United States Patent

Panico

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[54] THERAPEUTIC INSTRUMENTATION ELECTRODE

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[52] **U.S. Cl.** ..... **128/404,** 128/419 D

[51] **Int. Cl.** **A61n 1/04**

[58] **Field of Search** ..... 128/404–418, 419 D, 128/172.1, DIG. 4

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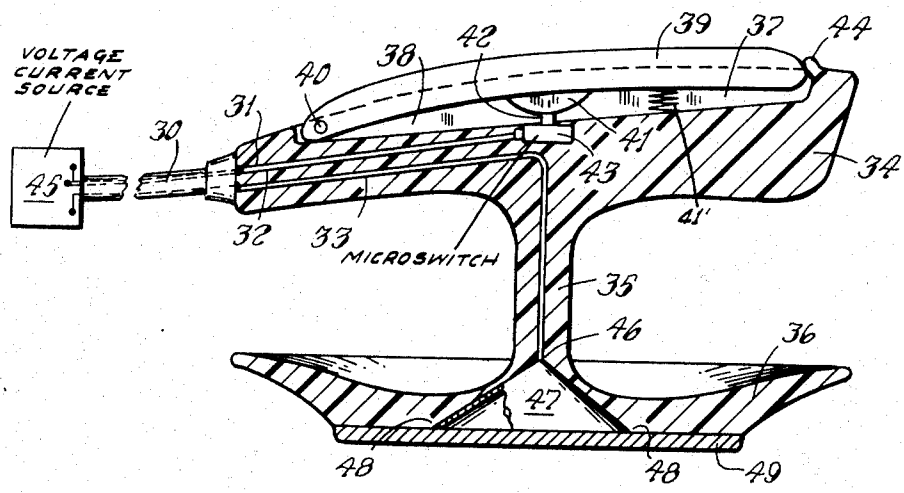
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[57] **ABSTRACT**

A medical electrode for applying electrical energy to or across the body of a patient which includes a paddle having a flat disc-like contact plate electrode for intimate contact with the skin. Electrical energy is supplied to the plate along a ring disposed centrally thereof through a hollow right cone at whose apex the energy is applied. The paddle also includes an upper dielectric horizontal handle having a control switch through which a supply wire passes to and through a vertical dielectric rod to the cone apex. Disposed above the plate is a dielectric shield protector which is integral with the rod and extends outwardly past the plate.

