

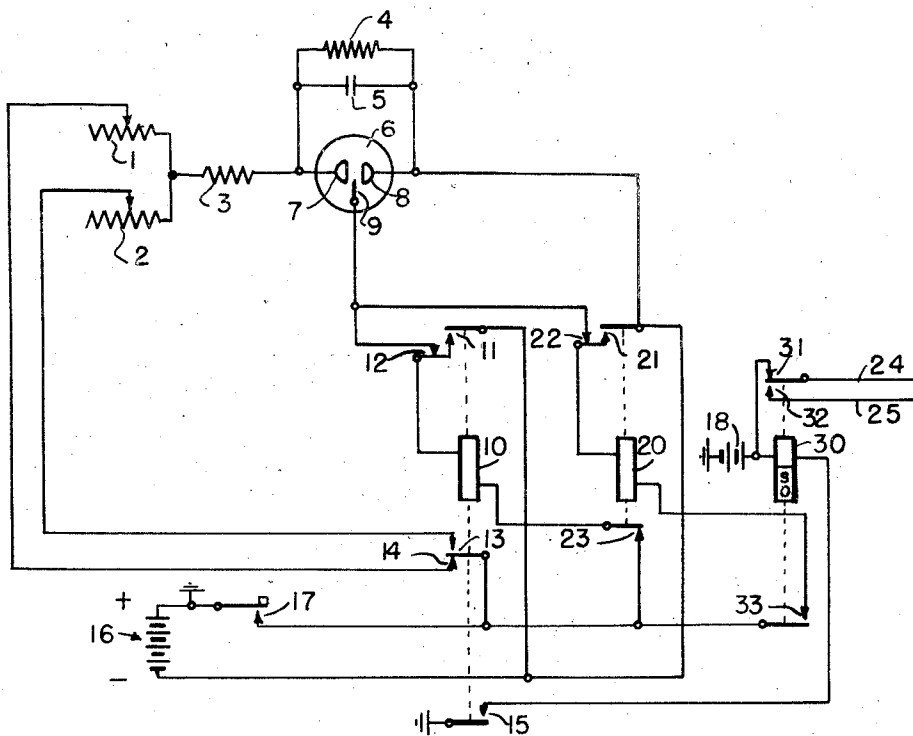
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RELAY TIMING INTERRUPTER CIRCUIT

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RELAY TIMING INTERRUPTER CIRCUIT

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The present invention relates to electric timing devices of the type that periodically interrupts an electric circuit.

An object of the invention is to provide a simple circuit that has easily adjustable means for determining accurately and independently the interval that a controlled circuit is closed and the interval that the controlled circuit is open.

In the accompanying drawing, tube 6 is a gas-filled cold-cathode tube, for example Western Electric type 333A, having a control gap between the anode 7 and the cathode 8, and a main gap between the anode 9 and the cathode 8. Condenser 5 is connected directly across the control gap. Adjustable resistors 1 and 2 are connected alternately in a circuit to determine the time required for charging condenser 5 to the breakdown potential of the control gap. Relay 10 remains released while the condenser is charging through resistor 1, and is energized while the condenser is charging through resistor 2. Slow-operating relay 30 which is controlled by relay 10 interrupts or changes the condition of an electrical circuit which, for example, is connected to conductors 24 and 25. Other arrangements for controlling circuits are possible by using additional contact spring combinations on relay 30, or by using additional contact springs controlled by relay 10 or 20. Resistor 4 in parallel with condenser 5 provides a high resistance path so that the rate of subsequent charging of the condenser will be uniform.

When switch 17 is closed, a circuit is completed for charging condenser 5 from positive battery, switch 17, contacts 14, adjustable resistor 1, resistor 3, to negative battery. The condenser accumulates a charge until the potential reaches the value at which the gas within the control gap ionizes to form a low resistance discharge path for the condenser. When ionization at the control gap occurs, the breakdown point of the main gap is reduced below the voltage supplied by battery 16 through relay 10 to the anode 9 and cathode 8. Relay 10 operates. At contacts 11 a locking circuit for relay 10 connects the winding directly to battery; at contacts 12 the main gap anode circuit is opened to render the tube non-conductive; at contacts 14 resistor 1 is disconnected from the charging circuit; at contacts 13 the circuit including resistor 2 is completed to recharge condenser 5; and at contacts 15 a circuit is completed for slow-operating relay 30. Upon operating, relay 30 at contacts 33 connects positive battery to the main gap anode again through the winding of relay 20.

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When the potential of condenser 5 which is now connected to the charging potential through resistor 2 and contacts 13 rises to the breakdown potential of the control gap, the main gap is again conductive to operate relay 20 over the following circuit: positive battery, switch 17, contacts 33, relay 20, main gap anode 9, cathode 8, and negative battery. Relay 20 at contacts 21 completes its locking circuit, at contacts 22 disconnects battery from the main gap anode to render the tube non-conductive, and at contacts 23 opens the locking circuit of relay 10. Relay 10 releases. At contacts 11 a point is opened in the incomplete locking circuit; at contacts 12 relay 10 is connected again to the main gap anode; at contacts 13 and 14 the charging circuit is transferred from resistor 2 to resistor 1; and at contacts 15 the operating circuit of relay 30 is opened. Relay 30 releases, and at contacts 33 opens the locking circuit of relay 20. Relay 20 releases, at contacts 22 connects its winding to the main gap anode, at contacts 21 opens another point in its locking circuit, and at contacts 23 prepares the operating circuit of relay 10. Condenser 5 continues to charge through resistor 1 as previously described until its potential rises to the breakdown potential of the control gap for causing the operation of relay 10 again. As long as switch 17 is closed, the relays operate at uniform intervals.

