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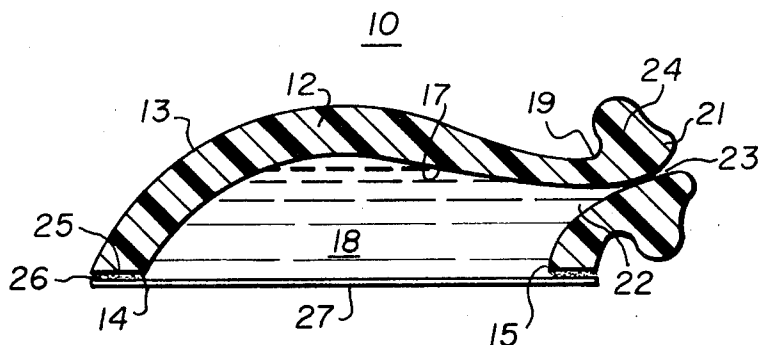
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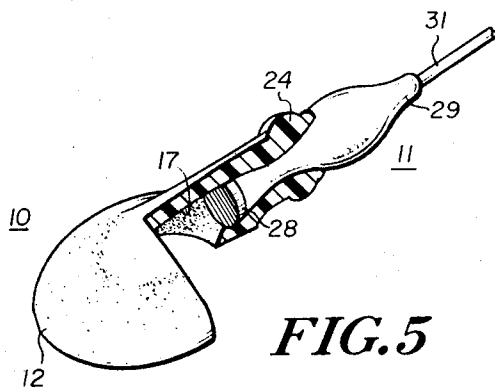
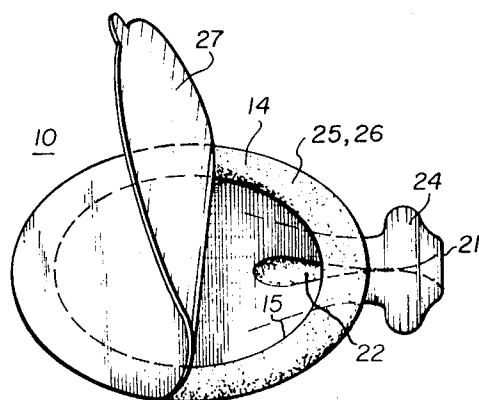
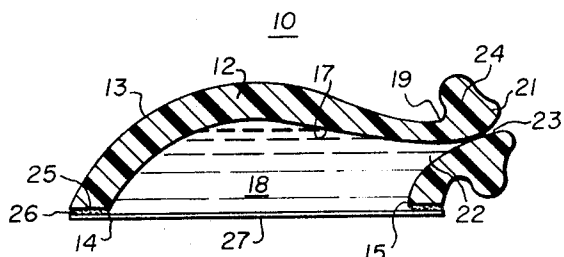
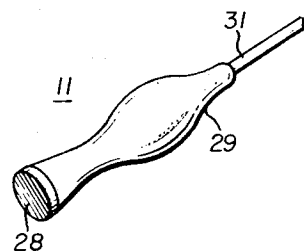
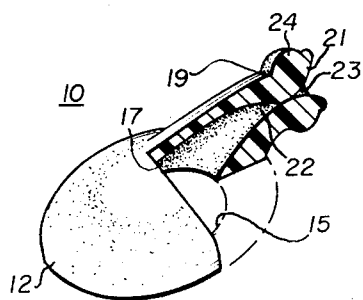
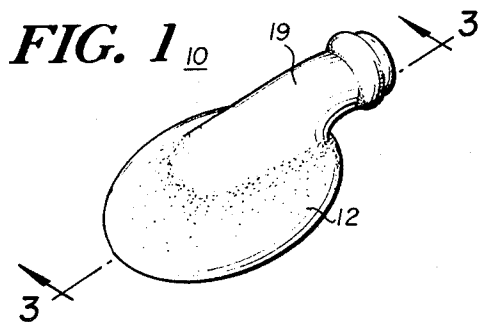
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[54] **DISPOSABLE ELECTRODE WITH SELF-SEALING
 PLUG OUTLET**
 5 Claims, 5 Drawing Figs.

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ABSTRACT: In an electrode apparatus for use in deriving electrical signals from an animal or human subject including a disposable interface unit and a reusable electrode plug unit where the disposable interface unit comprises: a unitary fabricated nonconductive member having a reservoir adapted to contain a viscous electrolyte, and outlet means extending from the reservoir to an upper surface of the member including a self-sealing closure means adapted to detachably receive the electrode plug when inserted therein.





DISPOSABLE ELECTRODE WITH SELF-SEALING PLUG OUTLET

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates broadly to improvements in electrodes and, more particularly, to such electrodes which are especially designed for application on an animal or human subject in the monitoring of bioelectronic potentials.

