

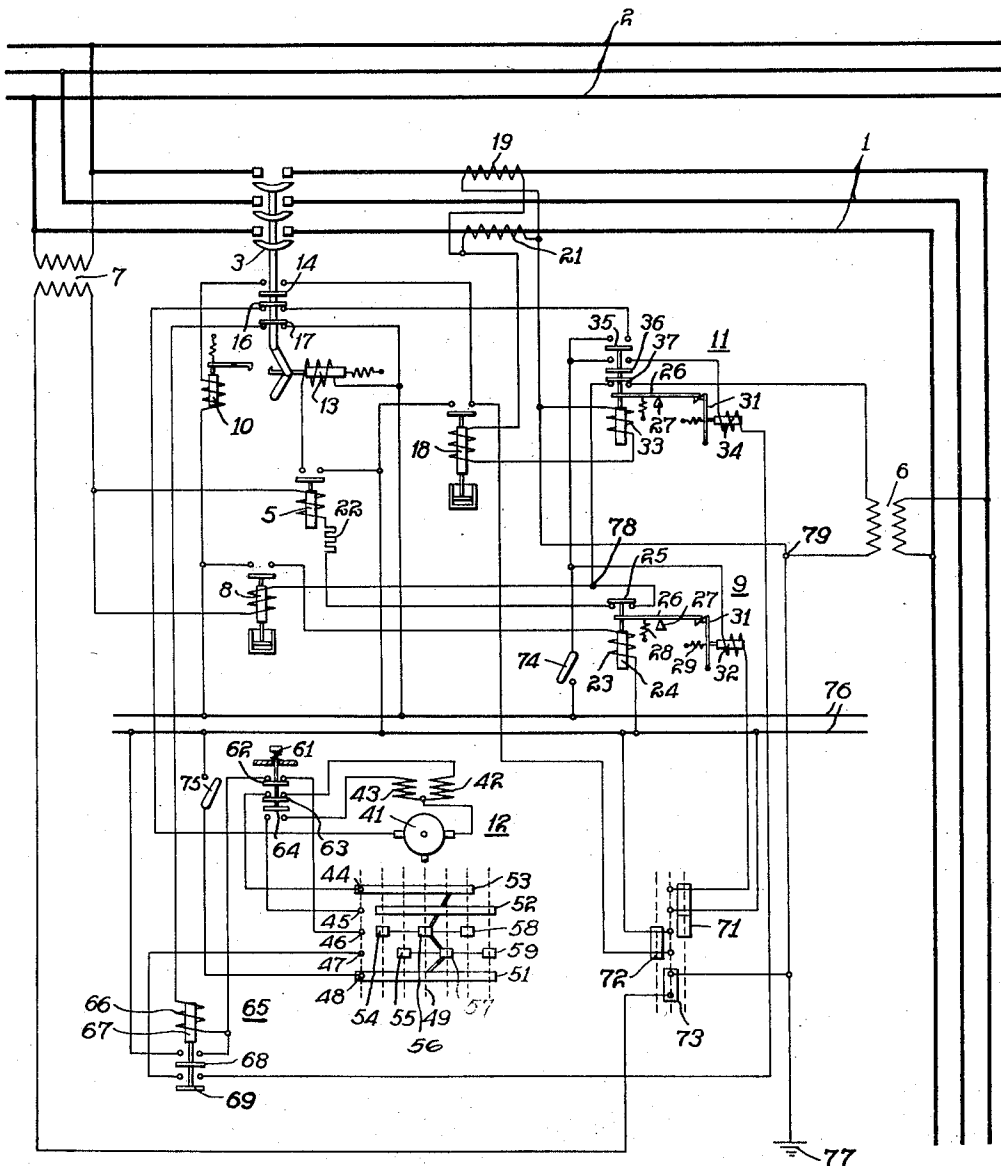
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PERIODIC RECLOSING CIRCUIT INTERRUPTER

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PERIODIC RECLOSING CIRCUIT INTERRUPTER.

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My invention relates to electrical protective devices and more particularly to periodic reclosing circuit interrupters.

One object of my invention is to provide a reclosing circuit interrupter that shall effect a number of reclosures in rapid succession when an overload below a predetermined value exists on the circuit to be protected.

Another object of my invention is to provide a reclosing circuit interrupter that shall effect a number of reclosures in rapid succession when an overload below a predetermined value exists on the circuit to be protected but that shall operate at predetermined intervals a definite number of times if an overload in excess of a predetermined value shall occur.

