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DELAYED OPERATION CIRCUIT

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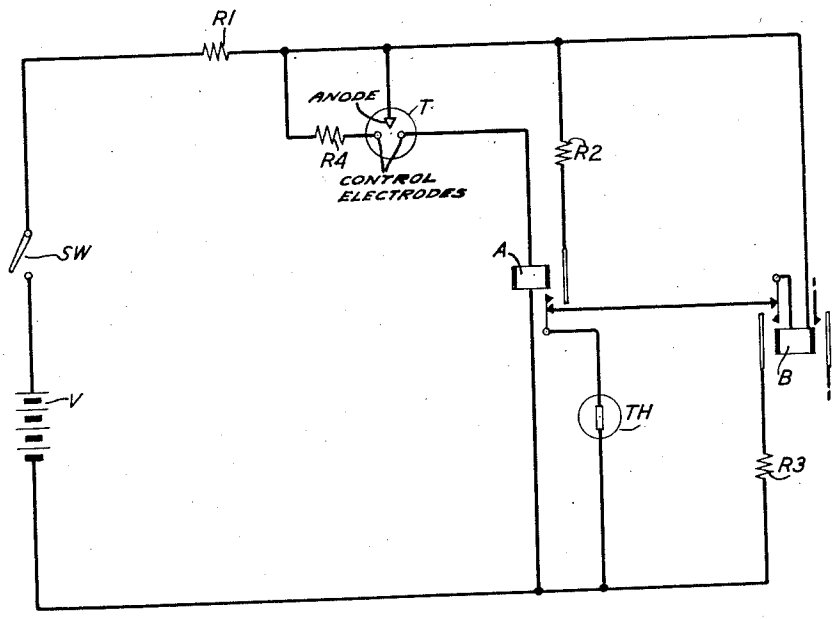

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DELAYED OPERATION CIRCUIT

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4 Claims. (Cl. 175—320)

This invention relates to delayed-operation circuits and the object of the invention is a circuit which is adapted to reduce the percentage variation in the delayed interval for operating a relay, an interval which is due to the wide ratio of operate to non-operate current adjustments of the relay in a circuit serially including a source of current and a resistor, hereinafter termed a thermistor, which has a high resistance at a low temperature and a low resistance at a high temperature.

In circuits employing thermistors and using a known type of relay, for instance, the maximum allowable non-operate current adjustment is approximately 50 per cent of the current required to guarantee its operation. This means that the operation of the relay may be expected within these two current limits and in order to have a narrow range of time variation, the current must rise over this range at a fairly rapid rate.

In the circuit of my invention, the current is prevented from being applied to the relay the operation of which is desired until the current through the thermistor has reached a value that will insure the positive operation of the relay. This eliminates the need of the relay having a non-operate current adjustment.

Referring, now, to the drawing, relay B is the relay whose operation is to be delayed. At the closure of switch SW, a potential from the battery V is applied across the control electrodes of cold cathode gas-filled device T, over a circuit which extends from the positive terminal of battery V, contacts of switch SW, resistance R1, resistance R4, across the control electrodes of said device T, winding of relay A to the negative terminal of battery V. The voltage thus applied is sufficient to cause device T to ionize and break down in the space between its control electrodes whereupon, the space current path immediately transfers to the anode and the one control electrode having the winding of relay A in series with it thereby completing a circuit from the positive terminal of battery B, contacts of switch SW, resistance R1, anode and right control electrode of tube T, winding of relay A, to the negative terminal of battery B. Initially, the voltage across the circuit just traced is sufficient to sustain ionization and, also, to operate relay A which, upon operating, opens the circuit to relay B and connects thermistor TH and resistance R2 in parallel with the device T and the winding of relay A. These two parallel circuits have a common resistance R1 and, as the thermistor TH becomes heated and starts to draw current because of its reduced resistance, the voltage drop across resistance R1 increases until the difference between the battery voltage and that across resistance R1 is less than the sustaining voltage of the gas-filled device T. When the voltage is thus rendered less than sustaining, the device T is deionized and relay A, however, releases. Relay A will probably release before the device T is fully deionized and when it releases, the current which has been flowing through the thermistor TH will have reached a value that will positively operate relay B over a circuit which may be traced from the negative terminal of battery V through thermistor TH, normal contacts of relay A, normal contacts of relay B, resistance R1, contacts of switch SW to the positive terminal of battery V. Relay B, upon operating, locks in series with resistance R3 which can be of any value suitable to allow holding current for relay B. The operation of relay B then disconnects the thermistor TH thereby causing it to cool and relay B remains in an operated condition until released by opening the switch SW.

It is believed that the variations in the operation of gas-filled device T and the release of relay A, will result in considerably less percentage variation in the operation of relay B than the range of 50 per cent usually allowed in a simple thermistor relay circuit.

What is claimed is:

1. A delayed-operation circuit for a relay comprising a variable current circuit, a second circuit including a thermistor, and a third circuit including said thermistor and a relay, means responsive to the application of a potential across the terminals of said variable current circuit for establishing said second circuit to heat said thermistor to the degree required to pass a current of given intensity therethrough, and means in said variable current circuit responsive to said current for rendering said third circuit effective to operate said relay with said current.

2. A delayed-operation circuit for a relay comprising a first circuit including a relay, a second circuit including a thermistor controllable over the operated contacts of the relay in said first circuit, a third circuit including said thermistor and another relay controllable over the unoperated contacts of the relay in said first circuit, means responsive to the application of a potential across the terminals of said first circuit for operating the relay therein whereby said second circuit is completed over the contacts thereof, means common to all three circuits operative after the closure of said first circuit for causing the opening said first circuit whereby the relay

therein is released to complete said third circuit over the unoperated contacts thereof and whereby said second relay is caused to operate by the current flowing serially through said thermistor and said second relay.

3. A delayed-operation circuit for a relay comprising a first current path including a gas-filled device and a first relay, a parallel current path including a thermistor and controllable over the operated contacts of said first relay, a second relay operably controlled over the normal contacts of said first relay and through said thermistor, means responsive to the application of a potential across said gas-filled device and said first relay for rendering said device conductive to operate said first relay and for rendering said parallel circuit effective, whereby the current drawn therethrough heats said thermistor to reduce the voltage across said gas-filled device below its sustaining value, and whereby upon the release of said first relay in consequence thereof the circuit of said second relay is completed through said thermistor and the normal contacts of said first relay.

4. A delayed-operation circuit for a relay comprising a first current path including a gas-filled device and a first relay, a parallel current path including a thermistor and controllable over the operated contacts of said first relay, a second relay operably controlled over the normal contacts of said first relay, over its own normal contacts and through said thermistor, means responsive to the application of a potential across said gas-filled device and said first relay for rendering said device conductive to operate said first relay and for rendering said parallel circuit effective whereby the current drawn therethrough heats said thermistor to reduce the voltage across said gas-filled device below its sustaining value, and whereby upon the release of said first relay in consequence thereof the circuit of said second relay is completed through said thermistor and the normal contacts of said first relay, said second relay upon operating opening its own operating circuit through said thermistor and closing a locking circuit for itself.

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