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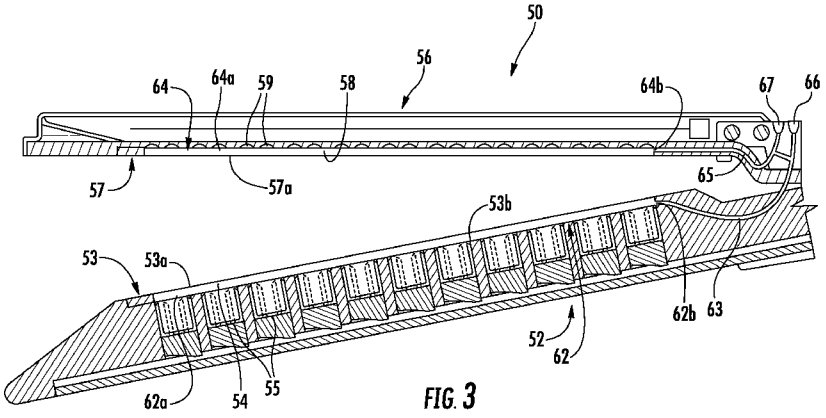


FIG. 3

(57) Abstract: An end effector includes first and second members that each have a tissue contacting surface and are moveable relative to one another. The first and second members are configured to clamp tissue therebetween when in an approximated configuration. The tissue contacting surface of the first member defines a first groove. The end effector also includes a bladder that is defined within the first groove and is configured to receive and retain fluid.

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SURGICAL STAPLER WITH INTEGRATED BLADDER

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of and priority to U.S. Provisional Patent Application Serial No. 62/148,827 filed April 17, 2015, this application also claims the benefit of and priority to U.S. Provisional Patent Application Serial No. 62/145,930 filed April 10, 2015, the entire disclosure of which is incorporated by reference herein.

BACKGROUND

1. *Technical Field*

[0002] The present disclosure relates to surgical instruments and, more specifically, to surgical instruments with integrated bladders.

2. *Discussion of Related Art*

[0003] Throughout the years the medical field has utilized various techniques in an effort to join or bond body tissue together. Surgical staplers have been developed for joining adjacent tissue, for providing hemostasis of adjacent tissue, and for providing hemostasis in conjunction with cutting of adjacent tissue. Such surgical staplers include both linear and annular type configurations. The intended function of staples is to hold the edges of a wound or tissue against one another during the healing process so as to reduce discomfort, pain, scarring and the time required for healing.

[0004] Linear or annular surgical stapling devices are employed by surgeons to sequentially or simultaneously apply one or more rows of surgical fasteners, e.g., staples or two-part fasteners, to body tissue for the purpose of joining segments of body tissue together and/or for the creation of anastomoses. Linear surgical stapling devices

generally include a pair of jaws between which body tissue to be joined is placed. When the surgical stapling device is actuated and/or "fired", firing bars move longitudinally and contact staple drive members in one of the jaws, and surgical staples are pushed through the body tissue and into/against an anvil in the opposite jaw thereby crimping the staples closed. A knife blade may be provided to cut between the rows/lines of staples.

[0005] Annular surgical stapling devices generally include an annular staple cartridge assembly including a plurality of annular rows of staples, typically two rows of staples, an anvil assembly operatively associated with the annular cartridge assembly, and an annular blade disposed internal of the rows of staples.

[0006] In addition to the use of surgical staples, biological tissue adhesives have been developed for joining tissue. Generally, biological adhesives bond separated tissues together. Such adhesives may be used instead of suturing and stapling, for example, in surgical procedures, for the repair of tissue or the creation of anastomoses.

[0007] In addition to the use of biological adhesives, following the formation of the anastomosis, a separate instrument or device may be used to apply biological sealants to the outer surface of the anastomosis, typically in a separate step. The biological sealants are intended to reduce and/or stop the incidence of leakage from the anastomosis.

[0008] The application of adhesives and/or sealants offers many advantages to the patient and the surgeon alike, such as, for example, the possible reduction in the number of staples used, immediate sealing of the tissue being treated, a strengthening of the anastomosis, minimizing foreign body reaction and scarring, and a reduction in the

occurrence of bleeding from the blood vessels, leakage through the tissue joint, and stricture.

[0009] There remains room for improvement in the delivery of fluids, such as adhesives and/or sealants, from surgical stapling instruments.

SUMMARY

[0010] Surgical staplers in accordance with this disclosure include end effectors having integrated bladders which dispense fluid (e.g., therapeutic drug, sealant, adhesive, or medicant) when punctured by a fastener during the joining of tissue by the surgical stapler. The bladder may be prefilled with fluid or fluid may be injected into the bladder prior to or during a surgical procedure.

[0011] In an aspect of the present disclosure, an end effector includes first and second members that each have a tissue contacting surface and are moveable relative to one another. The first and second members are configured to clamp tissue therebetween when in an approximated configuration. The tissue contacting surface of the first member defines a first groove. The end effector also includes a bladder that is defined within the first groove and is configured to receive and retain fluid.

[0012] In aspects, the bladder is configured to receive a fluid when the first and second members are in the approximated position. The bladder may be defined by an inner surface of the first groove and a first film disposed on the tissue contacting surface of the first member.

[0013] In some aspects, the end effector includes an injection port that is in fluid communication with the bladder. The injection port may be located on one of the first or second members and is configured to receive fluid from an injection device while the first and second members are in the approximated configuration.

[0014] In certain aspects, the first member includes a fastener that is configured to pierce the bladder as the fastener is ejected from the first member. The bladder may be configured to dispense a fluid onto tissue adjacent or proximate to the tissue contacting surface of the first member when the fastener pierces the bladders.

[0015] In particular aspects, the tissue contacting surface of the second member defines a second groove. The end effector may include a second bladder defined by an inner surface of the second groove and a second film disposed on the tissue contacting surface of the second member.

[0016] In aspects, the end effector is an annular end effector with the first member being a shell assembly and the second member being an anvil assembly. Alternatively, the end effector is a linear end effector with the first member being a lower jaw and the second member being an upper jaw.

[0017] In another aspect of the present disclosure, a method of joining tissue includes approximating first and second members of an end effector to clamp tissue to be joined between the first and second members, injecting fluid into a bladder defined in one of the first or second members while the first and second members are clamped on tissue, and ejecting a fastener from the first member such that the fastener pierces the bladder to release fluid from the bladder.

[0018] In aspects, ejecting the fastener from the first member includes the fastener piercing the bladder before the fastener passes through the tissue to be joined and coating the fastener with fluid disposed within the bladder. Ejecting the fastener from the first member may include the fastener piercing the bladder after the fastener passes through the tissue to be joined such that the bladder secretes fluid on tissue adjacent a tissue contacting surface of the second member.

[0019] In some aspects, injecting fluid into a bladder includes injecting fluid that includes at least one of a therapeutic drug, a biocompatible adhesive, or a biocompatible sealant. Injecting fluid into a bladder may include injecting a first fluid into a bladder that is defined by the first member and injecting a second fluid into a bladder that is defined by the second member. The second fluid may be different from the first fluid.

