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(54) **SEAL FOR MEDICAL INSTRUMENT**

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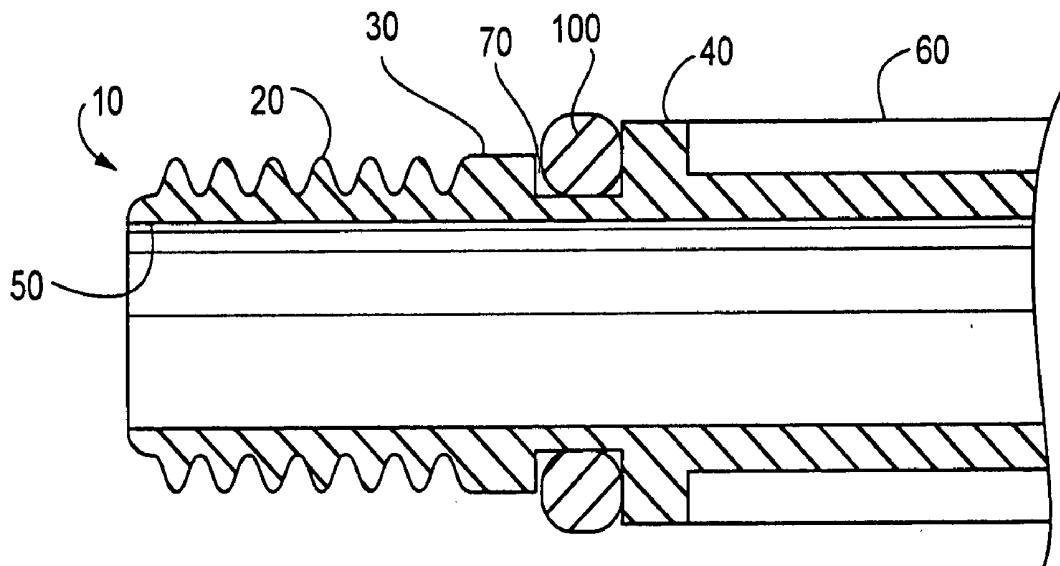
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ABSTRACT

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A laparoscopic tube end for interfacing a tube with a tip may include an attachment portion to attach to the tip, and a tapered flare portion to frictionally abut the tip when the tip is attached to the tube end.



