

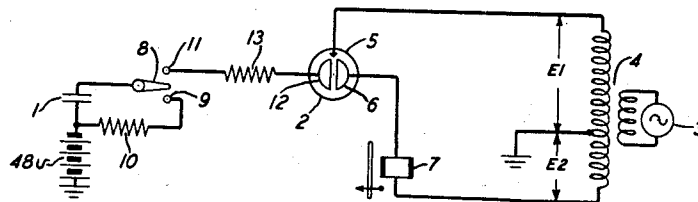
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TIMING ARRANGEMENT

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TIMING ARRANGEMENT

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4 Claims. (Cl. 250—27)

This invention relates to timing means for use in telephone systems and has for its object the provision of a timing device requiring no special machines or sources of current supply.

In automatic telephone systems, if the operations do not proceed smoothly, some means must be provided to dispose of uncompleted calls, for example, by signaling an attendant. For this purpose the various pieces of equipment have associated with them some form of signaling means which is operated under the control of common timing means. In large offices this timing means may be a mechanical interrupter.

While it has heretofore been suggested that some form of electrical interrupter be employed using gas-filled tubes, such arrangements usually required a source of high potential and in some offices no such source is available.

In accordance with the present invention, a timing arrangement is provided in which rectified alternating current obtained from a constant voltage rectifying device is used to charge a condenser, which supplies the breakdown potential to a gas-filled tube.

More specifically, a single tube acts both as rectifier of the alternating current and as a detector of the condenser charge.

This invention will be more clearly understood from a consideration of the following description in connection with the drawing which shows a circuit arrangement embodying the invention.

In the drawing, the same cold cathode, gas-filled tube serves as the means of charging a timing condenser and as a device for detecting the voltage across the condenser at the end of the timing period. In this arrangement the timing condenser 1 is biased by a battery of -48 volts. The tube 2 is of the type having a high anode-cathode breakdown voltage and a low deionization time. The first characteristic allows the use of a sufficiently high alternating current potential on the anode to operate the relay, without the occurrence of anode breakdown independent of the control electrode. The second characteristic allows the use of an alternating current potential on the anode of the commercial frequency of 60 cycles.

Alternating current voltage from source 3 is applied through transformer 4 to the anode 5 and the cathode 6 of the tube 2. The arrangement is such that the anode supply E1 may be 80 to 200 volts and the cathode bias E2 may be 55 to 80 volts. Relay 7 is a slow-release relay which operates from the pulsating current that flows when the anode-cathode gap breaks down.

With switch 8 in its lower position on contact 9, condenser 1 discharges through resistance 10 and tube 2 is extinguished, since the deionization time of the tube is less than a half cycle of source 3 and the anode current ceases when the voltage from anode 5 to cathode 6 becomes negative. With tube 2 extinguished, relay 7 releases. The timed period is started by moving switch 8 to its upper position onto contact 11. The subsequent action of the circuit depends on the value of voltage E1, the more stable action occurring when E1 is between 80 and 115 volts.

Assume that E1 is 100 volts and that E2 is 60 volts. Under this assumption, at the start of the timed period, during the half cycles when voltage E1 is positive to ground and E2 is negative to ground, no current can flow because the potential between the control anode 12 and the cathode 6 is always less than the breakdown value for this gap. The breakdown voltage is 65-75 volts, while the applied potential varies from -48 volts to +37 volts. Similarly no current can flow from anode 5 to the control anode 12 or to the cathode 6 because the potential across these gaps, which varies from 0 to 225 volts, is always less than the breakdown voltage of these gaps.

During the half cycles when E1 is negative to ground and E2 is positive, the potential across the control gap varies from 48 to 133 volts and from the time that it equals the breakdown value of the control gap to the time that it becomes less than the sustaining values, that is 55-65 volts, a charging current flows to the condenser 1 from ground, through the winding of transformer 4, winding of relay 7, from cathode 6 to control anode 12 through the tube 2, resistance 13, switch 8 to condenser 1. As a result, the charge on condenser 1 increases and the potential on the tube side of the condenser 1 becomes more positive.

