

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
29 November 2007 (29.11.2007)

PCT

(10) International Publication Number
WO 2007/136894 A2

(51) International Patent Classification:
A61B 1/00 (2006.01)

(21) International Application Number:
PCT/US2007/061974

(22) International Filing Date:
12 February 2007 (12.02.2007)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/747,780 19 May 2006 (19.05.2006) US
11/669,633 31 January 2007 (31.01.2007) US

(71) Applicant (for all designated States except US): **AMS RE-SEARCH CORPORATION** [US/US]; 10700 Bren Road West, Minnetonka, MN 55343 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **NAHEN, Kester** [DE/DE]; Zum Steinberg 42, 69121 Heidleberg (DE). **ARNOLD, Ken** [US/US]; 3893 Aldo Court, Soquel, CA 95073 (US). **STINSON, Douglas, G.** [US/US]; 1017 Joshua Place, Fremont, CA 94539 (US). **ASTURIAS, Eduardo** [US/US]; 84 Middlefield Drive, San Francisco, CA 94132 (US). **LAZZARO, Victor** [US/US]; 1988 Cherry Hill Drive, Discovery Bay, CA 94514 (US). **KERMODE,**

James, Raymond [US/US]; 614 Palm Avenue, Los Altos, CA 94022 (US).

(74) Agents: **HANN, James, F.** et al.; Haynes Beffel & Wolfeld LLP, P.O. Box 366, Half Moon Bay, CA 94019 (US).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LV, LY, MA, MD, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

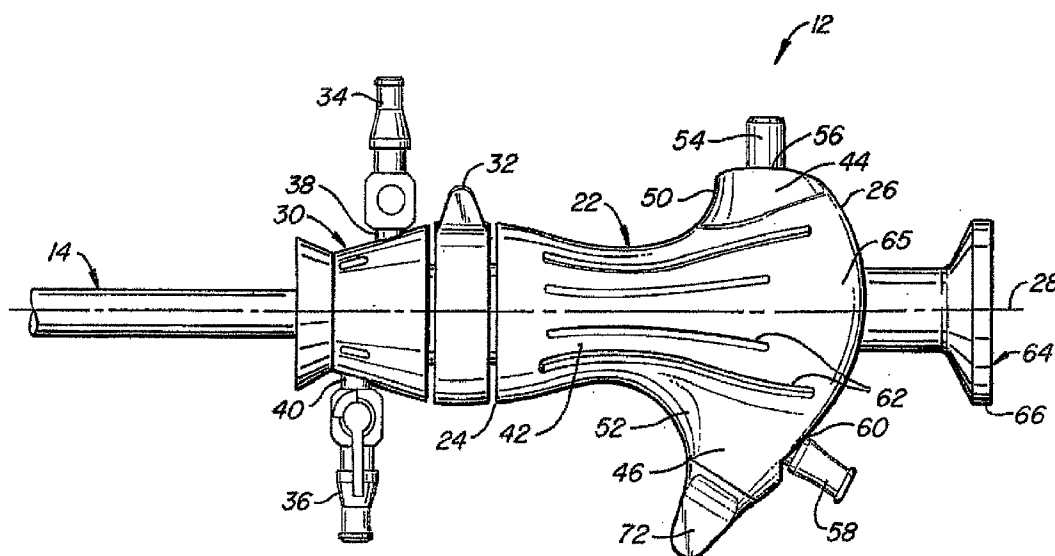
(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— without international search report and to be republished upon receipt of that report

[Continued on next page]

(54) Title: HANDLE FOR MULTIFUNCTION ENDOSCOPE



(57) Abstract: A multifunction endoscope handle comprises a body cover, a first body cover extension and a second body cover extension. The body cover comprises distal and proximal ends with a waist of therebetween. The proximal and distal end circumferences part each larger than the waist circumference. The body cover also comprises an outer surface tapering from the distal and proximal ends to the waist. Both of the first and second body cover extensions extend radially outwardly directions from the outer surface of the body cover. In some embodiments the proximal circumference is larger than the distal circumference. The outer surface is preferably a smoothly tapering outer surface. The body cover may comprise a plurality of ports at a proximal portion thereof.

WO 2007/136894 A2



For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

HANDLE FOR MULTIFUNCTION ENDOSCOPE

Inventors: Kester Nahen
Ken Arnold
Douglas G. Stinson
Eduardo Asturias
Victor Lazzaro
James Raymond Kermode

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates generally to endoscopes, and in particular the configuration of a handle used for a multifunction endoscope.

Description of Related Art

[0002] An endoscope is an illuminated medical device used look inside the body and examine organs. An endoscope can be rigid or flexible. Endoscopes designed for particular procedures often have specialized names, such as cystoscope (bladder), nephroscope (kidney), bronchoscope (bronchi), laryngoscope (larynx), otoscope (ear), arthroscope (joint) and laparoscope (abdomen). In addition to being used for viewing and examination, endoscopes are often used with various types of medical instruments for diagnostic and therapeutic procedures. An example of these medical instruments includes a medical laser device using fiber optics to deliver the laser energy to, typically, the distal end of the endoscope. Other medical instruments that can be used with endoscopes include grasping, cutting, tissue sampling and suturing medical instruments as well as medical instruments designed to provide energy other than laser energy such as RF and ultrasonic energy.

[0003] Endoscopic removal of tissue by means of lasers has been realized in procedures such as photoselective vaporization of prostate (PVP) for the treatment of lower urinary tract symptoms (LUTS) due to benign prostatic hyperplasia (BPH). Lasers in the visible and invisible spectral range have been utilized for endoscopic procedure of tissue removal. Tissue removal is typically carried out under endoscopic visualization of the operating field through a telescope. Laser light is guided to the operating field by an optical light guide (laser fiber). To steer the light guide to the

target tissue an endoscope is often utilized. In some implementations the telescope can be embodied in the endoscope as a fixed or modular component.

[0004] Performing a surgical laser procedure through an endoscope creates several challenges. Vaporization of tissue in a body cavity filled with an irrigant creates vapor bubbles and tissue particles that get released into the irrigant and that can obscure the view of the surgeon.

[0005] Controlling the surgical effect the laser has on tissue requires the surgeon to position the laser fiber with high precision. The surgeon has to consider the characteristics of the laser beam such as its divergence coming out of the laser fiber and control the distance between laser fiber and tissue to achieve the desired effect. In some instances the laser effect can change its nature dependent on the distance between laser fiber and tissue. In some cases vaporization will occur when the fiber is close to tissue but coagulation without vaporization will occur when the fiber is further away from tissue.

[0006] The surgeon has to control the position of the distal tip of the laser fiber relative the distal tip of the endoscope to avoid damage to the endoscope by unintentional exposure of the endoscope to laser light.

[0007] Thus, in some high power laser applications, it is possible to damage an endoscope by inadvertently directing laser radiation into the structure. In addition, it is necessary to provide for an effective irrigation flow in such systems. Finally, is desirable to provide a structural design which is comfortable to hold and utilize by surgeons. An endoscope is described herein that allows surgeons to safely and effectively perform laser surgery, including transurethral laser vaporization of prostate tissue.

SUMMARY OF THE INVENTION

[0008] A simple endoscope used for examination of an organ may have only two ports, one for the light source and one for the optical image. However, endoscopes used for medical procedures such as ablation of tissue using laser energy will typically have many more ports and therefore make the design of the proximal portion of the endoscope more complicated. The increased complexity includes the presence of tubes, lines, wires and other things extending from the proximal portion of the endoscope. One aspect of the invention is the recognition that different

individuals using the same endoscope will often hold and manipulate the endoscope by its proximal portion in different ways. This is particularly true for multifunction endoscopes used for both of viewing and for treatment, at least in part because of the increased complexity of the procedure and the number of things extending from the proximal portion, as well as the personal preferences of the operator.

[0009] A handle for a multifunction endoscope comprises a body cover, a first body cover extension and a second body cover extension. The body cover comprises distal and proximal ends with an axis extending therebetween with a waist between the distal and proximal ends. The distal and proximal ends and the waist have distal and proximal circumferences and a waist circumference, respectively. The proximal circumference is larger than the waist circumference and the distal circumference is larger than the waist circumference. The body cover also comprises an outer surface, the outer surface tapering from the distal end to the waist and from the proximal end to the waist. The first body cover extension extends in a first radial direction from the outer surface of the body cover between the proximal end and the waist. The second body cover extension extends in a second radial direction from the outer surface of the body cover between the proximal end and the waist.

[0010] In some embodiments the proximal circumference is larger than the distal circumference. The outer surface is preferably a smoothly tapering outer surface. The body cover may comprise a plurality of ports at a proximal portion thereof. The handle may also comprise a second body cover positioned distally of the distal end of the body cover. The second body cover may comprise additional ports therein.

