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FLUID COLUMN SUCTION ELECTRODE

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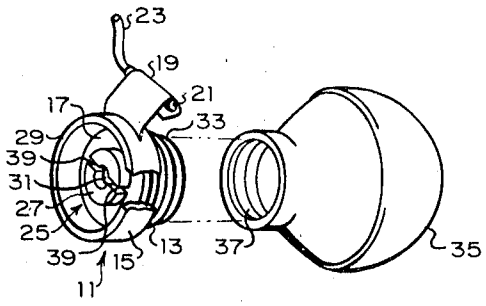


Figure 1

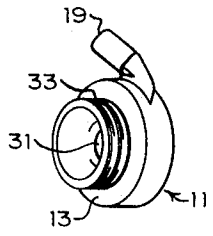


Figure 2

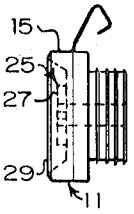


Figure 3

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FLUID COLUMN SUCTION ELECTRODE

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U.S. Cl. 128—2.06 5 Claims

ABSTRACT OF THE DISCLOSURE

An electrode structure provides an electrically conducting fluid column interface between a patient and a cardiac signal receiving cable. A suction bulb draws a vacuum in the fluid column when in contact with a patient to thereby removably secure the electrode to the patient.

BACKGROUND OF THE INVENTION

In cardiac signal monitoring applications, several different types of electrodes have been used to couple electrical impulses from a patient to the input of an electrocardiograph or other monitoring device. One such electrode employs a metal suction cup which is secured to the skin of a patient by a vacuum. This type of electrode is easily applied to and removed from the patient; however the metal suction cup is affixed in direct contact with the patient with the result that undesirable spurious noise signals are easily produced whenever there is a slight movement of the electrode on the patient's skin.

Another electrode which has been used to receive cardiac signals is one wherein a metal disc, for example, is coated with a layer of electrically conducting fluid or cream and then secured to a patient. Due to the effect of the fluid layer, this type of electrode is less susceptible to patient movement than is the above mentioned metal suction cup electrode; however, the electrode is generally secured to the patient by adhesive tape or the like, which is undesirable in that the process of properly positioning the electrodes and thereafter removing them may be difficult and time consuming as well as uncomfortable to the patient.

Accordingly, an object of the present invention is to provide an electrode for sensing cardiac signals which may easily and quickly be applied to and removed from a patient and which also minimizes spurious noise signals resulting from shifts in the electrode position on the patient.

SUMMARY OF THE INVENTION

The illustrated embodiment of the present invention includes a deformable suction bulb which is attached to a suction cup. Positioned in the suction cup is an interposer member which is spaced from the side walls of the cup so as to define an annular shaped cavity for receiving an electrically conducting fluid. The cup and the interposer member are formed of an electrically insulating material, and at the bottom of the cup there is provided an electrical contact which is connectable to a signal receiving cable. The annular shaped cavity in the suction cup is first filled with a conducting fluid to form a conducting fluid column, and then placed in contact with the skin of a patient. Thereafter a vacuum is drawn in the cup so that the fluid in the column is compacted between the patient's skin and the electrical contact inside of the cup. The interposer member in the cup limits against the patient's skin and insures that the fluid column is maintained at a predetermined depth. The suction cup configuration permits the electrode to be secured to and removed from the patient in a convenient manner, and the deep fluid column acts as a buffer between the electrical contact and the patient to thereby minimize noise signals generated by patient movement.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a fragmented perspective view of the preferred embodiment of the electrode of the present invention.

FIG. 2 is a perspective view of the external rear portion of the suction cup as viewed in FIG. 1.

FIG. 3 is a side view of the preferred embodiment of the suction cup.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the figure, there is shown a suction cup **11** formed of an electrically insulating material such as polypropylene plastic. The suction cup **11** includes a base portion **13**, a cylindrical side wall portion **15**, and a ring-shaped electrically conducting member **17** positioned on the base portion inside of the cup. The conducting member is electrically coupled to a connector **19** which is configured to receive and securely hold a pin **21** connected to a signal cable **23** from a cardiac monitor, for example.

