US 20190350622A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2019/0350622 A1**

Abou El Kheir (43) **Pub. Date: Nov. 21, 2019**

(54) **COLPOTOMY SYSTEM WITH UTERINE MANIPULATOR AND ELECTROCAUTERY FOR TOTAL LAPAROSCOPIC HYSTERECTOMY**

(71) Applicant: **Tarek Ahmed Nabil Abou El Kheir**, Salt Lake City, UT (US)

(72) Inventor: **Tarek Ahmed Nabil Abou El Kheir**, Salt Lake City, UT (US)

(21) Appl. No.: **15/985,650**

(22) Filed: **May 21, 2018**

Publication Classification

(51) **Int. Cl.**

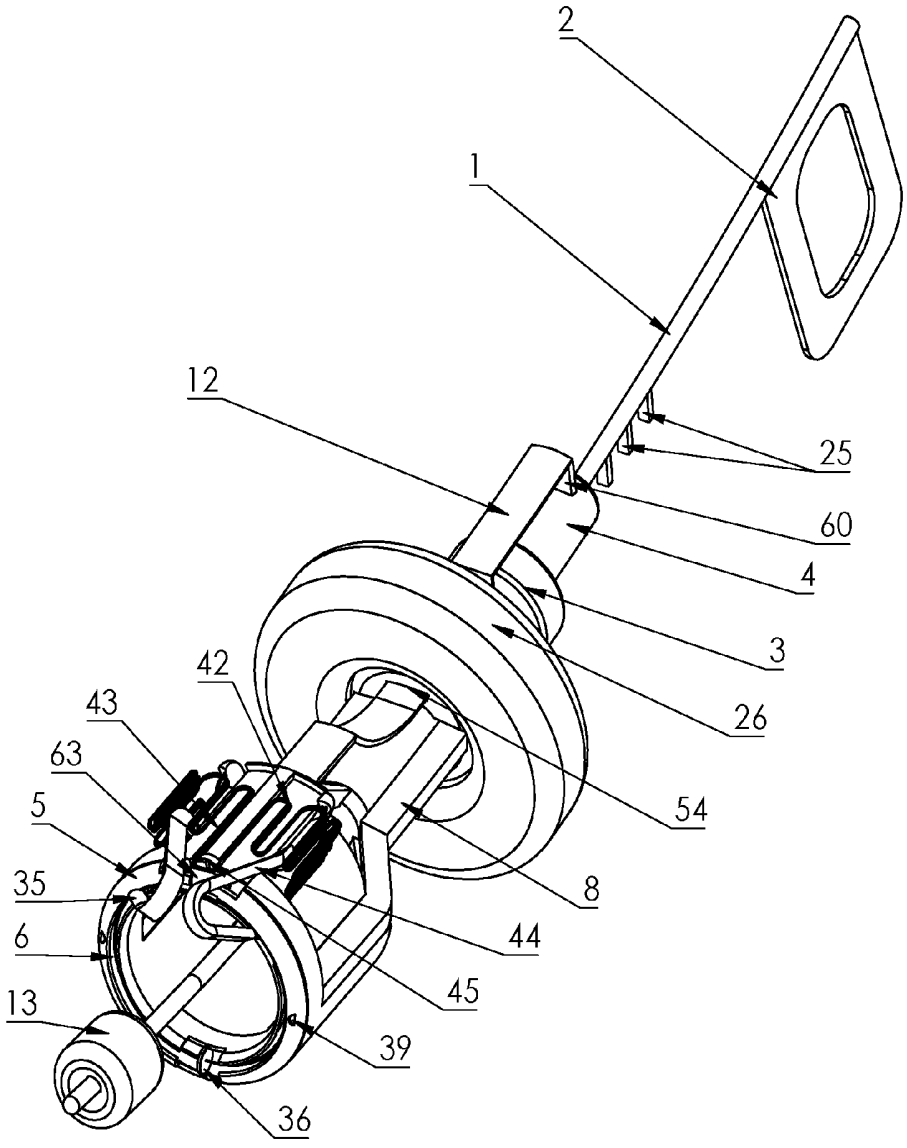
A61B 17/42	(2006.01)
A61B 17/32	(2006.01)
A61B 18/14	(2006.01)
A61B 34/00	(2006.01)

(52) **U.S. Cl.**

CPC .. ***A61B 17/4241*** (2013.01); ***A61B 17/320016*** (2013.01); *A61B 2017/00743* (2013.01); ***A61B 34/70*** (2016.02); ***A61B 18/14*** (2013.01)

(57) **ABSTRACT**

A device for facilitating a total laparoscopic hysterectomy includes a cervical cup adapted to abut the cervicovaginal junction. An electrocautery wire has an uninsulated portion housed in the cervical cup which includes a channel for housing and controlled releasing the uninsulated portion. An introducer is coupled to the electrocautery wire and configured to penetrate the cervicovaginal junction thereby introducing the electrocautery wire into the intra-abdominal cavity. A shaft secures the electrocautery wire and pulling the electrocautery wire causes a controlled release of the uninsulated portion along a predetermined circumferential path around the cervix along the channel. Thus, the vagina is severed from the cervix along the circumference of the cervicovaginal junction.



