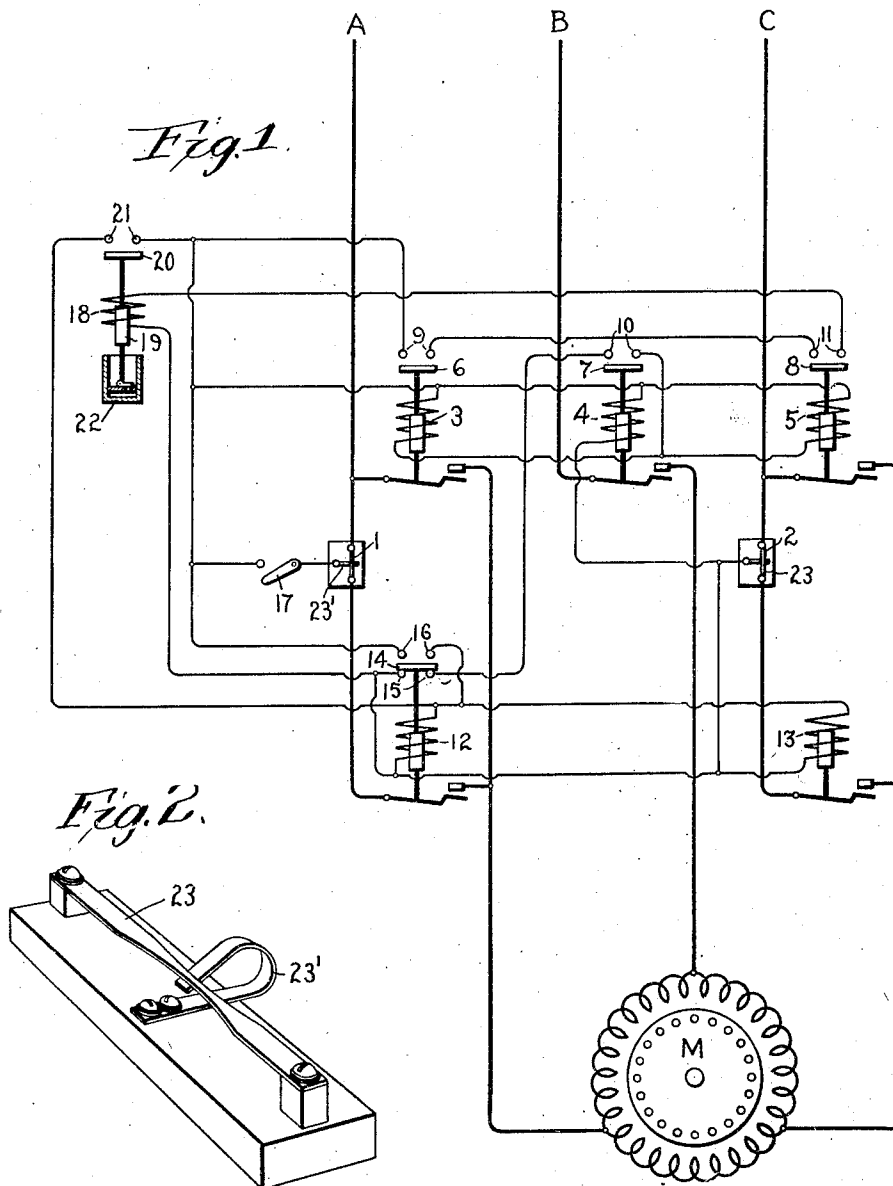


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MOTOR STARTING AND PROTECTIVE DEVICE.  
APPLICATION FILED JULY 9, 1910.

1,060,895.

Patented May 6, 1913.



Witnesses:

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# UNITED STATES PATENT OFFICE.

GEORGE T. EAGAR, OF BALLSTON SPA, AND CHARLES H. WILLIAMS, OF SCHENECTADY,  
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NEW YORK.

MOTOR STARTING AND PROTECTIVE DEVICE.

1,060,895.

Specification of Letters Patent.

Patented May 6, 1913.

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*To all whom it may concern:*

Be it known that we, GEORGE T. EAGAR, a citizen of the United States, residing at Ballston Spa, county of Saratoga, State of New York, and CHARLES H. WILLIAMS, a subject of the King of Great Britain, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Motor Starting and Protective Devices, of which the following is a specification.

This invention relates to the control of electric motors and has for its object the provision of means whereby the motor may be started and likewise protected against abnormal circuit conditions in a reliable and efficient manner.

Our invention relates more specifically to the starting of induction motors on poly-phase circuits, one of the objects of our invention being to provide means whereby the motor may be automatically started without the blowing of protective fuses due to the abnormally large starting current.

Another object of our invention is to provide means whereby when one or more phases of the circuit is opened, certain of the other phases will be automatically opened so as to prevent the motor from running under abnormal conditions.

Other objects of our invention will appear in the course of the following specification, in which we have shown our invention embodied in concrete mechanism for purposes of illustration.

In the accompanying drawings disclosing our invention embodied in concrete form, Figure 1 is a diagram of the circuit connections and Fig. 2 is a detail of the fuse.

