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Inventor Allan Langston, Jr.

(1)

NOTICE

The Government-owned invention described herein is available for licensing. Inquiries and requests for licensing information should be addressed to:

DEPARTMENT OF THE AIR FORCE
AF/JACP
Washington, D.C. 20314

Patent Application Filed 29 Nov 76

A REUSABLE SILVER/SILVER CHLORIDE ECG RECORDING ELECTRODE

PH7L-APPL-735 296

ABSTRACT OF THE DISCLOSURE

A silver/silver chloride disc having one end of a silver metal strip compressed therein with the other end of the strip silver soldered to a male connector pin is formed. The silver strip is then bent around over the top of the disc and spaced therefrom. The disc/strip/pin assembly is then cast within a one-piece epoxy resin housing to provide for the structural integrity of all of the components. The lead out connector pin becomes an integral part of the assembly housing and is protected thereby from damage by the corrosive action of electrode paste and cannot be separated from the electrode proper.

STATEMENT OF GOVERNMENT INTEREST

The invention described herein may be manufactured and used by or for the Government for governmental purposes without the payment of any royalty thereon.

BACKGROUND OF THE INVENTION

This invention relates to an ECG electrode assembly and, more particularly, the invention is concerned with providing a silver/silver chloride ECG recording electrode

assembly designed for optimal signal quality under conditions requiring repeated and/or extended use.

The electrode which has been found to be most satisfactory for the acquisition of electrocardiographic data is a conducting silver/silver chloride electrode which makes a low impedance contact with the skin through a paste electrolyte. However, when conductive electrodes are used repeatedly and for extended periods of time, the corrosive action of the electrode paste sooner or later causes one or more of the connector points to fail electrically. This failure can occur anywhere between the electrode disc and the lead-out pin. Another disadvantage of presently known ECG electrodes is the location of the connector pin which is typically attached to the end of a lead-cut wire and some distance away from the electrode assembly housing. In this configuration, the pin and wire are highly vulnerable to damage and/or detachment.

The present invention resolves these problems by using improved and unique design criteria.

SUMMARY OF THE INVENTION

The present invention is concerned with providing an improved ECG electrode assembly which is protected from electrode paste corrosion damage and subsequent failure by replacing the lead-out wires which are usually attached to the electrode disc by solder, with a pure silver metal strip.

One end of the metal strip is physically compressed within the silver/silver chloride electrode disc at the time of manufacture while the other end of the silver strip is silver soldered to a modified connector pin. The silver/silver chloride electrode disc - silver metal strip - connector pin assembly is cast within a one piece epoxy resin housing. This single unit housing largely contains the corrosive electrolyte within the electrode disc, protecting the crucial silver metal strip-connector pin junction from corrosion.

In order to protect the silver/silver chloride ECG electrode from physical damage and subsequent failure, the silver/silver chloride electrode disc - silver metal strip - connector pin assembly is cast within a one piece epoxy resin housing thereby providing for structural integrity of all components. The completed electrode assembly contains the lead-out connector pin as an integral part of the assembly housing. This connector pin is protected from damage by the housing and cannot be separated from the electrode proper.

Accordingly, it is an object of the invention to provide a reusable silver/silver chloride ECG recording electrode wherein one end of a silver metal strip is physically compressed within the silver/silver chloride electrode disc at the time of manufacture thereof.

Another object of the invention is to provide an ECG

recording electrode wherein the silver metal strip eliminates the need for lead-out wires which are usually attached by solder or conducting glue, both of which are susceptible to damage by the corrosive action of electrode paste.

Still another object of the invention is to provide a reusable silver/silver chloride ECG recording electrode wherein the silver metal strip joining the disc to the connector pin is 99.9 per cent pure and is physically and chemically compatible with the silver/silver chloride electrode disc.

A further object of the invention is to provide a ECG electrode wherein the other end of the silver metal strip is silver soldered to a suitable male connector pin, for example, a modified Winchester pin.

