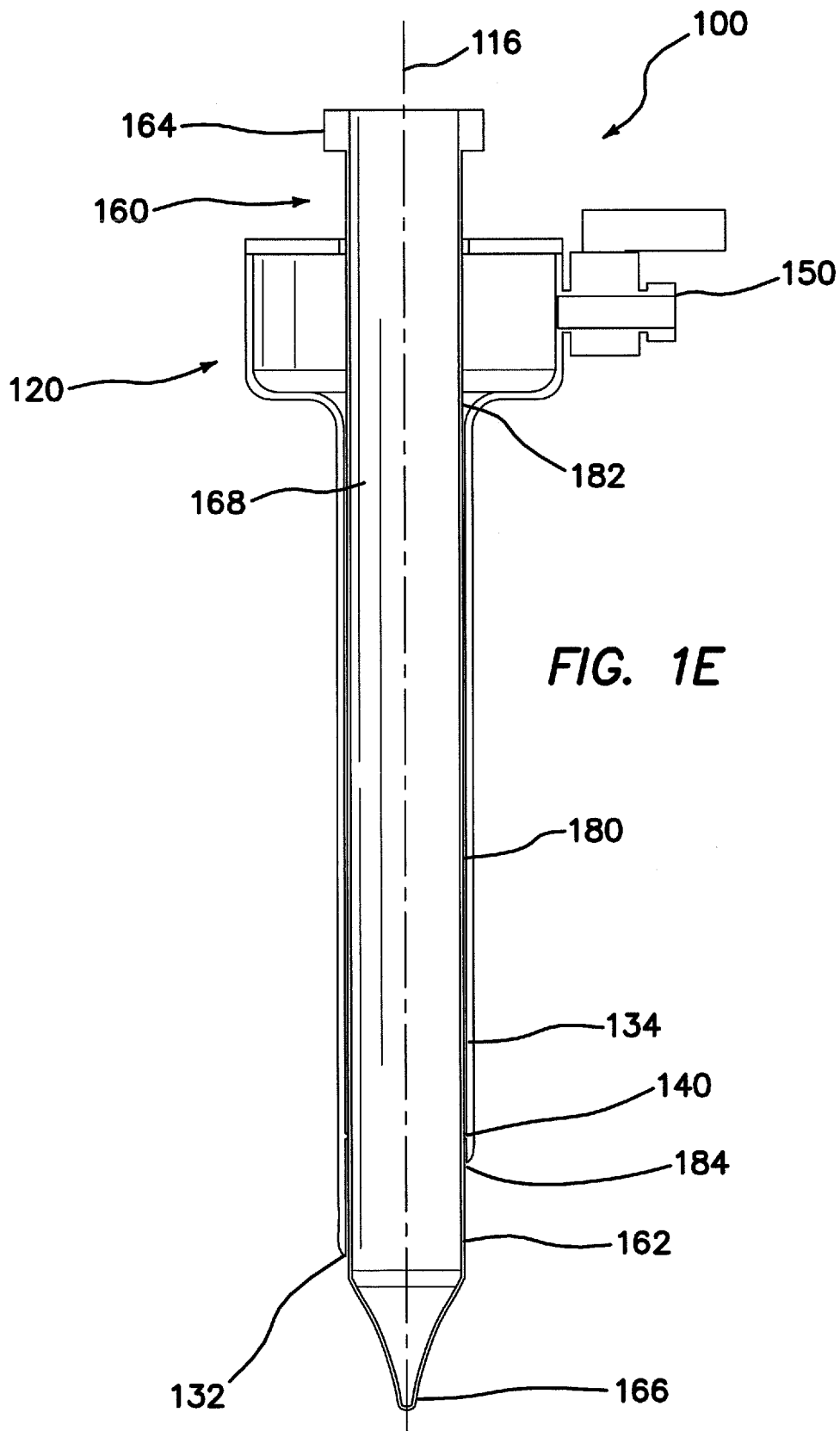


FIG. 1D



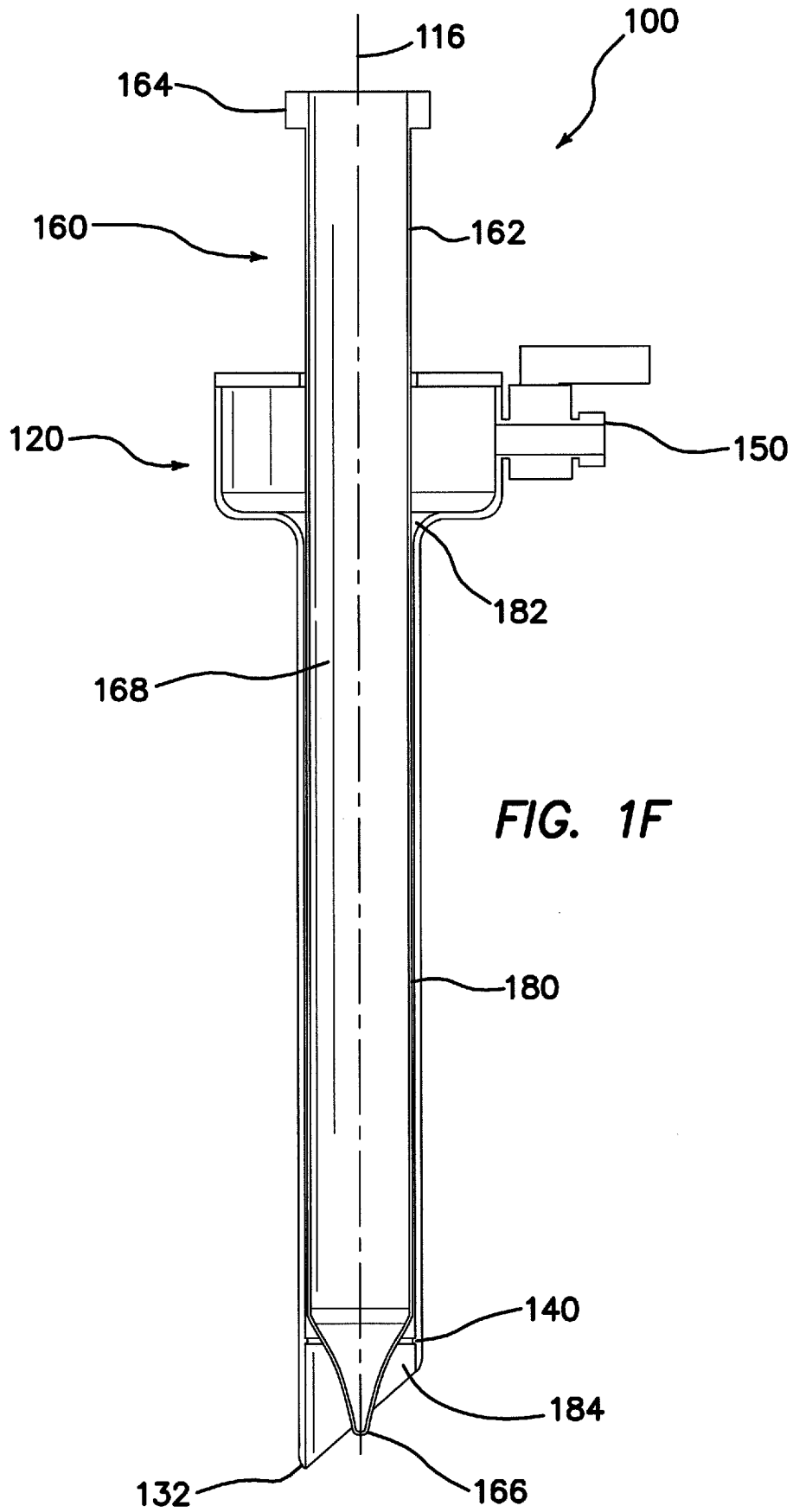


