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(54) **SURGICAL MARKER**

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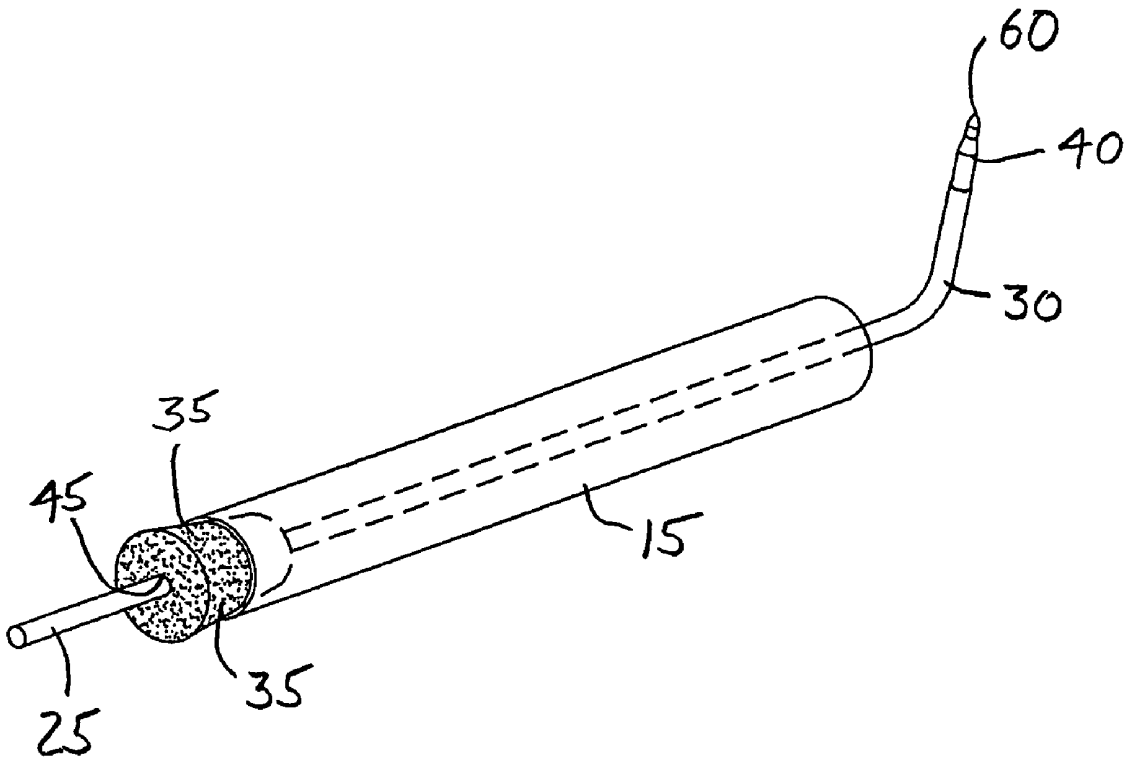
(57) **ABSTRACT**

A surgical instrument for use with a trocar that provides access to an interior portion of a patient. The instrument includes an elongated rod portion sized to fit within the trocar and a leg portion attached to the elongated rod portion and movable with respect to the leg portion to define an acute angle therebetween. A marker is attached to the leg portion and is operable to apply a marking substance to the interior of the patient.