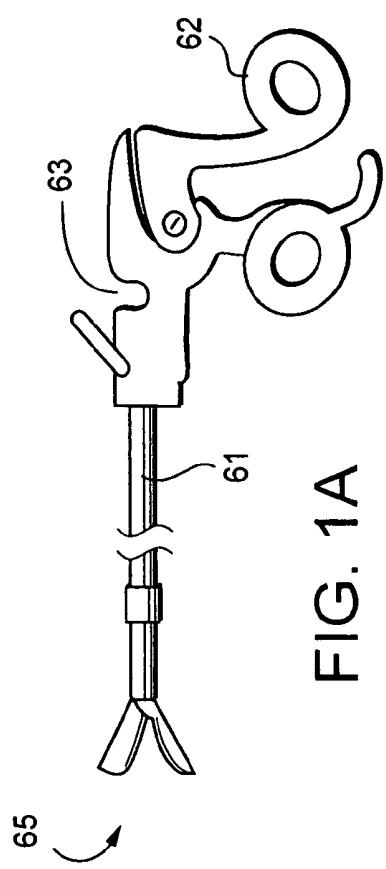


FIG. 1A

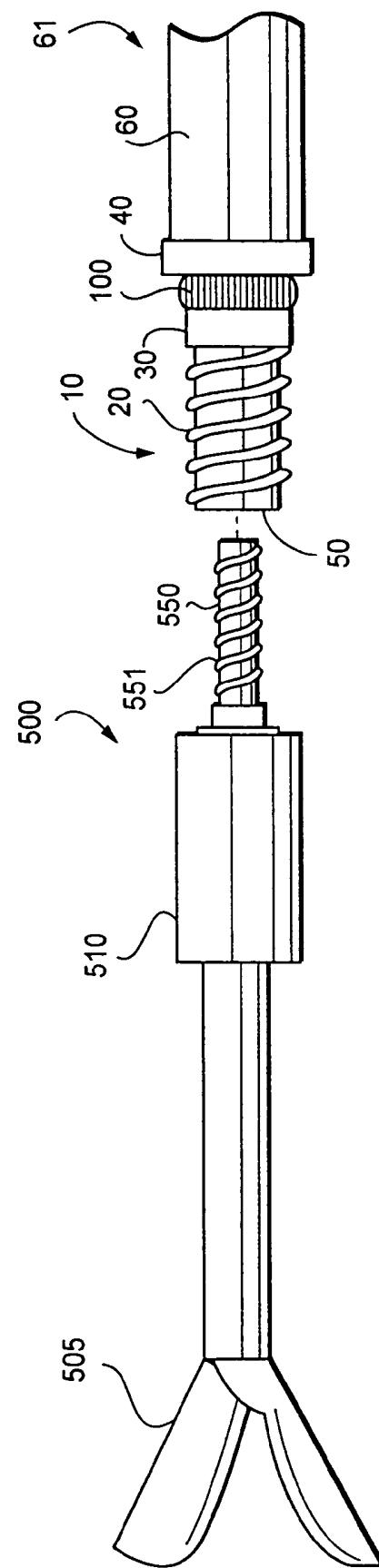


FIG. 1B

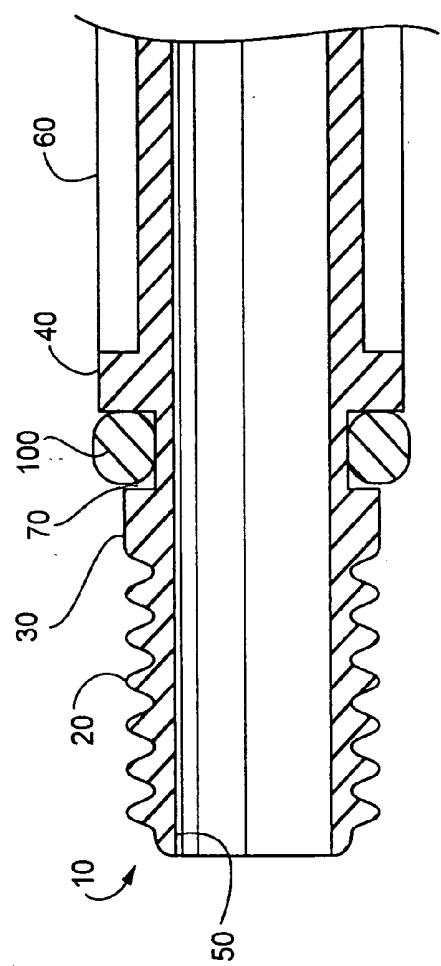


FIG. 2A

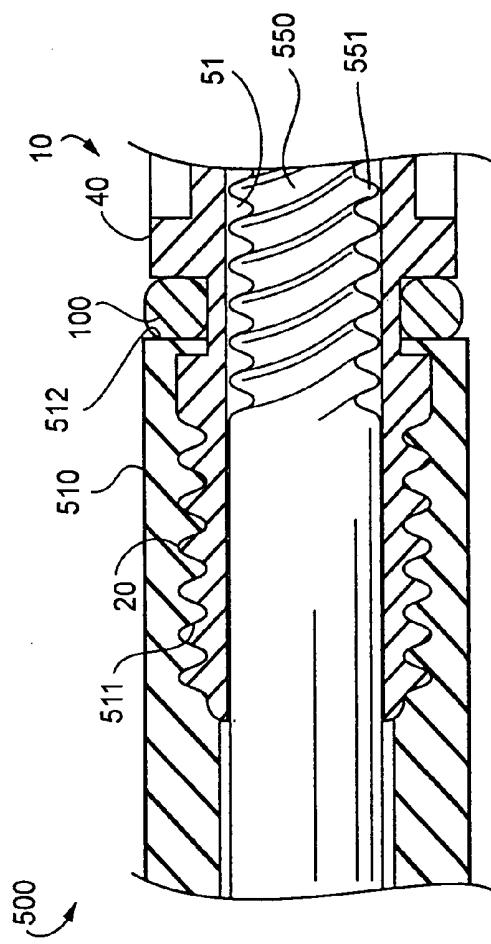
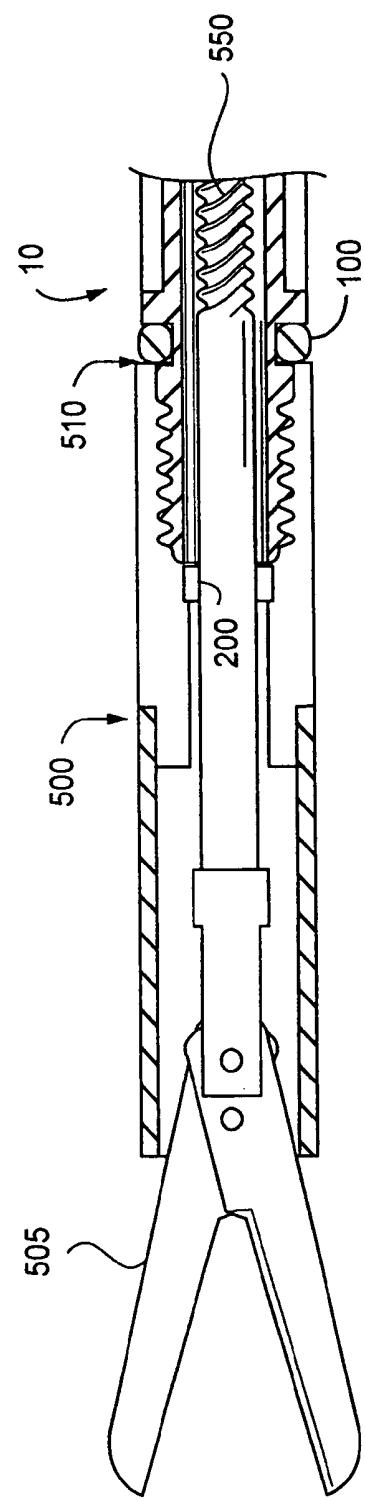
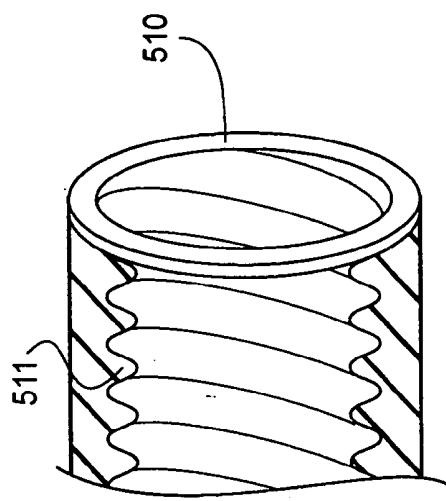


