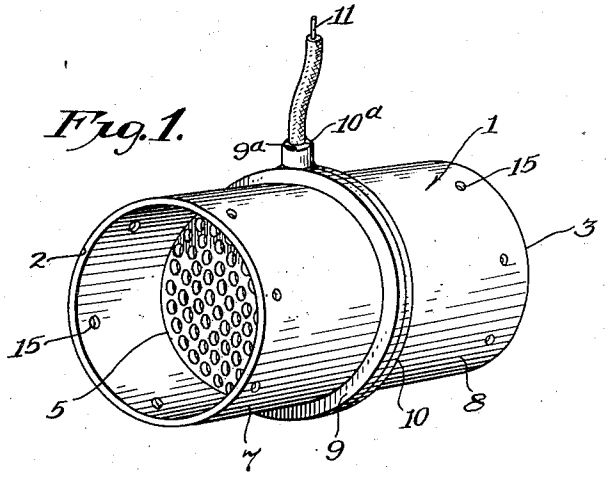
Sept. 20, 1938. E. J. ROSE 2,130,759

ELECTRODE FOR DIATHERMY TREATMENT

Filed Dec. 11, 1937 2 Sheets-Sheet 1

Fig. 1.



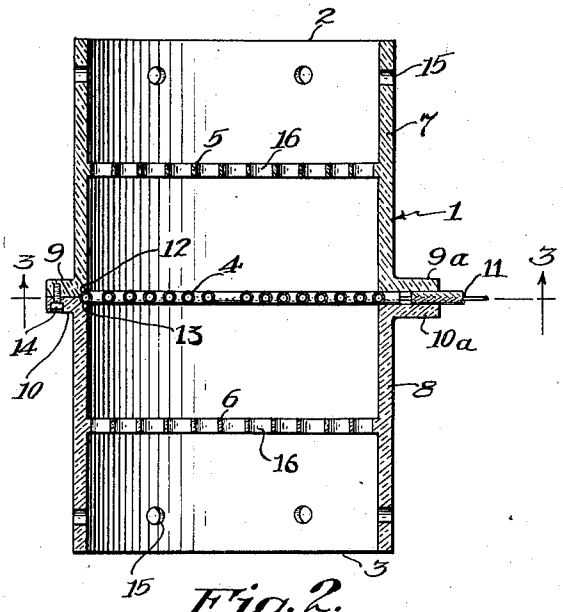


Fig. 2.

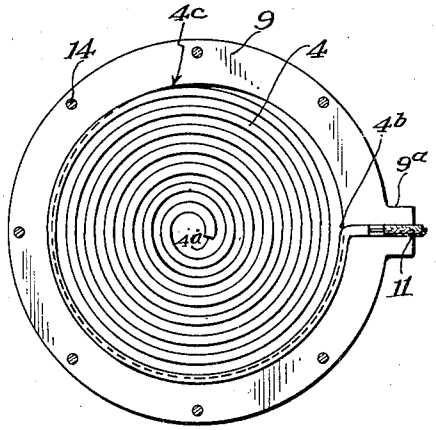


Fig. 3.

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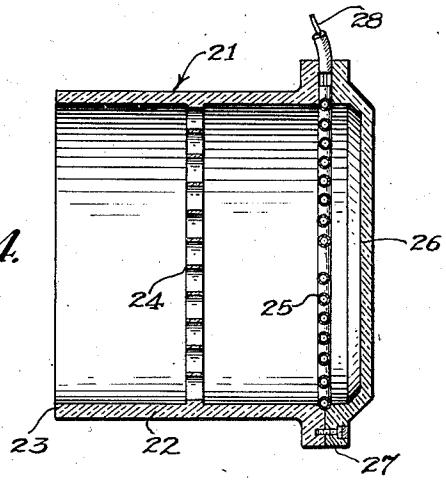

Fig. 4.

