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CAPACITOR CLOSED RELAY HAVING RETENTIVE MAGNETIC CIRCUIT

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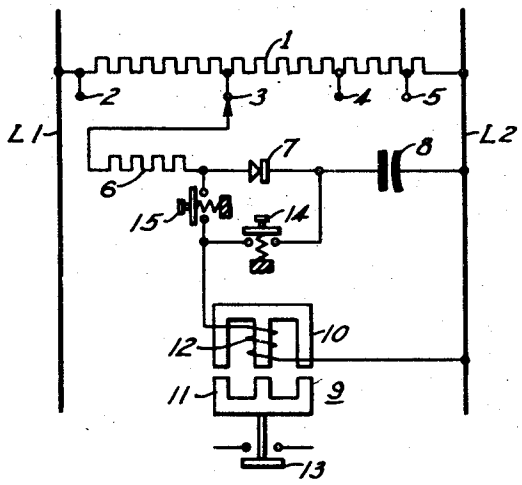

WITNESSES:

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CAPACITOR CLOSED RELAY HAVING RETENTIVE MAGNETIC CIRCUIT

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My invention relates to control systems for electromagnetic relays of the magnetically retentive type and is related to that of my copending and divisional application Serial No. 714,827 filed December 7, 1946.

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.

Another and more specific object of the invention is to devise a control system, for relays of the magnetically retentive type, which when operated from an alternating current source secures a safe switching-in and sealing operation that is always effective upon a single actuation of a control contact and produces always sufficient residual magnetism in the magnet system to afford a higher degree of safety from uncontrolled opening of the relay than obtainable in known alternating current relays of this type.

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 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 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 is of the retentive type so that 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 embodiments illustrated in the drawing, which represents the circuit diagram of a control system provided with a latched-in relay of the magnetically retentive type.

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According to the drawing, a resistor 1 is connected across the two wires L1 and L2 of an energizing circuit. The resistor has four taps denoted by 2, 3, 4 and 5 and serves as a voltage divider in order to adapt the relay system to different operating voltages. That is, when the relay system is to operate with a supply voltage of, for instance, 550 volts, the slider of rheostat 1 is placed on tap 2. For operation at 440 volts, the slider engages tap 3, while taps 4 and 5 are provided for voltages of 220 volts and 110 volts, respectively.

Connected between the slider of rheostat 1 and the wire L2 is a series arrangement composed of a resistor 6, a rectifier 7 and a capacitor 8. The electromagnetic relay to be controlled is denoted, as a whole, by numeral 9. This relay has a retentive magnetic circuit which is formed of a stationary field structure 10 and a movable armature 11. The armature 11 is biased by gravity or spring force toward the illustrated open position and is provided with a contact assembly here represented by a contact 13. The field structure 10 is magnetically associated with a control coil 12, and this coil is connected across the capacitor 8 through a normally open control contact 14, for instance, of the push button type. Another control contact 15, which may also consist of a push button, is connected between coil 12 and a point between resistor 6 and rectifier 7. Contact 15 is also normally open.

The magnetic circuit of relay 9 contains a material whose retentive magnetism is of sufficient magnitude to maintain the armature 11 sealed against the field structure 10, due to residual magnetism, once the magnetic circuit has been magnetized above the critical pickup value. Consequently, a single current surge through coil 12 is necessary to close the relay which thereafter is sealed in the closed position until a demagnetizing effect is imposed on the magnetic circuit. Sufficient retentive magnetism can be obtained by making only one of parts 10 and 11 of spring steel or the like material which has higher coercive force and lower permeability than customary (nonretentive) dynamo iron. It is also possible to use such a retentive material for one or a few laminations of one or both parts 10 and 11, or to arrange one or several pieces of permanent-magnet material in the magnetic flux path. These different ways of designing the relay are known as such and not essential as regards the invention proper.

When the wires L1 and L2 are energized, the capacitor 8 is charged through the resistor 6 and

the rectifier 7. When thereafter the control contact 14 is closed, a temporary discharge current passes from capacitor 8 through coil 12 and causes the relay to pick up and seal in. The subsequent closure of contact 15 passes an alternating current of low magnitude through resistor 6 and coil 12 and thereby causes demagnetization of the magnetic circuit until the permanent magnetism subsides below the value necessary for overcoming the armature bias. The relay will then drop out.

The resistor 6 is so rated that the capacitor 8 charges through the rectifier 7 within a reasonable period of time, for instance, two or three seconds. The capacitor rating need only be sufficient to hold back the peak voltage.

Due to the fact that with both contacts 14 and 15 open no continuous current flows through the capacitor 8. The continuous power consumption in the relay circuit proper is zero or negligible. However, the accumulated charge of capacitor 8 has the effect of providing temporarily sufficient discharge current to secure a safe pickup and sealing operation of the relay. In this respect the control system, according to the invention, is superior to the known alternating current systems for retentive relays which operate either with a relatively large continuous current or by means of a flicker or finding contact. When using a finding contact, the relay will not necessarily close instantaneously but may require several repeat operations of the finding contact. Furthermore, upon closure of the relay by means of a finding contact, there is no assurance that the residual magnetism of the retentive relay is sufficiently in excess of the critical value to retain the relay in closed condition during the occurrence of demagnetizing effects, vibration or shock. In contrast thereto, the invention, despite the low current and low continuous power consumption, affords a safe operation of the relay by means of a single control impulse and secures an optimum degree of residual magnetism upon each individual actuation of the control contact.

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 a similar device can also be used for direct current, it being merely necessary to omit the rectifier 7 in such cases of application.

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 claims annexed hereto.

I claim as my invention:

1. 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, a relay having a retentive magnetic circuit so as to remain closed by retentive magnetism upon sufficient pickup magnetization until demagnetized, said relay having a magnetizing coil connected across said capacitor, a control contact disposed between said coil and said capacitor, said resistor being rated relative to said coil so that the continuous current flowing through said resistor and coil when said contact is closed is lower than the pickup value required by said coil for closing said relay, 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, and controllable means for demagnetizing said magnetic circuit for releasing said relay.

2. 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, a relay having a retentive magnetic circuit so as to remain closed by retentive magnetism upon sufficient pickup magnetization until demagnetized, said relay having a magnetizing coil connected across said capacitor, a control contact disposed between said coil and said capacitor, said resistor being rated relative to said coil so that the continuous current flowing through said resistor and coil when said contact is closed is lower than the pickup value required by said coil for closing said relay, 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, and a normally open releasing contact arranged between said resistor and said coil so as to complete, when closed, an alternating current circuit through said resistor and coil between said terminals in order to cause demagnetization of said magnetic circuit so as to release said relay.

FREDERICK D. SNYDER.

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