Jan. 16, 1934. W. J. McFADDEN 1,943,543

SURGICAL INSTRUMENT

Filed June 21, 1932

FIG. 1

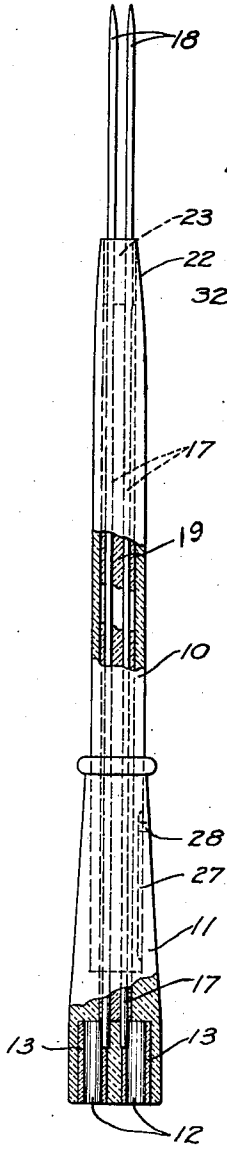


FIG. 3 FIG. 4

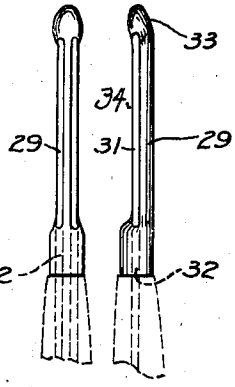


FIG. 6

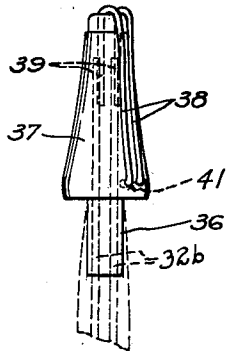


FIG. 5

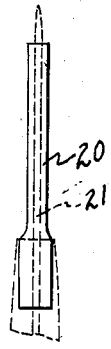


FIG. 7

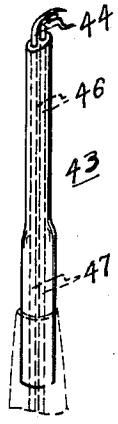


FIG. 8

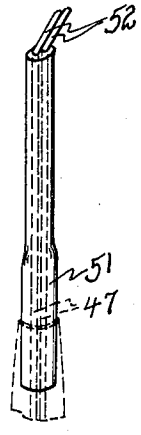


FIG. 9

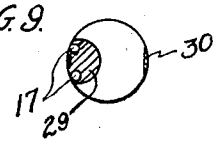
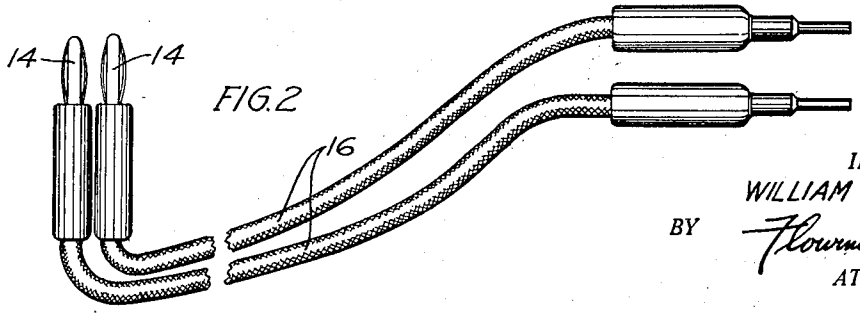


FIG. 2



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UNITED STATES PATENT OFFICE

1,943,543

SURGICAL INSTRUMENT

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Application June 21, 1932. Serial No. 618,457

12 Claims. (Cl. 174—89)

My invention relates to surgical instruments and has particular relation to electrodes suitable for use in diathermy and kindred medical and surgical treatments.

The tonsils have long been recognized as a common site of focal infection bearing a causal relationship to arthritis, neuritis, certain forms of heart trouble, etc. But within the last few years, attention has been called to certain infectious diseases of the cervical canal, processes which are situated in the small glands, and in the larger glands around the cervical opening which have become cystic and which contain mucoid or mucopurulent material. Such infections are constantly found, especially in cases of rheumatic involvement of small joints in women, and in cases of ocular disease, such as chronic recurring iritis, inflammation of the ciliary body, and phlyctenular keratitis, which appear first in one eye and then in the other, often greatly injuring the sight.

