

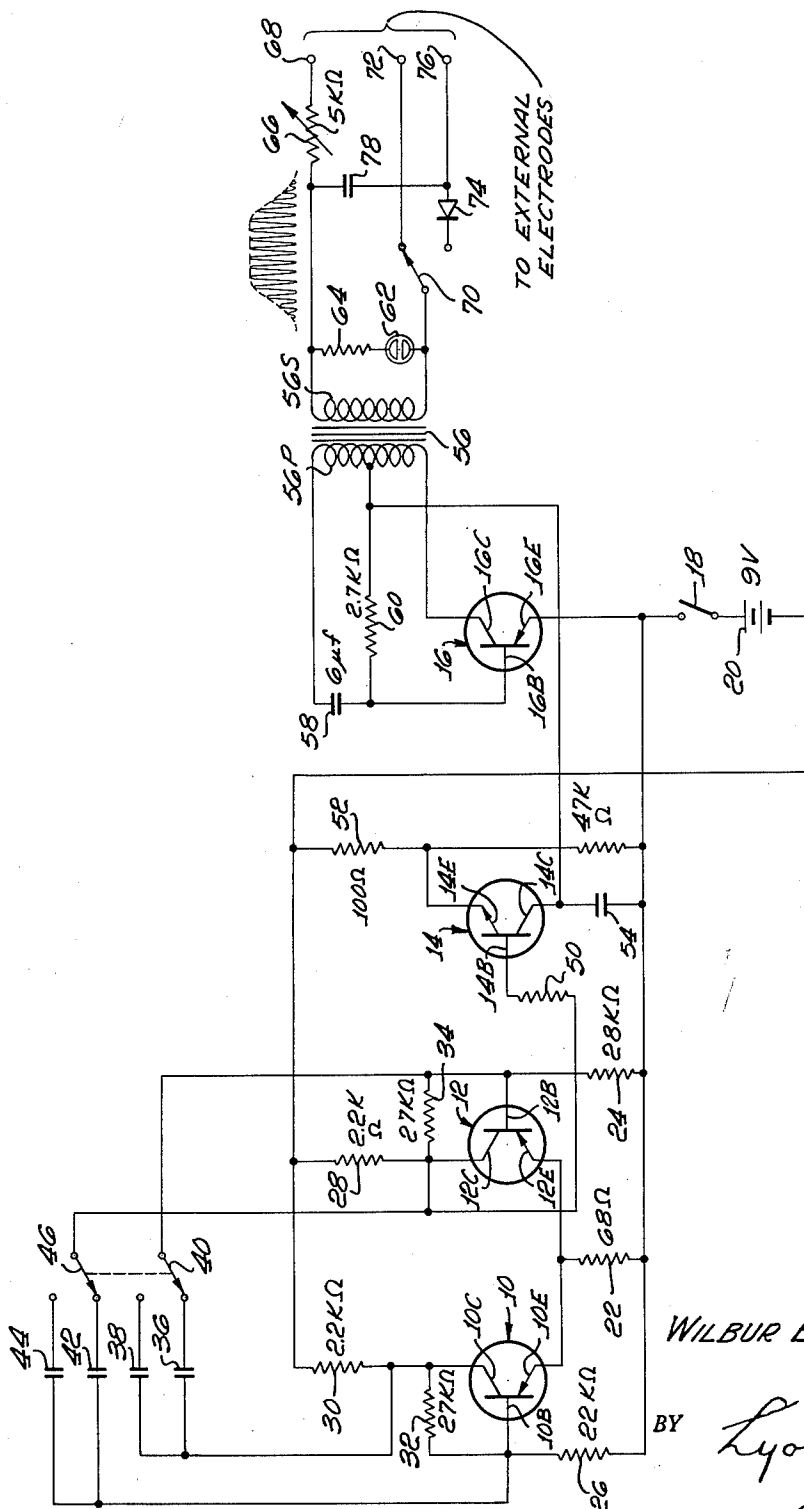
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PULSE GENERATOR FOR HUMAN TREATMENT

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1

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PULSE GENERATOR FOR HUMAN TREATMENT
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This invention relates to pulse generators, the electrical output from which is applied to the human body for the treatment thereof, and more particularly to improvements therein.

