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[54] **APPARATUS FOR THE DIATHERMIC REMOVAL OF GROWTHS**

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[51] **Int. Cl.** **A61b 17/38**

[58] **Field of Search** ..... 128/303.14, 303.15, 303.16, 128/304, 305, 130, 310, 3 B; 30/116

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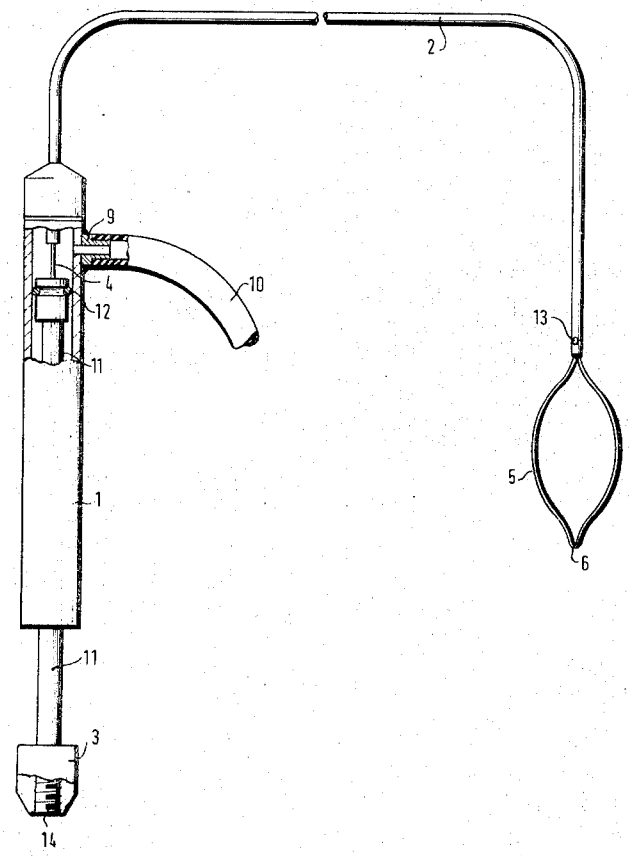
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[57] **ABSTRACT**

The present apparatus is a so called polypectome for the diathermic removal of growths, such as polyps, especially from the intestinal tract, by means of a high frequency heated wire loop which is extended out of and pulled back into a flexible tubular member. A guide bushing for the wire loop is located at the outer end of the tubular member. The guide bushing comprises guide means therein which guides the loop so that it forms an oval in its extended position and substantially an eight in its retracted position. The wire loop has a bent tip having a diameter which is smaller than the inner diameter of the guide bushing to facilitate the controlled shaping of the loop.

