May 9, 1933. R. H. WAPPLER 1,908,583

DIATHERMIC ELECTRODE

Filed Sept. 13, 1929

Fig. 1

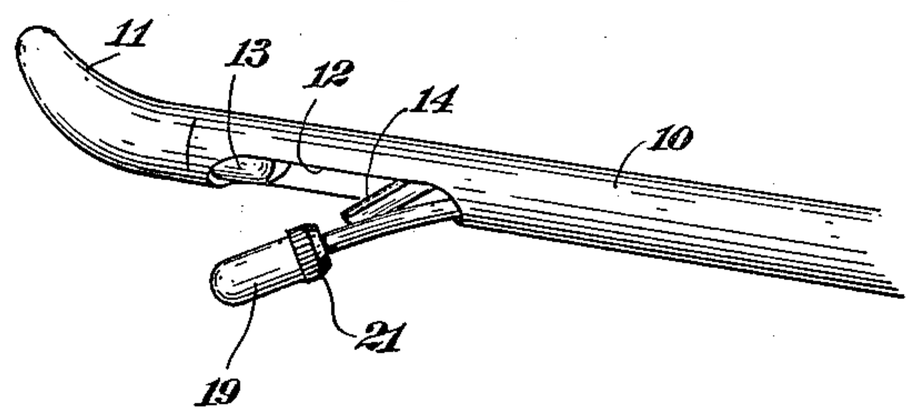

Fig. 2

Fig. 3

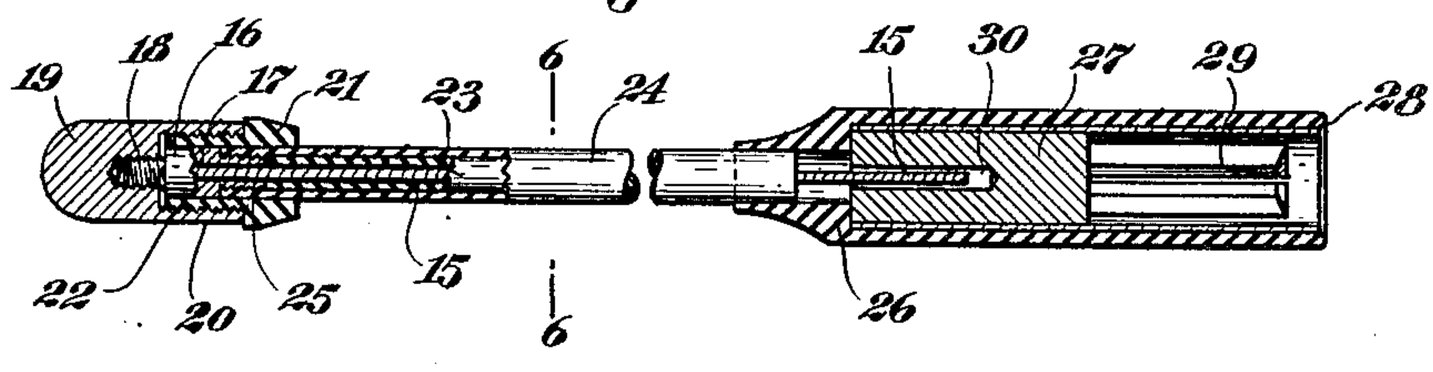

Fig. 4

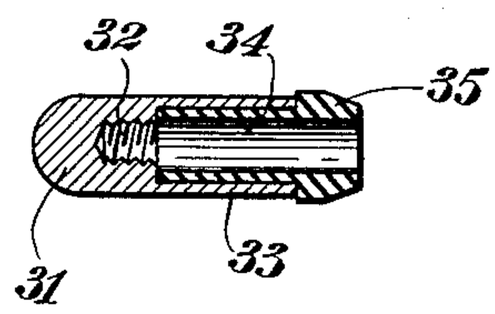

Fig. 5

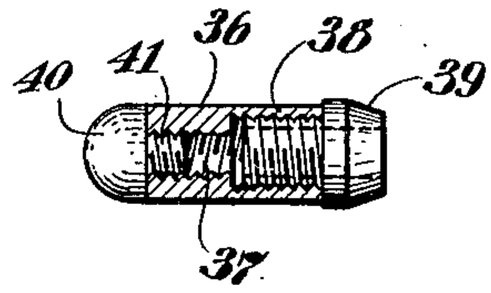

Fig. 6

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DIATHERMIC ELECTRODE

Application filed September 13, 1929. Serial No. 392,296.