FIG. 1F

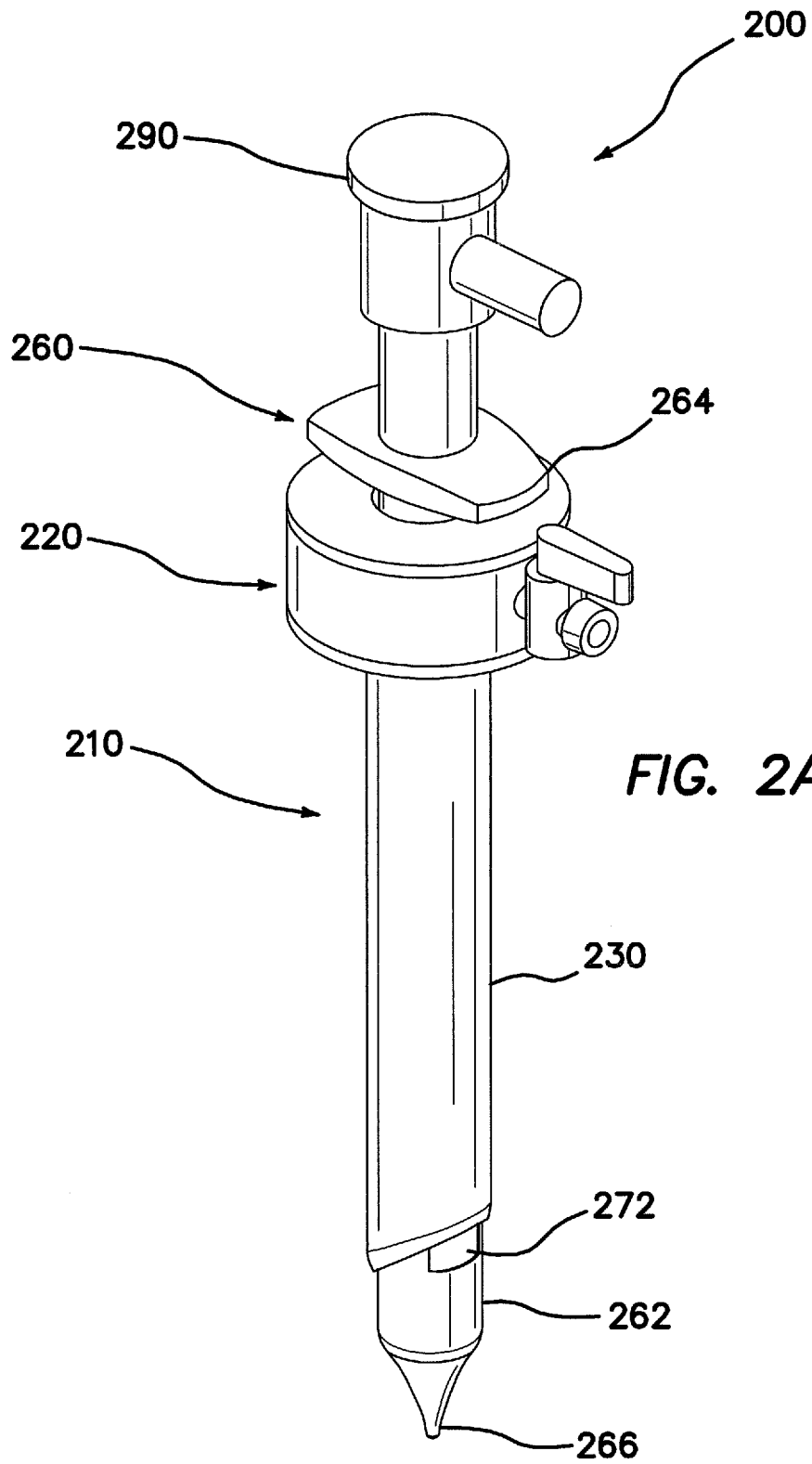


FIG. 2A