[0011] A method for manipulating an endoscope comprises selecting an endoscope, the endoscope comprising a handle, an external cannula extending from the handle, and an optical fiber. The optical fiber extends through the handle and through the external cannula with a proximal portion of the optical fiber extending proximally from a port at the second body cover extension. The body cover of the handle is grasped with a first hand using a chosen gripping technique. A user-manipulable knob mounted to the proximal portion of the optical fiber is grasped with a second hand. The optical fiber is selectively moved within the external cannula by at least one of rotating the optical fiber around its own axis and longitudinally sliding the optical fiber through the external cannula using the user-manipulable knob.

[0012] Other features, aspects and advantages of the present invention can be seen on review the Figs., the detailed description, and the claims which follow.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] Fig. 1 is a simplified overall view of a multifunction endoscope including a handle made according to the invention;

[0014] Fig. 1A is a simplified side view of a portion of a laser fiber showing a rotation limiting element, a coupler and a fiber manipulator mounted thereto;

[0015] Fig. 2 is an enlarged view of the handle of Fig. 1;

[0016] Figs. 3-6 illustrate four different handle holding techniques accommodated by the handle of Figs. 1 and 2; and

[0017] Figs. 7 and 8 are somewhat simplified overall cross-sectional views with crosshatching omitted for clarity, Fig. 9 is a proximal end half-sectional elevational view, and Figs. 10 and 11 are top and bottom half-sectional plan views of the endoscope of Fig. 1 further illustrating the shape of the outer surface of the handle;

[0018] Fig. 12 a side view of the distal end of the endoscope positioned within a urethra near prostate tissue;

[0019] Fig. 13 is a perspective view of the opening at the distal end of the endoscope, looking from the working region into the opening;

[0020] Fig. 14 is a somewhat simplified cross-sectional view, with crosshatching omitted for clarity, illustrating the cooperation of a travel limiter and a pin within a fiber lumen on the endoscope;

[0021] Fig. 15 illustrates the structure of a travel limiter for use with a fiber adapted for the endoscope described herein;

[0022] Fig. 16 is an end view of the fiber lumen with a travel limiter cam positioned inside in a vertical position; and

[0023] Fig. 17 is an interview of the fiber lumen with a travel limiter cam positioned in a rotated position.

DETAILED DESCRIPTION

[0024] Fig. 1 illustrates a multifunction endoscope 10, such as a transurethral cystoscope, including a handle 12 with an external cannula 14 extending distally from the handle 12. In this embodiment multifunction endoscope 10 is designed for use

with a medical laser device of the type including an optical fiber 16 having a fiber end member 19 which extends into a cavity formed by a hood structure (described in more detail below and in Provisional Patent Application No. 60/747,780, the disclosure of which is incorporated by reference) on the distal tip 18 of external cannula 14. The optical fiber 16 has a fiber manipulator knob 17 attached near the handle 12, that is adapted to be used by a surgeon to manipulate the position of the fiber end member, rotationally and longitudinally. External cannula 14 has a number of passageways or lumens formed by an internal structure, not shown, extending generally from handle 12 to distal tip 18 to accommodate, in this disclosed embodiment, optical fiber 16 and fiber end element 19, a telescope type of visualization device typically coupled to a display monitor (not shown), an inflow irrigation pathway, and an outflow or suction pathway. The endoscope 10 in the illustrated embodiment includes an internal cannula which receives the fiber 16 in a manner which allows easy movement of the fiber 16 at least over a range of motion that allows manipulation of the fiber end member 19 longitudinally and rotationally within a working field by a surgeon grasping the fiber manipulator knob 17. Other embodiments are adapted for manipulation of the fiber end member 19 by a mechanical system under computer control with active feedback based on the video images of the procedure, with or without real time user input.

[0025] Individual lumens may be used for a single purpose, such as delivery of irrigation liquid, or for two or more purposes, such as housing the telescope and a optical fiber.

[0026] As suggested in Fig. 1, a laser beam 20 is directed laterally in the illustrated embodiment from fiber end element 19 in a side-firing fashion. Optical fiber 16 could also have an end element adapted for forward firing. Visualization in the general direction of laser beam 20 is provided by a telescope with appropriately angled optical elements at its distal end. In addition, other types of medical instruments may be used as a part of endoscope 10 instead of, or in addition to, a medical laser device.

[0027] Fig. 1A is a simplified diagram of an optical fiber assembly adapted for use with the endoscope of Fig. 1. The fiber 16 is connected to a coupler 71 adapted to connect the fiber to the output of a laser system. The fiber end element 19 in the illustrated embodiment comprises a fused quartz cap which captures air between a beveled end 21 of the fiber 16. The air/fiber interface provided by the

beveled end 21 causes essentially total internal reflection of the beam 20 in the side firing direction. At a predetermined distance from the fiber end element 19, a rotation limiting element 76, in the form of a cam in this embodiment, is attached to the fiber 16. The rotation limiting element 76 is adapted to cooperate with a corresponding element within the endoscope, as described in more detail below and in Provisional Patent Application No. 60/747,780, the disclosure of which is incorporated by reference, to prevent the surgeon from withdrawing the fiber end element 19 into the cannula so that the beam 20 does not damage the cannula, and to prevent the surgeon from rotating the fiber end element 19 toward the hood structure on the distal tip 18 of the external cannula, so that the beam 20 does not damage the hood structure on the distal tip 18. In addition, the fiber is threaded through a coupler 70, which is adapted to couple with a fiber port on the endoscope 10, as illustrated in Fig. 1, which secures the rotation limiting element 76 within the endoscope, and provides a seal on the cannula within which the fiber 16 is received without interfering with movement of the fiber as described above within the predetermined ranges of longitudinal and rotational motion.

[0028] In a preferred embodiment the longitudinal motion of optical fiber 16 is directed axially along axis 28 (illustrated in Fig. 2) and also rotationally about its own axis to permit laser beam 20 to be directed proximally and distally as optical fiber 16 moves generally along axis 28 as well as being swept side to side as optical fiber 16 rotates about its own axis. Distal tip 18 of external cannula 14 is beveled to permit this range of movement of laser beam 20 while providing for proper viewing of working region 68.

[0029] Fig. 2 shows more detail of handle 12. Handle 12 includes a body cover portion or cover 22 having a distal end 24 and a proximal end 26 and defining a central axis 28. The axial distance between distal and proximal ends 24, 26 is preferably about 8 to 15 cm, and typically about 9 to 12 cm. This size range is chosen primarily to accommodate different hand grasping techniques, such as shown in Figs. 3-6, for users with a range of sizes of hands and styles of use for the endoscope. Handle 12 also includes a supplemental body cover 30 positioned distally of body cover 22 with a bayonet mount 32 therebetween adapted for covering the proximal end of the external cannula 14 and various fittings used for connecting the internal structures to the external cannula 14. The external cannula 14 is connected with irrigation inflow and outflow fittings 34, 36, and secured by bayonet mount 32 to

internal structures (not shown) which are adapted to receive the telescope 64 and the fiber 16. Handle 12 has a number of ports opening into the interior of the handle. For example, inflow and outflow fittings 34, 36 extend from supplemental body cover 30 and provide access to inflow and outflow ports 38, 40 which open into an inflow irrigation pathway defined by internal structures and an outflow or suction pathway extending along external cannula 14. Inflow fitting 34 may be connected to a source of an appropriate irrigation liquid, such as saline fed by a gravity feed structure or by a pump, while outflow fitting 36 may be connected to an appropriate suction source.

[0030] Body cover 22 has a smoothly tapering outer surface 48 that tapers radially inwardly from distal and proximal ends 24, 26 towards a central or waist portion 42. The circumference of proximal end 26 is larger than the circumference of distal end 24, which is larger than the circumference of waist portion 42. Outer surface 48 has a generally circular, slightly oval cross-sectional shape along axis 28 with a diameter in a range of about 1.5 to 2 cm, for example. Outer surface 48 may have other, preferably smoothly curving, shapes, such as egg-shaped, at various positions along axis 28 or along the entire length of axis 28.

[0031] Handle 12 also has first and second body cover extensions 44, 46 extending radially outwardly from the outer surface 48 of body cover 22 adapted to comfortably shield the surgeon's hand from fittings for the telescope and the fiber 16. Extensions 44, 46 are positioned between proximal end 26 and waist portion 42. Extensions 44, 46 have smoothly curving, distally-facing outer surfaces 50, 52 to provide a smooth transition between outer surface of 48 of body cover 22 and extensions 44, 46. As seen in Fig. 2, first body cover extension 44 extends generally directly radially outwardly while the second body cover extension 46 extends both radially outwardly and distally. An illumination fitting 54 extends from first body cover extension 44 and opens into an illumination port 56. An optical fiber fitting 58 extends from second body cover extension 46 and opens into an optical fiber port 60. Optical fiber 16 passes through fitting 58, through port 60, and through an appropriate passageway in handle 12 for entry into and through an appropriate lumen within external cannula 14. A valve handle 72 is mounted flush with second body cover extension 46 with a smooth or otherwise comfortable surface transition. The valve handle 72 is turned to control a stop cock within the handle 12, to seal off port 60 when desired, typically when optical fiber 16 is removed from handle 12.