An interposer member **25** is formed of an electrically insulating material inside the cup **11**. The interposer **25** is cylindrically configured and has a central axis coincident with the central axis of the cylindrical side wall **15**. The interposer **25** is dimensioned so that it is in spaced-apart relation with the side wall **15**, thereby to define an annular column or cavity which may be filled with an electrically conducting fluid or cream. The depth of the fluid column is determined by the lengths of the cylindrical side wall **15** and the interposer **25** along their common axs and may be on the order of .19 inch, for example.

As shown in FIG. 3, the length of the interposer **25** is slightly less than that of the side wall **15** so that the interposer terminates at an end portion **27** which is inside the cup **11**. That is, if the rim **29** of the side wall **15** is considered to lie in a plane, the end portion **27** is spaced apart from this plane a small distance, on the order of .10 inch for the above described case where the fluid column is .19 inch deep.

The base portion **13** and the interposer **25** have a bore **31** therein extending along the axis of the interposer from the end portion **27** (FIG. 1) to the external surface of the base portion **13** (FIG. 2) thereby to provide communication between the fluid column cavity and the external portion of the base. The external part of the base portion of the cup **11** is formed in the shape of a cylinder **33** which surrounds the external opening **31** of the base and has a circumferentially serrated lateral surface. A deformable rubber suction bulb **35** has an apertured end portion **37**, the internal surface of which is configured with circumferental grooves. The end portion **37** is slipped over the cylinder **33** so that the serrations and grooves interlock, thereby to provide an air-tight seal and securely fasten the suction bulb **35** to the suction cup **11**.

As shown in FIG. 1, the end portion **27** of the interposer **25** has two radial slots **39** extending between the central bore **31** and the lateral edge of the interposer **25**. The purpose of these slots is to enable a vacuum to be drawn in the entire fluid column cavity, as hereinafter described.

In use, the suction cup **11** is filled with an electrically conducting cream such as that sold by the Hewlett-Packard Company under the trademarked name "Redux." The rim of the suction cup **11** is then placed in contact with a patient and a vacuum is drawn in the cup by operating the suction bulb. The interposer **25** limits against the patient's skin and the fluid column is compacted between

the ring contact member **17** and the patient's skin. The slots on the end portion **27** prevent the vacuum from being limited to the small area of the aperture, and instead permit a vacuum to be drawn in the entire cavity over the surface of the patient's skin within the outer rim of the suction cup, thereby holding the suction cup securely in place. Since the side walls of the cup **11** are formed of an electrically insulating material and the electrical contact member **17** is coupled to the patient by a buffer column of conducting fluid, any movement of the patient or the electrode produces only a negligible disturbance so that spurious noise signals are minimized during cardiac signal monitoring.

We claim:

1. An electrode device for coupling biomedical signals from a patient to a signal receiving cable comprising:

a suction cup including:

a base portion having a surface internal to said cup;

an electrically conducting member disposed on the internal surface of said base portion and being connectable to said signal receiving cable;

a side wall portion formed of an electrically insulating material around said conducting member, said side wall portion having a rim for contacting a patient;

an interposer member formed of an electrically insulating material and disposed in said suction cup in spaced-apart relation with said side wall portion to define a cavity therebetween for receiving an electrically conducting fluid, said interposer member being configured to extend from said base portion and to terminate at an end portion within said cup;

said interposer member and said base portion having a bore therein communicating with said cavity; and

deformable suction bulb means affixed to said base and disposed in communication with said bore for drawing a vacuum in said cavity when said side wall rim

is positioned contiguously to a patient, thereby to secure said electrode device to the patient and to compact said conducting fluid in said cavity into a fluid column disposed between said conducting member and the patient.

2. The electrode device of claim **1**, wherein the side wall portions of said suction cup and said interposer member are cylindrically configured and coaxially aligned, thereby to provide an annular fluid column between said side wall portion and said interposer member.

3. The electrode device of claim **2**, said electrically conducting member of said suction cup including electrical connector means for securing said signal receiving cable.

4. The electrode device of claim **2**, wherein the rim of said side wall portion defines a plane, and the end portion of said interposer member is disposed internally of said suction cup in spaced-apart relation to said plane.

5. The electrode device of claim **4** wherein the bore in said interposer member extends to the end portion of said interposer member, and said end portion includes at least one slot laterally intersecting said bore and communicating between said cavity and said bore.

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