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Lampman et al.

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[54] **LAPAROSCOPY SYSTEM**

[75] Inventors: **Russell A. Lampman,** Yardley; **William R. Knepshield,** Malvern, both of Pa.

[73] Assignee: **KLI, Inc.,** Ivyland, Pa.

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[52] **U.S. Cl.** **128/303.13,** 128/4

[51] **Int. Cl.** **A61b 17/36**

[58] **Field of Search**..... 128/303.13, 303.14, 303.15, 128/303.17, 303.18, 303.1, 4, 347, 6

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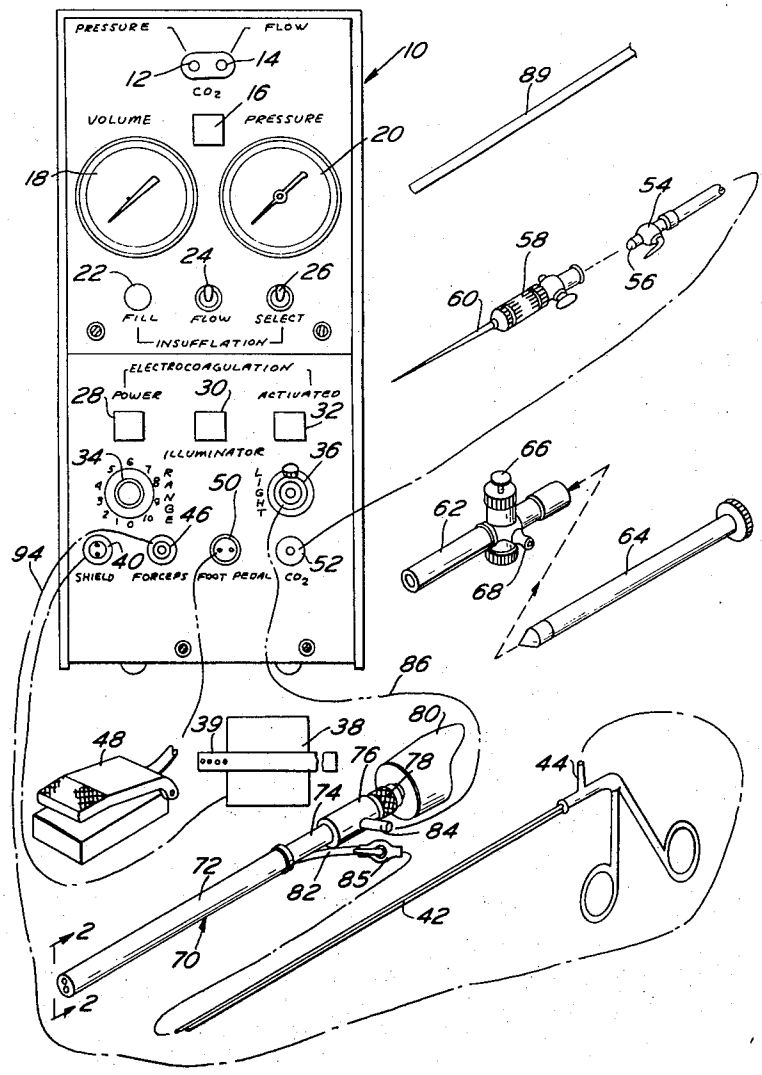
Primary Examiner—Lucie H. Laudenslager

