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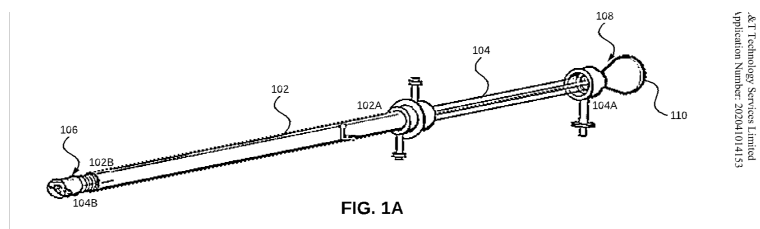
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(54) Title: A DEVICE FOR PERFORMING A HYSTEROSCOPY

(57) Abstract: This disclosure relates to a probing instrument (100) that includes an outer tubular shaft (102) having an associated proximal end (102A) and a distal end (102B), an inner tubular shaft (104) having an associated proximal end (104A) and a distal end (104B). The inner tubular shaft (104) is configured to be positioned and move inside the outer tubular shaft (102). The probing instrument (100) may include a probing assembly including an end effector unit (106) positioned at the distal end (104B) of the inner tubular shaft (104) and a manipulating unit (108) coupled to the end effector unit (106). The manipulating unit (108) may include an input device (110) positioned at the proximal end (104A) of the inner tubular shaft (104). The manipulating unit (108) is configured to reconfigure the end effector unit (106), in response to the input device (110) receiving an intervention from a user.



FORM 2

THE PATENTS ACT 1970

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The Patent Rules, (200)3

Complete Specification

(See Section 10 and Rule 13)

1. TITLE OF THE INVENTION

A Device For Performing Hysteroscopy

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3. PREAMBLE TO THE DESCRIPTION

COMPLETE

The following specification particularly describes the invention and the manner in which it is performed.

DESCRIPTION

TECHNICAL FIELD

[001] This disclosure relates generally to a probing instrument, and more particularly to a probing instrument with wide angle view for use in diagnostic and surgical hysteroscopic procedures.

BACKGROUND

[002] Probing instruments find great importance in diagnostic and surgical procedures. Probing instruments include endoscopes, such as hysteroscopes. Hysteroscopy refers to inspection of a uterine cavity of a subject using the hysteroscope with access through the cervix of the subject. As such, the hysteroscopy may allow diagnosis of intrauterine pathology and surgical intervention.

[003] Currently, hysteroscopes may be used in an operating room setting with the subject being under some type of anesthesia because size of such hysteroscopes is large and may have a blunt end. As a result, such hysteroscopes may cause discomfort and pain to the subject. In certain other scenarios, the hysteroscopes may typically have limited visibility or scope of view. Consequently, such hysteroscopes may need to be rotated to view different parts inside the body of the subject causing more discomfort and pain to the subject.

[004] Accordingly, there is a need for an improved probing instrument which improves precision of surgical hysteroscopic procedures and improves medical safety of subjects.

SUMMARY

[005] In accordance with an embodiment, a probing instrument is disclosed. The probing instrument may include an outer tubular shaft having an associated proximal end and a distal end, an inner tubular shaft having an associated proximal end and a distal end. In accordance with an embodiment, the inner tubular shaft may be configured to be positioned and move inside the outer tubular shaft. The probing instrument may include a probing assembly. The probing assembly may include an end effector unit positioned at the distal end of the inner tubular shaft and a manipulating unit coupled to the end effector unit. In accordance with an embodiment, the manipulating unit may include an input device positioned at the proximal end of the inner tubular shaft. In accordance with an embodiment, the manipulating unit may be configured to

reconfigure the end effector unit, in response to the input device receiving an intervention from a user.

[006] It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory only and are not restrictive of the invention, as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

[007] The accompanying drawings, which are incorporated in and constitute a part of this disclosure, illustrate exemplary embodiments and, together with the description, serve to explain the disclosed principles.

[008] **FIG. 1A** illustrates an isometric view of a probing instrument, in accordance with an embodiment of the present disclosure.

[009] **FIG. 1B** illustrates a magnified view of an end effector of the probing instrument, in accordance with an embodiment of the present disclosure.

[010] **FIG. 2A** illustrates a partial view of the probing instrument towards distal end of end of the probing instrument, according to an embodiment of the disclosure.

[011] **FIG. 2B** illustrates a partial view of the probing instrument towards proximal end of end of the probing instrument, according to an embodiment of the disclosure.

[012] **FIG. 3A** illustrates a perspective view of the probing instrument, according to another embodiment of the present disclosure.

[013] **FIG. 3B** illustrates a magnified view of a distal end portion of the probing instrument, according to an embodiment of the present disclosure.

[014] **FIG. 3C** illustrates a perspective view of an end effector unit of the probing instrument, according to an embodiment of the present disclosure.

[015] **FIG. 3D** illustrates a partial view of the probing instrument towards the proximal side of the probing instrument, according to an embodiment of the present disclosure.

[016] **FIG. 4** illustrates a process of changing orientation of a platform of an end effector of the probing instrument, in accordance with an embodiment of the present disclosure.

[017] FIG. 5 illustrates an isometric exploded view of an exemplary probing instrument for using in a diagnostic or surgical hysteroscopic procedure on a subject, in accordance with an embodiment of the present disclosure.

5 DETAILED DESCRIPTION

[018] Exemplary embodiments are described with reference to the accompanying drawings. Wherever convenient, the same reference numbers are used throughout the drawings to refer to the same or like parts. While examples and features of disclosed principles are described herein, modifications, adaptations, and other implementations are possible without
10 departing from the spirit and scope of the disclosed embodiments. It is intended that the following detailed description be considered as exemplary only, with the true scope and spirit being indicated by the following claims.

[019] The following described implementations may be found in the disclosed probing instrument for using in a diagnostic or surgical hysteroscopic procedure on a subject, such as a
15 human subject. The probing instrument may correspond to a diagnostic assistive device and/or a surgical assistive device. For example, a surgeon may insert the probing instrument within the body of the subject to visualize different internal organs, such as, uterus, liver, spleen, kidney, and the like, on a screen during performing surgery or a clinical examination. The foremost reason to visualize such internal organs is associated with an estimation of the locations of
20 specific organs of interest within the body of the subject within a region associated with incision in the body.

[020] Various embodiments of the disclosure provide the probing instrument that may provide a wide angle of view of some portion or an entire internal organ of interest of the subject. The wide angle of view of the internal organ of interest provided by the probing instrument may
25 help a surgeon in image-guided surgery to track the internal organ of interest of the subject effectively without rotating the probing instrument (a hysteroscope). The rotating or removing the hysteroscope from the subject and re-insertion for better view may cause major discomfort to the subject, due to friction. As such, a friction less probing instrument avoids discomfort and pain to the subject.

[021] Thus, a location of the internal organ of interest may be determined with higher
30 accuracy within the body of the subject by way of using the improved probing instrument during surgery or clinical examination. Such accurate determination of the location of the internal

organ may have a positive impact on accuracy and proficiency of the surgeon while performing a surgery and may facilitate quick assistance to the surgeon, and facilitate medical safety of the subject. Therefore, robust determination of internal region associated with the internal organ of interest by using the probing instrument which offers simple motion at an end effector may mitigate bias of the surgeon generated based on abnormal appearance, growth, variations in anatomical structure, and other factors.

[022] FIG. 1A illustrates an isometric view of an exemplary probing instrument 100 for using in a diagnostic or surgical hysteroscopic procedure on a subject, in accordance with an embodiment of the present disclosure.

[023] As illustrated, the probing instrument 100 may include an outer tubular shaft 102 having an associated proximal end 102A and a distal end 102B. The probing instrument 100 may further include an inner tubular shaft 104 having an associated proximal end 104A and a distal end 104B. The inner tubular shaft 104 may be configured to be positioned and move inside the outer tubular shaft 102. In particular, the outer tubular shaft 102 may be hollow form inside, in which the inner tubular shaft 104 may be positioned and move. As such, the inner tubular shaft 104 may be configured to move linearly or rotate about its central axis, inside the outer tubular shaft 102.

