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(54) AUTOMATED PROBE PLACEMENT DEVICE

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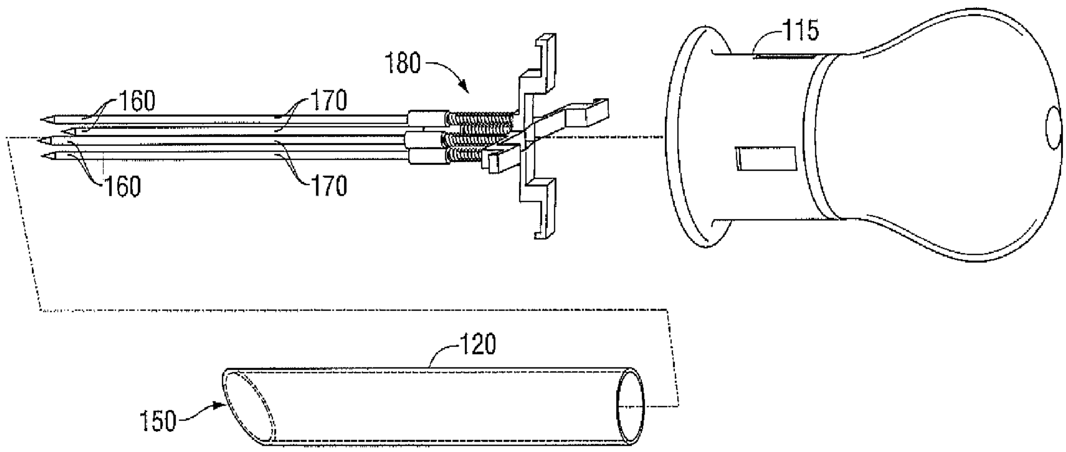
(57) **ABSTRACT**

A probe includes a handle and an elongated shaft with proximal and distal ends. The elongated shaft includes a plurality of axial holding tube projections to house a corresponding plurality of measurement probes. The probe further includes an actuation system to operably engage each of the plurality of measurement probes to permit selective actuation thereof. Each of the plurality of measurement probes is capable of being advanced distally relative to the handle in response to the actuation thereof. The plurality of measurement probes measure one or more parameters selected from a group consisting of temperature, physiological pressure, conductivity, aquametry, pH level, and oxygen level.



