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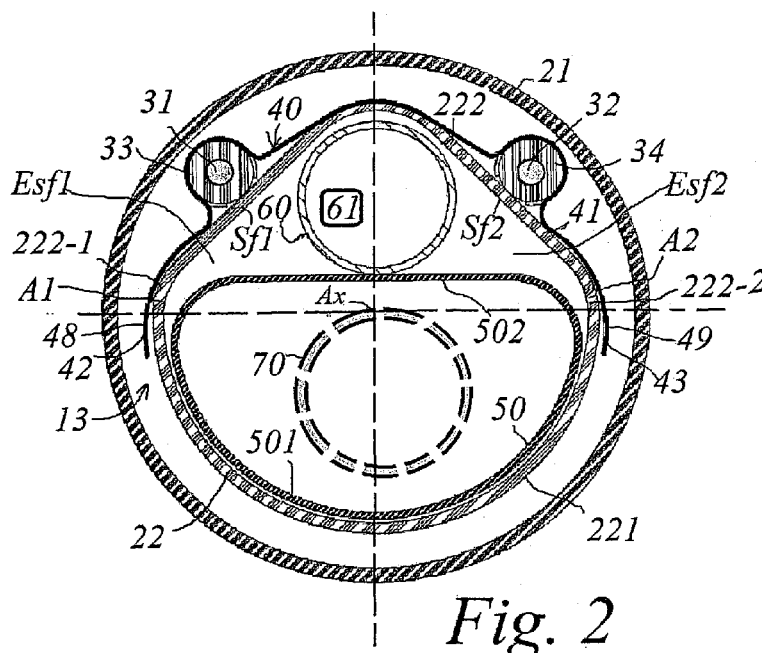


Fig. 2

(57) Abstract : The present invention relates to devices for resecting an organ in a cavity of a living body, in particular of a human being. The device according to the invention is essentially characterized in that it comprises a guide (10) composed of at least a tube (21) and a tube (22), both of them cylindrical, the tube (22) being mounted in the first tube (21); at least one electrical conductor surrounded by a sheath (33, 34) made of an electrically insulating material, the tube (21) being a cylinder of revolution with an inner radius of value R1, the tube (22) comprising a part (221) which is a cylinder of revolution with an outer radius of value R2 less than R1 and with an angle at the centre of a value Ac, and a part (222) which is not a cylinder of revolution and has an angle at the centre of value "360° - Ac"; the insulated conductor (31, 32) being mounted in contact with the part (222) of the tube (22), between the outer wall of this tube (22) and the inner wall of the tube (21); and means (40) for keeping this insulated conductor (31, 32) in contact with the part (222) of the tube (22).

(57) Abrégé :

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La présente invention concerne les dispositifs pour réaliser la résection d'un organe dans une cavité d'un corps vivant, notamment d'un être humain. Le dispositif selon l'invention est essentiellement caractérisé par le fait qu'il comporte un guide (10) constitué d'au moins un tube (21) et un tube (22), tous deux cylindriques, le tube (22) étant monté dans le premier tube (21); au moins un conducteur électrique entouré d'une gaine (33, 34) en un matériau électriquement isolant, le tube (21) étant cylindrique de révolution de rayon intérieur de valeur R_1 , le tube (22) comportant une partie (221) cylindrique de révolution de rayon extérieur de valeur R_2 inférieure à R_1 et d'angle au centre d'une valeur Ac et une partie (222) cylindrique non de révolution et d'angle au centre de la valeur " $360^\circ - Ac$ "; le conducteur isolé (31, 32) étant monté au contact sur la partie (222) du tube (22), entre la paroi extérieure de ce tube (22) et la paroi intérieure du tube (21); et des moyens (40) pour maintenir ce conducteur isolé (31, 32) au contact sur la partie (222) du tube (22).

DEVICE FOR RESECTING AN ORGAN IN A CAVITY OF A BODY[†]

The present invention relates to devices for performing resection of all or part of an organ situated in a cavity of a living body, in particular of a human being, regardless of the nature of the organ, and
5 regardless of whether it is healthy or not healthy, and more particularly the invention relates to devices known in the art under the term "resectoscopes".

