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2,983,273

ELECTRODE

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FIG. 1.

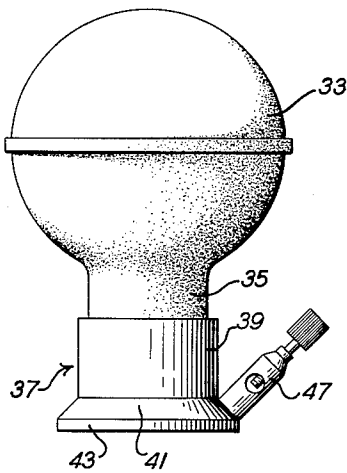


FIG. 2.

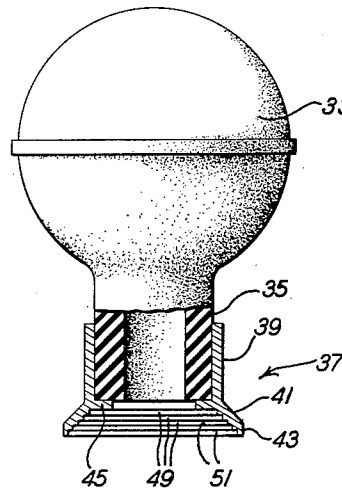
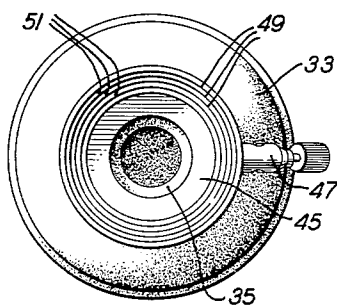


FIG. 3.



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2,983,273

ELECTRODE

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1 Claim. (Cl. 128—417)

This application is a continuation in part of application Serial No. 675,441, filed July 31, 1957 and now abandoned.

This invention relates broadly to the art of electrodes and in its more specific aspects it relates to such electrodes which are especially adapted for application to various parts of the human body in the making of electrocardiograms and in other electro-medical applications and is specifically designed so that the conventional pastes which are used with such electrodes are not required; and the nature and objects of the invention will be readily recognized and understood by those skilled in the arts to which it relates in the light of the following explanation and detailed description of the accompanying drawings illustrating what I at present believe to be preferred embodiments or mechanical expressions of my invention from among various other forms, arrangements, combinations and constructions, of which the invention is capable within the spirit and scope thereof.

In the making of electrocardiograms and in other electro-medical applications it is necessary to obtain a good electrical contact between the electrode and the skin of the patient and it is desirable that the resistance be as low as possible. In the past, in an effort to obtain these desirable electric characteristics, it has been the general practice in this art to use an electric conductive paste which is applied to the skin at those areas where an electrode is to be placed. It will be recognized, and every worker in the field is fully aware of the many objectionable features which are inherent in this procedure and any practical and efficient means to eliminate the necessity for electrolytic pastes would represent a substantial advance in this art. For instance, the application of the pastes either to the skin or to the electrode is a time consuming and a messy operation to both the patient and the technician and is relatively expensive due to the cost of the pastes which are used. It is also a fact that many of the pastes now in common use cause an unpleasant and skin irritating reaction on the patient.

It has been one of my major objects to provide an electrode for application to the human skin which makes an electric contact therewith with low resistance and without requiring the use of the aforesaid objectionable electric conducting pastes.

I have devised a novel and ingenious electrode which only requires the use of an electrolyte in the form of a nonviscous liquid which may conveniently comprise a salt and water solution to which a wetting agent may be added for a purpose to be hereinafter pointed out. The electrode of this invention has been so designed that it need only be dipped in the non-viscous electrolyte and the electrolyte will be caused to adhere to the operative surfaces of the electrode and maintained thereon in good electric contact making position with the skin when the electrode is applied thereto. The wetting agent or agents will cause the electrolyte to spread over the

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electrode in the manner desired. The particular construction of my electrode assures the maintenance of the electrolyte in proper contact making position during the course of the tests on the patient and under normal conditions the addition of electrolyte to the electrode will not be necessary.

In evolving an electrode which produces a good low resistance contact with the skin without using conventional pastes I have so formed, constructed and arranged the operative surfaces of the electrode so that the non-viscous electrolyte which I use will be attracted to the operative surface of the electrode in contact forming position between it and the human skin. Thus, the electrolyte will be maintained in functioning position, it will not spread and additions thereof will be kept at a minimum during the course of normal tests.

In achieving the highly desirable features of this invention I have formed the operative surface of the electrode in such a manner that it has a substantial capillary potential and by capillary attraction causes the electrolyte to adhere to the entire operative surface of the electrode. It will be appreciated that this construction providing the means which attracts and causes adherence of the electrolyte permits a non-viscous and therefore non-objectionable electrolyte to be used. With my electrode it is no longer necessary to use a paste which must be smeared over the operative surface of the electrode or over the skin and is inherently sticky in order to stick to and cover the operative surface of the electrode.