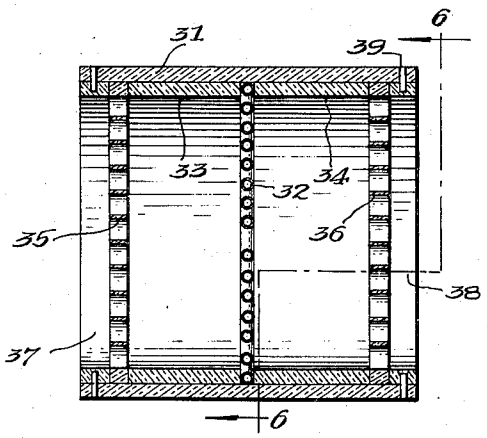

Fig. 5.

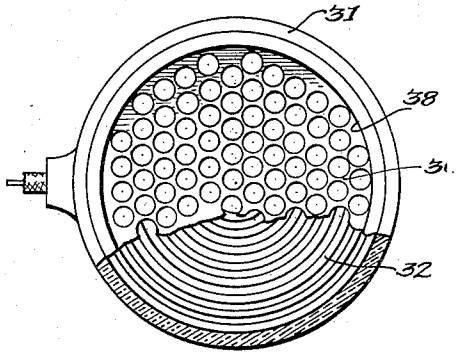

Fig. 6.

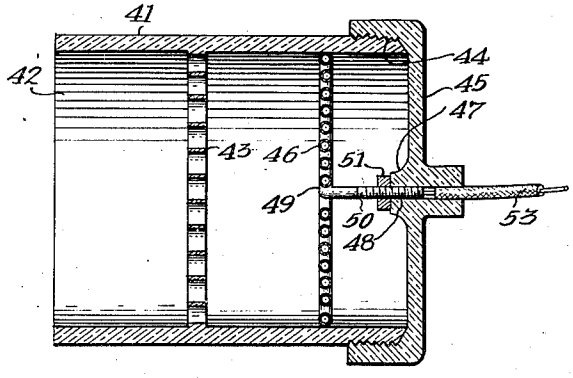

Fig. 7.

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2,130,759

ELECTRODE FOR DIATHERMY TREATMENT

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Application December 11, 1937, Serial No. 179,323

6 Claims. (Cl. 128—413)

This invention relates to diathermy apparatus and pertains particularly to an advantageous form of treatment electrode which may be associated with a suitable source of high frequency electrical energy to produce heating of the body tissues.

This application is a continuation-in-part of my copending application Serial No. 24,493, filed June 1, 1935, and is directed particularly to an advantageous form of electrode unit employing an electrode of the type disclosed therein.

Another object of the invention is to provide such an electrode in which there is a minimum amount of energy-consuming dielectric material between the patient and the electrode element.

Another object of the invention is to provide a diathermy treatment electrode which may be handled with impunity and which maintains a given air spacing between the patient and the electrode element.

Another important object of the invention is to provide a diathermy treatment electrode which is well insulated and is so constructed as to prevent a patient from coming in contact with its metallic parts.

Another object of the invention is to provide a diathermy treatment electrode which may be simply and inexpensively constructed and easily repaired.

Other objects and advantages of the invention will either be specifically brought out in the following description or will be apparent therefrom. Referring to the drawings:

Fig. 1 is a perspective view of a diathermy treatment electrode according to my invention;

Fig. 2 is a longitudinal cross-section thereof;

Fig. 3 is a transverse section thereof taken on line 3—3 in Fig. 2 with the electrode element in elevation;

Figs. 4 and 5 are longitudinal sections of modified forms of the device;

Fig. 6 is a partly sectional end elevation taken on line 6—6 in Fig. 5; and

Fig. 7 is a longitudinal section of a further modified form of the device.

The diathermy treatment electrode of this invention may comprise an elongated casing having a treatment end which is adapted to be disposed in close engagement with a body member undergoing treatment. A metallic electrode member is disposed within the casing at a position removed from the treatment end and is insulated therefrom, and a protecting partition is positioned adjacent the treatment end at a position intermediate the treatment end and the electrode member in protecting relation to the electrode member so as to restrict manual access to said member through the treatment end. The electrode member may comprise an electrical conductor wound in substantially flat spiral form and having an open end, and is preferably arranged transversely of the casing so that the axis of the spiral electrode extends substantially in the direction of the length of the casing. The spiral electrode member is associated with one side of a source of high frequency energy through an insulated conductor which is connected to a spiral conductor at one point only. The construction of spiral electrode members and the modes of connection thereof are disclosed and claimed in said copending application, and the electrode member of the present disclosure may be any of the types disclosed therein.

