Dec. 10, 1957 N. H. FRIEDMAN 2,815,749

ELECTROCARDIOGRAPHIC CONTACT ATTACHMENT

Filed Nov. 30, 1953

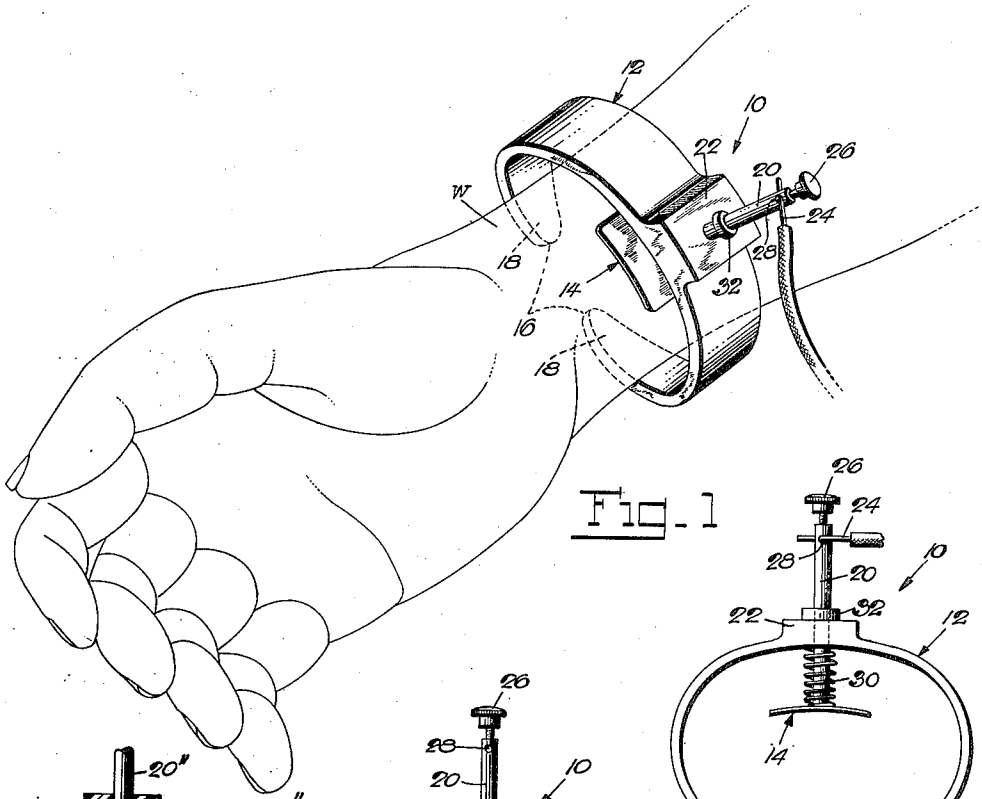


Fig. 1

Fig. 2

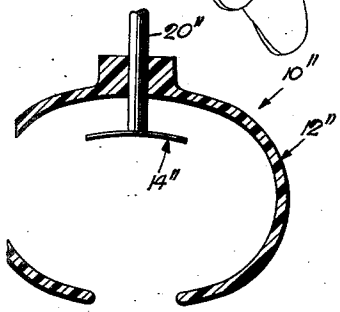


Fig. 6

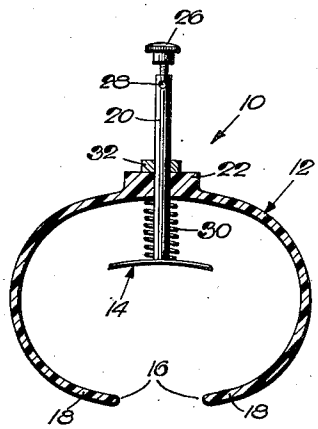


Fig. 4

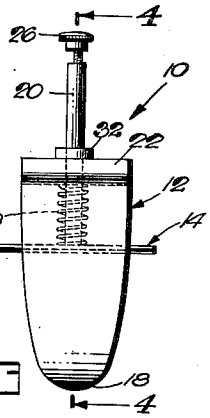


Fig. 3

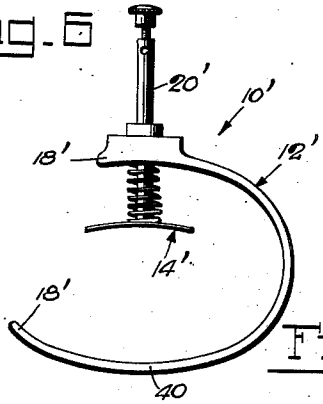


Fig. 5

Inventor:
Nathan H. Friedman

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ELECTROCARDIOGRAPHIC CONTACT ATTACHMENT

Nathan H. Friedman, Stratford, Conn.

