May 21, 1929. N. H. LOWRY ET AL 1,713,970

MEDICAL ELECTRODE

Filed June 17, 1925

Fig. 1.

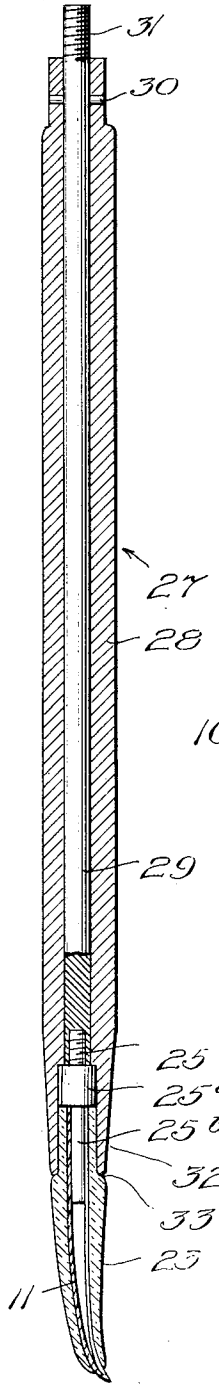


Fig. 2.

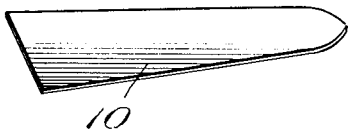


Fig. 3.

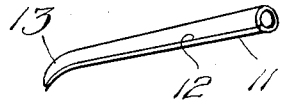


Fig. 4.

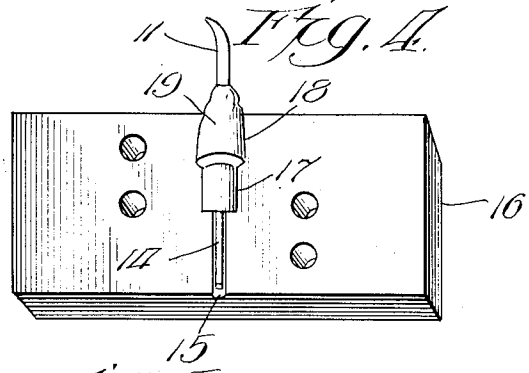


Fig. 6.

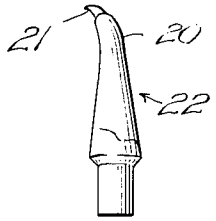


Fig. 5.

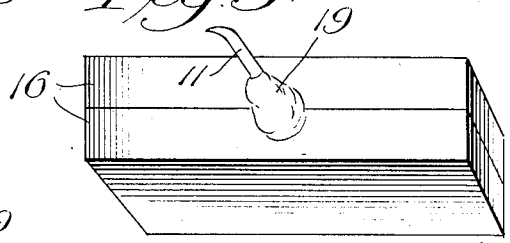
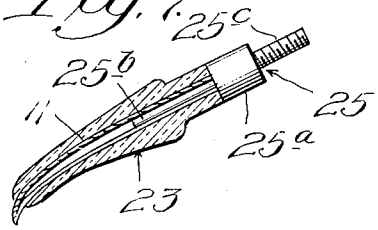


Fig. 7.



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UNITED STATES PATENT OFFICE.

NELSON H. LOWRY AND LLOYD F. MEGAW, OF CHICAGO, ILLINOIS.

MEDICAL ELECTRODE.

Application filed June 17, 1925. Serial No. 37,622.

This invention relates to improvements in medical electrodes and its purpose is to provide an improved electrode adapted particularly for use for electro-dissection, or the cutting of tissue or bone, by means of high frequency oscillatory currents, as in the apparatus described and claimed in the co-pending application of Nelson H. Lowry, Serial No. 732,532, filed August 16, 1924.

The principal object of the invention is to provide a durable electrode of improved structure which will be capable of withstanding the severe conditions which are encountered in service. In the cutting of bone or tissue by means of high frequency oscillatory currents in surgical work, some chemical action takes place at the instant of cutting and various organic acids are produced in the nascent state. The temperatures at the point at which cutting occurs vary violently within fairly wide limits. It is essential that the electrode be able to withstand the temperature variation as well as the presence of the organic acids. A further important requirement is that the electrode be so designed that only a very small area of conducting material is exposed, the remainder of the conducting material being covered with insulating material, so that the electrode can be caused to reach the point where cutting is to occur without causing a dissection of the tissues at other points. The present invention satisfies the foregoing requirements by providing an improved electrode capable of withstanding the high temperatures and presence of acids and having also, embodied therein, insulating material of high dielectric strength capable of withstanding the pressures of the high frequency oscillatory currents employed with this kind of surgical apparatus. Other objects and advantages of the invention relate to various features of construction and arrangement which will appear more fully hereinafter.

