

Sept. 13, 1927.

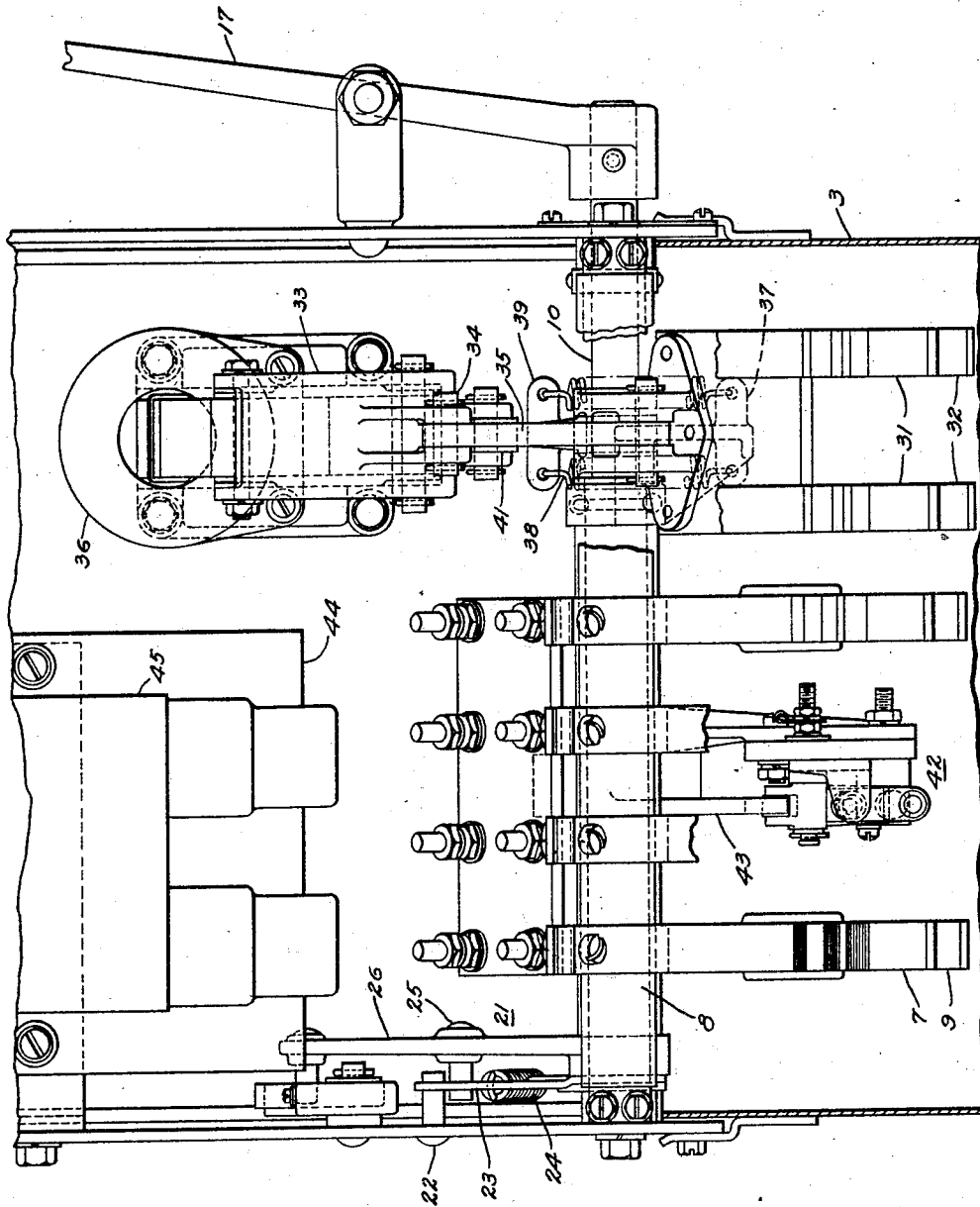
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1,642,001

AUTOSTARTER FOR INDUCTION MOTORS

Filed May 25, 1925

3 Sheets-Sheet 1



WITNESSES:
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Fig. 1.