Such devices are described and illustrated by way of
10 example in patent applications WO 2014/114600, DE 10 2009 025 047, CN 201529144, and in particular US 6 358 200.

Such a known device essentially comprises: a guide defined between a proximal end and a distal end, the
15 guide comprising a through duct that is open at both of its ends; two electrically conductive wires that are externally insulated and slidably mounted in the duct, each of the two wires having a first end and a second end, which ends are suitable, when the wires move in
20 translation in the duct, for emerging respectively from the proximal end and from the distal end of the duct, the first ends of the two wires having means for connection to two poles of an electrical power supply; an open loop defined between two free terminals and made of an
25 electrically conductive resistive material so as to produce heat by the Joule effect and thus enable all or part of a determined organ to be ablated by burning; and means for electrically connecting the two free terminals of the open loop respectively to the two second ends of
30 the two conductive wires.

Inside the guide, tubes are also provided that serve, by way of example, for passing surgical instruments or the like, for introducing or for insufflating various fluids, in particular gaseous

[†] Translation of the title as established *ex officio*.

fluids, into the cavity, for sucking out any element present in the cavity, etc.

The guide that is to be introduced into the cavity (or lumen) in which it is to perform resection must also
5 present a transverse dimension that is as small as possible and have an outer shell that is easy to obtain both industrially and commercially, and it must also be able to contain a non-negligible number of tubes and elements that are essential for performing resection, and
10 possibly for performing surgical operations other than resection.

Thus, an object of the present invention is to provide a device as defined above for performing resection of all or part of an organ in a cavity of a
15 living body, in particular of a human being, that satisfies the above-mentioned requirements and that is easy to make industrially.

More precisely, the present invention provides a device for performing resection of an organ in a cavity
20 of a living body, in particular of a human being, the device being known under the term "resectoscope", and comprising at least: a guide defined between a proximal end and a distal end, said guide defining a duct that is open at both its proximal end and at its distal end, said
25 guide being constituted at least by a first cylindrical tube and by a second cylindrical tube, the second tube being mounted in the first tube, at least one electrical conductor surrounded by a sheath made of electrically insulating material, said electrical conductor as
30 insulated in this way being mounted in said duct, and inlet/outlet means mounted in cooperation with the proximal end of said guide, the device being characterized by the facts that said first tube is a cylinder of revolution having an inside radius of value
35 R_1 , said second tube comprises: a first portion, being a portion of a cylinder of revolution having an angle at the center of value A_c and having an outside radius of

value R_2 , where R_2 is less than R_1 , and a second portion that is a portion of a cylinder that is not a portion of a cylinder of revolution and that has an angle at the center of value " $360^\circ - A_c$ ", the two edges of the second
5 portion of the second tube being in continuity respectively with the two edges of the first portion of the second tube, and said insulated conductor is mounted in contact on said second portion of said second tube between the outside wall of the second tube and the
10 inside wall of the first tube, and that it further includes means for holding said insulated conductor in contact on said second portion of the second tube.

Other characteristics and advantages of the present invention appear from the following description given
15 with reference to the accompanying drawings by way of non-limiting illustration, in which:

• Figure 1 is a general side view of a device of the invention for performing resection of all or part of an organ in a cavity of a living body, in particular of a
20 human being, the device including a guide and inlet/outlet means mounted in association with the guide; and

• Figure 2 is a section view of an embodiment of the guide used in the structure of the device of the
25 invention.

It is specified that, in the present description, if the adverb "substantially" is associated with a qualification to any given means, the qualification may be understood equally well as meaning approximately or
30 exactly.

The present invention relates to a device for performing resection of an organ in a cavity of a living body, in particular of a human being, by burning, which device finds a particularly advantageous application in
35 the field of hysteroscopy for intra-uterine surgery. Such a device, known to practitioners under the term "resectoscope", enables intrauterine interventions to be

performed to ablate all or part of an organ, e.g. a polyp, a tumor, a synechia, a uterine malformation, or the like.

