

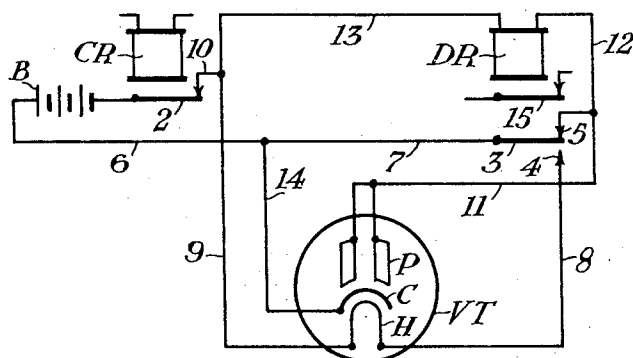
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APPARATUS FOR CAUSING DELAYED OPERATION OF ELECTRORESPONSIVE DEVICES

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APPARATUS FOR CAUSING DELAYED OPERATION OF ELECTRORESPONSIVE DEVICES

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1 Claim. (Cl. 175—320)

My invention relates to apparatus for causing delayed operation of electro-responsive devices such as relays, for example. Apparatus embodying my invention is well adapted for providing delayed operation of relays in railway signaling circuits, especially where a substantial time delay period is required, although my invention is not limited to such circuits.

I will describe one form of apparatus embodying my invention and will then point out the novel features thereof in the claim.

The accompanying drawing is a diagrammatic view showing the apparatus embodying my invention adapted for causing a time delay in the operation of a relay.

Referring to the drawing, the reference character CR designates a control relay which is at times picked up by means which form no part of my invention and which are, therefore, not shown in the drawing. The picking up of relay CR closes a pickup circuit for the time delay relay DR which latter relay is deenergized prior to the time relay CR is operated, so that its back contact 3—4 is closed. The pickup of relay DR is controlled by a vacuum tube VT having a heater H and a cathode C which requires an appreciable time for reaching its operating temperature. As soon as contact 2 of relay CR closes, a circuit is completed for the heater H, which circuit may be traced from one terminal of battery B, wires 6 and 7, back contact 3—4 of relay DR, wire 8, heater H, wires 9 and 10, and contact 2 of relay CR, to the other terminal of battery B.

At the same time, a circuit is prepared for energizing relay DR. This circuit extends from one terminal of battery B, wires 6 and 14, cathode C, plate P, wires 11 and 12, winding of relay DR, wires 13 and 10, and contact 2, to the other terminal of battery B. The voltage of battery B is so chosen with respect to the type of vacuum tube which is used that the required time will elapse before the cathode C reaches the proper temperature for permitting sufficient current to pass to the plate P for picking up relay DR.

After the lapse of a predetermined time interval following the closing of contact 2 of relay CR, relay DR will pick up and in so doing will open its back contact 3—4 and close its front contact 3—5. Any suitable control apparatus (not shown) can now be operated over the front contact 15 of relay DR. The opening of back contact 3—4 interrupts the heater circuit and permits the cathode C to cool, in preparation for a subsequent time delay operation. The flow of current to relay DR is, however, not interrupted during the transfer time of contact finger 3 because the temperature of cathode C is maintained for a short time interval following the

opening of the heater circuit. The closing of front contact 3—5 establishes a holding circuit for relay DR, which circuit is directly energized from the battery B and excludes the vacuum tube VT. From this point on, relay DR will remain energized as long as relay CR remains in its picked up condition. When relay CR is released, relay DR will also release and cannot be picked up again until after contact 2 is closed and the vacuum tube VT goes through its previously described heating cycle.

The vacuum tube VT may be of any suitable type but is preferably a high vacuum or "hard" rectifying tube. Using a standard commercial type of rectifying tube, I have obtained pickup times up to 10 seconds in duration for a 500 ohm line relay, and an 8.5 volt battery.

Although I have illustrated a four-element vacuum tube, it is obvious that tubes having a different number of elements can be used. For example, a single-anode tube or a two-element tube having only the usual cathode and an anode may be used, if desired. By suitably proportioning the parts, delay times either shorter or longer than the 10 second interval referred to above may be obtained.

Although I have herein shown and described but one form of apparatus embodying my invention, it is understood that various changes and modifications may be made therein within the scope of the appended claim without departing from the spirit and scope of my invention.

Having thus described my invention, what I claim is:

In combination, a relay having a contact finger with a front contact and a back contact cooperating therewith, a thermionic valve having a cathode, an anode, and a heater electrode, a single source of current for energizing both said relay and said thermionic valve, a first connection from the negative terminal of said source to said contact finger, a heating circuit for said heater electrode including said source, said first connection, said contact finger, and said back contact, a connection from said cathode to the negative terminal of said source, a connection from said anode through the winding of said relay to the positive terminal of said source whereby a pick-up circuit is provided for said relay including the cathode-to-anode path of said thermionic valve, and a holding circuit for said relay including said source, said first connection, said contact finger, and said front contact for maintaining said relay energized independently of said cathode-to-anode path following a pick-up operation of said relay.

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