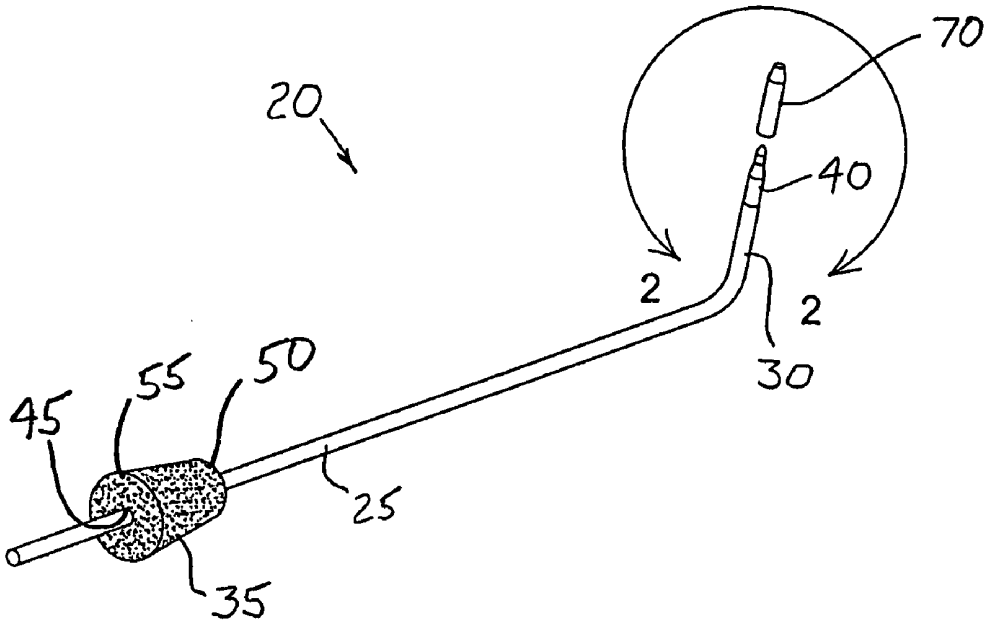


FIG. 1

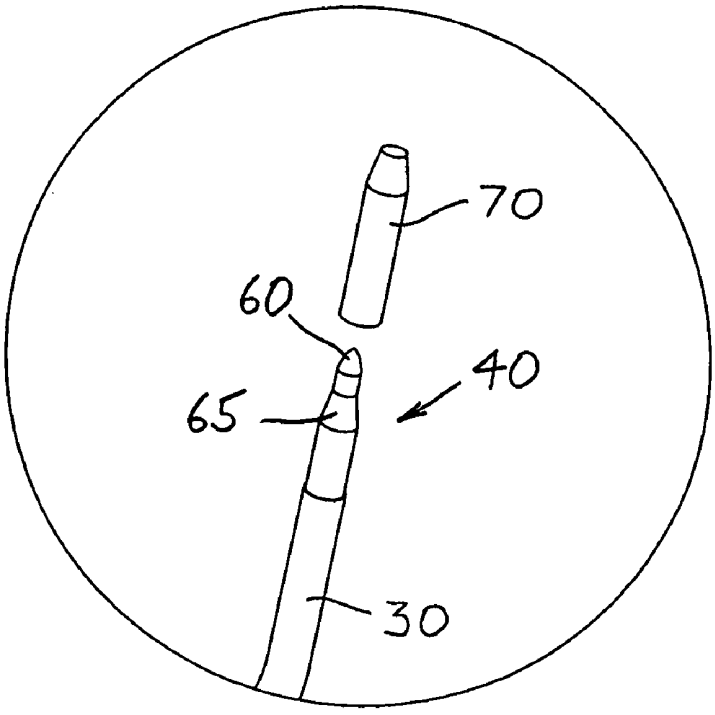


FIG. 2

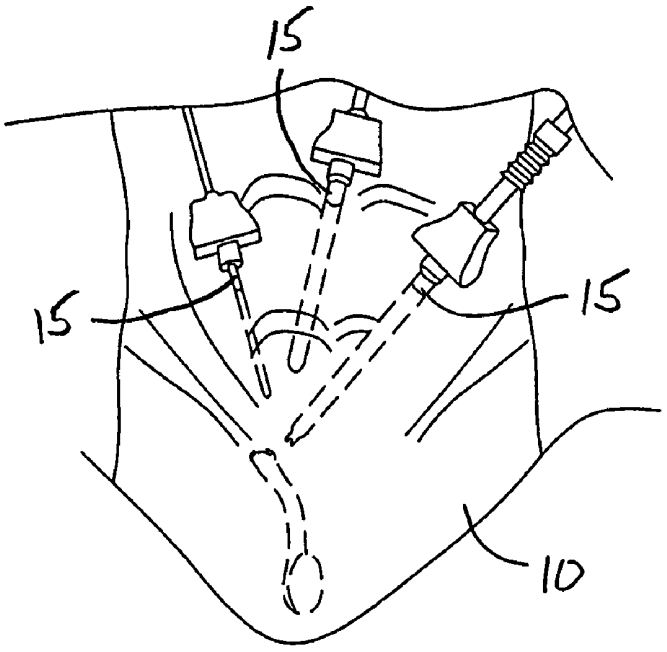


FIG. 3

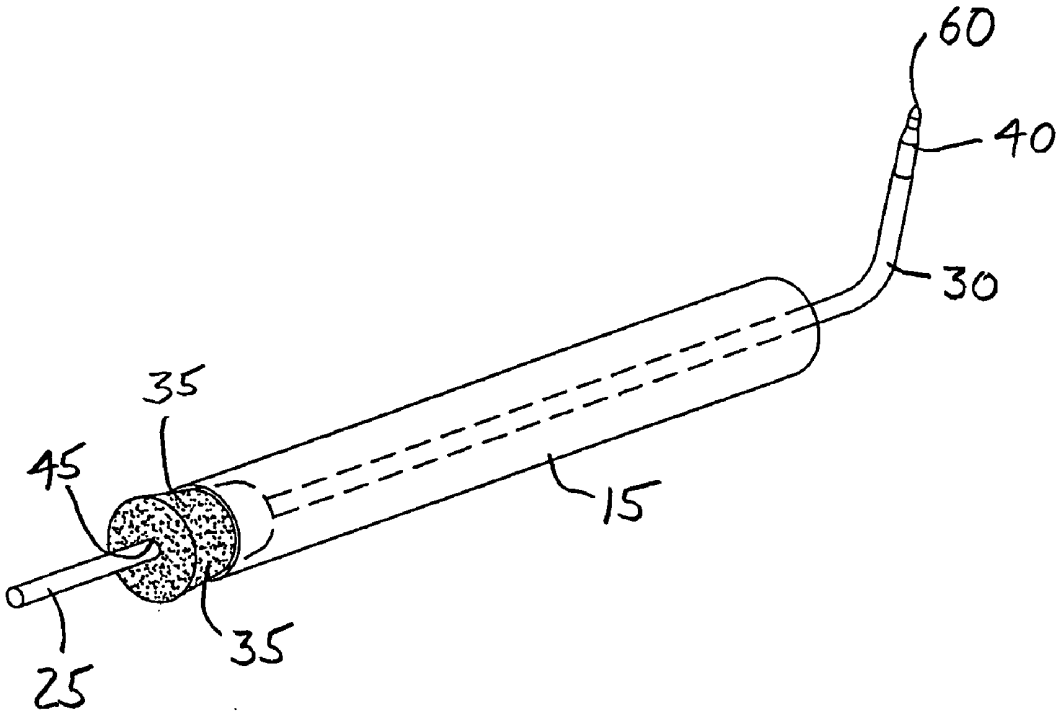


FIG. 4

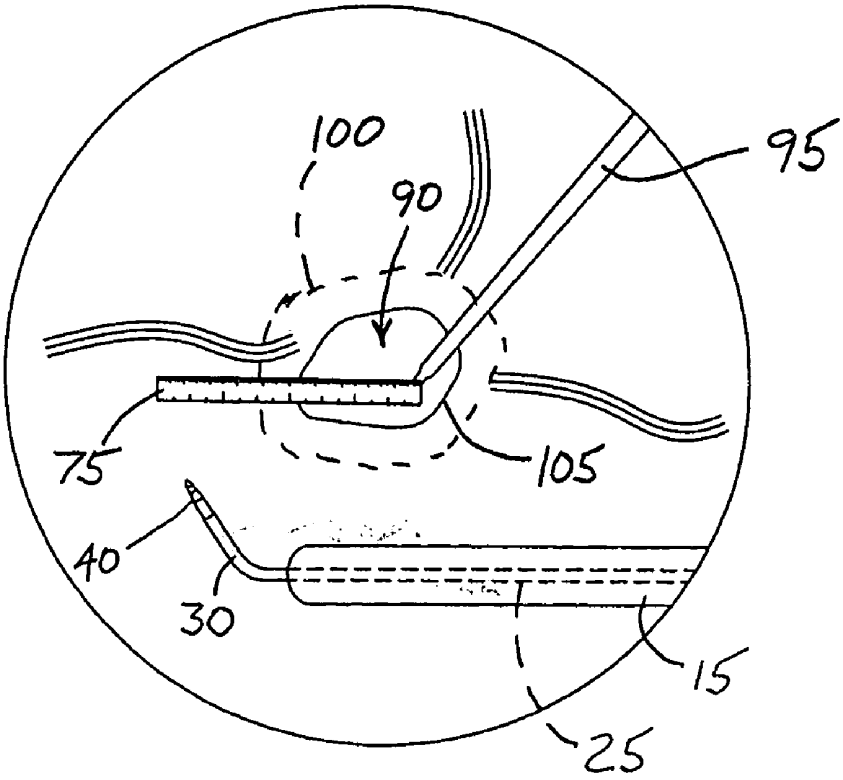


FIG. 5

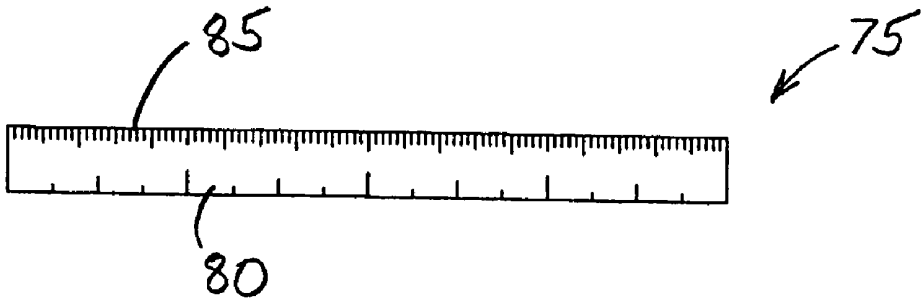


FIG. 6

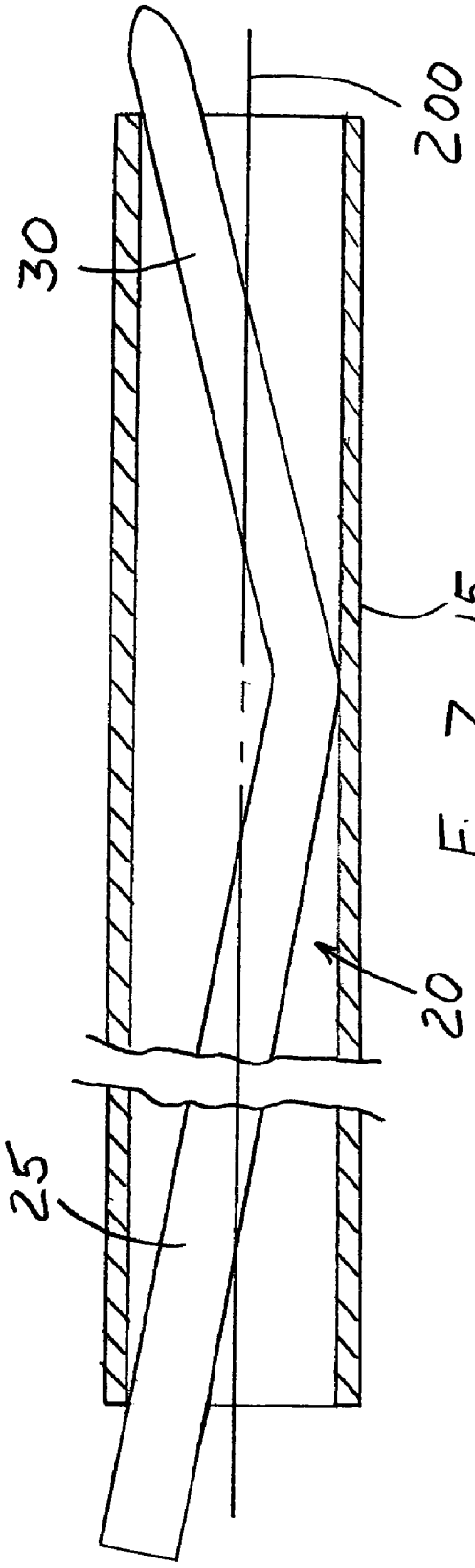


Fig. 7

SURGICAL MARKER

BACKGROUND

[0001] The present invention relates to a surgical marker. More particularly, the present invention relates to a surgical marker adapted to be inserted into a patient via a trocar to mark the interior of the patient.

[0002] During surgery, it is often necessary, or desirable, to mark the body of the patient. However, during laparoscopic procedures, this can be difficult. Thus, the surgeon relies on experience to determine size and position within the patient. For example, during a laparoscopic hernia repair a mesh is positioned to cover a defect. However, once the mesh is positioned, the mesh may obscure reference points typically used by the surgeon, thereby making it more difficult to properly position the mesh.

SUMMARY

[0003] The present invention provides a marker for use inside the body of a patient. The marker is supported on the end of an elongated rod. A leg portion of the instrument is curved slightly to allow the proper positioning of the marker within the body. The marker and rod are sized to pass through a variety of trocars.

[0004] In one embodiment, the invention provides a surgical instrument for use with a trocar that provides access to an interior portion of a patient. The instrument includes an elongated rod portion sized to fit within the trocar and a leg portion attached to the elongated rod portion and movable with respect to the leg portion to define an acute angle therebetween. A marker is attached to the leg portion and is operable to apply a marking substance to the interior of the patient.

