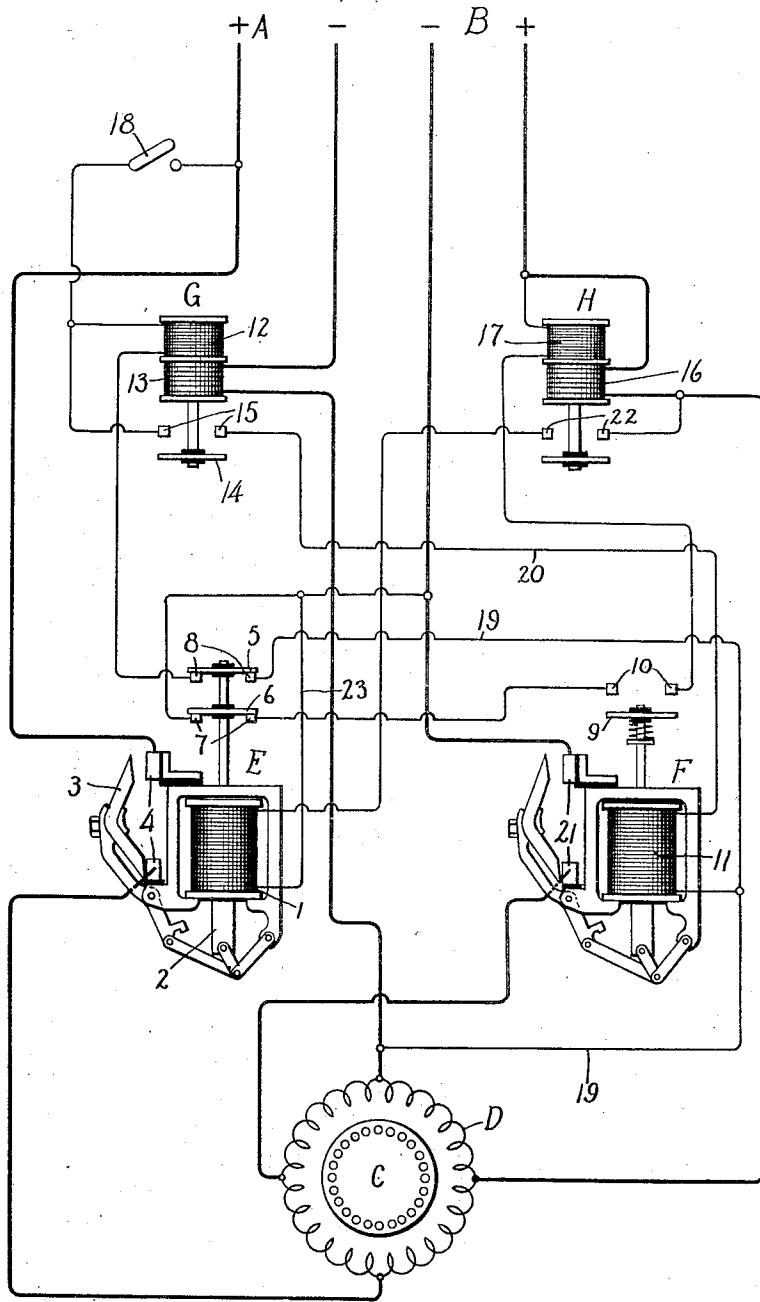


W. O. LUM.
 MOTOR STARTING DEVICE FOR POLYPHASE CIRCUITS.
 APPLICATION FILED JULY 24, 1908.

1,001,765.

Patented Aug. 29, 1911.



Witnesses:
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 By *Alfred S. Davis* Atty.

UNITED STATES PATENT OFFICE.

WALTER O. LUM, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

MOTOR-STARTING DEVICE FOR POLYPHASE CIRCUITS.

1,001,765.

Specification of Letters Patent. Patented Aug. 29, 1911.

Application filed July 24, 1908. Serial No. 445,133.

To all whom it may concern:

Be it known that I, WALTER O. LUM, a citizen of the United States, residing at Schenectady, in the county of Schenectady, State of New York, have invented certain new and useful Improvements in Motor-Starting Devices for Polyphase Circuits, of which the following is a specification.

This invention relates to devices for controlling electric circuits and has for its object the provision of a device of this character whereby an electric motor may be started on a polyphase circuit and protected against abnormal circuit conditions in a reliable, simple and efficient manner.

My invention relates more particularly to the starting of motors on polyphase circuits.

In the operation of motors on polyphase circuits there is always the danger of one or more of the phases becoming short-circuited so as to leave the motor running under abnormal conditions, which tend to destroy the motor. In two-phase motors when one phase becomes short-circuited the motor will run single phase.

One of the objects of my invention, therefore, is to provide means whereby when the voltage falls upon one phase of a polyphase circuit, the circuit of the other phase or phases will be automatically opened. This I accomplish by having a relay in each phase controlling an electromagnetic switch in another phase. The electromagnetic switches as they operate to close the circuit likewise control the lifting coils of the relay in its own circuit, so that only the holding coil which is in series with the motor is left in the circuit.

In the accompanying drawing I have shown my invention embodied in concrete form for purposes of illustration.

Referring to the drawing, A and B represent a two-phase or "quarter-phase" circuit and C and D represent respectively the armature and field of an induction motor adapted to be operated by the two-phase circuit. The two phases of the circuit are closed separately by the two electromagnetic switches E and F. The particular construction of these switches forms no part of my invention and simply consists of a solenoid 1 provided with a plunger 2 which is connected with a series of links forming toggle mechanism for operating the bridging contact 3 arranged to bridge the contacts 4

when the solenoid is energized. The plunger 2 has secured at its upper end a rod upon which are mounted the two bridging contacts 5 and 6, which are insulated from the rod and adapted to bridge the contacts 7 and 8 respectively when the solenoid is de-energized. The electromagnetic switch F is similar to switch E, but the extension upon the core is provided with a single bridging contact 9 which bridges the contacts 10 when the solenoid is energized, but is normally out of contact with them as shown.