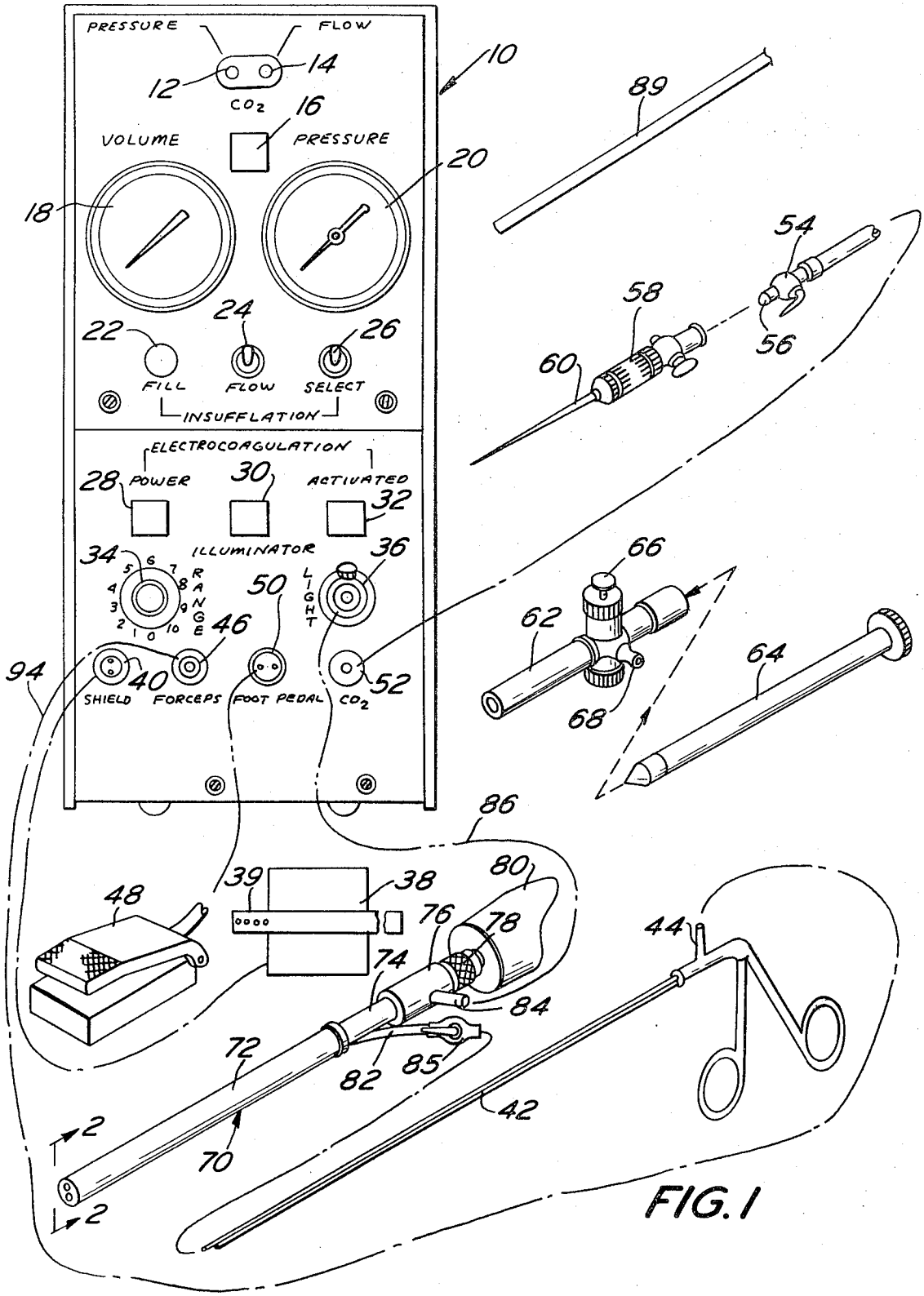
Attorney, Agent, or Firm—Arthur A. Jacobs

[57] **ABSTRACT**

A laparoscopy system for female sterilization whereby a single unit contains the power source to provide illumination, oscillatory electrical power and CO_2 for a laparoscopy. CO_2 gas, under pressure, is first passed into the body through a needle into the peritoneal cavity. The fallopian tubes are identified and then the laparoscope, which contains a telescope connected to a source of illumination, is inserted into the body cavity. A flexible forceps is, thereafter, inserted through the laparoscope into the body cavity. The forceps is manipulated to successively close the passage through each fallopian tube, either by means of sending electrical oscillations through the forceps to simultaneously cut, seal and cauterize each tube in turn, or by means of a specific clamp which clamps the passage shut.