[024] The probing instrument 100 may further include a probing assembly that may include an end effector unit 106 positioned at the distal end 104B of the inner tubular shaft 104, and a manipulating unit 108 coupled to the end effector unit 106. The manipulating unit 108 may include an input device 110 positioned at the proximal end 104A of the inner tubular shaft 104. The input device 110 may allow a user (for example, a surgeon) to control or manipulate the end effector. As such, for example, the input device 110 may be implemented as a joystick or a knob. For example, the joystick may correspond to a handle made up of any durable material, such as, but not limited to, plastic, metal, etc. In other words, the input device 110 may provide a mechanical interface for controlling the end effector unit. However, according to some alternate embodiments, the input device 110 may correspond to an electronic panel with buttons. The manipulating unit 108 may be configured to reconfigure the end effector unit 106, in response to the input device 110 receiving an intervention from a user.

[025] In accordance with an embodiment, the input device 110 may be configured to undergo a three-dimensional angular rotation relative to the axis of the inner tubular shaft 104 based on the intervention received by the input device 110. Further, in some embodiments, input

device 110 may be configured to undergo a rotation about the axis of the inner tubular shaft 104 based on the intervention received by the input device.

[026] According to an embodiment, the outer tubular shaft 102 may be made from a durable material, such as, but not limited to, stainless steel, medical grade plastic, and the like.

5 According to an embodiment, the inner tubular shaft 104 may be made from a durable material, such as, but not limited to, stainless steel, medical grade plastic, and the like. The outer diameter of the inner tubular shaft 104 may be slightly lesser than the inner diameter of the outer tubular shaft 102. According to an embodiment, the outer diameter of the inner tubular shaft 104 may be one millimeter lesser than the inner diameter of the outer tubular shaft 102. The arrangement
10 being such that the inner tubular shaft 104 may be substantially adapted to move in a hollow region of the outer tubular shaft 102.

[027] According to an embodiment, the inner tubular shaft 104 may be longer than the outer tubular shaft 102. The distal end 104B of the inner tubular shaft 104 may stay in proximity to the distal end 102B of the outer tubular shaft 102. In accordance with an embodiment, the
15 inner tubular shaft 104 may be configured to slide and roll inside the outer tubular shaft 102.

[028] The probing instrument 100 may provide a real-time or near real-time assistance to the user, such as, a surgeon in a surgery by providing wide angle of view of internal organ of interest of a subject, and a flexibility to change the angle by manipulating the input device 110. Examples of the probing instrument 100 may include, but are not limited to, an endoscope like
20 a hysteroscope, a computer-assisted surgical system or a robot-assisted surgical system, a medical device, an electronic surgical instrument, a display device, and/or a computing device.

[029] In accordance with an embodiment, a display device (not shown in FIG. 1A) may be configured to display a sequence of video frames or an image to a user, such as, the surgeon. In accordance with an embodiment, the display device may display a test video frame from the
25 sequence of video frames, in real time or near-real time, while the surgical or diagnostic procedure is performed on the internal organ of interest of the subject. Examples of the display device may include, but are not limited to, a smartphone, a camera, a tablet computer, a laptop, a wearable electronic device, a television, an Internet Protocol Television (IPTV), and/or a Personal Digital Assistant (PDA) device.

30 **[030]** A person of ordinary skill in the art will understand that in accordance with an embodiment, the display device may be integrated with the probing instrument 100. Alternatively, the display device may be communicatively coupled to the probing instrument

100. A user, such as the surgeon, of the display device may control the probing instrument 100, with visual support, instructions, and/or guidance from a user-interface of the display device.

[031] The internal organ of interest may correspond to an abdominal organ. The abdominal organ may include a uterus, a liver, a kidney, a spleen, a pancreas and/or the like.

5 The internal organ of interest may include infected abdominal organ, diseased abdominal organ and/or the abdominal organs with cyst, tumour or other abnormal growth.

[032] FIG. 1B illustrates a magnified view of an end effector unit 106 of the exemplary probing instrument 100 for using in a diagnostic or surgical hysteroscopic procedure on a subject, in accordance with an embodiment of the present disclosure.

10 **[033]** As illustrated, the end effector unit 106 may include at least one illumination source 112 (the at least one illumination source, individually or collectively, may be referred to as at least one illumination source 112) configured to illuminate an internal region of the body of the subject. The end effector unit 106 may further include at least one imaging device 114 (the at least one imaging device, individually or collectively, may be referred to as at least one imaging
15 device 114) configured to obtain images of the internal region illuminated by the illumination source 112. In accordance with an embodiment, the imaging device 114 may be configured to obtain a sequence of video frames of the internal region of the subject. The sequence of video frames of the internal region of the subject may be obtained based on insertion of the probing instrument 100 in the body of the subject. The manipulating unit 108 may be provided for
20 controlling an inclination or position of the imaging device 114 and therefore the angle of view of the imaging device 114.

[034] In accordance with an embodiment, the end effector unit 106 may further include a platform 116. For example, the platform may be built of a surgical-grade material selected from a metal, an alloy, a plastic, etc. The platform 116 may have any shape, based on its
25 implementation, including cylindrical, rectangular, semi-spherical, etc. In accordance with an embodiment, the illumination source 112 and the imaging device 114 may be positioned on the platform 116 of the end effector unit 106. For example, the illumination source 112 and the imaging device 114 may be fitted on the platform 116, by way of welding, or pasting using an adhesive, or mechanical fitting, etc. In accordance with an embodiment, the illumination source
30 112 and the imaging device 114 may be covered with an outer glass covering that may envelope the platform 116. In accordance with an embodiment, the reconfiguring of the end effector unit 106 may be performed for changing a viewing angle of the imaging device 114. In accordance with an embodiment, reconfiguring of the end effector unit 106 may include performing at least

one of linear displacement of the platform 116 along an axis of the inner tubular shaft 104 or angular displacement of the platform 116 relative to the axis of the inner tubular shaft 104.

[035] Examples of the illumination source 112 may include, but are not limited to, LED lights, tungsten, metal halide, halogen and xenon lamps. Examples of the imaging device 114 may include, but are not limited to, an endoscopic/laparoscopic camera, a medical resonance imaging (MRI) device, a computer tomography (CT) scanning device, a minimally invasive medical imaging device, and/or a minimal incision medical imaging device. In accordance with an embodiment, the imaging device 114 may correspond to a digital camera. In accordance with an embodiment, the imaging device 114 may use Complementary Metal-Oxide Semiconductor (CMOS) technology.

[036] A person of ordinary skill in the art will understand that the scope of the disclosure is not limited to implementation of the disclosed probing instrument 100 to assist in a surgery or clinical examination of the internal region or the internal organ of interest of a human subject. In accordance with an embodiment, the disclosed probing instrument 100 may be used to assist in a surgery or clinical examination of the internal region or internal organ of interest of an animal subject. Further, the disclosed probing instrument 100 may also be useful to provide assistance in a clinical examination or surgery of anatomical portions or regions other than the abdominal organs, as discussed above.

[037] FIG. 2A illustrates a partial view of the exemplary probing instrument 200 (corresponding to the probing instrument 100) towards distal end of end of the probing instrument 200, according to an embodiment of the disclosure. FIG. 2B illustrates a partial view of the probing instrument 200 towards proximal end of end of the probing instrument 200, according to an embodiment of the disclosure.

[038] As shown in FIG. 2B, in accordance with this embodiment of the probing instrument 200 may include an outer tubular shaft (not shown in FIG. 2B) having an associated proximal end and a distal, an inner tubular shaft 204 having an associated proximal end and a distal end. The inner tubular shaft 204 is configured to be positioned, move linearly, and rotate inside the outer tubular shaft 202. The probing instrument 200 further includes a probing assembly. The probing assembly may be implemented on the inner tubular shaft 204. The probing assembly may include an end effector unit 206 positioned at the distal end of the inner tubular shaft, and a manipulating unit 208 positioned near the proximal end of the inner tubular shaft 204. The manipulating unit 208 may be coupled to the end effector unit 206. The manipulating unit 208 may include an input device 210 positioned at the proximal end of the inner tubular shaft 204.

