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G. SPEISER

CIRCUIT INTERRUPTER

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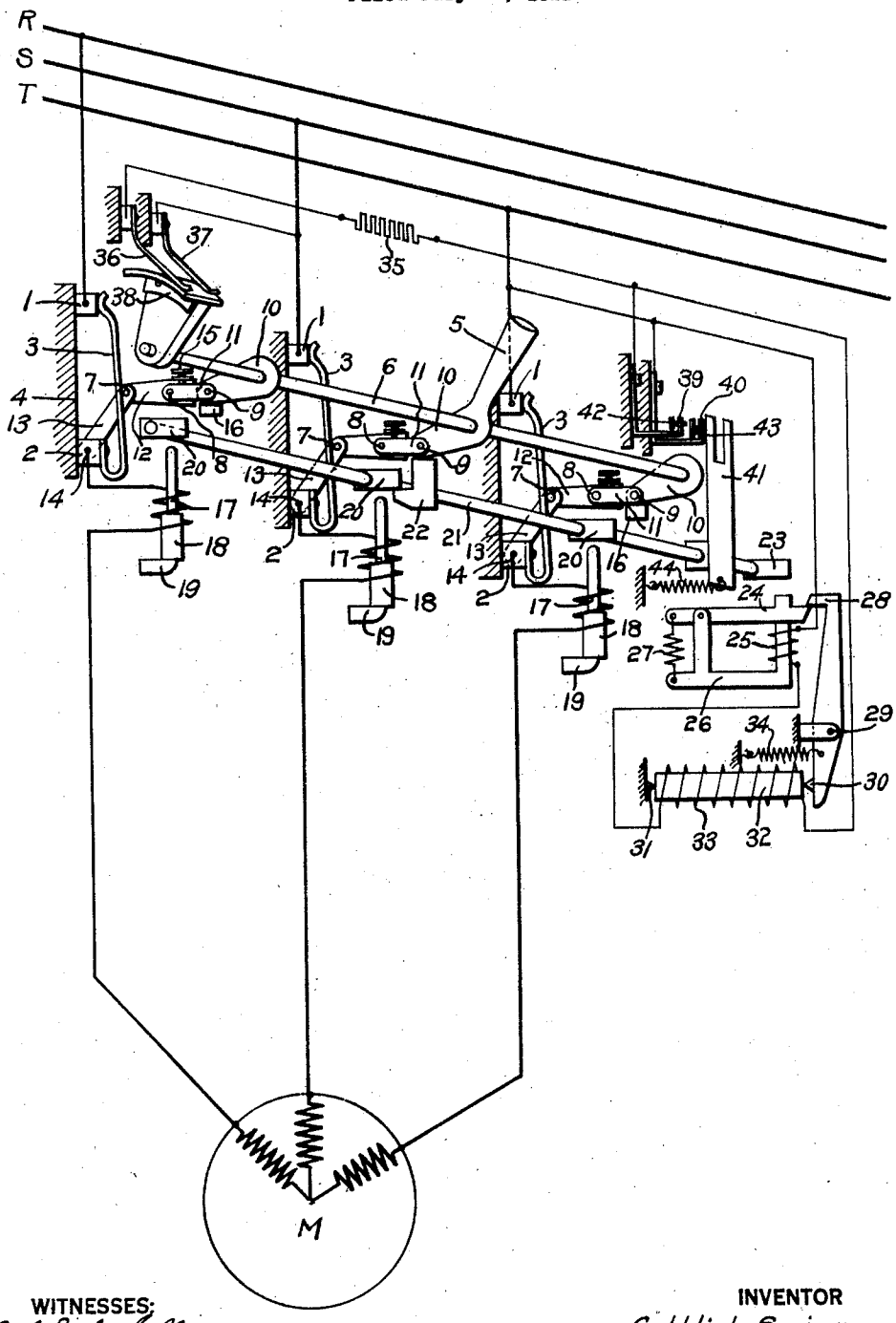

WITNESSES:

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UNITED STATES PATENT OFFICE.

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CIRCUIT INTERRUPTER.

Application filed July 23, 1925, Serial No. 45,521, and in Germany June 12, 1924.

My invention relates to circuit-interrupters and particularly to circuit-interrupters having automatic means for tripping the same under predetermined conditions.

One object of my invention is to provide a circuit interrupter having low-voltage tripping means and a thermal-responsive device cooperating therewith to prevent tripping the interrupter upon a momentary reduction of voltage.

Another object of my invention is to provide a circuit-interrupter having overload tripping means and retarding means cooperating therewith to retard the operation of the interrupter, said retarding means being effective only for moderate overloads.

