

APPLICATION FILED NOV. 19, 1907.

Patented Mar. 5, 1912.



Fig. 1.

Irving E. Steers.
J. Ellis Allen.

GEORGE H. DORGELON,
BY *Alfred Davis*

ATT'Y.

UNITED STATES PATENT OFFICE.

GEORGE H. DORGELOH, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

STARTING DEVICE FOR SINGLE-PHASE MOTORS.

1,019,435.

Specification of Letters Patent.

Patented Mar. 5, 1912.

Application filed November 19, 1907. Serial No. 402,790.

To all whom it may concern:

Be it known that I, GEORGE H. DORGELOH, a subject of the Emperor of Germany, residing at Schenectady, in the county of Schenectady and State of New York, have invented certain new and useful Improvements in Starting Devices for Single-Phase Motors, of which the following is a specification.

10 This invention relates to the control of alternating current motors and particularly of single-phase motors of the induction type. It is well-known that this type of motor will not start from rest unless provided with
15 special starting means, such as auxiliary starting windings or phase-splitting devices or both. It is generally desirable when such starting devices are employed that they should be cut out of circuit when the motor reaches running speed since they are generally
20 designed to be in circuit for a short time only and would otherwise become overheated. Furthermore the running efficiency of the motor would be impaired by keeping
25 these starting devices in circuit. If, however, after the motor is running normally and the starting devices are cut out of circuit, the motor should be brought to rest from some cause, such as the failure of voltage, and current should again be supplied
30 to the motor, the latter would not start but would draw a large current from the line which would overheat and eventually damage the motor.

35 One of the objects of my invention is to provide automatic means for cutting in the starting devices when the motor is connected to a suitable source of current and for automatically cutting out said devices
40 after the motor is started, provision being made whereby upon failure of voltage, the starting devices will always be connected in circuit.

My invention further comprises certain
45 circuit connections and arrangement of parts, which are best understood by reference to the accompanying drawing, which shows diagrammatically a motor provided with automatic controlling means in accordance with my invention.
50

In the accompanying drawing illustrating my invention, Figure 1 shows the complete device, somewhat diagrammatically; and Fig. 2 shows a detail of the latch mechanism.

55 Referring to this drawing, M represents

the primary of an induction motor. This motor is shown as having auxiliary starting windings so connected as to constitute three phase connections of which A is the main winding and B and C the auxiliary windings. The starting arrangement for this motor comprises four solenoids D, E, F and G. Solenoid D is provided with a plunger or core 10 having an extension rod 11 upon which is loosely mounted a contactor 12 operating between the collars 13 and 14. The plunger is arranged to be retarded in its upward movement by a dashpot 15, but will move downward freely in a manner well understood in the art. The contactor 12 in its lowermost position bridges contacts 16 while in its upper position it bridges contacts 17. Solenoid E is provided with a similar plunger having an extension 18 provided at its lower end with contactors 19 and 20 adapted to bridge contacts 21 and 22 when raised. The plunger of solenoid F is provided at its lower end with a contactor 23 adapted when raised to bridge contacts 24. This contactor 23 is arranged to be mechanically locked in its upper position, and the solenoid F is simultaneously deenergized. The locking mechanism whereby this is done forms no part of my invention and may be of any suitable type, such for instance as that disclosed in an application filed by Charles D. Knight, Serial No. 378,255 and assigned to the General Electric Company. Briefly described, the locking mechanism comprises a latch 25 normally spring-pressed by means of a spring 25' so as to engage a groove in the extension 26 of the core when the latter is in its raised position. This latch is controlled by a pivoted lever 27 arranged to shift the latch 25 so that it will release the rod 26 as hereinafter described. The rod 26 is also adapted to engage the switch arm 28 so as to open its own circuit as well as the circuit of solenoid D at contacts 29. The lever 27 is controlled by a no-voltage magnet, the core of which when released drops into engagement with the lever 27 so as to shift the latch out of engagement with the extension 26. When, however, the solenoid G is energized and the core 30 raised, the latch 25 slides into a position to lock the extension 26 when the latter is raised.