2. Description of the Prior Art

The present invention is mainly directed for implementation with measurement instruments such as electrocardiographic, electroencephalographic and similar devices, which require for their operation an electrically conductive link with a human subject, to apply electrical signals to and/or derive electrical signals from the subject. In connection with the above, it is well known to apply an electrolytic liquid or paste to a human subject intermediate the skin surface and an electrode, for enhancing the passage of electrical current.

Currently, electrodes of the kind made reference to above, fall into two general categories including disposable and non-disposable types. The nondisposable type such as those employing solid silver plates or silver-silver chloride pellets are, as a rule, quite costly. Furthermore, the common experience with these type electrodes has found them to be difficult to clean. The most common disposable electrode presently available is ordinarily of cupped configuration and usually contains a silver chloride coated silver disc recessed within the cup. Disposable type electrodes have been found to be relatively inexpensive and, have been proven to be extremely advantageous as they provide savings in application time and conserve valuable nursing time by eliminating electrode cleaning for reuse. However, on the whole, the disposable electrodes do not provide as good a quality recording as the non-disposable type.

SUMMARY

It is the primary object of the present invention to provide a disposable electrode interface unit which, to some extent, incorporates the desirable electrical characteristics of non-disposable type electrodes with the simplicity and convenience of disposable types. Achievement of the foregoing is attained in this invention by a disposable electrode interface unit comprising an electrolyte filled reservoir adapted for physical contact by releasable securement with the skin surface of a subject, and where an electrode connection is accomplished with a self-sealing closure arrangement contained within the disposable electrode interface unit. The disposable electrode unit is fitted for use with a removable protective cover at the reservoir area allowing for convenient packaging of the device. Additional advantages of the invention include: the superfluous need for a patient to continuously wear and bear the inconvenience of an electrode unit with dangling wires; the capability of conveniently using only a single machine and a common electrode connection for immediate recording with a number of patients; and, enabling the electrode portion of a disposable electrode unit to be easily cleaned and normally stored in a dry state.

BRIEF DESCRIPTION OF THE DRAWING

Other objects, advantages and capability of the present invention will become apparent from the following detailed description, taken in conjunction with the accompanying drawing, showing only a preferred embodiment of the invention.

In the drawing:

FIG. 1 is a perspective view of the invention.

FIG. 2 is a perspective view with part shown in section and a detachable electrode plug.

FIG. 3 is an enlarged vertical section taken along the center line 3-3 of FIG. 1.

FIG. 4 is a bottom view of the disposable electrode member illustrated in FIG. 1.

FIG. 5 is a perspective view with part shown in section and an electrode plug connected to the disposable electrode member.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawing, there is shown in FIGS. 1 and 2 an electrode unit of the present invention, basically comprising a disposable member 10 separable from but designed for use with an electrode member 11.

As may be best observed with reference to FIG. 3, the disposable member 10 basically comprises a circular disclike member 12 having a low-profile including a slightly rounded top 13 and a generally flat planar bottom 14 made to be compatible with an animal or human surface for placement thereon. Member 12 is of unitary fabrication comprising an electrical insulating material e.g., plastic or rubber, and preferably of a suitable lightweight resilient material. The underside or bottom of member 12 is substantially recessed from an opening 15, to generally reduce member 12 to a relative thin wall defining a reservoir 17 adapted to contain an electrolyte 18, preferably of the viscous type.

Projecting outwardly from a side of member 12 and integral therewith, there is shown in FIGS. 2 and 3, a neck portion 19 having an outlet 21 adapted to communicate with a passageway 22 extending through the neck into the reservoir. The neck configuration depicted is not only aesthetically pleasing, but is also quite practical as will become readily apparent to the reader hereinafter. The passageway 22 at outlet 21, is constructed to contain a self-sealing closure feature 23 which, as illustrated, normally maintains outlet 21 in a closed condition.

The self-sealing closure, in the present embodiment, is achieved in the fabrication of resilient member 12 where an area of neck portion 19 is formed to have a normally doughnutlike closed hole 24 shape. The self-sealing closure at outlet 21 is analogous, in certain respects, to a balloon shaped opening. Closure 23, as constructed, will so enclose an electrolytic paste stored in the reservoir and passageway, to prevent the paste from leaking out.

As a consequence of the circular opening 15, the bottom of member 10 takes on an annular shape 25, which is covered with a suitable adhesive material 26, facilitating application of member 10 to that skin portion of the subject selected for investigation. Overlying bottom 14 is a removable impermeable protective cover 27 which serves the double function of maintaining adhesive surface 26 in a clear condition prior to use and preventing exposure of electrolyte 18 during storage of member 10. An electrode plug member 11, depicted in FIGS. 2 and 5, is adapted to be compatible with outlet 21, for conjugation purposes as will be described hereinafter. The head of electrode plug member 11 has a conductive pellet 28 preferably of silver, silver chloride, which pellet 28 is encased in a housing member 29 of epoxy or other suitable material such as hard rubber. The housing member is given a configuration compatible with outlet 21 and passageway 22 in such a manner that a firm detachable engagement is formed, as depicted in FIG. 5, upon insertion of the electrode plug in outlet 21. Within the electrode plug member pellet 28 is connected to a suitably shielded conductor lead 31 for transmitting a signal output from the electrode member 10 to a recording device.

