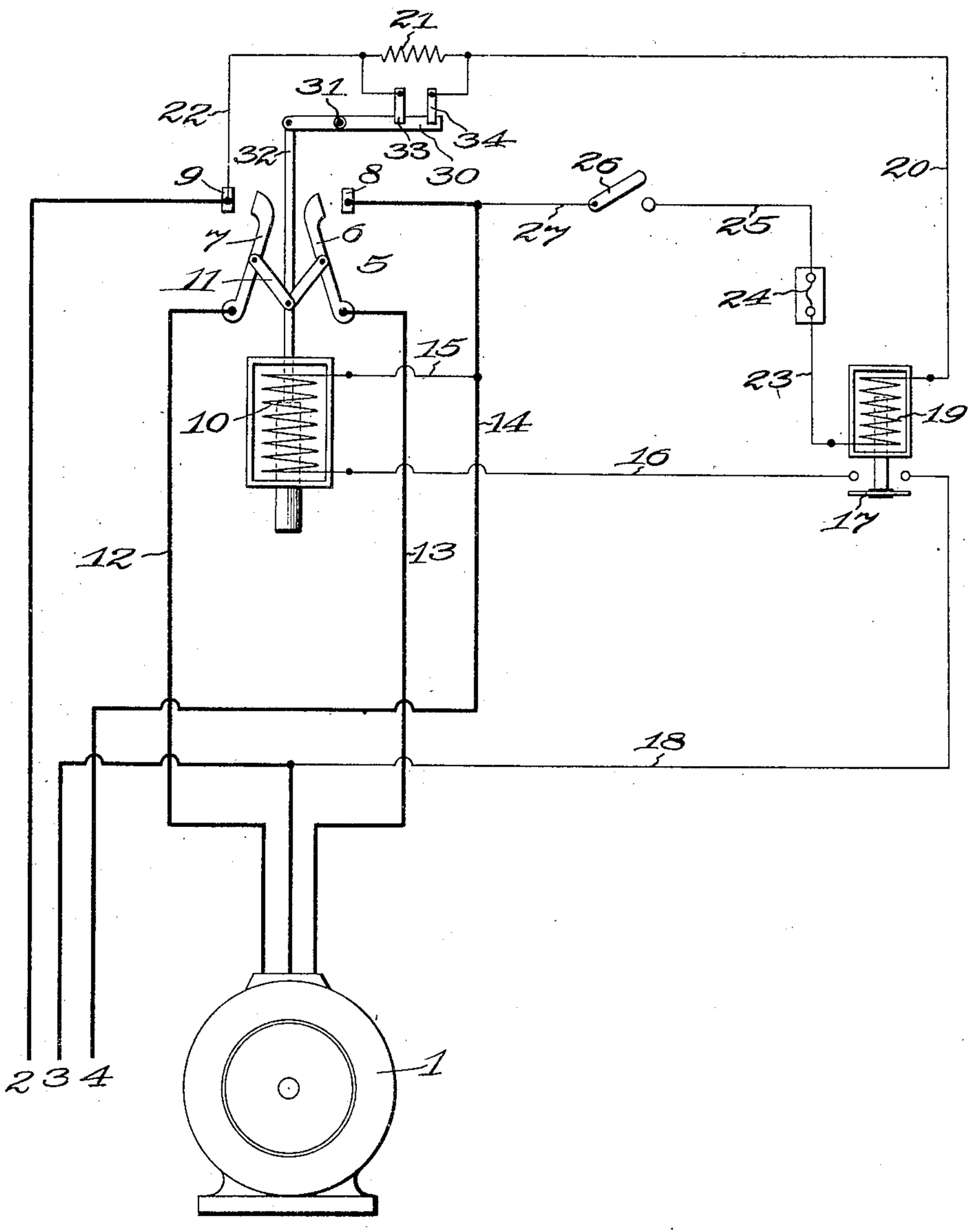
A. SIMON.

CIRCUIT CONTROLLER.

APPLICATION FILED NOV. 27, 1911.

1,154,733. Patented Sept. 28, 1915.



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CIRCUIT-CONTROLLER.

1,154,733. Specification of Letters Patent. Patented Sept. 28, 1915.

Application filed November 27, 1911. Serial No. 662,678.

To all whom it may concern:

Be it known that I, ARTHUR SIMON, a citizen of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented new and useful Improvements in Circuit-Controllers, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawing, forming a part of this specification.

My invention relates to improvements in circuit controllers and more particularly to those for polyphase alternating current circuits.

It is one of the objects of my invention to provide a circuit controller which will, upon the occurrence of abnormal conditions in any phase of the controlled circuit, protect the translating device or devices connected therein and at the same time fully protect its own controlling windings.

Various other objects and advantages of my invention will be hereinafter clearly and fully set forth.

In order to disclose the nature and characteristic features of my invention, I shall describe the controller diagrammatically illustrated in the accompanying drawing which embodies my invention in its preferred form. It should be understood however, that my invention may be carried out by means of other instrumentalities than those illustrated in the accompanying drawing and may be used in other relations.

