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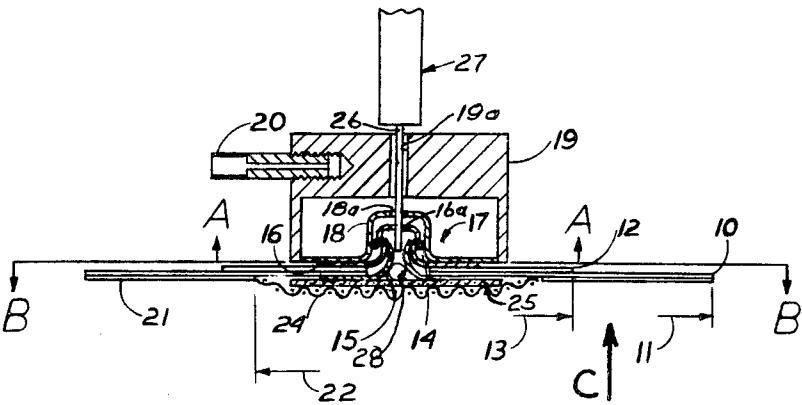
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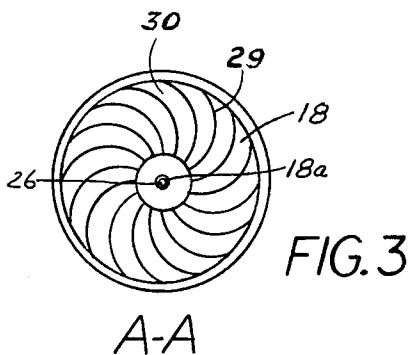
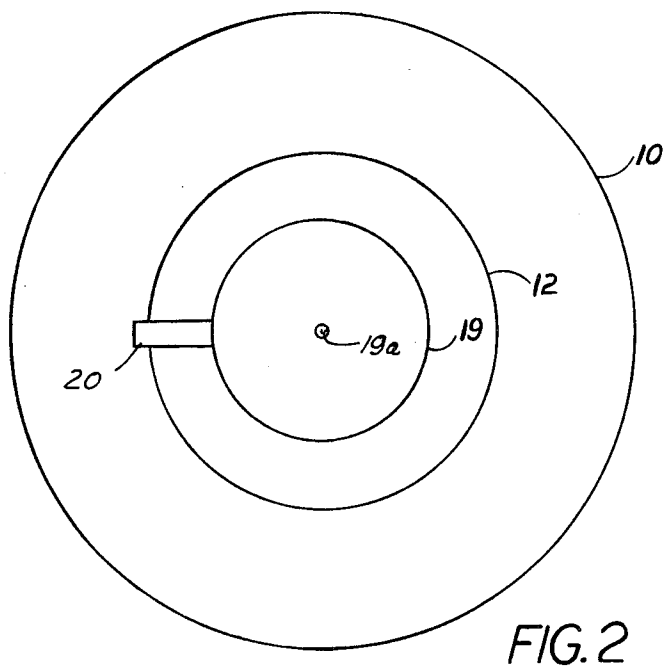
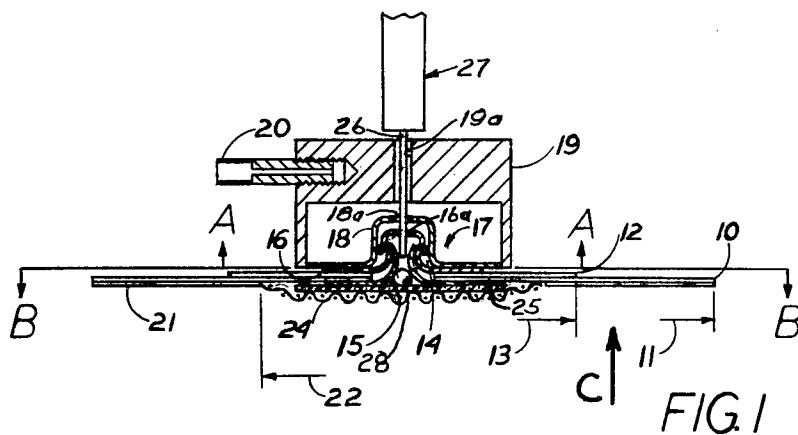
[54] ELECTROCARDIOGRAPH ELECTRODES WITH CONDUCTIVE JELLY SUPPLY MEANS
7 Claims, 5 Drawing Figs.
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416-418, 404, 218 NV, DIG. 4

