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(54) **ARGON BEAM COAGULATION FLEX PROBE FOR LAPAROSCOPIC SURGERY**

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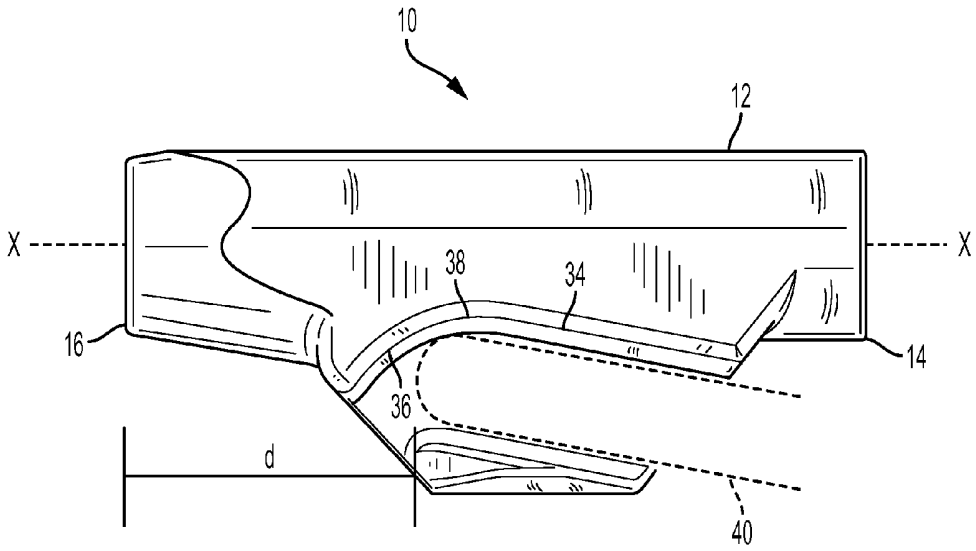
CPC ***A61B 18/042*** (2013.01); ***A61B 34/30*** (2016.02); *A61B 2034/302* (2016.02); *A61B 2018/00589* (2013.01)

(57) **ABSTRACT**

An argon beam coagulation probe for a robotic surgery system having a body with an argon gas entry port and an argon gas exit port and a pedestal interconnected to the underside of body that includes a pair of opposing arcuate channels that positioned equidistantly about the body. As a result, the argon gas jet exit port will be aligned equidistantly between the two fingers of a robotic arm and the body will be aligned in the same direction as the yaw axis of the robotic arm, so that argon gas will be expelled in the same direction that the fingers are pointing. A surgeon manipulating the robotic arms from the master control can thus easily align the probe based on the positioning of the robotic fingers and will still have the entire range of pitch, yaw, and roll movement of the robotic system.