9 Claims, 4 Drawing Figures



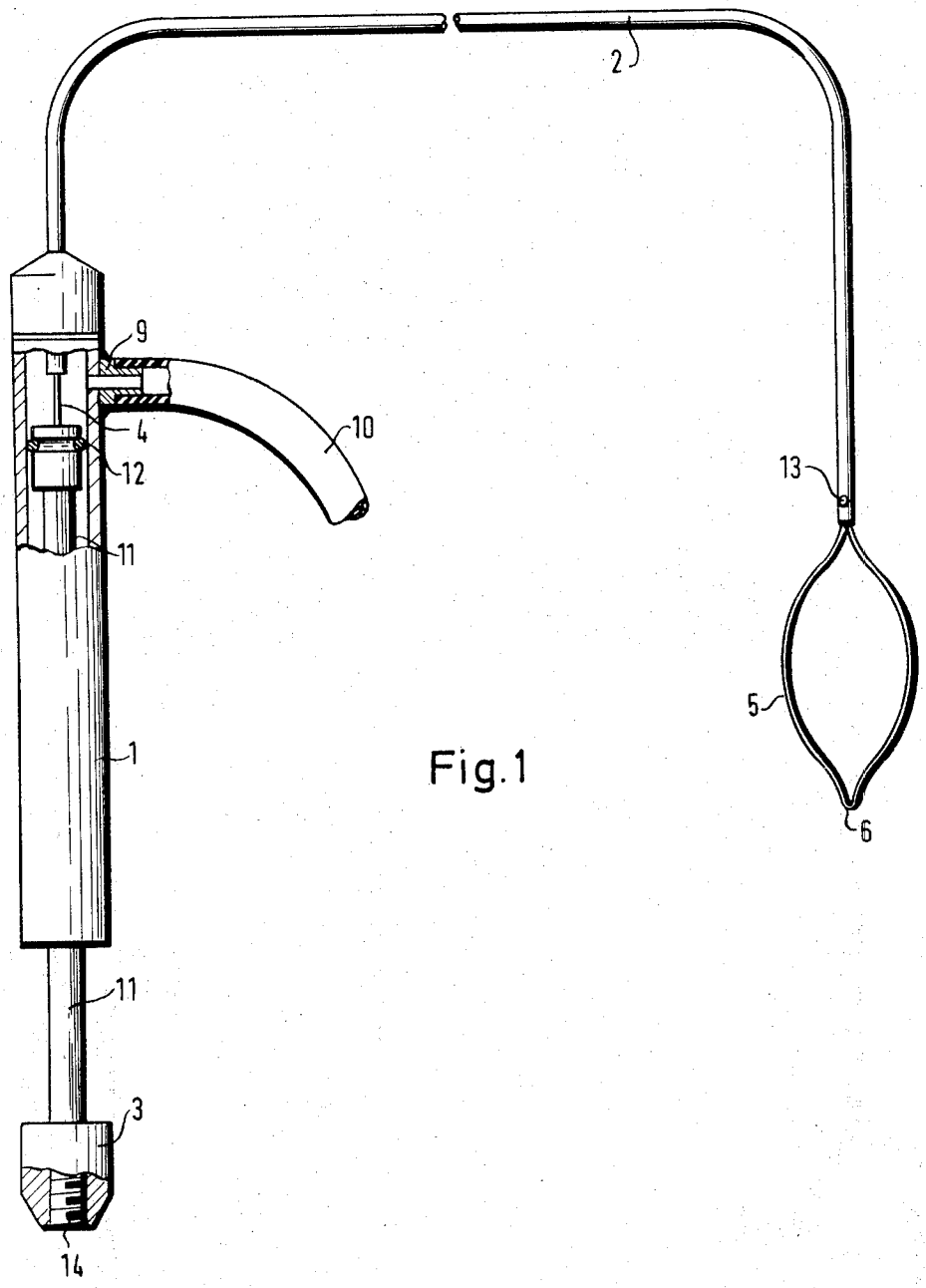


Fig.1

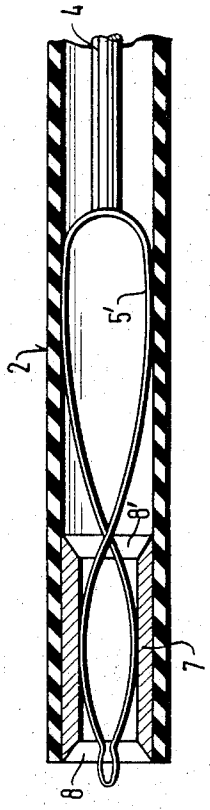


Fig.4

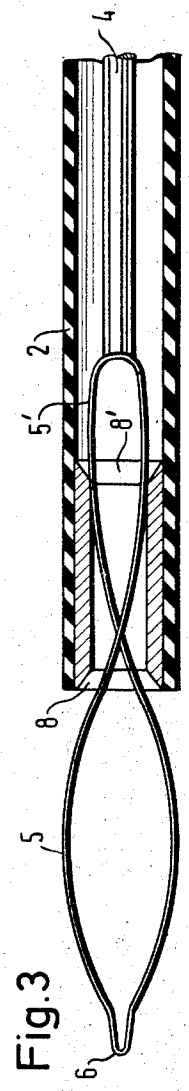


Fig.3

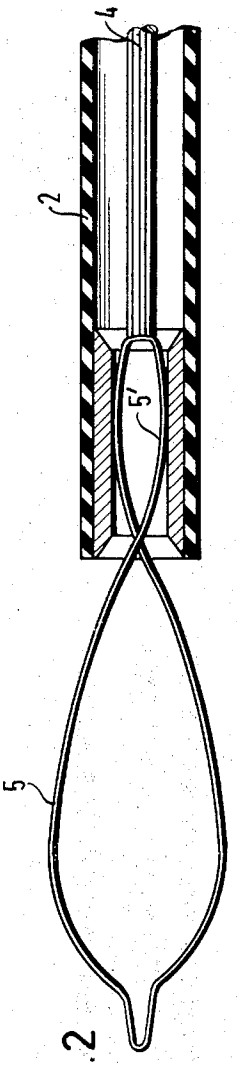


Fig.2

APPARATUS FOR THE DIATHERMIC REMOVAL OF GROWTHS

BACKGROUND OF THE INVENTION

The present apparatus is a so called diathermy wire loop or snare for the diathermic removal of growths, more specifically, of rank growths or so called proud flesh, tumors, polyps, and the like. The present apparatus is especially suitable for use in the entire intestinal tract.