When the charge on condenser 1 becomes sufficiently positive, the potential between control anode 12 and cathode 6, during a half cycle when E1 is positive to ground and E2 is negative, equals or exceeds the breakdown value of the control gap for a sufficient length of time for the ionization of the control gap to cause the main gap, between anode 5 and cathode 6 to also break down.

During the following half cycle, the charging current again flows. The amount of this charging current on the succeeding half cycles when E1 is negative to ground, diminishes until it is only sufficient to restore the condenser charge that is dissipated by the ionization of the con-

control path during the half cycles when E1 is positive to ground. No current flows at this time between anode 5 and cathode 6 since the voltage is not sufficient to break down this gap in the reverse direction even though the control gap is ionized.

During successive half cycles when E1 is positive, the gap between anode 5 and cathode 6 is repeatedly broken down in the manner above described. Relay 7 operates in response to the pulses of current which flow during these half cycles and, due to its slow-releasing character, holds closed the circuit controlled by it.

Relay 7 is released by moving switch 8 to its lower position. While shown as a manual switch, switch 8 would probably be a relay contact, closed to the upper position when it is desired that the timing start and closed to its lower position when the timing has been completed or is no longer needed.

For higher values of E1 reverse breakdown takes place between control anode 12 and anode 5 and also between cathode 6 and anode 5 during the half cycles when E1 is negative resulting in a slower charging rate for condenser 1.

With this circuit the timed period may be varied from .25 second to 10 seconds. The time limits are determined by resistance 13, the minimum time being determined by the value of resistance 13 which will limit the current from the cathode 6 to the control anode 12 to a safe value for the tube, while the maximum time depends on the value of resistance 13 which will provide a sufficiently large ionizing current from the control anode 12 to the cathode 6 to cause ionization of the anode-cathode gap when E1 is positive to ground.

What is claimed is:

1. A timing device comprising a gas-filled tube having an anode, a cathode and a control anode, a source of alternating voltage, means to connect said source with said tube so that the potentials simultaneously applied to said anode and said cathode vary reversely, a condenser connected in series with said control anode cathode path, responsive means connected in series with said cathode anode path, means to apply increments of charge to said condenser during half cycles when said cathode is positive, said responsive means operating during a half cycle when said anode is positive in response to a charge on said condenser sufficient to render the anode-cathode path conducting.

2. A time delay device comprising a gas-filled tube having a control gap and a main gap, a condenser, a resistance, a source of alternating current and a load device, means for deriving a pair of reciprocally varying sources of alternating voltage from said current source, and circuits connecting one of said voltage sources with said condenser and resistance in series with said control gap and connecting the other of said sources of voltage with said load device in series with said main gap, said tube acting as a rectifier for charging said condenser and as a detector to operate said load device responsive to a predetermined charge on said condenser.

3. A time delay device comprising a gas-filled tube having an anode, a cathode and a control anode, a source of alternating current, means to connect said source with said cathode and anode so that potentials simultaneously applied thereto are of opposite polarity, a load device in said cathode-anode circuit, a condenser, a resistance and a battery, means to connect said condenser, said resistance and said battery in series with the cathode-control anode circuit of said tube, said condenser receiving increments of charge on alternate half cycles of said source until the breakdown potential from said control anode to said cathode is reached, said cathode-anode circuit becoming conducting responsive to said breakdown potential to operate said load device.

4. A time delay device comprising a gas-filled tube having an anode, a cathode and a control anode, a source of alternating current, means to connect said source with said cathode and anode so that potentials simultaneously applied thereto are of opposite polarity, a load device in said cathode-anode circuit, a condenser, a resistance and a battery, means to connect said condenser, said resistance and said battery in series with the cathode-control anode circuit of said tube, said condenser receiving increments of charge on alternate half cycles of said source until the breakdown potential from said control anode to said cathode is reached, said cathode-anode circuit becoming conducting responsive to said breakdown potential to operate said load device, said charging circuit and said cathode-anode circuit being subsequently effective in response to successive half cycles of said source, and means to hold said load device operated during the half cycles when said charging circuit is effective.

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