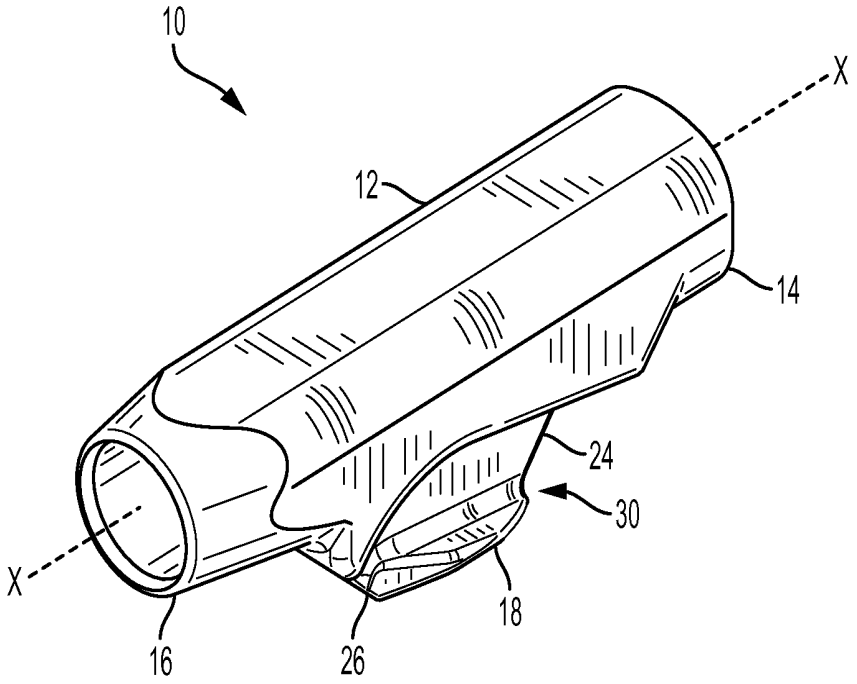


FIG. 1

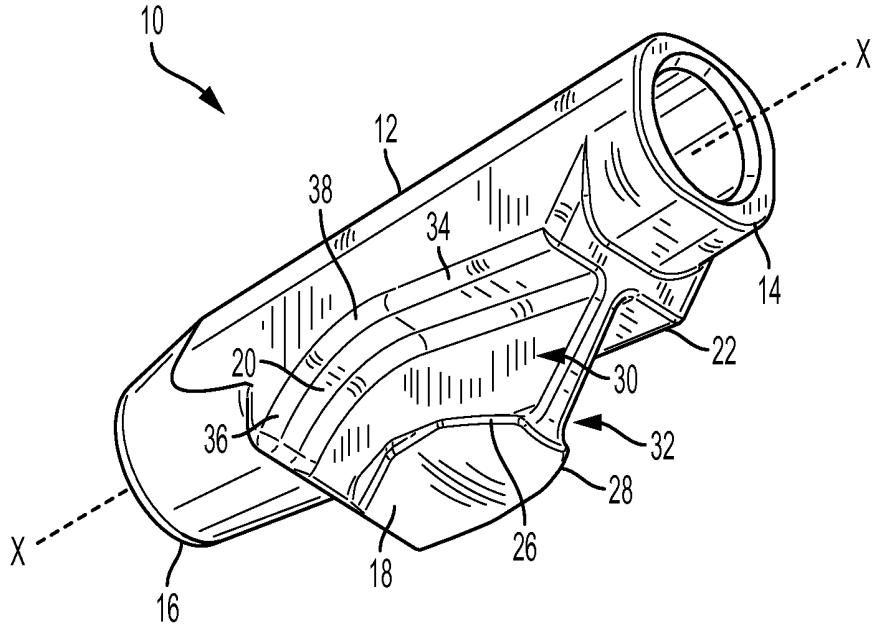


FIG. 2

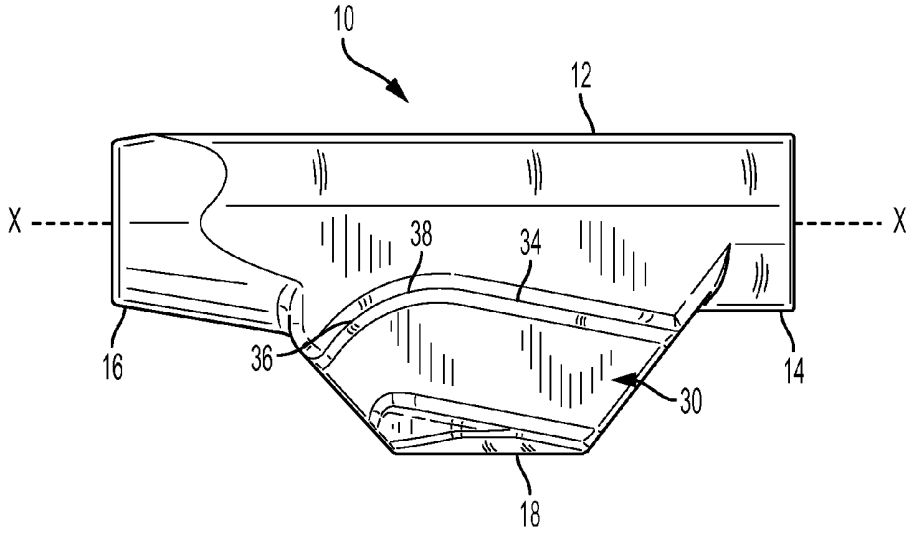


FIG. 3

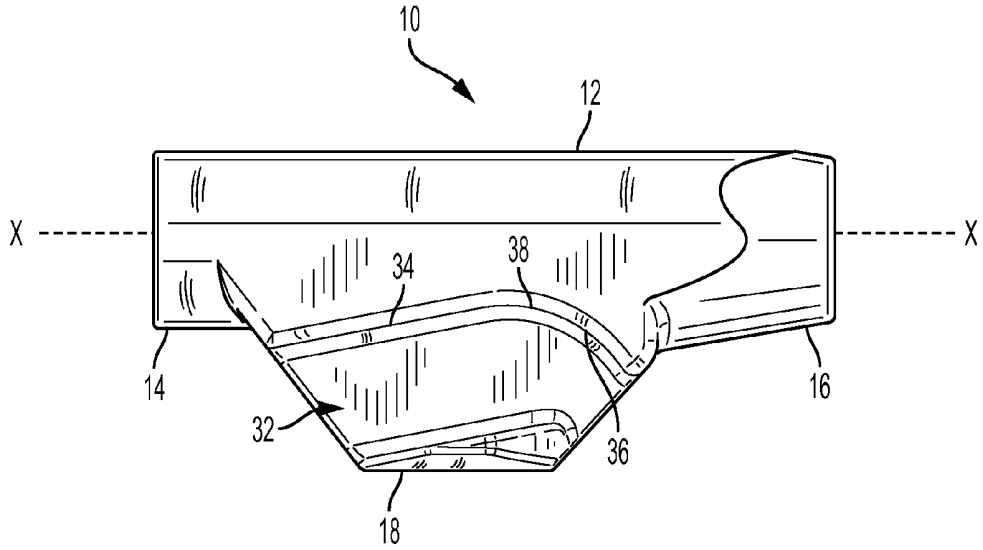


FIG. 4

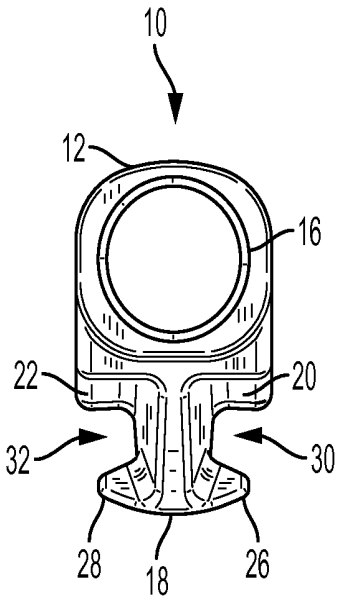


FIG. 5

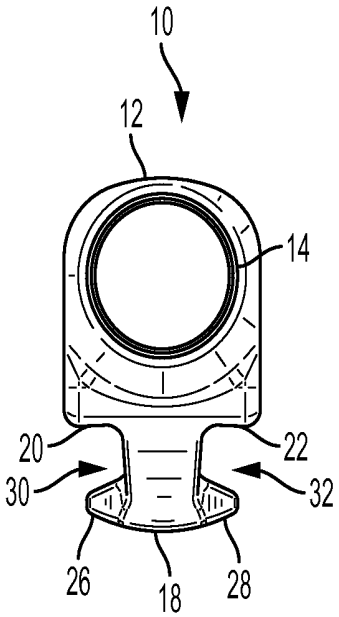


FIG. 6

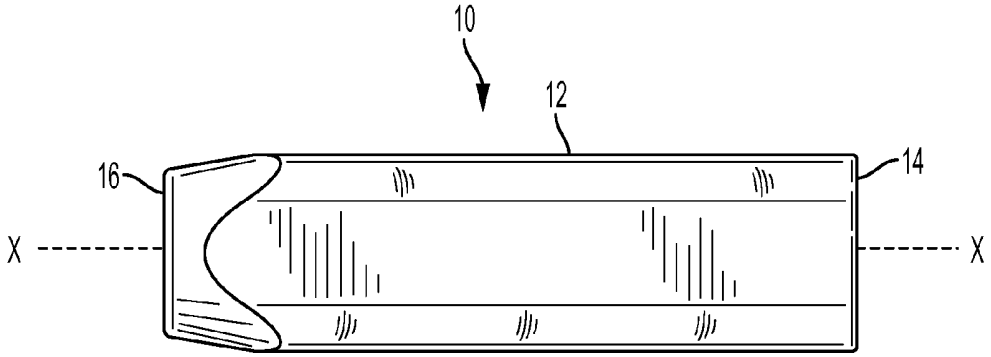


FIG. 7

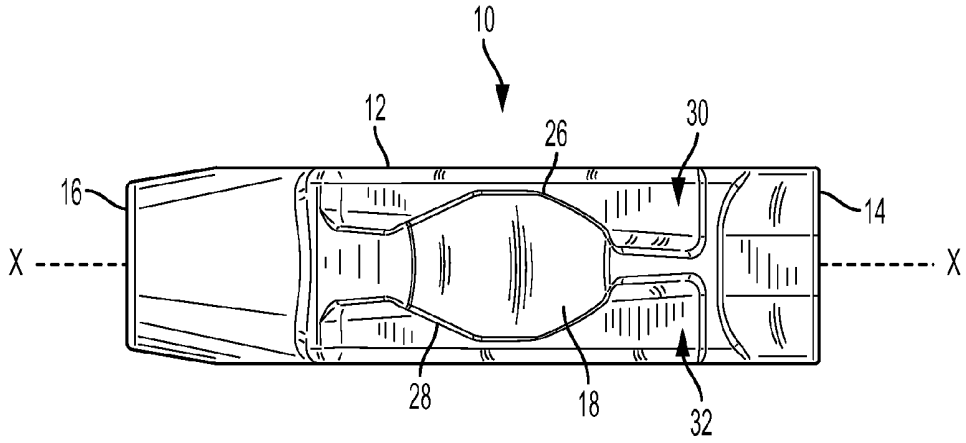


FIG. 8

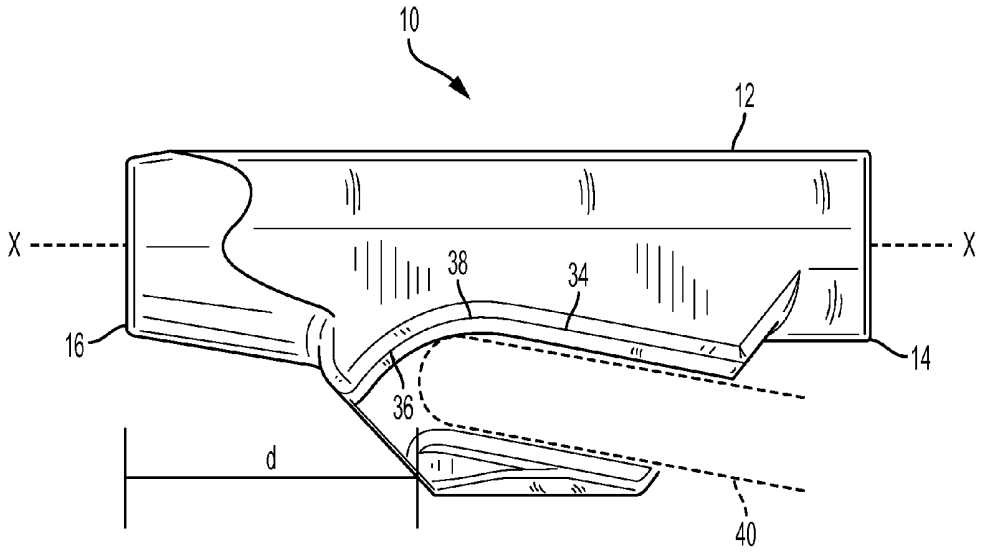


FIG. 9

ARGON BEAM COAGULATION FLEX PROBE FOR LAPAROSCOPIC SURGERY

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates to argon beam coagulation flex probes and, more particularly, and probe for use with minimally invasive robotic surgical systems.

[0003] 2. Description of the Related Art

[0004] Minimally invasive robotic surgical systems, such as the da Vinci System available from Intuitive Surgical of Sunnyvale, Calif., have multiple robotic arms that can hold tools, such as scalpels, for manipulation by a