US009987042B2

(12) **United States Patent**
Singh et al.

(10) **Patent No.: US 9,987,042 B2**
(45) **Date of Patent: Jun. 5, 2018**

(54) **GENERAL UTERINE MANIPULATOR AND SYSTEM**

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(72) Inventors: **Jai Singh**, Woodvale (AU); **Jiwan Steven Singh**, Woodvale (AU)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 254 days.

(21) Appl. No.: **14/722,025**

(22) Filed: **May 26, 2015**

(65) **Prior Publication Data**

US 2016/0081717 A1 Mar. 24, 2016

Related U.S. Application Data

(63) Continuation of application No. 14/498,166, filed on Sep. 26, 2014, now Pat. No. 9,101,390, which is a (Continued)

(51) **Int. Cl.**
A61B 17/42 (2006.01)
A61B 17/46 (2006.01)
(Continued)

(52) **U.S. Cl.**
CPC ***A61B 17/4241*** (2013.01); ***A61B 17/42*** (2013.01); ***A61B 90/30*** (2016.02);
(Continued)

(58) **Field of Classification Search**
CPC . A61B 17/4241; A61B 17/34; A61B 17/3415; A61B 17/3421; A61B 17/3423;
(Continued)

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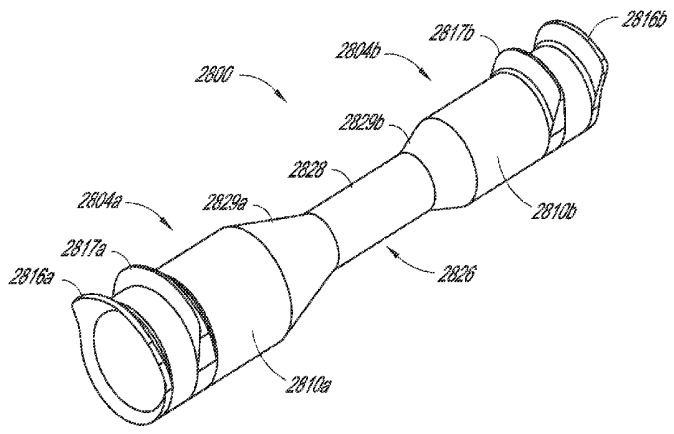
(57) **ABSTRACT**

A medical instrument configured to be inserted into a body cavity comprises a body comprises a first probe at a first end, the first probe comprising a first cylindrical portion with a first outer circumferential surface of a first diameter; a first circumferential edge at a distal end of the first probe; a first distal lip projecting outwardly from the first outer circumferential surface beyond the first circumferential edge and extending for at least a part of a circumference of the first circumferential edge; and a first marker lip projecting outwardly from the first outer circumferential surface and extending for at least a part of a circumference of the first outer circumferential surface; wherein the first distal lip is positioned distal to the first marker lip; and wherein the body
(Continued)



comprises a hollow cavity to enable a second medical instrument to pass therethrough.

45 Claims, 26 Drawing Sheets

Related U.S. Application Data

continuation of application No. PCT/US2013/061180, filed on Sep. 23, 2013, which is a continuation-in-part of application No. 13/720,086, filed on Dec. 19, 2012, now abandoned, which is a continuation-in-part of application No. 13/625,255, filed on Sep. 24, 2012, now abandoned, which is a continuation-in-part of application No. PCT/AU2012/000332, filed on Mar. 30, 2012.

(60) Provisional application No. 61/472,705, filed on Apr. 7, 2011.

(51) **Int. Cl.**

A61D 1/10	(2006.01)
A61B 90/30	(2016.01)
A61B 17/00	(2006.01)
A61B 10/02	(2006.01)
A61B 90/00	(2016.01)
A61B 19/00	(2006.01)

(52) **U.S. Cl.**

CPC *A61B 10/0291* (2013.01); *A61B 19/54* (2013.01); *A61B 2017/00398* (2013.01); *A61B 2017/00464* (2013.01); *A61B 2017/00473* (2013.01); *A61B 2017/4216* (2013.01); *A61B 2090/306* (2016.02); *A61B 2090/309* (2016.02); *A61B 2090/3962* (2016.02)

(58) **Field of Classification Search**

CPC A61B 2017/345; A61B 2019/5462; A61B 1/00073; A61B 1/00075; A61B 2017/3458; A61M 25/00; A61M 2025/006; A61M 2025/0293; A61M 39/00; A61M 39/10; A61M 39/02; A61M 5/34; A61M 25/0014; A61M 2039/1027; A61M 2039/1033; A61F 2002/30884; A61F 2220/0016

USPC 606/119, 108, 191; 604/264

See application file for complete search history.

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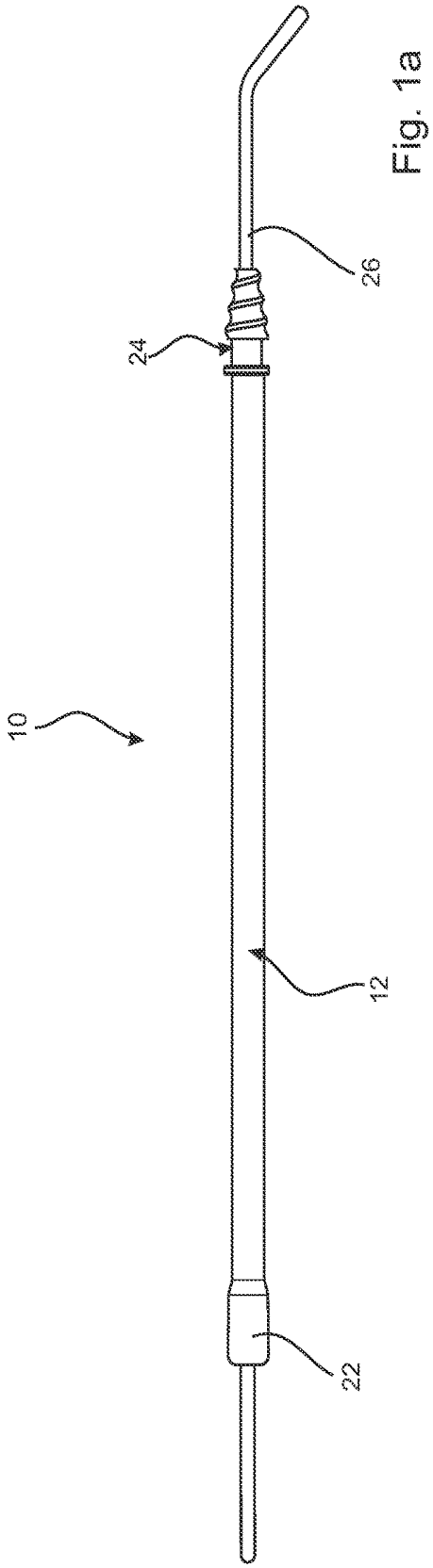


Fig. 1a

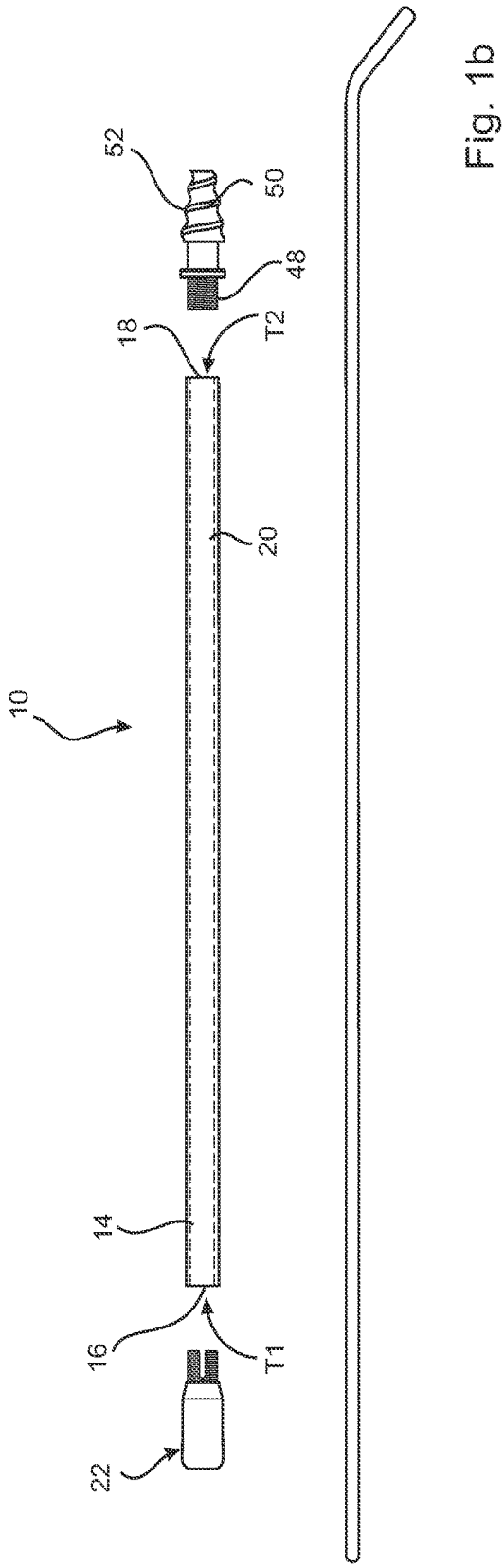


Fig. 1b

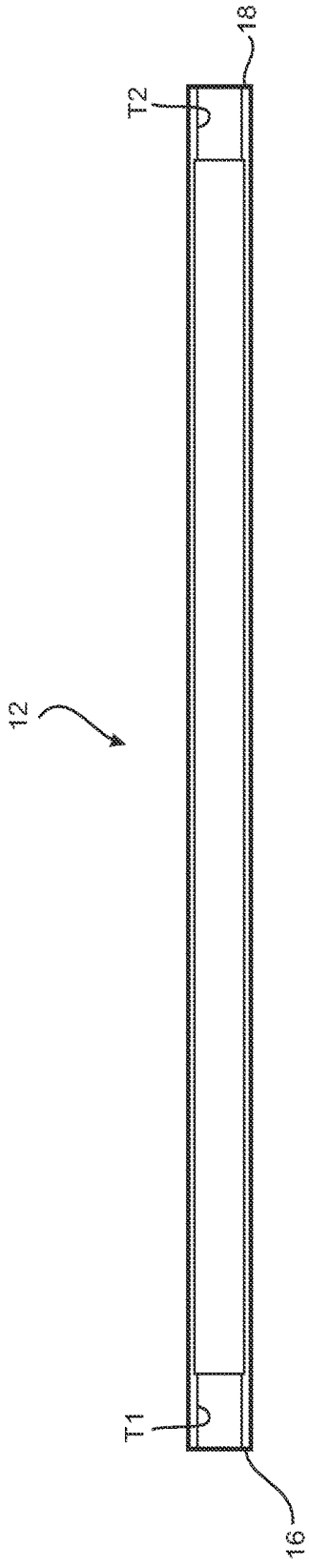
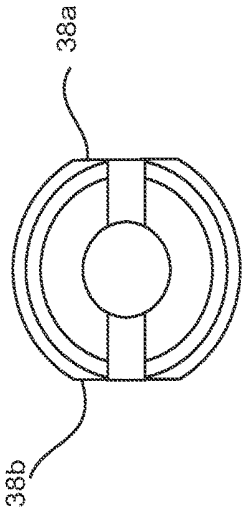


Fig. 2



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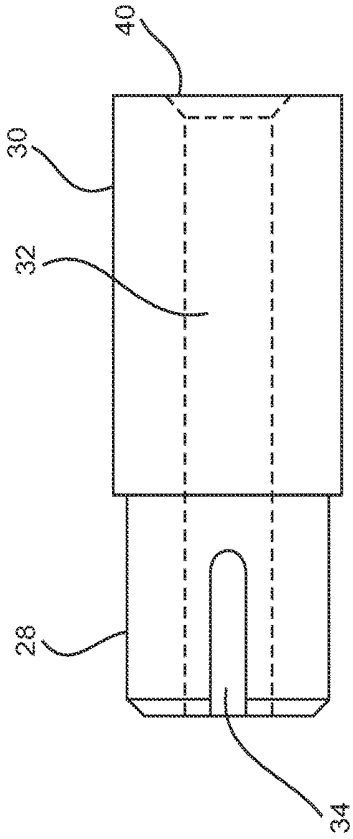


Fig. 4

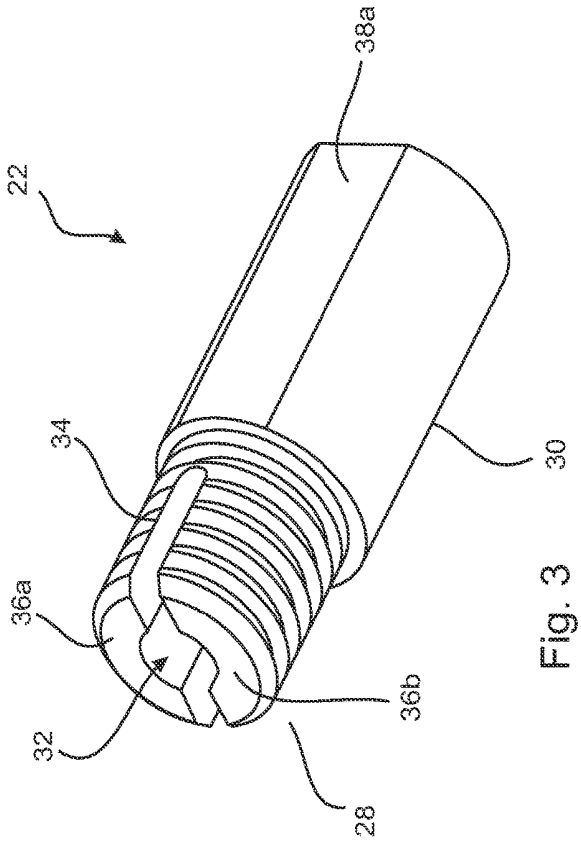


Fig. 3

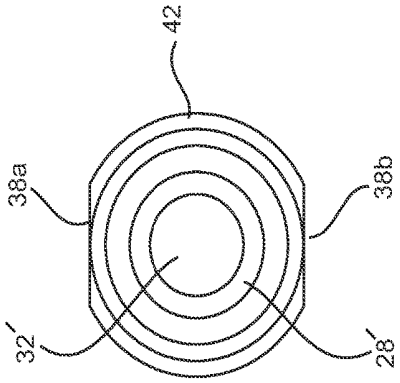


Fig. 8

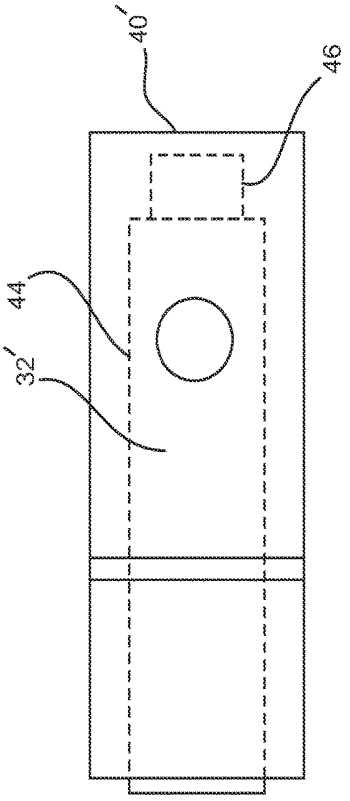


Fig. 7

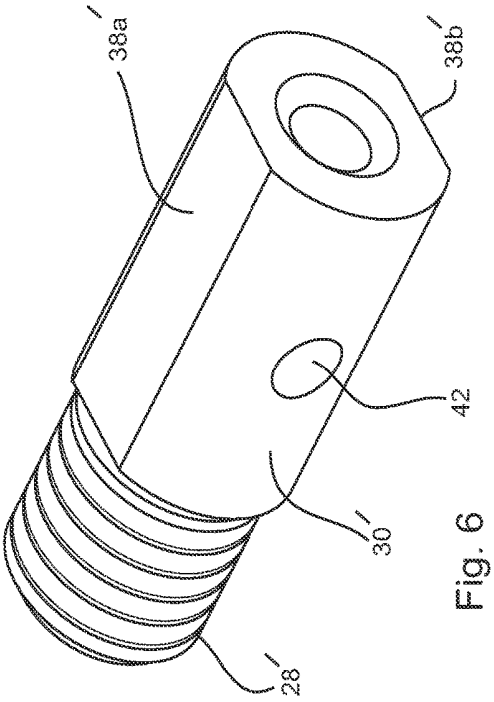


Fig. 6

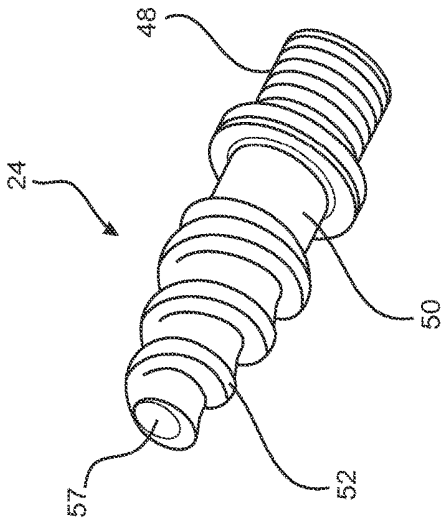


Fig. 9c

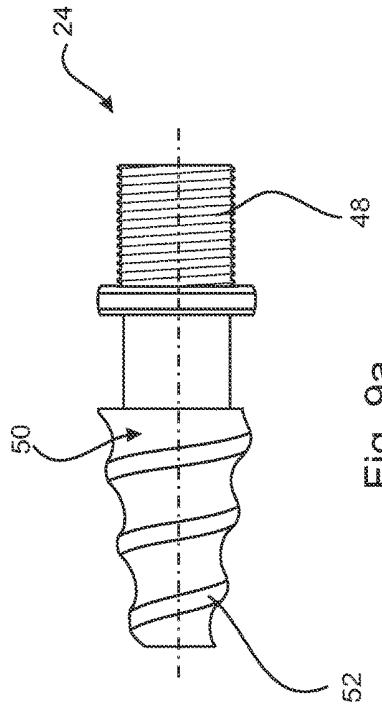


Fig. 9a

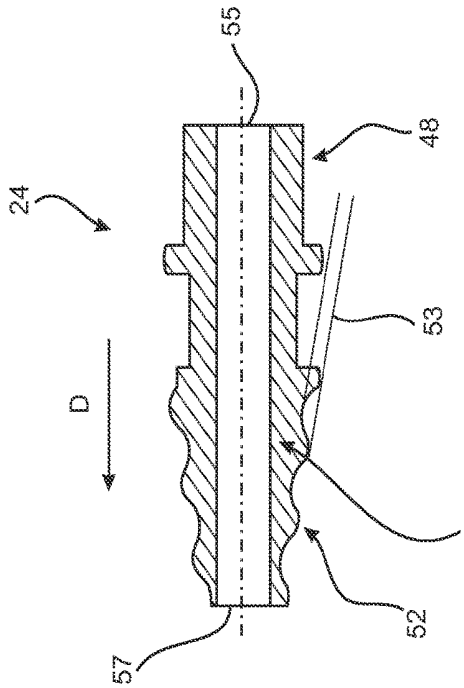


Fig. 9b

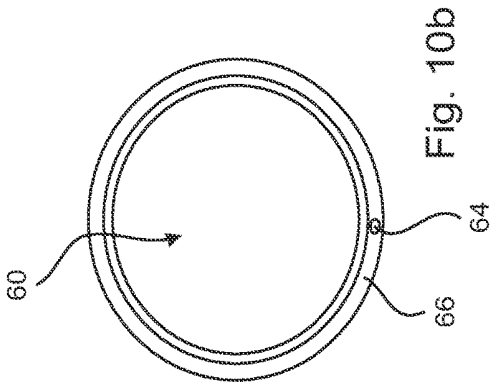
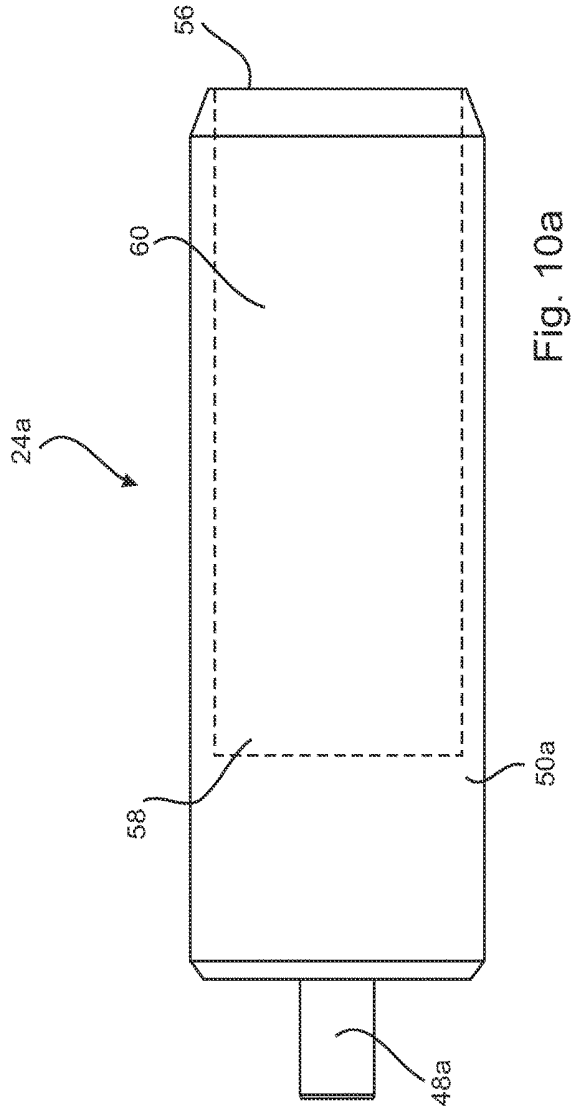


Fig. 10b



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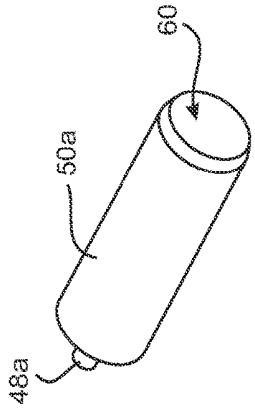