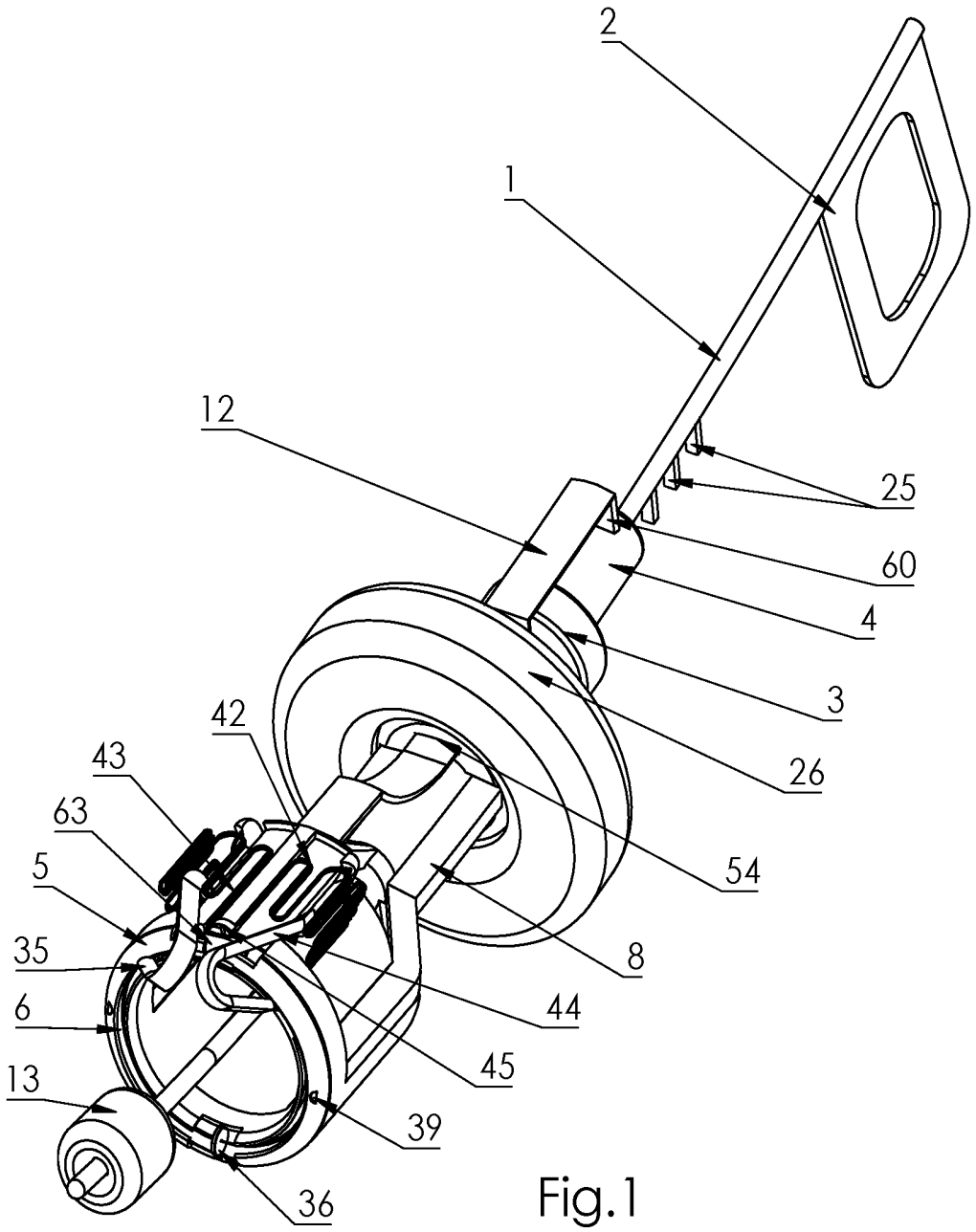


Fig.1

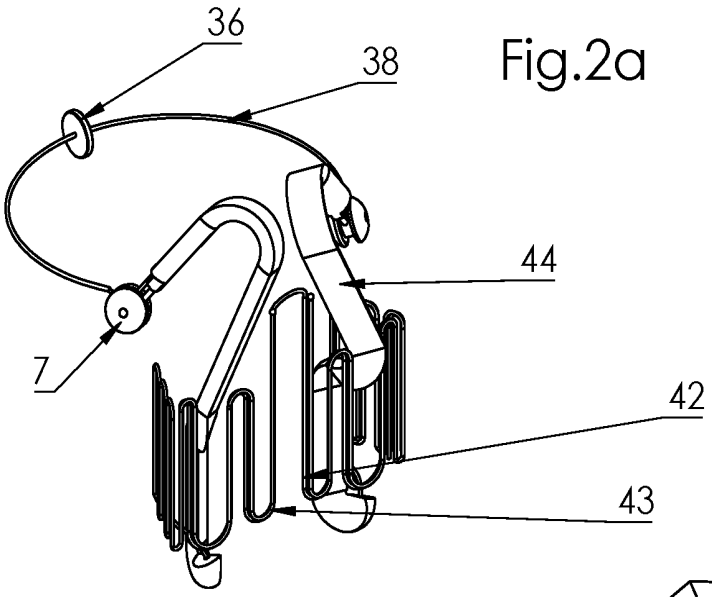


Fig.2a

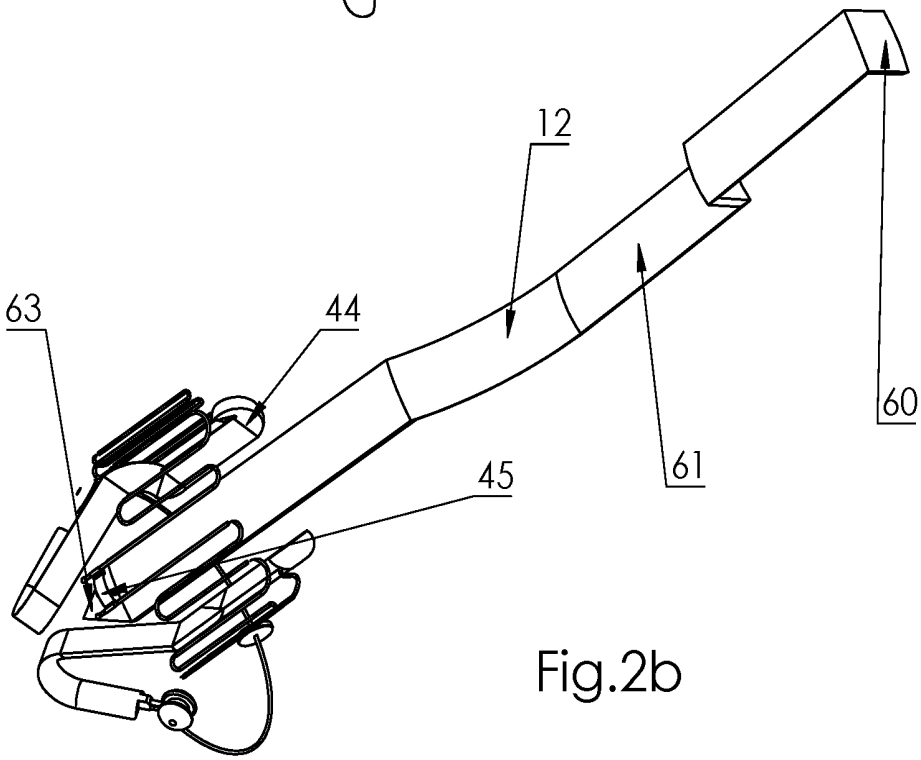


Fig.2b

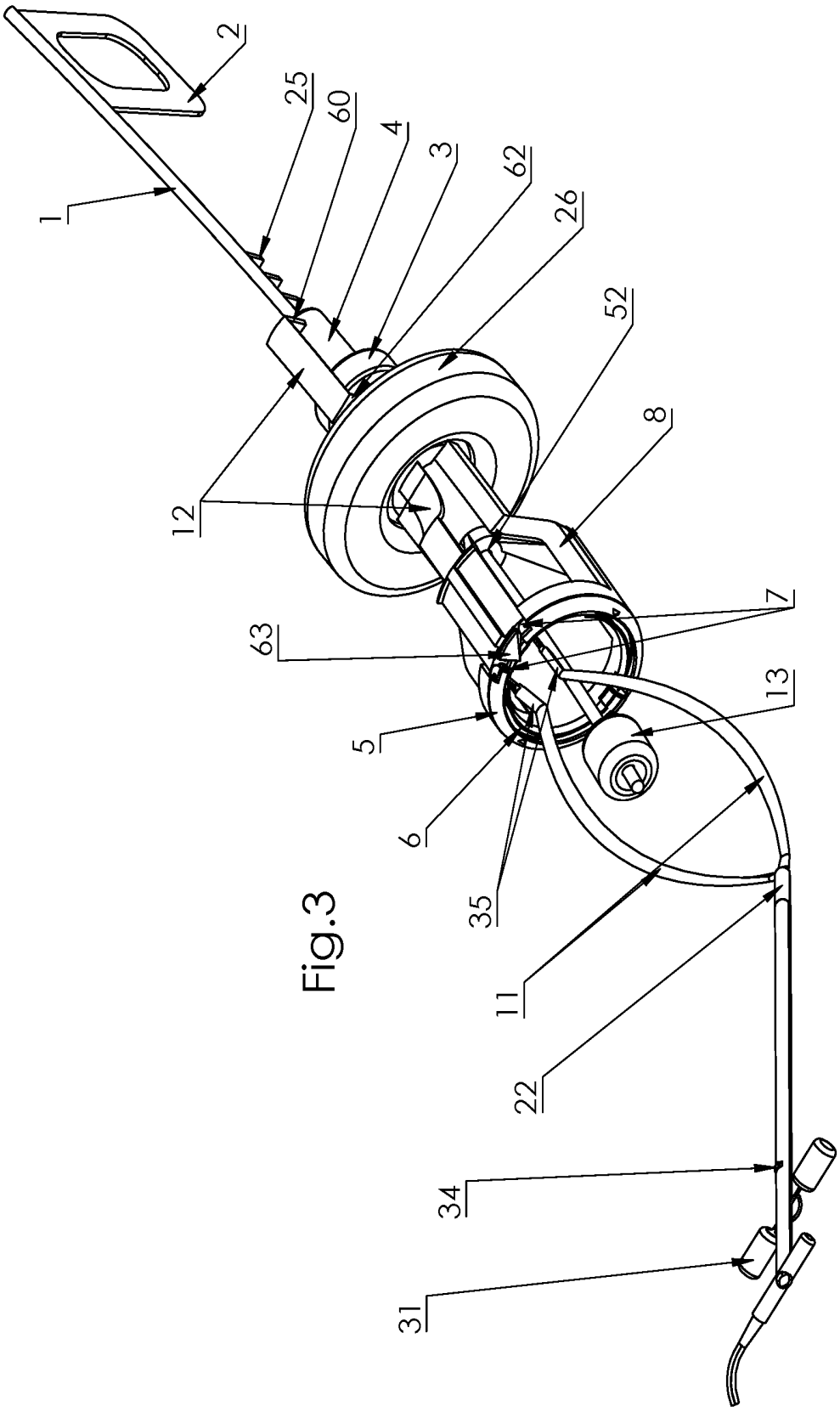


Fig.3

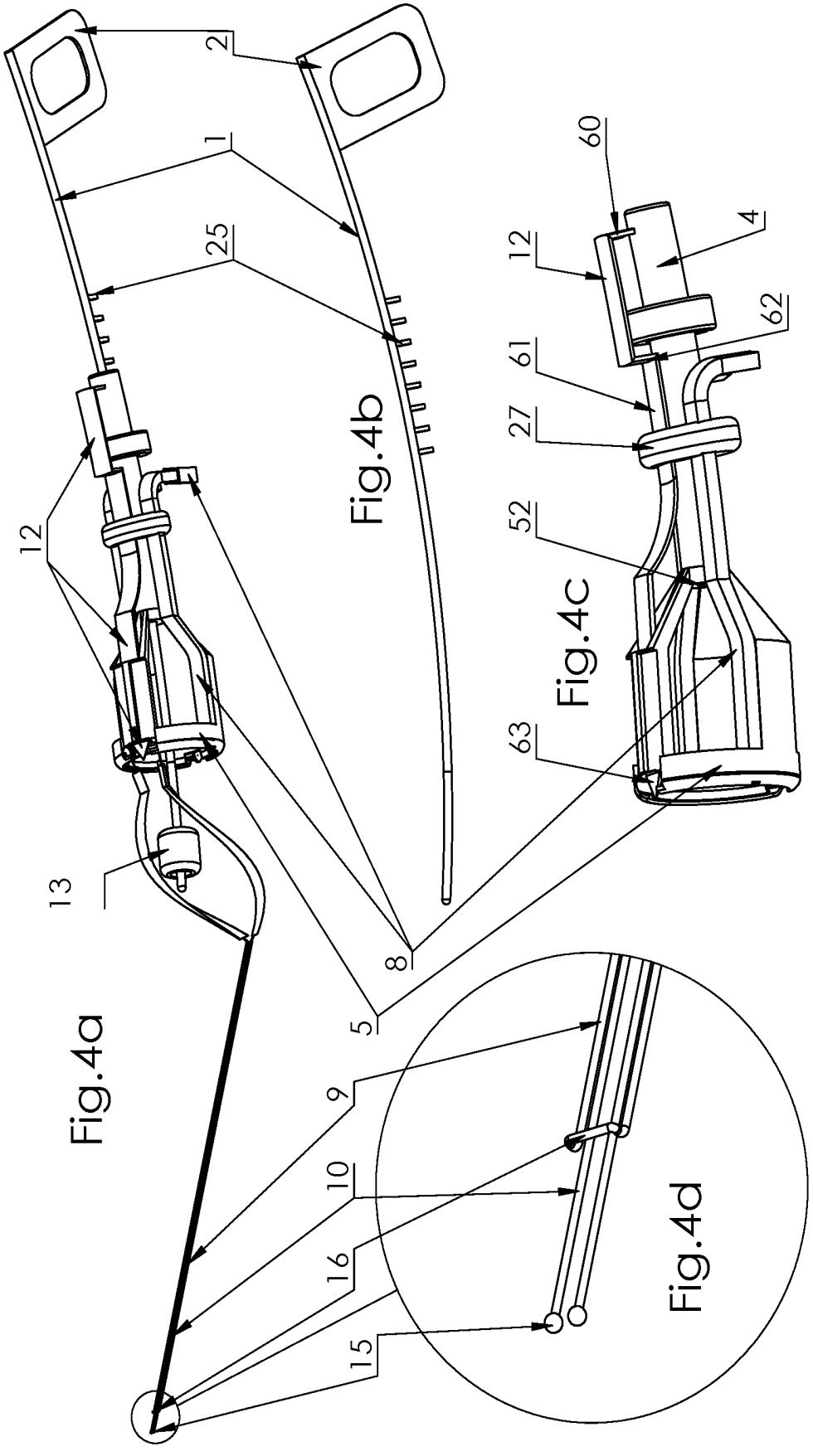
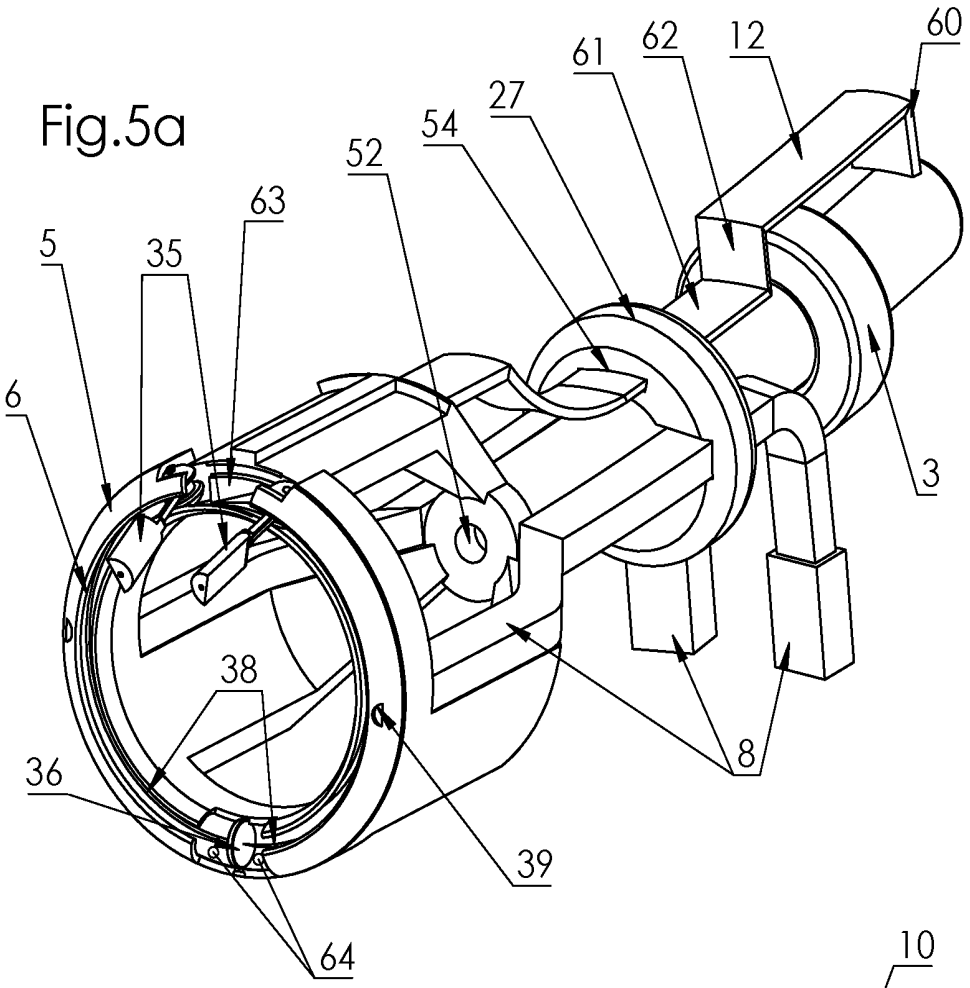