Treatment of infection in the tonsils or in the cervix may be carried on in any one of several ways, but the present generally accepted therapy is the complete removal of the infected tissue. This can be done surgically, or by heat destructive methods, such as the cautery, or diathermy coagulation. My present invention deals with the method of treating infected tonsils and infected cervix by means of heat destruction, in the form of diathermy coagulation, and my invention provides an electrode particularly well suited for such treatment.

It is apparent that a device constructed according to my invention may be used or modified for use in treating other diseases, infections and the like, as for instance in destroying tumors such as cysts, moles and epitheliomas.

While instruments of this general type have been used for treatment of the above diseases, I have observed that their field of usefulness is materially limited because the instruments have not been adapted for the treatment of all shapes and sizes of canals and for the treatment of tumors and like disorders which are difficult to reach.

I have devised an instrument which, by reason of its construction, is capable of a much wider field of usefulness than the devices of the prior art and in which treatment of definite selected areas is accurately obtained without effect upon unselected areas. The parts of the device are readily interchangeable for treatment of various sized areas and for treatment of canals of various diameters and configurations. The extent of the area treated may be readily regulated while the instrument is in place and the instrument may be inserted and removed with the conductors thereof sheathed in a non-conducting shell.

A broad object of my invention, therefore, is to provide a new and improved electrode for treating endocervicitis, both acute and chronic and of both specific and non-specific character, to destroy any inflammation of the Bartholin glands, to destroy erosions of any magnitude around the external os of the cervix, to promote healing of bilateral tears of the cervix, to destroy polyps and cysts of any magnitude adhering to the vaginal portion of the cervix, to treat and destroy infected tonsils, and to treat and destroy benign and malignant tumors.

A more particular object of my invention is to provide an electrode in which the conductors may be sheathed or partly or fully exposed while the instrument is being inserted and removed and while it is being used.

Another object of my invention is to provide a device of the above character which is adapted to treat selected areas and which may be regulated to treat areas of varying widths and depths without affecting adjacent areas.

Another object of my invention is to provide a device which is adapted for the treatment of tonsils or tumors or the like, and which may also be used for the treatment of the walls of canals of varying diameters and shapes and which is furthermore adapted for the treatment of only certain portions of the walls of such canals as selected by the operator.

Still another object of my invention is to provide a device of the above character which is adapted to treat selected areas in equal uniformity throughout the area treated and such that the strength of treatment can be so gauged and set that all subsequent treatments can be given in identical strength and uniformity.

Other and further features and objects of the invention will be more apparent to those skilled in the art upon a consideration of the accompanying drawing and following specification, wherein are disclosed several exemplary embodiments of the invention, with the understanding, however, that such changes may be made therein as fall within the scope of the appended claims without departing from the spirit of the invention. The device may be used or adapted for use for other purposes.

In said drawing:

Figure 1 is a view, partly in elevation and partly in section, of an embodiment of my invention in which the conductors which project

from one end of the device may be regulated in and out with reference to the insulating sleeve of the electrode by means of a structure located at the other end of the electrode.

Figure 2 is a view in perspective of the electrical connection utilized for connecting the electrodes of my device with a source of suitable high-frequency current.

Figure 3 is a plan view of the contacting end of an electrode constructed according to my invention, which electrode is more readily adapted for use in treating certain restricted areas and for treating various canals in the anatomy.

Figure 4 is a view in side elevation of the electrode shown in Figure 3.

Figure 5 is a view in side elevation of an electrode constructed according to my invention and utilizing a structure which is adapted to selectively cover a portion of the exposed conductors.

Figure 6 is a plan view of an electrode constructed according to my invention and adapted for use in selectively treating the walls of large canals or canals of varying diameter or shape, or curved areas in the anatomy, more particularly in treating large erosions and bilateral tears about the external os of the cervix.

Figure 7 is a view in perspective of an electrode constructed according to another embodiment of my invention, and this embodiment finds particular use in puncturing and treating tonsils, cysts and tumors, or curved areas in the anatomy.