For viewing and examining the intestinal tract, so called esophagus-scopes, gastro-scopes, duodeno-sopes and colonoscopes as well as endoscopes are used. These scopes comprise substantially a long tubular light conductor which includes a conduit or channel for the insertion of an instrument. It is known to insert through this instrument channel so called biopsy tongues to bring the tongues close to a viewing window of the endoscope in order to remove tissue samples for test purposes.

An earlier development of our diathermy snare includes a thin steel wire forming the loop which is connected to an insulated handle by means of a flexible wire extending through a tubular member whereby a so called Bowden cable is formed. When the handle is operated the snare may be extended out of the end of the tubular member or it may be drawn into the tubular member. The wire with the loop attached thereto is connected to one electrode of a high frequency source delivering a frequency of, for example, 1 Mega Hz and a power of about 40 to 80 watts. The other electrode at the high frequency source is connected to the patients body.

The just described snare works satisfactorily. However, it has been found that there is room for improvement with regard to the control of the shape of the snare as it is moved into and out of the tubular member to avoid tangling.

OBJECTS OF THE INVENTION

In view of the above, it is the aim of the invention to achieve the following objects singly or in combination:

- to provide a device by means of which it is possible to remove an internal growth such as polyps, or the like;
- to perform the operation under a steady supply of protective gas in order to avoid the ignition of gases which may be present in the intestinal tract;
- to perform such removal without a laparotomy, whereby an opening of the body will be avoided;
- to provide a removal instrument which will avoid or prevent bleeding at the place where the removal is carried out, for example by assuring a quick coagulation; and
- to provide an instrument, the snare of which may be controlled as to its shape as it is moved in and out of a tubular member whereby to avoid tangling of the wire loop or snare.

SUMMARY OF THE INVENTION

According to the invention there is provided an apparatus for the diathermic removal of growths which comprises a springy wire loop adapted for connection to a high frequency source of power. The loop may be pulled tight and opened by means of a connecting wire

extending from actuator means through a flexible, tubular member to the loop whereby a so called Bowden cable is formed. The outer end of the loop has a bent tip of, for example, substantially semicircular shape and has a diameter smaller than the inner width of a guide bushing through which the loop extends. The guide bushing is provided with guide means shaped in such a manner that the wire loop in its extended position forms a oval which is twisted and its two arms are pressed together when the loop is pulled into said guide bushing so that the loop as it moves into the guide bushing and inside thereof assumes the shape of a somewhat longitudinal eight.

In order to avoid during the operation a possible ignition of the gases which are generated in the intestinal tract, the invention further teaches to provide a hollow handle or actuator means of the present apparatus with a connecting flange to which is attachable a hose or pipe connected to a source of protective gas. The above mentioned guide bushing is provided adjacent to its outer end, that is, adjacent to the loop with lateral aperture means whereby the hollow actuator means together with the flexible tubular member forms a continuous, substantially uninterrupted supply path for the protective gas from the inlet at the actuator means to the lateral aperture means in the guide bushing.

BRIEF FIGURE DESCRIPTION

In order that the invention may be clearly understood, it will now be described, by way of example, with reference to the accompanying drawings, wherein:

FIG. 1 illustrates the complete apparatus in a side view partially in section;

FIG. 2 shows a detail of the loop end of the present apparatus on an enlarged scale with the loop substantially fully extended and illustrating the guide bushing;

FIG. 3 is a view similar to that of FIG. 2 but with the loop in a partially retracted position;

FIG. 4 is also a view similar to that of FIG. 2 but with the loop fully retracted; and

DETAILED DESCRIPTION OF EXAMPLE EMBODIMENTS

The apparatus for the diathermic removal of growths comprises actuator means including a hollow body 1 which is connected to a flexible guide conduit or tubular member 2 which may, for example be 2.5 meters long. The actuator means further include an actuator rod 11 which is axially movable back and forth inside the hollow body 1 by means of a handle 3 for actuating a wire loop 5 through a flexible connecting means or loop slider 4 which may be made of spring wire. The just described elements may form a so called Bowden- or push-pull arrangement whereby the connecting wire 4 is connected at one end thereof through the rod 11 to the operating handle 3 and at the other end to the wire loop 5. The guide hose or tubular member 2 is preferably made of elastic, synthetic, insulating material.