[0020] Further, to the extent consistent, any of the aspects described herein may be used in conjunction with any or all of the other aspects described herein.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] Various aspects of the present disclosure are described hereinbelow with reference to the drawings, which are incorporated in and constitute a part of this specification, wherein:

[0022] FIG. 1 is a perspective view of a surgical instrument with a manually actuated handle assembly and a linear stapling end effector in accordance with an exemplary embodiment of the present disclosure;

[0023] FIG. 2 is an enlarged view of the indicated area of detail of FIG. 1 with an injection device inserted into an injection port of the end effector;

[0024] FIG. 3 is a cross-sectional view taken along the section line 3-3 of FIG. 2;

[0025] FIG. 4 is a perspective view of the end effector of FIG. 2 with jaws of the end effector approximated on tissue;

[0026] FIG. 5 is a cross-sectional view taken along the second line 5-5 of FIG. 4;

[0027] FIG. 6 is a cross-sectional view of the end effector of FIG. 5 with fasteners ejected from the lower jaw to form staples;

[0028] FIG. 7 is a perspective view of a surgical instrument with a powered handle and a annular stapling end effector in accordance with another exemplary embodiment of the present disclosure;

[0029] FIG. 8 is an enlarged view of the indicated area of detail of FIG. 7 with an injection device inserted into an injection port of the end effector;

[0030] FIG. 9 is a cross-sectional view taken along the section line 9-9 of FIG. 8; and

[0031] FIG. 10 is a cross-sectional view of the end effector of FIG. 9 with the anvil assembly actuated over tissue and fasteners ejected from the shell assembly towards the anvil assembly.

DETAILED DESCRIPTION

[0032] Embodiments of the present disclosure are now described in detail with reference to the drawings in which like reference numerals designate identical or corresponding elements in each of the several views. As used herein, the term "clinician" refers to a doctor, a nurse, or any other care provider and may include support personnel. Throughout this description, the term "proximal" refers to the portion of the device or component thereof that is closest to the clinician and the term "distal" refers to the portion of the device or component thereof that is farthest from the clinician.

[0033] This disclosure is generally related to end effectors for surgical staplers including integrated bladders which disperse a fluid (e.g., therapeutic drug, sealant, adhesive, or medicant) when punctured by a fastener to assist in the joining of tissue with the surgical stapler. The bladder may be prefilled with the fluid during manufacture of the instrument or the fluid may be injected into the integrated bladder prior to or during a surgical procedure. The end effector may have an integrated bladder on each side of the tissue with the same or different fluid being dispensed from each integrated bladder. The end effector may be supplied as a part of a loading unit (disposable or reusable) or may be supplied as part of surgical instrument. The end effector may be linear or annular in configuration. In addition, the surgical stapler may be manually actuated, may be actuated by an electromechanical handle, or may be actuated by a pneumatic handle. For example, the pneumatic handle can be a handle powered by a gas cylinder.

[0034] Referring now to FIG. 1, a surgical instrument 10 having a manually actuated handle assembly 20 including a linear stapling end effector 50 is provided in accordance

with an exemplary embodiment of the present disclosure. The surgical instrument 10 includes the manually actuated handle assembly 20, an elongate portion 30, a loading unit 40, and an end effector 50. The elongate portion 30 extends from the handle assembly 20 and supports the loading unit 40. The loading unit 40 is releasably coupled to the distal end of the elongate portion 30. The end effector 50 is supported at a distal end of the loading unit 40 and includes first and second jaws 52, 56 that are moveable relative to one another. The handle assembly 20 includes a moveable handle 22 that is configured to actuate the end effector 50 to approximate the first and second jaws 52, 56 of the end effector 50 relative to one another and to fire or eject a plurality of fasteners (e.g., staples) through tissue positioned between the first and second jaws 52, 56. For a detailed description of a suitable manually actuated handle assembly and stapling instrument reference may be made to U.S. Patent No. 8,789,737 ("the '737 Patent"), the entire contents of which is incorporated herein by reference.

[0035] With reference to FIGS. 2 and 3, the first or lower jaw or member 52 of the end effector 50 includes a tissue contacting surface 53 that defines longitudinal grooves 54. Each of the grooves 54 includes an inner surface (in embodiments a pair of sidewalls and a bottom surface) and is positioned over a line of fasteners 55. The lower jaw 52 includes an integrated bladder 62 disposed within one or more of the grooves 54. The integrated bladder 62 is formed from an upper film 53a disposed along the tissue contacting surface 53 of the lower jaw 52 and a lower film 53b that is disposed over a bottom surface of the groove 54 such that sidewalls of the groove 54 form sidewalls of the integrated bladder 62. The upper film 53a may be disposed over the entire tissue contacting surface 53 of the lower jaw 52 and secured to the tissue contacting surface 53

between each of the grooves 54. The end effector 50 defines an injection port 66 and includes a delivery tube 63 that extends from the injection port 66, through the lower jaw 52, and to the integrated bladder 62 such that the injection port 66 is in fluid communication with the integrated bladder 62. The integrated bladder 62 may include fingers 62a with each finger 62a extending through a respective groove 54 and a plenum 62b in fluid communication with each finger 62a. The plenum 62b is in fluid communication with the injection port 66 through the delivery tube 63. Alternatively, the integrated bladder 62 may be formed from individual fingers 62a with the delivery tube 63 in fluid communication with each of the individual fingers 62a. The injection port 66 may include an auto-sealing septum to prevent injected fluid from exiting through the injection port 66.

[0036] It is also contemplated, that the integrated bladder 62 may be formed from individual fingers 62a with each finger 62a in fluid communication with the injection port 62 through an individual delivery tube 63 such that each individual delivery tube 63 is separately accessible through the injection port 66 to deliver a different fluid to each individual finger 62a. In such an embodiment, the individual fingers 62a may be paired with one or more delivery tubes 63 such that the inner fingers 62a of the integrated bladder 62 (adjacent a knife slot (not explicitly shown)) may be filled with a first fluid and the outer fingers 62a of the integrated bladder 62 (away from a knife slot (not explicitly shown)) may be filed with a second fluid that is different from the first fluid.

[0037] Further, it is contemplated that the second or upper jaw or member 56 may define longitudinal grooves 58 in a tissue contacting surface 57 of the upper jaw 56.

Each of the grooves 58 is positioned over a line of staple pockets 59 or retainers (not shown). The upper jaw 56 includes an integrated bladder 64 that is disposed within each of the grooves 58 and a delivery tube 65 in fluid communication with the integrated bladder 64. The integrated bladder 64 is formed from a lower film 57a that is disposed along the tissue contacting surface 57 of the upper jaw 56 such that the staple pockets 59 and sidewalls defining the grooves 58 form the integrated bladder 64. The lower film 57a may be disposed over the entire tissue contacting surface of the upper jaw 56 and secured to the tissue contacting surface 57 between each of the grooves 58. The injection port 66 and the delivery tube 65 are also in fluid communication in a manner similar to the integrated bladder 62 and delivery tube 63 of the lower jaw 52. Similarly, the integrated bladder 64 may include fingers 64a with each finger 64a extending through a respective groove 58 and a plenum 64b in fluid communication with each finger 64a. The plenum 64b is in fluid communication with the injection port 66 through the delivery tube 65. Alternatively, the integrated bladder 64 may be formed from individual fingers 64a with the delivery tube 65 in fluid communication with each of the individual fingers 64a. In addition, the end effector 50 may define a second injection port 67 adjacent the injection port 66 which is in fluid communication with the integrated bladder 64. In such embodiments, the integrated bladder 64 of the upper jaw 56 is in fluid communication with the second injection port 67 and the integrated bladder 62 of the lower jaw 52 is in fluid communication with the injection port 66 such that each of the bladders 62, 64 may be individually and separately filled as detailed below. As shown, both injection ports 66, 67 are positioned on the upper jaw 56; however, it is contemplated that one or both of the injection ports 66, 67 may be positioned on the lower jaw 52.