Figure 8 is a view in perspective of another embodiment of my invention which finds particular use in treating the diseased area about the mouth of the cervix, for treating bilateral tears, or mouths of glands or infected folds or crevices and for surface application on tumors, tonsils, cysts and the like, and

Figure 9 is a diagrammatic view showing how a device constructed according to my invention may be used so that stenosis and like adhesions are prevented.

Referring now more particularly to Figure 1, there is shown, generally, an elongated cylindrical sleeve 10 which is slidingly engaged within a knob or handle 11. A pair of needle-like conductors 17 pass through the knob, are engaged thereto, and the sleeve 10 is preferably slidingly mounted over the conductors. The sleeve 10, an inner insulating rod 19, and the handle 11 may be made of any suitable insulating material such as a phenolic condensation product, hard rubber, or similar insulating material.

The handle 11 is preferably a bottle-shaped cylinder and is provided at its outer end with a pair of parallel-extending bores 12 which extend from the outer end and part way into the handle. A pair of electrically conducting sleeves 13 are located within the bores 12 and these sleeves constitute the female portion of the connector in which the male plugs 14 of the conductors 16, shown in Fig. 2, may be inserted. Any suitable conductors and plugs may be utilized and these conductors and plugs constitute no part of my present invention except as a means of conducting current to the needles 17 of the electrode.

A pair of slots or grooves are cut in the adjacent portions of the inner ends of the sleeves 13 and the outer or lower ends of the needle-like conductors 17, whose diameters are approximately the thickness of the walls of the sleeves 13, are soldered or otherwise secured to the sleeves and in the grooves. The upper ends of these conductors are preferably sharpened as shown at 18 in order that they may be inserted into diseased areas or into such bodies as cysts, tumors and the like, and also so that they may readily make contact with the conductors of modified forms of electrodes which are shown in the drawing and which are hereinafter more particularly described.

While the sleeve 10 might readily be a solid rod slidably engaged on the conductors 17, it is preferable, from the standpoint of manufacturing efficiency, and in order that the parts of the device may be readily cleaned, that an inner rod 19 be employed for furnishing support to the conductors 17. This inner rod 19 has preferably a sliding fit within the sleeve 10 and is, of course, drilled with longitudinal bores adapted to receive the conductors 17. The insulating rod 19 covers the needles or conductors 17 from the point where they emerge into the recess in the handle 11 up to the upper end of the sleeve 10 and is glued or otherwise secured to them.

The inner rod 19 is preferably shorter than the outer sleeve in order that a cylindrical recess is provided at the inner or upper end of the electrode as at 23. The sleeve 10 preferably tapers at its upper or inner end, as shown at 22, in order that this portion of the electrode will be only slightly greater in outside diameter than the recess 23 so that a relatively smooth joint may be made between the sleeve and the parts hereinafter more particularly described.

The sleeve or stem 10, as has been explained, is slidingly engaged within the handle 11, and the relative outside diameter of the stem 10 and the inside diameter of the handle 11 is preferably such that the handle will not move on the sleeve unless it is moved by the operator.

The extent of movement of the stem 10 within the handle 11 is preferably limited. Although this result may be accomplished in several ways, I prefer to provide a groove 27 within the outer or lower wall of the stem 10 and to suitably drill the handle 11 and insert a plug 28 therein which projects into the groove 27.

The plug 28 may be of a different color from the handle and may be so aligned with the instrument that the operator may determine the exact position of the projecting ends of the conductors 17, and of the conductors of the devices herein after described, even when they are hidden from view, as in using the instrument. The dot of contrasting color furnished by the plug 28 may also be used to indicate to the operator how far the instrument has rotated or is being rotated in use.

It is apparent that movement of the stem 10 in the handle 11 will cause the conductors 17 to project to a greater or lesser extent in accordance with the position of the stem 10 in the handle, and it will be apparent from descriptions more particularly hereinafter made, that this means of controlling the conductors 17 with reference to the stem 10 by means of a handle located at the outer end of the electrode, is particularly advantageous.

