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ELECTRODE

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FIG. 1

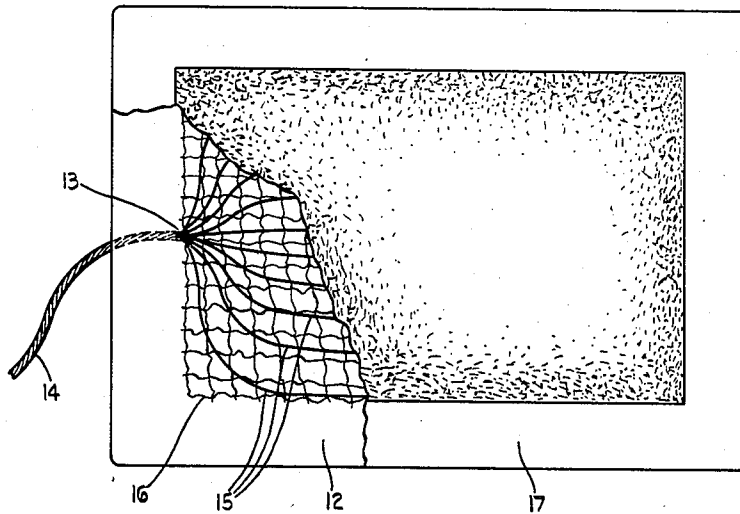
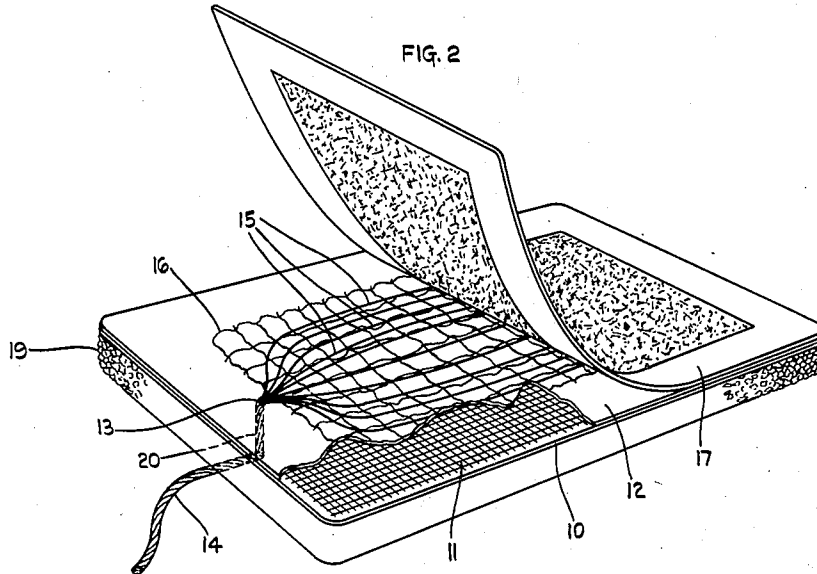


FIG. 2



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ELECTRODE

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3 Claims. (Cl. 174—89)

The present invention has to do with an electrode and a method for its production. It relates particularly to diathermy in that one of the products of the invention may be used as an electrode for the application of diathermy or other electric current.

The utility of diathermy upon the human body has been recognized with considerable force. The reasons for its rapid advance have been improvement in electrodes and a better understanding of methods for its application.

Until the present invention, however, no wholly satisfactory means for applying a diathermic current directly to the human body had been found. Metal electrodes have been proposed. These are excellent conductors but have the defect of not evenly contacting the surface of the body covered thereby. Relatively thin non-flexible metal electrodes have been fairly efficient but such electrodes are difficult to manipulate and after several applications cease to be capable of uniform spreading over the treated area.

None of the electrodes heretofore proposed has possessed the flexibility which is necessary to obtain a uniform distribution of current over the treated area. The present invention overcomes this difficulty as well as the others which have confronted the operator.

The objects of the present invention, among others, include:

A new and improved electrode;
Novel means for producing an electrode; and
A highly flexible but substantial electrode having insulation at one side and a current distributing surface at the other side, the electrode being deformable to meet any configuration of the surface to be treated to establish a uniform flow of current thereto and being deformable indefinitely without losing efficiency.

These objects, and such other objects as may hereinafter appear, are obtained by the novel construction and combination of parts, and by the unique method whereby the electrode is fabricated.

One form of the invention is illustrated in the accompanying drawing which is hereby made a part of this application and in which:

Figure 1 is a plan view of an electrode embodying the subject matter of the invention taken from above, the various laminations thereof being illustrated fragmentarily at one corner thereof; and

Figure 2 is an exploded perspective view of the device shown in Figure 1.

Like reference characters are used to designate similar parts in the drawing and in the description of the invention which follows.

In the production of the electrode hereinabove referred to and illustrated in the accompanying drawing, it is usual to obtain a suitable sheet to which pure gum rubber will not adhere. Upon that sheet is placed a layer 10 of pure gum rubber. Over such layer of pure gum rubber, ordinary surgical gauze 11 is disposed. Thereabove, a second layer 12 of pure gum rubber is spread.

A perforation 13, or more than one if desired, is formed in the supporting sheet and through the laminations of gum rubber and gauze. Through such perforation or aperture, a length of conducting cable 14 is inserted. The conducting wires 15 of the cable 14 are separated one from another and are spread, in fan-like formation, upon the sheet of the pure gum rubber 12. Thereafter, a coarse network of woven copper wire cloth or the like 16 is spread over the wire strands and pressed into the pure gum rubber 12 therebeneath.