OPERATION

In utilizing the disposable electrode unit of the present invention, the user would first tear open a package in which disposable electrode member 10 might be stored. After cleaning the skin with alcohol, the impermeable protective cover 27 is removed from over adhesive surface 25 and opening 15. The bottom surface of member 10 including the electrolytic paste in the reservoir, is then attached to the patient by an application of light pressure.

The electrode plug member 11, which may be permanently connected with a recording device, is then inserted into outlet 21 and by application of sufficient pressure closure 23 will open to permit further insertion of the electrode plug providing for a detachable engagement within electrode member 10 as is shown in FIG. 5, in which position pellet 28 is drawn into electrical contact with electrolytic paste 18 enabling a desired recording to be accomplished.

Subsequently, electrode plug member 11 may be disengaged from the disposable electrode member 10, and readily cleaned for immediate use on any other patient, whereas upon such removal, closure 23 immediately returns to its closed condition by reason of the self-sealing feature to maintain the electrolytic paste in an unexposed state. The nonexposure of the electrolytic paste is desirable as virtually most all of these pastes lose their viscosity and electrical transmitting characteristics when exposed to air for substantial durations. As a result, electrode member 10 may be advantageously left in place on the patient without a multitude of dangling wires, for later use, thus enabling a single recording machine to be employed for several patients.

An electrode unit, fabricated in accordance with the principles of the present invention, was tested on the body of a human patient, whereby in use it was found to be completely free from motion artifacts and DC baseline shifts. In addition, it was found to exhibit low polarization impedance and provided signal recordings equivalent or better than existing electrode techniques.

ALTERNATIVE EMBODIMENTS

It is understood, of course, that neck 19 of electrode member 10 may take on other shapes or configurations, and may extend upwardly as opposed to the sideward projection illustrated with respect to the preferred embodiment. It is also noted, that outlet 21, closure 23 and passageway 22, could, with proper fabrication, be incorporated into the main body of disposable electrode member 11 rather than in an extension portion exemplified by neck 19.

Needless to say, a number of compatible complementary configurations between the neck interior and the plug housing could be arrived at, to provide suitable detachable engagements of the type disclosed in the preferred embodiment. In addition, the outlet 21 of disposable electrode member 10 might be supplied with a cap for further minimizing electrolytic paste leakage or exposure, especially in its packaged state. Also, in implementation of the disposable electrode unit 10 straps might be employed in attaching the disposable electrode member to a body area, as a substitute for or to supplement adhesive 25.

Accordingly, while a preferred embodiment of this invention has been illustrated, it will be apparent to one skilled in

the art that various modifications thereto could be made without departing from the underlying principles of the invention within the scope of the appended claims.

I claim:

1. In an electrode apparatus for use in a system for deriving electrical signals from a human or animal subject, including a disposable interface unit and a reusable electrode plug unit, said disposable interface unit comprising:
 - a unitary fabricated nonconductive member having an upper surface including outlet means and a bottom surface adapted for placement on the subject
 - a recess at the bottom surface defining in said member a reservoir adapted to contain a viscous electrolyte,
 - said outlet means extending from said reservoir to the upper surface of said member and including self-sealing closure means adapted to detachably receive the electrode plug unit when inserted therein.
2. A unit according to claim 1 wherein:
 - said outlet means comprises an elongated neck and said self-sealing closure means defines an inwardly protruding portion forming a resilient circular ridge to bias said closure means in a normally closed configuration.
3. A unit according to claim 2 wherein
 - said electrode plug unit includes
 - a surface formed on said plug unit to complement said outlet means when said self-sealing closure means is biased in an open condition for tight fitting mechanical engagement therewith.
4. In an electrode apparatus for use in a system for deriving electrical signals from a human or animal subject including a disposable interface unit and a reusable electrode plug unit said disposable interface unit comprising:
 - a unitary fabricated resilient, nonconductive disclike member including outlet means and having a bottom surface adapted for placement on the subject,
 - a viscous electrolyte,
 - a recess at the bottom surface defining in said member a reservoir containing said viscous electrolyte,
 - adhesive means extending about the recess at said bottom surface,
 - protective cover means overlying said recess and releasably held to said adhesive means, and
 - said outlet means extending from said reservoir to an upper surface of said member and including self-sealing closure means adapted to detachably receive the electrode plug unit when inserted therein.
5. A unit according to claim 4 wherein:
 - said outlet means comprises an elongated neck and said self-sealing closure means includes an inwardly protruding portion forming a doughnutlike closed hole.