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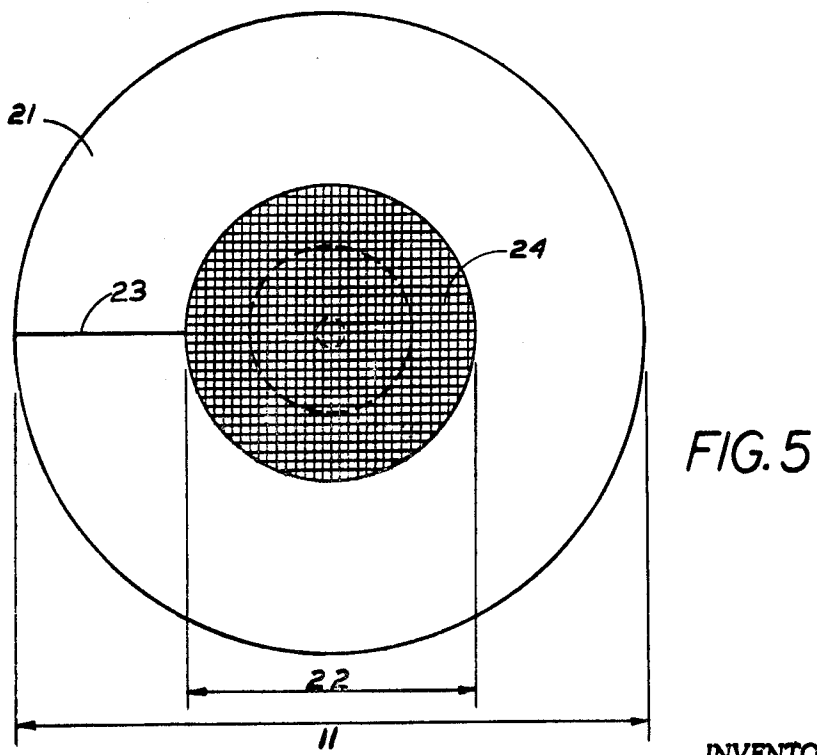
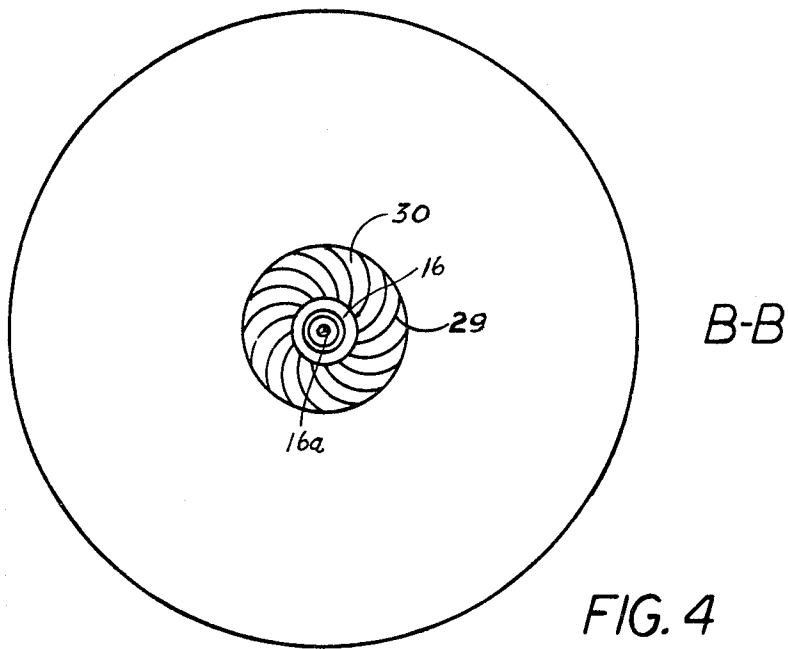
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ABSTRACT: An electrode for an electrocardiograph comprising a reinforced base sheet having the underside thereof coated with a pressure-sensitive adhesive and protected by a thin layer of removable paper. A snap fastener comprising a male and female portion extends through the center of the base sheet with the male portion of the snap fastener being firmly attached to the base sheet. The contacting surfaces of the male and female portion of the snap fastener are provided with a plurality of alternating grooves and ridges to increase the contact area and to prevent relative rotation of the respective male and female portions. A screen or sponge is attached to the underside of the male portion of the fastener and may be impregnated with an electrically conductive jelly. The female portion of the fastener is mounted into a housing designed for easy gripping with the fingers. The male and female portion and the housing have central openings defining a passage for receiving a syringe needle for flow of a conductive jelly and a ball check valve is preferably provided.





