

March 20, 1962

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3,025,858

AMBULATORY ELECTRICAL MUSCLE STIMULATING DEVICE

Filed Oct. 19, 1956

FIG. 1.

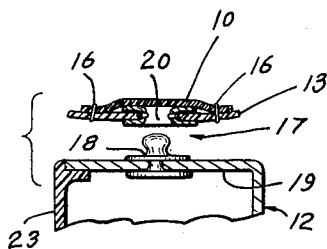
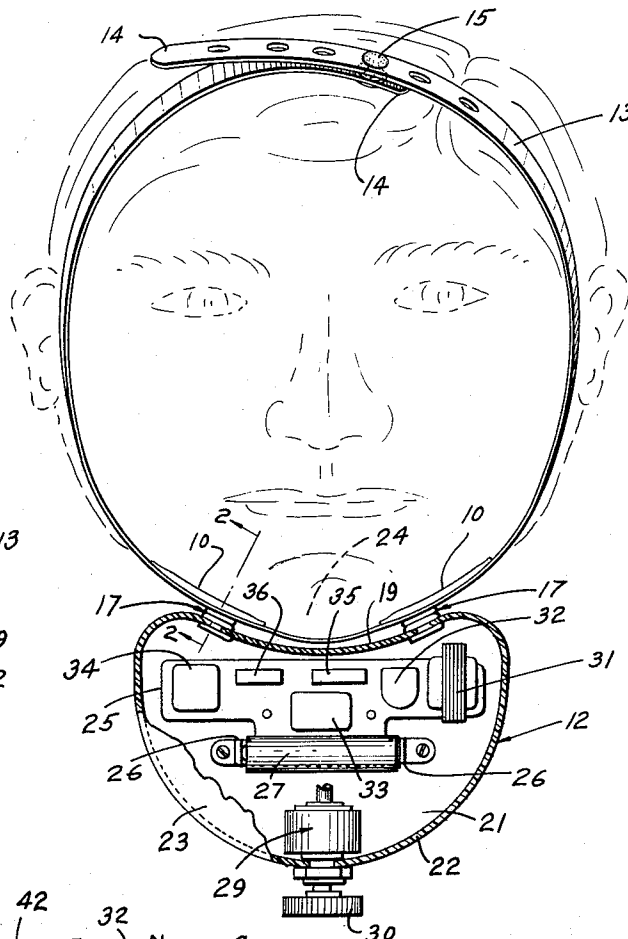


FIG. 2.

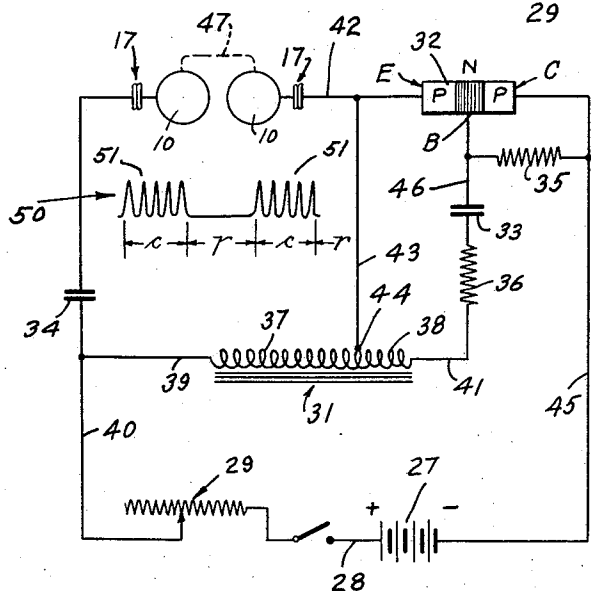


FIG. 3.

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3,025,858

AMBULATORY ELECTRICAL MUSCLE  
STIMULATING DEVICE

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Filed Oct. 19, 1956, Ser. No. 617,102

12 Claims. (Cl. 128—422)

This invention relates to means for the electrical stimulation of human tissues and relates in particular to a device for electrically effecting contraction of the muscles of the chin so as to effect the firming of the chin.

It is an object of the invention to provide a device including a supporting member or casing having at least one pair of electrodes thereon for engagement with spaced areas of the body when the support is brought into a position contiguous to the body, the support having thereon a generator of muscle contracting current connected to the electrodes.