My present invention relates generally to surgical instruments, and has particular reference to a diathermic electrode.

It is a general object of my invention to provide an electrode having features of construction which render it peculiarly efficient in the diathermic treatment of internal organs, such as the bladder. An electrode of the character to which my invention relates is designed to be inserted through an endoscopic tube and out of a suitably provided fenestra at the inner end of such tube.

A more particular object of my invention is to provide an electrode having advantageous characteristics of smallness, compactness, flexibility, and safety; and embodying a construction which permits the employment, for diathermic purposes, of larger currents than those heretofore employed.

Briefly, my improved electrode comprises a relatively thin, flexible and resilient stem and a relatively enlarged head. The stem consists of a core of conducting material ensheathed in suitable insulation, and the head consists essentially of a conducting material, as will be readily understood.

A particular feature of my invention lies in the provision of a stem core in the form of twisted wires, such construction lending greater strength and flexibility to the device. Another feature lies in providing a construction wherein the head is removably applicable to the stem, thereby permitting the selective employment of that particular type of head which is most suitable or desirable for the particular treatment in contemplation.

An important feature of my present invention lies in the provision of a head which is constructed partly of conducting material and partly of insulating material, the structure being such that possibility of short-circuiting is practically eliminated. In this way, the likelihood of injury and pain to the patient, and of impairment of smooth operation, is greatly reduced.

Another important feature of my present invention lies in the construction of an electrode whose stem insulation is of such a nature that relatively large currents may be passed through the electrode with a minimum likelihood of breakdown. Briefly, my construction consists in the employment of a plurality of mutually telescoped insulating tubes surrounding or ensheathing the core of the electrode stem.

For the attainment of the foregoing objects and such other objects as may hereinafter appear or be pointed out, I have constructed a device embodying the features of my invention and illustrated in the accompanying drawing, wherein—

Figure 1 is a perspective view of the forward portion of an endoscopic tube with an electrode of the present character emanating therefrom;

Figure 2 is a general view of an electrode of the present character, by itself, showing the general proportions of the device;

Figure 3 is an enlarged longitudinal cross-section of the electrode of Figure 2;

Figure 4 is a longitudinal cross-section through an electrode head of slightly different construction;

Figure 5 is a view similar to Figure 4, illustrating a second modification; and

Figure 6 is an enlarged cross-sectional view taken substantially along the line 6—6 of Figure 3.

In Figure 1, I have shown the inner end of an endoscopic tube 10 provided with the customary nose or beak 11 and a lateral fenestra 12. I have shown a lamp 13 mounted at the forward end of the fenestra 12.

The particular construction of the endoscopic tube and its associated parts is not essential so far as the present invention is concerned, and I have therefore eliminated all detailed showing of the customary auxiliary construction such as the pet-cocks, the binding posts, the eyepiece, and the catheter guides. I will state, however, that the electrode of the present invention is adapted to be passed through a suitable catheter guide so that the end thereof will emanate from the fenestra 12, and I will state further that the employment of my electrode is accomplished by a deflection and guidance of the forward end of the electrode by means of a suitable catheter-deflecting device.

Thus, in Figure 1, I have shown the de-

flector blade 14 of a catheter-deflecting device, the movements of this blade being controlled from the rear end of the endoscopic tube 10, and the blade 14 being adapted to bear against the forward end of the electrode to deflect the latter in an accurate manner out of the fenestra 12 and into the particular position desired. Furthermore, it will be understood that a suitable telescopic tube is provided within the endoscopic tube 10 so that the electrode may be efficiently guided and applied to the desired portion of the body cavity under illuminated vision.

I will state further that in the employment of electrodes of the present character, it is customary to utilize the endoscopic tube 10 as an indifferent electrode, the electric current passing through the body of the patient and the circuit being completed through the diseased portion with which the electrode head is brought into contact. It is therefore important, in view of the electrical circuit just described, that short-circuiting be avoided.

In Figure 3, I have illustrated an electrode wherein the stem comprises a core 15 formed of a pair of thin mutually twisted or spiralled conducting wires, preferably of Monel metal or the like. At the forward end of this core, I attach a connector 16 which is provided in the illustrated form with a rearwardly opening bore 17 adapted to receive the forward ends of the twisted wires 15.