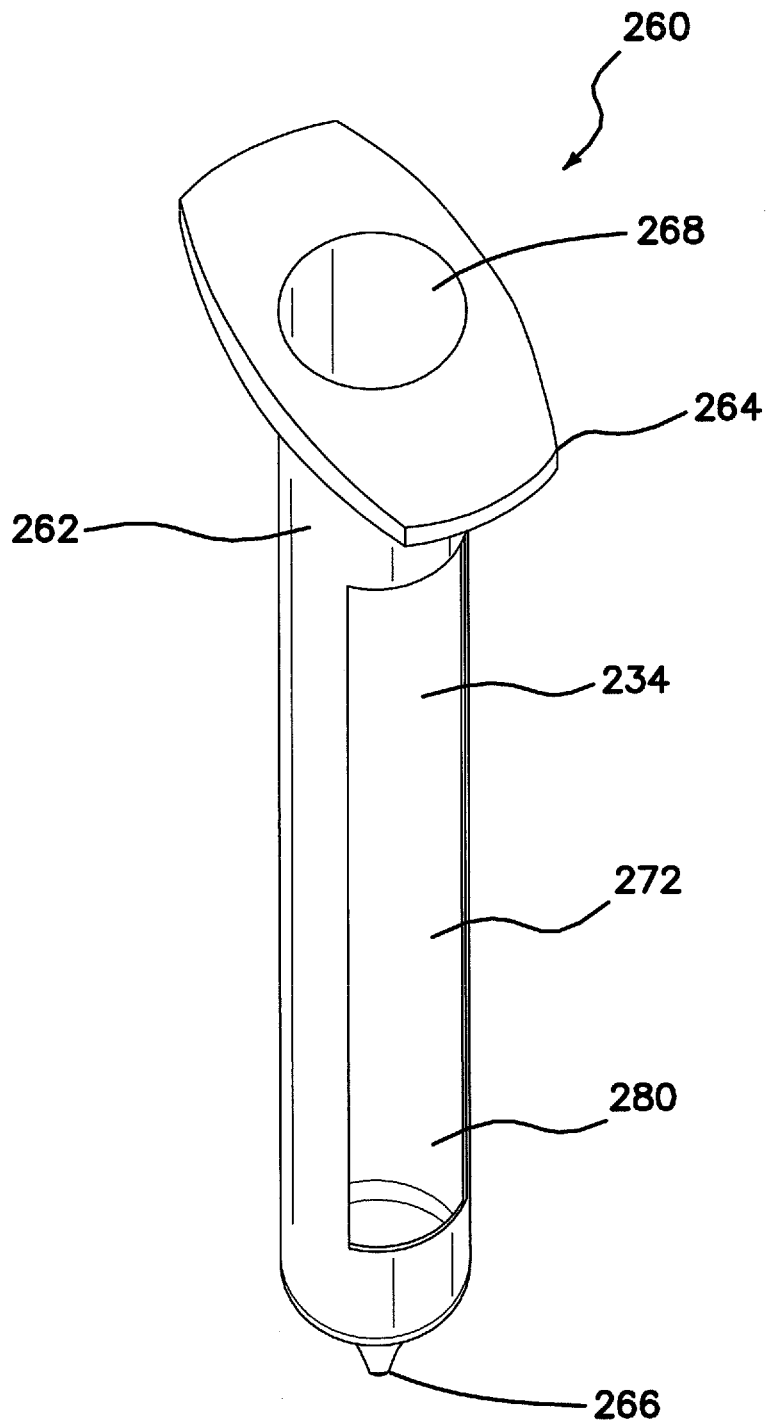


FIG. 2B

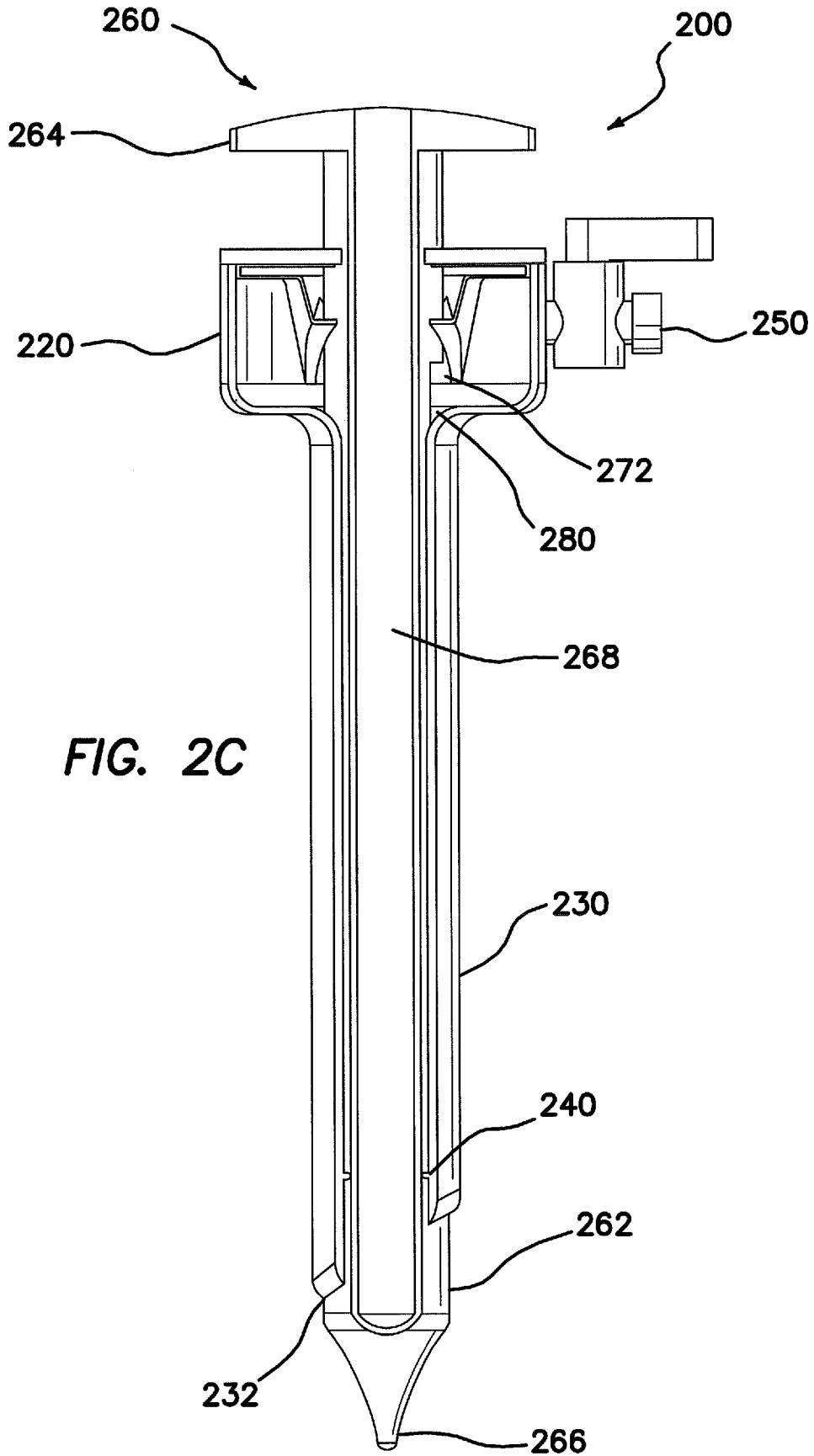