The importance of the features just described becomes more apparent on consideration of the structure shown in Figure 5. This structure comprises a removable sheath 20, having a pair of parallel bores 21 extending the length thereof, in order that the sheath may be slipped on over the projecting ends of the conductors 17. The lower or outer end of the sheath is preferably cylindrical in shape and is of such a diameter that it has a relatively tight fit within the recess 23 of the

stem 10. It is apparent that if the outside diameter of the outer end of the sheath is sufficiently great that the sheath has a tight fit within the stem 10 and if the bores 21 of the sheath are slightly greater than the diameter of the conductors 17, that when the sheath is in place on the end of the stems, the conductors 17 may be moved in and out of the sheath by moving the handle 11 and the sheath will not be dislodged from the stem 10 except when the operator manually removes it.

The sheath is preferably flattened, as shown in Fig. 5, from a point close to the sleeve 10 to the upper end so as not to obstruct the line of vision to the conductor points 18 when the instrument is in use. It is apparent that the conductors or needles 17 may be completely sheathed within the sheath 20 or may be made to project from it to any desired extent.

The sheath shown in Figure 5 is preferably used for treating cysts and like tumors. If the cyst or other tumor is located within a cavity, the usual technique is to cover the ends of the needles by moving the handle 11 outwardly on the stem 10, to insert the end of the electrode in the cavity with the inner end of the sheath adjacent the part to be treated, to move the handle on the stem until the points 18 of the conductors 17 project to the desired extent from the end of the sheath, to insert the point into the tumor, to turn on the electric current for a desired period of time, and to then remove the points, slide the sheath over the points and remove the instrument from the cavity.

It is apparent therefore that the instrument may be inserted in a cavity without exposing the points of the conductors and that the points may then be uncovered to the extent desired and in accordance with the desired depth of treatment. The end of the sheath will prevent the points from projecting into the tumor to a greater extent than desired. In this way the walls of the cavity in which the instrument is used are not injured while the instrument is being inserted and removed.

In Figures 3 and 4 is shown a tip 29 in which a portion of a side as at 31 has been cut away so that when the conductors 17 are inserted in the parallel bores 32 of the tip, the conductors are exposed, but are separated by a ridge 34 of insulating material. The end of the tip 29 is slightly enlarged as shown at 33 and is preferably olive-shaped to facilitate inserting and removing the tip in narrow canals and folds. The end 33 of the tip is preferably brought up over the ends of the channels 32 in order to cover the tips and points of the conductor 17.

The bores 29 are perfectly parallel and lie in the same plane. Consequently when the conductors 17 are inserted in the bores, they, too, are parallel and lie in the same plane and therefore are equally spaced from each other throughout their exposed length. Since the path between conductors is the same distance at all points along the exposed portions thereof, electrical discharge across the gap will be substantially uniform through the entire length of the exposed portions of the conductors.

As has been stated, this tip is particularly advantageous for treating small canals, certain restricted areas, crevices and the like.

In operation the tip is inserted in the canal or other crevice and the current applied. The electrode tip may be held in one place or may be rotated or moved as desired. For an explanation of the technique of this operation, reference may be had to Fig. 9, which is an enlarged diagrammatic view of a section of the wall of a canal or the like. In treating this area, the tip would be inserted within the canal with the conductors in contact with a portion of the wall of the canal as shown at 30 and the current turned on. The electricity would flow between the two conductors and produce coagulation of the portion of the wall between the two conductors. The rest of the wall would not be affected because the electrical current would take the shortest path. After treatment of one portion of the wall, the current would be turned off, the tip rotated through 180 degrees, the current turned on and an oppositely disposed portion of the wall coagulated. The current would then be turned off and the tip removed. Two months later the coagulation operation would be repeated with the instrument applied to the two remaining untreated portions of the wall of the canal. In this way stenosis of the walls of the canal would be prevented, since the untreated portions of the wall serve to hold the treated portions away from each other until regrowth of mucous membrane is completed.

It is apparent that flat or curved areas may be treated in the same way and that accurate control of the area of treatment may readily be secured. It may readily be understood that the tip shown may be utilized on canals of substantially the same diameter as the tip, or of a materially greater diameter by moving or rolling the tip over the area to be treated.