The component parts may have the following values when the circuit is adapted for use as a ringing interrupter in a telephone system: adjustable resistors 1 and 2, 2.0 megohms; resistor 3, 120,000 ohms; and condenser 5, 1.0 microfarad. Battery 16 represents a D. C. voltage source of 110 volts. The interval that relays 10 and 30 are energized may be varied from 0.5 second to 4.0 seconds by the adjustment of resistor 2 and the interval that the relays are released may be varied independently a like amount by the adjustment of resistor 1. Switch 17 may correspond to the contacts in a ringing machine start lead and is closed whenever ringing current is to be applied to any subscriber's lines with which the interrupter is associated. Conductor 25 is connected to a ringing generator and conductor 24 is connected to switches for applying ringing current to the called subscriber's lines. During the ringing interval relay 30 completes the ringing circuit at contacts 32, and during the silent period conductor 24 is connected at contacts 31 to the negative potential of battery 18 which represents the main D. C. power supply of the telephone system.

The circuit of this invention that has been

illustrated and described may be modified or adapted to control various devices and still be within the scope of the invention as defined by the appended claims.

What is claimed is:

1. In a timing device, a condenser, a source of current for charging said condenser, a resistor for determining the charging rate of said condenser, a relay, a tube responsive to a predetermined charge received by said condenser for discharging said condenser through said tube to cause said tube to operate said relay, a second resistor, means responsive to the operation of said relay for removing control of the charging rate of said condenser from said first resistor and placing control of the charging rate of said condenser under said second resistor, said tube responsive to a predetermined charge received by said condenser when the charging rate is controlled by said second resistor for again discharging said condenser through said tube to cause release of said relay, and said first means responsive to the restoration of said relay for removing control of the charging rate from said second resistor and returning control to said first resistor.

2. In a timing device, an electron discharge tube, means for rendering said tube conductive at predetermined intervals, a relay, an operating circuit for said relay controlled by said tube, a locking circuit for said relay, said relay operated in response to said tube becoming conductive for closing said locking circuit to maintain said relay operated and for opening said operating circuit to render said tube non-conductive, a second relay, a second operating circuit and a locking circuit for said second relay, means also responsive to the operation of said first relay for connecting said second relay in said second operating circuit controlled by said tube, said second relay operated in response to said tube becoming conductive in the second instance for closing its locking circuit, for opening said second operating circuit to render said tube non-conductive, and for opening said first locking circuit to restore said first relay, said last means in response to the restoration of said first relay opening said second locking circuit to restore said second relay, whereupon the restoration of said relays restores said operating circuits to repeat the cycle of operations.

3. A circuit interrupting device comprising a gas-filled tube having a cathode, a main gap anode, and a control gap anode, a source of supply for applying potential between said control gap anode and said cathode to start ionization in said tube, two relays, each of said relays having a winding connected alternately in series with the positive terminal of said source of supply and said main gap anode, a locking circuit for each of said relays, the first one of said relays

operated in response to the first ionization in said tube for closing the first one of said locking circuits to maintain the first relay operated, and for disconnecting said main gap anode from said source to deionize said tube, means also responding to the operation of said first relay for connecting the second one of said relays in series with said main gap anode and said source, said second relay operated in response to the second ionization for closing the second one of said locking circuits to maintain the second relay operated, for disconnecting said main gap anode from said source, and for opening said first locking circuit to restore said first relay, said last means responding to the restoration of said first relay to open said second locking circuit, the restoration of said relays causing the cycle of operations to be repeated.

4. The combination of a gas-filled tube having a cathode, a control gap anode, and a main gap anode, a relay and a source of current connected in a circuit including said main gap anode, means for momentarily applying a potential between said cathode and said control gap anode to render the tube conductive, said relay operated in response to the conductivity at the control gap anode to render said tube non-conductive, a locking circuit closed in response to the operation of said relay, means for again applying a potential between said cathode and said control gap anode to render said tube conductive, and means responsive to the conductivity of the second instance for opening said locking circuit to release said relay.

5. In a timing device, a gas-filled tube having at least an anode and a cathode, an anode circuit for said tube, a relay and a source of current in the anode circuit of said tube, a slow-acting relay, means for ionizing the gas in said tube to conduct current in said anode circuit, a second circuit, said first relay operated in response to the current in said anode circuit for opening said anode circuit and for closing said second circuit to energize said slow-acting relay, a third relay having an operating winding, a third circuit, said slow-acting relay operated to complete said third circuit including the winding of said third relay, said anode, and said source of potential.

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