A further object of my invention is to combine the overload and low-voltage tripping devices of the interrupter, the latter being retarded in its operation and the former being arranged to short-circuit the low-voltage device to obtain a retarded operation on moderate overloads and arranged to trip the interrupter directly to open the circuit instantaneously on extreme overloads.

It has been customary to protect large motors and other electrical apparatus with circuit-interrupters arranged to disconnect the motor upon overload or in the event that the supply voltage fails. It has been found, however, that the momentary drop in voltage accompanying a short-circuit in the distribution system causes operation of the circuit-interrupter. In many instances, disconnection from this cause is of frequent occurrence and is a source of considerable trouble and expense. In accordance with my invention, the low-voltage tripping device is latched by a thermal-responsive element which may be heated by a heating coil in series with the low-voltage holding coil. The low-voltage coil and the heating coil are energized from the supply circuit and, if the supply voltage fails, the coils are de-energized. However, the thermal-responsive device is so retarded in its operation that the circuit-interrupter is only tripped if the low-voltage condition exists for an appreciable period of time.

Ordinary motors and other electrical apparatus will carry small overloads for a considerable time and rather large overloads for a short time without injury. A circuit-interrupter, therefore, which trips instantaneously when a predetermined overload is reached may disconnect the apparatus from the circuit unnecessarily. However, an excessive current, such as may be drawn by a short-circuit in the motor or its terminal leads, imposes a severe strain upon the generator and distribution system. Under such conditions the motor should be disconnected as quickly as possible.

In accordance with my invention, the overload tripping means, while operative to trip the interrupter instantaneously on severe overloads, is arranged to short-circuit the low-voltage device on moderate overloads. If such an overload continues, the interrupter is tripped after a predetermined time interval which is the same as that obtaining in the case of a failure of the supply voltage.

In the accompanying drawings, an electrical system is shown in which a circuit interrupter embodying my invention is employed.

Referring to the drawing, the system comprises a motor M connected to the conductors R, S and T of a three-phase circuit through a circuit-interrupter. The circuit interrupter comprises three pairs of terminals 1 and 2 bridged by resilient contact members 3. The terminal members 1 and 2 are mounted on a base plate 4. The circuit interrupter is actuated to the closed position by a handle 5 that is mounted on the shaft 6 and is held in its closed position by a double toggle mechanism.

The toggle mechanism comprises an arm 10 mounted on the shaft 6, an arm 13 mounted on the base plate and links 11 and 12 pivoted to said arms and to each other at the points 7, 8 and 9. The arm 13 is pivoted at the point 14. The pivot 7 comprises a lateral extension engaging the contact member 3 to hold the same in the closed position, as shown.

In the closed position of the interrupter, the pivots 8 and 9 of the toggle mechanism are below the line connecting the pivotal points of the arms 10 and 12. The downward movement of the pivot 8 is prevented, however, by the adjustable screw 15, and a similar movement of the pivot 9 is prevented by the stationary lug 16. The toggle mechanism is, therefore, restrained in its downward movement to hold the switch members closed but may be collapsed when actuated in the upward direction.

The interrupter is tripped on overloads by

a tripping magnet 17 comprising a core member 18 normally supported by a stationary lug 19 and adapted to cooperate with a cam member 20 on a pivoted shaft 21. The shaft 21 may be controlled by the core members 18 of the respective phases of the circuit and is normally held in the position shown by the stationary member 22.

A lug 23 on the shaft 21 projects into the path of the armature 24 of a low-voltage tripping magnet 25. The low-voltage tripping device comprising a core member 26, an energizing winding 25 and a movable armature member 24. The armature member 24 is normally biased by the spring 27 into engagement with the lug 23. The armature member 24 is normally engaged by a latch member 28, pivoted at the point 29 to the base plate. Two conical projecting members 30 and 31, mounted on the latch member and the base plate, respectively, support a thermally-responsive member 32 having a heating winding 33 thereon. A spring 34, secured to the latch member, maintains the same in engagement with the thermally-responsive member 32.

The winding 25 of the low-voltage tripping device and the heating coil 33 are connected in series across the conductors S and T through a resistor 35 and the circuit-controlling devices 36 and 37.

Resilient contact members 36 and 37 cooperate with a contact segment 38 that is mounted upon the shaft 6 and insulated therefrom. The contact segment 38 closes a circuit through the resilient contact members 36 and 37 when the contact member 3 engages the stationary contact terminal 1 but does not close the circuit when the interrupter is in the open position.