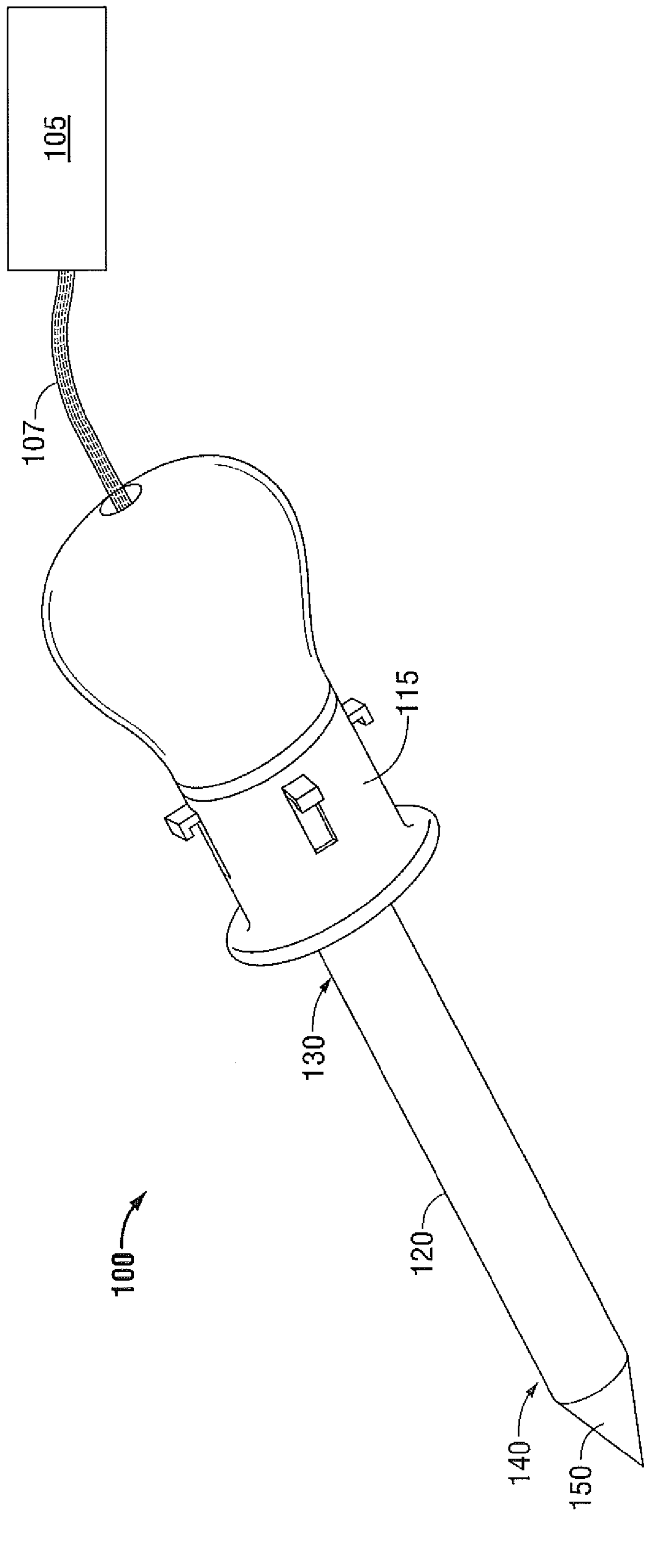


FIG. 1

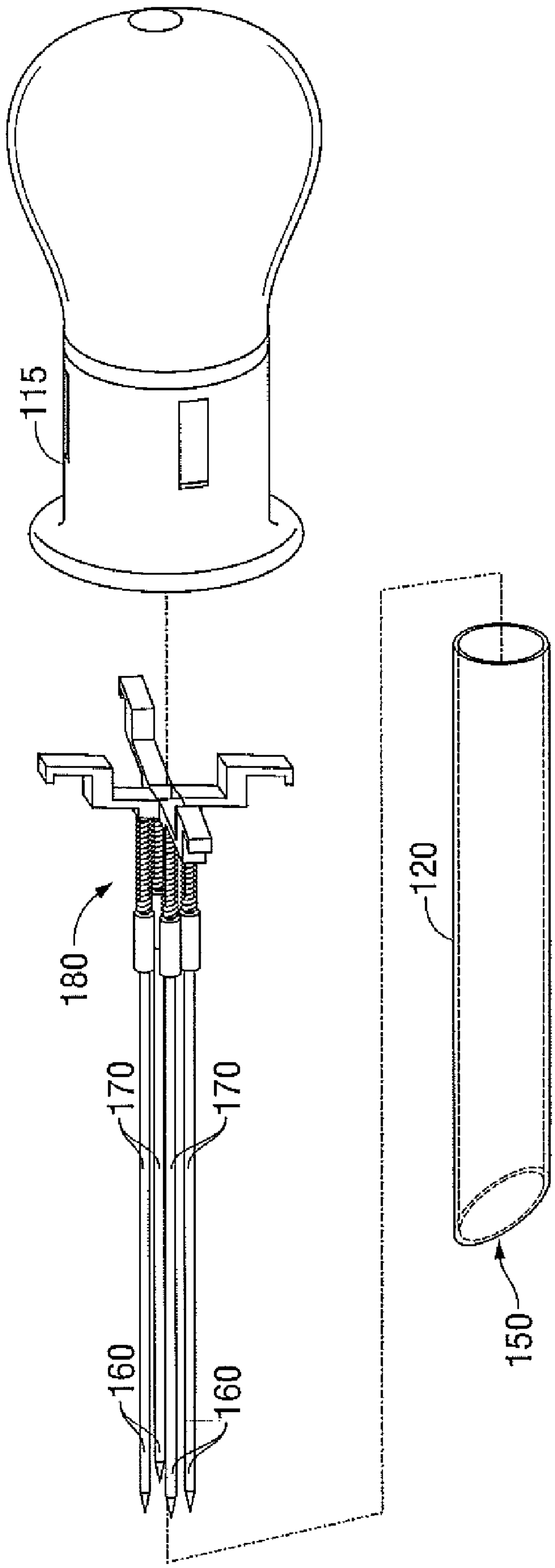


FIG. 2

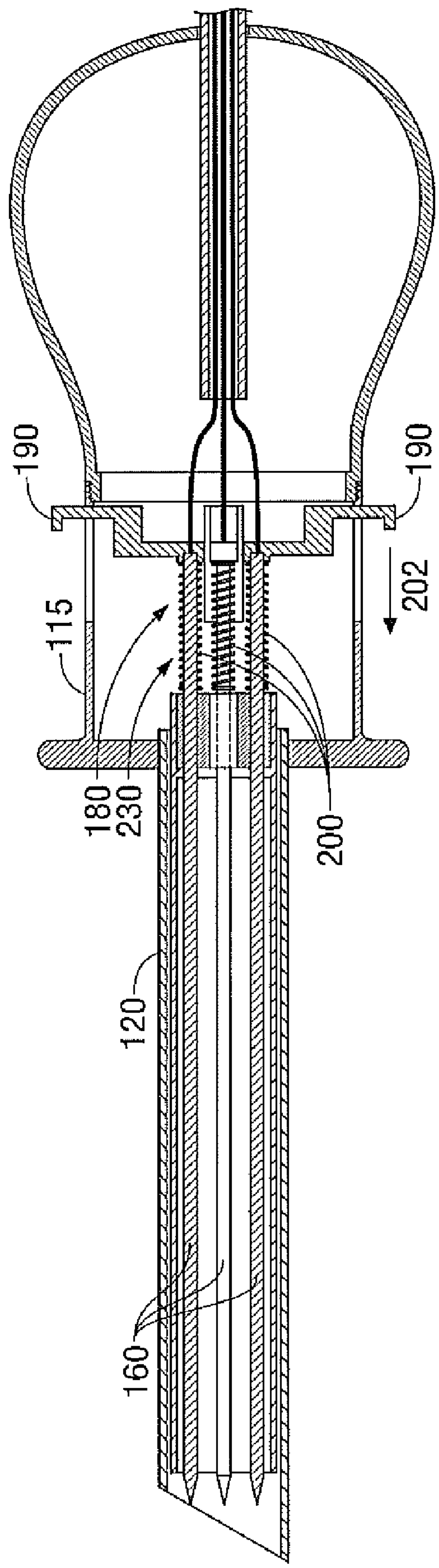


FIG. 3A

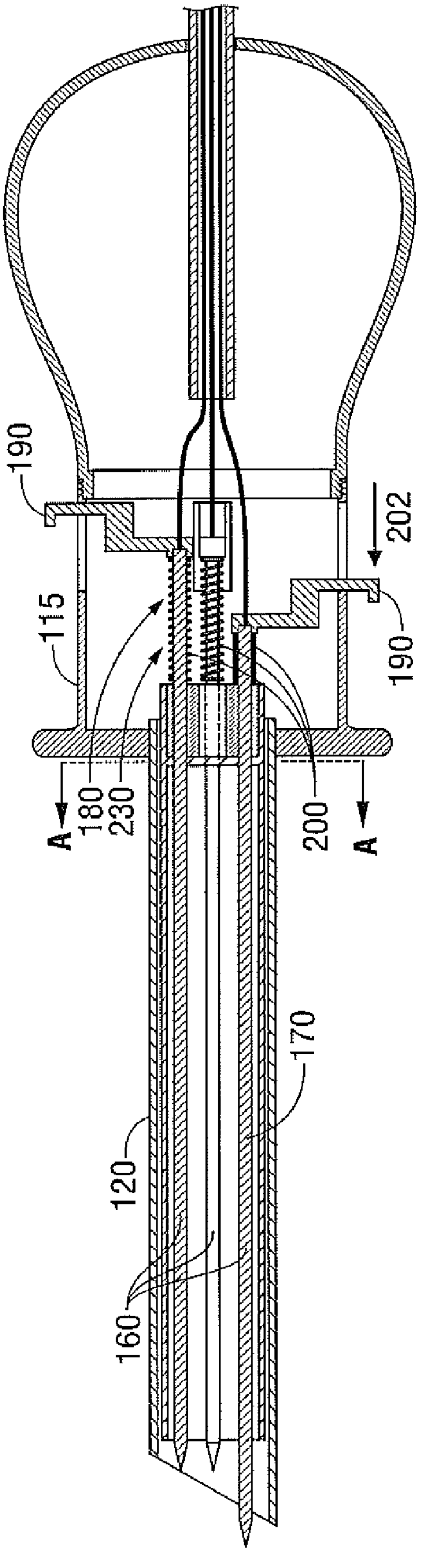


FIG. 3B

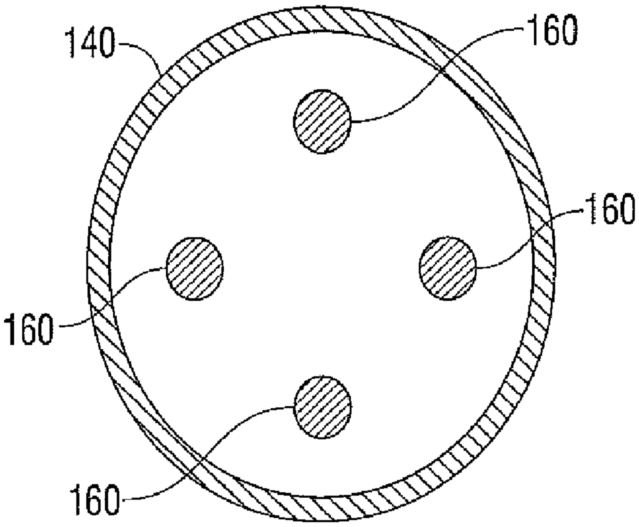


FIG. 4A

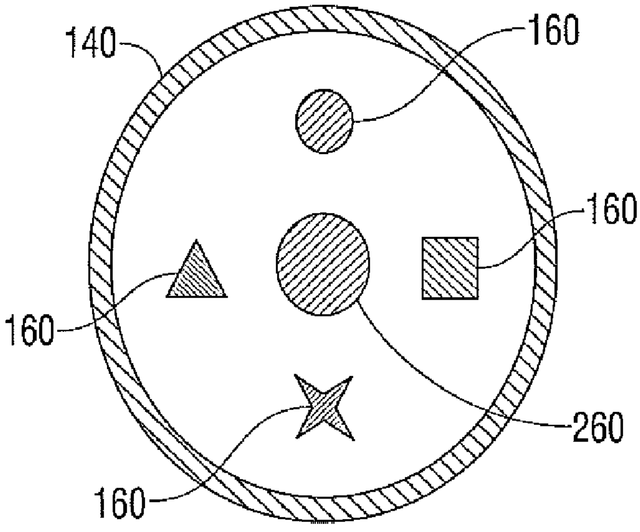


FIG. 4B

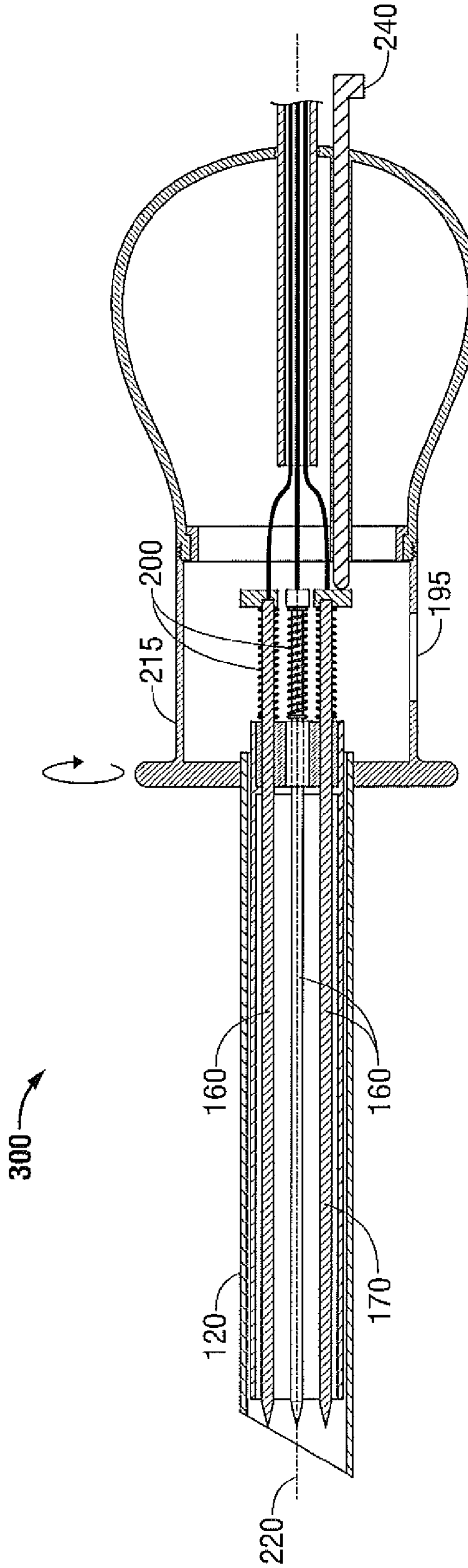


FIG. 5A

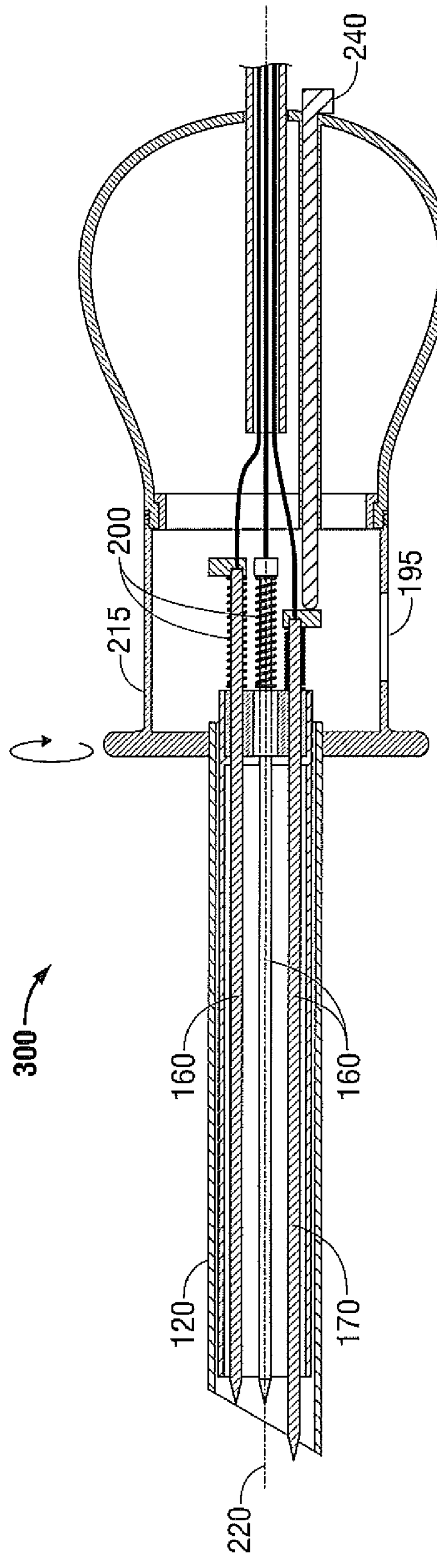


FIG. 5B

AUTOMATED PROBE PLACEMENT DEVICE

BACKGROUND

[0001] 1. Technical Field

[0002] The present disclosure relates to an automated placement probe and method to measure, monitor, and assess efficacy of a body cavity. In particular, the present disclosure relates to the design and use of a multi-measurement probe for providing multiple, and not necessarily complementary functions, such as measuring in-vivo activity of human or animal body tissues.

[0003] 2. Background of Related Art

[0004] This present disclosure relates to instruments and methods for ablation monitoring. More particularly, the present disclosure relates to probes and methods for measuring and accessing efficacy of a body cavity.

[0005] Conventional surgical procedures involve cutting through bodily structures to expose a lesion or organ within the body for treatment. Because these procedures create considerable trauma to the patient, physicians have developed minimally invasive procedures using probes inserted into the body through body orifices or through small holes to treat or measure structures within the body. For example, the devices commonly