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ELECTROCARDIOGRAPH ELECTRODES WITH CONDUCTIVE JELLY SUPPLY MEANS

This application is a continuation-in-part of my copending application entitled "ELECTROCARDIOGRAPH ELECTRODES," filed Dec. 20, 1968, Ser. No. 785,481.

This invention relates in general to the art of electrocardiography and in particular to a new and improved electrode to be attached to the human body in order to pick up and convey electrical impulses to the recording instrument generally referred to as an electrocardiograph.

The electrocardiograph is an instrument designed to record the electromotive force generated by the heart muscle preliminary by the physical contraction of the muscle.

In recording the graph the differences in electrical potential of two points on the surface of the body are measured. This is accomplished by electrodes which may be placed on the extremities of the body and on the chest. The electrode on the right leg usually acts as a ground while other electrodes are utilized in a definite sequence to record the various sections of the completed tracing. Normally, the highest potential difference or the peak of the highest wave recorded by the electrocardiograph is in the order of from 0.70 to 1.80 millivolts.

It will thus be appreciated that the electrodes employed to pick up and convey the small potential differences, as above indicated, must be extremely accurate and ensure good contact with the human body as well as provide for good electrical conduction within the electrode.

It is accordingly an important object of the present invention to provide for an electrocardiograph electrode which ensures positive contact with the human body.

Another object of the instant invention is to provide for an electrode of the above type which has substantially improved electrical conductivity between its constituent parts.

Another object of the invention is to provide means for supply of an electrically conductive jelly.

A more specific object of the instant invention is to provide an electrode wherein the leads can be quickly and effectively disconnected from the portion of the electrode attached to the body by means of a snap fastener.

Yet another object of the instant invention is to provide an electrode including a quick disconnect snap fastener and in which the connecting conductive surfaces of the snap fastener are provided with a plurality of alternating minute grooves and ridges to ensure complete electrical conductivity between the male and female parts of the snap fastener and to prevent relative rotation therebetween.

A further object of the present invention is to provide an electrode for an electrocardiograph including a snap fastener and in which the female part of the fastener is mounted into relatively heavy housing to accommodate easy gripping by the fingers of an operator.

A still further object of the present invention is to provide an electrode for an electrocardiograph including a snap fastener in which the electrical current is transmitted from the human body to the snap fastener by means of a screen member of electrically conductive material or combined with or replaced by a sponge impregnated with an electrically conductive jelly.

These and other objects of the present invention will appear from time to time particularly when reference is made to the accompanying drawings and specification.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a cross-sectional view of the electrode of the present invention;

FIG. 2 is a plan view of the structure indicated in FIG. 1;

FIG. 3 is a plan view taken substantially along lines A—A of FIG. 1;

FIG. 4 is a plan view taken substantially along the lines B—B of FIG. 1; and

FIG. 5 is a bottom plan view taken in the direction of the arrow C as shown in FIG. 1.