7 Claims, 7 Drawing Figures



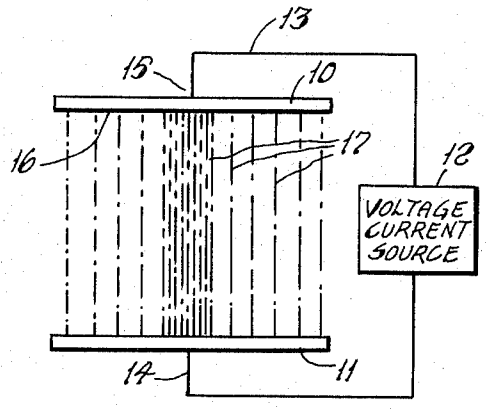


Fig. 1

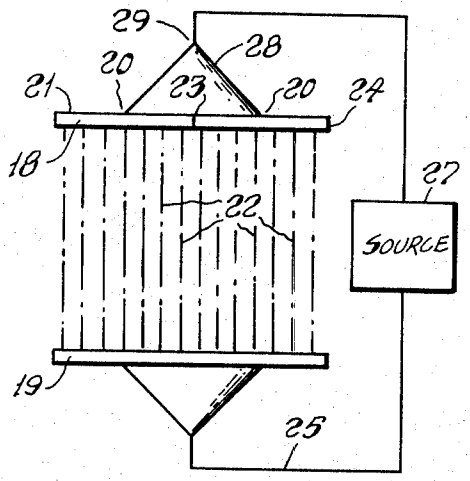


Fig. 2

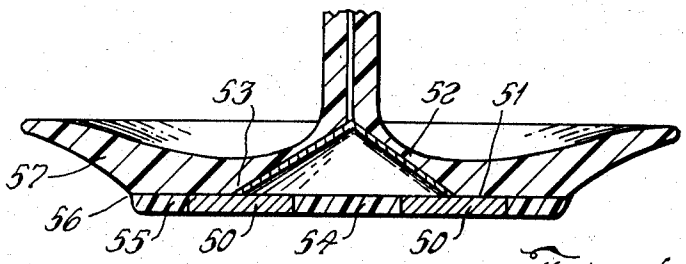


Fig. 6

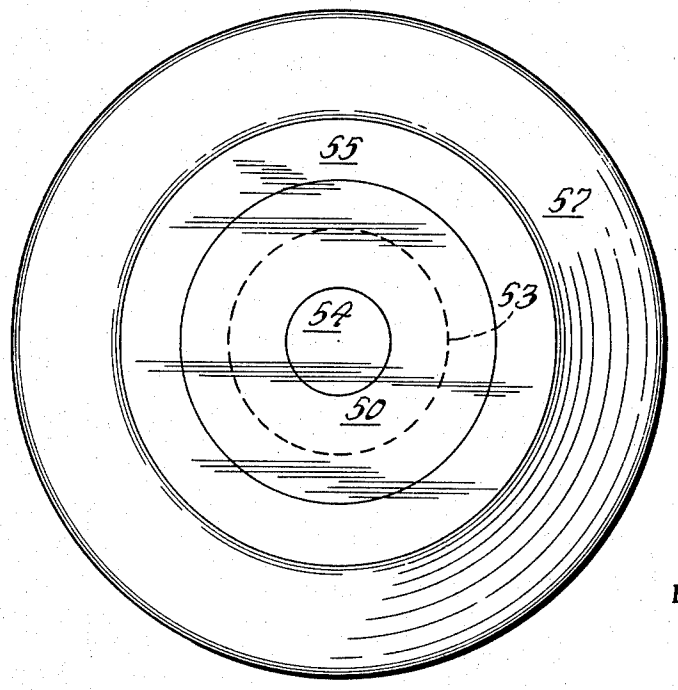


Fig. 7

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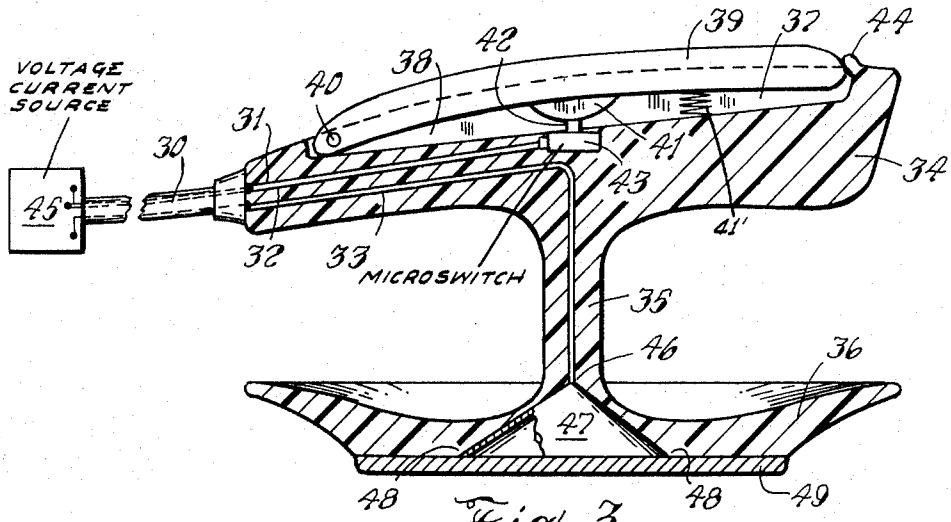
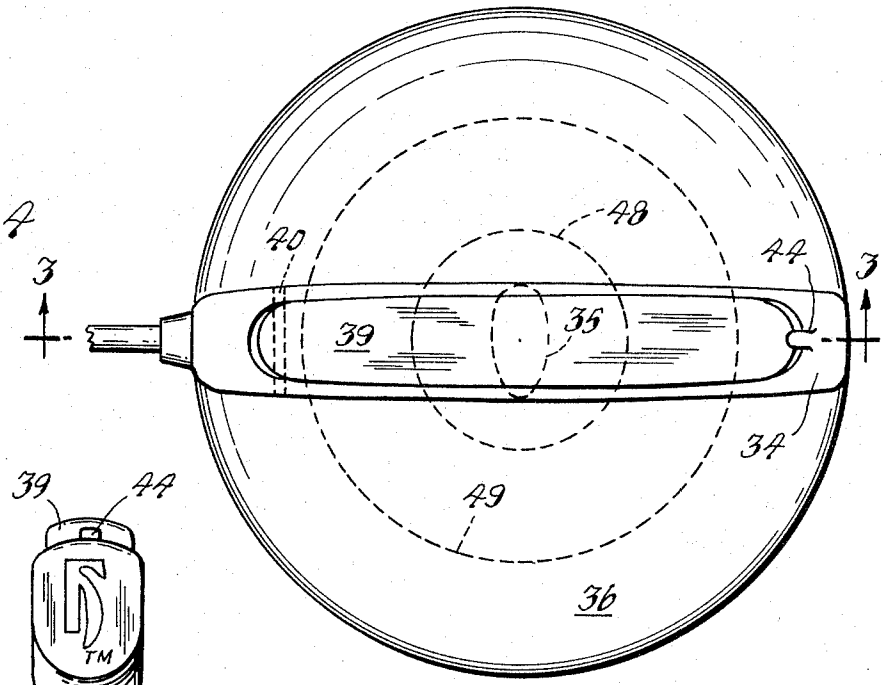