My invention provides an arrangement whereby a suction type electrode provides an increased skin contact area in comparison to prior art suction type electrodes while still providing the capillary attraction features discussed above. Because of this increased skin contact area this suction type electrode has substantially reduced trauma to the skin. Skin trauma has been found to be one of the disadvantageous characteristics of prior types of suction electrodes. The suction type electrode which I have devised substantially lowers skin resistance and has been constructed with a view to eliminating corrosion in inaccessible areas which results from the action of the electrolyte on metal parts of the device.

In designing an electrode having the aforesaid characteristics I have not sacrificed economy of production or facility in use. The electrode of this invention may be economically produced and may be used much more expeditiously than many prior art electrodes.

With the foregoing general objects, features and results in view, as well as certain others which will be apparent from the following explanation, the invention consists in certain novel features in design, construction, mounting and combination of elements, as will be more fully and particularly referred to and specified herein-after.

Referring to the accompanying drawings:

Fig. 1 is a view in elevation of a form of suction type electrode.

Fig. 2 is a view in elevation of the electrode illustrated in Fig. 1 with parts thereof in section.

Fig. 3 is a bottom plan view of the electrode of Figs. 1 and 2.

In the accompanying drawings I have illustrated my suction type electrode which embodies many highly advantageous features and characteristics. This electrode comprises a usual rubber bulb 33 having a rubber or the like tubular neck 35, the walls of which are of substantial thickness relative to the bulb to lend a degree of rigidity thereto. I have used the numeral 37 to designate the conducting portion of this electrode in its entirety. This conducting portion of the electrode may be formed of any metal which is a good conductor

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of electricity and consists of an upstanding collar 39 from which an annular outwardly flaring skirt 41 depends, the skirt preferably terminating in a peripheral portion 43 which may be co-axial to the collar 39. At the juncture of skirt 41 and collar 39 I form a radially inwardly extending annular rib or flange 45 for a purpose to be hereinafter described. While I have disclosed this rib as being of continuous annular form it will be understood that I may provide one or more radial inwardly extending lugs or projections instead of the rib. Fixed to and in electrical contact with the skirt 41 is a binding post 47 which may be of any suitable type.

The inner operative or capillary surface of the skirt 41 is of circular configuration and flares downwardly and outwardly so that the inner diameter of the skirt is progressively greater from the inner part thereof outwardly. This inner surface of the skirt and the inner surface of the peripheral portion 43 are milled or otherwise formed to provide a stepped construction, this is accomplished by providing a series of annular shoulders 49 of increasingly greater diameter outwardly of the skirt and by forming an annular flat 51 between each two shoulders, the flats also being of increasingly greater diameter outwardly of the skirt.

When the suction type electrode is in assembled operative condition the tubular neck 35 of the bulk 33 is inserted in collar 39 of the electrode with the end of the neck in engagement with the annular rib 45 which keeps the neck from being projected into the skirt. The neck is fixed in the collar by being cemented thereto. When the electrode is to be used it is dipped in a non-viscous electrolyte which will be held by capillary attraction to the capillary surfaces of the skirt. The electrode is applied to the human skin with the peripheral section 43 in contact therewith and the bulb 33 being depressed a suction will be created in the skirt and the skin drawn up into the skirt and in contact with the stepped surfaces formed by the shoulders 49 and flats 51. It will now be recognized that by this stepped arrangement of the circular operative or capillary surfaces of the electrode I have now provided an increased skin contact area over prior art electrodes without sacrificing the capillary attraction features. This insures excellent electrical contact while substantially reducing trauma to

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the skin. It will also be appreciated that there are no inaccessible parts of the metal electrode which would become corroded and could not be cleaned. This is due to my construction wherein the rubber of the like material neck is inserted in the metal collar and protects the collar from the corrosive action of the electrolyte.

It will now be understood that I have provided an electrode which eliminates the necessity of using objectionable electrolytic pastes and provides simple and elective means for causing a non-viscous electrolyte to adhere to the operative surface thereof to provide a good electric contact between the skin and the electrode.

I claim:

A suction electrode adapted to be used with a non-viscous electrolyte, said suction electrode including a substantially rigid member formed of electrically conductive material and adapted to be dipped into a non-viscous electrolyte and to then be applied to and to make electrical contact with the skin of a patient, means fixed on said member for connection to an electrical conductor, a hollow resilient bulb connected to said member, said member including a skirt and said hollow resilient bulb being in communication with the interior of the skirt and the skirt having a progressively greater inner diameter outwardly of the skirt and the inner surface of the skirt adapted to be in contact with the skin when suction is created in the skirt upon compressing said bulb, and said inner surface consisting of a plurality of relatively small shallow steep-walled circumferential grooves of a size and shape to hold substantial amounts of contiguous quantities of the non-viscous electrolyte so as to form a large area of conduction between the electrode and the skin of the patient.

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