THERAPEUTIC ELECTRIC PULSE GENERATING APPARATUS

The present invention generally relates to therapeutic electric pulse generating apparatus used for various treatments in which it appears useful that high voltage discharges or glow discharges are caused to flow through some portions of the body of a patient.

Apparatus of this type is used particularly for treatment of muscular pains and includes electrodes between which flows a current of piezoelectric origin.

Piezoelectric generators are also used in fields of application other than the therapeutic field and, in particular, they are used as igniters of various devices due to their great operational safety.

There are in this respect particularly known gas lighter devices which comprise in a body of plastics material, a piezoelectric generator having a terminal connected to an electrode while another terminal is connected to a conductive nipple forming, with the electrode, an air gap in which flashes a spark when the piezoelectric generator is energised.

According to the present invention, there is provided a therapeutic electric pulse generator apparatus comprising a body with a distribution head provided with notches and having a peripheral conductive belt disposed for placement in contact with the skin of a patient, a piezoelectric generator, a plurality of electrodes connected to one pole of said generator, wherein said plurality of electrodes are respectively located in said notches at a level lower than the level of said conductive belt, and wherein said peripheral conductive belt is connected to another pole of said generator, whereby a current of piezoelectric origin is caused to flow through said notches between said plurality of electrodes and said

conductive belt of said head.

The present invention is concerned with improving the operation of apparatus, particularly apparatus of a similar principle to gas lighter devices, but enabling control of the flow of the glow discharges and electric sparks dependent on the therapy to be applied.

An embodiment of the invention can provide a motorised apparatus which produces a glow discharges or electrical sparks at a chosen rate without having to resort to other operations except maintaining a pressure on a switch.

Various other features of the invention will become more apparant from the following description.

Embodiments of the invention are shown, by way of non-limiting examples, in the accompanying drawings, wherein:

Fig.1 is a longitudinal elevation sectional view of a therapeutic device embodying the present invention;

Fig.2 is a front elevation view of the device;

Fig.3 is a front elevation view of the

distribution head of a preferred embodiment of this invention ;

Fig. 4 is a side elevation view of an electrode which is part of the device ;

Figs. 5 and 6 are sectional views respectively taken along lines V-V and VI-VI of Fig.2 ;

Fig. 7 is an elevation view similar to Fig.3 of the distribution head of a variant ; and

Fig. 8 is a view similar to Fig. 1 of another embodiment.

The device shown in the drawings comprises a body 1 of any suitable shape, preferably designed for having ergonomic qualities, particularly in order to be easily maintained in hand of a user when the user wishes to present a distribution head 2, which is described hereafter, on a portion of his body to be treated.

The body 1 of the device is hollow and contains a piezoelectric generator 3 which can be operated by a boss 4 of a handle or pedal 5.

Fig. 1 shows that the handle 5 is articulated for example on a pin 6.

It is advantageous that the body 1 and handle 5 are made of a synthetic material, since in that case their manufacture is made easy, particularly by molding.

A spring 7 is fixed inside an abutment 8 in order to bear against the inner face of the handle 5 with a tendency to pivot the handle 5 in direction of an arrow f_1.

An abutment 8 limits amplitude of the motion which can be made by the handle 5.

As shown in Fig.1, the body 1 is formed at one end with an opening 9 in which is inserted and maintained the distribution and treatment head 2.

The treatment head 2 comprises a grid 10 (Fig.3) in an insulating material, for example a plastics material. The face of the grid 10 which is directed outwardly is formed with transverse walls 11 separating successive notches 12 having alternately a deep portion 12a and a shallow portion 121b.

Figs.5 and 6 are sectional views of two successive notches 12, and as shown the deep portion 12a and the shallow portion 12b are separated by a shoulder 13 at the foot of which is formed an opening 14 in the bottom of each notch.

The openings 14 are used for passage of electrodes 15 extending from a small bar 16 (Fig.4) fixed below the grid 10 and connected by a lead 17 (Fig.1) to one of the poles of the piezoelectric generator 3.

It is advantageous, as shown in the drawings,

that the grid 10 be engaged with a slip fit in the opening 9 so that it can be possibly changed as a function of the treatment to be carried out.

The grid 10 is maintained inside the opening 9 of the body 1 by a belt 18 made of a conductive material, for example a metal, which is fitted onto the body 1 and fixed to the body 1 either by a clipping arrangement or by simple friction in order also to allow, if so desired, the belt 18 to be changed.