The manipulating unit 208 may be configured to reconfigure the end effector unit 206 in response to the input device 210 receiving an intervention from a user. To this end, the input device 210 may be implemented as a joystick, a knob, or any other input means capable to undergo a three-dimensional angular rotation relative to the axis of the inner tubular shaft 204, and reflecting this three-dimensional angular rotation on the end effector unit 206.

[039] As shown in FIG. 2B, the manipulating unit 208 may include a plurality of connecting cables 218 positioned inside the inner tubular shaft 204 and along the axis of the inner tubular shaft 204. For example, the connecting cables 218 may be resilient in nature. Each of the plurality of connecting cables 218 may be coupled to the input device 210 via one end of each of the plurality of connecting cables 218 at a distinct location on the input device 210. Further, as it can be seen in the FIG. 2A, in accordance with an embodiment, each of the plurality of connecting cables 218 may be coupled to a platform 216 of the end effector unit 206, via other end of each of the plurality of connecting cables 218 at a distinct location on the platform 216.

[040] In accordance with an embodiment, each of the plurality of connecting cables 218 may be configured to move linearly along the axis of the inner tubular shaft 204. The plurality of connecting cables 218 may be configured to reproduce the intervention received by the input device 210 on the end effector 206. In accordance with an embodiment, the input device 210 may be configured to undergo a three-dimensional angular rotation relative to the axis of the inner tubular shaft 204, based on the intervention received by the input device 210.

[041] According to an embodiment, the connecting cables 218 may be non-resilient cables. According to yet another embodiment, four connecting cables 218 may be connected to the platform 216. The other end of the four connecting cables 218 may be connected to the input device 210. The manipulating unit 208 may further include a plurality of discs 220 like structures configured substantially equidistant inside the inner tubular shaft 204, such that each disc 220 has a plurality of holes 224 for enabling passage of the connecting cables 218. According to an embodiment, each disc 220 may be made up of a durable material, such as, but not limited to, steel, titanium, nickel, germanium, stainless steel, surgical-grade plastic and rubber, etc. According to another embodiment, the disc 220 may have a central hole (not shown in FIGS. 2A-2B) for providing a safe passage to a connection cable for end effector unit 206. According to yet another embodiment, one or more spring members 222 may be provided between the end effector unit 206 and the last disc 220.

[042] It may be understood that cables and discs may help in effectively transferring the three-dimensional angular rotation from the input device 210 to the end effector unit 206. Further, the spring 222 may help in restoring the position of the input device 210 and of the end effector unit 206 in its original position, once the intervention is stopped.

5 [043] According to embodiments of the disclosure, the angle of view of the imaging device 214 of the end effector unit 206 may be changed by operating an input device (shown in FIG. 2B) that in turn move the connecting cables 218, thereby changing the angle of view of the internal region of the body of the subject. In accordance with an embodiment, the input device 210 may be configured to undergo a rotation about the axis of the inner tubular shaft 204
10 based on the intervention received by the input device 210. In other words, the user (i.e., a surgeon, a pathologist) may be able to change the angle of view of the imaging device 214 by manipulating the input device 210. The input device 210 upon being manipulated, may reflect movement of intervention on the end effector unit 206 through the one or more connecting cables 218, one or more discs 220, and the spring 222.

15 [044] In accordance with an embodiment, each of the plurality of connecting cables 218 may be configured to move linearly along the axis of the inner tubular shaft 204. The plurality of connecting cables 218 may be configured to reflect the intervention received by the input device 210. In accordance with an embodiment, the input device 210 may be configured to undergo a three-dimensional angular rotation relative to the axis of the inner tubular shaft 204,
20 based on the intervention received by the input device 210.

[045] According to embodiments of the disclosure, the angle of view of the imaging device 214 of the end effector unit 206 may be changed by operating the input device 210 that in turn move the connecting cables 218, thereby changing the angle of view of the internal region of the body of the subject.

25 [046] In accordance with an embodiment, the end effector unit 206 may be reconfigured for changing a viewing angle of the imaging device 214. In accordance with an embodiment, reconfiguring the end effector unit 206 may include performing at least one of linear displacement of the platform 216 along an axis of the inner tubular shaft 204 or angular displacement of the platform 216 relative to the axis of the inner tubular shaft 204.

30 [047] FIG. 3A illustrates a perspective view of a probing instrument 300 (corresponding to the probing instrument 100) for performing a hysteroscopy according to an embodiment of the present disclosure. FIG. 3B illustrates a magnified view of a distal end portion of the probing

instrument 300, according to an embodiment of the present disclosure. FIG. 3C illustrates a perspective view of an end effector unit 306 of the probing instrument 300, according to an embodiment of the present disclosure. FIG. 3D illustrates a partial view of the probing instrument 300 towards the proximal side (i.e., towards the manipulating unit 308) of the probing instrument 300, according to an embodiment of the present disclosure.

[048] In accordance with an embodiment, the probing instrument 300 may include an outer tubular shaft 302 having an associated proximal end and a distal, an inner tubular shaft 304 having an associated proximal end and a distal end. The inner tubular shaft 304 is configured to be positioned and move inside the outer tubular shaft 302. The probing instrument 300 further includes a probing assembly. The probing assembly may be implemented on the inner tubular shaft 304. The probing assembly may include an end effector unit 306 positioned at the distal end of the inner tubular shaft, and the manipulating unit 308 (shown in FIG. 3D) positioned near the proximal end of the inner tubular shaft 304. The manipulating unit 308 may be coupled to the end effector unit 306. The manipulating unit (not shown in FIG. 3A-3C) may include an input device positioned at the proximal end of the inner tubular shaft 304. The manipulating unit may be configured to reconfigure the end effector unit 306 in response to the input device 310 (shown in FIG. 3D) receiving an intervention from a user. To this end, the input device 310 may be implemented as a joystick, a knob, or any other input means capable of undergoing rotation about the axis of the inner tubular shaft 304 based on the intervention received by the input device. In accordance with an embodiment, the input device may be configured to undergo a rotation about the axis of the inner tubular shaft 304 based on the intervention received by the input device 310. The angle of view of the imaging device 314 may be controlled by rotating the input device in a clockwise or anticlockwise direction, that in turn changes the lateral position of the imaging device 314.

[049] The manipulating unit 308 may include an actuator shaft 318 positioned inside the inner tubular shaft 304 and along the axis of the inner tubular shaft 304. The actuator shaft 318 may be configured to be manipulated, upon user intervention, via an input device (not shown in FIGS. 3A-3C). The input device may be configured so as to provide a rotation to the actuator shaft 318 about a central axis of the actuator shaft 318. In accordance with an embodiment, the actuator shaft 318 may be coupled to the input device via one end of the actuator shaft 318. In accordance with an embodiment, the actuator shaft 318 may be coupled to a platform 316 via another end of the actuator shaft 318 via a threaded coupling. The actuator shaft 318 may be configured to reflect the intervention received by the input device at the end effector unit 306.

[050] In accordance with an embodiment, the platform 316 may include a nut 320 having an inner threaded surface configured to couple with a threaded portion 322 of the actuator shaft 318. The nut 320 may be configured to linearly slide along the axis of the inner tubular shaft 304 via the threaded coupling, in response to rotation of the input device and the actuator shaft 318, based on the intervention received by the input device 310.