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3 Claims. (Cl. 128—2.06)

This invention relates generally to contact electrodes of the type used especially, though not exclusively, in electrocardiography, and more particularly to their attachment to the limbs of the human body.

Contact electrodes of this type are at present applied to the limbs of the human body almost exclusively by adjustable straps which hold the electrodes in place. While these straps are entirely satisfactory in achieving good contact between the electrodes and the human body for the attainment of satisfactory electrocardiograms, they are objectionable in several important respects. Thus, the time required for applying the electrodes and straps to a patient's limbs is all out of proportion to the actual time required for making an electrocardiographic recording of the patient's heart action once the electrodes are attached. Further, some skill and dexterity is required on the part of a medical technician or doctor in holding an electrode in the right place on one of the limbs of a patient while at the same time applying and tightening a strap without dislocating the placed electrode. Moreover, medical personnel frequently deplores the fact that these straps almost invariably pick up some of the paste customarily smeared on a patient's limbs for conductive purposes and the ensuing need for cleaning the straps almost after each application. Medical personnel in general and doctors in particular also frown upon the rather crude expediency of laboriously strapping the electrodes onto a patient's limbs in this technologically advanced day and age. Furthermore, medical technicians and doctors alike apply the straps exactly in the manner their definition purports, namely with a tightness which in any event is in excess of that required to keep the electrode safely in place and which is resented vociferously or silently by many patients. Last but by no means least, the practice of strapping on the electrodes is psychologically bad in that it reminds many patients who are ignorant of the weak, non-perceptible currents involved in electrocardiography of the strapped-on electrodes used in the gruesome lethal electrocution of criminals, with the results that some patients become apprehensive of purely imaginary dangers which do not at all exist in fact.

It is one of the important objects of the present invention to provide for a contact electrode of the electrocardiographic type an attachment by means of which the electrode may be applied to a patient's limb without giving rise to any of the aforementioned objections to the prior attachment straps.

It is another object of the present invention to provide for a contact electrode of the aforementioned electrocardiographic type an attachment which, in contrast to the previous attachment straps, may quickly and with exceptional ease be snapped on a patient's limb.

Another object of the present invention is to provide for a contact electrode of the aforementioned type an attachment which for its ready snap-on application to a patient's limb requires neither skill nor dexterity on the part of the operator performing the task.

A further object of the present invention is to provide

for a contact electrode of the aforementioned type an attachment which is far less liable to pick up some of the conductive paste usually applied to a patient's limb than the previous attachment straps, thereby normally requiring after each application cleaning of the electrode only and not of its attachment, this being a task which requires far less time and effort than the previously required cleaning of an electrode and its attachment strap.

It is another object of the present invention to provide for a contact electrode of the aforementioned type an attachment which by virtue of its construction may be applied to a patient's limb with only a pressure that is so slight as to be hardly perceptible by the patient, yet sufficient to maintain good contact between electrode and limb for an accurate electrocardiogram even if the patient should be unruly and move slightly prior to or during the recording.

It is a further object of the present invention to provide for a contact electrode of the aforementioned type an attachment which in no wise resembles straps and their dangling ends, thereby to disassociate in a patient's mind any parallel between the attachment and the straps used in the lethal execution of criminals.

Further objects and advantages of this invention appear obvious from the following specification which describes preferred forms of the present electrode attachment.