FIG. 2B



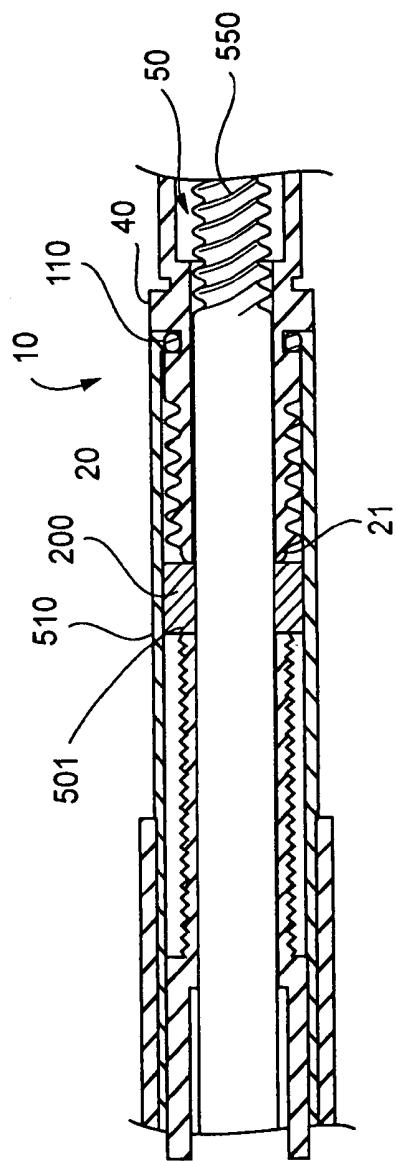


FIG. 5A

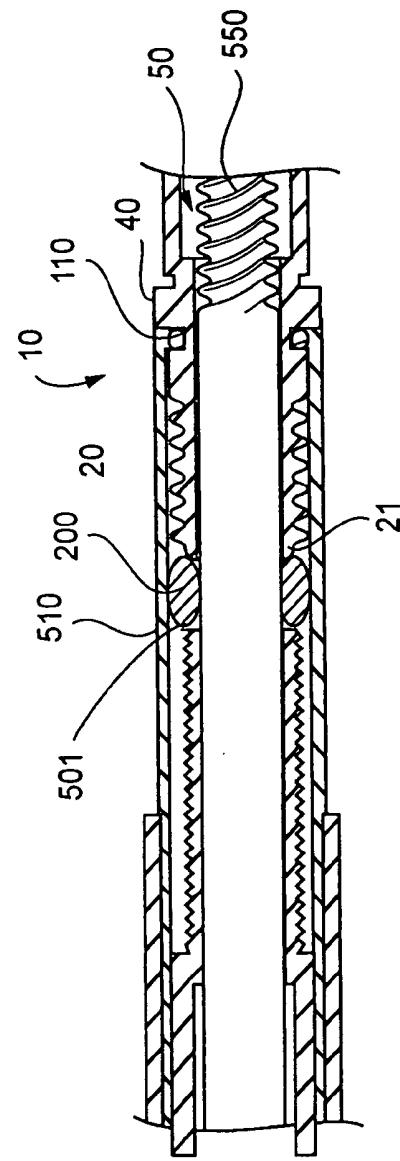
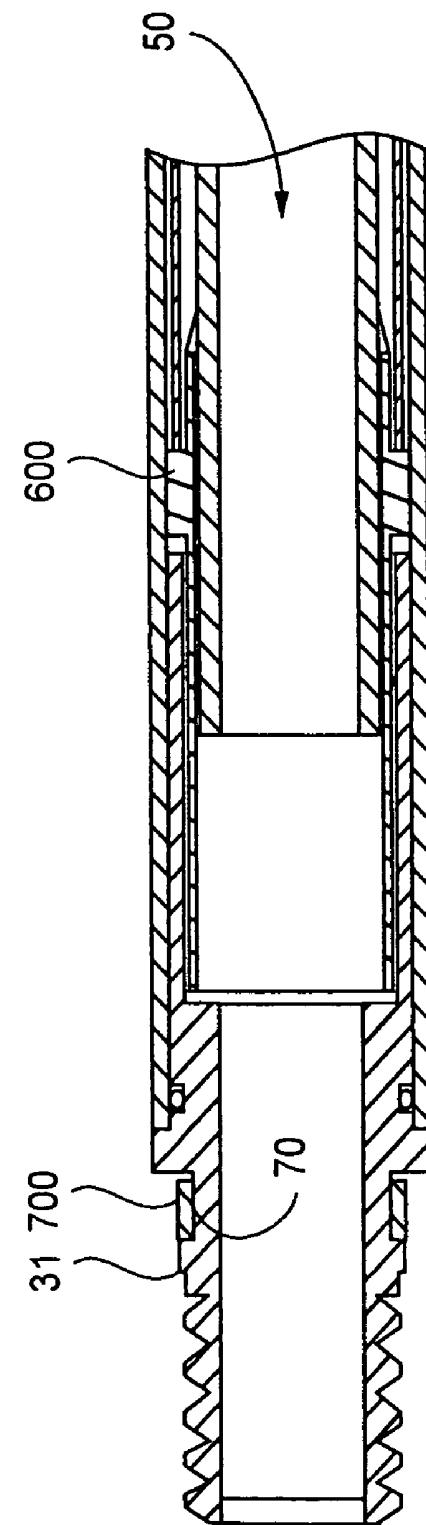
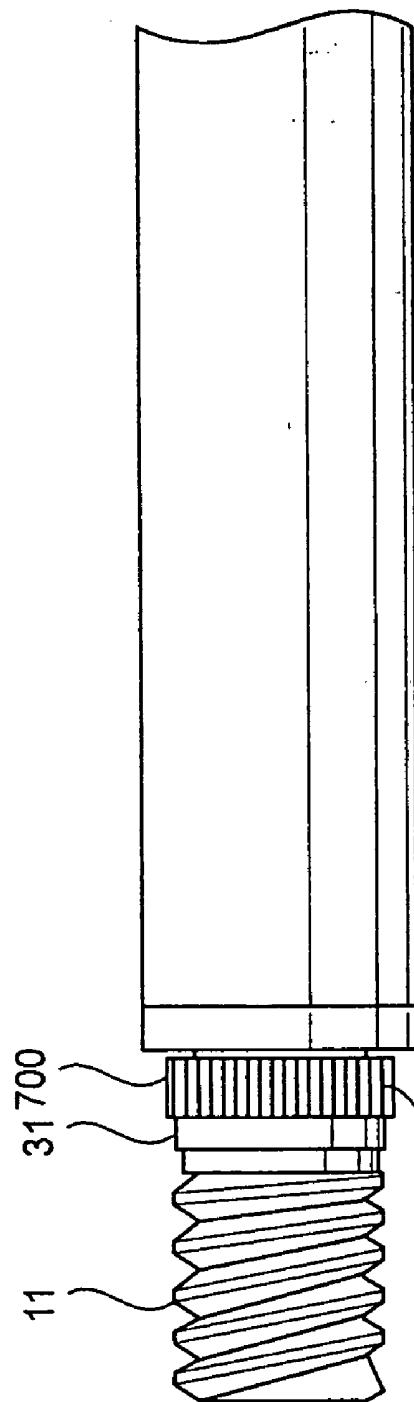


FIG. 5B



SEAL FOR MEDICAL INSTRUMENT

1. FIELD OF THE INVENTION

[0001] This invention relates to a medical instrument including an electrosurgical apparatus, such as a laparoscopic tube end used for performing laparoscopic, pelvoscopic, arthroscopic, thoroscopic and/or similar such procedures, and more particularly to an electrosurgical apparatus having a fluid-resistant seal for fluidically isolating and electrically insulating a detachable tip when engaged with a laparoscopic tube end.

2. BACKGROUND OF THE INVENTION

[0002] Medical procedures such as laparoscopy and the like, which employ a tip at the end of a tube for insertion into the patient, are beneficial because the incisions necessary to perform them are minimal in size, therefore promoting more rapid recovery and lower costs. For example, a patient who undergoes laparoscopic surgery may typically return to normal activity within a period of a few days to about a week, in contrast to more invasive procedures requiring a relatively larger incision (which may require about a month for recovery). (Although the term "laparoscopic" is typically used hereinafter, such use of the term "laparoscopic" should be understood to encompass any such similar or related procedures such as, for example, arthroscopic, endoscopic, pelvoscopic and/or thoroscopic or the like, in which relatively small incisions are used.)

[0003] However, when a tip is detachably connected to the tube end of a laparoscopic device, complications may occur if fluid breaches the connection and enters the interior of the tip or tube end. For example, septic contamination may arise in the laparoscopic device and/or electrical current may unintentionally leak therefrom.

SUMMARY OF THE INVENTION

[0004] Accordingly, it is a feature of the present invention to mitigate the risk of electrical shock and/or contamination of a tube by fluids, and to provide isolation from electrical shock and/or shorting caused by fluid contact.

[0005] In view of the above-noted, and other, features, the present invention provides a seal for medical instruments for preventing electrical and/or fluidic contact between a tip and a tube end of a surgical or laparoscopic device.