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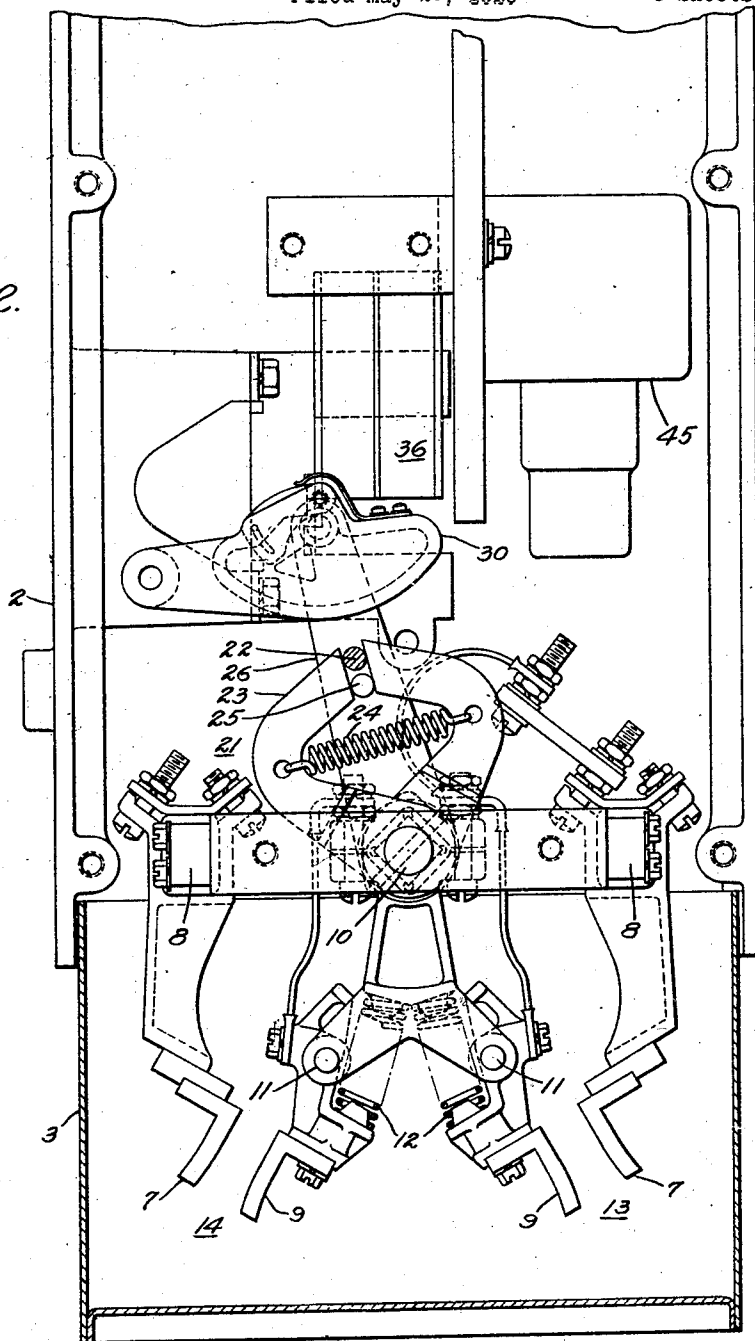
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Fig. 2.



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AUTOSTARTER FOR INDUCTION MOTORS

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Fig. 3.