referred to as endoscopes include an elongated body having a distal end and a proximal end. The distal end of the probe body can be inserted into the gastrointestinal tract through a body orifice. The endoscope may be equipped with optical devices such as cameras or fiber optics to permit observation of the tissues surrounding the distal end, and surgery may be performed by inserting and maneuvering surgical instruments through a channel in the endoscope body. Other probes commonly referred to as laparoscopes and orthoscopes are inserted into the body through small holes formed in surrounding tissues to reach the bodily structures to be treated or measured. Still other probes commonly referred to as catheters, can be advanced through the vascular system, as through a vein or artery, or through other bodily passages such as the urinary tract.

[0006] Typically, many of the above-described techniques require the surgeon to insert different instruments through the working lumen of the endoscope to treat tissue, separate vessels or perform other surgical procedures. Moreover, typical practice in ablation monitoring uses diagnostic imaging that is performed after a procedure is completed to assess efficacy. The ablation monitoring process uses, for example, temperature probes that are integrated into a probe or separate from the probe to gather additional information. However, these probes measure only one particular type of parameter such as temperature. If another parameter is required, the surgeon would use another type of probe. The need for careful and precise control over the probe is critical when monitoring and measuring the body cavity at the same treatment site. Additionally, multiple insertions of different probes require additional body orifices or small holes to treat or measure structures within the body. As can be appreciated, this simply adds to the overall complexity of the operation since it requires the repeated exchange of probes to measure the different data associated with a given surgical procedure.

SUMMARY

[0007] In general, it is an object of the present invention to provide a probe to measure and/or assess efficacy of a body cavity. The probe for measuring and assessing efficacy of a body cavity includes a handle and an elongated shaft with proximal and distal ends. The elongated shaft includes a plurality of axial holding tube projections to house a corresponding plurality of measurement probes. The probe further includes an actuation system to operably engage each of the plurality of measurement probes to permit selective actuation thereof to monitor and assess efficacy of a body cavity. Each of the plurality of measurement probes advances distally relative to the handle in response to actuation thereof.

[0008] In one embodiment, the plurality of measurement probes is arranged in an array-like manner within the elongated shaft. In another embodiment, the measurement probe is selected from a group consisting of temperature, physiological pressure, conductivity, aquametry, pH level, and oxygen level.

[0009] In yet another embodiment, the actuation system includes a resilient member, such as a spring removably disposed on a proximal end of each of the axial holding tube projections. The actuation system further includes at least one projecting edge coupled to a surface of the handle. The at least one projecting edge engages with a corresponding proximal end of one of the plurality of axial holding tube projections. The at least one projecting edge enables a respective plurality of axial holding tube projections to advance distally relative to the handle in response to the actuation.

[0010] In yet another embodiment, the handle of the probe is rotatable so the surgeon can selectively actuate one type of measurement probe (e.g., temperature). The probe includes an indicator number that reflects the type of measurement probe being actuated.

[0011] In yet another embodiment, the probe is able to actuate at least two measurement probes simultaneously to measure and/or assess efficacy of the treatment site.

[0012] In yet another embodiment, the operating portions are configured to deploy the plurality of measurement probes into the body cavity from first, second, and at least third positions. The first position is the plurality of measurement probes being completely inside the elongated shaft, the second position is the plurality of measurement probes being fully extended beyond the distal end of the elongated shaft, and the at least third position is the plurality of measurement probes being extended in-between the first and second positions.

