

[54] **ELECTRODE FOR RECORDING BIOELECTRICAL PROPERTIES**

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[22] Filed: **May 4, 1972**

[21] Appl. No.: **250,168**

[30] **Foreign Application Priority Data**

May 13, 1971 U.S.S.R. 1660558

[52] U.S. Cl. **128/2.06 E**, 128/DIG. 4

[51] Int. Cl. **A61b 5/04**

[58] Field of Search 128/2.06 E, 416, 417, 418,
128/2.1 E, DIG. 4, 404, 405, 410, 411

[56] **References Cited**

UNITED STATES PATENTS

2,208,023 7/1940 Ellis 128/404
2,318,207 5/1943 Ellis 128/418

3,294,084 12/1966 Schuler et al. 128/206 E
3,534,733 10/1970 Phipps 128/418 X
3,545,432 12/1970 Berman 128/DIG. 4

FOREIGN PATENTS OR APPLICATIONS

960,656 3/1957 Denmark 128/404
1,535,432 7/1968 France 128/418

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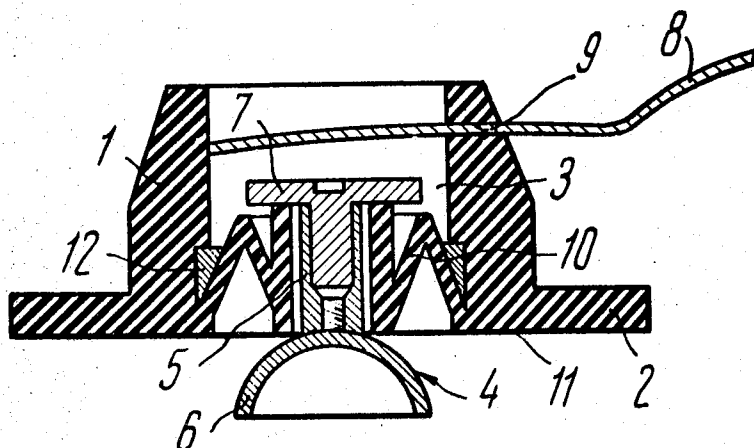
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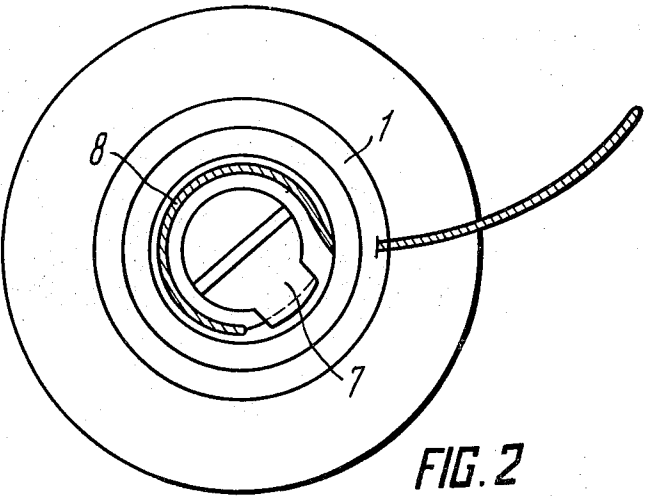
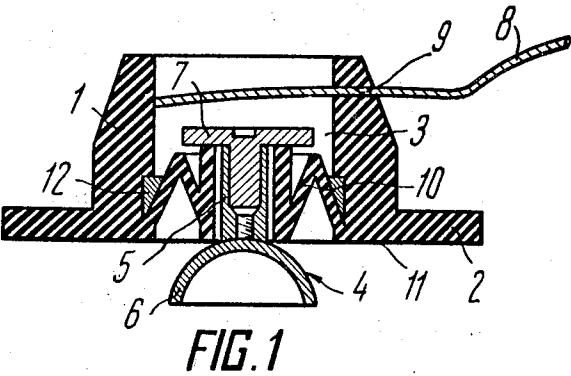
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ABSTRACT

An electrode for recording bioelectrical properties is disclosed, the electrode comprising a housing having a flange which serves to fix the electrode to a surface of a biological object, the housing has an internal cavity accommodating a contact member which is mounted in said cavity for vertical movement by means of a membrane provided with annular undulations.

