

[54] MICROCAUTERY DEVICE

[76] Inventor: Khosrow Jamshidi, 610 Winston Court, Minneapolis, Minn. 55118

[22] Filed: Nov. 19, 1973

[21] Appl. No.: 416,760

[52] U.S. Cl.: 128/303.1; 219/233

[51] Int. Cl.: A61b 17/36; A61h 3/06

[58] Field of Search: 128/2 B, 303.17, 303.14, 128/347, 310, 303.13, 303.1, 303.12; 219/233

[56] References Cited  
UNITED STATES PATENTS

|           |         |                |            |
|-----------|---------|----------------|------------|
| 2,430,666 | 11/1947 | Burger         | 219/233    |
| 3,141,087 | 7/1964  | Schoenwald     | 219/233    |
| 3,234,356 | 2/1966  | Babb           | 128/303.14 |
| 3,301,258 | 1/1967  | Werner et al.  | 128/303.1  |
| 3,526,750 | 9/1970  | Siegal         | 128/303.14 |
| 3,558,854 | 1/1971  | Siegal         | 128/303.14 |
| 3,598,108 | 8/1971  | Jamshidi       | 128/2 B    |
| 3,630,192 | 12/1971 | Jamshidi       | 128/2 B    |
| 3,685,518 | 8/1972  | Beverle et al. | 128/303.17 |
| 3,698,394 | 10/1972 | Piper et al.   | 219/233 X  |

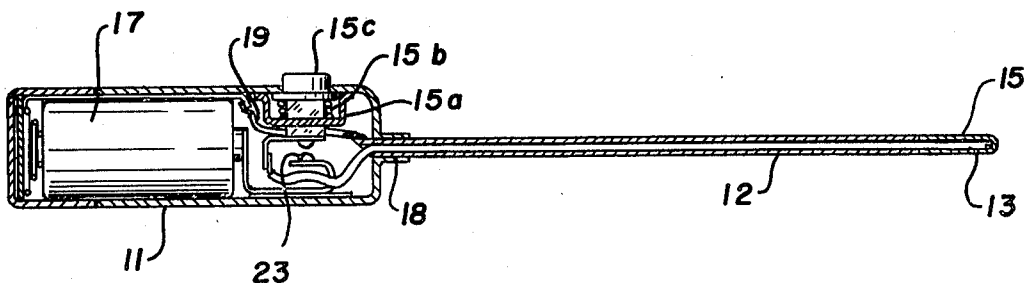
Primary Examiner—Richard A. Gaudet  
Assistant Examiner—Lee S. Cohen

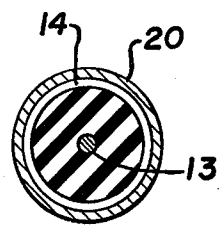
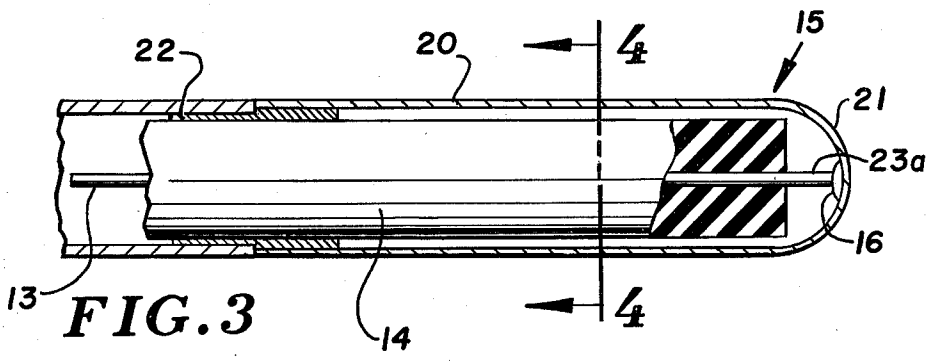
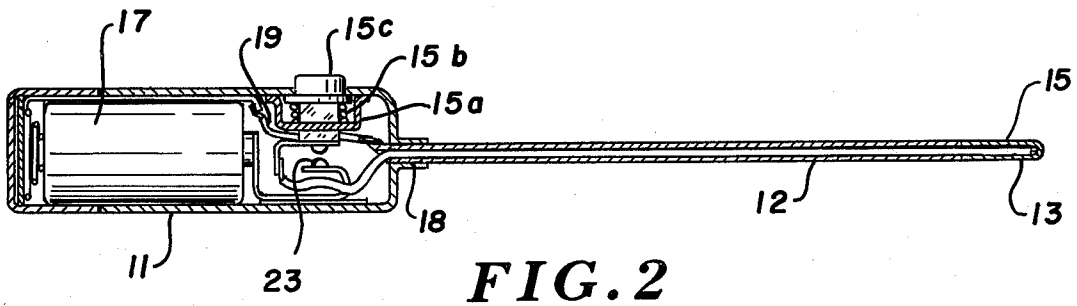
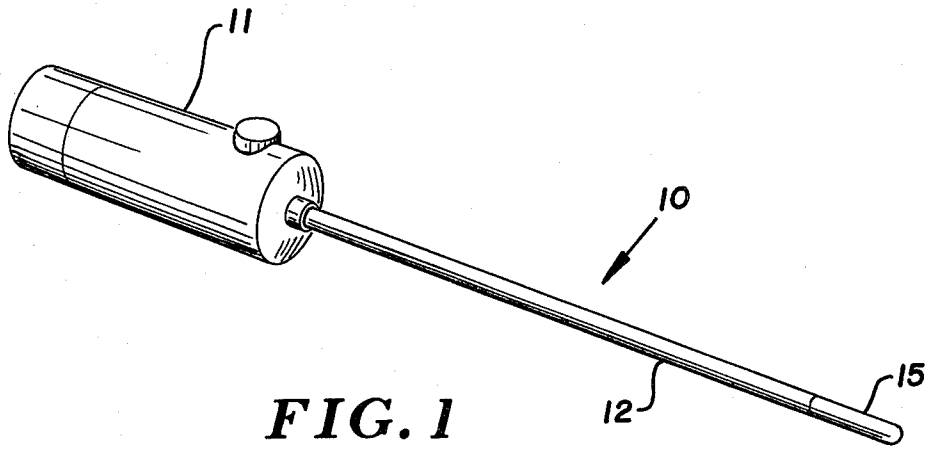
[57]