[0013] These and other objects will be more clearly illustrated below by the description of the drawings and the detailed description of the preferred embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] The accompanying drawings, which are incorporated in and constitute a part of this specification, illustrate embodiments of the invention, and together with a general description of the invention given above, and the detailed description of the embodiments given below, serve to explain the principles of the invention.

[0015] FIG. **1** is a perspective view of a probe according to an embodiment of the present disclosure;

[0016] FIG. **2** is an exploded, perspective view of the probe of FIG. **1** according to an embodiment of the present disclosure;

[0017] FIGS. **3**A-**3**B are schematically-illustrated, internal views of the probe according to an embodiment of the present disclosure;

[0018] FIGS. **4**A-**4**B are side sectional views taken along sectional lines A-A in FIG. **3**B according to an embodiment of the present disclosure; and

[0019] FIGS. **5**A-**5**B are schematically-illustrated, internal views of a probe according to an embodiment of the present disclosure.

DETAILED DESCRIPTION

[0020] Particular embodiments of the presently disclosed probe are described in detail with reference to the drawing figures wherein like reference numerals identify similar or identical elements.

[0021] As used herein, the term "distal" refers to that portion which is further from the user while the term "proximal" refers to that portion which is closer to the user or surgeon.

[0022] Various medical conditions, diseases and dysfunctions may be treated by ablation, using various ablation devices and techniques. Ablation is generally carried out to kill or destroy tissue at the site of treatment to bring about an improvement in medical condition being treated. In order to monitor the ablation treatment site, diagnostic imaging is typically performed after a medical procedure to assess efficacy. Moreover, various probes are used to gather medical data that requires multiple insertions into the treatment site.

[0023] As will be further described below in detail, a probe and method are disclosed to provide for the automatic deployment of multiple measurement probes. The probe enables a trocar to perform a combination of multiple functions, enabling the performance of complete procedures for ancillary or essential analytical procedures, diagnostic procedures, quantitative and qualitative analysis, operational environmental determinations, and any other task or information providing mechanism that provides information useful to the operation procedure. For example, the probe according to an embodiment of the present disclosure measures various information or parameters, such as temperature, physiological pressure, conductivity, aquametry, pH level, and oxygen level. Advantageously, the probe is easily deployed and ensures that multiple and repeated measurements are taken at the same treatment site for one point of entry into the body cavity.

[0024] FIGS. **1** and **2** (an exploded perspective view of the probe **100** of FIG. **1**) show a probe **100** configured to measure and/or assess efficacy of a body cavity. The probe **100** includes a handle **115** and an elongated shaft **120** with proximal and distal ends **130**, **140**, respectively. A pointed end **150** for piercing a body tissue is disposed at a distal end of the probe **100**. The elongated shaft **120** includes axial holding tube projections **160** that are configured to house a corresponding measurement probe **170**. The probe **100** further includes an actuation system **180** configured to engage the measurement probes **170** and to actuate each measurement probe **170** to monitor and assess efficacy of a body cavity. Each measurement probe **170** advances distally relative to the handle **115** in response to actuation of the actuation system **180**. The measurement probe(s) **170** may be configured for in-vivo measurement of human or animal body tissue. The measurement probe(s) **170** is capable of measuring and obtaining one or more parameters selected from a group consisting of: temperature, blood, physiological pressure, conductivity, aquametry, pH level, and oxygen level. For example, the blood parameter includes pH, pO_2 or pCO_2.

[0025] In one embodiment, the measurement probe(s) **170** is a fiber optic measurement probe(s). Optical measurement probe(s) **170** has the advantage of operating without taking samples, enable the simultaneous determination of the concentrations of analytes and can also be employed in unfavorable milieus (toxic, corrosive, radioactive, at risk of explosion, sterile, contaminated). Optical measurement probe(s) **170** is generally a fiber-optic element including a distal end with a light entrance opening (not shown) arranged in the axial holding tube projection(s) **160**, i.e., proximate the analytes or in direct contact therewith. The probe(s) **170** is used to carry out measurements of the treatment site with the aid of a light source (not shown).

[0026] The probe **100** is connected to accessory equipment **105** via a cable **107**. The accessory equipment **105** includes one or more sensors that are configured to measure, locate, orient or "index" the various measurement probes **170** disposed within the axial holding tube projections **160** of the elongated shaft **120**. For example, one of the measurement probes **170** measures temperature of the treatment site and includes a sensor or an indexing tool (or other visual indicator) that cooperates with the temperature probe.

[0027] FIGS. **3**A-**3**B are schematically-illustrated, internal views of the probe **100** and actuation system **180**. The actuation system **180** enables the probe **100** to automatically retract, thereby resulting in decreased placement time and increased placement accuracy into the body cavity. As shown in FIG. **3**A, the actuation system **180** includes one or more resilient members **200**, such as springs, removably disposed on a proximal end **230** of each axial holding tube projection **160**. The actuation system **180** further includes an operating portion (or projecting edge) **190** coupled to each axial holding tube projection **160**. The operating portion **190** is engaged with one or more axial holding tube projections **160** to enable the axial holding tube projections **160** to advance distally relative to the handle **115** in response to actuation thereof.