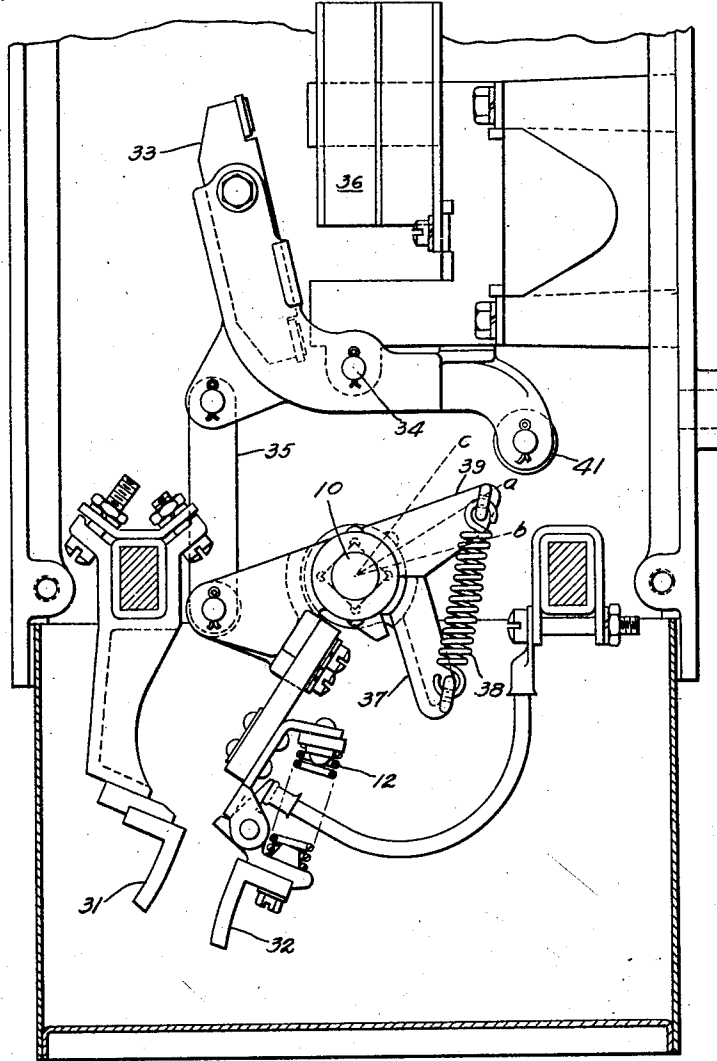
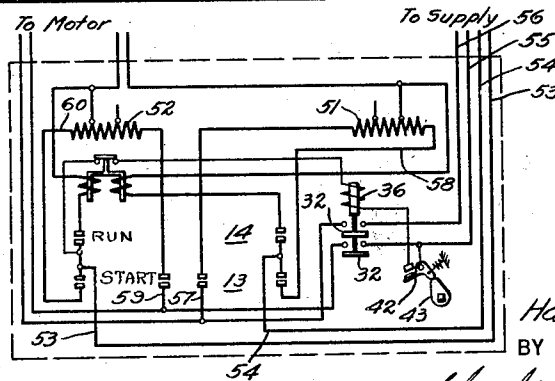


Fig. 4.



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AUTOSTARTER FOR INDUCTION MOTORS.

Application filed May 25, 1925. Serial No. 32,527.

My invention relates to control apparatus and it has particular relation to controllers for starting alternating-current motors of the induction type.

5 An object of my invention is to provide a controller having manually operable starting and running switches and an electromagnetic line switch adapted to so make and break the motor circuit as to avoid destructive arcing and burning of the switches.

10 Another object of my invention is to provide mechanically operable interlocking means to insure the opening of the electromagnetic line switch under predetermined conditions.

15 Other objects of my invention will appear from the following description of my invention.

20 My invention will be described in connection with the accompanying drawings, in which Fig. 1 is a front view of a controller constructed in accordance with my invention.

Fig. 2 is a side view of the controller illustrated in Fig. 1.

25 Fig. 3 is a side view of the controller illustrated in Fig. 1, showing details of the line switch and interlocking mechanism, and

Fig. 4 is a diagrammatic view of circuits and apparatus embodying my invention.

30 My invention finds particular application in connection with controlling mechanisms, such as auto-starters of the type illustrated and described in Patent No. 1,430,589 of W. S. Roberts and C. H. Hodgkins, dated October 3, 1922, and assigned to the Westinghouse Electric and Manufacturing Company.

35 Referring particularly to Figs. 1 and 2, the controlling mechanism comprises a casing having an upper stationary part 2 that is adapted to be secured to any suitable support and a lower tank or casing 3 for enclosing the switching mechanism.

40 The switching mechanism comprises two rows of stationary contact members 7 that are mounted upon, and insulated from, supporting bars 8. A corresponding number of pairs of oppositely disposed movable contact members 9 are mounted upon, and insulated from, a rock shaft 10. The respective contact members 9 are pivotally mounted upon bearing pins 11 and the members of each pair are yieldingly retained in the relative positions, illustrated in Fig. 2, by means of springs 12. The left-hand switch

members, illustrated in Fig. 2, comprise a 4-pole starting switch 13, and the right-hand members comprise a 2-pole running switch 14 (Fig. 4).

45 The switching mechanism is operated by a lever 17 that is located outside the casing and is connected to the rock shaft 10. This operating lever and the switching mechanism are normally biased to an inoperative position by a centering device 21, which comprises a stationary pin 22 and two oppositely disposed arms 23 that resemble a pair of "calipers." The arms 23 are pivotally supported by the shaft 10 and bear against the pin 22 in the off position.