Referring particularly to Figs. 1 through 3, the diathermy treatment electrode of this invention is shown as comprising an elongated cylindrical casing 1 provided with open ends 2 and 3, either or both of which may constitute treatment ends, and with an electrode element comprising a spiral conductor 4 extending transversely of the casing 1 and arranged with its axis extending substantially in the direction of the length of the casing 1. The casing 1 further comprises perforated partitions 5 and 6 which are arranged intermediate the electrode member 4 and the respective ends, and in protecting relation to said electrode member.

The casing may comprise a pair of cylindrical portions 7 and 8 provided with flanges 9 and 10, respectively, which may be used to join the two portions together. The casing portions and the partitions may be of any suitable material, preferably insulating. For example, the portions 7 and 8 may be molded from "Bakelite" or other comparable material and the partitions 5 and 6 carried thereby molded integrally with these portions to obviate the necessity of separate mountings for these partitions.

The partitions 5 and 6 are preferably constructed so as to provide a minimum quantity of dielectric material in the electrode field, and thus maintain the electrical losses from such source at a minimum. Where the partitions are formed integrally with the casing portions, as shown in Figs. 1 to 3, such partitions may be perforated as at 16, to accomplish this desired end, the size of the perforations being such as to restrict manual access to the electrode 4, in view of the fact that the prime function of such partitions is that of protecting the patient or user from coming in contact with such electrode.

The electrode element 4 may be open at its inner end 4a and may be connected to an electrical conductor 11 at its outer end 4b, which conductor may be associated with one side of a source of high frequency energy. The casing portions 7 and 8 may be provided with recesses 12 and 13 at their abutting ends, which cooperate to form a channel for positioning the spiral conductor 4; and in this connection, the outer

turn of this conductor may be made substantially circular in configuration for somewhat more than one-half turn, as from 4b to 4c in Fig. 3, which substantially circular portion will extend in close engagement with the channel formed by the recesses 12 and 13. The flanges 9 and 10 may be extended as at 9a and 10a to form a boss to hold the insulated conductor 11 and the end 4b of the spiral conductor from rotation and at the same time prevent manual contact with the end 4b. Screws are shown at 14 for holding the portions 7 and 8 in engagement with one another.

In practice, the devices may be used in pairs and the conductors 11 each connected to the respective sides of a source of high frequency energy, and each of the devices disposed with a treatment end against the body member which is undergoing treatment. During treatment the patient's body will become heated and the skin adjacent the treatment end of the electrode will usually perspire so that considerable moisture will be present. These drops of moisture may form local circuits and become heated sufficiently to cause painful burns when the electrode element 4 is in close proximity to the skin, especially when high frequency currents having a frequency on the order of 100 megacycles are employed. By mounting the electrode element as shown, with both the protective partition and the element removed from the skin, this type of burning is prevented. The casing 1 may be provided, if desired, with suitable ventilation means, as by providing perforations 15 in the casing adjacent the treatment end which cooperate with the perforations 16 in the protective partitions, so that air may enter the casing at 15 and pass upwardly through the partition 5, the electrode element 4 and outwardly through the partition 6. In order to obviate the possibility of body contact with the partitions 5 and 6, I prefer to remove them for a short distance within the casing. The perforations indicated at 16 in the partition 5 should be as large as possible to allow free air circulation, and should be small enough to prevent manual access to the electrode element 4, as above brought out, so that an individual cannot come in chance contact with the element 4 and may handle the treatment electrode with impunity.