Fig. 10d

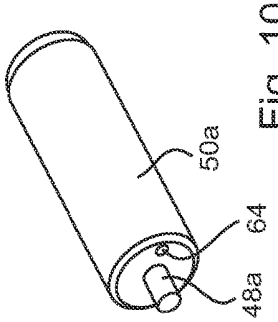

Fig. 10c

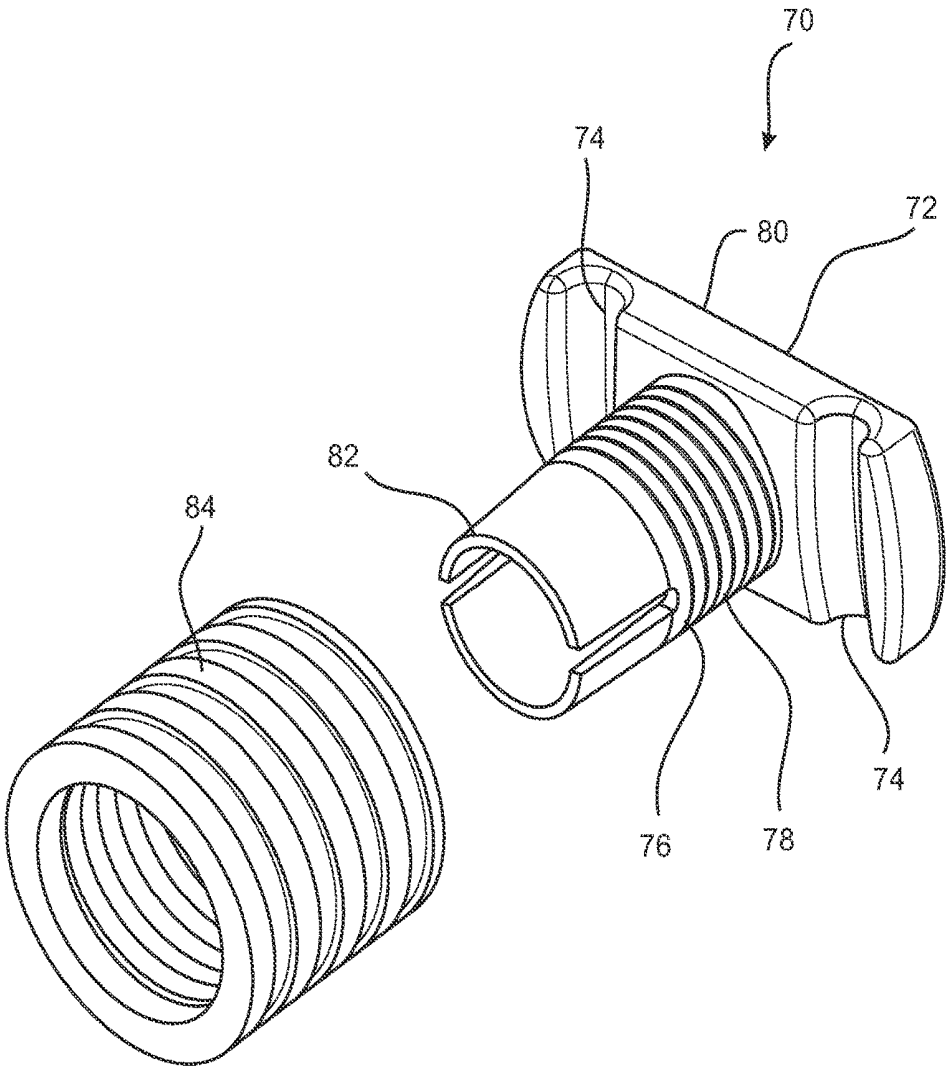

Fig. 11

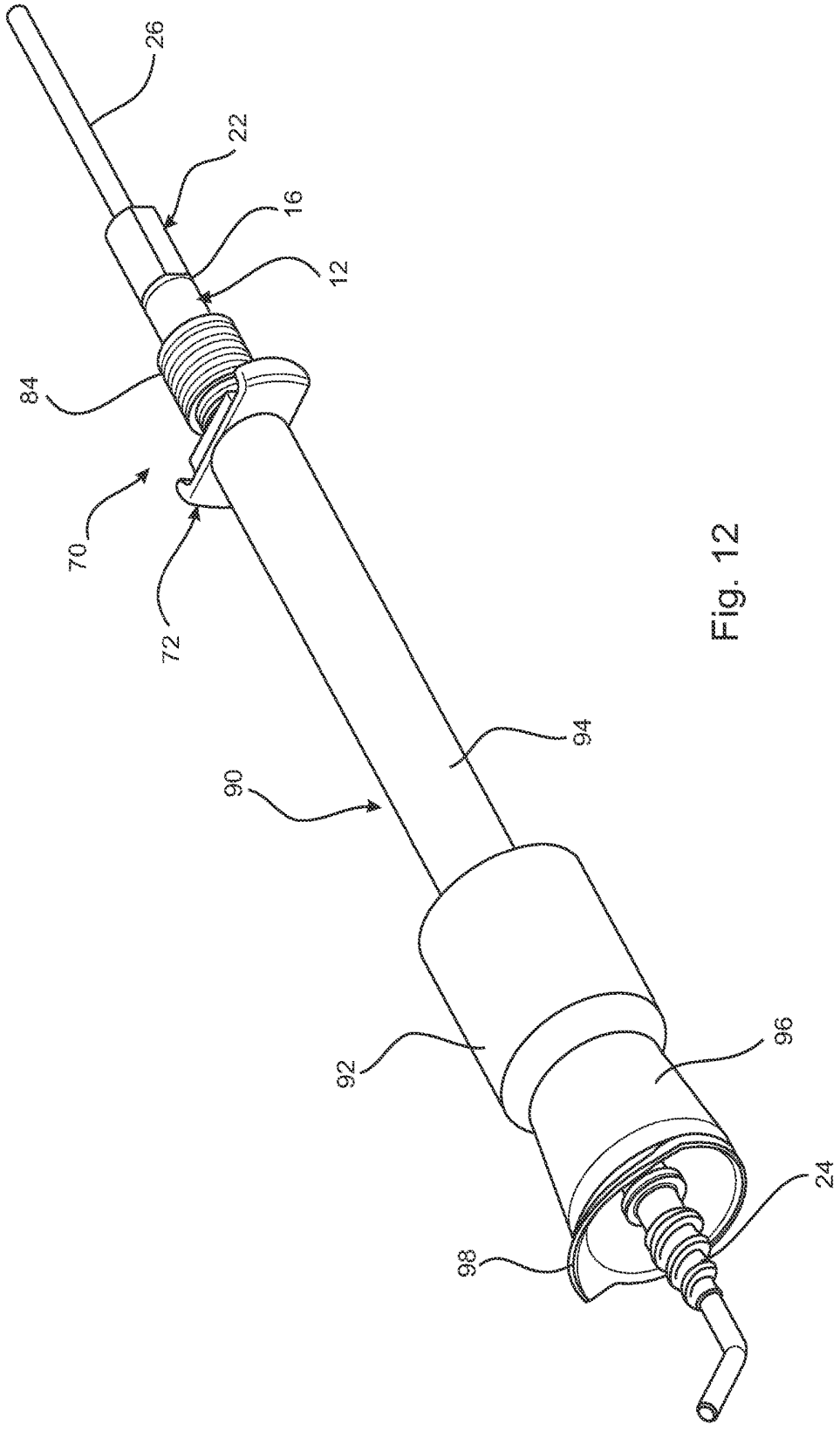

Fig. 12

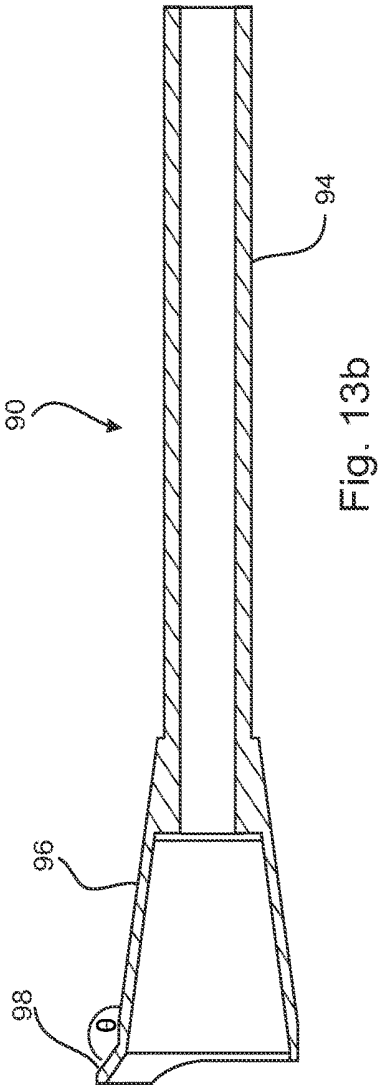

Fig. 13b

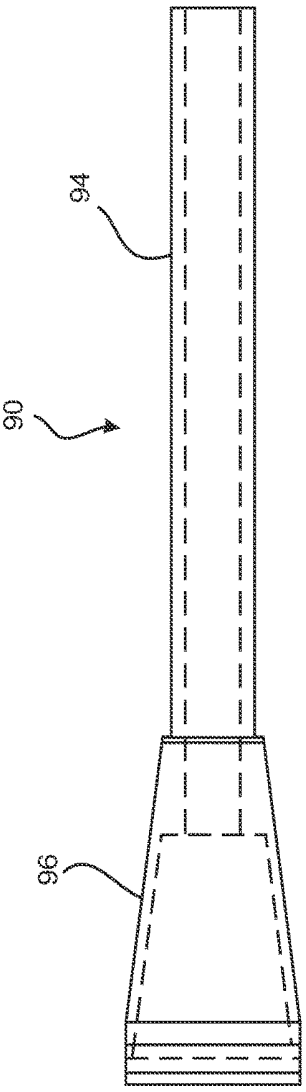

Fig. 13a

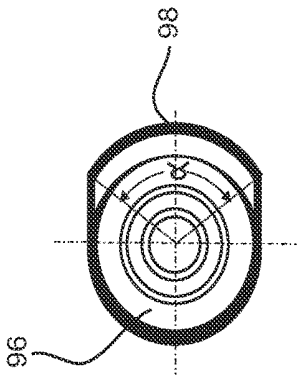

Fig. 13c

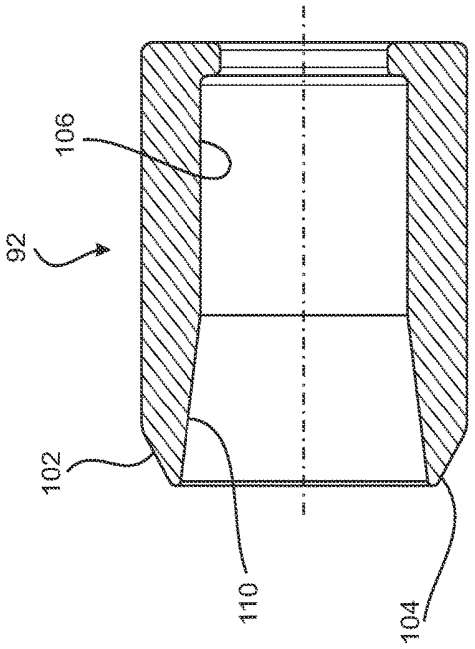

Fig. 14b

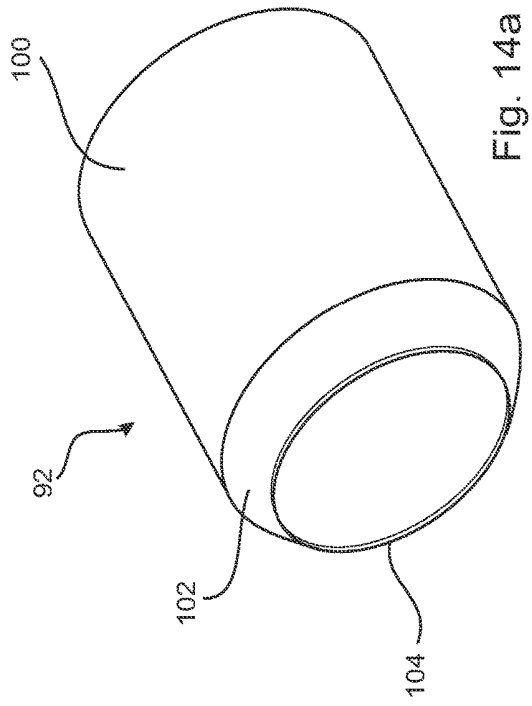

Fig. 14a

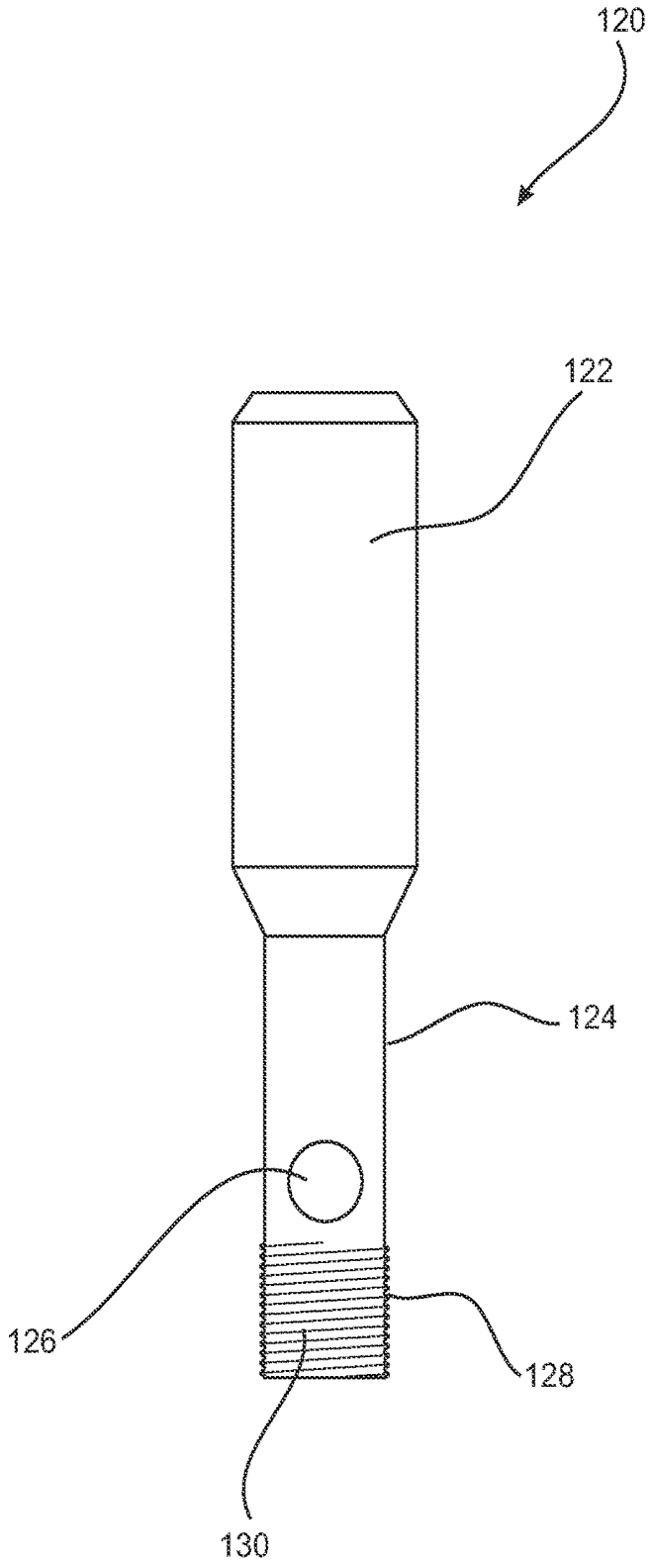

Fig. 15

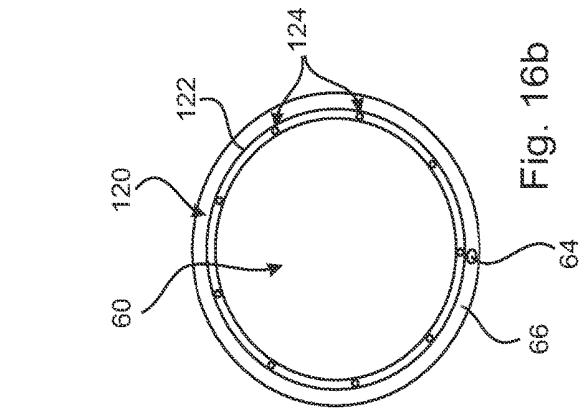

Fig. 16b

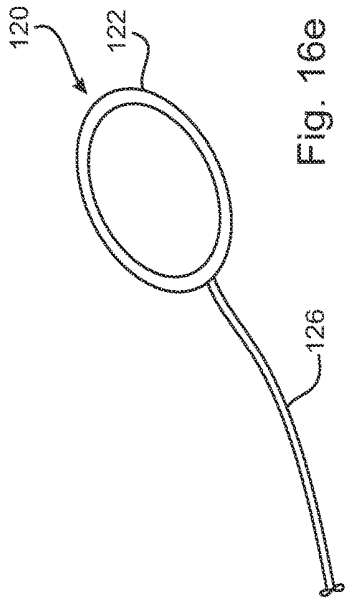

Fig. 16e

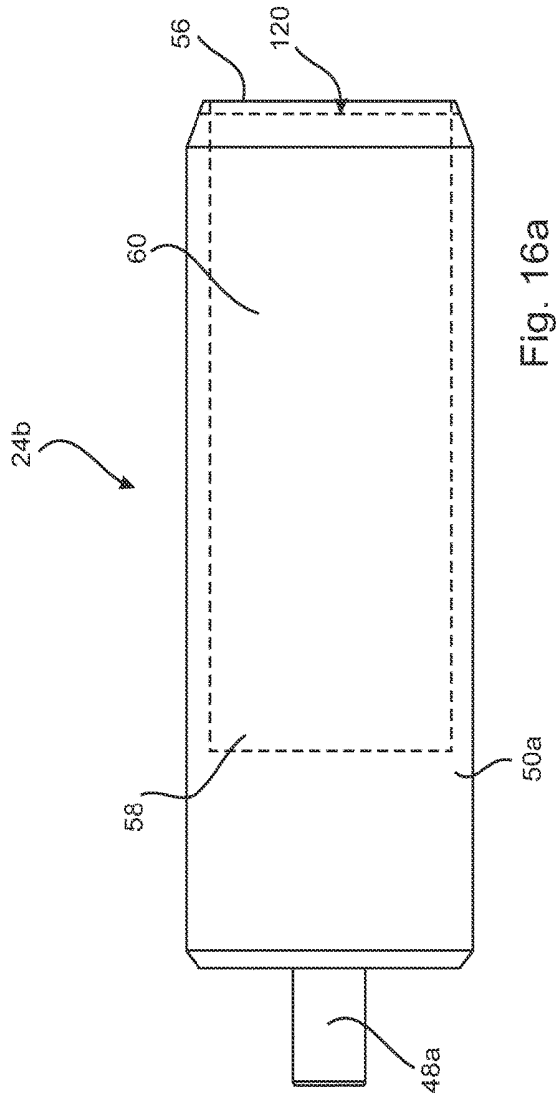

Fig. 16a

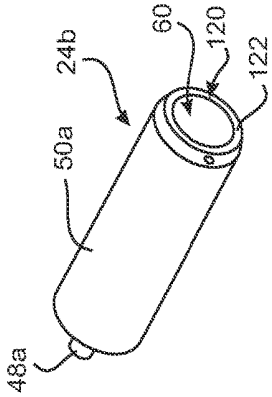

Fig. 16d

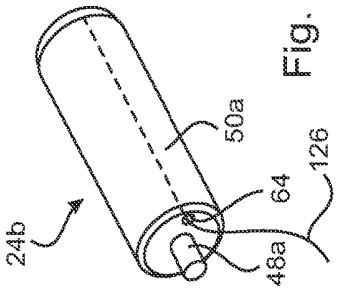

Fig. 16c

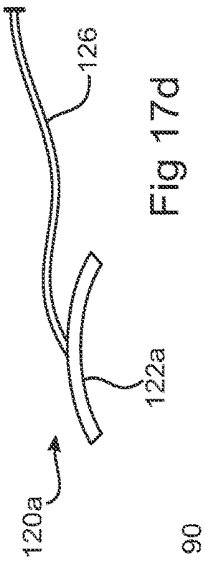

Fig 17d

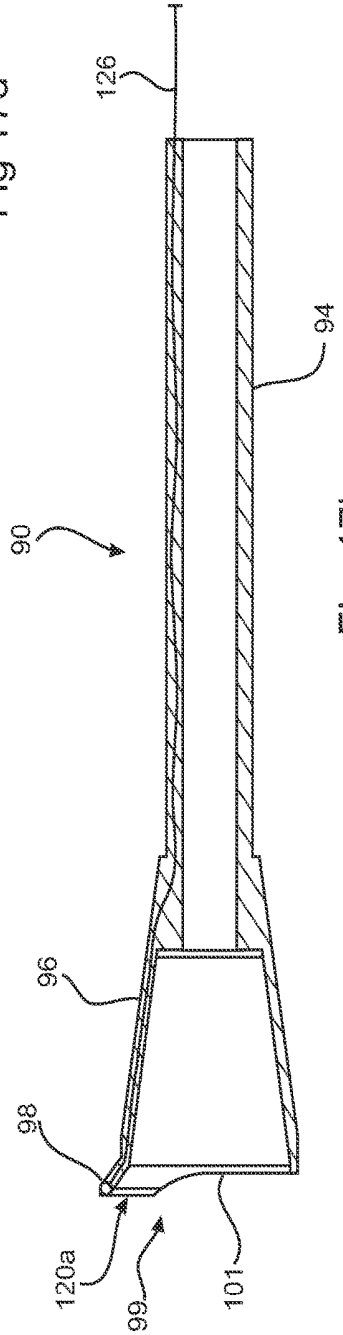

Fig. 17b

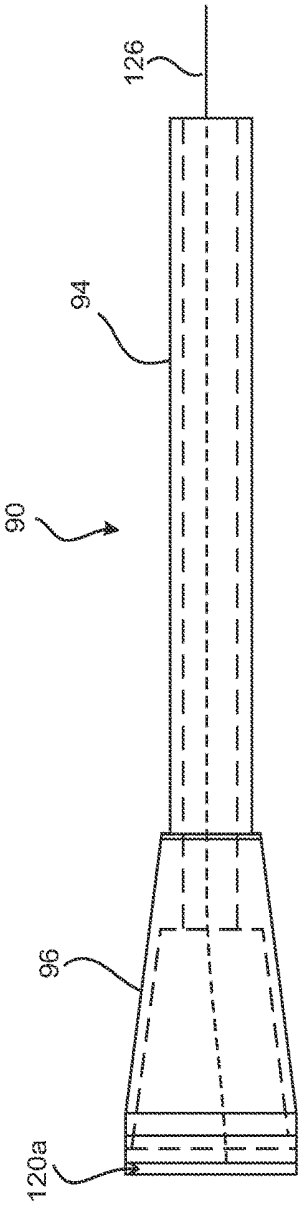

Fig. 17a

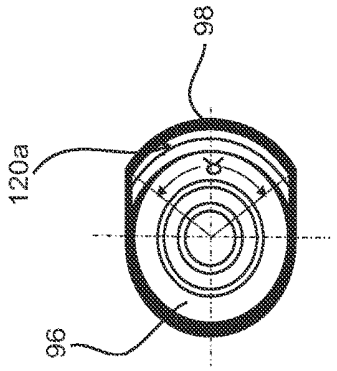

Fig. 17c

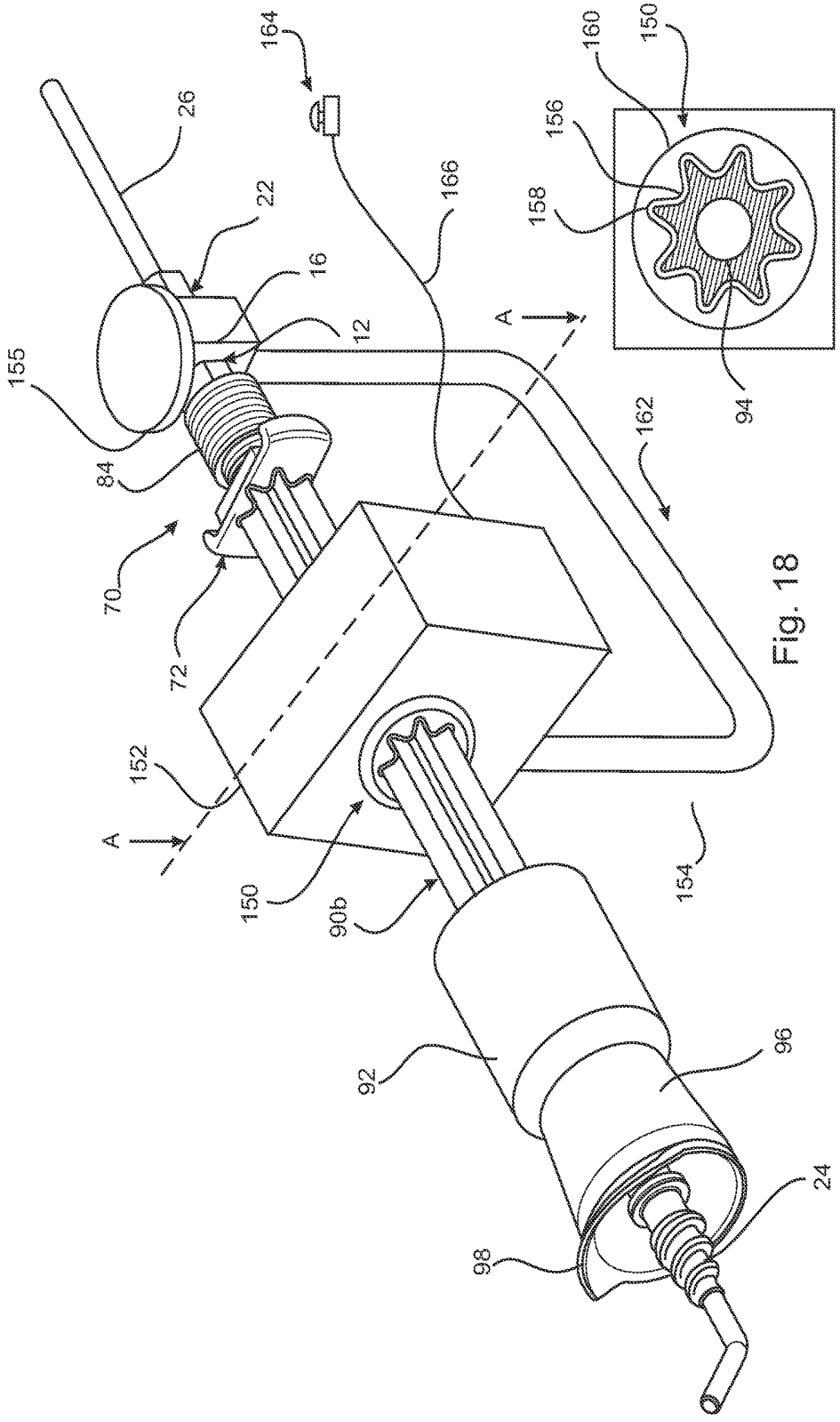
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Fig. 18