[0006] According to an aspect of the present invention, a laparoscopic tube end may include a flange having a contact surface, a groove adjacent to the contact surface of the flange, and an engagement portion to engage with a tip, and a gasket which is elastically deformable, disposed in the groove to compressibly abut the contact surface of the flange when the tip is engaged with the engagement portion. The gasket may include an elastomeric material to electrically isolate an interior of the tube end from an exterior of the tube or tip when the tip compresses the gasket, and the attachment portion may include threading on an exterior surface of the laparoscopic tube end or an interior surface of the laparoscopic tube end. The laparoscopic tube end may include the tip, detachably engaged with the engagement portion. Also, the gasket may have a generally square, circular or rounded cross-section, and may be connected to the groove by an adhesive material or by the elasticity of the

gasket. Further, the tip may compress the gasket against the contact surface of the flange and form a fluid-resistant seal between the tip and the tube end.

[0007] The laparoscopic tube end may also include an interior to receive a yoke of the tip, and an interior threaded portion to threadedly engage with the yoke of the tip. In addition, the gasket may have an outer radius which increases from an uncompressed radius to a maximal radius when the gasket is compressed by the tip against the contact surface of the flange, in which the maximal radius does not exceed an outermost radius of the flange. Further, grease may be disposed on any one or more of the flange, the groove, the engagement portion, the instrument tip or the gasket, and may seal and/or insulate an interior of the tube end from an exterior of the tube end; also, the engagement portion may include threading on an exterior surface of the instrument tip and/or an interior surface of the instrument tip.

[0008] In accordance with another aspect of the present invention, a tip for engaging with a laparoscopic tube end may include a threaded portion to threadedly engage with the laparoscopic tube end, a back hub connected to the threaded portion, and a seal which is elastically deformable and connected with the back hub, in which the seal may compressibly abut the laparoscopic tube end when the tip is engaged with the laparoscopic tube end. The tip may also include an extremity which abuts a flange of the laparoscopic tube end and the gasket of the laparoscopic tube end. Further, the tip may include a yoke (or, more generally, a stem, post or any other suitable internal member and the like, which may be generally equivalent with a yoke and for which the term "yoke" used hereinafter may be understood to encompass) which threadedly engages with an interior of the laparoscopic tube end, in which the resulting seal electrically insulates an external surface of the laparoscopic tube end or the tip from the interior of the laparoscopic tube end. Also, the seal may be molded to the back hub, or connected by adhesive.

[0009] In accordance with yet another aspect of the present invention, a laparoscopic tube end for interfacing a tube with a tip may include an attachment portion which threadedly attaches to the tip, the threaded portion including a semi-crystalline electrically resistive plastic material, and a tapered flare which may frictionally abut the tip when the tip is engaged with the tube end. The semi-crystalline electrically resistive plastic material may include at least one polyether ether ketone (PEEK) material, and the laparoscopic tube end may further include a groove in the attachment portion, and a band of heat-shrink material disposed in the groove. The heat-shrink material may include at least one fluorinated ethylene propylene (FEP) material and/or any other elastic or elastomeric material (such as, for example, plastic, rubber, etc., but not necessarily limited thereto) or combination thereof. The laparoscopic tube end may further include the tip engaged with the tube end, in which the attachment portion includes threading to detachably attach to the tip. The laparoscopic tube end may also include a metal interface fixedly attached to the tube end, and the metal interface may include stainless steel. Grease or any other such viscous fluid or material may also be disposed on the tip or tube end (or any components thereof) and

may seal and/or insulate the interior of the tube end from the exterior of the tube end.

[0010] Other exemplary embodiments and advantages of the present invention may be ascertained by reviewing the present disclosure and the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] The present invention is further described in the detailed description which follows, in reference to the noted drawings by way of non-limiting examples of certain embodiments of the present invention, in which the numerals represent like elements throughout the several views of the drawings, in which:

[0012] FIG. 1A illustrates an example of a laparoscopic medical device including a tip and a laparoscopic tube;

[0013] FIG. 1B illustrates a tip disengaged from a laparoscopic tube end, according to a first embodiment of the present invention;

[0014] FIG. 2A is a cutaway view illustrating a laparoscopic tube end having a gasket, according to the first embodiment;

[0015] FIG. 2B illustrates the laparoscopic tube end having the gasket, as shown in FIG. 2A, engaged with a back hub of a tip;

[0016] FIG. 3 is a partial cutaway view illustrating a back hub having threading;

[0017] FIG. 4 is a partial cutaway view illustrating a tip engaged with the laparoscopic tube end, according to a second embodiment of the present invention;

[0018] FIG. 5A illustrates the laparoscopic tube end according to the second embodiment having a seal with a square cross-section;

[0019] FIG. 5B illustrates the laparoscopic tube end according to the second embodiment having a seal with a round cross-section;

[0020] FIG. 6A illustrates a laparoscopic tube end formed of PEEK material and a heat-shrink tubing, according to a third embodiment of the present invention; and

[0021] FIG. 6B is a cutaway view along line A-A shown in FIG. 6A, illustrating an interior of the laparoscopic tube end made of PEEK material and having the heat-shrink tubing and a tapered flare, as well as a stainless-steel tube end portion, according to the third embodiment.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0022] The particulars shown herein are by way of example and for purposes of illustrative discussion of the embodiments of the present invention only, and are presented for providing what is believed to be the most useful and readily understood description of the principles and conceptual aspects of the present invention. In this regard, no attempt is made to show structural details of the present invention in more detail than is necessary for the fundamental understanding of the present invention, the description taken with the drawings making apparent to those skilled in the art how the several forms of the present invention may be embodied in practice.