[0028] The operating portion **190** is exposed on the outside surface of the probe handle **115** to enable the surgeon to actuate a desire measurement probe **170**. Although FIG. **3**A shows two (2) operating portions **190**, it should be understood that there could be any suitable number of operating portions. In one particular embodiment, there are two (2) more operating portions that are placed around the circumference of the handle for a total of four (4) operating portions **190**. It should further be understood that for each measurement probe **170**, there is one corresponding operating portion **190**. However, one operating portion **190** may be capable of actuating two or more measurement probes **170**. Further, each operation portion **190** may have an indicator number to indicate the type of measurement probe (e.g., temperature, physiological pressure, conductivity, aquametry, pH level, and oxygen level.) The indicator number may include colors, labels, surface roughness, or have various shapes. For example, the indicator number may have a color on the surface of the operating portion **190** so that a user/surgeon can easily discriminate the different measurement probes.

[0029] In operation, the probe **100** may include four measurement probes **170**, e.g., temperature, pH, pressure, and oxygen level. After surgery, a surgeon may want to obtain medical data from a specific treatment site. Instead of utilizing four different probes (one for each parameter) and trying to maneuver the respective probe to the same treatment site, the surgeon is able to use probe **100** to obtain all four parameters from the same treatment site in one single placement. To this end, the surgeon clicks or actuates one of the measurement probes **170** by sliding the operating portion **190** in the direction labeled as **202**, as illustrated in FIG. **3**A. By sliding the operating portion **190**, a corresponding measurement probe (e.g., temperature) advances distally relative to the handle **115**, as illustrated in FIG. **3**B. The tip of the temperature probe, now in a deployed state, is capable of obtaining the temperature of the treatment site. Once the temperature data is obtained, the surgeon slides the operating portion **190** back to the original position (non-deployed state) where the tip of the temperature probe is now fully retracted inside the elongated shaft **120**. The surgeon may repeat the same steps but for a different measurement probe (e.g., oxygen level).

[0030] When the measurement probe(s) **170** is deployed, the actuation system **180** may include a lockout mechanism (not shown) that enables the measurement probe(s) **170** to remain in a fully deployed state until the surgeon moves the measurement probe(s) **170** back to the non-deployed state. In another embodiment, the actuation system **180** is able to automatically deploy one or more measurement probes **170** simultaneously and then also automatically retract the measurement probes **170** simultaneously to a non-deployed state. In another embodiment, there may be a third state of deploying the measurement probe(s) **170**; the third state (or intermediate position) of deployment being between the non-deployed state and deployed state.

[0031] FIGS. **4**A-**4**B are side sectional views taken along sectional lines A-A of FIG. **3**B.

[0032] Referring to FIG. **4**A, the measurement probe(s) **170** via the axial holding tube projection(s) **160** is arranged in an array-like manner within the elongated shaft **120**. In another embodiment, as illustrated in FIG. **4**B, the elongated shaft **120** may include a working channel **260** disposed in the center of the elongated shaft **120** and is surrounded by the axial holding tube projection(s) **160**. The working channel **260** allows for various surgical instruments to be deployed by the surgeon. The surgical instrument may include vessel sealers, coagulators, biopsy instruments, needles, probes, sensors, graspers, forceps, knives, scissors, sutures, balloon dissectors, stents, irrigators, suction devices, stabilizers, blunt dissectors, lasers, optical devices, implants and anchors. FIG. **4**B also illustrates that the axial holding tube projection(s) **160** may be of any suitable shape to accommodate the various measurement probes **170**. For example, the holding tube projection(s) **160** may take the shape of a square, circle, oval, rectangle, or an "X" shape.

[0033] FIGS. **5**A-**5**B are schematically-illustrated, internal views of a probe **300** according to other embodiments of the present disclosure. Probe **300** has similar working parts as probe **100** with some differences. The handle **215** of probe **300** is rotatable around a longitudinal axis **220** of the elongated shaft **120**. A user deploys one of the measurement probes **170** by actuating a single operating portion **240**. The single operating portion **240** is engaged with a proximal end of one of the axial holding tube projections **160**. In operation, the surgeon rotates the handle **215** to a desired measurement probe **170** and then actuates the operating portion **240** as illustrated in FIG. **5**B. As the handle **215** rotates, the operating portion **240** also rotates until the surgeon selects the desired measurement probe **170**.

[0034] The handle **215** includes an indicator **195** to indicate a type of the plurality of measurement probe(s) **170** being actuated in the body cavity. The indicator **195** may be made of a transparent material and a user may visually distinguish the measurement probe(s) **170** by the various colors of the axial holding tube projection(s) **160** or the measurement probe(s) **170**.