Referring to the drawing illustrating our invention, M represents a three phase induction motor adapted to be operated from the three phases A, B and C of the supply circuit, and fuses 1 and 2 are connected in the phases A and C, respectively. Contactors 3, 4 and 5 are for closing the circuit of the phases A, B and C, respectively, through the motor. These contactors may be of any standard design and are each provided with interlocks consisting of contacts 6, 7 and 8, adapted to bridge contacts 9, 10 and 11, respectively, as the contactors close. Two contactors 12 and 13 are likewise provided for closing the circuit of the phases A and C through the motor in parallel with

the contactors 3 and 5. These contactors, however, close the circuit through the fuses 1 and 2, respectively. Contactor 12 is provided with an interlock consisting of bridging contact 14 which bridges contacts 15 when the contactor is open, and contacts 16 when the contactor is closed. The three contactors 3, 4 and 5 are arranged to close the motor circuit when the switch 17 is closed and the contactors 12 and 13 are to close the motor circuit through the fuses 1 and 2 within a predetermined interval after the closing of the contactors 3, 4 and 5. In order to effect this result we provide a time limit relay consisting of a coil 18 having a core 19 at the upper end of which is a contact 20 arranged to bridge the contact studs 21 when the coil is energized. The lower end of the core is provided with a dashpot 22 which is adapted to retard the upward movement of the core, but permits the core to drop freely. The fuses 1 and 2 each consist of a fuse wire 23 supported at its ends and having a spring 23' normally pressing against its middle portion. This spring forms a circuit terminal so that when the fuse blows the spring will snap outward and cut itself off from both sides of the line.

The arrangement of circuits and mode of operation are as follows: When the control switch 17 is closed contactor 4 closes, the circuit being as follows: from phase A to the spring 23' of fuse 1, thence through switch 17, coil of contactor 4 to the spring on fuse 2 and back to phase C. When the contactor 4 closes, it closes the energizing circuit for contactors 3 and 5 as follows. From phase A, switch 17, coils of contactors 3 and 5 in parallel, bridging contacts 7 and 14, back to phase C. The three phases of the supply circuit are now connected directly to the motor. When the contactors 5 and 3 close, the coil of the time limit relay is energized, the circuit being as follows: from phase A, switch 17, bridging contacts 6 and 8, through coil 18 and back to fuse 2. The coil 18 being energized, the core rises slowly, being retarded by the dashpot. After a predetermined interval which gives the motor time to start, the contacts 21 are bridged by contact 20. This energizes the coils of contactors 12 and 13 as follows: from phase A and switch 17 across contact 20, coils of contactors 12 and 13 in parallel and back to fuse 2. As soon as contactors

12 and 13 close, contactors 3 and 5 open, since the energizing circuits of the contactors 3 and 5 both pass through the interlocking contact 14. Contactors 3 and 5, therefore, drop out, leaving contactors 12, 4, and 13 closed. By the closing of the contactors 12 and 13, the fuses 1 and 2 are connected in the circuit so as to protect the motor from dangerous overloads. If the fuses had been connected in the motor circuit during starting, the excessive starting current taken by the motor would have caused them to blow. Inasmuch as the system is built to stand this excessive current for a short time, this blowing of the fuses during starting is undesirable, so that we provide means for automatically connecting the fuses in circuit after the heavy rush of current has passed.

20 In order to immediately shut down the motor to prevent it from running single phase in case one phase should open, the circuits are so arranged that when a fuse in one of the phases blows the other phases will immediately be opened to shut down the motor. It will be observed that the circuit of contactors 12, 13 and 4 passes from fuse 1 to fuse 2. If, therefore, fuse 2 should blow to open phase C, contactors 12, 13 and 4 will drop out to stop the motor. In the same way, if fuse 1 should blow to open phase A, contactors 12, 13 and 4 would also drop out and stop the motor. Consequently the motor cannot be operated unless fuses 1 and 2 are in place. The circuits of contactors 3, 4 and 5 and the time limit relay all pass from fuse 1 to fuse 2. Therefore none of the contactors can close unless both fuses are in place.

40 It will be seen that we have provided a simple and effective means for automatically starting a motor without blowing the protective fuses and likewise preventing the motor from running under abnormal conditions. For purposes of illustration we have shown our invention as embodied in concrete form, but it is obvious that our inven-

tion is not limited to the particular structure or circuit arrangement herein shown and described, since various modifications thereof will suggest themselves to those skilled in the art without departing from the spirit of our invention, the scope of which is set forth in the annexed claims.

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

1. The combination with a three phase supply circuit, of an electric motor, a fuse for each of two phases of said circuit, a plurality of electromagnetic switches for first connecting the motor directly to the supply circuit and then connecting the motor to the supply circuit through the fuses after a predetermined interval, and connections whereby the opening of one fuse opens the phase of the circuit containing the other fuse.

2. The combination with a three phase supply circuit, of an electric motor, a fuse for each of two phases of said circuit, a plurality of electromagnetic switches for first connecting the motor directly to the supply circuit and then connecting the motor to the supply circuit through the fuses after a predetermined interval, and connections whereby the opening of a fuse in one phase opens the circuit of one of the other phases.

3. The combination with a polyphase supply circuit, an electric motor, a plurality of fuses for certain of the phases of said circuit, a plurality of electromagnetic switches for first connecting the motor directly to the supply circuit and then connecting the motor to the supply circuit through fuses after a predetermined interval, and connections whereby the opening of a fuse in one phase opens the circuit of another phase.

In witness whereof, we have hereunto set our hands this 8th day of July, 1910.

GEORGE T. EAGAR.

CHARLES H. WILLIAMS.

Witnesses:

BENJAMIN B. HULL,  
HELEN ORFORD.