[0005] In another embodiment, the invention provides a laparoscopic surgical instrument usable during a surgical procedure in which at least one trocar provides access to an interior portion of a patient having a defect. The surgical instrument includes a marking device sized to pass at least partially through the trocar. The marking device includes a marker portion, a rod portion, and a leg portion. The leg portion supports the marker portion and is movable with respect to the rod portion to define a variable angle therebetween. A measuring device is sized to pass through the trocar such that the measuring device is positionable adjacent the defect and cooperates with the marking device to define a perimeter.

[0006] In still another embodiment, the invention provides a method of performing a laparoscopic procedure. The method includes positioning a trocar to provide access to an interior of a patient and passing a portion of a marking device through the trocar to position a leg portion within the interior. The leg portion defines an oblique angle with respect to a rod portion and supports a marker. In addition, the invention includes contacting the marker and the interior of the patient to make a visible mark, bending at least one of the leg portion and the rod portion to substantially align the leg portion and the rod portion along a common axis, and removing the marking device from the interior via the trocar.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] **FIG. 1** is a perspective view of an instrument suited for use in a laparoscopic procedure;

[0008] **FIG. 2** is an enlarged perspective view of a portion of the instrument of **FIG. 1**, taken along line **2-2** of **FIG. 1**;

[0009] **FIG. 3** is a schematic illustration of a patients torso during a laparoscopic procedure;

[0010] **FIG. 4** is a perspective view of the instrument of **FIG. 1** disposed within a trocar;

[0011] **FIG. 5** is an interior view of a patient showing the instrument in use;

[0012] **FIG. 6** is a measuring device for use with the instrument of **FIG. 1**; and

[0013] **FIG. 7** is a side view of the instrument of **FIG. 1** being removed or inserted through a trocar.

DETAILED DESCRIPTION

[0014] Before any embodiments of the invention are explained in detail, it is to be understood that the invention is not limited in its application to the details of construction and the arrangement of components set forth in the following description or illustrated in the following drawings. The invention is capable of other embodiments and of being practiced or of being carried out in various ways. Also, it is to be understood that the phraseology and terminology used herein is for the purpose of description and should not be regarded as limiting. The use of "including," "comprising," or "having" and variations thereof herein is meant to encompass the items listed thereafter and equivalents thereof as well as additional items. Unless specified or limited otherwise, the terms "mounted," "connected," "supported," and "coupled" and variations thereof are used broadly and encompass both direct and indirect mountings, connections, supports, and couplings. Further, "connected" and "coupled" are not restricted to physical or mechanical connections or couplings.

[0015] Laparoscopic surgery is becoming a more popular alternative to conventional open surgery. The minimally-invasive nature of laparoscopic surgery generally reduces the recovery time and the pain experienced by the patient. Laparoscopic techniques have been successfully applied to many procedures (e.g., hernia repair, gastric bypass, appendectomy, etc.). While laparoscopic surgery is applicable for many different procedures, the invention described herein will be discussed as being used in a hernia repair procedure. This should not be read as limiting the invention in anyway. Rather, the hernia repair is used for exemplary purposes.

[0016] **FIG. 3** illustrates the torso of a patient **10** undergoing a laparoscopic procedure. Typically, the surgeon places three small incisions in the patient to allow for the insertion of three trocars **15**. Of course, other procedures may require fewer or more incisions and trocars **15**. The trocars **15** are generally hollow tubes that allow for the insertion of various instruments. One instrument includes a miniature video camera that can be positioned by the surgeon to provide a view of the interior cavity of the patient **10**. Generally, the video camera enlarges or magnifies the view to allow the surgeon to see all of the necessary details. The other two trocars **15** allow for the insertion and use of other instruments (e.g., scissors, forceps, graspers, and the like).

[0017] **FIG. 1** illustrates one possible instrument **20** that can be inserted into one of the trocars **15**. The instrument **20**

includes an elongated rod portion **25**, a leg portion **30**, a stopper or adapter **35**, and a marker **40**. Generally, the elongated rod portion **25** and the leg portion **30** are integrally-formed as a single piece, preferably from a single material. However, other constructions may form the rod portion **25** and the leg portion **30** separately and then attach them to one another (e.g., adhesive, fasteners, welding, and the like).