50 A centering tension spring 24 is connected between the arms 23 to resist the separation of said arms when the lever 17 is actuated in either direction from the neutral position. A pin or stop-member 25 is mounted upon an arm 26 that is secured to the shaft 10 and is adapted to stress the centering spring 24. The controller is provided with an anti-vibration catch 30, similar in character to that described in the above-mentioned patent. Detailed description of this device is believed to be unnecessary and it forms no part of my invention.

55 Referring to Figs. 1 and 3, the electromagnetic line-switch embodies a pair of stationary contact members 31 and cooperating movable contact members 32. The movable contact members 32 are rotatably mounted upon, and insulated from, the rock shaft 10. A magnet armature 33 is pivotally mounted upon a bearing pin 34 and connected, through a link member 35, for operating the movable switch member 32. The armature 33 is controlled in a familiar manner by means comprising an operating coil 36. A lever 37 is fixed upon the shaft 10 and is flexibly connected, through springs 38, to operate a lever 39, which is rotatably mounted on the shaft 10 and is adapted to mechanically interlock with the armature 33. For this purpose, armature 33 is provided with a lower extension or "tail piece," carrying a roller 41.

60 Referring to Figs. 1 and 4, an auxiliary switch 42, commonly termed an electrical interlock, is actuated in accordance with the movement of the controller-operating lever 17 for controlling the energization of the line-switch coil 36. The interlock 42 is of a

familiar spring-closed type and is opened in the off position of the controller by a cam member 43. Within the controller casing are mounted, in a familiar manner, the auto-transformer 44 and an overload relay 45.

When the rock shaft 10 is rotated in a clockwise direction, the left-hand contact members 7 and 9 are engaged to set up the motor-starting circuits. The starting circuits, however, are not completed until the line-switch contact members 31 and 32 are closed. When the rock shaft 10 is rotated to starting position, the lever 39 occupies the dotted-line position "b", and interlock 42 closes to effect the energization of line switch coil 36. The movable switch member 32 is closed by armature 33 to complete the motor starting connections.

Referring to the diagram of connections, Fig. 4, the auto-transformer coils 51 and 52 are energized from a source of supply comprising conductors 53, 54, 55 and 56. A circuit for coil 51 extends from line conductor 56, through the upper movable contact member 32, conductor 57, starting switch 13, coil 51, conductor 58 and switch 13, to line conductor 54. Similarly, a circuit for coil 52 extends from line conductor 55, through lower line switch member 32, conductor 59, starting switch 13, coil 52, conductor 60, and switch 13, to line conductor 53. A reduced voltage is, therefore, applied to the motor, which in accordance with a familiar practice, is connected to transformer-winding-taps and, when the motor has started, the shaft 10 should be rotated in a reversed or counterclockwise direction, whereupon interlock 42 is opened to de-energize the line-switch coil 36.

The lever 39 is carried from the starting position "b" toward the running position "c", thereby engaging roller 41 and insuring the opening of line-switch contact members 32 prior to the closure of the running switch 14, which is actuated, as indicated in Fig. 2, upon a counterclockwise rotation of rock shaft 10. The interlock 42 is again closed in the running position to re-energize coil 36, so that the line switch contact members 32 close subsequently to the closure of the running switches.

When lever 39 (Fig. 3) occupies the dotted line position "c", the controller is latched in the running position, since the armature 33 is closed and the roller 41 engages the right-hand side of the lever 39.

When the controller is actuated to its "off" position the rock shaft 10 is operated in a clockwise direction by means of lever 17, but this motion is resisted by the action of the tension springs 38, which are stressed by the movement of lever 37, which is actuated by the rock shaft 10. During a part of the movement toward the "off" position,

lever 39 is retained in position "c", being latched in position by means of the roller 41. In this manner, considerable pressure is brought to bear against the armature 33, in opposition to the action of the coil 36. After a suitable angular movement of lever 37, and a corresponding angular movement of the interlock cam 43, the interlock 42 is opened to de-energize coil 36; and switch members 32 are thereupon opened with a snap-action that is occasioned by the mechanical interlocking of the members 39 and 41 and the tension of springs 38. The springs 38 are preferably of such strength as to resist the movement of the controller to the off position prior to the opening of line-switch members 32. That is to say, a slight movement of the operating lever 17 toward the off position insures the opening of the line switch prior to the opening of the running switches.

It will also be apparent that, in the event of overload or upon a failure of voltage, coil 36 will become de-energized and permit the controller to return automatically to its off position by reason of the action of the centering device 21 and independently of the normal manual operation of the controller.