ABSTRACT

A microcautery device particularly adapted for use in connection with the cauterization of elongated unnatural openings of small diameter formed in a body, for example, for biopsy purposes, the device including a gripping handle having an elongated tubular metallic shaft of small diameter extending from one end of the handle. The metallic shaft consists of a shank portion having a generally cylindrical tip portion with an electrically resistive closed tip end coupled thereto at the end thereof, with the body of the tip portion extending in continuation with the shank portion. An electrically insulated highly conductive electrical conductor is disposed within the confines of the tubular shaft and extends from the handle to the tip of the shaft, and is electrically coupled to the tip portion along the inner surface of the closed tip end. A source of electrical energy is coupled across the electrical conductor and the proximate end of the tubular metallic shaft, so as to complete an electrical circuit. The cauterizing device is arranged to be inserted in the opening formed in the body being treated, energized to cauterizing temperatures, and removed slowly while heated so as to perform the cauterizing operation.

4 Claims, 4 Drawing Figures





## MICROCAUTERY DEVICE

## BACKGROUND OF THE INVENTION

The present invention relates generally to a cauterizing device, and more specifically to a cauterizing device particularly adapted to be used following the performing of a biopsy operation wherein an internally disposed sample is obtained. The cauterizing device of the present invention is arranged for use following a biopsy procedure performed with that certain structure disclosed and claimed in U.S. Pat. No. 3,628,524, dated Dec. 21, 1971 and entitled "Biopsy Needle," with the structure being adapted to be inserted in the opening formed by the biopsy needle stylet. The structure is provided with an elongated, at least moderately electrically conductive tubular metallic shaft, with a resistive closed tip end which is arranged to be electrically energized and heated to a cauterizing temperature. Heating is accomplished by material selection and by geometry, such as by utilization of resistive material with a significantly smaller cross-sectional thickness for this material than is utilized for the remaining portion of the tubular metallic shaft. The entire structure is arranged for insertion into a biopsy tract, energized while disposed within the tract, and removed with continued heating so as to cauterize the wound with the tip portion only as the device is being extracted.

Examples of biopsy needles which are in use by medical practitioners are those biopsy needle structures which are found in U.S. Pat. No. 3,598,108, for example.

Each of these biopsy needle structures contains a relatively elongated needle stylet which is used to form the tract or opening into the area to be examined, and the sample gathering device is thereafter inserted into the tract for its intended purpose. Normally, it is desirable to cauterize the wound, and the apparatus of the present invention is particularly adapted to perform this cauterizing operation in a progressive fashion, from the inner area of the wound outwardly to the surface as the cautery device is being withdrawn. In one operative embodiment, such as is illustrated in U.S. Pat. No. 3,598,108 entitled "Biopsy Technique and Biopsy Device," the cautery device of the present invention may be inserted into the outer sleeve structure disclosed in U.S. Pat. No. 3,598,108, and with the heated tip portion projecting beyond the end of the sleeve, the composite assembly is withdrawn from the body of the patient so as to cauterize the tract upon withdrawal.