[0032] As shown in Fig. 2, smoothly tapering outer surface 48 is provided with a number of grooves 62 to facilitate grasping by the user. The same or other types of embossing or debossing may also be provided for outer surface 48 as well as outer surfaces 50, 52 to promote a good grip of handle 12. One or more of outer surfaces 48, 50 and 52 may be provided with a mat or other suitable surface texture. In the preferred embodiment body cover 22 is of a stiff polymer material or metal. In alternative embodiments, the entire body cover 22, portions of body cover 22 and/or a skin on the body cover 22 may comprise a resilient or otherwise yieldable material.

[0033] Endoscope 10 also includes a telescope 64 extending through a telescope port 65 at proximal end of 26 and aligned with axis 28. Telescope 64 includes a camera fitting 66 to permit images of the working region 68 in the vicinity of laser beam 20 captured by the telescope at distal tip 18 to be recorded and/or monitored during use. Illumination port 56 is coupled to the interior of telescope 64 so the light from the illumination source passes distally along the telescope to illuminate working region 68.

[0034] In a preferred embodiment the motion of optical fiber 16 is both axially along axis 28 and also rotationally about its own axis to permit laser beam 20 to be directed proximally and distally as optical fiber 16 moves generally along axis 28 as well as being swept side to side as optical fiber 16 rotates about its own axis. Distal tip 18 of external cannula 14 is beveled to permit this range of movement of laser beam 20 while providing for proper viewing of working region 68. This manipulation of optical fiber 16, see Figs. 1 and 1A, can be aided by the use of a coupler 70, a fiber manipulator knob 17 and a rotation limiting element 76. Fiber manipulator knob 17 and rotation limiting element 76 are both secured to optical fiber 16 while optical fiber 16 slides freely through coupler 70. Coupler 70 engages optical fiber fitting 58, typically through the use of a luer coupling. The axial movement of the distal tip of optical fiber 16 at the distal tip 18 of external cannula 14 is limited in the distal direction by the engagement of fiber manipulator knob 17 with coupler 70 and in the proximal direction by the engagement of rotation limiting element 76 with coupler 70. Other structure or methods for limiting this axial movement to fixed or adjustable distances may also be used. By limiting the axial or longitudinal movement of optical fiber 16 through coupler 70, laser beam 20 is kept within working region 68. Rotation limiting element 76 is designed to engage structure, not shown, within handle 12 to limit the rotation of optical fiber 16 about its own axis. It is important, especially

when laser beam 20 is a high-power laser beam, to prevent laser beam 20 from impinging against external cannula 14, possibly causing external cannula 14 to be vaporized, by pulling optical fiber 16 too far into the sheath or by over-rotating optical fiber 16 during lasing operations.

[0035] Figs. 7-11 are somewhat simplified half-section views of endoscope 10 showing body cover 22 and body cover extensions 44, 46 from different vantage points. Proximal end 26 of body cover 22 provides an opening 80 into the interior of handle 12 for telescope 64. First body cover extension 44 is a generally U-shaped structure having an outer edge 82 that partially defines illumination port 56. Outer edge 82 joins with proximal end of 26 for receipt of illumination fitting 54 extending from telescope 64. This configuration facilitates insertion of telescope 64 into and removal of the telescope from handle 12 and external cannula 14.

[0036] Figs. 3-6 illustrate four typical ways a surgeon can comfortably and securely hold or grasp handle 12 of endoscope 10 by grasping body cover 22 with one hand while leaving the other hand (not shown) free to manipulate optical fiber 16 using fiber manipulator knob 17 to adjust both the axial and rotary positions of laser beam 20. Other grasping techniques may be accommodated by the shape of handle 12. The different grasping techniques can be based upon different personal preferences as well as the particular procedure being accomplished. For example, an operator may find the grasping technique of Fig. 6 to be most satisfactory when initially introducing the endoscope to the target site to provide the most sensitivity to this procedure. The provision of the smaller circumference waist portion 42 provides an exceptionally secure grasping surface between the user's thumb and opposed fingers. The grasping techniques of Figs. 3 and 4 provide extremely stable and secure positioning of handle 12 due to the provision of the smaller circumference waist portion 42 and the larger circumference proximal end 26, as well as first and second body cover extensions 44, 46 with their smoothly tapering, forward facing outer surfaces 50, 52. The grasping technique of Fig. 5 may be chosen by some users when, for example, manipulating optical fiber 16 extending from optical fiber fitting 58. In all cases, the smoothly tapering surfaces from the larger circumference distal and proximal ends 24, 26 to the smaller circumference waist portion 42 provide a comfortable and a secure gripping surface for the user.

[0037] Fig. 12 illustrates the distal end 18 of the endoscope positioned within a urethra adjacent prostate tissue. The fiber end element 19 directs radiation 20 into the

prostate tissue to cause vaporization or other effects in the tissue. The distal end 18 includes a hood structure 101 with a blunt distal face 102 adapted to be inserted into the urethra. The hood structure 101 acts as an obturator which prevents constriction of the urethra onto the fiber end element 19, and defines an open area between the top surface 103 and the working region 68 on the prostate tissue. The internal structure (not shown) within the external cannula at the distal end 18 includes a guide element that is adapted to movably support the optical fiber in a position so that the emission face of the end element 19 is spaced away from the working region 68 on the prostate tissue within the open area defined by the hood structure 101. In addition, the external cannula includes a nozzle for directing inflowing irrigant, and regions for suction of outflowing irrigant which together define an irrigation pathway represented by arrows 104. The irrigation pathway 104 flows across the emission face of the fiber end element 19 as the fiber end element 19 is moved within the open area, maintaining irrigation flow during the delivery of radiation to facilitate clear visualization through the telescope and to maintain the emission face of the fiber end element 19 clear of debris.

[0038] Fig. 13 provides a prospective of the distal end of the endoscope outer cannula from the direction of the working region 68. As illustrated in Fig. 13, the distal face 102 of the endoscope represents the end of a hood structure. An opening on the end of the external cannula is defined by the distal face 102, and side walls which slope away from the end. The inner cannula 110 includes a first lumen having an upper ridge 112 which receives the telescope so that the telescope face 108 faces the working region 68, and which supports the fiber end element 19. Thus the upper ridge 112 has a radius which matches that of the telescope, and the lower ridge 113 as a radius which matches that of a bearing surface on the fiber end element 19. An irrigant inflow channel is defined by a second lumen which is bonded to the first lumen by welding or otherwise, and having crescent shaped opening 106 which acts as an irrigant nozzle directing irrigation flow outwardly over the fiber end element 19. In the illustrated embodiment, a tube 107 is attached to the outside surface of the upper ridge 112 of the first lumen acting as a spacer between the inner cannula that defines the first and second lumens, and of the inside wall at the top of the outer cannula. An opening established by tube 107 between the inner cannula and the external cannula provides an irrigation outflow channel which is coupled to a suction source tending to cause the irrigant which is forced through the crescent shaped

opening 106 of the irrigant inflow channel to flow outwardly and an upwardly across the fiber end element 19.

[0039] Fig. 14 illustrates the proximal end of the lumen in the endoscope adapted received the fiber and cooperate with the travel limiter 300, which is shown apart from the fiber in the drawing. The fitting 58 defines a lumen 275 into which the fiber with of the travel limiter 300 bonded thereto is received. The fitting 58 is coupled to a stopcock valve 278 which is opened to receive the fiber, and provide a continuous lumen within which the travel limiter 300 is able to move. On the distal side of the stopcock valve 278, a tube is bonded which directs the fiber into the internal structure of the endoscope as described above. As shown in Fig. 14, the cover 65 includes an extension 46 surround the stopcock valve 278 and the tube 280, while the fitting 58 extends outwardly. A pin 276 extends into the lumen 275 and cooperates with the travel limiter 300 to prevent rotation beyond a predefined arc of the fiber.

[0040] The structure of the travel limiter 300 (in the form of a cam in this embodiment) is illustrated in Fig. 15. The travel limiter includes a cylindrical fiber sheath body 310 adapted to fit over the sheath of the optical fiber and be bonded thereto. Appendages 311, 312, 313 are formed on the body 310 with arcuate outside surfaces (e.g. surface 315 on appendage 312) which are adapted to slide rotationally within the lumen 275. A ridge 314 extends along the major axis of the body 310 having sidewalls with a rear beveled surface 320 (and a front beveled surface) set at an angle θ , such as about 60° . The sidewalls are positioned so that in cooperation with the pin 276, rotational movement of the fiber is limited to a predefined arc.