Another form of tip is shown in Figure 6. In this form of tip, which may be termed the conical tip, a small cylindrical portion thereof, as at 36, is adapted to fit within the end of the stem 19, and another portion 37 of the tip is constructed in a tapered and curved cone shape as shown. The portion 37 is really a modified frustum of a cone in order that the blunt inner end thereof may be readily inserted in various cavities or canals which are to be treated.

A pair of auxiliary conductors 38 extend in substantial parallel relation through suitable channels 39 within the tip, out over the end of the tip, out and back along the side of the cone-shaped portion thereof and are fastened at the outer ends by inserting them in suitable radially-disposed openings 41 in the wall of the cone tip 37. Channels 32*b* are formed within the cylindrical portion 36 of the tip and extend a little more than half-way into the conical portion of the tip. It will be noticed that the bores 32*b* and 39 are not concentric but are slightly offset so that when the tips 18 of the conductors 17 are inserted in the bores 32*b*, the ends thereof are wedged into contact with the conductors 38 thereby completing electrical connections therewith.

This conical tip is well adapted for treating the walls of relatively large cavities and canals or curved areas. If, for instance, a large canal is to be treated, the cone tip may be made to contact either a certain restricted area or may be rolled or rotated about to contact larger areas or the entire area of the canal.

Another form of tip is shown in Figure 7 at 43. This form of tip is substantially of the same appearance as the sheath shown in Figure 5, but is longer and the flattened portion starts in at a distance of about one-third the length between the stem and the end of the tip. A pair of conductors 44 are molded into the upper or outer end of the tip or, if a moldable composition is not

used, the conductors 44 are glued or otherwise secured in suitable parallel, longitudinal bores 46. The conductors 44 are preferably curved and pointed at their exposed ends. Other parallel bores 47 extend from the lower or outer end of the tip into the tip and these bores communicate but are not concentric with the bores 46. The bores 46 and 47 are off-center with respect to one another in order that when the conductors 17 are inserted in the tip 43, and the tip inserted in turn in the recess 23 of the stem 10, the conductors 17 will make electrical contact with the conductors 44.

This form of tip is of particular advantage in the coagulation of tonsils, and like bodies. The curved, pointed ends of the conductors 44 may be inserted into the tonsil and the current turned on for a selected period of time to coagulate the tonsil as desired. The instrument shown in Figure 1 may be used just as readily with this form of tip as with the others and therefore constitutes an instrument which may be used for the coagulation of tonsils as well as coagulation of other portions of the anatomy.

Still another form of tip is shown in Figure 8 at 51. This tip 51 is of substantially the same shape and appearance as the tip 43 except that the conductors 52, instead of being curved and sharpened as shown in Figure 7, are bent at an angle of about 30 degrees with reference to the plane of the flattened portion of the sheath and are blunt at the ends thereof. The conductors 52 are embedded or secured within the end of the tip in the same manner as the conductors 44, and parallel bores 47 within the tip permit the conductors 17 of the stem 10 to be inserted therein, to make electrical contact with the conductors 52.

This tip may be used for the treatment of the outer walls of bulbous bodies such as the external walls of the cervix. In treating bodies of this type the parallel ends of the conductors 52 are placed against a portion of the outer wall of the body to be treated, the current turned on, and the instrument rotated to cause the conductors to successively contact areas on the outer wall as desired.

It is apparent that with my invention it is possible to treat almost any type or size of affected areas whether they be in a plane, curved, or the walls of canals and other cavities. Devices constructed according to my invention may be used to treat tonsils, tumors, cysts and the like. Still other embodiments of my invention may be used for treating bulbous bodies of various kinds. It is apparent that the device may be readily adjusted while it is being used or during insertion and removal of the instrument so that the conductors may be fully or partly exposed or may be entirely concealed. It will be readily understood that the device will find many new uses and may be modified as desired.

Such modifications as may be made by those skilled in the art may be made without departing from the spirit and scope of my invention as set forth in the appended claims.

I claim as my invention:

1. A surgical instrument for electrical treatment comprising a handle and a stem portion of insulating material, conductors secured to the handle portion and extending through the stem portion, the stem being slidable within the handle portion whereby the length of the uncovered portion of the conductors may be regulated from the handle end of the instrument, and the stem having a groove located beneath the handle and the handle having a projection extending into the groove whereby the motion of the stem within the handle may be limited.