A still further object of the invention is to provide an ECG recording electrode wherein a one piece epoxy resin housing is cast around the silver/silver chloride electrode disc - silver metal strip - connector pin assembly in order to protect the crucial silver metal strip - connector pin junction from damage caused by the corrosive electrolyte largely contained within the electrode disc.

These and other objects, features and advantages will become more apparent after considering the following detailed description taken in conjunction with the annexed drawings and appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1a is a view of a suitable connector pin such as a Winchester pin before modification;

Figure 1b is a view of the connector pin after modification and a view of a silver metal strip before attachment to the pin element;

Figure 1c is a view of the pin connector with the silver metal strip attached thereto;

Figure 1d is a view of the disc material in loose form prior to pressing and molding;

Figure 1e is a view of the disc/strip/pin assembly after the disc has been molded on the free end of the metal strip;

Figure 1f is a view of the disc/strip/pin assembly after the strip has been bent around over the disc;

Figure 2 is a top view of the ECG recording electrode according to the invention showing the disc/strip/pin assembly after being cast in epoxy resin;

Figure 3 is a bottom view of the ECG electrode shown in Figure 2; and

Figure 4 is a cross sectional view of the ECG recording electrode according to the invention taken along the line 4-4 of Figure 2.

DESCRIPTION OF A PREFERRED EMBODIMENT

Referring now to the drawings wherein like reference

characters refer to like elements in the several views, the reusable silver/silver chloride recording electrode of the present invention includes a suitable male connector 13, such as a Winchester pin shown in Figure 1a, commonly found in electrical connectors and of size and shape needed for the particular application. The pin 13 is modified by cutting and milling as shown in Figure 1b so that a flat portion 15 on one end is adapted to receive a strip of silver metal 17. The assembled pin/strip shown in Figure 1c is fabricated by silver soldering the strip 17 on the flat portion 15 of the pin 13. Electrode disc materials 19 consisting of silver and silver chloride with a binder and magnesium stearate are mixed together as shown in Figure 1d.

The free end of the strip 17 is placed in a pressure mold with a suitable amount of the disc material 19 and pressure is applied and the fisc 21 is formed on the end of the strip 17 thereby producing the disc/strip/pin assembly shown in Figure 1e. The silver strip 17 is then bent around the disc 21 to achieve the configuration shown in Figure 1f. Finally, the disc/strip/pin assembly (Figure 1f) is placed in a special mold and an electrode housing 23 is then cast with an epoxy resin binder and baked and cured to produce the completed ECG electrode assembly shown in Figures 2, 3 and 4.

In a typical electrocardiograph recording electrode fab-

ricated according to the invention, the strip of silver metal is 1.00 inches long and 0.07 inches wide and 0.01 inch thick. The connector pin 13 and silver strip 17 are cleaned in organic solvent and placed in asbestos clamps (not shown) preparatory to soldering. An anti-capillary compound is applied to the silver strip 17 just beyond the point where the soldering is to be done and the pin 13 and silver strip 17 are silver soldered to yield the strip/pin unit shown in Figure 1c. The strip/pin unit is then immersed in boiling water for ten minutes to remove soldering residues.

The electrode disc materials 19 shown in Figure 1d consist of a mixture of silver metal powder (99.9% pure), silver chloride salt (analytical grade), Zeogel (a binder, National Lead Co.) and magnesium stearate (analytical grade). Disc materials are fabricated as follows: silver powder (90% by weight) and silver chloride salt (10% by weight) and thoroughly mixed togther. Zeogel (5% by weight) is added and mixed in thoroughly. Magnesium stearate (0.0% by weight) is added and mixed in thoroughly. The indicated components of this mixture and their proportions in the mixture are identical to those identified and disclosed in U. S. Government owned patents numbered 3,490,440 and 3,665,064.