2
1
25
12
13
8
5
Fig.4a
Fig.4b
60
4
12
62
61
27
52
63
Fig.4c
9
10
16
15
Fig.4d

Fig.5a



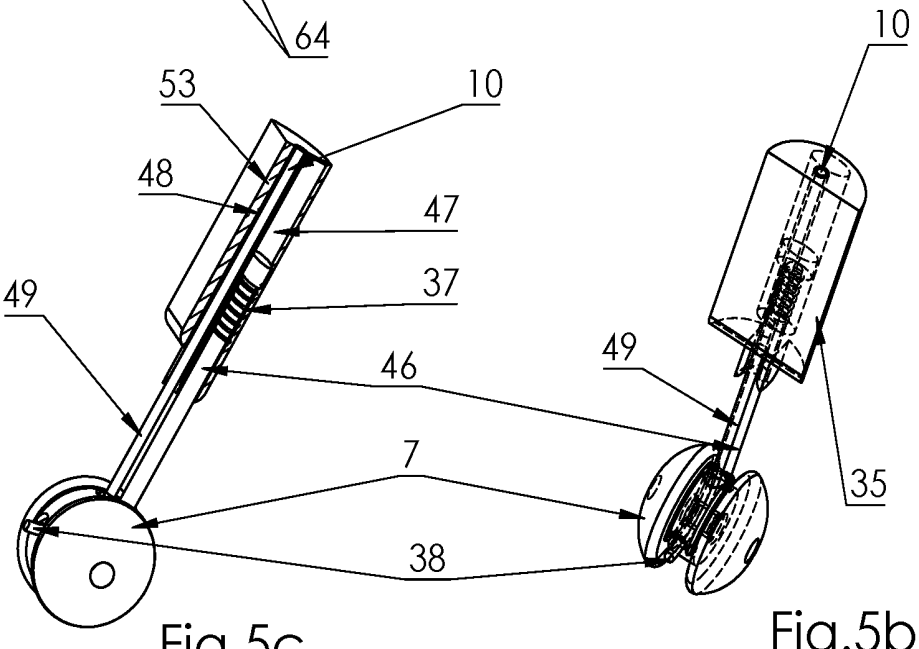


Fig.5c

Fig.5b

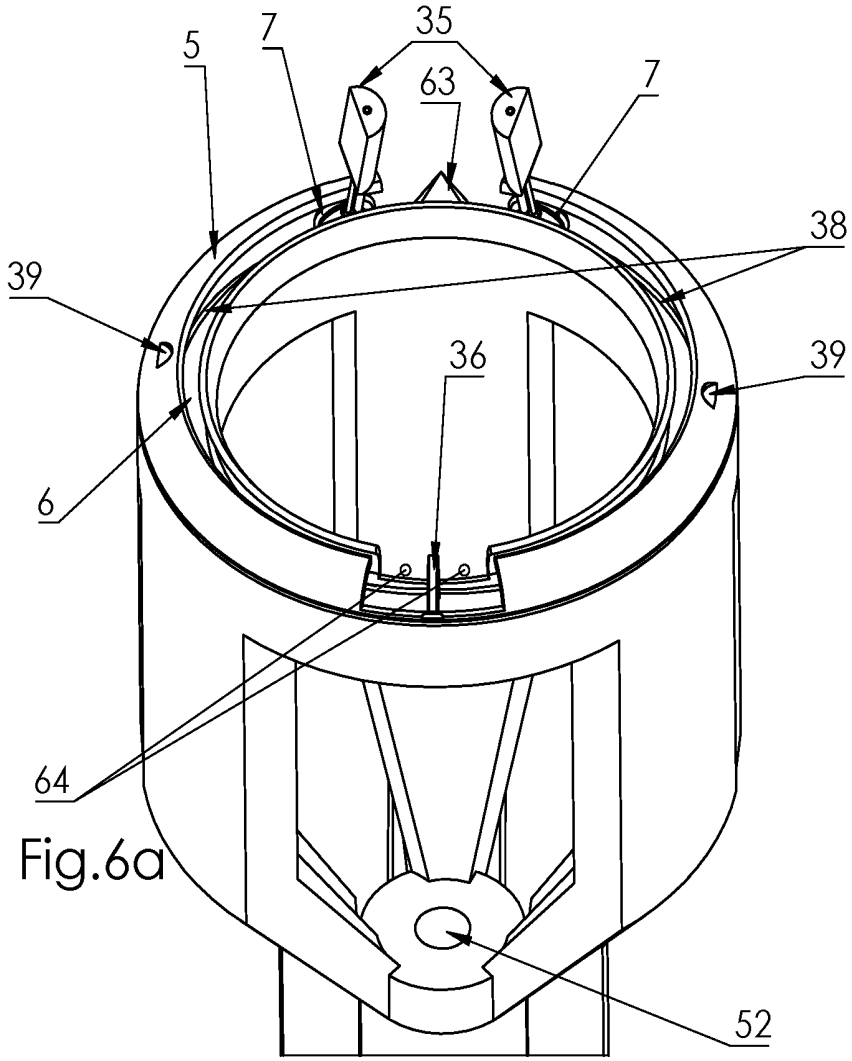


Fig.6a

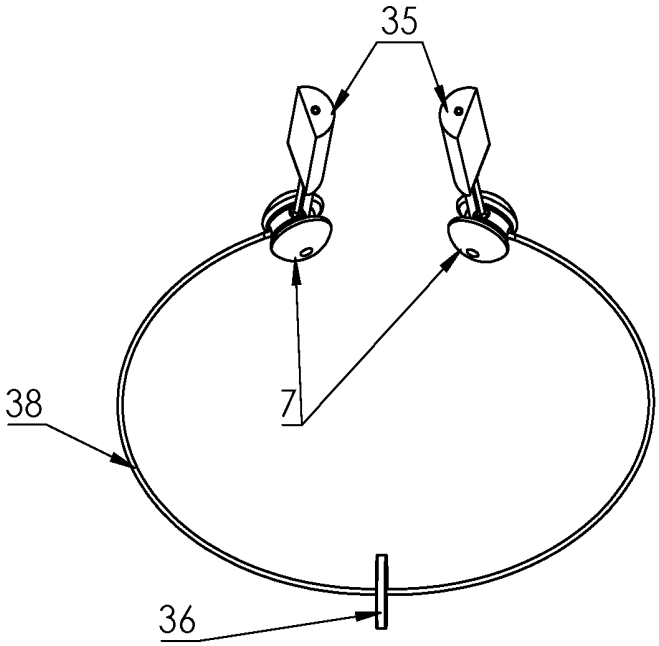


Fig.6b

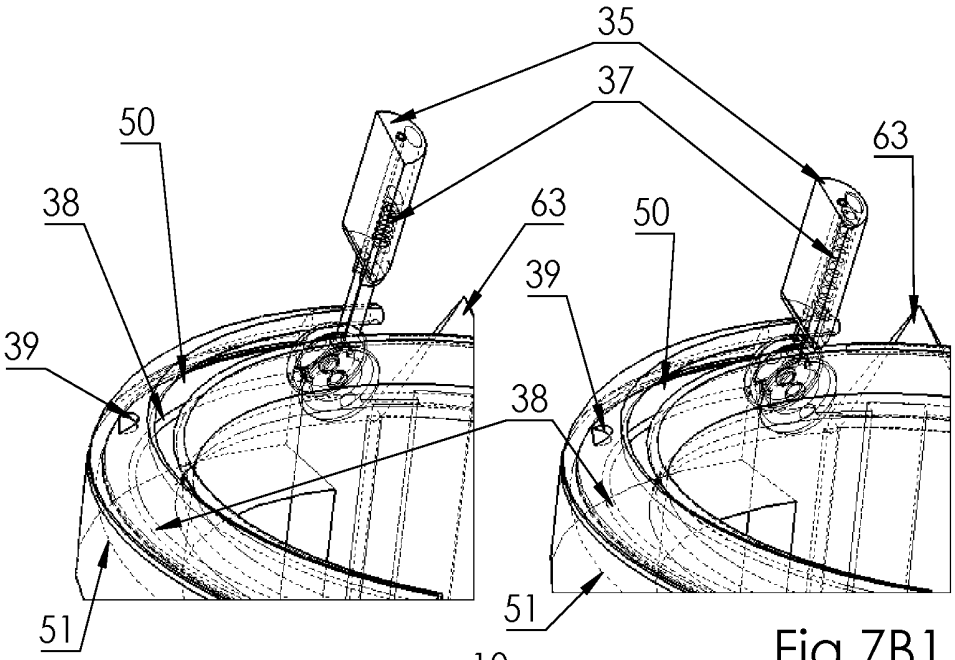


Fig.7A1

Fig.7B1

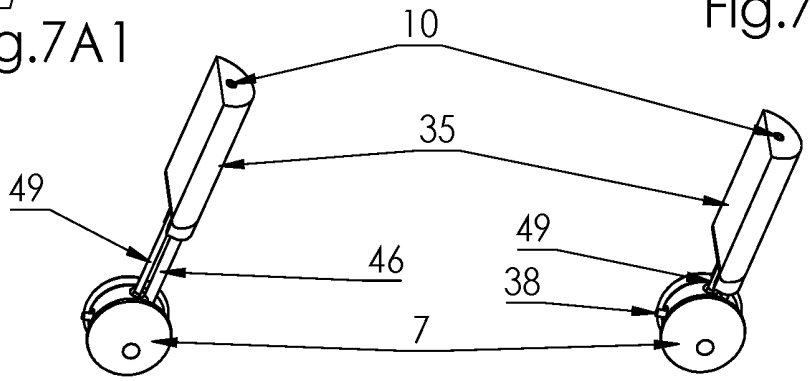


Fig.7A2

Fig.7B2

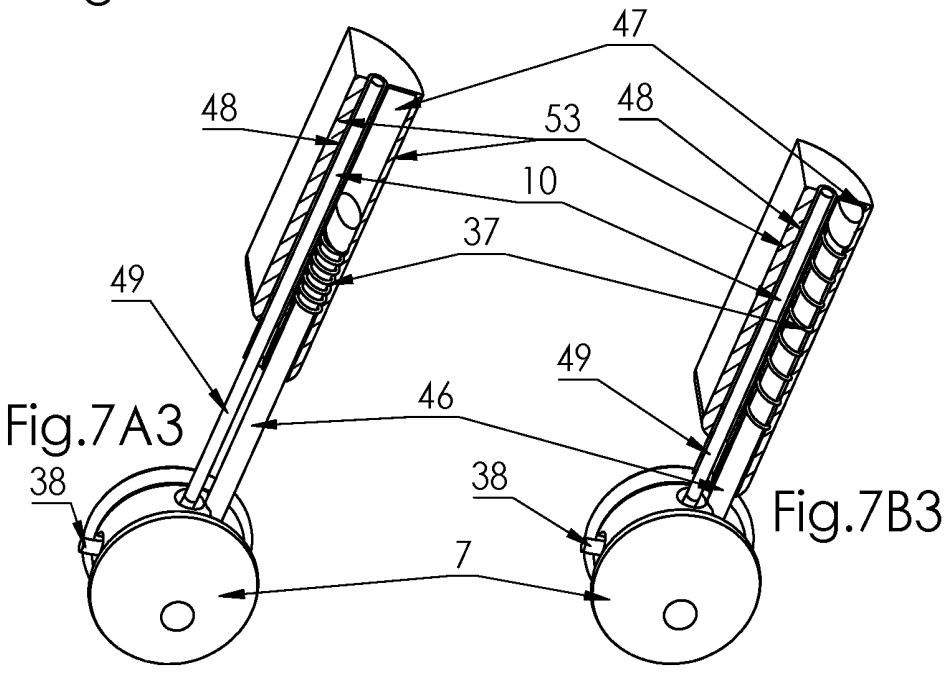


Fig.7A3

Fig.7B3

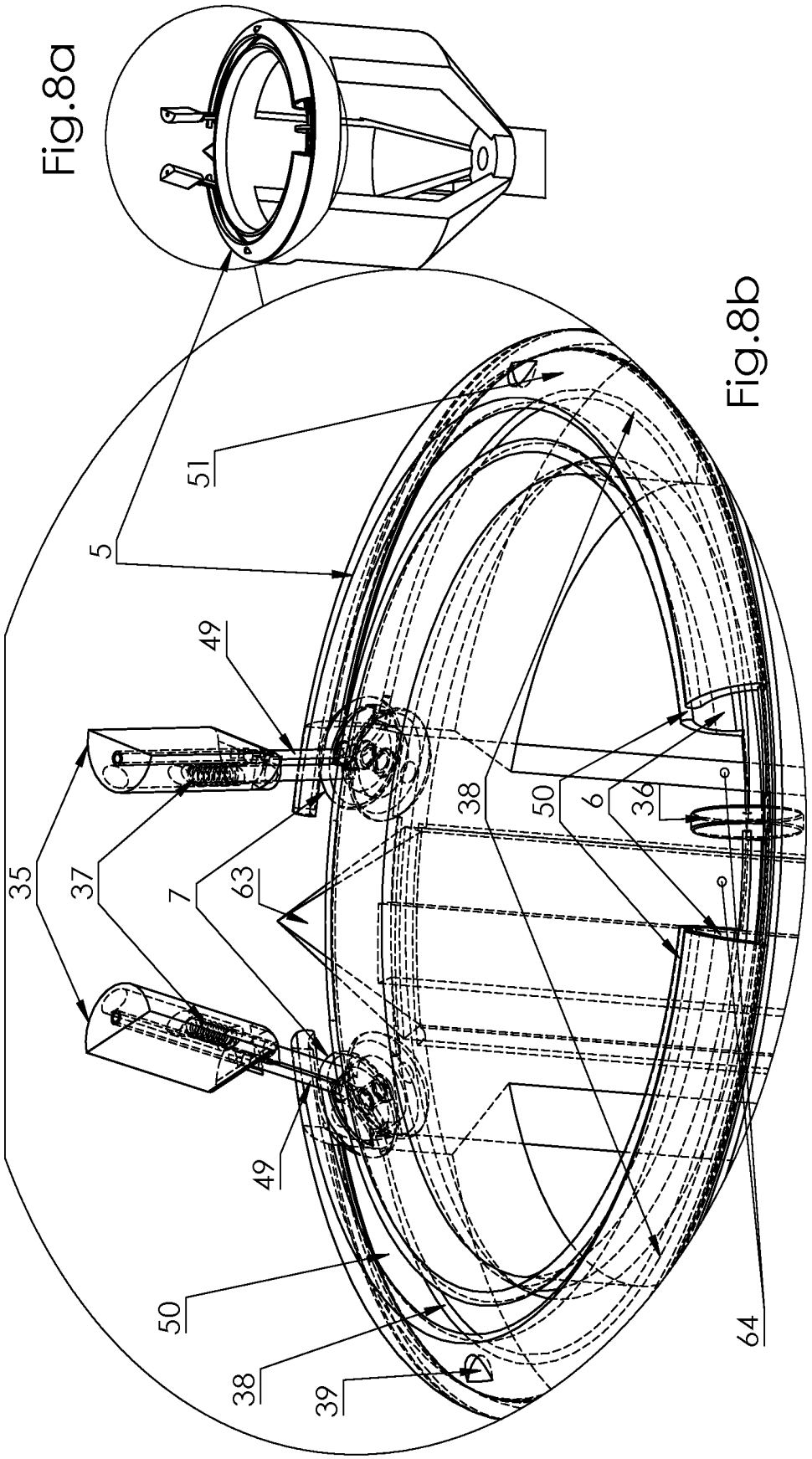


Fig.8a
Fig.8b
5
51
49
35
37
7
63
38
50
6
36
49
50
38
39
64

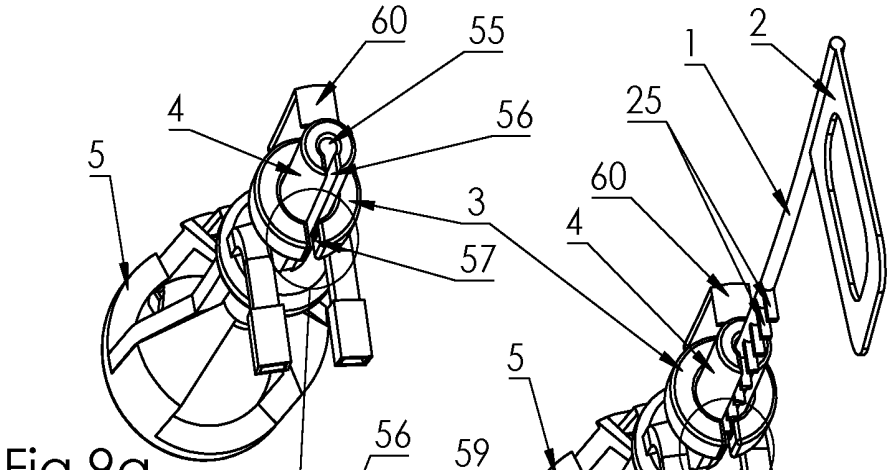


Fig.9a

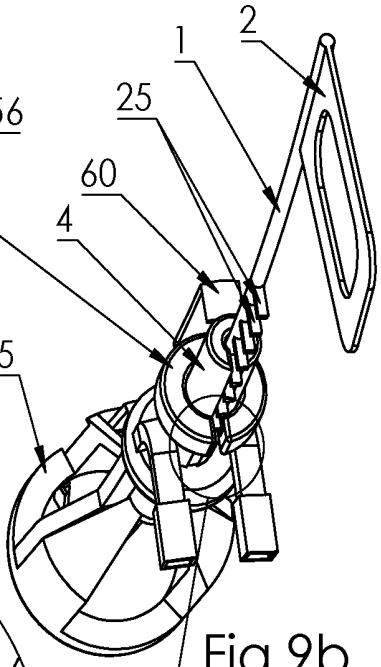


Fig.9b

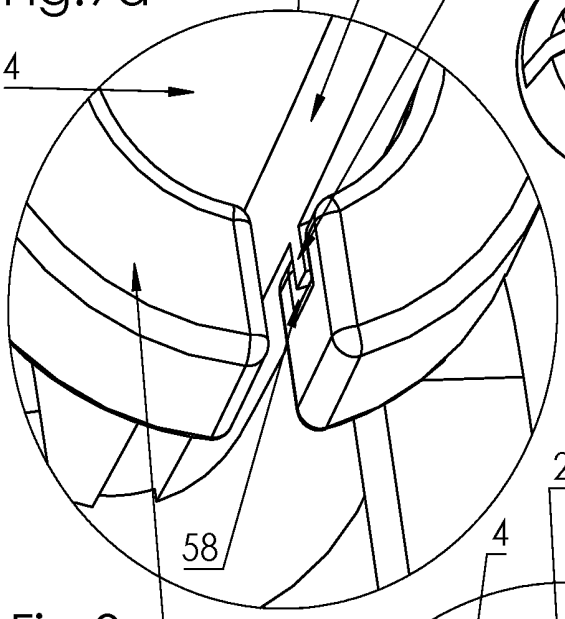


Fig.9c

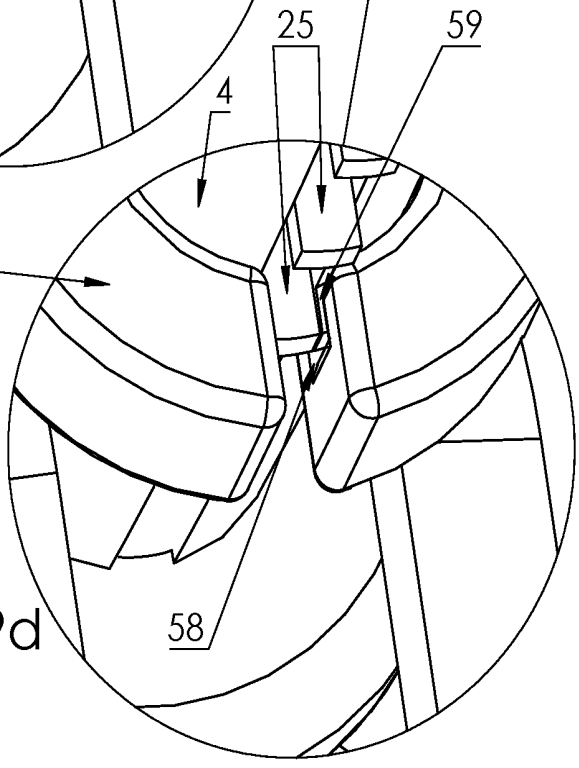
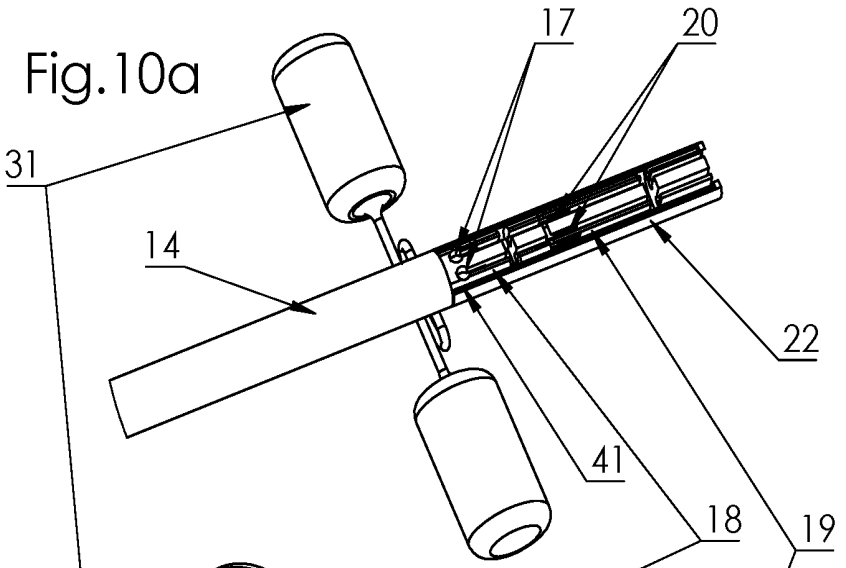