2. In a surgical instrument for electrical treatment comprising a stem portion and electrodes located within the stem and extending therefrom, a tip of insulating material adapted to be fastened to the stem and provided with channels for the reception of the conductors, and the tip being cut away so as to expose the channels and the conductors through a selected intermediate portion of their length.

3. In a surgical instrument for electrical treatment comprising a stem portion and electrodes located within the stem and extending therefrom, a tip of insulating material adapted to be fastened to the stem and provided with channels for the reception of the conductors, the tip being cut away so as to expose the channels and the conductors through a selective portion of their length, and the end of the tip being brought up in a knob adapted to cover the ends of the conductors when they are in place in the channels.

4. In a surgical instrument a stem portion, electric conductors associated with the stem, a cone-shaped tip of insulating material adapted to be fastened to the stem, and electrical conductors mounted on the outside wall of the cone-shaped tip and adapted to make contact with the conductors of the stem.

5. In a surgical instrument a stem, electrical conductors associated with the stem and extending from the end thereof, a tip of insulating material adapted to be fastened on the end of the stem and provided with channels therein which are exposed at portions thereof in order to receive the exposed ends of the conductors and to expose them along suitable portions of the tip.

6. In a surgical instrument of the character described, a stem, electrical conductors associated with the stem and extending therefrom, a cone shaped tip of insulating material adapted to be fastened on the end of the stem and provided with channels adapted to receive the exposed ends of the conductors, and other electrical conductors associated with the tip and adapted to make contact with the first named conductors when the tip is in place on the stem.

7. In a surgical instrument adapted for use in electrical treatment, a handle portion, a stem portion located within the handle portion and slidably engaged therein, conductors fastened to the handle portion and extending through and beyond the stem portion, and a removable sheath of insulating material adapted to fit over the exposed portions of the conductors in such manner that when the sheath is fully in place the conductors project therethrough and to be engaged on the stem whereby the conductors may be moved in the sheath by the handle to cause them to be exposed, partly exposed, or sheathed as desired.

8. In a surgical instrument for electric treatment, a stem, conductors located within the stem and extending therefrom, a cone-shaped tip of insulating material adapted to be located over the exposed ends of the conductors and to be removably attached to the stem, and conductors extending along the outer wall of the cone-shaped tip and into the inner portion thereof to make contact with the first named conductors when the tip is in place on the stem.

9. In a surgical instrument for electric treatment, a stem, conductors associated with the stem and extending therefrom, a tip of insulating

material adapted to be fastened on the stem over the exposed ends of the conductors and having its own conductors which are adapted to make contact with the first named conductors, the second named conductors being extended over the outside wall of the tip and the tip being cone-shaped but being also curved along the side walls thereof in longitudinal section in order that the tip may be used to treat areas which are curved in both directions.

10. In a surgical instrument for electric treatment, a stem, conductors associated with the stem and extending therefrom and a tip of insulating material adapted to be fastened on the stem over the exposed ends of the conductors and having its own conductors which are adapted to make contact with the first named conductors, the second named conductors being extended from the end of the tip and being curved and pointed in order that they may be used for the coagulation of tonsils, tumors and bulbous bodies.

11. In a surgical instrument for electric treatment, a stem, conductors associated with the stem and extending therefrom and a tip of insulating material adapted to be fastened on the stem over the exposed ends of the conductors and having its own conductors which are adapted to make contact with the first named conductors, the second named conductors being extended from the end of the tip in parallel flat relationship and at an angle with reference to the plane of the conductors within the tip in order that the instrument may be used for the treatment of outside walls of bulbous bodies.

12. In a surgical instrument for electric treatment, a stem, conductors associated with the stem and extending therefrom, and a tip of insulating material adapted to be removably engaged on the stem over the exposed ends of the conductors, the tip having a pair of parallel-extending channels therein and a portion of the side of the tip being cut away to expose the conductors when they are located in the channels, part of the remaining material of the tip constituting a ridge of insulating material between the conductors, to insure the electrical current passing through the area to be treated and not directly between the electrodes.

WILLIAM J. McFADDEN.