Fig. 19

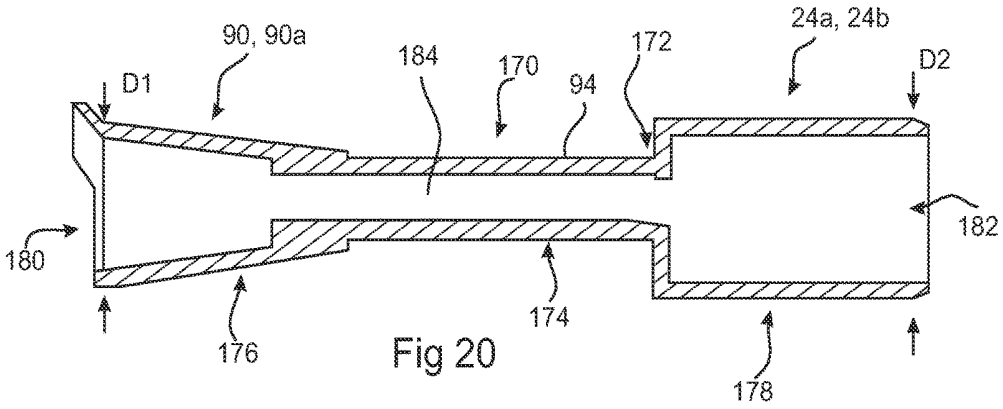

Fig 20

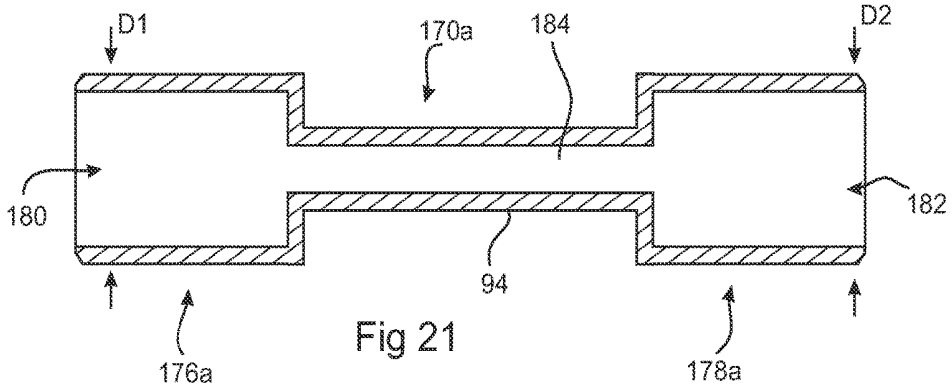

Fig 21

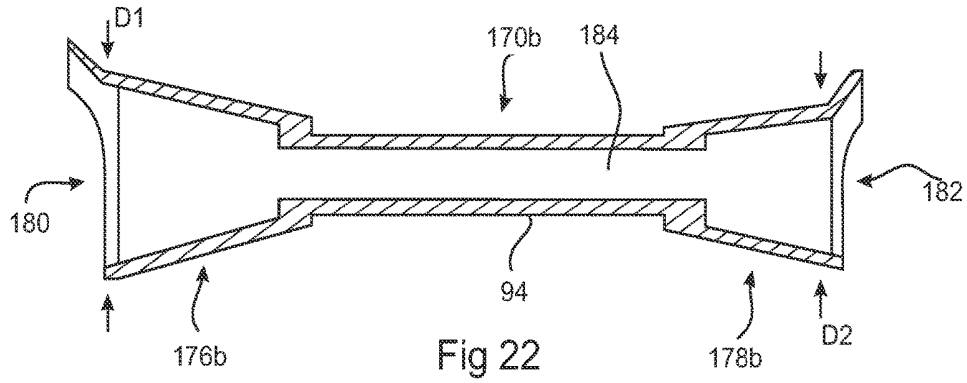

Fig 22

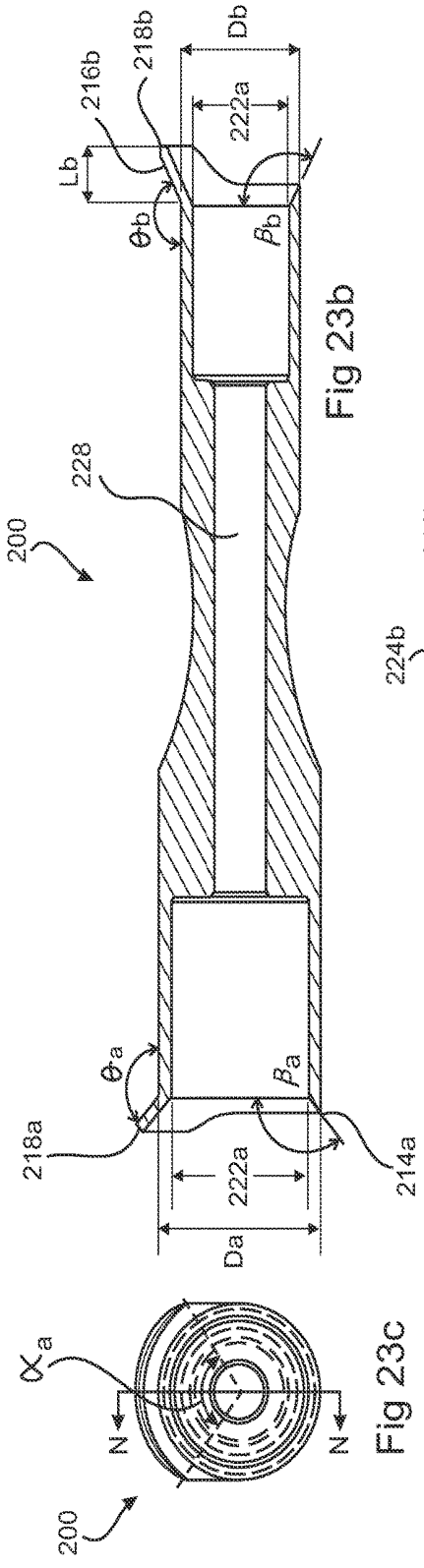

Fig 23b

Fig 23c

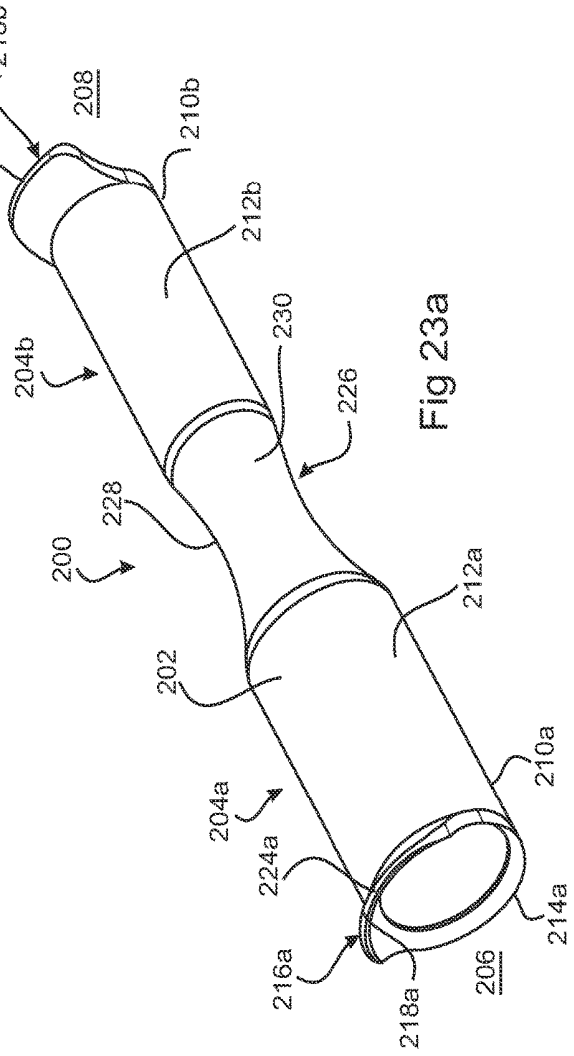

Fig 23a

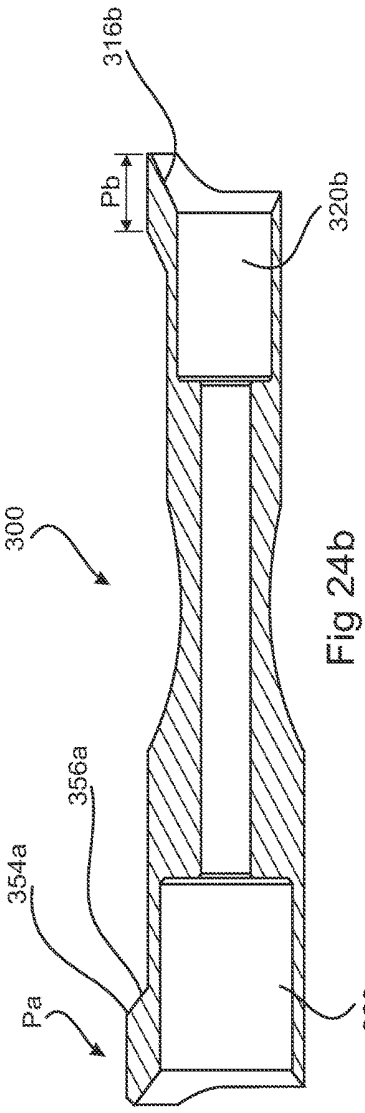

Fig 24b

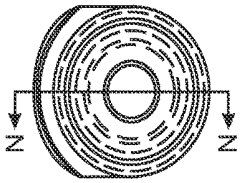

Fig 24c

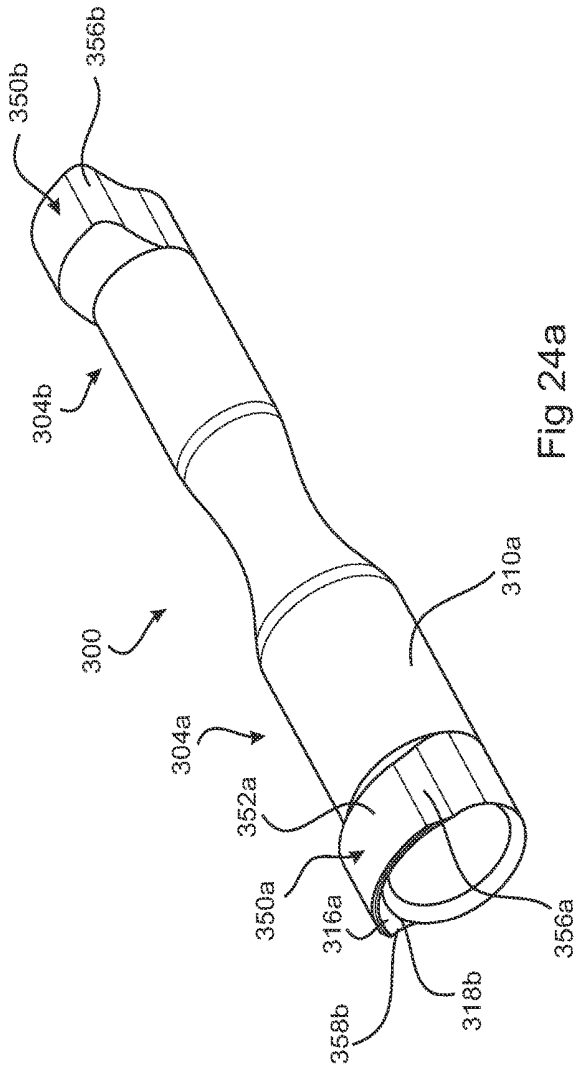

Fig 24a

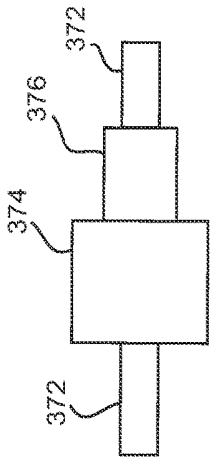

Fig 25

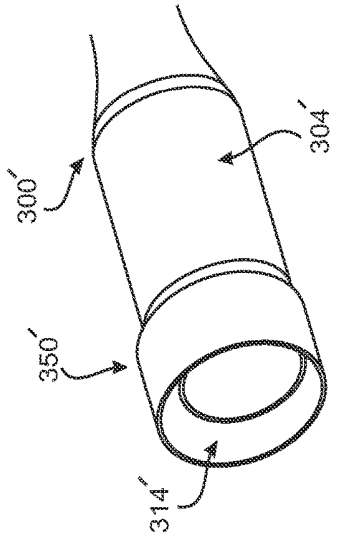

Fig 26

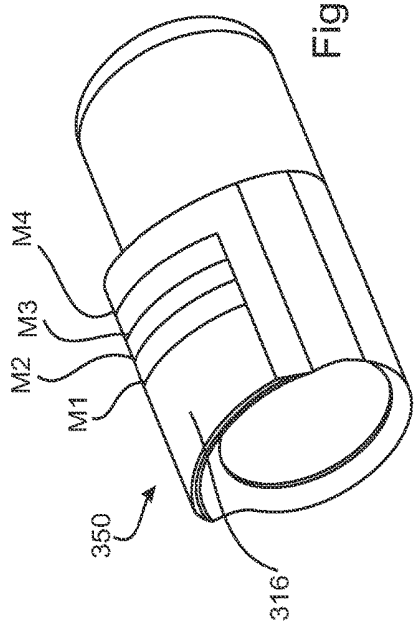

Fig 24d

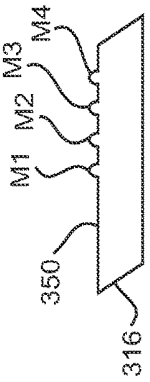

Fig 24e

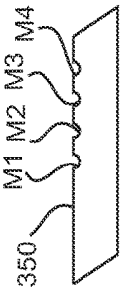

Fig 24f

Fig 24g

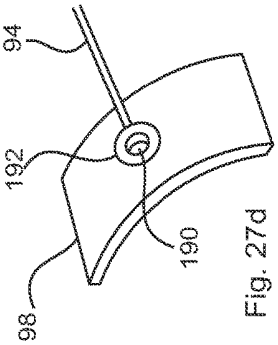

Fig. 27d

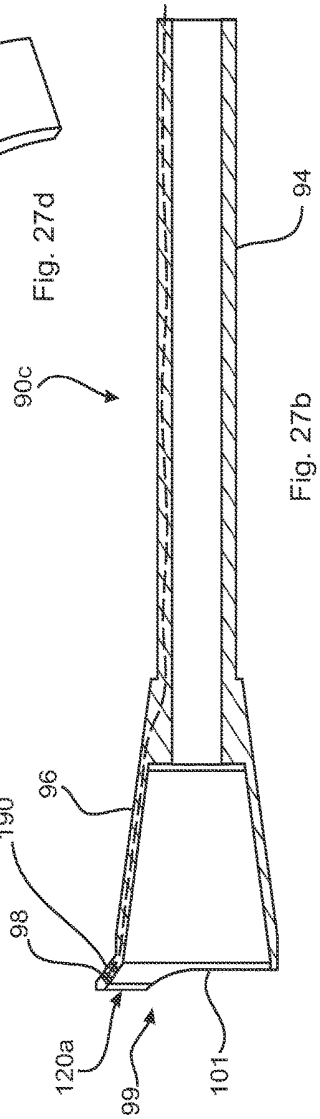

Fig. 27b

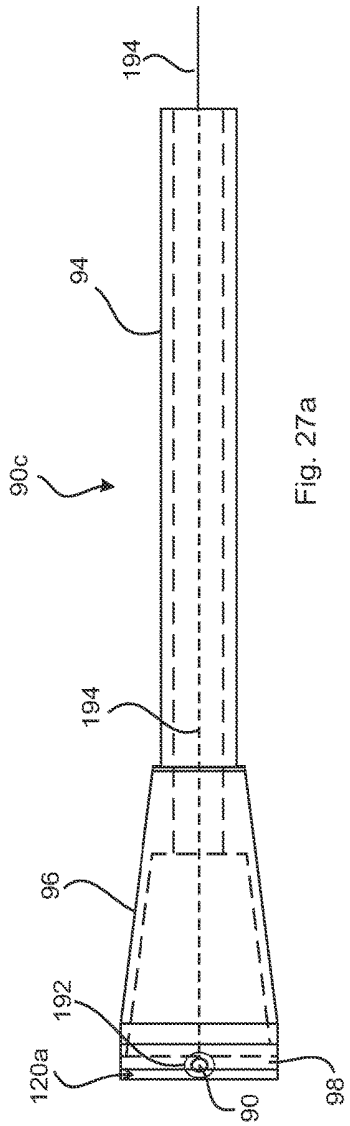

Fig. 27a

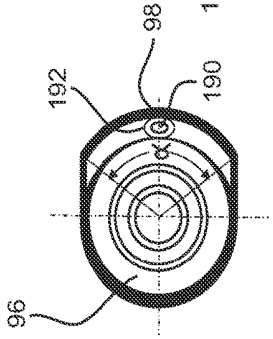

Fig. 27c

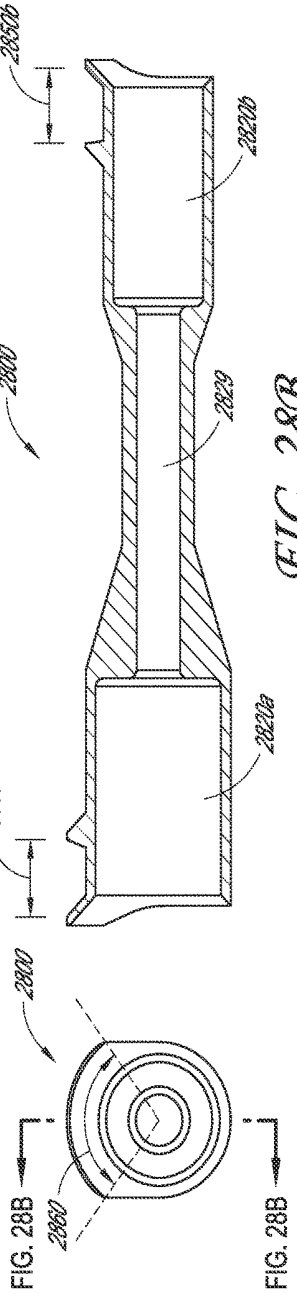

FIG. 28C

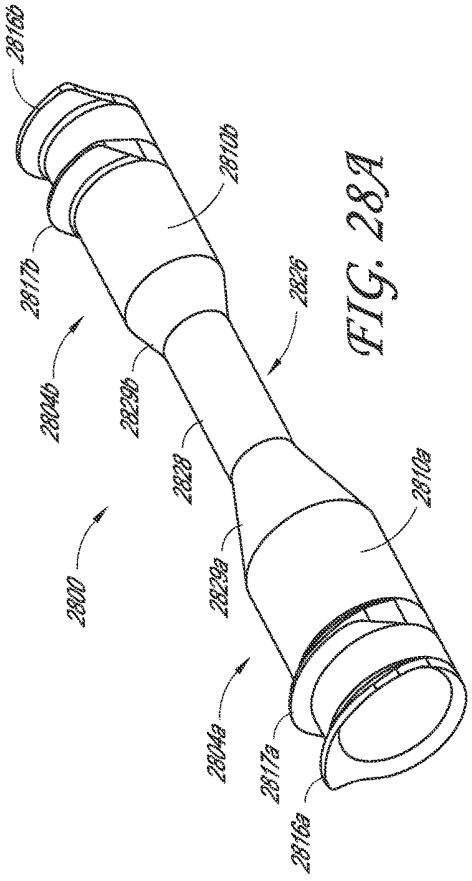

FIG. 28A

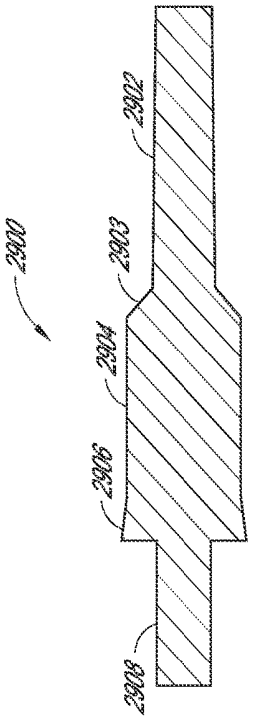

FIG. 29B

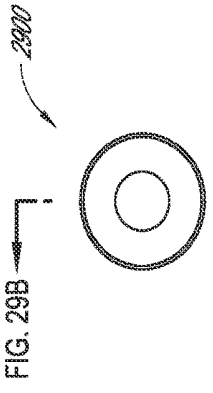

FIG. 29C

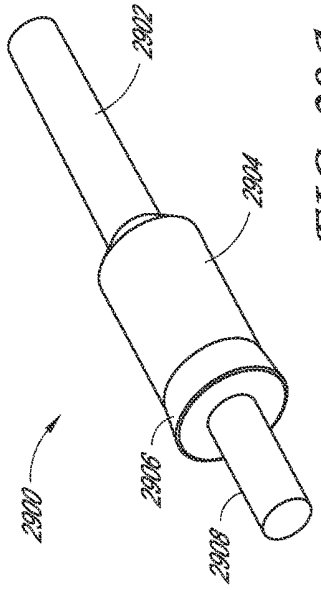

FIG. 29A

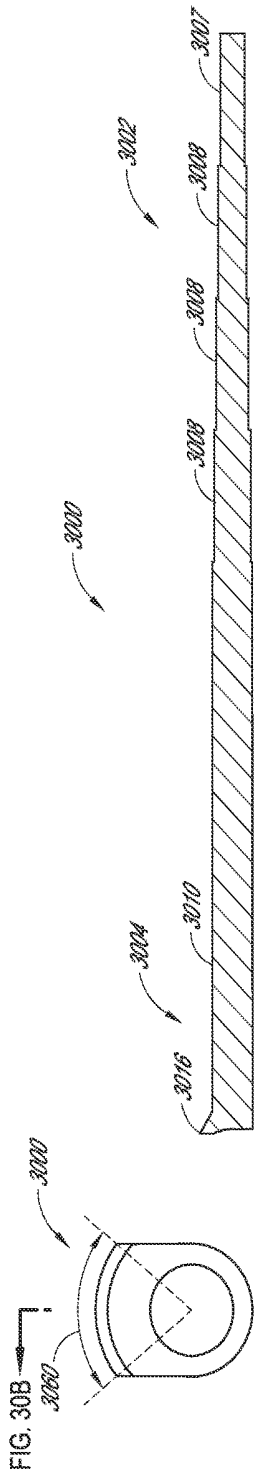

FIG. 30C

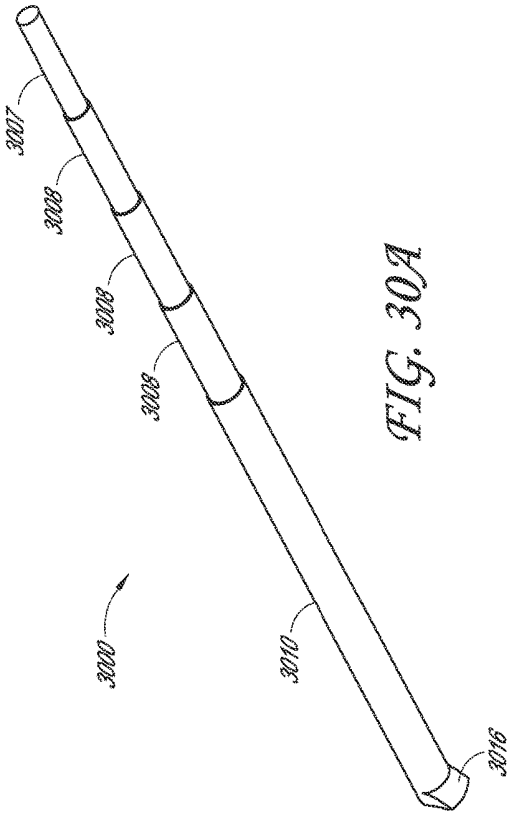

FIG. 30A

FIG. 29B

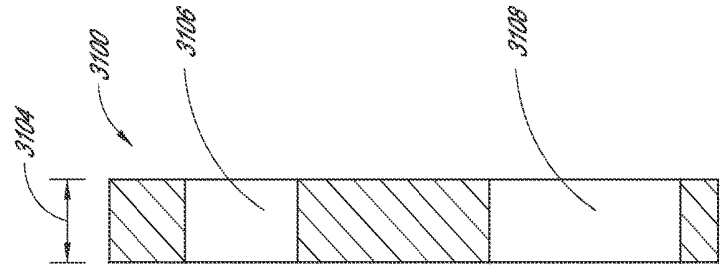

FIG. 31B

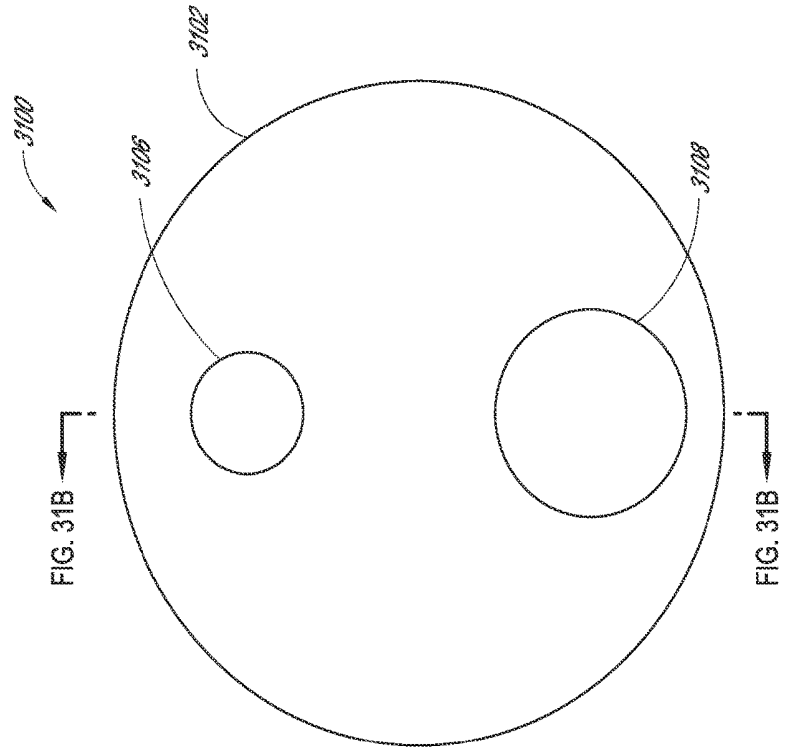

FIG. 31A

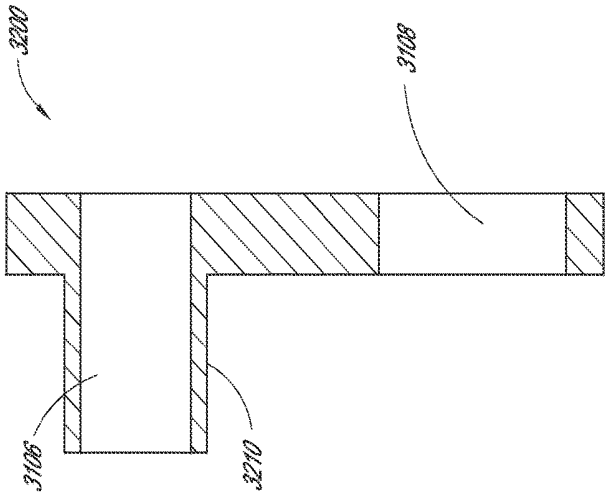

FIG. 32B

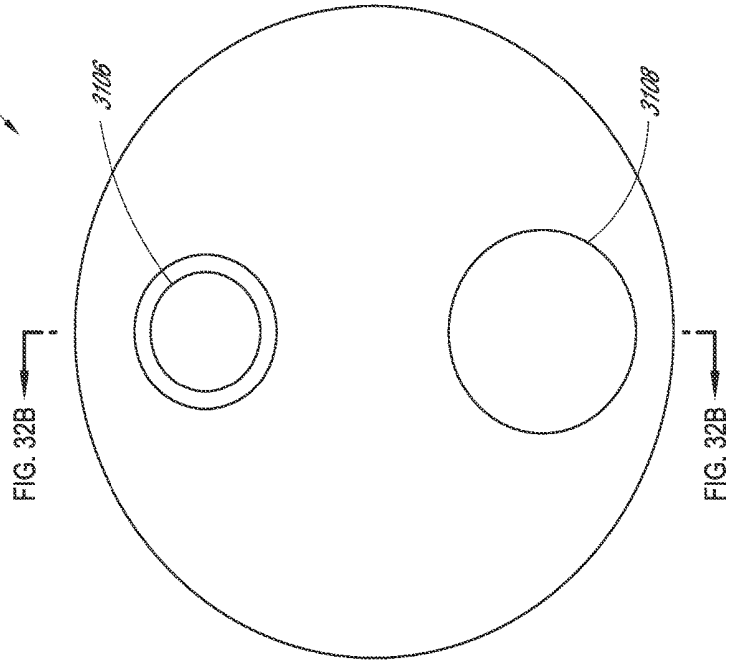

FIG. 32A

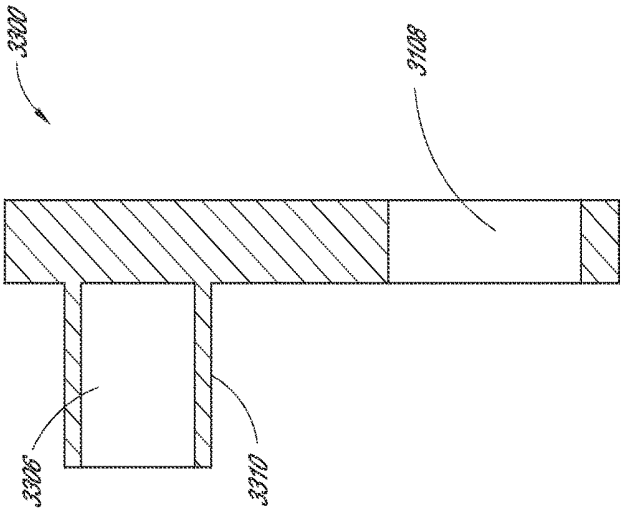

FIG. 33B

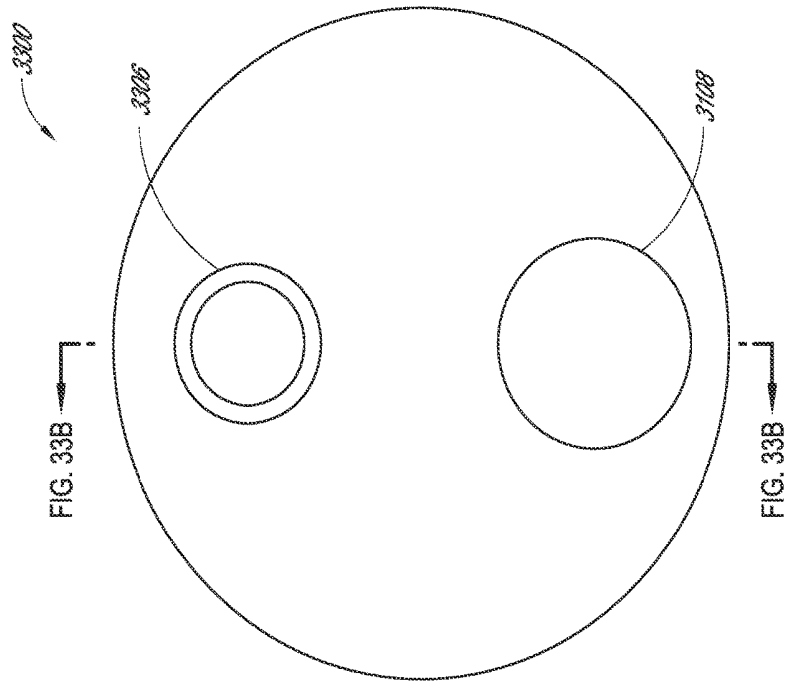

FIG. 33A

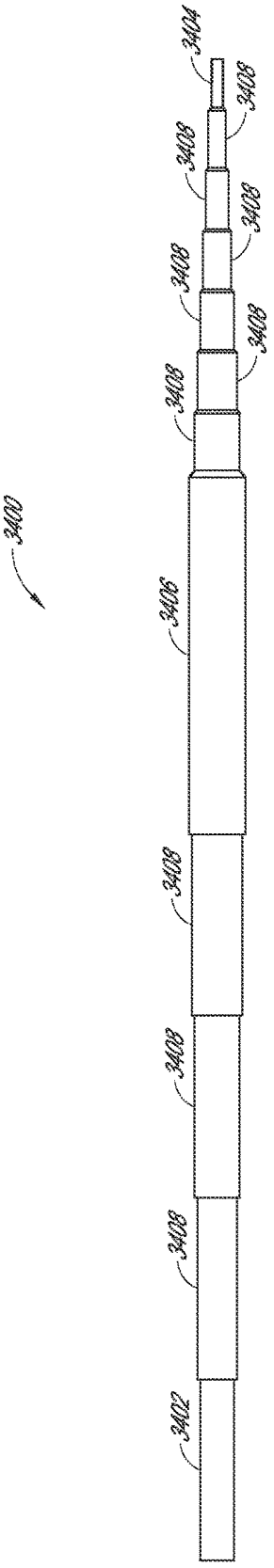
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FIG. 34

GENERAL UTERINE MANIPULATOR AND SYSTEM

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation of U.S. Application Ser. No. 14/498,166, filed Sep. 26, 2014, now U.S. Pat. No. 9,101,390, which is a continuation of PCT Application No. PCT/US2013/061180, filed Sep. 23, 2013, which is a continuation-in-part of U.S. application Ser. No. 13/720,086, filed Dec. 19, 2012, which is a continuation-in-part of U.S. application Ser. No. 13/625,255, filed Sep. 24, 2012, which is a continuation-in-part of PCT Application No. PCT/AU2012/000332, filed Mar. 30, 2012, which claims the benefit of U.S. Provisional Application No. 61/472,705, filed Apr. 7, 2011. Each of the foregoing applications is hereby incorporated herein by reference in its entirety.

BACKGROUND

Field

The present disclosure relates to a general uterine manipulator and system which may be used in general surgery, gynaecological or non-surgical procedures.

Description

The present inventor has invented numerous medical instruments which are currently in use in surgical and non-surgical procedures. One such instrument is described in International publication no. WO 2008/074054 which is used in various procedures including total laparoscopic hysterectomy. The instrument described in this publication comprises a tube provided with an integral funnel at one end and through which a uterine cannula can be inserted. Both the tube and the cannula are provided with longitudinal slots or cut outs that aid in visualising the rotational position of a distal end of the instrument when inserted into the vagina and also aid in gripping of the instrument.

The success and efficacy of the above described and other instruments developed by the present inventor together with the need for improved and more versatile instruments have led to the present disclosure.

SUMMARY

According to one aspect of the present disclosure there is provided a general uterine manipulator comprising:

an elongated hollow tube defining an internal passage and having opposite first and second ends;

a smooth continuous outer surface of constant outer diameter extending between the first and second ends; and,

internal first and second screw threads formed in the elongated hollow tube, the first screw thread being formed at the first end and the second screw thread being formed at the second end.

The general uterine manipulator may comprise a first fitting having a screw thread arranged to engage the first screw thread, the first fitting also having an axial through hole and configured to receive an inner manipulator shaft.

In some embodiments the first fitting is configured to apply increasing clamping force on a received inner manipulator when the first fitting a screw further into the first end.

The general uterine manipulator may comprise a hydrotubation port in fluid communication with the internal passage wherein a fluid injected into or through the hydrotubation port is able to flow into the internal passage.

In some embodiments the hydrotubation port is formed in the elongated hollow tube at a location near the first end and beyond the first screw thread.

In some embodiments the hydrotubation port is formed in the first fitting and is in fluid communication with the axial through hole.

The axial through hole may comprise a first length which opens onto an end of the first fitting distant the screw thread of the first fitting, and a second contiguous length wherein the first length has a first internal diameter and the second length has a second internal diameter which is greater than the first internal diameter; and wherein the hydrotubation port opens onto the second length of the axial through hole.

The general uterine manipulator may comprise a second fitting having a threaded portion provided with a screw thread configured to engage the second internal thread on the elongated hollow tube and a body portion extending co-linearly from the threaded portion.

In some embodiments the body portion comprises a tubular member which is open at one end distal the threaded portion and is closed at an end near to the threaded portion to form a cavity.

In some embodiments the tubular member comprises a circumferential wall and at least one internal passage formed in the circumferential wall, the or each internal passage opening onto axially opposite ends of the circumferential wall.

In some embodiments the body portion comprises a conically shaped portion with decreasing outer diameter in a taper direction being away from the threaded portion and wherein the conically shaped portion is provided with an external coarse screw thread.

In some embodiments the second fitting is provided with an axial through hole.

The general uterine manipulator may comprise an inner manipulator shaft, the shaft capable of being received in the axial through hole of the first fitting and the axial through hole of the second fitting and extending through the internal passage.

In some embodiments a crest of the coarse screw thread is provided with a flattened surface wherein a line on the flattened surface is inclined relative to a central axis of the coarse screw thread in the taper direction.

In some embodiments the coarse screw thread is a ball screw thread.

In some embodiments the general uterine manipulator comprising a forceps holder supported on the elongated hollow tube and configured to be releasably lockable in a plurality of positions along the elongated hollow tube.