A circuit-controlling device controlled by the overload tripping magnets comprises stationary contact terminals 39 and 40 mounted on the base plate and a short-circuiting contact plate 41 mounted on the shaft 21. Adjusting screws 42 and 43, that are mounted on the contact members 39 and 40, permit adjustment of the point of closing the circuit. A spring 44 secured to the contact segment 41 biases the segment away from the stationary contact members. The stationary contact members 39 and 40 are connected in shunt to the low-voltage tripping device 25 and the heating coil 33 and, therefore, when short circuited, cause the deenergization of said coils.

When the circuit interrupter is in the closed position, as shown, the motor M is energized from the circuit. If the voltage fails on the supply circuit, the low-voltage tripping device 25 becomes deenergized. However, the latch member 28 prevents the armature member 24 from tripping the circuit if the drop in the voltage is momentary. If the low voltage condition continues, the thermally-responsive device 32 becomes deenergized and, after a predetermined period, disengages the latch member 28 from the armature member 24. The armature member 24, being actuated by the spring 27, engages the lug 23 on the shaft 21 and turns the shaft until the cam members 20 engage the toggle mechanism and cause it to collapse, thereby opening the circuit-interrupter.

The interrupter is also tripped, in the case of an overload, by means of the overload tripping magnets 18 which engage the cam members 20. However, the spring 44 opposes the movement of the shaft 21 under the control of the overload tripping magnets and, therefore, the tripping will not be effected instantaneously except in the case of a severe overload, such as is caused by a short-circuit. In the case of a moderate overload, the motor M will not be injured unless such a condition continues and, accordingly, the overload tripping magnets are not effective to trip the interrupter directly under these conditions. However, the tripping magnets turn the shaft 21 under such conditions sufficiently to short-circuit the low-voltage magnet 25 and the heating coil 33 by means of the contact segment 41 cooperating with the stationary contact members 39 and 40. Therefore, if the overload continues for a predetermined period of time, the thermally-responsive device 32 releases the latch member 28 and the armature member 24 of the low-voltage tripping device and trips the circuit-interrupter after a predetermined period of time.

It should be noted that the circuit-interrupter described combines the functions of the low-voltage and overload tripping means in such a manner that a single retarded element is effective to retard the operation of the interrupter under both low-voltage and overload conditions.

I do not consider that my invention is limited to the precise details shown and described, and, accordingly, I do not wish to be limited in scope, except as may be indicated by the appended claims.

I claim as my invention:—

1. A circuit-interrupter comprising cooperating contact members, means including a low-voltage tripping magnet having a movable armature member for controlling said contact members, the release of said armature operating to trip the circuit interrupter, and a thermally-controlled latch engaging said armature member and adapted to retain said armature out of tripping position a predetermined time after the supply voltage fails.

2. A circuit interrupter comprising contact members, a low voltage tripping magnet, said magnet having an armature operable when released to trip the circuit interrupter, a latch for retaining said arma-

ture out of tripping position, and a thermal element expansible to retain said latch in its retaining position.

3. A circuit-interrupter comprising cooperating contact members, means for latching the same in closed position, a low-voltage device having a movable armature member arranged to release said contact members, a latch member normally engaging said armature member and a thermal-responsive device for disengaging said latch member from said armature member upon a failure of the supply voltage whereby said latch member is operated a predetermined time after de-energization of said low-voltage device.

4. A circuit-interrupter comprising cooperating toggle-controlled contact members, an overload-responsive member arranged to cause said toggle to collapse to actuate said contact members and time-element restraining means opposing said overload-responsive member for ordinary overloads, said restraining means being ineffective for heavy overloads.

5. A circuit-interrupter comprising cooperating contact members, means for latching the same in closed position, tripping means, electromagnetic means for controlling said tripping means upon the occurrence of an overload, low-voltage electromagnetic means for controlling said tripping means and means for retarding the operation of said tripping means under conditions of overload and low-voltage, said last-mentioned means being ineffective for extreme overloads.

6. A circuit-interrupter comprising cooperating contact members, means for latching the same in closed position, tripping means, electromagnetic means for controlling said tripping means upon the occurrence of an overload, low-voltage electromagnetic means for controlling said tripping means and means actuated by said overload electromagnetic means for short-circuiting said low-voltage means on moderate overloads.

7. A circuit-interrupter comprising cooperating contact members, means for latching the same in closed position, tripping means, electromagnetic means for controlling said tripping means upon the occurrence of an overload, low-voltage electromagnetic means for controlling said tripping means, means for retarding the operation of said low-voltage tripping means and means actuated by said overload electromagnetic means for short-circuiting said low-voltage means on moderate overloads.

In testimony whereof, I have hereunto subscribed my name this 14 day of May 1925.

GOTTLIEB SPEISER.