The arrangement of circuits and mode of operation are as follows: R represents the resistance and R' the reactance adapted to

operate as a phase-modifying device in a manner well-known in the art. When the line switch 31 and the switch 32 are closed, current passes from the line at L so as to energize solenoids D, E and G. The latter is energized from the line L through switch 32, while the solenoids D and E are energized through the conductor 33, switch 28, through conductor 35 and back to line through conductor 36, current passing directly through solenoid D and across the bridging contactor 12 to solenoid E. Solenoid E being energized, the pairs of contacts 21 and 22 are immediately bridged so as to close the motor circuit through the starting windings and the resistance-reactance devices R, R', current passing from the line L through conductor 37, resistance-reactance R, R', contacts 21 and 22 and back to line L' through conductor 36, whereupon the motor starts. At the same time, the solenoid D being energized, its core rises slowly being retarded by the dashpot 15 and the solenoid G is energized so as to allow the latch 25 to lock the rod 26 when it reaches its raised position. After a predetermined interval, which will depend upon the extent of retardation of the dashpot, which in turn may be adjusted to suit the time the motor takes to reach approximately running speed, the contacts 17 are bridged by the contactor 12 and the bridging contact between the contacts 16 is opened. The contactor 12 is shifted with a quick movement when the plunger of the dashpot passes the hole 15' in the barrel. This deenergizes solenoid E and energizes solenoid F through conductor 38. The deenergizing of solenoid E opens the circuit of the starting windings and resistance-reactance devices, while the energizing of solenoid F bridges contacts 24 and connects the main winding A of the motor in circuit as follows: conductor 37, winding A, conductor 39, contacts 24, conductor 40 and back to line through conductor 36. The opening of the circuit of solenoid E and the closing of solenoid F are accomplished practically simultaneously by reason of the arrangement of the dashpot as shown in the application above referred to. When the core of solenoid F is raised, the extension 26 engages the switch 28 and opens the circuit of solenoid D so that the core of the latter drops back quickly. This also deenergizes solenoid F but the contactor 23 will not drop since it is mechanically locked by means of the latch 25. So long as the contactor 29 remains open, the solenoid D will likewise be deenergized. The solenoids D, E and F are thus all deenergized and solenoid G alone remains in the circuit. Upon failure of voltage either from opening the switch 32 or from other causes, the core 30 will drop and release the rod 26 whereupon the motor

circuit will be opened with all the parts in protective position so that the foregoing operation must be repeated to again start the motor.

It will be understood, of course, that various modifications of my invention will suggest themselves to those skilled in the art without departing from the spirit of my invention, the scope of which is set forth in the annexed claims.

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

1. The combination with a single-phase motor, of a resistance reactance device for producing a current of displaced phase in a portion of the windings thereof, an electromagnetic switch for actuating said device, an automatically operated circuit controller for said switch, and means for retarding the operation of said controller.

2. The combination with a single-phase motor, of a resistance reactance device for producing a current of displaced phase in a portion of the windings thereof, an electromagnetic switch for connecting the same in circuit, an automatically operated circuit controller for said switch, means for retarding the operation of said controller, and an electromagnetic switch controlled by said circuit controller for closing the motor circuit independently of said resistance reactance.

3. The combination with a single phase motor, a resistance-reactance device in the motor circuit, a solenoid switch for closing the motor circuit independently of the device, means whereby said solenoid switch deenergizes itself upon closing, means for mechanically locking said switch in closed position, and a no-voltage magnet for controlling the locking device.

4. The combination with a single-phase motor, of a resistance reactance device for producing a current of displaced phase in a portion of the windings thereof, an electromagnetic switch for connecting the same in circuit, an electromagnetically operated circuit controller for said switch, means for retarding the operation of said controller, an electromagnetic switch controlled by said circuit controller for closing the motor circuit independently of said resistance reactance, and means for opening the circuit of the circuit controller when said latter switch is closed.

5. The combination with a single-phase motor, of a resistance reactance device for producing a current of displaced phase in a portion of the windings thereof, an electromagnetic switch for connecting the same in circuit, an electromagnetically operated circuit controller for said switch, means for retarding the operation of said controller, an electromagnetic switch controlled by said circuit controller for closing the motor cir-

cuit independently of said resistance reactance, and means for mechanically locking said latter switch closed.

5 6. In combination with a single-phase motor, of a resistance reactance device for producing a current of displaced phase in a portion of the windings thereof, an electromagnet switch for connecting the same in circuit, an electromagnetically operated
10 circuit controller for said switch, means for retarding the operation of said controller, an electromagnet switch controlled by said circuit controller for closing the motor cir-

cuit independently of the said resistance reactance and simultaneously deenergizing 15 the circuit controller, means for mechanically locking said latter switch closed, and a no-voltage magnet for controlling the locking means.

In witness whereof, I have hereunto set 20 my hand this 18th day of November, 1907.

GEORGE H. DORGELOH.

Witnesses:

BENJAMIN B. HULL,
HELEN ORFORD.