Another object of my invention is to provide a reclosing circuit interrupter that shall operate to reestablish the circuit at different time intervals in accordance with whether the overload on the circuit exceeds or is below a predetermined value.

In the accompanying drawings,

Figure 1 is a diagrammatic view of circuits and apparatus embodying my invention.

My invention comprises, in general, an electrical feeder circuit 1 that is connected to a source of electrical energy such as a busbar 2 through a circuit interrupter 3, the latter being caused to reclose a number of times in rapid succession by the action of a quick-acting relay 5 that is connected between voltage transformers 6 and 7 disposed on opposite sides of the circuit interrupter 3. During the repeated operations of the quick-acting relay 5, a long-time interval relay 8 is slowly actuated to its closed position, whereupon the circuit to the quick-acting relay 5 is interrupted by a lockout relay 9.

If the overload exceeds a predetermined value, a transfer relay 11 is energized to control a motor-operated relay 12, having predetermined time intervals of operation. The motor-operated relay 12 controls the reclosing of the circuit interrupter 3 a definite number of times or until the overload on the circuit 1 is cleared.

The circuit interrupter 3 is provided with a closing coil 13, a trip coil 10, a front contact pallet switch 14 and back contact pallet switches 16 and 17. A time-limit relay 18

for controlling the trip coil 10 is energized from current transformers 19 and 21 that are connected in the circuit 1. A current-limiting resistor 22 is connected in series with the quick-acting relay 5.

The lock-out relay 9 comprises an operating coil 23, a movable core member 24, a bridging contactor 25 carried thereby, a lever 26, pivoted at 27, retrieving springs 28 and 29, a latch 31 for engaging the lever 26 and a latch controlling electromagnet 32. The mechanical structure of the relay 11 is similar to that of the relay 9, except for the provision of a plurality of front contact switches 35 and 36 and a rear contact switch 37. In the transfer relay 11, the energizing coil is designated as 33 and the latch controlling electromagnet as 34.

The motor-operated relay 12 comprises a motor 41 having oppositely-acting alternately-connected field-magnet windings 42 and 43, stationary contact members 44 to 48, inclusive, and a drum 49 that carries a plurality of contact segments 51 to 59, inclusive.

The contact member 51 extends completely around the drum 49, and is electrically connected to the other contact members 52 to 59, inclusive, for supplying electrical energy thereto. The contact members 52 and 53 are of equal length although their ends are staggered with respect to each other, the member 53 being in advance of member 52 in the forward direction of rotation of the drum 49. The contacts 54, 56 and 58 are disposed in staggered relation to and paired with the contacts 55, 57 and 59, respectively. The stationary contact members 44, 45 and 48 engage the contact members 53, 52 and 51, respectively. The stationary contact members 46 and 47 successively engage the series of contact members 54, 56 and 58, and the series of contact members 55, 57 and 59, respectively.

A manually operable switch 61, comprising rear contact switches 62 and 63 and a front contact switch 64, is provided for manually resetting the relay 12 in case the relay 12 has locked itself out due to a permanent fault in circuit 1.

A "set-up" relay 65 is provided for automatically adjusting the connections to the motor 41 and it comprises a coil 66 and a movable core member 67, the latter being provided with bridging contacts 68 and 69.

A manually operable switch 71 is provided for resetting the lockout relay 9, in a manner hereinafter described. A second manually operable switch 72 is provided for operating the trip coil 10 and a third switch 73 is provided for rendering the system non-automatic. The switch 73 is mechanically connected to switches 71 and 72 in such manner that it interrupts its circuit whenever the latter are manipulated, thereby rendering the device nonautomatic so long as the operator holds either switch in an advanced position.

Suitable service switches 74 and 75 are provided for controlling the connections to a direct-current supply circuit 76. A ground connection 77 is provided for the circuit of transformers 6 and 7. Terminals 78 and 79 define the connecting points for the circuits extending from the transformers 6 and 7.

The coil 33 is connected in series with the relay 18 and in parallel-series connection with the current transformers 19 and 21. The coil 33 is adjusted to instantaneously operate the transfer relay 11 upon the occurrence of overloads of a definite value, such as 500% of the normal rated capacity of the circuit 1, and the relay 18 is adjusted to operate slowly upon the occurrence of any overloads of relatively less value in the circuit 1. By virtue of this relation between relays 11 and 18, the device as a whole has a characteristic such that the time for reclosing the circuit interrupter 3 is proportional to a function of the amount of the overload in the circuit 1. It is obvious that the mathematical values of the overloads at which the interrupter 1 operates may be varied at will.