[0035] It should also be understood that various alternatives and modifications could be devised by those skilled in the art. The present disclosure is intended to embrace all such alternatives, modifications and variances that fall within the scope of the appended claims.

1. A probe comprising:
a handle;
an elongated shaft with proximal and distal ends, the elongated shaft including a plurality of axial holding tube projections configured to house a corresponding plurality of measurement probes; and
an actuation system configured to operably engage each of the plurality of measurement probes to permit selective actuation thereof, wherein each of the plurality of measurement probes is configured to advance distally relative to the handle in response to actuation thereof.

2. The probe according to claim **1**, wherein at least one of the plurality of measurement probes is configured for in-vivo measurement of human or animal body tissue.

3. The probe according to claim **1**, wherein at least one of the plurality of measurement probes is configured to measure at least one parameter selected from a group consisting of temperature, physiological pressure, conductivity, aquametry, pH level, and oxygen level.

4. The probe according to claim **1**, wherein at least one of the plurality of measurement probes is a fiber optic measurement probe.

5. The probe according to claim **1**, wherein the plurality of measurement probes is arranged in an array-like manner within the elongated shaft.

6. The probe according to claim **1**, wherein the actuation system includes an operating portion coupled to each of the axial holding tube projections, the operating portion disposed on an outer surface of the probe.

7. The probe according to claim **6**, wherein each of the operating portions is configured to deploy a corresponding measurement probe into the body cavity.

8. The probe according to claim **1**, wherein each of the plurality of measurement probes is actuated individually in the body cavity to measure and assess efficacy of a body cavity.

9. The probe according to claim **1**, wherein at least two of the plurality of measurement probes are actuated simultaneously in the body cavity to measure and assess efficacy of a body cavity.

10. The probe according to claim **1**, wherein the handle includes an indicator to identify a type of the plurality of measurement probes being actuated in the body cavity.

11. The probe according to claim **1**, wherein the actuation system includes:
a resilient member removably disposed on a proximal end of each of the axial holding tube projections; and
at least one projecting edge coupled to a surface of the handle, the at least one projecting edge engages with a corresponding proximal end of one of the plurality of axial holding tube projections, the at least one projecting edge configured to enable a respective plurality of axial holding tube projections to advance distally relative to the handle in response to the actuation.

12. A method comprising the steps of:

providing a probe having:

an elongated shaft with proximal and distal ends, the elongated shaft including a plurality of axial holding tube projections that house a corresponding plurality of measurement probes; and

at least one actuator configured to actuate at least one of the plurality of measurement probes to advance distally relative to the handle in response to actuation thereof; and

actuating one of the plurality of measurement probes to measure a parameter of a body cavity via the actuated measurement probe.

13. The method of claim **12**, further including the steps of:

retracting the measurement probe after the measurement; and

actuating another one of the plurality of measurement probes to measure another parameter of the body cavity.

14. The method according to claim **12**, wherein the parameter is selected from a group consisting of: temperature, physiological pressure, conductivity, aquametry, pH level, and oxygen level.

15. The method according to claim **12**, wherein the plurality of measurement probes are arranged in an array-like manner within the elongated shaft.

16. The method according to claim **12**, wherein each of the plurality of actuators includes a corresponding operating portion, each of the operating portion being exposed to an outer surface of the probe.

17. The method according to claim **12**, wherein each of the operating portions is configured to deploy a corresponding measurement probe into the body cavity.

18. The method according to claim **12**, wherein each of the plurality of measurement probes is actuated individually into the body cavity.

19. The method according to claim **12**, further including the step of providing an indictor operably associated with the probe configured to indicate a type of the plurality of measurement probes being actuated into the body cavity.

* * * * *

专利名称(译)	自动探针放置设备		
公开(公告)号	US20110224504A1	公开(公告)日	2011-09-15
申请号	US12/722034	申请日	2010-03-11
[标]申请(专利权)人(译)	柯惠有限合伙公司		
申请(专利权)人(译)	泰科医疗集团LP		
当前申请(专利权)人(译)	泰科医疗集团LP		
[标]发明人	LADTKOW CASEY M DECARLO ARNOLD V		
发明人	LADTKOW, CASEY M. DECARLO, ARNOLD V.		
IPC分类号	A61B5/00		
CPC分类号	A61B5/6848		
其他公开文献	US8672923		
外部链接	Espacenet USPTO		

摘要(译)

探针包括手柄和具有近端和远端的细长轴。细长轴包括多个轴向保持管突起，以容纳相应的多个测量探针。探针还包括致动系统，以可操作地接合多个测量探针中的每一个以允许其选择性致动。多个测量探针中的每一个能够响应于其致动而相对于手柄向远侧推进。多个测量探针测量选自温度，生理压力，电导率，水分，pH水平和氧水平的一个或多个参数。