[**0018**] The leg portion **30** is angled relative to the long axis of the elongated rod portion **25** to allow for the desired positioning of the marker **40**. Specifically, the angle allows the surgeon to manipulate the marker **40** to mark interior surfaces of the patient **10**. In preferred constructions, an acute or oblique angle between about zero and 90 degrees is defined. In more preferred constructions, the angle is between about 20 degrees and 70 degrees when in a non-deformed, or stress free condition. In some constructions, the leg portion **30** is articulated such that the surgeon can manipulate the angle between the leg portion **30** and the rod portion **25** during surgery. For example, one construction may include an inflatable bladder disposed within the leg portion **30** and/or the rod portion **25**. When the bladder is inflated, the pressure forces the leg portion **30** to straighten relative to the rod portion **25**. Careful control of the pressure within the bladder allows the surgeon to orient the leg portion **30** to almost any desired angle. In another construction, a cable, wire, shaft, or other linkage means engages the leg portion **30** and extends out of the rod portion **25** to provide access to the surgeon. In one example, the linkage means rotates a cam within or near the leg portion **30** that moves the leg portion **30** from an angled position to a position in which the leg portion **30** is substantially aligned with the rod portion **25**. As one of ordinary skill will realize, there are many different ways to produce the desired articulated motion of the leg portion **30** relative to the rod portion **25**. As such, the invention should not be limited to the few examples described herein.

[**0019**] In preferred constructions, a shape-memory material or superelastic material (e.g., titanium oxide, Nitinol, plastic, etc.) is employed to form the leg portion **30** or the leg portion **30** and the elongated rod portion **25** together. The superelasticity allows the angle of the leg portion **30** to change significantly relative to the rod **25** without permanently deforming the components. In still other constructions, a metal or plastic material is employed to form the rod **25** and/or the leg portion **30**. Many different materials can be used to form the rod **25** and/or the leg portion **30** so long as the material is elastic enough to allow significant displacement of the leg portion **30** relative to the rod **25** without causing damage to the rod **25** or leg portion **30**, and rigid enough to allow for manipulation and accurate positioning within the body of the patient **10**. In one construction, plastic is used to achieve the desired results.

[**0020**] In most constructions, the rod **25** and leg portion **30** are smaller than the inside diameter of the smallest trocar **15** anticipated. For example, if a 5 mm trocar **15** is the smallest trocar **15** generally used, a rod **25** and leg portion **30** formed to be less than 5 mm in diameter will pass through the trocar **15**. Of course, other constructions may employ a larger diameter rod **25** and leg portion **30**, and be limited to use with larger trocars **15**.

[**0021**] The stopper or adaptor **35** is generally frustoconical in shape and includes an opening, such as a central aperture **45**. The central aperture **45** is sized to engage the elongated rod portion **25** and define a substantial airtight seal therebetween. The rod **25** is able to slide within the aperture **45** to move the marker **40** as necessary within the patient **10**. It should be noted that while a centrally located aperture **45** is illustrated in **FIGS. 1 and 4**, there is no requirement that the aperture **45** be centrally located within the stopper **35**.

[**0022**] The stopper or adaptor **35** includes a small diameter portion **50** that is smaller than the smallest trocar **15** that is anticipated, and a large diameter portion **55** that is larger than the largest diameter trocar **15** anticipated. For example, most trocars **15** are between 5 mm and 15 mm in diameter. Thus, one construction of a stopper **35** includes a small diameter portion **50** of about 3 mm and a large diameter portion **55** of about 17 mm. This stopper **35** will fit within any trocar **15** between 5 mm and 15 mm and will provide a seal between the outer surface of the stopper **35** and the inner surface of the trocar **15**. Generally, a resilient material such as rubber (natural or synthetic), plastic, and the like, is employed to form the stopper **35**. It should be noted that 5 mm trocars **15** are generally the smallest trocar **15** employed. Typically, 5 mm trocars **15** do not require a stopper or adaptor **35**. As such, one preferred construction will employ a stopper having a small diameter portion **50** that is about 5 mm or greater. As one of ordinary skill in the art will realize, the small diameter portion **50** and the large diameter portion **55** are sized to engage and seal the trocar **15**. As such, the sizes of the small diameter portion **50** and the large diameter portion **55** can vary greatly as can the size of the trocar **15** employed.

[**0023**] Turning to **FIG. 2**, the marker **40** and a portion of the leg portion **30** are shown enlarged. The marker **40** attaches to, or is formed as part of the leg portion **30** and extends along the long axis defined by the leg portion **30**. The marker **40** includes a tip **60** and a reservoir **65** that holds a marking substance, such as ink. The ink flows from the reservoir **65** to the tip **60** and can be applied to the patient **10** as is well known in the art. Generally, the reservoir **65** is small, as the marker **40** is used once and discarded. However, some constructions may employ reusable markers **40** that require larger reservoirs **65**. In most constructions, the reservoir **65** contains a surgical ink such as, but not limited to, gentian violet ink, or the like. The ink is preferably non-toxic, non-smearing, and non-irritating. In other constructions, other color inks, or other marking substances, may be employed as required for the particular procedure being performed. It should be noted that some constructions place all the needed ink in the tip **60** such that the tip **60** at least partially defines the reservoir **65**.