[051] In accordance with an embodiment, a first end 316A of the platform 316 may be hinged to the inner tubular shaft 304. In accordance with an embodiment, a second end 316B of the platform 316 may be coupled to the nut 320, via a coupling cable 324. The coupling cable 324 may be coupled to the nut 320 at one end of the coupling cable 324, and to the platform 316 at another end of the coupling cable 324. In accordance with an embodiment, in response to the linearly sliding of the nut 320, the platform 316 may be configured to rotate about the first end 316A of the platform 316. In particular, the linearly sliding movement of the nut 320 may be transferred to the platform 316 via the coupling cable 324. In accordance with an embodiment, the platform 316 may be rotated in a clockwise or anticlockwise direction that in turn changes the lateral position of the imaging device 314, and therefore the viewing angle of the imaging device 314. This is further explained in conjunction with the FIG. 4.

[052] FIG. 4 illustrates a process 400 of changing orientation of the platform 316 of the end effector unit 306 of the exemplary probing instrument 300, in accordance with an embodiment of the present disclosure.

[053] At stage 402, the platform 316 is at an initial position. A manipulating unit (not shown in FIG. 4) of the probing instrument 300 may be configured to reconfigure the end effector unit 306, in response to the input device (of the manipulating unit) receiving an intervention from a user. In accordance with an embodiment, the input device may be configured to undergo a rotation about the axis of the inner tubular shaft 304 based on the intervention received by the input device.

[054] When an intervention is received from the user, by way of rotation of the actuator shaft 318, this rotation of the actuator shaft 318 may cause linear sliding of the nut 320. As a result, the coupling cable may be pulled or pushed, which may further cause the rotation of the platform 316 about its first end 316A (about the hinge). As result, the orientation of the platform 316 may change, and therefore, the platform 316 is repositioned at step 404.

[055] In accordance with an embodiment, the probing instrument 300 may have articulation mechanism on the end effector unit 306 (say, of 5 mm diameter shaft) for easy

manipulation. The articulation mechanism may include three degrees of freedom, viz., up-down (that is, the end effector unit 306 moves up and down), left-right (that is, the end effector unit 306 moves left and right), in-out (that is, the end effector unit 306 moves in and out). The nut 320 and the actuator shaft 318 arrangement in the probing instrument 300 facilitates a rotary to
5 linear motion.

[056] FIG. 5 illustrates an isometric exploded view of an exemplary probing instrument 500 (corresponding to probing instrument 100) for using in a diagnostic or surgical hysteroscopic procedure on a subject, in accordance with an embodiment of the present disclosure.

[057] In accordance with an embodiment, the probing instrument 500 may include an outer tubular shaft 502 having a proximal end 502A and a distal end 502B. The outer tubular shaft may be hollow from the inside. The probing instrument 500 may further include an inner tubular shaft 504 configured to be positioned and move inside the outer tubular shaft 502. According to another embodiment, the outer tubular shaft 502 may have at least one inflow port,
15 such as, an inflow port 506A configured in proximity to the proximal end 502A. The inflow port 506A may be configured for supplying a lubricating liquid inside the hollow shaft, i.e., the out shaft 502. According to an embodiment, the outer tubular shaft 502 may have one inflow port 506A and one outflow port 506B. According to another embodiment, the inflow port 506A may discharge a fluid form perpendicular to the axis of the outer tubular shaft 502 to provide
20 fluidic expansion in a uterine cavity.

[058] It will be appreciated that, for clarity purposes, the above description has described embodiments with reference to different functional units and processors. However, it will be apparent that any suitable distribution of functionality between different functional units, processors or domains may be used without detracting from the disclosure. For example,
25 functionality illustrated to be performed by separate processors or controllers may be performed by the same processor or controller. Hence, references to specific functional units are only to be seen as references to suitable means for providing the described functionality, rather than indicative of a strict logical or physical structure or organization.

[059] Although the present disclosure has been described in connection with some
30 embodiments, it is not intended to be limited to the specific form set forth herein. Rather, the scope of the present disclosure is limited only by the claims. Additionally, although a feature may appear to be described in connection with particular embodiments, one skilled in the art

would recognize that various features of the described embodiments may be combined in accordance with the disclosure.

5 **[060]** Furthermore, although individually listed, a plurality of means, elements or process steps may be implemented by, for example, a single unit or processor. Additionally, although individual features may be included in different claims, these may possibly be advantageously combined, and the inclusion in different claims does not imply that a combination of features is not feasible and/or advantageous. Also, the inclusion of a feature in one category of claims does not imply a limitation to this category, but rather the feature may be equally applicable to other claim categories, as appropriate.

10 **[061]** It is intended that the disclosure and examples be considered as exemplary only, with a true scope and spirit of disclosed embodiments being indicated by the following claims.

What We Claim Is:

1. A probing instrument (100) comprising:

an outer tubular shaft (102) having an associated proximal end (102A) and a distal end (102B),

5 an inner tubular shaft (104) having an associated proximal end (104A) and a distal end (104B), wherein the inner tubular shaft (104) is configured to be positioned and move inside the outer tubular shaft (102); and

a probing assembly comprising:

10 an end effector unit (106) positioned at the distal end (104B) of the inner tubular shaft (104); and

15 a manipulating unit (108) coupled to the end effector unit (106), the manipulating unit (108) comprising an input device (110) positioned at the proximal end (104A) of the inner tubular shaft (104), wherein the manipulating unit (108) is configured to reconfigure the end effector unit (106), in response to the input device (110) receiving an intervention from a user.

2. The probing instrument (100) as claimed in claim 1, wherein the end effector unit (106) comprises:

20 at least one illumination source (112) configured to illuminate an internal region of a human body; and

at least one imaging device (114) configured to obtain images of the internal region illuminated by the at least one illumination source (112).

25 3. The probing instrument (100) as claimed in claim 2, wherein the end effector unit (106) further comprises a platform (116), wherein each of the at least one illumination source (112) and each of the at least one imaging device (114) is positioned on the platform (116) of the end effector unit (106).

4. The probing instrument (100) as claimed in claim 3, wherein reconfiguring of the end effector unit (106) is for changing a viewing angle of the at least one imaging device (114), and wherein reconfiguring the end effector unit (106) comprises performing at least one of:

linear displacement of the platform (116) along an axis of the inner tubular shaft (104); or

5 angular displacement of the platform (116) relative to the axis of the inner tubular shaft (104).

5. The probing instrument (100) as claimed in claim 1, wherein the input device (110) is configured to undergo a three-dimensional angular rotation relative to the axis of the inner tubular shaft (104) based on the intervention received by the input device (110).

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6. The probing instrument (100) as claimed in claim 5, wherein the manipulating unit (108) further comprises a plurality of connecting cables (218) positioned inside the inner tubular shaft (104) and along the axis of the inner tubular shaft (104),

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wherein each of the plurality of connecting cables (218) is coupled to the input device (110) via one end of each of the plurality of connecting cables (218) at a distinct location on the input device (110),

wherein each of the plurality of connecting cables (218) is coupled to the platform (116) via other end of each of the plurality of connecting cables (218) at a distinct location on the platform (116),

20

wherein each of the plurality of connecting cables (218) is configured to move linearly along the axis of the inner tubular shaft (104), and

wherein the plurality of connecting cables (218) is configured to reflect the intervention received by the input device (110).

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7. The probing instrument (100) as claimed in claim 1, wherein the input device (110) is configured to undergo a rotation about the axis of the inner tubular shaft (104) based on the intervention received by the input device.

8. The probing instrument (100) as claimed in claim 7, wherein the manipulating unit (108) further comprises an actuator shaft (318) positioned inside the inner tubular shaft (104) and along the axis of the inner tubular shaft (104),

wherein the actuator shaft (318) is coupled to the input device (110) via one end of the actuator shaft (318),

wherein the actuator shaft (318) is coupled to the platform (116) via another end of the actuator shaft (318) via a threaded coupling,

wherein the actuator shaft (318) is configured to reflect the intervention received by the input device (110) at the end effector unit (106).

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9. The probing instrument (100) as claimed in claim 8, wherein the platform (116) comprises a nut (320) having an inner threaded surface configured to couple with a threaded portion (322) of the actuator shaft (318), wherein the nut (320) is configured to linearly slide along the axis of the inner tubular shaft (104) via the threaded coupling, in response to rotation of the input device (110) based on the intervention received by the input device (110).