Fig. 3

Fig. 4



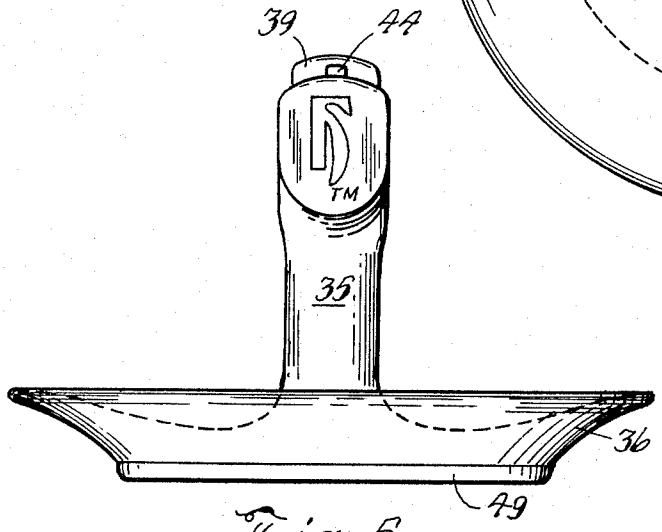


Fig. 5

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THERAPEUTIC INSTRUMENTATION ELECTRODE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to therapeutic medical devices and more particularly pertains to body contact electrodes for electro-therapeutic treatment wherein the electrical energy is applied through the body in a uniform current distribution between the surfaces of electrodes. It further pertains to a unique paddle structure for ease of operation and handling while protecting the operator.

2. Description of the Prior Art

In the field of electro-therapeutic and cardiac medicine, it has been the general practice to apply electrical energy to the body by means of a disc-like electrode which is supplied by a central wire or cable from a suitable source. The entire electrical structure is surrounded or encased in a dielectric jacket to form an upstanding handle with only the lower electrode surface exposed. Such medical devices have proved to be unsatisfactory in that they are difficult to manipulate and handle and, more basically, when employed in cardiac defibrillation, the current distribution through the body is concentrated in a narrow channel between the centers of the paddle electrodes thereby not encompassing the entire heart muscle.