Fig.9d

Fig.10a



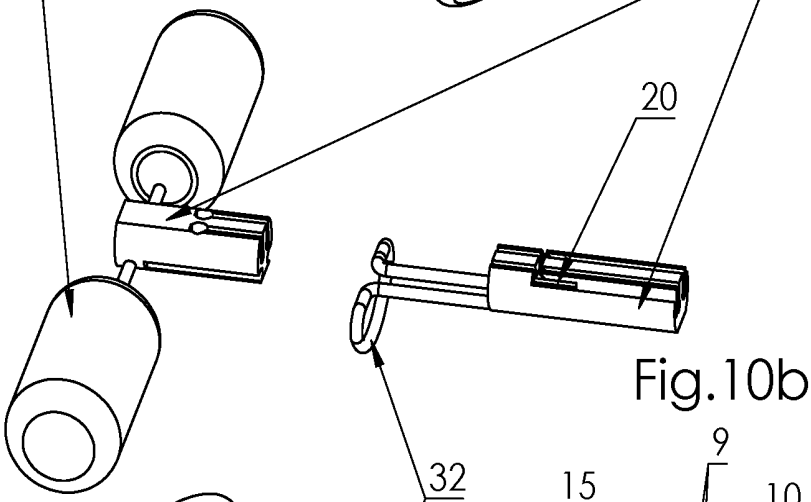


Fig.10b

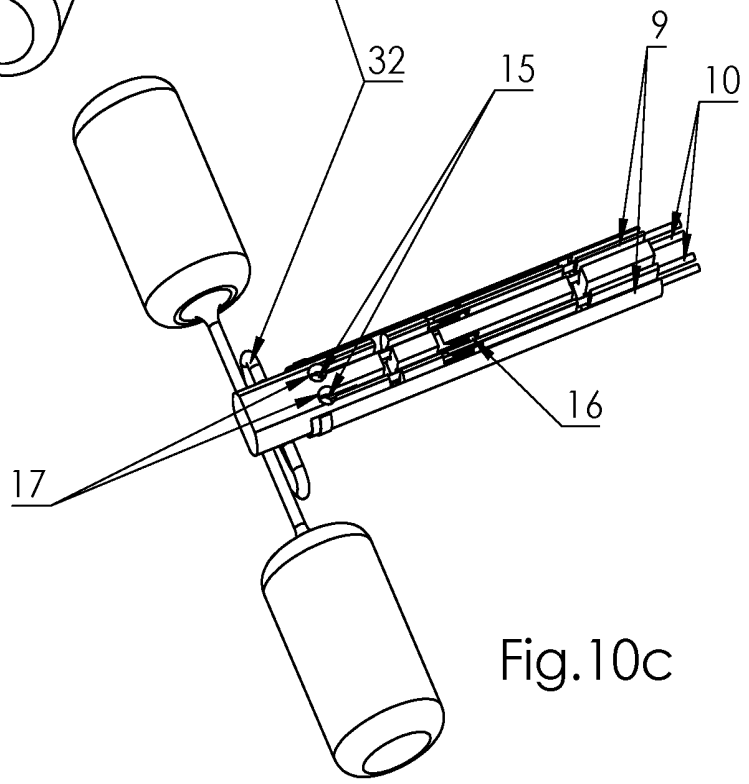


Fig.10c

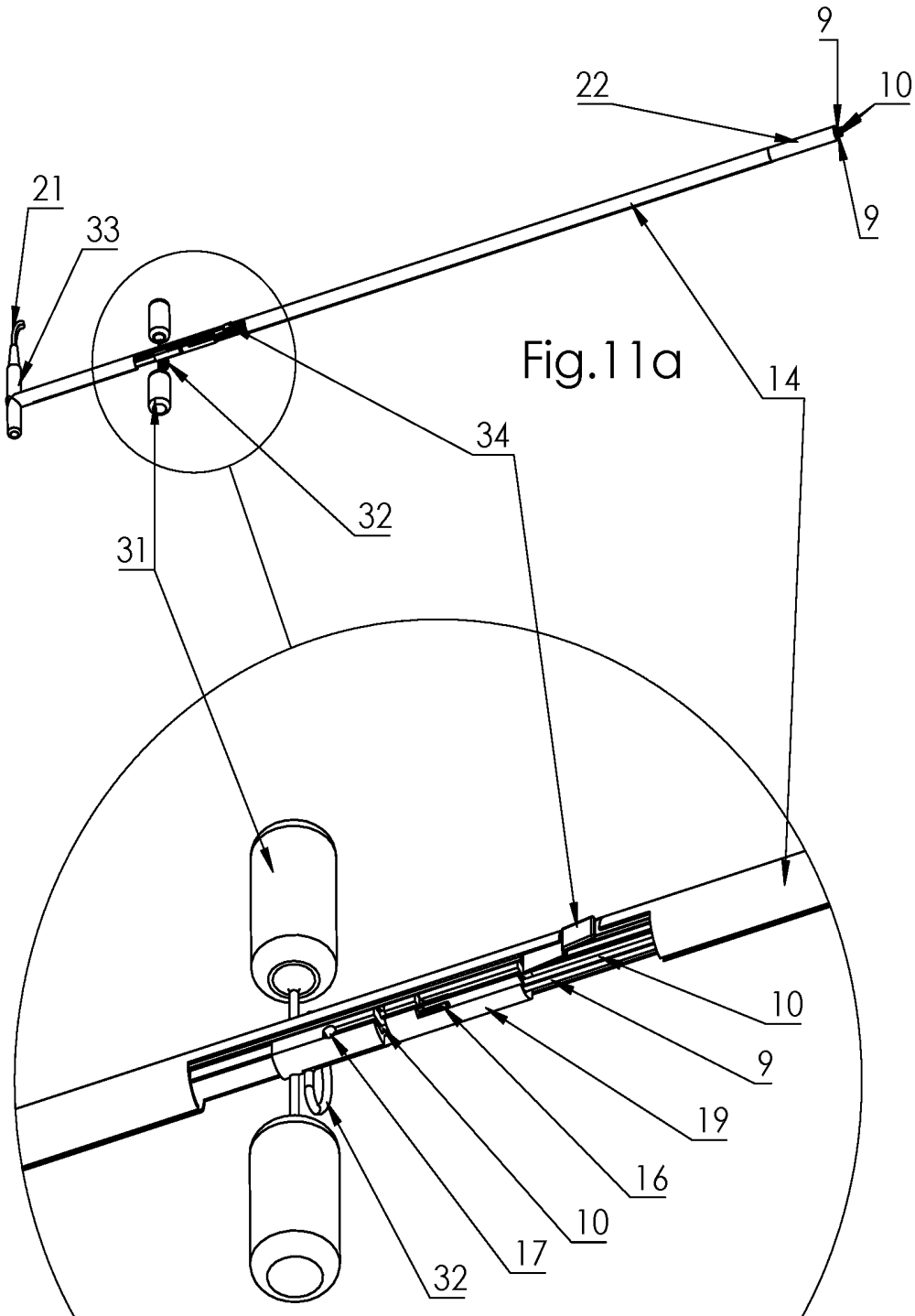


Fig.11a

Fig.11b

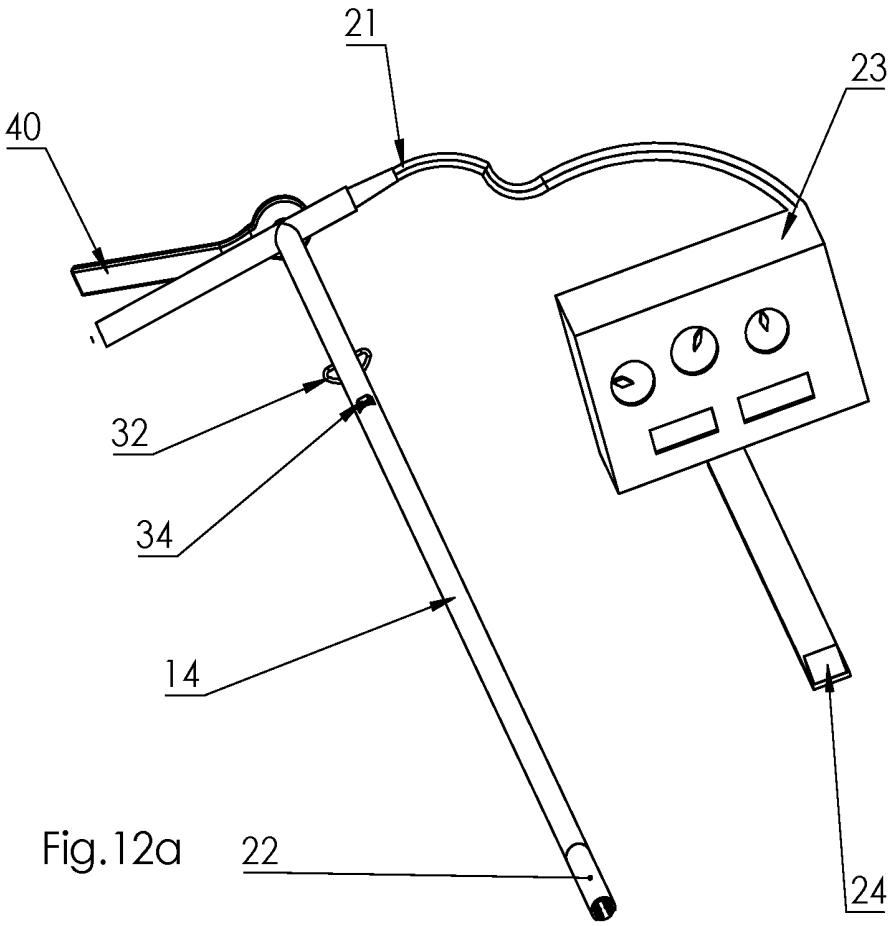


Fig.12a

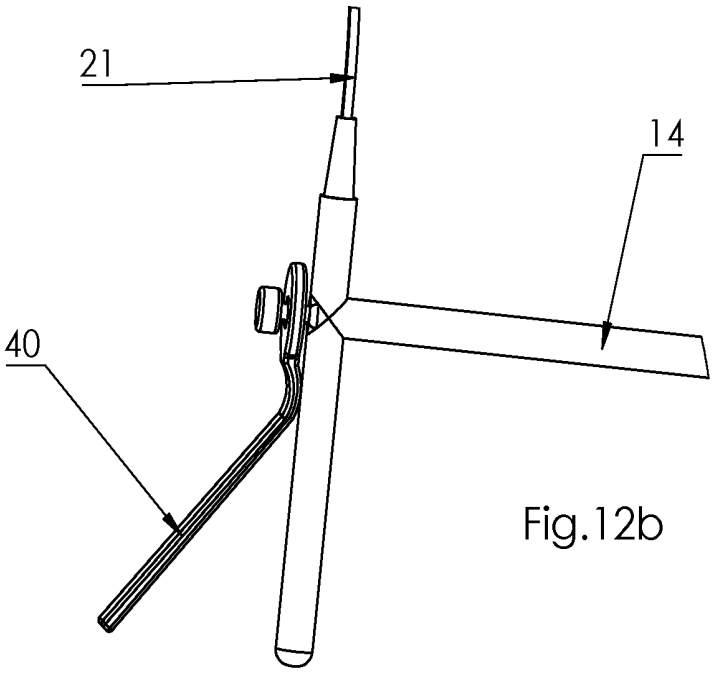


Fig.12b

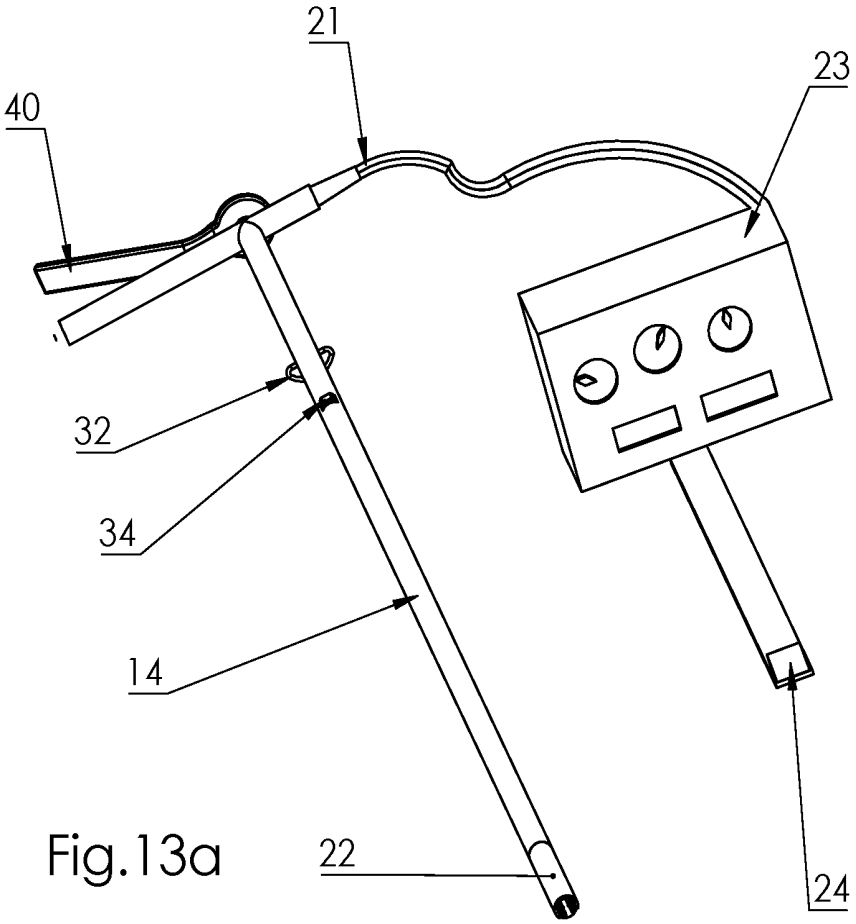


Fig.13a

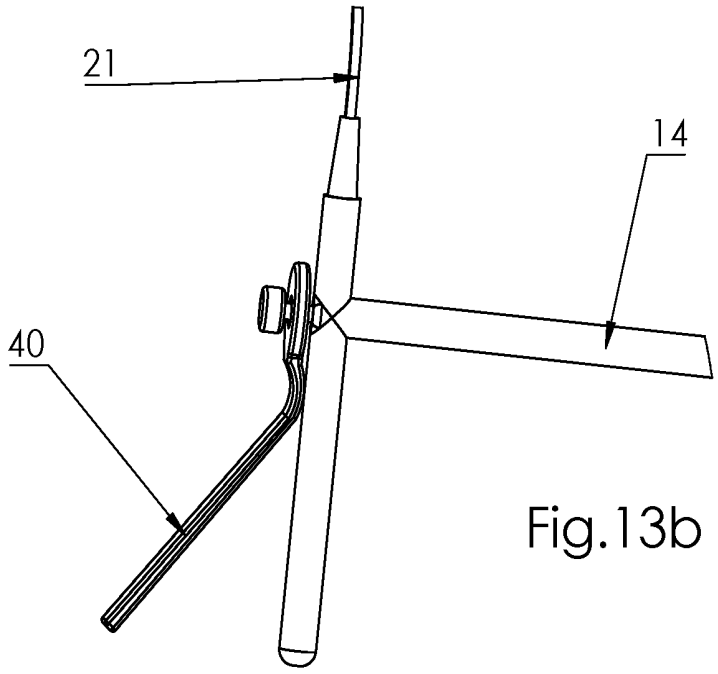


Fig.13b

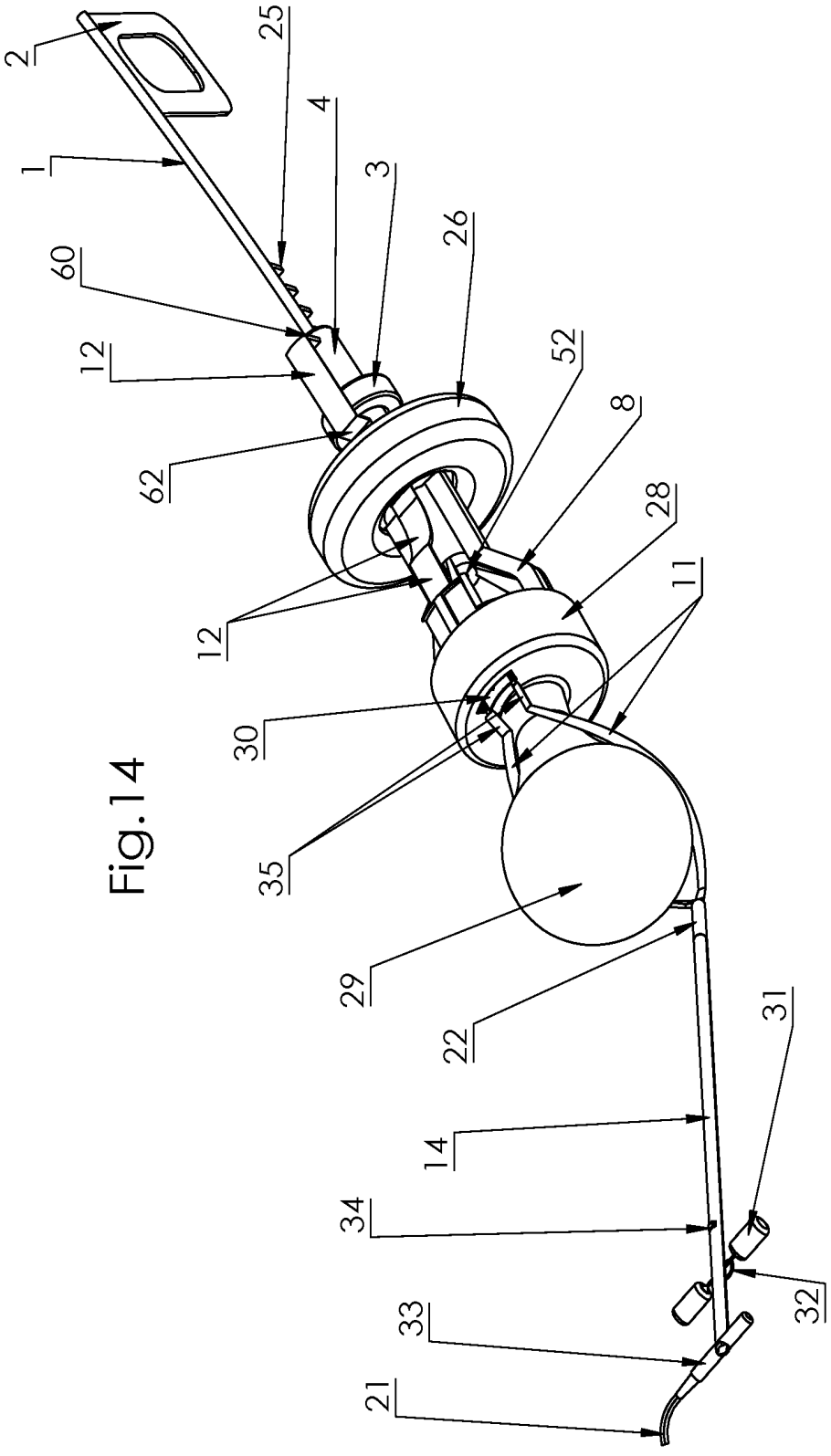


Fig.14

COLPOTOMY SYSTEM WITH UTERINE MANIPULATOR AND ELECTROCAUTERY FOR TOTAL LAPAROSCOPIC HYSTERECTOMY

BACKGROUND

[0001] Total hysterectomy procedures involving the use of a colpotomy ring are known in the art, including the removal of the patient's uterus and cervix. In such a procedure, the patient's vagina is separated from the patient's uterus and cervix prior to extraction. Performing that portion of the procedure is difficult because there currently exists no way of uniformly cutting around the patient's cervicovaginal junction and vaginal fornix. Under current practices, several incisions must be made laparoscopically, which is time consuming and prone to error due to the difficulty in locating and manipulating the patient's cervicovaginal junction and vaginal fornices, adjacent the uterus.

[0002] Hence, what is needed is a device for severing a patient's vagina from the patient's uterus and cervix in a minimally invasive and controlled manner. There is also a need for such a device that is installed on an otherwise conventional colpotomy ring and uterine sound assembly. Finally there is a need for such a device that uses limited electrocautery to sever the patient's uterus from the vagina without impacting the surrounding tissue, and which may be subsequently removed through a laparoscopy port or through the vagina.

SUMMARY

[0003] A device is provided for facilitating a total laparoscopic hysterectomy including removing a patient's uterus and cervix, when the uterus and a portion of the patient's cervix are located inside an intra-abdominal cavity and a vagina is circumferentially attached to the cervix creating a cervicovaginal junction, wherein the cervix has a cervical canal, the uterus has an intrauterine cavity, and the intra-abdominal cavity includes a laparoscopic access installed through the anterior abdominal wall.

[0004] Among other features, the device includes a cervical cup having a cervical cup proximal end and a cervical cup distal end. The cervical cup distal end is adapted for embracing the cervix with the cervical cup distal end abutting the cervicovaginal junction, and the cervical cup proximal end extending away from the cervix. An electrocautery wire having an electrocautery wire proximal end and an electrocautery wire distal end is included within the cervical cup, and the electrocautery wire distal end includes an uninsulated portion. The cervical cup distal end includes a channel for housing the uninsulated portion of the electrocautery wire, and the channel is configured for a controlled release of the uninsulated portion of the electrocautery wire distal end.

[0005] An introducer is provided, having an introducer proximal end and an introducer distal end, the introducer proximal end is releasably coupled to the electrocautery wire proximal end, and the introducer is configured to penetrate the cervicovaginal junction upon activation of the introducer distal end, thereby introducing the electrocautery wire proximal end into the intra-abdominal cavity. A shaft is provided, the shaft having a shaft proximal end, and a shaft distal end, wherein the shaft distal end is configured for introduction into the intra-abdominal cavity through the access installed in the anterior abdominal wall.

[0006] The shaft is configured to secure the electrocautery wire proximal end through the shaft distal end and move the electrocautery wire proximal end through the shaft toward the shaft proximal end, thereby pulling the electrocautery wire uninsulated portion from the channel and causing a controlled release of the uninsulated portion along a predetermined circumferential path around the cervix along the channel. Thus, the vagina is severed from the cervix along the circumference of the cervicovaginal junction.

[0007] The apparatus preferably also includes two sliders inside the channel, with each slider configured to slide in an opposing **180** degree semi-circular track until the two sliders meet. Each slider preferably includes a duct having an inlet and an outlet, and the uninsulated portion of the electrocautery wire passes through the duct of each slider from the inlet to the outlet, emerging from each outlet toward the outside of the channel. That arrangement allows the uninsulated portion to be released along the channel and for the electrocautery wire to disengage the cervical cup through the outlet of each duct.

[0008] The apparatus preferably also includes two flexible insulated sheaths, wherein each flexible insulated sheath has a sheath proximal end and a sheath distal end. Each sheath distal end is individually coupled to a slider, such that each flexible insulated sheath can move a predetermined distance toward or away from each slider. Each flexible insulated sheath also preferably includes a duct having a duct proximal end and a duct distal end. Each duct distal end faces each slider and each duct proximal end is releasably coupled to the shaft distal end, such that each of the ducts house a portion of the electrocautery wire, with the electrocautery wire extended from the duct distal end to the duct proximal end.

[0009] The flexible insulated sheaths are configured such that pulling on the proximal end of the shaft with the shaft distal end coupled to each flexible insulated sheath causes each of the flexible insulated sheaths to move away from each slider a predetermined distance, exposing portion of the uninsulated electrocautery wire. The electrocautery wire is also configured such that moving the proximal end through the long shaft causes the electrocautery wire to move through the duct in a manner that the uninsulated portion extends only between a slider and a flexible insulated sheath, thereby causing the uninsulated portion to slide through a predetermined circular path around the cervix.

[0010] The apparatus preferably also includes an elongated curved stem having a stem proximal end, a stem distal end and a first curved axis, the stem distal end is adapted to be introduced through the cervical canal into the intrauterine cavity, thereby providing a means for manipulating the uterus, and the proximal end includes a handle. The device preferably includes an elongated curved cylinder having a proximal end, a distal end, with a duct along its length and a second curved axis matching the first curved axis. The elongated curved cylinder is preferably shorter in length than the elongated curved stem, and the distal end of the elongated cylinder is adapted to be coupled with the proximal end of the cervical cup. This allows them to move as one unit, wherein the elongated curved stem is configured for sliding through the duct of the elongated curved cylinder and adapted to be locked in place at a predetermined distance set by the operator.

[0011] The device preferably also includes a cable having a cable proximal end and a cable distal end. The cable distal end is attached to the flexible insulated sheath proximal end and the cable proximal end is configured for releasably coupling to the shaft distal end, thereby facilitating temporary coupling of the shaft with the insulated flexible sheath, and allowing them to move as a single unit. The cable proximal end is also configured to be releasably coupled to the introducer proximal end alongside the electrocautery wire proximal end, so that actuating the introducer distal end pushes the introducer forward, penetrating a small portion of the cervicovaginal junction, thereby introducing both the cable proximal end and the electrocautery wire proximal end to the inside of the intra-abdominal cavity.

[0012] The semicircular tracks of the channel at the cervical cup distal end are preferably tilted interiorly, thereby causing the sliders to be tilted interiorly along the track. This causes the angle of the exposed portion of the electrocautery wire extending between each slider and each flexible insulated sheath to be tilted interiorly closer to the cervix, thereby causing the cutting area severed by the uninsulated portion in the cervicovaginal junction to be closer to the cervix and away from other body organs. Additionally, a portion of the shaft may be flexible, a portion of the shaft may be bifurcated, and the shaft may be insulated.

