

W. O. LUM.
 AUTO STARTER.
 APPLICATION FILED MAY 3, 1915.

1,269,625.

Patented June 18, 1918.

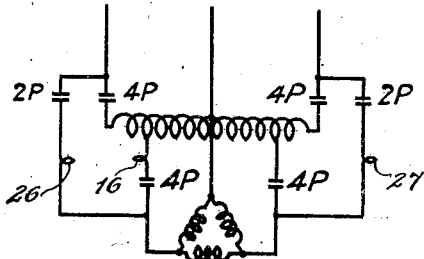


Fig. 2.

Sw.	Start	Run.
4P.	o	
2P.		o

Fig. 3

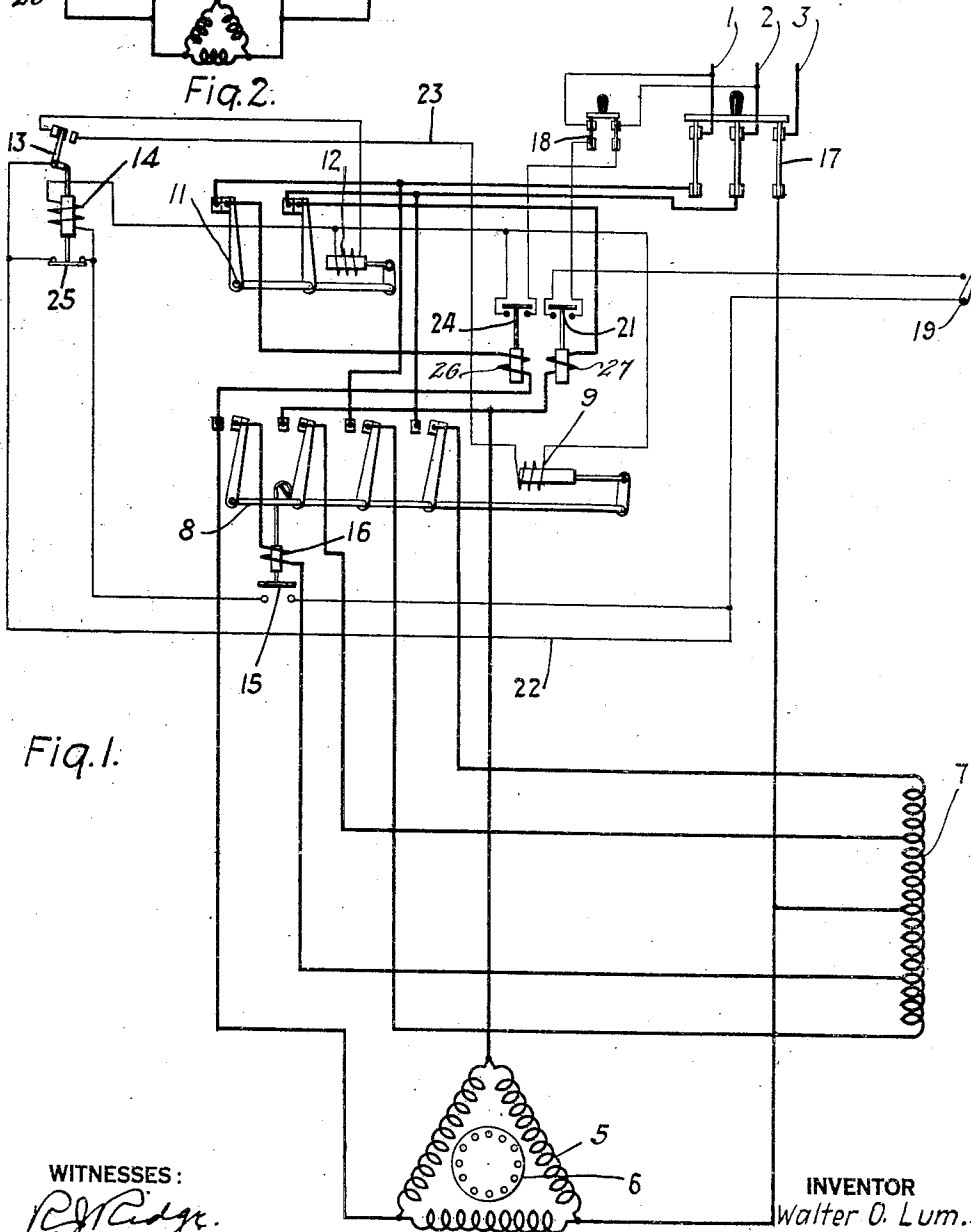


Fig. 1.