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10. The probing instrument (100) as claimed in claim 9, wherein a first end (316A) of the platform (116) is hinged to the inner tubular shaft (104), wherein a second end (316B) of the platform (116) is coupled to the nut (320), and wherein in response to the linearly sliding of the nut (320), the platform (116) is configured to rotate about the first end (316A).

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Dated this 31st Day of March 2020

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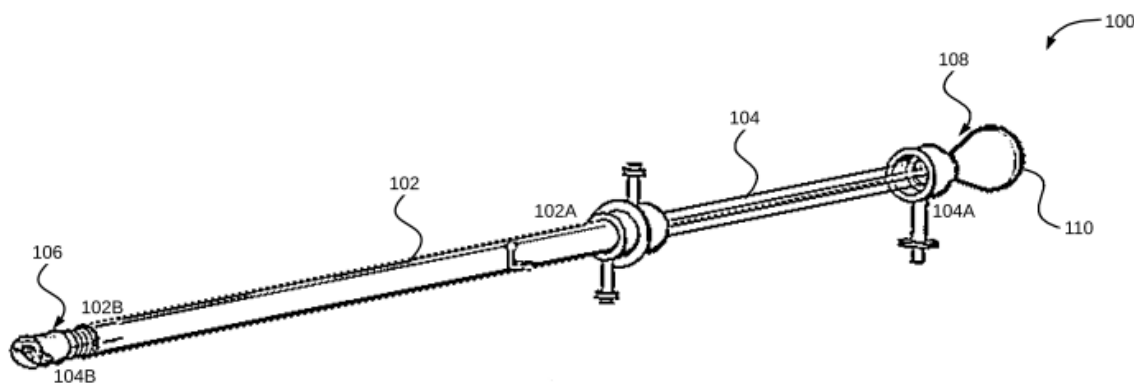
Head, IPR Dept.
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Manapakkam, Chennai 600089.

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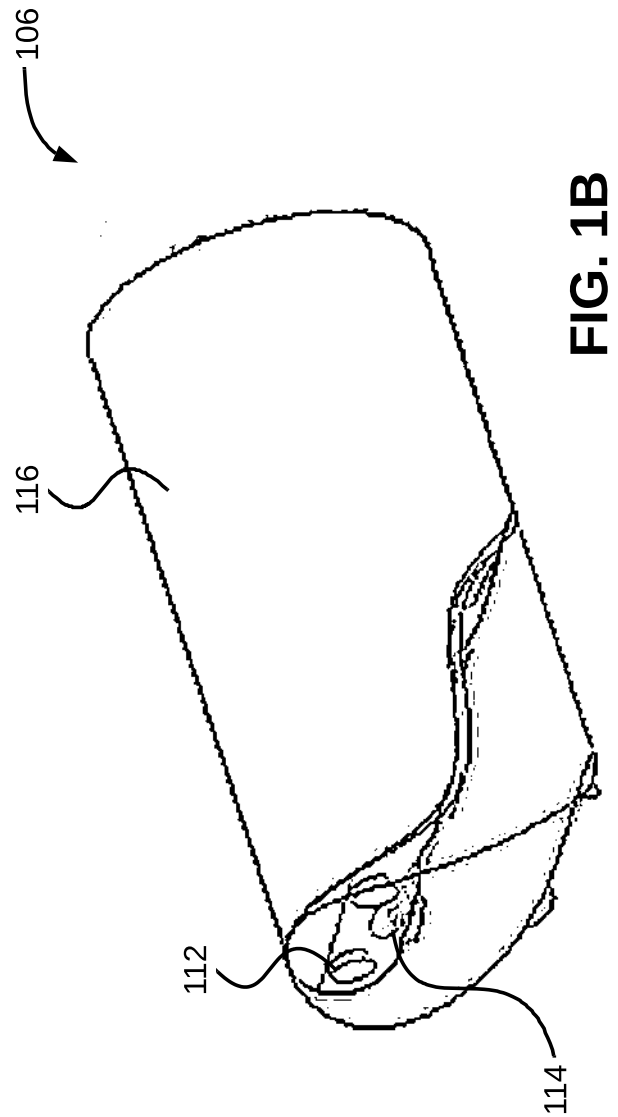
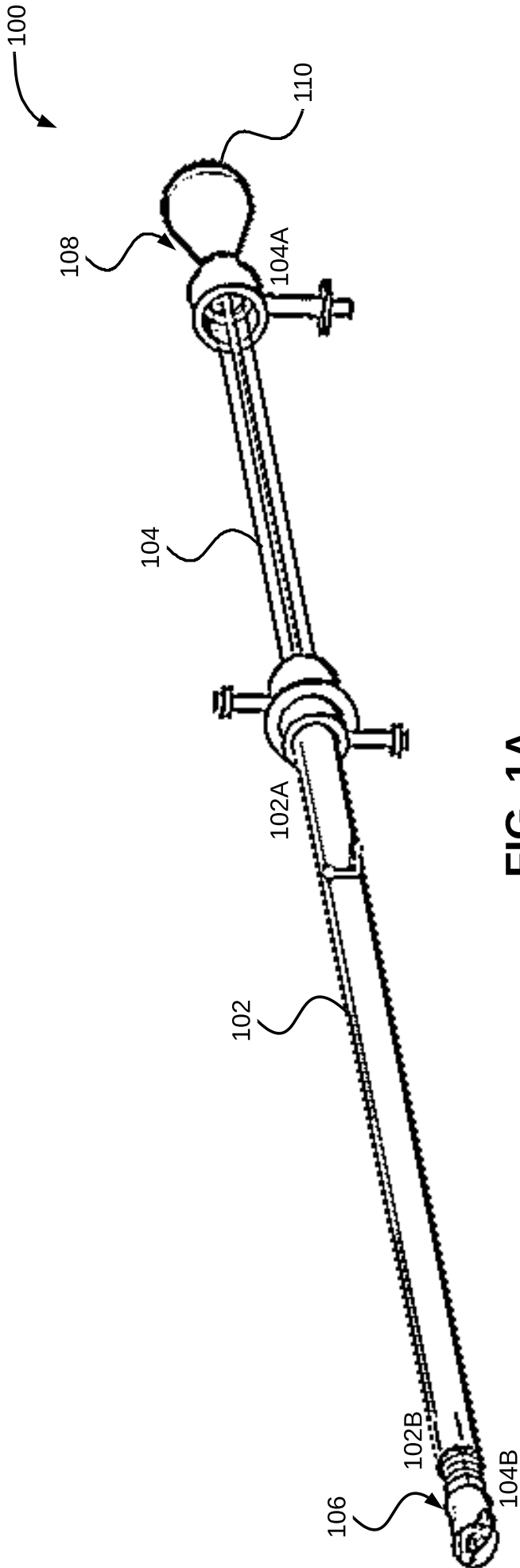
A DEVICE FOR PERFORMING HYSTEROSCOPY