[0038] Referring now to FIGS. 2-5, the integrated bladder 62 has an initial or unfilled configuration (FIGS. 2 and 3) and a filled configuration (FIGS. 4 and 5). In the unfilled configuration, the integrated bladder 62 is collapsed such that an upper surface of the integrated bladder 62 is positioned below the tissue contacting surface 53 of the lower jaw 52. In the filled configuration, fluid which is injected through the injection port 66 fills or expands the integrated bladder 62 such that the upper surface of the integrated bladder 62 is coplanar with the tissue contacting surface 53 of the lower jaw 52. In addition, as the integrated bladder 62 is filled through the injection port 66, the integrated bladder 62 may expand to fill any cavities within the grooves 54. It is contemplated that the integrated bladder 62 may include semi-rigid walls such that in the unfilled configuration the upper surface of the integrated bladder 62 is coplanar with the tissue contacting surface 53 of the lower jaw 52.

[0039] With particular reference to FIG. 2, an injection device or needle 90 may be inserted into the injection port 66 to inject a fluid into the integrated bladder 62. The fluid may include a therapeutic drug, a biocompatible sealant, a biocompatible adhesive, or a combination thereof. The material can be a bioactive material such as a drug, an immunosuppressant, steroid, entihistimine, etc. Anti-adhesives, antimicrobials, anesthetics, growth factors, or other materials are contemplated.

[0040] As the fluid is injected into the integrated bladder 62, the integrated bladder 62 transitions to the filled configuration as detailed above. As the integrated bladder 62 reaches the filled configuration, the pressure of the fluid within the needle 90 may exceed a threshold pressure to indicate that the integrated bladder 62 is in the filled

configuration. Additionally or alternatively, as the integrated bladder 62 reaches the filled configuration, the fluid may flow out of the injection port 66 to provide an indication that the integrated bladder 62 is in the filled configuration. It will be appreciated that the fluid may be injected into the integrated bladder 62 before or after the upper and lower jaws 52, 56 are approximated over tissue. To fill the integrated bladder 62 after the upper and lower jaws 52, 56 are approximated over tissue, the fluid may be injected through injection port 68 or 69 (FIG. 1) which may be disposed outside of the body cavity of a patient and connected to bladders 62, 64 via a delivery tube (not explicitly shown).

[0041] As detailed above, the unfilled and filled configurations were detailed with respect to the integrated bladder 62 of the lower jaw 52. It will be appreciated that the integrated bladder 64 of the upper jaw 56 has unfilled and filled configurations substantially similar to the integrated bladder 64. As such, the unfilled and filled configurations of the integrated bladder 64 will not be discussed in detail for reasons of brevity.

[0042] With reference to FIG. 6, as the fasteners 55 are ejected from the lower jaw 52 towards the upper jaw 56, the fasteners 55 pierce the integrated bladder 62 of the lower jaw 52 such that the fasteners 53 are coated with the fluid disposed within the integrated bladder 62. The coated fasteners 55 then pass through tissue T positioned between the upper and lower jaws 52, 56. After the fasteners 55 pass through the tissue T, the fasteners 55 pierce the integrated bladder 64 of the upper jaw 56 before engaging staple pockets 59 or retainers (not shown) to secure the tissue T together.

[0043] When the integrated bladders 62, 64 are pierced, the fluid from the integrated bladders 62, 64 may coat the fasteners 55 and/or the tissue T between the upper and lower jaws 52, 56. The fluid may also flow into openings in the tissue T created by the fasteners 55 to enhance anastomosis, to enhance adhesion, or to seal the tissue T to prevent bleeding of the tissue T.

[0044] Referring now to FIG. 7, a surgical instrument 110 having a powered handle 120 including an annular or circular stapling end effector 150 is provided in accordance with another exemplary embodiment of the present disclosure. The surgical instrument 110 includes a powered handle 120, an adapter 130, a loading unit 140, and an end effector 150. The adapter 130 is releasably coupled to the powered handle 120 and extends from the powered handle 120. The loading unit 140 is releasably coupled to a distal end of the adapter 130. The end effector 150 is supported at a distal end of the loading unit 140 and includes a shell assembly 152 and an anvil assembly 156 that are moveable relative to one another. The powered handle 120 is configured to actuate the end effector 150 to approximate the shell and anvil assemblies 152, 156 of the end effector 150 relative to one another and to fire a plurality of fasteners (e.g., staples) through tissue positioned between the shell and anvil assemblies 152, 156. For a detailed description of the structure and function of an exemplary adapter and loading unit, please refer to commonly owned U.S. Provisional Patent Application Serial No. 62/066,518 filed October 21, 2014. For a detailed description of the structure and function of an exemplary powered handle, please refer to commonly owned U.S. Patent Publication No. 2012/0253329. Each of these applications is incorporated herein by reference in its entirety.

[0045] With reference to FIGS. 8 and 9, the first or shell assembly or member 152 has a tissue contacting surface 153 that defines an annular groove 154 with an outer surface of the shell assembly 152. The shell assembly 152 includes an integrated bladder 162 disposed within the annular groove 154 and positioned between a plurality of fasteners 155 and the tissue contacting surface 153. The integrated bladder 162 is defined between an outer film 153a disposed along the tissue contacting surface 153 and an inner film 153b disposed over the plurality of fasteners 155. The shell assembly 152 defines an injection port 166 that is in fluid communication with the integrated bladder 162 via a delivery tube 163.

[0046] Additionally or alternatively, the anvil assembly 156 has a tissue contacting surface 157 defines an annular groove 158. The annular groove 158 is positioned between the tissue contacting surface 157 and staple pockets 159 or retainers (not shown) of the anvil assembly 156. The anvil assembly 156 includes an integrated bladder 164 disposed within the annular groove 158. The integrated bladder 164 is defined between an outer film 157a and the staple pockets 159. The distal surface of the anvil assembly 156 may define a second injection port 167 that is in fluid communication with the integrated bladder 164 via a delivery tube 165.

[0047] With reference to FIGS. 8-10, the integrated bladders 162, 164 have an unfilled configuration (FIG. 9) and a filled configuration (FIG. 10) which are substantially similar to the unfilled and filled configurations of the integrated bladders 62, 64 detailed above. As shown, the integrated bladders 162, 164 have semi-rigid walls;

however, it is contemplated that integrated bladders 162, 164 may have collapsible walls as detailed above with respect to integrated bladders 62, 64.