The free end of the strip/pin unit shown in Figure 1c is placed in a 0.5 inch diameter pressure mold (not shown); 1.1 grams of disc material 19 (Figure 1d) is added to this

mold and pressure of 40,000 pounds is applied, resulting in the disc/strip/pin assembly shown in Figure 1e. The thickness of the electrode disc 21 is 0.05 inches. The silver strip 17 is then bent around the disc 21 to achieve the configuration shown in Figure 1f. The distance between the outer end of the connector pin 13 and the edge of the electrode disc 21 is 0.31 inches. The back side of the electrode disc 21 is then primed with an appropriate sealer.

Finally, the disc/strip/pin assembly (Figure 1f) is placed in a special mold (not shown). An electrode housing is then cast with an epoxy M6 resin binder which is a mixture of 4.25cc A and 2.50cc B. The cast electrode assembly is placed in an oven for four hours at 140 degrees F. The electrode assembly is then removed from the mold and is air cured for 24 hours. The completed electrode assembly is shown in detail in Figures 2, 3 and 4 and weighs approximately 4.25 grams. The completed electrode assembly can be used with standard ECG recording paste, or with an electrolyte impregnated, disposable sponge.

Although the invention has been illustrated in the accompanying drawings and described in the foregoing specification in terms of a preferred embodiment thereof, the invention is not limited to this embodiment or to the particular configuration shown and described. It will be apparent to those skilled in the art that certain changes,

modifications and substitutions can be made, particularly with respect to the shape and positioning of the various elements without departing from the true spirit and scope of the appended claims.

Having thus set forth the nature of our invention, what we claim and desire to secure by Letters Patent of the United States is:

CLAIMS

1. An electrocardiographic recording electrode for producing optimum signal quality with repeated and extended use comprising a disc shaped electrode element, an elongated metal strip conducting member having one end thereof embedded in said disc shaped electrode, a male connector pin fixedly attached to the other end of said metal strip conducting member, said metal strip being bent around up and over the upper surface of said disc and spaced therefrom such that said attached connector pin extends laterally beyond the outer edge of said disc, and means for housing the assembled disc, strip and pin elements within a single unit protective environment thereby preventing the recording electrode from being damaged by the corrosive action of electrode paste and by physical damage from repeated and extended use.

2. The electrocardiographic recording electrode defined in claim 1 wherein said disc shaped electrode is comprised of a mixture of solver metal powder, silver chloride salt, and a colloidal material.

3. The electrocardiographic recording electrode defined in claim 1 wherein said elongated metal strip conducting member is fabricated of 99.9% pure silver.

4. The electrocardiographic recording electrode defined in claim 1 wherein said means for housing the assembled disc, strip and pin elements includes a one-piece molded epoxy resin casting for containing said assembled elements and preventing separation of said pin from the recording electrode.

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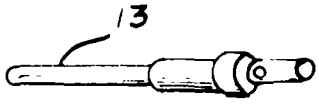


FIG. 1a

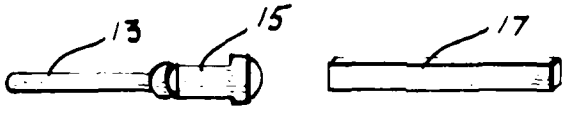


FIG. 1b

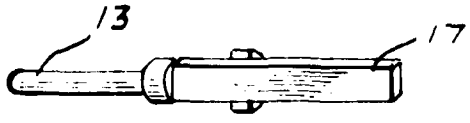


FIG. 1c

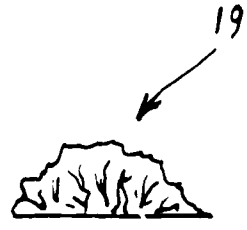


FIG. 1d

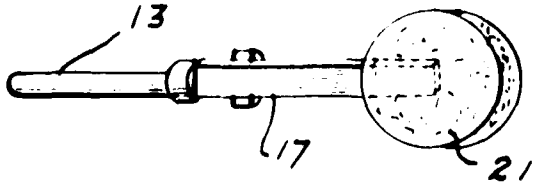


FIG. 1e

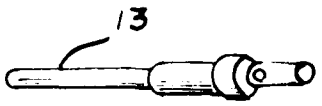
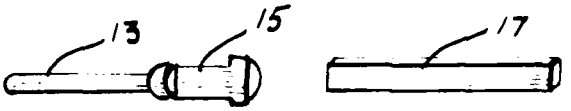