ABSTRACT

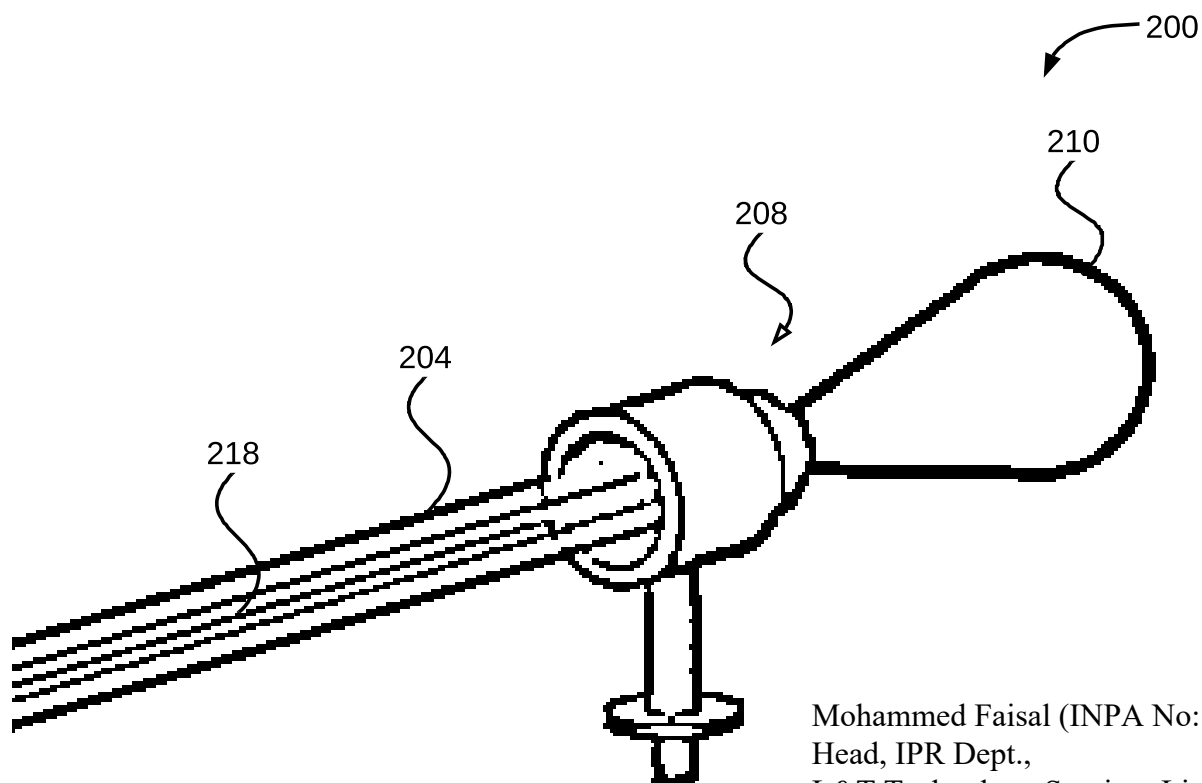
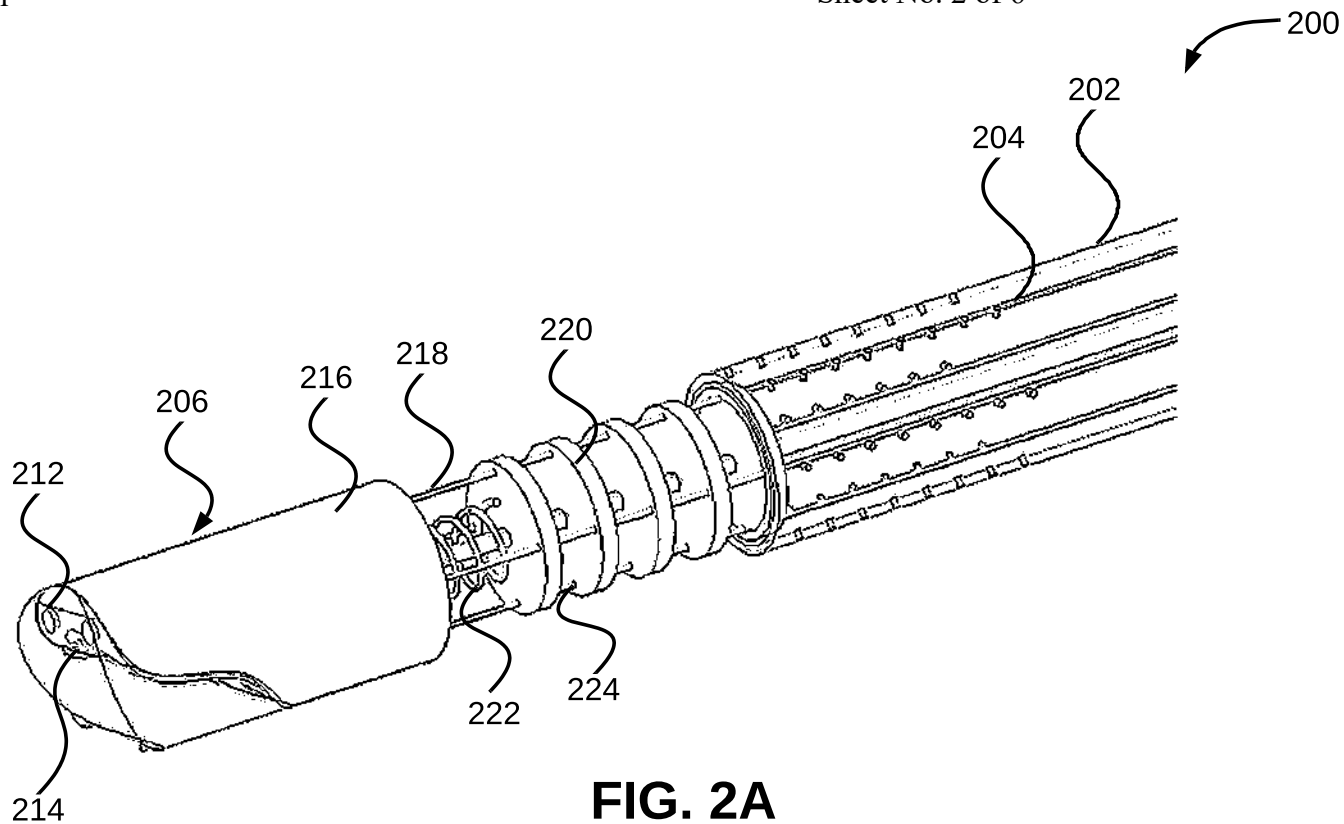
This disclosure relates to a probing instrument (100) that includes an outer tubular shaft (102) having an associated proximal end (102A) and a distal end (102B), an inner tubular shaft (104) having an associated proximal end (104A) and a distal end (104B). The inner tubular shaft (104) is configured to be positioned and move inside the outer tubular shaft (102). The probing instrument (100) may include a probing assembly including an end effector unit (106) positioned at the distal end (104B) of the inner tubular shaft (104) and a manipulating unit (108) coupled to the end effector unit (106). The manipulating unit (108) may include an input device (110) positioned at the proximal end (104A) of the inner tubular shaft (104). The manipulating unit (108) is configured to reconfigure the end effector unit (106), in response to the input device (110) receiving an intervention from a user.