In some embodiments the forceps holder comprises a first component seated on the elongated hollow tube and provided with a detent for gripping a finger hole of the forceps.

In some embodiments the forceps holder comprises a locking nut engagable with the first component and arranged to releasably lock the first component in a fixed position along the elongated hollow tube when rotated in a first direction, and to release the second component to allow sliding motion along the elongated hollow tube when rotated in an opposite direction.

In a second aspect there is provided general uterine manipulator comprising:

an elongated hollow tube defining an internal passage and having opposite first and second ends;

a smooth continuous outer surface of constant outer diameter extending between the first and second ends;

internal first and second screw threads formed in the elongated hollow tube, the first screw thread being formed at the first end and the second screw thread being formed at the second end;

a first fitting having a screw thread arranged to engage the first screw thread, the first fitting also having an axial through hole;

a second fitting having a threaded portion provided with a screw thread configured to engage the second internal thread on the elongated hollow tube and a body portion extending co-linearly from the threaded portion; and,

an inner manipulator shaft arranged to extend through the axial through hole, the internal passage and the second fitting, the inner manipulator shaft having one end which is bent and protrudes from the second fitting.

In one embodiment the general uterine manipulator comprises a resistance mechanism enabling the axial and rotational position of the inner manipulator shaft to substantially held in the absence of adjustment by a user of the manipulator.

In one embodiment the resistance mechanism comprises clamp shells incorporated in the first fitting.

In one embodiment the resistance mechanism comprises a bend in a portion of the inner manipulator shaft within the internal passage the bend being to an extent that the inner manipulator shaft bears against an inside surface of the tube.

In one embodiment the general uterine manipulator comprises a hydrotubation port formed in the first fitting and in fluid communication with the axial through hole wherein a fluid injected into or through the hydrotubation port is able to flow into the internal passage. In this embodiment the axial through hole comprises a first length which opens onto an end of the first fitting distant the screw thread of the first fitting, and a second contiguous length wherein the first length has a first internal diameter and the second length has a second internal diameter which is greater than the first internal diameter; and the hydrotubation port opens onto the second length of the axial through hole.

In one embodiment the second fitting comprises a threaded portion provided with a screw thread configured to engage the second internal thread on the elongated hollow tube and a body portion extending co-linearly from the threaded portion, the body portion having a frusto-conical shape with decreasing outer diameter in a direction away from the threaded portion and on which is provided an external coarse screw thread.

In one embodiment the general uterine manipulator comprises a forceps holder supported on the elongated hollow tube and configured to be releasably lockable in a plurality of positions along the elongated hollow tube.

In one embodiment the forceps holder comprises a first component seated on the elongated hollow tube and provided with a detent for gripping a handle of the forceps.

In one embodiment the forceps holder comprises a locking nut engagable with the first component and arranged to releasably lock the first component in a fixed position along the elongated hollow tube when rotated in a first direction, and to release the second component to allow sliding motion along the elongated hollow tube when rotated in an opposite direction.

In one embodiment the general uterine manipulator comprises a cervical funnel mounted on the tube.

In a third aspect there is provided a general uterine manipulator system comprising:

an elongated hollow tube defining an internal passage and having opposite first and second ends;

a smooth continuous outer surface of constant outer diameter extending between the first and second ends;

internal first and second screw threads formed in the elongated hollow tube, the first screw thread being formed at the first end and the second screw thread being formed at the second end;

at least one first fitting the or each first fitting having a screw thread arranged to engage the first screw thread, the first fitting also having an axial through hole;

at least one second fitting the or each second fitting having a threaded portion provided with a screw thread configured to engage the second internal thread on the elongated hollow tube and a body portion extending co-linearly from the threaded portion;

wherein the at least one first fitting comprises one or both of: (a) a clamping first fitting configured to apply increasing clamping force on a received inner manipulator when the first fitting a screw further into the first end; and (b) a hydrotubation first fitting which has a hydrotubation port in fluid communication with the internal passage wherein a fluid injected into or through the hydrotubation port is able to flow into the internal passage; and

wherein the at least one second fitting comprises one or both of: (c) a cervical second fitting in which its body portion is of a frusto-conical shape with decreasing outer diameter in a direction away from the threaded portion and is provided with an external coarse screw thread; and (d) a tubular second fitting in which its body portion comprises a tubular member which is open at one end distal the threaded portion of the second fitting and is closed at an end near to the threaded portion of the second fitting to form a cavity.

In one embodiment the tubular member of the tubular second fitting comprises a circumferential wall and at least one internal passage formed in the circumferential wall, the or each internal passage opening onto axially opposite ends of the circumferential wall.

In one embodiment the general uterine manipulator system comprises an inner manipulator shaft arranged to extend through the axial through hole, the internal passage and the second fitting when the second fitting is the cervical second fitting, the inner manipulator shaft having one end which is bent and protrudes from the cervical.

In one embodiment the general uterine manipulator system a resistance mechanism enabling the axial and rotational position of the inner manipulator shaft to substantially held in the absence of adjustment by a user.

In one embodiment the general uterine manipulator system a forceps holder supported on the elongated hollow tube and configured to be releasably lockable in a plurality of positions along the elongated hollow tube.