4 Claims, 3 Drawing Figures




PRESSURE
FLOW
12
14
CO2
16
VOLUME
PRESSURE
18
20
22
24
26
FILL
FLOW
SELECT
INSUFFLATION
ELECTROCOAGULATION
28
POWER
30
ACTIVATED
32
ILLUMINATOR
34
RANGE
36
LIGHT
50
46
94
40
SHIELD
FORCEPS
FOOT PEDAL
CO2
52
10
89
54
58
60
56
66
62
64
68
86
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80
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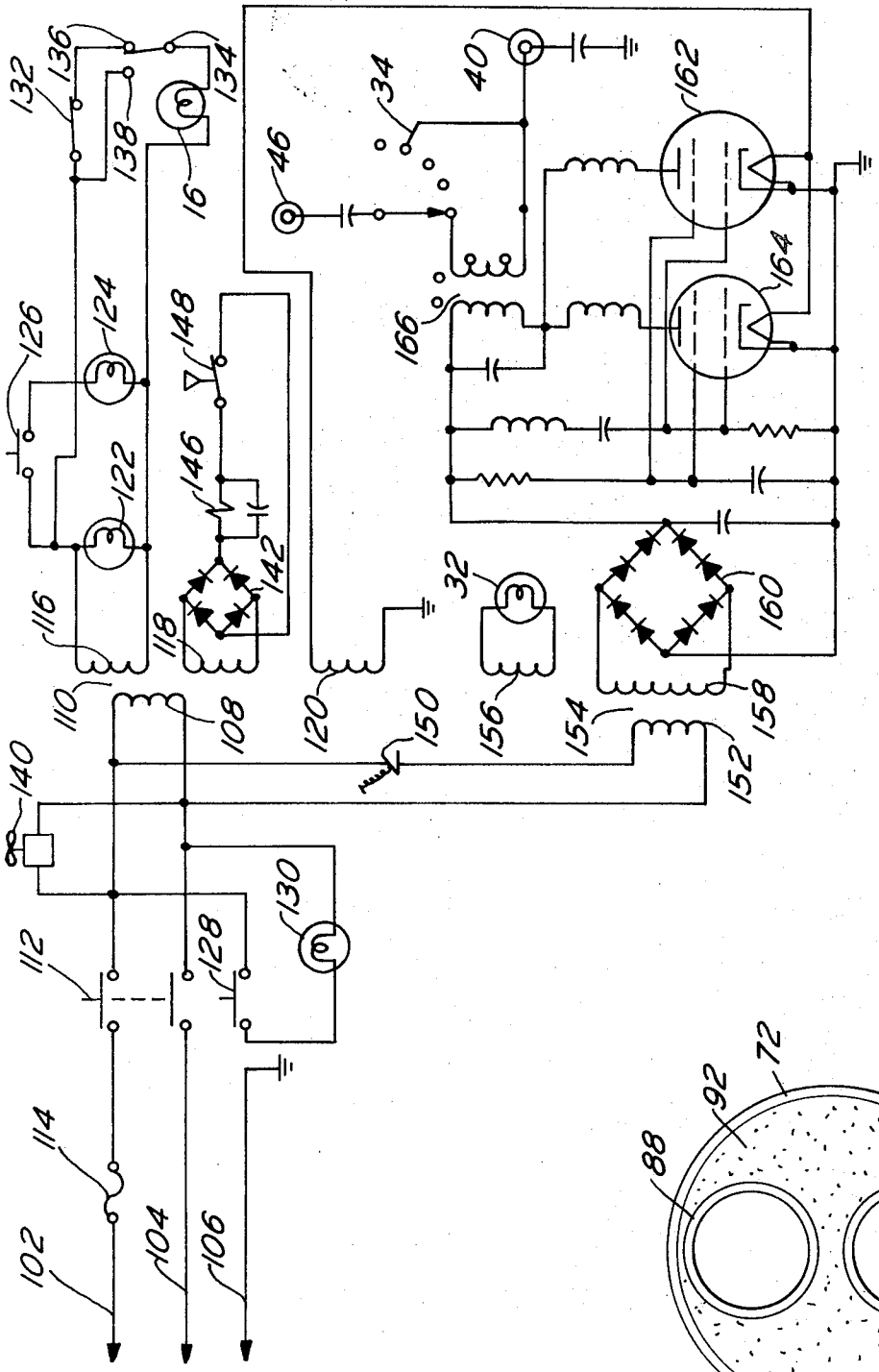
70
2
2

FIG. 1


132
136
134
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34
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162
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142
116
118
32
160
110
108
120
150
156
154
158
152
140
130
112
128
114
102
104
106

FIG. 3

72
92
88
90

FIG. 2

LAPAROSCOPY SYSTEM

This invention relates to a laparoscopy system for female sterilization, and it particularly relates to a system of this type which is embodied in a single unitary assembly.

A laparoscopy system is used for female sterilization by minor surgical means wherein the fallopian tubes are separated, cut and sealed.

Heretofore, in laparoscopy, it was necessary for the operator to use a variety of different surgical instruments as well as separate heat sealing means or clamps in order to complete the process. The assembling of the various instruments and their separate use was not only time-consuming, but their proper use depended largely on the skill and experience of the operator. It was also often necessary to use a variety of make-shift instruments and apparatus which were never designed for this specific task so that much time and effort were wasted and much skill was needed to obtain the exact correlation of steps and the exact results desired.