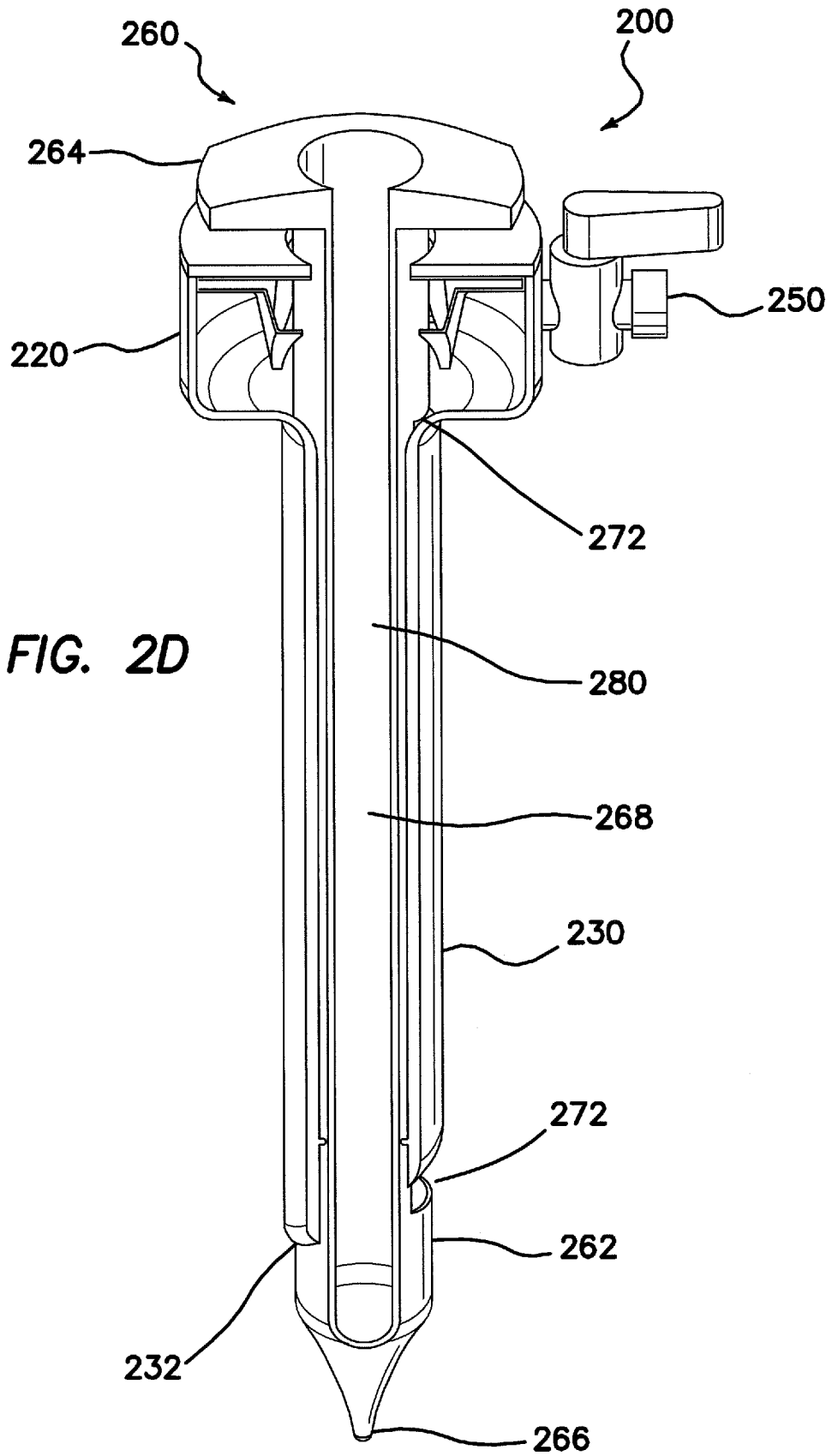
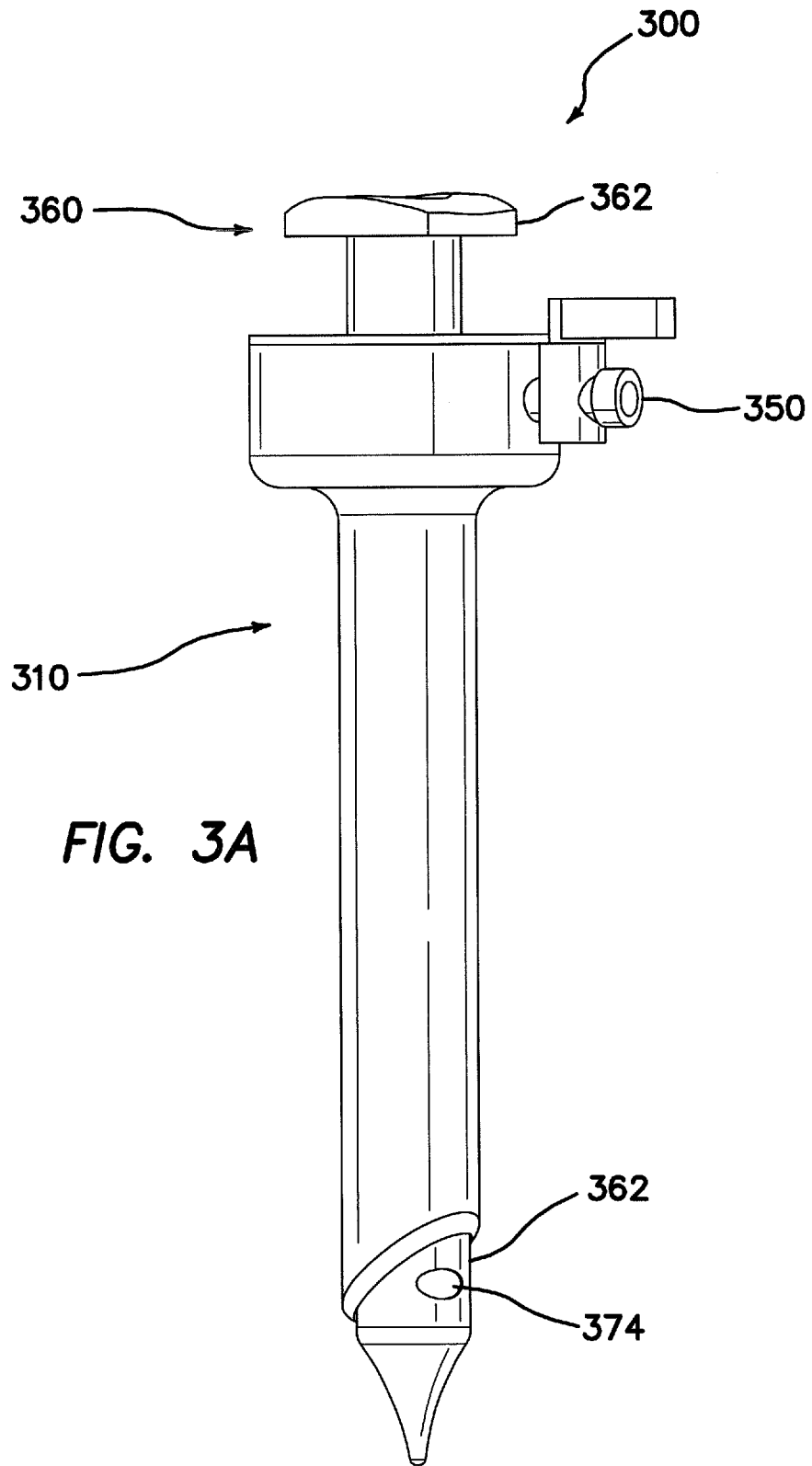