In a fourth aspect there is provided a medical instrument configured to facilitate a gynaecological procedure comprising:

a body provided with opposite first and second end portions, the first end portion having a first opening and the second end portion having a second opening;

a throughway extending between the first and second openings, the throughway arranged to enable the body to be supported on a shaft to facilitate insertion of one of the first and second end portions into a body cavity.

In one embodiment the first and second end portions are different in one or more of their shape, size and configuration.

In one embodiment the first end portion is of a tubular configuration and has a first outer diameter.

In one embodiment the second end portion is of a tubular configuration and has a second outer diameter that is different to the first outer diameter.

In one embodiment the second end portion is of a frusto conical configuration.

In one embodiment the first end portion is of a frusto conical configuration and has a first outer diameter.

In one embodiment the second end portion is of a frusto conical configuration and has a second outer diameter that is different to the first outer diameter.

In one embodiment the or each end portion of frusto conical configuration is provided with a lip that extends radially outward from an outer surface of the second end portion and for an arc of less than 360°.

In one embodiment one or both of the first and second end portions is provided with an illumination device arranged to enable the emission of light from the respective end portion.

In one embodiment the device comprises an illumination device arranged to enable the emission of light from the lip.

In one embodiment the general uterine manipulator system comprises an illumination device arranged to enable the emission of light from an end of the tubular portion.

In one embodiment the general uterine manipulator system comprises an illumination device arranged to enable the emission of light from an end of the cervical funnel.

In one embodiment the general uterine manipulator system comprises an illumination device arranged to enable the emission of light from an end of the tubular second fitting.

In one embodiment the general uterine manipulator system comprises a motor arranged to engage and rotate the cervical funnel.

In one embodiment the general uterine manipulator system comprises a foot operated switch associated with the motor and switchable between a first position wherein the motor rotates in a clockwise direction and a second position wherein the motor rotates in an anti-clockwise direction.

In one embodiment the cervical funnel has conical portion and a through hole formed in or near a large diameter end the conical portion.

In one embodiment the large diameter end of the conical portion has an outwardly flared lip that extend for a part of the circumference of the conical portion and wherein the hole is formed in the lip.

In one embodiment the general uterine manipulator system comprises an illumination device arranged to illuminate the through hole.

In a fifth aspect there is provided a cervical funnel comprising a conical portion and a through hole formed in or near a large diameter end the conical portion.

In one embodiment the funnel comprises the large diameter end of the conical portion has an outwardly flared lip that extend for a part of the circumference of the conical portion and wherein the hole is formed in the lip.

In one embodiment the funnel comprises an illumination device arranged to illuminate the through hole.

In one embodiment the illumination device comprises an annular light guide surrounding the through hole.

In a sixth aspect there is provided a cervical funnel comprising a conical portion and a tube extending coaxially form a small diameter end of the conical portion, wherein an outer surface of the tube is profiled to mechanically engage a motor to facilitate rotation of the cervical funnel.

In one embodiment the outer surface of the tube is provided with gear teeth arranged to enable mechanical engagement with the motor.

In one embodiment the funnel comprises a through hole formed in or near a large diameter end the conical portion.

In one embodiment the large diameter end of the conical portion has an outwardly flared lip that extend for a part of the circumference of the conical portion and wherein the hole is formed in the lip.

In a seventh aspect there is provided a double ended medical instrument arranged for insertion into a body cavity comprising:

a body having a first probe at first end, a second probe at a second opposite end;

the first probe having a cylindrical portion with an first outer circumferential surface of a first diameter, a first circumferential edge distant the first end and a first lip projecting outwardly from the first outer circumferential surface beyond the first circumferential edge and extending for at least a part of a circumference of the first circumferential edge;

the second probe having a cylindrical portion with a second outer circumferential surface of a second outer diameter, a second circumferential edge distant the first probe and a second lip projecting outwardly from the second outer circumferential surface beyond the second circumferential edge and extending for at least a part of a circumference of the second circumferential edge;

wherein the first outer diameter and the second outer diameter are different from each other.

In one embodiment the first and second lips have respective mid-points that are located in axial alignment.

In one embodiment the part of the circumference of the first and second circumferential edges about which the first and second lips respectively extend are the same.

In one embodiment the first probe is provided with a first cavity extending axially from the first circumferential edge toward the second probe and having a first inner diameter.

In one embodiment the second probe is formed with a second cavity extending axially from the second circumferential edge toward the first probe and having a second inner diameter wherein the second inner diameter is different to the first inner diameter.

In one embodiment the first probe is provided with a first platform of constant first outer diameter extending over the first cylindrical portion from a circumferential edge of the first lip toward the second probe.

In one embodiment the first platform is co-extensive in a circumferential aspect with the first lip.

In one embodiment a side of the first platform rearward of the first lip slopes from the first outer diameter to first outer circumferential surface in a direction toward the second probe.

In one embodiment circumferentially opposite sides the first platform transition smoothly from first outer diameter the first outer circumferential surface.

In one embodiment the second probe is provided with a second platform of constant second outer diameter extending over the second cylindrical portion from a circumferential edge of the second lip toward the first probe.

In one embodiment the second platform is co-extensive in a circumferential aspect with the second lip.

In one embodiment a side of the second platform rearward of the second lip slopes from the second outer diameter in a direction toward the first probe.

In one embodiment circumferentially opposite sides the second platform transition smoothly from second outer diameter the second outer circumferential surface.

In one embodiment the platform has a circumferential surface of constant diameter extending coaxially with the first outer circumferential surface.

In one embodiment the double ended medical instrument comprises an intermediate portion that transitions smoothly between the first and second probes.

In one embodiment the intermediate portion has a central region of an outer diameter less than each of the first diameter and the second outer diameter.

In one embodiment the double ended medical instrument comprises an intermediate portion that transitions smoothly between the first and second probes wherein the intermediate portion is formed with an internal bore the bore extending in an axial direction between the first and second cavities and having an inner diameter smaller than each of the first and second inner diameters.

In one embodiment the first lip and second lip extend for the full circumference of first circumferential edge and the second circumferential edge respectively; the first probe being provided with a first platform of constant first outer diameter extending wholly about the first cylindrical portion from a circumferential edge of the first lip toward the second probe; and the second probe being provided with a second platform of constant second outer diameter extending wholly about the second cylindrical portion from a circumferential edge of the second lip toward the first probe.

In an eighth aspect there is provided a medical instrument configured to be inserted into a body cavity, the medical instrument comprising: a body comprising a first probe at a first end, the first probe comprising: a first cylindrical portion with a first outer circumferential surface of a first diameter; a first circumferential edge at a distal end of the first probe; a first distal lip projecting outwardly from the first outer circumferential surface beyond the first circumferential edge and extending for at least a part of a circumference of the first circumferential edge; and a first marker lip projecting outwardly from the first outer circumferential surface and extending for at least a part of a circumference of the first outer circumferential surface; wherein the first distal lip is positioned distal to the first marker lip; and wherein the body comprises a hollow cavity to enable a second medical instrument to pass therethrough.

In some embodiments, the body further comprises: a second probe at a second end, the second probe comprising: a second cylindrical portion with a second outer circumferential surface of a second diameter; a second circumferential edge at a distal end of the second probe; a second distal lip projecting outwardly from the second outer circumferential surface beyond the second circumferential edge and extending for at least a part of a circumference of the second circumferential edge; and a second marker lip projecting outwardly from the second outer circumferential surface and extending for at least a part of a circumference of the second outer circumferential surface; wherein the second distal lip is positioned distal to the second marker lip; wherein the second end is opposite the first end; and wherein the first diameter and second diameter are different from each other.

In some embodiments, the first marker lip is positioned approximately 20 millimeters in a longitudinal direction from the first distal lip.

In some embodiments, the second marker lip is positioned approximately 20 millimeters in a longitudinal direction from the second distal lip.

In some embodiments, the first marker lip and first distal lip have respective mid-points that are located in axial alignment.

In some embodiments, the second marker lip and second distal lip have respective mid-points that are located in axial alignment.

In some embodiments, the first distal lip and second distal lip have respective mid-points that are located in axial alignment.

In some embodiments, the medical instrument further comprises a pneumatic plug having a tapered surface configured to pneumatically plug at least a portion of the hollow cavity.

In some embodiments, the medical instrument further comprises an intermediate portion that transitions smoothly between the first and second probes.

In some embodiments, the medical instrument further comprises an intermediate portion positioned between the first and second probes, wherein the intermediate portion is cylindrical.

In some embodiments, the intermediate portion has a central region of an outer diameter less than each of the first diameter and second diameter.

In a ninth aspect there is provided a double ended medical instrument configured to be inserted into a body cavity, the double ended medical instrument comprising: an elongate body comprising: a first cylindrical segment positioned at a first end of the body; a second cylindrical segment positioned at a second end of the body; a first plurality of graduated cylindrical segments positioned between the first cylindrical segment and a central cylindrical segment; and a second plurality of graduated cylindrical segments positioned between the second cylindrical segment and the central cylindrical segment; wherein the first cylindrical segment, second cylindrical segment, and central cylindrical segment each have different outer diameters, with the central cylindrical segment having the largest outer diameter; wherein the first plurality of graduated cylindrical segments comprise outer diameters larger than the first cylindrical segment, but smaller than the central cylindrical segment; wherein the second plurality of graduated cylindrical segments comprise outer diameters larger than the second cylindrical segment, but smaller than the central cylindrical segment; and wherein the first cylindrical segment, second cylindrical segment, central cylindrical segment, first plurality of graduated cylindrical segments, and second plurality of graduated cylindrical segments are positioned collinearly.

In some embodiments, the first cylindrical segment comprises an outer diameter configured to be smaller than an undilated diameter of a human cervical canal.

In some embodiments, the first cylindrical segment comprises an outer diameter of approximately two millimeters.

In some embodiments, the second cylindrical segment comprises an outer diameter larger than any of the first cylindrical segment and the first plurality of graduated cylindrical segments.

In a tenth aspect there is provided a double ended medical instrument configured to be inserted into a body cavity, the double ended medical instrument comprising: a body comprising a probe at a first end, the probe comprising: a cylindrical plug portion with an outer circumferential surface of a first diameter; a circumferential edge at a distal end of the probe; and a lip projecting outwardly from the outer circumferential surface beyond the circumferential edge and extending for at least a part of a circumference of the circumferential edge; wherein the body further comprises a dilator at a second end, the second end opposite the first end, the dilator comprising: a first cylindrical segment positioned at a distal end of the dilator; and a plurality of graduated cylindrical segments positioned between the first cylindrical segment and the cylindrical plug portion of the probe, wherein the plurality of graduate cylindrical segments com-

prise incremental outer diameters having values larger than an outer diameter of the first cylindrical segment and smaller than the first diameter of the cylindrical plug portion; wherein the cylindrical plug portion, first cylindrical segment, and plurality of graduated cylindrical segments are positioned collinearly.

In some embodiments, the first cylindrical segment comprises an outer diameter of approximately six millimeters and the first diameter of the cylindrical plug portion is approximately ten millimeters.

In some embodiments, the first diameter of the cylindrical plug portion is of a size configured to pneumatically plug a vaginal canal of young pig.

In some embodiments, the double ended medical instrument further comprises a cylindrical disc configured to support the body, the cylindrical disc comprising: a first port extending from a front surface of the disc to a rear surface of the disc, the first port having an inner diameter of a size to enable the body to pass therethrough; and a second port extending from the front surface of the disc to the rear surface of the disc, the second port having an inner diameter of a size to enable a tail of a pig to pass therethrough to anchor the cylindrical disc in relation to the pig.

In some embodiments, the cylindrical disc further comprises a hollow tube extending from the front surface of the disc, the hollow tube positioned collinearly to the first port.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1***a* is a representation of one embodiment of a general uterine manipulator in accordance with the present invention;

FIG. **1***b* is a disassembled view of the general uterine manipulator depicted in FIG. **1***a;*

FIG. **2** is a longitudinal section view of the tube incorporated in the general uterine manipulator shown in FIGS. **1***a* and **1***b;*

FIG. **3** is an isometric view of a tail screw incorporated in the general uterine manipulator shown in FIGS. **1***a* and **1***b;*

FIG. **4** is a side view of the tail screw shown in FIG. **3**;

FIG. **5** is an end view of the tail screw shown in FIG. **3**;

FIG. **6** is an isometric view of a second form of tail screw that may be incorporated in the general uterine manipulator shown in FIGS. **1***a* and **1***b;*

FIG. **7** is a side view of the tail screw shown in FIG. **6**;

FIG. **8** is an end view of the tail screw shown in FIG. **6**;

FIG. **9***a* is a side view of a second fitting incorporated in the general uterine manipulator shown in FIGS. **1***a* and **1***b;*

FIG. **9***b* is a longitudinal section view of the second fitting shown in FIG. **9***a;*

FIG. **9***c* is an isometric representation of the second fitting;

FIG. **10***a* is a side view of a second form of setting fitting that may be incorporated in the general uterine manipulator depicted in FIGS. **1***a* and **1***b;*

FIG. **10***b* is an end view of the second fitting shown in FIG. **9***a;*

FIG. **10***c* is an isometric view from one end of the second fitting;

FIG. **10***d* is a isometric view from an opposite angle of the second fitting;

FIG. **11** is an isometric view of a forceps holder incorporated in the uterine manipulator;

FIG. **12** is an isometric view of an embodiment of the general uterine manipulator and associated system with additional fittings to enable performance of a total laparoscopic hysterectomy; and,

FIG. **13***a* is a side view of a cervical funnel incorporated in an embodiment of the general uterine manipulator shown in FIGS. **1***a* and **1***b;*

FIG. **13***b* is a longitudinal section view of the cervical funnel;

FIG. **13***c* is an end view of the cervical funnel shown in FIGS. **13***a* and **13***b;*

FIG. **14***a* is an isometric representation of a vaginal plug incorporated in an embodiment of the general uterine manipulator shown in FIGS. **1***a* and **1***b;*

FIG. **14***b* is a section view of the vaginal plug shown in FIG. **14***a;*

FIG. **15** is a side view of a manipulator handle which may be incorporated in an embodiment of the general uterine manipulator;

FIG. **16***a* is a side view of a further from of second fitting that may be incorporated in the general uterine manipulator depicted in FIGS. **1***a* and **1***b;*

FIG. **16***b* is an end view of the second fitting shown in FIG. **16***a;*

FIG. **16***c* is an isometric view from a first angle of the second fitting shown in FIG. **16***a;*

FIG. **16***d* is a isometric view from a second angle of the second fitting shown in FIG. **16***a;*

FIG. **16***e* is a schematic representation of an illumination device incorporated in the second fitting shown in FIG. **16***a;*

FIG. **17***a* is a side view of a cervical funnel with an illumination device incorporated in a further embodiment of the general uterine manipulator;

FIG. **17***b* is a longitudinal section view of the cervical funnel shown in FIG. **17***a;*

FIG. **17***c* is an end view of the cervical funnel shown in FIGS. **17***a* and **17***b*

FIG. **17***d* is a schematic representation of the illumination device incorporated in the cervical funnel shown in FIGS. **17***a* and **17***b;*

FIG. **18** is an isometric view of the general uterine manipulator shown in FIG. **12** but modified with the inclusion of a drive to enable powered rotation of an associated cervical funnel;

FIG. **19** is view of cross section A-A of the manipulator shown in FIG. **18**;

FIG. **20** is a schematic representation of a medical instrument that can be incorporated in or used with an embodiment of the general uterine manipulator;

FIG. **21** is a schematic representation of an alternate medical instrument that can be incorporated in or used with an embodiment of the general uterine manipulator;

FIG. **22** is a schematic representation of a further form of medical instrument that can be incorporated in or used with an embodiment of the general uterine manipulator;

FIG. **23***a* is an isometric view of a double ended medical instrument that can be incorporated in or used with an embodiment of a general uterine manipulator;

FIG. **23***b* is a longitudinal section view of the instrument shown in FIG. **23***a;*

FIG. **23***c* is an end view of the instrument shown in FIG. **23***a;*

FIG. **24***a* is an isometric view of a further double ended medical instrument that can be incorporated in or used with an embodiment of a general uterine manipulator;

FIG. **24***b* is a longitudinal section view of the instrument shown in FIG. **24***a;*

FIG. **24***c* is an end view of the instrument shown in FIG. **24***a;*

FIG. **24***d* is an enlarged view of an extended probe that can be incorporated in the instrument shown in FIG. **24***a;*

FIG. **24***e* depicts a cross section of a platform of the probe shown in FIG. **24***a* with markings in the form of ridges;

FIG. **24***f* depicts a cross section of a platform of the probe shown in FIG. **24***a* with markings in the form of grooves;

FIG. **24***g* depicts a cross section of a platform of the probe shown in FIG. **24***a* with markings in the form of sets of adjacent grooves and ridges;

FIG. **25** illustrates a plug that can be used with the instruments depicted in FIGS. **20-24***g;*

FIG. **26** illustrates one end of a modified form of the double ended medical instrument shown in FIG. **24***a* having a full circumference platform;

FIG. **27***a* is a side view of a further embodiment cervical funnel with an illumination device that may be used with the general uterine manipulator;

FIG. **27***b* is a longitudinal section view of the cervical funnel shown in FIG. **27***a;*

FIG. **27***c* is an end view of the cervical funnel shown in FIGS. **27***a* and **27***b*; and

FIG. **27***d* is a schematic representation of a lip portion of the cervical funnel shown in FIGS. **27***a* and **27***b*.

FIG. **28**A illustrates a perspective view of an embodiment of a double ended medical instrument.

FIG. **28**B illustrates a side cross sectional view of the double ended medical instrument of FIG. **28**A.

FIG. **28**C illustrates a front view of the double ended medical instrument of FIG. **28**A.

FIG. **29**A illustrates a perspective view of an embodiment of a pneumatic plug.

FIG. **29**B illustrates a side cross sectional view of the pneumatic plug of FIG. **29**A.

FIG. **29**C illustrates a front view of the pneumatic plug of FIG. **29**A.

FIG. **30**A illustrates a perspective view of an embodiment of another double ended medical instrument.

FIG. **30**B illustrates a side cross sectional view of the double ended medical instrument of FIG. **30**A.

FIG. **30**C illustrates a front view of the double ended medical instrument of FIG. **30**A.

FIG. **31**A illustrates a front view of an embodiment of a medical instrument support.

FIG. **31**B illustrates a side cross sectional view of the medical instrument support of FIG. **31**A.

FIG. **32**A illustrates a front view of another embodiment of a medical instrument support.

FIG. **32**B illustrates a side cross sectional view of the medical instrument support of FIG. **32**A.

FIG. **33**A illustrates a front view of another embodiment of a medical instrument support.

FIG. **33**B illustrates a side cross sectional view of the medical instrument support of FIG. **33**A.

FIG. **34** illustrates a side view of an embodiment of a cervical dilator.

DETAILED DESCRIPTION

Embodiments of the general uterine manipulator and associated system provide a multipurpose manipulator that may be used for a variety of procedures by interchanging particular fittings of the manipulator. With particular reference to FIGS. **1***a* to **2**, each embodiment of the general uterine manipulator **10** (hereinafter referred to in general as "manipulator **10**") is based on or incorporates an elongated hollow tube **12** defining an internal passage **14**. Tube **12** has opposite first and second ends **16** and **18** and a smooth continuous outer surface **20** of constant outer diameter. A first internal screw thread T**1** is formed at the first end **16** and a second internal screw thread T**2** is formed at the second end **18**.

The versatility of the manipulator **10** and associated system arises from the ability to connect with a number of different fittings depending on the specific application at hand. FIGS. **1***a* and **1***b* illustrate a first fitting in the form of tail screw **22** and a second fitting in the form of a cervical screw **24**. An inner manipulator rod **26** is also illustrated in FIGS. **1***a* and **1***b* which extends through the first fitting **22**, tube **12**, and second fitting **24**.

One form of the first fitting **22** is shown in greater detail in FIGS. **3** to **5**. In this embodiment the first fitting **22** comprises a threaded portion **28**; an integral body portion **30**; and, an internal axial hole **32**. Threaded portion **28** is configured to engage screw thread T**1** and is provided with a transverse slot **34** terminating prior to the body portion **30**. Slot **34** in effect divides the threaded portion **28** into opposed clamp shells **36***a* and **36***b* (hereinafter referred to in general as "clamp shells **36**"). Body portion **30** is in the general form of a cylinder with two flats **38***a* and **38***b* on opposed sides that assist in gripping of the fitting **22**. Axial hole **32** is of constant diameter for the length of the fitting **22** except for a counter sink **40** at a distal end of fitting **22**.

Threaded portion **28** is slightly flared outwardly so as it is screwed into screw thread T**1** at end **16**, the clamp shells **36** move toward each other. When an inner manipulator rod **26** is used in the manipulator **10** this results in a clamping action on the rod providing resistance to movement of the rod **26** so as to hold it at a desired rotational and translational position. Unscrewing of the portion **28** releases or reduces this resistance to enable adjustment of the position and orientation of the rod **26**. Thus the first fitting can be considered in this embodiment as incorporating or comprising a resistance mechanism which substantially maintains the position of the rod **26** until moved or adjusted by a surgeon or other user.

FIGS. **6** to **8** depict an alternate form of the first fitting denoted as **22'**. Features of the fitting **22'** which are of the same or similar configuration or function as those of fitting **22** are denoted with the same reference numbers but with the addition of the prime (') symbol. Fitting **22'** comprises a threaded portion **28'**, body **30'**, an inner axial hole **32'** with counter sink **40'** at a distal end, and opposed flats **38'***a* and **38'***b* formed on body portion **30'**. Fitting **22'** differs from fitting **22** by the omission of slot **34**, the inclusion of a hydrotubation port **42**, and a re-configuring of the axial hole **32'**. With particular reference to FIG. **7** it can be seen that the axial hole **32'** has a first length **44** and a contiguous second length **46**. The first length **44** extends from the threaded portion **28'** for a majority of the axial length of fitting **22'**. The second length **46** extends between and joins the counter sink **40'** to the first length **44**. The inner diameter of the first length **44** is greater than the inner diameter of second length **46'**. Further, the inner diameter of second length **46** is dimensioned to be slightly greater than an outer diameter of the inner manipulator rod **26** forming a close fit but enabling the rod **26** to pass through the axial hole **32'**.

Hydrotubation port **42** is formed in the body **30'** at a location where it communicates with the first length **44**. The thread on threaded portion **28'** is arranged to engage with the thread T**1** at end **16**. In the event that for example the manipulator **10** is being used in a gynaecological application and it is desired to inject a liquid such as a dye to assist in the visualisation of tissue the dye may be injected through the hydrotubation port **42**. The dye then flows through the internal passage **14** and from an opposite end of second

fitting **24** attached to end **18**. In this regard in the event that manipulator rod **26** is in use, a clearance exists between second fitting **24** and an outer surface of rod **26** to allow the flow of dye or other fluid. Further, the close fitting between the rod **26** and second length **46** of axial hole **32'** substantially prevents any back leakage of the dye. Alternately and/or in addition if desired, a rubber grommet seal (not shown) may be provided in the second length **46** to further minimize back leakage of dye or other liquid injected through the hydrotubation port **42**.