It is one object of the present invention to overcome the aforesaid disadvantages by providing a unitary laparoscopy assembly wherein all the elements are correlated and coactive with each other for the specific purpose required and wherein the proper metering and indicating devices co-act with each other to obtain a rapid, highly coordinated and effective result with a minimum of skill and experience.

Another object of the present invention is to provide an assembly of the aforesaid type that is relatively simple and inexpensive in construction and which requires a minimum of maintenance.

Another object of the present invention is to provide an assembly of the aforesaid type which is compact and relatively portable.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following description when read in conjunction with the accompanying drawings wherein:

FIG. **1** is a view, partly in elevation and partly in perspective of the various components constituting a laparoscopy device embodying the present invention.

FIG. **2** is an enlarged end view taken on line **2—2** of FIG. **1,** in the present invention.

FIG. **3** is a schematic view of the electronic circuit utilized in the present invention.

Referring now in greater detail to the various figures of the drawings wherein similar reference characters refer to similar parts, there is shown a housing **10** having a pair of fluidic indicators, **12** and **14,** each of which consists of a small spring-pressed piston. These indicators are of the type manufactured by the Micro Switch Company, Freeport, Ill., a division of Honeywell. These indicators are operatively connected between an internal tank and the patient output. The indicator **12** shows red when the pressure is below a predetermined level and the indicator **14** shows red when there is no flow of CO_2 gas.

Below the indicators **12** and **14** is a lamp **16** which indicates the CO_2 input, being adapted to glow when the pressure in the supply (external tank) is below a predetermined level.

Below the lamp **16** are two dials, the dial **18** indicating the CO_2 volume in the internal tank, and the dial **20**

indicating the CO_2 pressure in the body cavity of the patient being treated.

Below the dials **18** and **20** are three mechanical switch means indicated at **22, 24** and **26** respectively. The switch **22** is a push-button device which mechanically activates a fill valve for the CO_2 flowing from the primary (external) supply to the internal tank when it is pushed in; the toggle switch **24** mechanically activates or deactivates an "on-off" valve to allow flow of CO_2 from the internal tank to the patient; the toggle switch **26** is a "high-low" pressure selector which selects flow from either a high or low pressure second stage regulator of standard construction.

The electrocoagulation activator system comprises a push-button, "on-off" electrical switch **28** to activate or deactivate the electronic network, a push-button, "on-off" electrical switch **30** for the illuminator system, and a glow lamp **32** to indicate activation of the electrocoagulation means, this lamp being adapted to glow when the foot-pedal, hereinafter described, is depressed. The push-buttons **28** and **30** also contain glow lamps which will be hereinafter described.

Below the aforementioned switches is a selector switch **34** which is used to regulate the high frequency oscillator to set the range of electrocoagulation, and a fitting or adaptor **36** which is provided for the purpose of providing illumination to the telescope through a fiberoptic cable hereinafter described. Behind the fitting **36** is contained a projection bulb, hereinafter described, which is electrically connected to the push-button **30** which turns it on and off.

A groundplate **38** is adapted to be strapped to the patient by a rubber band or the like, indicated at **39,** and this groundplate is connected at **40** to the electronic network. A cable-type forceps **42** is provided with a jack **44** that is connected by a cable to a connector **46** connected into the oscillator circuit of the electronic network. A footpedal **48** is connected by a cable to the plug **50** connected to the oscillator circuit. A CO_2 outlet **52** is connected to a valve **54** which has an outlet **56** that is selectively connected to either the housing **58** of a Verees needle **60** or a trocar sleeve **62.** The sleeve **62** is adapted to hold a trocar **64** which is insertable through the sleeve and held in place by a spring-pressed plunger **66.** The sleeve **62** is also provided with an inlet tube **68** which is adapted to receive the outlet **56** of the valve housing **54.**

The laparoscope is indicated generally at **70,** and comprises a tubular housing **72** having a neck portion **74** and a connector portion **76** which is connected through an optionally provided knurled focusing knob **78** to an eyepiece **80.** A tubular inlet **82** extends outwardly from the interior of neck portion **74** and is adapted to receive the forceps **42.** The inlet **84** is provided with a shut-off valve **85** similar to the valve **54.** A tubular extension **84** projects outwardly from the interior of connector portion **76.** This extension **84** comprises a bundle of fiberoptic strands and is adapted to be connected to a light-transmitting cable **86** which is also a bundle of fiberoptic strands encased in a flexible sheathing. This cable **86** is connected to the adaptor **36.**

The housing **72,** as best seen in FIG. **2,** contains an elongated tube **88,** adapted to receive a telescope **89** (shown in FIG. **1**), and an elongated tube **90** integral and continuous with the inlet **82** and adapted to receive the forceps **42** which is inserted through inlet **82.** The

interior of the housing **72** is filled with fiberoptic material **92** around the two tubes **88** and **90.** The cable **86** is adapted to transmit light from the projection bulb behind the adaptor **36** through the extension **84** into the housing **72** to provide light for the telescope.