FIG. 2C





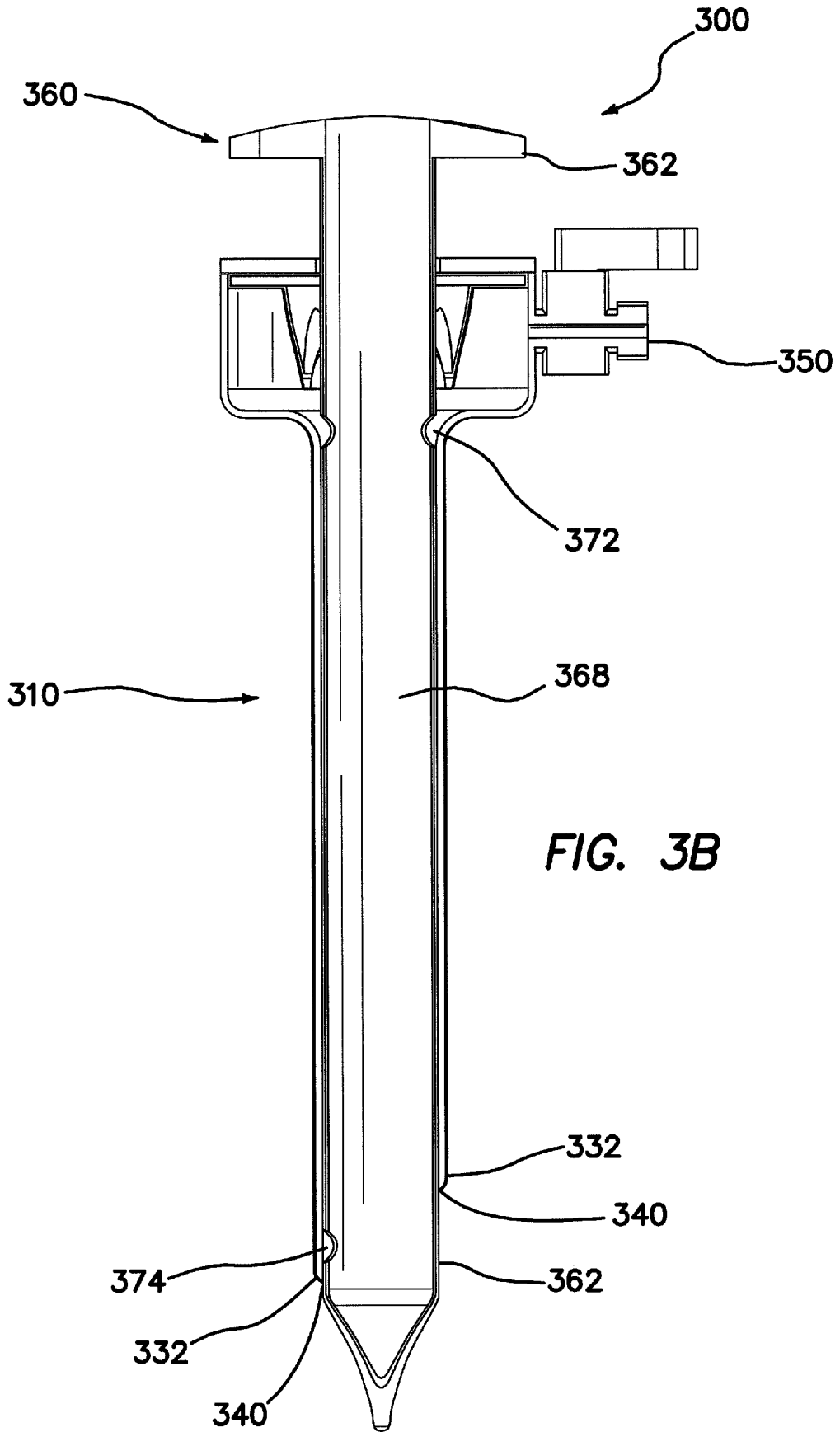
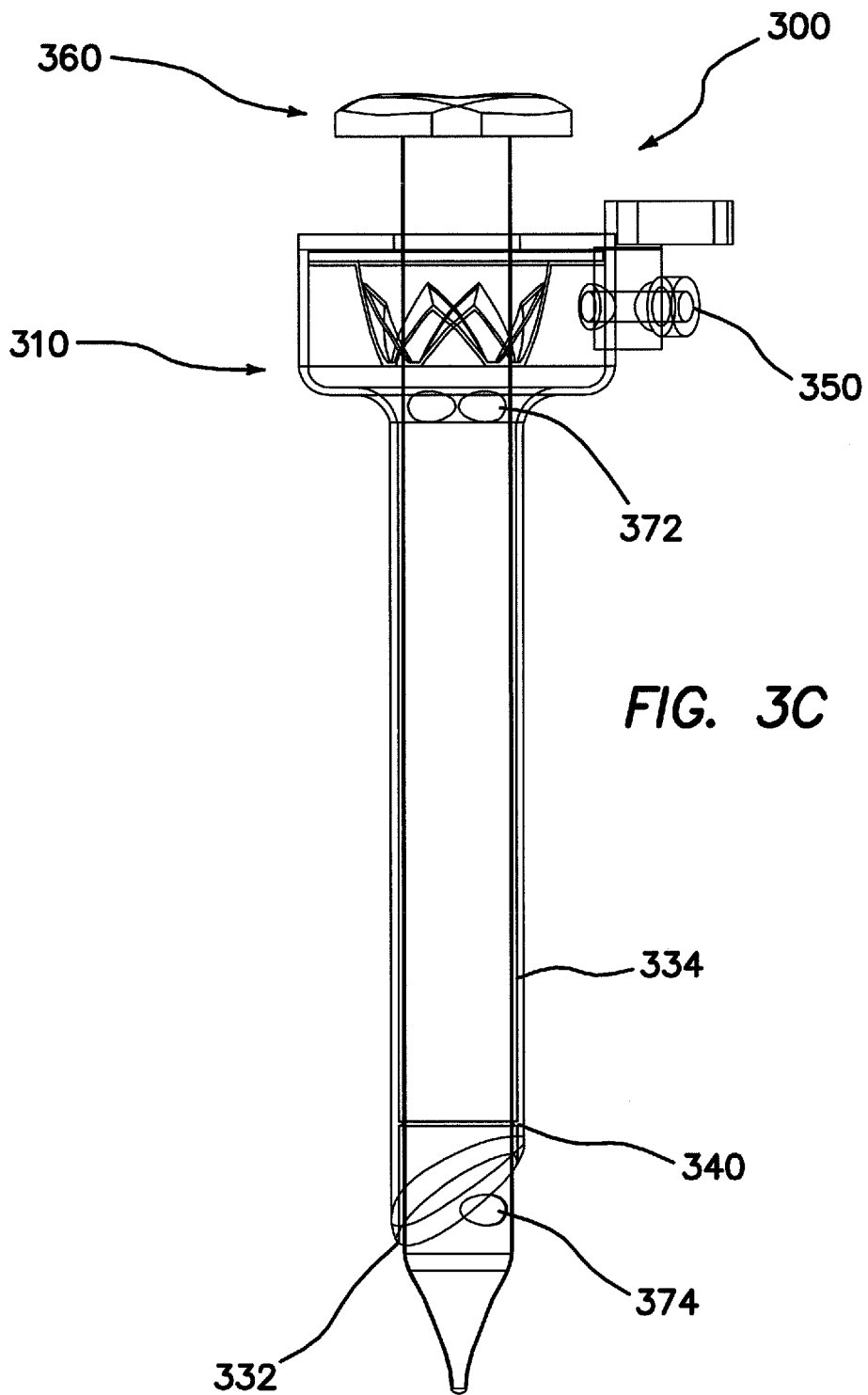