[**0024**] In some constructions, a cap **70** is provided to cover the marker **40** before use of the instrument **20**. The cap **70** inhibits contact between the marker tip **60** and other objects that may damage the tip **60** or deplete the ink supply. The cap **70** also inhibits drying of the tip **60**, as often occurs when a marker tip **60** is left exposed to the air.

[**0025**] **FIG. 4** shows the instrument **20** positioned within a trocar **15**. As illustrated, the rod **25** is partially disposed within the trocar **15** such that the leg portion **30** extends beyond the end of the trocar **15** that is disposed within the patient **10** during the procedure. The rod **25** extends through the central aperture **45** of the stopper **35** such that the surgeon is able to manipulate the rod **25** (or the bladder,

linkage means, etc.) to move the leg portion **30** and marker **40** from outside of the patient **10**. The stopper **35** engages the end of the trocar **15** outside of the patient **10** and maintains a substantially air tight seal.

[**0026**] When the surgeon is using the instrument **20**, it is sometimes necessary to make an accurate measurement within the patient. To that end, a measuring device **75**, illustrated in **FIG. 6**, may be employed to allow for the accurate measurement of distance. The measuring device **75** is formed from a shape-memory material or superelastic material. Thus, the measuring device **75** can be rolled or deformed into a shape that will pass through one of the trocars **15**, but that will not permanently deform the measuring device **75**. The measuring device **75** can be unrolled within the patient and used to take measurements. In preferred constructions, the measuring device **75** is marked with both English units (inches) **80** and metric units (cm) **85**. Of course, other constructions could use other measuring units as desired by the surgeon.

[**0027**] The use of the instrument **20** and the measuring device **75** will now be described as applied to a hernia repair procedure, and as illustrated in **FIG. 5**. **FIG. 5** illustrates the view provided to the surgeon by the miniature camera positioned within the patient **10**. As can be seen, the camera position is such that a defect **90** is centered in the surgeon's view. The surgeon inserts the measuring device **75** through one of the trocars **15** and holds it in the desired position using a grasper **95** that is inserted through the second trocar **15**. The grasper **95** allows the surgeon to position the measuring device **75** as desired near the defect **90**. The surgeon inserts the instrument **20** through the third trocar **15** and positions the stopper **35** in the trocar **15** to maintain a substantially air tight seal. The surgeon then manipulates the rod **25** (or the bladder, linkage means, etc.) to position the marker tip **60** as desired. The surgeon then uses the instrument **20** and the measuring device **75** in conjunction to place the desired markings on the patient **10** around the defect **90**. For example, the surgeon may wish to mark a perimeter **100** around the defect **90** that is spaced a predefined distance (e.g., one inch, two inches, etc.) from an edge **105** of the defect **90**.

[**0028**] Once the perimeter **100** is marked, the surgeon removes the measuring device **75** and the instrument **20** and inserts a mesh (not shown). The mesh is positioned over the defect **90** to repair the hernia. However, the mesh employed is generally opaque and as such blocks the surgeon's view of the defect **90**. The surgeon is able to use the perimeter **100** marked using the instrument **20** to assure that the mesh is properly positioned over the defect **90**.

[**0029**] When inserting or removing the instrument **20**, the leg portion **30** and/or the rod portion **25** are bent such that they are substantially aligned along a common axis **200**. The amount of alignment required is only enough to allow the instrument to pass through the trocar **15**, as illustrated in **FIG. 7**. Thus, it is not necessary that the leg portion **30** and rod portion **25** lie completely on the common axis **200**, only that they sufficiently align with the common axis **200** to allow movement through the trocar **15**.

[**0030**] As one of ordinary skill will realize, the instrument **20** described herein is suitable for use in virtually any laparoscopic procedure that could benefit from accurate markings placed within the body of the patient **10**.

[**0031**] Generally, the instrument **20** (shown in **FIGS. 1 and 2**) is a single use item that is used during a laparoscopic surgical procedure. Thus, the instrument **20**, including the ink within the marker **40**, is sterilized before use. While many different sterilization procedures are possible, it is believed that gamma ray sterilization is best suited to the task of sterilizing the instrument **20**, with other sterilization processes also being possible. In some constructions, the measuring device **75** is included with the instrument to define a kit. The kit is disposed within a container to provide storage of the instrument **20** and the measuring device **75** and to facilitate easy transfer of the kit from one location to another. For these constructions, the entire kit is sterilized before use and may be discarded after use, or reconditioned, resterilized, and reused.