It has been found that when electrical pulses are applied to particular portions of the human body certain muscles in the vicinity of the application of these pulses will twitch in response to these pulses. This phenomenon has been put to use for different purposes. One of these purposes is to provide passive exercise of the muscles involved for reducing or eliminating sagging facial muscles. For further examples, pulses are applied to the heart, either as a pacemaker to maintain its regular rhythmic beat or as a defibrillator, for the purpose of stopping heart fibrillation. Heretofore, the pulse generator apparatus employed was plugged into the house lighting circuit from which power for the operation thereof was derived. In view of the direct application of electrodes to the body of a human being, extra precautions were required to be taken to insure isolation between the applicator electrodes and the power source. Despite these precautions, severe shocks are often sustained from causes such as external humidity or the buildup of electrostatic charges which are discharged through the body of a person to ground, etc.

An object of the present invention is to provide a pulse generator for use in treating the human body wherein accidental shocks cannot occur.

Another object of the present invention is the provision of a novel pulse generator for treating the human body which is operated independently of the usual 110-volt power sources.

Still another object of the present invention is to provide a portable pulse generator for treating the human body which can be used anywhere.

A further object of the present invention is the provision of a pulse generator for treating the human body which does not require expensive insulation precautions.

These and other objects of the present invention are achieved in an arrangement for generating pulses wherein transistors powered by a 9-volt battery are employed. These transistors are connected in a circuit arrangement to generate pulses of a required frequency and voltage amplitude to achieve the muscular reaction desired in response thereto.

The novel features that are considered characteristic of this invention are set forth with particularity in the appended claims. The invention, itself, both as to its organization and method of operation, as well as additional objects and advantages thereof, will best be understood from the following description when read in connection with the accompanying drawing, which is a circuit diagram of an embodiment of the invention.

Reference is now made to the drawing, which shows a circuit diagram of an embodiment of the invention. This will include four transistors, respectively 10, 12, 14, and 16. Each transistor has a base 10B, 12B, 14B, 16B, a collector 10C, 12C, 14C, and 16C, and an emitter 10E, 12E, 14E, and 16E. Transistors 10, 12, and 16 are of the same type which is indicated in the drawings as the PNP type, and transistor 14 is of the NPN type.

In order to initiate operation of the pulse oscillator, a switch 18 is closed. This applies power from a 9-volt battery 20 to all the transistors. The two transistors 10, 12 are interconnected by resistors and capacitors to form

2

a multivibrator oscillator. The resistor 22 is connected between the battery power source and the emitters 10E, 12E. Resistor 24 is connected from the battery power source to the base 12B. Resistor 26 is connected from the battery power source to the base 10B. A collector load resistor 28 is connected between the negative terminals of the battery 20 and the collector 12C. A second collector load resistor 30 is connected between the battery negative terminal and the collector 10C. A base bias resistor 32 connects the collector 10C to the base 10B. Another base bias resistor 34 connects the collector 12C to the base 12B. The base 12B is coupled to the collector 10C through either capacitor 36 or capacitor 38, as may be selected by the switch arm 40. The base 10B is coupled to the collector 12C through either capacitor 42 or 44 as selected by the switch arm 46. The switch arms 40, 46 are ganged to make the capacitor selection simultaneously. The switching between capacitors determines the frequency of oscillation of the multivibrator.

As is well known, first one, then the other of the multivibrator transistors becomes conductive. The frequency of the transfer of conduction between transistors, as well as the duration of conduction by one or the other of the two transistors is determined by the resistor and capacitor values, as well as the types of transistors themselves which are employed. Illustrative values are shown in the drawing. Transistors 10, 12, and 16 are Western Electric type 2N226 and transistor 14 is RCA type 2N35. These values are to be taken as exemplary, and not by way of restriction of the invention. Assume, now, that when the switch 18 is closed due to transient disturbances, the transistor 10 will first become conductive. It will conduct in saturation. As a result, a pulse is applied from the collector 10C over the capacitor 36 to the base 12B, which raises the base to or above the potential of the emitter 12E, and therefore the transistor 12 will be maintained nonconductive. Capacitor 36, which is charged by the pulse, will keep the transistor 12 nonconductive until such time as the charge leaks off through the resistors to which it is coupled. As a result, the potential of the base 12B can drop below the potential of the emitter 12E, and transistor 12 will begin to conduct. Thereby, a cutoff pulse will be applied from the collector of the transistor 12 to the base 10B of the transistor 10. This will cut off current conduction to transistor 10 until such time as the charge on the capacitor 42 will leak off, at which time the two transistors will interchange conduction again.