surgeon using a set of master controls. The use of such system has expanded to include advanced surgical systems, such as ultrasonic scalpels, electrosurgical tools, and even fiber optic surgical systems that can be gripped by the robotic arms and then positioned by the surgeon for use. However, the manner in which these advanced surgical systems are coupled to the robotic system often obscures the surgical site and fails to preserve the high range of motion and alignment that is at the heart of the robotic systems. Accordingly, there is a need in the art for an argon beam coagulation probe that, when attached to a robotic surgical system, will allow a surgeon to properly manipulate, position, and use the probe.

BRIEF SUMMARY OF THE INVENTION

[0005] The present invention is an argon beam coagulation probe having a body extending along a longitudinal axis from a proximate end having an argon gas entry port to a distal end having an argon gas exit port and a pedestal interconnected to the body to define a pair of opposing channels positioned equidistantly about the longitudinal axis. The pedestal comprises a central member extending along a plane that encompasses the longitudinal axis and a pair of flanges extending from the central member opposite from the body. The body has a pair of shoulders spaced apart from the pair of flanges to define the two opposing channels. Preferably, each of the pair of channels are arcuate and include a first, longer portion at the proximate end of body and a second, short portion at the distal end of the body. The first, longer portion of each of the pair of channels extends toward the longitudinal axis from the proximate end of body to the distal end of the body. The second, shorter portion of each of the paid of channels extends away from the longitudinal axis from the proximate end of body to the distal end of the body.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING(S)