2 Claims, 2 Drawing Figures





ELECTRODE FOR RECORDING BIOELECTRICAL PROPERTIES

BACKGROUND OF THE INVENTION

The present invention relates to medical techniques, and more particularly is concerned with the provision of electrodes for recording bioelectrical properties. The electrode according to the invention may be used for electromiographic, electrocardiographic, electroencephalographic, rheographic, and especially for electrodermatographic examination, the comparability of the results of these examinations depending upon stability and thoroughness of the application of the electrodes to the surface of a biological object under examination taking into account the relationship between the level of electric conductance of the integument and the amount of pressure applied by the electrode to the surface thereof.

Known electrodes for recording biological properties comprise a housing made of an insulating material having a flange which serves to support the electrode on the surface of a biological object, and an internal cavity accommodating a contact member. The contact member is provided with an active part fixed to a rod. The contact member is movable in a direction perpendicular with respect to the support surface of the flange and is urged by means of a resilient member comprising a helical spring. In operation of the electrode, the spring applies an active pressure to the surface of a biological object via the contact member, said pressure only negligibly depending upon a force of application of the housing to a biological object. A wire lead is connected to the contact member.

Some disadvantages of known electrodes are that they have cumbersome and complicated structure. This is due to the fact that during deformation of zones of a biological object under examination in the case, where continuous dynamic tests are to be conducted, a rod of the contact member is constrained to move along the wall of the internal cavity of the housing. The required elimination of misalignment of the rod and of blocking thereof results in a relatively great height of the housing which is necessary to increase a ratio between the peripheral and the end walls of the rod, respectively. The increased size of the housing and the rod results, however, in the creation of an additional friction between the surfaces in contact during the movement of the rod, whereby the formation of electrostatic charges becomes more likely which introduce distortions into the results of the examination.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide an electrode for recording bioelectrical properties which ensures reliable mechanical contact between a contact member and a surface of a biological object and which provides the elimination of blocking of a contact member rod during the movement of the latter under deformation of the zone under examination, while having minimum height and excluding the possibility of formation of electrostatic charges.

The above object is accomplished by the provision of an electrode for recording bioelectrical properties comprising a housing made of an insulating material and having a flange for fixing the electrode to a surface of a biological object and an internal cavity accommodating a contact member which is movable in a direc-

tion substantially perpendicular with respect to a support surface of the flange and urged in this direction by means of a resilient member, said resilient member according to the invention comprising a membrane provided with annular undulations, said membrane having outside edges of which are fixed to the walls of the internal cavity of the housing, while the central portion of the membrane is adapted to support the contact member attached thereto.

The wall of the housing may be provided with a through lateral hole for accommodating a wire lead fixed to the contact member.

The electrode according to the invention ensures relatively stable mechanical contact between the contact member and the integument during spontaneous and positive motions of a biological object, as well as during external mechanical action, due to the creation of smooth and stable active pressure applied by the contact member relative to the base of the housing, whereby comparative result of electrodermatographic examinations can be obtained.

The absence of any guides and other component parts in frictional contact therebetween eliminates the possibility of blocking of the contact member and the formation of electrostatic charges.

The electrode according to the invention is simple in construction, has smaller size and weight as compared to prior art electrodes and is convenient for use under garment.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be described with reference to the embodiment thereof illustrated in the accompanying drawings, in which:

FIG. 1 shows an electrode for recording bioelectrical properties according to the invention, in longitudinal section.