The nature of the invention will be understood from the following specification taken with the accompanying drawings in which one embodiment is illustrated. In the drawings, Figure 1 shows a longitudinal axial section through the improved electrode; Fig. 2 shows a perspective view of a metal plate from which the tip of the electrode is formed; Fig. 3 is a perspective view of the tip of the electrode formed from the plate illustrated in Fig. 2; Fig. 4 is a perspective view showing a portion of the mold by which insulating material is applied to the electrode; Fig. 5 is a perspective view of the complete mold showing the electrode and insulating material projecting therefrom; Fig. 6 shows a side elevation of the electrode after the insulating material has been applied thereto, and Fig. 7 shows a longitudinal section through the tip of the electrode illustrated in Fig. 6.

The blade or terminal of the electrode is formed separately from a sheet of suitable metal or alloy, such as platinum. The platinum plate should preferably be relatively thin, for example, about 5/1000ths of an inch, and a triangular sheet 10 is cut therefrom, as illustrated in Fig. 2. The shape of this sheet 10 will of course vary with the shape of the terminal or blade to be formed. After cutting the triangular sheet, it is operated on by means of suitable dies to put it into the form of a hollow tapered blade or tube 11, as shown in Fig. 3. The edges of the plate meet to form a seam 12 along one edge of the blade or terminal and the tip 13 is bent or curved transversely to the axis of the tube, the part 13 forming the surface or terminal from which the oscillatory discharge takes place during the cutting operation. It has been found that additional stiffness may be imparted to the cutting point by using a metal sheet 10 consisting of an alloy of iridium and platinum, containing 30 per cent of iridium. The hollow blade or terminal 11 is adapted to withstand variations in temperature without cracking or injurying the surrounding enamel or insulating material and a blade or terminal of this form is therefore preferably used instead of a solid member. If desired, the joint 12 of the tube 11 may be fused to form a continuous cylinder or tube.

The tube 11 is then placed on a centering pin 14 which is mounted in the grooves 15 of two complementary mold members 16. The grooves 15 in the complementary mold member communicate with other grooves 17 adapted to form a cylinder and the grooves 17 communicate with other enlarged grooves 18 adapted to form a substantially cylindrical but slightly tapered body when the material to be molded is placed in the cavities of the mold. When placed on the centering tip 14, the blade 11 extends from the lower end of the grooves 17, as illustrated in Fig. 4, upwardly beyond the edge of the mold, the cavity 18 opening at the edge of the mold.

After the mold members are in place, the cavity of the mold is filled with high fusing porcelain of the variety commonly employed in the construction of porcelain dentures. This porcelain is used in the form of a paste made by mixing the powdered porcelain with water and also preferably with a small amount of starch. After filling the mold cavity with the paste, it is carefully tamped down and the entire mold together with the tube or blade 11 is then placed in an oven and brought up to a temperature of approximately 350 to 400 degrees Fahrenheit. This temperature is sufficient to harden the starch binder so that the molded porcelain 19 can be handled without falling apart. The insulated tip having some insulation projecting beyond the mold, as illustrated in Fig. 5, is then removed from the mold, and put in an oven where its temperature is brought up to a point preferably between 2100 degrees and 2500 degreese Fahrenheit depending upon the grade of porcelain used, thus fusing the porcelain into a monogeneous mass. When the insulated tip having the form illustrated in Figs. 4 and 5 has been thus fused at a high temperature, it is cooled and after cooling additional porcelain is added, using a different grade of porcelain which will fuse at a lower temperature so that its surface may be highly glazed without warping or destroying the shape of the molded insulating base 19 beneath. The additional porcelain is brought out nearly to the tip or extreme end of the tube or blade 11, as shown at 20 in Fig. 6, thus leaving only a small projecting metal tip or terminal 21 exposed. After adding the additional porcelain, the tip 22 having the form shown in Fig. 6 is again placed in the oven and brought to a temperature that will fuse the newly applied porcelain, preferably a temperature ranging between 1800 degrees and 2300 degrees Fahrenheit.

The porcelain base applied as shown in Fig. 4 and the additional insulating sheath applied as illustrated in Fig. 6 amalgamate to form a single insulating sheath or covering 23 having the cross-sectional form illustrated particularly in Fig. 7. This insulating sheath has a highly glazed finish and is substantially resistant to all known acids except possibly hydrofluoric acid and aqua regia. This insulating sheath has a high dielectric strength and has approximately the same coefficient of linear expansion as the platinum or platinum alloy tubing forming the blade or terminal 11 so that the cracking of the insulating sheath on account of temperature changes is prevented.