The wire loop 5 is made of stainless spring steel having a diameter of approximately 0.2 mm and a length of about 50 to 60 mm. The wire loop 5 is bent in such a manner that its front end forms a bent tip 6 having, for example, a substantially semicircular shape with a diameter smaller than the inner width or given diame-

ter of a bore 7' extending longitudinally through a guide bushing 7.

The guide bushing 7 is preferably, but not necessarily, made of stainless steel and is securely connected to one end of the tubular member 2. Preferably, the guide bushing is inserted into the end of the tubular member 2. The bushing 7 is provided with guide means 8 and 8' which may be in the form of chamfers as shown in FIGS. 2 to 4 at the inner and outer ends of the bushing 7. The chamfers control the shape of the spring steel wire loop 5, which in its extended position (FIG. 2) has the shape of a oval, so as to cause the two arms of the loop to move toward each other when the loop is pulled into the guide bushing 7 so that the two arms assume a predetermined shape and position, preferably in such a manner that the loop in its retracted position (FIG. 4) inside the bushing 7 assumes the shape of a somewhat elongated eight.

FIG. 3 shows the loop 5 drawn into the guide bushing 7 for about half of its stroke or back and forth movement. It will be noted that the arms of the loop 5 glide along the chamfers 8, 8' in order to assume said somewhat longitudinal eight shape including an inner bight 5'. This gliding contact will first be established with the outer end chamfer 8 and then with the inner end chamfer 8'. At a particular intermediate instant the bights of the eight may contact both chamfers 8, 8'.

Incidentally, in an actual embodiment the guide bushing 7 may have, for example, an outer diameter of 1.6 mm to snugly fit into the tubular member 2 which may have an outer diameter of about 2.1 mm and an inner diameter of about 1.5 mm to assure said snug fit. The bore through the bushing may have a diameter of about 1.0 mm leaving a wall thickness for the bushing of about 0.3 mm. The chamfers 8, 8' may be considered to be part of the bore through the guide bushing so that the diameter of the bent tip 6 as taught by the invention, should be smaller than the widest diameter of the chamfer.

The hollow body 1 comprises a hollow cylinder to which is attached a connecting flange 9 which is connected through a hose 10 to a source not shown of protecting gas. Such source of protecting gas may, for instance, contain carbon dioxide. The operating handle 3, preferably of insulating material, is connected to one end of said actuator or push rod 11, the other end of which is formed as a guide piston 12 which is movable back and forth in the hollow body 1. The push rod 11 is sealed relative to the hollow body 1 by means of a ring seal 12' so that a sealed or closed chamber is formed in the lower end of the hollow body 1 for the admission of the protective gas from the gas container through the hose 10, the connecting flange 9, said chamber and the tubular member 2 all the way to the guide bushing 7, the outlet end of which is provided with at least one lateral aperture 13 whereby the protective gas may emerge laterally and not only forwardly in the direction of the loop 5. Thus, the entire area in which the loop is operated is continuously scavenged with the protective gas. This has the advantage that ignitions are avoided which otherwise might occur because under adverse conditions small sparks may occur during the removal work. Such sparks are as such not dangerous, however, they could cause an ignition if the area in which the loop is being operated is filled with ignitable gases such as methane. The supply of the protective gas effectively eliminates any ignition danger.

The actuator rod 11 may be made of conducting material and the handle member 3 which is made of insulating material may be provided with connecting means 14 such as an inner thread for electrically connecting a high frequency source through the actuator 11 and through the push-pull wire 4 to the loop 5. As a modification of the embodiment of FIG. 1, it is possible to supply the protective gas instead of through the connecting flange 9 through the handle member 3. For this purpose, the hose 10 could be connected to the inner thread 14 in the handle member 3. The push rod 11 would be hollow so that the protective gas may be supplied through the push rod to the tubular member 2.

The apparatus according to the invention is operated as follows. The tubular member 2 acts as a guide conduit. The wire loop 5 is drawn into the bushing 7, and the apparatus is inserted into the instrument channel or conduit of an endoscope, not shown, which has been inserted into the patient previously. The member 2 is pushed through the channel of the endoscope until the front end of the tubular member 2 exits from the instrument channel of the endoscope. Thereafter the handle member 3 is pushed toward the hollow body 1 whereby the wire loop 5 is extended as shown in FIGS. 1 and 2. With the optical aid of the endoscope, the loop 5 is placed around the growth to be removed. Thereafter, the protective gas is supplied and the high frequency energy switched on. By pulling the handle member 3, the loop 5 is slowly closed whereby the growth such as a polyp is removed without any spilling of blood due to the coagulation caused by the diathermic loop.