AS SHOWN ON THE DRAWINGS

As shown in FIG. 1, the device of the instant invention comprises a circular sheet of paper 10 having a predetermined relatively large diameter 11. Concentrically attached to the sheet of paper 10, on the upper side thereof, is a sheet of reinforcing paper 12 having an outer diameter 13. Both sheets of paper 10 and 12 have a central common circular opening of equal diameter as indicated by the numeral 14.

The two sheets of paper 10 and 12 are clamped between the metal portions 15 and 16 which form the male portion of the snap fastener 17 which is of generally circular configuration. The portion 15 of the male portion of the snap fastener protrudes through the central opening 14 and through the sheets of paper 10 and 12 and is firmly clamped to the portion 16 of the male portion of the snap fastener 17. In this manner, both sheets of paper 10 and 12 are firmly secured at their center to the male portion 15-16 of the snap fastener 17. The snap fastener 17 also comprises a female portion 18 which may be snapped over the male portion 15-16 of the fastener 17 in a manner well known to those skilled in the art.

Fixedly attached to the female portion 18 of the snap fastener 17 is a relatively heavy metal housing 19 which is of sufficiently large size to enable easy gripping with the fingers. This relatively heavy housing 19 is preferably made of brass to ensure good electrical conductivity. Attached to the housing 19 is an electrical connector 20 which forms with said housing 19 a means for conveying electrical currents from said portion 18 to the electrocardiograph recording device through electrical cables suitably connected to connector 20.

As shown in FIG. 2, the sheets of paper 10 and 12 are preferably of circular configuration but it should be understood that any desirable configuration may be employed. Also, the gripping piece 19 is preferably made of circular configuration but square or hexagonal configurations may also be employed.

As further shown in FIG. 1, the underside of the circular sheet of paper 10 has attached thereto, an annular sheet of paper 21 which has an outer diameter equal to the diameter 11 of the sheet of paper 10 and an inner diameter 22 having a diameter of approximately one-half of the outer diameter 11.

The underside of the sheet of paper 10 is coated with a pressure-sensitive adhesive and the annular sheet of paper 21 merely performs the function of protecting the pressure-sensitive adhesive coated to the underside of the sheet of paper 10. As shown in FIG. 5, the annular sheet of paper 21 is cut along the line 23 so that it may be easily stripped from the underside of the sheet of paper 10 whereupon the sheet of paper 10 may be firmly adhered to the human body.

As further shown in FIG. 1, a screen 24 is mounted to the underside of the sheet of paper 10. Screen 24 has an outer diameter approximating the inner diameter 22 of the annular sheet of paper 21 and is firmly attached to the underside of the paper sheet 10 by means of the pressure-sensitive adhesive previously discussed in connection with paper sheet 10.

The screen 24 serves the important function of conducting the electrical current from the human body through the snap fastener 17 and the gripping portion 19 to the electrocardiograph instrument. The screen 24 is urged into firm contact with the human body by means of the sheet of paper 10 the underside of which is coated with a pressure-sensitive adhesive as previously described. In order to increase the conductivity of the screen 24 the screen may be impregnated or coated with an electrically conductive jelly which may be supplied as described below. It may be made of metal with or without the electrically conductive jelly.

Other devices may be substituted for the screen 24 such as, for example, a sponge pad 25 impregnated with an electrically conductive jelly which may be disposed above the screen 24 as shown to increase the electrical conductivity of the entire device, or may be disposed below the screen 24 or may be used alone without the screen 24 and in place thereof.

An important feature of the invention is in the provision of means for supplying a conductive jelly into the region of the screen 24 and/or the sponge pad 25. In accordance with this feature the housing 19, the female portion 18 and the male portion 16 have aligned central openings 19a, 18a and 16a, respectively, the male portion 15 being hollow to also provide an opening. Such aligned openings together define a passage which may receive a hollow needle 26 of a conventional syringe 27 only an end portion of which is shown in FIG. 1. The syringe is used to force a conductive jelly into the region of the screen 24 and/or the sponge pad 25 to ensure maximum electrical conductivity.