The belt 18 comprises studs or contacts 19 which are provided in order to protrude into the notches 12, either in the deep portion of the notches 12, as shown, or in the shallow portion by simply turning the belt 18 over.

A contact 20 is provided in the thickness of the body 1 for electrically connecting the belt 18 with the second pole of the piezoelectric generator 3 by a lead 21.

Fig. 3 shows that the notches 12 can be rectilinear, while Fig.7 shows that the notches 12_1, 12_2 can be arcuate. Possibly, they could also have a zigzag shape according to the type of treatment which it is desired to practice.

Fig. 8 shows a development of this invention in which the piezoelectric generator 3 is no more operated manually by a lever or a knob, but by means of a mobile element 22 which is electrically operated.

In the example as shown, the mobile element forms a cam 23 actuating a pusher element 24 of the piezoelectric generator 3.

The element 22 forms on the other hand the core of an electromagnet 25 with a plunger. It is advantageous that the element 22 is connected to a spring 26 used for bringing it back to its starting position after each impulse caused by the electromagnet 25. Supplying current to the electromagnet 25 is advantageously controlled by a time delay circuit 27.

In the embodiment of Fig. 8, the only thing an user has to do is, once he has set in position an electric lead in a socket 28, to act on a switch 29 closing a circuit of the electromagnet 25 so that an operative frequency of the electromagnet 25 depends thereafter only on the time delay unit 27.

Of course, the hereabove described device can be replaced, if one wishes so, by a rotating electric motor.

The drawings show that the walls 11 of the grid 10 are protruding with respect to the electrodes 15 which are therefore at a lower level than that of the upper edge of the walls 11 and of the most protruding portion of the conducting belt 18. In this way, the skin of a patient to be treated cannot come in direct contact with the electrodes 15, and the result is that the glow discharges and sparks are

always produced even when the patient skin is wet.

The studs or contacts 19 of the conductive belt 18 are shown with an arcuate configuration in Figs. 5 and 6. It is within the scope of the invention to make them flat or substantially flat, or with any other shape for modifying the path of travel of the glow discharges and sparks, particularly for patients whose skin is wet or exhibits characteristics such that the glow discharges and/or sparks have to be more or less reinforced.

The invention is not limited to the embodiments shown and described in detail and various modifications thereof can be carried out thereto without departing from its scope as shown in the dependent claims.

CLAIMS:

1. A therapeutic electric pulse generator apparatus comprising a body with a distribution head provided with notches and having a peripheral conductive belt disposed for placement in contact with the skin of a patient, a piezoelectric generator, a plurality of electrodes connected to one pole of said generator, wherein said plurality of electrodes are respectively located in said notches at a level lower than the level of said conductive belt, and wherein said peripheral conductive belt is connected to another pole of said generator, whereby a current of piezoelectric origin is caused to flow through said notches between said plurality of electrodes and said conductive belt of said head.

2. The apparatus as set forth in claim 1, wherein said notches are defined by walls in the distribution head separate from said electrodes.

3. The apparatus as set forth in claim 2, wherein said plurality of electrodes are at a level inferior to that of an upper edge of the walls, whereby sparks are produced even when said walls are in contact with a wet skin.

4. The apparatus as set forth in claim 1,2 or 3, wherein said belt has studs or contacts protruding into at least some of the notches.

5. The apparatus as set forth in claim 4, wherein said studs or contacts of said conductive belt have a curvature which is a function of the flow of current.

6. The apparatus as set forth in any preceding claim, wherein each of said notches comprises a deep portion and a shallow portion for defining a shoulder, with one of said plurality of electrodes being placed in the vicinity of said shoulder.

7. The apparatus as set forth in claim 6, wherein

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said belt forms a removable cover having studs or contacts which are indifferently engaged in the deep portion and in the shallow portion of said notches.

8. The apparatus as set forth in any preceding claim, wherein said distribution head is removably mounted in said body to be interchangeable.

9. The apparatus as set forth in any preceding claim, wherein said notches are rectilinear.

10. The apparatus as set forth in any of claims 1 to 8, wherein said notches are arcuate.

11. The apparatus according to any preceding claim, wherein said piezoelectric generator is operated by a mobile element, said mobile element being in turn operated by an electromagnet or a rotating motor.

12. A therapeutic electric pulse generator apparatus, substantially in accordance with any of the embodiments hereinbefore described with reference to the accompanying drawings.

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