It is a further object of the invention to provide an electrical muscle contracting device adapted to be carried by the user and having associated therewith a pair of spaced electrodes for engagement with skin surfaces and said support having also thereon an electrical generator for delivering muscle stimulating current through the electrodes and the bodily tissues lying between the electrodes. In the preferred form of the invention the device includes a relatively small and light casing with a strap member extending from opposite sides of the casing and over the top of the head, to hold the electrodes situated on the upper portion of the casing in engagement with the selected skin areas of the chin.

One of the advantages of the invention is that it may be used for its intended purpose while the user is occupied with other matters. For example it may be employed by a woman to exercise the muscles of the chin-neck area while she proceeds with her normal daily activities.

It is an object of the invention to provide a muscle toning device having means which may include a strap or belt for holding electrodes in contact with selected surfaces of the body and simple means supported upon the body of the patient for supplying electrical potential through the electrodes to the parts of the body to be treated, making it possible for the patient to be ambulatory if desired.

A further object of the invention is to provide a means for supplying muscle-contracting current to the electrodes which is operated by low voltage current, such as a small battery for example, and which uses a transistor as part of its oscillatory circuit.

A further object of the invention is to provide a simple means for supplying muscle contracting current to the electrodes having an electronic oscillatory circuit utilizing a transistor, and wherein the electrically energized portion of the body is a component of the oscillatory circuit.

A further object of the invention is to provide a device for supplying muscle-contracting current wherein a simple arrangement of oscillatory circuit components controls or determines the frequency and wave form of the muscle-contracting current, the amplification of the voltage of the operating current which is ordinarily obtained from a small battery, and also the surge time or consecutive On and Off periods in the supplying of muscle-contracting current to the body to effect intermittent contraction and relaxation of the musculature undergoing treatment.

Further objects and advantages of the invention may be brought out in the following part of the specification wherein relatively small details of the invention are described for the purpose of competence of disclosure with-

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out intention, however, of limiting the scope of the invention defined in the accompanying claims.

Referring to the accompanying drawings, which are for illustrative purposes only:

FIG. 1 is a face view of a preferred embodiment of the invention with the cover of the receptacle removed:

FIG. 2 is an enlarged fragmentary section taken as indicated by the line 2—2 of FIG. 1; and

FIG. 3 is an electrical diagram of the preferred embodiment invention.

The invention shown in FIG. 1 has electrodes 10 which are held in position against spaced areas of the skin of a user by a strap 13, which may be of rubber or plastic, provided with overlapping ends 14 and an adjustable connector 15 of button form adapted to be passed through selected openings in the ends 14. The electrodes 10 consist of pieces of electro-conductive plastic material, such as a carbon-rubber chemical compound, secured to the upper face of the strap 13 by stitches 16.

The electrodes 10 are detachably connected to the upper wall of a case 12 by metal snap fasteners 17 which are shown with their component parts in separated relation in FIG. 2. The base portions 18 of the snap fasteners are mounted in the upper wall 19 of the case 12, and the ring parts 20 of the snap fasteners are mounted in the strap 13 underlying the electrodes 10. When the fastener parts are connected as shown in FIG. 1, the fasteners provide electrical connections between electrical parts contained in the case 12 and the electrodes 10.

The case 12 has a back wall 21, a side wall 22 extending forwardly from the edge of the back wall 21, and a removable cover 23. The upper wall portion 19 of the case 12, which is a part of the side wall 22, is curved so as to generally conform to the shape of the human chin 24, and the size of the case 22 is proportioned with relation to the chin 24 as shown in FIG. 1. Accordingly, the device may be placed in operative position by the user through the simple expedient of securing the strap around the forward portion of the head with the overlapping ends connected over the top.

Referring now to FIGS. 1 and 3, a supporting plate 25, secured within the case 12, has thereon clips 26 to receive a small battery 27, one terminal of which, as shown in FIG. 3, is connected through a conductor 28 with a switch and rheostat device 29 which is mounted in the bottom portion of the side wall 22 with its operating knob 30 projecting from the case 12. The supporting plate 25 also carries thereon an auto-transformer 31, a transistor 32, capacitors 33 and 34 and resistors 35 and 36, which are electrically connected as shown in FIG. 3. In place of an auto-transformer 31 there may alternatively be used an ordinary transformer and on the outside of such a transformer one lead from each winding could be joined to produce the electrical equivalent of an auto-transformer. The transformer 31 has two coil portions 37 and 38. The outer end 39 of the coil portion 37 is connected through a conductor 40 with the switch device 29 and is connected through the capacitor 34 with one of the electrodes 10. The outer end 41 of the coil portion 38 is connected through a series R-C network consisting of the resistor 36 and the capacitor 33 with the base B of the transistor 32 which is of the PNP type. It will, of course, be understood that an NPN type transistor may alternately be used although a polarity reversal will be required in the circuit in such case. The emitter electrode E of the transistor 32 is connected by a conductor 42 with the remaining skin-contacting electrode 10, and a conductor 43 connects the conductor 42 with the tap 44 between the inner ends of the transformer coil portions 37 and 38. A conductor 45 connects the collector electrode C of the transistor 32 with the re-

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maintaining terminal of the battery 27 and a bleed connection is provided between the base B and the collector electrode C of the transistor 32 by the resistor 35 which connects the conductor 45 with the conductor 46 extending from the capacitor 33 to the base B.