[0023] Referring to FIGS. 1A and 1B, a medical device 65 for performing laparoscopic surgery such as excision of tissue with cauterization, for example, may typically include (but is not limited to) a tip 500 having a tool 505 such as electrified shears or a cauterization tool, for example, in which the tip 500 may engage with the tube end 10 of a tube 61 which extends from a base portion 63 connected to handles 62 (or other suitable control device) operable by the medical personnel or physician performing the surgery. As shown in FIGS. 1B, 2A and 2B, for example, a laparoscopic tube end 10 according to a first embodiment of the present invention may include exterior threading 20 (which may threadedly engage and/or attach to a back hub 510 of the tip 500), as well as a flange 40 and outer sheath 60. Further, the laparoscopic tube end 10 according to the first embodiment may include a gasket 100 which may be either entirely or partially formed of an elastomeric material including, but not limited to, for example, natural or artificial rubber, plastic (such as, for example, polyethylene, polypropylene or any other suitable plastic polymer), and/or resin (and/or any suitable mixture or compound thereof, noting that the elastomeric material is not limited to the exemplary materials thus noted). Further, a gasket 100 may typically surround and conform to a groove 70 disposed between the exterior threading 20 and a flange 40 of the laparoscopic tube end, and the gasket 100 may have any suitable cross-section such as, for example, a generally square, round or rounded cross-section (see, for example, the generally rounded cross-section of the gasket 100 shown in FIG. 2A). The gasket 100 may be connected to the groove 70 by, for example, the elasticity inherent in the gasket 100 which is fitted around the exterior of the groove 70, and/or an adhesive, or by molding.

[0024] FIG. 2B shows the engagement of the back hub 510 of the tip 500 with the laparoscopic tube end 10 when the laparoscopic tube end 10 is fully engaged with the laparoscopic tube end 10. It is noted that although the back hub 510 and yoke 550 of the tip 500 are shown as engaging with respective portions of the laparoscopic tube end 10 via threading 511 and 551, respectively, the present invention is not limited to engagement by threading, but may alternatively use any suitable engagement technology such as, for example, a spring-loaded bead and socket mechanism, a barrel pin, or dog-tooth ratchet mechanism, among other suitable engagement mechanisms. Furthermore, the respective rates of the threading of the yoke 551 and the threading of the back hub 511 may be substantially different, although they may also be substantially equivalent in some implementations.

[0025] When the back hub 510 is fully engaged with the laparoscopic tube end 10 (by threading, for example), an abutment surface 512 of the back hub 510 may abut the gasket 100, and urge the gasket 100 against the flange 40. This engagement seals the interior of the laparoscopic tube end from any fluids surrounding the tip 500 or tube end 10, and electrically insulates and fluidically isolates the laparoscopic tube end 10 from the exterior of the tube 61 and tip 500 because the pressure between the abutment surface 512, gasket 100 and flange 40 and the adhesiveness and elasticity of the gasket 100 form a fluidic seal, and the electrically insulating properties of the elastomeric material of the gasket 100 form a high electrical impedance. In addition, the

pressure of the back hub **510** when fully engaged against the gasket **100** may beneficially prevent rotation and/or disengagement of the back hub **510** from the laparoscopic tube end **10**, because the frictional resistance resulting from the abutment of the abutment surface **512** of the back hub **510** against the elastomeric material of the gasket **100** tends to prevent rotation and unscrewing of the back hub **510** from the tube end **10**. The composition, shape and/or materials of the gasket **100** may be selected to optimize the frictional contact with the back hub **510**, the effectiveness of the fluidic seal, and/or the effectiveness of the electrical impedance thereof, for example.

[0026] Further, the height (or outermost radius) of the gasket **100**, and/or the deformation properties of the gasket **100**, may be selected such that the top surface of the gasket **100** does not exceed the height of the flange **40** when the back hub **510** is fully engaged with the laparoscopic tube end **10**, for example, or such that the top of the gasket **100** deforms from an initial, uncompressed height to a maximal height thereof which forms a substantially continuous or smooth overall outer surface across the back hub **510**, gasket **100** and flange **40**, in order to minimize snags or unwanted friction during insertion or removal of the laparoscopic device **65**, for example. Grease, oil, putty, epoxy, glue, resin, viscous fluid or material and/or any other suitable material (not shown) may also be used to seal and/or insulate the laparoscopic tube end **10** and/or other components, either alone or in combination with other ways of sealing and/or insulating.