In view of the above, it will be appreciated that the apparatus according to the invention may be used for the internal removal of growths such as rank growths, polyps, and the like, whereby the springy wire loop is placed around the growth in the manner of a so called electric knife whereby the wire loop is connected at its opposite end through a metallic gliding member 11 with a conventional high frequency surgical power source. As the loop is slowly closed, the growth is cut off while bleeding is simultaneously prevented due to the coagulation caused by the high frequency heated loop.

Thus, it is possible to avoid the so called "bloody" operation which requires the opening of the abdomen. Moreover, the patient may take nurishment immediately after the removal of the growth and may also leave the bed forthwith.

Although the invention has been described with reference to specific example embodiments, it is to be understood, that it is intended to cover all modifications and equivalents within the scope of the appended claims.

What is claimed is:

1. In an apparatus for the diathermic removal of growths of the type comprising a tubular member, actuator means, flexible connecting means, and a wire loop having two arms, wherein the inner end of said arms is connected to said actuator means by said flexible connecting means extending through said tubular member to form a Bowden connection, wherein said loop has a bent tip interconnecting said two loop arms at the outer end thereof and wherein means are provided for supplying to said wire loop high frequency power, the improvement comprising a guide bushing located at an end of said tubular member remote from said actuator means and adjacent to said wire loop, said bushing

comprising guide means for said loop, said bushing having a longitudinal bore therethrough, said bore having a given diameter, said bent tip having a diameter smaller than said given diameter, said guide means in the bushing controlling the shape of the loop as the loop is moved in and out of the bushing so that the bight formed at the outer end of the loop in its extended outer position has the shape of an oval and the size of said bight is reduced as the loop is pulled into the bushing.

2. The apparatus according to claim **1,** wherein said actuator means comprise a hollow body connected to said tubular member at its end remote from said wire loop, an actuator rod axially movable back and forth in said hollow body, said actuator rod having an inner end connected to said flexible connecting means extending through said tubular member, said actuator rod including an outer end extending out of said hollow body and handle means attached to said outer end of the actuator rod.

3. The apparatus according to claim **2,** wherein said actuator rod has a piston attached to its inner end for sliding back and forth in said hollow body, sealing means between said piston and said hollow body for closing an inner chamber in said hollow body against the outer end of the hollow body, an inlet port in said hollow body for connecting said inner chamber to a source of a protective gas and gas outlet aperture means in said bushing adjacent to said wire loop whereby an uninterrupted and substantially closed gas conduit is provided from said inlet port through said chamber and tubular member to said aperture means in the bushing.

4. The apparatus according to claim **2,** wherein said actuator rod has a longitudinal bore therethrough, means at said outer end of the actuator rod for connecting said bore to a source of a protective gas, sealing means between said actuator rod and said hollow body to provide an inner chamber in said hollow body between the inner end of the actuator rod and the tubular member, and gas outlet aperture means in said bushing adjacent to said wire loop whereby an uninterrupted and substantially closed gas conduit is provided from said bore in the actuator rod through said chamber and tubular member to said aperture means in said bushing.

5. The apparatus according to claim **2,** wherein said actuator rod includes conductor means, insulating means for electrically insulating said handle means from said conductor means, said flexible connecting means between said wire loop and said actuator rod comprising an electrical conductor and connector means at the outer end of said actuator rod for connecting a source of high frequency power through said actuator rod and through said flexible connecting conductor to said wire loop.

6. The apparatus according to claim **1,** wherein said bent tip at the outer end of the wire loop has the shape of a semicircle, the diameter of which is smaller than said given inner diameter of said bushing.

7. The apparatus according to claim **1,** wherein said guide means of said bushing comprise a chamfer extending along the outer end of said bushing to surround said longitudinal bore through the bushing at the outer end thereof.

8. The apparatus according to claim **7,** wherein said guide means of said bushing comprise a further chamfer extending along the inner end of said bushing to surround said longitudinal bore through the bushing at the inner end thereof.

9. The apparatus according to claim **1,** wherein said bushing is inserted into said tubular member with a snug fit.

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