[**0032**] Thus, the invention provides, among other things, an instrument **20** suited for use in marking the interior of a patient **10** during a laparoscopic procedure. More specifically, the invention provides a kit that allows for the accurate measurement and marking within a patient **10** during a laparoscopic procedure.

What is claimed is:

1. A surgical instrument for use with a trocar that provides access to an interior portion of a patient, the instrument comprising:

an elongated rod portion sized to fit within the trocar;

a leg portion attached to the elongated rod portion and movable with respect to the leg portion to define an acute angle therebetween; and

a marker attached to the leg portion and operable to apply a marking substance to the interior of the patient.

2. The instrument of claim 1, wherein the elongated rod portion and the leg portion are integrally-formed as a single piece using a shape-memory material.

3. The instrument of claim 1, wherein the acute angle is between about 20 degrees and 70 degrees.

4. The instrument of claim 1, wherein the leg portion is movable to vary the acute angle between zero degrees and 90 degrees without permanent deformation of the elongated rod portion and the leg portion.

5. The instrument of claim 1, further comprising an articulation member coupled the leg portion and adjustable to vary the acute angle.

6. The instrument of claim 5, wherein the articulation member includes an inflatable bladder.

7. The instrument of claim 1, wherein the marker includes a reservoir that contains a surgical ink.

8. The instrument of claim 7, wherein the marker further includes a tip that at least partially defines the reservoir.

9. A laparoscopic surgical instrument kit usable during a surgical procedure in which at least one trocar provides access to an interior portion of a patient, the surgical instrument comprising:

a marking device sized to pass at least partially through the trocar and including a marker portion, a rod portion, and a leg portion, the leg portion supporting the marker portion and movable with respect to the rod portion to define a variable angle therebetween; and

a measuring device sized to pass through the trocar such that the measuring device is positionable in the interior portion of the patient.

10. The laparoscopic surgical instrument kit of claim 9, wherein the rod portion and the leg portion are integrally-formed as a single piece.

11. The laparoscopic surgical instrument kit of claim 9, wherein the marker includes a reservoir that holds a marking substance and a tip that applies a portion of the marking substance to the interior of the patient.

12. The laparoscopic surgical instrument kit of claim 9, wherein the measuring device is elastically-deformable into a shape that allows for passage into the interior of the patient via the trocar.

13. The laparoscopic surgical instrument kit of claim 9, wherein the variable angle is variable between about zero degrees and ninety degrees.

14. The laparoscopic surgical instrument kit of claim 9, wherein the variable angle is between about 20 degrees and 70 degrees when the leg portion and the rod portion are in a stress free condition.

15. A method of performing a laparoscopic procedure, the method comprising:

positioning a trocar to provide access to an interior of a patient;

passing a portion of a marking device through the trocar to position a leg portion within the interior, the leg portion defining an oblique angle with respect to a rod portion and supporting a marker;

contacting the marker and the interior of the patient to make a visible mark;

bending at least one of the leg portion and the rod portion to substantially align the leg portion and the rod portion along a common axis; and

removing the marking device from the interior via the trocar.

16. The method of claim 15, further comprising bending at least one of the leg portion and the rod portion to substantially align the leg portion and the rod portion to facilitate insertion of the marking device into the trocar.

17. The method of claim 15, further comprising manipulating the rod portion from outside of the patient to move the marker.

18. The method of claim 15, further comprising additionally contacting the patient interior with the marker to mark a perimeter.

19. The method of claim 15, further comprising passing a measuring instrument through the trocar, positioning the measuring instrument adjacent a defect, and marking a perimeter a substantially fixed distance from the defect.

20. The method of claim 15, further comprising sterilizing the marking device.

* * * * *

专利名称(译)	手术标记		
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[标]申请(专利权)人(译)	VECTOR手术		
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当前申请(专利权)人(译)	VECTOR手术		
[标]发明人	PHILLIPS MICHAEL		
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优先权	60/647652 2005-01-27 US		
外部链接	Espacenet USPTO		

摘要(译)

一种与套管针一起使用的外科器械，其提供进入患者内部的通路。该器械包括细长杆部分和腿部，细长杆部分的尺寸适于配合在套管针内，腿部部分连接到细长杆部分并且可相对于腿部部分移动以在它们之间限定锐角。标记附接到腿部并且可操作以将标记物质施加到患者的内部。