Assuming the circuit interrupter 3 to be in its open position, the current from the secondary winding of the transformer 7 traverses a circuit extending to the relays 5 and 8 in parallel circuit, their common terminal 78, back contact switch 37, the secondary winding of the transformer 6 through the common terminal 79 to the non-automatic switch 73 and thence back to the other end of the secondary winding of transformer 7.

The relay 5 is thereupon energized and its contact members complete a circuit extending from one of the conductors of the circuit 76, through the closing coil 13 to the contact members of relay 5 and the other conductor of the circuit 76. The closing coil 13 actuates the circuit interrupter 3 to its closed position, and the secondary winding of the transformer 6 opposes the transformer 7. Relay 5 thereupon falls back under the influence of the force of gravity and interrupts the circuit of the closing coil 13. At the same time, the slow-acting relay 8 is given a slight movement towards its closed position.

If an overload on the circuit 1 exceeds the operative setting of the relay 18, but is below the value of the operative setting of the winding 33 of the relay 11, the relay 18 closes after a predetermined interval of time. A circuit that is thereby completed extends from one of the conductors of the circuit 76 through the relay 18, the switch 14, and the trip coil 10 to the other conductor of the circuit 76. The circuit interrupter 3 is then actuated to its open position. The relation of the component parts of the system is then that shown in the drawings, except that the relay 8 has not fully returned to its fully open position.

So long as the overload on the circuit 1 continues, and does not exceed the operating value of the relay 11, the above described cycle of operations is repeated in rapid succession until the slow-acting relay 8 reaches its closed position by reason of the summation of the increments of movement given thereto during each reclosing operation.

If the overload on the circuit 1 should be cleared after any reclosure of the interrupter 3, the relay 8 slowly returns to its fully open position, without ever reaching its closed position.

Upon the closing of the relay 8, a circuit is completed that extends from one of the conductors of the circuit 76, through the contact members of the relay 8, and the winding 23 of the lockout relay 9 to the other conductor of the circuit 76. The contact switch 25 is thereupon actuated to its open position, where it is held by the locking action of the lever 26, spring 29 and latch 31, thereby permanently open-circuiting the relay 5 that controls the closing coil 13. The lockout relay 9 is releasable only after the energization of the coil 32 through the manually operable switch 71, and the switch 74.

If, at any time, the overload or short-circuit condition on the circuit 1 exceeds in value the setting of the coil 33, the transfer relay 11 is energized and latched in its advanced position before the operation of the slower acting relay 18 and the consequent operation of the circuit interrupter 3. The connection between the transformers 6 and 7 is interrupted at the contact switch 37.

The circuit interrupter 3 being in its open position and the transfer relay 11 being latched in its advanced position, a circuit to the motor 41 is completed that extends from one of the conductors of the supply circuit 76, through the switch 75, stationary contact member 48, contact members 51 and 53, stationary contact member 44, switch 63, field-magnet winding 42, motor 41, switch 16, switch 35 and switch 74 to the other conductor of the circuit 76. The drum 49 thereupon turns until the stationary contact members 45 and 46 are in engagement with

the contact members 52 and 54, respectively. The circuit between contact 52 and the motor 41 is normally open at the switch 64.

Upon the completion of the circuit between the contact member 54 and the stationary contact member 46, a circuit extends from one of the conductors of the circuit 76, to the switch 75, stationary contact member 48, contact member 51, contact members 54 and 46, switch 62 and coil 66 through switch 17 to the other conductor of the circuit 76. The set-up relay 65 is thereupon energized and completes its own holding circuit extending from one of the conductors of the circuit 76 to the contact switch 68, and the coil 66 through the switch 17 to the other conductor of the circuit 76.

Further rotation of the drum 49 causes the contact member 55 to engage the stationary contact member 47. A circuit is completed that extends from one conductor of the circuit 76 to the switch 75, stationary contact member 48, contact member 51, contact member 55, stationary contact member 47, switch 69, coil 34 of the relay 11, and switch 36 through switch 74 to the other conductor of the circuit 76. The transfer relay 11 is unlatched and returns to its de-energized position under the influence of its spring 28. The switch 37 restores the circuit between the transformers 6 and 7, whereupon the relay 5 operates to cause the closure of the circuit interrupter 3, in the manner heretofore described.

In the event that the overload persists in the circuit 1 beyond the value of the setting of the coil 33 of the transfer relay 11, that relay and the motor-operated relay 12 continue to perform their cycle of operations, with the exception that contact members 56, 57 and 58, 59 are successively substituted for the contact members 54 and 55. These several groups of contact members may be disposed at varying peripheral distances on the drum 49 in order to secure increasing intervals between the reclosures of the circuit interrupter 3.