These ends may be soldered in this bore or suitably attached to the connector 16 in any other desired manner. The connector 16 has also been shown provided with a forwardly projecting threaded stem 18 which facilitates the removable application of an electrode head such as that shown at 19. The latter is substantially cylindrical and is provided not only with an internally threaded bore adapted to cooperate with the stem 18, but also with a rearwardly extending skirt portion 20 internally threaded.

In accordance with an important feature of my invention, a sleeve or collar of insulating material 21 is associated with the rear end of the electrode head and is preferably formed much like a bushing or the like. In Figure 3, the insulating material has a forwardly extending, externally threaded portion 22 adapted to be firmly threaded into engagement with the skirt 20 previously mentioned. The rear portion of the insulating bushing or element 21 is preferably rearwardly beveled and of a diameter slightly greater than that of the metallic portion of the head 19.

This construction results in an electrode head which is not only removably applicable to the forward end of the electrode stem, but one which is extremely efficient in use because of the reduced possibility of short-circuiting the device. Thus, referring again to Figure 1, the electrode head presents from the exterior thereof a main electrically conductive portion or body 19 and a rear band or portion 21 of insulating material. In the adjustment and deflection of the electrode within the cavity to be treated, any contact that may occur will be between the deflecting blade 14 and the insulating band 21, and not between the blade 14 and the conducting portion 19. This is of extreme importance, because in the lateral adjustment of the electrode head and in the longitudinal shifting thereof to position it accurately in the proper and desired place, there is an extreme likelihood of inadvertently causing the blade 14 to contact with the rear end of the electrode head.

Referring again to Figure 3, I will point out that I have ensheathed the core 15 within a pair of insulating tubes 23 and 24. Each of these tubes is of a flexible and resilient character, preferably of an insulating material formed by the suitable impregnation with gum or the like of a suitable fabric tube. Each of these tubes is a complete insulating sheath by itself, and I have found it of extreme advantage, for reasons presently to be pointed out, to employ two independent and separate tubes mutually telescoped in the snug manner illustrated in Figure 3. I have shown the inner tube contacting at its forward end with the rear end of a rearwardly extending stem 25 carried by the connector 16 and externally threaded. I have shown the outer tube 24 extending forwardly all the way to the body portion of the connector 16. The rearwardly extending externally threaded stem 25 is preferably associated with the outer tube 24 by a screw-threaded engagement, although this not absolutely essential. It is to be particularly noted that the inside diameter of the head 19, and more particularly, of the insulating portion 21, is substantially equal to the exterior diameter of the outer insulating sheath 24, whereby the application of the head to the stem of the electrode will provide a continuous surface of insulation at the external point of juncture.

In other words, upon referring again to Figure 1, I will point out that the blade 14 may safely be adjusted and maneuvered without any danger of contacting with the core 15 or the head 19 electrically connected therewith.

At the rear end of the stem I provide a hollow handle 26 of insulating material, and mounted within this handle I provide a binding post 27 of suitable character to receive a terminal wire or the like through the rear open end 28 of the handle 26. In Figure 3, the binding post proper is designated by the reference numeral 29 and constitutes a split construction adapted frictionally to make contact with a pin inserted thereinto. Obviously, the binding post 27 is electrically connected with the core 15, and I have illustra-

tively shown the manner in which the rear end of the core 15 may be inserted into a suitable bore 30 in the binding post 27, and soldered into position.

By the employment of a multi-layer insulating sheath around the core of the electrode, I am enabled to employ my electrode with larger currents than those heretofore used, and thereby to increase the range of utility of the device. Since the endoscopic tube 10 is the indifferent electrode and the core 15 is the active electrode, it follows that the employment of the electrode within the tube 10 produces an arrangement much in the nature of an electrical condenser. The opposite sides of the condenser are the core 15 and the tube 10, and the dielectric of the condenser is constituted of the insulating sheath around the core 15. It has frequently happened that because of excess current or for other reasons, the insulation has broken down, thereby frequently resulting in undesired short-circuits, in possible injury and pain to the patient, and obviously in impairment of smooth operation. The breakdown of a condenser dielectric is due in many cases to conducting impurities in the dielectric. By the employment of two independent and separate sheaths, the likelihood of such breakdown is greatly minimized, because the possibility of conducting impurities of one tube aligning with similar impurities in the other tube is extremely slight. For this reason, and for other obvious reasons of a similar character, the insulating quality of the multi-layer sheath illustrated by me is much greater than that of a single sheath, even though such sheath may have the same thickness as the conjoint thickness of the sheaths provided by me.