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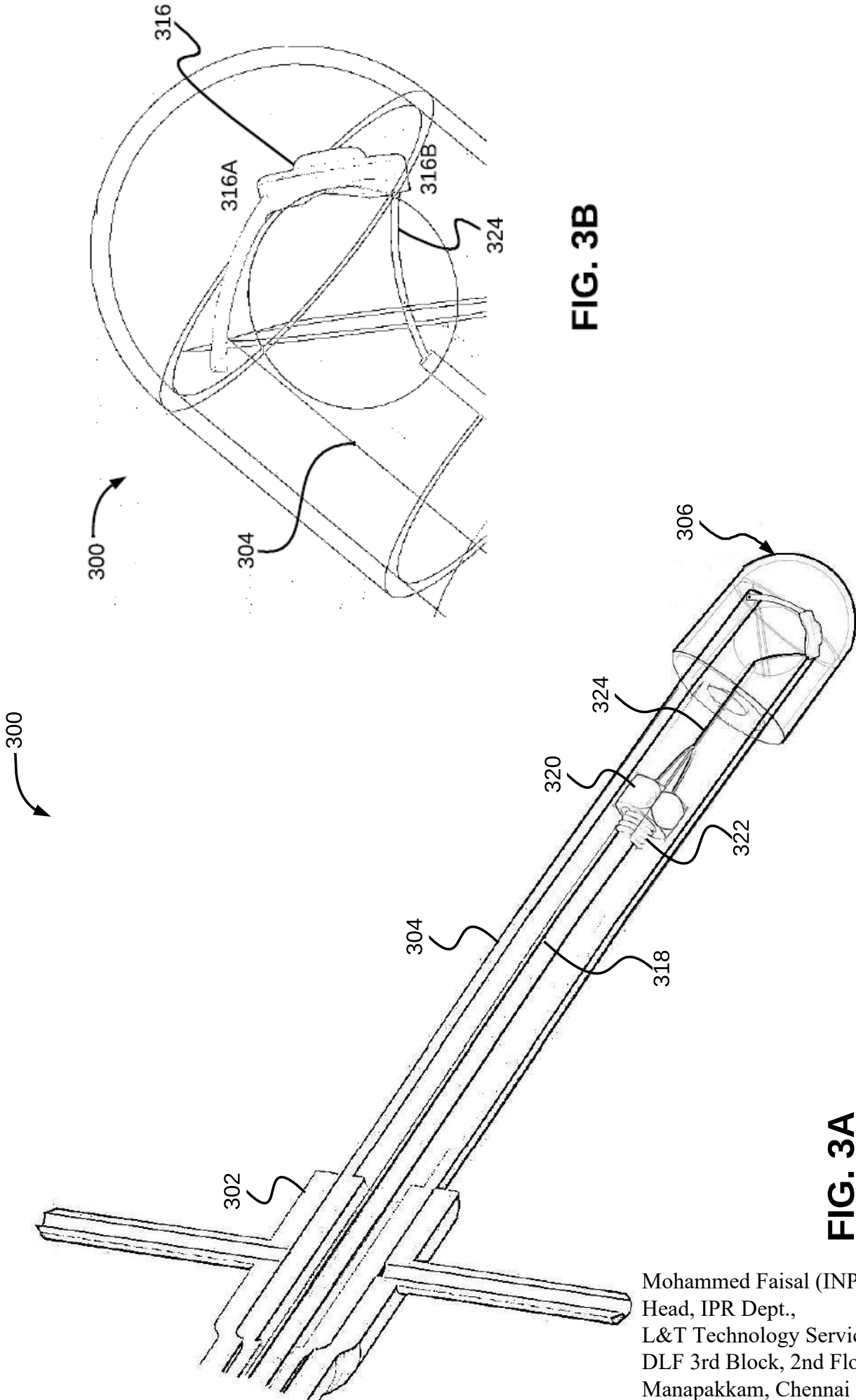


FIG. 3B

FIG. 3A

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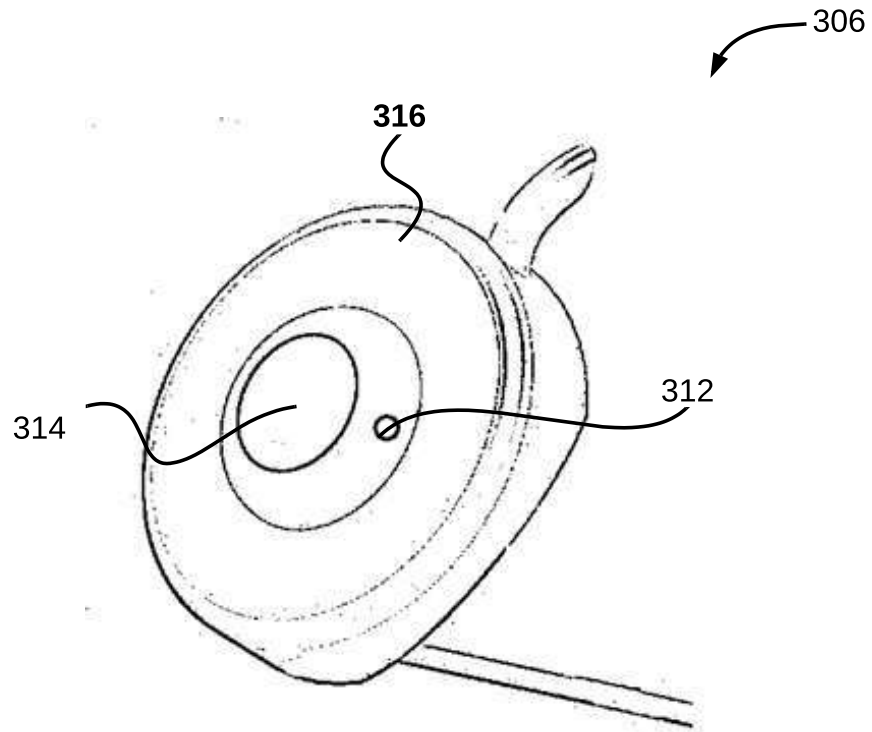