During each closing operation of the circuit interrupter 3, contactor switches 16 and 17 are opened, thereby de-energizing the motor 41 and the set-up relay 65.

The drum 49 rotates with each operation of the circuit interrupter until the contact member 53 moves out of engagement with the stationary contact member 44 and interrupts the circuit to the motor 41. The circuit interrupter system is thereby automatically brought to rest after a given number of operations of the motor-operated relay 12, regardless of the time between closures of the circuit interrupter 3 that have preceded the final operation. This feature is especially advantageous in systems wherein it is desired to inspect the circuit interrupter

3 after a definite number of operations at or near its maximum rated capacity.

In order to restore the drum 49 to its initial position, the switch 61 manually depressed thereby opening the switches 62 and 63 and closing the switch 64. A circuit is completed that extends from one of the conductors of the circuit 76, through the switch 75, stationary contact member 48, contactor 51, contactor 52, stationary contact member 45, switch 64, field-magnet winding 43, motor 41, switch 16 and switch 35 through switch 74 to the other conductor of circuit 76. The motor thereupon operates in the reverse direction until its circuit is interrupted between the stationary contact member 45 and the contact member 52.

It will thus be seen that I have provided a periodically reclosing circuit interrupter that operates a number of times in rapid succession when an overload below a predetermined value exists on the protected circuit. The reclosing circuit interrupter is also rendered inoperative after a number of such reclosures, that is, directly proportional to the time interval between reclosures. However, should the overload on the protected circuit exceed the predetermined value, a transfer relay is energized that controls the reclosing device in such manner that the circuit interrupter is reclosed a definite number of times at predetermined intervals and the circuit interrupter is then rendered inoperative.

It is immaterial whether the last-mentioned cycles of operation take place at approximately the same time or whether their occurrence is extended over weeks or months. An indication is thereby given of the fact that the circuit interrupter has been operated a definite number of times at a predetermined capacity and an opportunity is given for examining the structural details of the circuit interrupter.

I do not wish to be restricted to the specific circuit connections or arrangement of parts herein set forth, as various modifications thereof may be effected without departing from the spirit and scope of my invention. I desire, therefore, that only such limitations shall be imposed as are indicated in the appended claims.

I claim as my invention:

1. The combination with an electrical circuit, a circuit interrupter therein, and means for tripping the circuit interrupter in response to overload conditions, of means for automatically reclosing the circuit interrupter and means responsive to the amount of current traversing the circuit before the circuit interrupter is tripped, for varying the time interval between successive reclosures of the circuit interrupter.

2. The combination with an electrical circuit, a circuit interrupter therein and means

for tripping the circuit interrupter in response to overload conditions, of means for automatically reclosing the circuit interrupter, and means for varying the time interval between successive reclosures of the circuit interrupter in proportion to the amount of current traversing the circuit before the circuit interrupter is tripped.

3. The combination with an electrical circuit, a circuit interrupter therein and means influenced in accordance with the value of the current traversing the circuit for tripping the circuit interrupter, of means for reclosing the circuit interrupter, and means for increasing the time of operation of the reclosing means only when the current traversing the circuit exceeds a definite value.

4. The combination with an electrical circuit, a circuit interrupter therein and means influenced in accordance with the value of the current traversing the circuit for tripping the circuit interrupter, of means for causing the reclosures of the circuit interrupter to occur in rapid succession while the current traversing the circuits remains below a predetermined value, and means brought into operation when the value of the current exceeds the predetermined value for increasing the time of operation of the reclosing means.

5. The combination with an electrical circuit, a circuit interrupter therein and means influenced in accordance with the value of the current traversing the circuit for tripping the circuit interrupter, of means for causing the reclosures of the circuit interrupter to occur in rapid succession while the current traversing the circuit remains below a predetermined value, and means brought into operation when the value of the current exceeds the predetermined value for varying the period of operation of the reclosing means.

6. The combination with an electrical circuit, a circuit interrupter therein and means influenced in accordance with the value of the current traversing the circuit for tripping the circuit interrupter, of means for causing the reclosures of the circuit interrupter to occur in rapid succession while the current traversing the circuits remains below a predetermined value, and means brought into operation when the value of the current exceeds the predetermined value for determining the number of reclosures and the time interval between such reclosures of the circuit interrupter.