FIG. 3B



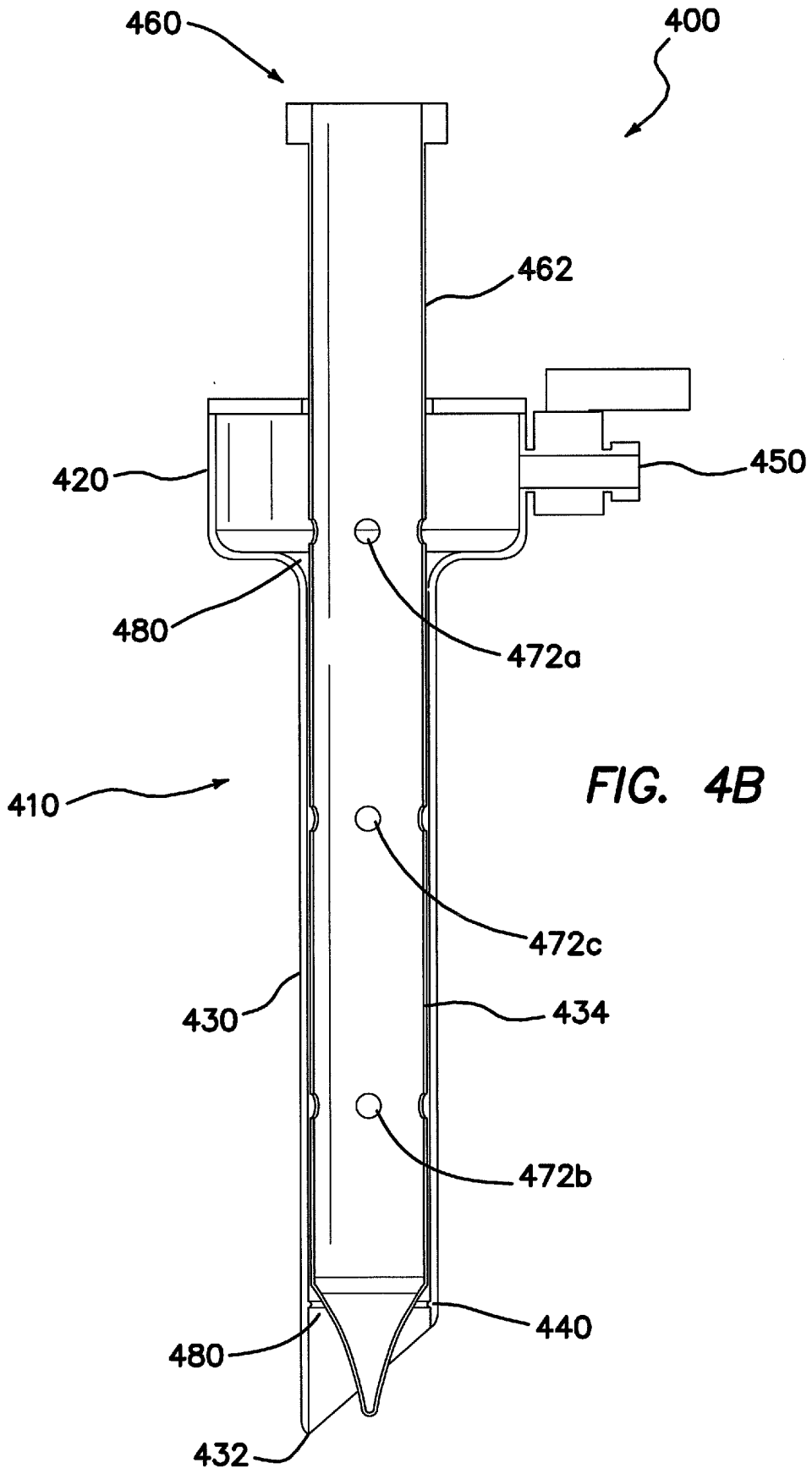
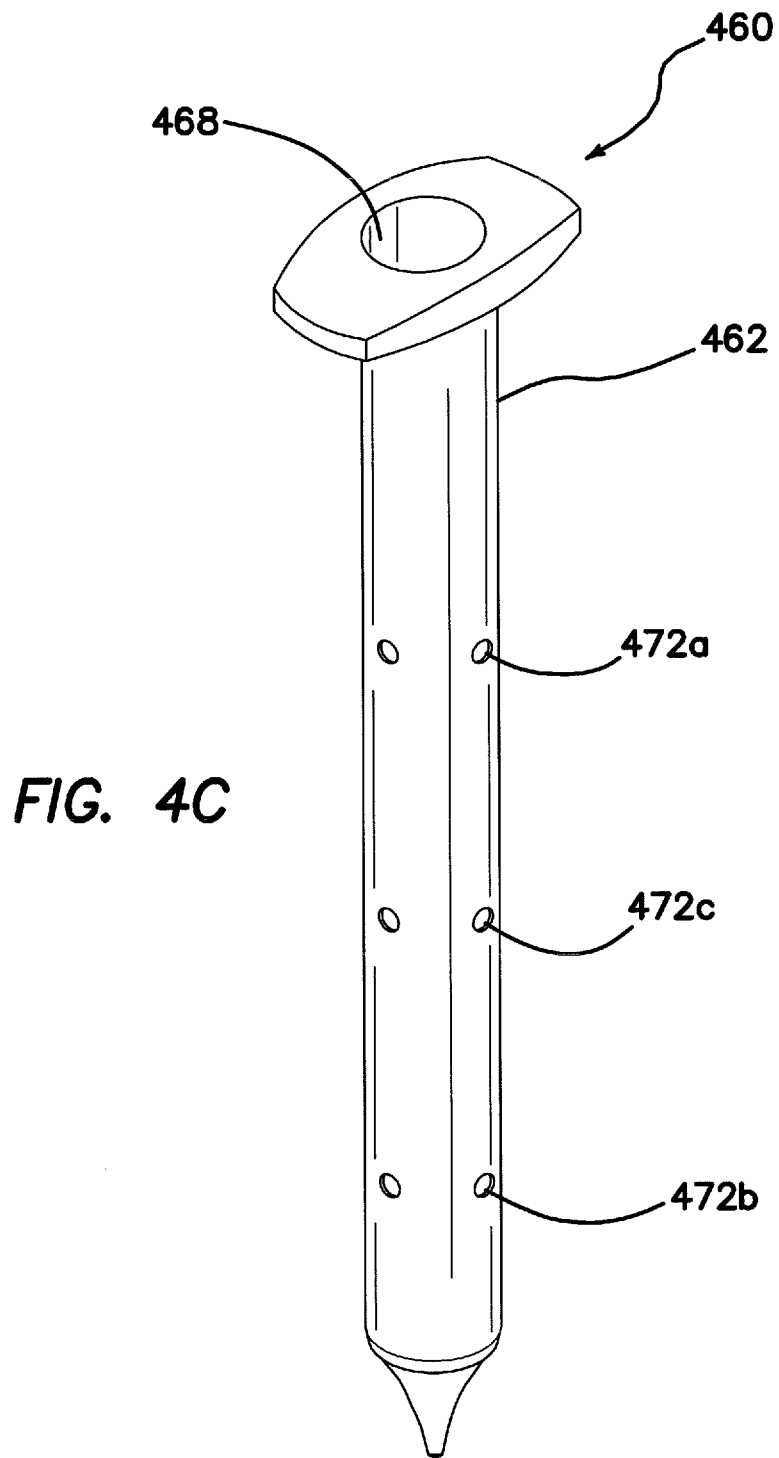


