

UNITED STATES PATENT OFFICE

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PROTECTIVE SYSTEM

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My invention relates to protective systems and particularly to protective systems embodying a circuit-interrupter that is retarded in its operation up to a predetermined value of overload and opens instantaneously for values of load in excess of this predetermined value.

One object of my invention is to provide a circuit-interrupter having a trip coil and a relay comprising an instantaneous control device and an inverse time-element control device for controlling the trip coil of the circuit-interrupter.

Another object of my invention is to provide a circuit-interrupter with a relay for tripping the interrupter that embodies a time element in its operation when moderate sustained overloads occur and is instantaneous when an excessive overload occurs.

A system embodying my invention comprises a circuit-interrupter having a trip coil and a relay comprising two control elements energized from the circuit, one element having an inverse time-element characteristic in controlling the energization of the trip coil for moderate overloads and the other element being instantaneous in operation and controlling the energization of the trip coil upon excessive overloads. The inverse time-element device provides protection for the connected apparatus against overloads and the instantaneous element provides protection for the circuits and generating apparatus against severe short-circuits, such as those that may occur in the connecting circuits or at the terminals of the connected apparatus.

Referring to the accompanying drawings, Figure 1 is a diagrammatic view of a protective system embodying my invention;

Fig. 2 is a curve showing the operating characteristics of the circuit-interrupter shown in Fig. 1, under different conditions; and

Fig. 3 is a plan view of a relay that may be used in the system shown in Fig. 1.

Referring to Fig. 1, a circuit-interrupter 1 is shown controlling a circuit 2, the circuit-interrupter being provided with a trip coil 3 for actuating the same.

A battery 4 is provided for the purpose of

energizing the trip coil 3 of the circuit-interrupter 1 in accordance with the operation of two control elements 5 and 6, which may be combined in a single relay as shown in Fig. 3. The thermally operated control element 5 has an inverse time-element characteristic and comprises a bimetallic member 7 controlled by a heating coil 8 and provided with a contact member 9 adapted, when energized, to bridge the stationary contact members 10 to complete the circuit of the trip coil 3. The control device 6 is an instantaneous circuit-closing device and comprises a magnetizable core member 11, an operating winding 12 and a contact member 13 on the core member 11 adapted, when the relay is energized, to engage the stationary contact members 14 to complete the circuit of the trip coil 3. The elements 5 and 6 are energized from the circuit 2, a current transformer 15 that is provided for this purpose having its secondary winding connected to the heating coil 8 and the operating winding 12. The setting of the element 6 may be controlled by the adjusting member 16 to operate at a current value indicated on the associated scale 17.

For moderate sustained overloads, the thermal element 5 is actuated to close its contacts 9 and 10 in a time that is inversely proportional to the overload, thereby energizing the trip coil 3 and opening the circuit-interrupter 1. For an excessive overload or severe short-circuit, however, the instantaneous element 6 closes its contacts instantaneously, thereby opening the circuit-interrupter 1 before the excessive current causes damage to the supply circuits or generating or transmission apparatus.

The operating characteristics of the circuit-interrupter are shown in Fig. 2. As shown by the curve 18, the tripping time of the circuit-interrupter 1 is inversely proportional to the overload up to a certain value which is assumed to be approximately 350%. If an overload occurs that is greater than 350% or a short-circuit that draws a current equivalent to such overload, the element 6 operates to trip the circuit-interrupter 1 substantially instantaneously.

Adjustment of the instantaneous element 6, as provided by the adjusting member 16, permits the characteristic to be changed as desired. Thus, if it is desired to trip the circuit interrupter 1 instantaneously upon 200% overload, as indicated by the dotted line 19 in Fig. 2, the member 16 is adjusted in such manner that the instantaneous element 6 will be operated at this current value.

The control elements 5 and 6 may be combined in a unitary structure as shown in Fig. 3. A base 20 is provided upon which the thermal element 7, the winding 12 and terminals 22 are supported. The contact members 9, 10, 13 and 14 are so connected that the operative energization of either the thermal element 5 or the electro-magnetic element 6 completes the circuit including the terminals 22 associated therewith.

I do not consider that my invention is limited to the precise form shown and prescribed. Accordingly, I do not wish to be limited in scope except as indicated in the appended claims.

I claim as my invention:

1. A relay comprising a base, a solenoid mounted thereon, contacts disposed adjacent thereto, a core for said solenoid having a conducting member adapted when actuated thereby to bridge said contacts, an extension on one of said contacts, and a thermal element mounted on said base and electrically connected to another of said contacts, heating means for said thermal element, said element adapted, when heated, to engage said extension to bridge said contacts, said solenoid and said heating means being so connected and arranged as to be responsive to the same electrical characteristics.

2. In a protective relay, the combination with a base, a solenoid mounted thereon, an insulating sleeve surrounding said solenoid, contacts disposed thereon, a core for said solenoid having a conducting member adapted, when actuated, to bridge said contacts, one of said contacts having an extension, a thermal element, also mounted on said base in electrical connection with one of said contacts, heating means for said thermal element, said element adapted, when heated, to engage said extension to bridge said contacts, said solenoid and said heating means being so connected and arranged as to be energized in accordance with the same electrical characteristics.

3. A protective relay comprising a base, relay contacts disposed thereon, a solenoid having a core arranged to bridge said contacts when said solenoid is energized, additional means for bridging said contacts including a thermal-responsive element having one end thereof secured to said base and electrically connected to one of said contacts and having the free end thereof disposed for co-operation with another of said contacts, and

energizing means for said thermal-responsive element, said energizing means and said solenoid being so connected and arranged as to be responsive to the same electrical characteristics.

4. In a protective relay, relay contacts for controlling an external circuit, means for bridging said contacts comprising a magnetic over-current element embodying means for varying the current-responsiveness thereof, additional means for bridging said contacts including a thermal-responsive element having a fixed portion electrically connected to one of said contacts and so disposed that the other of said contacts is in the path of movement of a free portion thereof, and energizing means for said thermal-responsive element, said energizing means and said magnetic over-current element being so connected and arranged as to be responsive to the same electrical characteristics.

In testimony whereof, I have hereunto subscribed my name this 9th day of March, 1925.

LESLIE N. CRICHTON.