

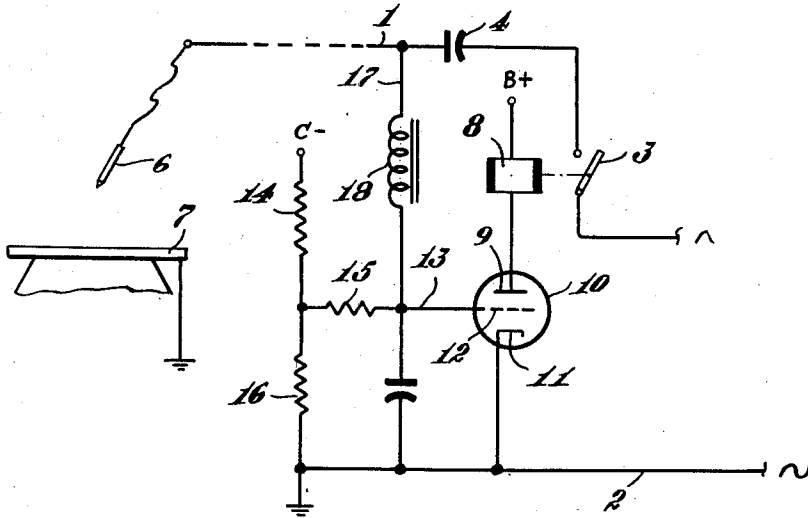
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ELECTRODE DISCHARGE CONTROL FOR SURGICAL APPARATUS

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ELECTRODE DISCHARGE CONTROL FOR SURGICAL APPARATUS

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This invention relates to apparatus for controlling the discharge of current from an electrode into a body which is more or less conductive. More particularly the invention relates to apparatus for discharging high frequency current to a wound in a human body for the purpose of cauterizing the wound:

Heretofore the flow of current to such an electrode has been controlled by a manual switch on the electrode itself or a foot switch controlled by the operator. Neither control has been satisfactory because they both interfere with the work of the operator which is often of a delicate nature as, for example, in the case of a surgeon cauterizing a wound. Moreover a switch on the electrode often interferes with the facile operation of the electrode.

Objects of the present invention are to provide a control which eliminates all manual controls, which automatically supplies discharge current when the electrode is presented to the body, and which requires only a single conductor leading to the electrode.

According to the present invention the apparatus comprises a work circuit for supplying alternating current to the body when the electrode is presented to the body, and a control circuit including a source of direct current and control means responsive to the aforesaid source for initiating flow of alternating current to the work circuit when the control circuit is closed, the aforesaid circuits having a common portion including said body and electrode, whereby the control circuit is closed by touching the body with the electrode.

In a more specific aspect the apparatus comprises an electronic device having a control electrode which puts the device in non-conducting condition at one potential and in conducting condition at another potential, and a control circuit including the aforesaid body and electrodes for changing the potential of the control electrode from the first to the second of the aforesaid potentials when the discharge electrode is presented to the body, whereby current in the work circuit is initiated when the discharge electrode is presented to the body. Preferably the electronic device comprises a triode or transistor having direct current bias means for normally holding the control electrode at a potential to maintain the device in non-conductive condition. The control circuit should be connected to the work circuit at a point between the source of alternating current and the discharge electrode so that the electrode requires only one conductor. Also the apparatus should have an inductor in the control circuit between the two electrodes and a condenser in the work circuit between the source of alternating current and a point at which the control circuit is connected to the work circuit. Preferably the electronic device is of the type having an output circuit for controlling the supply of current to the work circuit and an input circuit including the aforesaid body and electrode for changing the potential from inoperative to operative when the discharge electrode is presented to the body.

For the purpose of illustration a typical embodiment

of the invention is shown in the accompanying drawings in which the figure is a circuit diagram.

The particular embodiment illustrated in the drawing comprises a work circuit 1—2 supplied from any suitable source of alternating current and containing a switch 3; a condenser 4; the aforesaid discharge electrode 6 and a support 7 for the aforesaid body to which the electrode 6 is to be presented. While the support 7 may be connected directly to the side 2 of the work circuit, as illustrated both the conductor 2 and the support 7 are grounded. The switch 3 is closed by means of a relay 8 connected to the plate 9 of a triode 10 comprising a cathode 11 and a grid 12, the cathode being connected to the side 2 of the work circuit. The grid 12 is biased by means of a direct current source C— through a conductor 13 and two resistors 14 and 16. Connected across the work circuit is a bridge circuit 17 containing inductance 18 and capacitance 19; the conductor 17 being connected to 13 intermediate the inductance and capacitance. The capacitance 4 prevents the flow of direct current back to the source of alternating current and the inductance 18 blocks the flow of alternating current through the control circuit. A high resistance 15 may also be included in conductor 13 as illustrated.

For cauterizing wounds the discharge current may have a frequency of the order of one megacycle or more and a potential of the order of one thousand volts, in which case the value of the resistors 14 and 16 may be of the order of ten million ohms each. The value of C— should be approximately twice the voltage required to effectively cut off the flow of plate current in the triode, for example forty volts.

Normally no substantial amount of current flows through the triode because of the bias produced by the source C—. However, when the electrode 6 is grounded, by contact with a conducting body resting on the grounded support 7, the potential drop between plate 9 and cathode 11 is greatly reduced. This results in the energization of relay 8 which closes the switch 3, thereby automatically supplying alternating current to the electrode 6.

From the foregoing it will be evident that the present invention eliminates manual switches and initiates the flow of discharge current automatically the moment the discharge electrode touches the patient or other grounded body which is more or less conducting. It will also be evident that the apparatus requires only a single conductor leading to the discharge electrode, thereby facilitating the use of the electrode. When the body being operated on is a human body it may be grounded merely by resting on the grounded support 7. However, in this case the body is preferably rested on a more comfortable support and grounded by means of one or more electrodes held against the body by suitable means.

When operating on a human body, particularly in the region of the brain, it is important not to impart a stimulus, and this is accomplished with the present invention by employing high frequency current in the work circuit and, in the control circuit, low potential and high resistance so that there is no substantial direct current flow through the body.

It should be understood that the present disclosure is for the purpose of illustration only and that this invention includes all modifications and equivalents which fall within the scope of the appended claims.

I claim:

1. For discharging current into a human body from a discharge electrode, surgical apparatus comprising a work circuit for supplying current to the electrode, and means for controlling the supply of current to the work circuit, said means comprising an electronic device having a control electrode which puts the device in non-conduct-

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charge electrode is presented to the body, the control current being connected to the supply circuit at a point between the source of alternating current and the electrode so that the electrode requires only one conductor, and an inductor in the control circuit between said electrodes. **5**

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