5 With reference to the two accompanying figures, the device comprises at least a guide 10 defined between a proximal end 11 and a distal end 12, the guide defining a duct that is open at both its proximal end and at its distal end, the guide being constituted at least by a first cylindrical tube 21 and by a second cylindrical
10 tube 22, the second tube 22 being mounted in the first tube 21, at least one electrical conductor surrounded by a sheath 33, 34 made of an electrically insulating material, the electrical conductor 31, 32 as insulated in this way being mounted in the duct 13, and inlet/outlet
15 means 14 mounted in cooperation with the proximal end 11 of the guide 10.

According to an essential characteristic of the invention, The first tube 21 is a cylinder of revolution having an inside radius of value R_1 , while the second
20 tube 22 has a first portion 221 being a portion of a cylinder of revolution having an angle at the center having a value A_c , e.g. substantially 180° , as shown, and an outside radius of value R_2 that is less than R_1 , and a second portion 222 that is not a portion of a cylinder of
25 revolution and that has an angle at the center of value " $360^\circ - A_c$ ", the two edges 222-1 and 222-2 of the second portion 222 of the second tube 22 being in continuity respectively with the two edges of the first portion 221 of the second tube 22.

30 To facilitate the present description, the above defined tube 21 is always referred to as the tube that is a "cylinder of revolution". However it should be understood, in the meaning of the present description, this terminology covers both a tube that is a cylinder of
35 revolution in the true mathematical meaning of the term, and a tube that can be considered, at least functionally, as being a cylinder of revolution.

Also, as shown in Figure 2, the at least one insulated conductor 31, 32 is mounted in contact on the second portion 222 of the second tube 22 between the outside wall of the second tube and the inside wall of the first tube 21, and the device includes means 40 for holding the at least one insulated conductor 31, 32 in contact on the second portion 222 of the second tube 22.

According to a preferred characteristic of the invention, the means 40 for holding the second conductor 31, 32 in contact on the second portion 222 of the second tube 22, which contact need not necessarily be stationary but could be slidable along the longitudinal axis, are themselves constituted by a clip 41 made of relatively resilient metal material, such as a pre-formed plate made of a material such as stainless steel. The clip then has two lateral longitudinal edges 48, 49, each in the form of a re-entrant resilient hook 42, 43 (i.e. presenting a shape that is substantially concave). These two re-entrant resilient hooks are clipped by passing resiliently over the two connection edges A1, A2 formed respectively between the first portion 221 of the second tube 22 and its second portion 222, and by wrapping at least in part around these two edges, the at least one insulated conductor 31, 32 being clamped relatively between the clip 41 and the second portion 222 of the second tube 22, Figure 2.

In a preferred embodiment, the second portion 222 of the second tube 22 presents at least one substantially plane surface Sf1, Sf2 facing the inside wall of the first tube 21. This plane surface can be obtained easily, either from a conventional tube that is a cylinder of revolution, by flattening a portion of its wall, or else directly by profiling.

Advantageously, in order to satisfy nearly all possible uses of the device, the second portion 222 of the second tube 22 presents two substantially plane surfaces Sf1, Sf2 facing the inside wall of the first

tube, which two surfaces Sf1, Sf2 make between them an angle lying between 0° to 180° (bounds not included) and are inscribed in the surface of revolution defined by the outside surface of the first portion 221 of the second tube 22. In still more advantageous manner, the two substantially plane surfaces Sf1, Sf2 make between them an angle that is substantially equal to 90° , Figure 2.

Under such circumstances, the device can then most advantageously include two insulated conductors 31, 32 held in contact respectively on each of the two substantially plane surfaces Sf1, Sf2, while using the same clip 41 as described above.

In the above-described configuration, the device can also advantageously include a third cylindrical tube 50, this third tube having a first portion 501 that is a cylinder of revolution with an angle at the center having a value substantially equal to 180° and an outside radius of value R3 substantially equal to the value of the radius of the cylindrical inside surface of revolution of the first portion 221 of the second tube 22, and a second portion 502 that is substantially plane, the two edges of this second portion of the third tube being in continuity respectively with the two edges of the first portion 501 of this third tube, the third tube 50 being arranged inside the second tube 22 in such a manner that its first portion 501 is substantially congruent and in correspondence with the inside surface of the first portion 221 of the second tube 22, as shown in Figure 2.