FIG. 3C

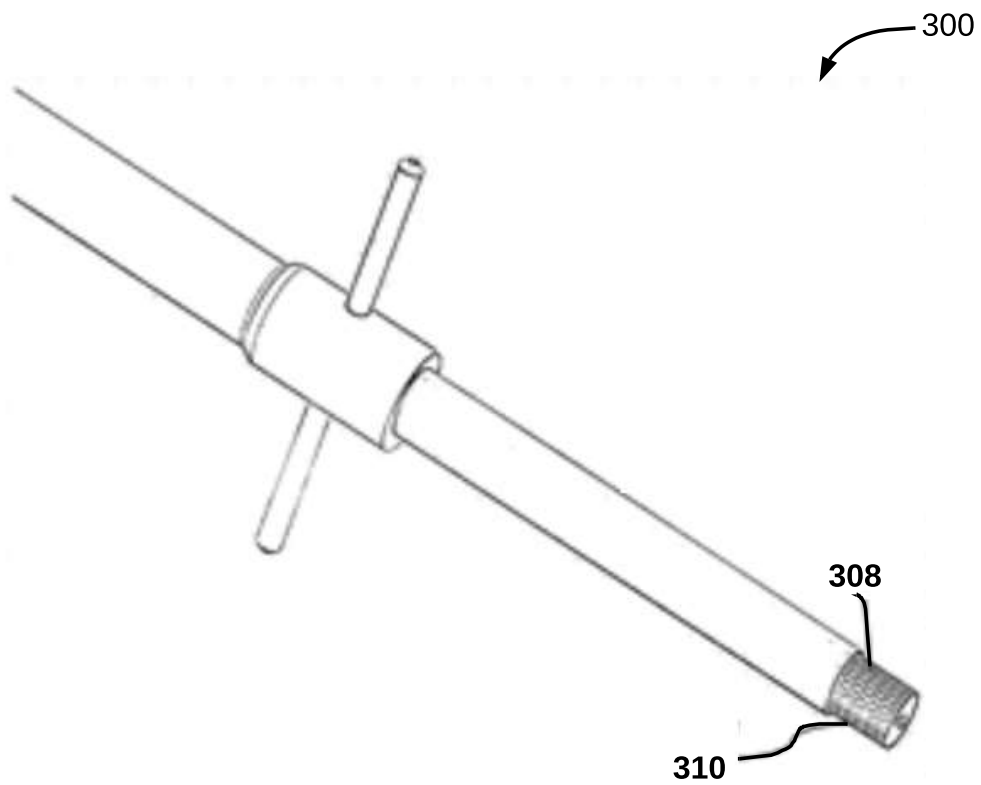


FIG. 3D

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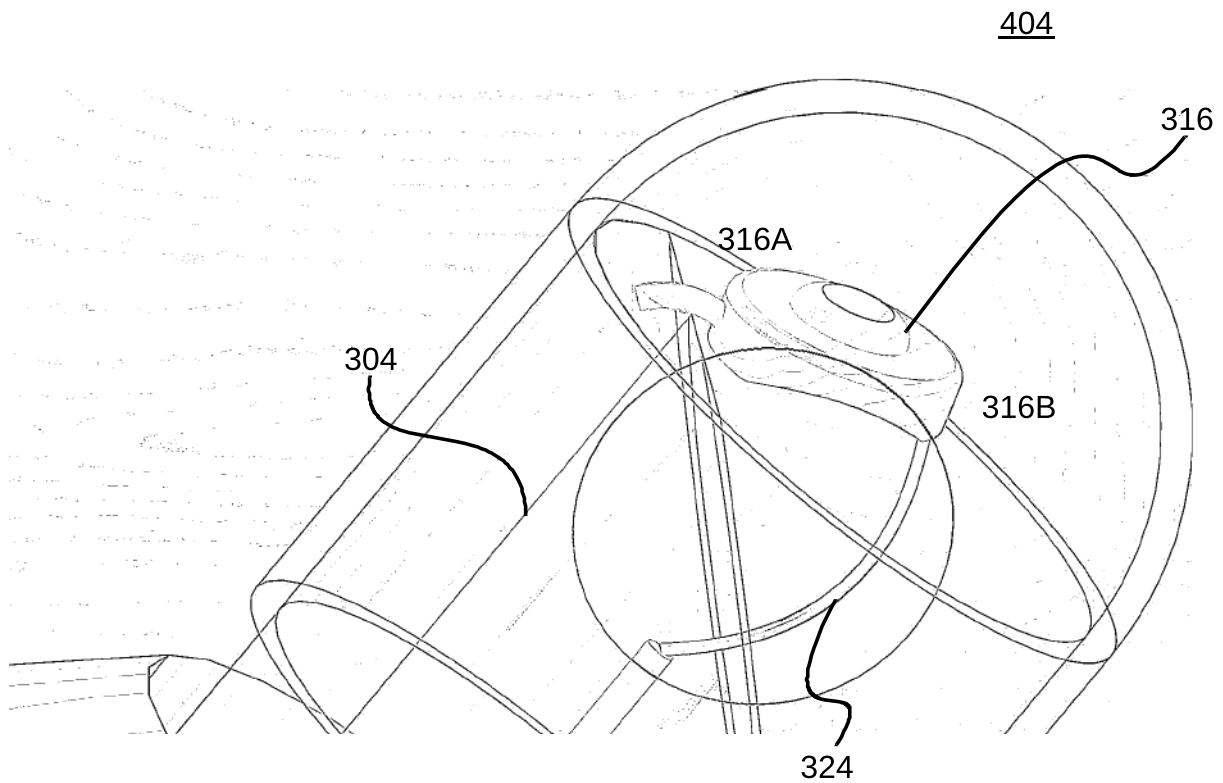
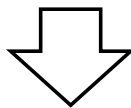
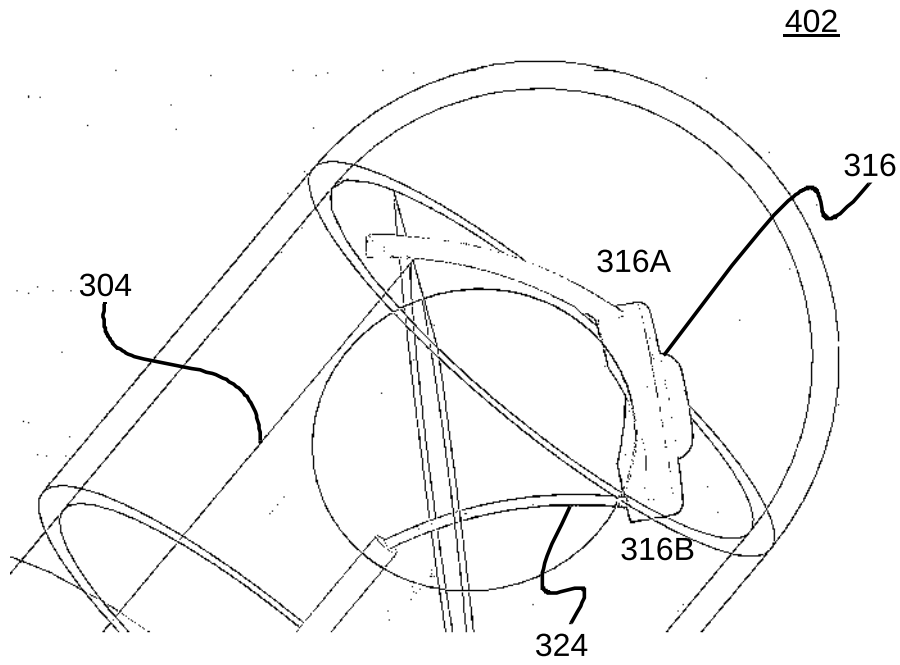


FIG. 4

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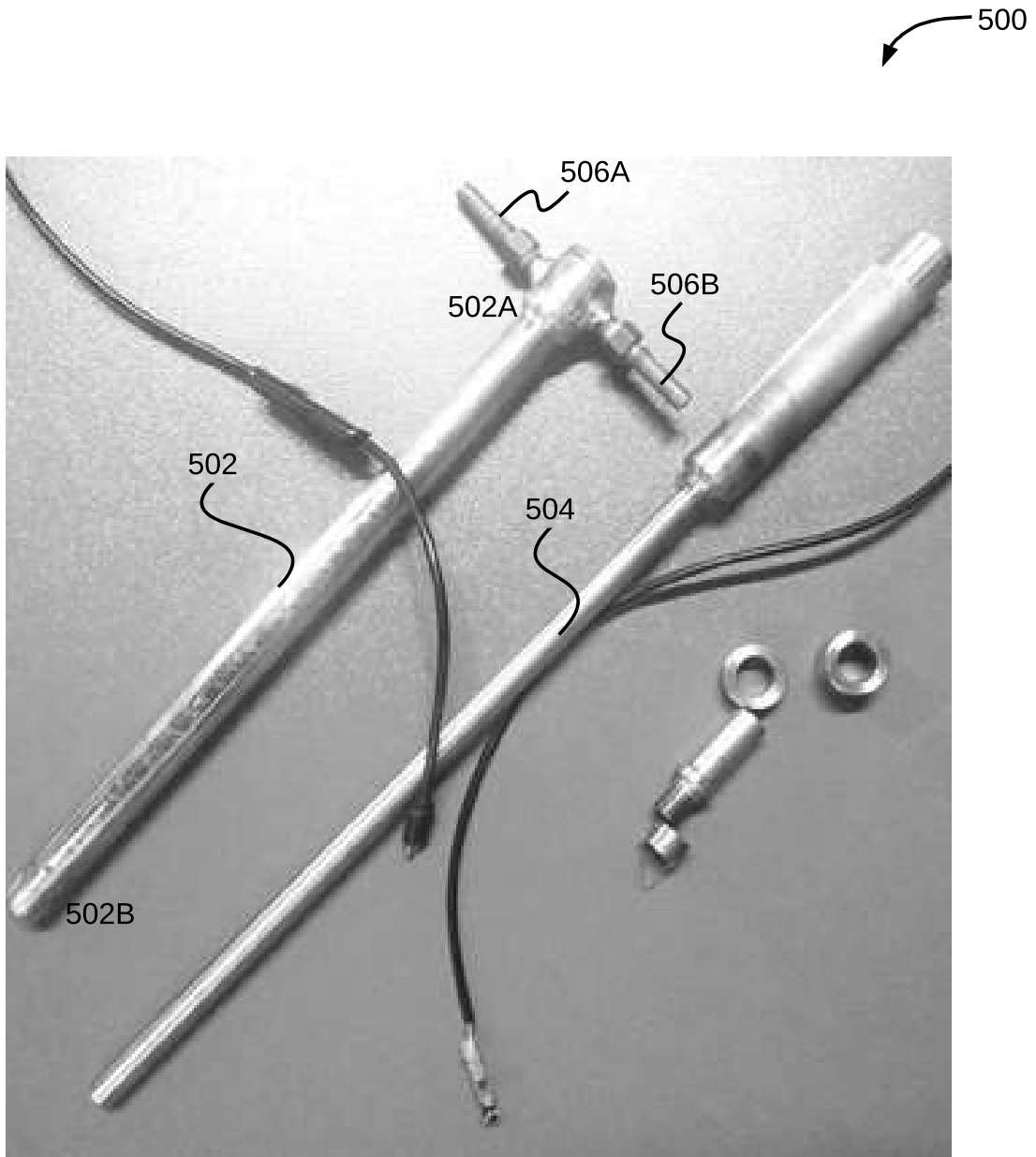


FIG. 5

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