As the fitting **22'** does not have the clamping shells **36** of fitting **22** it is unable to clamp inner manipulation rod **26**. However in embodiments of the manipulator **10**, the inner manipulator rod **26** can be bent to varying degrees intermediate of its length so that the rod **26** bears against an inside surface of tube **12** to provide resistance to both axial and rotational motion when fitting **22'** is used. This still allows the rod **26** to substantially maintain its position until moved or adjusted manipulated by a surgeon or other user. Thus the intermediate bend in the rod **26** can be equated with or considered to be another or alternate form of resistance mechanism which substantially maintains the position of the rod **26** until moved or adjusted by a surgeon or other user.

The second fitting **24** of FIGS. **1***a* and **1***b* is shown in greater detail in FIGS. **9***a*, **9***b* and **9***c*. The fitting **24** comprises a threaded portion **48** configured to engage thread T**2**, and an integral body portion **50**. Body portion **50** is of a frusto-conical shape with a decreasing outer diameter in a taper direction D being away from threaded portion **48**. A coarse screw thread **52** is formed about the conically shaped body portion **50**. The crest of thread **52** has a flattened surface orientated so that a line **53** on the surface of the crest is inclined parallel with a central axis **55** of second portion **24**. An axial through hole **57** is also formed through second portion **24**. This allows for the passage of the inner manipulator rod **26** and/or other instruments as well as fluids including saline, dye, and air. In this embodiment of the manipulator **10**, second fitting **24** is a cervical screw which is configured to screw into the cervix forming an attachment point as well as a seal.

However, alternate forms of second fittings may be incorporated in the manipulator **10**. FIGS. **10***a*-**10***d* illustrate an alternate second fitting **24***a*. Fitting **24***a* is in the form of a hollow probe having a threaded portion **48***a* and a body portion **50***a*. Threaded portion **48***a* has a thread configured to engage with thread T**2**. Body portion **50***a* is in the form of a tubular member which is open at its distal end **56** and is closed at an end **58** near threaded portion **48***a* to define or otherwise form a cavity **60**. Distal end **56** is formed with a chamfer or bevel **62** to assist in insertion of the fitting **24***a* into a body cavity such as a vagina or rectum. Fitting **24***a* may be used for example during a hysterectomy to maintain pneumoperitoneum after removal of the uterus. The cavity **60** also allows for collection of pelvic tissue and specimens from the abdominal and pelvic cavities. A lumen (i.e. through hole) **64** may be formed axially through a circumferential wall **66** of the body **50***a*. In one embodiment the lumen **64** may have an internal diameter of approximately 6 mm to enable the receipt of a 4 mm telescope to enable illumination and visualization of tissue in cavities. For example this may be used in pelvic floor operations where the vagina and rectum septum need to be dissected out. This reduces the possibility of a recto-vaginal fistula occurring.

It is envisaged that the fitting **24***a* may be made in a variety of different sizes and in particular different diameters. For example 40 mm outer diameter, 30 mm outer diameter, and 20 mm outer diameter.

FIG. **11** illustrates one form of a forceps holder **70** that may be incorporated in an embodiment of manipulator **10**. The forceps holder **70** is configured to seat on the elongated hollow tube **12** and releasably lock at a desired location along the tube **12**. Forceps holder **70** comprises a first component **72** that is able to slide over and along tube **12** and is provided with detents **74** for gripping a handle of the forceps. Two detents **74** are shown on opposite sides of a central boss **76**. However in other configurations alternate numbers of detent **74** may be provided. The boss **76** is provided with a screw thread **78** extending from a cross piece **80** which contains the detent **74**. Extending axially from the thread portion **78** is a split collar **82**. The forceps holder **70** also includes a locking nut **84** that is able to screw onto the threaded portion **78** over the split collar **82** and act to clamp the collar **82** onto an outer surface of the tube **12** thereby releasably locking the holder **70** at an outside location along the tube **12**. In one example, the forceps holder **70** may be used to hold vulsellum forceps which in turn holds the manipulator **10** to the cervix making the manipulator self-retaining.

With reference to FIGS. **12**-**14***b*, the manipulator **10** may also support a cervical funnel **90** and a plug **92**. The cervical funnel **90** is formed as a unitary device comprising a tube **94** of constant inner and outer diameter and an integral conical portion **96** which increases in outer diameter in a direction away from first end **16** of tube **12**. The conical portion is provided with a lip **98** that extends about a part of the circumference of conical portion **96** and is flared in a radial outward direction.

Plug **92** sits on the outside of funnel **90** and when used in gynaecological procedures forms a plug in the vagina. With reference to FIG. **12**, it can be seen that the forceps holder **70** may also act as a positioning device for the funnel **90**.

FIGS. **13***a* and **13***b* depict in greater detail the cervical funnel **90** incorporated in the manipulator **10** shown in FIG. **12**. The lip **98** is flared outwardly by an angle θ of approximately 130° but may lay in the range of 130°-160°. In this embodiment the outermost edge of the lip **98** extends for an arc α of approximately 115° about the conical portion **96** but may lay in the range of about 100°-130°. An inside diameter of the tube **94** is arranged to be slightly greater than the outer diameter of the tube **12** to enable the cervical funnel **90** to be rotatably and linearly moveable with respect to the tube **12**.

FIGS. **14***a* and **14***b* depict in greater detail the vaginal plug **92** shown previously in FIG. **12**. The plug **92** has a main body **100** formed of a constant outer diameter and a contiguous distal end portion **102** of progressively reducing outer diameter tapering to the distal end **104** of the plug **92**. When the plug **92** is used with the manipulator **10**, it is orientated so that the distal end portion **102** is directed toward the second fitting **24**. An interior surface **106** of the plug **92** has a first portion **108** of constant inner diameter, and a contiguous second portion **110** of progressively increasing outer diameter. More particularly, the surface of the portion **110** is arranged to seat an exterior surface of the conical portion **96** of cervical funnel **90**. Thus the increase in inner diameter of the surface of portion **110** is substantially the same as the angle of increasing diameter of the outer surface of conical portion **96**.

FIG. **15** depicts an optional handle **120** incorporated in embodiments of the manipulator **10**. The handle **120** comprises a grip **122** and a contiguous extension **124**. The extension **124** is provided with a through hole **126** and a screw thread **128**. The screw thread **128** extends from approximately the location of the hole **126** to an end **130** of

the handle **120**. The through hole **126** is dimensioned to enable the tube **12** to pass there through either with a slight interference fit or a small clearance. Thus the handle **120** extends perpendicular to the tube **12**. The screw thread **130** is configured to enable coupling with a nut such as a second locking nut **84**. The locking nut when tightened on screw thread **128** can then act to clamp the handle **120** to the tube **12**. The handle **120** can be applied to any portion of the tube **12** between the end fittings **22** and **24** which is not otherwise covered by other components such as the cervical funnel **90**.

From the above description it will be recognised that dependent on the application at hand the manipulator may take many different forms owing the interchangability of first and second fittings and the ability to use additional components such as the rod **26**, the forceps holder **70**, cervical funnel **90** and the plug **92**. It is envisaged that a general uterine manipulator system or kit may be provided to surgeons and doctors composed of all or at least a selection of the first and second fitting; together with other components such as the rod **26**, forceps holder **70**, cervical funnel **90** and the plug **92**. In this way the surgeon or doctor will always have at hand various components to enable the performance of many different procedures.

FIGS. **16***a*-**16***d* illustrate a further form of a second fitting **24***b* which primarily differs from the second fitting **24***a* by the inclusion of an illumination device **140**. Features of the fitting **24***b* that have the same structure or function as the fitting **24***a* are designated with the same reference numbers. In this embodiment the illumination device **140** is in the form of a ring **142** fitted to or otherwise supported at the distal end **56** of fitting **24***b*. The illumination device **140** enables light to be emitted from the distal end **56**. In one form the ring **140** is a ring of material embedded with one or more light emitting diodes (LEDs) **124**. In this embodiment ring **142** may be made from a transparent acrylic resin. Power to the LEDs **144** is provided via a cable **146** that extends through the lumen **64**. In the embodiment the lumen **64** may nevertheless be configured to also receive a telescope to enable visualization of the body cavity into which the fitting **24***b* is inserted. In a variation of the illumination device **140**, the ring **142** itself comprises a light guide that receives light from an optical fiber that passes through the lumen **64**. Light transmitted through the optical fiber enters and travels about the ring **142** thus enabling the emission of light from the distal end **56**.

FIGS. **17***a*-**17***c* depict a cervical funnel **90***a* which differs from the cervical funnel **90** by the provision of a light emitting device **140***a* enabling the emission of light form distal end **99** and more particularly from the **98** of the funnel **90***a*. The funnel **90***a* has essentially the same physical structure as a funnel **90** and accordingly includes a first conical portion **96** and integrally formed tube **94**. The lip **98** extends partly about an opening **101** formed at the distal end **99**. The illumination device **140***a* comprises an arcuate transparent body **142***a* which may for example be made from of a transparent acrylic resin. Coupled to the body **142***a* is an optical fiber **146** which is arranged to transmit light from a source to the body **142***a*. The body **142***a* has a configuration enabling it to be attached to the lip **98** in a manner so as to form a substantially continuous surface of the lip **98**. The optical fiber **146** extends can through a channel or hole **148** formed in the funnel **90***a*. In one embodiment, a channel or groove can be cut in the exterior surface of the body **90***a* in which the optical fibre **146** is laid. Thereafter the groove can be filled with a resinous material and smoothed, effectively encapsulating the fiber **146** in the funnel **90***a*. A coupling **148** at the end of the optical fiber **146** enables coupling with a light source or another optical fiber which carries light from the light source. In a variation to the illumination device **140***a*, the body **142***a* may have embedded therein one or more LEDs which when provided with electric current either: emit light directly from the body **142***a*; or alternatively transmit light into the body **122***a* from which it is emitted. In the event that the body **122***a* carries one or more LEDs, then the optical fiber **126** is replaced with a wire or cable to provide electrical power to the LEDs.

FIG. **18** illustrates a manipulator **10** similar to that shown in FIG. **12** but with a modified cervical funnel **90***b* and a motor **150** arranged to rotate the cervical funnel **90***b* on, and relative to, the tube **12**. The motor **150** is held within a housing **152** which is supported on a bracket **154**. The bracket **154** is a squared U shaped configuration with opposed arms. The motor **150** is attached to one of the arms and a clamp **155** attached to the other arm. The clamp **155** can be operated to selectively grip and release the tube **12**. When the clamp **155** is tightened it grips the tube **12** preventing axial or rotational motion of the tube **12**.

The cervical funnel **90***b* is provided with a wave like outer surface profile on its tube **94** as depicted most clearly in FIG. **19**. Successive troughs **156** and peaks **158** of the wave like profile act as rounded gear teeth about the periphery of tube **94***b*. These engage with a complementary shaped annular gear **160** driven by the motor **150**. When the motor **150** is energized it rotates the gear wheel **160** and, due to its engagement with the outer surface of the tube **94***b*, causes the funnel **90***b* to rotate about and on the tube **12**. Due to the manner of engagement of the motor **150** with the outer surface of the tube **94**, the funnel **90***b* can be slid linearly along the tube **12** while maintaining engagement with the motor **150**. The bracket **154** is attached to an arm **162** that in turn can be clamped on to a stable support such as an operating table. A foot controlled switch **164** communicates with the motor **150** via a cord **166**. A surgeon is able to operate the motor **150** by the foot operated switch **164**. The motor may be in the forms of a bi-directional stepper motor and the switch arranged to control the direction of rotation. The illuminating device **120***a* depicted in FIGS. **17***a*-**17***c* may also be incorporated with the funnel **90***b*.

FIGS. **20***a*-**20***c* illustrate variations of a medical instrument that may be used with the manipulator **10**. In FIG. **20** the medical instrument **170** comprises in effect the second fitting **24***a* or **24***b* formed back to back and integrally with the cervical funnel **90** or **90***a*. The second fittings **24***a*, **24***b* differs slightly from those previously described in that they does not comprise a thread portion **48** but rather have a through hole at their proximal end **172** that communicates with the tube **94**. Instrument **170** may be considered as comprising a body **174** provided with opposite first and second end portions **176** and **178**. First end portion **176** has a first opening **180** and the second end portion **178** has a second opening **182**. A throughway **184**, constitute by the tube **94** extends between the first and second openings **180** and **182** and is arranged to enable the body **174** to be supported on a shaft such as the tube **12**. With reference to FIG. **1***a*, if the end of the manipulator **10** provided with the cervical screw **24** is taken is the leading end, then the instrument **170** can be supported on the tube **12** with either of the first and second end portions **176**, **178** at the leading end of the manipulator **10**. Whichever of the end portions **176** or **178** is at the leading end will be inserted into the body cavity during a medical procedure.

In the embodiment in FIG. **20**, it can be readily seen that the end portions **176** and **178** differ in one or more of their shape, size and configuration. In particular in FIG. **20**, the

end portions **176** and **178** differ in at least their shape and configuration. End portion **176** has an outer diameter D**1** measured in a plane of the opening **180** while the end portion **178** has an outer diameter D**2** measured in a plane containing opening **162**. In this embodiment D**1** may equal D**2** or alternatively D**1** and D**2** may be different.

FIG. **21** illustrates an alternate form of medical instrument denoted as **170***a* comprising an opposite first and second end portions **176***a* and **178***a* respectively joined by an integral tube **94**. Each of the portions **176***a* and **178***a* is of the general configuration of the portion **178** described in FIG. **20** but with different outer diameters D**1** and D**2**. In particular in this embodiment D**1** is less than D**2**. Instrument **170***a* would be used in substantially the same manner as the second fitting **24***a* or **24***b*. However having the two end portions of different diameters D**1** and D**2** allows a medical specialist to simply use the end of instrument **170***a* which is dimensioned for the best suit the body cavity into which it is to be inserted.

FIG. **22** illustrates a form of the medical instrument **170***b* in which the first and second end portions **176***b* and **178***b* are both of the same general frusto conical configuration as the first end portion **176** in FIG. **20**. The difference between the end portion **176***b* and **178***b* being their respective outer diameters D**1** and D**2**. In this specific embodiment D**1** is greater than D**2**. When the instrument **170***b* is used with the manipulator **10** a medical specialist orientates the instrument **170***b* with the end portion **176***b* or **178***b* at the leading end determined on the basis of the best match of outer diameter D**1** or D**2** to the vagina in to which it is to be inserted.

The instruments **170-170***b* may be considered to be double ended instrument as each of the end portions **176-176***b* and **178-178** is configured to be inserted in a vagina or rectum. FIGS. **23***a*-**23***c* illustrate a further form of double ended instrument **200** for insertion into a body cavity. Double ended instrument **200** comprises a body **202** having a first probe **204***a* and a second probe **204***b* (referred to in general as "probe(s) **204**") at one end **206** and an opposite end **208** respectively of the body **200**. The same reference numbers will be used to denote the same features of each probe. Reference number that includes the suffix "a" relate to the features of probe **204***a*; reference the number that includes the suffix "b" relate to the features of probe **204***a*; and reference numbers with no suffix "a" or "b" refer the feature in general pertaining to either probe **204***a* or **204***b*.

The first probe **204***a* has a cylindrical portion **210***a* of a first circumferential surface **212***a* having an outer diameter Da. Probe **204***a* is also provided with a first circumferential edge **214***a* at the first end **206** and a first lip **216***a* projecting outwardly from the outer circumferential surface **212***a* and beyond the first circumferential edge **214***a*. The first lip **216***a* extends for a part of the circumference of the edge **214***a*. The lip **216***a* may extend for between 100-130° of the circumference. This is akin to the angle α and the angular extent of the lip **98** shown in FIG. **13***c*.

The second probe **204***b* has the same general configuration as the probe **204***a* but with several differences including in dimensions of various aspects. The probe **204***b* has a cylindrical portion **210***b* with an outer circumferential surface **212***b* having an outer diameter Db. At the end **208** the probe **204***b* is formed with a second circumferential edge **214***b* and a second lip **216***b*. The second lip **216***b* projects outwardly from the outer circumferential surface **212***b* and beyond the second circumferential edge **214***b*.

In this embodiment the diameters Da and Db are different from each other. In particular Da is >Db. In one example the diameter Da is about 40 mm while the diameter Db is about 30 mm. A further difference in the dimensions and configuration of the probes **204***a* and **204***b* is that the lip **216***b* projects at a greater angle θ with respect to its corresponding adjacent second outer circumferential surface **212***b*. As a result the lip **216***b* is inclined at a shallower angle to a central longitudinal axis of the instrument **200** than lip **216***a*. In a general sense, each of the lips **216** projects at an angle θ relative to its adjacent circumferential surface **212** where θ is in the range of 130°-160°. This is akin to the angle θ of the lip **98** shown in FIG. **13***b*. However in this specific embodiment the angle of projection of the lip **216***a* is about 140° whereas the angle θb for the lip **216***b* is about 154°.

A further difference between the probes **204** is the axial difference by which each of the lips **216** project in the axial direction. The lip **216***a* which is inclined at a steeper angle than the lip **216***b* projects in an axial direction from a location immediately adjacent the outer circumferential surface **212***a* by a length La. The length La is different to and shorter than the length Lb of axial extent of the lip **216***b*. In one specific example, the distance La may be in the order of 9 mm where the distance Lb may be in the order of 13 mm.

Probe **214***a* is provided with an internal cavity **220***a* of circular cross section and having an inner diameter **222***a*. The outer circumferential edge **214***a* is formed by tapering or flaring the material of the probe **204***a* at the end **206**. The angle of the taper is shown as angle β in FIG. **23***b* and may lie in a range of 110°-140°. However in this specific embodiment flaring angle β is 130°.

The internal configuration of the probe **204***b* is generally the same as that of probe **204***a* but with different dimensions. Specifically, the probe **204***b* has an internal cavity **220***b* with an internal diameter **222***b* which is not the same as and more particularly smaller than the internal diameter **222***a*. In one example the diameter **222***a* is about 35 mm and the diameter **222***b* is about 35 mm. The probe **204***a* at the end **208** is also tapered to reduce in thickness at an angle β*b* which is different to and in this embodiment less than the angle β*b*. In one example, the angle β*b* may be 116°.

The probe **200** is formed so that the lips **216** have respective circumferential mid points **224***a* and **224***b* that are in axial alignment. Thus when one probe **204** is inserted into a body cavity with the other probe outside of the cavity, a surgeon is able to easily visualize the position of the lip on the inserted probe by simple reference to the position of the lip of the non-inserted probe. The arcuate extend of the lips **216**, i.e. the angles αa and αb can be arranged to be the either the same or different. However in this specific embodiment the angle αa>αb.

The double ended probe **200** is also formed with an intermediate portion **226** that smoothly transitions between the probes **204***a* and **204***b*. The probe **226** has a central region **228** which is necked and has an outer diameter less than each of the diameters Da and Db. Thus, the outer circumferential surface **230** of the intermediate portion **226** has a concave profile. In one example the overall length of the probe **200** is about 230 mm with each probe **204** having a length of 85 mm and the intermediate portion having a length of 60 mm.

As shown most clearly in FIG. **23***b*, the intermediate portion **226** is formed with an internal bore **228** that extends in an axial direction between and providing fluid communication with the first and second cavities **220***a* and **220***b*. The bore **228** enables the double ended instrument **200** to be supported on the manipulator **10** and in particular the hollow tube **12** in the same manner as the funnel **90** and the medical instruments **170**, **170***a* and **170***b*.

In a general sense, the double ended medical instrument **200** comprises a combination of the instrument **170***a* shown in FIG. **21** but with the addition of the funnel lips **98** and a reshaping and smoothing of the tube **98** and respective adjacent back ends of the portions **176***a* and **178***a*.

FIGS. **24***a*-**24***c* depict a further embodiment of a double ended medical instrument. In this embodiment the double ended medical instrument is denoted by the reference number **300**. The medical instrument **300** is a modified form of the medical instrument **200**. All features of the medical instrument **300** that are the same as those of the medical instrument **200** are denoted with a reference number incremented by 100. For example, the probes of the medical instrument **300** are denoted by the numbers **304***a* and **304***b*, the lips are denoted by the reference numbers **316***a* and **316***b* and the intermediate portion is denoted by the reference number **326**. Also as with the numbering convention for the instrument **200**, reference number that includes the suffix "a" relate to the features of probe **304***a*; reference the number that includes the suffix "b" relate to the features of probe **304***a*; and reference numbers with no suffix "a" or "b" refer the feature in general pertaining to either probe **304***a* or **304***b*.

The double ended medical instrument **300** differs from the double ended medical instrument **200** solely by the provision of a platform **350***a* on the probe **304***a*; and a platform **350***b* on the probe **304***b*. Platform **350***a* has a constant first outer diameter extending over the cylindrical portion **310***a*. More particularly, the platform **350***a* has an outer circumferential surface **352***a* that is concentric with the outer circumferential surface **310***a* but of a greater radius. The platform **350***a* extends rearwardly from the outer circumferential edge **318***a* of the corresponding lip **314***a*. Also in this example the circumferential extent of the platform **350***a* is the same as that of the underlying lip **316***a*. The platform **350***a* extends in an axial direction toward the second probe **304***b*. Thereafter, the platform smoothly transitions from its rearward edge **354***a* to the circumferential surface **310***a*. This transition forms a ramp **356***a* between the outer circumferential surfaces **352***a* and **310***a*. Opposite sides **356***a* and **358***a* of the platform **350***a* transition smoothly to the outer circumferential surface **318***a*. Indeed rounded surfaces can be provided between the outer circumferential surfaces **352***a* and the sides **356***a* and **358***a*.

In this embodiment, the length Pa, that is the axial length of the platform **350***a* is in the order of 20 mm. While this distance may be varied and in particular extended the significance of the 20 mm length will be described in greater detail below. Suffice to say that it is possible to increase this length to say 30 or 40 mm and have tactile markers for example circumferential ridges or circumferential grooves at various set distances or lengths such as 20 mm, 25 mm, 30 mm, 35 mm.

The platform **350***b* is of the same general shape and configuration as the platform **350***a*. However the radius of the platform **350***b* is different to and in this embodiment smaller than the radius of a platform **350***a*. Further, as the lip **314***b* is formed with a smaller arc angle αb, the circumferential width of the platform **350***b* is smaller than that of platform **350***a*. However, the axial length Pb of the platform **350***b* in this embodiment is the same as the length Pa.

Each of the double ended medical instruments **200** and **300** may be used in laparoscopic gynecological surgery and in particular, for laparoscopic hysterectomy. The instrument **200** may be considered as a "standard" model and the instrument **300** as an "oncology" model.