[0013] In various alternative embodiments, an optical/light system terminating at the cervical cup. The shaft includes sliding bars configured to move the electrocautery wire through the shaft. The uninsulated portion of the electrocautery wire distal end may be divided into two arms, wherein each arm is coupled to an opposing side of a non-conductive element, thereby allowing the electrocautery wire to function using a bipolar electrocautery technique. Additionally, the non-conductive element may be anchored in place in the channel at the cervical cup distal end. In various alternative embodiments, the device may also include a component selected from the group consisting of a monopolar wired electrocautery energy generator, a bipolar wired electrocautery energy generator, a monopolar batteries operated electrocautery energy generator, a bipolar batteries operated electrocautery energy generator, a pedal activating electrocautery, a manual activating electrocautery, and a button activating electrocautery, a gas seal vaginal element, a gas seal vaginal balloon occluder, and at least one handle.

[0014] The device may also be characterized as a device to facilitate a total laparoscopic hysterectomy of a uterus, wherein the uterus and a portion of a cervix are inside an intra-abdominal cavity and a vagina is circumferentially attached to the cervix creating a cervicovaginal junction, wherein the cervix has a cervical canal, the uterus has an intrauterine cavity, and the intra-abdominal cavity includes an access installed through the anterior abdominal wall. The device in this embodiment includes a cervical cup having a cervical cup distal end adapted to abut the cervicovaginal junction, and a cervical cup proximal end extending away from the cervix. An electrocautery wire is provided having an insulated portion, and an uninsulated portion disposed in the cervical cup distal end.

[0015] The cervical cup distal end preferably includes a channel housing the uninsulated portion, the channel comprising a pair of sliders configured to move through the channel and release of the uninsulated portion of the electrocautery wire. An introducer having an introducer proximal end and an introducer distal end is included, with the introducer proximal end releasably coupled to the electrocautery wire insulated portion, and the introducer slidable relative to the cervical cup, such that the proximal end is configured to penetrate the cervicovaginal junction upon activation of the introducer distal end, thereby introducing the electrocautery wire insulated portion into the intra-abdominal cavity.

[0016] The device preferably also includes a shaft having a shaft proximal end, and a shaft distal end, wherein the shaft distal end is configured for introduction into the intra-abdominal cavity through the access installed in the anterior abdominal wall. The shaft is further configured to secure the electrocautery wire insulated portion through the shaft distal end and urge the electrocautery wire through the shaft toward the shaft proximal end, thereby pulling the electrocautery wire uninsulated portion through the sliders and around the channel, and thereby cause a controlled release of the uninsulated portion along a predetermined circumferential path around the cervix.

[0017] A method is also provided for separating a patient's cervix from the patient's vagina at the cervicovaginal junction. The method includes the steps of providing a colpotomy cup assembly having a colpotomy ring, providing an electrocautery wire on the colpotomy cup assembly, passing the electrocautery wire through an insulated flexible sheath, providing a tensioner cable on the insulated flexible sheath.

[0018] An introducer trocar is provided on the colpotomy cup assembly in a sliding relationship to the colpotomy ring, and the introducer trocar is anchored to the electrocautery wire and the tensioner cable to the introducer trocar. The colpotomy ring is placed against the cervicovaginal junction, and urged through the cervicovaginal junction, thereby carrying the electrocautery wire and tensioner cable through the cervicovaginal junction. The electrocautery wire and the tensioner cable are captured with a laparoscopic shaft assembly, placed under tension, and the electrocautery wire is pulled through the insulated flexible sheath while causing the electrocautery wire to travel around the colpotomy ring.

[0019] In various alternative embodiments of the method, two sliders are provided and coupled to the two flexible insulated sheaths. The two sliders are configured to travel along with the flexible insulated sheaths around two semicircular portions of the colpotomy ring and control the release of the electrocautery wire from the colpotomy ring. Additionally, a first handle may be provided for moving the tensioner cable into the laparoscopic shaft assembly, such that the flexible insulated sheath abuts the laparoscopic shaft assembly, a second handle may be provided on the laparoscopic shaft assembly for drawing the electrocautery wire through the flexible insulated sheath, and a release system may be provided comprising a colpotomy cup roller affixed to a roller rod. When the electrocautery wire is urged through the colpotomy cup roller, such that the colpotomy cup roller travels around the colpotomy ring, a channel provided in the colpotomy ring is configured to allow the colpotomy cup roller to pass therethrough. By providing a roller rod channel and a spring in the flexible insulated sheath, the roller rod channel and spring are configured to arrest movement of the insulated sheath away from the colpotomy ring.

BRIEF DESCRIPTION OF THE FIGURES

[0020] FIG. **1** illustrates a perspective view of a uterine colpotomy system assembly;

[0021] FIG. **2***a* illustrates a perspective view of an accordion folded electrocautery wire and tensioner cable, including flexible insulated sheaths and a release system;

[0022] FIG. **2***b* illustrates a perspective view of the accordion folded electrocautery wire and tensioner cable attached to an introducer trocar, including flexible insulated sheaths and a release system;

[0023] FIG. **3** illustrates a perspective view of the uterine colpotomy system assembly, with the electrocautery wire and tensioner cable extending into a laparoscopy shaft assembly;

[0024] FIG. **4***a* illustrates a perspective view of the uterine colpotomy system assembly with the electrocautery wire, tensioner cable, and flexible insulated sheaths extended.

[0025] FIG. **4***b* illustrates a perspective view of a uterine sound;

[0026] FIG. **4***c* illustrates a perspective view of a colpotomy cup assembly;

[0027] FIG. **4***d* illustrates the terminal ends of the electrocautery wire and tensioner cable;

[0028] FIG. **5***a* illustrates a perspective view of the colpotomy cup assembly, including a colpotomy ring bearing the electrocautery wire and release system in a channel;

[0029] FIG. **5***b* illustrates a perspective view of the release system;

[0030] FIG. **5***c* illustrates a partial cut-away perspective view of the release system;

[0031] FIG. **6***a* illustrates an enlarged view of the colpotomy ring;

[0032] FIG. **6***b* illustrates an enlarged view of the electrocautery wire and release mechanism, including an electrocautery disc;

[0033] FIG. **7***a***1** illustrates a perspective view of a portion of the colpotomy ring and the release mechanism in a retracted configuration.

[0034] FIG. **7***b***1** illustrates a perspective view of a portion of the colpotomy ring and the release mechanism in a non-retracted configuration.

[0035] FIG. **7***a***2** illustrates a perspective view of the release mechanism in a retracted configuration.

[0036] FIG. **7***b***2** illustrates a perspective view of the release mechanism in a non-retracted configuration.

[0037] FIG. **7***a***3** illustrates a cut-away perspective view of the release mechanism in a retracted configuration.

[0038] FIG. **7***b***3** illustrates a cut-away perspective view of the release mechanism in a non-retracted configuration.