FIG. 4B



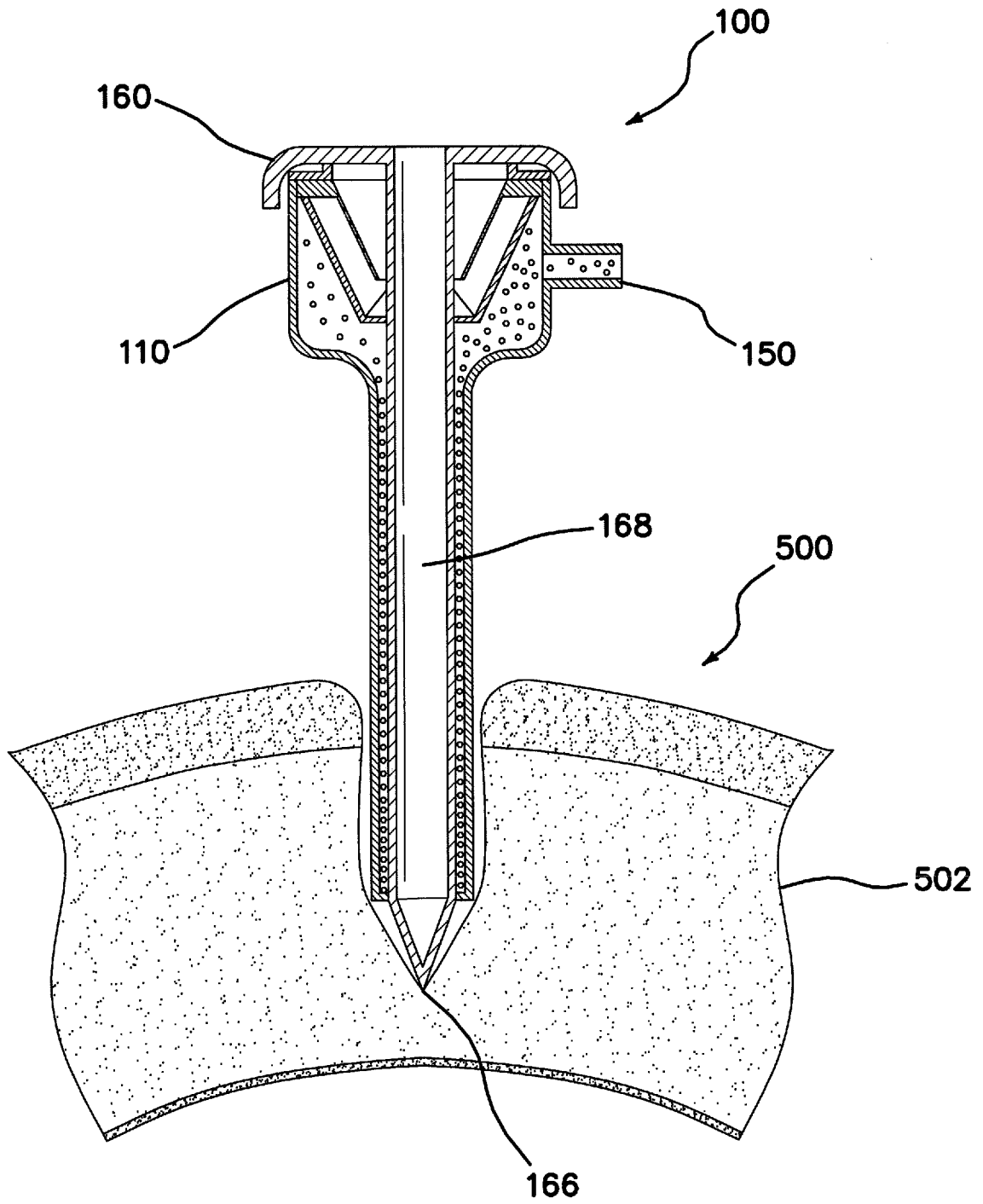


FIG. 5A

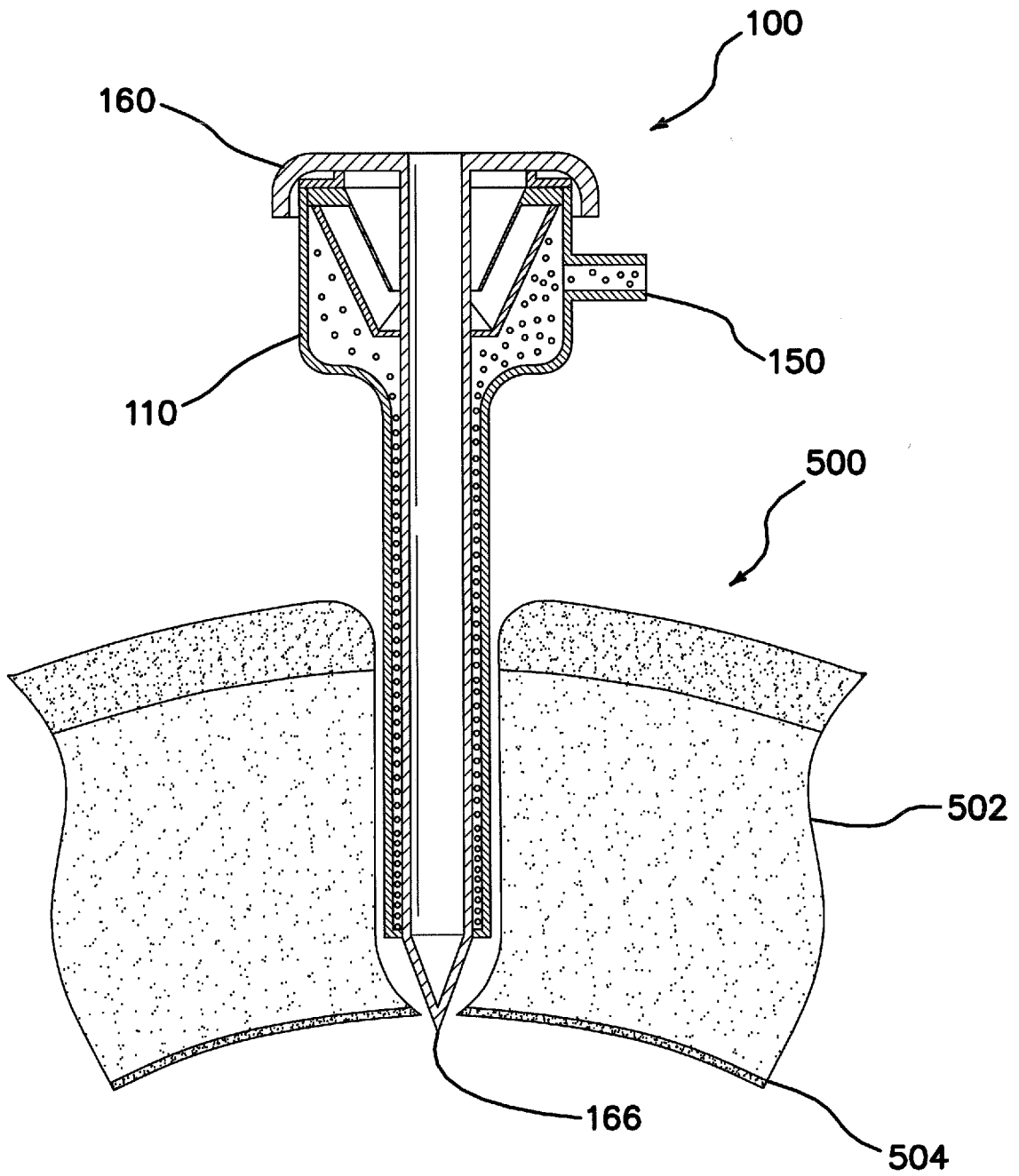


FIG. 5B

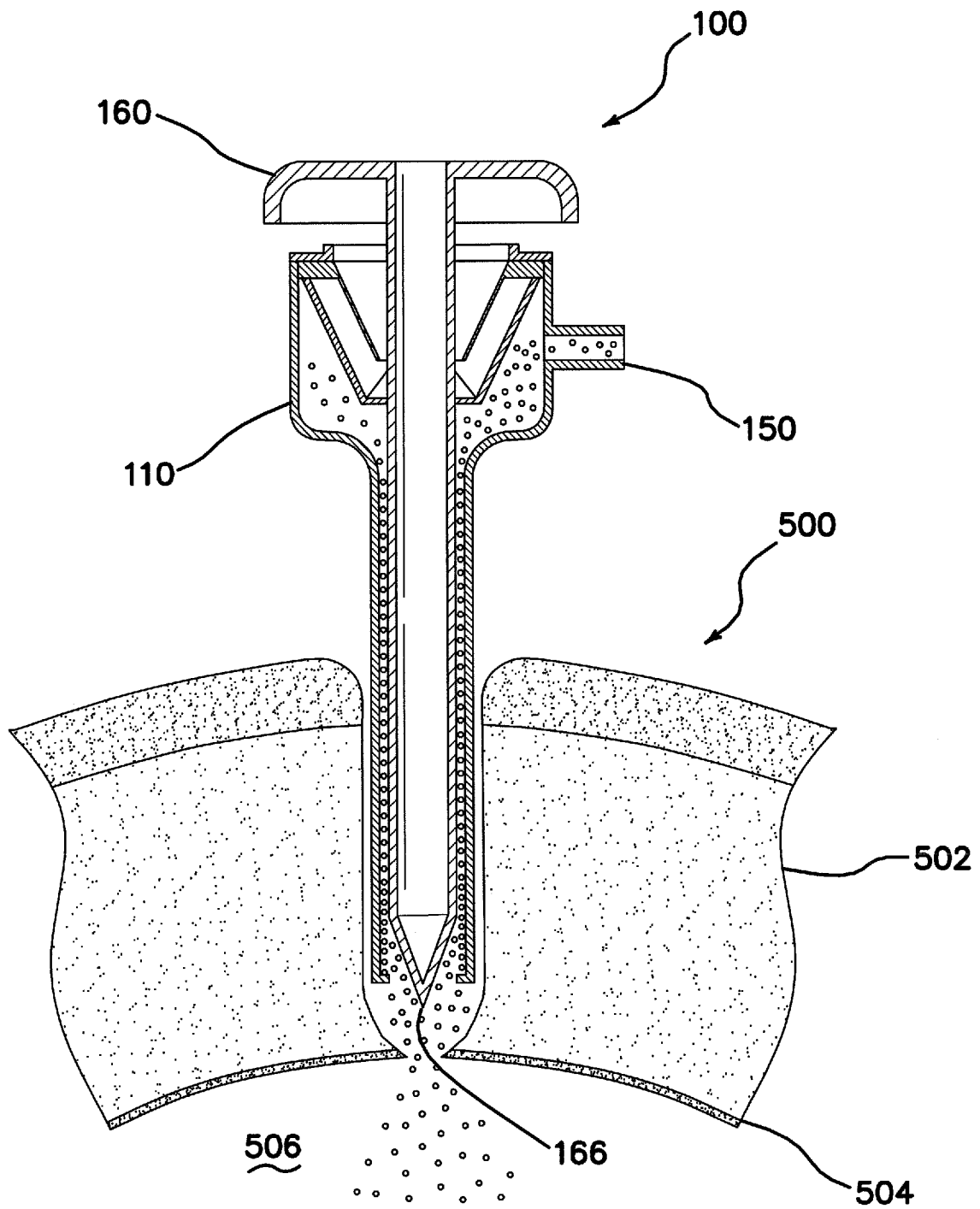


FIG. 5C

REFERENCES CITED IN THE DESCRIPTION

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- EP 1733707 A1 [0007]
- US 2005007851 A1 [0007]
- WO 03020140 A1 [0007]
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专利名称(译)	填充访问系统		
公开(公告)号	EP2851020B1	公开(公告)日	2016-01-20
申请号	EP2014190029	申请日	2009-01-26