FIG. 2 is a top plan view of the device in FIG. 1.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

An electrode for recording bioelectrical properties comprises a housing 1 (FIG. 1) made of an insulating material, such as rubber. The housing 1 is provided with a flange 2 which is adapted to fix the electrode to a surface of a biological object.

The housing 1 defines an internal cavity 3 accommodating a contact member 4, comprising a rod 5, a spherical portion 6 and a fastening tongue 7 by means of which tongue the contact member 4 is connected to a wire lead 8 (FIGS. 1 and 2). In order to ensure more reliable and compact structure, the wall of the housing 1 is provided with a through lateral hole 9 (FIG. 1) to accommodate the wire lead 8.

The contact member 4 is movably mounted in the internal cavity 3 by means of a resilient member comprising a membrane 10 made of an elastic material and provided with annular undulations, said membrane being fixed by its outside edges to the walls of the internal cavity 3, whereby the contact member 4 is movable in a direction perpendicular with respect to the support surface 11 of the flange 2, said contact member being resiliently urged in this direction. In the initial position, the contact member 4 extends outside the internal cavity 3 beyond the support surface 11 of the flange 2.

The height of the housing 1 is greater than the height of the contact member 4 by an amount of possible

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movement of the contact member 4, whereby the electrode may be comfortably used under a garment.

The wall of the internal cavity 3 is reinforced by means of a metal ring 12, which in combination with the elastic flange 2 ensures reliable contact between the support surface 11 of the flange 2 and the surface of a biological object and eliminates the possibility of blocking of the spherical portion of the contact member 4 during the deformation of the zone under examination.

When the support surface 11 of the flange 2 is adhesively fixed to the surface of a biological object, e.g., by means of collodian glue, the contact member 4 with the spherical portion 6, which may be partially filled up with a contact substance, is retracted into the internal cavity 3 at the level of the support surface 11. Accordingly, the contact member 4 tends to occupy the initial position, whereby an active pressure is applied by the contact member 4 to the surface of a biological object relative to the housing 1. The degree of stability of the amount of the active pressure applied by the contact member 4 during its movement with respect to the support surface 11 of the flange 2 depends upon the characteristics of the material of the membrane 10 and the ratio between the thickness and the height thereof.

When used for recording biocurrents and for measuring the level of electric conductance of the integument in dynamic tests, the electrode according to the invention exhibits high efficiency and ensures comfortable, high-quality and continuous recording of bioelectric properties.

The use of the membrane 10 ensures the stability of the amount of contact pressure applied to the integument of the zone under examination due to relative stability of the amount of the active pressure applied by the contact member 4 to the surface of a biological object.

The electrode according to the invention has no guides or component parts in frictional contact therebetween, whereby the possibility of the formation of elec-

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trostatic charges and the blocking of the rod 5 of the contact member 4 during the deformation of the zone of a biological object under examination is eliminated.

What is claimed is:

1. An electrode for attaching to the surface of a biological object to record biological properties thereof and comprising:

housing means made of an insulating material and having a support surface for supporting said electrode on the surface of said biological object, and an internal cavity with internal walls, said internal cavity communicating exteriorly of said housing means through said supporting surface;

a resilient membrane means for providing a resilient force and having outside edges, a central portion and annular undulations, between said central portion and said edges the outside edges of said membrane being fixedly attached to the internal walls of said cavity;

a contact member means attached to the central portion of said resilient membrane means and having an initial position of operation in which it is caused to protrude from said support surface under the resilient force provided by said resilient membrane, said contact member means being movable in said internal cavity in a direction substantially perpendicular to said support surface, so that when said electrode is attached to the surface of said biological object, said contact member means moves inwardly of said cavity while being continuously urged to adopt said initial position, and means for connecting said electrode to an external device for recording biological properties.

2. An electrode as claimed in claim 1, wherein said external connecting means comprises an exterior wire lead connected to said contact member means through a lateral hole provided in said housing means, said lateral hole communicating said internal cavity exteriorly of said housing means.

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