[0039] FIG. **8***a* illustrates a perspective view of the colpotomy ring;

[0040] FIG. **8***b* illustrates a close-up perspective view of the colpotomy ring;

[0041] FIG. **9***a* illustrates a perspective rear view of the colpotomy cup assembly;

[0042] FIG. **9***b* illustrates a perspective rear view of the colpotomy cup assembly, including a uterine sound;

[0043] FIG. **9***c* illustrates a perspective view of a locking mechanism for the uterine sound in the colpotomy cup assembly;

[0044] FIG. **9***d* illustrates a perspective view of the locking mechanism with the uterine sound in position for locking relative to the colpotomy cup assembly;

[0045] FIG. **10***a* illustrates a perspective view of electrocautery wire and tensioner cable attachment portions of the laparoscopic shaft assembly, including sliding handles;

[0046] FIG. **10***b* illustrates an exploded perspective view of the electrocautery wire and tensioner cable attachment portions;

[0047] FIG. **10***c* illustrates a perspective view of sliding attachments for the electrocautery wire and tensioner cable with the electrocautery wire and tensioner cable attached;

[0048] FIG. **11***a* is a perspective view of the laparoscopic shaft assembly;

[0049] FIG. **11***b* is a perspective view of the electrocautery wire and tensioner cable attachment portions, including a locking release button;

[0050] FIG. **12***a* is a perspective view of an electrocautery machine attached to the laparoscopic shaft assembly and FIG. **12***b* is a close-up view of the laparoscopic shaft assembly handle;

[0051] FIG. **13***a* is a perspective view of an electrocautery machine attached to an alternative embodiment laparoscopic shaft assembly;

[0052] FIG. **13***b* is a perspective view of a handle portion of the alternative embodiment laparoscopic shaft assembly; and

[0053] FIG. **14** is a perspective view of the uterine colpotomy system assembly and the laparoscopic shaft assembly being used to cut through a cervicovaginal junction to separate a cervix from a vagina.

COMPONENT LISTING

[0054] 1. Uterine sound [see FIG. **1**, Sheet 1/14; FIG. **3**, Sheet 3/14; FIGS. **4***a* and **4***b*, Sheet 4/14; FIG. **9***b*, Sheet 9/14; and FIG. **14**, Sheet 14/14].

[0055] 2. Uterine sound handle [see FIG. **1**, Sheet 1/14; FIG. **3**, Sheet 3/14; FIGS. **4***a* and **4***b*, Sheet 4/14; FIG. **9***b*, Sheet 9/14; and FIG. **14**, Sheet 14/14]

[0056] 3. Locking ring to adjust uterine sound intrauterine length [see FIG. **1**, Sheet 1/14; FIG. **3**, Sheet 3/14; FIG. **5***a*, Sheet 5/14; FIGS. **9***a*, **9***b*, **9***c* and **9***d*, Sheet 9/14; and FIG. **14**, Sheet 14/14].

[0057] 4. Colpotomy cup cylinder [see FIG. **1**, Sheet 1/14; FIG. **3**, Sheet 3/14; FIG. **4***c*, Sheet 4/14; FIGS. **9***a*, **9***b*, **9***c* and **9***d*, Sheet 9/14; and FIG. **14**, Sheet 14/14].

[0058] 5. Colpotomy cup [see FIG. **1**, Sheet 1/14; FIG. **3**, Sheet 3/14; FIGS. **4***a* and **4***c*, Sheet 4/14; FIG. **5***a*, Sheet 5/14; FIG. **6***a*, Sheet 6/14; FIGS. **8***a* and **8***b*, Sheet 8/14; and FIGS. **9***a* and **9***b*, Sheet 9/14].

[0059] 6. Colpotomy cup channel (tilted interior) [see FIG. **1**, Sheet 1/14; FIG. **3**, Sheet 3/14; FIG. **5***a*, Sheet 5/14; FIG. **6***a*, Sheet 6/14; and FIG. **8***b*, Sheet 8/14].

[0060] 7. Colpotomy cup roller [see FIG. **2***a*, Sheet 2/14; FIG. **3**, Sheet 3/14; FIGS. **5***b* and **5***c*, Sheet 5/14; FIGS. **6***a* and **6***b*, Sheet 6/14; FIGS. **7A2**, **7B2**, **7A3**, **7B3**, Sheet 7/14; and FIG. **8***b*, Sheet 8/14].

[0061] 8. Light optical system [see FIG. **1**, Sheet 1/14; FIG. **3**, Sheet 3/14; FIGS. **4***a* and **4***c*, Sheet 4/14; FIG. **5***a*, Sheet 5/14; and FIG. **14**, Sheet 14/14].

[0062] 9. Tensioner cable handling insulated flexible sheath (Cable) which is attached permanently to one end of the flexible insulated sheath (**11**) [see FIGS. **4***a* and **4***d*, Sheet 4/14; FIG. **10***c*, Sheet 10/14; and FIGS. **11***a* and **11***b*, Sheet 11/14].

[0063] 10. Electrocautery wire [see FIGS. **4***a* and **4***d*, Sheet 4/14; FIGS. **5***c* and **5***b*, Sheet 5/14; FIGS. **7A2**, **7B2**, **7A3**, **7B3**, Sheet 7/14; FIG. **10***c*, Sheet 10/14; and FIGS. **11***a* and **11***b*, Sheet 11/14].

[0064] 11. Flexible insulated sheath (flexible sheath, insulated flexible sheath, insulated sheath, sheath) [see FIG. **3**, Sheet 3/14; and FIG. **14**, Sheet 14/14].

[0065] 12. Introducer trocar that carries the electrocautery wire (**10**) and the tensioner cable (**9**) through the cervicovaginal junction [see FIG. **1**, Sheet 1/14; FIG. **2***b*, Sheet 2/14; FIG. **3**, Sheet 3/14; FIGS. **4***a* and **4***c*, Sheet 4/14; FIG. **5***a*, Sheet 5/14; and FIG. **14**, Sheet 14/14].

[0066] 13. Uterine sound intrauterine balloon or other uterine sound anchoring element to the uterus or intrauterine cavity [see FIG. **1**, Sheet 1/14; FIG. **3**, Sheet 3/14; and FIG. **4***a*, Sheet 4/14].

[0067] 14. Laparoscopy shaft (Shaft) [see FIG. **10***a*, Sheet 10/14; FIGS. **11***a* and **11***b*, Sheet 11/14; FIGS. **12***a* and **12***b*, Sheet 12/14; FIGS. **13***a* and **13***b*, Sheet 13/14; and FIG. **14**, Sheet 14/14].

[0068] 15. Ball tips of the electrocautery wire (**10**) (Ball tips) [see FIGS. **4***a* and **4***d*, Sheet 4/14; and FIG. **10***c*, Sheet 10/14].

[0069] 16. Horse shoe tip of the tensioner cable (**9**) handling the insulated Flexible sheath (**11**) [see FIGS. **4***a* and **4***d*, Sheet 4/14; FIG. **10***c*, Sheet 10/14; and FIG. **11***b*, Sheet 11/14].

[0070] 17. Electrocautery ball socket to receive the Ball tips (**15**) of the electrocautery wire (**10**) [see FIGS. **10***a* and **10***c*, Sheet 10/14; and FIG. **11***b*, Sheet 11/14].

[0071] 18. Sliding bar for electrocautery wire (**10**) hook up and constriction [see FIG. **10***a*, Sheet 10/14].

[0072] 19. Sliding bar for tensioner cable (**9**) handling insulated Flexible sheath hook up and constriction (**11**) [see FIGS. **10***a* and **10***b*, Sheet 10/14; and FIG. **11***b*, Sheet 11/14].

[0073] 20. Groove in the Sliding bar to hook up the Horse shoe tip of the tensioner cable (**9**) handling the insulated Flexible sheath (**11**) [see FIGS. **10***a* and **10***b*, Sheet 10/14; and FIG. **11***b*, Sheet 11/14].

[0074] 21. Cable attachment to electrocautery Machine [see FIG. **11***a*, Sheet 11/14; FIGS. **12***a* and **12***b*, Sheet 12/14; FIGS. **13***a* and **13***b*, Sheet 13/14; and FIG. **14**, Sheet 14/14]

[0075] 22. Cover of the distal end of the laparoscopic shaft [see FIG. **3**, Sheet 3/14; FIG. **10***a*, Sheet 10/14; FIG. **11***a*, Sheet 11/14; FIG. **12***a*, Sheet 12/14; FIG. **13***a*, Sheet 13; and FIG. **14**, Sheet 14/14].

[0076] 23. Electrocautery Machine [see FIG. **12***a*, Sheet 12/14; and FIG. **13***a*, Sheet 13].

[0077] 24. Electrocautery Machine pedal to activate electrocautery machine with alternative activation button on the laparoscopy shaft handle (**33**) [see FIG. **12***a*, Sheet 12/14; and FIG. **13***a*, Sheet 13].

[0078] 25. Uterine sound projections [see FIG. **1**, Sheet 1/14; FIG. **3**, Sheet 3/14; FIGS. **4***a* and **4***b*, Sheet 4/14; FIGS. **9***b* and **9***d*, Sheet 9/14; and FIG. **14**, Sheet 14/14].

[0079] 26. Vaginal occluder balloon with alternative other gas seal vaginal elements [see FIG. **1**, Sheet 1/14; FIG. **3**, Sheet 3/14; and FIG. **14**, Sheet 14/14].

[0080] 27. Vaginal occluder balloon base [see FIG. **4***b*, Sheet 4/14; and FIG. **5***a*, Sheet 5/14].

[0081] 28. Vaginal vault [see FIG. **14**, Sheet 14/14].

[0082] 29. Uterus [see FIG. **14**, Sheet 14/14].

[0083] 30. A cut in the vaginal vault made by the introducer (**12**) to sever vagina from cervix [see FIG. **14**, Sheet 14/14].

[0084] 31. Handle for Sliding bar (**18**) for electrocautery wire hook up and constriction [see FIG. **3**, Sheet 3/14; FIGS. **10***a* and **10***b*, Sheet 10/14; FIGS. **11***a* and **11***b*, Sheet 11/14; and FIG. **14**, Sheet 14/14].

[0085] 32. Handle for Sliding bar (**19**) for tensioner cable (**9**) handling insulated Flexible sheath (**11**) hook up and constriction [see FIGS. **10***b* and **10***c*, Sheet 10/14; FIGS. **11***a* and **11***b*, Sheet 11/14; FIG. **12***a*, Sheet 12/14; and FIG. **13***a*, Sheet 13; and FIG. **14**, Sheet 14/14].

[0086] 33. Handle for laparoscopy shaft [see FIG. **11***a*, Sheet 11/14; and FIG. **14**, Sheet 14/14].

[0087] 34. Release button for releasing locking system for Sliding bar (**19**) for tensioner cable (**9**) handling insulated Flexible sheath (**11**) [see FIG. **3**, Sheet 3/14; FIGS. **11***a* and **11***b*, Sheet 11/14; FIG. **12***a*, Sheet 12/14; and FIG. **13***a*, Sheet 13; and FIG. **14**, Sheet 14/14].

[0088] 35. Release system of electrocautery wire at distal end of insulated Flexible sheath (**11**) [see FIG. **1**, Sheet 1/14; FIG. **3**, Sheet 3/14; FIGS. **5***a* and **5***b*, Sheet 5/14; FIGS. **6***a* and **6***b*, Sheet 6/14; FIGS. **7A1**, **7B1**, **7A2**, **7B2**, Sheet 7/14; FIG. **8***b*, Sheet 8/14; and FIG. **14**, Sheet 14/14].

[0089] 36. Electrocautery disc for supporting the electrocautery wire (**10**) with its folded configuration (**43**) and allows for both bipolar and monopolar electrocautery [see FIG. **1**, Sheet 1/14; FIG. **2***a*, Sheet 2/14; FIG. **5***a*, Sheet 5/14; FIGS. **6***a* and **6***b*, Sheet 6/14; and FIG. **8***b*, Sheet 8/14].

[0090] 37. Spring [see FIG. **5***c*, Sheet 5/14; FIGS. **6***a* and **6***b*, Sheet 6/14; FIGS. **7A1**, **7B1**, **7A3**, **7B3**, Sheet 7/14; and FIG. **8***b*, Sheet 8/14].

[0091] 38. The uninsulated portion of Electrocautery wire (**10**) in colpotomy cup channel (**6**) [see FIG. **2***a*, Sheet 2/14; FIGS. **5***a*, **5***b* and **5***c*, Sheet 5/14; FIGS. **6***a* and **6***b*, Sheet 6/14; FIGS. **7A1**, **7B1**, **7B2**, **7A3**, **7B3**, Sheet 7/14; and FIG. **8***b*, Sheet 8/14].

[0092] 39. LED [see FIG. **1**, Sheet 1/14; FIG. **5***a*, Sheet 5/14; FIG. **6***a*, Sheet 6/14; FIGS. **7A1** and **7B1**, Sheet 7/14; and FIG. **8***b*, Sheet 8/14].

[0093] 40. Alternative handle for manipulating Sliding bar (**18**) for electrocautery wire (**10**) hook up and constriction [see FIGS. **12***a* and **12***b*, Sheet 12/14; and FIGS. **13***a* and **13***b*, Sheet 13/14].

[0094] 41. Ridge on laparoscopy shaft to guide Cover (**22**) at the distal end of the laparoscopic shaft (**14**) [see FIG. **10***a*, Sheet 10/14].

[0095] 42. Folded Tensioner cable handling insulated flexible sheath (Tensioner cable (**9**) in accordion-folded configuration) [see FIG. **1**, Sheet 1/14; FIG. **2***a*, Sheet 2/14].

[0096] 43. Folded electrocautery wire (electrocautery wire (**10**) in accordion-folded configuration) [see FIG. **1**, Sheet 1/14; FIG. **2***a*, Sheet 2/14].

[0097] 44. Folded insulated Flexible sheath (insulated flexible sheath (**11**) in accordion-folded configuration) [see FIG. **1**, Sheet 1/14; FIGS. **2***a* and **2***b*, Sheet 2/14].

[0098] 45. A temporary attachment between the electrocautery wire **10**,**43**, the cable **9**, **42** and the introducer trocar **12** [see FIG. **1**, Sheet 1/14; FIG. **2***b*, Sheet 2/14].

[0099] 46. Roller rod [see FIGS. **5***b* and **5***c*, Sheet 5/14; and FIGS. **7A2**, **7A3** and **7B3**, Sheet 7/14].

[0100] 47. Roller rod channel in release system (**35**) of electrocautery wire (**10**) at distal end of insulated Flexible sheath (**11**) [see FIG. **5***c*, Sheet 5/14; and FIGS. **7A3** and **7B3**, Sheet 7/14].

[0101] 48. Electrocautery duct in insulated Flexible sheath (**11**) [see FIG. **5***c*, Sheet 5/14; and FIGS. **7A3** and **7B3**, Sheet 7/14].

[0102] 49. Exposed portion of electrocautery wire (**10**) with its continuity (**38**) in colpotomy cup channel (**6**) [see FIGS. **5***b* and **5***c*, Sheet 5/14; and FIGS. **7A2**, **7B2**, **7A3** and **7B3**, Sheet 7/14; and FIG. **8***b*, Sheet 8/14].

[0103] 50. Top opening of the Colpotomy cup channel [see FIGS. **7A1** and **7B1**, Sheet 7/14; and FIG. **8***b*, Sheet 8/14].

[0104] 51. Floor of the Colpotomy cup channel (tilted interior) [see FIGS. **7A1** and **7B1**, Sheet 7/14; and FIG. **8***b*, Sheet 8/14].

[0105] 52. Distal opening of the Colpotomy cup cylinder (**4**) duct through which the uterine sound is housed when the device is in use.

[0106] 53. Cut face of distal end of insulated Flexible sheath [see FIG. **5***c*, Sheet 5/14; and FIGS. **7A3** and **7B3**, Sheet 7/14].

[0107] 54. Groove for the Introducer trocar (**12**) for electrocautery wire (**12**) within the vaginal occluder balloon base (**27**) [see FIG. **1**, Sheet 1/14; and FIG. **5***a*, Sheet 5/14].