[0027] As shown in FIGS. 2A, 2B and 3, for example, the laparoscopic tube end **10** may include an interior **50**, having interior threading **51** for engaging with the threading **551** of the yoke **550** of the tip **500**. Further, as shown in FIG. 3, the back hub **510** of the tip **500** may also include threading **511** for engaging with the exterior threading **20** of the tube end **10**, and the respective threading pitches of the threading of the yoke **551** and the threading of the back hub **511** may be different.

[0028] FIGS. 4, 5A and 5B illustrate a second embodiment of the present invention, in which the tip **500** includes a first seal **200** where the back hub **510** contacts an extremity of the tube end **10**. Accordingly, as the back hub **510** is tightened against the tube end **10**, a seal is created by compression of the elastomeric material of the first seal **200** between the distal tip **21** of the tube end **10** and the compression surface **501** of the back hub **510**, for example. Although the first seal **200** is exemplified as attached to the back hub **510** of the tip **500**, it may alternatively be attached to the extremity of the tube end **10**, for example. Furthermore, the cross-section of the first seal **200** may have any appropriate form, such as square, circular, or any other suitable form.

[0029] As shown in FIG. 5A, the tube end **10** may also include a second seal **110** adjacent to the flange **40** of the laparoscopic tube end **10**. According to one aspect of the second embodiment, the second seal **110** may have a cross-sectional diameter or area which is smaller than that of the first seal **200** (which may be round as shown in FIG. 5B or rectangular as shown in FIG. 5A, for example), permitting enhanced sealing and insulating effectiveness. According to yet another aspect of the second embodiment, the second seal **110** may have a size and form suitable for allowing the back hub **510** to abut flushly against the flange **40** of the

laparoscopic tube end **10**, while forming a seal generated by compressive contact of the bottom surface of the back hub **510** against the elastomeric material of the second seal **110** and the floor of the groove **70**.

[0030] FIGS. 6A and 6B illustrate a third embodiment of the present invention, in which a laparoscopic device includes a laparoscopic tube end **11** made either entirely or at least partially of a semi-crystalline electrically-resistive plastic material (such as, for example, polyether ether ketone, or PEEK). According to another aspect of the third embodiment, the laparoscopic tube end **11** may include a flare **31** or tapered section to provide at least a slight interference fit with the back hub of the tip. Friction resulting from the interference fit of the flare **31** and back hub provides an anti-torque effect, enhancing the stability of the tip for staying in place while the tip is engaged with the laparoscopic tube end **11** during use of the laparoscopic device **65**.

[0031] According to another aspect of the third embodiment, the laparoscopic tube end **11** may include a groove **70** into which a band **700** of heat-shrink material is disposed. The heat-shrink material, which may be formed either entirely or partially of at least one type of fluorinated ethylene propylene (FEP) material, may have a shape and material composition selected so as to generate minimal additional friction during engagement of the tip **500** to the laparoscopic tube end **11** beyond the friction that would otherwise be produced by the laparoscopic tube end **11** if the band **700** of heat-shrink material were not included. When the tip **500** is engaged with the laparoscopic tube end **11**, the band **700** of heat-shrink material may provide a water-resistant seal, enhancing the fluid-resistant and electrically insulating properties of the laparoscopic device **65**.

[0032] In a further aspect of the third embodiment, the interior **50** of the tube end **11** may include a metal interface or adapter **600** made of stainless steel or any other suitable material (such as a biologically inert ferrous or non-ferrous metal, for example) for use in medical devices, in which the metal interface or adapter **600** is bonded to the interior **50** of the tube end **11** (by molding, adhesives, or welding, for example). The metal interface **600** may provide a surface suitable for welding to other components, and may include a sufficiently durable material for incorporating a slot mechanism or movement assembly such as, for example, a slot feature and/or barrel pin which controls the movement of an inner shaft assembly.

[0033] Because a laparoscopic tube end **11** that is composed of a semi-crystalline electrically resistive plastic material such as PEEK provides electrical resistivity, especially in conjunction with a band **700** of heat-shrink material composed of, for example, FEP to create a fluid resistive seal, the overall electrically insulating and fluidically isolating qualities of the laparoscopic device **65** may be enhanced.

[0034] In addition, although the laparoscopic device **65** has been exemplified as including a tool **505** in the form of shears on a tip **500**, it is to be understood that the present invention is not limited thereto but may alternatively include, for example, a grasping tool, an optical device and/or light, electrical or heat cauterization tool, or any other

tool suitable for use in a laparoscopic or other surgical or medical device.

[0035] It is noted that the foregoing examples have been provided merely for the purpose of explanation and are in no way to be construed as limiting of the present invention. While the present invention has been described with reference to certain embodiments, it is understood that the words which have been used herein are words of description and illustration, rather than words of limitation. Changes may be made, within the purview of the appended claims, as presently stated and as amended, without departing from the scope and spirit of the present invention in its aspects. Although the present invention has been described herein with reference to particular means, materials and embodiments, the present invention is not intended to be limited to the particulars disclosed herein; rather, the present invention extends to all functionally equivalent structures, methods and uses, such as are within the scope of the appended claims.