[0041] Although not shown in Fig. 14, seal 70 when attached to the fitting 58 acts to prevent longitudinal motion of the travel limiter 300 in a direction away from the distal end of the endoscope. Longitudinal motion in a direction toward the distal end of the endoscope is not actively limited in this embodiment, but is controlled by the surgeon by observing the fiber end element within the field of view of the telescope. In an alternative embodiment, a structure may be added to limit longitudinal motion toward the distal end. The length of the ridge 314 is selected so that when the fiber is fully withdrawn against the seal 70, the ridge remains in a position to cooperate with the pin 276, thereby providing for control of rotational motion of the fiber over a predefined length of longitudinal motion which is the equal to about twice the length of the ridge 314.

[0042] Fig. 16 illustrates positioning of the travel limiter 300 from an end of view within the lumen 275. Appendages 311 and 312 and the ridge 314 are adapted to secure the body 310 at a position that is substantially centered within the lumen 275, and so that as the fiber is rotated, it remains positioned near the center and does not contact the pin 267.

[0043] As illustrated in Fig. 17, when the fiber is rotated in a counterclockwise direction, the ridge 314 eventually contacts the tin 276 to limit the rotational motion. The ridge 314 cooperates in a similar manner with the pin 276 to limit clockwise motion. In illustrated embodiment, the travel limiter will allow rotational motion of about 270°, with the remaining 90° of the circle being blocked to prevent irradiation of the hood structure on the distal end of the endoscope.

[0044] The above descriptions may have used terms such as above, below, top, bottom, over, under, et cetera. These terms are used to aid understanding of the invention are not used in a limiting sense.

[0045] While the present invention is disclosed by reference to the preferred embodiments and examples detailed above, it is to be understood that these examples are intended in an illustrative rather than in a limiting sense. It is contemplated that modifications and combinations will occur to those skilled in the art, which modifications and combinations will be within the spirit of the invention and the scope of the following claims.

[0046] Any and all patents, patent applications and printed publications referred to above are incorporated by reference.

///

CLAIMS

Claims:

1. A handle for a multifunction endoscope comprising:
a body cover comprising:
distal and proximal ends with an axis extending therebetween;
a waist between the distal and proximal ends;
the distal and proximal ends and the waist having distal and proximal circumferences and a waist circumference, respectively;
the proximal circumference being larger than the waist circumference and the distal circumference being larger than the waist circumference; and
an outer surface, the outer surface tapering from the distal end to the waist and from the proximal end to the waist;
a first body cover extension extending in a first radial direction from the outer surface of the body cover between the proximal end and the waist; and
a second body cover extension extending in a second radial direction from the outer surface of the body cover between the proximal end and the waist.
2. The handle according to claim 1 wherein the proximal circumference is larger than the distal circumference.
3. The handle according to claim 1 wherein the outer surface is a smoothly tapering outer surface.
4. The handle according to claim 1 wherein the distance between the distal and proximal ends is 8 to 15 cm.
5. The handle according to claim 1 wherein the distance between the distal and proximal ends is 9 to 12 cm.
6. The handle according to claim 1 wherein the first and second body cover extensions comprise forward-facing surfaces, said outer surface and said forward facing surfaces creating a smoothly curving user-grasping surface.

7. The handle according to claim 1 wherein the second radial direction extends both radially outwardly away from the axis and axially towards the distal end.

8. The handle according to claim 1 wherein the body cover comprises a proximal portion, the proximal portion comprising a plurality of ports.

9. The handle according to claim 1 further comprising a first port at the first body cover extension, a second port at the second body cover extension and a third port at the proximal end and along the axis.

10. The handle according to claim 9 further comprising an illumination fitting at the first port, an optical fiber fitting at the second port and a camera fitting at the third port.

11. The handle according to claim 10 further comprising a valve at the second body extension associated with the second port.

12. The handle according to claim 1 further comprising a second body cover positioned distally of the distal end of the body cover.

13. The handle according to claim 12 further comprising fourth and fifth ports in the second body cover.

14. The handle according to claim 13 for the comprising an inflow fitting at the fourth port and an outflow fitting at the fifth port.

15. The handle according to claim 12 further comprising a coupler between the second body cover and the body cover.

16. A multifunction endoscope comprising:
a handle made according to claim 1;
an external cannula extending from the handle;
a port at the second body cover extension;

an optical fiber extending through the handle and external cannula with a proximal portion of the optical fiber extending proximally from the port;

a user-manipulable knob mounted to the proximal portion of the optical fiber, so that a user may grasp the body cover of the handle with one hand and manipulate the optical fiber through the user-manipulable knob with the other hand.

17. A method for manipulating an endoscope comprising:

selecting an endoscope comprising a handle made according to claim 1, an external cannula extending from the handle, and an optical fiber extending through the handle and through the external cannula with a proximal portion of the optical fiber extending proximally from a port at the second body cover extension;

grasping the body cover of the handle with a first hand using a chosen gripping technique;

grasping a user-manipulable knob mounted to the proximal portion of the optical fiber with a second hand; and

selectively moving the optical fiber within the external cannula by at least one of rotating the optical fiber around its own axis and longitudinally sliding the optical fiber through the external cannula using the user-manipulable knob.

18. A handle for a multifunction endoscope comprising:

a body cover comprising:

distal and proximal ends with an axis extending therebetween;

a waist between the distal and proximal ends;

the distal and proximal ends and the waist having distal and proximal circumferences and a waist circumference, respectively;

the proximal circumference being larger than the distal circumference and the distal circumference being larger than the waist circumference; and

an outer surface, the outer surface smoothly tapering from the distal end to the waist and from the proximal end to the waist;

a first body cover extension extending in a first radial direction from the outer surface of the body cover between the proximal end and the waist;

a second body cover extension extending in a second radial direction from the outer surface of the body cover between the proximal end and the waist;

the first and second body cover extensions comprising forward-facing surfaces, said outer surface and said forward facing surfaces creating a smoothly curving user-grasping surface;

a first port at the first body cover extension, a second port at the second body cover extension and a third port at the proximal end and along the axis;

a second body cover positioned distally of the distal end of the body cover;

fourth and fifth ports at the second body cover.

19. The handle according to claim 18 wherein the second radial direction extends both radially outwardly away from the axis and axially towards the distal end.

20. The handle according to claim 18 further comprising:

an illumination fitting at the first port;

an optical fiber fitting at the second port;

a camera fitting at the third port;

a valve at the second body extension associated with the second port;

an inflow fitting at the fourth port; and

an outflow fitting at the fifth port.