## SUMMARY OF THE INVENTION

Briefly, the improved cauterizing device of the present invention includes a gripping handle having an electrically conductive elongated tubular metallic shaft of small diameter extending outwardly from one end of the handle. The tubular shaft consists of a shank portion having a generally cylindrical tip portion with a closed tip secured to the shaft at the end thereof, with the tip portion being therefor disposed at the distal end of the shaft. A single electrically insulated, highly conductive electrical conductor is disposed within the confines of the shaft and extends from the handle to the closed tip where it is electrically coupled to the inner surface of the closed tip end. The tubular shaft portion may have a certain first cross-sectional thickness which is significantly greater than the cross-sectional thickness of the tip portion so as to avoid heating of the

shaft. This arrangement provides for dissipation of more energy in the highly resistive tip portion disposed at the end of the shaft. A source of electrical energy is coupled across the electrical conductor and the proximate end of the tubular metallic shaft, thus forming a completed circuit through the resistive tip. The handle is arranged with switch means in order to appropriately energize the tip following insertion in the wound, and if desired, electrical power may be provided from a source within the handle, either battery power or normal 115 volt AC power equipped with transformer means arranged to reduce the voltage to the desired level.

Therefore, it is a primary object of the present invention to provide an improved cauterizing device which is particularly adapted for the cauterizing of elongated unnatural openings of small diameter formed in a body from a needle stylet of a biopsy device.

It is yet a further object of the present invention to provide an improved cauterizing device for the cauterization of elongated unnatural openings or wounds of small diameter formed in a body, the cauterizing device including a gripping handle having a tubular metallic shaft of small diameter secured to one end thereof, and with means for providing an electrically resistive portion at the tip end of the shaft for the progressive cauterization of a wound from the interior to the outer surface opening.

Other and further objects of the present invention will become apparent to those skilled in the art upon a study of the following specification, appended claims, and accompanying drawing.

## BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a perspective view of a microcautery device prepared in accordance with the present invention;

FIG. 2 is a vertical sectional view taken through the diameter of the microcautery device shown in FIG. 1, and illustrating the mechanism employed in the device;

FIG. 3 is a detailed sectional view, partially broken away and on an enlarged scale, and illustrating the tip end portion of the improved microcautery device; and

FIG. 4 is a vertical sectional view taken along the line and in the direction of the arrows 4-4 of FIG. 3.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

The improved cauterizing device of the present invention generally designated 10 includes a gripping handle member 11 and an elongated tubular metallic shaft 12 extending from the end of the gripping handle 11. Tubular shaft 12, which is hollow, is of small diameter, normally not exceeding approximately 1.2 mm O.D. The wall thickness is preferably about 4 mils to provide a desirable and useful device, however 9 mil wall tubing may be useful. The tubular shaft 12 is electrically conductive, preferably consisting of stainless steel such as 18-8 Stainless, or other suitable material for surgical use. The outer surface of the shaft 12 is preferably polished in order to render the structure readily sterilizable.

As is apparent in FIG. 2, shaft 12, being hollow, contains electrically insulated conductor 13 therewithin, (see FIG. 3) with an insulation layer 14 being disposed about the circumference thereof. The tip end of shaft 12 is closed, such as is indicated in FIGS. 2 and 3, by tip member 15. Conductor 13 is electrically coupled to the

inner surface of the closed tip end portion of tip 15 adjacent the outer end 23a, as at 16, with the proximate end 18 of shaft 12 being coupled by electrical conductor 19 to a source of electrical energy, such as illustrated at 17, the completion of the electrical circuit is apparent.

With attention being directed to FIG. 3 of the drawing, it will be observed that the tip portion 15 includes a shank portion 20 having a generally cylindrical form with the tip portion thereof being closed, as is apparent at 21. The shank portion of the tubular metallic shaft 12 has a certain first cross-sectional thickness of wall, such as in the range of about 4 mils to 9 mils, while the tip portion has a second cross-sectional thickness which is equal to or significantly less than the first cross-sectional wall thickness. For example, the tip portion may have a wall thickness of approximately 4 mils, which is approximately one-half of that of the remaining portion of the metallic shaft 12 when 9 mil tubing is being used. This reduction in wall thickness will render it possible for the resistive characteristics to enable the tip portion to be heated to a cauterizing temperature, such as normally between about 500° C. and 1,000° C. while the cauterizing procedure is being performed.