Each of the medical instruments **200** and **300** can be slid over the uterine manipulator and in particular the tube **12** as described herein above in relation to the instruments **170**, **170***a* and **170***b*. Alternatively, the medical instruments **200** and **300**, and other medical instruments disclosed herein, can be inserted into a body cavity on their own without the uterine manipulator. In some embodiments, as further described below, a plug is inserted into the medical instrument to pneumatically plug the medical instrument when the medical instrument is inserted into a body cavity without the uterine manipulator. The specific probe which is inserted is simply dependent upon the size of the cavity at hand. An advantage or benefit of the instruments **200** and **300** over say the instrument **170***b* shown in FIG. **22** is that as the probe **204** or **304** is of a cylindrical shape rather than in the form of a frusto conical funnel, the outer surface **210** can act as a stopper in say the vaginal cavity to prevent leakage of CO_2 gas. Thus the probes **204** may be considered as integral functional combination of the instrument **170***b* shown in FIG. **22** together with respective plugs **92**. In this way the instrument **200**/**300** can replace the instrument **170***b* and respective stops **92** for each of the portions **176***b* and **178***b* of the instrument **170***b*.

The lips **216**/**316** function as previously described to present the vaginal vault tissue for incision. After a hysterectomy is performed and the uterus is delivered through the vagina, usually an appropriate sized probe is inserted to prevent CO_2 leakage. This function is now performed as mentioned before by the provision of the cylindrical probes **204**/**304**. A suture needle can be placed in the cavity **220**/**320** of the inserted probe **204** to be picked up by a laparoscopic needle holder to subsequently suture the vaginal vault.

The instrument **300** by virtue of the provision of the platforms **350** may be used in oncology procedures relating to cervical cancer. When cervical cancer is detected in the early stages, common procedure is to remove a 20 mm cuff from the vagina to adequately excise cancer tissue. Usually there is no indicator of how much margin to incise apart from the surgeon's subjective perception of adequate cuff removal. The instrument **300** provides a platform **350** of known length for example 20 mm to indicate to the surgeon the line of incision to remove an adequate margin of vaginal cuff. By rotating the lip **314** the vaginal margins are freed from the bladder anteriorly, the uterine vessels laterally and the rectum posteriorly, ensuring that these important structures are clear from the vaginal cuff before the vaginal incisions are made. The principles and functions of the instrument **300** is the same as the standard instrument **200** after the uterus and cervix is removed.

To the best of the Applicant's knowledge there is no vaginal marker colpotomizer available to accurately measure the vaginal margin of clearance that is required for gynecological oncology cases both in laparoscopy and open incision or laparotomy surgery. If too much vaginal tissue is removed the shortened vagina will make intercourse uncomfortable. Conversely, inadequate margins will result in cancer recurrences. Current practice is to gauge the depth of vaginal margin by estimation, and every surgeon has their own estimation method. Embodiments of the instrument **300** provide an accurate measuring tool for adequate vaginal margin removal to ensure the patient has the best clearance result and the best chance to have a functioning vagina. The platforms **350** provide a hard surface to push away the bladder anteriorly and the rectum posteriorly. The lips **314** ensure adequate ureteric displacement. The vagina is dis-

sected at the edge of the platform **250**. This can be performed in a number of different ways including but not limited to:

(a) a knife cutting along the end of the platform **350**;

(b) cautery or cutting current being applied by a hook electrode or sharp scissors to the edge of the platform **350**;

(c) harmonic scalpel energy to incise the vagina at the edge of the platform **350**;

(d) a recessed trough at an edge of the platform **350** to guide vaginal incisions;

(e) by providing a hole near an edge of the platform **350** into which an electrode, monopolar or bipolar is inserted. In this event by rotating the instrument **300** the vagina is incised by the energy source being applied.

FIG. **26** depicts one end only of a further embodiment of a double ended medical instrument **300'** which differs from the instrument **300** by virtue of its platforms **350'** and the lips **314'** that extend for the full circumference of the respective probe **304'**. (The opposite end of the instrument **300'** is of the same general configuration as shown in FIG. **26** but with the probe **304'** at that end being of a different dimension akin to the differences between probes **204***a* and **204***b*; or **304***a* and **304***b*.) The instrument **300'** can be used in laparotomy or open surgery. In these cases, the platform can be directly palpated hence there is no need to rotate the lip **314'**/platform **350'** to visualize the margin as in laparoscopic surgery. By a direct palpitation the vaginal margin is reflected before incisions are made to remove a desired length of vaginal cuff, for example 20 mm.

As mentioned hereinbefore, the platform of the instrument **300** or **300'** used in laparotomy or open surgery can be provided with an axial length P greater than say 20 mm with palpatible markings such as circumferential ridges or grooves at set lengths or distances to provide an indication of a precise length of vaginal cuff for incision. This is shown for example in FIGS. **24***d*-**24***g* where markings M**1**-M**4** are provided on the platform **350** at spacings of 20 mm, 25 mm, 30 mm, and 35 mm from the outer edge of associated lip **316**. In FIG. **24***e* the markings M are ridges, in FIG. **24***f* the markings M are grooves, and in FIG. **24***g* the markings M comprise sets of immediately adjacent circumferential grooves and troughs. The double ended medical instrument with the platform and lip that extend wholly about the respective probes **304** may be termed as the laparotomy double ended instrument.

In the case of sacrocolpopexy where the bladder and rectum are reflected back to facilitate placement of mesh on the vagina, the platforms **350**/**350'** in both the oncology and laparotomy double ended medical instrument provide a solid dissecting base. However in the event of use of the oncology double ended medical instrument **300** rotation may be required in order to place the platform **350** in the appropriate location. Clearly no rotation is required for the laparotomy double ended medical instrument **300'**.

A double ended plug **370** shown in FIG. **25** can be used with the either of the standard, oncology or laparotomy double ended medical instrument. The plug has an axially aligned and opposite cylindrical stems **372** of a diameter that provides a light interference fit with the inner circumferential surface at one end of the bore **228**,**328** of the intermediate portions. Between the stems **372** is a large diameter cylindrical portion **374** and an intermediate diameter cylindrical portion **376**. The portion **374** is dimensioned to form a light interference fit with the cavity **220***a*, or **320***a*; and portion **376** is dimensioned to form a light interference fit with the cavity **220***b*, **320***b* of the probes **204***b* or **304***b*. The plug when fitted into the corresponding end of the medical instrument forms a fluid seal at that end of the seal. Naturally the plug **370** can only be used when the double ended instrument is not supported on the manipulator **10**. It is envisaged that the plug **300** would be used to assist in maintaining pneumoperitoneum when the double ended instrument is used without the manipulator **10**. In exactly the same way the plug **370** can be used with any one of the instruments, **170**, **170***a* and **170***b* shown in FIGS. **20**-**22**.

In some embodiments, a medical instrument, such as, for example, the various double ended medical instruments and cervical funnels described herein, is configured to maintain pneumoperitoneum without requiring a plug. For example, the medical instruments shown in FIGS. **20**-**22** may comprise a solid central section instead of a tube **94** with a throughway **184**. In such an embodiment, the first opening **180** and second opening **182** are not in fluid communication with each other through the central section and therefore no plug is required. Further, in such an embodiment, there is no throughway **184**, so a tube **12** cannot pass through the medical instrument. This may be advantageous for users that do not desire or require, for example, uterine manipulation, such as with some laparoscopy or laparotomy.

FIGS. **27***a*-**27***d* illustrate further variations to the cervical funnel **90***c*. The funnel **90***c* is of the same general shape and configuration and works in the same way as funnel **90**, but differs by the provision of a through hole **190** in the lip **98**. The through hole **190** is provided mid way along the arc of the lip **98**. Optionally the funnel **98** may also comprise an illumination device **192**. In this embodiment the illumination device **192** is in the form of an annular light guide coupled to an optical fiber. The annular light guide **192** surrounds the through hole **190**. When the optical fiber is coupled to a light source the light is guided by the fiber **194** to the annular light guide and illuminates the annular light guide **192** providing a ring of light about the hole **190**. The annular light guide **192** can be in the form a transparent acrylic resin ring. The optical fiber **194** can be embedded/encapsulated in a groove formed along the cervical funnel **90***d*.

The hole **190** is dimensioned to receive the tip of an electrical cautery probe. During say a hysterectomy the probe is inserted into the hole **190**. It is believed that the hole **190** will ordinarily be easily visible or locatable by a surgeon. However the provision of the illumination device **192** will assist in visually locating the hole **190**. The electrical cautery probe is inserted through the vagina wall (which is being lifted by the lip **98**) and into the hole **190**. By applying electric current and rotating the funnel **90***d* a very clean and precise circumcision can be made of the vaginal wall to separate it from the cervix.

The through hole **190** may also of course be incorporated in every other form of cervical funnel described hereinbefore. As can the annular light guide **192**.

FIGS. **28**A-**28**C illustrate a further embodiment of a double ended instrument **2800**. The double ended instrument **2800** is similar in design to the double ended instruments **200** and **300** illustrated in FIGS. **23**A-**23**C and **24**A-**24**C, respectively. The double ended instrument **2800** comprises a first probe **2804***a*, a second probe **2804***b*, and an intermediate portion **2826** positioned between the first and second probes. Unlike the double ended instrument **300**, which comprises a generally concave intermediate portion positioned between that double ended instrument's first probe and second probe, the double ended instrument **2800** utilizes

a generally cylindrical central region **2828** with generally tapered transition regions **2829***a* and **2829***b* positioned at either end.

As with other embodiments of double ended instruments, the first probe **2804***a* and second probe **2804***b* comprise cylindrical portions **2810***a* and **2810***b* which may be utilized, for example, as a plug to maintain pneumoperitoneum. The transition regions **2829***a* and **2829***b* can be configured to have a generally tapered shape to transition between an outer diameter of the central region **2828** and an outer diameter of each probe to, for example, enable smooth insertion into and retraction from a body cavity.

The double ended instrument **2800** further comprises a first lip **2816***a* and a second lip **2816***b* configured to operate similarly to the lips **216***a* and **216***b* of the double ended instrument **200**. Namely, the first lip **2816***a* and second lip **2816***b* can be configured to, for example, present the vaginal vault tissue for incision. The double ended instrument **2800** further comprises a first marker lip **2817***a* and a second marker lip **2817***b* positioned a longitudinal distance **2850***a* and **2850***b*, respectively, from the first and second lips. In this embodiment, the distances **2850***a* and **2850***b* are each approximately 20 millimeters. The first and second marker lips can be utilized to, for example, act as visual landmarks to indicate where a surgeon should cut. For example, the double ended instrument **2800** may be utilized in oncology procedures, similar to as described above, to enable a surgeon to easily determine where to cut to remove the cuff from the vagina to adequately excise cancer tissue.

Although in this embodiment, the marker lips **2817***a* and **2817***b* are positioned approximately 20 millimeters in an axial or longitudinal direction away from the first and second lips, in various other embodiments, the marker lips can be positioned different distances away from the first and second lips to accommodate different lengths or margins of vaginal cuff to excise. In some embodiments, more than one marker lip is positioned on each of the probes. For example, multiple marker lips may be positioned at various distances from the first or second lip, similar to the indicators illustrated in FIGS. **24**D through **24**G. Further, in this embodiment, the outer edges of the first marker lip **2817***a*, first lip **2816***a*, second marker lip **2817***b*, and second lip **2816***b* comprise approximately the same included angle **2860**. However, in other embodiments, the outer edges of the marker lips may comprise a smaller or a larger included angle than the first or second lips. Further, although the marker lips in this embodiment are illustrated as being rotationally aligned with the first and second lips along a central axis of the double ended instrument **2800**, in other embodiments, the marker lips may be positioned at a different rotational orientation relative to the first and second lips and/or each other.

The double ended instrument **2800** further comprises a first cavity **2820***a*, a second cavity **2820***b*, and an internal bore **2829**. The first and second cavities and internal bore can be configured to operate similarly to the internal cavities and bores of the double ended instruments **200** and **300** as further described above.

Pneumatic Plug

FIGS. **29**A-**29**C illustrate an embodiment of a plug **2900**. The plug **2900** can be configured to operate similarly to the plug illustrated in FIG. **25**, in that the plug **2900** can be configured to pneumatically plug, for example, a double ended instrument, such as the double ended instruments illustrated in FIGS. **28**A-**28**C, **24**A-**24**C, and **23**A-**23**C. Note that, while the plug **2900** is described in this disclosure in relation to double ended instruments, such a plug may further be used with various other embodiments of cervical funnels, colpotomizers, and/or the like.

The plug **2900** comprises a first stem **2908**, a second stem **2902**, a central region **2904**, and a tapered region **2906**. The second stem **2902**, in some embodiments, is configured to be inserted into an internal bore of a double ended instrument to plug the internal bore to maintain pneumoperitoneum. The plug **2900** would take the place of, for example, a hollow tube **12** as further described above. In this embodiment, the second stem **2902** is configured to be generally tapered to ease installation into and retraction from an internal bore, such as the internal bore **2829** illustrated in FIG. **28**B. In this embodiment, the second stem **2902** comprises an approximately 12 millimeter outer diameter at a distal end and tapers to an approximately 13.8 millimeter outer diameter at a proximal end where the second stem **2902** meets the central region **2904**. In some embodiments, as illustrated in FIG. **29**B, the plug comprises a tapered region **2903** between the second stem **2902** and central region **2904**. In some embodiments, the internal bore **2829** of the double ended instrument **2800** comprises an inner diameter of approximately 13.1 millimeters. Accordingly, the tapered second stem **2902** can be easily guided into the internal bore **2829** to generate an interference fit with the internal bore **2829** to enable an airtight or substantially airtight seal.

In some embodiments, the central region **2904** and/or the tapered region **2906** can be configured to generate an interference fit with one or more cavities of a double ended instrument to generate an airtight or substantially airtight seal. For example, in some embodiments, the second cavity **2820***b* illustrated in FIG. **28**B comprises an approximately 25 millimeter inner diameter. Further, the central region **2904** of the plug **2900**, in some embodiments, comprises an outer diameter of approximately 25 millimeters to enable an interference fit with the second cavity **2820***b*. In some embodiments, both the second stem **2902** and central region **2904** are configured to generate interference fits with a double ended instrument. In other embodiments, only one or the other is configured to generate an interference fit with a double ended instrument.

In some embodiments, the first stem **2908** can also be configured to generate an interference fit with, for example, an internal bore of a double ended instrument. In other embodiments, the first stem **2908** can be configured to operate merely as a handle to ease insertion and retraction of the plug **2900**. In some embodiments, the tapered region **2906** can also or alternatively be configured to form an interference fit with an internal bore or cavity of a double ended instrument.

Pig Colpotomizer

FIGS. **30**A-**30**C illustrate a double ended medical instrument or pig colpotomizer **3000**. The double ended medical instrument **3000** has some features in common with the various medical instruments described above for use in, for example, laparoscopic hysterectomies. However, the double ended instrument **3000** is configured to be used with a pig, rather than a human.

When surgeons are training for laparoscopic surgery, the surgeons often use an animal model to teach laparoscopic techniques which involve incisions, dissections, energy use, and suturing. Various organs in an animal model are deliberately incised or removed to simulate events in the human patient. In the case of laparoscopic abdominal or vaginal surgery, piglets are typically weaned at four weeks old and then fed for another two weeks so that they weigh approximately 30 kilograms. Their abdominal cavities then suffi-

ciently simulate a human and are suitable to be used for laparoscopic surgery training. The piglets' reproductive organs, however, especially the vagina, are typically not fully developed in size at this point. This is because female pigs typically breed at nine months, when they are sexually mature and weight approximately 120 kilograms.

Performing a total laparoscopic hysterectomy (TLH) using pigs is challenging anatomically due to, among other things, differing anatomy of the reproductive organs and small organ size, especially with the vagina, due to the relatively young age of the animals used. Accordingly, performing a successful TLH on a piglet has historically been a difficult task.

The pig colpotomizer or double ended instrument **3000** illustrated in FIGS. **30**A-**30**C is configured to enable a surgeon to successfully perform a TLH on a young pig. A typical piglet's vagina is approximately 100 millimeters to 140 millimeters long. At the end of the vagina, an inner sleeve of cervix is attached. The cervix is connected to a short central body from which two uterine horns arise. In these horns, future piglets develop. At the end of each uterine horn there is an ovary and fallopian tube. Past hysterectomy workshops on a pig have involved resection of the central cervical body where the two uterine horns meet, not the vaginal-cervical junction as in a true TLH. Additionally, resection at the vaginal-cervical junction involves securing the uterine vessels either by energy or ligating, a step that most closely simulates TLH in the human. The technique of vaginal-cervical resection is not possible without a colpotomizer, such as, for example, the double ended medical instrument **3000**, to accurately outline and delineate this anatomical landmark.

The double ended instrument **3000** comprises a colpotomizer portion **3004** and a dilator portion **3002**. The instrument **3000** comprises generally an elongated cylindrical tool having the dilator portion **3002** on approximately one-half of the device and the colpotomizer portion **3004** on the other half. In some embodiments, an overall length of the instrument **3000** is approximately 250 millimeters. However, in other embodiments, the overall length and the length of each portion can vary.

The dilator portion **3002** is configured to gently dilate a pig's vagina by utilizing multiple graduated regions **3008**. The dilator portion **3002** begins with a first end **3007** having a first outer diameter. The multiple graduated regions **3008** increase in diameter until the dilator portion **3002** meets the colpotomizer portion **3004**, which has a cylindrical portion **3010** of a larger diameter than the nearest graduated region **3008** of the dilator portion **3002**. In some embodiments, the graduated dilator commences at six millimeters outer diameter and increases to ten millimeters outer diameter in one millimeter increments. For example, the first end **3007** may be approximately six millimeters in outer diameter, while the cylindrical portion **3010** is approximately ten millimeters in outer diameter, with each graduated region **3008** comprising a diameter between six and ten millimeters.

In some embodiments, the cylindrical portion **3010** comprises an overall length of approximately 120 to 140 millimeters. The cylindrical portion **3010** comprises at one end an asymmetrical funnel or lip **3016**. The lip **3016** can be configured to operate similarly to the lips illustrated in various other embodiments as described herein. The included angle **3060** of the lip **3016** can vary, as with other embodiments.

In use, the double ended instrument **3000** is operated by first inserting the dilator portion **3002** into the pig's vagina to dilate the vagina. Then, the double ended instrument **3000** is extracted, and the colpotomizer portion or asymmetrical funnel end is inserted and advanced to the end of the cervical canal. Similar to with the other cervical/vaginal funnels as further described above, when the colpotomizer is rotated, the asymmetrical end with the raised lip **3016** is configured to raise the vaginal vault (the junction between the cervix and the vagina) to, for example, indicate placement of the vaginal incision to the surgeon. After incision of the vagina to free the cervix, the cervix, uterus, ovaries, and tubes, which have been dissected prior to the vaginal incision technique, can be placed into the vaginal canal by gently pulling out the colpotomizer **3000**. After extraction of the tissue, the colpotomizer **3000** can be inserted back into the vagina to prevent CO_2 leakage while the vaginal vault opening is closed by sutures. For example, the cylindrical portion **3010** can be configured to form an airtight or substantially airtight seal with the vaginal tissue.

In this embodiment, the colpotomizer **3000** is a solid device, unlike the hollow embodiments further described above as used with humans. One reason for this is that, in human operations, uterine manipulation is often required. However, in pig hysterectomy operations, uterine manipulation is often not required.

In some embodiments, the pig colpotomizer **3000** can be held in place in the pig's vagina by a person. In other embodiments, a medical instrument support is utilized to hold the medical instrument in position in the pig's vagina. For example, embodiments of such medical instrument supports can be seen in FIGS. **31**A-**31**B, **32**A-**32**B, and **33**A-**33**B. FIGS. **31**A and **31**B illustrate an embodiment of a medical instrument support **3100**. The medical instrument support **3100** comprises a generally circular disc having an outer diameter **3102** of approximately 60 millimeters to 80 millimeters, and a width **3104** of approximately ten millimeters. Note that, although the medical instrument support **3100** and other medical instrument supports described in this disclosure generally comprise a circular disc shape, various other shapes and sizes may be utilized as long as the medical instrument support adequately performs the functions as described herein with respect to supporting, for example, a pig colpotomizer.

The medical instrument support **3100** comprises a medical instrument port **3106** and an appendage port **3108**. The medical instrument port **3106** can be configured to enable insertion of a medical instrument therethrough, for example, the pig colpotomizer **3000** illustrated in FIGS. **30**A-**30**C, to enable support of the medical instrument and/or rotation of the medical instrument while inserted into the pig's vagina. In some embodiments, the medical instrument port **3106** can comprise an inner diameter of approximately 15 millimeters to 20 millimeters.

The appendage port **3108** can be configured to enable an appendage of a subject being operated on to be passed therethrough to anchor the medical instrument support **3100**. For example, in this embodiment, the appendage port **3108** is configured to enable a surgeon to pass a pig's tail therethrough to anchor the medical instrument support **3100**. In some embodiments, the tail is secured to the medical instrument support **3100** by placing a suture through the tail and passing the tail through the appendage port **3108**, and optionally repeating that procedure one or more times until the tail is anchored securely. When an appendage is anchored to the medical instrument support **3100**, this enables stabilization of the colpotomizer, while still allowing rotation of the colpotomizer within the medical instrument port **3106**.

FIGS. **32**A-**32**B and FIGS. **33**A-**33**B illustrate further embodiments of medical instrument supports. The medical instrument support **3200** illustrated in FIGS. **32**A and **32**B is configured to operate similarly to the medical instrument support **3100**, except the medical instrument support **3200** further comprises a sleeve **3210**. The sleeve **3210** comprises a generally cylindrical tube extending from a face of the medical instrument support **3200** generally parallel to a central axis of the medical instrument port **3106**. The sleeve **3210** can be configured to provide additional surface area for the support and stabilization of a medical instrument passing therethrough.

FIGS. **33**A and **33**B illustrate a further embodiment of a medical instrument support **3300**. The medical instrument support **3300** is configured to operate similarly to the medical instrument support **3200**. However, the medical instrument support **3300** utilizes a medical instrument port **3306** comprising a blind hole within the sleeve **3310**, rather than being a through hole as with the embodiments illustrated in FIGS. **31**A-**31**B and **32**A-**32**B. In this embodiment, the medical instrument port **3306** is still configured to support a medical instrument, such as a pig colpotomizer, except the medical instrument can only be inserted up to the depth of the blind hole comprising the medical instrument port **3306**.

Cervical Dilator

FIG. **34** illustrates a cervical dilator **3400** that can be utilized to dilate, for example, a human cervical canal. The cervical dilator **3400** comprises a first end **3402**, a second end **3404**, a central region **3406**, and a plurality of graduated regions **3408** positioned between the first end **3402**, the central region **3406**, and the second end **3404**. The cervical dilator **3400** can be configured to utilize the concepts illustrated by the dilator portion **3002** of the pig colpotomizer **3000** illustrated in FIGS. **30**A-**30**C. Namely, the cervical dilator **3400** can be configured to gradually dilate a human or other animal cervical canal to enable the insertion of instruments to, for example, sample the uterus or to enable insertion of a hysteroscope to visualize the uterus. A typical uterine cavity length is approximately 70 millimeters to 80 millimeters. Accordingly, the overall length of the dilator **3400** and/or the length of each of its segments can be configured to accommodate various uterine lengths.