SUMMARY OF THE INVENTION

The general purpose of this invention is to provide an electro-therapeutic medical paddle that has all the advantages of similarly employed prior art devices and has none of the above described disadvantages. To attain this, the present invention provides a unique electrode structure wherein the electric current energy is applied to the contact plate along a surface contact loop which is central thereof. Specifically, for a circular disc plate, the current is applied along a ring which is equidistant from the center and the outer edge thereof. One suitable structure therefore is a right circular hollow cone having its base central of the plate and the current input at its apex whereby a uniform and stable current distribution is provided over the entire plate surface and through the body.

An object of the present invention is to provide a reliable, simple, inexpensive, easily manipulated electro-therapeutic contact electrode.

Another object is to provide a contact electrode for use in cardiac defibrillation which electrode, will develop a uniform current distribution over the entire electrode face and through the body.

Still another object is to provide a defibrillator paddle which will supply a broad uniform current distribution sufficient to encompass the entire cardiac muscle.

A still further object is to provide a defibrillator paddle which may be readily and easily handled by the operator with a positive control switch and a high voltage protector.

Other objects and many of the attendant advantages of the present invention will be readily appreciated as the same become better understood by reference to the following detailed description when considered in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 illustrates the current pattern or distribution through a human body for conventional defibrillator paddle electrodes;

FIG. 2 illustrates the current distribution between defibrillator paddles made in accordance with the principle of this invention;

FIG. 3 is a cross-sectional view taken approximately along 3—3 of FIG. 4 of a defibrillator paddle made in accordance with the principle of the present invention;

FIG. 4 is top elevation of the embodiment of the invention of FIG. 3;

FIG. 5 is a front elevation of the embodiment of FIG. 3;

FIG. 6 is another embodiment of the invention showing the basic structure; and,

FIG. 7 is a bottom elevation of the embodiment for FIG. 6.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In the illustration of FIG. 1, a pair of conventional defibrillator electrodes 10 and 11 are disposed on opposite sides of the patients chest directly across or in line with the heart. The electrodes are connected to a source 12 of proper voltage and current is passed through the heart. The electrodes 10 and 11 are connected to the source by wires 13 and 14 which are affixed to the center of the disc electrodes. Thus, the current enters the electrode at the center point 15 of one electrode and is expected to distribute equally throughout the lower surface 16 which is in contact with the skin of the patient through some conductive paste or saline solution (not shown). Two factors enter the present consideration, namely, the fact that initially the current enters at a specific point and, that living tissue in response to current passing therethrough, offers a lower resistance or lowers its resistance along the current path in accordance with the current density. This resistance at peak energy varies between 50 and 100 ohms between paddles and it is clear that as current initially flows from the center, the resistance between the centers of the paddles will decrease and therefore increase the current therealong. This effectively restricts the major portion of the current into a narrow tubular region between electrode centers. The current distribution is illustrated by the field lines 17 which are most dense at the center. It is well known that for the current to effect defibrillation it must pass through or encompass all parts of the heart muscle. The conventional defibrillator paddle with its restricted current distribution does not facilitate encompassing the entire cardiac muscle and in order to overcome this inherent limitation and deficiency in providing effective and efficient defibrillation, the overall dimensions of the paddle electrode have been enlarged. This does not effectively solve the problem since other drawbacks and operational difficulties are introduced thereby.

Applicants solution of this problem is illustrated in FIG. 2 where similar disc paddle electrodes 18 and 19 are placed in contact with the skin of the patient. By providing a line of electrical contact 20 at the upper surface 21 of the paddle which is equipositioned thereon, the current distribution as shown by lines 22 is of equal density. The term "equiposition" is herein defined to mean a line of contact which is equidistant from the center 23 of the disc paddle and the outer peripheral edge 24. This, of course, could be applied to shapes other than circular such as elliptical discs, squares, etc. Thus, it merely remains to join the connecting wires 25 and 26 from the energy source 27 to the paddle electrodes along such an equiposition closed loop line. It is clear that many intervening coupling means of various shapes could be employed and, for the sake of illustration the most regular has been selected, namely a hollow metallic or electrical conducting cone 28. The base is connected by any suitable means such as brazing, soldering, etc. to the electrode and the connecting wires to the apex 29, thereof. Thus this form of a paddle causes the current to spread out equally over the entire surface of the paddle to provide a wide area of defibrillation current.