The several forms of the present invention are illustrated in the accompanying drawings, in which:

Fig. 1 is a perspective view of an electrocardiographic contact attachment according to this invention as applied to a human limb;

Figs. 2 and 3 are end and side views, respectively, of the same electrocardiographic contact attachment;

Fig. 4 is a section taken on the line 4—4 of Fig. 3;

Fig. 5 is an end view of an electrocardiographic contact attachment embodying the present invention in a modified manner; and

Fig. 6 is a fragmentary section through an electrocardiographic contact attachment embodying the present invention in a further modified manner.

Referring to the drawings, and especially to Figs. 1 to 4 thereof, the reference numeral **10** denotes an electrocardiographic contact attachment which comprises an attachment band **12** and a contact electrode **14**.

The attachment band **12**, which is preferably made of any suitable resilient dielectric material, such as plastic, for instance, is generally cuff-like in shape and is preferably of substantially elliptic outline with transverse long and short axes. The dimensions of the band **12** are such that without the spring-urged electrode to be described it would dangle rather loosely on wrists or ankles of the normally varying sizes of human patients to which it is adapted to be applied in electrocardiography. The band **12** is at one side open as at **16** to provide thereat inward wings **18** which in any event are so spaced apart as to require expansion of the band for its direct lateral passage over and onto human limbs of various sizes, such as wrists and ankles. In the present instance, the inward wings **18** of the band are equally spaced from the short axis of the latter (Figs. 2 and 4).

The contact electrode **14**, which is preferably made of the material and size recommended by recognized medical authorities in electrocardiography, is provided with a conductive shank **20** which extends with a sliding fit through the band **12**. In order to provide adequate bearing surface for the shank **20** of the electrode **14**, the band **12** is preferably provided with a boss-like extension **22** through which the shank **20** extends. As shown in Figs. 1 to 4, the electrode **14** is carried by the band **12** at all times and, hence, forms with the latter a normally inseparable unit. More particularly, the electrode

14 is on the inside of the band 12 and its shank 20 extends to the outside thereof and is there provided with terminal provisions for the removable attachment thereto of a lead wire 24 (Figs. 1 and 2). In this instance, the outer end of the electrode shank 20 is provided with a tapped central recess (not shown) for the reception of a terminal screw 26 with which to clamp the lead 24 in place after its insertion through a transverse hole 28 in the electrode shank 20. The electrode 14 is normally urged inwardly of the band 12 by means of a spring, in this instance by a helical compression-type spring 30 which surrounds the electrode shank 20 and is interposed between the band 12 and the electrode 14 (Figs. 2 and 4). Inward motion of the electrode 14 is preferably limited by means of a stop collar 32 which is provided on the electrode shank 20 and bears against the boss-like extension 22 on the band 12 when the latter is not applied to a human limb (Figs. 2 and 4).

In applying the instant contact attachment 10 to a human limb, such as the wrist *w* shown by way of example in Fig. 1, the doctor or medical technician performing the task need merely expand the band 12 sufficiently to pass it directly over the patient's wrist, preferably over the lesser thickness of the wrist so as to require minimum expansion of the band. In thus applying the band to a human wrist, for instance, the spring-urged electrode 14 will automatically come into contact with the wrist and will even yield, to an extent depending on the size of the encircled wrist, to permit the bracelet to clamp itself to the wrist with a relatively light pressure under the compulsion of the spring 30. Once the band 12 is applied to the wrist, or to an ankle as the case may be, in this quick and facile manner, it is merely necessary to check the position of the electrode on the limb and, if necessary, quickly twist the band sufficiently to place the electrode accurately if the same is not already in the right position on the limb, i. e., against the prominent arteries running along the human wrist, for instance.