From the foregoing description of the operation of the controller, it will be apparent that the making and breaking of the motor circuit is effected through the operation of an electromagnetic line switch and mechanism associated therewith for insuring a quick opening and closing of the motor circuit to prevent such destructive arcing at the switch members as is present in many manually operable controllers, especially when manipulated by inexperienced operators.

I have illustrated my invention in one form for which it is peculiarly adapted, namely, in connection with auto-starters; however, I desire that it shall not be limited to the precise structure described but only in accordance with the scope of the appended claims.

I claim as my invention:

1. In a motor starter, the combination with a plurality of starting and running switches and actuating means therefor, of a magnetically operable line switch, and means for insuring the closure of the line switch subsequent to the closure of the starting switches and for insuring the opening of said line switch prior to the closure of said running switches.

2. In a motor starter, the combination with a plurality of starting and running switches and actuating means therefor, of a magnetically operable line switch, means for insuring the closure of the line switch subsequent to the closure of the starting switches and for insuring the opening of said line

switch prior to the closure of said running switches, and means for insuring the opening of said line switch prior to the opening of said running switches.

5 3. In a motor starter, the combination with a plurality of starting and running switches and actuating means therefor, of a magnetically operable line switch, means for insuring the closure of the line switch
10 subsequent to the closure of the starting switches, means for effecting the demagnetization of said line switch and mechanically operable means for insuring the opening of said line switch.

15 4. In a motor starter, the combination with a plurality of starting and running switches and actuating means therefor, of a magnetically operable line switch, means for insuring the closure of the line switch sub-
20 sequent to the closure of the starting switches, means for effecting the demagnetization of said line switch and mechanically operable yielding means for insuring a snap-action opening movement of said line switch
25 when the starter is operated to its inoperative position.

5 5. In a motor starter, the combination with a plurality of starting and running switches and actuating means therefor, of a
30 magnetically operable line switch, means for insuring the closure of the line switch subsequent to the closure of the starting switches, means for effecting the demagnetization of said line switch and mechanically
35 operable means for insuring the opening of said line switch prior to the opening of the starting and running switches, respectively.

40 6. In a motor starter, the combination with a plurality of starting and running switches and actuating means therefor, of a magnetically operable line switch, means for insuring the closure of the line switch
45 subsequent to the closure of the starting switches and means comprising the line switch magnet for holding said running switches closed.

7. In a motor starter, the combination with a plurality of starting and running switches and actuating means therefor, of
50 a magnetically operable line switch, means for insuring the closure of the line switch subsequent to the closure of the starting switches and for insuring the opening of said line switch prior to the closure of said
55 running switches, and holding means for said running switches comprising the line switch magnet.

8. In a motor starter, the combination with a plurality of starting and running switches and actuating means therefor, of
60 a magnetically operable line switch, means for insuring the closure of the line switch subsequent to the closure of the starting switches and a single electro-responsive
65 means for rendering said line and running switches effective.

9. In a motor starter, the combination with a plurality of starting and running switches and actuating means therefor, of
70 a magnetically operable line switch, and means comprising the line switch magnet for also controlling said running switch.

10. In an autostarter, the combination with a plurality of starting and running
75 switches and manually operable means for actuating said members, of a magnetically operable line-switch, an electrical interlock operable with said starting and running
80 switches for controlling said line switch, means for opening said line switch when deenergized, and biasing means associated with said interlock for effecting a quick
opening of said line switch.

11. In an autostarter, the combination with a plurality of starting and running
85 switches and manually operable means for actuating said members, of a magnetically operable line-switch, an electrical interlock operable with said starting and running
90 switches for controlling said line switch, spring actuated means for opening said line switch when deenergized, and biasing means comprising a link mechanism operable with
95 said interlock for effecting a quick opening of said line switch.

12. In an autostarter, the combination with a plurality of starting and running
switches and a manually operable rock-shaft therefor, of a magnetically operable line-
100 switch, an electrical-interlock operated by said rock-shaft for controlling said line-switch, a centering-spring device for restoring said rock-shaft, a cam member rotatably mounted on said rock-shaft for operat-
105 ing said line switch, and a yielding connection between said rock-shaft and said cam comprising a lost motion device, whereby
110 said cam becomes effective to stress said line switch toward its open position prior to the operation of said interlock.

In testimony whereof, I have hereunto subscribed my name this 13th day of May, 1925.

HAROLD E. WHITE.