In the operating embodiment of the invention shown in FIG. 3, a cable 30 which carries both the switch wires 31 and 32 and the defibrillation energy wire 33 enter the upper handle portion 34 and can be molded therein. The handle 34 can be molded integral with the depending stem 35 and the lower outwardly extending protector 36 the entire structure being of a suitable dielectric plastic as for example Bakelite. The upper face 37 of the handle 34 is provided with a longitudinal recess 38 wherein a switch arm 39 is pivotally supported at 40 for movement toward and away from the handle. The lower central portion of the switch arm 39 carries an extension 41 which is in line with the movable trip 42 of microswitch 43 to which the switch wires 31, 32 are connected. The structure may also be provided with a biasing means 44' in addition to that of the microswitch urging the switch handle upwardly so that when the switch handle is released it will cause the normally open

microswitch to assume that position. A detent or extension **44** opposite the pivot **40** limits the upper movement of the handle **39**.

The wire **33** which carries the defibrillation current and voltage from the source **45** passes downwardly through the stem **35** and terminates at the apex **46** of hollow metallic cone **47**. The lower peripheral edge **48** of the cone **47** is electrically connected in any suitable manner to the base electrode **49** which may be a nickel plated brass contact disc imbedded or supported central of the lower protector portion **36**. In use, the operators hand grips completely around the handle **34** and extends over the switch so as to "throw" the switch and permit single handed utility. The lower winged protector portion shields the operators hand against the electrical potential.

FIGS. **4** and **5** clearly illustrate the relationships of the parts described above for both a top and side elevation.

FIGS. **6** and **7** illustrate another embodiment wherein the entire structure with the exception of the contact base electrode is identical to that previously described. The base contact electrode here consists of a metallic washer-like disc **50** to whose upper surface **51** and equipositioned thereon is the base of metallic cone **52** affixed along a ring **53**. The inner open area of the washer disc **50** is filled with a dielectric plastic disc **54** and the peripheral edge of the disc **50** is extended by a disc ring **55** of similar plastic. This same configuration could be accomplished by imbedding or molding the contact washer **50** into the plastic and affixing the outer edge **56** to the molded lower portion **57**. This configuration provides improved electrical isolation and protection for both the operator and the patient.

It should be understood, of course, that the foregoing disclosure relates to only a preferred embodiment of the invention and that numerous modifications or alterations may be made therein without departing from the spirit and the scope of the invention as set forth in the appended claims.

I claim:

1. A pair of electrical contact paddles for providing a uniform current distribution from paddle to paddle through the body of a patient intermediate the paddles each of which comprises:

an electrically conducting base electrode,

an electrically conducting coupling means affixed to one face of said electrode along a closed line loop equipositioned between the electrode center and its outer edge whereby when current is applied to said electrodes through said coupling means the current between said electrodes is distributed uniformly through the body of said patient.

2. The paddles according to claim **1** wherein said electrodes are circular discs and said coupling means is a hollow electrically conducting cone having its base edge electrically connected to said electrodes at said closed line loop.

3. The paddles according to claim **1** further including:

a dielectric housing carrying said electrodes and said coupling means.

4. The paddles according to claim **3** wherein said housing comprises:

an upper handle portion having a depending central stem affixed to and carrying a lower outwardly extending protector portion,

said protector portion having affixed to and facing outwardly thereof said electrode and having therein said cone.

5. The paddles according to claim **4** further including an electrical switch carried by one of said housings and a switch actuator handle facing outwardly of and carried by said handle portion on said one housing for selectively operating said switch.

6. The paddles according to claim **5** further including means for biasing said switch handle and means for limiting the movement thereof.

7. The paddles according to claim **1** wherein said electrode is an annular member.

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