In use, the cervical dilator **3400** can be inserted into the vaginal canal, with the second end **3404** leading the dilator into the canal. The cervical canal can then be dilated gradually by further inserting the cervical dilator **3400** to enable the graduated regions **3408** of increasing diameter to gradually increase the dilation of the cervical canal. In some embodiments, only one end or half of the cervical dilator **3400** is utilized. For example, either the second end **3404** or the first end **3402** is inserted into the vaginal canal. Which end is inserted into the vaginal canal may depend upon, for example, the undilated diameter of the cervical canal. In some embodiments, both ends or halves are used to dilate a cervical canal. For example, the second end **3404** and its adjacent graduated regions **3408** can be inserted into the cervical canal to begin the dilation. Then, the cervical dilator **3400** can be extracted and flipped, and the first end **3402**, along with its adjacent graduated regions **3408**, can be inserted to complete the dilation up to potentially the largest diameter of the cervical dilator **3400**, shown here in the central region **3406**.

In some embodiments, one end or both ends of a cervical dilator can commence at two or three millimeters in diameter and gradually increase, at longitudinal distances from five millimeters to 20 millimeters, to outer diameters of any dimension within the limits of the overall outer diameter of the dilator. In some embodiments, one end of the dilator commences at the largest outer diameter of the opposite end. For example, referring to the cervical dilator **3400**, in some embodiments, the first end **3402** may be configured to be approximately the same outer diameter as the largest graduated region **3408** of the opposite end of the cervical dilator **3400**.

Cervical dilators as described herein can be advantageous for use in gynecological procedures. Such a one piece dilator can be easier to use than other potential solutions, such as dilators that comprise individual dilator rods each having a fixed outer diameter. Such rods may, for example, begin at two millimeters and progress to 20 millimeters or any other desired outer diameter, with a different rod being used for each diameter. If such dilator rods are used, a surgeon must insert and remove a plurality of dilator rods before the surgeon is able to get the cervical canal to the proper dilation. However, utilizing a cervical dilator such as the cervical dilator **3400** described herein, a surgeon can use a single tool to easily and quickly dilate the cervix. Further, a cervical dilator as described herein can more gradually dilate the cervix by incorporating a plurality of graduated regions **3408**. When using dilator rods having fixed outer diameters, a surgeon may be tempted to use a smaller number of rods, and will not as gradually dilate the cervical canal. Accordingly, it can be seen that a cervical dilator such as the cervical dilator **3400** shown in FIG. **34** has several advantages over dilator rods of fixed outer diameter.

Now that an embodiment of the invention has been described in detail it will be apparent to those skilled in the relevant arts that numerous modifications and variations may be made without departing from the basic inventive concepts. For example, in one embodiment, the hydrotubation port **42** is illustrated and described as being formed on the first fitting **22**. However in an alternate embodiment, a hydrotubation port may be formed on the tube **12** at a location near first end **16** but beyond the screw thread T**1**. In one embodiment, the first and second fittings **22**, **24** may be formed from a plastics material so as to be disposable after a single use while the elongated hollow tube **12** may be made from surgical grade stainless steel so as to be reusable. Also as would be readily apparent to one of ordinary skill further double ended instruments may be constructed using combinations end portions or probes shown in FIGS. **20**-**26** of the same or different size. For example a double ended instrument could comprise: a probe **204***a* at one end and a probe **304***a* at another, where the probes are of the same or different outer diameter; a probe **204***a* at one end and a probe **304'***a* at another, where the probes are of the same or different outer diameter; an end portion **176***a* at one end and a probe **204***b* at the other, where the probes are of the same or different outer diameter; etc. All other combinations of the currently disclosed probes and end portions are possible. All such modifications and variations together with others that would be obvious to persons of ordinary skill in the art are deemed to be within the scope of the present invention the nature of which is to be determined from the above description and the appended claims.

What is claimed is:

1. A medical instrument for performing a laparoscopic oncology procedure, the medical instrument comprising:

a probe comprising:

an outer circumferential surface, the outer circumferential surface extending in a longitudinal direction and sized for non-traumatic insertion into a human

vaginal cavity, wherein the outer circumferential surface is substantially cylindrical; and

a lip projecting outwardly from the outer circumferential surface and extending circumferentially about only a portion of the outer circumferential surface, the lip configured to raise vaginal tissue to provide a visual landmark for dissection during the laparoscopic oncology procedure, the lip positioned such that the lip is set back from a distal-most point of the probe by approximately 20 millimeters and the outer circumferential surface extends both distally and proximally to the lip,

wherein the outer circumferential surface comprises a surgical grade material comprising sufficient stiffness to support the lip in raising the vaginal tissue to provide the visual landmark for dissection during the laparoscopic oncology procedure, and

wherein the probe comprises a hollow inner cavity; and

a pneumatic plug configured to pneumatically plug at least a portion of the probe.

2. The medical instrument of claim **1**, wherein the lip extends circumferentially about the outer circumferential surface through an arc that subtends an angle of at least 100 degrees.

3. The medical instrument of claim **1**, wherein the probe further comprises:

a passage configured to enable a medical device to pass therethrough; and

the medical device, wherein the medical device comprises a uterine manipulator.

4. The medical instrument of claim **1**, further comprising:

an elongate hollow body comprising surgical grade material, the elongate hollow body extending in a longitudinal direction from a proximal end to a distal end;

wherein the probe is disposed at the distal end of the elongate hollow body.

5. The medical instrument of claim **1**, further comprising:

a second lip projecting outwardly from the outer circumferential surface and extending circumferentially about only a portion of the outer circumferential surface, the second lip configured to raise vaginal tissue to provide a visual landmark for dissection, the second lip positioned such that at least a portion of the second lip extends distally beyond a distal end of the outer circumferential surface.

6. A medical instrument for performing a laparoscopic oncology procedure, the medical instrument comprising:

a probe comprising:

an outer circumferential surface, the outer circumferential surface extending in a longitudinal direction and sized for non-traumatic insertion into a human vaginal cavity, wherein the outer circumferential surface is substantially cylindrical; and

a lip projecting outwardly from the outer circumferential surface and extending circumferentially about only a portion of the outer circumferential surface, the lip configured to raise vaginal tissue to provide a visual landmark for dissection during the laparoscopic oncology procedure, the lip positioned such that the lip is set back from a distal-most point of the probe by approximately 20 millimeters and the outer circumferential surface extends both distally and proximally to the lip, and

a second lip projecting outwardly from the outer circumferential surface and extending circumferentially about only a portion of the outer circumferential surface, the second lip configured to raise vaginal tissue to provide a visual landmark for dissection, the second lip positioned such that at least a portion of the second lip extends distally beyond a distal end of the outer circumferential surface;

wherein the outer circumferential surface comprises a surgical grade material comprising sufficient stiffness to support the lip in raising the vaginal tissue to provide the visual landmark for dissection during the laparoscopic oncology procedure, and

wherein the probe comprises a hollow inner cavity;

an elongate hollow body comprising surgical grade material, the elongate hollow body extending in a longitudinal direction from a proximal end to a distal end,

wherein the probe is disposed at the distal end of the elongate hollow body, and

wherein the elongate hollow body transitions smoothly into the outer circumferential surface of the probe;

a second probe disposed at the proximal end of the elongate hollow body, the second probe comprising a second outer circumferential surface comprising a different diameter than the outer circumferential surface of the probe disposed at the distal end of the elongate hollow body; and

a third lip projecting outwardly from the second outer circumferential surface and extending circumferentially about only a portion of the second outer circumferential surface, the third lip configured to raise vaginal tissue to provide a visual landmark for dissection during the laparoscopic oncology procedure.

7. The medical instrument of claim **6**, wherein the lip extends circumferentially about the outer circumferential surface through an arc that subtends an angle of at least 100 degrees.

8. The medical instrument of claim **6**, wherein the probe further comprises:

a passage configured to enable a medical device to pass therethrough; and

the medical device, wherein the medical device comprises a uterine manipulator.

9. The medical instrument of claim **6**, wherein the second lip comprises the distal-most point of the probe.

10. A medical instrument for performing a laparoscopic oncology procedure, the medical instrument comprising:

a probe comprising:

an outer circumferential surface, the outer circumferential surface extending in a longitudinal direction and sized for non-traumatic insertion into a human vaginal cavity, wherein the outer circumferential surface is substantially cylindrical; and

a lip projecting outwardly from the outer circumferential surface and extending circumferentially about only a portion of the outer circumferential surface, the lip configured to raise vaginal tissue to provide a visual landmark for dissection during the laparoscopic oncology procedure, the lip positioned such that the lip is set back from a distal-most point of the probe by approximately 20 millimeters and the outer circumferential surface extends both distally and proximally to the lip;

wherein the outer circumferential surface comprises a surgical grade material comprising sufficient stiffness to support the lip in raising the vaginal tissue to provide the visual landmark for dissection during the laparoscopic oncology procedure, and

wherein the probe comprises a hollow inner cavity; and

a second lip projecting outwardly from the outer circumferential surface and extending circumferentially about

only a portion of the outer circumferential surface, the second lip configured to raise vaginal tissue to provide a visual landmark for dissection, the second lip positioned such that at least a portion of the second lip extends distally beyond a distal end of the outer circumferential surface.

11. The medical instrument of claim **10**, wherein the second lip comprises the distal-most point of the probe.

12. The medical instrument of claim **10**, wherein the lip extends circumferentially about the outer circumferential surface through an arc that subtends an angle of at least 100 degrees.

13. The medical instrument of claim **10**, wherein the probe further comprises:

a passage configured to enable a medical device to pass therethrough; and

the medical device, wherein the medical device comprises a uterine manipulator.

14. The medical instrument of claim **10**, further comprising:

an elongate hollow body comprising surgical grade material, the elongate hollow body extending in a longitudinal direction from a proximal end to a distal end;

wherein the probe is disposed at the distal end of the elongate hollow body.

15. A method of using a medical instrument to perform a laparoscopic oncology procedure, the method comprising:

inserting a probe of the medical instrument into the human vaginal cavity, the probe comprising:

an outer circumferential surface, the outer circumferential surface extending in a longitudinal direction and sized for non-traumatic insertion into a human vaginal cavity, wherein the outer circumferential surface is substantially cylindrical; and

a lip projecting outwardly from the outer circumferential surface and extending circumferentially about only a portion of the outer circumferential surface, the lip configured to raise vaginal tissue to provide a visual landmark for dissection during the laparoscopic oncology procedure, the lip positioned such that the lip is set back from a distal-most point of the probe by approximately 20 millimeters and the outer circumferential surface extends both distally and proximally to the lip,

wherein the outer circumferential surface comprises a surgical grade material comprising sufficient stiffness to support the lip in raising the vaginal tissue to provide the visual landmark for dissection during the laparoscopic oncology procedure, and

wherein the probe comprises a hollow inner cavity;

positioning the lip of the medical instrument to act as a visual landmark that indicates where a surgeon should cut to remove a cuff from the vagina to excise cancer tissue;

cutting vaginal tissue to remove the cuff; and

removing the probe from the vaginal cavity.

16. The medical instrument of claim **15**, wherein the lip extends circumferentially about the outer circumferential surface through an arc that subtends an angle of at least 100 degrees.

17. The medical instrument of claim **15**, wherein the probe further comprises:

a passage configured to enable a medical device to pass therethrough; and

the medical device, wherein the medical device comprises a uterine manipulator.

18. The medical instrument of claim **15**, further comprising:

an elongate hollow body comprising surgical grade material, the elongate hollow body extending in a longitudinal direction from a proximal end to a distal end;

wherein the probe is disposed at the distal end of the elongate hollow body.

19. The medical instrument of claim **15**, further comprising:

a second lip projecting outwardly from the outer circumferential surface and extending circumferentially about only a portion of the outer circumferential surface, the second lip configured to raise vaginal tissue to provide a visual landmark for dissection, the second lip positioned such that at least a portion of the second lip extends distally beyond a distal end of the outer circumferential surface.

20. A medical instrument for performing a laparoscopic oncology procedure, the medical instrument comprising:

a probe comprising:

an outer circumferential surface, the outer circumferential surface extending in a longitudinal direction and sized for non-traumatic insertion into a human vaginal cavity, wherein the outer circumferential surface is substantially cylindrical; and

a lip projecting outwardly from the outer circumferential surface and extending circumferentially about only a portion of the outer circumferential surface, the lip configured to raise vaginal tissue to provide a visual landmark for dissection during the laparoscopic oncology procedure, the lip positioned such that the lip is set back from a distal-most point of the probe by approximately 20 millimeters and the outer circumferential surface extends both distally and proximally to the lip,

wherein the outer circumferential surface comprises a surgical grade material comprising sufficient stiffness to support the lip in raising the vaginal tissue to provide the visual landmark for dissection during the laparoscopic oncology procedure,

wherein the probe comprises a hollow inner cavity, and

wherein the lip further comprises:

a distal face angled proximally with respect to a longitudinal axis of the instrument; and

a proximal face angled distally with respect to the longitudinal axis of the instrument; and

a second lip projecting outwardly from the outer circumferential surface and extending circumferentially about only a portion of the outer circumferential surface, the second lip configured to raise vaginal tissue to provide a visual landmark for dissection, the second lip positioned such that at least a portion of the second lip extends distally beyond a distal end of the outer circumferential surface.

21. The medical instrument of claim **20**, wherein the lip extends circumferentially about the outer circumferential surface through an arc that subtends an angle of at least 100 degrees.

22. The medical instrument of claim **20**, wherein the probe further comprises:

a passage configured to enable a medical device to pass therethrough; and

the medical device, wherein the medical device comprises a uterine manipulator.

23. The medical instrument of claim **20**, further comprising:

an elongate hollow body comprising surgical grade material, the elongate hollow body extending in a longitudinal direction from a proximal end to a distal end;

wherein the probe is disposed at the distal end of the elongate hollow body.

24. The medical instrument of claim **20**, wherein the second lip comprises the distal-most point of the probe.

25. A medical instrument for performing a laparoscopic oncology procedure, the medical instrument comprising:

a probe comprising:

an outer circumferential surface, the outer circumferential surface extending in a longitudinal direction and sized for non-traumatic insertion into a human vaginal cavity, wherein the outer circumferential surface is substantially cylindrical; and

a lip projecting outwardly from the outer circumferential surface and extending circumferentially about only a portion of the outer circumferential surface, the lip configured to raise vaginal tissue to provide a visual landmark for dissection during the laparoscopic oncology procedure, the lip positioned such that the lip is set back from a distal-most point of the probe by approximately 20 millimeters and the outer circumferential surface extends both distally and proximally to the lip;

wherein the outer circumferential surface comprises a surgical grade material comprising sufficient stiffness to support the lip in raising the vaginal tissue to provide the visual landmark for dissection during the laparoscopic oncology procedure,

wherein the probe comprises a hollow inner cavity, and

wherein the circumferential surface extends proximally from the lip toward a tapered region that is tapered radially inwardly in a proximal direction; and

a second lip projecting outwardly from the outer circumferential surface and extending circumferentially about only a portion of the outer circumferential surface, the second lip configured to raise vaginal tissue to provide a visual landmark for dissection, the second lip positioned such that at least a portion of the second lip extends distally beyond a distal end of the outer circumferential surface.

26. The medical instrument of claim **25**, wherein the lip extends circumferentially about the outer circumferential surface through an arc that subtends an angle of at least 100 degrees.

27. The medical instrument of claim **25**, wherein sides of the lip transition smoothly from the outer circumferential surface to limit damage to body tissue when the medical instrument is rotated within the human vaginal cavity.

28. The medical instrument of claim **25**, wherein the lip comprises a tapered shape that is wider adjacent the outer circumferential surface than at an outer edge of the lip.

29. The medical instrument of claim **25**, wherein the outer circumferential surface comprises a diameter of approximately 40 millimeters.

30. The medical instrument of claim **25**, wherein the probe further comprises:

a passage configured to enable a medical device to pass therethrough; and

the medical device, wherein the medical device comprises a uterine manipulator.

31. The medical instrument of claim **25**, wherein the probe is tapered at the distal-most point of the probe, wherein a first diameter of the distal-most point of the probe is larger than a second diameter of a proximal end of the probe.

32. The medical instrument of claim **25**, further comprising:

an elongate hollow body comprising surgical grade material, the elongate hollow body extending in a longitudinal direction from a proximal end to a distal end;

wherein the probe is disposed at the distal end of the elongate hollow body.

33. The medical instrument of claim **25**, wherein the second lip comprises the distal-most point of the probe.

34. A medical instrument for performing a laparoscopic oncology procedure, the medical instrument comprising:

a probe comprising:

an outer circumferential surface, the outer circumferential surface extending in a longitudinal direction and sized for non-traumatic insertion into a human vaginal cavity; and

a lip projecting outwardly from the outer circumferential surface and extending circumferentially about only a portion of the outer circumferential surface, the lip configured to raise vaginal tissue to provide a visual landmark for dissection during the laparoscopic oncology procedure, the lip positioned such that the lip is set back from a distal-most point of the probe and the outer circumferential surface extends both distally and proximally to the lip,

wherein the outer circumferential surface comprises a surgical grade material comprising sufficient stiffness to support the lip in raising the vaginal tissue to provide the visual landmark for dissection during the laparoscopic oncology procedure,

wherein the lip comprises a tapered shape that is wider adjacent the outer circumferential surface than at an outer edge of the lip, and

wherein the lip further comprises:

a distal face angled proximally with respect to a longitudinal axis of the instrument; and

a proximal face angled distally with respect to the longitudinal axis of the instrument; and

a second lip projecting outwardly from the outer circumferential surface and extending circumferentially about only a portion of the outer circumferential surface, the second lip configured to raise vaginal tissue to provide a visual landmark for dissection, the second lip positioned such that at least a portion of the second lip extends distally beyond a distal end of the outer circumferential surface.

35. The medical instrument of claim **34**, wherein the probe further comprises:

a passage configured to enable a medical device to pass therethrough; and

the medical device, wherein the medical device comprises a uterine manipulator.

36. The medical instrument of claim **34**, wherein

the second lip comprises the distal-most point of the probe.

37. A medical instrument for performing a laparoscopic oncology procedure, the medical instrument comprising:

a probe comprising:

an outer circumferential surface, the outer circumferential surface extending in a longitudinal direction and sized for non-traumatic insertion into a human vaginal cavity; and

a lip projecting outwardly from the outer circumferential surface and extending circumferentially about only a portion of the outer circumferential surface, the lip configured to raise vaginal tissue to provide a visual landmark for dissection during the laparoscopic oncology procedure, the lip positioned such that the lip is set back from a distal-most point of the

probe and the outer circumferential surface extends both distally and proximally to the lip,

wherein the outer circumferential surface comprises a surgical grade material comprising sufficient stiffness to support the lip in raising the vaginal tissue to provide the visual landmark for dissection during the laparoscopic oncology procedure,

wherein the lip comprises a tapered shape that is wider adjacent the outer circumferential surface than at an outer edge of the lip, and

wherein the circumferential surface extends proximally from the lip toward a tapered region that is tapered radially inwardly in a proximal direction; and

a pneumatic plug configured to pneumatically plug at least a portion of the probe.

38. The medical instrument of claim **37**, wherein

a second lip comprises the distal-most point of the probe.

39. The medical instrument of claim **37**, further comprising:

an elongate hollow body comprising surgical grade material, the elongate hollow body extending in a longitudinal direction from a proximal end to a distal end;

wherein the probe is disposed at the distal end of the elongate hollow body; and

a second probe disposed at the proximal end of the elongate body, the second probe comprising a second outer circumferential surface comprising a different diameter than the outer circumferential surface of the probe disposed at the distal end of the elongate body.

40. The medical instrument of claim **37**, wherein the probe comprises a hollow inner cavity.

41. The medical instrument of claim **37**, wherein the outer circumferential surface is substantially cylindrical.

42. The medical instrument of claim **37**, wherein the probe further comprises:

a passage configured to enable a medical device to pass therethrough; and

the medical device, wherein the medical device comprises a uterine manipulator.

43. A medical instrument for performing a laparoscopic oncology procedure, the medical instrument comprising:

a probe comprising:

an outer circumferential surface, the outer circumferential surface extending in a longitudinal direction and sized for non-traumatic insertion into a human vaginal cavity; and

a lip projecting outwardly from the outer circumferential surface and extending circumferentially about only a portion of the outer circumferential surface, the lip configured to raise vaginal tissue to provide a visual landmark for dissection during the laparoscopic oncology procedure, the lip positioned such that the lip is set back from a distal-most point of the probe and the outer circumferential surface extends both distally and proximally to the lip,

wherein the outer circumferential surface comprises a surgical grade material comprising sufficient stiffness to support the lip in raising the vaginal tissue to provide the visual landmark for dissection during the laparoscopic oncology procedure,

wherein the lip comprises a tapered shape that is wider adjacent the outer circumferential surface than at an outer edge of the lip; and

a second lip projecting outwardly from the outer circumferential surface and extending circumferentially about only a portion of the outer circumferential surface, the second lip configured to raise vaginal tissue to provide a visual landmark for dissection, the second lip positioned such that at least a portion of the second lip extends distally beyond a distal end of the outer circumferential surface.

44. The medical instrument of claim **43**, wherein the probe further comprises:

a passage configured to enable a medical device to pass therethrough; and

the medical device, wherein the medical device comprises a uterine manipulator.

45. The medical instrument of claim **43**, wherein

the second lip comprises the distal-most point of the probe.

* * * * *

专利名称(译)	一般子宫操纵器和系统		
公开(公告)号	US9987042	公开(公告)日	2018-06-05
申请号	US14/722025	申请日	2015-05-26
[标]申请(专利权)人(译)	JAI SINGH SINGH几碗史蒂芬		
申请(专利权)人(译)	SINGH，JAI 辛格几碗史蒂芬		
当前申请(专利权)人(译)	SINGH，JAI 辛格几碗史蒂芬		
[标]发明人	SINGH JAI SINGH JIWAN STEVEN		
发明人	SINGH, JAI SINGH, JIWAN STEVEN		
IPC分类号	A61B17/42 A61D1/10 A61B17/46 A61B90/30 A61B10/02 A61B90/00 A61B17/00		
CPC分类号	A61B17/4241 A61B17/42 A61B90/30 A61B10/0291 A61B2017/00398 A61B90/39 A61B2017/00473 A61B2017/4216 A61B2090/306 A61B2090/309 A61B2090/3962 A61B2017/00464		
优先权	61/472705 2011-04-07 US		
其他公开文献	US20160081717A1		
外部链接	Espacenet USPTO		

摘要(译)

一种构造成插入体腔中的医疗器械，包括：主体，包括在第一端处的第一探针，所述第一探针包括具有第一直径的第一外圆周表面的第一圆柱形部分;在所述第一探针的远端处的第一圆周边缘;第一远端唇缘，所述第一远端唇缘从所述第一外圆周表面向外突出超过所述第一圆周边缘且为所述第一圆周边缘的至少一部分圆周延伸;以及第一标记唇部，其从所述第一外圆周表面向外突出并且延伸所述第一外圆周表面的至少一部分圆周;其中所述第一远侧唇缘定位在所述第一标记唇缘的远侧;并且其中所述主体包括中空腔以使第二医疗器械能够穿过其中。