It is conceivable that the partitions 5 and 6 may be formed of metal and protected by a suitable insulating cover such as varnish. However, they will be heated rapidly and will absorb considerable energy, and it is for this reason that I prefer to use a dielectric material which has a minimum of dielectric loss and to interpose as small an amount as practicable of any material between the treatment end and the electrode element. It will be appreciated that a thin membrane of dielectric material may be substituted for the perforated partition, in which case it may be advantageous to provide additional perforations in the casing to allow access of air between the protecting partitions and the electrode element. Exposed metal parts should be avoided where possible since such bodies become charged in a high frequency field and are liable to cause high frequency burns when touched, and for this reason the screws 14 may be set in recesses and covered with suitable insulating material such as wax.

Referring to Fig. 4, a diathermy treatment electrode having a single treatment end is indicated generally at 21 and is shown as comprising an elongated, substantially cylindrical casing 22 which may correspond to either one of the casing portions 7 or 8 of Figs. 1 to 3, and is provided with a treatment end 23, a perforated protecting partition 24 and a spiral electrode member 25. A protecting partition or cover is provided at 26 at the end of the casing removed from the treatment end and may be held to the casing by means of screws 27 in the same manner as the two portions 7 and 8 are held together. The partition 26 may be made from suitable insulating material and may be perforate or imperforate. A conductor 28 is shown connected to the outer end of the spiral electrode 25 and the inner end thereof is open. It should be noted that in a simple form of the diathermy treatment electrode the protecting partition 26 may be omitted, especially if some form of clamping or supporting device is associated with the electrode for holding the same in engagement with a patient.

In Figs. 5 and 6 I have shown a diathermy treatment electrode which may be assembled from parts which are easily obtainable. This electrode is shown as comprising an outer casing 31 of suitable material, such as "Bakelite" or fiber tubing, for example, within which is disposed a spiral electrode 32. Two short lengths of similar tubing are shown within the outer casing 31 and at opposite sides of the spiral electrode 32 at 33 and 34 and serving as spacer members. Partitions 35 and 36 are shown mounted within the casing 31 and abutting the spacing members 33 and 34 respectively. The whole assembly is then held in position by short tubular end pieces 37 and 38 which may be fastened in place through the agency of insulating dowel pins or the like, extending through outer casing 31 as at 39.

Referring to Fig. 7, an advantageous embodiment of my invention is shown as comprising a substantially cylindrical casing 41 having a treatment end 42 and provided with a perforated partition 43 which is located at a position removed from the treatment end. The other end of the casing 41 is provided with threads as at 44, and an end partition 45, on which is mounted spiral electrode member 46, is shown in threaded engagement with the casing 41.

The end partition 45 may be provided with a boss which is provided with a threaded bore 48 within which an extension 50 of the inner end 49 of the spiral electrode member is threadedly disposed. A lock nut 51 is shown in engagement with the threaded portion of the electrode member and with the inner end of the boss 47. An insulated conductor, shown at 53, extends into the boss 47 and is connected to the end of the spiral electrode. In assembling the device, the conductor would be connected to the end of the spiral electrode and the electrode would then be mounted on the end partition 45, after which the end partition would be screwed in place on the casing 41.

The side walls of the casing 41 may be provided with perforations if desired, and it is to be understood that in any of the above-described embodiments of the invention, the ventilating perforations in the side walls may be omitted and that the electrode will perform satisfactorily without them.

Although I have shown only forms of the electrode element in which connection to one side of a source of high frequency current is made to either the inner or the outer end of the electrode element while leaving either the outer

or inner end thereof open, it is to be understood that both ends may be left open and that connection may be made at a point intermediate the ends as shown in Fig. 5 of said copending application.

It will be understood that any of the spiral electrodes may be proportioned so as to be resonant to the frequency of the source of high frequency energy whereby the advantages of such resonance may be realized. As specifically brought out in said copending application, the spiral electrode produces an advantageous "voltage intensification". Thus, when electrical connection is made to one end of the spiral electrode member, the greatest voltage intensification will appear at the other end thereof. In the case of the outer or "rim" connection, as shown in Fig. 3, the outside turn which is adjacent the casing will be at a lower voltage than the inside turn and there will be a lower insulation requirement on the casing than with the "center connection" shown in Fig. 7, in which the outer turn adjacent the casing is at a higher voltage than the inside turn. Without regarding certain structural advantages I find it preferable to utilize the "rim connection" since it removes the high voltage portions of the electrode element away from the outside of the casing toward the center thereof where it is less liable to be contacted manually and where there is less liability of causing a dangerous insulation breakdown through the casing.

