

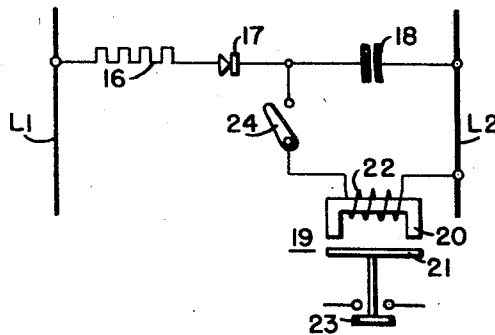
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CAPACITOR CLOSED RELAY HAVING REDUCED HOLDING CURRENT

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WITNESSES:

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## UNITED STATES PATENT OFFICE

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CAPACITOR CLOSED RELAY HAVING  
REDUCED HOLDING CURRENT

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Original application March 29, 1945, Serial No.  
585,515. Divided and this application Decem-  
ber 7, 1946, Serial No. 714,827

1 Claim. (Cl. 175—320)

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My invention relates to control systems for electromagnetic relays and represents a division from my copending application Serial No. 585,515, filed March 29, 1945.

It is an object of the invention to provide relay control systems which are applicable for control by either direct current or alternating current and which combine a simple design of the relay circuit with a reliable relay operation and a low power consumption during continuous energization of the relay circuit.

Another object of the invention is to provide a relay control system for ordinary, i. e., nonretentive relays in which a continuous holding effect is obtained without the use of a separate self-sealing contact and holding circuit usually required for such relays.

Another object of the invention is to devise a low voltage relay which requires only a two-wire control circuit and thereby affords simplifying the appertaining control system. The latter object, more specifically, is intended to permit obtaining low voltage protection in magnetic starters for motors when using a two-wire master control system for the motor. Such two-wire control systems are used, for instance, when a limit switch, thermostat or some similarly simple contact device is employed for governing the operation of a motor. Two-wire systems for obtaining low voltage control are also of advantage where the control apparatus proper is installed at a long distance away from a push button or the like control contact. In such cases the possibility of affording low voltage protection by means of a two-wire relay circuit permits saving one control wire between the control equipment and the appertaining push button contact.

In order to achieve the above-mentioned objects and in accordance with my invention, I interconnect the two input terminals of the relay circuit by resistance means in series connection with a rectifier and a capacitor so that the capacitor is charged through the resistance means and the rectifier when the terminals are energized. The relay to be controlled has a control coil connected across the capacitor; and a control contact is disposed between the coil and the capacitor. In conjunction with the just-mentioned circuit arrangement, the resistance means and the relay coil are rated relative to each other so that the continuous current which flows through the resistance means and coil when the control contact is closed, is lower than the pickup value required by the relay coil for closing the relay. It is further essential in conjunction with the

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above-mentioned requirements that the capacitor be rated for providing, when the control contact is closed, a temporary discharge current which flows through the relay coil and exceeds the critical or pickup value and hence causes the relay to close.

It is understood in the foregoing that the electromagnetic relay incorporated in the control system has a marked difference between the current value necessary for causing the relay to pick up and the minimum value of current required for holding the relay in closed condition once it has picked up. Such a difference exists, for instance, in clapper type relays where the armature gap is large when the relay is in dropped-off condition and is small or fully closed after the relay has picked up. The above-mentioned conditions are also present in relays of the latched-in type in which no continuous holding current is required for securing the relay in the closed position.

The above-mentioned and other objects and features of my invention will be apparent from the following description in conjunction with the embodiment illustrated in the drawing which represents the circuit diagram of an ordinary, i. e., nonretentive relay, especially designed for affording low voltage protection by means of a two-wire connection.

According to the drawing, the two wires or terminals L1 and L2 of the energizing circuit are cross connected by means of a resistor 16 in series with a rectifier 17 and a capacitor 18. The relay 19 of this system is of the nonretentive type. That is, it requires a continuous holding or sealing current in order to be maintained in the closed position in opposition to its armature bias. The relay field structure is denoted by 20, the appertaining armature by 21, and the contact assembly of the armature by 23. The control coil 22 of the relay is connected across the capacitor 18 through a control contact 24. The resistor 16 and the coil 22 are rated relative to each other so that the continuous current which flows through the coil 22, when the contact 24 is closed, is lower than the current magnitude required for closing the relay to pick up. However, when the two terminals are energized, the capacitor 18 assumes a charge which upon closure of contact 24 is discharged through the coil 22. The current surge exceeds the pickup value and hence causes the armature 21 to move against the structure 20. Thereafter the continuous current is effective to hold the armature closed since its value is sufficiently above the critical holding value.

In this manner the relay 19 stays closed as long

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as the control contact 24 remains closed, and no voltage failure occurs at the terminals of the system. Upon occurrence of voltage failure, the contact 24 must first be opened and then reclosed in order to charge the capacitor 18 and thereafter discharge it through the relay coil. The holding effect is produced within the energizing circuit of the relay coil so that no separate sealing contact and sealing circuit are necessary to achieve low voltage protection.

While I have especially described an embodiment of my invention for use in connection with alternating current circuits, it will be understood from the foregoing that the same devices can also be used for direct current, it being merely necessary to omit the rectifier 17 in such cases of application.

Other modifications and changes as to detail will be apparent to those skilled in the art upon the study of the foregoing disclosure. I, therefore, wish this specification to be understood chiefly as illustrative while the essential features and scope of my invention are intended to be defined by the claim annexed hereto.

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I claim as my invention:

A relay control system comprising two terminal means for connection to a single phase alternating current circuit, a connection between said terminals having a resistor and a rectifier and a capacitor series-connected with one another so that said capacitor is charged when said terminals are energized, an electro-magnetic relay having a relatively high pickup current value and a relatively low holding current value and being provided with a control coil connected across said capacitor, a control contact disposed between said coil and said capacitor, said resistor and coil being rated so that the continuous current normally flowing therethrough when said contact is closed is above said holding value and below said pickup value, and said capacitor being rated for providing, when said contact is closed, a temporary discharge current above the pickup value in order to cause closure of said relay.

FREDERICK D. SNYDER.