At this stage of fabrication, the several elements of the pad so far assembled are vulcanized following their detachment from the sheet on which the layer 10 was spread. The vulcanization preferably is partial. The next stage of production is that of placing a border on the pad and covering the remainder of the pad with the current conducting material.

The edges of the pad are next treated with a pure gum rubber ribbon 17 approximating 1/64 of an inch thick. Subsequently, a mixture of vulcanizable cement and selected proportions of fine and coarse metallic powder is spread over the mesh within the borders of pure gum rubber to provide conductive layer 17. The whole assembly is allowed to set from 8 to 12 hours and subsequently is vulcanized.

When complete vulcanization has been had, the sheet 10 is treated with a rubber cement and a layer of sponge rubber 19 of suitable thickness is applied thereto. The conducting cable 14 may project through an aperture 20 in the sponge rubber, the aperture being arranged to register with aperture 13. If preferred, the cable may be kept between the vulcanized pad and the sponge rubber back. The vulcanizing cement, before its application to the pad, should be thoroughly mixed with the particles of metal, the proportion of fine to coarse particles and the strength of the metallic particles to the cement

varying with the intensity and character of the current desired.

Such an electrode provides for an even distribution of electric current. The fan-like spread of the conducting wires 15 transmits its current over a wide area through the agency of the copper mesh 16 which is spread over the strands of wire. Even distribution is had even though the meshes of the wire 16 may be broken in numerous places for the channels for flow of the current are numerous, and contact wires 15 at many places. There will be opportunity for distribution of the current by the many courses the mesh provides by contact with the plurality of wire strands spread in fan-like formation. The result will generally be found to be quite regular distribution.

To aid in further even distribution, the strands of the mesh engage numerous of the coarse and fine grains of metal embedded in the vulcanizing cement transmitting electric energy thereto. Such particles are in physical contact one with another to a certain extent, so that the outer surface of the electrode comprises a great number of metallic particles, some thinly coated and others without coating, each of which is charged by the electric current fed into the pad.

So far as is now known, there is no superior method for distributing diathermic current than that here illustrated and described. Such construction permits of ready bending of the electrode to perform with uneven anatomical contour of the part to be treated without impairing the conductivity of the electrode. In this way, a uniform distribution of current is assured and the possibility of burning the patient due to high intensity of current is thereby reduced.

The body of the electrode, including the metallic granular portion thereof, comprises vulcanizing cement of a highly flexible nature with a sponge rubber back member of an equally flexible nature. It is possible with such an electrode to reach any surface upon the human body to which diathermic or other electric current may be applied irrespective of the irregularities of the area treated, or the promontories thereon or depressions therein. During treatment the hand of the operator may be used to press the electrode into engagement with the area undergoing treatment. Likewise, the pad may be bandaged into position. Because of the compressibility and flexibility of the electrode body, the metallic particles may be made to cover effectively any area over which the device may be spread.

An electrode embodying the invention may be of any selected configuration or of any desired size and the thickness of the protective pad may be varied at will.

The copper mesh which is ordinarily employed and which has been employed with success, is one-eighth to one-quarter inch; the fine metallic powder is one-tenth millimeter or less in major transverse dimension; the course metallic powder is two-tenths millimeter or more in major transverse dimension; and the metallic substance generally used is bronze.

The mixture of fine powder and coarse powder may be in varying proportions. However, a mixture of equal parts of one with the other has proved highly successful.

What is claimed as new and is desired to be secured by Letters Patent of the United States is:

1. An electrode comprising a generally flat body, said body having a flexible non-conductive lamination to which is secured a flexible conductive laminated structure, said conductive structure comprising a lamination of wires spread in fan-form over the non-conductive lamination of said body, a second lamination in the form of a latticed conductive sheet contracting said wires, and a third lamination comprising cured flexible rubber having admixed therewith a quantity of coarse and a quantity of fine conductive particles, certain of said particles having exposed sections at the outside of said electrode and contacting a chain of other of said conductive particles to provide an unbroken conductive circuit extending from said latticed sheet.

2. An electrode comprising a flat body having an electrically conductive side and an insulated side, said insulated side comprising a sheet of highly flexible compressible material, and said conductive side comprising a plurality of flexible wires extending in fan-like arrangement from a conductor and in a flat plane, a flat sheet of flexible woven conductive material in electrical contact at numerous points with said wires and co-extensive with the useful area of the electrically conductive side of said electrode, and a lamination of a heterogeneous moisture free material at the exterior of said conductive side and comprising in part conductive substances in the form of particles of two different sizes and in part a moisture proof, elastic, coherent dielectric, the lamination comprising said heterogeneous material extending at one of its sides into and completely covering said conductive woven sheet and the particles of conductive material being evenly distributed through the moisture proof, flexible dielectric and in sufficient proportion to the coherent dielectric to provide a large number of evenly distributed paths for electrical current through such coherent dielectric and including said wires, said woven material, and a chain of contiguous particles of said conductive material.

3. An electrode comprising a flat body having an electrically conductive side and an insulated side, said insulated side comprising a sheet of highly flexible compressible material, and said conductive side comprising a plurality of flexible wires extending in fan-like arrangement from a conductor and in a flat plane, a flat sheet of flexible woven conductive material in electrical contact at numerous points with said wires and co-extensive with the useful area of the electrically conductive side of said electrode, and a lamination of a heterogeneous moisture free material at the exterior of said conductive side and comprising in part conductive particles and in part cured rubber, the lamination comprising said heterogeneous material extending at one of its sides into and completely covering said conductive woven sheet and the particles of conductive material being evenly distributed through the cured rubber and in sufficient proportion to the cured rubber to provide a large number of evenly distributed paths for electrical current through such cured rubber and including said wires, said woven material, and a chain of contiguous particles of said conductive material.

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