7. The combination with an electrical circuit, a circuit interrupter therein and means influenced in accordance with the value of the current traversing the circuit for tripping the circuit interrupter, of means for causing the reclosures of the circuit interrupter to occur in rapid succession while the current traversing the circuits remains be-

low a predetermined value, a slow-acting relay, and a transfer relay brought into operation when the value of the current exceeds the predetermined value for controlling the slow-acting relay thereby imparting a longer time interval between reclosures of the circuit interrupter.

8. The combination with an electrical circuit, a circuit interrupter therein and means influenced in accordance with the value of the current traversing the circuit for tripping the circuit interrupter, of means for causing the reclosures of the circuit interrupter to occur in rapid succession while the current traversing the circuits remains below a predetermined value, a transfer relay and a slow-acting relay brought into operation when the value of the current exceeds the predetermined value for controlling the slow-acting relay thereby imparting a longer time interval between reclosures of the circuit interrupter.

9. The combination with an electrical circuit, a circuit interrupter therein and means influenced in accordance with the value of the current traversing the circuit for tripping the circuit interrupter, of means for causing the reclosures of the circuit interrupter to occur in rapid succession while the current traversing the circuits remains below a predetermined value, and means for precluding further operations of the quick acting means after a number of operations.

10. The combination with an electrical circuit, a circuit interrupter therein and means influenced in accordance with the value of the current traversing the circuit for tripping the circuit interrupter, of means for causing the reclosures of the circuit interrupter to occur in rapid succession while the current traversing the circuits remains below a predetermined value, a slow-acting relay, a transfer relay brought into operation when the value of the current exceeds the predetermined value for controlling the slow-acting relay thereby imparting a longer time interval between reclosures of the circuit interrupter, and means for precluding the operation of the last-named relay after a definite number of operations regardless of the time interval between each reclosure.

11. The combination with an electrical circuit, a circuit interrupter therein and means influenced in accordance with the value of the current traversing the circuit for tripping the circuit interrupter, of means for causing the reclosures of the circuit interrupter to occur in rapid succession while the current traversing the circuits remains below a predetermined value, a slow-acting relay, a transfer relay brought into operation when the value of the current exceeds the predetermined value for controlling the slow-acting relay thereby imparting a longer time interval between reclosures of the

circuit interrupter, and means for precluding the operation of the last-named relay after a definite number of operations regardless of the time interval between each reclosure.

12. The combination with an electrical circuit, a circuit interrupter therein and means influenced in accordance with the value of the current traversing the circuit for tripping the circuit interrupter, of means for causing the reclosures of the circuit interrupter to occur in rapid succession while the current traversing the circuits remains below a predetermined value, a slow-acting relay, a transfer relay brought into operation when the value of the current exceeds the predetermined value for controlling the slow-acting relay thereby imparting a longer time interval between reclosures of the circuit interrupter and means for restoring the last-named relay to its initial position.

13. The combination with an electrical circuit, a circuit interrupter therein and means influenced in accordance with the value of the current traversing the circuit for tripping the circuit interrupter, of means for causing the reclosures of the circuit interrupter to occur in rapid succession while the current traversing the circuits remains below a predetermined value, a motor-operated relay, a transfer relay brought into operation when the value of the current exceeds the predetermined value for controlling a motor-operated relay thereby imparting a longer time interval between reclosures of the circuit interrupter, and means for restoring the last-named relay to its initial position.

14. The combination with an electrical circuit,

a circuit interrupter therein and means influenced in accordance with the value of the current traversing the circuit for tripping the circuit interrupter, of means for causing the reclosures of the circuit interrupter to occur in rapid succession while the current traversing the circuits remains below a predetermined value, a slow-acting relay, a transfer relay brought into operation when the value of the current exceeds the predetermined value for controlling the slow-acting relay thereby imparting a longer time interval between reclosures of the circuit interrupter, and manually operable means for restoring the last-named relay to its initial position.

15. The combination with an electrical circuit, a circuit interrupter therein and means influenced in accordance with the value of the current traversing the circuit for tripping the circuit interrupter, of means for causing the reclosures of the circuit interrupter to occur in rapid succession while the current traversing the circuits remains below a predetermined value, a motor-operated relay, a transfer relay brought into operation when the value of the current exceeds the predetermined value for controlling the motor-operated relay thereby imparting a longer time interval between reclosures of the circuit interrupter, and manually operable means for restoring the last-named relay to its initial position.

In testimony whereof, I have hereunto subscribed my name this 17th day of September, 1924.

HENRY A. TRAVERS.