As specifically brought out in said copending application, the spiral electrode produces an electromagnetic and electrostatic treatment field, or, in terms of the art, an "inductive" and a "condenser" field. It will be appreciated that the relative values of these two fields may be modified within limits by variation in the design or mode of connection of the electrode elements and that further modification of the treatment field may be accomplished by employing an electrode of this invention with an electrode of another type, such as the conventional flat pad electrode which is well known to the art.

Numerous modifications of the device will become apparent to those skilled in the art and I do not choose to be limited to the modifications shown and described herein, but rather to the scope of the appended claims.

It will be appreciated that the size and proportions of the device may be varied greatly according to the employment thereof and the sizes and proportions delineated herein are illustrative only.

I claim:

1. A diathermy treatment electrode which comprises: an elongated casing having a treatment end and including a protection partition positioned adjacent said treatment end; a metallic electrode member disposed within said casing at a position removed from said treatment end and insulated from said casing, said electrode member comprising an electrical conductor wound in spiral form and having an open end, the axis of said electrode extending substantially in the direction of the length of said casing; and an electrical conductor connected to said spiral conductor at one point only for electrical association of said spiral conductor with a source of high frequency energy, said partition being positioned between said treatment end of said casing and said electrode member in protecting relation to said electrode member so as to restrict manual access to said electrode member through said treatment end.

2. A treatment electrode as set forth in claim 1, said casing being perforated to provide circulation of air therein, said perforations being of such size as to restrict manual access to said casing.

3. A diathermy treatment electrode which comprises: an elongated non-metallic casing member having a treatment end; a metallic electrode member disposed within said casing at a position removed from said treatment end, said electrode member comprising a metallic conductor wound in substantially flat spiral form and having an open end, the axis of said electrode extending substantially in the direction of the length of said casing; an electrical conductor connected to said spiral conductor at one point only for electrical association of said spiral conductor with a source of high frequency energy; and a perforated partition of insulating material positioned in said casing between said treatment end and said electrode member in protecting relation to said electrode member to restrict manual access to said electrode member through said treatment end.

4. A diathermy treatment electrode which comprises; an elongated non-metallic casing member having a treatment end; a metallic electrode member disposed within said casing at a position removed from said treatment end and insulated therefrom, said electrode member comprising a metallic conductor wound in substantially flat spiral form and having an open end, the axis of said electrode extending substantially in the direction of the length of said casing; an electrical conductor connected to said spiral conductor at one point only for electrical association of said spiral conductor with a source of high frequency energy; a perforated partition of insulating material positioned in said casing at one side of said electrode member and between said treatment end and said electrode member; and a second partition member of insulating material positioned in said casing at the other side of said electrode member and removed from said treatment end, said partitions being positioned in protecting relation to said electrode member to restrict manual access thereto.

5. A diathermy treatment electrode as set forth in claim 4, said casing member having two treatment ends and said partition members being disposed intermediate said electrode member and the respective ends.

6. A diathermy treatment electrode which comprises: an elongated non-metallic casing member having a treatment end; a protective partition adjacent the other end of said casing member; a metallic electrode member mounted on said partition and disposed within said casing, said electrode member comprising a metallic conductor wound in substantially flat spiral form and having an open outer end, the axis of said electrode extending substantially in the direction of the length of said casing; an electrical conductor connected to said spiral conductor at one point only for association with a source of high frequency energy, said point being the inner end of said spiral conductor; and a perforated partition of insulating material positioned within said casing between said treatment end and said electrode member, each of said partitions being disposed in protecting relation to said electrode member so as to restrict manual access thereto.

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