What is claimed:

1. A laparoscopic tube end for interfacing a tube with an instrument tip, comprising:

- a flange including a contact surface;
- a groove adjacent to the contact surface of the flange;
- an engagement portion configured to engage with the tip; and
- a gasket which is elastically deformable, disposed in the groove and configured to compressibly abut the contact surface of the flange when the tip is attached to the engagement portion.

2. The laparoscopic tube end according to claim 1, wherein the gasket includes an elastomeric material configured to electrically isolate an interior of the tube end from an exterior of the tube end when the tip compresses the gasket.

3. The laparoscopic tube end according to claim 1, wherein the engagement portion includes threading on at least one of an exterior surface of the laparoscopic tube end or an interior surface of the laparoscopic tube end.

4. The laparoscopic tube end according to claim 1, wherein the tip is detachably engagable with the engagement portion.

5. The laparoscopic tube end according to claim 1, wherein the gasket has one of a generally square, circular or rounded cross-section, and is connected to the groove by an adhesive material.

6. The laparoscopic tube end according to claim 1, wherein the tip is configured to compress the gasket against the contact surface of the flange and form a fluid-resistant seal between the tip and the tube end.

7. The laparoscopic tube end according to claim 1, further comprising:

- an interior configured to receive a yoke of the tip; and
- an interior threaded portion configured to threadedly engage with the yoke of the tip.

8. The laparoscopic tube end according to claim 1, wherein the gasket has an outer radius configured to increase from an uncompressed radius to a maximal radius when the gasket is compressed by the tip against the first surface of the flange, and wherein the maximal radius does not exceed a radius of the flange.

9. The laparoscopic tube end according to claim 1, further comprising grease disposed on at least one of the flange, the groove, the engagement portion, the instrument tip or the gasket and configured to at least one of seal or insulate an interior of the tube end from an exterior of the tube end.

10. The laparoscopic tube end according to claim 1, wherein the engagement portion includes threading on at least one of an exterior surface of the instrument tip or an interior surface of the instrument tip.

11. A tip for engaging a laparoscopic tube end, comprising:

- a threaded portion configured to threadedly engage with a laparoscopic tube end;

- a back hub connected with the threaded portion; and

- a seal which is elastically deformable and connected with the back hub, the seal configured to compressibly abut the laparoscopic tube end when the tip is engaged with the laparoscopic tube end.

12. The tip according to claim 11, further comprising an extremity configured to abut a flange of the laparoscopic tube end and a gasket of the laparoscopic tube end.

13. The tip according to claim 11, further comprising a yoke configured to threadedly engage an interior of the laparoscopic tube end, wherein the seal electrically insulates an external surface of the laparoscopic tube end from the interior of the laparoscopic tube end.

14. The tip according to claim 11, wherein the seal is molded to the back hub.

15. The tip according to claim 11, further comprising grease disposed on at least one of the threaded portion, the laparoscopic tube end, the back hub, or the seal and configured to at least one of seal or insulate an interior of the laparoscopic tube end from an exterior of the laparoscopic tube end.

16. A laparoscopic tube end for interfacing a tube with a tip, comprising:

- an attachment portion configured to attach to the tip, the attachment portion including a semi-crystalline electrically resistive plastic material; and

- a tapered flare portion configured to frictionally abut the tip when the tip is attached to the tube end.

17. The laparoscopic tube end according to claim 16, wherein the semi-crystalline electrically resistive plastic material includes at least one polyether ether ketone material.

18. The laparoscopic tube end according to claim 16, further comprising:

- a groove in the attachment portion; and

- a band of heat-shrink material disposed in the groove.

19. The laparoscopic tube end according to claim 18, wherein the heat-shrink material includes at least one fluorinated ethylene material.

20. The laparoscopic tube end according to claim 16, further comprising the tip frictionally abutting the tapered flare portion.

21. The laparoscopic tube end according to claim 16, wherein the attachment portion includes threading configured to detachably engage with the tip.

22. The laparoscopic tube end according to claim 16, further comprising a metal interface fixedly attached to the tube end.

23. The laparoscopic tube end according to claim 21, wherein the metal interface includes stainless steel.

24. The tip according to claim 16, further comprising grease disposed on at least one of the attachment portion, the tip, the laparoscopic or the tapered flare and configured to at least one of seal or insulate an interior of the laparoscopic tube end from an exterior of the laparoscopic tube end.

* * * * *

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[标]申请(专利权)人(译)	MICROLINE PENTAX		
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当前申请(专利权)人(译)	MICROLINE PENTAX INC.		
[标]发明人	THEROUX MARC EWASCHUK MICHAEL DEGUILLEBON HENRI ALISKI PETER PELLETIER DENNIS MAZEJKA BRIAN		
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摘要(译)

用于将管与尖端连接的腹腔镜管端部可包括附接到尖端的附接部分，以及当尖端附接到管端时摩擦地邻接尖端的锥形扩口部分。