[0048] With reference to FIG. 10 and similar to the integrated bladders 62, 64 as detailed above with respect to the linear end effector 50, the integrated bladders 162, 164 of the circular end effector 150 coat the fasteners 155 and the tissue T as the fasteners 155 are driven through the integrated bladder 162 of the shell assembly 152 to pierce the integrated bladder 162 and to secrete fluid from the integrated bladder 164 of the anvil assembly 156 as the fasteners 155 pierce the integrated bladder 164.

[0049] In any of the embodiments disclosed herein, the instrument could have channels for conveying the fluid. In such embodiments, the channels would dispense the fluid whether or not the buttress was present.

[0050] While several embodiments of the disclosure have been shown in the drawings, it is not intended that the disclosure be limited thereto, as it is intended that the disclosure be as broad in scope as the art will allow and that the specification be read likewise. Any combination of the above embodiments is also envisioned and is within the scope of the appended claims. Therefore, the above description should not be construed as limiting, but merely as exemplifications of particular embodiments. Those skilled in the art will envision other modifications within the scope of the claims appended hereto.

WHAT IS CLAIMED:

1. An end effector comprising:

first and second members each having a tissue contacting surface, the first and second members moveable relative to one another and configured to clamp tissue therebetween in an approximated configuration, the tissue contacting surface of the first member defining a first groove; and

a bladder at least in part defined by the first member and configured to receive and retain fluid.

2. The end effector according to claim 1, wherein the bladder is configured to receive fluid when the first and second members are in the approximated configuration.

3. The end effector according to claim 1, wherein the bladder is defined by an inner surface of the first groove and a first film disposed on the tissue contacting surface of the first member.

4. The end effector according to claim 1, further comprising an injection port in fluid communication with the bladder.

5. The end effector according to claim 4, wherein the injection port is located on one of the first or second members and is configured to receive fluid from an injection device while the first and second members are in the approximated configuration.

6. The end effector according to claim 1, wherein the first member includes a fastener configured to pierce the bladder as the fastener is ejected from the first member.

7. The end effector according to claim 6, wherein the bladder is configured to dispense fluid onto tissue adjacent with the tissue contacting surface of the first member when the fastener pierces the bladder.

8. The end effector according to claim 1, wherein the tissue contacting surface of the second member defines a second groove.

9. The end effector according to claim 8, further comprising a second bladder defined by an inner surface of the second groove and a second film disposed on the tissue contacting surface of the second member.

10. The end effector according to claim 1, wherein the end effector is an annular end effector, the first member is a shell assembly, and the second member is an anvil assembly.

11. The end effector according to claim 1, wherein the end effector is a linear end effector, the first member is a lower jaw, and the second member is an upper jaw.

12. A method of joining tissue comprising:

approximating first and second members of an end effector to clamp tissue to be joined between the first and second members;

injecting fluid into a bladder defined in one of the first or second members before or after the first and second members are clamped on tissue; and

ejecting a fastener from the first member such that the fastener pierces the bladder to release fluid from the bladder.

13. The method according to claim 12, wherein ejecting the fastener from the first member includes the fastener piercing the bladder before the fastener passes through the tissue to be joined and coating the fastener with fluid disposed within the bladder.

14. The method according to claim 12, wherein ejecting the fastener from the first member includes the fastener piercing the bladder after the fastener passes through the tissue to be joined such that the bladder secretes fluid on tissue adjacent a tissue contacting surface of the second member.

15. The method according to claim 12, wherein injecting fluid into a bladder includes injecting fluid that includes at least one of a therapeutic drug, a biocompatible adhesive, or a biocompatible sealant.

16. The method according to claim 12, wherein injecting fluid into a bladder includes injecting a first fluid into a bladder defined by the first member and injecting a second fluid into a bladder defined by the second member.