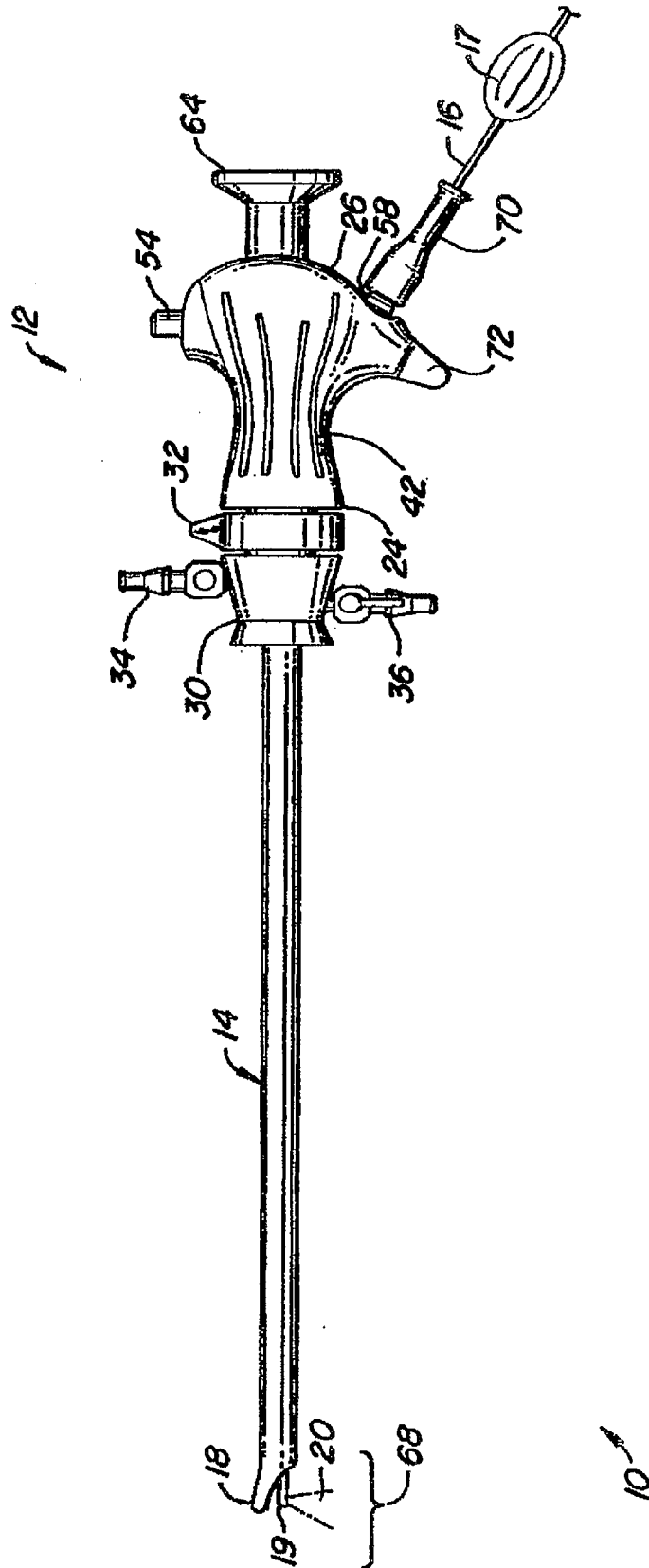


FIG. 1

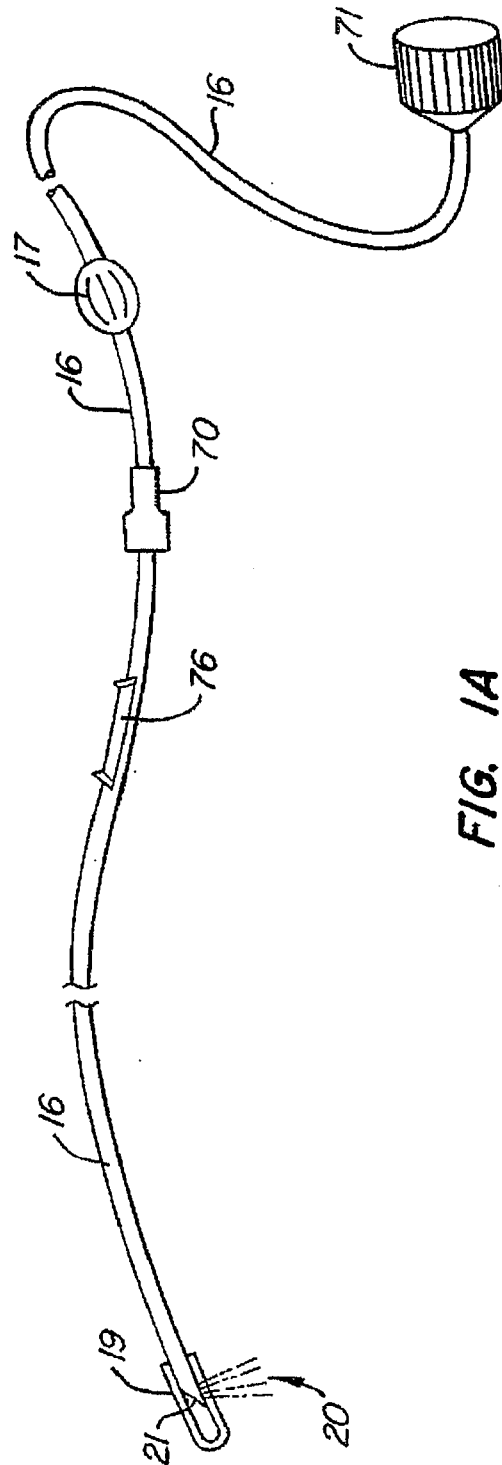


FIG. 1A

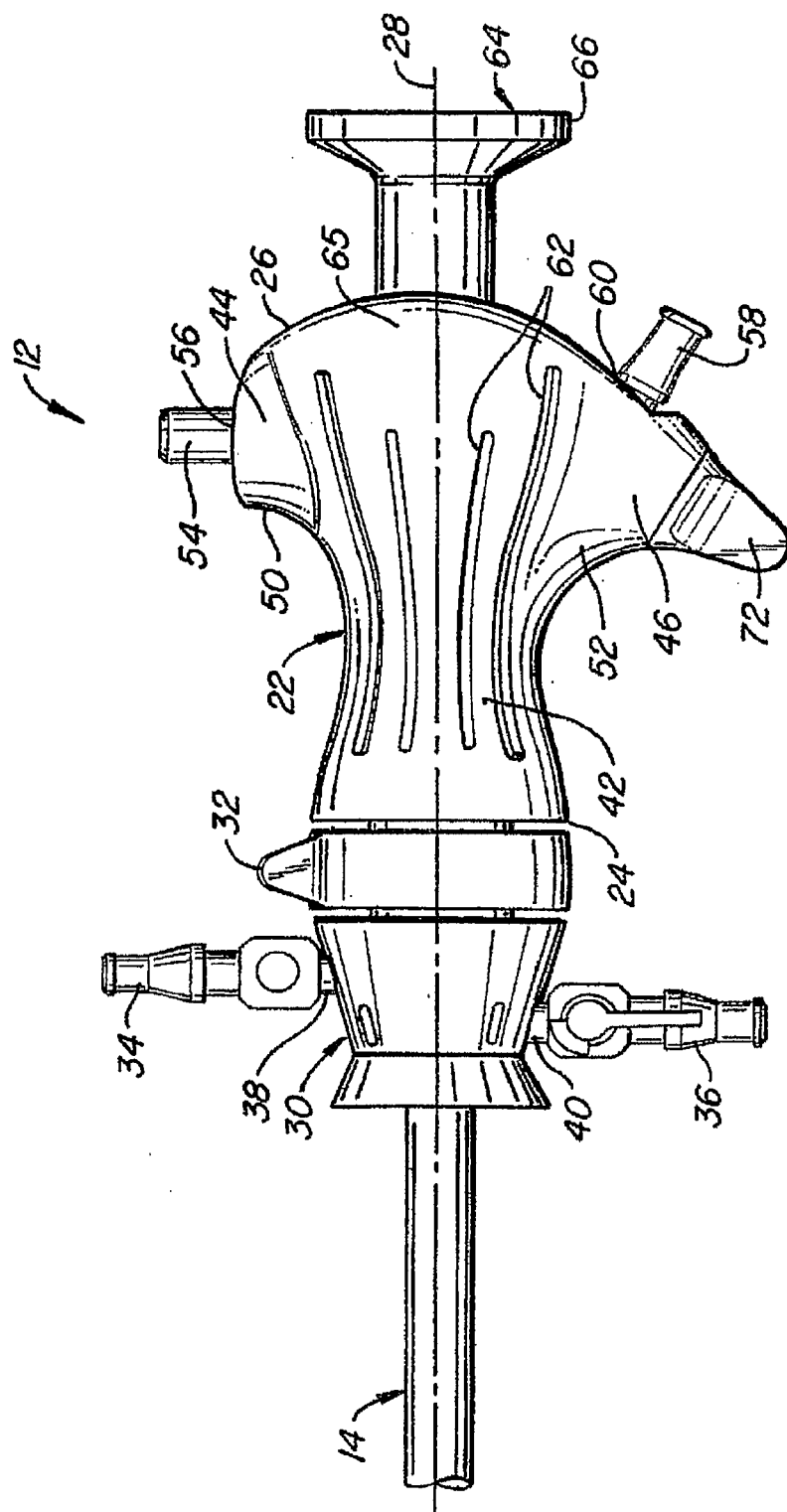


FIG. 2

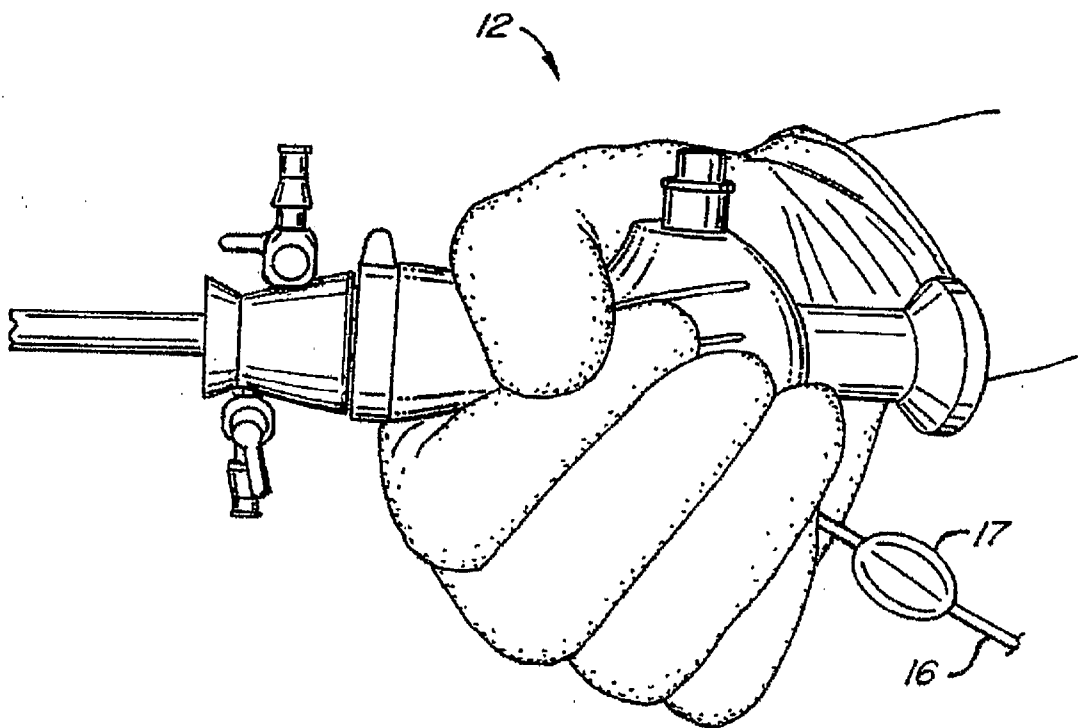


FIG. 3

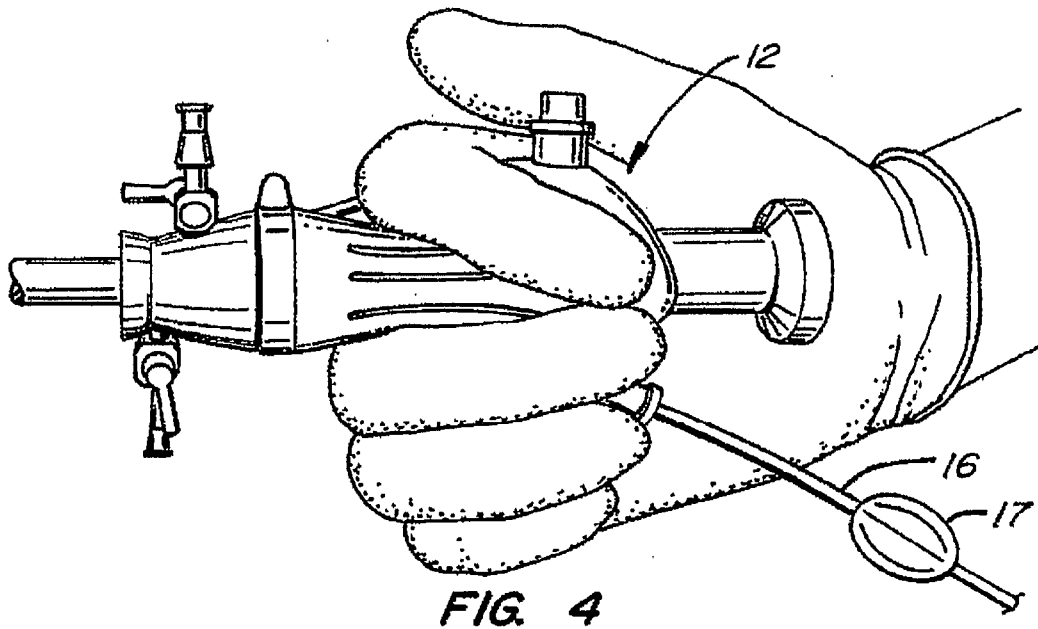