In operation, the valve **54** is attached to the housing **58** of the Verees needle **60** and the valve **54** is connected by a flexible tube to the CO_2 supply outlet **52.** The supply outlet **52** is connected to an internal tank in the housing **10** by a low pressure hose. The internal tank is filled with CO_2 from an external supply tank (not shown) by means of the push-button switch **22** which mechanically operates a valve in the connection between the external and internal tank after going through a primary stage regulator of standard construction.

The needle **60** is then injected into the peritoneal cavity of the patient and the select switch **26** is set to "high", which is about 30 mm. of mercury as set by the factory. The switch **24** is then activated to cause a flow of CO_2 into the patient's peritoneal cavity at the area selected by the operator. The needle **60** is adapted to pass through the tissue into the desired cavity where the fallopian tubes should be situated. If the pressure reading is then maintained, at 9–12 mm. Hg pressure, as shown by dial **20,** the gas flow is within the correct cavity. If it is not the correct cavity, the gas pressure rapidly increases and flow is slowed. In this case, the needle is then reinjected and the gas flow repeated until the correct cavity is found. The selector valve, operated by the select switch **26,** is then set to "low" (about 10 mm. of mercury) after approximately 2 liters of CO_2 is passed into the peritoneal cavity.

When the pressure reading indicates that the gas is flowing into the correct cavity, the gas flow is halted and the needle is withdrawn. A slight incision is then made with a scalpel just below the umbilicus, and through this incision is inserted the trocar **64** which is telescopically positioned within the sleeve **62.** The valve device **54,** which has been disassembled from the needle housing **58,** is then coupled to the inlet **68** and the CO_2 pressure is maintained at a constant 10 mm. of mercury. The trocar is manipulated to push between the tissue and into the peritoneal cavity.

The trocar is then pulled out and the laparoscope **70** is inserted in its place. With the laparoscope in position, the fiberoptic cable **86** is connected between the extension **84** and the adaptor **36** behind which is contained the light source. The ground plate **38** is also attached to the patient at this time.

With the laparoscope in position, the valve **85,** which is normally closed to prevent escape of the gas, is opened and the forceps **42** is inserted through the inlet **82** and the tube **90** into the body cavity. The forceps itself then substantially prevents escape of the gas. The pushbutton **30** is pushed in to turn on the lamp behind adaptor **36.** At this time the CO_2 is maintained at a constant 10 mm. mercury pressure which equalizes the pressure of the gas in the cavity, so that there is effectively no flow. The operator then peers through the eyepiece **80** and, while doing so, uses the forceps to grip a fallopian tube. With the forceps in the proper position around the fallopian tube, the operator steps on the footpedal **48** which activates the oscillator circuit, the power output of the oscillator having been set by adjustment of the selector switch **34** to a predetermined value. The oscillator sends its pulses through the cable **94,** leading from connector **46,** through the forceps **42.** This results in a simultaneous cutting, sealing and cauterizing of the fallopian tube by electrocoagulation. The same procedure is then repeated with the other fallopian tube.

Although an electrocoagulation process has been described above, it is also possible to substitute a clip means which can be inserted by a special forceps and manipulated thereby to clamp the fallopian tube, closing the passage therethrough.

The electronic control and actuating network is shown in FIG. **3.** The AC input is comprised of power input lines **102** and **104** and a ground line **106.** The ground line **106** is tied to the housing to prevent shock hazard. The lines **102** and **104** are placed into and out of the circuit with the primary winding **108** of a transformer **110** by means of a double pole double throw maintained contact illuminated pushbutton switch **112** operated by button **28.** A fuse **114** is provided in the power line **102** to prevent undesirable power surges.