FIG. 1a



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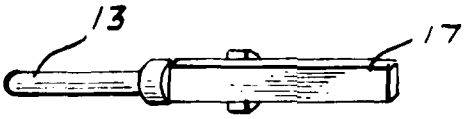

FIG. 1c

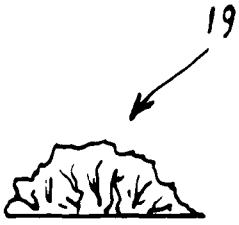

FIG. 1d

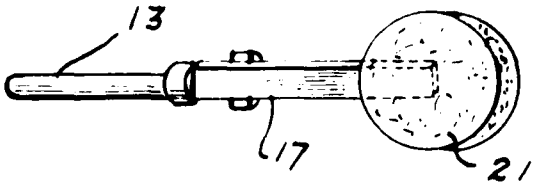

FIG. 1e

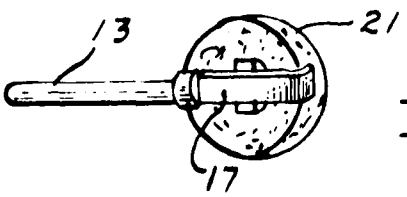

FIG. 1f

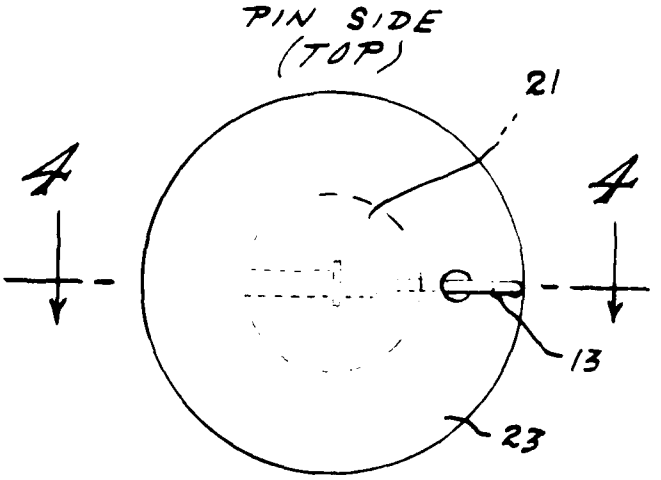

FIG. 2

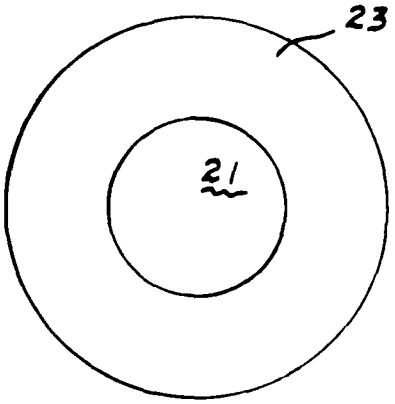

FIG. 3

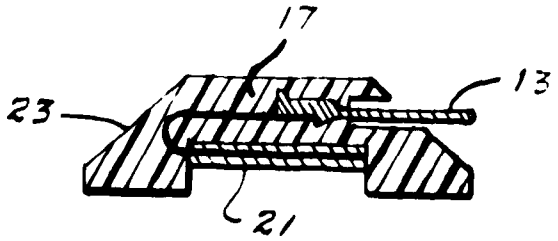

FIG. 4