FIG. 4

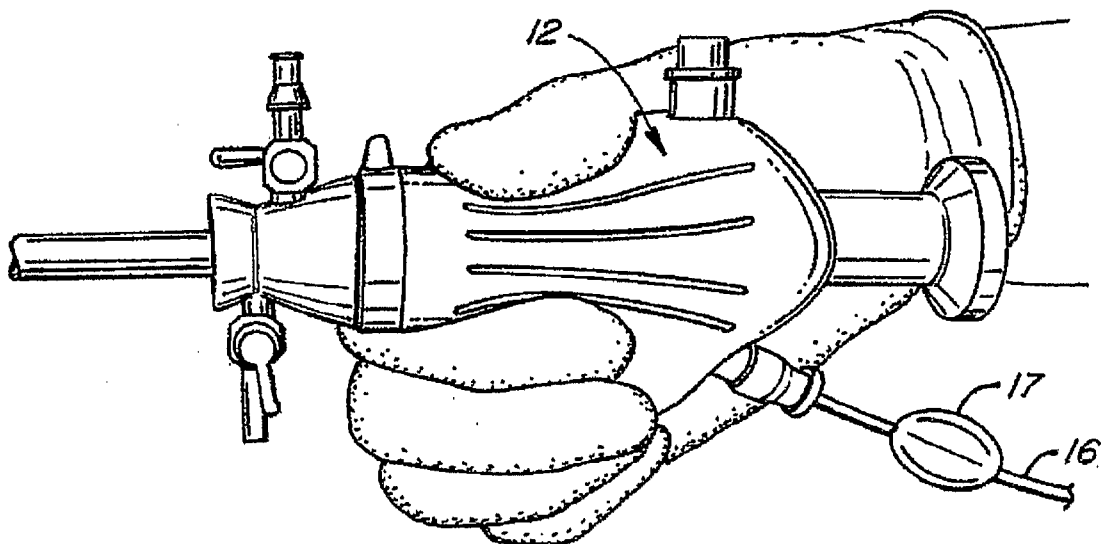


FIG. 5

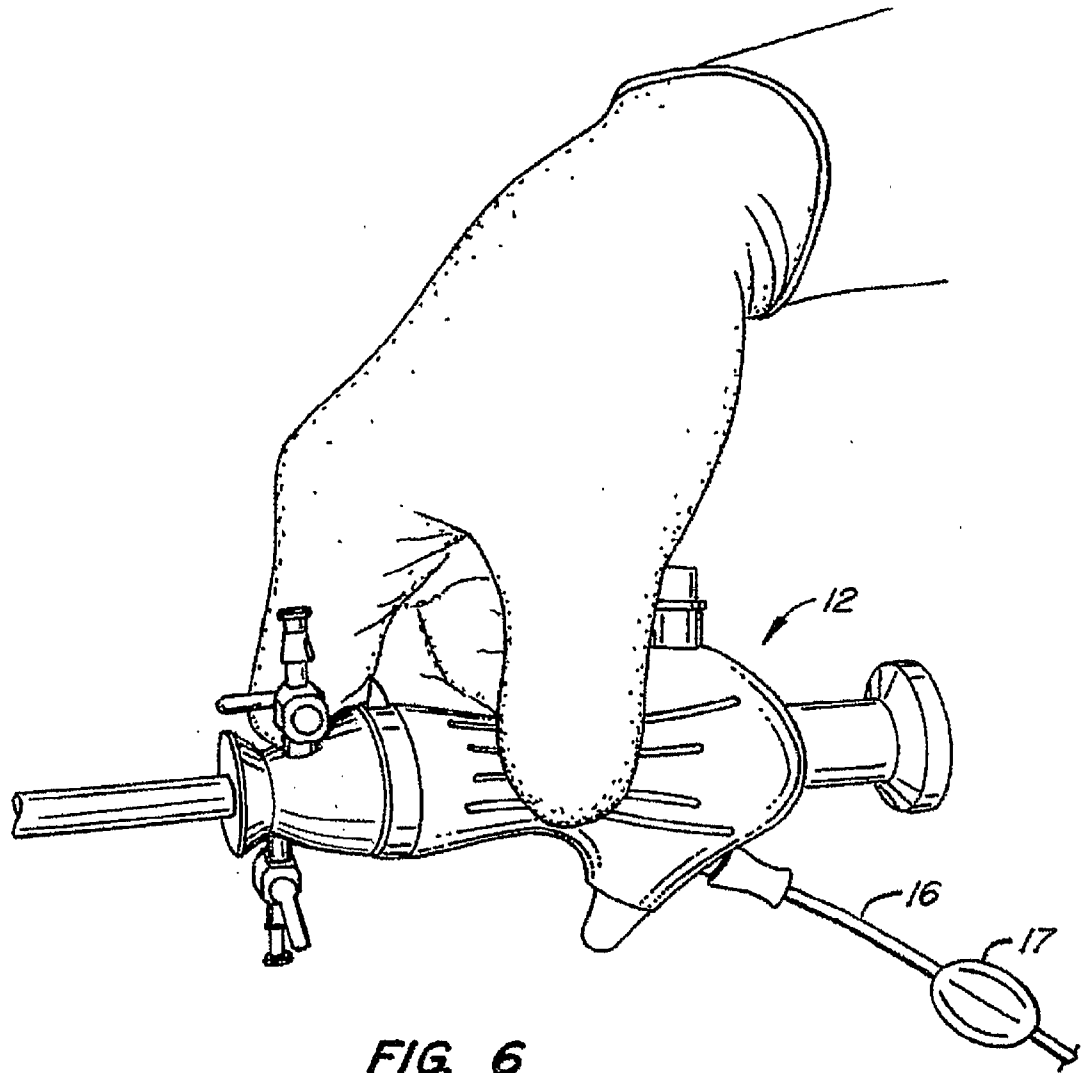


FIG. 6

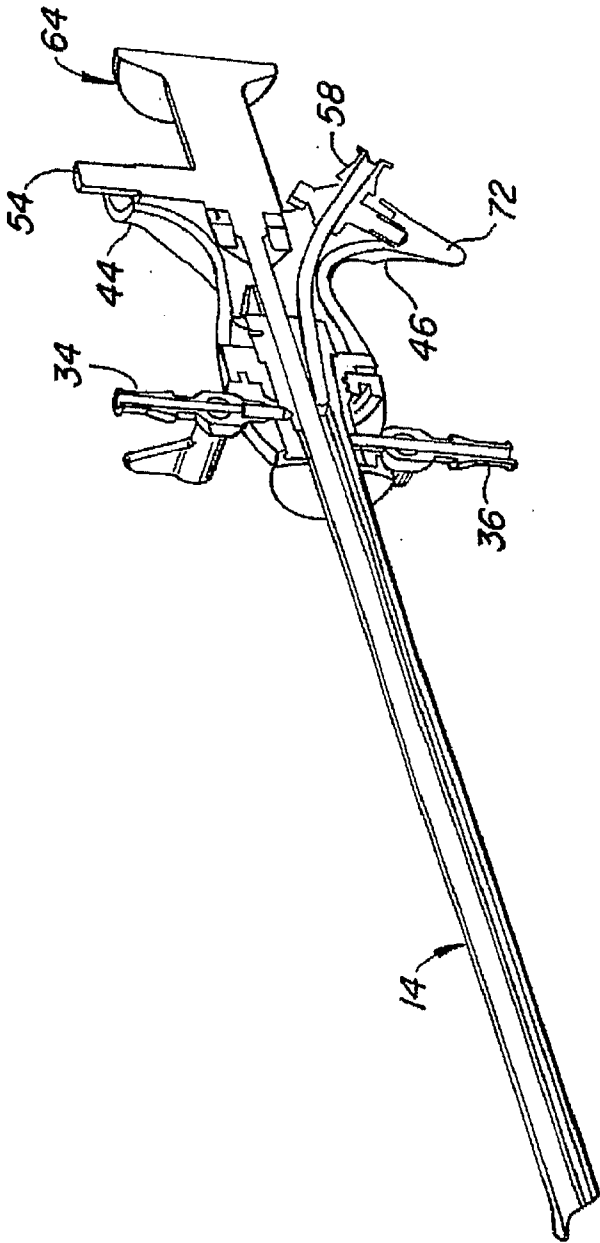


FIG. 7

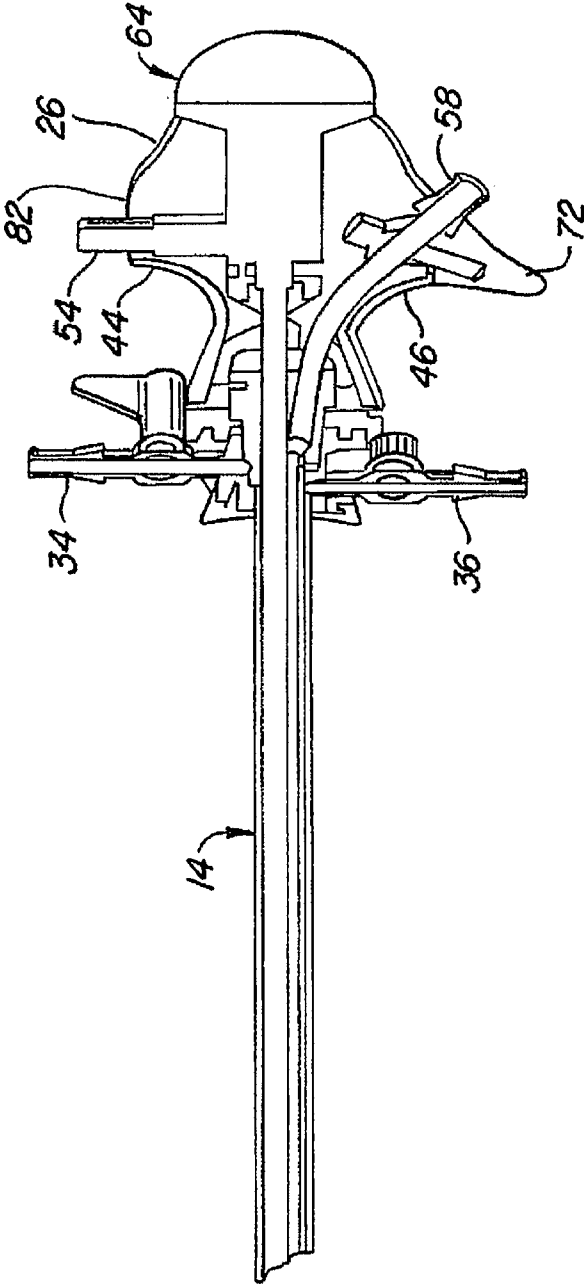


FIG. 8