[0006] The present invention will be more fully understood and appreciated by reading the following Detailed Description in conjunction with the accompanying drawings, in which:

[0007] FIG. **1** is a perspective view of an argon beam coagulation flex probe for laparoscopic surgery according to the present invention;

[0008] FIG. **2** is a second perspective view of an argon beam coagulation flex probe for laparoscopic surgery according to the present invention;

[0009] FIG. **3** is a left side view of an argon beam coagulation flex probe for laparoscopic surgery according to the present invention;

[0010] FIG. **4** is a right side view of an argon beam coagulation flex probe for laparoscopic surgery according to the present invention;

[0011] FIG. **5** is a front view of an argon beam coagulation flex probe for laparoscopic surgery according to the present invention;

[0012] FIG. **6** is a rear view of an argon beam coagulation flex probe for laparoscopic surgery according to the present invention;

[0013] FIG. **7** is a top plan of an argon beam coagulation flex probe for laparoscopic surgery according to the present invention;

[0014] FIG. **8** is a bottom plan of an argon beam coagulation flex probe for laparoscopic surgery according to the present invention; and

[0015] FIG. **9** is a left side view of an argon beam coagulation flex probe for laparoscopic surgery according to the present invention with robotic fingers shown in phantom.

DETAILED DESCRIPTION OF THE INVENTION

[0016] Referring now to the drawings, wherein like reference numerals refer to like parts throughout, there is seen in FIG. **1** an argon beam coagulation probe **10**, such as one used with an argon beam coagulation system, that may be readily used by a robotic surgical system, including the da Vinci System. Probe **10** comprises a body **12** having from a proximal end **14** defining a supply port to which the source of argon gas and the internal electrode needed for an argon beam coagulation system may be attached or positioned within. Body **12** extends along a longitudinal axis X-X from proximal end **14** to an open distal end **16** from which the argon gas and plasma beam may be expelled onto tissue to be treated by the argon beam coagulation system. As seen in FIG. **2**, distal end **16** can include a slight taper to assist in the flow of argon gas through and out of body **12**, and to improve visibility of the tissue site around probe **10** when used with a robotic surgical system.

[0017] Referring to FIG. **2**, body **12** includes a pedestal **18** positioned equidistantly between two shoulders **20** and **22** formed in body **12**. Pedestal **18** extending outwardly from body **12** and includes a central member **24** that is attached to the underside of body **12**. Central member **24** extends longitudinally along a portion of body **12** in a plane that intersects axis X-X. A pair of opposing flanges **26** and **28** extend outwardly from central member **24** to define, along with shoulders **20** and **22**, a pair of opposing channels **30** and **32** that are positioned equidistantly about pedestal **18** on the underside of body **12**, and thus equidistantly about axis X-X.

[0018] As seen in FIGS. **3** and **4**, channels **30** and **32** extend along the underside of body **12**. Channels **30** and **32** each include a first, linear portion **34** that extends toward axis X-X of body **12** and a second, arcuate **36** portion that extends from linear portion **34** away from axis X-X of body **12** to define a shoulder **38**. Channels **30** and **32** are each adapted to receive a corresponding one of the two fingers of a robotic arm of a robotic surgical system so that each finger is captured within a respective linear portion **34** of one of channels **30** and **32**, respectively. As seen in FIG. **8**, channels **30** and **32** are slightly offset from axis X-X so that the proximal ends of channels **30** and **32** are closer together and to axis X-X while the distal ends are father apart to correspond to the geometry of robotic fingers **40** when they are

closed from an open, V-shaped position into an almost fully closed grasping position to hold probe **10**.

[0019] Referring to FIG. **9**, shoulder **38** formed by the overall arcuate shape of channels **30** and **32** assists in the retention of robotic fingers **40** within channels **30** and **32** by allowing each finger to be received in linear portion **34** with shoulder **38** of arcuate portion **36** acting as a stop to prevent further longitudinal movement of each finger **40** along body **12**. Shoulder **38** is positioned and dimensioned to act as a stop that prevents the ends of each finger of the robotic arm from becoming too close to open distal end **16**, which could lead to arcing between the energized argon plasma exiting open distal end **16** and fingers **40** of the robotic arm, which are typically metal. For example, in a body having a length of 0.500 inches +/−0.020, shoulder **38** may be configured to provide a setback distance "d" of 0.169 inches between open distal end **16** and the distal end of robotic fingers **40** of an exemplary robotic device, such as the da Vinci large needle driver (8 mm) available from Intuitive Surgical of Sunnyvale, Calif. The setback distance may be varied according to the size of body **12**, the composition of robotic fingers **40**, and the energy to be provided by probe **10**. It should be recognized by those of skill in the art that shoulder **38** could instead be a protrusion or a wall at the end of liner portion **34**, which would also act as stop preventing fingers **40** from becoming too close to open distal end **16**. Shoulder **38** and arcuate portion **36** does allow probe **10** to be used with robotic fingers **40** having a curved or ovate shape, such as grasping forceps.