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AUTO-STARTER.

1,269,625.

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To all whom it may concern:

Be it known that I, WALTER O. LUM, a citizen of the United States, and a resident of Wilkesburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Auto-Starters, of which the following is a specification.

My invention relates to auto-starters for electric motors, and it has for its object to provide a simple automatic means for successively establishing starting and operating connections between a source of power and an electric motor.

In the construction of devices of the same general character as that hereinafter set forth, it has been necessary, heretofore, to provide mechanical means for interlocking the switches which successively establish starting and operating connections for the motor. This structure has been necessary in order to insure that both of the switches cannot be in circuit at the same time.

According to the present invention, I provide electro-responsive controlling means for insuring the proper sequence in operation of the switches. The switches for establishing the successive connections are electromagnetically controlled. The actuating coils of the electromagnetic switches are controlled by a double-throw switch which, according to its position, renders operative one or the other of the electromagnetic switches. The relay switch is controlled by a current-limit switch that is in series with the motor. The arrangement operates automatically, upon the closing of a master switch, to close the starting switch and, when the current falls to a predetermined value, to open the starting switch and, at the same time, to close the running switch.

In the accompanying drawings, Figure 1 is a diagrammatic view of circuits and apparatus embodying my invention. Fig. 2 is a diagrammatic view of a schematic arrangement of the circuits and apparatus of Fig. 1. Fig. 3 is a diagram indicating the sequence of the switches.

Line conductors 1, 2 and 3, which may be connected to any suitable source of alternating current, supply energy to an electric motor having primary windings 5 and a

rotor of the squirrel-cage type indicated at 6. An auto-transformer 7 is connected in circuit with the primary windings 5 of the motor by a four-pole starting switch 8 which is controlled by an actuating coil 9. A second switch 11, which establishes the normal or running connections between the motor and the source, is provided with an actuating coil 12.

The circuits of the coils 9 and 12 are controlled by a relay 13 which may be termed a transfer relay, since it transfers the connections from one actuating coil to the other. The relay switch 13 is provided with an actuating coil 14 that is in circuit with a current-limit relay switch 15. The current-limit relay switch 15, which is mechanically connected to the starting switch 8, is provided with a coil 16 that is in circuit with the motor during starting conditions.

Referring to Fig. 2, the respective starting and running switches are designated 4P and 2P in accordance with the number of poles embodied therein. The actuating coil 16 of relay 15 is in series with one of the starting switches, and the actuating coils 27 and 26 of overload relays 21 and 24, respectively, are indicated as being in series with the running switch.

It may be assumed that the four-pole switch 8 and the two-pole switch 11 are in their respective open positions and that a main switch 17 and a switch 18 in the control circuit have been closed. To start the motor, a master switch 19 is closed to establish a circuit which extends from the line conductor 1, through the switch 18, overload relay switch 21, master switch 19, conductor 22, relay switch 13, which is in its right-hand position, conductor 23, coil 9, overload relay 24 and switch 18 to line conductor 2.

The coil 9 is energized thereby to close the starting switch 8 which connects the auto-transformer 7 and the primary windings 5 in circuit with line conductors 1, 2 and 3. The motor is then supplied with current at a relatively low voltage. The closing of the four-pole switch 8 permits the relay switch 15 to close when the current traversing the series coil 16 falls to a predetermined value. Since the motor is at rest, a relatively heavy

current will traverse its primary circuit, which includes the coil 16, and the switch 15 will be maintained in its open position until the motor has attained such speed that the current has fallen to the predetermined value.