As shown by the dotted line 47 in FIG. 3, the human tissues connected to the electrodes 10 form a series part of an oscillatory circuit. The electrodes 10 are not merely means for delivering to the body oscillating electric current from an oscillating electrical source but the bodily tissues between the electrodes 10 are a component of the oscillatory circuit of the device. Consequently, the device will not oscillate unless the electrodes 10 make good electrical contact with the skin of the user, which is accomplished by wetting the surfaces of the electrodes 10 with water before the device is placed in operative position.

A feature of the invention is that it does not require an intermittently acting switch for producing time spaced periods of energization of the bodily tissues so that the muscles will be contracted and then relaxed in alternate order, and a further feature is that it operates without connection to high voltage electrical supply systems and eliminates all danger of electrical shock to the user. As schematically indicated at 50 in FIG. 3, electrical oscillations 51 are passed through bodily tissues during spaced periods of time indicated at *c*, these muscle-contraction periods being separated by periods of relaxation *r*. Very good muscle-contraction is obtained where the frequency of the oscillations 51 is in the range 96 to 108 cycles per second, with a power input of approximately 75 milliwatts. The resistors 35 and 36 control the durations of the On and Off periods *c* and *r*, and therefore the length of these periods may be changed by varying the resistance of these resistors 35 and 36. The resistor 36 controls the rate of the building up of a positive charge in the capacitor 33 capable of initiating oscillation of the device, and therefore determines the length of the Off period *r*. The resistor 35 acts as a bleed for the capacitor and the rate of current flow therethrough determines the length of the period of oscillation *c*. In the form of the invention illustrated, the battery 27 is one of those customarily employed in hearing aids, and has a potential of thirty volts. The peak voltage represented by the tops or points of the electrical wave indicated at 51 in FIG. 3 may reach the value of 336 volts, but good muscular contraction, where the bodily tissues are a component of the oscillatory circuit, at values lower than this.

I claim:

1. In an electrical generator of muscle-contracting electrical current: a transistor; battery and transformer means for energizing said transistor; conductors forming emitter and collector circuits connecting said transistor and said battery and transformer means; timing means for producing predetermined time spaced periods of electrical current generation, said timing means including a resistor connected between the base and collector of said transistor and a series R-C network connected between the base of said transistor and said transformer means; and body-engaging electrodes connected in series in one of said circuits.

2. In an electrical generator of muscle-contracting electrical current: a transistor; battery and transformer means for energizing said transistor; conductors forming base, emitter and collector circuits connecting said transistor and said battery and transformer means, there being body engaging electrodes in said emitter circuit; capacitors in said base and emitter circuits; a resistor in said base circuit for controlling the rate of build-up of a positive charge in the capacitor in said base circuit so as to control the length of the Off period of the generator; and a high resistance leak connecting said collector circuit with the base of said transistor to control the length of the On period of the generator.

3. In an electrical generator of muscle-contracting electrical current: a transistor; an auto-transformer having one

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end thereof connected to the base of said transistor through a resistor and a capacitor, having its other end connected to the emitter of said transistor through circuit forming means comprising a capacitor and body-engaging electrodes, and having an intermediate tap connected to said emitter of said transistor; a battery; a conductor connecting one terminal of said battery with the collector of said transistor; a conductor connecting the other terminal of said battery to said other end of said transformer; and a high resistance bleed connecting said first named terminal of said battery to the base of said transistor.

4. In an electrical generator of muscle-contracting electrical current: a P-N-P transistor; an auto-transformer having one end thereof connected to the base of said transistor through a resistor and a capacitor and having its other end connected to the emitter of said transistor through circuit-forming means comprising a capacitor and body-engaging electrodes, and having an intermediate tap connected to said emitter of said transistor; a battery; a conductor connecting the negative terminal of said battery with the collector of said transistor; a conductor connecting the positive terminal of said battery to said other end of said transformer; and a high resistance bleed connecting said negative terminal of said battery to the base of said transistor.