[0020] Referring to FIGS. **5-8**, channels **30** and **32** are positioned equidistantly from axis X-X on either side of body **12** due to the positioning of pedestal **18** along a plane that intersects to axis X-X of body **12**. As a result, distal end **16** of body **12** that provides the argon gas jet exit port will be aligned equidistantly between the two fingers of the robotic arm. In addition, axis X-X will be aligned in the same direction so the two fingers of the robotic arm, commonly referred to as the yaw axis of the robotic arm, so that argon gas will be expelled in the same direction that the fingers are pointing. As a result, a surgeon manipulating the robotic arms from the master control can easily align the argon gas stream existing probe **10** based on the positioning of the fingers. In addition, the alignment of axis X-X of probe **10** along the yaw axis of the robotic arm allows a surgeon to more easily transition probe **10** through the entire range of pitch, yaw, and roll movements that are the stated advantages of a robotic system having wrist-like movement capabilities.

What is claimed is:

1. An argon beam coagulation probe, comprising:

a body extending along a longitudinal axis from a proximate end having an argon gas entry port to a distal end having an argon gas exit port;

a pedestal interconnected to the body and defining a pair of opposing channels positioned equidistantly from each other about the longitudinal axis.

2. The probe of claim **1**, wherein the pedestal comprises a central member extending along a plane that encompasses the longitudinal axis.

3. The probe of claim **2**, wherein the pedestal further comprises a pair of flanges extending from the central member opposite from the body.

4. The probe of claim **3**, wherein the body further comprises a pair of shoulders spaced apart from the pair of flanges to define the two opposing channels.

5. The probe of claim **4**, wherein each of the pair of channels are arcuate.

6. The probe of claim **5**, where each of the pair of channels include a first, linear portion at the proximate end of body and a second, arcuate portion at the distal end of the body.

7. The probe of claim **6**, wherein the first, longer portion of each of the pair of channels extends toward the longitudinal axis from the proximate end of body to the distal end of the body.

8. The probe of claim **7**, wherein the second, shorter portion of each of the pair of channels is curved away from the longitudinal axis from the proximate end of body toward the distal end of the body.

9. The probe of claim **8**, wherein the arcuate portion defines a stop providing a predetermined setback distance between the argon gas exit port and a robotic finger position in the channel.

10. The probe of claim **9**, wherein the pair of channels are closer together and to the longitudinal axis at the proximate end than at the distal end.

* * * * *

专利名称(译)	用于腹腔镜手术的氩束凝固柔性探针		
公开(公告)号	US20170007312A1	公开(公告)日	2017-01-12
申请号	US14/878356	申请日	2015-10-08
[标]申请(专利权)人(译)	康曼德公司		
申请(专利权)人(译)	CONMED CORPORATION		
当前申请(专利权)人(译)	CONMED CORPORATION		
[标]发明人	BOJANOWSKI MICHAEL SANKHOLKAR SACHIN A		
发明人	BOJANOWSKI, MICHAEL SANKHOLKAR, SACHIN A.		
IPC分类号	A61B18/04 A61B34/30		
CPC分类号	A61B18/042 A61B34/30 A61B34/37 A61B2018/00589 A61B34/35 A61B2034/302 A61B2017/00477		
其他公开文献	US10398490		
外部链接	Espacenet USPTO		

摘要(译)

一种用于机器人手术系统的氩梁凝固探针，其具有带氩气入口和氩气出口的主体和与主体下侧相互连接的基座，该基座包括一对相对的弓形通道，所述弓形通道围绕主体等距地定位。结果，氩气射流出口将在机械臂的两个指状物之间等距地对准，并且主体将在与机器人臂的偏航轴相同的方向上对准，从而氩气将被排出。手指指向的方向相同。因此，从主控制器操纵机器人臂的外科医生可以基于机器人手指的定位容易地对准探针，并且仍将具有机器人系统的整个范围的俯仰，偏转和滚动运动。