The task of thus applying a contact electrode to a human limb is considerably simpler and much quicker than that involved in the previous practice of strapping on an electrode. Furthermore, the quick and effortless spread-over attachment of the instant band to a human limb does not require disconnection of the lead wire from the electrode shank for the attachment of the electrode as in the previous practice of strapping on the electrode. Thus, the lead wire 24 may remain connected with the electrode shank 20 while the band 12 is applied to a human limb, and the band may conveniently have a distinguishing color or any other distinctive mark in order readily to indicate its correct application to a particular human limb for obtaining a true electrocardiogram. The spring 30 may, furthermore, be relatively weak and yet exert sufficient pressure on the electrode 14 to provide good contact between the same and a patient's limb without giving the patient undergoing the electrocardiography any real perception of clamping pressure. Also, since the conductive paste customarily smeared on a patient's limb is more or less confined to the limb area to be contacted by the electrade, the instant band 12 is much less liable to pick up any of this paste than the previous electrode straps, primarily because the spring-urged electrode 14 effectively keeps the adjacent band portion out of contact with the applied paste during and after the application of the attachment to the limb. Hence, if the instant contact attachment is spread over a patient's limb with the electrode substantially lined up with the paste-coated limb area, the band will hardly ever pick up any of the applied paste and require only infrequent cleaning in consequence. Last, but by no means least, the band 12 is of a pleasing bracelet-like design and bears no resemblance whatsoever to the previously used straps for holding the contact electrodes in place. Hence, the instant contact attachment goes far in disassociating in a patient's mind any parallel between the instant attachment and the straps used in lethal executions in the electric chair.

The instant contact attachment is unique in that the band 12 is, in comparison to the patient's limb, quite spacious and may be spread over the latter with the greatest of case and rapidity, and the electrode 14 will, under the compulsion of its spring 30 and without any further ado on the part of the operator, move into good contact engagement with the patient's limb and further draw the loose band 12 into good holding engagement with the limb. This is in distinct contrast to the previous practice of strapping on a contact electrode in accordance with which the electrode had to be placed first on the selected area of the patient's limb and held thereagainst while the strap was applied in an awkward manner.

While the spring-urged electrode 14 of the hereinbefore described contact attachment will, on application of the band 12 to a patient's limb, draw the wings 18 of the band into holding engagement with the limb (Fig. 1), the modified contact attachment 10′ shown in Fig. 5 will, on application of the band 12′ to a patient's limb, draw a band portion 40 intermediate the wings 18′ into holding engagement with the limb. This is due to the fact that the wings 18′ are in this instance spaced from the long axis of the substantially elliptic band 12′, while the electrode 14′ and its shank 20′ extend substantially in line with the short axis of the band. The instant modified band may by some be preferred over the one shown in Figs. 1 to 4 due to its ready application over the lesser thickness of the wrist of a patient with minimum expansion of the band and the consequent alignment of the electrode 14′ with the correct wrist area with which it is adapted to make contact, without requiring subsequent twisting of the applied band.

Fig. 6 shows a further modified contact attachment 10″ which distinguishes from the spring-urged electrodes of the hereinbefore described attachments by having a contact electrode 14″ which is manually adjustable into contact with a patient's limb rather than self-contacting therewith under the compulsion of a spring. To this end, the shank 20″ of the contact electrode 14″ is received in the band 12″ with a friction fit which is sufficiently tight to hold the electrode against the patient's limb and at the same time hold the band snugly against the latter to prevent ready displacement of the same while an electrocardiogram is being taken.

While the contact attachment is herein shown and described as embodied in a preferred form of construction in several different forms, it is to be understood that other forms of the invention may be adapted without departing from the scope of this invention as expressed in the following claims. Therefore, without limiting myself in this respect, I claim:

1. An electrocardiographic contact attachment, comprising a cuff-like band of resilient dielectric material and of a size to dangle loosely on human limbs of various sizes, said band being generally of elliptic shape with transverse long and short axes and being open at one side to provide thereat opposite wings which are spaced so as to require momentary expansion of the band for its lateral passage over limbs of various sizes; and a contact electrode within said band having a conductive terminal shank projecting outside the latter substantially in line with said short band axis and being adjustably carried by said band for movement of the electrode into and from contact with a limb in said band and simultaneous movement of the latter into holding engagement with said limb.

2. An electrocardiographic contact attachment as defined in claim 1, in which said wings are spaced from said

short axis of said band, so that said wings are moved into holding engagement with a limb in said band on inward adjustment of said shank.

3. An electrocardiographic contact attachment as defined in claim 1, in which one of said wings extends to one side of said short axis of the band and terminates in close proximity thereto, and the other wing extends to the same side of said short axis and terminates at a considerably larger distance from the latter than said one wing, and said shank extends through said one wing, so that said other wing and a band portion continuous therewith is

on inward adjustment of said shank moved into holding engagement with a limb in said band.

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