The primary **108** coacts with three secondary windings designated **116, 118** and **120** respectively. The secondary **116** is in circuit with a lamp **122** inside button **28** and a lamp **124** inside button **30.** A double throw double pole maintained contact illuminated pushbutton switch is operated by button **30,** one of the switch blade contacts being shown at **126** and the other at **128.** When the button **30** is pushed in, it simultaneously closes both contacts **126** and **128** to cause both the lamp **124** and a projection lamp **130** to glow. The projection lamp **130** is positioned within the unit and provides the illumination for the telescope in the laparoscope at its output connector **36.**

The light circuit also includes a pressure-operated switch **132,** single pole double throw momentary contact press to test switch **134** and lamp **16.** The switch **134** is normally held in engagement with a contact **136** but may be passed into engagement with contact **138** for a purpose to be hereinafter described.

When the button **28** is pushed in to close switch **112,** it activates a blower **140** to keep the equipment cool and activates the transformer **110.** This also causes the lamp **122** to glow. When the button **30** is pushed in, it closes switch contacts **126** and **128** causing lamps **124** and **130** to glow. Normally, the switch **132** is open and the lamp **16** does not glow. However, when the primary (external) pressure falls below a predetermined minimum value, the switch **132** closes and the lamp **16** glows indicating low primary gas pressure. If it is desired to test the circuit to determine if the lamp **16** is operative, the switch **134** is moved from contact **136** by pressing pushbutton **32** to contact **138,** thereby bypassing the switch **132** and causing lamp **16** to glow.

The secondary winding **118** is in circuit with a rectifier bridge **142** for changing AC to DC current. The bridge **142** is in circuit with a relay solenoid **146** which is operated by a foot-pedal switch **148.** When the foot-pedal switch **148** is closed, it causes the relay solenoid **146** to energize which, thereupon, acts to close the solenoid switch **150.** This energizes the primary winding **152** of a transformer **154** thereby actuating the electrocoagulatory oscillator.

The transformer **154** has two secondary windings **156** and **158.** Energization of secondary **156** causes lamp **32** to glow, indicating activation of the electrocoagulator oscillator. Energization of secondary **158** sends current

through the high voltage rectifier bridge **160** to actuate the high frequency oscillator partially comprised of pentodes **162** and **164,** whose filaments are in circuit with secondary **120** of transformer **110.** The resultant high frequency oscillations pass through transformer **166** and through the pre-set range selector switch **34** to the forceps connector **46** and in turn to the forceps **42.** The circuit from transformer **166** is completed through the shield connector **40.** The shield **38** is attached to the patient and by means of the shield cable is connected to shield connector **40.**

When the operator releases the foot-pedal **48,** it opens the switch **148** and this inactivates the oscillator circuit. Generally only a momentary or very short activation time is required.

The invention claimed is:

1. In a laparoscopy system comprising a housing, a gas tank in said housing, conduit means connecting said tank to a source of gas under pressure, penetrating means constructed and arranged to penetrate into a body cavity through the abdominal wall, said penetrating means being in selective gaseous fluid connection with said tank and being constructed and arranged to project said gas into said body cavity, and a piercing means constructed and arranged to pierce the abdominal wall and pass between muscle layers under the skin to form a passage into a body cavity, said piercing means being in selective gaseous fluid connection with said tank, the improvement comprising a laparoscope selectively insertable through said passage into said body cavity, said laparoscope comprising an elongated casing containing a telescope and a forceps guide tube, said telescope and forceps guide tube extending longitudinally of said elongated casing in substantial parallelism with each other, said telescope being in selective operative connection with a source of illumination in said housing, an elongated flexible forceps adapted to grasp a fallopian tube, said forceps being selectively positioned in said forceps guide tube and extending therefrom in a position to grasp said fallopian tube while said telescope is illuminated by connection with said source of illumination, whereby said forceps may be manipulated while said telescope provides an illuminated view to the operator through the same passage into said body cavity, means connected to said forceps for closing the passage of said fallopian tube, said laparoscope having means to substantially prevent escape of gas from said body cavity when said forceps is not positioned in said forceps guide tube, and said forceps being constructed and arranged to substantially prevent escape of said gas from said body cavity when it is positioned in said forceps guide tube.

2. The system of claim **1** wherein said means for closing the passage of the fallopian tube is an oscillatory electrical current, said current being supplied by an electrical oscillation circuit in said housing, a source of electrical energy operatively and selectively connected to said oscillation circuit, said forceps being constructed and arranged to receive and transmit said oscillatory current from said oscillation circuit to said fallopian tube, said forceps being in selective operative connection with said oscillation circuit, and means to selectively actuate said oscillation circuit.

3. The system of claim **2** wherein adjusting means are provided in said oscillation circuit to vary the power output thereof.

4. The system of claim **1** wherein said means for closing the passage of the fallopian tube is a clip means.

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