The solenoid 11 of the switch F is controlled by a relay G, while the solenoid 1 of the switch E is controlled by the relay H. The solenoid of the relay G comprises two windings, a lifting winding 12 and a holding winding 13, while the core operates a contact 14 which is adapted to bridge contacts 15 when the solenoid is energized. The holding winding 13 is in series with phase A and the motor field D, while contact 14 controls the circuit of the switch F in phase B. The lifting coil 12 is connected across phase A, but is controlled by the switch E. The holding coil 16 of relay H is in series with phase B and the motor field, while the lifting coil 17 of this relay is connected across phase B and is controlled by the operation of both switches E and F.

The arrangement of circuits and mode of operation are as follows: When the switch 18, which may be an ordinary manually-operated switch, is closed, the lifting coil 12 is energized as follows: from the positive main, phase A, switch 18, winding 12, contacts 8, conductor 19 to the negative main through winding 13. This causes the relay to operate and close the circuit of winding 11 of switch F at contact 15, the circuit being as follows: from the positive main, switch 18, contacts 15, conductor 20, winding 11, and conductor 19 to the negative main. The winding 11 being energized, switch F closes phase B through the motor field at contacts 21. As this switch closes, the contacts 10 are bridged so that the lifting coil 17 of relay H is energized, the current passing from the positive main of phase B, winding 17, contacts 10, and contacts 7 to the negative main. Relay H being energized the circuit of winding 1 of switch E is closed from the positive main through winding 16, contacts 22, winding 1 and conductor 23 to the negative main. The oper-

ation of switch E closes phase A at contacts 4 and also closes the circuit of the holding coil 13 through the motor field. The operation of switch E likewise opens the circuits of lifting windings 12 and 17 of the relays G and H at contacts 7 and 8. The holding windings 13 and 16 being closed respectively by the switches E and F, the relays will remain closed during normal operation of the motor. Upon failure of voltage in one of the phases, as for instance phase A, the holding coil 13 will be deenergized and drop the contactor 14, which in turn will deenergize winding 11 to open phase B. The opening of phase B likewise deenergizes winding 16 and opens the circuit of winding 1 of switch E at contacts 22. The two phases of the motor are, therefore, open and the motor is prevented from running on single phase.

While I have described my invention in connection with a specific type of motor, viz., an induction motor operated on a two-phase circuit, it should be understood that I do not limit my invention thereto except in so far as it is limited by the scope of the claims annexed hereto.

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

1. The combination with an alternating current motor and a polyphase supply circuit, of a plurality of electromagnetic switches for separately closing the circuits of the different phases, and a relay having an actuating circuit and a holding circuit in one phase arranged to control the switch in another phase.

2. The combination with an alternating current motor and a polyphase supply circuit, of a plurality of electromagnetic switches for separately closing the circuit through said phases, and a relay having a series coil and a shunt coil in one phase arranged to control the switch in another phase.

3. The combination with an alternating current motor and a polyphase supply circuit, of a plurality of electromagnetic switches for separately closing the circuit of said phases, and a relay in one phase arranged to control the switch of another phase, said relay having a holding coil in series with the motor and a lifting coil controlled by the operation of the switch in its own phase.

4. The combination with an alternating current motor and a polyphase supply circuit, of a pair of electromagnetic switches for separately closing phases of said circuits, a pair of relays each having a holding coil and a lifting coil in one of said phases ar-

ranged to control another phase, and connections whereby the lifting coil of one relay is energized by the operation of the switch in its own phase.

5. The combination with an alternating current motor and a polyphase supply circuit, of a plurality of electromagnetic switches for separately closing the circuits of said phases, and a relay having a holding coil and a lifting coil in one phase for controlling the switch in another phase.

6. The combination with an alternating current motor and a two-phase supply circuit, of a pair of electromagnetic switches for separately closing the circuits of said phases, a relay in each phase arranged to control the switch of the other phase, each of said relays having a holding coil in series with the motor, and a lifting coil controlled by the operation of the switch in its own phase.

7. The combination with an alternating current motor and a two-phase supply circuit, of a pair of electromagnetic switches for separately closing the circuits of said phases, a relay in each phase having a holding coil and a lifting coil and arranged to control the switch of the other phase, and connections whereby the lifting coil of one relay is energized by the operation of the switch in its own phase and both the lifting coils are deenergized by the operation of the other switch.

8. The combination with an alternating current motor and a two-phase supply circuit, of a pair of electromagnetic switches for separately closing the circuits of said phases, and a pair of relays each having a holding coil in series with one phase and a lifting coil connected across the same phase and arranged to control the switch in the other phase.

9. The combination with an alternating current motor and a two-phase supply circuit, of a pair of electromagnetic switches for separately closing the circuits of said phases, a pair of relays each having a holding coil in series with one phase and a lifting coil connected across the same phase and arranged to control the switch in the other phase, and connections whereby the lifting coil on one relay is energized by the operation of the switch in its own phase and both lifting coils are deenergized by the operation of the other switch.

In witness whereof, I have hereunto set my hand this 23rd day of July, 1908.

WALTER O. LUM.

Witnesses:

BENJAMIN B. HULL,
HELEN ORFORD.