The controller selected for the purpose of illustration controls the circuit of a motor 1 supplied with current from a three phase alternating current supply circuit, the lines of which I have numbered 2, 3 and 4.

The controller includes a main switch 5 which may in practice be of any preferred type. As illustrated this switch includes two movable contact members 6 and 7 provided with coöperating contacts 8 and 9 respectively. The contact members 6 and 7 are operated by a solenoid 10 through toggle links 11. The contact member 7 is electrically connected by conductor 12 to the left hand terminal of the motor, while its coöperating contact 9 is connected to the supply line 2. Contact member 6 is connected by conductor 13 to the right hand terminal of the motor while its coöperating contact 8 is connected by conductor 14 to supply line 4. Thus upon engagement of the contact members 6 and 7 with their respective coöperating contacts, the outside terminals of the motor will be connected to supply lines 2 and 4. The middle terminal of the motor is permanently connected to supply line 3. Hence closure of the switch 5 serves to complete all phases of the motor circuit.

One terminal of the solenoid winding 10 is connected by conductor 15 to conductor 14, while the opposite terminal of said winding is connected by conductor 16 through a relay switch 17 by conductor 18 to line 3. The relay switch 17 thus serves to control the circuit of the operating winding of the main switch.

Relay switch 17 is provided with an operating winding 19. One terminal of this winding is connected by conductor 20 through a resistance 21 or a short circuit around said resistance by conductor 22 to line 2, while its opposite terminal is connected by conductor 23 through a fuse 24 by conductor 25 through single pole central switch 26 by conductor 27 to conductor 14 and thence to line 4. Accordingly upon closure of switch 26, the winding 19 of relay 17 is connected across lines 2 and 4.

The operation of the controller thus far described is as follows:—Assuming the several switches of the controller to be in the positions illustrated, the motor circuit will be open. To start the motor the switch 26 must first be closed. This connects the winding 19 of relay 17 across supply lines 2 and 4 as previously described, causing said relay switch to respond and connect the operating winding 10 of main switch 5 across supply lines 3 and 4. Switch 5 thereupon responds causing the contact members 6 and 7 to engage their respective coöperating contacts and thus close the motor circuit. The relay switch 17 must be closed and maintained closed in order to energize main switch 5.

The relay winding 19 being connected across lines 2 and 4 and the winding 10 of the main switch being connected across lines 3 and 4 it is apparent that the energization of these windings is dependent upon the voltage conditions of all three phases of the supply circuit. Accordingly if after the motor circuit is closed, there should be an abnormal drop in voltage in any phase of the circuit, one or the other of said windings would be deënergized. In either case,

main switch 5 opens, thereby disconnecting the motor from circuit. Thereafter the motor circuit cannot be reclosed until normal voltage is restored to all phases of the supply circuit.

If after closure of the motor circuit there should be a failure or an abnormal drop in voltage across the lines 3 and 4, the winding 10 would be weakened to such an extent as to release the main switch. The relay 19, however, might remain energized, thereby maintaining the circuit of the winding 10 closed. This would result in a useless expenditure of energy in maintaining the relay switch energized and also a waste of energy through the winding 10, in the event of only a partial failure of voltage across its terminals. Further, if there was only a partial failure of voltage the winding 10 might be injured or even burned out, should it be left in circuit under the altered conditions. Likewise, should the relay switch drop out upon a partial failure of voltage, its winding would be left in circuit, thereby causing a useless expenditure of current therethrough and subjecting the same to danger of injury, as in the case of the winding 10. Accordingly, I desire to provide means for avoiding waste of current and for protecting the controller winding under the conditions just set forth.

I shall now describe the means illustrated for protecting the controller windings. This means includes the fuse 24, the resistance 21 and a switch 30 operated by the main switch 5 to open and close a short circuit around the resistance 21. The fuse 24, which is in series with the relay winding, is so designed as to be capable of carrying a comparatively heavy current for a given period but to melt and disrupt the circuit of the relay winding, unless the flow of current therethrough is reduced to a predetermined degree within a given time. The switch 30 before mentioned is pivoted at 31 and connected by a link 32 to the plunger of the operating solenoid of the main switch in such a manner that when said main switch is deënergized it is actuated to engage contacts 33 and 34 to complete the short circuit around the resistance 21 and to be actuated to disengage said contacts to interrupt said short circuit upon response of main switch 5. The resistance 21 is thus excluded from the circuit of the relay winding when the main switch is open and inserted in circuit with the relay winding when the main switch is closed. Thus provision is made for securing a comparatively heavy surge of current for operating the relay switch and then reducing the flow of current through the relay winding upon response of the main switch. In practice, the resistance 21 is so designed that when inserted in the circuit of the relay winding it will reduce the flow of current therethrough to a value which said winding may safely carry and below the value at which the fuse 24 melts. The fuse 24 should therefore be so designed as to carry the heavy surge of current desired for operating the relay for a sufficient time to enable the main switch to close.