The insulated tip 22 is mounted on a supporting member 25 comprising a cylindrical block 25^a having substantially the same diameter as the adjacent end of the insulating sheath 23, this block having projecting therefrom a pin 25^b and a screw 25^c. The pin 25^b is adapted to fit closely the bore of the tube or blade 11 and is held therein in any desired way as, for example, by silver soldering. The assembled device as illustrated in Fig. 7 is then ready for application to the handle 27 of the electrode which preferably has the form illustrated in Fig. 1. The handle 27 comprises a hollow tube 28 formed of bakelite or other suitable insulating material, having mounted therein a conducting rod 29 provided at one end with a threaded recess adapted to receive the threaded screw 25^c of the supporting member 25. The rod 29 is held in place in the insulating handle 28 by means of a transverse pin 30 and is threaded at its upper end as shown at 31 for connection with an electric conductor leading from one terminal of the high frequency apparatus. The lower end of the insulating tube or handle is slightly tapered as shown at 32 and the lower end thereof is adapted to abut against the shoulder 33 formed at the upper end of the enlarged portion of the insulating sheath 22, the upper end of the insulating sheath and the supporting member 25 being located within the insulating handle 28.

Although we have shown and described a particular embodiment of the invention by way of illustration, it will be understood that the invention may be constructed in various other forms within the scope of the appended claims.

We claim:

1. In a medical electrode, a conductor, and insulating material having a high fusing temperature surrounding said conductor, the coefficient of linear expansion of said conductor being substantially the same as the coefficient of linear expansion of said insulating means.

2. In a medical electrode, a hollow conductor tapered to a discharge point at one end, and insulating means surrounding the hollow portion of said conductor, the coefficients of linear expansion of said conductor and said insulating means being substantially equal.

3. In a medical electrode, a conductor having a hollow portion and an operating point, and insulating means surrounding the hollow portion of said conductor leaving said operating point only exposed.

4. In a medical electrode, a terminal conductor, and insulating means surrounding said conductor and leaving one extremity thereof exposed, said exposed portion of said conductor being formed of non-corrodible metal, said conductor and said insulating material having substantially the same coefficient of linear expansion.

5. In a medical electrode, a conductor having a tip formed of an alloy of iridium and platinum, and insulating means surrounding said conductor and leaving said tip exposed.

6. In a medical electrode, a conductor of tapered tubular form having an operating

point, and insulating material molded and baked around said conductor leaving said point exposed.

7. In a medical electrode, a conductor having a tapered platinum tubular tip arranged with a flattened end, and insulating means molded and baked around said conductor leaving said flattened end exposed, the coefficient of linear expansion of said tubular tip being substantially the same as that of said insulating means.

8. In a medical electrode, a tubular terminal conductor having a tapered end, a supporting member having a pin extending into the other end of said conductor, insulating material surrounding said conductor and leaving the tapered end only thereof exposed, and means for connecting said supporting member in an electrical circuit.

9. In a medical electrode, an operating blade having a tapered point, insulating material surrounding said blade and leaving said point exposed, a supporting member connected to said blade, an insulating handle having a part surrounding the body of said supporting member and a portion of said insulating means, and a conducting rod mounted in said handle and connected to said supporting member.

10. In a medical electrode, an insulating sleeve forming a handle, a conductor mounted in said sleeve, a separate conducting tip projecting from said sleeve, means for attaching said tip to said conductor, and insulating means secured on and surrounding said tip leaving the extremity thereof exposed.

11. In a medical electrode, an insulating sleeve forming a handle, a conductor mounted in said sleeve, a platinum operating tip connected to said conductor, and a porcelain insulating sheath extending into said sleeve and surrounding said platinum operating member leaving the extremity thereof exposed.

12. In a medical electrode, a conductor having means for forming an electric connection at one end thereof, an insulating sleeve surrounding said conductor and having a recess at the end of said conductor, a hollow terminal conductor tapered toward a sharp point at one end, insulating material having a high fusing temperature molded and baked around said terminal conductor to form an insulating coating leaving the tip of said sharp point exposed, a supporting member having an external surface forming a continuation of said insulating coating and adapted to be fitted in said recess with a portion of said insulating coating at the large end of said terminal conductor, and means for forming a connection between said supporting member and said terminal conductor and between said supporting member and said first named conductor.

13. In a medical electrode, a conductor having means for forming an electric connection at one end thereof, an insulating sleeve surrounding said conductor and having a recess at the end of said conductor, a hollow terminal conductor tapered toward a sharp point at one end, insulating material having a high fusing temperature molded and baked around said terminal conductor to form an insulating coating leaving the tip of said sharp point exposed, a supporting member having an external surface forming a continuation of said insulating coating and adapted to be fitted in said recess with a portion of said insulating coating at the large end of said terminal conductor, and means for forming a connection between said supporting member and said terminal conductor and between said supporting member and said first named conductor, said insulating coating on said terminal conductor having an annular shoulder at the end of said insulating sleeve and being tapered to form a continuation of the outer surface of said sleeve.

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