In an embodiment that is possible with the above-described configuration, the device may then advantageously further include a fourth cylindrical tube 60 that is optionally a cylinder of revolution, situated in the space of 61 defined between the substantially plane second portion 502 of the third tube 50 and the two plane surfaces Sf1, Sf2 of the second tube 22.

In certain applications, it is also advantageous to provide a fifth tube 70, shown in dashed lines in Figure 2, mounted in the third tube 50.

In an embodiment that is preferred, industrially speaking, the first tube 21, the first portion 221 of the second tube 22, and the first portion 501 of the third tube 50, all three of which are in the shape of cylinders of revolution, share a substantially common axis Ax, Figure 2.

10 The above-mentioned inlet/outlet means 14 as shown in Figure 1 are known in the prior art and are mounted in fluid flow or mechanical connection with the various tubes and elements that are defined above.

15 Thus, with the device of the invention an embodiment of which is shown in Figures 1 and 2:

- the space between the first tube 21 and the second tube 22 is used to perform suction during surgical intervention, this suction having an outlet via the extraction opening 101;

- 20 • in order for the scene of the operation inside the lumen to be visible, it is necessary to have lighting at the distal outlet 12 of the guide 10. In advantageous and known manner, this lighting is provided by a bundle of optical fibers mounted in cooperation with a light source (not shown in figures). This bundle is situated 25 in the space comprising two portions Esf1, Esf2 as defined by the second tube 22, the third tube 50, and the fourth tube 60. This bundle of optical fibers is generally constituted as two branches situated on either 30 side of the fourth tube 60, essentially in the two portions Esf1 and Esf2, and emerging via the outlet opening 102;

- as in any intervention, in order to be able to observe during the operation, it is necessary to 35 introduce an endoscopic camera. This introduction takes place via the inlet eyepiece 103 that is connected to the fourth tube 60, the camera going along the inside of the

fourth tube 60 in order to emerge at the distal end 12 of the guide 10. However, it should be observed that instead of an endoscopic camera, it is possible to arrange optical elements, lenses, waveguides, etc. in the tube 60 in order to transmit images of the scene of the operation, with the camera being installed solely in cooperation with the inlet eyepiece 103;

• as mentioned above in the introduction, such a device makes it possible to perform resections by cutting off bodies, such as polyps, situated in a lumen, by using a resistance that is heated by the Joule effect. Under such circumstances, the electrical conductors 31, 32 and possibly the first tube 21 are suitable for connecting to an electrical power supply. The ends of the two conductors 31, 32 are situated at the electrical connector 104;

• when it is necessary to use specific instruments other than those for resection, these instruments are introduced to the field of the operation via the inlet 105 of the device, which includes the fifth tube 70 mounted in cooperation with this inlet and lying on the axis Ax of the guide 10, thereby facilitating introducing these instruments, which are generally relatively rigid, and which can therefore be introduced and moved in sliding along a straight line only;

• the inside of the third tube 50 is used, during the surgical intervention, for delivering an irrigation fluid that is introduced via the inlet 106 and that is sucked out together with the waste generated by the operation via the space connected to the above defined outlet 101 (Figure 1).

Finally, it is mentioned that the tubes 21, 22, 50, and 60 are advantageously made of stainless steel, that the insulated electrical conductors 31, 32 are generally made of a material that is a good conductor of electricity, such as copper, and that the insulating

material out of which the sheaths 33, 34 are made is polytetrafluoroethylene (PTFE), for example.

The way the above-described device is used is itself well known. It is not described in greater detail herein
5 for the reason of simplifying the present description, particularly since this use does not come within the field protected by the invention.

It is nevertheless emphasized that, by virtue of its structure, the device of the invention as described above
10 is very compact, occupying little space transversely, while providing practitioners with a maximum of options in use, even for surgical interventions in cavities for which access is relatively narrow and difficult.