With this arrangement, if upon closure of the control switch 26, the relay 19 responds and thereafter the main switch responds in due course the controller will close the motor circuit and maintain the same closed. If, on the other hand, the main switch should fail to respond after response of the relay, due to an abnormally low voltage in one or more phases of the supply circuit, then the continued heavy surge of current flowing through the relay winding would melt the fuse 24. This would cause interruption of the circuit of the relay which would open thereby interrupting the circuit of the winding of the main switch. This protects both windings against injury and also saves useless expenditure of energy. Assume now that upon closure of switch 26 the relay fails to respond due to an abnormal drop in voltage across lines 2 and 4. Under such conditions the resistance 21 is maintained short-circuited with the result that unless the drop in voltage is sufficient to reduce the flow of current through the relay winding to a safe value the fuse 24 would melt with the results aforesaid.

It will thus be seen that the controller illustrated insures full protection to the motor upon an abnormal drop in voltage in any phase of the circuit and at the same time fully protects its own windings.

What I claim as new and desire to secure by Letters Patent of the United States is as follows:—

1. In a controller for polyphase alternating current circuits, in combination, means controlling the continuity of circuit and a plurality of electro-responsive devices dependent on different phases of the circuit for energization thereof and upon one another for continued energization, said means being operable by certain of said devices but only upon response of all and being dependent for retention in circuit closing position upon continued energization of all of said devices.

2. In a circuit controller for polyphase alternating current circuits, in combination, means controlling the continuity of circuit, and a plurality of electro-responsive devices including an operating device for said means, and another device controlling said former device, said devices being dependent upon different phases of the circuit for energization thereof and said controlling device being responsive independently of said operating device but dependent for continued

energization upon response and continued energization of said operating device.

3. In a controller for polyphase alternating current circuits, in combination, means controlling the continuity of circuit, a plurality of electro-responsive devices including an operating device for said means, said devices being dependent upon different phases for energization thereof and said operating device being further dependent for initial energization upon response of another of said devices and means controlling the energizing circuit of the latter device to render maintenance thereof dependent upon response of said operating device within a limited period following response of said latter device.

4. In a polyphase circuit controller, in combination, a plurality of electro-responsive switches responsive successively to close all phases of the circuit, the operating windings of said switches being dependent for their energization upon the voltage conditions in the different phases of the circuit, means controlling the energizing circuit of the first responding switch to open the same after a temporary period and means operated by the last responsive switch to render said former means ineffective.

5. In a polyphase circuit controller, in combination, a plurality of electro-responsive switches responsive successively to close all phases of the circuit, the operating windings of said switches being dependent for their energization upon the voltage conditions in the different phases of the circuit, means adapted to open the energizing circuit of the first responsive switch but having a time element, permitting response of the last responsive switch under normal conditions and means operated by the last responsive switch for rendering said former means ineffective.

6. In an alternating current circuit controller, in combination, two electro-responsive devices dependent for their energization upon the electrical conditions of different phases of the circuit, one of said devices controlling the energizing circuit of the other and means controlling the energizing circuit of the former device to render maintenance thereof dependent upon response and continued energization of the other of said devices.

7. In an alternating current circuit controller, in combination, two electro-responsive devices dependent for their energization upon the voltage conditions of different phases of circuit, one of said devices controlling the energization of the other, and the former being initially responsive independently of the latter and means rendering continued energization of said former device dependent upon the response of said latter device within a limited period following the response of said former device.

8. In an alternating current circuit controller, in combination, two electro responsive devices dependent for their energization upon the voltage conditions of different phases of the supply circuit, one of said devices controlling the energizing circuit of the other, a fuse in circuit with the operating winding of the first responding device, said fuse tending to interrupt the circuit therethrough after the lapse of a temporary period and means operated upon the response of the other device to protect said fuse.

9. In an alternating current circuit controller, in combination, two electro responsive devices dependent for their energization upon the voltage conditions of different phases of the controlled circuit, means necessitating the response of one of said devices prior to response of the other, a fuse in circuit with the operating winding of the former and a resistance for the circuit of the former device controlled by the latter device, said fuse tending to interrupt the circuit of the former device unless the latter device operates within a predetermined time.

10. In a polyphase circuit controller, in combination, a plurality of switches having their operating windings connected in different phases of the circuit, said switches being interlocked to operate successively to close the several phases of the circuit, a fuse in the energizing circuit of the first responsive switch tending to interrupt said circuit but having a time element enabling response of the last responsive switch under normal conditions, a resistance to be included in circuit with said fuse and means operable upon the response and deënergization of the last responsive switch to insert and remove said resistance.

In witness whereof, I have hereunto subscribed my name in the presence of two witnesses.

ARTHUR SIMON.

Witnesses:
FRANK H. HUBBARD,
JEANETTE S. BROCK.