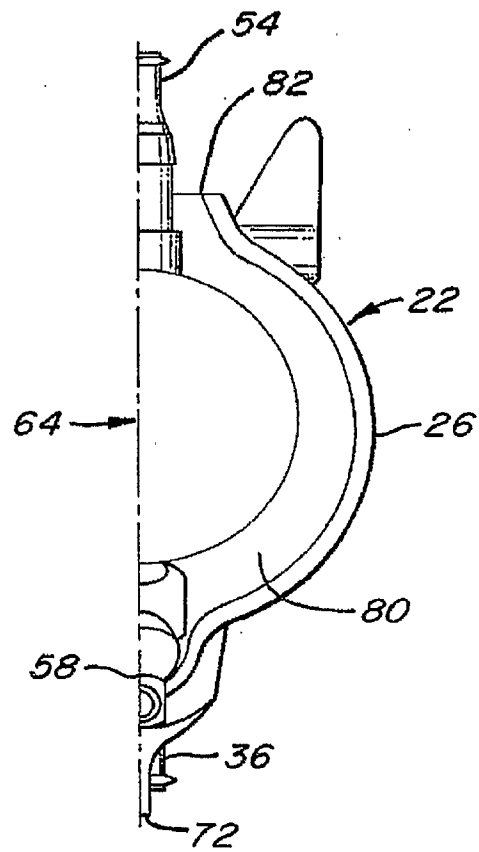


FIG. 9

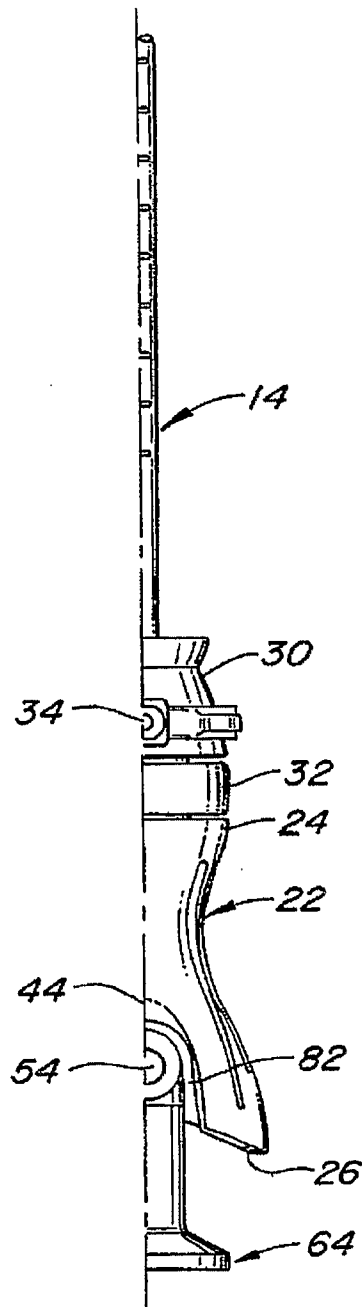


FIG. 10

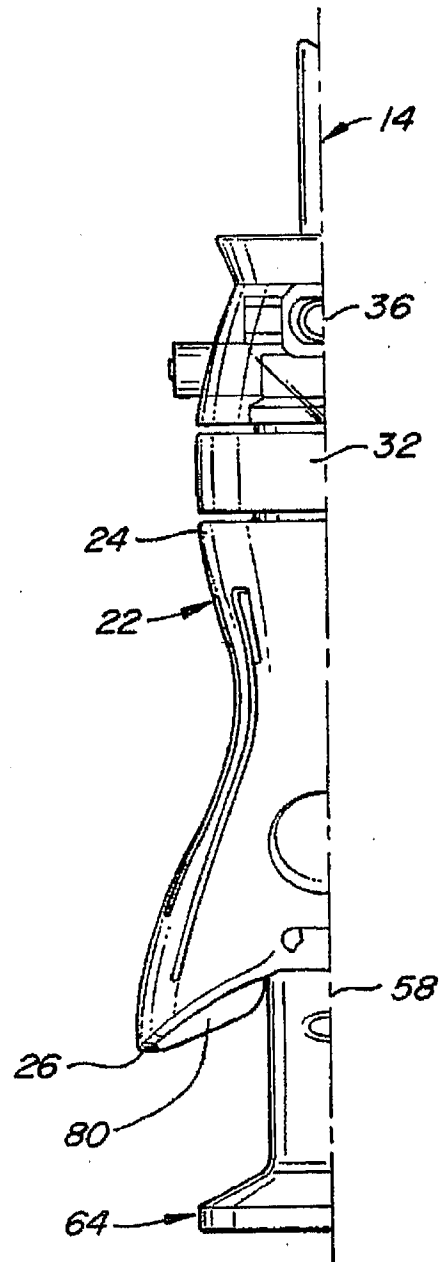


FIG. 11

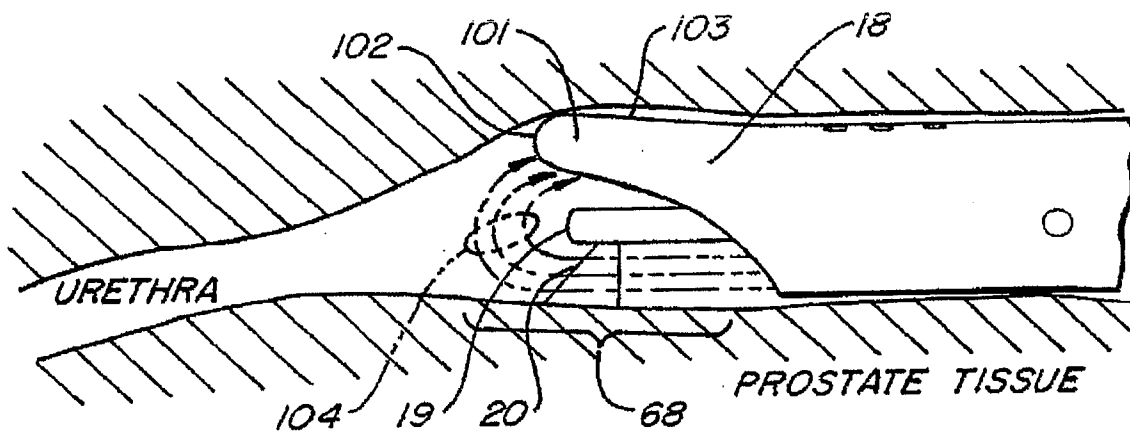


FIG. 12

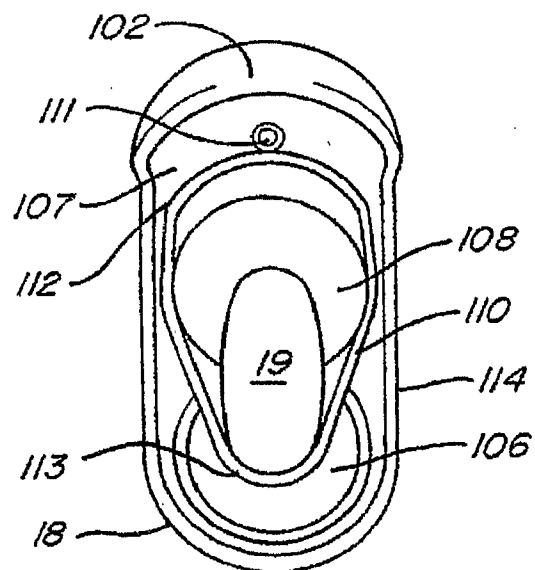