17. The method according to claim 16, wherein the second fluid is different from the first fluid.

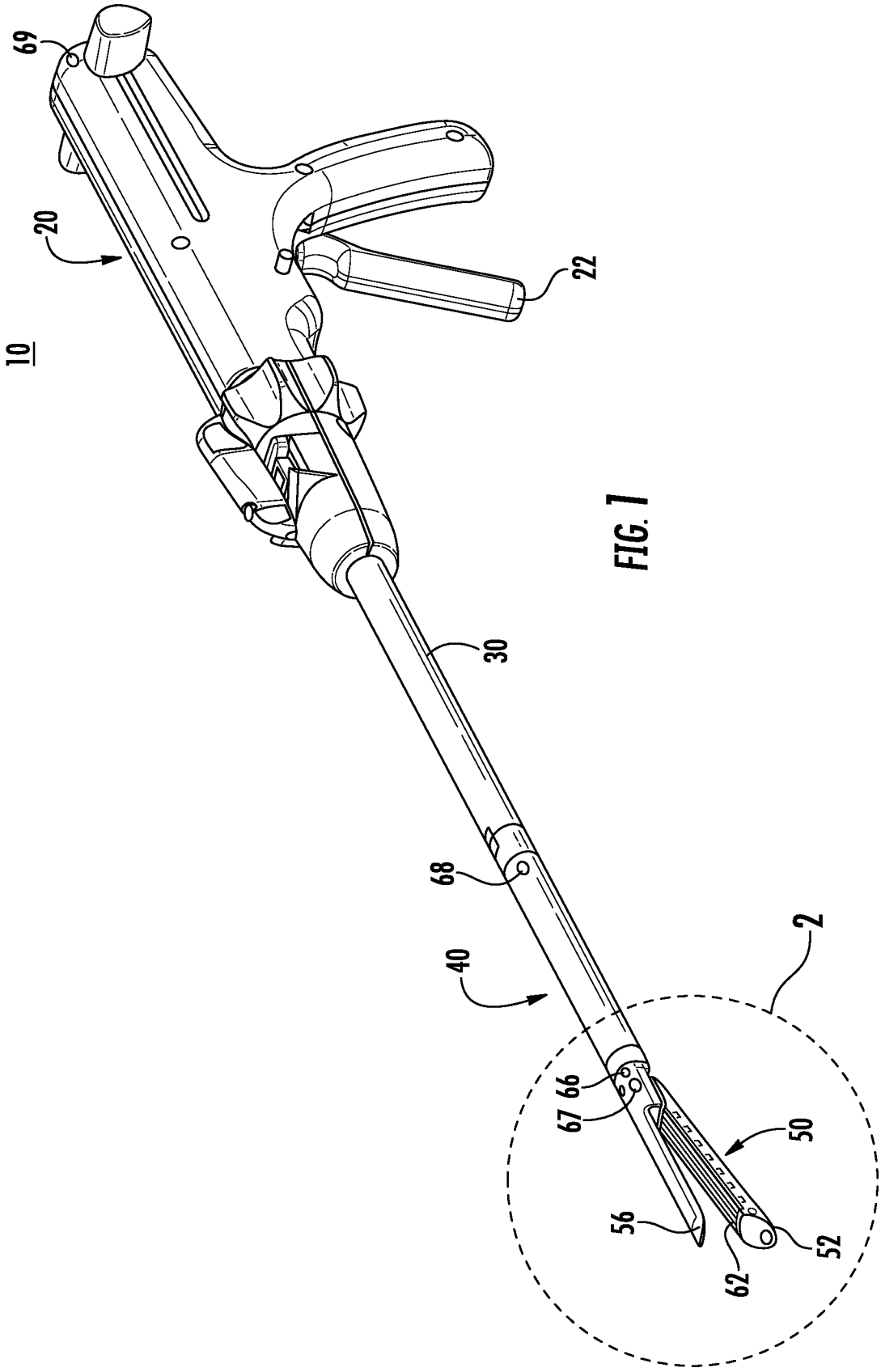


FIG. 1

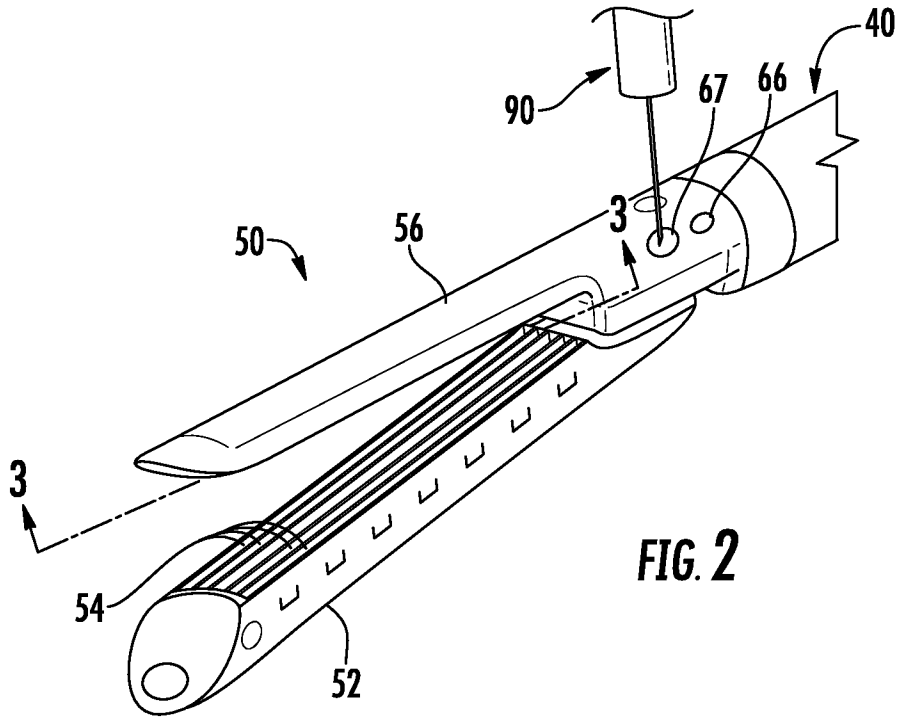


FIG. 2

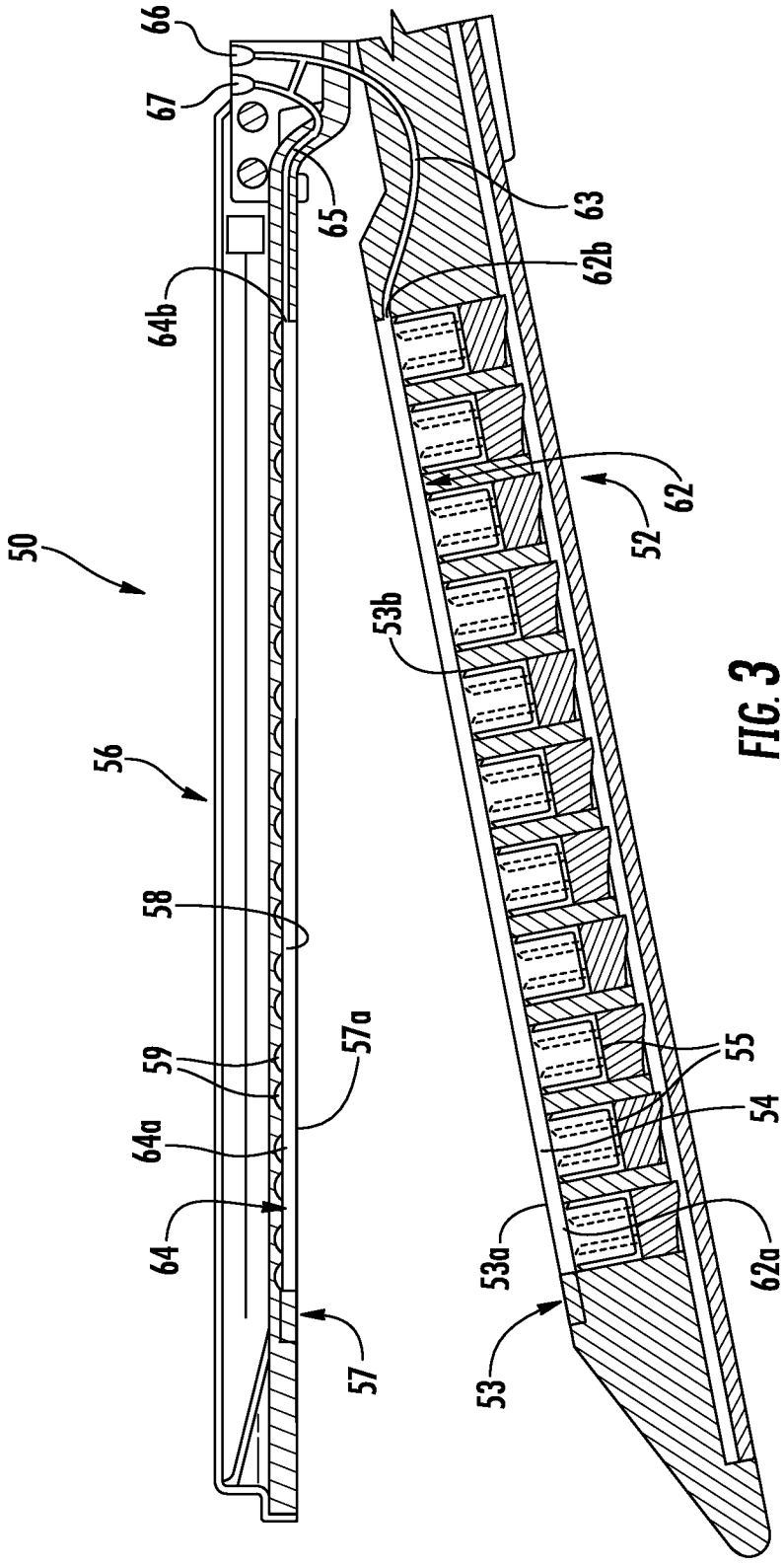

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FIG. 3

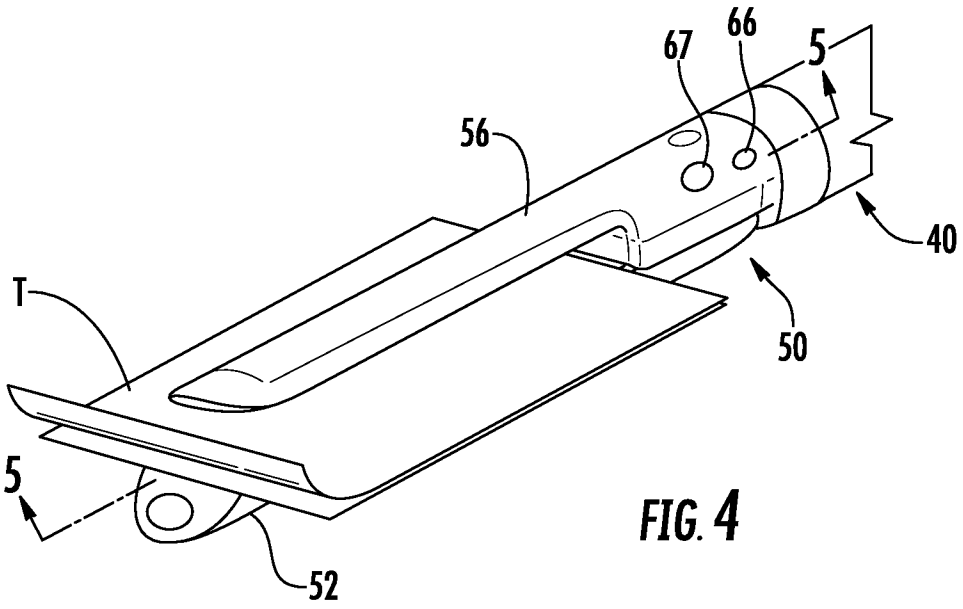


FIG. 4

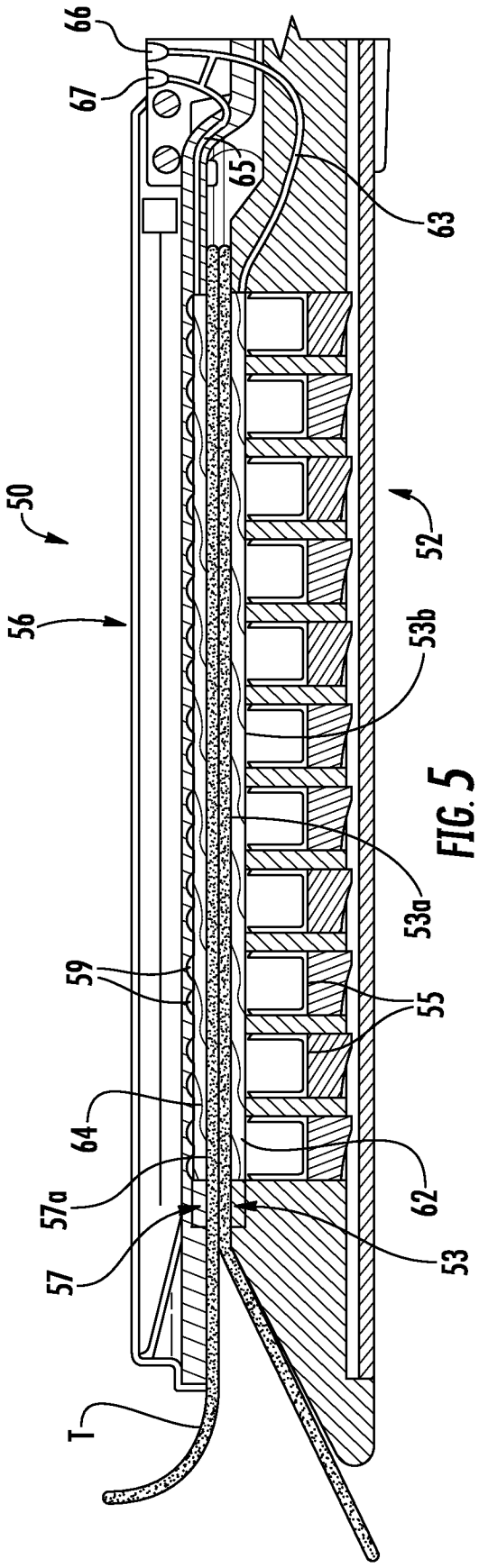

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FIG. 5

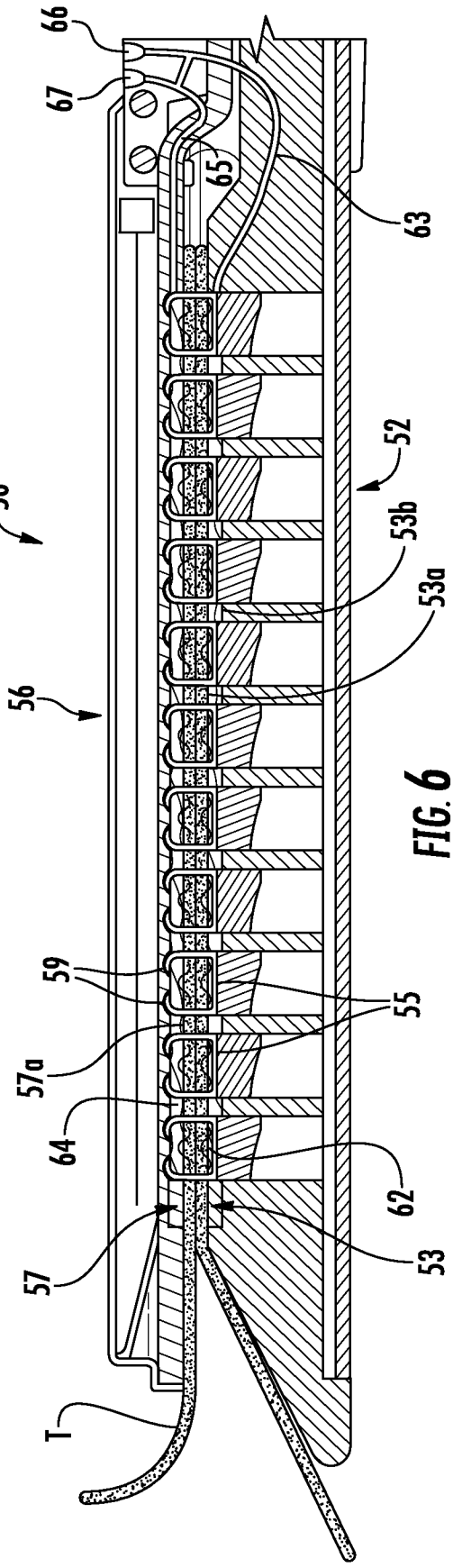

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FIG. 6

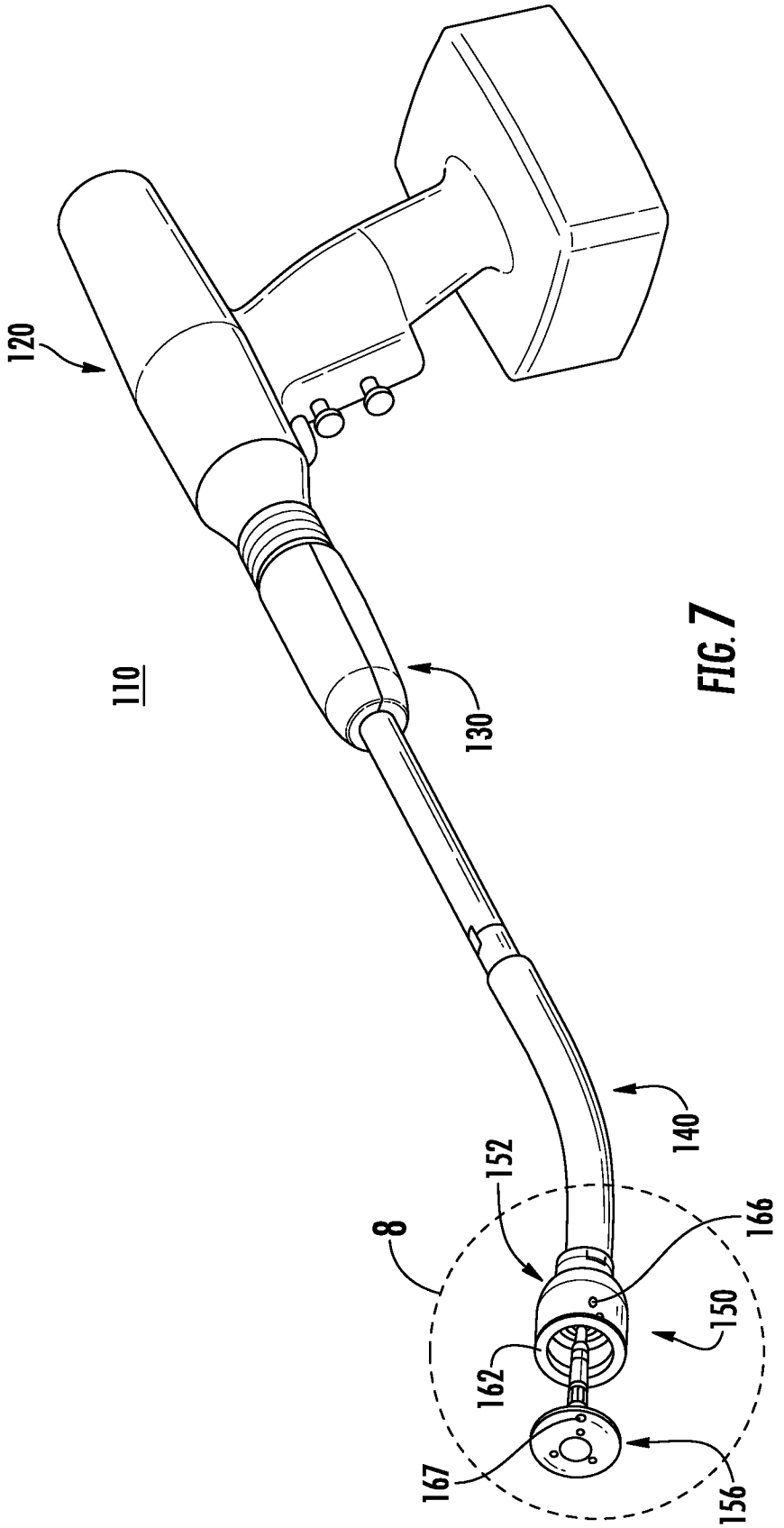


FIG. 7

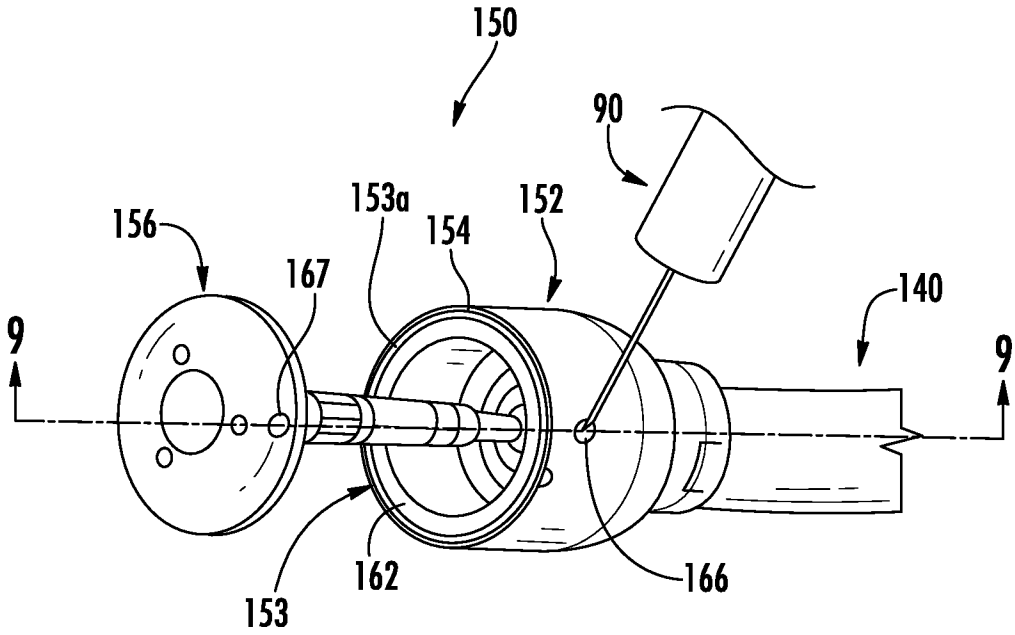


FIG. 8

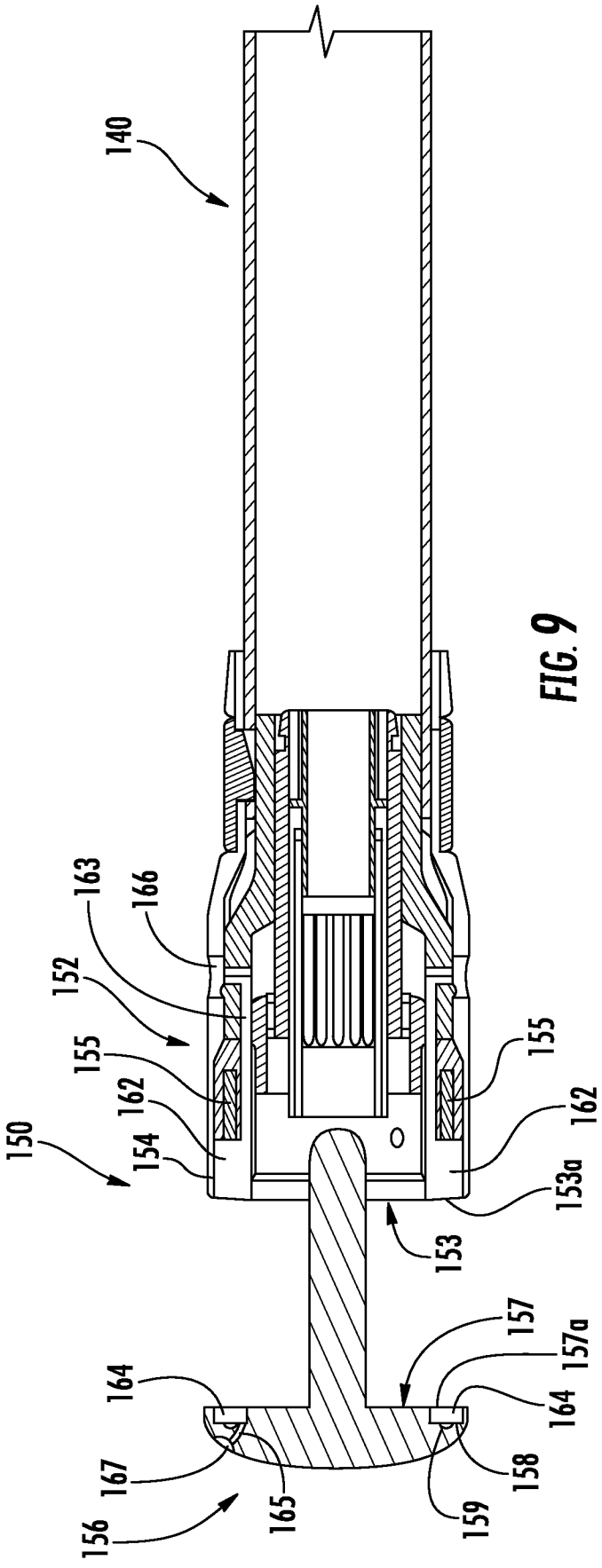

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FIG. 9

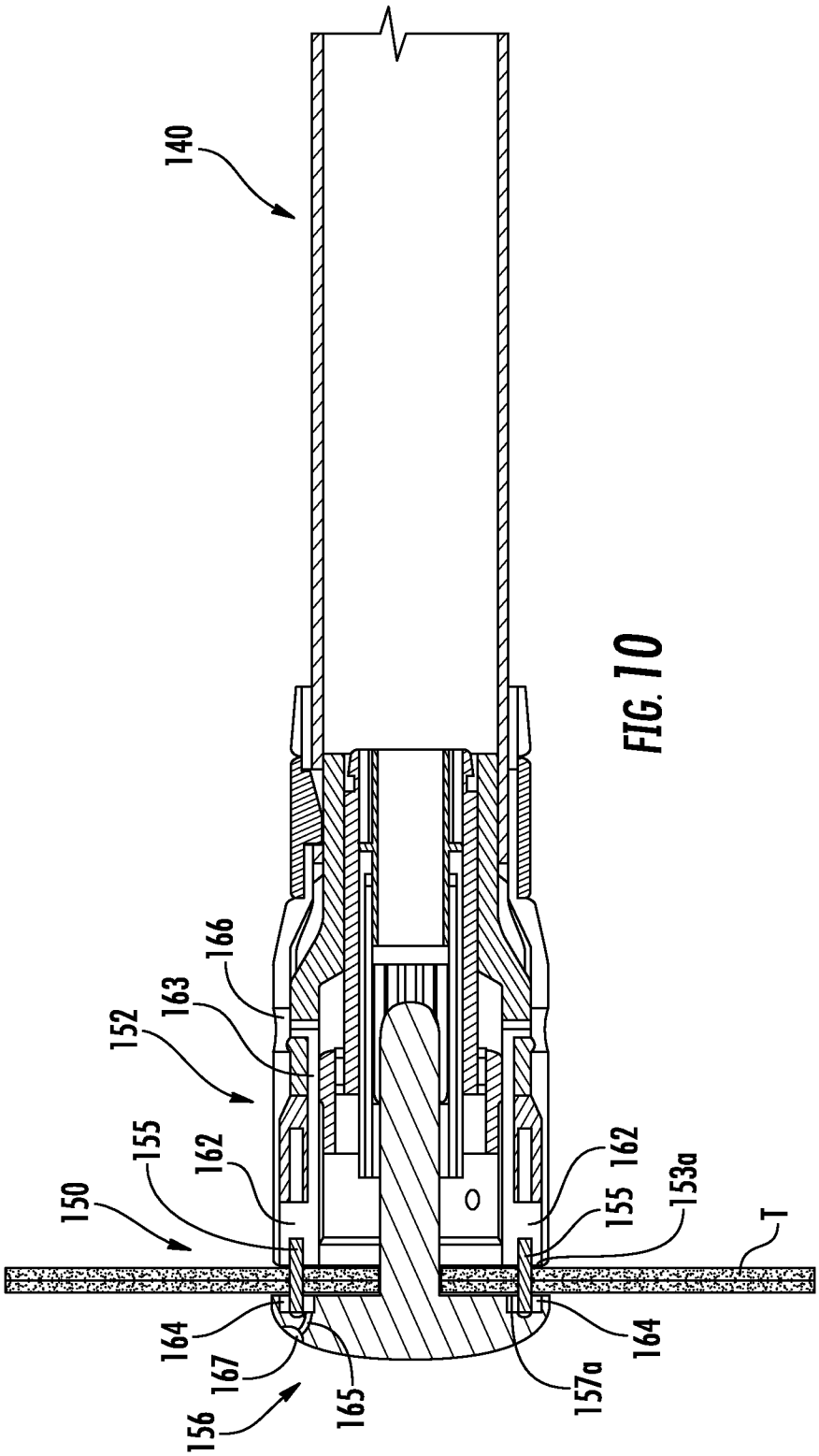


FIG. 10