The switch 15 then closes to complete a circuit which extends, as above traced, to the master switch 19 and thence through the relay switch 15, coil 14, overload relay 24 and switch 18 to line conductor 2. The coil 14 is thus energized to actuate the relay switch 13 to the left to establish a circuit which is the same as that traced above in connection with the coil 9 to the relay 13, thence through the coil 12, overload relay 24, and switch 18 to line conductor 2. The circuit of the coil 9 is broken at the relay 13, and the starting switch 8 returns to its open position. The circuit of the coil 16 is then broken at one of the arms of the starting switch 8.

The coil 12 is energized by the circuit established by the transfer relay 13, and the two-pole switch 11 is closed thereby. The primary windings 5 are then directly connected to line conductors 1, 2 and 3, the auto-transformer being shunted by the two-pole switch 11. Current is then supplied to the motor at full line voltage, and normal operating conditions are established. When the relay switch 13 occupies its illustrated position, the switch 25, which is mechanically connected thereto, is closed to short circuit the overload relay switch 15. The circuit of the coil 14 is then controlled by the overload relays 21 and 24.

In case an overload occurs during the operation of the motor, and the current rises above the value at which the overload relays 21 and 24 are arranged to operate, the latter open the circuit of the coil 14, and the relay 13 is actuated to the right by gravity. The circuit of the coil 12 is broken and that of the coil 9 is established. The corresponding switches 11 and 8 are opened and closed, respectively, and starting conditions are again established. When the current falls to a normal value, the overload relays 21 and 24 close and, when the relay 15 closes, the coil 14 is energized to establish running conditions in the manner above described.

To stop the motor, it is only necessary to actuate the master switch to its "off" position. The circuit of the coil 14 is broken at the master switch 19, and the relay switch 13 returns to its original position. The circuit of the coil 12 is broken at the relay switch 13 and the switch 11 then opens. The circuit of the coil 9 is not completed because the control circuit is broken at the master switch 19.

It will be noted that I provide a means for automatically insuring operation of the

switches to successively establish starting and running conditions. The controlling means and the switches are so arranged that it is impossible for the switches to be connected in circuit simultaneously. When an overload occurs, the starting conditions are automatically established and maintained until the current falls to a predetermined value, whereupon running conditions are again established. When the motor stops, the various parts are in such positions that the sequence of operation automatically occurs upon the closing of the control circuit at the master switch.

I claim as my invention:

1. In an auto-starter, the combination with a source of current, an electric motor, and a plurality of electromagnetic switches for successively establishing starting and operating connections between said motor and said source, of means for automatically controlling said switches in accordance with motor-circuit conditions, said means comprising a current-limit device directly and mechanically connected to one of said switches.

2. In an auto-starter, the combination with a source of current, an electric motor, and a plurality of electromagnetic switches for successively establishing starting and operating connections between said motor and said source, of means for automatically controlling said switches in accordance with motor-circuit conditions, said means comprising a double-throw switch which operates, according to its position, to render one or another of said electromagnetic switches operative and a current-limit device directly and mechanically connected to one of said electromagnetic switches for electrically controlling said double-throw switch.

3. In an auto-starter, the combination with a source of current and an electric motor, of a four-pole switch for establishing starting connections between said source and said motor, a two-pole switch for establishing running connections for said motor, means for controlling said switches, said means comprising a relay which operates, according to its position, to render operative either of said switches, a current-limit device having a switch member for controlling the energizing circuit of said relay during the starting of said motor and an overload device for controlling said relay during the normal operation of said motor.

4. In an auto-starter, the combination with a source of current and an electric motor, of a plurality of electromagnetic switches for successively establishing starting and running connections between said source and said motor, of a relay which is biased to close a circuit for the actuating coil of one of said switches and which operates, under predetermined circuit condi-

tions, to open said circuit and close a second circuit for the actuating coil of a second switch, a current-limit device directly and mechanically connected to one of said
5 switches for controlling said relay during the starting of said motor and an overload device having a switch member for control-

ling the energizing circuit of said relay during the normal operation of the motor.

In testimony whereof, I have hereunto
10 subscribed my name this 27th day of April, 1915.

WALTER O. LUM.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."