It will be appreciated that a reduction in wall thickness is achieved by utilizing a common or continuous outer diameter, with the inner diameter being increased or decreased at the tip end in order to provide the appropriate control in wall thickness.

In order to provide a source of electrical power, battery element 17 is disposed within the interior of handle 11, with switch means having an attachment casing 15a, spring biased plunger member 15b, and button 15c being employed to control a flow of electrical power from battery source 17 to the tip 15. The battery source is preferably provided with adequate power capabilities so as to provide an I<sup>2</sup>R loss sufficient to raise the temperature of tip 15 to a cauterizing level of between about 500° C. and 1,000° C. while internally disposed. Normal commercially available low internal impedance battery or other power sources will ordinarily be sufficient to generate sufficient power to permit certain surgically accepted stainless steel alloys to be employed, with stainless steel of sufficiently small diameter being useful, along with certain other alloys of commonly used cauterizing elements. Stainless steels such as seamless tubing of Type 18-8 or equivalents may be employed for the materials of construction. When selecting the materials of construction for the tip heater portion, a substance having significantly greater electrical resistance than utilized in the tubular shaft portion is needed. In this connection, therefore, a material such as Type 18-8 stainless steel may be employed. This material having a thickness of, for example, 4 mils may be utilized when a tubular shaft of a wall thickness of 9 mils is employed. The material is also suitable for use when the tubular shaft is formed with Nichrome tubing.

In certain instances, Nichrome V may be employed, with this material being, of course, readily commercially available on a variety of mechanical configurations.

In order to provide electrical continuity in the structure, an electrically conductive sleeve member such as the sleeve 22 may be employed between the tip portion 15 and the tubular shaft portion 12, as indicated in FIG. 3.

If desired, battery source 17 may be eliminated and a transformer power supply employed to permit the unit to be coupled directly to the 115 A.C. power, and if such is the case, contacts 23 will continue to be employed to controllably interrupt the flow of electrical power to the tip 15. However, in this case, if normal 115 volt A.C. power is employed, it may be desirable to utilize a pair of mating contacts, with one such contact being utilized with each of the two conductors. Such switch devices are, of course, normally commercially available.

As is indicated in FIG. 2 of the drawing, the individual leads extending from the source of power make contact with tip 15 through tubular metallic shaft 12 by means of the junction at 18, with the other line or main being coupled directly to tip 15 through conductor 13.

It will be appreciated that in use, a biopsy technique will normally employ the preparation of an elongated unnatural opening or tract of small diameter in the body, this opening being formed by a small diameter biopsy needle stylet. The tubular metallic shaft 12 is of comparable diameter, and is arranged to be inserted into the wound following the completion of the biopsy procedure. Following insertion, and while at the base of the wound or tract, power is supplied to the tip 15 and the heat generated through the I<sup>2</sup>R losses will be adequate to cauterize the wound. The attendant then withdraws the needle from the wound slowly, as to permit continuous cauterization at the tip during the withdrawal of the device.

I claim:

1. Means for cauterizing elongated and unnatural openings of small diameter formed in a body with a small diameter biopsy needle stylet and comprising:

- a. gripping handle means having an elongated hollow tubular metallic shaft of small diameter stainless steel extending from one end thereof;
- b. said tubular metallic shaft consisting of a tubular shaft portion having a generally cylindrical tip portion with a closed hemispherical tip at the end thereof, said closed tip portion being disposed at the distal end of said tubular shaft portion opposite said handle means, said tubular shaft portion having a certain first electrical conductivity, and said tip portion having an electrical conductivity which is significantly less than that of said tubular shaft portion;
- c. an electrical conductor disposed within the confines of said tubular metallic shaft and being arranged generally coaxially therewithin, means for coupling said electrical conductor and said tubular shaft portion to opposite poles of a source of electrical energy, said electrical conductor extending from said handle means to the inner surface of said closed tip end of said tubular metallic shaft and having a layer of electrical insulation disposed generally coaxially therearound, and being secured electrically to the inner wall of said closed tip portion adjacent the distal end thereof.

2. The cauterizing means as defined in claim 1 being particularly characterized in that said tubular shaft portion and closed tip portion have constant and common outer radii.

3. The cauterizing means as defined in claim 1 being particularly characterized in that the cross-sectional wall thickness of said tubular shaft portion is substantially equal to that of said closed tip portion.

4. The cauterizing means as defined in claim 1 being particularly characterized in that said tubular shaft portion and closed tip have a polished exterior surface along the entire extent thereof.

\* \* \* \* \*