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2016/026334

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☒ Claims Nos.: 12-17
because they relate to subject matter not required to be searched by this Authority, namely:
Claims 12-17 pertain to methods for treatment of the human body by surgery and thus relate to a subject-matter which this International Searching Authority is not required to search under PCT Article 17(2)(a)(i) and PCT Rule 39.1(iv).

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

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

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

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

1. ☐ As all required addtional search fees were timely paid by the applicant, this international search report covers all searchable claims.

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

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2016/026334

A. CLASSIFICATION OF SUBJECT MATTER

A61B 17/068(2006.01)i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A61B 17/068; A61F 2/02; A61B 17/04; A61B 17/08

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean utility models and applications for utility models
Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
eKOMPASS(KIPO internal) & Keywords:end effector, first and second members, tissue contact surface, groove, bladder, dispense, fluid, fastener, pierce

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2011-0278346 A1 (HULL et al.) 17 November 2011 See abstract; paragraphs [0076], [0104]-[0111]; and figures 1-4, 11, 12.	1-11
X	US 2013-0062391 A1 (BOUDREAUX et al.) 14 March 2013 See paragraphs [0044]-[0057]; and figures 10-16.	1-3,6-11
X	US 8678263 B2 (VIOLA, FRANK J.) 25 March 2014 See column 4, line 5 - column 5, line 33; column 6, lines 5-18; claims 1, 2, 4, 11, 13, 14; and figures 2, 3, 6, 13, 14.	1-3,8-11
A	US 7845536 B2 (VIOLA et al.) 07 December 2010 See column 17, line 64 - column 15, line 34; column 18, line 65 - column 21, line 9; column 21, line 51 - column 22, line 11; and figures 31-39, 42, 43.	1-11
A	US 2009-0120994 A1 (MURRAY et al.) 14 May 2009 See paragraphs [0032]-[0035], [0049]-[0057]; and figures 1-3, 6-11.	1-11

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents,such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
21 July 2016 (21.07.2016)	**25 July 2016 (25.07.2016)**

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2016/026334

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2016/026334

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