[0108] 55. Proximal opening of the Colpotomy cup cylinder (**4**) duct through which the uterine sound is housed when the device is in use [see FIG. **9***a*, Sheet 9/14].

[0109] 56. Groove in the colpotomy cup cylinder through which uterine sound projections (**25**) can pass [see FIGS. **9***a* and **9***c*, Sheet 9/14].

[0110] 57. Slit opening in the locking ring (**3**) [see FIG. **9***a*, Sheet 9/14].

[0111] 58. Groove in the locking ring (**3**) that encase the locked uterine sound projection when the locking ring (**3**) is turned [see FIGS. **9***c* and **9***d*, Sheet 9/14].

[0112] 59. Ridge on the colpotomy cup cylinder to guide the locking ring [see FIGS. **9***c* and **9***d*, Sheet 9/14].

[0113] 60. The introducer trocar (**12**) handle tab [see FIG. **1**, Sheet 1/14; FIG. **2***b*, Sheet 2/14; FIG. **3**, Sheet 3/14; FIG. **4***c*, Sheet 4/14; FIG. **5***a*, Sheet 5/14; FIGS. **9***a* and **9***b*, Sheet 9/14; and FIG. **14**, Sheet 14/14].

[0114] 61. Introducer trocar (**12**) off-set portion [see FIG. **2***b*, Sheet 2/14; FIG. **4***c*, Sheet 4/14; and FIG. **5***a*, Sheet 5/14].

[0115] 62. Introducer trocar **12** off-set face [see FIG. **3**, Sheet 3/14; FIG. **4***c*, Sheet 4/14; FIG. **5***a*, Sheet 5/14; and FIG. **14**, Sheet 14/14].

[0116] 63. Introducer trocar **12** pointing tip or a blade [see FIG. **1**, Sheet 1/14; FIG. **2***b*, Sheet 2/14; FIG. **3**, Sheet 3/14; FIG. **4***c*, Sheet 4/14; FIG. **5***a*, Sheet 5/14; FIG. **6***a*, Sheet 6/14; FIGS. **7A1**and **7B1**, Sheet 7/14; and FIG. **8***b*, Sheet 8/14].

[0117] 64. Colpotomy cup (**5**) opening for releasing colpotomy cup rollers (**7**) [see FIG. **5***a*, Sheet 5/14; FIG. **6***a*, Sheet 6/14; and FIG. **8***b*, Sheet 8/14].

[0118] 65. Button activating electrocautery [see FIG. **14**, Sheet 14/14].

DETAILED DESCRIPTION

[0119] The following description is presented to enable any person skilled in the art to make and use the invention, and is provided in the context of a particular application and its requirements. Various modifications to the disclosed embodiments will be readily apparent to those skilled in the art, and the general principles defined herein may be applied to other embodiments and applications without departing from the spirit and scope of the present invention. Thus, the present invention is not limited to the embodiments shown, but is to be accorded the widest scope consistent with the principles and features disclosed herein.

[0120] Referring to FIG. **1**, a colpotomy system assembly is shown. The colpotomy system assembly includes a uterine sound **1** and a handle **2**. A locking ring **3** is provided on the uterine sound **1**, the locking ring **3** engaging one of a series of uterine sound projections **25** for adjusting and locking the uterine sound **1** in position relative to the a colpotomy cup **5** at the proper intrauterine length.

[0121] A colpotomy cup cylinder **4** surrounds the uterine sound **1** around a portion of its length, and supports the colpotomy cup **5**. The colpotomy cup **5** has a forward facing toroidal profile and includes a colpotomy cup channel **6**. The colpotomy cup channel **6** is disposed at a slightly inward angle along the toroidal surface. A light optical system **8** extends along the colpotomy cup cylinder **4**, and extends to the colpotomy cup **5** to illuminate the area around the colpotomy cup **5**, and may include one or more LEDs **39** to provide effective illumination of the vagina and vaginal fornices during the introduction of the colpotomy cup around the cervix and to transilluminate through the cervicovaginal junction and the surrounding tissue to help during the laparoscopic tissues dissection and avoid injury to blood vessels and surrounding organs.

[0122] An introducer trocar **12** is provided for introducing an electrocautery wire **10**, shown here in an accordion-folded configuration **43**, as well as a cable **9**, also shown here in an accordion-folded configuration **42** from the vagina into the intrauterine cavity through the cervicovaginal junction, and allowing the electrocautery wire **43** and cable **42** to be grasped by a regular laparoscopic grasper (not shown) and coupled to a laparoscopy shaft assembly (See, FIGS. **3**, **4***a*, **11***a*, **12** and **14**). The introducer trocar **12** extends through an introducer trocar groove **54** located in a vaginal occluder balloon base **27** which supports a vaginal occluder balloon **26**. A uterine sound intrauterine balloon **13** is provided near a terminal end of the uterine sound **1** opposite the uterine sound handle **2** which help to stabilize and anchor the distal end of the uterine sound to the uterus and the uterine cavity.

[0123] Additional components of the colpotomy system assembly discussed in more detail below include release systems **35** for the electrocautery wire **10**, **43** located at a distal end of insulated flexible sheaths **11**, **44**. An electrocautery disc **36** is provided for supporting the electrocautery wire **10**, **43** and allows for both bipolar and monopolar electrocautery. A temporary attachment **45** is provided between the electrocautery wire **43**, the cable **42** and the introducer trocar **12**.

[0124] Referring to FIGS. **2***a* and **2***b*, the electrocautery portions of the colpotomy system assembly are shown in more detail. Referring to FIG. **2***a*, the cable **42** and electrocautery wire **43** are preferably accordion folded together. While the cable **9**, **42** is attached to the proximal end of the insulated sheaths **44**, the electrocautery wire **10**, **43** extends through the insulated sheaths **44**, continuing along roller rods **46** and through colpotomy cup rollers **7** before traveling around the colpotomy cup **5** in the colpotomy cup channel **6** (not shown). The electrocautery wire **10**, **43** includes an

uninsulated portion **38** disposed in the colpotomy cup channel **6**, which terminates at the electrocautery disc **36**.

[0125] In an alternative embodiment, the folded electrocautery wire **43**, the folded insulated flexible sheaths **44** and the folded cable **42** are enclosed in a sterile encasement (not shown) to protect them from being contaminated from the different microbes that are present in the vagina prior to their introduction into the intra-abdominal cavity.

[0126] Referring to FIG. **2***b*, The introducer trocar **12** is shown interfacing with the electrocautery wire **43** and cable **42**. The introducer trocar **12** includes a handle portion **60** for engagement by the surgeon, to push the introducer trocar **12** forward relative to the colpotomy cup **5** (not shown). Continued forward movement of the introducer trocar **12** may be arrested by providing a handle tab **60** configured to catch on the locking ring **3**. The introducer trocar **12** also includes an off-set portion **61** allowing it to travel through the vaginal occluder balloon base **27** and not interfere with the vaginal occluder balloon **26** once inflated. The off-set portion **61** may include an off-set face **62** configured to abut the vaginal occluder balloon base **27** when the handle tab **60** engages the locking ring **3**. The introducer trocar **12** also preferably includes a pointing tip or a blade **63** for piercing the vaginal fornix and the cervicovaginal junction tissue. The electrocautery wire **43** and cable **42** are preferably semi-permanently attached to the introducer trocar **12** such that they are carried from the vagina through the vaginal fornix and the cervicovaginal junction along with its tip **63** in order to be grasped by a regular laparoscopic grasper in the intra-abdominal side and manually or in a different embodiment automatically coupled with the laparoscopy shaft assembly.

[0127] Referring to FIG. **3**, the colpotomy system assembly is shown with cable **9**, the electrocautery wire **10**, and the flexible sheaths **11** extended into the laparoscopy shaft assembly. The laparoscopy shaft assembly includes a cover **22** distal from the laparoscopy shaft handle **33**. The laparoscopy shaft assembly also includes an electrocautery wire sliding bar handle **31** pulling the electrocautery wire **10** through the laparoscopy shaft assembly and a cable sliding bar handle **32** for pulling the cable/tensioner cable **9** through the laparoscopy shaft assembly. A release button **34** is provided for releasing the cable sliding bar handle **32**. Also shown in this view, opposite the cover **22**, the flexible sheaths **11** each comprise a release system **35** for controlling the exposure of the uninsulated portion of the electrocautery wire to the cervicovaginal junction tissue.

[0128] Referring to FIGS. **4***a*-**4***d*, details of the colpotomy system assembly are shown, including the uterine sound **1** and uterine sound handle **2** disposed opposite the uterine sound intrauterine balloon **13**. The colpotomy cup cylinder **4** is also shown, including the introducer trocar **12**, vaginal occluder balloon base **27** and the colpotomy cup cylinder distal opening **52** through which the uterine sound **1** passes. In this view the cable/tensioner cable handling insulated flexible sheath **9** is shown along with the insulated electrocautery wire **10**. The insulated electrocautery wire **10** includes ball tips **15** for engaging the laparoscopy shaft assembly, while the cable/tensioner cable handling insulated flexible sheath **9** ends in a horseshoe tip for the same purpose.

[0129] Referring to FIGS. **5***a*-**5***c*, the release systems **35** for the electrocautery wire **10** with its portion **38** located in colpotomy cup channel **6** are shown in more detail. As shown in FIG. **5***b* and in the partial cross section in FIG. **5***c*, each release mechanism **35** includes a colpotomy cup roller **7** that travels around the colpotomy cup channel **6**. Specifically, FIG. **5***c* shows a cut through the distal end of the insulated flexible sheath **53** that shows the cut face of the distal end of the insulated flexible sheath **53**. A roller rod **46** extends from each colpotomy cup roller **7**, extending into a roller rod channel **47**. A spring **37** is housed in each roller rod channel **47**, and an electrocautery duct **48** is provided in each insulated flexible sheath **11** such that the exposed portion electrocautery wire **49** can travel through the insulated flexible sheaths **11** and into the laparoscopy shaft assembly. The exposed portion electrocautery wire **49** also extends through the colpotomy cup rollers **7**, which guide its movement around the colpotomy cup **5**.

[0130] Referring to FIGS. **6***a* and **6***b*, the placement of the electrocautery wire **38** in the colpotomy cup channel **6** is shown. The electrocautery wire **38** terminates in an electrocautery disc **36**, thus allowing for bipolar electrocautery if the disc **36** prevents the transmission of electricity between the electrocautery wire on both sides of the disc **36**, and alternatively, for monopolar electrocautery if it allows the transmission of electricity between the electrocautery wire on both sides of the disc **36**. As shown in this view the introducer trocar **12** is located adjacent the release systems **35** in their starting positions. Once the colpotomy cup rollers **7** have travelled the circumference of the colpotomy cup channel **6** and reached the electrocautery disc **36**, the electrocautery wire **10** and the cable **9** are uncoupled from the laparoscopy shaft assembly and the colpotomy system assembly will be removed from the vagina along with the severed cervix and the uterus, or in a different embodiment the colpotomy cup rollers **7** are released from the colpotomy cup **5** by an opening in the colpotomy cup channel **6** adjacent to the electrocautery disc **36** and they are removed from the body through the laparoscopic port along with the electrocautery wire **10**, the cable **9** and the laparoscopy shaft assembly.

[0131] Referring to FIGS. **7***a***1** through **7***b***3**, the release systems **35** are shown in their extended (**7***a***1**, **7***a***2** and **7***a***3**) and contracted (**7***b***1**, **7***b***2** and **7***b***3**) states. Referring to FIGS. **7***a***1** and **7***b***1**, the uninsulated portion fo the electrocautery wire **38** travels along a floor **51** of the colpotomy cup channel **50**. Referring to FIGS. **7***b***1**, **7***b***2** and **7***b***3**, when the cable handling insulated flexible sheath **9** is not under tension, the spring **37** causes the insulated sheath **11** to extend downward along the roller rod **46**, substantially covering the exposed portion electrocautery wire **49** in the process. When a user pulls the cable **9**, the insulated sheaths **11** are pulled upward along the roller rods, compressing the spring **37** in each roller rod channel **47**, and exposing the exposed portion electrocautery wire **49** between the colpotomy cup rollers **7** in the colpotomy cup channel **6**. The exposed portion electrocautery wire **49** is located in front of the roller rod **46** in the direction of travel of each colpotomy cup roller to facilitate cutting.

[0132] Referring to FIGS. **8***a* and **8***b*, a detail of the colpotomy cup **5** is shown. In this view the release systems **35** are in their retracted state, exposing the electrocautery wire **38** between the insulated sheaths **11** and the colpotomy cup rollers. Also, as shown in this view, the colpotomy cup channel **6** comprises a semicircular channel having an opening **50** through which the electrocautery wire **38**, but not the colpotomy cup rollers **7** can pass. The opening is oriented slightly inward, angled more toward the cervix (not

shown) and away from the surrounding organs (not shown) to decrease the risk of injury of the surrounding organs by the exposed electrocautery wire **49**. Also shown in this view is the electrocautery disc **36**, and adjacent spaces through which the colpotomy cup rollers **7** pass when disengaging from the colpotomy cup **5**. Preferably, the channel **6** may comprise a translucent material such that the LEDs **39**, or similar lighting system illuminate area adjacent the colpotomy cup **5**.

[0133] Referring to FIGS. **9***a*-**9***d*, operation of the locking ring **3** to adjust the uterine sound intrauterine length is shown in detail. FIG. **9***a* shows the colpotomy cup cylinder **4** and colpotomy cup **5**, including the proximal opening of the colpotomy cup cylinder duct **55** through which the uterine sound **1** extends when in use. The colpotomy cup cylinder **4** includes a groove **56** through which the uterine sound projections **25** can pass as the uterine sound **1** travels through the colpotomy cup cylinder **4**. Additionally, the locking ring **3** includes a slit opening **57** coinciding with the groove **56**. A ridge **59** on the colpotomy cup cylinder **4** guides the locking ring **3** with a groove **58** in the locking ring **3**, enabling the uterine sound **1** to be locked in position using the uterine sound projections **25** as shown in FIG. **9***d*.

[0134] Referring to FIGS. **10***a*-**10***c*, the proximal portion of the laparoscopy shaft assembly is shown. The laparoscopy shaft **14** includes a ridge **41** for guiding the cover **22** at the end of the laparoscopy shaft **14**. A pair of electrocautery ball sockets **17** are provided for receiving the ball tips **15** of the electrocautery wire **10**. A first sliding bar **18** is provided to connect and constrict the electrocautery wire **10**. A second sliding bar **19** is provided for connecting the cable **9** which is connected to the insulated sheaths **11**. A groove **20** is provided in the second sliding bar **19** for receiving the horse shoe tip **16** of the cable **9** handling the insulated flexible sheaths **11**. As shown in FIG. **10***c*, the horseshoe tip **16** of the cable **9** is installed in the groove **20**, which may be manipulated by operating the cable sliding bar handle **32**, while the electrocautery wire sliding bar handles directly control the electrocautery wire **10** using the ball tips **15**.

[0135] FIGS. **11***a* and **11***b* show an enlarged view of the laparoscopy shaft assembly controls. In particular, the release button **34** is shown enabling a user to release the cable sliding bar handle **32** after it has been pulled to take up all of the cable **9**, such that the insulated flexible sheaths **11** are abutting the distal end of the laparoscopy shaft **14**. The electrocautery ball sockets **17** and first sliding bar **18** are also shown, which are controlled by the electrocautery wire sliding bar handle **31**. The laparoscopy shaft handle **33** is connected to a cable attachment to an electrocautery machine **23** (FIG. **12**).