[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	ALBRECHT JEREMY J JOHNSON GARY M BRUSTAD JOHN R		
发明人	ALBRECHT, JEREMY J JOHNSON, GARY M BRUSTAD, JOHN R		
IPC分类号	A61B17/34		
CPC分类号	A61M13/003 A61B17/3439 A61B17/3474 A61B2017/00907 A61B2017/3441 A61B2017/3456 A61B2017/347		
优先权	61/023539 2008-01-25 US		
其他公开文献	EP2851020A1		
外部链接	Espacenet		

摘要(译)

系统，装置和方法允许在将套管插入体腔之前绝缘体腔。进入系统的实施例包括填塞器（160），套管针（110）和流体流动通道（180）。进入系统具有闭合配置，其中进入系统的远端与流体流动通道流体隔离，以及打开配置，其中进入系统的远端流体连接到流体流动通道，从而允许流体流动，例如，绝缘气体进入体腔。

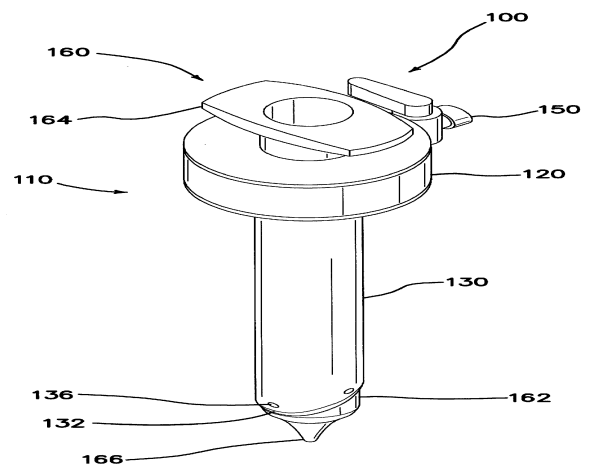


FIG. 1A