5. In an electrical generator of muscle-contracting electrical current: a transistor; battery and transformer means for energizing said transistor; conductors forming emitter and collector circuits connecting said transistor and said battery and transformer means; timing means for producing predetermined time spaced periods of electrical current generation, said timing means including a resistor connected between the base and collector of said transistor and a series R-C network connected between the base of said transistor and said transformer means; and body-engaging electrodes connected in series with one of said circuits so that when the generator is in use the bodily tissues between said electrodes will be a component of the electrical generating system of the generator of muscle-contracting current.

6. In an electrical generator of muscle-contracting electrical current: a transistor; battery and transformer means for energizing said transistor; components forming base, emitter and collector circuits connecting said transistor and said battery and transformer means, there being body engaging electrodes in series in said emitter circuit, said base circuit having a capacitor therein; means for controlling the build-up of a positive charge in said capacitor; and a high resistance leak connecting said collector circuit with the base of said transistor.

7. In an electrical generator of oscillating current having Off and On periods: a transistor; battery and transformer means for energizing said transistor; components forming base, emitter and collector circuits connecting said transistor and said battery and transformer means, there being means for connecting a load in series in said emitter circuits; a capacitor in said base circuit; a resistor in said base circuit for controlling the rate of build-up of a positive charge in said capacitor so as to control the length of the Off period of the generator; and a high resistance leak connecting said collector circuit with the base of said transistor to control the On period of operation of the generator.

8. In an electrical generator of oscillating current, having Off and On periods: a transistor; an autotransformer having one end thereof connected to the base of said transistor through a resistor and a capacitor, having its other end connected to the emitter of said transistor through circuit forming means comprising a capacitor and means for connecting a load in series, and having an intermediate tap connected to said emitter of said transistor; a battery; a conductor connecting one terminal of said battery with the conductor of said transistor; a conductor connecting the other terminal of said battery to said other end of said transformer; and a high resistance bleed con-

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necting said first named terminal of said battery to the base of said transistor.

9. In an electrical generator of oscillating current having Off and On periods: a transistor having a base, a collector and an emitter; first resistance means coupled between said base and said collector; an auto-transformer having an intermediate tap thereof coupled to said emitter; load connecting means coupled between one end of said auto-transformer and said emitter for application of said oscillating current through an electrically conductive load connected thereacross; capacitance means and second resistance means in series to form an R-C network, said R-C network being coupled between said base and the other end of said auto-transformer; and a source of direct current potential coupled between said emitter and said collector.

10. In an electrical generator of oscillating current having Off and On periods: a transistor having a base, a collector and an emitter; first resistance means coupled between said base and said collector; an auto-transformer having an intermediate tap thereof coupled to said emitter; a pair of load contacting terminals for connection across an electrically conductive load, one of said terminals being coupled to said emitter and the other of said terminals being coupled to one end of said auto-transformer through first capacitance means; second capacitance means and second resistance means in series, the end of said second resistance means opposite said second capacitance means being coupled to the other end of said auto-transformer, and the other end of said second capacitance means opposite said second resistance means being coupled to said base; a source of direct current potential having one terminal thereof coupled to said collector; and variable resistance means coupled between said one end of said auto-transformer means and the other terminal of said source of direct current potential.

11. In a device for effecting electrical contraction of the muscles of the body: a transistor having a base, a collector and an emitter; an auto-transformer having an intermediate tap thereof coupled to said emitter; a pair of body engaging electrodes, one of such electrodes being coupled to said emitter; first capacitance means coupled between the other of said electrodes and one end of said

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auto-transformer; second capacitance means and a first resistance means in series, said first resistance means having one end thereof coupled to the other end of said auto-transformer, said second capacitance means having the end opposite said resistance means coupled to the base of said transistor; second resistance means coupled between said base and said collector; and a source of direct current potential coupled between said emitter and said collector.

12. In a device for effecting electrical contraction of the muscles of the body: a transistor having a base, a collector, and an emitter; first resistance means coupled between said base and said collector; second resistance means and capacitance means in series, the end of said capacitance means opposite said second resistance means being coupled to said base; an auto-transformer having an intermediate tap thereof coupled to said emitter, and one end thereof coupled to the end of said second resistance means opposite said capacitance means; a pair of body engaging electrodes one of said electrodes being coupled to said emitter, the other of said electrodes coupled to the other end of said auto-transformer; a source of direct current potential having one end thereof coupled to said collector; and variable resistance means coupled between said other electrode and the other end of said source of direct current potential.

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