CLAIMS

1. A device for performing resection of an organ in a cavity of a living body, in particular of a human being, known by the term "resectoscope", and comprising at least:

· a guide (10) defined between a proximal end (11) and a distal end (12), said guide defining a duct (13) that is open at both its proximal end and its distal end, said guide being constituted at least by a first cylindrical tube (21) and by a second cylindrical tube (22), the second tube (22) being mounted in the first tube (21);

· at least one electrical conductor surrounded by a sheath (33, 34) made of electrically insulating material, said electrical conductor as insulated in this way (31, 32) being mounted in said duct (13); and

· inlet/outlet means (14) mounted in cooperation with the proximal end (11) of said guide (10);

the device being characterized by the facts that:

· said first tube (21) is a cylinder of revolution having an inside radius of value R_1 ;

· said second tube (22) comprises:
* a first portion (221), being a portion of a cylinder of revolution having an angle at the center of value A_c and an outside radius of value R_2 , where R_2 is less than R_1 ; and

* a second portion (222) that is a portion of a cylinder that is not a cylinder of revolution and having an angle at the center of value " $360^\circ - A_c$ ", the two edges (222-1, 222-2) of the second portion (222) of the second tube (22) being in continuity respectively with the two edges of the first portion (221) of the second tube; and

· said insulated conductor (31, 32) is mounted in contact on said second portion (222) of said second tube

(22) between the outside wall of the second tube and the inside wall of the first tube (21);

• and that it further includes means (40) for holding said insulated conductor (31, 32) in contact on
5 said second portion (222) of the second tube (22).

2. A device according to claim 1, characterized by the fact that the means (40) for holding said insulated conductor (31, 32) in contact on the second portion (222)
10 of the second tube (22) are constituted by a clip (41) having two lateral longitudinal edges, each in the form of a re-entrant resilient hook (42, 43), the two re-entrant resilient hooks being clipped by going over the two connection edges (A1, A2) formed respectively between
15 the first portion (221) of the second tube (22) and its second portion (222), and wrapping at least in part around these two edges, said insulated conductor (31, 32) being positioned between the clip (41) and said second portion (222) of the second tube (22).

20

3. A device according to claim 1 or claim 2, characterized by the fact that said second portion (222) of the second tube (22) presents at least one substantially plane surface (Sf1, Sf2) facing the inside
25 wall of the first tube (21).

4. A device according to claim 3, characterized by the fact that said second portion (222) of the second tube (22) presents two substantially plane surfaces (Sf1, Sf2)
30 facing the inside wall of the first tube, these two plane surfaces (Sf1, Sf2) forming between them an angle lying between 0° and 180° , bounds not included, and being inscribed in the surface of revolution defined by the outside surface of the first portion (221) of the second
35 tube (22).

5. A device according to claim 4, characterized by the fact that the two substantially plane surfaces (Sf1, Sf2) make between them an angle that is substantially equal to 90°.

5

6. A device according to claim 4 or claim 5, characterized by the fact that it includes two insulated conductors (31, 32) held by said clip (41) in contact respectively on each of the two substantially plane surfaces (Sf1, Sf2).

10

7. A device according to any preceding claim, characterized by the fact that it includes a third cylindrical tube (50), said third tube comprising:

15

- a first portion (501) forming a portion of a cylinder of revolution with an angle at the center having a value substantially equal to 180° and an outside radius of value R3 substantially equal to the value of the radius of the cylindrical inside surface of revolution of the first portion (221) of the second tube (22);

20

- a substantially plane second portion (502), the two edges of the second portion of the third tube being in continuity respectively with the two edges of said first portion (501) of said third tube; and

25

- said third tube (50) being arranged inside the second tube (22) in such a manner that its first portion (501) is substantially congruent and in correspondence with the inside surface of the first portion (221) of the second tube (22).

30

8. A device according to claim 7, when dependent claim 5, characterized by the fact that it includes a fourth cylindrical tube (60) optionally forming a cylinder of revolution, situated in the space (61) defined between the substantially plane second portion (502) of the third tube (50) and the two plane surfaces (Sf1, Sf2) of the second tube (22).

35

9. A device according to claim 7 or claim 8,
characterized by the fact that it includes a fifth tube
(70) mounted in said third tube (50).

5

10. A device according to claims 1 and 7, characterized
by the fact that said first tube (21), the first portion
(221) of the second tube (22), and the first portion
(501) of the third tube (50), all three of which are in
10 the shape of portions of cylinders of revolution, share a
substantially common axis (Ax).

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