To prevent reverse flow of the jelly after the needle 26 is removed, a ball check valve 28 is provided which may be of steel or other metal or of a plastic or of any suitable material and which is disposed between the sponge pad 25 and the center of the male portion 15 in the arrangement as shown.

It will thus be seen sponge with the use of the screen 24 and/or the sponge pad 25 and the conductive jelly, proper electrical conductivity is obtained between the human body and the male portion of the snap fastener 17. It will, of course, be appreciated the connection between the male portion 15-16 of the snap fastener 17 and the female portion 18 thereof, must be equally effective in order to ensure proper recording of the electrical impulses generated by the human body. It is therefore extremely important that the connection between the male and female portions of the fasteners 17 are made in such a manner to ensure the greatest possible amount of electrical conductivity obtainable.

Accordingly, as shown in FIGS. 3 and 4, the contacting surfaces of the male and female portions of the snap fastener 17 are provided with a plurality of alternating grooves and ridges, the grooves being indicated by the numeral 29 and the ridges being indicated by the numeral 30. These grooves and ridges perform a dual function in that they provide for additional surface area between the male and the female contacting portions of the snap fastener 17 and more importantly they prevent the male and the female portions from rotating with respect to one another. The increased contact area provided by the grooves and ridges 29 and 30, respectively, increases the amount of electrical conductivity between the male and female portions of the snap fastener 17, while their function of preventing the respective male and female portions from rotating with respect to one another ensures electrical conductivity of the same degree at all times.

As will be appreciated by those skilled in the art, it is important to be able to remove one electrode from the human body and attach it to another part of the human body. For example, it may be desirable to shift the electrode attached to the left leg over to the right leg. In that instance, one would merely disconnect the snap fastener on the right leg and left leg respectively, and interchange the female portion to which the electrical leads leading to the recording instrument are connected. The heavy metal housing 19 provides for easy gripping

as a result of which a change of electrodes may be easily accomplished.

While reference has herein been made to circular sheets of paper it will, of course, be understood that other materials such as plastics or textiles may also be used and that suitable substitutions may be made depending upon the particular type of application.

The term "human body" is used herein, however, it is to be understood that the inventive electrode may also be used with animals and other objects.

It will be understood that variations and modifications may be effected without departing from the spirit and scope of the novel concepts of this invention.

I claim as my invention:

1. An electrode adapted for use with an electrocardiograph and adapted to be attached to a body, comprising:
 - attaching means adapted to be attached to a surface portion of the body, said attaching means including porous means adapted to engage the body,
 - first conductive snap fastener means connected to said attaching means at said porous means
 - second conductive snap fastener means fastened to said first conductive snap fastener means, said first and second means including first and second mating portions snapped together and electrically connected,
 - means for electrically connecting said second means to an electrocardiograph,
 - means defining a first opening in said first mating portion,
 - means defining a second opening in said second portion and disposed in alignment with said first opening, said first and second openings forming a passage for supply of a conductive jelly therethrough and directly into contact with said surface portion of the body via said porous means when the electrode is attached to the body and connected to said electrocardiograph, and means in said electrically connecting means defining an opening for access to said first and second openings.
2. The structure of claim 1 wherein said first and second mating portions are male and female snap fastener portions and wherein said openings are through the center portions of said female and male snap fastener portions.
3. The structure of claim 1 further including check valve means associated with said passage for preventing reverse flow of the jelly.
4. The structure of claim 3 wherein said check valve means comprises a ball having a diameter greater than the end of said passage closest to said porous means.
5. The structure of claim 4 wherein said porous means limits movement of said ball toward said surface portion while permitting flow of jelly therethrough.
6. The structure of claim 5 wherein said porous means comprises a screen.
7. The structure of claim 5 wherein said porous means comprises a sponge pad.

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