In Figure 4, I have shown a modified type of head, somewhat longer and thinner than the head of Figure 3. In this case, the forward conductive portion 31 is again provided with a threaded bore 32 adapted to receive the forward end of a suitable connector carried by the stem. In a rearwardly extending skirt 33 is the forwardly extending skirt portion 34 of an insulating collar whose rear portion 35 is similar to the portion 21 of Figure 3. In this instance, I have not shown the skirts 33 and 34 mutually threaded but merely held in association by friction.

In Figure 5, I have illustrated a further modification of the head in which both the front and rearward portions are of insulating material. A cylindrical body portion 36 of conducting material is provided with a threaded bore 37 at its forward end and a somewhat enlarged threaded bore 38 at its rearward end. Associated with the bore 38 is an insulating collar 39 similar to those above described and provided with a bore adapted to receive the forward portion of the stem of the electrode. Mounted in the bore 37 is a rounded tip 40 of insulating material preferably provided with a rearwardly extending, externally threaded stem 41. The outside diameter of the tip 40 is preferably the same as that of the body portion 36.

The head of Figure 5 is particularly advantageous where the portion to be treated with the diathermic current lies in such a position that it would be dangerous or undesirable to have the forward portion of the electrode head contact with any other portion of the body cavity. The head of Figure 5 is, for example, particularly advantageous in the treatment by diathermy of the prostate lobes.

It will thus be seen that I have provided an electrode of extreme simplicity and embodying a number of advantageous characteristics rendering its use not only more efficient from the standpoint of currents employed, but also more safe. The likelihood of injury or pain to the patient and the likelihood of short-circuiting are reduced to a minimum, and relatively large currents may be employed without risking a breakdown of the insulation. It is particularly to be noted that the heads are removable and hence interchangeable without impairing the insulating and safety characteristics of the device. It is further to be noted that the application of any head to the connector at the forward end of the stem will not induce a loosening or breaking of the metallic core of the stem, this being due to the fact that the threads of the portion 18 spiral in a direction opposite to that in which the wires 15 are twisted. Should the head be turned too far, during its application, it will serve to tighten the twist of the wires 15 rather than loosen them.

It will be obvious that changes in the details herein described and illustrated for the purpose of explaining the nature of my invention may be made by those skilled in the art without departing from the spirit and scope of the invention as expressed in the appended claims. It is therefore intended that these details be interpreted as illustrative, and not in a limiting sense.

Having thus described my invention and illustrated its use, what I claim as new and desire to secure by Letters Patent is—

1. For use with a fenestrated endoscopic tube constituting an indifferent electrode, an active electrode insertable through said tube and out of said fenestra, said active electrode being provided with a head which is partly of conducting and partly of insulating material.

2. For use with a fenestrated endoscopic tube constituting an indifferent electrode, an active electrode insertable through said tube and out of said fenestra, said active elec-

trode being provided with a head whose rearward portion is of insulating material to prevent accidental short-circuiting thereof with said tube.

3. For use with a fenestrated endoscopic tube constituting an indifferent electrode, an active electrode insertable through said tube and out of said fenestra, said active electrode being provided with a head whose forward and rearward portions are of insulating material.

4. For use with a fenestrated endoscopic tube constituting an indifferent electrode, an active electrode insertable through said tube and out of said fenestra, said active electrode comprising a thin flexible stem with a sheathing of insulation, and an enlarged head whose rearward portion is of insulating material.

5. For use with a fenestrated endoscopic tube constituting an indifferent electrode, an active electrode insertable through said tube and out of said fenestra, said active electrode comprising a thin flexible stem formed of twisted conducting wires, a sheathing of insulation around said wires, and an enlarged head of conducting material attached to the forward ends of said wires.

6. For use with a fenestrated endoscopic tube constituting an indifferent electrode, an active electrode insertable through said tube and out of said fenestra, said active electrode comprising a thin flexible stem formed of twisted conducting wires, a sheathing of insulation around said wires, and an enlarged head of conducting material attached to and enveloping the forward ends of said wires, said head being provided at the rear thereof with an insulating collar.

7. As a new article of manufacture, an electrode head for application to a portion of the body, said head comprising a body of conducting material provided at its rear end with means for removably attaching said body to the forward end of a relatively thin electrode stem, and said rear end having its exposed surface formed of insulating material.

In witness whereof I have signed and sealed this specification this 10 day of September 1929.

REINHOLD H. WAPPLER.