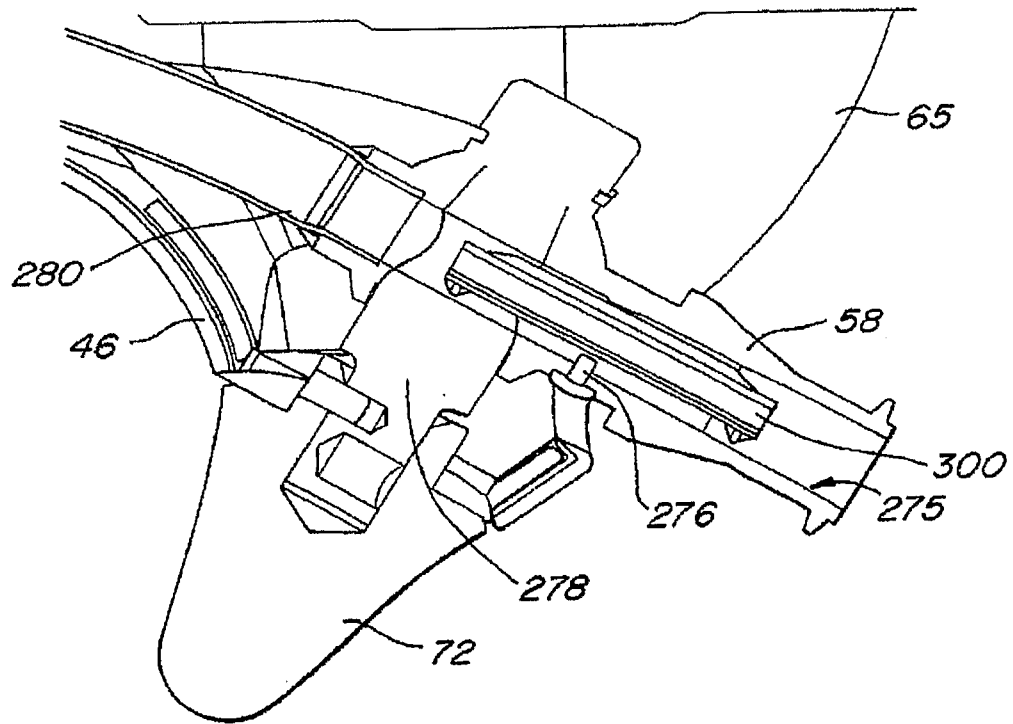
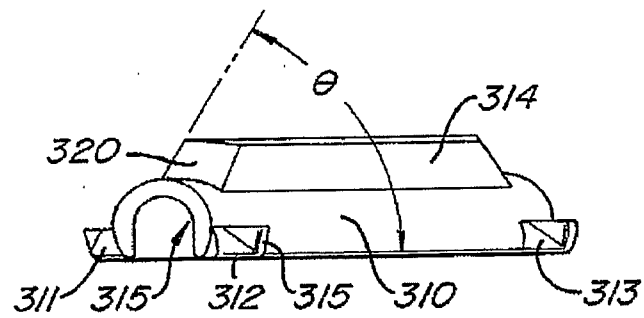


FIG. 13

**FIG. 14****FIG. 15**

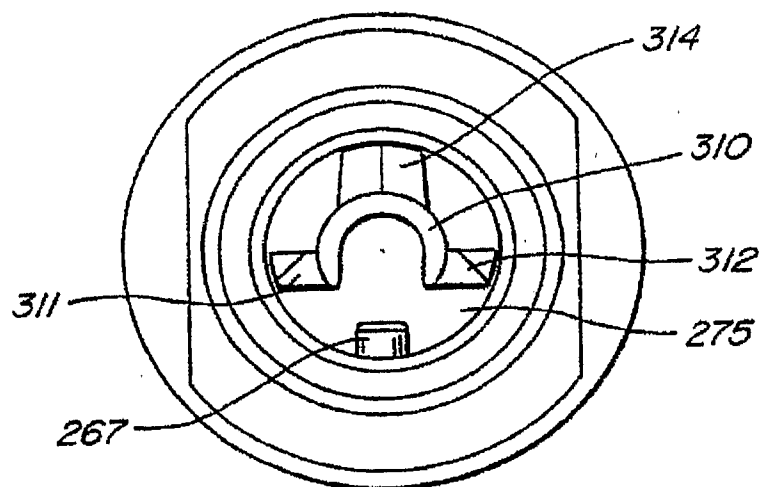


FIG. 16

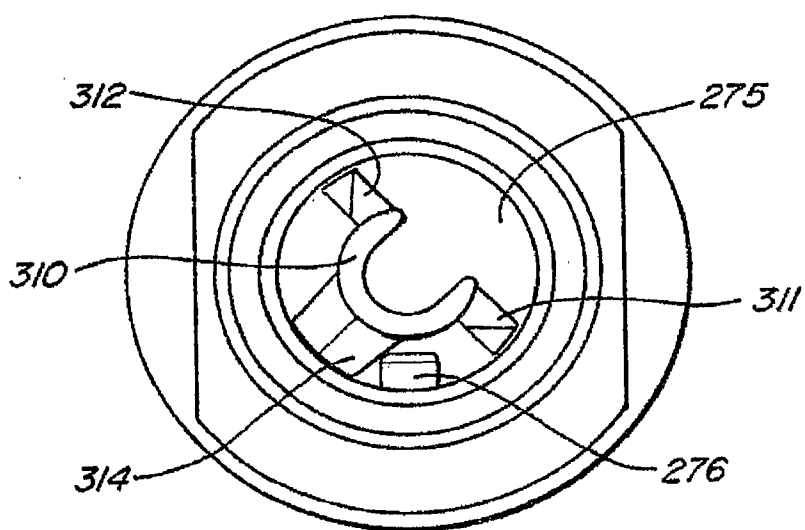


FIG. 17