[0136] Referring to FIGS. **12***a* and **12***b*, the electrocautery machine **23** is shown, including an electrocautery machine pedal **24**. The electrocautery machine **23** is connected to the cable attachment **21** and laparoscopy shaft handle **33**. With the electrocautery machine **23** connected to the laparoscopy shaft assembly, and the cable sliding bar handle **32** retracted until the release button **34** catches it, the electrocautery wire sliding bar handle **31** may be retracted, or otherwise manipulated, to pull the electrocautery wire **10** with its uninsulated portion located in colpotomy cup channel **38** around the colpotomy cup **5**.

[0137] Referring to FIGS. **13***a* and **13***b*, an alternative laparoscopy shaft assembly is shown featuring an alternative handle **40** for manipulating the first sliding bar **18** and manipulating the electrocautery wire. In this embodiment, compression of the alternative handle **40** against the laparoscopy shaft handle **33** causes tension in the first sliding bar **18** and ball tips **15** and thus pulls the electrocautery wire **38** from the colpotomy cup channel **6**.

[0138] FIG. **14** shows the colpotomy system assembly and the laparoscopy shaft assembly in use separating a vagina at the vaginal vault, represented by cylinder **28**, from a uterus, represented by sphere **29**. In this view, the uterine sound assembly is inserted into the vagina such that the colpotomy ring **5** abuts the vaginal vault **28**. This is done after sounding the uterus **29**, and locking the uterine sound **1** in position using the uterine sound projections **25** and the locking ring **3**. The vaginal occluder balloon **26** is inflated, although shown in a relatively smaller diameter in this view for illustration purposes.

[0139] Still referring to FIG. **14**, the introducer trocar **12** has been pushed forward from the vagina through the vaginal vault **28** and the cervicovaginal junction, carrying with it, the ball tips **15** of the electrocautery wire **10** in its folded state **43**, and the horseshoe tip **16** of the cable **9** in its folded state **42**. In the process the folded electrocautery wire **43** and cable **42** have unfolded and travelled through the cut **30** in the vaginal fault **28** into the intra-abdominal side which are then grasped by a regular laparoscopic grasper (not shown) and manually coupled with the laparoscopy shaft assembly after bringing them out of the abdomen through the laparoscopy port (not shown) or in a different embodiment automatically coupled with the laparoscopy shaft assembly.

[0140] The user has moved the electrocautery bar handle **31** and the cable sliding bar handle **32** back until the release button **34** has caught, preventing the cable sliding bar handle **32** from moving in a reverse direction. At which time the insulated flexible sheaths **11** are abutting the distal end of the laparoscopy shaft **14** and they both move as one unit. Pulling the laparoscopy shaft **14** causes pulling on the insulated flexible sheath which in turn cause the release systems **35** to be activated, exposing the electrocautery wire **49**. Once the electrocautery machine **23** is activated, the exposed electrocautery wire **49** will heat up and cut the vaginal vault **28** as the electrocautery wire sliding bar handle **31** is pulled, the electrocautery wire **10** is pulled causing the uninsulated portion of the electrocautery wire in the colpotomy channel **38** to shorten, causing the colpotomy cup rollers **7** to travel around the colpotomy cup channel **6** of the colpotomy cup **5**, which is pressed against the vaginal vault **28**, thereby severing it from the uterus **29**.

[0141] Once the release systems **35** reach the electrocautery disc **36**, the electrocautery wire **10** and the cable **9** are uncoupled from the laparoscopy shaft assembly and the colpotomy system assembly will be removed from the vagina along with the severed cervix and the uterus, or in a different embodiment, the colpotomy cup rollers **7** are released from the colpotomy cup **5** by an opening **64** in the colpotomy cup channel **6** adjacent the electrocautery disc **36** and they are removed from the body through the laparoscopic port along with the electrocautery wire **10**, the cable **9** and the laparoscopy shaft assembly.

[0142] The foregoing descriptions of embodiments of the present invention have been presented only for purposes of illustration and description. They are not intended to be exhaustive or to limit the present invention to the forms disclosed. Accordingly, many modifications and variations

will be apparent to practitioners skilled in the art. Additionally, the above disclosure is not intended to limit the present invention. The scope of the present invention is defined by the appended claims.

1. A device to facilitate a total laparoscopic hysterectomy wherein a uterus and a portion of a cervix are inside an intra-abdominal cavity and a vagina circumferentially attached to the cervix creating a cervicovaginal junction, wherein the cervix has a cervical canal, the uterus has an intrauterine cavity, and the intra-abdominal cavity includes an access installed through the anterior abdominal wall, the device comprising:

a cervical cup with a cervical cup proximal end and a cervical cup distal end, the cervical cup distal end adapted to embrace the cervix with the cervical cup distal end abutting the cervicovaginal junction, and the cervical cup proximal end extending away from the cervix;

an electrocathery wire having an electrocautery wire proximal end and an electrocathery wire distal end, wherein the electrocautery wire distal end includes an uninsulated portion;

the cervical cup distal end having a channel housing the uninsulated portion, the channel configured for controlled release of the unillsulated portion of the electrocautery wire distal end;

an introducer having an introducer proximal end and an introducer distal end, the introducer proximal end releasably coupled to the electrocautery wire proximal end;

wherein the introducer is configured to penetrate the cervicovaginal junction upon activation of the introducer distal end, thereby introducing the electrocauter wire proximal end into the intra-abdominal cavity;

the device further comprising a shaft having a shaft proximal end, and a shaft distal end, wherein the shaft distal end is configured for introduction into the intra-abdominal cavity through the access installed in the anterior abdominal wall;

wherein the shaft is further configured to secure the electrocautery wire proximal end through the shaft distal end and move the electrocautery wire proximal end through the shaft toward the shaft proximal end, thereby pulling the electrocautery wire uninsulated portion from the channel and causing a controlled release of the uninsulated portion along a predetermined circumferential path around the cervix along the channel; and

wherein the vagina is severed from the cervix along the circumference of the cervicovaginal junction.

2. The device of claim **1** further comprising two sliders inside the channel, wherein each slider is configured to slide in opposing 180 degree semi-circular tracks until the two sliders meet; wherein each slider has a duct having an inlet and an outlet, and wherein the uninsulated portion of the electrocautery wire passes through the duct of each slider from the inlet to the outlet, emerging from each outlet toward an outside of the channel, thereby allowing the uninsulated portion to be released along the channel and the electrocautery wire to disengage the cervical cup through the outlet of each duct.

3. The device of claim **2** further comprising two flexible insulated sheaths, wherein each flexible insulated sheath has a sheath proximal end and a sheath distal end, wherein each sheath distal end is individually coupled to a slider such that each flexible insulated sheath can move a predetermined distance toward or away from each slider, wherein each flexible insulated sheath includes a duct having a duct proximal end and a duct distal end, wherein each duct distal end faces each slider and each duct proximal end is releasably coupled to the shaft distal end, wherein each of the ducts house a portion of the electrocautery wire, with the electrocautery wire extended from the duct distal end to the duct proximal end, and wherein the flexible insulated sheaths are configured such that pulling on the proximal end of the shaft with the shaft distal end coupled to each flexible insulated sheath causes each of the flexible insulated sheaths to move away from each slider for a predetermined distance exposing portion of the uninsulated electrocautery wire; and wherein the electrocautery wire is configured such that moving the proximal end through the long shaft causes the electrocautery wire to move through the duct in a manner that the uninsulated portion extends only between a slider and a flexible insulated sheath, thereby causing the uninsulated portion to slide through a predetermined circular path around the cervix.

4. The device of claim **1** further comprising an elongated curved stem having a stem proximal end, a stem distal end and a first curved axis, the stem distal end adapted to be introduced through the cervical canal into the intrauterine cavity thereby providing a means for manipulating the uterus, the proximal end having a handle; the device further comprising an elongated curved cylinder having a proximal end, a distal end, a duct along its length and a second curved axis matching the first curved axis, the elongated curved cylinder being shorter in length than the elongated curved stem, and wherein the distal end of the elongated cylinder is adapted to be coupled with the proximal end of the cervical cup thereby allowing them to move as one unit, wherein the elongated curved stem is configured for sliding through the duct of the elongated curved cylinder and adapted to be locked in place at a predetermined distance set by the operator.

5. The device of claim **1** further comprising a cable having a cable proximal end and a cable distal end, the cable distal end attached to the flexible insulated sheath proximal end and the cable proximal end configured for releasably coupling to the shaft distal end, thereby facilitating temporary coupling of the shaft with the insulated flexible sheath, and allowing them to move as a single unit; wherein the cable proximal end is configured to be releasably coupled to the introducer proximal end alongside the electrocautery wire proximal end, and wherein actuating the introducer distal end pushes the introducer forward, penetrating a small portion of the cervicovaginal junction, thereby introducing both the cable proximal end and the electrocautery wire proximal end to the inside of the intra-abdominal cavity.

6. The device of claim **2** wherein the semicircular tracks of the channel at the cervical cup distal end are tilted interiorly, thereby causing the sliders to be tilted interiorly along the track, and causing the angle of the exposed portion of the electrocautery wire extending between each slider and each flexible insulated sheath to be tilted interiorly closer to the cervix, thereby causing the cutting area severed by the uninsulated portion in the cervicovaginal junction to be closer to the cervix and away from other body organs.

7. The device of claim **1** wherein a portion of the shaft is flexible.

8. The device of claim **1** wherein a portion of the shaft is bifurcated.

9. The device of claim **1** wherein the shaft is insulated.

10. The device of claim **1** further comprising an optical/light system terminating at the cervical cup.

11. The device of claim **1** wherein the shaft includes sliding bars configured to move the electrocautery wire through the shaft.

12. The device of claim **1** wherein the uninsulated portion of the electrocautery wire distal end is divided into two arms, wherein each arm is coupled to an opposing side of a non-conductive element, thereby allowing the electrocautery wire to function using a bipolar electrocautery technique.

13. The device of claim **1** wherein the non-conductive element is anchored in place in the channel at the cervical cup distal end.

14. The device of claim **1** further comprising a component selected from the group consisting of a monopolar wired electrocautery energy generator, a bipolar wired electrocautery energy generator, a monopolar batteries operated electrocautery energy generator, a bipolar batteries operated electrocautery energy generator, a pedal activating electrocautery, a manual activating electrocautery, and a button activating electrocautery, a gas seal vaginal element, a gas seal vaginal balloon occluder, and at least one apparatus chosen from the list of handle, uterine sound's intrauterine balloon, and uterine sound's anchoring element to the uterus.

15. A device to facilitate a total laparoscopic hysterectomy wherein a uterus and a portion of a cervix are inside an intra-abdominal cavity and a vagina circumferentially attached to the cervix creating a cervicovaginal junction, wherein the cervix has a cervical canal, the uterus has an intrauterine cavity, and the intra-abdominal cavity includes an access installed through the anterior abdominal wall, the device comprising:

a cervical cup having a cervical cup distal end adapted to abut the cervicovaginal junction, and a cervical cup proximal end extending away from the cervix;

electrocautery wire having an insulated portion, and an uninsulated portion disposed in the cervical cup distal end;

the cervical cup distal end having a channel housing the uninsulated portion, the channel comprising a pair of sliders configured to move through the channel and release of the uninsulated portion of the electrocautery wire;

an introducer having an introducer proximal end and an introducer distal end, the introducer proximal end releasably coupled to the electrocautery wire insulated portion, the introducer slidable relative to the cervical cup such that the proximal end is configured to penetrate the cervicovaginal junction upon activation of the introducer distal end, thereby introducing the electrocautery wire insulated portion into the intra-abdominal cavity;

the device further comprising a shaft having a shaft proximal end, and a shaft distal end, wherein the shaft distal end is configured for introduction into the intra-abdominal cavity through the access installed in the anterior abdominal wall;

wherein the shaft is further configured to secure the electrocautery wire insulated portion through the shaft distal end and urge the electrocautery wire through the shaft toward the shaft proximal end, thereby pulling the electrocautery wire uninsulated portion through the sliders and around the channel, thereby causing a controlled release of the uninsulated portion along a predetermined circumferential path around the cervix.

16. A method of separating a patient's cervix from the patient's vagina at the cervicovaginal junction, the method comprising the steps of:

providing a colpotomy cup assembly having a colpotomy ring

providing an electrocautery wire on the colpotomy cup assembly;

passing the electrocautery wire through an insulated flexible sheath;

providing a tensioner cable on the insulated flexible sheath;

providing an introducer trocar on the colpotomy cup assembly in a sliding relationship to the colpotomy ring;

anchoring the electrocautery wire and the tensioner cable to the introducer trocar;

placing the colpotomy ring against the cervicovaginal junction;

urging the introducer trocar through the cervicovaginal junction, thereby carrying the electrocautery wire and tensioner cable through the cervicovaginal junction;

capturing the electrocautery wire and the tensioner cable with a laparoscopic shaft assembly;

placing the electrocautery wire and the tensioner cable under tension; and

pulling the electrocautery wire through the insulated flexible sheath while causing the electrocautery wire to travel around the colpotomy ring.

17. The method of claim **16** further comprising the step of providing a two sliders coupled to the two flexible insulated sheaths, the two sliders are configured to travel along with the flexible insulated sheaths around two semi-circular portions of the colpotomy ring and control the release of the electrocautery wire from the colpotomy ring.

18. The method of claim **16** further comprising the step of providing a first handle for moving the tensioner cable into the laparoscopic shaft assembly, such that the flexible insulated sheath abuts the laparoscopic shaft assembly.

19. The method of claim **16** further comprising the step of providing a second handle on the laparoscopic shaft assembly for drawing the electrocautery wire through the flexible insulated sheath.

20. The method of claim **16** further comprising the step of providing a release system comprising two colpotomy cup rollers, each colpotomy cup roller affixed to a roller rod, and urging the electrocautery wire through the colpotomy cup rollers, such that the colpotomy cup rollers travel around the colpotomy ring in opposite directions, providing a channel in the colpotomy ring, the channel configured to allow the colpotomy cup rollers to pass therethrough, and providing a roller rod channel and a spring in each flexible insulated sheath, each roller rod channel and each spring configured to arrest movement of each insulated sheath away from the colpotomy ring.

* * * * *

专利名称(译)	子宫机械手结肠电切术系统及电烙术进行全腹腔镜子宫切除术		
公开(公告)号	US20190350622A1	公开(公告)日	2019-11-21
申请号	US15/985650	申请日	2018-05-21
[标]申请(专利权)人(译)	ABOU El Kheir酒店TAREK AHMED NABIL		
申请(专利权)人(译)	ABOU El Kheir酒店，TAREK AHMED NABIL		
当前申请(专利权)人(译)	ABOU El Kheir酒店，TAREK AHMED NABIL		
[标]发明人	ABOU EL KHEIR TAREK AHMED NABIL		
发明人	ABOU EL KHEIR, TAREK AHMED NABIL		
IPC分类号	A61B17/42 A61B17/32 A61B18/14 A61B34/00		
CPC分类号	A61B34/70 A61B2018/0063 A61B2017/00743 A61B2018/00601 A61B18/14 A61B17/4241 A61B17/320016 A61B2018/00559 A61B18/082 A61B2018/00184 A61B2018/00285 A61B2018/144		
外部链接	Espacenet USPTO		

摘要(译)

用于促进全腹腔镜子宫切除术的装置包括适于抵靠子宫颈阴道交界处的宫颈杯。电灼线具有容纳在宫颈杯中的未绝缘部分，该未绝缘部分包括用于容纳并受控释放未绝缘部分的通道。导引器联接到电灼线并且被构造成穿透宫颈阴道接合部，从而将电灼线引入腹腔内。轴固定电灼线，并且拉动电灼线导致未绝缘部分沿着围绕子宫颈的预定圆周路径沿着通道沿着通道受控释放。因此，沿着子宫颈-阴道交界处的子宫颈将阴道切开。