Output from the multivibrator is derived from the collector 12C. This collector is connected through a resistor 50 to the base 14B of the transistor 14. Transistor 14 is connected in the circuit to act as the gate. Normally, it is in its nonconducting, or biased-off, state. Upon receiving a pulse from the multivibrator, it is enabled to conduct and transmit a pulse to the succeeding portion of the circuit. The emitter of transistor 14, which is of the NPN type, is connected to the negative side of the battery 20 through a resistor 52. The collector 14C of the transistor 14 is connected through a capacitor 54 to the positive terminal of the battery 20.

Upon the application of a positive pulse from the collector 12C to the base 14B, transistor 14 can become conductive, whereupon a current pulse is enabled to flow through capacitor 54. This current pulse is applied to transistor 16, which is connected in a blocking-oscillator type of circuit. This blocking-oscillator circuit is quiescent until a pulse is received from the transistor 14, at which time it will commence oscillating and will continue to oscillate as long as the pulse is maintained. The duration of the applied pulse is determined by the value of the capacitor 54 and the resistors connected to the

3

transistor 14, through which it is enabled to discharge. A step-up transformer 56 has a primary winding 56P, which is tapped. One end of the primary winding is connected to the collector 16C of transistor 16, and the other end of the primary winding is connected through a capacitor 58 to the base 16B of transistor 16. The collector 14C of transistor 14 is connected to the tap on the primary winding 56P. A resistor 60 is connected between the tap on the primary winding and the base 16B of transistor 16.

The secondary winding 56S of the transformer 56 has connected thereacross a neon lamp 62 in series with a current-limiting resistor 64. This lamp will illuminate for each pulse and serves to indicate whether the circuit, and, more specifically, the battery, are functioning adequately. One end of the secondary winding 56S is connected through a potentiometer 66 to a first output terminal 68. The other end of the secondary winding 56S is connected to a switch 70. The switch 70 will connect to either an output terminal 72 or through a rectifier 74 to another output terminal 76. A capacitor 78 serves in conjunction with rectifier 74 to provide pulsed direct current at output terminals 68 and 76 when the switch 70 is connected to the rectifier 74. Output terminals 68 and 72 provide pulse alternating current. Potentiometer 66 serves to adjust the selected type of output voltage to a desired amplitude.

The blocking oscillator circuit, upon receiving a pulse from transistor 14, is shocked into oscillation. The pulse serves to provide collector current for the transistor 16 and the transformer primary winding 56P serves as a feedback winding between the collector and base, whereby the transistor 16 can oscillate at a frequency determined by the capacitor 58 and resistor 60. The output wave shape will have the form shown above the output circuit, wherein the dotted line represents the waveform of the gating pulse received from transistor 14 and the solid lines represent the waveforms derived from the output of the transistor 16.

The output terminals 68 and 72 or 68 and 76 may be connected to any type of electrode desired for applying the oscillation pulses to the human body. For example, for passively exercising facial muscles, the electrodes may take the form of sponges which are moistened with an electrolytic fluid. These electrodes may be the type required where it is desired to provide either pacemaker or defibrillator type of operation. Since the circuit is completely independent of the usual 110-volt sources, no

4

danger of electrostatic shock or shock due to leakage across insulation can occur. The device is completely portable. As may be seen from the drawing, the components are simple and inexpensive, and since the usual heavy insulation as well as electrical underwriter precautions are not necessary with the type of low-voltage circuits shown, the system is much simpler and cheaper to manufacture than those of other types for this purpose.

I claim:

1. A pulse generator for human treatment comprising a multivibrator circuit of the continuously oscillating type including a first and second transistor, a third transistor, means biasing said third transistor to be nonconductive in the quiescent state, means for applying output from said second to said third transistor to render said third transistor conductive responsive thereto, a blocking oscillator circuit including a fourth transistor, means for applying output from said third to said fourth transistor to render said blocking oscillator circuit oscillatory responsive thereto, output terminals, rectifier means connected to said output terminals, and switch means for selectively applying output from said blocking oscillator directly to said output terminals or to said rectifier means.

2. A pulse generator as recited in claim 1 wherein said blocking oscillator output circuit includes a transformer having a tapped primary and secondary winding, means connecting said tapped primary winding to said fourth transistor, a glow lamp, a resistor, and means connecting said glow lamp and resistor in series across said secondary winding whereby said glow lamp can indicate when said blocking oscillator circuit is operative.

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